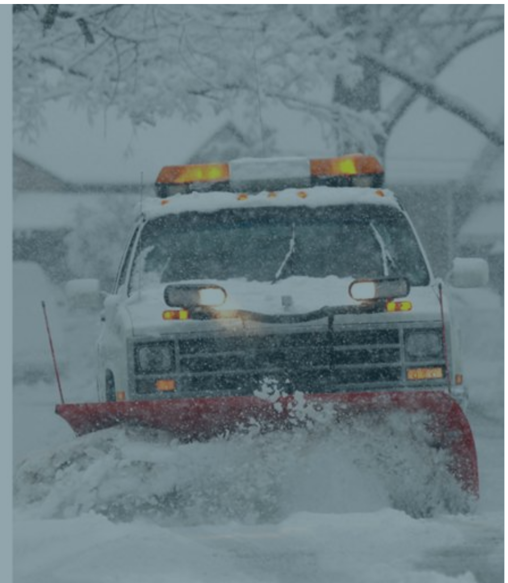
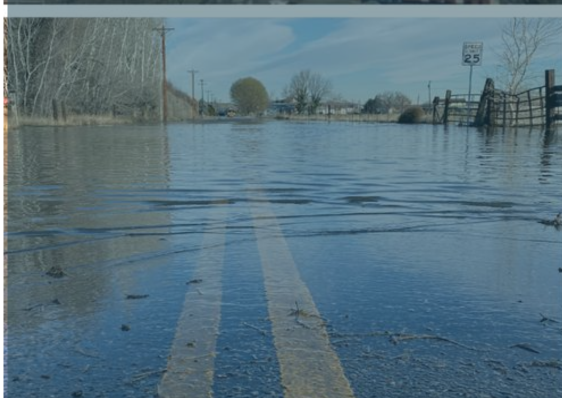



# TOWN OF LEE
# DRAFT HAZARD MITIGATION AND CLIMATE ADAPTATION PLAN

*5/27/2025*



## ACKNOWLEDGEMENTS

The development of this *Lee Hazard Mitigation and Climate Adaptation Plan* has been made possible with financial support from the Hazard Mitigation Grant Program, issued by the Federal Emergency Management Agency and administered by the Massachusetts Emergency Management Agency (MEMA). Additional public participation, climate adaptation and preparedness has been made possible through a Municipal Vulnerability Preparedness (MVP) planning grant provided by the Massachusetts Executive Office of Energy & Environmental Affairs (EOEEA). The Town would like to thank the unerring support and guidance provided by MEMA's hazard mitigation staff and EOEEA's MVP staff throughout this planning process.

The Town of Lee would like to thank the members of the Lee Hazard Mitigation & Municipal Vulnerability Preparedness Committee, who served as the advisory committee for this planning effort. The Berkshire Regional Planning Commission provided technical assistance to the Town and the Planning Committee throughout the planning and approval processes.

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# Chapter 1 Introduction

Hazard mitigation planning reduces or eliminates the need to respond to hazardous conditions that threaten human life and property. As noted in the 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP, 2018):

> *Natural Hazards are natural events that threaten lives, property, and other assets. Often, natural hazards can be predicted and tend to occur repeatedly in the same geographical locations because they are related to weather patterns or physical characteristics of an area.*

Hazard Mitigation is a term that describes an action taken to reduce the harm that natural disasters have on people and property – it is the up-front work to mitigate or reduce the impacts of a disaster when it strikes. In short, it addresses where and how things are built to reduce the risk of disaster's worst impacts. Mitigation is pro-active rather than reactive and is taken to solve a problem on a permanent, long-term basis. Climate Adaptation is an adjustment in natural or human systems that respond to actual or expected climatic stimuli or their effects (SHMCAP, 2018). In man-made systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment. Resilience is the ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event or a changing climate in a timely and efficient manner - the ability to "bounce back" where mitigation may not work.

The Town of Lee Hazard Mitigation and Climate Adaptation Plan (HMCAP) was prepared to meet the requirements of the Code of Federal Regulations, Title 44 CFR § 201.6, pertaining to local hazard mitigation plans. Title 44 CFR § 201.6(a)(1) states that "a local government must have a mitigation plan approved pursuant to this section in order to receive hazard mitigation project grants. A local government must have a mitigation plan approved pursuant to this section in order to apply for and receive mitigation project grants under all other mitigation grant programs."

## Purpose

The Town's eligibility for FEMA's hazard mitigation grants is crucial. This plan was also prepared to meet the requirements of the Massachusetts Executive Office of Energy and Environmental Affairs' (EEA) Municipal Vulnerability Preparedness (MVP) Planning Grant, which enabled Lee to complete this plan and to integrate local effects of climate change into their hazard mitigation action plan. By completing the Community Resilience Building (CRB) process, Lee will be an MVP community eligible for MVP Action Grants to adapt to the impacts of climate change on the community.

## Mission

The defined mission for the Town of Lee Hazard Mitigation and Climate Adaptation Plan is to "identify observed and projected risks; to develop sustainable, cost-effective actions that reduce the loss of life, property, and infrastructure during natural disaster; and to build climate resiliency for the Town's economic, cultural and environmental resources." In accordance with Title 44 CFR § 201.6, the local mitigation plan is the representation of the Town's commitment to reducing risks from natural hazards, serving as a guide for decision-makers as they commit resources to reduce the effects of natural hazards. Additionally, the HMCAP is meant to serve as the basis for the Commonwealth of Massachusetts to provide technical assistance and prioritize project funding. This plan must be updated at least once every five years to remain eligible for FEMA hazard mitigation project grants and must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval.

## Plan Structure

Below is a summary of the chapters of the Town of Lee Hazard Mitigation Plan. The planning process closely adhered to FEMA guidelines and to the intent of those guidelines.

### *Chapter 2: Planning Process*

This chapter outlines the methodology and approach used in the hazard mitigation planning process. It summarizes the Hazard Mitigation Planning Committee (HMPC) meetings and public outreach efforts, including public meetings. This section guides the reader through the process of creating this plan and highlights its open and inclusive public involvement.

### *Chapter 3: Risk Assessment*

This chapter provides an overview of the Town of Lee, including its history, population, economy, natural assets, and infrastructure. It also offers an in-depth risk analysis, profiling each hazard with the potential to impact the Town of Lee. Each hazard assessment includes the following components:

Hazard Profile: An overview of the hazard's characteristics and behavior.
Probability: An evaluation of the likelihood of the hazard occurring.
Severity: An analysis of the potential impacts and magnitude of the hazard.
Historic Data: A review of past occurrences and patterns related to the hazard.
Vulnerability Assessment: A detailed examination of hazard effects, focusing on:

- Geographic Areas of Concern: Specific locations within the town are at higher risk.
- People: Populations may be more vulnerable due to age, mobility, or other factors.
- Built Environment: Critical infrastructure, buildings, and utilities at risk.
- Natural Environment: Potential impacts on ecosystems and natural resources.
- Economy: Economic vulnerabilities and potential disruptions.
- Future Conditions: Consideration of factors such as climate change, population changes, and development trends that may alter risk profiles over time.

### *Chapter 4: Capability Assessment*

This chapter evaluates the Town of Lee's current capabilities to mitigate hazards, including existing policies, programs, and resources. Capacity-building actions are listed at the end of the chapter.[i]

### *Chapter 5: Mitigation Strategy*

This chapter details the town's mitigation goals, objectives, and proposed actions to reduce risks and enhance resilience to hazards.

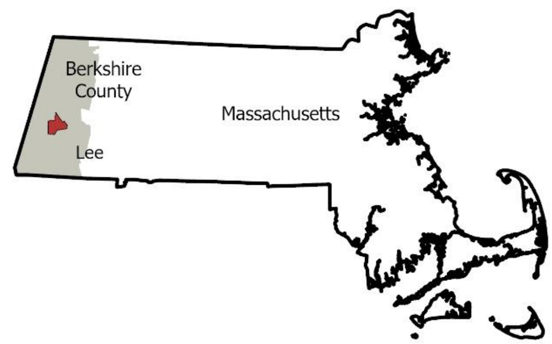
*Chapter 6: Plan Implementation and Maintenance*

The final chapter outlines how the plan will be implemented, monitored, and maintained over time to ensure its effectiveness and relevance.

## Background

The Town of Lee covers an area of 27.0 square miles (~17,281 acres). As of the 2020 census, the town boasts a population of 5,707, resulting in a population density of roughly 211 people per square mile. With 2,306 households, the average household size stands at about 2.42 people.[ii] The Town of Lee borders Tyringham and Great Barrington on the south, Lenox on the northwest, Becket on the east, Washington on the northeast, and Stockbridge on the west. Lee is 9 miles south of Pittsfield, 122 miles west of Boston, and 138 miles from New York City.

Figure 1.1 Location of Town of Lee in Massachusetts




The majority of land area in Town consists of forests, wetlands, waterbodies and watercourses, and other forms of open space and recreational lands, most of which are protected lands held by the state, Town, Lee Land Trust, and other conservation organizations. Forested property alone makes up approximately 64% of conservation land. Agriculture, including crop, hay, and pastureland, accounts for 10% (1,207 acres), while commercial (185 acres), industrial (85.42 acres), and residential development (253 acres) combined only account for 4.27% of land area. [iii]

To the northeast, rising, is the iconic peak of October Mountain, part of the October Mountain State Forest, along with the Bear Mountain State Forest in the southwest corner of the Town. Additionally, Lee is rich in water resources, including brooks, streams, ponds, vernal pools, and wetlands. Among them, Laurel Lake stands out on the northern edge of the Town along Route 20, serving as a popular destination for fishing, boating, and swimming and a small beach for residents. In the southeast, Goose Pond consists of lower and upper sections. The upper pond is wilderness-like and intersects the Appalachian Trail, while the lower pond features summer homes. The area surrounding the upper pond is part of the Appalachian Trail Corridor, managed by the National Park Service, and designated as a premier coldwater pond by the Massachusetts Division of Fisheries and Wildlife.
Lee is settled in a valley along the banks of the Housatonic River, the major water resource in central and southern Berkshire County. Due to Lee's steep topography, some development was built on the flat lands within or near the Housatonic River floodplain but also on the elevated hilly landscape around the town. The Town's major roads are the Massachusetts Turnpike (I-90) and U.S. Route 20, which runs east to west, with Route 102, which extends north–south intersecting Route 20. Lee's proximity to the Turnpike (I-90) has earned it the moniker "Gateway to Berkshires," serving as a transition point for visitors entering the Berkshires. The Town's center is built around the intersection of Main Street (Route 20) and Park Street, acting as a focal point for community activities and local businesses. Many travelers entering or exiting the Mass Turnpike must travel through Downtown via

Route 20. Historic buildings, particularly along Main Street, distinguish Lee's Town Center and house a mix of local businesses, including shops, restaurants, and galleries.

Notably, in April, following Easter weekend, the Town experiences a surge of visitors, with approximately 15,000 pilgrims passing through to celebrate Divine Mercy Sunday at the National Shrine of The Divine Mercy located in the neighboring Town of Stockbridge. During the summer, Lee's population swells with an influx of tourists staying in Lee and passing through the area to nearby cultural attractions. Peak tourism typically between May and August, in Lee was observed with a 29.78% increase in traffic counts compared to other seasons, according to 2021 reporting from MassDOT. [iv] Within the town are 159 registered accommodations for tourists, predominantly consisting of short-term rentals, making up 83.02%, and hotels, accounting for 11.95% of the options.[v] In 2023, Lee secured the Appalachian Trail Community designation, amplifying its existing range of outdoor attractions.

Despite its high visitor rate, Lee stands apart culturally due to its diversified economy that supports its year-round community. Key employers, including Dresser Hull, Onyx, Berkshire Sterile, Boyd, and Oldcastle Stone, represent a broad spectrum of sectors, such as light manufacturing, construction, and mining as well as shops catering to locals and visitors. Despite the mountainous terrain, working farms contribute to the agricultural landscape, with Lee having over 7 farms. One of the region's few remaining dairy farms, High Lawn Farm, is located on a hill overlooking Laurel Lake and encompasses over 749 acres within the Town. Healthcare and education also significantly influence the Town's economic fabric. Over a five-year period, healthcare has consistently exhibited growth, while education and construction have retained their stability with minor fluctuations, and accommodation and food services have grown by 10%.[vi]

Lee has its own water system, sewer system, Police Department, Fire Department, and other community services. Notably, most of Lee's Critical Facilities, such as the Police and Fire departments, Town Hall, and Public Works, are in the flat lands within or near the Housatonic River floodplain. The Police station is in the Town Hall's basement and is prone to frequent flooding. The Central Fire Station located on Main Street no longer fully serves the needs of Lee's Fire Department. The Town has proposed building a combined Police and Fire Public Safety Complex. See Figure 1.3 for the map of critical facilities.

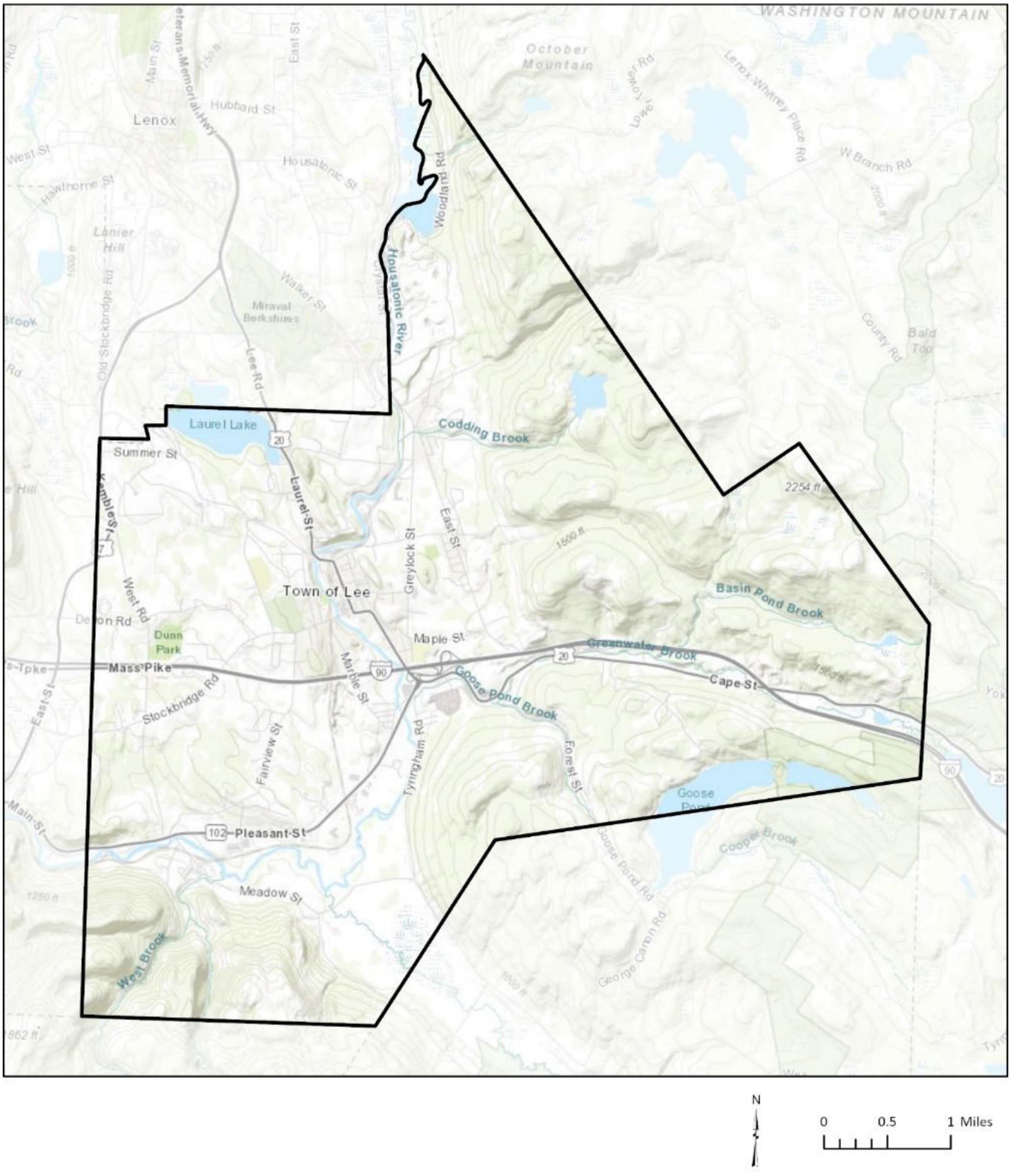
The Town has two school options – the Lee public school district and the private school of St. Mary's. St. Mary's serves 120 students Pre-K through Middle School. Lee's public school district supports grades K-12, serving 666 students (as of the 2022-2023 enrollment year) from Lee and their neighboring Town, Tyringham. Additionally, students from the Towns of Otis, Sandisfield, and Becket can attend Lee High School. The district comprises two buildings: Lee Elementary and Lee Middle/High School, which are situated on the Greylock St. campus upland of most of downtown.

Housing primarily comprises single-family homes (69%), slightly lower than the average of 76% statewide and 79% for Developing Suburb-type municipalities. Additionally, 12% of all units are in two- to four-family buildings, and 13.3% are in multi-family buildings with five or more units. Mobile home parks occupy a small tract near the Turnpike on Water St. and Bradley St. in the northeast section of Town, which is for senior residents only.[vii] Clarke Court provides affordable housing for economically challenged families. Central block, now known as 57 Main Street, was renovated to offer affordable housing on its upper floors, maintaining the first floor as retail space.

Lee provides various senior housing options, including Hyde Place on Main St. and Brown Memorial Court on Marble Street, which are short distances from the Housatonic River. Moreover, the old Lee Central School on High Street serves as additional senior housing – Crossway Village and Crossway Towers. The Council of Aging (COA) runs or coordinates senior services, including transportation, nutrition, education, exercise, and social programs. The COA works with Elder Services of Berkshire County and networks with other organizations to provide additional resources to the elderly community and their families.

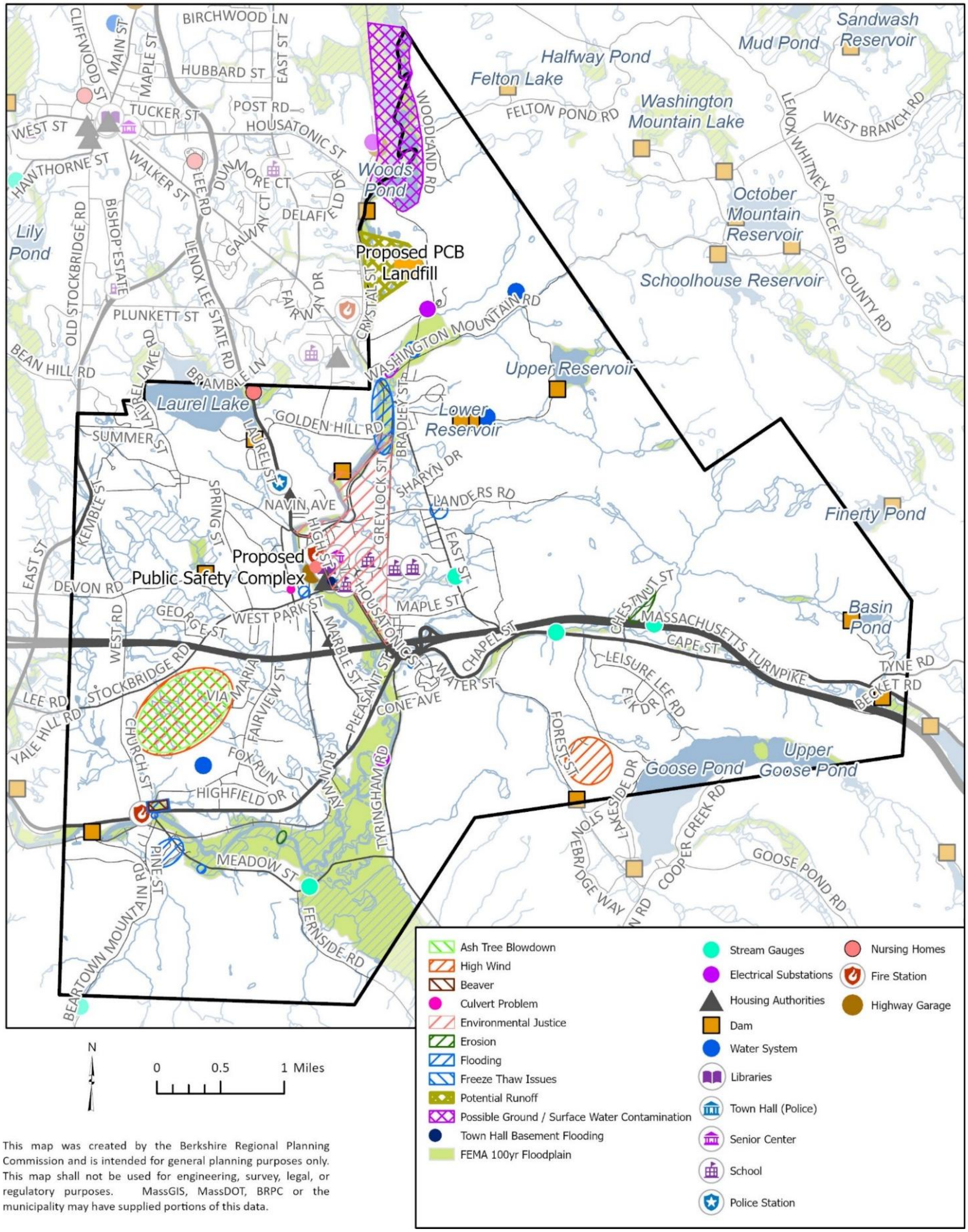
Income disparity can significantly contribute to vulnerability during natural disasters. In communities with uneven financial resources, those with lower incomes often face more significant challenges in preparing for, responding to, and recovering from natural disasters. As per the Massachusetts Environmental Justice Mapper, Lee's census tract 9141 is identified as an environmental justice community due to income disparity, with 25% of households earning 65% or less than the state's median household income.[viii] This tract contains a population of 956 in 300 households in a residential section in the center of the Town between Main St. and Greylock St. [ix]

Figure 1.2 Topography of Lee, MA




This map was created by the Berkshire Regional Planning Commission and is intended for general planning purposes only. This map shall not be used for engineering, survey, legal, or regulatory purposes. MassGIS, MassDOT, BRPC or the municipality may have supplied portions of this data.

Figure 1.3 Town of Lee Critical Facilities and Areas of Concern




This map was created by the Berkshire Regional Planning Commission and is intended for general planning purposes only. This map shall not be used for engineering, survey, legal, or regulatory purposes. MassGIS, MassDOT, BRPC or the municipality may have supplied portions of this data.

[i] Some actions are critical to both improving capacity and achieving hazard mitigation goals, reinforcing the connection between capacity building and mitigation efforts. As such, some actions appear in both Chapter 4 and Chapter 5

[ii] U.S. Census Bureau. (2022), Table LN110210. July 1, 2022 https://www.census.gov/quickfacts/fact/table/leetownberkshirecountymassachusetts/LND110210

[iii] Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services, 2016. Agriculture listed here includes tax parcels listed as agricultural, pasture/hay, and cultivated lands, while commercial, industrial, and residential development includes mixed uses and tax-exempt parcels.

[iv] Data source: MassDOT Traffic Count Database. The referenced traffic counter is situated 5 miles north of Lee on Route 7 /junction of 7A and may not comprehensively capture the entirety of traffic volume entering and exiting the town.

[v] https://www.mass.gov/info-details/public-registry-of-lodging-operators

[vi] Census Bureau ACS 5-year Estimate. https://datausa.io/profile/geo/lee-ma

[vii] Metropolitan Area Planning Council. Basic Housing Needs Assessment for Lee. Housing MA. Web. 20 Jul 2023. www.housing.ma/lee/report

[viii] https://www.mass.gov/info-details/massgis-data-2020-environmental-justice-populations.

[ix] US Census Bureau, 2020

# Chapter 2 PLANNING PROCESS

44 CFR § 201.6(b) & 44 CFR § 201.6(c)(1)

## Introduction

This chapter outlines the development of the Town of Lee Hazard Mitigation and Climate Adaptation Plan (HMCAP). It identifies who was involved in the process, how they were involved, and the methods of public participation employed. During the drafting stage, an open public involvement process was essential to developing the HMCAP. Chapter 6 will discuss how the community will continue public participation in the plan maintenance process (44 CFR § 201.6(c)(4)(iii)).

The Town retained the Berkshire Regional Planning Commission (BRPC) to aid them in developing the HMCAP and the MVP Plan. The Lee HMCAP is a compilation of data collected by BRPC, information gathered from the Lee Hazard Mitigation and Municipal Vulnerability Preparedness Committee (the HMP/MVP Committee) during meetings, and interviews conducted with key stakeholders outside of working meetings. The Lee HMCAP reflects comments provided by participants and the public through the MVP planning process, the Planning Committee, local officials and citizens, neighboring towns, and ultimately MVP, MEMA, and FEMA.

## Planning Meetings and Participation

44 CFR § 201.6(c)(1)

During the HMCAP planning process, there was an opportunity for public comment by town residents, neighboring communities, local and regional agencies or partners involved in hazard mitigation activities, and agencies that have the authority to regulate development. Input was also sought from businesses, academics, and other private and non-profit interests during the planning process. Making the document available to the public for review meets requirements of 44 CFR § 201.6(b)(1), and solicitation of comment from neighboring towns meets requirements of 44 CFR § 201.6(b)(2), pertaining to the involvement of regional partners in the planning process. See Appendices for documentation.

In 2022, the Town of Lee formed the Hazard Mitigation/Municipal Vulnerability Preparedness Committee (the Planning Committee) to steer the process. Members of the Planning Committee include town department heads, town boards, and representatives from the citizenry. The HMCAP members are listed in Table 2.1 The HMCAP committee held a series of meetings to assemble data on the Town's infrastructure, identify known hazards to residents, including visitors and seasonal residents, and review existing plans, procedures, bylaws and protections already in place.

In September 2023, the Committee held a Community Resilience-Building (CRB) Workshop, which over thirty people attended, consisting of town officials, residents, community groups, stakeholder organizations, and emergency responders. The town of Lee utilized the CRB workshop to collect input from as diverse a group of community members and stakeholders as possible, with particular outreach to climate-vulnerable populations such as individuals over 65 and student groups. Invitations were sent to residents and stakeholders through emails, phone calls, and flyers. Core team members contacted invitees directly to encourage participation and ensure receipt of an invitation. Workshop participants are listed in the table below.

Table 2.1 Workshop Attendee List

| Name | Affiliation |
|---|---|
| Facilitators | |
| Courteny Morehouse | Berkshire Regional Planning Commission – Project Coordinator |
| Britney Danials | Berkshire Regional Planning Commission |
| Nick Russo | Berkshire Regional Planning Commission |
| Wiley Goodman | Berkshire Regional Planning Commission |
| Seth Jenkins | Berkshire Regional Planning Commission |
| Sherdyl Fernandez-Aubert | Berkshire Regional Planning Commission |
| HM/MVP Core Team | |
| Joan Angelo | Greening the Gateway Community |
| Gail Ceresia | Resident/Wetland Scientist |
| Lenny Tisdale | Lee Highway and Water Department |
| Chris Brittain | Town Administrator |
| Chief DeSantis | Lee Police Department |
| Chief Brown | Lee Fire Department |
| Rob Wright | Board of Public Works |
| Beth Mead | Planning, Zoning, and Land Use |
| Sarah Navin | Admin Accessor |
| Workshop Attendees | |
| Perry Flood | Kiwanis Club |
| Richard Brittain | Son of Italy |
| Tom Swift | Lions Club |
| Adam Mead | Fire Captain |
| Libby Mead | Youth Representative from Lee High School |
| Father McGrath | St. Mary's Church |
| Jordan Meyers | Lee Public School |
| Lindsey Cysz | Lee Land Trust |
| Travis Clairmont | DCR Forester |
| James Wilusz | Tri-Town Health |
| Deb Pedericini | Lee Housing Authority |
| Pat Digrigoli | Council of Aging |
| Susan Stone | Historical Commission |
| Harold Sherman | Laurel Lake Commission |
| Stephen Boyd | CEO Boyd Technologies |
| Andrew Bergowicz | Onyx Papers |
| Lee Donsbough | Lee Bank |
| John Philpott | Goose Pond District/ Chamber of Commerce |
| Nico | Youth Rep from Lee High School |
| Gordon Bailey | Select Board |
| Matt Kosiorek | College Internship Program |
| Kathy Hall | Youth Commission |

## Public Comment on the Draft MVP Plan and HMCAP

*to be inserted once the public comment period closes*

## Environmental Justice Populations

According to information provided by the Executive Office of Energy and Environmental Affairs (EEA), in Massachusetts, an environmental justice population is a neighborhood where one or more of the following criteria are true:

- the annual median household income is 65 percent or less of the statewide annual median household income
- minorities make up 40 percent or more of the population
- 25 percent or more of households identify as speaking English less than "very well"
- minorities make up 25 percent or more of the population, and the annual median household income of the municipality in which the neighborhood is located does not exceed 150 percent of the statewide annual median household income.

## Municipal Vulnerability Preparedness (MVP) Workshop

The central objective of the workshop was first to review regional weather events from the past and climate change data and projections, then collect local data from attendees to help:

1) Define top local natural and climate-related hazards of concern;
2) Identify existing and future strengths and vulnerabilities;
3) Develop prioritized actions for the community;
4) Identify immediate opportunities to advance actions to increase resilience collaboratively

## Categories of Concerns and Challenges

Major themes that came out of the initial public participation in Lee highlighted the common vision residents and stakeholders have for the resilience of the entire region. These themes were about more than specific concerns or challenges but about how they wanted to address vulnerabilities and build upon existing strengths. The following summarizes the categories that will be discussed in further detail throughout the plan, with specific steps to accomplishing the vision in the Action Plan, which is detailed in the Mitigation Strategy.

Flooding

Dams

Emergency Management

Hazardous Materials

## Incorporation of Existing Information

44 CFR § 201.6(b)(3)

No plan should be created in a silo, particularly a hazard mitigation plan, because of its applicability to land use, municipal and emergency services, and vulnerable people. This is especially important for small towns like Lee, who work closely with their neighbors to address issues on a larger, regional scale. This HMCAP update incorporates relevant data and information from existing plans, plans in development, studies, reports, and technical information. Main data sources and local plans include:

- Berkshire County Hazard Mitigation Plan, 2012
- Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP), 2018
- Town of Lee Comprehensive Emergency Management Plan, 2021
- Massachusetts State Climate Assessment Report, 2022
- Goose Pond Emergency Action Plan, 2022
- Laurel Lake Emergency Action Plan, 2023
- MA State Hazard Mitigation and Climate Adaptation Plan 2023
- Capital Improvement Plan FY 24-28
- Town of Lee Master Plan 2024

This plan should be used in conjunction with other local and regional plans, specifically transportation and capital improvement programs, Comprehensive/Master Plan, lake management plans, and emergency preparedness planning.

The flood hazard assessment for the Town of Lee relies on data from the 1982 Flood Insurance Study (FIS) conducted by FEMA. The FIS provides detailed hydrologic and hydraulic analyses, including historical flood events, base flood elevations (BFEs), and flood zone delineations. This technical data underpins the Flood Insurance Rate Map (FIRM), which visually represents flood risks and floodplain boundaries, serving as a critical tool for local planning and flood management.

The FIRM, derived from the FIS, identifies flood-prone areas and establishes regulatory requirements for development and flood insurance. Figure 3.3: The Town of Lee Floodplain Map Based on 100-Year Floodplain FIRM Data illustrates the flood vulnerabilities identified in Lee, focusing on the Housatonic River, its tributaries, and nearby critical facilities. Together, the FIS and FIRM provide a comprehensive framework for assessing and mitigating flood risks.

# Chapter 3 RISK ASSESSMENT

44 CFR § 201.6(c)(2)

## FEMA Requirements

In accordance with 44 CFR § 201.6 (c)(2), this risk assessment provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. The risk assessment analyzes the hazards and risks facing the Town of Lee. It contains hazard profiles and loss estimates to serve as the scientific and technical basis for mitigation actions. This chapter also describes the decision-making and prioritization processes to demonstrate that the information analyzed in the risk assessment enabled the Town to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards. This section also provides information on previous occurrences of hazard events and on the probability of future hazard events with consideration to climate change (44 CFR § 201.6(c)(2)(i). This plan also includes a section on Invasive Species and Vector-borne illnesses because this growing threat could disable critical facilities and the essential services they provide to the community.

### *People*

The total population, according to the 2021 United States Census, is 5,784 with an average of approximately 211 people per square mile. Lee has the second largest population in the southern half of Berkshire County after Great Barrington (7,169). There are 2,306 households in Lee with an average 2.42 per household. The American Community Survey reports a median age of 47.8, exceeding Berkshire County by 0.6 years and Massachusetts by 8.2 years. The median household income for Lee residents is $73,750, marginally lower than Berkshire County's $74,17, and is approximately 61% of the median household income for Massachusetts ($120,626). The poverty rate stands at 3.6 %, constituting one-third of Berkshire County's overall rate, which is 11.9%. [i]

Like much of the Berkshires, Lee population makeup consists of adults aged 65 and older. Two notable population segments are held by groups 40 to 44 and 55 to 59, with the smallest age group being children under 5. Lee's population dynamics reveal a mix of growth and declines across different age brackets from 2017-2021. Younger populations experienced declines, with an 11% decrease in both the under-5 and 5-to-9 age groups. The 15-to-19 age group, however, grew by 16%, while the 20-to-29 age bracket saw notable declines. Positive growth was observed among the 30-to-34 and 70-to-74 age groups. Older adults showed substantial increases, with a 17% rise in the 75-to-79 group, 8% in the 80-to-84 group, and 12% in those 85 and older.[ii],[iii]

Lee's housing inventory encompasses owner-occupied, rental, and seasonal. As of 2021, owner-occupied homes constituted 76% and renter-occupied 24% of the housing stock for full-time residents. Over the past decade, there has been a 14% decrease in the overall number of housing units, but owner-occupied units have remained the majority. In comparison, the number of renter-occupied units has fluctuated, peaking at 36% in 2018 but declining to the lowest (24% as of 2021). According to 2021 data, the median year of construction for the housing stock is 1959, a figure closely aligned with other urban areas in the county. Seasonal homes make up 12% of the housing stock, which is relatively low compared to neighboring towns of Stockbridge and Becket, where seasonal homes exceed more than 45%.

Unlike its rural neighbors, Lee offers a range of economic opportunities, employing 3,210, which has remained relatively stable from 2009 to 2019. However, the COVID pandemic significantly disrupted these economic prospects. Recent census data indicates a gradual recovery, with 2,914 employed in the Town of Lee. [iv] Residents also have easy access to U.S. Route 20 and 7, key thoroughfares through the Berkshires connecting to Pittsfield, the largest urban and economic center. The average commuting time to work is 21 minutes via car. Public transportation in Lee is facilitated by local bus routes connecting to two downtown hubs and other key locations within Berkshire County. Bus services outside these hubs are limited and can pose challenges navigating to other parts of town using public transportation. Of those who commute, 87.8% work in Berkshire County, and 11% work in nearby Connecticut or New York.

Lee has four identified vulnerable populations. The Executive Office of Energy and Environmental Affairs (EEA) lists one census tract as an environmental justice (EJ) community based on the criteria that at least 25% of households have a median household income of 65% or less than the Massachusetts median household income. This tract contains a population of 956 in 300 households in a residential section in the Town center between Main St. and Greylock St. Nineteen percent are school-aged children. Over one-quarter of the population (28%) are seniors. Mobile home neighborhoods are on Water St. near the Turnpike and Bradley Park in the northeast section of Town, which is for senior residents only.

Within a one-mile radius of the town's epicenter along Route 20/Main St., a hub for local businesses church services, town facilities, education and shopping thrives. This central area also boasts numerous cultural and recreational attractions, including Laural Lake beach, athletic fields, and the Premium Outlet shopping, catering to both residents and tourists. When it comes to people, daily visitors and seasonal tourism peaks need to be factored in in addition to full-time residents. Crowds visiting attractions in Lee bring in a new level of exposure and vulnerability to hazards.

### *Economy*

The Town's total FY22 budget was $21.6 million. The majority of the revenue is from taxes, which make up 75% of the budget, while 17 % consists of state revenue and grants, 7% service charges, and less than 1% a small mix of licenses, permits, and federal ARPA funds. [v] The top five industries in Lee are education, healthcare and social services, accommodation and food service, retail trade, manufacturing, and construction.

### *Built Environment*

The built environment of the town of Lee is a critical focal point in comprehensive Hazard Mitigation planning. Understanding the intricacies of the built environment is essential to crafting effective mitigation strategies that will safeguard the town and its residents in the face of various threats. 44 CFR § 201.6 (c)(2)(ii)(C) asks that vulnerability in the risk assessment be addressed in terms of land uses and development trends within the community so that mitigation options can be considered in future land use decisions. Future planning investments in Lee include the adaptive reuse of abandoned mill buildings, a new public safety complex, and many other facility improvements. Given these new developments, proactive hazard resilience planning is a matter of urgency to ensure people and assets are not placed in harm's way, and opportunities to integrate projects. Critical facilities are the buildings and infrastructure hubs that are necessary for continued operation during a hazardous event. Table 3.1 shows Lee's Critical Facilities, and Figure 1.3 provides a map of the critical facilities and areas of concern. These facilities were digitized into GIS and used to determine their vulnerability to various hazards.

Table 3.1 Lee's Critical Facilities

| Facility and Function | Address |
|---|---|
| **Town Hall:** Town Offices, Public Meeting Space, Dept Public Works, and Fire Chief Office. | 32 Main St. |
| **Lee Fire Department:** Emergency services & rescue equipment, Emergency Operations Center | 179 Main St. |
| **Senior Center:** Public Meeting Space, Senior Services, Council on Aging | 21 Crossway St |
| **Lee Youth Association:** Daycare center, youth sports center | 480 Pleasant St. |
| **Lee Middle and High School:** Emergency center, vulnerable population center | 300 Greylock St. |
| **Lee Elementary School:** Emergency center, vulnerable population center | 310 Greylock St. |
| **Tri-Town Health**: Public Health | 45 Railroad St. |
| **Library**: Public Meeting Space | 100 Main St. |
| **Highway Garage:** Highway Department | 35 Railroad St. |
| **Eversource Woodland Substation**: Communications Facility | Willow Hill Rd. |
| **Wastewater Treatment Plant**: public utility | 379 Pleasant St. |
| **Crossway Village**: Housing for Vulnerable Populations | 21 Crossway St. |
| **Marble St Housing:** Housing for Vulnerable Populations | 10/12 Clarke Court |
| **Clarke Court:** Housing for Vulnerable Populations | 185 Marble St. |
| **Hyde Place:** Housing for Vulnerable populations | 46 Railroad St. |

The Town of Lee maintains approximately 60.1 miles of roads, and the Massachusetts Department of Transportation (MassDOT) maintains an additional 11.39 miles of major state roads, including Route 20, Route 102, Route 7, and I-90.[vi] Route 20 is the main entry point to Lee, serving travelers from the central county and providing access to the highway. It plays a vital role in both local navigation within the town and the flow of tourists exploring the county, particularly from I-90 and Route 7 northbound.

### *Natural Environment*

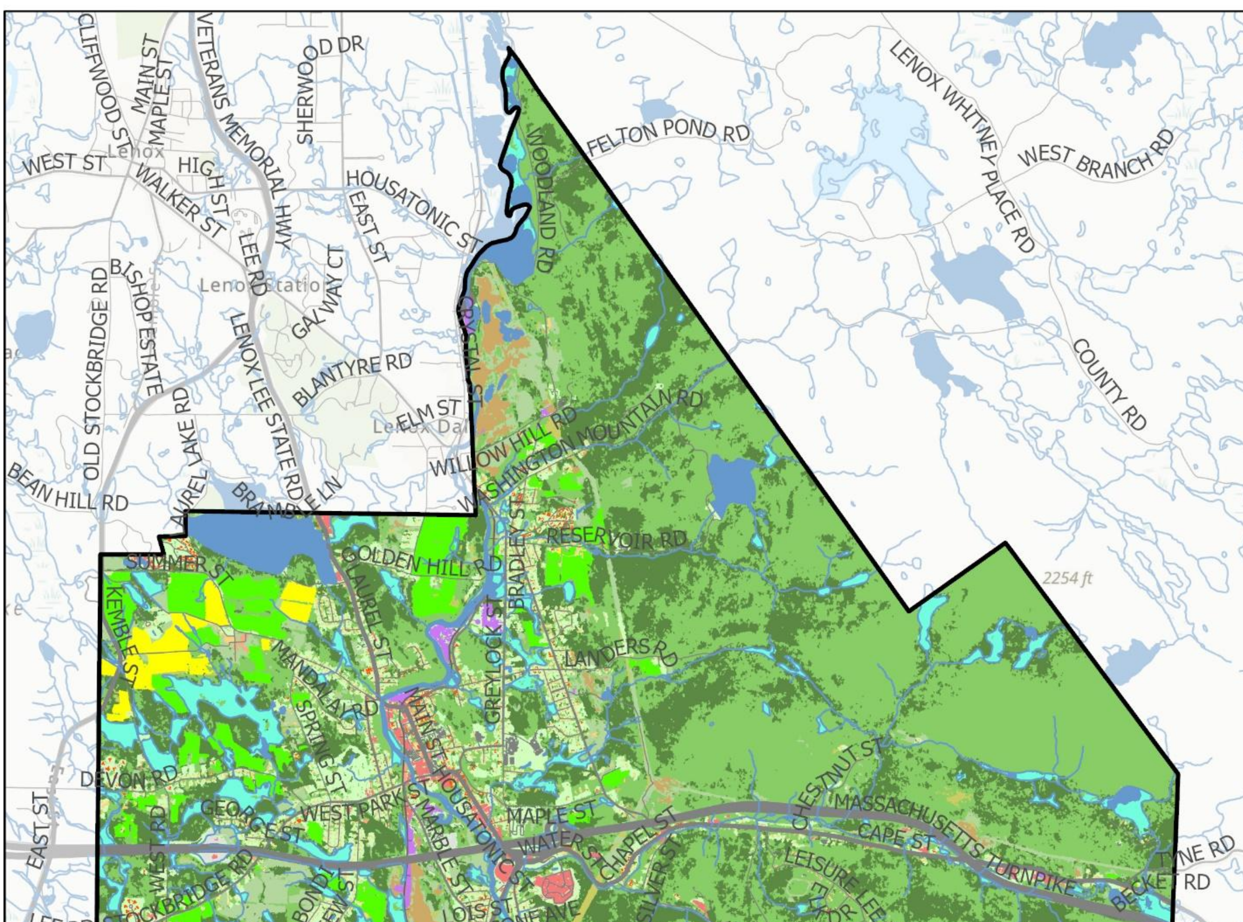
The natural environment is a vital community asset, providing benefits like clean air and water, carbon storage, wildlife habitat, and mental well-being. While disasters such as floods, fires, and storms can damage these ecosystems, they also play a role in natural renewal. In contrast, the built environment is often more vulnerable to destruction. Balancing natural and human-made systems is essential for community safety and resilience.

Lee has an abundant amount of natural space where 57% (9,943 acres) of its total acres are considered conservation or protected lands, most of which is private land in protected status or Chapter 61. These lands include forests, wetlands, water bodies, watercourses, and other open spaces and recreational areas. [vii] Notably, forests constitute around 64% of the town's overall land area, as shown in Figure 3.1 Town of Lee Land Use. Lee's natural landscape also consists of the Housatonic River which enters from the north, winding along the northern boundary shared with Lenox, and then flowing south through the town before making a sharp westward turn at Beartown Mountain.

Lee's lowlands belong to the Western New England Marble Valley's ecological region, a highly distinct and biologically diverse region in Massachusetts and throughout New England. This ecoregion is a vital habitat for many of Massachusetts' state-listed species and Priority Natural Communities. Some of these species are exclusive to the ecoregion, while others are found more broadly. The town boasts three moderately sized lakes: Laurel Lake and Woods Pond in the north and Goose Pond in the south. These bodies of water and the adjacent marshlands in the marble valleys along the Housatonic River and Hop Brook provide habitat for numerous rare and priority species. [viii]

The largest parcels of protected natural spaces are in South and East Lee as part of the October Mountain and Beartown State forests and Hop Brook Wildlife Management Area all of which are considered priority conservation areas. These state forests account for 2776 acres or 51% of all conservation land within the Town. Throughout Lee, there are 3,419 acres of forest core, 291 acres of wetland core, 809 acres of vernal pool core, and 1546 acres of rare species core. Other priority conservation areas include 244 acres around Laurel Lake in northwest Lee, which supports several state-listed upland plant species. These natural spaces also have recreational activities, including hunting, camping, fishing, snowmobiling, and cross-country skiing, and support significant tourism through outdoor recreation.

Figure 3.1 Town of Lee Land Use



### *Hazard Identification and Risk Assessment Processes*

In order to identify potential hazards that can affect the Town of Lee, a number of interviews of local Town staff and stakeholders were held. Surveys were conducted Town wide, and hazards described in neighboring town Hazard Mitigation Plans were included. Hazards were characterized further through a workshop of major stakeholders and research that included archival newspapers going as far back as 1930s. The hazards identified through these sources were Flooding, Dam Failure, Wildfire, Snow, High Wind, and Other Natural hazards (i.e. severe storms and tornadoes). To build on this list, the 2018 *Massachusetts State Hazard Mitigation and Climate Adaptation Plan* (SHMCAP) for the Commonwealth of Massachusetts was consulted. Accounting for the location, natural and built environments, history, and scientific studies of the area, it was determined that the Town of Lee must plan for the following hazards:

- Flooding (including Dams, Ice Jam, Beaver Activity)
- Severe Winter Event (Ice Storm, Blizzard, Nor'easter)
- Severe Storms (High Wind, Thunderstorms)
- Drought
- Annual / Extreme Temperatures
- Invasive Species
- Tornado
- Hurricane & Tropical Storms
- Wildfire
- Landslide
- Earthquake
- Vector-borne Diseases
- Cybersecurity Threats
- Hazardous Material

The Core Team reviewed and omitted the following natural hazards because Lee is too far inland to be impacted directly by coastal-related hazards:

- Coastal hazards
- Coastal erosion
- Sea level rise
- Tsunamis

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[i] U.S. Census Bureau (2021). American Community Survey 5-year estimates. Retrieved from Census Reporter Profile page for Lee, Berkshire County, MA
[ii] U.S. Census Bureau (2021). American Community Survey 5-year estimates. Retrieved from Town of Lee, Berkshire County Table S0101 from 2017-2021.
[iii] U.S. Census Bureau (2021). American Community Survey 5-year estimates. Retrieved from Town of Lee, Berkshire County Table DP05 from 2017-2021.
[iv] US. Census Bureau (2019). American Community Survey 5-year estimates. Retrieved from Tables ACSST5Y209 and ACSST5Y2021.
[v] Department of Revenue, Division of Local Services. Accessed on 10/18/23. Data retrieved from https://dlsgateway.dor.state.ma.us/reports/rdPage.aspx?rdReport=ScheduleA.GenFund_MAIN
[vi] Town of Lee FY 22 Annual Report. https://www.lee.ma.us/home/news/fy22-annual-town-reports

vii Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services, 2016

viii https://www.mass.gov/doc/lee/download, https://www.mass.gov/info-details/biomap-town-report-lee

# Inland Flooding, Including Dam Impacts

## *Hazard Profile*

Inland flooding results from moderate precipitation over several days, intense precipitation over a short period, or melting snowpack. Developed, impervious areas can contribute to inland flooding. [i] Common types of local or regional flooding including riverine, ground failures, ice jams, dam overtopping or failure, beaver activity (tree removal, dam construction, and dam failure), levee failure, and urban drainage. Overbank flooding occurs when water in rivers and streams flows into the surrounding floodplain or into "any area of land susceptible to being inundated by floodwaters from any source (MEMA & EEOEA SHMCAP, 2018). The hazards that produce these flooding events in the area include spring melt, hurricanes, tropical storms, heavy rain events, winter rain-on-snow, thunderstorms, and recovering beaver populations. This Inland Flooding section will focus on flood impacts due to severe precipitation events that result in impacts approaching the 100-year event or caused significant damages and on potential dam failure risk. Hurricanes/tropical storms, winter-related flooding, thunderstorms, and flood-related contamination are discussed in later sections.

## *Likely Severity*

In general, the severity level of flood damage is affected by flood depth and flood velocity. The deeper and faster flood flows become, the more power they have thereby inflicting greater damage. Shallow flooding with high velocities can cause as much damage as deep flooding with slow velocity. This correlation is especially true when a channel migrates over a broad floodplain, redirecting high-velocity flows and transporting debris and sediment. However, flood damage to homes and buildings can occur even during shallow, low-velocity flows that inundate the structure, its mechanical system, and furnishings.

The frequency and severity of flooding are measured using a discharge probability, which is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. The 100-year flood elevation or discharge of a stream or river has a 1% chance of occurring or being exceeded in any given year. In this case, the statistical recurrence interval would be 100 years between the storm events that meet the 100-year discharge/flow. With a 1% chance of occurrence, such a storm is commonly called the 100-year storm. Similarly, the 50-year storm has a statistical recurrence interval of 50 years, and an "annual flood" is the greatest flood event expected to occur in a typical year. It should be understood, however, that these measurements reflect statistical averages only; two or more floods with a 100-year flood discharge can occur in a short time period.
A dam is an artificial barrier that can impound water for storage or flood control. Ten dams in Lee have the potential to cause damage if they were to fail in some way. These are listed in Table 3.2 Dams with the Potential to Impact Lee, and their locations are shown on Figure 1.3. Size class may be determined by either the volume of water stored or height, whichever gives the larger size classification. Small impoundments store between 15-50 acre-feet, Intermediate impoundments store 50-1,000 acre-feet, and large impoundments store over 1,000 acre-feet. An acre-foot is defined as enough water to cover one acre of land one foot deep, which equals slightly less than 326,000 gallons.

The Hazard Potential Classification rating pertains to potential loss of human life or property damage in the event of failure or improper operation of the dam or appurtenant works. Low Hazard dams are those that are defined as being located where failure or mis-operation may cause minimal property damage to others, and loss of life is not expected. High Hazard and Significant dams are those located where failure will likely cause loss of life and serious damage to home(s), industrial or commercial facilities, important public utilities, main highway(s) or railroad(s).[ii] In Lee, there are three significant hazard-rating dams in the Housatonic River and two high-hazard-rating dams at isolated bodies of water, which can be referenced in Table 3.2 below.

Probable future development of the area downstream from the dam that would be affected by its failure shall be considered in determining the classification. Even dams that, theoretically, pose little threat under normal circumstances can overspill or fail under the stress of a cataclysmic event such as an earthquake or sabotage. Dam owners are legally responsible for having their dams inspected on a regular basis.

### *Probability*

Table 3.2 Dams with the Potential to Impact Lee

| Name and Year Completed | Hazard Code | Size Class (Max. acre-feet storage) | Inspection Date & Condition | Owner |
|---|---|---|---|---|
| Woods Pond Dam, 1864 but rebuilt in 1989 | Significant Hazard | Large (5,300) | 2021, Satisfactory | Private |
| Columbia Mill, 1901 | Significant Hazard | Intermediate (100) | 2022, Poor | Private |
| Willow-Hurlbut Dam, 1872 | Significant Hazard | Intermediate (250) | 2022, Satisfactory | Private |
| Laurel Lake Dam, | High Hazard | Intermediate (1577) | 2020, Satisfactory | Private |
| Leahy (Upper) Reservoir Dam | High Hazard | Large (1,100) | 2008, Satisfactory | Town of Lee |
| *Diversion Dam | N/A | | | Private |
| *Gamelli Lake | N/A | | | Private |
| *Perkins Dam | N/A | | | Private |
| *Lake Lee Dam | N/A | | | Private |
| *Source: Office of Dam Safety, 2012. Note: Some records may be out of date if procured by Office of Dam Safety prior to 2012. *Non-jurisdictional dams are defined as being less than 6 feet in height and store less than 15 acre-feet of water. There is no data available on the condition of these because inspections are not regulated by the Office of Dam Safety.* | | | | |

The extent of the area of flooding associated with a 1% annual probability of occurrence (the base flood or 100-year flood), most commonly termed the 100-year floodplain area, is a tool for assessing.

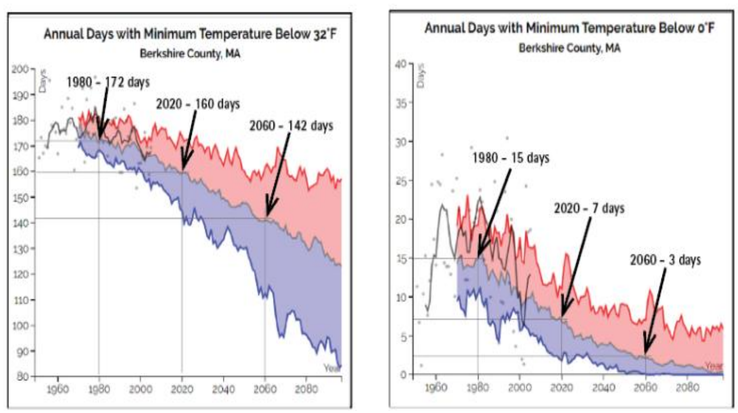
vulnerability and risk in flood-prone communities. The 100-year flood boundary is used as the regulatory boundary by many agencies, including FEMA and MEMA. Most municipalities also use this boundary when regulating development within flood-prone areas. The FEMA Flood Insurance Rate Maps (FIRM) developed in the early 1980s for Berkshire County typically serve as the regulatory boundaries for the National Flood Insurance Program (NFIP) and municipal floodplain zoning.

Due to high slopes and minimal soil cover, Western Massachusetts is particularly susceptible to flash flooding caused by rapid runoff during heavy precipitation combined with spring snowmelt. These conditions contribute to riverine flooding. Frozen ground conditions can also contribute to low rainfall infiltration and high runoff events that may result in riverine flooding. Berkshire County is particularly susceptible to flash flooding because its ground is frozen for a more extended period compared to the rest of the state.[iii] According to the Northeast Climate Adaptation Science Center, the county is projected to experience a more than 6.3% annual total precipitation increase by 2030, with a greater increase of 8.2% in the spring. Additionally, the temperature is likely to reach 28° by October 22nd, with a 90% chance of ground-freezing conditions until May 20th the following year. [iv] Future projections for annual days below freezing and deep freezing are expected to decrease, and freeze-thaw cycles will increase, leading to a higher potential for flooding during moderate to heavy precipitation and snowmelt.  These conditions are likely to increase inland flooding.

Table 3.3 Recurrence Intervals and Probabilities of Occurrences

| Recurrence interval | Probability | Percent chance |
|---|---|---|
| | | |
| 500 | 1 in 500 | 0.2 |
| 100 | 1 in 100 | 1 |
| 50 | 1 in 50 | 2 |
| 25 | 1 in 25 | 4 |
| 10 | 1 in 10 | 10 |
| 5 | 1 in 5 | 20 |
| 2 | 1 in 2 | 50 |

Figure 3.2 Decreasing trend of projected annual days in temperatures below 0 degrees Fahrenheit over a 120-year period.



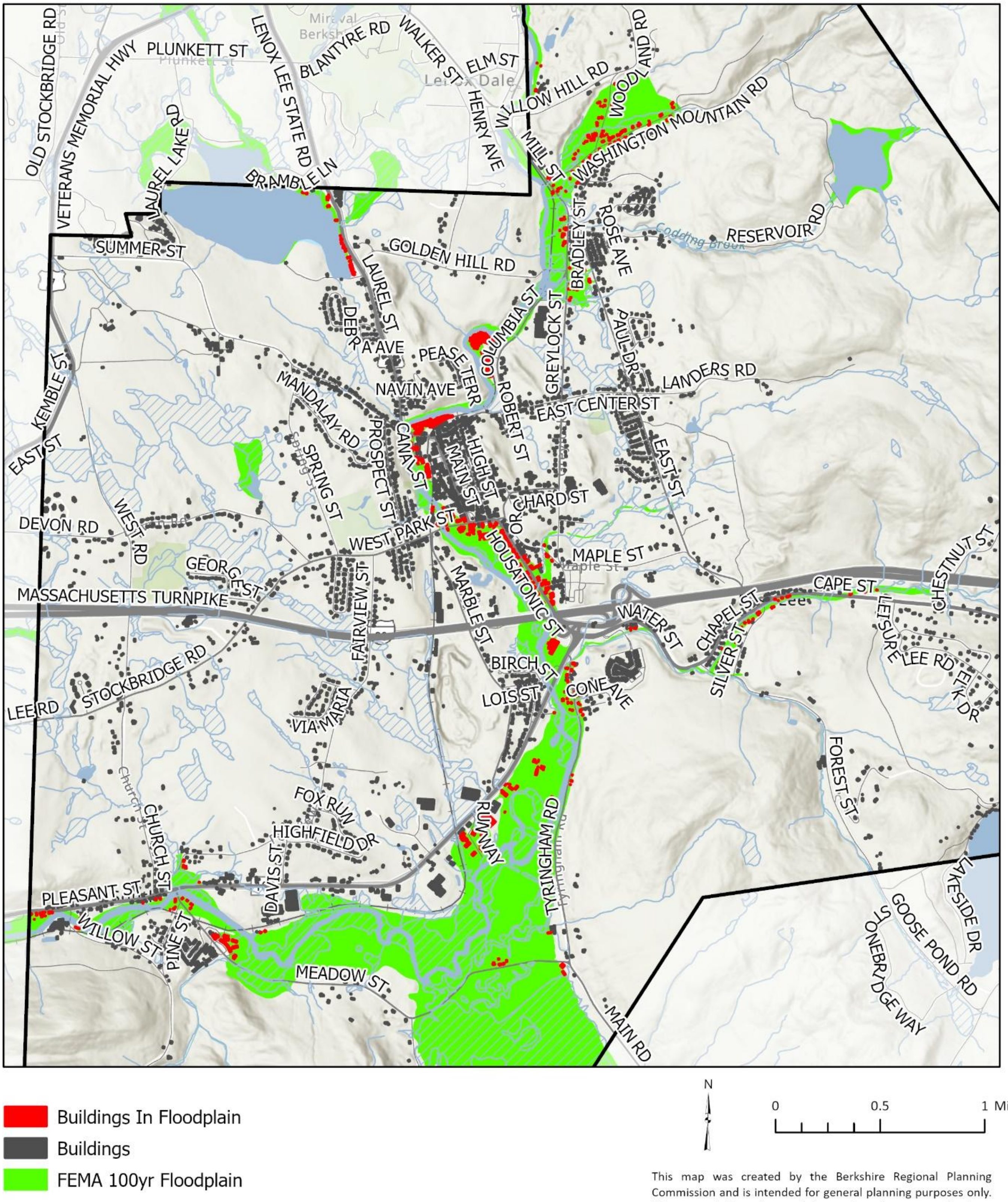

Factors that contribute to dam failure include design flaw, age, over-capacity stress and lack of maintenance.  There are two primary types of dam failure: catastrophic failure, characterized by the sudden, rapid, and uncontrolled release of impounded water, or design failure, which occurs as a result of minor overflow events. Dam overtopping is caused by floods that exceed the capacity of the dam, and it can occur as a result of inadequate spillway design, settlement of the dam crest, blockage of spillways, and other factors. Overtopping accounts for 34% of all dam failures in the U.S.[v]

In Massachusetts the Office of Dam Safety, within the DCR, is the regulating authority that oversees dam safety.

By state law, dam owners are legally responsible for maintaining their dams, inspecting them on a regular basis and liable for damages and loss of life that occur as a result of a dam failure. Significant Hazard dams must be inspected every five years and Low Hazard dams must be inspected every 10 years. Owners of Significant Hazard dams are required to develop Emergency Action Plans (EAP). This Plan would include a notification flow chart, list of response personnel and their responsibilities, a map of the inundation area that would be impacted, and a procedure for warning and evacuating local residents in the inundation area. The EAP would be filed with local and state emergency agencies. The Town of Lee has four dams with a Significant Hazard Code. These dams have current EAPs that are held by the Town Administrator, Police, Fire Department, the EMD and the Towns of Lenox and Stockbridge for additional emergency assistance.

Figure 3.3 Town of Lee Flood plain - FEMA 100-year floodplain FIRM data

BRPC



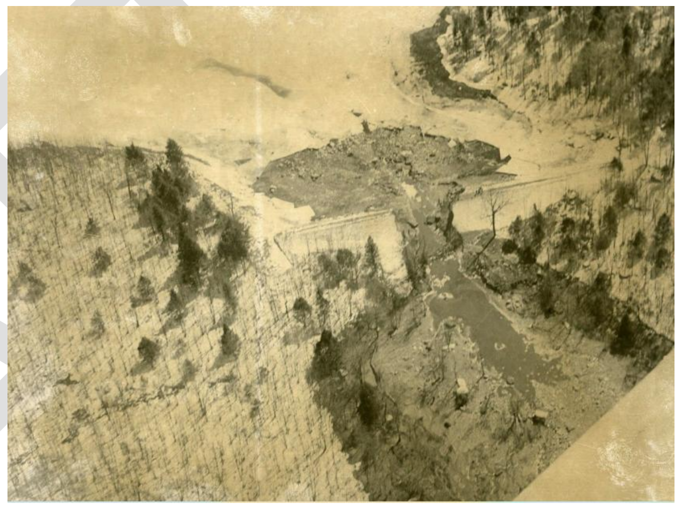

This map was created by the Berkshire Regional Planning Commission and is intended for general planning purposes only. This map shall not be used for engineering, survey, legal, or regulatory purposes. MassGIS, MassDOT, BRPC or the municipality may have supplied portions of this data.

### *Historic Data*

The Berkshires have never received a Federal declaration of a flooding-related disaster. There have been dozens of severe precipitation events that caused flooding in the Berkshire County region, the more severe of which are listed with a brief description in Table 3.4 with entries in bold denoting a 1% annual chance of flood events. The worst events in Lee's history are associated with heavy rain and flooding, which have destroyed homes and businesses and led to several deaths. The most catastrophic flooding was caused by The Mud Pond Dam failure on April 20, 1886, which caused destruction and heavy damage to 12 shops and industries along Greenwater Brook and resulted in the deaths of 7 people (MEMA & EEOEA SHMCAP, 2018).

"The Great Hurricane of 1938" was considered a 1% annual chance flood event. This flood caused damages of $70,000 for roads and bridges. Ten years later, in 1949, South Lee experienced severe flooding, resulting in one death and eight homes being isolated and evacuated. The flooding occurred as the Housatonic River exceeded its 1938 flood crest. In March 1968, the former Mud Pond Dam, known as Lee Lake Dam, breached again, destroying six homes and damaging 20 homes and a plant, resulting in two fatalities. Lawsuits reached over $5 million (Image 3.1).

Image 3.1 (1968) Lake Lee dam after breech. Digital Commonwealth.



Other catastrophic events in Lee's history include the flood caused by the "Great Rain Storm" in July 1915, which flooded trolley tracks with three feet of water and washed out six feet of tracks and one bridge. Additionally, in April 1987, a pair of spring storms produced record or major flooding in New England, leading to the Berkshires being declared a disaster area and 500 people were evacuated. The county received $600,000 in emergency funding for repairs. The latest event occurred in July 2021, when heavy rains caused flash flooding and closed roads.

Table 3.4: Previous Flooding Occurrences in the Berkshire County Region.

*(Entries in bold denote 1% annual chance flood events)*

| Date of Event | Description of Event |
|---|---|
| April 1886 | The Mud Pond Dam in East Lee failed on April 20, 1886, causing destruction or heavy damage to 12 shops and industries along Greenwater Brook and killing 7 people (MA State Hazard Mitigation Plan 2018). |
| July 1915 | "Great Rain Storm" floods trolly tracks with 3 feet of water and washed out 6 feet of tracks and one bridge. The region received over 8 inches of rainfall in 8 days (Berkshire Eagle 1915) |
| Nov 1927 | 3 days of heavy rain from a late season Hurricane brought 10 inches of rain, flooding homes near the Housatonic River (Berkshire Evening Eagle Nov 1927), |

| | |
|---|---|
| Sept 1933 | A heavy storm caused water to overflow the Housatonic, which flooded several fields, highways, and broke a main gas line. (Berkshire Evening Eagle 1933). |
| April 1936 | heavy spring rainfall combined with snowmelt, causing significant flooding along the Housatonic River and its tributaries. It was one of the most severe events recorded in the region, inundating residential and commercial areas and damaging infrastructure. (FIS 1982) |
| 1938 | "The Great Hurricane of 1938" was considered a 1% annual chance flood event in several. Flood damages for roads and bridges totaled $70,000 (Berkshire Eagle Sept 1938) |
| Jan 1949 | South Lee had severe flooding resulting in one death, with 8 homes being isolated and evacuated as the Housatonic River exceeded its 1938 flood crest (North Adams Transcript Jan 1949). |
| 1955 | Hurricanes Connie and Diane combined to flood many of the communities in the region and registering in 1% - 0.2% annual chance flood event (100-500-year flood event) (FEMA 1977-1991). |
| March 1968 | The former Mud Pond Dam, known called the Lee Lake Dam, destroyed 6 homes, damaging 20 homes and a plant, with 2 fatalities (mass.gov). Lawsuits reached over $ 5 million (Berkshire Eagle 1968). |
| April 1978 | Heavy rainfall and saturated soils resulted in the Housatonic River peaking at a discharge of 15,000 cfs. The flood inundated approximately 250 acres of residential, commercial, and industrial properties, causing significant damage. (FIS, 1982). **For context, the average streamflow for the Housatonic River is approximately 4,651 cfs during this time of year.* |
| May 1984 | 3 days of heavy rain caused main roads and highways to close. 10" of water was observed at Laurel Lake boat ramp. (Berkshire Eagle 1984). *In MA this event was 80-year event in the Housatonic River Watershed.* |
| June 1984 | Flooding of the Housatonic River caused $450,000 of damage to homes, farms, roads, and businesses throughout Lee and South Lee (Berkshire Eagle June 1984). |
| April 1987 | A pair of spring storms occurring in March and April 1987 combined with snowmelt to produce record or major flooding in New England. Berkshires were declared a disaster area and 500 people were evacuated. County receives $600,000 in emergency funding for repairs (North Adams Transcript, 1987). |
| Jan 1996 | Heavy rain and melting snow cause major flooding in basements and lead to major road closures. The Housatonic River was observed reaching the bottom of bridges. High winds snapped power lines and felled trees throughout the town (Berkshire Eagle, 1996). |
| Sept 1999 | The remnants from Hurricane Floyd brought between 2.5-5" of rain and produced significant flooding throughout the region. Due to significant amounts of rain and the accompanying wind, there were numerous reports of trees down. |
| Dec 2000 | A complex storm system brought 2-4" of rain with some areas receiving an inch an hour. The region had numerous reports of flooding |
| March 2003 | An area of low pressure brought 1-2" of rain, however this and the unseasonable temperatures caused a rapid melting of the snowpack. |

| | |
|---|---|
| Sept 2004 | The remnants from Hurricane Ivan brought 3-6" of rain. This, combined with previously saturated soils, caused flooding throughout the region. |
| Aug 2005 | The remnants of Hurricane Katrina dropped up to 4.17 of rain and caused gusty winds that blew down trees and tree limbs. State declares Berkshires a disaster zone (MA State Hazard Mitigation Plan 2018). |
| Oct 2005 | Remnants of Tropical Storm Tammy and Subtropical Depression Twenty-Two produced torrential rains over interior New England During this 10-day period, approximately 6 to 15 inches of rainfall occurred within New England River basins. Flooding was reported on the Hoosic and Housatonic rivers and in small streams, creeks, urban areas, and poorly drained areas due to rainfall exceeding an inch per hour. Lee reports 4 -5" of water on most roads. The Housatonic River reached 2 feet over flood stage. This series of storms resulted in a presidential disaster declaration (FEMA-DR-1614) and Massachusetts received over $13 million in individual and public assistance. (Berkshire Eagle 2005, MA State Hazard Mitigation Plan 2018). |
| Nov 2005 | Lee experiences significant flooding around Laurel Lake and several traffic accidents from heavy rain fall. (Berkshire Eagle, 2005). |
| April 2007 | A coastal storm brought wet snow, sleet, and rain to western Massachusetts. Snowmelt and heavy rain caused moderate flooding of small streams and creeks. Affected counties received over $8 million in public assistance from FEMA. The storm mainly rained due to warmer temperatures, but higher elevations experienced significant snow and ice (NWS). |
| Sept. 2007 | Moderate to heavy rainfall occurred, which lead to localized flooding. |
| Mar. 2008 | Heavy rainfall ranging from 1-3" impact the area. Combined with frozen ground and snowmelt, this led to flooding across the region. |
| Aug. 2008 | A storm brought very heavy rainfall and resulted in flash flooding across parts of the region. |
| Dec. 2008 | A storm brought 1-4" of rain to the region, with some areas reporting ¼ to 1/3 of an inch an hour of freezing rain, before changing to snow. Moderate flooding and ponding occurred throughout the region. |
| June 2009 | Numerous slow-moving thunderstorms developed across the region with intense rainfalls and up to 6" of hail. This led to flash flooding in the region. |
| Jan 2010 | A recent storm, melting snow and ice, and record-warm days led to rising water levels throughout the county (North Adams Transcript 2010). |
| Mar. 2010 | Heavy rainfall of 1.5-3" across the region closed roads due to flooding. |
| Oct. 2010 | The remnants from Tropical Storm Nicole brought 50-60 mph winds and 4-6" of rain resulting in urban flooding. |
| Aug. 2011 | Two distinct rounds of thunderstorms occurred producing heavy rainfall and localized flooding of roads. |
| Aug. 2011 | T.S. Irene tracked over the region with widespread flooding and damaging winds. Riverine and flash flooding resulted from 3-9 inches of rain within a 12-hour period. Widespread road closures occurred throughout the region. In MA, this event was a 1% annual chance flood event in the Hoosic River Watershed and a 50-year event in the Housatonic River Watershed. |

| | |
|---|---|
| Sept. 2011 | Remnants of Tropical Storm Lee brought 4-9" of heavy rainfall to the region. Due to the saturated soils from T.S. Irene, this rainfall led to widespread flooding on rivers as well as small streams. |
| Aug. 2012 | Remnants from Hurricane Sandy brought thunderstorms repeatedly bringing heavy rains over the region. Upwards of 4-5" of rain occurred and flash flooding caused the closure of numerous roads. |
| May 2013 | Thunderstorms brought wind and heavy rainfall caused flash flooding and road closures in areas. |
| Aug 2013 | Heavy rainfall repeatedly moved across the region causing more than 3" of rain in a few hours causing streams and creeks to overflow their banks and flash flooding. |
| Sept. 2013 | Showers and thunderstorms tracked over region and resulted in persistent heavy rain, flash flooding and road closures. |
| June 2014 | Slow moving showers and thunderstorms developed producing very heavy rain over a short period of time. This led to some flash flooding and road closers, especially in urban and poor drainage areas. |
| July 2014 | A cluster of strong to severe thunderstorms broke out causing heavy rainfall and flash flooding with 3-6" of rainfall occurring. |
| May 2016 | Lee town faced a brutal storm with heavy rain, hail, thunder, and flash floods. Trees fell, causing power outages. Housatonic Street flooded, slowing traffic. On Greylock Street, intense rain created a path between homes. |
| Aug. 2017 | Widespread rain moved through the area, resulting in isolated flash flooding. |
| Jan 2018 | Heavy rains flooded roads, roiled rivers and even caused mudslides across the Berkshires. Lee and Stockbridge towns have increased flooding due to ice jams. (Berkshire Eagle, 2018) |
| Sept 2018 | Rain from the remnants of Hurricane Florence caused rivers to swell and streets to flood in the region. (Berkshire Eagle, 2018). |
| July 2019 | Monsoon-like rain brought 3 inches of rain in three hours, washing out several roads and causing widespread flooding in the Berkshires (Berkshire Eagle, 2019). |
| Dec 2020 | A significant rain event combined with snowmelt caused urban flooding. |
| July 2021 | Flash flooding after intense rain closes roads (Berkshire Eagle, 2021). |
| July 2023 | A nightlong deluge dumped torrents of rain on Berkshire County, causing damage and disruption throughout the region. Lee received more than 3.68 inches of rain ranking the top fourth impacted community in the county. North Berkshires received a state of emergency (Berkshire Eagle, 2023). |
| Sept 2023 | Hurricane Lee, a tropical storm turned Category 2 hurricane, brought high winds and heavy rain from September 15th- 17th, resulting in a presidential disaster declaration for Massachusetts, including Berkshire County (EM-3599-MA). |

## *Vulnerability Assessment*

### *Geographic areas likely impacted*

Due in part to the Housatonic River and the mountainous terrain, the floodplain acreage in Lee is concentrated along the Housatonic River. Additional floodplain areas exist around Laurel Lake, Sargent Brook, Willow Brook, Upper Reservoir, and Green Water Brook in South Lee. The FIRM map delineates approximately 1,871.6 acres of land as floodplain, constituting 10.5% of the town. Of this, around 68.28 acres have been developed, representing 3.6% of the total floodplain acres, as illustrated on Figure 3.3. It's essential to note that Lee's FIRM map was issued in 1982, over 40 years ago. As precipitation patterns and flow regimes evolve in a warming climate, the boundaries of the 100-year floodplain could shift.

The largest sections of the floodplain area in Town are situated near Mill St. and Washington Mountain Rd with the most expansive section in South Lee near Pleasant St. (Route 102) and its associated wetland complexes. The floodplain crosses Housatonic St., a major route through town and to and from the Interstate 90 exit (Mass Turnpike). In South Lee, it also crosses Pleasant St., which houses the town's wastewater treatment plant. Flooding has occurred at the treatment plant but has not interrupted treatment. Road flooding, identified as the top hazard in the Hazard Mitigation survey, is particularly concerning. Areas at risk due to flooding are highlighted on Figure 3.3Error! Reference source not found..

Lee maintains 60.1 miles of roads. 11.39 miles of major state roads, such as Route 20, Route 102, Route 7, and I-90, are managed by the Massachusetts Department of Transportation (MassDOT). Route 20 is a main regional artery, bypassing Laurel Lake and running through the town center. Its proximity to Laurel Lake and the Housatonic River increases the risk of flooding during heavy rainfall or severe weather events.

Figure 3.4: Flood waters rise over Mill St during "monsoon like" rain. Berkshire Eagle, July 2021

In South Lee, Route 102 connects residential and industrial sectors to the main town and the turnpike and is a major route for tourists heading to South County, particularly Stockbridge. It is also susceptible to flooding due to its proximity to the Housatonic River. Route 102 connects to smaller rural communities, such as Tyringham, which relies on the Town of Lee for essential services.

Beavers are part of the natural landscape, and by damming streams, they create wetlands and open water habitats that support a more complex and biodiverse ecosystem. Wetland systems can provide flood storage capacities and reduce flashy flood conditions when beaver dams are intact. However, expansion of water levels and upgradient of the dams can flood residential properties and impact the quality of drinking water sources and the functionality of septic systems. In these instances, risk to human health may require action to control water levels. In many instances installing water leveler devices in beaver dams to allow continued water flow or structures that bar beavers from clogging culverts alleviates flooding problems. Grants from the Human Society have helped to fund several such projects across the Berkshires. Where such methods do not solve the problem, removal of the beaver population must be undertaken, although this has become more difficult as trappers in the region have become less common.  In Lee, certain areas grapple with persistent beaver activity affecting both infrastructure and private property. The most concerning area is situated along the Housatonic River, near the intersection of Pleasant St. and Fairview St., where the Lee's Fire Station and a Town Park are located. The beaver activity contributes to increased flooding at this intersection and the adjacent wetlands surrounding Meadow St. These areas are noted in brown hatching on Figure 1.3 Town of Lee Critical Facilities and Areas of Concern.

Dams serve as both protective barriers and potential sources of risks. The dams on the Housatonic River in Lee include the Woods Pond Dam (off of Valley/Crystal St.), Columbia Mill Dam (off of Columbia St.), and Willow-Hurlbut Dam (just south of Route 102) pose and additional risk to their immediate downstream are due to the potential of dam failure (i.e. a sudden uncontrolled release of water) or overtopping.

*People*

The impact of flooding on life, health, and safety is contingent upon various factors with severity of the event and the availability of adequate warning.  The 2023 Massachusetts State Hazard Mitigation Plan lists inland flooding and dam overtopping from precipitation as very high likelihood occurrence (almost certain to occur multiple times in a year ) with very high human magnitude of consequences (MEMA & EEOEA SHMCAP, 2018). Residents in or near floodplain-prone areas, particularly vulnerable populations, such as those with low socioeconomic status, individuals over 65, young children, those with medical needs, and those with low English language fluency, face heightened vulnerability during flood events. For instance, economic considerations may impact evacuation decisions for those of low economic status, while challenges in evacuating or accessing medical facilities increase vulnerability for the elderly and medically dependent. Those with low English language fluency may not receive or understand the evacuation warnings. Vulnerable populations may also be less likely to have adequate resources to recover from the loss of their homes and jobs.

According to the U.S. Environmental Protection Agency (EPA), floodwater often contains a wide range of infectious organisms from raw sewage. These organisms include intestinal bacteria, MRSA (methicillin-resistant staphylococcus aureus), strains of hepatitis, and agents of typhoid, paratyphoid, and tetanus. [vi]Floodwaters may also contain agricultural or industrial chemicals and hazardous materials swept away from containment areas. The 2023 Massachusetts State Hazard Mitigation Plan details that residents can face water quality and safety threats as excessive groundwater from flooding may compromise drinking water sources, especially for residents who rely on well water. Currently, 124 households rely on private wells, which could be particularly vulnerable during droughts.[vii]

Individuals who evacuate and move to crowded shelters to escape the storm may face the additional risk of contagious disease; however, seeking shelter from storm events when advised is considered far safer than remaining in threatened areas. Individuals with pre-existing health conditions are also at risk if flood events (or related evacuations) render them unable to access medical support. Flooded streets and roadblocks can also make it difficult for emergency vehicles to respond to calls for service, particularly in rural areas. Flood events can also have significant impacts after the initial event has passed. For example, flooded areas that do not drain properly can become breeding grounds for mosquitos, which can transmit vector-borne diseases. Exposure to mosquitos may also increase if individuals are outside of their homes for longer than usual because of power outages or other flood-related conditions.

Finally, the growth of mold inside buildings is often widespread after a flood. Investigations following Hurricane Katrina and Superstorm Sandy found mold in the walls of many water-damaged homes and buildings. Mold can result in allergic reactions and can exacerbate existing 32 respiratory diseases, including asthma.[viii] Property damage and displacement of homes and businesses can lead to loss of livelihood and long-term mental stress for those facing relocation. Individuals may develop post-traumatic stress, anxiety, and depression following major flooding events.[ix]
Downstream populations, including those in the vicinity of the three significant hazard dams in Lee, are at risk from dam failures. Lee's specific areas such as Bradley St. Mill Street, Columbia St. and the northern end of Greylock St. have consistently experienced floods due to their proximity to Washington mountain brook, placing them within a floodplain. Position just four miles downstream of Woods Pond Dam and surrounded by wetlands, these neighborhoods face the risk of inundation during intense precipitation events such as those highlighted on Lee's critical facilities and floodplain.

In South Lee, Meadow St., though not officially designated in the floodplain according to FIRM, is in close proximity to the Housatonic floodplain to the South and East Brook to the north, surrounded by wetlands. Located just one mile West of the Holbrook wildlife management area was seasonally flooded Meadowlands this geographical positioning heightens the vulnerability of the area to flooding risk. A notable case in July 2021 saw an intense rainstorm wreaking havoc on Lee and Tyringham's vital connections. A mudslide at the Meadow St. intersection closed the thoroughfare, covering the road and five inches of silt. The 334-room Holiday Inn Oak and Spruce resort, capable of accommodating hundreds of tourists, is also located on Meadow St., making it particularly sensible to the impacts of flooding events.

Flooded roads signal potential danger and could impede emergency services and access, particularly impacting the route to Lee High School, the emergency shelter, on the southern and upland section of Greylock St. This poses a critical challenge for residents as the emergency shelter may be cut off during flooding events. In response, the town utilizes Reverse 911 to issue emergency notifications as a proactive step to inform residents of flood risks and enhance community preparedness. Most residents in these vulnerable areas are enrolled in the town's emergency notification system. The Massachusetts Wetlands Protection Act provides some protection for wetland resources, requiring that development be conducted outside wetland and riverfront areas. Where development does occur within these areas, wetland mitigation can be required, including flood storage replication.

*Built Environment*

Floodwaters can severely damage or completely destroy homes and business structures. As noted by FEMA, owning a property is one of the most important investments most people make in their lives. Flooding is the most common and costly natural disaster in the U.S., just one inch of water can cause $25,000 in damages to residential homes.[x] Repeated flooding can over time render homes and structures unaffordable over time, or even uninhabitable. As defined by FEMA, a Repetitive Loss Structure is one that is an NFIP-insured structure that has had at least two paid flood losses of more than $1,000 each in any 10-year period since 1978.

This Hazard Mitigation Plan attempts to quantify the potential losses to building owners if their buildings were flooded during a 100-year flood event. To determine potential losses, MassGIS FIRM and MassGIS assessor parcel data were reviewed, and all properties that were fully or partially located within the FIRM boundaries were selected for analysis. Assessor building value data relating to those properties was used to estimate potential structural losses. It should be noted that values here are at assessed value, not market or replacement value. Therefore, they likely underestimate the costs to bring a building back to its pre-disaster value. Also, this analysis includes only buildings and does not include potentially significant losses from infrastructural damage to roads, water lines or utility systems. For the purposes of this analysis, the value of contents for residential buildings is 50% of the assessed value, and the value of commercial contents is 100% of the assessed value. Town of Lee building content losses, which includes the DPW facility, were calculated using the commercial rate of 100%; given the high cost of heavy vehicles and equipment, this estimate may be undervalued. See **Table 3.5: Properties in the 100-year Floodplain** for potential losses due to a 100-year flood event.

Table 3.5: Properties in the 100-year Floodplain and Estimates of Losses (U.S Dollars)

| Type of Building | Number of Units | Building Value | Land Value | Total |
|---|---|---|---|---|
| Residential | 135 | $19,277,300 | $ 1,2877,200 | $31,215,400 |
| Commercial | 34 | $31,938,700 | $8,237,000 | $40,175,700 |
| Industrial | 17 | $12,356,000 | $2,752,900 | $15,108,900 |
| Mixed Use | 11 | $4,912,400 | $1,399,600 | $6,312,000 |
| Other | 4 | $234,400 | $596,800 | $831,200 |
| Town Owned (Lee Athletic Field, Waste Water Treatment Plant, | 3 | $2,275,000 | $671,000 | $2,946,000 |
| Total | 204 | $70,993,800.00 | $26,534,500.00 | $96,589,200.00 |

In the Berkshire region rivers and streams tend to be dynamic systems, with stream channel and bank erosion common in both headwater streams and in the level, meandering floodplains of the Housatonic and Hoosic Rivers. Fluvial Erosion is the process where the river undercuts a bank, usually on the outside bend of a meander, causing sloughing and collapse of the riverbank. Fluvial erosion of stream and riverbanks can creep towards the built environment and threaten to undercut and wash away buildings, roads, and bridges. Many roads throughout the region follow streams and rivers, having been laid in the floodplain or carved along the slopes above the bank. Older homes, barns and other structures were also built in floodplain or just upgradient of stream channels in both rural and urban areas. Fluvial erosion can also scour and down cut stream and river channels, threatening bridge pilings and abutments. This type of erosion often occurs in areas that are not part of a designated floodplain.

Landslides on steep slopes can occur when soils are saturated and give way to sloughing, often dislodging trees and boulders that were bound by the soil. The damage from T.S. Irene in 2011 to

Route 2 in the Florida/Charlemont and the Savoy area was a combination of fluvial erosion from the Cold and Deerfield Rivers and a landslide on the upland slope of the road.

Flooding of homes and businesses can impact human safety health if the area of inundation is not properly dried and restored. Wood framing can rot if not properly dried, compromising building structure and strength. Undetected populations of mold can establish and proliferate in carpets, duct work, wall board and almost any surface that is not properly dried and cleaned. Repeated inundation brings increased risks of both structural damage and mold.

Regarding dam failures, all structures, critical facilities and roadways in the inundation zone are vulnerable to damage. A severe flood event can threaten the functionality or structural integrity of the dams that are overtopped or fail. Flood waters may potentially cut off evacuation routes, limit emergency access, and destroy power lines and communication infrastructure. Additionally, Lee's environmental history with General Electric (GE) and polychlorinated biphenyl (PCB) contamination is a cause for heightened concern. Details regarding GE's historical contamination of PCBs into the Housatonic watershed and its connections to flooding hazards will be covered in the section title "Hazardous Material." Lee's three significant hazard dams have all had recent inspection as part of the Housatonic River remedial action under the EPA's Revised Permit.

The Woods Pond Dam

The dam was inspected in 2023 with the capacity to manage its spillway design flood (500-year flood). However, according to the inspection, during extreme weather events, overtopping could occur, with water levels potentially rising 1.8 feet above the dam crest for up to 37.5 hours. Although a structural breach is considered unlikely, overtopping would contribute to downstream flooding along the Housatonic River, primarily affecting areas downstream of the dam. This flooding would not result from a sudden, catastrophic release of water but rather from riverine flooding as the system exceeds its capacity. This riverine flooding would most likely affect structures in the 100 year flood plain. A dam break analysis was conducted to model potential impacts and enhance disaster preparedness. The Woods Pond Dam has an Emergency Action Plan (EAP) in place, which coordinates response efforts among Lee, Lenox, and Stockbridge to mitigate risks and streamline emergency operations.

Columbia Mill Dam

The Columbia Mill Dam is slated for removal as part of the Housatonic River remedial action under the EPA's Revised Permit. The removal is expected to occur within the next decade. To mitigate risks prior to removal, General Electric (GE) has implemented a Monitoring and Maintenance (M&M) Plan to prevent dam failure. Repairs addressing issues identified during the August 2022 and were confirmed to be in good condition during the September 2024 inspection. While the Columbia Mill Dam currently lacks a physical early warning system, GE's M&M Plan includes regular visual inspections and vegetation management downstream to maintain structural integrity and reduce risks.

Willow-Hurlbut Dam

The Willow Hurlbut Dam's recent inspections revealed no immediate structural deficiencies but highlighted the need for ongoing maintenance to manage minor seepage and vegetation growth near the embankment. Overtopping during extreme weather events remains a concern, as heavy rainfall could exceed the spillway's capacity. While the likelihood of a catastrophic breach is low under current conditions, regular monitoring and maintenance, supported by the dam's Emergency Action Plan (EAP), will assist with mitigating potential risks.

Floodwaters can increase the risk of creating and dislodging ice dams during the winter months. Blocks of ice can develop in streams and rivers to create a physical barrier or dam restricting flow, causing water to back up and overflowing its banks. Large ice jam blocks that break away and flow downstream can damage culverts, bridges and roadways whose openings are too small to allow passage. The Housatonic River's most recent occurrence of ice jams occurred in 2018 from unseasonable warm temperatures and heavy rains which flooded Meadow St. in South Lee (see Image 3.2.) The same event also caused the Town of Stockbridge, just south of Lee, to declare a state of emergency due to local flooding near Route 7- a major north-south route to emergency and other services.

Image 3.2 Flood waters cover Meadow St. in Lee after a temperature spike and heavy rain breaking up more than a foot of snow and ice

Photo Courtesy of Gabriel Prendergast, 2018.

Electrical power outages can occur during flood storm events, particularly when storm events are accompanied by high winds, such as during hurricanes, tropical storms, thunderstorms, and micro-bursts. Fortunately, most flooding in the Berkshire region is localized and has resulted in few widespread outages in recent years, and where it occurs, service has typically been restored within a few hours.

*Natural Environment*

Flooding and saturated soil has the potential to affect the natural environment in several ways. Septic systems can flood, contaminating the surrounding areas, posing health risks, and damaging the environment. Flooding from increased runoff from impervious surfaces can spread chemical and bacterial contamination potentially harmful to people, the environment, and wildlife as well as increase nutrient and contaminant concentrations in freshwater bodies. Recreational, open space, natural area, and working land service impacts, including temporary loss of recreational fishing and boating access, impacts to habitat in natural areas that could limit access for recreational users, and loss of protected open space that could negatively affect species living in these areas (EOEEA ResilientMA Plan, 2023).

Flooding can remove trees, other vegetation, rocks and soil causing erosion, high turbidity and the loss of community assets. Excessive sedimentation of stream and lake beds can disrupt aquatic life cycles by smothering aquatic life and fish eggs. Sedimentation of lakes and ponds can create shallower, warmer shoreline conditions that favor infestation of invasive aquatic plants such as Phragmites, purple loosestrife, Eurasian water milfoil, water chestnut, and a host of others. Invasive aquatic plant species are a major environmental and public health concern in Laurel Lake. Invasive species can be carried downstream and dispersed into new areas in flood waters, particularly those like Japanese knotweed that readily spreads via broken plant fragments.

Stormwater drainage systems collect contaminants and sediment from roads and other surfaces and transport them into waterways if there is not a sufficient buffer to filter out the contaminants and sediment. Typically, there is no infrastructure in place to protect from nonpoint source pollution of this type.

The sudden and potentially extreme volumes of water released during dam failures can result in ecological damage both upstream and downstream of the dam. River channels downstream of the dam can experience severe scouring, banks can experience erosion and mass wasting, and boulders can become dislodged and move downstream. Trees and other vegetation can become uprooted and add to the debris moved by floodwaters, potentially clogging and threatening the integrity of culverts and bridges. Upstream of the dam the former impoundment could become partially or completely dewatered, altering, and potentially destroying lacustrine aquatic habitat (EOEEA ResilientMA Plan, 2023).

*Economy*

The impacts of flooding on the economy include the value of buildings and businesses potentially lost during a flood event, the loss of business revenue during the response and recovery period, economic loss due to an inability to commute to work or communicate, and the burden of paying for recovery and the rebuilding of infrastructure.

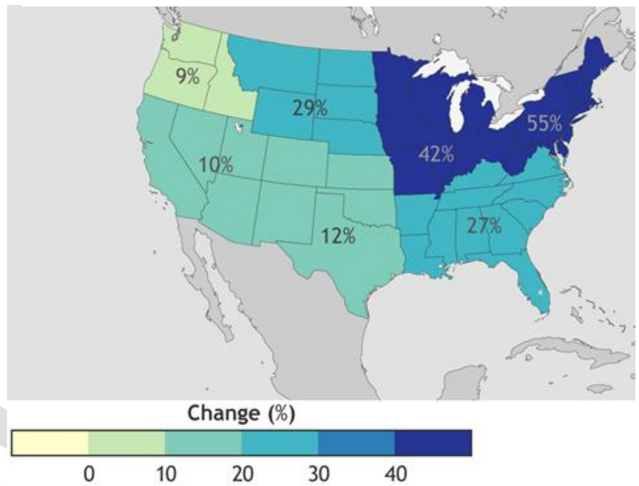
*Future Conditions*

In the realm of future conditions, a study on flooding in New England warns that what was once considered a 100-year flood event, with a mere 1% chance of occurring annually, could transform into a recurring, yearly phenomenon by the late 2100s. This escalating frequency poses a significant threat to dams, with dam overtopping already standing as the leading cause of dam failures in the U.S., contributing to 34% of such failures[xi] [xii]

Analyzing data from the Northeast Climate Science Center (NECSC), Berkshire County has witnessed a gradual increase in yearly precipitation, rising from 40.1 inches in the 1960s to 48.6 inches in the 2000s. Projections indicate a further increase by 3.55 inches in the 2050s and 4.72 inches in the 2090s.[xiii] These increases, coupled with predictions of more intense and frequent storms, will likely exacerbate flood risks, particularly in flood-prone areas like downtown Lee, the Housatonic River, and its tributaries. According to the 2023 Massachusetts State Hazard Mitigation Plan, such changing precipitation patterns place the Berkshires and Hilltown Region's infrastructure, particularly electric transmission and distribution systems and clean water supply, which heavily relies on groundwater, in a vulnerable position.

The scientific consensus echoes the reality of climate change altering precipitation patterns. The Intergovernmental Panel on Climate Change projections foresee temperature increases between 2.5-5.0°C (36-41°F) across the U.S. in the next century. These projections bring forth potential risks like increased mid-winter cold/thaw events, heightened rain-on-snow storm events, and a substantial rise in the frequency and magnitude of extreme storm and flood events, increasing the risk of ice jams. Many studies agree that warmer temperatures late in the year will result in more rain-on-snow storm events, leading to higher spring melt flows, which typically are already the highest flows of the year.

Figure 3.5 Increase in Precipitation Falling in Top 1% Extreme Precipitation Events 1958-2016



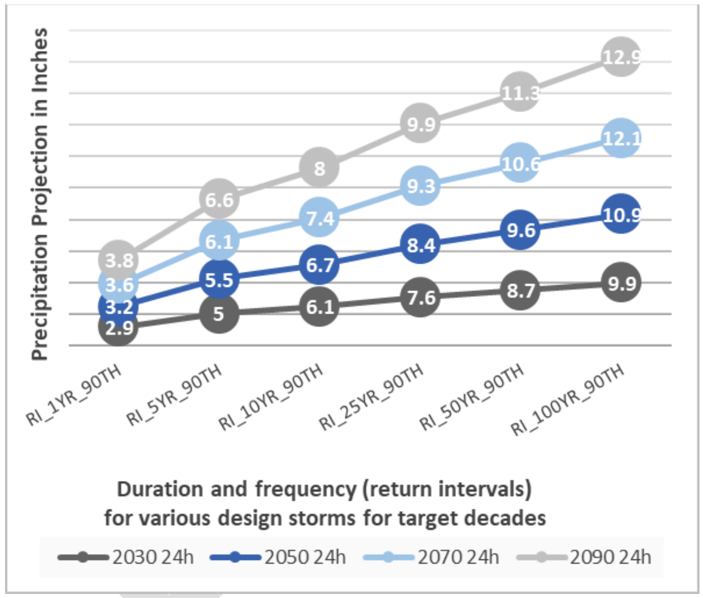

Data from USGS streamflow gages across the northeast show a clear increase in flow since 1940, with an indication that a sharp "stepped" increase occurred in the 1970s. This is despite the fact that much of the land within many New England watershed has been reforested, and this type of land cover change would tend to reduce, rather than increase, flood peaks.

NOAA has documented that extreme or heavy precipitation events have grown more frequent since the start of the twentieth century, and such events are likely to become even more frequent over the twenty-first. Heavy precipitation is defined by NOAA as those heavy rain or snow events ranking among the top 1 percent (99th percentile) of daily events, has increased 55% in the Northeast between 1958-2012.[xiv] It should be noted that during this period, a nine-year drought from 1961-1969, the drought of record for this region, occurred during this period. As such, this may underestimate the overall trend for future projections.

The Massachusetts Climate Change Projections report looked at the precipitation changes expected by greenhouse gas effects within the state's major watersheds. According to an upper-level scenario, the days per year with precipitation of more than one inch in the Housatonic River Watershed is predicted to increase from the baseline of six days per year to nine days by the 2050s, and to 10 days by the 2090s. The baseline reflects precipitation data 1971-2000. The upper scenario represents a 47% increase in these storms from the baseline by mid-century and a 66% [illegible] end of century.

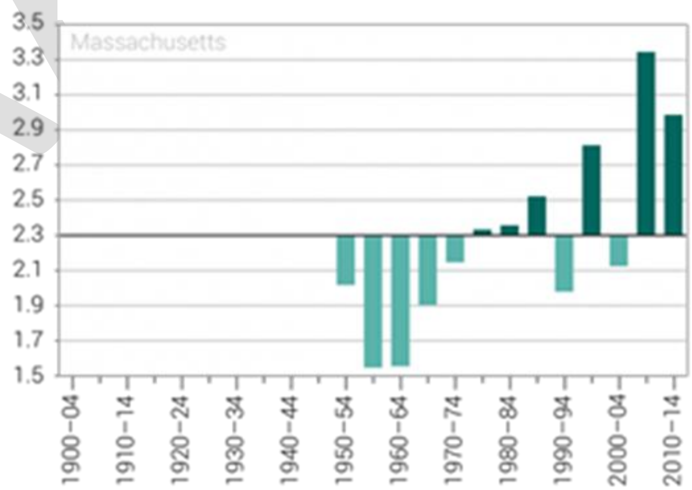
Lee is situated in the Housatonic watershed, where total precipitation is expected to increase by 8.2% by 2050 and 10% by 2070.xv Lee's geographic position, flanked by mountains to the east and west, creates natural funnel points for water flow, contributing to flood-prone conditions in lower-lying areas. in close proximity to local business and Town government offices, there substantial increase in precipitation is projected particularly by 2090. Figure 3.6 displays the duration and frequency for precipitation for various design storms at the 90th percentile during decades 2030-2090.xvi As the return interval increases (Year 1 to Year 100), there is a consistent growth in precipitation levels for each target decade. This upward trend implies that extreme weather events with higher return intervals are expected to increase precipitation over time.

Figure 3.6 Precipitation Projections 2030 - 2090 for Downtown Lee




Summer is currently a season when there is the greatest chance for extreme precipitation events to occur, and summer is projected to continue to be the season of greatest chance and the season with the greatest increases in the number of days with extreme precipitation. Already observed in Massachusetts, the number of extreme precipitation events, those defined as more than two inches in one day, has increased since the 1980s, with the greatest increase in the past decade (see Figure 3.7). This trend has direct implications on the design of municipal infrastructure that can withstand extreme storm and flood events, indicating that all future designs must be based on the most updated precipitation and stream gauge information available.

Figure 3.7 Number of Extreme Precipitation Events of 2" or more in 1 Day




*Source: NOAA Climate.gov*

It may be prudent, therefore, to slightly overdesign the size of new stormwater management and flood control systems so that they have the capacity to accept the increase in flow or volume without failing. For many piped systems, such as culverts, drainage ditches and swales, the slight increase in size may provide a large increase in capacity, and for very little increase in cost. If space is available, an increase in the capacity of retention/detention ponds may also be cost effective.

Bioretention cells can be engineered so that they can increase their holding capacity for extreme storm events with little incremental cost. The size of the engineered soil media, which is a costly component of the system, may remain the same size as current designs call for, but a surface ponding area surrounding the central soil media is increased to serve as a holding pond.

Future land use decisions will also play a critical role in shaping flood vulnerabilities. While Lee has historically resisted large-scale development, even modest housing or infrastructure projects near flood-prone areas could increase risks. Projects like the Eagle Mill redevelopment and the planned public safety complex on Railroad Street underscore the importance of updating FEMA flood maps and integrating climate-adaptive strategies. Enforcing the floodplain bylaw and protecting natural flood buffers, such as wetlands, will also be essential to managing flood risks effectively. Infrastructure should be designed to accommodate more intense precipitation patterns.

If climate change results in a greater number of severe precipitation events and shortens recurrence intervals them, as is predicted, it will require dam operators to become more vigilant in monitoring precipitation and temperature patterns. Individual rain events, particularly during periods of saturated or frozen soils that cannot absorb rainfall, may require dam operators to open spillways, flashboards and other safety features more often, causing a greater number of high discharges events and possible flooding on properties downstream of the dam. Although climate change may not increase the probability of catastrophic dam failure, it may increase the probability of design failures that were based on outdated precipitation patterns (MEMA & EEOEA SHMCAP, 2018).

Population dynamics further complicate future vulnerabilities. With Lee serving as a key commuter hub and a seasonal tourist destination, ensuring unimpeded road access is imperative. Flooding along major roads, such as Route 20 and Main Street, could disrupt not only local mobility but also access for emergency services and businesses reliant on visitor traffic. Additionally, Lee's aging population, comprising nearly a quarter of residents over 65, may face heightened challenges during flood events, particularly in accessing emergency services and temporary housing.

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# Severe Winter Storms (Ice Storms, Nor'easters, Blizzards)

## *Hazard Profile*

Severe winter storms, including ice storms, nor'easters, and blizzards, are common and potentially devastating hazards throughout Massachusetts. These events can cause widespread disruptions to transportation, utilities, and emergency services while posing significant risks to public safety, property, and the local economy. The combination of heavy snowfall, high winds, and freezing rain associated with these storms can amplify their impacts. Secondary hazards, such as flooding or levee and dam failures, can also occur due to severe winter weather.

### *Characteristics of Severe Winter Storms*

**Ice Storms:** Occur when rain freezes upon contact with cold surfaces, forming layers of ice building up to ¼ inch or more. An ice storm warning, now included in the criteria for a winter storm warning, is issued when ½ -inch or more of accretion of freezing rain is expected. Ice accumulation on trees, powerlines, and roads can cause power outages, fallen debris, and hazardous travel conditions.

**Nor'easters**: Large storm systems characterized by strong northeasterly winds and heavy precipitation, typically affecting the northeastern United States. They can bring prolonged snowfall, freezing rain, and storm surges along coastal areas. Sustained wind speeds of 20-40 mph are common during a nor'easter, with short-term wind speeds gusting up to 50-60 mph or even to hurricane force winds (MEMA & EOEEA, 2018).

**Blizzards:** Severe snowstorms defined by sustained winds of at least 35 mph and visibility of less than ¼ mile due to blowing snow. Blizzards can result in extreme cold, transportation disruptions, and prolonged isolation for residents. A severe blizzard is categorized as having temperatures near or below 10°F, winds exceeding 45 mph, and visibility reduced by snow to near zero (MEMA & EOEEA, 2018).

## *Likely Severity*

Winter storms in the region range from moderate snowfalls to severe nor'easters and ice storms, each capable of causing significant disruptions. The severity of a given storm depends on the interplay of precipitation type, accumulation, wind speeds, and duration. Blizzards and nor'easters, characterized by sustained winds over 35 mph and heavy snowfall, can bring prolonged transportation delays, power outages, and dangerous conditions for residents and emergency responders. Ice storms, while less frequent, pose a distinct risk due to the weight of ice accumulation on trees, power lines, and structures.

Berkshire County's topography exacerbates winter storm impacts. Narrow, winding roads become impassable under heavy snow, delaying emergency responses and isolating rural areas. Additionally, cold air pooling in valleys increases the likelihood of extreme temperature events, which can strain heating systems and endanger vulnerable populations.

The magnitude or severity of a severe winter storm depends on several factors, including a region's climatological susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, time of occurrence during the day (e.g., weekday versus weekend), and time of season (MEMA & EOEEA, 2018).

NOAA's National Centers for Environmental Information (NCEI) evaluates snowstorm severity using the Regional Snowfall Index (RSI), which ranks storms from 0 (minimal) to 5 (extreme) based on the spatial extent, snowfall amounts, and population affected (see Table 3.7: Regional Snowfall Index Ranking Categories). Data from 1900 provides historical context, with most storms classified as Category 0 or 1. Severe storms, such as Category 3 or higher, are much rarer, accounting for 5% or fewer of recorded events.

Of the 13 recent winter storm disaster declarations that included Berkshire County, two events were ranked as Extreme (EM-3103 in 1993 and DR-1090 in 1996), one as Crippling (EM-3175 in 2003), and two as Major (EM-3191 in 2003 and DR-4110 in 2013).

It's important to note that the ranking system incorporates population as a criterion, meaning storms impacting densely populated areas, such as Boston, are more likely to rank higher than those affecting less populated regions like the Berkshires. For example, the Blizzard of '78, one of the most notable storms in Massachusetts history, dropped over two feet of snow in Boston, brought 65 mph winds, and stranded hundreds of people on highways. While the storm was devastating for eastern Massachusetts, its impact on Berkshire County was less severe, with 11–19 inches of snow falling over 33 hours and winds reaching up to 50 mph. Berkshire County was not included in the disaster declaration for this event.

The Northeast States Emergency Consortium tracks one- and three-day record snowfall totals. According to their data, 99% of the one-day record snowfall events in the region typically yield snow depths in the range of 12"-24", while the majority of three-day record snowfall events yield snow depths of 24"-36".

One of the most serious storms to impact communities in the Berkshires was the Ice Storm of December 11, 2008. The storm created widespread downed trees and power outages across New York State, Massachusetts and New Hampshire. Over one million customers were without electricity, with 800,000 without power three days later and some without power weeks later.

Table 3.6 Regional Snowfall Index Ranking Categories

| Category | Description | RSI-Value |
|---|---|---|
| 0 | | 0-1 |
| 1 | Notable | 1-3 |
| 2 | Significant | 3-6 |
| 3 | Major | 6-10 |
| 4 | Crippling | 10-18 |
| 5 | Extreme | 18+ |

Source: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

Severe winter weather declarations became more common after the 1990s, but this does not necessarily reflect more severe conditions than those experienced in the Berkshires in the preceding decades. Local accounts suggest that snow depths before the 1990s were often greater than those observed in recent years (2010s–2020s).

### *Probability*

Residents and municipal staff in the Berkshires perceive blizzards and ice storms as routine challenges, anticipating several snowstorms and a few nor'easters each winter. The Northeast generally experiences at least one or two major winter storms each year with varying severity. These major storms can make roads impassable, close airports, halt the delivery of goods and services, and leave thousands without power for days. In the Berkshires, snowfall amounts vary due to orographic effects—upslope flow enhances precipitation on windward slopes, and downslope flow creates a shadow effect. The region's unique landscape, intersecting with valleys and mountains, magnifies these impacts. Higher elevations generally experience colder temperatures, influencing the persistence of moderate snowfall.

From 2000 to 2023, the NOAA-NCDC storm database recorded 91 winter storm events in the Berkshires, including 13 FEMA-declared winter storm disasters and 59 "notable" winter storms in the Northeast Urban corridor. Massachusetts has received over $30 million in federal funding for post-disaster winter/ice storm events since 1991 (EOEEA ResilientMA Plan, 2023).

Drawing insights from historical data, it is estimated that Lee will be at risk for approximately 4.14 severe winter storms annually, with 2.5- 4.4 days of 5 inches of snow or more (EOEEA ResilientMA Plan, 2023, Tables 4–7). However, the influence of climate change is expected to amplify winter precipitation and storm frequency. Rising temperatures enhance the atmosphere's water-holding capacity, intensifying rain events and impacting winter weather. The Massachusetts Climate Assessment indicates a correlation between climate change and more severe winter storms, marked by colder temperatures, even with a potentially shortened winter season. This shift results in increased instances of extreme winter weather, including ice storms, nor'easters, heavy snow, and blowing snow, particularly in January, with significant risk extending from December through March.

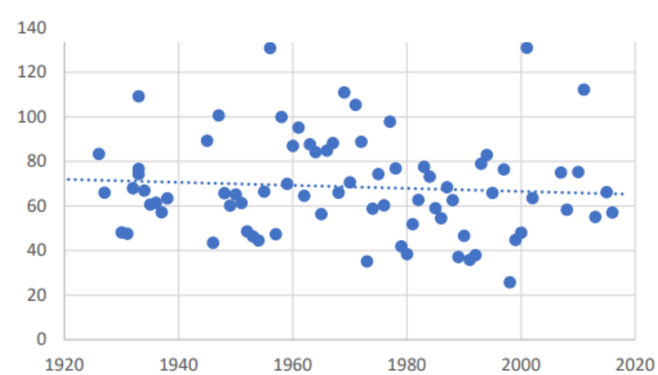
While the county may not consistently experience high snowfall amounts, warmer temperatures in future winters may lead to a greater number and severity of storms featuring heavy, wet snow or ice. This dynamic poses concerns for road travel, human safety, and the risk of roof failures.



### *Historic Data*

Snow and other winter precipitation occur very frequently across the entire region. Snowfall in the region can vary between 26 and 131 inches a year. However, it averages around 65 inches a year, down from around 75 inches a year in 1920. Figure 3.10 illustrates historic snowfall totals received in the county, indicating the average snowfall levels are trending downward. Overall, the Berkshires has had 13 FEMA disaster declarations with the last one in 2013. These are noted in the Table 3.7 below.

Figure 3.8 Average Snowfall in Berkshire County




*Source: Massachusetts EEOA 'Precipitation' Database' 2019*

The National Climatic Data Center, a division of NOAA, reports statistics on severe winter storms from 1996 through 2023. During this 27-year span, Berkshire County experienced 162 severe winter storms, ice storms, and heavy snow events for an average of six storm events per winter. This number varies each winter, ranging from one during 2006 to 15 during 2008.

Memorable events include the March 1888 storm, known as the "Great White Hurricane," that dropped 42 inches of snow on the Berkshires and left 15-foot snowdrifts in Pittsfield. In March 1916, a two-day storm brought 20 inches of snow to the county, with an additional 44 inches by the end of the month, making roads impassable. The November 1971 storm was the most significant November snowstorm on record, dumping 22.5 inches of snow and stranding many travelers.

The December 1969 storm, which left 23 inches of snow in the Berkshires, brought with it record subzero temperatures. It took one week to remove the snow from Main Street in Lee, and just two days later, a second snowstorm hit, causing traffic backups on the Mass Turnpike Lee exit. In October 1987, an early snowstorm brought 18 inches of snow across the county, causing power outages and hazardous driving. This severe storm canceled the Northern Berkshire Fall Foliage Parade the only time in its history. The Dec 1992 storm “Great Nor’easter” was a powerful Category 2 nor'easter that hit the Commonwealth region and caused intense snowfall. A state of emergency (FEMA DR-975) was declared in Berkshire County, and the higher elevations were buried under drifts as high as 12 feet. FEMA aid totaled $346,150,356.

The beginning of the 21st century saw some of the worst storms in Berkshire County's history. In March 2001, a two-day late-season coastal storm dumped between 12 and 30 inches of snow on Berkshire County, making it the snowiest March in 60 years. A nor'easter in March 2003 brought 22 inches of snow in 24 hours, packing winds of up to 70 mph, which helped create 10-foot snowdrifts. The same year, in December 2002, and January 2003, unprecedented back-to-back snowstorms buried parts of the Northeast during the Christmas and New Year holiday season, with both storms producing over 20 inches of snow. In January 2005, a massive winter storm brought about two feet or more of snow to a significant portion of Massachusetts and hurricane-force winds to the Cape and Islands. These storms declared state emergencies and caused significant disruption to the area. These events illustrate the trend of severe weather conditions that have become more common in the area, causing significant disruption and danger to residents.

The October 2011 snowstorm, commonly referred to as "Snowtober," was an unprecedented early-season Nor’easter that struck Massachusetts from October 29 to October 30, delivering heavy, wet snow to areas unaccustomed to such conditions in autumn. In Western Massachusetts, snowfall totals ranged from 6 to 20 inches, with higher elevations in the Berkshires receiving the heaviest accumulations. The timing of the storm, with most trees still retaining their leaves, exacerbated the impacts as the weight of the snow caused widespread tree damage, downed power lines, and blocked roadways. Berkshire County experienced significant disruptions, with prolonged power outages affecting thousands of residents and businesses. Transportation was severely impacted as roads became hazardous or impassable due to fallen debris and snow accumulation.

The winter of 2018 was marked by a series of intense snowstorms that significantly impacted Massachusetts, including Western Massachusetts. March alone saw four nor’easters in quick succession, bringing heavy snowfall, high winds, and coastal flooding to much of the state. In Berkshire County, snowfall totals from individual storms ranged between 8 and 20 inches, with accumulations particularly severe in higher elevations.

These storms disrupted daily life, causing widespread power outages, school closures, and dangerous travel conditions. The relentless pattern of storms strained municipal snow removal budgets and resources, highlighting the challenges of managing frequent, high-impact winter weather in a short timeframe.

Table 3.7 Historical Severe Winter Events

| Year | Description of Event |
|---|---|
| March 1888 | "The Great White Hurricane" A three-day blizzard leaves 42 inches of snow in the Berkshires. Fifteen-foot drifts are reported on North Street in Pittsfield. Farmers reportedly spend days in their barns because they cannot reach their houses. (Berkshire Eagle Archives 2016) |
| June 1905 | Melting blizzard snow turned into flash flooding |
| Dec 1915 | Berkshires experience the worst snowstorm since the Blizzard of 1888. Nearly three feet of snow falls, stalling trains, and crippling wire communications. Heavy snow accumulation in Hancock affects trade routes into Pittsfield. |
| March 1916 | A two-day storm brought 20 inches of snow, the county would receive an additional 44 inches by the end of the month. Snowdrifts reaching upward of 20 feet became common, making roads impassable (Berkshire Eagle Online, 2022). |
| March 1919 | A snowstorm with high snow drifts shut down the road between Hancock and Williamstown and took three days to clear. |
| March 1932 | Rural towns in Northern Berkshire were isolated for 24 hours due to winter storm and heavy snow fall (Berkshire Eagle Archives] |
| March 1947 | A snowstorm that lasts for 16 days drops more than 45 inches on the Berkshires. The greatest one-day snowfall occurs on March 3, when 16 inches fall. (Berkshire Eagle Archives 2016 |
| Jan 1962 | Snow storm with high winds damages Hancock worth $2,000 in damages. (Berkshire Eagle Archives] |
| Feb 1969 | Snow blizzard dumps 18 inches of snow in less than 24 hours forcing the town to shut down Hancock and cripples most of Berkshire County. (Berkshire Eagle Archives] |
| Dec 1969 | A two-day storm that begins on Christmas Day leaves 23 inches of snow in Berkshire County. State police on snowshoes wade through 5- to 6-foot snow drifts to reach a woman with severe frostbite who is stranded off Route 116 in Cheshire. (Berkshire Eagle 2016) |

| | |
|---|---|
| Nov 1971 | 2 day snowstorm brought 22.5 inches on Thanksgiving stranding many travelers. This storm was the greatest November snowstorm on record at the time (Berkshire Eagle Online 2022). |
| May 1973 | Storm uproots 6 trees. A silo on a nearby farm is blown over. Several homes went without power for 12 hours. |
| Feb 1976 | Rainy conditions switched to flash freezing during a 30-degree drop in the few hours. Rain changed to snow and winds increased to 50 MPH with gusts to 67 MPH to produce blizzard conditions. (Berkshire Eagle Online 2022) |
| Jan 1979 | Storm knocks out power for 100 customers along Route 43 for four hours for residents in Hancock |
| Aoril 1982 | Considered the worst April snowstorm in local history. The snowstorm was accompanied by heavy snowfall, high winds, blizzard conditions, and most notably; extensive thunderstorm activity. Most areas saw one to two feet of snow. Gusts of 70 to 80 MPH were observed (Berkshire Eagle Online 2022). |
| Oct 1987 | An early snowstorm brings 18 inches across the county, causing power outages and hazardous driving. It cancels the Northern Berkshire Fall Foliage Parade, the only time in its history. |
| March 1993 | Melting snow and heavy rains impacted dirt roads, with several vehicles stuck in the mud. Berkshire County flood watch remained in effect for 2 days. (EM-3103) |
| Dec 1992 | Nor'easter with snow 4'+ in higher elevations of Berkshires, with 48" reported in Becket & Peru; snow drifts of 12'+; 135,000 without power across MA. Declaration number: DR-975 |
| Nov 1995 | Winter snowstorm brings 60mph, knocking out power for more than 100 customers for 2 days. |
| Jan 1996 | Blizzard of 30+" in Berkshires, with strong to gale-force northeast winds; MEMA reported claims of approx. $32 million from 350 communities for snow removal. (DR-1090) |
| March 1997 | On March 31 and April 1, a classic late season nor'easter produced rain across Berkshire County during the morning hours. The rain changed to heavy wet snow by early afternoon. Snowfall amounts were highly elevation dependent with up to 30 inches in the highest peaks of the Berkshires. Some specific snowfall totals included: 8 inches at Great Barrington, 12 inches at North Adams, 23 inches at Dalton, 21 inches at Monterey and 20 inches at Lenoxdale. The wet snow brought down many trees and power lines causing widespread power outages and road closures. Some areas remained without power for several days. Estimated damage was $1 million. (NOAA Storm Database). |

| | |
|---|---|
| March 2001 | Heavy snow across eastern Berkshires to Worcester County; several roof collapses reported; $21 million from FEMA. (EM-3165) |
| Dec 2002– Jan 2003 | Unprecedented back-to-back snowstorms buried parts of the Northeast during the Christmas and New Year 2002-2003 holiday season. Both storms produced over 20 inches of snow. The first storm on Christmas Day was the biggest snowstorm since the "Superstorm" of 1993. 6-16 inches in western New England and considerable blowing and drifting. The second storm produced 20.8 inches of snow. It was the first time since 1887-88 that two storms of more than 20 inches were recorded. The second storm combined with ice left on trees from an ice storm that occurred January 1-2 to bring down numerous trees and bring many power outages. |
| Feb 2003 | "President's Day" Winter storm with snow of 12-24", with higher totals in eastern Berkshires to northern Worcester County; $28+ million from FEMA. (EM-3175) |
| March 2003 | A nor'easter dumps 22 inches of snow in 24 hours. The storm packs winds of up to 70 mph, which help create 10-foot snowdrifts. State of Emergency Declared (EM-3103). |
| Dec 2003 | A "classic nor'easter' resulted in the first major snowstorm of the early winter season across the Berkshires. Nine to 18 inches fell across the Berkshires with Dalton receiving 17 inches. (EM - 3191) |
| Jan 2005 | A powerful Nor'easter brought up to 30 inches of snow, hurricane-force winds, and blizzard conditions to parts of Massachusetts. While the coast bore the brunt of the impact with widespread power outages, significant coastal flooding, and paralyzed transportation, Berkshire County experienced an average snowfall of approximately 9 inches. (EM-3201 & DR-1614) |
| April 2005 | A strong cold front moved across the Berkshires. Ample moisture was supplied by the warm air mass over eastern New England. Enough cold air was both advected into the region as well as transported downward by heavy precipitation to change the rain over to snow and produce an unusually late season snowstorm. Snow, falling at the rate of more than an inch per hour was common during the height of the storm. Gusty winds approaching 35 mph produced near blizzard conditions at times, including both blowing and drifting of the snow. Five to 10 inches of snow covered northwestern Massachusetts with locally higher amounts. Some business were closed or delayed in opening. Estimated damage was $25,000. (NOAA Storm Database). |
| April 2007 | Severe Storm and Flooding; wet snow, sleet and rain added to snowmelt to cause flooding; higher elevations received heavy snow and ice; $8 million from FEMA. (DR-1701) |
| Dec 2007 | A winter storm with mixed precipitation and high winds brought down several trees and caused spotty power outages through Berkshire County. A 50ft tree uprooted on Main St. in Hancock, crashed onto the car and through a nearby second-story roof. |
| Dec 2008 | Major ice storm across eastern Berkshires & Worcester hills; at least ½" of ice accreted on exposed surfaces, downing trees, branches and power lines; 300,000+ customers without power in state, some for up to 3 weeks.; $49+ million from FEMA. (DR 1813) |

| | |
|---|---|
| Dec 2009 | Two day ice storm damages maple trees impacting 5% of maple sugar industry in the Berkshires (Berkshire Eagle Archives |
| Jan 2011 | Nor'easter with up to 2' within 24 hrs.; $25+ million received from FEMA; Savoy received 40.5" and N. Adams received 33" (DR-1959) |
| Oct 2011 | "Snowtober" Severe storm and Nor'easter with 1'-2' common; at peak 665,000 residents state-wide without power; 2,000 people in shelters statewide; $70+ million from FEMA statewide; Peru received 32" and Pittsfield received 18" (DR-4051 & EM-3343) |
| Feb 2013 | Severe Winter Snowstorm and Flooding; $65+ million from FEMA statewide; Boston received almost 15" of snow. (DR 4110) |
| March 2017 | Nor'easter, Pi Day Blizzard, was a significant storm that dumped 1 to 3 feet of snow. Across the Berkshires, winds gusted as high as 74 mph. The winds brought considerable blowing and drifting of snow. State of Emergency was declared. (NWS, 2017) |
| March 2018 | Massachusetts was hit by a "bomb cyclone," a meteorological expression referring to a rapidly intensifying low-pressure system. The storm resulted in 10 to 18 inches of snowfall across the region. The most notable aspect of the storm was the intense winds it brought to Massachusetts (Boston Globe 2018). |
| Jan 2022 | Higher elevation locations in the Catskills, Adirondacks, the southern Greens and northern Berkshires came in with 10"-14" on average |
| March 2023 | A nor'easter brings the heaviest snow to Berkshire County in 12 years, where Hancock received over 27 inches of snow in 2 days - the second-highest record in the county. |
| Source: FEMA, MEMA 2023 unless otherwise noted. | |

### *Vulnerability Assessment*

*Geographic areas of concern*

Winter storms are Massachusetts's most common and familiar hazards, affecting large geographical areas. Severe winter storm events generally occur across the entire area of Lee, although higher elevations have slightly higher snow depths. Snow clearing and power restoration efforts take much longer in areas furthest away from primary road access.  Erksin Drive, a private road and new development off Golden Hill Road, as well as the narrow roads around Goose Pond, have experienced emergency access issues in the past. Circular St. and Pease also have large pine trees that drop tree limbs during storm events results in expected but brief power outages. Additional areas of concern related to fall ash trees and high wind have been observed between Church St. and Fairview St. See Figure 1.3.

*People*

Many long-term residents of Lee pride themselves on being independent and self-sufficient during severe winter events. According to Lee's public survey, winter storms ranked as the third most concerning hazard out of 13, with the highest concerns being electricity loss and risks of injury or death.

According to the NOAA National Severe Storms Laboratory, every year, winter weather indirectly and deceptively kills hundreds of people in the U.S., primarily from automobile accidents, overexertion, and exposure. People who travel in winter storms are at the most risk. 70% of winter storm-related deaths occur in cars, more than the number of people caught out in the storm.[i] Winter storms often accompany strong winds creating blizzard conditions, blinding wind-driven snow, drifting snow, and extreme cold temperatures with dangerous wind chill. They are considered deceptive killers because most deaths and other impacts or losses are indirectly related to the storm. Injuries and deaths may occur due to traffic accidents on icy roads, heart attacks while shoveling snow, hypothermia from prolonged exposure to cold, or fires or carbon monoxide poisoning from generator use or faulty heating methods after a storm causes a power outage.[ii,iii]

Vulnerable populations include older adults (aged 65+), individuals with disabilities or mobility limitations, people living alone and low-income households. Those who live alone, particularly older adults, face heightened risks of falls, hypothermia, and delayed medical care during prolonged power outages or snow events. According to the Center for Disease Control and Prevention (CDC), people over 60 account for half of all exposure-related deaths. Low-income households may struggle to afford adequate heating, emergency supplies, or repairs to homes damaged by storms. Families with young children and those reliant on electrically powered medical devices are also at risk during prolonged outages or storm-related isolation.

Transportation disruptions during severe storms can impede access to hospitals and pharmacies, compounding risks for residents who require regular medical attention or essential prescriptions. Although isolation is less of a concern in Lee compared to neighboring hill towns due to its paved road network, local emergency services, and shelter availability, unpaved or privately maintained roads may still pose challenges for vehicles ill-equipped to handle snowy and icy conditions. Fallen trees, damaged structures, and debris carried by high winds during winter storms further increase the risk of injury or loss of life, particularly in rural or wooded areas.

*Built Environment*

Severe winter storms pose significant risks to the built environment, including the collapse of roofs under heavy snow, road blockages from snow and ice, and damage to road surfaces from freezing, thawing, or snowplow operations. Additional vulnerabilities include freezing and bursting pipes, downed trees and power lines, and flooding caused by rapid snowmelt. Utility power lines are particularly at risk from the heavy snow and high winds that often accompany severe storms, leading to power outages that can disrupt critical services.

In Lee, maintaining safe travel along key corridors such as Route 7 and Route 20 is essential for ensuring access to medical care, schools, fuel, and local businesses. Residential neighborhoods with older or poorly insulated buildings are especially vulnerable to structural damage from snow loads and frozen pipes.

Farms in Lee face unique vulnerabilities, as severe storms can disrupt the delivery of feed and other supplies, damage barns and outbuildings, and pose risks to livestock exposed to extreme cold or unable to access water due to frozen pipes. Prolonged power outages can impact heating systems, milking equipment, and water supply systems for livestock, further stressing agricultural operations.

Facilities and transport routes involving hazardous materials present additional risks during winter storms. Snow and ice accumulation, road blockages, or accidents involving vehicles transporting hazardous materials could lead to spills, exacerbating public safety and environmental concerns. These risks are heightened if emergency response vehicles are delayed due to poor road conditions, potentially prolonging exposure and containment efforts.

*Natural Environment*

Winter storms are a natural part of the Massachusetts climate, and native ecosystems and species adapt well to these events. However, changes in the frequency or severity of winter storms could increase their environmental impacts. Environmental impacts of severe winter storms can include direct mortality of individual plants and animals and felling of trees, the latter of which can alter the physical structure of the ecosystem. These impacts can include direct damage to species and ecosystems, habitat destruction, and the distribution of contaminants (road salt/deicing chemicals) throughout the environment. [iv]

*Economy*

Severe winter storms place significant financial and operational strain on municipalities, businesses, and residents in Lee. Snow and ice removal, coupled with repairing roads damaged by the freeze-thaw cycle, often drains municipal budgets due to overtime staffing costs, wear on equipment, and the need for frequent repairs. Heavy ice accumulation can bring down trees, power lines, telephone poles, and communication towers, disrupting travel, utilities, and communications. These impacts are compounded by business closures, loss of income—particularly for self-employed individuals—and interruptions to winter tourism and recreation, which are vital to Lee's economy.

Hazardous travel conditions and prolonged road closures on key routes, such as Route 7 and Route 20, deter visitors, negatively affecting local businesses, short-term rentals, and hospitality services reliant on seasonal tourism. These disruptions reduce revenue and strain municipal resources, as snow removal and infrastructure repairs divert funds from other priorities.

The agricultural sector is particularly vulnerable. Barns and equipment face damage from heavy snow loads, while ice accumulation on trees in orchards and forests can cause branches to break, further stressed by wind. These damages reduces the quality of timber, Christmas trees, and sugar maple production. Farms reliant on regular transportation for milk, produce, or feed deliveries may experience financial losses if shipments are delayed.

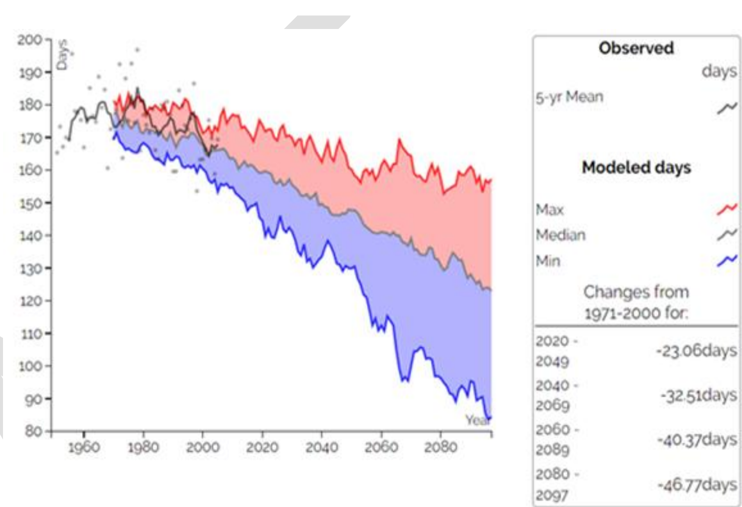
Manufacturing and industrial facilities in Lee also face challenges. Power outages can halt operations, damage equipment, and lead to financial strain from missed deadlines or spoiled inventory. Small businesses reliant on foot traffic may see decreased revenue during storm events, while employees lose wages due to closures or unsafe travel conditions. Recovery costs for homeowners and businesses—such as repairing structural damage or replacing frozen pipes—further contribute to the broader economic impact of severe winter weather.

*Future Conditions*

Winters in Berkshire County are expected to experience the most significant climate change impacts compared to other seasons. According to the Northeast Climate Center, the region is projected to lose nearly 47 days below freezing annually by the century's end (Figure 3.9). These changes will likely increase freeze-thaw cycles, with winter precipitation shifting to heavier, wetter snow, ice, or rain. These conditions present heightened risks for infrastructure, public safety, and the environment.

In Lee, freeze-thaw cycles will pose challenges to roadways and buildings, accelerating pothole formation, frost heaves, and structural damage such as cracked pavements and foundations. Mitigation measures such as improved drainage, thicker pavements, and stabilized subgrade soils will be critical.[v] Additionally, wetter snow and ice may increase stress on utility lines and building designs, necessitating enhanced weight-loading standards to prevent structural failures and frozen pipes.

Figure 3.9 Predicted Annual Days with Minimum Temperature




*Source: resilientma.org*

Future development in Lee could exacerbate these risks by increasing impervious surfaces, contributing to runoff and localized flooding during snowmelt. Careful land use planning, including stormwater management ordinances, resilient building codes, and floodplain management, will be essential to mitigate these impacts.

The environmental impacts of changing winter conditions include reduced snowpack, which diminishes groundwater recharge and spring river flows vital to aquatic ecosystems. Additionally, increased runoff from melting snow and ice can degrade water quality by carrying pollutants into local waterways. Prioritizing stormwater management strategies—such as enhancing drainage systems based on climate projections, incorporating permeable surfaces, and preserving natural buffers like wetlands—can help mitigate these impacts and protect water resources.

Lee's growing and aging population adds another layer of vulnerability. Older residents face heightened risks during winter storms due to mobility limitations, reliance on consistent heating, and the health risks of prolonged exposure to cold. Seasonal homeowners may be less prepared for winter conditions, leading to challenges such as frozen pipes and snow damage in unoccupied homes. Increased population density, if trends continue, may also strain emergency services and require more targeted outreach to ensure all residents have access to heating, shelter, and emergency assistance during severe weather events.

[i] https://www.weather.gov/otx/Winter_Storms
[ii] NOAA National Severe Storms Laboratory (2023)
[iii] Northeast State Emergency Consortium
[iv] Massachusetts Climate Adaptation Partnership. 2015. Massachusetts Wildlife Climate Action Tool
[v] FEMA Hurricane and Flood Mitigation Handbook for Public Facilities March 2022. https://www.fema.gov/sites/default/files/documents/fema_p-2181-fact-sheet-1-1-road-surfaces.pdf

# Hurricanes/Tropical Storms

## *Hazard Profile*

Hurricanes and tropical storms are powerful types of tropical cyclones—organized systems of thunderstorms with rotating winds—that form over the warm ocean waters of the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico. Sustained winds, heavy rainfall, and low-pressure systems characterize them. These systems can cause severe impacts, including wind damage, flooding, and erosion, threatening communities, infrastructure, and natural ecosystems. In the Atlantic, tropical cyclones are classified as:

- Tropical depression- a low-pressure center in the tropics has 25 - 33 mph winds.
- Tropical storm (T.S.) is a named event defined as having sustained winds from 34 to 73 mph.
- A hurricane is a storm with sustained winds reaching 74 mph or greater. Wind gusts associated with hurricanes may exceed the sustained winds and cause more severe localized damage.

Tropical cyclones form when ocean temperatures reach at least 80°F (27°C), allowing large quantities of warm, moist air to rise and create the ideal conditions for cyclonic circulation. Once formed, these storms can move across the ocean and may travel hundreds of miles inland, bringing high winds and intense rainfall even to areas far from the coast. In lower latitudes, hurricanes generally move from east to west. However, as a storm shifts further north, the westerly flow in the mid-latitudes often causes it to curve toward the north and east, potentially accelerating its forward speed. This dynamic is one reason why some of the most intense hurricanes on record have reached New England (MEMA & EEOEA SHMCAP, 2018).

The impacts of a hurricane vary depending on its intensity, size, and the geography of the affected area. Wind Damage is one of the primary threats, as hurricane-force winds can tear roofs off buildings, uproot trees, down power lines, and create hazardous airborne debris. Inland areas are more likely to experience rainfall-induced flooding, where heavy, sustained rainfall overwhelms rivers, streams, and drainage systems, leading to flash flooding and prolonged inundation. Hurricanes and tropical storms can also increase the risk of secondary hazards like landslides and soil erosion in hilly or flood-prone areas.

## *Likely Severity*

Hurricanes are classified using the Saffir-Simpson Hurricane Wind Scale, which rates them from Category 1 to Category 5 based on their sustained wind speeds:

- Category 1 (74–95 mph): Minimal damage, potential for some roof and siding damage and power outages.
- Category 2 (96–110 mph): Moderate damage, with substantial roof and siding damage and widespread power outages.
- Category 3 (111–129 mph): Extensive damage, including major structural damage to small buildings and homes.

- Category 4 (130–156 mph): Severe damage, with total roof failure on homes and many trees and power lines downed.
- Category 5 (157+ mph): Catastrophic damage, with a high percentage of homes destroyed, fallen trees, and prolonged power outages.

In Berkshire County, concerns related to tropical cyclones primarily center on flooding, as hurricane-force winds are relatively uncommon. The region's higher elevations and mountain ranges offer some natural protection from direct wind impacts. Most tropical cyclones that make landfall in New England, including hurricanes, tend to weaken to a Category 1 or downgrade to tropical storms as they move over cooler waters or land, losing energy after forming in the tropics. Consequently, heavy rainfall and subsequent flooding pose the most significant risks from these storms in Western Massachusetts.

### *Probability*

From 1842 to 2022, 97 combined hurricanes or tropical storms have occurred near Massachusetts, averaging one storm every two years. Four of these storms occurred between 2020 and 2022, suggesting a possible increase in frequency. (EOEEA ResilientMA Plan, 2023). While there is no strong evidence that the overall frequency of hurricanes will significantly increase due to climate change, the intensity and severity of hurricanes are very likely to increase. Given Berkshire County's location—approximately 85 miles from Long Island Sound and 115 miles from Boston Harbor—the region is expected to continue experiencing impacts from tropical cyclones.

The NOAA Hurricane Research Division has published probability maps showing the likelihood of a tropical storm or hurricane affecting a given area during "hurricane season" (June to November). Based on historical data from 1944 to 2020, this analysis indicates that Berkshire County has historically experienced around 10 to 29 named storms per 100 years.

In New England, tropical cyclones are most likely to occur in August and September. This pattern largely results from the time it takes for waters south of Long Island to reach the temperatures necessary to sustain these storms at northern latitudes. Additionally, as fall approaches, the upper-level jet stream develops more dips, causing steering winds to flow from the Great Lakes southward toward the Gulf States and then back northward along the eastern seaboard. This flow pattern can capture a tropical system over the Bahamas and accelerate it northward toward New England. Figure 3.10 displays the historical hurricane paths within 60 miles of the Berkshires.

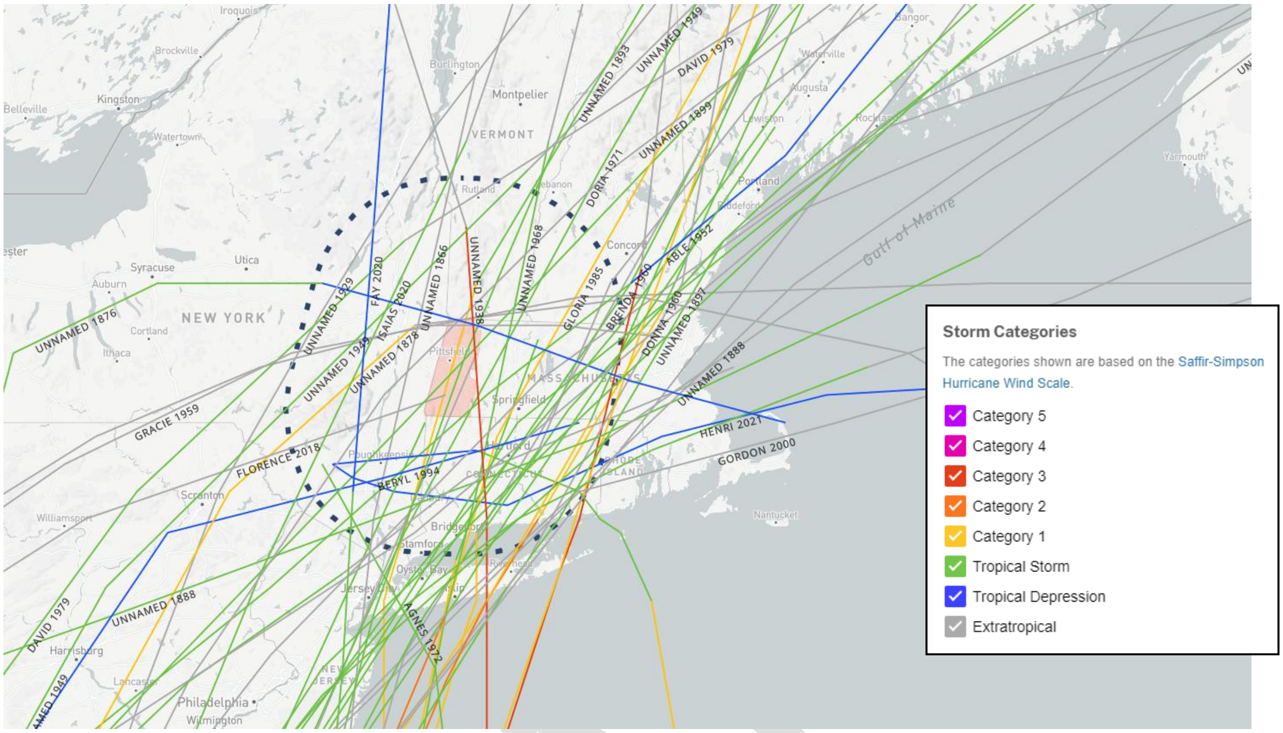



Figure 3.10 Historical Hurricane Paths within 60 miles of the Berkshires

## *Historic Data*

The National Oceanic and Atmospheric Administration (NOAA) is the primary agency that maintains and publishes historical data on hurricanes. Within NOAA, the National Hurricane Center (NHC), which is part of the National Weather Service (NWS), is responsible for tracking and archiving hurricane and tropical storms data, including storm paths, intensities, and impacts. NOAA and its predecessors have been documenting named storms since the mid-1800s. However, systematic and more accurate record-keeping began in 1944, when routine aerial reconnaissance flights started monitoring tropical cyclones, providing more consistent and detailed data on storm location, intensity, and movement. Further improvements came with the launch of weather satellites in the 1960s, which allowed for continuous, reliable observation of storms over the ocean. This technology significantly enhanced tracking and data accuracy, enabling NOAA to document these storms even before they reached land.

As shown in **Figure 3.10** several tropical cyclone events have passed through Berkshire County. Although high winds are notable aspects of these storms, heavy rainfall and flooding typically cause the most significant impacts in this inland region, including injuries, fatalities, and property damage. Between 1954 and 2023, Berkshire County received six FEMA disaster declarations related to hurricanes or tropical storms. **Table 3.8** highlights major storm events directly impacting Berkshire County with associated FEMA declarations. However, hurricane effects in the Berkshires aren't limited to local landfalls; atmospheric currents and jet streams can bring heavy rainfall and flooding from distant storms in

*Source: NOAA Historical Hurricane Tracks Online Tool, 2024* the mid-Atlantic and southeastern U.S., impacting the region indirectly. The Inland flooding section discusses additional details on documented flooding events.

Table 3.8 Historical Tropical Storm Activity across the Berkshire County Region

| Date | Description of Event |
|---|---|
| 8/17/1867 | (unnamed) Tropical Depression |
| 9/19/1876 | (unnamed) Tropical Storm |
| 10/24/1878 | (unnamed) Tropical Depression |
| 8/24/1893 | (unnamed) Category 1 Hurricane |
| 8/29/1893 | (unnamed) Tropical Storm |
| 11/1/1899 | (unnamed) Tropical Depression |
| 9/30/1924 | (unnamed) Tropical Depression |
| 9/21/1938 | "The Great Hurricane of 1938" was considered a Category 2 hurricane a 1% annual chance flood event. Flood damages for roads and bridges totaled $70,000 (Berkshire Eagle Sept 1938) |
| 9/1/1952 | Tropical Storm Able made landfall near Beaufort, South Carolina, on August 31, 1952, as a Category 2 hurricane. By the time it reached New England, it had diminished to a tropical storm. Despite this weakening, Able brought significant rainfall to the area, leading to localized flooding and minor wind damage. The storm's remnants contributed to swollen rivers and streams. |
| 1955 | Hurricanes Connie and Diane combined to flood many of the communities in the region and registering in 1% - 0.2% annual chance flood event (100-500-year flood event) (FEMA 1977-1991). |
| 10/1/1959 | Tropical Depression Grace made landfall near Beaufort, South Carolina, in late September 1959 as a Category 4 hurricane and weakened as it moved inland, bringing light rainfall and minimal impact to the area. |
| 8/28/1971 | Tropical Storm Doria brought heavy rainfall and moderate winds, leading to localized flooding and minor wind damage across the region. |
| 10/28/1985 | Hurricane Gloria (FEMA Declaration DR-751-MA) brought strong winds and heavy rainfall, leading to widespread power outages, downed trees, and minor structural damage. |
| Sept 1999 | The remnants from Hurricane Floyd brought between 2.5-5" of rain and produced significant flooding throughout the region.  Due to significant amounts of rain and the accompanying wind, there were numerous reports of trees down |
| August 2005 | Hurricane Katrina, though primarily devastating the Gulf Coast, indirectly impacted Berkshire County by prompting a FEMA emergency declaration for evacuee assistance. While Berkshire County did not experience direct storm impacts, the declaration facilitated support for displaced residents who relocated temporarily to Massachusetts. (FEMA Declaration EM-3252-MA) |
| Oct 2005 | Remnants of Tropical Storm Tammy and Subtropical Depression Twenty-Two produced torrential rains over interior New England During this 10-day period, approximately 6 to 15 inches of rainfall occurred within New England River basins. Flooding was reported on the Hoosic and Housatonic rivers and in small streams, creeks, urban areas, and poorly drained areas due to rainfall |

| | |
|---|---|
| | exceeding an inch per hour. Lee reports 4 -5" of water on most roads. The Housatonic River reached 2 feet over flood stage. This series of storms resulted in a presidential disaster declaration (**FEMA-DR-1614, FEMA EM-3264)** and Massachusetts received over $13 million in individual and public assistance. (Berkshire Eagle 2005, MA State Hazard Mitigation Plan 2018). |
| Oct. 2010 | The remnants from Tropical Storm Nicole brought 50-60 mph winds and 4-6" of rain resulting in urban flooding. |
| 8/26/2011 | T.S. Irene tracked over the region with widespread flooding and damaging winds. Riverine and flash flooding resulted from 3-9 inches of rain within a 12-hour period. Widespread road closures occurred throughout the region. In MA, this event was a 1% annual chance flood event in the Hoosic River Watershed and a 50-year event in the Housatonic River Watershed. (**FEMA Declaration EM-3330-MA)** |
| Sept. 2011 | Remnants of Tropical Storm Lee brought 4-9" of heavy rainfall to the region. Due to the saturated soils from T.S. Irene, this rainfall led to widespread flooding on rivers as well as small streams. |
| Aug 2012 | Hurricane Sandy brought high winds, downing trees and utility lines and leaving over 5,000 homes and businesses without power. Rainfall was minimal, with only 1.6 inches recorded in Savoy, while wind gusts reached 77 mph in Hancock, 61 mph in Otis, and 58 mph in Pittsfield. No injuries were reported, with the wind being the primary impact of the storm **(FEMA Declaration EM-3350-MA).** |
| 9/17/2018 | Hurricane Florence brought moderate rainfall, where 3 inches of rain fell at Pittsfield Municipal Airport. The average for the entire month was shy of 4 inches (Berkshire Eagle Archives). |
| 8/4/2020 | Tropical Storm Isaias brought strong winds that downed trees and utility lines. The storm left approximately 50,000 Berkshire residents without power, with some outages lasting several days. Road closures occurred due to fallen trees, and utility crews worked to restore power to affected areas. |
| 8/21/2021 | Tropical Strom Henri brought moderate rain, with towns receiving 1-2" of rain. |
| 9/15/2023 | Hurricane Lee, a tropical storm turned Category 2 hurricane, brought high winds and heavy rain from September 15th- 17th, resulting in a presidential disaster declaration for Massachusetts, including Berkshire County (**EM-3599-MA**). |

The Great Hurricane of 1938 remains one of the most memorable historic storms, with almost seven inches of rain falling over a three-day period. Rainfall from this hurricane resulted in severe river flooding across sections of Western Massachusetts, with three to six inches falling in the region. The rainfall from the hurricane added to the amounts that had occurred with a frontal system several days before the hurricane struck. The combined effects from the frontal system and the hurricane produced 10-17 inches rainfall across most of the Connecticut River Valley. In the Berkshires, 700 families were evacuated, two deaths occurred, many other people were injured, and 300 people were left homeless. Downtown North Adams and nearby Adams were flooded, and martial law was declared in North Berkshire.

In October 2005, the remnants of Tropical Storm Tammy, followed by a subtropical depression, produced significant rain and flooding across western Massachusetts. It was reported that between 9 and 11 inches of rain fell.13.73 inches fell at the Pittsfield Airport -- more than four times higher than the average for that month.

Tropical Storm Irene (August 27-29, 2011) produced significant rain, inland flooding, and wind damage across southern New England and much of the east coast U.S. The National Weather Service reported rainfall totals between 3 and 10 inches in northwestern Massachusetts. The NOAA's National Centers for Environmental Information recorded August 2011 as the second wettest August in Massachusetts in the past 117 years of precipitation records.[i] In western Massachusetts, the rainfall measured 11.21 inches, more than three times the average August rainfall of 3.41 inches, according to the Massachusetts DCR.[ii] Before the arrival of Tropical Storm Irene, western Massachusetts was already experiencing saturation of its soils due to excessive rainfall, making it vulnerable to flash flooding. [iii]The storm resulted in $40 million worth of damages in Berkshire County. A presidential disaster was declared (FEMA DR-4028), and the Commonwealth received over $31 million in individual and public assistance from FEMA.

Regionally, T.S. Irene is one of the most memorable storm events in recent history due to the flooding that occurred in northern Berkshire and Franklin Counties in Massachusetts and in southern Vermont. It caused flood levels equal to or greater than a 100-year flood event in Williamstown and North Adams. Extensive flooding in the Deerfield River watershed caused, among other damages, the closing of Route 2 in Florida/Charlemont (due to the collapse of the road and a landslide). Immediately after this, even the USGS recorded flood levels and recalculated and red-delineated the boundaries for the 100-year floodplain for the Hoosic River as it flows through portions of North Adams and Williamstown. This is one of the very few areas in Berkshire County where floodplain maps have been updated since the 1980s.

A year later, Hurricane Sandy was one of the largest storms to have hit New England. Fortunately, the Berkshires suffered relatively little damage compared to coastal communities. Heavy winds toppled trees and power lines throughout the county, closing roads and causing widespread power outages.

### *Vulnerability Assessment*

#### *Geographic Areas of Concern*

The entire Town of Lee is vulnerable to hurricanes and tropical storms, with the level of impact depending on each storm's specific track. Inland areas, particularly those in floodplains, near waterways, or isolated in hilly and mountainous regions, face heightened flooding risks from heavy rainfall and wind damage. In Lee, much of the damage following hurricanes and tropical storms typically stems from residual wind impacts and inland flooding, as recent storms have demonstrated.

#### *People*

Historical records indicate that the only fatalities from tropical storms in Berkshire County occurred during the 1938 hurricane, primarily due to flooding rather than high winds. While high winds from tropical storms and hurricanes can cause severe damage by downing trees, limbs, and power lines, damaging buildings, and creating hazardous debris, flooding remains the primary cause of fatalities.

Vulnerable populations, including economically distressed individuals, the elderly, and others with limited physical or financial resources, are particularly susceptible. This susceptibility stems from factors such as their ability to respond during a hazard, the location of their residences, and the construction quality of their housing.
Research shows that human behavior can significantly contribute to flood-related fatalities. For instance, during the flooding at The Spruces in Williamstown, some residents required forcible evacuation by emergency personnel. Additionally, individuals living or working near facilities that store or use toxic substances—such as those located near railroad tracks, the town garage, or the transfer station—face heightened exposure risks during flood events.

The most vulnerable populations include people with low income, individuals over 65, and those with medical needs. These groups often face specific preparedness challenges, such as limited access to emergency alerts, difficulties in securing transportation for evacuation, and a lack of resources for storm preparations. Furthermore, the mental health impacts of tropical storms can be significant, especially for elderly residents and those with existing health needs, as the stress of evacuation or the loss of a home can lead to lasting psychological effects. Vulnerable groups may also have fewer resources to recover from property loss, job displacement, or relocation from damaged neighborhoods, particularly if they lack adequate insurance or financial support.

During and after a storm, rescue and utility workers are at increased risk from high water, swift currents, and submerged debris, especially when working in areas with extended flooding. Addressing these vulnerabilities through targeted emergency planning and resource allocation is essential for protecting public health and safety (MEMA & EEOEA SHMCAP, 2018).

*Built Environment*

All elements of the built environment are exposed to severe weather events such as hurricanes and tropical storms. The most pressing concern is the impact of high winds and flooding on infrastructure, roadways, and electrical systems.

Given the town's reliance on Route 20 as a primary access point for residents, tourists, and emergency services, storm flooding or debris could significantly disrupt local mobility and emergency response efforts. Other main routes, such as Route 7, Route 102, and I-90, are essential corridors linking Lee with nearby communities. This linkage supports regional commerce and emergency services.

According to FEMA maps from 1982, the Wastewater Treatment Plant is the only critical facility currently located within the 100-year flood hazard zone. Town Hall, while not in a designated flood hazard zone, is situated near the 500-year flood hazard zone, which indicates areas with a 0.2% annual probability of flooding. Currently, the Police Station is housed in Town Hall's basement, which has experienced periodic flooding. Plans for a new public safety complex, combining Police and Fire services, aim to address the broader needs of both departments, including space, accessibility, operational efficiency, and climate resiliency. Construction is anticipated to begin in 2027.

Residential and commercial structures, particularly older buildings, also face heightened exposure to wind and flood damage. Many of these structures lack modern wind-resistance features and are susceptible to water intrusion and erosion, especially those on slopes or near water bodies. Power lines running along main roads are highly vulnerable to storm-related damage, posing risks of extended power outages, especially for residents reliant on private wells, further impacting water access.

Mobile home neighborhoods in Lee, particularly those on Water Street near the Turnpike and Bradley Park in the town's northeast (a senior-only community), are especially vulnerable. These homes often lack the structural resilience of conventional housing and are more susceptible to wind damage and flooding. Additionally, their locations in low-lying areas further elevate the risk of water intrusion and storm-related damage.  Several residential, commercial, and industrial buildings were destroyed during the floods of 1938, 1949, and 1955 in northern Berkshire County during tropical storm events. Most recently, the full destruction and permanent removal of all homes in The Spruces mobile home park in Williamstown demonstrates the vulnerability of structures due to hurricane-related flooding.

*Natural Environment*

Hurricanes and tropical storms in Lee can cause environmental impacts similar to those of inland flooding, severe winter storms, and other intense weather events. During storms, flooding disrupts ecosystem functions, while high winds may uproot trees and damage vegetation. Forested areas are especially vulnerable, as invasive species like the Emerald Ash Borer have left many ash trees dead and easily felled by strong winds. Falling trees can lead to habitat loss for local species, but they also provide nutrients to the soil as they decompose, supporting regrowth. Wind- and water-borne debris poses an additional hazard, potentially injuring animals or displacing them into unsuitable habitats.

In the long term, hurricanes and tropical storms reshape ecosystems. Floodwaters can scour riverbeds, alter habitats, and redistribute sediment, impacting aquatic life and increasing soil erosion. Wetlands, which serve as natural buffers, may be overwhelmed by intense rainfall, reducing their flood-mitigation function and further endangering local habitats. Invasive plants like knotweed spread more readily when floodwaters carry fragments, threatening native vegetation and biodiversity. Additionally, storm-driven pollutants can contaminate ecosystems, disrupting food and water supplies and causing lasting effects on wildlife populations.

*Economy*

Hurricane and tropical storm events can severely impact the economy, causing loss of business function, damage to inventory, relocation costs, wage loss, and rental loss due to the repair or replacement of buildings. For example, the Commonwealth received over $31 million in individual and public assistance from FEMA following Tropical Storm Irene in 2011 (FEMA DR4028). Regional storm impacts are further detailed in the Inland Flooding section of this plan.

Severe tropical weather events pose significant risks to Lee’s economy, particularly its reliance on tourism. Route 20, the primary entry point for visitors via the Mass Turnpike (I-90), is essential for accessing the Town Center and nearby attractions. Flooding, road closures, and debris can impede access to Main Street and surrounding areas, deterring tourists during peak seasons. Prolonged disruptions could result in revenue losses for local businesses, especially those catering to visitors, such as shops, restaurants, and galleries in Lee’s historic buildings.

Agriculture, including High Lawn Farm, also faces risks from heavy rains and high winds. Flooding can erode farmland, contaminate soil, and disrupt the delivery of goods, reducing yields and impacting farm revenues.

Storms could damage commercial properties and industrial facilities, affecting employers like Berkshire Sterile, Boyd, and Oldcastle Stone. Infrastructure damage or power outages could delay operations, leading to financial losses and reduced productivity. Seasonal workers and outdoor recreation businesses like the Oak N Spruce Resort are especially vulnerable to storm impacts, potentially resulting in revenue losses and job disruptions.

Property damage in flood-prone areas can lower property values and reduce tax revenues. Recovery efforts, including cleanup and infrastructure repairs, would strain the town's budget.

*Future Conditions*

According to the NOAA, recent Atlantic hurricane seasons have shown increasing intensity.

- ***2020:*** A record-setting year with 30 named storms, including 12 U.S. landfalls. This marked the fifth consecutive above-normal season, attributed to the warm Atlantic Multi-Decadal Oscillation phase, which has fueled stronger, more frequent storms since 1995.
- ***2022:*** Though fewer storms formed (14 total), hurricanes like Category 4 Ian (with wind speeds of 150 mph) caused severe damage in Florida and Puerto Rico.
- ***2023***: High activity continued with 20 named storms, the fourth highest on record, including seven hurricanes, three of which reached major hurricane status. Record-warm Atlantic temperatures and an El Niño pattern contributed to the storm intensity.
- ***2024:*** Although the full report is not yet available, Hurricane Milton, the second hurricane to develop within two weeks, has been recorded as the most intense hurricane in the Atlantic basin.

In a warming world, intense hurricane seasons will likely become more common. Higher temperatures, rising sea levels, and shifting weather patterns create ideal conditions for larger, more powerful, and longer-lasting storms. Oceans absorb over 90% of the excess heat trapped by greenhouse gases, and sea surface temperatures have risen about 2.8°F since the early 20th century.[iv] This additional heat fuels tropical storms, making them more destructive when they reach land.

Warmer air temperatures also enable the atmosphere to hold more moisture, allowing hurricanes to draw in and release more rainfall. This moisture release further intensifies the storm as it condenses, adding heat to the system. Research estimates that human-caused warming has increased extreme hourly rainfall rates in hurricanes by approximately 11%, indicating that tropical storms will likely continue to bring heavier rain upon landfall.[v]

Most models show no change or a decrease in overall hurricane frequency in a warmer climate. However, more storms will likely reach Category 4 or 5 intensity. Since 1975, the number of Category 4-5 hurricanes has roughly doubled, meaning that while there may be fewer storms, those that do form are more likely to be highly intense and destructive. As a result, the secondary hazards of hurricanes like flooding, landslides, and power outages are also expected to increase. Heavier rainfall can lead to widespread flooding and landslides in vulnerable areas, while stronger winds raise the risk of downed trees and power lines, resulting in extended power outages.

As severe hurricanes and storm surges increasingly affect coastal areas of Massachusetts and states in the South, some residents may choose to relocate to inland towns like Lee, which are perceived as safer. This climate migration could pressure Lee's housing market, potentially increasing housing demand and costs. With limited affordable housing options, vulnerable groups, such as low-income residents and older adults, may face challenges in finding and maintaining housing. An influx of new residents could also strain local resources, including emergency services and health infrastructure, particularly if these newcomers include individuals with high support needs or limited familiarity with local emergency protocols.

Nearly a quarter of Lee's population is 65 or older, with a similar percentage aged 40 to 64, indicating an aging community in the next decade. This demographic is particularly vulnerable during hurricane events due to potential reliance on electricity for medical devices, limited mobility, and increased difficulty accessing resources. Emergency planning and response efforts should prioritize tailored support, including evacuation assistance, temporary housing, and healthcare access for older residents. Family reunification plans are also crucial, as older adults separated from caregivers or family members during evacuations may face additional challenges in accessing essential services and emotional support.

With potential population growth, Lee may experience development pressures to expand housing and infrastructure. Future land use decisions must address these pressures while mitigating hurricane-related risks. According to the Insurance Institute for Business & Home Safety (IBHS), Massachusetts ranks 9th among hurricane-prone states for building codes and resilience measures, indicating room for improvement in preparing structures for intense wind and storm conditions.[vivii] This ranking highlights the need for stronger local building codes and resilience measures, particularly wind resistance and stormwater management. Enhanced building code regulations will ensure that new developments are equipped to withstand future storms. Limiting development in flood-prone areas and protecting natural flood buffers like wetlands will also be crucial for managing stormwater and reducing flood risk.

The new public safety complex is planned just outside the 500-year flood hazard zone identified on FEMA's 1982 maps. While this zone, with a 0.2% annual probability of flooding, is statistically rare, its designation relies on outdated data that may not account for current or future risks. Climate projections suggest that more intense storms and heavier precipitation could expand flood-prone areas beyond those mapped in 1982. To ensure resilience, modern climate-adaptive strategies, such as elevated building foundations, robust stormwater management systems, and reliable access routes, should be integrated into any new building designs. Additionally, the town should coordinate closely with state and federal agencies to stay informed about updated flood hazard maps and resources to guide long-term planning.

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[i] NOAA, 2016a, Data tools— 1981–2010 accessed February 2, 2023, at https://www.ncdc.noaa.gov/cdo-web/datatools/normals.

[ii] Massachusetts DER, 2011, Monthly precipitation composite accessed February 1, 2023, at http://www.mass.gov/ eea/agencies/dcr/waterres-protection/water-data-tracking/ rainfall-program

[iii] Lombard, P. J., Bent, G. C., & Dudley, R. W. (2016). Flood-inundation maps for the Housatonic River, Massachusetts, from the confluence of the East and West Branch Housatonic Rivers at Pittsfield downstream to Great Barrington (Scientific Investigations Report No. 2016–5027). U.S. Geological Survey. https://doi.org/10.3133/sir20165027

[iv] https://www.epa.gov/climate-indicators/climate-change-indicators-sea-surface-temperature
[v] Holland, G., & Bruyère, C. L. (2014). Recent intense hurricane response to global climate change. Climate Dynamics, 42(3–4), 617–627. https://doi.org/10.1007/s00382-013-1713-0
[vi] Insurance Institute for Business & Home Safety. (2024). Rating the states: 2024 edition. Retrieved from https://ibhs1.wpenginepowered.com/wp-content/uploads/RTS_2024_v2.pdf.
[vii] This ranking reflects the 9th edition of the building code. The 10th edition, effective October 11, 2024, reduces design wind speeds (potentially impacting climate resiliency) and updates solar panel and seismic standards, with a concurrency period until June 30, 2025

# Invasive Species

## *Hazard Profile*

"Invasives" are non-native plants and animals living in areas where they do not naturally exist and are likely to cause significant harm to the environment, economy, or human health. It's important to distinguish that "non-native" and "invasive" are not interchangeable. Many commonly grown fruits and vegetables, such as tomatoes and lettuce, are not native to the U.S. A considerable difference is that invasives compete with native plants and wildlife for resources, disrupt beneficial relationships, spread disease, cause direct mortality, and can significantly alter ecosystem function.[i]

The Massachusetts State Hazard Mitigation Plan categorizes invasive species as an environmental hazard with multifaceted implications. From a hazard mitigation planning aspect, the unchecked proliferation of invasive species can alter soils, affecting crop production, increasing erosion, and increasing wildfire risks. Invasive species further impede climate change mitigation efforts, notably diminishing forest carbon sequestration rates (EOEEA ResilientMA Plan, 2023). As such, the state recognizes the management of invasives as a high priority.

Specific costs associated with invasive species include control and management activities, prevention and early detection, rapid response programs, funding for research, public outreach campaigns, and removal and restoration programs. Several agencies assist with the detection, control, and education regarding invasives, such as the Massachusetts Department of Agricultural Resources (MDAR), UMass Extension Agriculture and Landscape Program, United States Department of Agriculture/ Animal and Plant Health Inspection Service, and the Massachusetts Invasive Plant Advisory Group (MIPAG). Combined, these collaborations assist the state, private, and public sectors with guidance to manage invasives.

Massachusetts also has a variety of laws and regulations in place that attempt to mitigate the impacts of these species. The Massachusetts Department of Agricultural Resources (MDAR) maintains a list of prohibited plants for the state, including federally noxious weeds and invasive plants recommended by MIPAG and approved for listing by MDAR. Species on the MDAR list are regulated with importation, propagation, purchase, and sale prohibitions in the Commonwealth. Additionally, the Massachusetts Wetlands Protection Act (310 CMR 10.00) includes language requiring all activities covered by the Act to account for and take steps to prevent the introduction or propagation of invasive species. Regulations 302 CMR 18.00 is designed to protect Massachusetts freshwater systems by establishing standards, criteria, and procedures for an effective aquatic nuisance control program. It enables the Department of Conservation and Recreation (DCR) to suppress, eradicate, control, and mitigate the spread of ANS (Aquatic Nuisance Species). In 2000, Massachusetts passed an Aquatic Invasive Species Management Plan, making the Commonwealth eligible for federal funds to support and implement the plan through the federal Aquatic Nuisance Prevention and Control Act. MassDEP is part of the Northeast Aquatic Nuisance Species Panel, which was established under the federal Aquatic Nuisance Species Task Force. This panel allows managers and researchers to exchange information and coordinate efforts to manage aquatic invasive species.

Several state laws also pertain to invasive species. Chapters 21, 128, 130, and 132 of Part I of the state's General Laws include language addressing water chestnuts, Japanese knotweed, Zebra mussels, the Asian longhorn beetle, and several other species. These laws also allow spaces to be surveyed for invasive species and quarantines to be put into effect at any time.

### *Likely Severity*

Invasive species can rapidly establish and spread, causing significant disruptions to local ecosystems. The severity of their impact can vary depending on the type of invasive species, the extent of their spread, and the resilience of the affected areas. Experts estimate that about 3 million acres within the U.S. (an area twice the size of Delaware) are lost each year to invasive plants (from Mass.gov "Invasive Plant Facts"). The massive scope of this hazard indicates that all of Massachusetts is susceptible to effects from invasive species. For example, the prevalence of the Emerald ash borer (EAB) targeting ash trees (Fraxinus spp.) poses a significant threat. To date, this invasive beetle is responsible for the loss of tens of millions of ash trees across 36 states. According to (DCR), 217 Massachusetts counties have detected EAB. [ii] Additionally, of the 2263 plant species in Massachusetts that have been documented as native or naturalized (established newcomers introduced directly or indirectly by humans), about 725 (32%) are naturalized. Of these, the MIPAG recognized 72 species as "Invasive," "Likely Invasive," or "Potentially Invasive.

Furthermore, the ability of invasive species to travel far distances (either via natural mechanisms or accidental human interference) allows invasive species to propagate rapidly over a large geographic area, both on terrain and in aquatic systems. Areas with high amounts of plant or animal life may be at higher risk of exposure to invasive species than less vegetated urban areas. However, invasive species can disrupt ecosystems of all kinds. Due to the abundance of plant and animal life throughout Lee and the Berkshire region, the severity of the invasive species hazard is likely moderate to high.

### *Probability*

Expanding global trade and travel routes have significantly increased the introduction of exotic species. This increase is particularly concerning in the case of international trade in ornamental plants, as many invasive species in the U.S. were originally imported for ornamental purposes. Massachusetts has established prohibitions on the propagation and sale of numerous invasive plant species to combat this issue. Despite these efforts, invasive species can still spread via animals, people, equipment, and machinery traveling through the region's landscapes and waterways. For instance, hikers, mountain bikers, ATVs, and boaters can unintentionally transport invasive species from infested areas to non-infested ones. As outdoor recreational tourism continues to rise in the Berkshires, this risk is expected to increase.

Natural hazards also play a significant role in the spread of invasive species. Flood events can uproot and transport invasive plant species, spreading them to new areas. For example, plant fragments and seeds from semi-aquatic and aquatic plants like Japanese knotweed, purple loosestrife, common reed, water chestnut, Eurasian water milfoil, and curly leaf pondweed can be widely distributed during floods. Similarly, berries and seeds from terrestrial invasive plants are often spread along river corridors and floodplain areas. Additionally, wind, ice storms, or poor forestry practices that fragment or open up the tree canopy can stress the remaining trees, creating temporary conditions that allow invasive species to establish and suppress the regeneration of native trees. The same windstorm that damages the tree canopy may also facilitate the dispersal of invasive plant seeds into the damaged forest.

Wildfires, typically surface fires in the Berkshires, burn forest duff and damage or kill seedlings and ground forbs. The temporary die-back of plants on the forest floor opens the way for invasive understory species such as honeysuckles, buckthorns, bittersweet, and hardy kiwi vine to establish. The risk of invasive infestation increases if the burned area is near, especially downwind of, existing invasive species populations and seed sources. This risk is further elevated if hikers and mountain bikers track seeds or plant fragments from infested areas into the burned sites.

The spread of forest pests is influenced by their life cycle, dispersal capabilities, and the abundance of their preferred food sources. For example, the emerald ash borer is a capable flyer, allowing it to move easily through the Berkshire landscape, which is rich in ash trees. The woolly adelgid spreads through wind, mammals, and birds, particularly from March through July, threatening connected hemlock landscapes.

The risk of invasive aquatic and riparian species spreading from one riverine, pond, or lake ecosystem to another is largely due to human activity. However, birds and mammals can also transport these species. Plant fragments, seeds, and aquatic animals easily travel from one water body to another via kayaks, canoes, boats, equipment, and waders.

### *Historic Data*

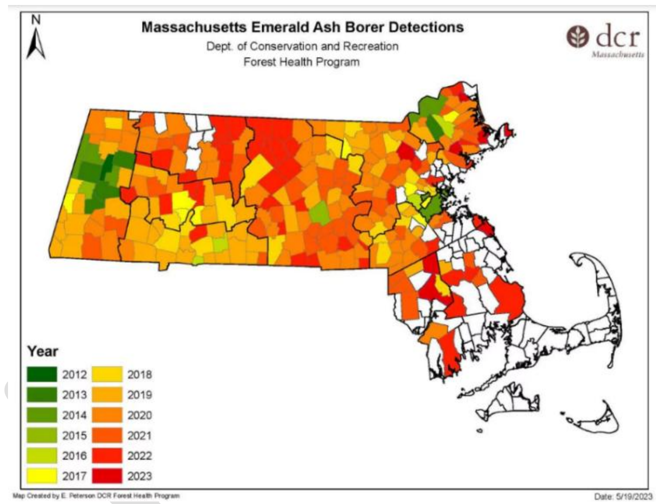
In July 2009, Laurel Lake in Lee became the first -- and so far the only -- Berkshire County lake or pond to be infested with zebra mussels. These mussels can greatly change a water body's ecology and attach themselves to boats, docks, water intake pipes, and aquatic animals. Zebra mussels have proliferated and represent a major threat to the Housatonic River, downstream impoundments, and other area lakes. Boat ramp inspections and use of a wash station limit spread by boats, but only on a part-time basis. The Housatonic River has received larval zebra mussels from Laurel Lake, two impoundments downstream in Connecticut have become infested, and there is great concern for Candlewood Lake, which receives diverted water from the Housatonic River. *See Image 3.3.* A boat washing station was erected in 2011 and continues to be in operation.

Image 3.3: Eurasian watermilfoil (left), Zebra Mussels (right)

The Laurel Lake Preservation Association, a volunteer citizens group, was formed in the early 2000s in response to the growing threat of invasive species. The association works with both the Town of Lee and Lenox, who share Laurel Lake. Since 2010, a drawdown of Laurel Lake has been implemented to limit the colonization of nearshore areas by zebra mussels and Eurasian watermilfoil. Over the last decade, these efforts have successfully achieved a 3-foot drawdown, significantly reducing milfoil abundance in the water. However, in 2017, the drawdown was not conducted due to permitting issues, leading to an alarming expansion of milfoil in the following growing season [iii]

Goose Pond also manages Eurasian watermilfoil and phragmites; however, the spread is less expansive than at Laurel Lake and responds well to draw-down treatments. According to the Goose Pond Maintenance District, zebra mussels have not been established at Goose Pond, and the area is generally considered low risk as the water does not have a desirable quantity of calcium for building shells.

The Emerald Ash Borer (EAB) is recognized as one of the most destructive insects in North America, feeding exclusively on ash trees. Ash trees are prevalent in northern hardwood forests, riparian areas along rivers and lakes, and wetlands. They provide essential food and habitat for wildlife and are also widely planted in developed/urbanized environments, making their decline a significant risk to both people and property due to falling trees.




EAB was first reported in the Berkshires in 2012, in the Town of Dalton, making Massachusetts the 18th state to detect EAB. There are now 36 states with confirmed cases. By 2013, confirmed cases were documented in Lee. Berkshire County, which contains 64% of the state's forest, has 12% of its forested area composed of ash trees. In 2021, 102 acres of forest in Lee were damaged by EAB; by 2022, this number had increased to 783 acres. By 2023, an additional 149 acres of forests were also damaged.

Each year DCR completes an annual aerial survey of the state forests to identify any significant forest events. In 2021, over 80,000 acres statewide were impacted from mix of biotic (pathogens and insects) and abiotic (wind, storms, etc) with Pitch Pine needle case impacting 45%, White pine needle damage 18%, Spongy Month 14%, and EAB 4%. In 2022, Spongy Moth damage accounted for 30,895 acres of damage (56%) statewide. Table 3.9 displays the total area of impact from forest according to the 2022 forest health report for Berkshire County. [iv]

Table 3.9: DCR's 2022 State Forest Health Report - Berkshire County

| Damaging Agent | Number of Acres Damaged |
|---|---|
| Lymantria Dispar (*Spongy Moth)* | 24,350 |
| Emerald Ash Borer | 3,126 |
| White Pine Needle Disease | 2,059 |
| Hemlock Woolly Adelgid | 406 |
| Elongated Hemlock Scale | 132 |
| Norway Spruce Needle cast | 154 |
| Red Pine Scale | 75 |

The Massachusetts Invasive Plant Advisory Group (MIPAG) provides comprehensive lists of invasive and likely invasive plant species across the state. Table 3.10 below list the plants reported for Berkshire County, last updated in 2022.

Table 3.10: MIPAG Invasives for Berkshire County (2023) Lists of Invasive and Likely Invasive Plants for Berkshire County, 2022

| Category | Plant Names |
|---|---|

| | |
|---|---|
| Trees (Invasive) | Acer platanoides (Norway maple), Acer pseudoplatanus (Sycamore maple), Ailanthus altissima (Tree-of-heaven), Alnus glutinosa (Black alder, European alder), Robinia pseudoacacia (Black locust), Salix atrocinerea/Salix cinerea L. (Large Gray Willow/Rusty Willow) |
| Shrubs (Invasive) | Berberis thunbergii (Japanese barberry), Elaeagnus umbellata (Autumn olive), Euonymus alatus (Winged euonymus; Burning bush), Frangula alnus (European buckthorn; glossy buckthorn), Rosa multiflora (Multiflora rose), Salix atrocinerea/Salix cinerea (Large Gray Willow/Rusty Willow) |
| Vines (Invasive) | Celastrus orbiculatus (Oriental bittersweet), Cynanchum louiseae (Black swallow-wort), Lonicera japonica (Japanese honeysuckle), Lonicera morrowii (Morrow's honeysuckle), Lonicera x bella (Bell's honeysuckle), Polygonum perfoliatum (Mile-a-minute vine or weed) |
| Perennial Herbs (Invasive) | Aegopodium podagraria (Bishop's goutweed), Alliaria petiolata (Garlic mustard), Euphorbia esula (Leafy spurge), *Fallopia japonica (Japanese knotweed), Ficaria verna (Lesser celandine), Hesperis matronalis (Dame's rocket), Iris pseudacorus (Yellow iris), Lepidium latifolium (Broad-leaved pepperweed), Lysimachia nummularia (Creeping jenny), Lythrum salicaria (Purple loosestrife), Phalaris arundinacea (Reed canary-grass) |
| Aquatic Plants (Invasive) | Cabomba caroliniana (Carolina fanwort), Myriophyllum heterophyllum (Variable water-milfoil), Potamogeton crispus (Crisped pondweed), *Phragmites australis (Cav.) Trin. ex Steud. subsp. australis (Common reed) |
| Grasses (Invasive) | Eragrostis curvula (Weeping lovegrass) |
| Trees (Likely Invasive) | Phellodendron amurense Rupr. (Amur cork-tree), Pinus thunbergii Parl. (Japanese black pine), Pyrus calleryana Decne. (Callery Pear; Bradford Pear) |
| Shrubs (Likely Invasive) | Berberis vulgaris L. (Common barberry), Cytisus scoparius (Scotch broom), Ligustrum obtusifolium (Border privet), Lonicera tatarica L. (Tatarian honeysuckle), Rubus phoenicolasius Maxim. (Wineberry; Japanese wineberry; wine raspberry) |
| Vines (Likely Invasive) | *Actinidia arguta (Hardy kiwi), Ampelopsis brevipedunculata (Porcelain-berry), Humulus japonicus (Japanese hops), Pueraria montana (Kudzu; Japanese arrowroot) |
| Perennial Herbs (Likely Invasive) | Anthriscus sylvestris (Wild chervil), Cardamine impatiens (Bushy rock-cress), Centaurea stoebe (Spotted knapweed), Cynanchum rossicum (European swallow-wort), Epilobium hirsutum (Hairy willow-herb), Euphorbia cyparissias (Cypress spurge), Festuca filiformis (Hair fescue), Heracleum mantegazzianum (Giant hogweed), Microstegium vimineum (Japanese stilt grass), Miscanthus sacchariflorus (Plume grass), Mycelis muralis (Wall Lettuce), Myosotis scorpioides (Forget-me-not) |
| Aquatic Plants (Likely Invasive) | Egeria densa (Brazilian waterweed), Hydrilla verticillata (Hydrilla; water-thyme) |
| Grasses (Likely Invasive) | Festuca filiformis Pourret (Hair fescue; fineleaf sheep fescue) |
| *of particular concern for the Town of Lee<br>Note: Once plant species are recognized as invasive, likely invasive or potentially invasive by "MIPAG", the Massachusetts Department of Agricultural Resources holds a hearing to determine if | |

species newly listed by MIPAG should be added to the list of noxious weeds regulated with prohibitions on importation, propagation, purchase and sale in the Commonwealth. Also, the Massachusetts Association of Conservation Commissions (MACC) now encourages Commissioners to consider the wetland impacts of these invasive species during project reviews as part of their jurisdiction under the Wetland Protection Act.

## *Vulnerability Assessment*

### *Geographic areas likely impacted*

All of Lee and the surrounding region is at risk of invasive species, including its lakes, ponds, and wetlands. Lee's abundant water resources make it particularly vulnerable to nuisance aquatic vegetation, with phragmites and Japanese knotweed as the major concerns. Phragmites, also known as common reeds, are tall wetland grass that harms the environment. It is an invasive species that can grow in any moist area, such as along highways, city streets, and farmland ditches. This plant has taken over valuable habitats, reducing the diversity of wetland plants and wildlife. Its dense growth can impede water flow, causing increased flood risks and compromising the natural hydrology of wetland areas. The extensive root system of phragmites can alter soil characteristics and drainage patterns, exacerbating flooding in affected areas.  Similarly, Japanese knotweed is another invasive species threatening native habitats, particularly along waterways. This plant can easily spread through its underground rhizomes and broken stem pieces, making it difficult to control. Flooding and water flow can carry rhizome and stem fragments downstream, leading to new infestations along riverbanks, stream edges, and other riparian areas. It can be found in various environments, including vacant lots, yards, and other areas where it can gain a foothold. Phragmites and Japanese knotweed are major concerns for conservation efforts and preserving natural habitats, especially along the Housatonic River.

Submerged invasive aquatic plants like Eurasian Watermilfoil and water chestnut threaten native plants and wildlife populations in Laurel Lake, Goose Pond, and Woods Pond.  Eutrophication is a problem common to both Laurel Lake and Goose Pond, and in both cases, it is the accelerated growth of invasive non-native aquatic plants, especially Eurasian Watermilfoil.  Honeysuckle and purple loosestrife, with other giant reed grass, are colonizing many wetland communities in several priority areas in Lee. These invasives and several others can be found in the areas of Woods Pond, Laurel Lake, Upper Reservoir, Goose Pond/Goose Pond Brook, the Housatonic River, and the Hop Brook Wildlife Management Area in South Lee. Similarly, in open freshwater ecosystems, invasive species such as zebra mussels can quickly spread once introduced, as there are generally no physical barriers to prevent establishment outside of physiological tolerances and multiple opportunities for transport to new locations (by boats, for example).

Lee has 1,154 acres of wetlands, equal to 7% of the town area. This figure includes emergent, scrub or shrub, and forested wetland ecosystems, but it does not include the smaller wetlands that exist throughout the town near or in developed areas. Larger wetlands are located mostly in wooded areas at the following locations:

- North and south of Devon Road;
- Along and to the south of Route 102;
- Along the Massachusetts Turnpike;

- Between Greylock Street and East Street;
- Along Washington Mountain Road;
- North of Woods Pond;
- Along the railroad tracks near the Lenox town border;
- South of the limestone quarry;
- West of Finnerty Pond; and
- South of Basin Pond

Forest pests like the spongy month, emerald ash borer, Asian longhorn better, hemlock woolly adelgid, and the southern pine beetle are the most concerning. They could cause widespread tree death and ecosystem disruption. DCR has noted these pests in October Mountain State Forest, the Appalachian Trail Corridor, Golden Hill Town Forest, Ferncliff Reservation, and between Maple and Fairview St. Additionally, residents have reported large areas of ash trees felled between Church St. and Fairview St. See Figure 1.3 Town of Lee Critical Facilities and Areas of Concern

*People*

Invasive species pose significant health risks to human populations. These risks arise from direct contact with harmful plants, the spread of diseases, and the exacerbation of existing health conditions. Certain invasive species are directly harmful to human health. For example, Giant Hogweed can cause severe skin reactions. Contact with its sap, especially when exposed to sunlight, can lead to painful blisters and long-lasting scars. This makes outdoor activities in infested areas hazardous, particularly for children and those unaware of the plant's dangers. Common Ragweed produces large amounts of pollen, which can exacerbate allergies and respiratory conditions like asthma. Increased pollen levels can affect vulnerable populations, including children, the elderly, and individuals with preexisting respiratory issues.

Invasive species can contribute to the spread of vector-borne diseases. For instance, invasive mosquito species like the Asian Tiger Mosquito (Aedes albopictus) can transmit diseases such as West Nile Virus and Eastern Equine Encephalitis (EEE). These mosquitoes thrive in the stagnant water often found in urban areas, increasing the risk of disease transmission to humans. Invasive plants like Japanese Barberry can alter local ecosystems in ways that increase the risk of tick-borne diseases. Dense barberry thickets create favorable habitats for white-footed mice and deer, both key hosts for black-legged ticks (Ixodes scapularis). These ticks are vectors for Lyme disease, anaplasmosis, and babesiosis. Higher tick populations in barberry-infested areas elevate the risk of these diseases to humans. People with compromised immune systems or pre-existing health conditions, children under five, and people over 65 might be particularly vulnerable to new diseases or aggravated health problems.

Invasive aquatic plants, such as Hydrilla, can create dense mats on water surfaces, affecting water quality and promoting conditions conducive to harmful algal blooms. These blooms can produce toxins harmful to human health, causing skin rashes, gastrointestinal illnesses, and respiratory problems when people come into contact with contaminated water during recreational activities.

Loss of urban tree canopy from invasive species and pests can lead to higher summertime temperatures and greater vulnerability to extreme temperatures. Additionally, compromised recreational bodies of water can reduce people's means of cooling off during extreme heat days.

*Built Environment*

Invasive plant species can cause significant damage to infrastructure. Mature roadside trees provide natural and cultural benefits to the community, creating the rural New England landscape that defines the region. Trees help to hold roadside soils in place and can act as windbreaks. Accelerated die-back of roadside trees can occur due to invasive pests such as the woolly adelgid or emerald ash borer or stressed and pulled down by prolific invasive vines such as bittersweet. [v] Damage and die-off of these trees present increased risk to homeowners who live in close proximity, to utility lines and to travelers who frequent the roads they are located on. Additionally, invasive insects like termites or wood-boring beetles can infest and damage wooden structures, causing significant financial losses and compromising building safety.

Facilities that rely on biodiversity or the health of surrounding ecosystems, such as outdoor recreation areas or agricultural/forestry operations, could be vulnerable to impacts from invasive species. Japanese knotweed is known to decrease streambank stability and contribute to topsoil erosion, which can contribute to flood damage. Japanese knotweed also grows on roadways, sometimes growing large enough to impair sightlines and growing over guardrails; this can contribute to maintenance and safety issues.

Buildings are expected to be directly impacted by invasive species under circumstances similar to our roadways. Roadways and roadside drainage areas are most acutely impacted by herbaceous invasives such as stilt grass and phragmites in wetland areas. Both species tend to grow in thick mats and through compacted soil, a particular problem for town roads which are almost all gravel. Maintenance of roadside ditches to remove invasives is required to allow for runoff transportation. Facilities that rely on native species, biodiversity or the health of surrounding ecosystems, such as outdoor recreation areas, public or botanical gardens or agricultural/forestry operations, are more vulnerable to impacts from invasive species.

Invasives can disrupt water management systems, creating potential hazards. Aquatic invasive plants like Hydrilla and Eurasian Watermilfoil can clog water intake systems, irrigation channels, and drainage ditches. This can hamper the functionality of these systems, increase the risk of flooding, and lead to water contamination in urban areas.[vi] Water storage facilities may be impacted by zebra mussels. Invasive species may lead to reduced water quality, which has implications for the drinking water supplies and the cost of treatment.

*Natural Environment*

The majority of the land area in the town consists of forests, wetlands, waterbodies, and watercourses. Forested property alone makes up approximately 64% of conservation land, making it particularly vulnerable to the impacts of invasive species. Invasive plants can outcompete native vegetation through rapid growth and prolific seed production, reducing plant diversity by dominating forests. When invasive plants dominate a forest, they can inhibit the regeneration of native trees and plants. This reduced regeneration capability further diminishes the forest's ability to recover effectively following a disturbance event. Additionally, invasive plants provide less valuable wildlife habitat and food sources than native species.

As previously discussed, the movement of invasive insects and diseases has increased with global trade. Many of these pests, such as the hemlock woolly adelgid, the Asian long-horned beetle, and beech bark disease, have been found in New England. These organisms have no natural predators or controls and significantly affect forests by altering species composition as susceptible trees are selectively killed.

Invasive species interact with other forest stressors, such as climate change, exacerbating their negative impacts. Examples include:

- An earlier growing season, more frequent gaps in the forest canopy from wind and ice storms, and carbon dioxide fertilization are likely to favor invasive plants over native trees and vegetation.
- Larger deer populations' preferential browsing of native plants may favor invasive species and inhibit forest regeneration after disturbances.
- Warming temperatures favor some invasive plants, insects, and diseases, whose populations have historically been kept in check by colder climates.
- Periods of drought weaken trees, making them more susceptible to insects and diseases.

Aquatic invasive species pose a particular threat to water bodies. Natural Heritage Endangered Species Program ranks invasive species as the number one threat to the Housatonic Watershed, followed by channeling/ alternation and pollution.[vii] In addition to threatening native species, invasives can degrade water quality and wildlife habitats. The impacts of aquatic invasive species include:

- Reduced diversity of native plants and animals
- Impairment of recreational uses, such as swimming, boating, and fishing
- Degradation of wildlife habitat
- Local and complete extinction of rare and endangered species

Several studies have documented the impact of invasive species on endangered species specifically in Massachusetts.

- The impact of invasive species on American eelgrass in the Charles River has been documented. Invasive water chestnut significantly reduces the growth and survival of this native plant, which is crucial for aquatic habitats.[viii]
- The MIPAG has reported that invasive species such as purple loosestrife and Phragmites australis (common reed) have severely impacted wetland habitats across the state, out-competing native vegetation and altering hydrology, which threatens the habitat of several rare and endangered species
- Research by the Massachusetts Department of Fish and Game indicates that invasive plant species like Japanese knotweed and multiflora rose have encroached on the habitats of the endangered bog turtle, contributing to its decline by altering its habitat and food sources. [ix]

BioMap, developed by the Massachusetts Division of Fisheries and Wildlife's Natural Heritage & Endangered Species Program (NHESP) and The Nature Conservancy, has identified several core habitats crucial for conservation in Lee and the surrounding region. Core habitats are critical areas designated for conservation due to their high biodiversity value and their importance for the survival of rare, threatened, and endangered species. These habitats are essential for maintaining the ecological integrity of the region, providing the necessary conditions for species to thrive, reproduce, and sustain their populations. Within the Town of Lee, the identified core habitats include:

- Rare Species Core: 1,564.3 acres
- Forest Core: 3,324.0 acres
- Aquatic Core: 1,711.2 acres
- Wetland Core: 534.3 acres
- Vernal Pool Core: 809.8 acres
- Priority Natural Communities: 88.6 acres

With the shifting climate favoring invasive species, these critical habitats are increasingly threatened, leading to a potential large-scale loss of biodiversity.

*Economy*

Invasive species pose significant threats to the economy of the Town of Lee and the broader region, impacting various sectors including outdoor recreation, agriculture, and tourism. The economic consequences of invasive species can be far-reaching, affecting local businesses and property values.

The Town of Lee is renowned for its outdoor recreational opportunities, vital to the local economy. The presence of invasive species can significantly diminish the appeal of these activities. The Appalachian Trail (AT) and October State Mountain are major draws for hikers. Invasive species can overgrow trails, making them less accessible and less enjoyable for hikers. This reduced trail quality can lead to fewer visitors, negatively impacting local businesses that rely on tourism. Similarly, invasive aquatic plants can choke waterways, impeding boating, fishing, and swimming activities. This reduces the lakes' recreational value and affects businesses dependent on water-based tourism, such as boat rentals, fishing guides, and waterfront restaurants.

Fall foliage season attracts numerous tourists to the region, generating significant revenue for the local economy. However, invasive pests like the Emerald Ash Borer and the Asian Long-Horned Beetle can decimate native trees, such as ash and maple, crucial for vibrant fall colors and maple syrup production. The decline in these trees not only diminishes the quality of fall foliage, potentially deterring tourists, but also impacts the local maple syrup industry. The loss of sugar maples affects syrup producers and associated industries, such as tourism during the sugaring season. This dual impact on tourism and agriculture reduces income for hotels, restaurants, and other local businesses that thrive during these seasons.

Managing invasive species requires significant financial investment. The cost of controlling invasive species, whether through mechanical removal, chemical treatments, or biological controls, is substantial. Nationally, the economic impact of invasive species is profound. According to the Native Plant Trust, invasive species alter 3 million acres of habitat annually in the United States, costing 36 billion dollars a year to control and eradicate.[x] Municipal budgets often need to allocate additional resources to manage these issues, straining local finances. For example, the Commonwealth of Massachusetts spends over $95,000 per year on invasive species control at state properties and over $290,000 annually for control efforts in over 290 infested lakes (MEMA & EEOEA SHMCAP, 2018).

Individuals particularly vulnerable to the economic impacts of invasive species include those working in forestry and agriculture-related fields, as well as those whose livelihoods depend on outdoor recreation activities such as hunting, hiking, or aquatic sports. Other noteworthy forest-based recreational activities include cross-country skiing, mountain biking, wildlife tracking, and birdwatching. A 2015 report estimated that about 9,000 people are employed in the diverse industries that support this sector, with a total annual payroll equivalent of $293 million.[xi] Another report in 2020 estimated that forest related recreation was a $2.2 billion industry in Massachusetts.[xii] This includes all individuals working in outdoor recreation activities and tourism based on maintaining a natural landscape. This is especially important in Berkshire County, where the scenic beauty and outdoor recreational opportunities complement the region's international status as a cultural destination. Homeowners whose properties are adjacent to vegetated areas or waterbodies experiencing a decline from an invasive species outbreak could experience decreases in property value.

The agricultural sector is vulnerable to increased invasive species associated with increased temperatures. More pest pressure from insects, diseases, and weeds may harm crops and cause farms to increase pesticide use. Farmers may face additional challenges as they are forced to invest in new pest control measures and deal with lower yields and poorer quality crops. In addition, floodwaters may spread invasive plants that are detrimental to crop yield and health.

*Future Conditions*

Climate change is expected to exacerbate the spread and impact of invasive species, increasing their abundance and expanding their habitat ranges. As ecosystems become stressed due to climate-related factors such as drought, increased temperatures, and wildfires, they become more susceptible to invasions. Key factors influencing species survival, such as temperature, atmospheric CO2 concentration, frequency and intensity of hazardous events, and available nutrients, are likely to be altered by climate change. This alteration will stress native ecosystems and increase the chances of successful invasions. Elevated atmospheric CO2 concentrations, for example, can reduce ecosystems' ability to recover after major disturbances like floods or fires, giving invasive species—which often establish more rapidly following disturbances—a greater chance of successful establishment or expansion.

Several climate change impacts could increase the severity of the invasive species hazard as noted in the Massachusetts State Hazard Mitigation and Climate Adaption Plan:

- Elevated CO2 Levels: Higher atmospheric CO2 can enhance photosynthetic rates in some organisms, improving their competitive advantage.
- Changes in Atmospheric Conditions: Decreased transpiration rates in some plants could increase soil moisture, benefiting species that capitalize on the increased water availability.
- Nitrogen Deposition: Fossil fuel combustion results in widespread nitrogen deposition, favoring fast-growing, often invasive, plant species.
- Shifts in Growing Season: As the growing season shifts earlier, invasive species like garlic mustard, barberry, buckthorn, and honeysuckle, which flower earlier, can outcompete native plants. The growing season in Massachusetts has increased by approximately 10 days since the 1960s.
- Increase in Forest Pests: Warming temperatures benefit ectothermic forest pests, leading to increased populations of defoliating insects and bark beetles. Warmer winters result in fewer pests being killed off, allowing populations to grow beyond previous limits.
- Aquatic Environment Changes: Increased water temperatures, decreased oxygen levels, and changes in pH can facilitate the spread of aquatic invasive species, enabling year-round establishment of species that previously could not survive New England winters.

Some invasive plant species can alter ecosystem conditions, such as soil chemistry and wildfire intensity. Invasive species that are not fire-adapted may take over fire-prone grassland or forest areas, thereby increasing wildfire risk. Invasive species can trigger a cascade of lost ecosystem services and reduce the resilience of ecosystems to future hazards by placing constant stress on these systems.

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[i] MassWildlife Climate Action

[ii] Department of Conservation and Recreation | Emerald Ash Borer Guide

[iii] Wagner, Ken, 2022 "Current Knowledge of Drawdown Relevant to Projects in Massachusetts" Accessed July 2024.

[iv] Massachusetts DCR Forest Health Program (arcgis.com)

[v] U.S. Forest Service, 2020

[vi] U.S. Geological Survey, 2022

[vii] EEE0A and US FWS, Rare Species and Natural Community Surveys in the Housatonic River Watershed of Western Massachusetts, July 2020

[viii] Smith, R. (2005). The Impact of Invasive Water Chestnut on Native American Eelgrass in the Charles River. Journal of Aquatic Plant Management

[x] https://www.nativeplanttrust.org/conservation/invasive/

[xi] EOEEA, DCR, Bureau of Forest Fire Control & Forestry, 2020

[xii] DCR, Massachusetts Forest Action Plan, 2020.

# Change in Average Temperature/Extreme Temperatures

## *Hazard Profile*

Temperature serves as a fundamental metric for understanding climate, encapsulating the prevailing weather patterns in a given region. These patterns not only dictate the distribution of plant and animal species but also shape the landscape and ecosystems. However, alterations in climate, particularly changes in average temperature and the occurrence of extreme temperature events, signal significant shifts in climate dynamics at both regional and global scales. Temperature variations occur due to several atmospheric phenomena. Increased greenhouse gas emissions from human activities contribute to an increase in the earth's surface temperature, causing more extreme temperatures. Shifts in temperatures are evident in gradual increases in overall temperature averages over time, alongside the emergence of extreme weather phenomena such as heatwaves and cold snaps, which deviate significantly from historical norms.

Changes in temperature patterns serve as vital indicators of broader climate trends, reflecting the intricate interplay of various environmental factors. For example, the interconnectedness of atmospheric conditions and oceanic currents plays a crucial role, with warmer ocean waters acting as a "heat sink" that influences air temperatures and contributes to the intensification of storms, impacting inland areas such as the Town of Lee. Understanding these changes is essential for grasping their multifaceted risks to public health, economic stability, and infrastructure resilience. In the Northeastern region, projections suggest a trend toward more frequent and intense precipitation, prolonged fall and spring seasons, and warmer winters accompanied by heavier snowfall.

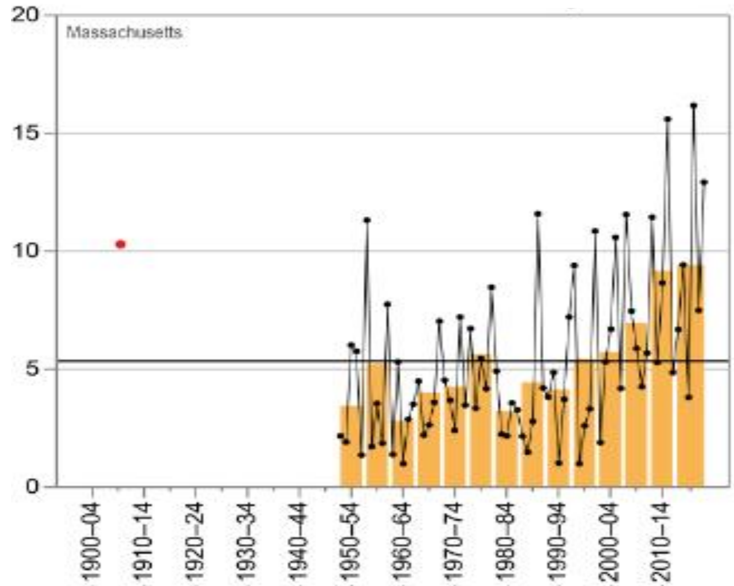
## *Likely Severity*

Heat is the leading weather-related killer in the U.S., even though most heat-related deaths are preventable through outreach and intervention.  When people are exposed to extreme heat, they can suffer from potentially deadly illnesses, such as heat exhaustion and heat stroke. It should be noted that temperature alone does not define heat's stress on the human body – humidity plays a powerful role in health impacts, particularly for those with pre-existing pulmonary or cardiovascular conditions. Locally, Berkshire County has not reported a significant increase in heat-related deaths. However, many Berkshire communities have begun to develop protocols for opening cooling centers.

What may be more concerning is the trend for higher nighttime temperatures. Warm nights are those where the minimum temperature stays above 70°F. The number of nights where the temperature did not dip below 70°F has increased from a median of slightly more than three in the years 1950 – 1990, to greater than seven in the 2010s (see Figure 3.13).

Historically, cooler evening temperatures in the Berkshires have allowed residents to cool their bodies and homes by opening windows and using fans. During sleep, core body temperature naturally dips, providing essential relief. Without this nighttime cooling, the body experiences prolonged physiological strain, increasing health risks.

Figure 3.11 Number of Days with Min Temp of 70°F or Higher




*Source: https://statesummaries.ncics.org/chapter/ma/*

The NWS issues a Heat Advisory when the NWS Heat Index is forecast to reach 100 to 104°F for 2 or more hours. The NWS issues an Excessive Heat Warning if the Heat Index is forecast to reach 105°F or higher for 2 or more hours. The NWS Heat Index is based both on temperature and relative humidity and describes a temperature equivalent to what a person would feel at a baseline humidity level. It is scaled to the ability of a person to lose heat to their environment. [i] It is important to know that the heat index values are devised for shady, light wind conditions. Exposure to full sunshine can increase heat index values by up to 15°F.

Figure 3.12 Heat Index Chart and Human Health Impacts

| Relative Humidity (%) | Temperature (°F) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 80 | 82 | 84 | 86 | 88 | 90 | 92 | 94 | 96 | 98 | 100 | 102 | 104 | 106 | 108 | 110 |
| 40 | 80 | 81 | 83 | 85 | 88 | 91 | 94 | 97 | 101 | 105 | 109 | 114 | 119 | 124 | 130 | 136 |
| 45 | 80 | 82 | 84 | 87 | 89 | 93 | 96 | 100 | 104 | 109 | 114 | 119 | 124 | 130 | 137 | |
| 50 | 81 | 83 | 85 | 88 | 91 | 95 | 99 | 103 | 108 | 113 | 118 | 124 | 131 | 137 | | |
| 55 | 81 | 84 | 86 | 89 | 93 | 97 | 101 | 106 | 112 | 117 | 124 | 130 | 137 | | | |
| 60 | 82 | 84 | 88 | 91 | 95 | 100 | 105 | 110 | 116 | 123 | 129 | 137 | | | | |
| 65 | 82 | 85 | 89 | 93 | 98 | 103 | 108 | 114 | 121 | 128 | 136 | | | | | |
| 70 | 83 | 86 | 90 | 95 | 100 | 105 | 112 | 119 | 126 | 134 | | | | | | |
| 75 | 84 | 88 | 92 | 97 | 103 | 109 | 116 | 124 | 132 | | | | | | | |
| 80 | 84 | 89 | 94 | 100 | 106 | 113 | 121 | 129 | | | | | | | | |
| 85 | 85 | 90 | 96 | 102 | 110 | 117 | 126 | 135 | | | | | | | | |
| 90 | 86 | 91 | 98 | 105 | 113 | 122 | 131 | | | | | | | | | |
| 95 | 86 | 93 | 100 | 108 | 117 | 127 | | | | | | | | | | |
| 100 | 87 | 95 | 103 | 112 | 121 | 132 | | | | | | | | | | |

| Category | Heat Index | Health Hazards |
|---|---|---|
| Extreme Danger | 130 °F – Higher | Heat Stroke or Sunstroke is likely with continued exposure. |
| Danger | 105 °F – 129 °F | Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity. |
| Extreme Caution | 90 °F – 105 °F | Sunstroke, muscle cramps, and/or heat exhaustions possible with prolonged exposure and/or physical activity. |
| Caution | 80 °F – 90 °F | Fatigue possible with prolonged exposure and/or physical activity. |

Also, strong winds, particularly with very hot, dry air, can increase the risk of heat-related impacts. Extreme heat temperatures are those that are 10°F or more above the average high temperature for the region and last for several hours. A heat wave, defined as a period lasting three or more days with temperatures surpassing 90°F, infers an extended duration of heightened atmospheric heat stress, leading to temporary lifestyle adjustments and potential health risks among affected populations. [ii] Limited financial resources may also hinder access to adequate shelter or cooling facilities, further magnifying the impact on vulnerable populations.

The extent (severity or magnitude) of extreme cold temperatures is generally measured through the Wind Chill Temperature Index. Wind Chill Temperature is the temperature that people and animals feel when they are outside, and it is based on the rate of heat loss from exposed skin by the effects of wind and cold. As the wind increases, the body loses heat at a faster rate, causing the skin's temperature to drop. The NWS issues a Wind Chill Advisory if the Wind Chill Index is forecast to dip to −15°F to −24°F for at least 3 hours, based on sustained winds (not gusts). The NWS issues a Wind Chill Warning if the Wind Chill Index is forecast to fall to −25°F or colder for at least 3 hours. On November 1, 2001, the NWS implemented a Wind Chill Temperature Index designed to calculate how cold air feels on human skin more accurately.

Due to its higher elevation and vegetation cover, Lee benefits from natural safeguards against extreme heat. The town's elevation varies from around 800 feet in lower areas, particularly near the Housatonic River, which flows through Lee, to about 1,400 feet in the hillier parts. Most roads and residences are in lower elevations, typically between 800 and 1100 feet. The community and its inhabitants have adapted to cooler climates; however, they remain susceptible to fluctuations in temperature, especially in a changing climate. Traditional home constructions prioritize heating systems and modest insulation to retain warmth, with central air conditioning systems being less common.

NOAA relies on land-based weather station data and satellite measurements to gauge average temperatures. In regions like the Berkshires, characterized by moderate climates, temperature variations can have significant repercussions, particularly affecting environmental integrity as fluctuations disrupt delicate ecosystems, leading to shifts in biodiversity and potentially threatening native species. For example, warmer temperatures may alter migration patterns or habitat availability for certain wildlife species, impacting ecosystem stability. [iii].

The seasonal economy of towns like Lee relies heavily on industries such as tourism and outdoor recreation, which are sensitive to changes in temperature. Warmer temperatures can lead to shortened ski seasons, reduced snowfall, and altered foliage patterns, affecting tourism revenue and agricultural productivity. This, in turn, can have ripple effects on local businesses and employment opportunities.

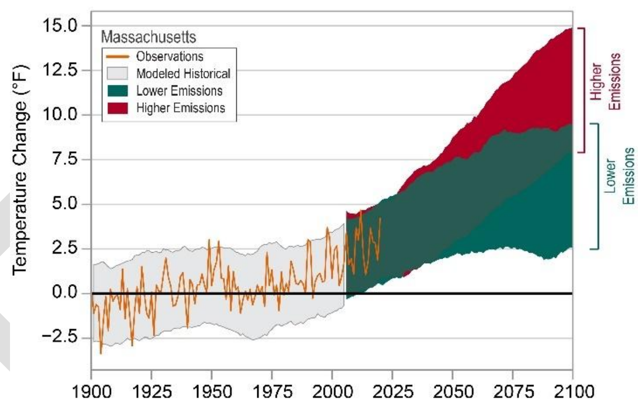
### *Probability*

Scientific research indicates that global climate changes are causing shifts in temperatures as weather patterns transform. Air temperatures generally rise worldwide, with the Northeastern United States experiencing comparatively higher increases. The Massachusetts Climate Change Clearinghouse (Resilient MA) is a vital resource, offering access to data and information essential for climate change adaptation and mitigation efforts across the state. It delivers the latest climate change science and decision-support tools to aid policymakers, practitioners, and the public in making scientifically sound and cost-effective decisions. Resilient MA is the primary information and data source utilized in this hazard mitigation plan to understand observed and projected temperature changes.

Integral to this initiative is the Department of Interior's Northeast Climate Adaptation Science Center (NE CASC), headquartered at the University of Massachusetts, Amherst. NE CASC is a crucial component of a federal network comprising eight Climate Adaptation Science Centers, collaborating with natural and cultural resource managers to compile scientific data and develop tools necessary for aiding fish, wildlife, and ecosystems in adapting to climate change impacts. Climate change projections for Massachusetts rely on simulations from the latest generation of climate models incorporated into the Coupled Model Intercomparison Project Phase 5 (CMIP5). To provide localized projections, the state employs county- and major watershed-level information derived through statistical downscaling of CMIP5 model results using the Local Constructed Analogs (LOCA) method.

Temperatures in Massachusetts have risen almost 3.5°F since the beginning of the 20th century as indicated in the orange line in Figure 3.13 Observed and Projected Temperate Changes for Massachusetts. Less warming is expected under a lower emissions future (the coldest end-of-year projections being about 2°F warmer than the historical average; green shading) and more warming under a higher emissions future (the hottest end-of-year projections being about 10ºF warmer than the hottest year in the historical record; red shading).[iv]

Figure 3.13 Observed and Projected Temperate Changes for Massachusetts




*Sources: Cooperative Institute for Satellite Earth System Studies (CISESS) and National Centers for Environmental Information (NOAA NCEI). Retrieved [Massachusetts State Climate Summaries.](#)*

Temperatures vary across Massachusetts, with higher temperatures typical in the southeast and colder in the northwest. The 2022 Massachusetts Climate Change Assessment predicts that temperatures will almost certainly rise across the Commonwealth. Humidity will rise as well, causing hot days to feel even hotter. These changes could have significant consequences for human and ecosystem health, as human populations and ecosystems in Massachusetts are not adapted or accustomed to these temperatures. Projections show that inland areas are very likely to warm more and experience more extreme heat than coastal areas. Detailed forecasts for the mid-century (2050s) through 2090s specific to the Town of Lee are provided in Table 3.11.

Degree days are used to measure how much outdoor temperatures deviate from a standard base temperature, typically 65°F in the U.S.

- Heating degree days (HDDs) indicate how much *colder* it is by counting the difference when temperatures fall below 65°F, as heating is typically needed in these conditions—for instance, a day with an average temperature of 40°F results in 25 HDDs.

- Cooling degree days (CDDs) represent *warmer* conditions by tracking temperatures above 65°F—as cooling is typically needed in these conditions.

HDDs impact energy consumption and costs, with higher values increasing demand for heating systems. Conversely, higher CDDs may strain air conditioning usage and utility bills. Degree days also affect public health, with elevated HDDs posing cold-related health risks and higher CDDs increasing heat-related illnesses.

Table 3.11 Projected Temperature Changes and Heat Stress Event in the Town of Lee (2050s -2090s)

| Variable | Change by 2050s | Change by 2070 | Change by 2090s |
|---|---|---|---|
| Max temperature (degrees F) | 6.3 | 8.1 | 9.9 |
| Days above 90 degrees F (days) | 20 | 33 | 47 |
| Days above 95 degrees F (days) | 4 | 9 | 15 |
| Days above 100 degrees F (days) | 0 | 1 | 2 |
| Number of heat stress events | 0 | 1 | 3 |
| Cooling degree days (degree days) | 644 | 881 | 1138 |
| Heating degree days (degree days) | -1654 | -2076 | -2478 |

*Source: https://resilient.mass.gov/*

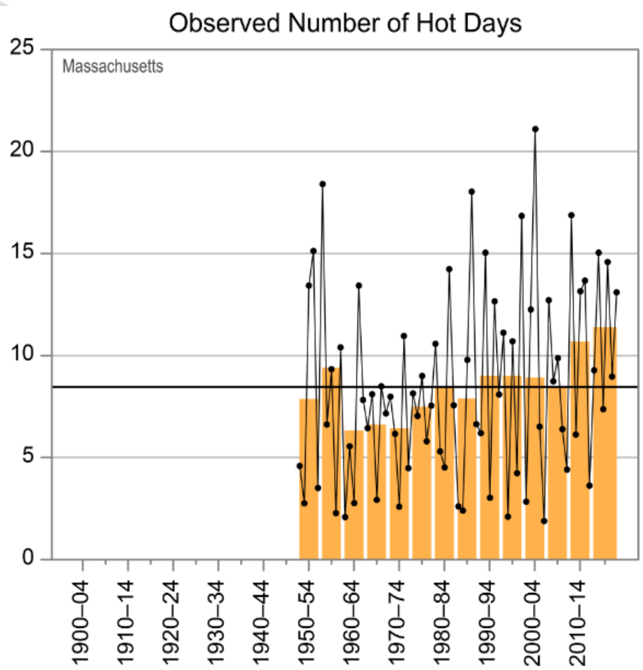


## *Historic Data*

In 2023, NOAA reported the warmest year since global records began in 1850 at 2.12°F above the 20th-century average of 57.0°F. This value is 0.27°F more than the previous record set in 2016. The 10 warmest years in the 174-year record occurred during the last decade (2014–2023). Of note, the year 2005, which was the first year to set a new global temperature record in the 21st century, is now the 12th-warmest year on record. The year 2010, which had surpassed 2005 at the time, now ranks as the 11th-warmest year on record. [v]

Also, in 2023, the contiguous United States experienced its fifth warmest year on record, with an average annual temperature of 54.4°F, surpassing the historical average of 2.4°F. The U.S. Climate Extremes Index (USCEI) for 2023 was particularly noteworthy, registering 65 percent above the average and ranking as the 11th highest in the 114-year record. This elevation in warm extremes was observed in maximum temperatures and minimum temperatures across portions of the Northeast.[vi]

Figure 3.14 Number of Days with Max Temp of 90 °F or Higher




Massachusetts stood out among the warmest states, alongside Texas, Louisiana, Mississippi, and New Hampshire, tying with 2012 as the hottest year on record within the state. This trend of warming temperatures is becoming increasingly apparent see Figure 3.14. Further analysis from a 2022 climate overview by the

University of Massachusetts Amherst highlighted significant temperature anomalies within Massachusetts. The state experienced its eighth warmest July, followed by the warmest August on record, contributing to the second warmest summer ever recorded. The average statewide temperature was 3.4 degrees above the 1901-2000 mean during this period. [vii]

The following are some of the highest temperatures recorded for the period from 1895 to 2017, showing as comparison Boston and three Berkshire County locations with data retrieved from the National Climatic Data Center.

- Boston, MA 103°F
- Pittsfield, MA 95 °F
- North Adams, MA 96°F

Just as the summers in the Berkshires tend to be cooler than in other parts of the state, the winters also exhibit a distinct coolness. The slightly higher elevations of the Berkshire hills contribute to the overall cooler temperatures experienced in Lee. However, the town's lower elevation, coupled with its proximity to the Housatonic, influences a milder winter climate compared to higher elevation regions. The following are some of the lowest temperatures recorded in the Berkshire region for the period from 1895 to 2017.

- Lanesborough, MA –28°F
- Great Barrington, MA –27°F
- Stockbridge, MA –24°F
- Pittsfield, MA -19°F

## Vulnerability Assessment

### *Geographic Areas Likely Impacted*

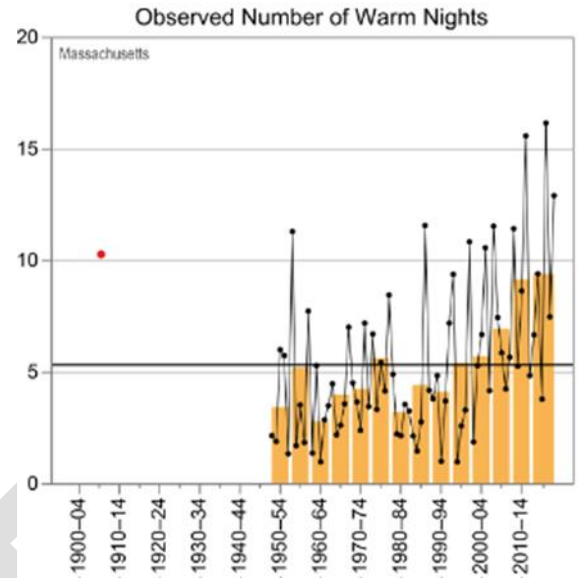
All of Lee is exposed to extreme temperatures and changes in average temperature. While predominantly rural, the effects of heat can vary based on local topography and land use. Lower elevations, such as valleys, can trap heat, leading to higher temperatures during heatwaves, disproportionately affecting residents in these areas. Additionally, areas near major routes and areas with more impervious surfaces, such as roads and parking lots, may experience localized heating due to the urban heat island (UHI) effect, where human activity and traffic increase temperatures more than in surrounding rural areas.

### *People*

Heat is the leading weather-related killer in the U.S., even though most heat-related deaths are preventable through outreach and intervention.  When people are exposed to extreme heat, they can suffer from potentially deadly illnesses, such as heat exhaustion and heat stroke. It should be noted that temperature alone does not define the stress that heat can have on the human body – humidity plays a powerful role in human health impacts, particularly for those with the pre-existing pulmonary or cardiovascular conditions. Locally, Berkshire County has not reported a significant increase in heat-related deaths.[viii] However, many Berkshire communities have begun to develop protocols for opening cooling centers.

What may be more concerning is the trend for higher nighttime temperatures. Warm nights are those where the minimum temperature stays above 70°F. The number of nights where the temperature did not dip below 70°F has increased from a median of slightly more than three in the years 1950 – 1990, to greater than seven in the 2010s (see Figure 3.15).

Figure 3.15 Days of Min Temp of 70°F or Higher




Historically, cooler evening temperatures in the Berkshires have allowed residents to cool their bodies and homes by opening windows and using fans. During sleep, core body temperature naturally dips, providing essential relief. Without this nighttime cooling, the body experiences prolonged physiological strain, increasing health risks.

According to the Centers for Disease Control and Prevention (CDC), certain demographics are at heightened risk during extreme heat and cold events.

- Individuals aged 65 and above, due to age-related physiological changes and health conditions, may struggle to regulate body temperature.
- Infants and young children under 5 years old, with developing regulatory systems, are more susceptible to temperature fluctuations.
- Those with pre-existing medical conditions such as heart or kidney disease.
- People living alone, particularly the elderly and individuals with disabilities, face increased risks of heat-related illnesses due to social isolation and reluctance to seek cooler environments.
- Low-income individuals and environmental justice populations may lack adequate heating or cooling options.
- Outdoor workers face prolonged exposure to temperature extremes.

Individuals with respiratory conditions like asthma or chronic obstructive pulmonary disease (COPD) may experience worsened symptoms during temperature extremes due to increased air pollution and elevated levels of allergens, such as pollen and mold, which thrive in hotter conditions. Extreme heat can also cause inflammation in the airways, leading to breathing difficulties. Berkshire County has a higher rate of asthma-related emergency room visits than other parts of the state.[ix]

The 2022 Massachusetts Climate Assessment Report highlights the vulnerability of communities in the Berkshires to the exacerbation of vector-borne diseases.[x] Warmer temperatures create more favorable habitats for disease-carrying vectors like mosquitoes and ticks, allowing them to thrive and expand their range into previously unaffected areas, including rural communities like Lee. Additionally, the increase in temperature can accelerate the breeding cycles of these vectors, leading to higher rates of disease transmission to humans.

Moreover, the reliance on well water in communities poses additional challenges in the face of rising temperatures. The demand for water may escalate, placing pressure on groundwater sources tapped by wells. This increased demand, coupled with potential shifts in precipitation patterns and groundwater recharge rates due to climate change, can compromise the quality and quantity of well water. Contaminated or depleted well water resources can undermine public health and sanitation efforts, further heightening the susceptibility of communities to waterborne illnesses and other health hazards.

*Built Environment*

All components of the built environment are susceptible to the hazards posed by extreme temperatures. The effects of extreme heat on buildings are manifold: increased thermal stresses on building materials accelerate wear and tear, thereby reducing the lifespan of structures; heightened demand for air-conditioning strains HVAC systems and may lead to overheating; and power outages can disrupt essential services, exacerbating the challenges posed by extreme heat.

Warmer winter temperatures, characterized by less consistency than in the past, have increased occurrences of warm "false spring" periods. Consequently, there has been a rise in freeze/thaw events starting earlier in late winter/early spring. This phenomenon has notably affected New England's traditional "mud season," with earlier and more frequent thaw events.

The changing and warming winter climate poses significant implications for both costs and safety. Extreme cold events can result in structural damage to buildings, including frozen or burst pipes and damage from freeze-thaw cycles. Manufactured buildings such as trailers, mobile homes, and antiquated or poorly constructed facilities may be particularly vulnerable to such effects. Additionally, heavy snowfall and ice storms associated with extreme cold events can cause power outages, underscoring the importance of backup power for critical facilities and infrastructure. Extreme cold can also impact materials such as plastic, making them more susceptible to breakage during severe cold snaps. In addition to these facility-specific impacts, extreme temperatures can have widespread implications for critical infrastructure sectors within the built environment.

Extreme heat potentially impacts the design and operation of the transportation system. Impacts on the design include the instability of materials, particularly pavement, exposed to high temperatures over longer periods, which can cause buckling and lead to increased failures. High heat can cause the pavement to soften and expand, creating ruts, potholes, and jarring and placing additional stress on bridge joints. Extreme heat may cause heat stress in materials such as asphalt and increase the frequency of repairs and replacements.

*Natural Environment*

The ramifications of shifting temperatures on the natural environment are myriad and far-reaching. As species within an ecosystem have evolved to thrive within specific temperature ranges, extreme temperature events can exert considerable stress on individual organisms and their ecosystems. Warming temperatures may precipitate a decline in forest health, including diminished biodiversity, biomass, and resilience. Forest types such as high-elevation spruce-fir forests, forested boreal swamps, and higher-elevation northern hardwoods are particularly vulnerable to the effects of climate change. Insect pest populations that are typically reduced in winter are now able to survive and expand year to year. Changing temperature and precipitation patterns are directly affecting forest health, according to the Massachusetts Climate Change Assessment and Mass Audubon Society Forest Health Report. [xi]

Changing climatic conditions alter suitable habitats for native flora and fauna, increase the risk of new species introductions, and escalate competition from established invaders, potentially resulting in losses in native biodiversity and culturally significant species (Parmesan & Yohe, 2003). Moreover, rising temperatures and changing precipitation patterns will likely lead to diminished ambient water quality and alterations in water quantity, causing shifts in habitat quality across rivers, streams, ponds, lakes, and freshwater wetlands (Melnick et al., 2005) Higher summer temperatures may disrupt wetland hydrology, leading to habitat loss and wetland desiccation, exacerbated by the heightened incidence and severity of droughts and increased evapotranspiration rates.[xii,xiii]
While individual extreme weather events usually exert limited long-term impacts on natural systems, unusual frost events occurring after plants begin to bloom in the spring can cause significant damage Overall, the cumulative impact of changing average temperatures and the shifting frequency of extreme climate events is expected to be extensive and widespread across natural resources.

*Economy*

The agricultural industry is particularly vulnerable to the economic impacts and damage caused by extreme temperatures and drought events. These climatic changes pose risks to crops like apples, cranberries, and maple syrup, which depend on specific temperature conditions. Unseasonably warm temperatures in early spring that are followed by freezing temperatures can result in crop loss of fruit-bearing trees. According to UMASS Amherst, in 2023, Massachusetts lost its entire peach crop on Feb. 4, when temperatures dipped as low as minus 14 degrees Fahrenheit. In May of the same year, one-third of apple orchards were impacted by frost and subsequent blight, with some orchards in the Berkshires losing over 75% of their crop.[xiv] Farmers may have the opportunity to introduce new crops that are viable under warmer conditions and longer growing seasons; however, a transition such as this may be costly.

Most of the town’s active agricultural land is in the western part of Lee. Covering 10% (1,207 acres), it plays a modest role in the town’s economy. High Lawn Farm is the most visible agricultural site in the town; several other properties support agricultural uses, including the Leahey Dairy Farm located below October Mountain. Local agriculture provides the community with a local source of produce, meat, and other foods and often provides scenic landscapes and wildlife habitat. Disruptions to the local agricultural sector, even if small, could have broader implications for food access in the region, as the surrounding Berkshires heavily depend on agriculture.

Livestock are also impacted, as heat stress can make animals more vulnerable to disease, reduce their fertility, and decrease the rate of milk production. Additionally, scientists believe the use of parasiticides and other animal treatments may increase as the threat of invasive species grows. Increased use of
these treatments increase the risk of pesticides entering the food chain and could result in pesticide resistance, which could result in additional economic impacts on the agricultural industry.

Maple syrup production, a cultural icon and economic cornerstone of New England, faces significant challenges. Researchers predict a northward shift in the maximum maple syrup flow region by 2100, favoring Canadian producers while diminishing production and quality in the Eastern United States. This shift threatens New England's maple syrup industry, with projections indicating a potential halving of production by century's end, excluding Northern Maine.   This shift could have profound economic impacts, as reduced production may lead to fewer tourists and higher costs for local businesses, ultimately affecting foot traffic and sales in Lee.

*Future Conditions*

As indicated by NOAA, there has been a discernible warming trend globally since the mid-1970s, with temperature changes projected to occur gradually over the coming years. However, meteorologists can reliably forecast extreme events and their severity several days in advance. Across Massachusetts, high, low, and average temperatures are all expected to rise significantly in the next century due to climate change. This trend may lead to increased electricity demand for cooling degree days (CDDs) across the Northeast, potentially straining the New England electricity grid system and resulting in brownouts or controlled blackouts. Such scenarios could adversely affect the health of vulnerable populations and impair critical government and communication functions.

For the Town of Lee, will be imperative to establish and maintain communication channels with vulnerable groups, including the elderly, individuals with underlying health conditions, and low-income residents lacking adequate cooling systems in their homes. With rising temperatures becoming more frequent, the necessity for cooling shelters as part of the emergency response strategy may become paramount, especially as the community's demographic ages and residents retire.

Rising temperatures and extreme weather events are expected to disproportionately impact Lee’s workforce, particularly those in agriculture, outdoor recreation, and construction. Workers in these sectors are vulnerable to heat stress, reduced productivity, and unpredictable seasonal employment patterns. For example, Oak N' Spruce Resort relies heavily on seasonal labor, while farms like High Lawn and Meadow Farm, each employing 20-49 people, face similar risks. Additionally, the town's construction workforce, represented by over 33 companies, will encounter increasing challenges. These disruptions could lead to economic instability, reduced tourism, and a weakened local economy as key industries struggle.

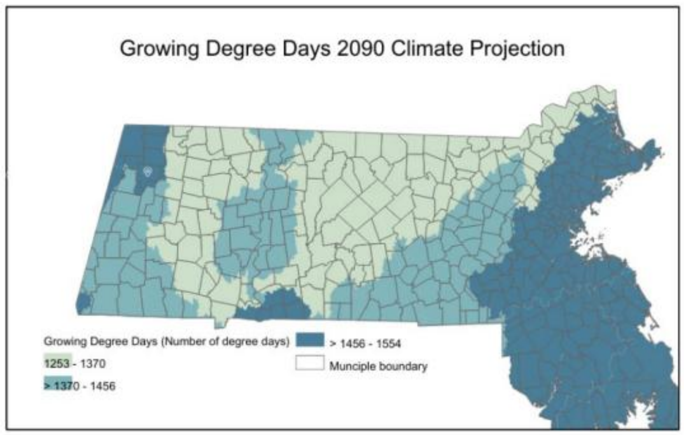
An increase in population due to climate migration could be likely in towns like Lee, as people from hotter regions seek cooler areas. While this could offer economic benefits, it may also place additional pressure on housing, water resources, and local services. Public services and infrastructure will need to expand to meet growing demand. Budgets for parks, lakes, and trails may require adjustments to accommodate increased use as more people seek outdoor spaces for cooling and recreation, leading to greater wear, maintenance needs, and staffing demands.

Climate change is anticipated to be the second-greatest contributor to the ongoing biodiversity crisis, necessitating a global shift in land use. One notable impact of increasing temperatures could be the northward migration of various plant and animal species. Consequently, the shifting habitats may create a mismatch between the locations of conservation lands and critical species habitats, undermining the efficacy of conservation efforts.  Between 1999 and 2018 (fiscal years), the Commonwealth spent more than $395 million on the acquisition of more than 143,033 acres of land and has managed this land under the assumption of a stable climate. Massachusetts is losing several thousand acres of Natural Working Lands, particularly forests, each year, threatening the essential role of these lands as a net carbon sink and provider of key ecosystem services.   As species adapt to climate change, traditional wildlife and habitat management methods, including land conservation and mitigation of non-climate stressors, may require significant revisions.

Moreover, warming temperatures are expected to significantly affect waterway sustainability and aquatic habitat connectivity, potentially leading to the drying up of entire river segments and the proliferation of harmful algal blooms. Cold-water fisheries supporting species like brook trout are particularly susceptible to changes in in-stream temperatures. Warming temperatures may lead to increased survival rates of pests and invasive species, posing significant challenges to the agriculture and forestry sectors. While longer growing seasons offer opportunities for new crops, they also present risks such as heightened fungal and bacterial activity, which can adversely affect crop health and increase the prevalence of plant diseases.

Furthermore, climate change is likely to alter the timing and duration of seasons, impacting the life cycles of flora and fauna. While a lengthened growing season(measured by growing degree days) may offer economic benefits, it also brings risks such as increased probability of frost damage and heightened impact of pests and diseases **(see Figure 3.16 GDD Projections (Resilient MA).** Vulnerable populations, particularly those with respiratory issues, may face exacerbated health challenges due to extended periods of plant growth and higher pollen levels, resulting in compromised air quality and respiratory symptoms.

Figure 3.16 GDD Projections (Resilient MA)




In anticipating future conditions, it is crucial to recognize that rural communities, such as Lee, are not insulated from the impacts of climate change. These impacts will progressively increase over this century and shift the locations where rural economic activities (like agriculture, forestry, and recreation) can thrive. From shifts in agricultural practices to heightened vulnerability to extreme weather events, the fabric of rural life is being reshaped. Moreover, their geographic and demographic characteristic make rural communities particularly vulnerable to these changes, as they have fewer resources and infrastructure to adapt to the impacts of climate change.

Towns like Lee increasingly adapt to climate change through smart land use planning and zoning updates. Lee's recently completed OSRP and Master Plan lay a foundation for heat resilience by emphasizing the preservation of open spaces, limiting suburban sprawl, and promoting revitalization in existing developed areas. However, additional efforts will be necessary to ensure the town's long-term resilience to extreme heat. To address the risks of heat retention in developed areas, Lee should prioritize further reducing impervious surfaces—such as pavement—and increasing green infrastructure. For instance, expanding tree canopies can help reduce the urban heat island effect, while integrating green roofs and shaded walkways into new developments can provide natural cooling benefits. Encouraging the use of low-emission, energy-efficient building materials and designs in zoning regulations will also help mitigate the effects of rising temperatures. Additionally, as extreme temperatures become more common, zoning ordinances should incorporate requirements for heat-resilient construction in all new developments or redevelopments, which could include mandates for reflective roofing materials, energy-efficient insulation, or systems designed to minimize the carbon footprint of buildings.

Lee's continued focus on connecting development to existing infrastructure will help limit sprawl, but zoning changes may also be needed to incentivize energy-efficient housing in higher-density areas. Updates to permitting and land use regulations should also encourage development that integrates natural cooling systems—like green roofs, expanded tree canopies, and shaded public spaces in developed areas—and incorporates stormwater management that can handle both heavy rainfalls and increased evaporation caused by hotter temperatures. These changes will ensure future developments help Lee adapt to the challenges posed by extreme temperatures, making the town more resilient for decades to come.

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[i] U.S. Environmental Protection Agency. (2023, July 13). Climate change indicators: U.S. and global temperature. https://www.epa.gov/climate-indicators/climate-change-indicators-us-and-global-temperature

[ii] National Oceanic and Atmospheric Administration. (n.d.). *Heat index*. NOAA JetStream. https://www.noaa.gov/jetstream/synoptic/heat-index

[iii] U.S. Environmental Protection Agency. (2017, January 19). *Climate impacts on ecosystems*. https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-ecosystems_.html

[iv] As cited on https://statesummaries.ncics.org/chapter/ma

[v] Data retrieved from National Oceanic and Atmospheric Administration (NOAA). "2023 was the warmest year in the modern temperature record."

[vi] National Centers for Environmental Information. (2023). *National climate report - September 2023*. National Oceanic and Atmospheric Administration. https://www.ncei.noaa.gov/news/national-climate-202312#:~:text=There%20were%2028%20separate%20billion,ranking%20fifth%20warmest%20on%20record

[vii] Bradley, R. S., & Estrella, B. (2022). *Ranks information on climate datasets*. University of Massachusetts Amherst, Climate System Research Center. https://www.geo.umass.edu/climate/papers2/ranks_info_2022.pdf

[viii] Heat-related ER visit data is tracked by the Massachusetts Department of Public Health. While some cases are reported, wide confidence intervals and lack of statistical significance limit clear trends. Adverse health outcomes, particularly deaths, may be too few to report or could be classified under other causes.

[ix] BRPC conducted analysis based on data sets from the Massachusetts Public Health Information Tool.

[x] A vector-borne disease is an illness caused by pathogens and parasites that are transmitted to humans or other animals through vectors. Vectors are living organisms, typically insects or arthropods, such as mosquitoes, ticks, fleas, or flies, that can carry and transmit infectious pathogens between hosts.

[xi] Mass Audubon Forst Health Report 2022

[xii] Brondízio, E. S., Settele, J., Díaz, S., & Ngo, H. T. (Eds.). (2019). The global assessment report of the intergovernmental science-policy platform on biodiversity and ecosystem services. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

[xiii] Walther, G.-R. (2010). Community and ecosystem responses to recent climate change. Philosophical Transactions of the Royal Society B: Biological Sciences, 365(1549), 2019–2024. https://doi.org/10.1098/rstb.2010.0021

[xiv] Reese, G. (2023, May 22). Late frost decimates early blooming apple crop at Bartlett's and Windy Hill Farm. The Berkshire Eagle. https://www.berkshireeagle.com/news/local/late-frost-decimates-early-blooming-apple-crop-bartletts-windy-hill-farm/article_72771374-f8dd-11ed-a7f4-f35b09ad8c66.html

# Tornadoes, High Winds and Thunderstorms

## *Hazard Profile*

Tornadoes, high winds, and thunderstorms are significant meteorological phenomena that pose substantial risks to life, property, and infrastructure. They are closely related hazards, often occurring within the same weather systems and amplifying the risks they pose. Thunderstorms are the common thread, as they create the conditions that lead to both high winds and tornadoes. Supercells are the storm most commonly producing tornadoes: severe, long-lived thunderstorms. Approximately 20 percent of supercells produce tornadoes (EOEEA ResilientMA Plan, 2023).

Thunderstorms develop when warm, moist air rises and cools, forming clouds and generating strong updrafts. As these storms grow in intensity, they can produce high winds, often resulting from downbursts—intense downward flows of air that hit the ground and spread out rapidly, causing damage across wide areas. These high winds can lead to power outages, tree damage, and structural impacts.[i](NOAA, n.d.)

Tornadoes, violent rotating columns of air extending from a thunderstorm to the ground, often emerge from the most severe thunderstorms. They form when wind patterns within the storm create rotation, which intensifies as it is stretched vertically by the storm's updraft. While not all thunderstorms produce tornadoes, those that do can cause devastating damage, with wind speeds exceeding 200 mph in the most extreme cases.

The common factors in tornado formation are:

- Very strong winds in the middle and upper levels of the atmosphere
- Clockwise turning of the wind with height (i.e., from southeast at the surface to west aloft)
- Increasing wind speed in the lowest 10,000 feet of the atmosphere (i.e., 20 mph at the surface and 50 mph at 7,000 feet)
- Very warm, moist air near the ground, with unusually cooler air aloft
- A forcing mechanism such as a cold front or leftover weather boundary from the previous shower or thunderstorm activity.

These phenomena are of significant concern because they have the potential to cause widespread destruction in a short time. A single thunderstorm can trigger high winds that spread damage over a large area and sometimes spawn a tornado that causes even more focused and severe impacts.

### *Likely Severity*

Figure 3.17 Enhance Fujita (EF) Scale

| EF SCALE | |
|---|---|
| **EF Rating** | **3 Second Gust (mph)** |
| **0** | 65-85 |
| **1** | 86-110 |
| **2** | 111-135 |
| **3** | 136-165 |
| **4** | 166-200 |
| **5** | Over 200 |

The severity of these hazards is determined by their potential to inflict damage, ranging from localized, minor impacts to widespread, which are particularly dangerous due to their capacity for extensive destruction. If a major tornado were to strike, the damage could be severe, especially if it impacts residential areas or critical facilities. Such an event could result in the displacement of individuals and families, significant structural damage or total destruction of buildings, prolonged business closures—some potentially permanent—and widespread disruptions to essential services such as electricity and telecommunications. The National Weather Service (NWS) uses the Enhanced Fujita (EF) Scale **(Figure 3.17 Enhance Fujita (EF) Scale )** to rate tornadoes, which measures not wind speed directly, but the extent of damage caused. This scale estimates 3-second wind gusts based on observed damage across various structure types, accounting for differences in height and exposure.

High winds and thunderstorms, while not always associated with major storm systems, can still cause significant damage. Lee and several communities across Berkshire County have experienced numerous thunderstorms and high wind events, including microbursts. High winds can lead to downed trees and power lines, roof and window damage, and other structural impacts. Wind speeds as low as 40 to 45 mph can cause scattered power outages, particularly if the region has experienced prolonged drought or excessive rainfall, weakening root systems and making trees more susceptible to wind. In contrast, winds under 30 mph are generally not considered hazardous.

Thunderstorms are generated within cumulonimbus clouds and are often accompanied by lightning, heavy rainfall, and gusty winds. The severity of a thunderstorm is classified as "severe" when it produces wind gusts exceeding 58 mph, hail at least one inch in diameter, or a tornado. Severe thunderstorms can range from brief, localized events to large-scale storms that cause significant direct damage and widespread flooding. Flooding, in particular, is a common consequence of severe storms and is often the primary reason for disaster declarations. The severity of flooding varies based on both the storm's characteristics and the specific geography of the affected region. Occasionally, lightning within thunderstorms can also pose severe hazards, particularly in cases where it leads to fires or other secondary impacts.

### *Probability*

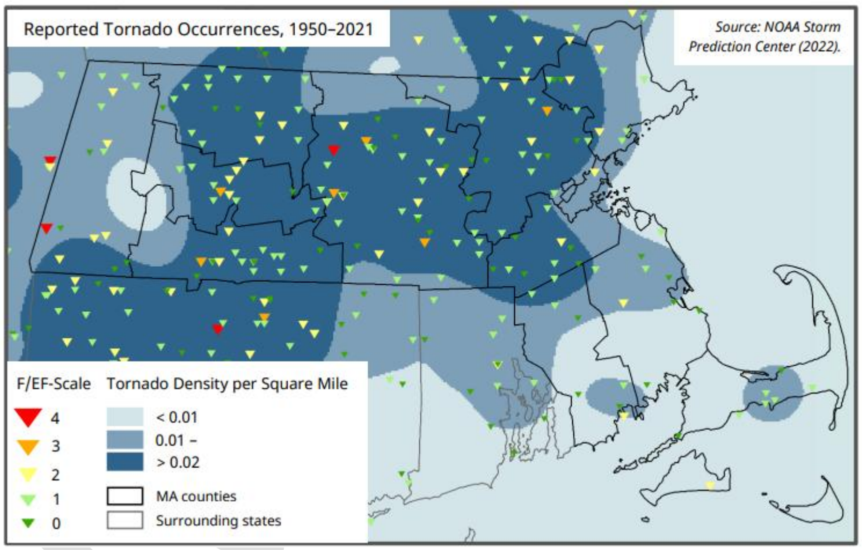
The Northeast experiences tornadoes less frequently compared to other regions of the U.S., such as the Central U.S. and the Great Plains. The varied topography of the Northeast can disrupt the formation and movement of storms capable of producing tornadoes. Additionally, the clash of warm, moist air—the fuel for storms—with cold, dry Canadian air occurs less frequently and with less intensity in the Northeast. While the Northeast does experience severe weather, it is less often subjected to the powerful low-pressure systems that drive the development of supercells, the type of storms most likely to produce tornadoes.

Berkshire County is less at risk for a tornado than Hampden County through Worcester, Middlesex, and part of Essex County (EOEEA ResilientMA Plan, 2023)However, if atmospheric conditions are ideal, the location of a tornado's impact is unpredictable. Tornadoes occur in Massachusetts usually during June, July, and August, although the county's most devastating was in Great Barrington in May 1995.

From 1951 to 2023, the Commonwealth experienced 198 tornadoes or an average annual occurrence of 2.6 tornado events yearly. In the last 20 years, the average frequency of these events has been 1.7 yearly. Massachusetts experienced an average of 1.4 tornadoes per 10,000 square feet annually between 1991 and 2010, less than half of the national average of 3.5 tornadoes per 10,000 square feet per year (MEMA & EEOEA SHMCAP, 2018).

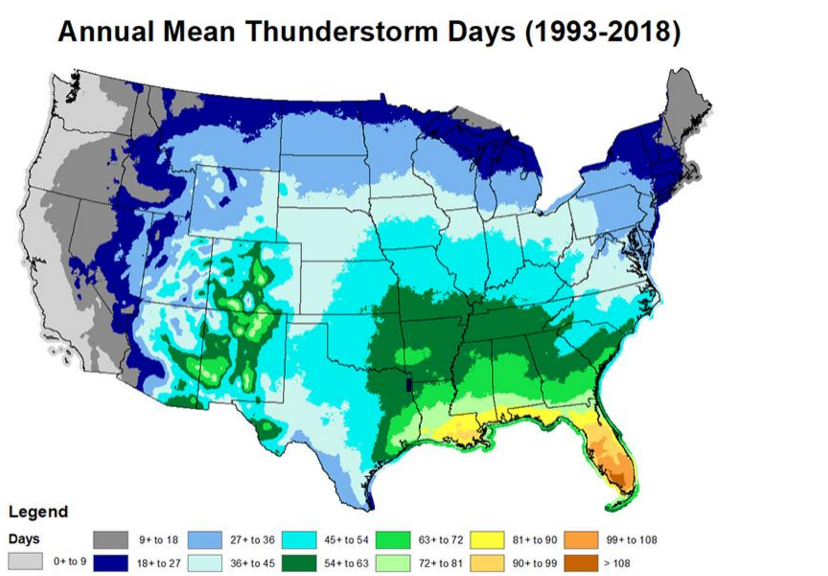
According to data from the National Climatic Data Center, Berkshire County has experienced 13 tornadoes since 1950. These tornadoes have either touched down within the county or moved through it as part of their path. Additionally, several tornadoes have occurred in neighboring counties and states within the region (see **Figure 3.18 Density of Reported Tornadoes per Square.**)

Figure 3.18 Density of Reported Tornadoes per Square




The most recent tornado struck Berkshire County in July 2014, when an EF1 tornado impacted Dalton. While these events average one tornado every five years, only two tornadoes in the region have reached the strength of an EF4, indicating that such severe tornadoes have an estimated recurrence rate of approximately once every 33 years.[ii]

Figure 3.19 Annual Mean Thunderstorms (1993- 2018) *Source: ResilientMA*




Between January 1, 2008, and December 31, 2017, Massachusetts experienced 435 high wind events, averaging about 43.5 yearly events. The NWS defines high winds as sustained winds of 40 mph or more for at least an hour or gusts of 58 mph or more at any duration. However, these numbers may overestimate the frequency, as many events were in the same weather system. Climate projections suggest an increased severe weather, which may lead to more frequent high-wind events.[iii] Thunderstorms require moisture, unstable rising air, and a lifting mechanism, such as topography or the meeting of different air masses. As warm air rises, it cools, causing condensation and cloud formation. Thunderstorms, averaging 15 miles across and lasting around 30 minutes, can grow larger and longer in severe cases. Massachusetts can experience 10–30 days of thunderstorms annually (**see Figure 3.19**). [iv] 33 lightning fatalities were recorded in the Commonwealth from 1959 -2016, with 6 fatalities in 2024.[v,vi] While climate change may increase storm volatility, the risk of lightning-related death or injury remains low.

### *Historic Data*

The National Climatic Data Center reports data on tornado events and does so as far back as 1950. Only two tornadoes in Massachusetts have received FEMA disaster declarations, one in 1953 ( DR-7-MA) and one in 2011 (DR-1994-MA); however, neither were in Berkshire County.

Table 3.12 list the document tornadoes in Berkshire County. In 1964, a Berkshire Eagle article reported on a "twister." This event was accompanied by an electrical storm with hail and 1.25 inches of rain falling in just 30 minutes. One child was injured, a garage was torn apart, and residents on West Mountain Road in Cheshire were without power for two days.

On August 28, 1973, a tornado struck West Stockbridge along a six-mile path. The tornado caused significant destruction, killing four people and injuring 33 others. The Berkshire Truck Plaza was destroyed, and several homes were heavily damaged or obliterated. The tornado also caused severe damage to the Berkshire Farm for Boys in Canaan, NY. Debris from the tornado was carried as far as 55 miles away.[vii]

The Great Barrington tornado, an EF4 event, began on May 29, 1995, causing devastating damage. It resulted in three deaths, 24 injuries, and approximately $25 million in property damage. This tornado is notable as one of only four EF-3 or stronger tornadoes in the National Weather Service Albany County Warning Area over the past 45 years. It is the strongest tornado in Massachusetts since the 1953 Worcester tornado. The tornado originated from a supercell formed in a cluster of severe thunderstorms. After crossing the Hudson River, the system intensified, and an EF2 tornado touched down in Hudson, NY. The storm then moved into Great Barrington, where the EF4 tornado developed, driven by enhanced wind shear in the Housatonic River Valley. The tornado traveled from North Egremont to West Otis, with damage extending over 18 miles. Among the casualties, three people were killed when their car was lifted and dropped into a wooded area. The storm also caused significant structural damage, including destroying a nursing home roof, a gas station, and buildings at the local fairgrounds. Debris from the tornado was found over 45 miles away in Belchertown.[viii]

Table 3.12 Historic Tornado Events in Berkshire County

| Date | EF Scale | Damage | Injured | Fatalities |
|---|---|---|---|---|
| 07/12/1955 | EF2 | $0 | 0 | 0 |
| 09/07/1958 | EF0 | $2,500 | 0 | 0 |
| 03/01/1966 | EF2 | $25,000 | 0 | 0 |
| 08/11/1966 | EF2 | $25,000 | 0 | 0 |
| 10/03/1963 | EF1 | $2,500 | 0 | 0 |
| 06/18/1970 | EF1 | $250,000 | 0 | 0 |
| 08/28/1973 | EF4 | $25 million | 36 | 4 |
| 07/13/1975 | EF2 | $25,000 | 0 | 0 |
| 07/27/1978 | EF0 | $250 | 0 | 0 |
| 07/11/1984 | EF1 | $25,000 | 0 | 0 |
| 05/29/1995 | EF4 | $25 million | 24 | 3 |
| 07/03/1997 | EF1 | $3 million | 0 | 0 |
| 06/29/2005 | EF0 | $0 | 0 | 0 |
| 08/02/2020 | EF0 | $60,000 | 0 | 0 |
| Source: NOAA, SHMCAP | | | | |

It is difficult to define the number of other severe weather events Lee experiences each year. Table 3.13 denotes historical storm events from local media news outlets. According to media reports, thunderstorm/microburst events have caused damage in Williamstown, North Adams, Cheshire, Lanesborough, Pittsfield, Lee, and Stockbridge in recent years. An event that struck Pittsfield and other central Berkshire communities in July 2011 caused extensive damage and was responsible for the death of a man in Hinsdale who was struck by a falling utility pole. WMECO called in 339 out-of-state work electric crews and 14 out-of-state tree crews to remove trees and repair damaged lines. [ix]
More recent thunderstorm activity occurred on June 3rd, 2016, when a two-hour afternoon thunderstorm caused flooding in Lee and Stockbridge. Streets, basements, and ground floors, including Stockbridge Town Hall, were affected. Stockbridge received nearly 5 inches of rain, while Lee received 4.5 inches. Another inch of rain fell the following evening in another storm.[x]
On July 27, 2021, The National Weather Service's storm survey confirmed that two microbursts caused by a severe thunderstorm hit Lenox. The first microburst hit Cliffwood Street, located northwest of downtown Lenox, while the second hit Housatonic Street, traveling up a hill in Kimball Farms before dissipating. The storm caused hardwood and softwood trees to snap and uproot, leading to wind damage to the siding of a home on Housatonic Street and fallen trees, damaging at least seven homes.
Microbursts occur throughout Berkshire County, downing trees and utility lines and sometimes causing property damage. In the Berkshires, microbursts are often accompanied by heavy rainfall that can cause additional damage from flooding.

In June 2014, Cheshire experienced a "monsoon season" after a series of severe thunderstorms with 60-mile-an-hour winds and flooding caused over $ 1 million in flooding damages to roads and existing infrastructure. In July 2016, as the Berkshire Eagle newspaper reported, Cheshire was hit with a short but high-intensity microburst – a localized column of sinking air within a thunderstorm that caused extensive damage. The worst of the affected areas were Main Street, East Main Street, Mill Hill Road and Meadowbrook Drive. Initially, power was cut for about 1,300 customers. Trees were knocked down, requiring the cleanup of branches and debris from area roads.

Table 3.13 Historical Local Storm Events

| Year | Description of Event |
|---|---|
| July 2012 | A thunderstorm knocked down dozens of trees and cracked two telephone poles on Route 102. Officials shut down about a quarter-mile of Route 102 for approximately an hour while crews cleared the poles, and the county remained under a tornado warning for 12 hours (Boston Globe, 2012). |
| May 2013 | Thunderstorms with heavy rainfall and wind caused flash flooding, road closures, and flooded basements. |
| September 2013 | Heavy rain from showers and thunderstorms caused flash flooding and road closures. |
| June 2014 | Slow-moving showers and thunderstorms resulted in heavy rain, flash flooding, and road closures, especially in urban areas with poor drainage. |
| June 2014 | Repeated showers and thunderstorms led to heavy rainfall and flash flooding in some areas. Many roads were closed, and some homes were affected. |
| July 2014 | Strong to severe thunderstorms caused 3 to 6 inches of rainfall and flash flooding. |
| May 2016 | Slow-moving showers and thunderstorms caused heavy rainfall and flash flooding, leading to temporary road closures. |
| August 2017 | Widespread rain caused isolated flash flooding. |
| July 2021 | According to unofficial tallies from weather observers, nearly 3 inches of rain swamped nearby towns during a three-hour downpour. Parts of Richmond, Stockbridge, Lee, Great Barrington and Otis were hit the hardest, with multiple road closings at the height of the storm. |
| Source: Berkshire Eagle Archives unless otherwise noted. | |



## *Vulnerability Assessment*

### *Geographic areas of concern*

All of Lee is vulnerable to tornados, high winds and thunderstorms that can cause extensive. damage. Microbursts can also occur anywhere associated with thunderstorms. The Berkshire Hills offer scenic beauty but can also create microclimates that exacerbate certain weather events. For example, valleys might trap heat and humidity, leading to localized weather phenomena. In the case of storms, valleys may also serve as funnels for wind, intensifying the impact in specific areas.

*People*

The entire population of Lee is exposed to tornado, high winds, and thunderstorm events. Elderly individuals, people with disabilities, and those dependent on electricity-powered medical devices are particularly vulnerable. Power outages caused by high winds can severely impact their ability to access life-sustaining equipment, and limited mobility may prevent quick evacuation during emergency situations. Low-income families and people living in substandard housing are also at heightened risk.

Homes not built to withstand high winds or flying debris are more susceptible to damage, putting occupants at greater risk of injury or death. The mobile home neighborhoods, such as those on Water St. and Bradley Park, are especially vulnerable as these homes typically offer less protection during severe storms and are more prone to destruction.

Additionally, the town's growing number of seasonal homes complicates disaster preparedness. Many of these properties may be vacant during the off-season, complicating response efforts and infrastructure damage assessments. Part-time residents may not be fully integrated into local emergency communication systems. Visitors unfamiliar with local emergency procedures and an increased demand for services during peak tourist times could strain resources during a natural disaster. Short-term rental properties (inns, resorts, and campgrounds), where many tourists stay, may not offer the same protection as permanent housing. Outdoor workers, individuals engaged in outdoor recreation, and first responders are particularly exposed to hazards like lightning strikes or falling debris during high winds and thunderstorms.

Lee has many rural and isolated homes spread out across the hilly landscape. This spread of isolated residences can make emergency response and communication more challenging during severe weather, as it may take longer for services to reach residents in more remote areas. Roads can be easily blocked by downed trees or power lines, increasing the isolation during emergencies. However, the Town does utilize Reverse 911 to issue emergency notifications as a proactive step to inform residents of flood risks and enhance community preparedness. Most residents in these vulnerable areas are enrolled in the Reverse 911 system.

The current average lead time for tornado warnings is 13 minutes. Occasionally, tornadoes develop so rapidly that little, if any, advance warning is possible. This short warning time is part of why tornados are so dangerous. Tornado watches and the local NWS office issues warnings. A tornado watch is released when tornadoes are possible in an area. A tornado warning means a tornado has been sighted or indicated by weather radar (MEMA & EEOEA SHMCAP, 2018). Power outages may also result in inappropriate use of combustion heaters, cooking appliances and generators in indoor or poorly ventilated areas, leading to increased risks of carbon monoxide poisoning (MEMA & EEOEA SHMCAP, 2018).

The most common problem associated with severe weather is the loss of utilities. Severe windstorms causing downed trees can seriously impact electricity and aboveground communication lines. Downed power lines can cause blackouts, leaving large areas isolated. Loss of electricity and phone connections would leave certain populations isolated because residents could not call for assistance. Additionally, the loss of power can impact heating or cooling systems and cause loss of electricity to power oxygen and other life-sustaining equipment. Downed wires can create the risk of fire, electrocution, or an explosion.

These severe wind events present potential safety impacts for individuals without access to shelter during these events. Additionally, research has found that thunderstorms may cause the rate of emergency room visits for asthma to increase to 5 to 10 times the normal rate. Much of this phenomenon is attributed to the stress and anxiety that many individuals, particularly children, experience during severe thunderstorms. During thunderstorms, high winds can cause a sudden release of spores and pollen into the air, leading to increased concentrations of allergens. Inhalation of these airborne particles can trigger asthma attacks, a phenomenon known as "thunderstorm asthma."[xi]

*Built Environment*

All elements of the built environment are exposed to severe weather events such as tornados, high winds and thunderstorms. The extent of damage to buildings depends on several factors, including wind speed, storm duration, the storm's path, and the construction quality of the buildings. The Massachusetts State Building Code (9th Edition), following national standards provided by the American Society of Civil Engineers (ASCE 7), defines wind risk zones that account for different levels of wind exposure. These zones help determine how structures should be designed to withstand wind forces in specific areas, and the state is divided into four wind risk categories:

1. Risk Category I (120 mph): Applies to low-hazard buildings like agricultural or temporary structures, with minimal risk to human life.
2. Risk Category II (130 mph): Covers most residential, commercial, and industrial buildings designed for moderate wind loads.
3. Risk Category III (140 mph): Includes high-importance buildings like schools and assembly areas, requiring greater wind resistance.
4. Risk Category IV (150 mph): Reserved for essential facilities (e.g., hospitals, emergency shelters), built to withstand extreme wind forces for disaster response.

Public safety facilities and equipment are particularly vulnerable to high winds, which could cause direct damage. Roads may become impassable due to flash flooding or landslides caused by heavy, prolonged rainfall. These impacts on transportation lifelines can have both immediate consequences, such as hampering evacuation efforts, and long-term effects on daily commuting and emergency services. Water and sewer systems may also fail if power is lost for extended periods.

Secondary hazards such as hail, wind, debris, and flash flooding associated with tornadoes can cause damage to infrastructure (EOEEA ResilientMA Plan, 2023). If a tornado hit a large expanse of Lee and/or its neighboring towns, electricity could be out for several days, as was the case when the ice storm of 2008 struck the Berkshire Hilltowns. High winds could down power lines and poles adjacent to roads. Damage to aboveground transmission infrastructure can result in extended power outages. Incapacity and loss of roads and bridges are the primary transportation failures resulting from tornadoes, and these failures are primarily associated with secondary hazards, such as landslide events. Tornadoes can cause significant damage to trees and power lines, blocking roads with debris, incapacitating transportation, isolating populations, and disrupting ingress and egress. Of particular concern are bridges and roads providing access to isolated areas and older residents.

*Natural Environment*

High wind events, such as tornadoes, can profoundly affect the natural environment. These events defoliate forest canopies, uproot or down trees, and significantly damage large plants, leading to structural changes that destabilize food webs and cause widespread ecosystem disruption. For example, a tornado-impacted neighborhood in Springfield experienced a dramatic reduction in tree cover, dropping from 40 percent to just 1 percent, resulting in observed temperature increases of up to 4°F due to the loss of natural shading (EOEEA ResilientMA Plan, 2023).

The loss of trees and root systems can increase the risk of soil erosion and heighten wildfire threats as decomposing felled trees add dry matter to the ecosystem. These disruptions also affect biodiversity and the composition of forests, providing opportunities for invasive plant species to establish themselves in the disturbed areas, taking advantage of increased sunlight and reduced competition from native species.

In addition to these impacts, high winds can also severely affect wildlife. Habitat destruction can displace animals, disrupt breeding and migration patterns, and lead to population declines, particularly for species that depend on forest canopies or specific ecological niches. The long-term effects of habitat loss can significantly alter local wildlife populations.

Water systems may also be affected as heavy winds and rains lead to soil erosion, causing sedimentation in rivers, streams, and other bodies of water. This sedimentation can degrade water quality and harm aquatic ecosystems, posing challenges to species reliant on clear water for breeding and feeding. Additionally, hazardous materials carried by high winds, such as asbestos-contaminated debris, can contaminate these water bodies, further exacerbating environmental damage.

Forest ecosystems' long-term recovery from tornadoes and high wind events can take decades. During this time, regrowth may be slow, and the composition of the ecosystem could change permanently due to invasive species and the loss of critical species. These combined effects make it essential to address not only the immediate aftermath of such events but also the extended recovery process for both flora and fauna.

*Economy*

In 2022, tornadoes caused approximately 708 million U.S. dollars in damage across the United States, marking a more than 200 percent increase compared to the previous year. The economic toll from tornadoes in the U.S. peaked in 2011, with nearly 9.5 billion U.S. dollars in damages. [xii]

Lee relies significantly on tourism, especially in the summer, which draws tens of thousands of visitors. Natural disasters during peak tourism season can severely disrupt this industry. A tornado or major storm could lead to road closures, damaged accommodations, and canceled events, all of which could deter tourists from visiting, impacting businesses like hotels, restaurants, and retail shops.

The downtown area of Lee, with its mix of small, locally owned businesses, could suffer heavily from tornado or storm damage. These businesses often have fewer financial resources to recover from disasters, especially if their physical locations are damaged or destroyed. Many of the town's historic buildings along Main Street may not be resilient to extreme weather, putting both property and business operations at risk. Severe weather events could disrupt supply chains, especially for local businesses that rely on deliveries of goods. Power interruptions could exacerbate already rising energy costs and reduce the sector's productivity, impacting overall economic stability. Road closures or damage to transportation routes, such as U.S. Route 20 or the Massachusetts Turnpike (I-90), would hinder the movement of supplies and goods both in and out of Lee, further impacting local businesses. Beyond direct physical damage, businesses may experience secondary impacts such as the cost of relocating operations, wage losses, and prolonged disruptions to day-to-day functions.

Lee has several key employers in light manufacturing, including companies like Berkshire Sterile and Boyd Technologies. While vital to the town's economy, these businesses are vulnerable to disruptions from severe storms or tornadoes. Damage to facilities, loss of power, and transportation issues could all result in halted production and layoffs, affecting the town's employment base.

While high winds and thunderstorms may cover a broader geographic area, they can still significantly disrupt local areas. These events may damage infrastructure, such as water supply systems, and lead to rental losses as properties undergo repairs. Power outages caused by these storms can further disrupt business activities, especially for industries reliant on continuous electricity, and recovery costs can be substantial. Historical data shows that the average economic loss from tornadoes in Massachusetts is approximately $3.9 million annually. (MEMA & EEOEA SHMCAP, 2018). [xiii]

Additionally, lightning strikes—often accompanying thunderstorms—can lead to severe losses. Lightning can ignite wildfires, damage infrastructure, and destroy crops, with damages ranging from minor to millions of dollars in large-scale events. Though secondary wildfires present a serious risk in Lee's rural, forested areas, potentially leading to extensive property loss and environmental damage. The cascading effects of these hazards often leave communities facing significant financial challenges long after the initial storm has passed.

Many of Lee's key tourist attractions, such as Laurel Lake, Goose Pond, and access to the Appalachian Trail and other scenic ski and hiking trails, are centered around the outdoors. Storm damage could heavily affect these areas, leading to a temporary or even long-term decline in outdoor recreational tourism, which would have a ripple effect on local businesses that rely on tourist spending. Disruptions to transportation infrastructure further compound these economic challenges.

*Future Conditions*

As climate change continues to affect the Northeast, Lee is expected to experience an increase in the frequency and intensity of thunderstorms, high winds, and tornadoes. Projections show a continuing trend of rising temperatures and more intense storms, bringing greater atmospheric moisture. This moisture will likely fuel increasingly severe thunderstorms, creating conditions that heighten risks of flash flooding, high winds, and tornadoes outside the typical tornado season. Longer periods of warmer weather could expand the window for tornado formation, raising the possibility of these events outside traditional summer months. Additionally, this shift in storm dynamics will likely strain Lee's existing infrastructure, necessitating future upgrades to stormwater systems and emergency response protocols to adapt to changing conditions.

Lee's population patterns are expected to shift in ways that could heighten vulnerability to storm events. In the coming years, as people migrate from regions more heavily impacted by climate change, Lee could see an increase in population density. The growing number of older residents—many already settled in flood-prone areas or homes with limited storm resilience—may necessitate expanded emergency preparedness efforts and accessible sheltering options. Furthermore, an influx of new residents, particularly retirees or climate migrants, could increase pressure on Lee's housing market, leading to higher prices and fewer affordable housing options for low-income residents. These shifts will require targeted strategies to support socially vulnerable groups, such as enhancing access to resilient housing, storm-ready facilities, and accessible emergency response services.

Lee's primarily rural landscape, with development concentrated around its historic downtown, provides a unique opportunity to embed resilience in new projects while maintaining its character. Current and future land use regulations may need to integrate stricter standards, particularly for developments near the Housatonic River or in areas at higher risk of wind damage. Necessary adaptations could include updating building codes to ensure that new developments meet enhanced wind resilience criteria and incorporating stormwater management improvements that align with more intense rainfall patterns. Redevelopment projects offer opportunities for adaptive reuse that strengthen the community's resilience. These projects can adopt resilient designs that withstand the increased severity of storms projected for both business and residential housing in the coming years.

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# Wildfires

## *Hazard Profile*

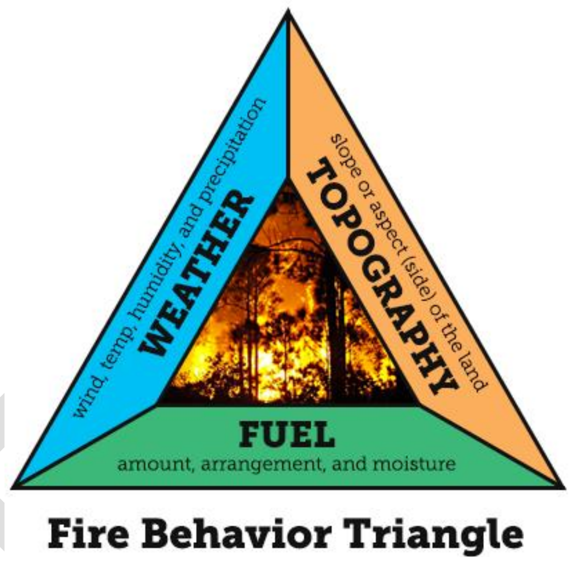
A wildfire can be defined as any non-structure fire that occurs in vegetative wildland containing grass, shrubs, leaf litter, and forested tree fuels. Wildfires can be caused by natural events (e.g., lightning), drought, extreme heat, forest management practices, invasive species, and human activity (e.g., smoking, campfires). They often begin unnoticed but spread quickly, igniting brush, trees, and potentially homes. In the Commonwealth, 98% of wildfires are human-caused (EOEEA ResilientMA Plan, 2023). There are three different classes of wildfires. Surface fires are the most common type and burn along a forest floor, moving slowly and killing or damaging trees. Ground fires are usually started by lightning and burn on or below the forest floor. Crown fires spread rapidly by wind, jumping along the tops of trees.

A wildfire differs significantly from other fires by its extensive size, speed at which it can spread out from its source, potential to unexpectedly change direction, and ability to jump gaps such as roads, rivers, and fire breaks. Wildfire season can begin in March and usually ends in late November. Most wildfires typically occur in April and May, when most vegetation is void of any appreciable moisture, making them highly flammable. Once "green-up" occurs in late May to early June, the fire danger is usually reduced somewhat. The National Wildfire Coordinating Group (NWCG) classifies the severity of wildfires based on their acreage as follows:

- Class A - one-fourth acre or less.
- Class B - more than one-fourth acre, but less than 10 acres.
- Class C - 10 acres or more, but less than 100 acres.
- Class D - 100 acres or more, but less than 300 acres.
- Class E - 300 acres or more, but less than 1,000 acres.
- Class F - 1,000 acres or more, but less than 5,000 acres.
- Class G - 5,000 acres or more (NWCG, 2023).

### *Likely Severity*

Image 3.4 Fire Behavior Triangle




*Source: WeatherStem*

The severity of wildfires can vary significantly based on several factors, including weather conditions, vegetation type, and topography. Three main factors influence wildfire behavior, often depicted as the Fire Behavior Triangle: weather, fuel, and topography (Image 3.4 Fire Behavior Triangle).

<u>Weather</u>: Weather conditions such as wind, temperature, humidity, and precipitation are crucial in wildfire behavior. Dry spring and summer conditions, or drought at any point of the year, increase fire risk. Similarly, the passage of a dry, cold front through the region can increase sudden wind speed and changes in wind direction. Wind can drive the fire's spread, pushing flames and embers ahead of the main fire front. High temperatures can increase the fire's intensity, while low humidity can dry out vegetation, making it more flammable. Conversely, precipitation can help control or extinguish fires. Thunderstorms in Massachusetts are usually accompanied by rainfall; however, during periods of drought, lightning from thunderstorm cells can result in fire ignition. Thunderstorms with little or no rainfall are rare in New England but have occurred.

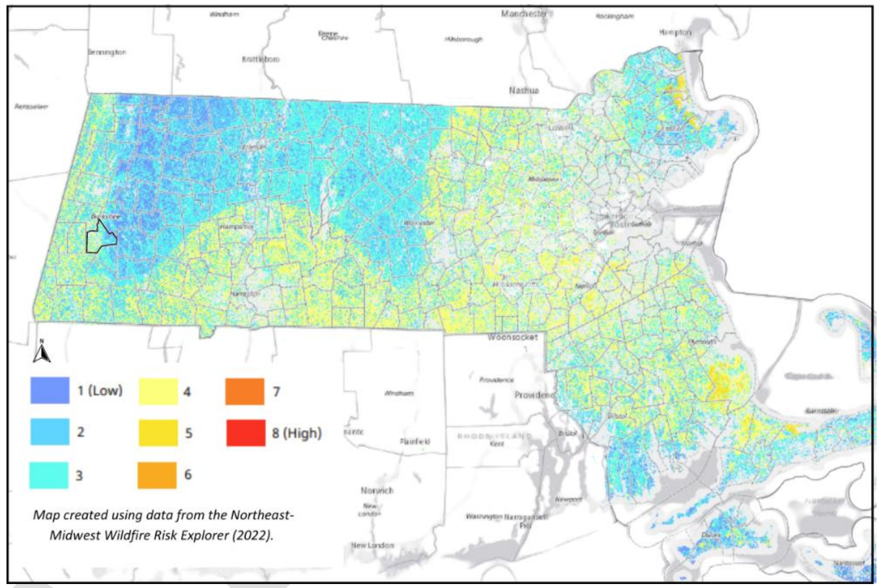
<u>Fuel</u>: The type, amount, arrangement, and moisture content of vegetation and other combustible materials are critical in determining how a wildfire spreads and its intensity. For example, dry grasses can ignite and spread fire rapidly, while wetter, greener vegetation may slow it down. Areas with dense forests, brush, and dry grasses are particularly susceptible to wildfires. The accumulation of dead plant material, such as leaves, twigs, and logs, serves as fuel, enabling fires to spread rapidly.

<u>Topography:</u> The landscape, including slope and aspect (the direction a slope faces), influences wildfire behavior. Fires tend to move faster uphill due to the preheating of vegetation above the fire. The shape and features of the landscape can also channel winds, affecting the fire's direction and speed. Steeper terrains can thus be more vulnerable to rapid fire spread.

### *Probability*

It is difficult to predict the likelihood of wildfires in a probabilistic manner as several factors affect fire potential and because some conditions, such as ongoing land use development patterns, location, and fuel sources, exert changing pressure on the wildland-urban interface zone. Wildland-urban interface (WUI) refers to areas where human-made structures and infrastructure are near wildland vegetation. This term will be discussed in greater detail later in this section.

Figure 3.20 Wildland-Urban Risk Assessment of the Commonwealth




A working group led by the U.S. Forest Service developed the Northeast Wildfire Risk Assessment model that considered three components: 1) fuels, 2) wildland-urban interface, and 3) topography (slope and aspect). These three characteristics are combined to identify wildfire-prone areas where hazard mitigation practices would be most effective. Figure 3.20 display Lee as a low wildfire risk in the east, which is dominated by large tracts of state forest. However, risk levels increase towards the Town's more developed sections where there is a greater density of people and, therefore, more pronounced forest-human interactions. Comparatively, in the eastern portion of the state, there are ranging moderate risk areas, which are a combination of fire-prone forest types (pitch pine-scrub oak and oak) and significant forest-human interaction.

### *Historic Data*

Since 1983, the National Interagency Fire Center has documented an average of approximately 70,000 wildfires per year, with the number of burned areas increasing since the 1980s. Of the 10 years with the largest acreage burned, all have occurred since 2004, including the peak years in 2015 and 2020. This period coincides with many of the warmest years nationwide, with the largest increases in the spring and summer months.[i]

Land area burned by wildfires varies by state. Fires burn more land in the western United States than in the East—an average of 1.8 million acres burned in July of each year from 2003 to 2021.[ii] In Massachusetts, the extent of burned land increased by 0.01 acres per square mile in 2003- 2021 compared to 1994-2002.[iii] In 2022, Massachusetts was reported as having 1,192 wildfires with 1,756 acres burned.[iv]

According to the 2019 Massachusetts Fire Incident Reporting System (MFIRS), the trend of wildfires (by incident, not by acres burned) reported to the DCR in the past five years has generally been downward.[v] Between 2007 and 2016, 901 fire incidents, both urban and wildland, were recorded in Berkshire County. Of these, 411 incidents (46%) occurred in Pittsfield, the region's urban center. During this period, 832 acres were burned in the county, with 631 acres (76%) classified as wildland. This data indicates that, on average, 63 acres of wildland were burned annually in Berkshire County over the ten years.

Among the 901 incidents, only 12 burned more than 10 acres; of these, two fires exceeded 100 acres. Notably, there were two significant wildland fires during this period: a 168-acre fire in Lanesborough in 2008 and a 272-acre fire in Clarksburg near the Williamstown border in 2015. Excluding these outliers, the average total burned acreage from 2007 to 2016 would be 39 acres, with the average wildland acreage burned to be 19 acres. In 2021, a wildfire that started in eastern Williamstown rapidly spread eastward across the town border into Clarksburg, consuming approximately 950 acres of forest land. One of the largest wildfires in Massachusetts on record was in Plymouth in May 1957. This catastrophic fire burned 15,000 acres and destroyed about 40 structures. Another large fire in the same area in 1964 burned 5,500 acres. [vi] Table 3.14 list the Federal and State declarations of emergencies for wildfires in the Commonwealth.

Table 3.14 Federal and State Declarations of Emergencies for Wildfires

| Date | Description of Event |
|---|---|
| 5/19/1957 | Plymouth, 15,000 acres: One of the largest wildfires on record destroyed about 40 structures. |
| 10/16/1973 | Suffolk County: FEMA declared disaster (DR 405). |
| 12/3/1981 | Essex County: FEMA declared disaster (DR 650). |
| 1964 | Plymouth, 5,500 acres: Large fire, destroyed cottages on Charge Pond. |
| 9/12/1995 | State Wide: FEMA declared disaster (DR 2116). |
| 12/6/1999 | Worcester: FEMA declared disaster (DR 3153). |
| 07/05-07/2002 | Western Massachusetts: Smoke from wildfires in northern Quebec obscured the sky, reduced visibility, and issued advisories. |
| 04/04-05/2012 | Dry conditions, combined with wind gusts between 25 and 30 mph, produced ideal conditions for fire spread. A brush fire in Brimfield moved into an area of blown-down debris from a tornado and became difficult to control. Due to a thunderstorm, firefighters had to stop until the storm passed. This brush fire burned approximately 50 acres. No structures were destroyed; however, many homes were threatened. |
| 4/19/2012 | Leicester-Paxton, 1 acre: Fire in meadowlands off Route 56, one firefighter injured. |
| 04/19-20/2012 | Dedham-Boston, 100 acres: Fire spread near Route 128, burned meadowlands. |
| 03/08-09/2016 | Westfield, 60 acres: Brush fire on Tekoa Mountain, spread due to dry weather, no structures in the area. |
| 07/22-24/2016 | Joint Base Cape Cod, 125 acres: Lightning-caused fire, burned through night, contained after 36 hours, helicopters assisted. |

Source: 2018 SHMCAP, FEMA Declaration for States and Counties

The Town of Clarksburg in northern Berkshire County has faced the two largest forest fires recorded in the county, occurring in 2015 and 2021. The 2015 fire began as a cooking fire at the Sherman Brook primitive campsite along the Appalachian Trail, which spread out of control under dry, Class 4 High fire danger conditions. It eventually consumed 272 acres within the Clarksburg State Forest. Incident reports indicated it was largely a surface fire, burning hardwood leaf litter and Mountain Laurel shrubs, rather than becoming a significant tree or crown fire. The firefighting efforts were complicated by the fire's inaccessible location and rugged, steep terrain. Initial firefighting required crews to hike with backpacks, portable water pumps, and refilling equipment from small mountain streams. Firebreaks were created using shovels, chainsaws, and leaf blowers. The fire was ultimately contained when the National Guard's Black Hawk helicopter began dropping 500 gallons of water at a time from the Mount Williams Reservoir in North Adams.[vii]

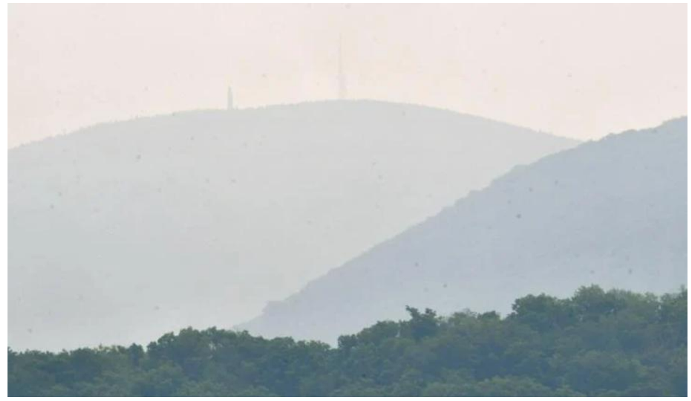
Image 3.5 Wildfire in Clarksburg (2015)

*Source: Berkshire Eagle, Photo Credit- Shane Naughton*

The 2021 East Mountain fire started on May 14th off Henderson Road in Williamstown and spread rapidly eastward. By May 16th, the fire had grown to almost 800 acres; by May 18th, it had consumed 950 acres, predominantly in Clarksburg. Similar to the 2015 fire, this blaze occurred in steep, rugged terrain inaccessible to fire trucks or tankers, necessitating firefighters and equipment being transported via ATVs or on foot. Firefighters accessed the site from landings in Williamstown and North Adams. Over 120 firefighters from 19 different companies and agencies in Massachusetts and Vermont battled the fire for four days, with support from water-dropping helicopters from the state police and National Guard. This fire, like the 2015 fire, was predominantly a surface fire, fueled by dry conditions likely resulting from the previous year's dry summer and fall season.[viii]

From June to July 2023, a nearly stationary low-pressure system near Maine and the Canadian Maritime Provinces caused persistent northerly winds to transport smoke from wildfires in Quebec into the northeastern U.S. This smoke event severely affected air quality for millions of people, resulting in Air Quality Index (AQI) readings that reached very unhealthy and hazardous levels in some areas. Visibility dropped to as low as one-half mile in places from Washington, D.C., to New York City, an uncommon occurrence given the distance from the source of the wildfires. (See **Image 3.6**).

Image 3.6 Berkshires blanketed in wildfire smoke during the 2023 Canadian Wildfires



*Source: Berkshire Eagle, 2023. Photo Credit-Gillian Jones*

The most significant near-surface smoke and poor air quality were observed on June 7th. During this period, tens of millions of people were under air quality alerts from June 6th through June 7th, with dense smoke advisories issued for near-shore waters. Air quality alerts remained in effect for several days across the northeast. In Massachusetts, five counties, including the Berkshires, exceed the Federal air quality standard for 24-hour particle pollution levels, prompting health officials to encourage people to wear masks, avoid going outside, and routinely check in with Air Quality updates. [ix]

Overall, more than 120 million people, roughly a third of the U.S. population, were affected by the smoke. In Canada, a record number of more than 20 million acres were charred by wildfires. The smoke led to schools adjusting outdoor activities and canceling recesses and field trips. The worsening air quality in New York was declared “an emergency crisis.” For the Berkshires, it was considered the worst air quality event in 20 years. [x]

### *Vulnerability Assessment*

#### *Geographic Areas Likely Impacted*

Lee’s vulnerability to wildfires is imparted due to its heavily forested landscape, including northern hardwoods, hemlock, and white pine, especially prominent in the October Mountain, Beartown State Forests, and Golden Hill Town Forest. The lower slopes support forests dominated by sugar maple, American beech, yellow birch, and northern red oak, with some areas featuring a mix of eastern hemlock and eastern white pine. These second-growth forests, typical of New England, add to the fire risk due to their dense understory and accumulation of leaf litter. The ecosystems most susceptible to the wildfire hazard are pitch pine, scrub oak, and oak forests, which contain the most flammable vegetative fuels.

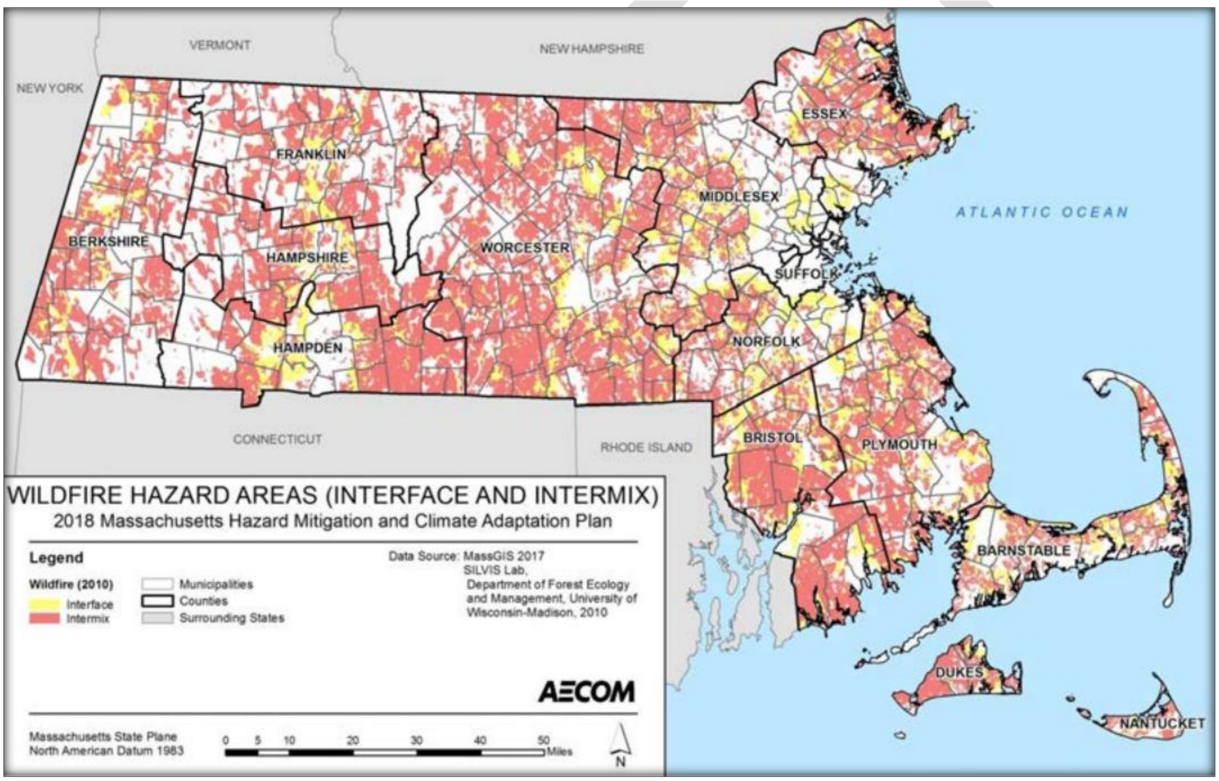
While the trees in Lee are generally less fire-prone, the presence of eastern hemlock and eastern white pine does increase the likelihood of wildfire. Eastern white pine, in particular, has a high resin content, contributing to fire spread. However, Lee has a lower wildfire risk than the eastern part of the state, where pitch pine and scrub oak communities are more abundant and large expansions of significant forest-human interaction.

Other areas susceptible to wildfires are those at the urban-wildland interface shown in Figure 3.21. The SILVIS Lab at the University of Wisconsin-Madison Department of Forest Ecology and Management classifies exposure to wildfire hazards as "interface" or "intermix." [xi]

- *Intermix communities* are those where housing and vegetation intermingle, with more than 50 percent vegetation and a housing density greater than one house per 16 hectares (approximately 6.5 acres).
- *Interface communities* are defined as those in the vicinity of contiguous vegetation, with more than one house per 40 acres, less than 50 percent vegetation, and within 1.5 miles of an area of more than 500 hectares (approximately 202 acres) that is more than 75 percent vegetated.

To assess potential exposure and impacts related to wildfire hazards, inventoried assets such as population, building stock, and critical facilities were overlaid with these data. This method helps determine the most risky areas and requires focused wildfire management and mitigation efforts.

Figure 3.21 Wildland-Urban Interface and Intermix for the Commonwealth of Massachusetts




Lee contains both interface and intermix, with higher concentrations of interface occurring in the center, where there is more dense development. This concentration indicates a moderate probability of wildfire impact compared to the rest of the town because fires can easily spread from wildlands to homes and other structures due to the lack of physical barriers. In interface areas, fire management strategies often focus on creating defensible space around homes, using fire-resistant building materials, and implementing buffer zones to prevent fire spread.

The presence of intermixed areas, where housing and vegetation intermingle, increases the risk of wildfires spreading and impacting both natural and built environments. In Lee, these areas create conditions where wildfires can easily ignite and spread, posing threats to the community and the surrounding natural landscapes. In intermix areas, fire management strategies may include thinning vegetation, creating fuel breaks, and ensuring that firefighting resources can access these dispersed communities.

The assessment model has a flaw in that it does not consider human activity outside the wildland interface and intermix areas. Local firefighters and other first responders highlight that many wildfires occur in remote areas where campfires or discarded lit cigarettes cause the fires. Due to lack of access, these fires can gain significant ground before fire crews and equipment can reach them.

For example, the two largest wildfires in Berkshire County in the last 100 years—one in April 2015 (272 acres burned) and another in May 2021 (over 950 acres burned)—occurred in areas in Clarksburg assessed as Low Wildfire Risk. An out-of-control campfire along the Appalachian Trail caused the 2015 fire. The cause of the 2021 fire was not specifically determined, but dry forest leaves and kindling due to drought contributed to its spread. The assessment modeling predicted a low risk of wildfire in the Clarksburg areas where the fires occurred, presumably because of a lack of a wildland-urban interface. These fires burned remote areas within Clarksburg State Forest, highlighting the model's limitations in accounting for human activities in remote locations.

*People*

People living in Wildland-Urban Interface areas are among the most vulnerable to wildfires. These areas are where homes and communities are near wildlands and forests, creating a higher risk due to the combination of human structures and flammable vegetation.[xii] Landowners with pets or livestock may face additional challenges in evacuating if they cannot easily transport their animals.

Changes in population patterns, such as an increasing population density and an aging population, can significantly affect the vulnerability to hazards. The higher population density in the central portion of Lee increases the number of individuals at risk during disasters. The elderly and people with disabilities are particularly at risk because they may have limited mobility, making rapid evacuation challenging. Given Lee's aging population, which includes significant increases in age groups 70 and over, there is an elevated need for specialized emergency response strategies. The older adult population is more likely to have mobility issues, chronic health conditions, and a reliance on medical equipment, all of which complicate evacuation and sheltering during wildfire events.

Smoke and air pollution from wildfires can be a severe health hazard. Smoke generated by wildfire consists of visible and invisible emissions containing particulate matter (soot, tar, and minerals), gases (water vapor, carbon monoxide, carbon dioxide ($CO2$), and nitrogen oxides), and toxics (formaldehyde and benzene). Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather. Other public health impacts associated with wildfire include difficulty breathing, reactions to odor, and reduced visibility. Due to the high prevalence of asthma in Massachusetts, there is a high incidence of emergency department visits when respiratory irritants like smoke envelop an area. Additionally, they may suffer from health conditions that are exacerbated by smoke and poor air quality.

Low-income populations often live in less resilient housing and may lack access to transportation or resources needed for effective evacuation and recovery, as well as less access to information and emergency services. Children are also highly vulnerable due to their reliance on adults for evacuation and safety, as well as their increased susceptibility to the health effects of smoke and poor air quality.[xiii]
Outdoor workers, such as firefighters, construction workers, and agricultural laborers, face increased risks due to their direct exposure to fire and smoke. Individuals with respiratory conditions, such as asthma or chronic obstructive pulmonary disease (COPD), are particularly vulnerable to the smoke and poor air quality associated with wildfires. Additionally, homeless populations, who often lack the means to evacuate and are more exposed to immediate dangers and harmful effects of smoke, are at significant risk.

*Built Environment*

All buildings and other facilities are vulnerable to wildfire through direct impacts of burning or indirect through cut off from utilities. Building materials and design play a critical role; structures constructed with combustible materials such as wood are more likely to sustain damage, while those made with fire-resistant materials like brick, stucco, and metal are better protected. If any portion of a communications or electrical system were impacted by wildfire, it would affect a portion or the entire system.

Additionally, the proximity of buildings to dense vegetation increases the risk, as flammable plants and trees can serve as fuel for fires. A community's layout also affects its vulnerability, with narrow roads and inadequate evacuation routes impeding emergency response and evacuation efforts. Fires can create conditions that block or prevent access and isolate residents and emergency service providers.

In addition to the immediate threat of flames, wildfires can cause secondary hazards that further impact the built environment and public health. One significant secondary hazard is the contamination of water reservoirs with ash and debris. When wildfires burn, the resulting ash can settle on surfaces and be washed into water bodies during subsequent rainfall. This can lead to degraded water quality in reservoirs, lakes, and rivers, affecting water supply and aquatic ecosystems. Ash in water can increase harmful substances, such as heavy metals and organic pollutants, making water treatment more challenging and expensive.

Wildfires can also lead to soil erosion and an increased risk of landslides. Removing vegetation by fire destabilizes the soil, making it more susceptible to erosion during heavy rains. This erosion can result in landslides that further damage infrastructure, block roads, and pose additional community hazards.

*Natural Environment*

Fire is a natural part of many ecosystems and serves important ecological purposes, including facilitating nutrient cycling from dead and decaying matter, removing diseased plants and pests, and regenerating seeds or stimulating the germination of certain plants. However, many wildfires, particularly man-made ones, can significantly negatively impact the environment. In addition to direct mortality, wildfires and the ash they generate can disrupt nutrient flow through an ecosystem, reducing the biodiversity it can support. Frequent wildfires can eradicate native plant species and encourage the growth of invasive species.

Increased wildfire frequency can lead to forest health degradation in ecosystems not adapted to frequent fires.[xiv] These ecosystems can suffer long-term damage as they lack the natural resilience to recover quickly, leading to further ecological imbalances. Insect outbreaks, particularly in pine forests, can also occur following wildfires. Fortunately, most of the dense pine forests are located in the eastern part of the state, which may help mitigate this risk in other areas.

There are also risks related to hazardous material releases during wildfires. Containers storing hazardous materials can rupture due to excessive heat, acting as fuel for the fire and causing rapid spreading. This escalation can lead to unmanageable wildfire levels. Additionally, these materials can leak into surrounding areas, saturating soils and seeping into surface waters, causing severe and lasting environmental damage.[xv]The risk of hazardous material releases is higher in urban-wildland intermix and interface area.

*Economy*

Wildfires can have profound economic impacts on affected communities and regions, encompassing both immediate costs and long-term financial burdens. The immediate costs include firefighting expenses, which cover the deployment of firefighters, equipment, and resources to combat wildfires. These costs also include salaries, overtime pay, fuel, maintenance of equipment, and the use of aircraft for water and retardant drops. During severe fire seasons, these firefighting expenses can strain local and state budgets. Additionally, property damage from wildfires leads to significant financial losses for homeowners, businesses, and insurance companies, with the destruction of property necessitating substantial rebuilding and repair costs. Moreover, wildfires increase the demand for state and municipal government services to address the impacts of loss and damage. This increased demand can stretch local resources and budgets, leading to higher taxes or reallocation of funds from other essential services.

Evacuation and emergency services also add to the immediate economic burden, as costs associated with evacuations, emergency shelter, food, and medical care for displaced residents can quickly accumulate. [xvi] There are also many direct and indirect costs to local businesses that excuse volunteers from work to fight these fires.[xvii]

According to the Incident Status Summary, drafted by the state DCR Bureau of Forest Fire Control, at the
close of the Clarksburg State Forest Fire of 2015, the cost to put out that fire was estimated to be between $20,000-30,000. This figure was for state-incurred costs and did not include locate fire company costs. The cost to the Clarksburg Fire Company was in the low thousands of dollars for food,
water, equipment and other direct costs; uncompensated were the hundreds of volunteers firefighters
who attended the fire and the local citizens who came to the staging area and provided food and support to the firefighters and other first responders at the scene.

Wildfires can disrupt local economies by forcing businesses to close, leading to a loss of income for business owners and employees. Tourism-dependent regions, in particular, suffer from decreased visitor numbers due to fire-related closures and perceived safety concerns. The agricultural and forestry sectors also face severe impacts, as wildfires can devastate agricultural lands and lead to crop losses, causing financial hardship for farmers. The forestry industry suffers from the loss of timber resources and long-term impacts on forest management and production. [xviii]

*Future Conditions*

During the summer months, Lee experiences a significant population influx due to tourism and seasonal residents. This seasonal increase in population can exacerbate the impacts of wildfires in several ways:

- Increased Human Activity: More people means a higher likelihood of human-caused ignitions, such as campfires, barbecues, and discarded cigarettes.
- Evacuation Challenges: Evacuating a larger population, including tourists who may not be familiar with the area or evacuation routes, can be more complex and time-consuming.

With warming temperatures, it is likely that the Berkshires, known for its more temperate climate, will see an increase in population. This influx could occur seasonally, as more people visit during the summer months, and individuals from hotter regions permanently seek cooler areas to reside. This population increase may pressure emergency services and infrastructure, particularly during peak tourist seasons.

Much of Lee is rural, with a significant amount of land protected, or lacks suitability for aggressive expansion. These restrictions confine any future development to the Town's core center, where opportunities exist for new housing in previously developed and lower-density development sites. This concentration of development increases the density of people living in the interface areas, where residential developments directly abut wildland vegetation, thereby elevating the risk of wildfire spread and impact.

The redevelopment of the Eagle Mill site, currently underway at the north end of downtown, is planning to implement over 100 new residential units along with some commercial spaces. Lee also has two other mill sites, the Schweitzer-Mauduit Mills on Niagara and Mills St. near October Mountain State Forest, that offer the possibility of similar redevelopment in the future. However, future redevelopment will significantly increase the population density in the area, putting more lives and properties at risk in the event of a wildfire. These former mill sites may also not have suitable access points to ensure safe and efficient evacuation routes.

Similarly, the Town's Master Plan includes an action to "Evaluate Adaptive Reuse Overlay District and other provisions of zoning bylaw meant to provide flexibility for practical use." This flexibility in zoning can impact wildfire risk and vulnerability by increasing the density of residential and commercial properties in areas closer to wildland vegetation. The proximity of these developments to vegetated areas increases the risk of fire spreading from wildlands to human structures, creating a higher potential for extensive damage and loss.

Climate change is expected to significantly impact the occurrence and severity of wildfires through various mechanisms. Rising global temperatures lead to increased evaporation and reduced soil moisture, resulting in drier vegetation that fuels fires. Extended periods of drought, a consequence of climate change, further exacerbate this drying effect, making forests and grasslands more susceptible to ignition. Additionally, climate change is predicted to alter precipitation patterns, with some regions experiencing more intense and less frequent rainfall. This change in patterns can create a cycle of wet conditions that promote vegetation growth followed by prolonged dry periods that increase fire risk. As droughts become more frequent and severe, forest types that do not usually burn and are not fire-adapted will be more likely to burn. This impact will negatively affect the timber harvest and production, recreation, and residents living near forested areas.

Furthermore, higher temperatures and changing weather patterns contribute to longer fire seasons. Historically, wildfire seasons have been limited to specific months, but climate change is extending these periods, allowing fires to occur more frequently throughout the year. Increased frequency of extreme weather events, such as heatwaves, strong winds, and lightning, also heightens the risk and intensity of wildfires.

Scientific studies indicate that these climate change-driven factors already contribute to more severe and frequent wildfires. For instance, the Intergovernmental Panel on Climate Change (IPCC) has reported that climate change has increased the risk of wildfires in many regions, and this trend is expected to continue as global temperatures rise.[xix] Overall, wildfires are projected to increase worldwide by 14% by 2030, 30% by 2050, and 50% 2100.[xx]

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# Drought

## *Hazard Profile*

In the most general sense, drought is a period of lower-than-average precipitation that results in a water shortage. Drought conditions occur in virtually all climatic zones, yet its characteristics vary significantly from one region to another relative to the normal precipitation in that region. According to the Federal Emergency Management Agency (FEMA), drought is a slow-onset hazard that can last for months or years and substantially impact the affected region's environment, ecosystem, and agriculture. Direct impacts of droughts include 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.

> The Massachusetts Office of Energy and Environmental Affairs (EEA) and MEMA partnered to develop the Massachusetts Drought Management Plan, of which December 2023 is the most updated version. The state's Drought Management Task Force, comprised of state and federal agencies, maximizes the state's ability to assess, prepare for, and respond to drought conditions effectively. Specifically, the DMP aims to minimize drought impacts on the Commonwealth by improving agency coordination, enhancing monitoring and early drought warning capabilities, and outlining preparedness, response, and recovery activities for state agencies, local communities, and other drought-related entities. [i]
>
> The Massachusetts Department of Conservation & Recreation (DCR)'s Office of Water Resources compiles data from various state agencies and develops a monthly Hydrologic Conditions Report. This report summarizes the condition of water resources across the Commonwealth, including the calculation of six drought indices: 1) Precipitation, 2) Groundwater, 3) Streamflow, 4) Lakes and Impoundments 5) Evapotranspiration, and 6) Fire-Keetch-Byram Drought Index.
>
> Precipitation and groundwater are the main factors that determine drought or reduce the drought level. These two factors have the greatest long-term impact on streamflow, water supply, reservoir levels, soil moisture, and potential for forest fires. Precipitation is crucial because it directly influences the onset and improvement of drought conditions. Groundwater levels, however, respond more slowly to changes in precipitation, making them reliable indicators of long-term recovery to normal conditions.

## *Likely Severity*

The severity of a drought is determined by several factors, including its duration, intensity, and the specific environmental and socioeconomic conditions of the affected area. Short-term droughts may primarily affect surface water and soil moisture, leading to moderate impacts such as reduced crop yields, increased wildfire risk, and stress on local water supplies. However, as drought conditions persist, the severity increases, with more significant consequences including prolonged water shortages, reduced streamflow, declining groundwater levels, and severe ecological impacts. The Northeast can also experience "flash" droughts—the rapid onset of intense dry periods that can follow a period of normal to above-normal precipitation. While these flash droughts may last only 2–6 months, they can impact the region, resulting in agricultural losses, shortages in public water supplies, and very low streamflows.[ii]

Droughts are not usually associated with immediate impacts on people or property, but they can significantly impact agriculture, which can impact the region's farming community. According to the National Drought Mitigation Center, droughts related to agriculture are quite common. Over the period from 2000 through 2023, roughly 10 to 70 percent of the U.S. land area experienced conditions that were at least abnormally dry at any given time[iii]. Droughts are typically regional events affecting large areas rather than specific, localized spots. Because of this, when a drought occurs, it is likely to impact the entire community rather than just a small portion.

The severity of drought can also stem from cascading hazards when different natural hazards overlap (drought and flood or when one follows another closely in time). The second hazard event compounds the first one, escalating the overall severity and threat. Droughts are likely to be part of a cascading hazard because they can cover a large area and go on for a long time.

Overall, the Town does not have a significant dependence on groundwater as a source of drinking water. In Lee, the town's municipal water system is sourced from two reservoirs, Leahey and Schoolhouse, with the Vanetti Reservoir available for emergencies. The system is equipped to service the town's 5,000 residents and handle up to two million gallons daily, indicating strong water security. However, given the town's economic reliance on agricultural and outdoor recreation economy, moderate population density, and abundance of natural resources, a drought could impact over 50% of the town. Additionally, 124 households rely on private wells, which could be particularly vulnerable during droughts.[iv] This widespread impact indicates that a drought would likely affect a large portion of the town.

According to the state’s DMP, drought conditions are classified into five levels:

1. Level 0 Normal (No Drought)
2. Level 1 Mild Drought (formerly listed as Advisory)
3. Level 2 Significant Drought (formerly listed as Watch)
4. Level 3 Critical Drought (formerly listed as Warning)
5. Level 4 Emergency Drought (formerly listed as Emergency)

These levels were selected to distinguish between different levels of drought severity and for adequate warning of worsening drought conditions.

The U.S. Drought Monitor (USDM) uses percentile ranges to classify drought levels. The 2019 Massachusetts Drought Management Plan adopted similar thresholds but with four categories instead of USDM’s five. Both use these ranges to assess drought severity. However, Massachusetts does not rely solely on the USDM because it is a national tool and doesn’t account for local data such as the Commonwealth’s groundwater, lakes, and reservoirs. See Table 3.15 below.

Table 3.15 Comparison of Percentile Ranges for the Massachusetts DMP and the USDM

| USDM Names | Recurrence | Percentile Ranges | MA DMP Levels | MA Percentile Ranges | MA DMP Names |
|---|---|---|---|---|---|
| D0: Abnormally Dry | once per 3 to 5 years | 21 to 30 | 1 | >20 and ≤30% | Mild Drought |
| D1: Moderate | once per 5 to 10 years | 11 to 20 | 2 | >10 and ≤20% | Significant Drought |
| D2: Severe Drought | once per 10 to 20 years | 6 to 10 | 3 | >2 and ≤10% | Critical Drought |
| D3: Extreme Drought | once per 20 to 50 years | 3 to 5 | | | |
| D4: Exceptional Drought | once per 50 to 100 years | 0 to 2 | 4 | ≤2% | Emergency |

Source: Massachusetts Drought Management Plan (2023)

The drought levels provide a framework from which to take actions to assess, communicate, and respond to drought conditions. Drought levels are used to coordinate both state agency and local response to drought situations. Water restrictions might be appropriate at the significant drought stage, depending on the capacity of each individual water supply system. A critical drought level indicates a severe situation and the possibility that a drought emergency may be necessary. A drought emergency is one in which mandatory water restrictions or use of emergency supplies is necessary.

MassDEP has the authority to declare water emergencies for communities facing public health or safety threats as a result of the status of their water supply systems, whether caused by drought conditions or for other reasons. The Department of Public Health in conjunction with the DEP, monitors drinking water quality in communities.



### *Probability*

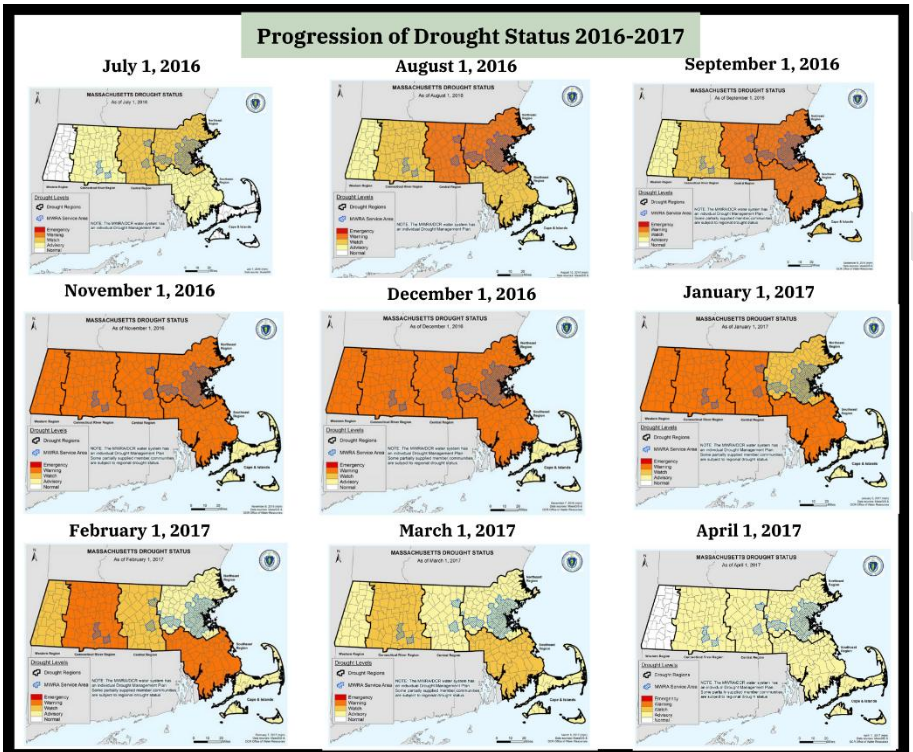
Berkshire County, including the Town of Lee generally faces a lower drought risk than other areas in Massachusetts. However, the potential for drought still exists, as historical records show instances where severe drought conditions were narrowly avoided. As temperatures rise, the likelihood of drought increases due to faster evaporation from reservoirs, waterways, and soils, as well as higher evapotranspiration rates in plants. These factors suggest that while the overall risk may be lower, the probability of drought cannot be ignored, especially with the potential impacts of climate change.

### *Historic Data*

Massachusetts is a water-rich state that has never received a Presidential Disaster Declaration for a drought-related disaster; however, a few occurrences have been documented. The most severe, state-wide droughts occurred in 1879-1883, 1908-1912, 1929-1932, 1939-1944,1961-1969,1980-1983, 2016-2017, and 2022.

Several less severe droughts occurred in 1999, 2001, 2002, 2007, 2008, 2010, 2014, 2020, 2023, and 2024. The nine-year drought from 1961-1969 is considered the drought of record. The longevity and severity of this drought forced public water suppliers to implement water-use restrictions, and numerous communities utilized emergency water supplies. Residents have reported increasing instances of wells running dry or becoming contaminated with sediment, with such occurrences becoming more frequent over the past 15 years. Residents reported wells running dry or becoming dirty, occurring more frequently in the last 15 years.

Figure 3.22 Progression of Drought Status 2016-2017




*Source: Drought Management Task Force, mass.gov*

The most recent and significant drought in Massachusetts since the 1960s occurred during a 10-month span in 2016-17. In July 2016 Advisory and Watch drought levels began to be issued for the eastern and central portions of the state, worsening in severity until the entire state was under a Drought Warning status for the months of November-December 2016.

In general, the central portion of the state faired the worst, and Berkshire County faired the best, with the county entering the drought later and emerging earlier than most of the rest of the state. Berkshire County was under an Advisory (yellow on Figure 3.22) or Watch status (gold) for five months and under a Warning status (orange) for three months during the height of the drought. The Massachusetts Water Resources Commission stated that the drought was the worst since the state's Drought Management Plan was first issued in 2001 and the most severe since the 1960s drought of record. While the 2016-2017 drought showed precipitation totals at or above the 1960s drought, the streamflow and groundwater impacts were more severe than those of the 1960s drought.

## *Vulnerability Assessment*

### *Geographic areas likely impacted*

To track drought conditions across Massachusetts, the state is divided into six regions, with Berkshire County forming the Western Region. The Town of Lee maintains three reservoirs, one designated for emergencies. Although a widespread drought event has not impacted the town in recent memory, for the purposes of this plan, the entire Town of Lee is considered at risk of drought.

### *People*

The entire population of Lee is vulnerable to the effects of drought. Public health issues such as dehydration, heat-related illnesses, and respiratory problems can arise, with the elderly, young children, and those with preexisting health conditions being particularly vulnerable. Drought often brings extreme heat, which compounds these health risks, making it more difficult for these populations to stay cool and hydrated.

In periods of limited rainfall, both human and animal behavior can change in ways that increase the likelihood of other vector-borne diseases. For instance, during dry periods, wild animals are more likely to seek water in areas where humans live. These behaviors increase the likelihood of human contact with wildlife, the insects they host, and the diseases they carry. Drought reduces the size of water bodies and causes them to become stagnant, providing additional breeding grounds for certain types of mosquitoes (for example, Culex pipiens).[v] Outbreaks of West Nile virus, transmitted to humans via mosquitoes, have occurred under such conditions. [vi] Inadequate water supply can cause people to collect rainwater, leading to stagnant water collections that can become manmade mosquito breeding areas.

Residents and stakeholders who rely on water for their livelihoods, such as farmers, seasonal workers, and hobbyist growers, face significant challenges during drought conditions. Reduced water availability can lead to lower crop yields, financial stress, and long-term economic instability. The mental health impact is also notable, as prolonged drought and economic strain can lead to increased stress, anxiety, and depression within the community.

Additionally, residents who rely on private wells may experience reduced groundwater levels, affecting their access to clean water. Lower water levels can also concentrate naturally occurring minerals and harmful substances, potentially leading to water quality issues that are difficult to detect and may pose health risks.

During a drought, there is also an increased risk of airborne dust and pollen as dry soil and plants release more particles into the air. This rise in airborne particles can exacerbate respiratory issues, such as asthma and allergies, particularly in individuals sensitive to aeroallergens. While mold typically thrives in damp conditions, droughts followed by sudden rains or irrigation can create environments conducive to mold growth. Previously dry areas exposed to moisture may see an increase in mold spores, which can trigger allergic reactions and respiratory problems.

*Built Environment*

Drought does not threaten the physical stability of critical facilities in the same way as wind-based or flood-related events. However, secondary hazards, such as reduced bank stability from dry soil in root zones, can increase erosion. Additionally, the risk of wildfires rises during drought conditions, putting structures and woodlots across Lee at risk. Wildfires could also damage or destroy electrical and communication systems, including the town's broadband internet services, which serve as the town's primary communication network. Additional impacts of wildfires are discussed in the Wildfire section of this plan.

*Natural Environment*

The natural environment is highly vulnerable to drought. Prolonged dry periods can lead to low streamflow and decreased groundwater levels, threatening the flow of streams and rivers. Cold-water fishery streams, which are critical habitats for native brook trout and other cold-water species, may become too dry or warm to support these species, leading to population declines.

Lower water levels in lakes and ponds force aquatic life into smaller volumes of water with lower oxygen levels, increasing stress and the likelihood of fish kills. Reduced groundwater recharge during drought further diminishes streamflow, degrading freshwater ecosystems that rely on consistent water levels.

Drought also stresses terrestrial ecosystems. Lower soil moisture can cause vegetation to die back, resulting in leaf drop in trees and dieback in forbs. This reduction in moisture limits the decomposition of plant and animal matter, leading to a build-up of dry material on the forest floor, which increases the risk of wildfires.

Forest health is particularly at risk, as drought weakens trees, making them more susceptible to pests and diseases. This weakening can lead to shifts in species composition, with drought-tolerant species potentially replacing those less adaptable. Drought conditions can also alter the distribution of both native and invasive species, allowing resilient invasive species to spread and further disrupt local ecosystems.

*Economy*

Drought can have significant economic impacts on agriculture, recreation, tourism, energy, and forestry. Agriculture is particularly vulnerable, with drier summers and intermittent droughts straining irrigation, stressing crops and livestock, and affecting harvests. Lee has 1207 acres, or 10% of its land, designated for agriculture—more than its combined industrial and commercial land. A drought would directly impact this sector, leading to economic losses for farmers, workers, and nurseries, and potentially driving water-intensive industries to relocate.

The tourism sector could also suffer, particularly recreation activities such as camping and water-based outdoor activities like boating, swimming, and fishing. Reduced water levels and the deterioration of natural attractions due to drought could lead to a decline in visitors, affecting local businesses that rely on tourism.

During drought conditions, there is often an increased demand for electricity due to the higher use of air conditioning and irrigation systems, especially during hotter, drier summers. This energy demand can strain the local energy grid and potentially lead to higher energy costs.

*Future Conditions*

Climate change is expected to impact future drought conditions in Massachusetts significantly. Rising temperatures and shifting precipitation patterns will likely increase droughts' length, frequency, and intensity. Although total annual precipitation is anticipated to rise over the next century, this increase will be accompanied by more severe and unpredictable dry spells. As discussed in greater detail in the Changes in Average Temperature/Extreme Temperature section of this plan , greenhouse gas emission models project a continued rise in temperatures, leading to a higher prevalence of days above 90°F and 95°F, as well as an increase in the frequency and duration of heatwaves. These extreme heat events are strongly correlated with drought conditions, as higher temperatures accelerate evaporation rates, further drying out soils and reducing water availability.

More intense rainfall over shorter periods will reduce groundwater recharge, as saturated ground cannot absorb as much water as more evenly distributed rainfall. This trend will be further exacerbated by a projected reduction in snowpack, which traditionally serves as a critical water source during the spring melt. Faster-than-normal snowmelt increases the risk of flooding and shortens the period for groundwater recharge, reducing water availability during the spring growing season. This diminished recharge will lower the stream's base flow, essential for sustaining ecosystems and groundwater supplies during dry periods. Overall, both ground and surface water systems may face challenges in meeting future demand, necessitating adjustments to operating rules to accommodate changing precipitation patterns and hydrology.

In terms of population patterns, Lee may see an influx of people migrating from regions with severe climate impacts, like the western United States, which has experienced significant increases in heatwaves, droughts, and wildfires. Additionally, the town attracts short-term visitors during the summer, when droughts are more likely to occur. This seasonal increase in population, combined with the potential arrival of new residents, particularly among socially vulnerable groups, could strain emergency operations. As Lee grows and experiences population fluctuations, evaluating emergency management strategies will also be crucial. These strategies include focusing on effective water supply management, public health preparedness, and robust communication efforts to ensure that all residents and visitors are informed and supported.

Private wells are more susceptible to drought impacts due to their reliance on underground aquifers, which depend on precipitation for recharge. Well owners, including residents and those using wells for agricultural purposes, may face significant challenges as groundwater levels drop, causing wells to yield less water or even run dry. This risk underscores the importance of including private wells in the town's drought preparedness and response plans, potentially exploring future opportunities to survey and develop plans for connecting private wells to the town's water supply, thereby enhancing water security.

Regarding water availability, existing reservoirs and treatment plants have significantly improved water quality and doubled the available supply over the last twenty years. Although the town doesn't heavily rely on groundwater, hydro-geological studies have identified potential subsurface supplies. Lee has two major aquifers: Woods Pond/October Mountain and Greenwater Pond Brook. Both have the potential to yield over a million gallons a day,but suffer from water quality issues. Due to sufficient reservoir capacity, these aquifers remain untapped for public water supply. However, should demand increase and prolonged drought periods occur, the town may need to consider developing these groundwater sources for reliable water security.

The current public water infrastructure in Lee is inadequate, particularly in relation to the potential mill redevelopment projects. The existing system cannot meet the demands of the present redevelopment efforts of the Eagle Mill without additional upgrades. These future upgrades would enhance fire safety, support the redevelopment of the Eagle Mill, Columbia, and Greylock mills, and protect future businesses and housing developments that may occupy these sites. As noted in the capital investment plan, the Town plans to invest $153,000 in its water infrastructure, including capital improvements, meter reading technology, and essential equipment. Additionally, the Town's recently completed master plan identified the development of a long-range plan for water system improvements as an action item. The Town has existing land use regulations designed to minimize the impact of drought, which will be discussed in greater detail under Existing Protections in Chapter 4.

# Landslides

## *Hazard Profile*

Landslides are the downslope movement of earth materials (like rock, debris, and soil) that can occur slowly over time or suddenly, sometimes moving faster than a person can run. In Massachusetts, the most common types of landslides are rotational and translational slides. Rotational slides involve a curved slip surface, causing the material to rotate as it moves, while translational slides occur on a flat surface, allowing debris to slide straight down. Although gravity acting on an over-steepened slope is the primary reason for a landslide, other contributing factors exist (USGS, 2013).

1) ***Geologic*** **-** Weak or sensitive materials, like clay or weathered rock, make some areas more prone to landslides.

2) ***Morphologic*** - Natural changes can destabilize slopes, such as erosion from rivers, glaciers, or waves, and events like earthquakes, volcanic activity, or vegetation loss from fires.

3) ***Human Activities*** - Human actions like excavation, deforestation, mining, and adding heavy structures can increase landslide risks by disturbing slopes.

Most landslides require two key ingredients: a trigger and a suitable landscape. Common triggers include intense rainfall, drought, and geological events like earthquakes, while steep or mountainous areas are particularly prone to landslides. Slope saturation by water is a primary cause of landslides in the Commonwealth. This effect can be in the form of intense rainfall, snowmelt, changes in groundwater level, and water level changes along coastlines, earth dams, and the banks of lakes, rivers, and reservoirs. Water added to a slope can not only add weight to the slope, which increases the driving force but can increase the pore pressure in fractures and soil pores, which decreases the internal strength of the earth materials needed to resist the driving forces (MEMA & EEOEA SHMCAP, 2018).

## *Likely Severity*

Landslides can deliver sudden, devastating impacts, potentially burying homes, damaging infrastructure, and disrupting transportation and utilities. They are highly unpredictable and can range from slow-moving shifts to rapid, destructive flows that travel thousands of feet, even over flat ground.

Although most landslide-prone areas are concentrated in the Western U.S., landslides still cause approximately 25 to 50 deaths annually in the United States, primarily due to debris flows that can occur without warning.[vii] The financial toll is estimated to be in the billions annually, though indirect losses—like road closures that disrupt commercial traffic—are less well documented.

There is no universally accepted measure of landslide extent, but it has been represented as a measure of destructiveness varying with volume and speed. A 2001 study (Cardinali et al., 2002) estimated landslide destructiveness based on the volume and speed of material movement.

Destructiveness varies by landslide type: fast-moving rock falls are the most intense, rapid debris flows are moderately intense, and slow-moving slides have the lowest intensity. Volume estimates depend on factors like movement depth for slides, catchment size and debris volume for flows, and block size for rock falls. For context, the 2011 Mohawk Trail landslide involved around 5,000 cubic yards of material.

Table 3.16 Risk of Landslide Destructiveness

| Estimate Volume (cubic yards) | Expected Landslide Velocity | | |
|---|---|---|---|
| | Fast moving (rock fall) | Rapid moving (debris flow) | Slow moving (slide) |
| <0.001 | Slight intensity | -- | -- |
| <0.6 | Medium intensity | -- | -- |
| >0.6 | High intensity | --- | -- |
| <654 | High intensity | Slight intensity | -- |
| 654-13,080 | High intensity | Medium intensity | Slight intensity |
| 13,080 – 65,398 | Very high intensity | High intensity | Medium intensity |
| >653,976 | -- | Very high intensity | High intensity |
| >>653,976 | -- | -- | Very high intensity |

*Source: Cardinali, et al, 2002*.

According to the Massachusetts Department of Transportation (MassDOT), the estimated average annual cost of highway contracts to address landslide problems from 1986 to 1990 was $1,000,000, with an additional $2,000,000 spent annually on landslide-related maintenance to keep highways safe. These figures only account for state highways and do not include local roads or private properties. For instance, remediation and cleanup of debris from four landslide-related events during an October 2005 rainstorm cost MassDOT $2,300,000.[viii]

### *Probability*

For the purpose of this plan, the probability of future landslide occurrences is based on past events over a set period. From 1996 to 2012, nine notable landslides were reported in Massachusetts, though many occur in remote areas and go unobserved.[ix] The Massachusetts Department of Transportation (MassDOT) estimates that between 1986 and 2006, roughly 30 landslide events occurred, equating to one to three incidents annually.

The probability of landslides in Massachusetts is influenced by several key factors. Intense rainfall is a primary trigger, as heavy or prolonged precipitation saturates the soil, reducing slope stability. Soil type and geological composition also play a significant role; areas with clay-rich or loose soil are more prone to landslides due to their lower cohesion. Steep slopes in regions like the Berkshires increase landslide risk, particularly along highways and developed areas where slope modifications have occurred. Additionally, human activities such as construction, deforestation, and excavation can exacerbate landslide risk by altering natural slopes and drainage patterns.
Massachusetts' landscape, with its hilly terrain and periodic heavy rain events, is particularly vulnerable to landslides during the spring thaw and following hurricanes or tropical storms. These

environmental and human factors combine to increase the likelihood of future landslides across the Commonwealth.

To assess instability risk, the Massachusetts Geological Survey created an updated landslide hazard map in 2013, funded by FEMA's Hazard Mitigation Grant Program. This map helps the public and local governments identify areas at risk of landslides, especially during prolonged moisture or high-intensity rainfall. The results of this study for the Town of Lee are illustrated on Figure 3.23**Error! Reference source not found.** with corresponding map legend on the following page.

Figure 3.23 Town of Lee Slope Stability

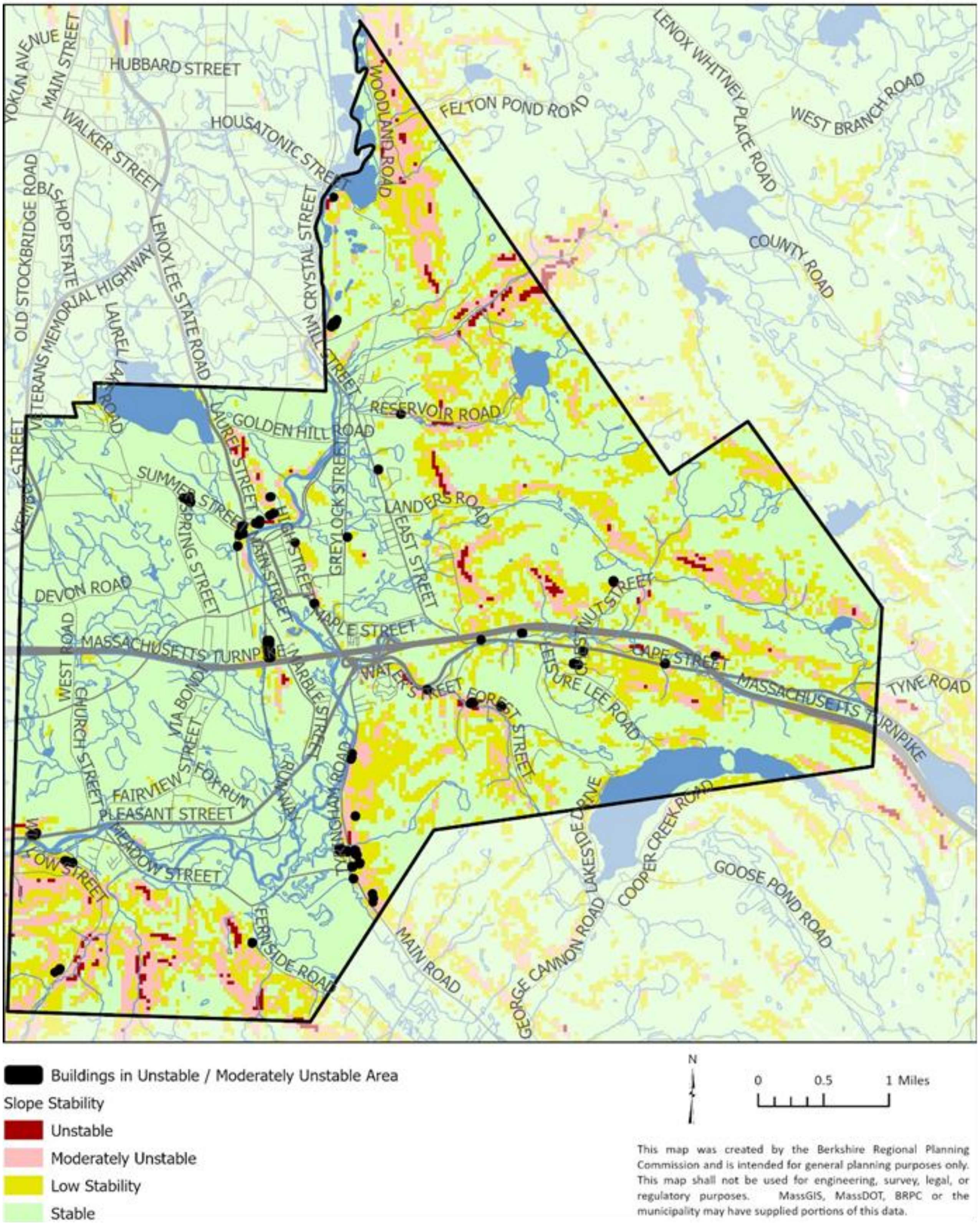


Table 3.17 Landslide Hazard and Stability Classification

| Map Color Code | Predicted Stability Zone | Relative Slide Ranking[1] | Stability Index Range[2] | Factor of Safety (FS)[3] | Probability of Instability[4] | Predicted Stability With Parameter Ranges Used in Analysis | Possible Influence of Stabilizing or Destabilizing Factors[5] |
|---|---|---|---|---|---|---|---|
| | Unstable | High | 0 | Maximum FS<1 | 100% | Range cannot model stability | Stabilizing factors required for stability |
| | Upper Threshold of Instability | | 0 - 0.5 | >50% of FS≤1 | >50% | Optimistic half of range required for stability | Stabilizing factors may be responsible for stability |
| | Lower Threshold of Instability | Moderate | 0.5 - 1 | ≥50% of FS>1 | <50% | Pessimistic half of range required for instability | Destabilizing factors are not required for instability |
| | Nominally Stable | Low | 1 - 1.25 | Minimum FS=1 | – | Cannot model instability with most conservative parameters specified | Minor destabilizing factors could lead to instability |
| | Moderately Stable | | 1.25 - 1.5 | Minimum FS=1.25 | – | Cannot model instability with most conservative parameters specified | Moderate destabilizing factors are required for instability |
| | Stable | Very Low | >1.5 | Minimum FS=1.5 | – | Cannot model instability with most conservative parameters specified | Significant destabilizing factors are required for instability |

Source: Massachusetts Geological Survey, Mabee and Duncan (2013)

Relative Slide Ranking—This column designates the relative hazard ranking for the initiation of shallow slides on unmodified slopes.

Stability Index Range—The stability index is a dimensionless number representing the relative hazard for initiating shallow translational slope movements. It is calculated from the factors of safety at each point on a 9-meter (~30-foot) DEM grid derived from the National Elevation Dataset. This index, generated by the SINMAP model, assesses stability by considering both the most and least favorable stability parameters. The ranges are based on default values recommended by SINMAP developers.

Factors of Safety—The factor of safety (FS) is a dimensionless number representing the ratio of stabilizing to destabilizing forces for a slope, computed using a modified version of the infinite slope equation within SINMAP. An FS > 1 indicates a stable slope, while an FS = 1 represents a marginally stable condition where stabilizing and destabilizing forces are balanced.

Probability of Instability— This column reflects the likelihood that a factor of safety within the map unit is less than one (FS < 1), indicating instability, based on the range of parameters used. For instance, a probability of instability below 50% means the location is more likely to be stable than unstable under the analyzed conditions.

Possible Influence of Stabilizing and Destabilizing Factors—This column describes factors that may affect stability. Stabilizing factors include improved soil strength, root reinforcement, and drainage. Destabilizing factors include increased wetness, additional loading, or a loss of root strength.

## *Historic Data*

According to FEMA, Landslides are a significant geologic hazard across the United States, occurring in all 50 states, with annual damages of $1-2 billion and over 25 fatalities on average. Landslides often occur alongside other major natural disasters, such as earthquakes and floods, complicating relief and reconstruction efforts.

In Massachusetts, landslides typically follow a pattern of two or more months of above-average precipitation, culminating in a single, high-intensity rainfall event of several inches or more (MEMA & EEOEA SHMCAP, 2018). Massachusetts has never had a federal disaster declaration specifically for landslides or mudslides. Table 3.17  Landslide Hazard and Stability Classification The table below denotes significant historical occurrences, sourced from the State Geologist Office at the University of Massachusetts Amherst unless otherwise specified.

The most severe landslide to occur in the Berkshire region occurred along Route 2 in Savoy during T.S. Irene in 2011(Image 3.7 Landslide in Savoy, MA along Mohawk Trail, 2011
). The slide was 900 feet long, approximately 1.5 acres, with an average slope angle is 28° to 33°. The elevation difference from the top of the slide to the bottom was 460 feet, with an estimated volume of material moved being 5,000 cubic yards. Only the top 2 to 4 feet of soil material was displaced (BRPC, 2012). The soil and tree debris covered the entire width of Route 2 and caused its closure for weeks. The landslide significantly impacted norther Berkshire County communities because Route 2 is a major east-west transportation route in that region.

Image 3.7 Landslide in Savoy, MA along Mohawk Trail, 2011

*Source: Massachusetts Geological Survey, Mabee and Duncan (2013)*

More locally, the only known mudslide in Lee occurred in July 2021 following a "monsoon-like rain" that deposited 5" of silt covering Tyringham Road at the Meadow Street intersection—two major links between Lee and Tyringham. Cleanup took approximately 12 hours, with similar but less intense cleanup on Forest Street.

Table 3.18 Historic Landslides in Massachusetts

| Date | Event Description |
|---|---|
| 1901 | 11 landslides occurred along the east face of Mount Greylock after heavy rains (Mabee, 2010). |
| 1936 | One home was destroyed, and six others were evacuated during a slide in North Adams (Mabee, 2010). |

| | |
|---|---|
| June 13, 1996 | Thunderstorms brought torrential rain and strong winds to western and central Franklin County. Mudslides and flooding damaged the Ashfield Inn, Greenfield Senior Citizens Center, and several homes in Greenfield. |
| April 16, 2007 | A strong coastal storm caused flooding and a mudslide that closed a portion of Route 112 in Colrain, Franklin County. |
| September 6, 2008 | Remnants of Tropical Storm Hanna caused widespread flooding in central Hampden County, resulting in minor mudslides on Route 32 in Wilbraham. |
| September 2008 | A small landslide in Holyoke covered several cars and a paved area under mud and debris, likely caused by saturated soils and poor drainage. |
| July 7, 2009 | Showers and thunderstorms led to flooding and mudslides in Middlesex County, particularly affecting Framingham and Marlborough. |
| March 14, 2010 | Heavy rainfall caused a mudslide across Route 1 in Topsfield, closing the road in both directions. |
| March 7, 2011 | Heavy rains and melting snow led to a mudslide in Greenfield, Franklin County, causing property damage and evacuations, totaling approximately $100,000 in losses. |
| August 2011 | Hurricane Irene caused landslides, debris flows, and extensive road damage along a 5.8-mile section of Route 2 from West Charlemont to South County Road in Florida. Temporary repairs were estimated at $23.5 million (Mabee and Kopera, 2011). |
| October 2011 | Post-October snowstorm slides in Deerfield caused culverts clogging, leading to wetland siltation and flooding of nearby homes (Mabee, 2010). |

*Geographic Areas of Concern*

As previously discussed, the primary trigger for landslides in Massachusetts is slope saturation, which occurs when water infiltrates soil layers on a slope, leading to saturation and increasing the risk of failure. Landslides caused by saturation typically occur on steep slopes underlain by bedrock (solid rock beneath the surface) and glacial till (a mixture of unsorted sediments left by glaciers). Bedrock and glacial till are less permeable than the soil above, causing water to accumulate at the interface, raising pore pressure and creating a potential weak plane. When these conditions align, slope failure can result (Mabee, 2010, as cited in MEMA & EOEEA, 2018).

Certain geologic conditions increase landslide susceptibility, particularly in areas with marine or lacustrine clay deposits, which are clays with low structural strength that often formed in ancient glacial lakes. These deposits, present in parts of Massachusetts, are especially prone to landslides when saturated (MEMA & EOEEA, 2018). Although individual landslides are difficult to predict, slope stability maps help identify areas more vulnerable to landslides following heavy rainfall or rapid snowmelt.

In Lee, areas marked as highly unstable on the slope stability map (Figure 3.20) include October Mountain State Forest and other conservation lands. Fortunately, these regions contain minimal development, and future development is unlikely. Other areas of concern include a ridgeline in Beartown Mountain State Forest and the steep slopes of Ferncliff, a town-owned recreation area, and the Pinnacle, a 69.5-acre property managed by the Conservation Commission. Development in these unstable or moderately unstable areas is limited, with urban and residential areas concentrated in more stable zones. Overall, Lee has approximately 168 acres categorized as "Unstable" and 1,342 acres as "Moderately Unstable." Notably, there is no historical record of landslides in these designated areas.

### *People*

In Lee, 42 structures identified as residential are located within areas modeled as moderately unstable, with only 2 residential buildings in an area classified as unstable. Populations dependent on roads for critical transportation needs are particularly vulnerable to landslides. A growing population and increasing construction on slopes and bluffs heighten the risks for more residents, particularly during large-scale events. For Lee, landslides' greatest health impacts stem from potential infrastructure damage that restricts emergency access and healthcare services. Landslides on major roads can deposit tons of debris, making road restoration time-consuming and costly.

Landslide risk in the county often arises from prolonged rainfall and saturated soils. Residents in identified unstable areas face greater risks.

- Lower-income residents may live in older or less stable housing, lacking structural reinforcements to withstand landslide forces, and have fewer resources to recover from displacement or property damage.
- Older residents with limited mobility may face difficulties evacuating quickly and may lack support networks for preparedness and recovery.
- People with disabilities or medical needs may need specialized assistance during evacuations and may face disrupted access to essential services in landslide-prone areas.
- Tourists in Lee's scenic areas, trails, and resorts may be unfamiliar with local risks and evacuation routes, increasing their vulnerability.

Loss of life from landslides can occur due to the sudden, powerful movement of earth and debris, which can bury or crush anything in its path before individuals have time to evacuate. While landslides lack a standardized early warning system, a combination of weather monitoring, soil movement sensors, and public awareness can sometimes provide limited advance notice, allowing residents in high-risk areas to take precautionary steps.

### *Built Environment*

The slope stability analysis for Lee identifies a total of 51 properties that are fully or partially located within areas classified as Unstable or Moderately unstable. Of these, four properties are within the unstable category, with one of these properties designated as forested open land. The combined value of buildings on properties in both unstable and moderately unstable areas in Lee is estimated at $14,199,400. Including building contents, estimated at 50% of building value, the potential total building loss due to landslide risk rises to approximately$21,299,100.

It's important to note, as referenced in the Inland Flooding cost estimate analysis that these figures are based on assessed values rather than market or replacement values. Consequently, the actual reimbursement needed to restore buildings to pre-disaster conditions may be higher, as assessed values often underestimate full replacement costs.

Buildings, transportation routes, and essential infrastructure in Lee are highly vulnerable to both direct and secondary impacts from landslides. Landslides pose immediate threats by causing structural damage and obstructing key routes, potentially delaying emergency response efforts. In the mountainous terrain of Lee, landslides impacting transmission towers could lead to prolonged power outages, affecting residents and critical facilities and creating hazardous conditions for both residents and emergency responders.

Secondary hazards from landslides are a significant concern for water quality. Landslides often carry sediment, rocks, and other potentially harmful materials into local waterways, leading to contamination (EOEEA ResilientMA Plan, 2023). Residents in the southeastern section of town rely on private wells for drinking water. While these draw from deeper sources, contamination of nearby rivers and streams could seep into groundwater over time, impacting water quality and requiring costly cleanup.

*Natural Environment*

Landslides impact multiple aspects of the natural environment, including the landscape, water quality, and habitat health. Soil and organic materials can be carried into streams, reducing water quality and harming aquatic ecosystems. Forest health may suffer as the mass movement of soil can uproot trees and understory vegetation, and the stripped landscape often lacks the topsoil necessary for flora to re-establish. Streams and water bodies near landslide areas face heightened pollution risks, and excess sediment can create natural dams, impacting both water quality and fish habitats (EOEEA ResilientMA Plan, 2023).

*Economy*

Landslides pose economic risks for Lee by potentially damaging property, infrastructure, and key services. Buildings, roads, and utility lines in steep-slope areas are especially vulnerable, and landslides in these locations could lead to disruptions due to road closures and utility outages. For small businesses, these interruptions can impact operations, while damage to transportation routes could delay the movement of goods. Additionally, property values in affected areas may decline, reducing the town's tax revenue base. The financial burden of cleanup, debris removal, and infrastructure repair can also strain town and state resources, adding to the economic impact of landslides. For example, the damage to a 6-mile stretch of Route 2 caused by tropical storm Irene in 2011, which included debris flows, four landslides, and fluvial erosion and undercutting of infrastructure, cost $23 million for the initial repairs (MEMA & EEOEA SHMCAP, 2018).

Landslides may disrupt access routes to farms and result in delayed delivery of supplies and products, which can affect income for local farmers. Furthermore, soil displacement and debris from landslides could contaminate fields or water sources used for irrigation, increasing costs for recovery and remediation.

Trails and natural attractions frequented by tourists in both summer and winter are increasingly susceptible to landslides and erosion. Heavy use, combined with weather shifts and more frequent intense storms, may degrade popular trails, requiring more maintenance or rerouting, especially in landslide-prone zones.

*Future Conditions*

The increased likelihood of landslides is directly linked to the projected rise in heavy precipitation events. As outlined in the Inland Flooding section of this plan, climate models project an increase in annual precipitation of 3.55 inches by the 2050s and 4.72 inches by the 2090s. Coupled with these projections and anticipated frequent and intense storms—driven by warming atmospheric and ocean conditions—are expected to lead to prolonged soil saturation, elevating landslide and mudflow risks. Additionally, warmer winter temperatures leading to more frequent freeze-thaw cycles keep soils wetter and more susceptible to movement. Projected increases in droughts and wildfires also pose indirect landslide risks by reducing vegetation cover, which compromises soil stability.

Shifts in population patterns—such as climate migration—could bring more people to the area. For instance, people relocating from urban areas with higher risks of climate-related hazards (e.g., coastal flooding or extreme heat) may seek refuge in quieter, rural settings like Lee. Even small increases in population could increase the number of residents living near landslide-prone areas, raising the importance of preparedness and response planning for potential landslide events.

Upgrades to infrastructure or new residential developments can increase landslide vulnerability, particularly if they expand access to rural or steep-sloped areas. Such changes may necessitate road maintenance or slope stabilization measures to mitigate risks. Future land use decisions should evaluate and minimize these hazards to avoid placing homes, roads, and utilities in vulnerable areas. Limiting development in steep or landslide-prone regions preserves natural land buffers, which contribute to slope stability. While Lee has historically resisted large-scale development, even minor shifts—such as housing or infrastructure near unstable slopes—could heighten risks. As demand for housing and outdoor recreation grows, prioritizing hazard mitigation strategies, such as preserving vegetation and

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[i] Massachusetts Drought Management Plan (2023). https://www.mass.gov/doc/massachusetts-drought-management-plan/download. Retrieved September 2024.

[ii] National Integrated Drought Information System (NIDIS). Massachusetts drought. Drought.gov. https://www.drought.gov/states/massachusetts

[iii] National Drought Mitigation Center. (2024). U.S. drought monitor. Retrieved February 1, 2024, from https://droughtmonitor.unl.edu

[iv] Information retrieved from MassDEP Massachusetts Well Location Viewer Web Map last updated 4/26/23. Count includes active and inactive registrations. Active registrations refer to wells currently in use, while inactive registrations indicate wells that are no longer operational or have lapsed in compliance. As such, the count provided is an estimate and may contain inaccuracies.

[v] https://www.mass.gov/info-details/mosquitoes-in-massachusetts

[vi] https://www.cdc.gov/drought-health/health-implications

[vii] https://community.fema.gov/ProtectiveActions/s/article/Landslide

[viii] MassDOT estimates retrieved from the Massachusetts slope stability map and landslide risk assessment. https://www.geo.umass.edu/stategeologist/Products/Landslide_Map/Slope_Stability_Map_MA_Report.pdf

[ix] Available reports on landslide incidence, history, and probability in Massachusetts are limited, with few resources published after 2013 from state and federal sources.

# Earthquakes

## *Hazard Profile*

Earthquakes are natural events caused by the sudden release of energy within the Earth's crust, creating seismic waves. Earthquakes have no season or time of day; they can occur anytime without warning. Because earthquakes originate in the rock miles below the earth's surface, they are unaffected by the weather. Earthquakes occur along faults—fractures in the Earth's crust—where tectonic plates move and shift. The northeastern U.S. is part of a stable continental interior, with less intense seismic activity than along tectonic plate boundaries. However, earthquakes in this region can still cause damage due to the underlying geological conditions, which can amplify seismic waves.

Although earthquakes in Massachusetts are less frequent than in more seismically active regions, they still pose a potential hazard. Although Lee and the broader Berkshire County region are not near major fault lines, the state has experienced low-magnitude earthquakes.

Several agencies oversee the monitoring and mitigating of earthquake impacts in Massachusetts and across the U.S. The U.S. Geological Survey (USGS) monitors seismic activity and provides hazard assessments, while the New England Seismic Network (NESN) tracks regional seismic events. At the federal level, the National Earthquake Hazards Reduction Program (NEHRP) coordinates efforts through agencies like FEMA, NIST, and NSF to support research, establish building codes, and enhance public preparedness. Locally, the Massachusetts Emergency Management Agency (MEMA) helps ensure statewide readiness and response to earthquake risks.

## *Likely Severity*

The severity of an earthquake is determined by its magnitude, focal depth, and location relative to population centers. Earthquakes with shallow focal depths (up to 43.5 miles) generally cause more surface damage because seismic waves lose less energy as they travel toward the surface. Though potentially powerful, deeper earthquakes tend to have a lesser impact on surface structures.

Magnitude is measured on the Richter scale, which records the amplitude of seismic waves. Earthquakes with a magnitude of 5.0 or higher have the potential to cause damage near their epicenter. However, damage is also dependent on the local population density and building resilience. Even from quakes of the same magnitude, a densely populated area can experience greater devastation than a remote location.

The intensity of shaking, as perceived by those in the affected area, is described using the Modified Mercalli Intensity (MMI) scale. Unlike the Richter scale, which measures seismic energy, the MMI scale rates how strongly the earthquake is felt and the extent of damage in specific locations, ranging from I (not felt) to XII (total destruction). This variability in intensity explains why a single earthquake can be barely noticeable in one place but cause severe damage in another. Figure 3.24 Levels of Modified Mercalli intensity

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Figure 3.24 Levels of Modified Mercalli intensity

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

Due to the low frequency of earthquakes and typically mild ground shaking, both the Commonwealth of Massachusetts and the Town of Lee face a low to moderate risk of earthquake damage compared to other regions in the country (NESEC, n.d.). However, impacts at the local level can vary based on types of construction, building density, and soil type, among other factors (EOEEA ResilientMA Plan, 2023; MEMA & EEOEA SHMCAP, 2018). For example, unreinforced masonry buildings are especially vulnerable to damage from ground shaking. Secondary hazards from earthquakes can affect critical infrastructure and non-critical structures alike. Fires in residential buildings, landslides, and wildfires, are common secondary impacts.

There is a small but present risk of soil liquefaction in areas with loose, water-saturated soils, such as river valleys or floodplains. This phenomenon occurs when intense shaking causes these soils to behave like a liquid, potentially damaging buildings and infrastructure. Although liquefaction generally requires an earthquake of magnitude 5.0 or higher, uncommon in the region, the risk exists in areas with susceptible soil profiles. Much of the soil in Western Massachusetts is composed of glacial till and other dense materials that are less prone to liquefaction compared to areas with more extensive sandy or loose soils.[i]

### *Probability*

The USGS has characterized the Northeast U.S. as a low to moderate earthquake hazard region indicating an approximately 2% chance of experiencing a potentially damaging earthquake over the next 50 years. However, the probability of an earthquake with a magnitude of 5.0 or greater occurring within New England in a 10-year period is estimated to be around 10–15%, though not all such earthquakes would necessarily cause significant damage (EOEEA ResilientMA Plan, 2023). While statistically low, the occurrence of an earthquake is not impossible. According to the Massachusetts Geological Survey and the New England Seismic Network, earthquakes of magnitude

3.0 to 4.0 occur periodically in the region, but significant earthquakes are rare.[ii] Earthquakes in other parts of New England or Canada could also affect the Commonwealth.

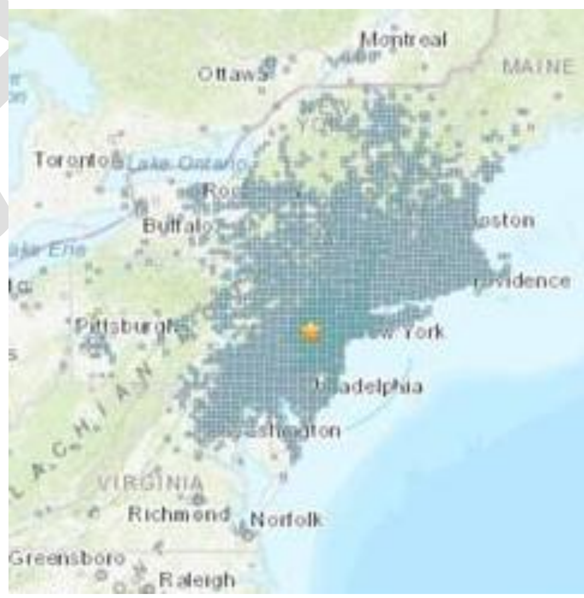
### *Historic Data*

USGS reports that two smaller earthquakes are felt each year throughout New England. Massachusetts has never had a state or federal disaster declaration for earthquakes. However, historical records show that the Commonwealth has experienced larger earthquakes. For example, in 1727, an earthquake, estimated at a magnitude of 5.6 to 6.0, struck near Newbury, Massachusetts, causing structural damage and being felt as far away as Pennsylvania and Nova Scotia. In 1755, the Cape Ann earthquake, estimated at a magnitude of 6.0 to 6.3, struck off the coast of northeastern Massachusetts on November 18, 1755. It caused widespread damage to New England's chimneys, buildings, and infrastructure. This remains one of the most significant seismic events in the region's history.

On April 20, 2002, a 5.1-magnitude earthquake shook Berkshire County, waking residents and causing noticeable vibrations. People described the shaking as loud, like a passing train or truck, with items rattling on walls. The only reported damage was a cracked foundation on Houghton Street in Clarksburg, and no injuries occurred. Another notable earthquake, centered in Virginia on August 23, 2011, was also felt in Western Massachusetts.

Small earthquakes seem to occur regularly in some places in New England.  For example, since 1985, there has been a small earthquake approximately every 2.5 years within a few miles of Littleton, Massachusetts. It is not clear why some localities experience such clustering of earthquakes, but a possibility suggested by Weston Observatory at Boston College is that these clusters occur where strong earthquakes were centered in the prehistoric past. The clusters may indicate locations with an increased likelihood of future earthquake activity. According to the Weston Observatory Earthquake Catalog, thousands of earthquakes have occurred in New England and adjacent areas. However, only 35 of these events were considered significant  (MEMA & EEOEA SHMCAP, 2018).

Figure 3.25 An earthquake centered in New Jersey



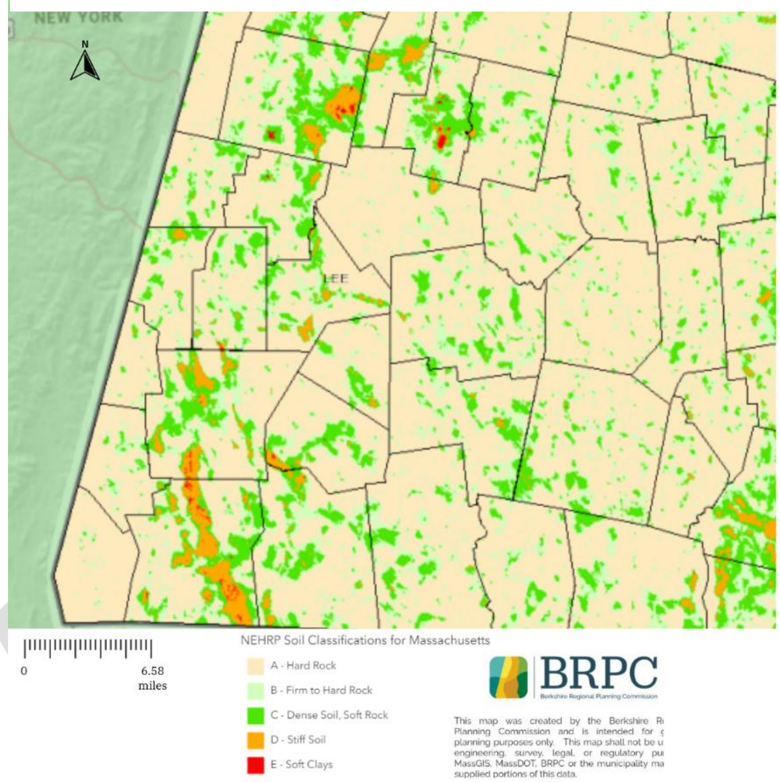

*Source: USGS as reported in the NY Times 2024*

More recently, in April 2024, a 4.8-magnitude earthquake occurred in NJ and was recorded by the USGS as the strongest earthquake in Massachusetts in the past 10 years. The relatively mild earthquake caused noticeable shaking and startled residents, but no major damage or injuries were reported. [iii]
The epicenter of the earthquake was in New Jersey but felt throughout much of New England.

### *Vulnerability Assessment*

*Geographic areas of concern*

Figure 3.26 NEHRP Soil Classification (2024)




New England lies in the middle of the North American Plate, which is being compressed by global tectonic movements. The plate's western edge collides with the Pacific Plate, while the eastern edge spreads away from the European and African Plates in the Atlantic Ocean. This compression causes cracks in the Earth's crust, leading to earthquakes. Unlike regions with well-defined fault lines, New England's earthquakes do not follow mapped faults or specific geological structures, meaning seismic activity could occur anywhere in the region. A probabilistic analysis was conducted using HAZUS, a nationally recognized software program developed by FEMA, to evaluate earthquake impacts in Massachusetts. HAZUS models earthquake impacts across various Mean Return Periods (100, 500, 1,000, and 2,500 years), helping to predict potential damage and economic losses across the state(MEMA & EEOEA SHMCAP, 2018). Statistical findings are noted further in this section.

Ground shaking is the primary cause of earthquake damage to man-made structures, and this damage can be worsened by soft soils that amplify shaking. The velocity at which soil or rock transmits shear waves (S waves) affects how much shaking is amplified. The National Earthquake Hazards Reduction Program (NEHRP) classifies soils from A (hard rock, which reduces ground motions) to E (soft soils, which amplify shaking and increase damage). Soil classifications are incorporated into the HAZUS analysis to assess earthquake exposure and vulnerability in Berkshire County (MEMA & EOEEA, 2018). Lee's most developed area consists primarily of dense soil and soft rock, which suggests that ground shaking during an earthquake could be moderately amplified (see Figure 3.26 NEHRP Soil Classification (2024)

This characteristic could lead to an increased risk of damage to structures, highlighting the need for proper building standards to account for potential seismic activity.

*People*

The entire population of Massachusetts is vulnerable to direct or indirect impacts from earthquakes, with risks influenced by factors such as building construction, soil type, and proximity to faults. Structures built on soft soils amplify ground shaking, increasing damage potential. Earthquakes can disrupt daily life through business interruptions, road closures, and utility loss, even for those without direct damage.

Vulnerable groups, including the elderly, low-income residents, and residents in substandard housing, face more significant risks due to limited resources for preparation and recovery. HAZUS modeling provides estimates of injuries and casualties depending on the time of day and the event's severity, highlighting peak vulnerability during high occupancy, such as residential hours at 2 a.m. and commuting periods at 5 p.m.
Table 3.19 summarizes potential injuries and casualties in Berkshire County under various scenarios.

Additionally, displaced residents may need temporary or long-term shelter, although shelter needs vary. Many displaced individuals may prefer hotels or families to shelters. HAZUS estimates offer general guidance, particularly noting that shelter demands may rise during winter if an earthquake leads to infrastructure failures, such as heat loss. While these estimates are valuable for planning purposes, they should be seen as broad averages rather than exact figures (MEMA & EEOEA SHMCAP, 2018).

Table 3.19 Estimated Number of Injuries, Causalities, and Sheltering Needs in Berkshire County

*(based upon Mean Return Period)*

| Mean Return Period (MRP) | 100-Year MRP | | | 500-Year MRP | | | 1,000-Year MRP | | | 2,500-Year MRP | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Time of Event | 2 am | 2 pm | 5 pm | 2 am | 2 pm | 5 pm | 2 am | 2 pm | 5 pm | 2 am | 2 pm | 5 pm |
| Injuries | 0 | 0 | 0 | 4 | 6 | 4 | 9 | 13 | 10 | 22 | 35 | 25 |
| Hospitalization | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 1 | 3 | 6 | 5 |
| Casualties | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| | | | | | | | | | | | | |
| Displaced Households | 0 | | | 21 | | | 51 | | | 143 | | |
| Short-Term Sheltering Needs | 0 | | | 12 | | | 29 | | | 82 | | |

*Source: MEMA & EOEEA, 2018 HAZUS*



## *Built Environment*

All elements of Lee's built environment are exposed to earthquake hazards. Municipal water, sewer lines, and energy infrastructure, including power plants, gas lines, and transmission systems, could be damaged, leading to widespread service disruptions. Earthquakes may also trigger hazardous material releases from facilities, transportation, and pipelines, posing significant environmental risks. Secondary hazards like soil liquefaction, landslides, and wildfires could amplify damage. Liquefaction, in particular, threatens building foundations and infrastructure in water-saturated areas, increasing the risk of structural failure. State estimates that Estimated transportation and utility losses of nearly $10.1 million from a 100-year MRP earthquake and over $1.3 billion from a 2,500-year MRP earthquake (EOEEA ResilientMA Plan, 2023; MEMA & EEOEA SHMCAP, 2018). Earthquakes may damage cultural resources, which can be irreplaceable and hold significant historical, social, or economic value. The loss of these assets not only affects the community's heritage but can also have long-term impacts on tourism and local identity.

## *Natural Environment*

Earthquakes can significantly impact natural resources and ecosystems through direct and secondary effects. Gas pipe damage may lead to hazardous material spills, contaminating water sources and local environments. Fires triggered by earthquakes can devastate ecosystems, while strong shaking may cause trees to fall or cliffs to collapse, disrupting habitats. Physical changes to ecosystems can disturb species balance, leaving areas more vulnerable to the spread of invasive species. Soil erosion, landslides, and contamination of water bodies may further compound the environmental impacts (EOEEA ResilientMA Plan, 2023; MEMA & EEOEA SHMCAP, 2018).

*Economy*

Economic impacts from earthquakes include loss of business functions, inventory damage, relocation costs, and wage and rental losses due to building repairs. Business interruption losses occur when businesses cannot operate, and temporary living expenses may be incurred for displaced residents.

In agriculture, earthquakes can cause crop and livestock losses and damage barns and equipment, especially if landslides occur. Additional costs, such as debris removal and repair of transportation and utility systems, further compound economic losses. Table 3.20 Economic Loss Estimates, HAZUS Probabilistic Scenarios
summarizes building-related losses for earthquake scenarios in Massachusetts (EOEEA ResilientMA Plan, 2023; MEMA & EEOEA SHMCAP, 2018).

Table 3.20 Economic Loss Estimates, HAZUS Probabilistic Scenarios

| Economic Losses for Berkshire County | 100-Year MRP | 500-Year MRP | 1,000-Year MRP | 2,500-Year MRP |
|---|---|---|---|---|
| Building-Related Loss Estimates, Hazus Probabilistic Scenarios | $570,000 | $25,660,000 | $66,220,000 | $200,810,000 |
| Transportation and Utility Losses | $170,000 | $7,800,000 | $23,180,000 | $74,200,000 |

*Source: MEMA & EOEEA, 2018 HAZUS*

*Future Conditions*

While climate change does not directly cause earthquakes, the environmental changes it drives—such as increased precipitation and shifts in weather patterns—may elevate the risk of secondary hazards following seismic events. In Lee, the increased likelihood of heavy rainfall and shifting soil conditions could lead to greater susceptibility to landslides and soil erosion post-earthquake, particularly in rural and hilly areas.  These environmental shifts may also increase the risk of soil erosion, especially in rural areas like Lee, where soil conservation is vital for the landscape's stability (EOEEA ResilientMA Plan, 2023; MEMA & EEOEA SHMCAP, 2018).

Looking forward, Lee's aging population presents unique challenges for emergency preparedness. As the town's demographic continues to shift toward older residents, future earthquake resilience efforts will need to prioritize enhanced emergency response infrastructure and accessible housing options. Ensuring that critical services, such as hospitals and emergency transport systems, are capable of responding quickly to an earthquake will be essential to safeguarding public health. Moreover, as population patterns shift, future planning must consider how to accommodate displaced residents in a housing market already under strain, particularly those most vulnerable to long-term housing instability.

As Lee develops its downtown and surrounding areas, building codes should be updated to ensure that renovations and small projects meet seismic safety standards. Retrofitting older structures, particularly those in historically significant areas, will enhance their ability to withstand earthquake forces, preserving Lee's character while improving resilience.

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[i] NESEC. (n.d.). Earthquakes Hazards. Northeast States Emergency Consortium. https://nesec.org/earthquakes-hazards

[ii] Ebel, J. E. (2012). New England Seismic Network. Boston College Weston Observatory. https://earthquake.usgs.gov/cfusion/external_grants/reports/G10AC00086.pdf

[iii] Davis, W. B., Jones, J., Dong, M., Gamio, Lazaro, Malsky, B., & Keefe, J. (2024). Earthquake in New York and New Jersey. The New York Times. https://www.nytimes.com/interactive/2024/04/05/nyregion/earthquake-new-york-new-jersey.html#

# Cybersecurity Hazards

## *Hazard Profile*

The Town of Lee chose to examine the hazard of cybersecurity, defined as defending computers, servers, mobile devices, electronic systems, networks, and data from malicious attacks. Cybersecurity is integral to emergency management and involves safeguarding digital systems, networks, and data from unauthorized access, attacks, and disruptions. Cybersecurity becomes a hazard when malicious actors exploit vulnerabilities, potentially disrupting communication, compromising data integrity, and hindering the efficiency of emergency response efforts. As technology dependence grows, so does the potential impact of cybersecurity threats on community resilience.

## *Likely Severity*

The damage rendered by cybersecurity can be significant.  A failure of networked computer systems could result in the interruption or disruption of Town services (including public safety and other critical services), the disruption or interruption of the functioning of Town departments, and the potential for loss or theft of important data (including financial information of the Town and residents). Municipalities may see their entire system compromised by cyberattacks, which, in worst-case scenarios, could close governmental operations.  It could require the municipality to expend significant financial resources to recover files and possibly pay a ransom to the hacker to retrieve files in the event of a ransom attack.

There are many possible causes of a network failure, but most either happen because of damage to the physical network/computer system infrastructure or the network in cyberspace. Physical damages are incidents that damage physical telecommunications infrastructure or server/computer hardware. Examples are a water main break above a server room, a fire/lighting strike that destroys equipment, a construction accident damaging a buried fiber line, or a power outage and other issues affecting the Internet Service Provider (ISP). Damage to the cyberinfrastructure can be malicious attacks or critical software errors that affect computer systems, from individual computers to the entire network. These virtual hazards can cause a lack of access to the network, permanent data loss, and permanent damage to computer hardware, and they can impact the ability to access programs or systems on the network. The power outage in 2003 that caused a two-day blackout in much of the Northeast resulted from a cyber-attack.  This outage was related to at least 11 deaths and caused an estimated $6 billion in economic damages over two days.[i]

When incidents are malicious attacks, they can impact:

- Confidentiality: protecting a user's private information.
- Integrity: ensuring that data is protected and cannot be altered by unauthorized parties.
- Availability: keeping services running and giving administration access to key networks and controls.
- Damage: irreversible damage to the computer or network operating system or "bricking" and physical, real-world damages caused by tampering with networked safety systems.
- Confidence: the confidence of stakeholders in the organization who were victims of the attack.

Motives for cyber-attacks can vary tremendously, ranging from the pursuit of financial gain the primary motivation for what is commonly referred to as "cyber-crimes" is for profit, retribution, or vandalism. Other motivations include political or social aims. Hacktivism is the act of hacking or breaking into a computer system for a political or social purpose.

### *Probability*

As computers and connectivity become more pervasive in our lives, the number of vulnerabilities increases. As of 2023, the average cost of a data breach in the United States amounted to 9.48 million dollars, up from 9.44 million dollars in the previous year.[ii] The same report also listed government as the 6th ranked industry to be a victimized by cybercrime. Nation-state-sponsored groups are the most likely to target this sector, using, selling, or delivering compromised information to their respective governments, typically for economic or political gain.[iii] The most probable motives for cyber-attacks on a community like Lee are for ransom or to access personal information about residents.

Like any organization, the greatest risk of cyber-attacks on municipal computer systems comes from the number and variety of people who work on these systems. There are a variety of factors that increase risks:

- Varied computer literacy: Municipal staff are hired for the various skills needed to run the many governmental departments and operations within a Town, and the level of computer literacy is varied. New staff are typically screened and go through background and reference checks, but few are evaluated as to their computer habits or ability to recognize potential security issues.
- Staff turnover: New staff often inherit the same desk and computer as their predecessors, and for ease in transition often inherit their usernames and passwords.
- Personal emails and devices: For a variety of reasons, municipal staff may use their own accounts and devices for work, opening risk to municipal emails and accounts.
- Non-staff access: In addition to staff, elected and appointed board and committee members are often given access to municipal computer systems, with even less security oversight than staff.
- Limited ability to act quickly: Once a security breach has been identified, municipal staff may be unable to act quickly to contain the damage. Staff may not be trained or given the authority to shut down systems or quickly hire consultants to help deal with the situation. If the cost of containment or ransom is high, it may require a vote of the select board or even a Town Meeting to authorize funding to address the issue.

### *Historic Data*

Cyberattacks are human-caused hazards, often spread by users who have inadvertently allowed access to their systems. In 2015, two major breaches last year of U.S. government databases holding personnel records and security-clearance files exposed sensitive information about at least 22.1 million people.[iv] During 2016-2019, more than 11.7 billion records and over 11 terabytes of data were leaked or stolen in publicly disclosed incidents. These compromised records contain information such as social security numbers, addresses, phone numbers, banking/payment card information, and passport data. The recent disclosure that the U.S. Pentagon and other high-ranking federal agencies had been hacked illustrates the breadth of the danger.

The recent ransomware on the Colonial Pipeline in 2021 forced the closure of one of the nation's key fuel pipelines. The Colonial Pipeline is a 5,500-mile-long pipeline that carries 2.5 million barrels a day of gasoline, diesel, heating oil, and jet fuel on its route from Texas to New Jersey. Closure of the pipeline for 11 days in May prompted gasoline shortages and panic buying in the southeastern U.S., including in the nation's capital. Against the advice of its consultants and that of the FBI, Colonial paid $4.4 million to foreign hackers to release its systems. Had the shutdown gone on longer, it could have affected airlines, mass transit and chemical refineries.

In 2022, the Federal Bureau of Investigation (FBI) issued a Private Industry Notification (PIN) to alert partners within the U.S. Government Facilities Sector about cyber actors engaging in ransomware attacks on local government agencies. These attacks have led to disruptions in operational services, posed risks to public safety, and resulted in significant financial losses. Several months later, the City of Lowel temporarily shut down all computer systems to isolate and control a cyberattack.[v]Fortunately, no major systems were compromised, or data was breached. However, attacks of these nature can cost the communities anywhere from tens of thousands of dollars to millions of dollars in ransom and countless hours restoring their systems and improving their resilience to a future attack.

In some cases, health data may also be stolen. In December 2023, Ann Jaques Hospital, 35 miles north of Boston, had a cyber incident that knocked out the electronic health records system and caused the facility to turn away ambulances on Christmas Day.[vi]

Between 2015 and 2019, at least two towns in Berkshire County, as reported by the Massachusetts Municipal Association, experienced ransomware attacks. In one instance, the affected town, guided by its insurance company's advice, chose to pay the ransom to regain access to its files. In 2016, Berkshire Health Systems, the region's central health care system that includes the county's three hospitals, numerous physician practices and clinics, was attacked by malware. In April 2021, the Massachusetts Auto Inspection System was shut down due to a cyber-attack.

For the Town of Lee, a singular hacking incident was reported in 2017 when an employee lost control of their computer. However, IT promptly shut down the system, isolated the event, and removed the hacker before it spread to other computers. Immediately after, security measures were enhanced and no incidents have occurred since.

### *Vulnerability Assessment*

#### *Geographic Areas Likely Impacted*

Municipal facilities are more likely to be targeted for cybercrime, but all residents and businesses are also at risk. In addition, the regional electrical grid and telecommunication networks are at risk of attacks and could result in large sections of the Town being without power or communications.

#### *People*

Cyberattacks rarely have direct, physical impacts on humans aside from the anguish caused by a breach. Personal identifiable information that may be stolen from a municipal system can cause disruption to people's lives, impacting their finances, security, and future. Municipal operations may be shut down during a breach, causing a delay in services, issuing permits or tax bills, or a host of other governmental functions. Cyberattacks that impact the utilities may cause potential harm to those who rely on electricity for life support, heat, and water. Hospitals and medical facilities utilizing networked monitoring systems are vulnerable to hacking.

*Built Environment*

Cyberattacks on the built environment may result in the loss of power, communications and equipment failure in government offices. Attacks on the utilities would likely result in temporary loss of service, however utilities can also be attacked where the systems are taken control of and purposely overloaded, damaging the physical infrastructure, which will result in a costlier recovery and a longer recovery time. Government computer equipment can also be damaged or locked, preventing the use of that equipment unless a ransom is paid. This equipment can be replaced, but the data on the computers may not be recoverable, resulting in the loss of data and governmental records unless the computers have been properly backed up.

*Natural Environment*

Cyberattacks pose a threat to the natural environment as well. Systems such as wastewater or drinking water treatment plants are vulnerable to ransomware if they are connected to the internet, as hackers could control pumps, valves, chemical applications or many other parts of the systems. Chemical and other leaks from businesses can occur in the same manner.

*Economy*

The economy is susceptible to the threat of cyberattacks due to the loss of utilities and computers causing a reduction in economic output. Computerized control systems known as a Supervisory Control and Data Acquisition (SCADA) systems allow industries and utilities remote controlling and monitoring of industrial processes. An attach in these systems can disrupt production, shut down operations completely or otherwise damage the business' output. The power blackout of 2003 was an attack on the utility's SCADA system. The weakest link in these systems is employees unwittingly opening emails or some other back-door way into the system (Wagner, 2016). The U.S. government estimates that malicious cyber activity costs the U.S. economy between $57 billion and $109 billion in 2016.[vii] Reported ransomware payments in the United States reached over $590 million in 2021, compared to a total of $416 million in 2020.[viii] This indicates a growing trend of ransomware and cyberattacks.

*Future Conditions*

Cybersecurity is a constantly evolving discipline. Mitigation to reduce risk includes constant vigilance, including making sure equipment and software is up to date throughout the system. Someone in municipal government should be trained and responsible for staying current with malware risk and protecting the system as needed. Training more than one staff member will add redundancy to system oversight and maintain constant coverage. Lastly, train all municipal staff and anyone using the system to avoid scams, malicious emails, and attachments to reduce the risk of someone inadvertently allowing malware to enter the system.

The Town of Lee received a grant in 2023 to advance staff training. While the Town does not have an internal IT department, it does contract with Bug Buster Computer Services to manage its IT infrastructure and security. Additionally, the Town has an Incident Response Plan (IRP] for cyber security events. The IRP was formulated to provide a structure and effective methodology for identifying, managing, and mitigating cyber security incidents that could disrupt the operations and compromise the information and assets of the Town of Lee. These methodologies consist of rapid identification and response, damage mitigation, information protection, regulatory compliance, and continuous improvement to security. The plan is updated annually.

The best way to prevent a cyber-attack is to follow best practices in cyber-security. Following these best practices will greatly mitigate the likelihood a cyber-attack is successful. MA Executive Office of Technology Services and Security is the chief MA State program that can assist local governments with cyber-security. Educational opportunities throughout the region aim to assist municipalities in learning and implementing these practices. All of Lee's municipal employees complete the state's annual cyber security training program.

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[ii] IBM, (2023)."Cost of Data Breach Report 2023"
[iii] The Evolution of Ransomware: A 5-Year Perspective | New Jersey Cybersecurity & Communications Integration Cell (nj.gov)
[iv] The Washington Post, (2015). "Hacks of OPM databases compromised 22.1 million people."
[v] https://www.cbsnews.com/boston/news/cyberattack-lowell-city-government/
[vi] The Record Media, (2023) "Cyberattack on Massachusetts hospital."
[vii] CEA Report: The Cost of Malicious Cyber Activity on our Economy: https://trumpwhitehouse.archives.gov/articles/cea-report-cost-malicious-cyber-activity-u-s-economy/, (2016)
[viii] US Department of Treasury, Treasury Continues to Counter Ransomware as Part of Whole-of-Government Effort

# Hazardous Materials

## *Hazard Profile*

Hazardous materials (HAZMATs) are substances that pose significant risks to health, safety, or property when released into the environment. These materials can be non-natural, artificial, or biological, including chemicals, biological agents, radioactive substances, and other toxic materials. According to the U.S. Environmental Protection Agency (EPA), HAZMATs can harm humans, animals, or the environment when improperly managed.[i] These substances can be found in various forms, including solids, liquids, gases, and sludges.[ii] Common HAZ MATs include industrial chemicals, pesticides, heavy metals, and biological contaminants. The Department of Transportation (D.O.T.) organizes substances into nine classes and The National Fire Protection Association (NFPA) outlines the Standard System for the Identification of the Hazards of Materials for Emergency Response, which identifies hazards by the severity of the hazard in three principal categories (health, flammability, and instability).

### Common Sources

Various industrial, commercial, and medical facilities are common sources. Chemical manufacturers and industrial plants are primary sources of producing and using hazardous substances in large quantities. Service stations and fuel storage facilities handle flammable and combustible liquids. Hospitals and medical facilities generate biomedical waste and use radioactive materials in treatments and diagnostics. Additionally, hazardous waste sites and landfills contain various toxic substances that can pose risks if not properly managed.[iii,4] Many products are shipped daily on the nation's highways, railroads, waterways, and pipelines, making transportation a significant source of risk for hazardous material incidents.[iv]

Environmental dumping and contamination are also sources. Illegal dumping or improper disposal of industrial waste can contaminate soil, water, and air. For instance, contaminants can leach into groundwater or be carried into surface waters, affecting ecosystems and human health. Abandoned industrial sites, often called "brownfields," may contain residues of hazardous substances from previous activities, posing long-term environmental and health risks. The federal government defines brownfields as "abandoned, idled, or underused industrial and commercial properties where expansion or redevelopment is complicated by real or perceived environmental contamination." [v] They can be significant sources of contamination and may contain a wide range of HAZ MATs, making their remediation complex but crucial. Several funding and technical assistance programs exist for private and municipal landowners to assist with remediation efforts.
Most non-natural or manmade hazards fall into two general categories: intentional acts and accidental events, although these categories can overlap. Intentional acts include explosive devices, biological and radiological agents, and arson. Accidental events can arise from human activities such as manufacturing, transporting, storing, and using of toxic substances. Examples of accidental events include nuclear hazards, infrastructure failure, and industrial and transportation accidents. In their various forms, they can cause death, serious injury, long-lasting health effects, damage to buildings, homes, and other property, as well as environmental damage and significant economic impacts.

## Significance and Complexity of Hazardous Materials

Although not formally required by FEMA, the inclusion of HAZMATs in this hazard mitigation plan is crucial due to the potential risks they pose to the community. This plan does not address all manmade hazards and hazardous materials that could affect the Town of Lee, as a full analysis was not available for the scope of this plan. Addressing these risks aligns with the broader goals of hazard mitigation, which aim to reduce the loss of life and property by minimizing the impact of disasters.[vi] Natural disasters, such as floods, storms, hurricanes, and landslides, can exacerbate the risks associated with HAZ MATs. These events can cause the unintentional release of hazardous substances from industrial facilities, storage sites, and transportation networks, leading to air, water, and soil contamination. For example, flooding can mobilize chemicals stored in low-lying areas, while landslides can damage transportation networks, resulting in spills or leaks. As a result, the intersection of natural disasters and hazardous materials necessitates an integrated approach to hazard mitigation planning.

The risks and vulnerability associated with hazardous materials cannot be quantified similarly to natural disasters due to the inherent differences in predictability, variability, and impact factors. Unlike natural disasters, which can often be forecasted and modeled based on historical data and environmental patterns, hazardous material incidents are less predictable. They can vary widely in their severity and consequences. The impact depends on multiple factors, including the type and quantity of the substance, the mode of release, environmental conditions, and proximity to human populations. These complexities make applying a standardized quantification approach similar to that used for natural hazards challenging.

## Regulations Governing Hazardous Materials

Several federal and state regulations govern the management, storage, and disposal of hazardous materials to protect public health and the environment. In many instances, Massachusetts regulations are more stringent than federal guidelines.[vii]

1) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): Also known as Superfund, CERCLA provides a federal program for cleaning up hazardous waste sites and responding to environmental emergencies
2) Resource Conservation and Recovery Act (RCRA): RCRA governs the management of hazardous and non-hazardous solid waste, ensuring proper handling and disposal to prevent harmful releases into the environment
3) Emergency Planning and Community Right-to-Know Act (EPCRA): EPCRA requires facilities to report on the storage, use, and release of hazardous substances to support local emergency planning and response efforts. Facilities are required to submit Tier II data through the Toxic Release Inventory (T.R.I.) program [viii]. This act governs facilities that are large quantity generators (LQGs) of hazardous waste and facilities required to submit Risk Management Plans (RMPs) to the E.P.A.
4) Occupational Safety and Health Administration (OSHA) Regulations: OSHA sets standards for the safe handling and exposure limits of hazardous materials in the workplace to protect worker health and safety
5) Pipeline and Hazardous Materials Safety Administration (PHMSA): PHMSA regulates the safe and secure movement of hazardous materials by all modes of transportation, including

pipelines. PHMSA's Office of Hazardous Materials Safety develops regulations and standards for classifying, handling, and packaging hazardous materials

6) Massachusetts Hazardous Waste Management Act (M.G.L. Chapter 21C): Outlines state requirements for hazardous waste accumulation, transportation, treatment, storage, recycling, and disposal.
7) Massachusetts Hazardous Waste Facility Siting Act (M.G.L. Chapter 21D): Establishes criteria and procedures for state and local review and approval of hazardous waste treatment, storage, recycling, and disposal facility siting and construction in Massachusetts.
8) Massachusetts Oil & Hazardous Material Release Prevention & Response Act (M.G.L. Chapter 21E): Tasks MassDEP to ensure the identification, assessment, and permanent cleanup of oil and hazardous material sites and spills, also known as the State Superfund Act.
9) Massachusetts Toxics Use Reduction Act (M.G.L. Chapter 21I): Requires Massachusetts companies that use large quantities of specific toxic chemicals to evaluate their operations, plan for pollution prevention, and report on the results each year.
10) Chemical Facility Anti-Terrorism Standards (CFATS) Program: Overseen by the Department of Homeland Security, CFATS sets risk-based performance standards for the security of high-risk chemical facilities to prevent terrorist attacks.[ix]

### *Probability*

As mentioned earlier, estimating the probability of hazardous material contamination differs from estimating the probability of natural hazards due to their inherent unpredictability and variability. While predicting the exact frequency of such events is challenging, understanding the influencing factors allows for better risk assessment and, therefore, mitigation strategies. [x,xi]

Several factors, including the presence of HAZMAT facilities, transportation routes, and regulatory compliance, influence this probability. Incidents are more likely to occur in areas with numerous facilities that produce, store, or handle hazardous substances. These include industrial plants, chemical manufacturers, fuel storage facilities, and medical institutions. Regular operations in these facilities increase the potential for accidental releases or spills.[xii]
HAZ MATs are frequently transported via highways, railroads, waterways, and pipelines. The Town of Lee's proximity to major transportation routes increases the probability of incidents related to the transit of hazardous materials. Lee serves as a key entrance and exit point for trucks carrying various goods and materials via the Mass Turnpike (Interstate 90). Accidents during transportation, such as vehicle collisions or derailments, can result in possible releases. [xiii,xiv]

### *Likely Severity*

The severity of incidents involving hazardous materials can vary widely depending on several factors, including the type and quantity of the material, the mode of release, environmental conditions, and the proximity to human populations. [xv] According to the Occupational Safety and Health Administration (OSHA) and FEMA, HAZMAT incidents can generally be classified into three categories based on their potential impact: minor, moderate, and severe.

1. Minor Incidents: Involve small quantities of hazardous materials, limited exposure, and localized impact.
    - Examples: Minor spills or leaks during transportation, small-scale industrial accidents, or minor containment failures.

- Impact: Limited to minor injuries or health effects, minimal property damage, and negligible environmental impact

2. Moderate Incidents: These involve larger quantities of hazardous materials or higher-toxicity substances, with the potential for wider exposure and more significant impact.
    - Examples: Industrial accidents with medium-scale spills, moderate transportation accidents, or incidents involving moderately hazardous substances.
    - Impact: Potential for serious injuries or health effects, moderate property damage, and localized environmental contamination requiring professional cleanup and remediation efforts

3. Severe Incidents: Involve large quantities of highly toxic or reactive hazardous materials, significant release or exposure, and extensive impact.
    - Examples: Major industrial accidents, large-scale transportation accidents, or incidents involving highly hazardous substances such as radioactive materials or highly toxic chemicals.
    - Impact: High potential for fatalities, severe health effects, significant property damage, and extensive environmental contamination. These incidents often require extensive emergency response and long-term cleanup efforts and can have lasting impacts on the community and environment.

### *Historic Data*

The Town of Lee's industrial heritage and position along major transportation routes has led to several notable HAZ MATs incidents. In the late 1800s, Lee was home to 25 paper mills, with the town producing more paper than any other town in the United States. As industrial manufacturing dwindled, it left behind the industrial infrastructure and, in many cases, contamination within the floodplains where mills were built. In Lee, there are four main mills along the Housatonic totaling 700 acres of industrial land use, all of which have the potential for hazardous materials in their soil and building materials. For example, Brownfields remediated the Eagle Mill and found petroleum soil contamination.[xvi] Further sampling and assessment are needed to determine the presence of other contaminants.

The Federal Railroad Administration, as reported in the Berkshire Eagle Newspaper, reported 33 rail incidents, including ten derailments, from 2010 to the end of 2022.[xvii] Only one of the incidents was weather-related. In 2010, seven Housatonic Railroad cars derailed in Lee due to heavy rain, including a car holding 20,000 gallons of ethanol. Fortunately, the cargo did not leak.
Along with other communities along the Housatonic River, Lee has a history of significant polychlorinated biphenyls (PCBs) contamination. P.C.B.s are HAZ MATs that pose serious risks to human health and the environment. They have been linked to various adverse health effects, including cancer and negative impacts on the immune, reproductive, nervous, and endocrine systems.[xviii] P.C.B.s do not readily break down once in the environment, and they can remain for long periods, cycling between air, water, and soil. The E.P.A. classified P.C.B.s as probable human carcinogens and have been banned since 1979.[xix] During the mid-20th century (1932-1977), General Electric (G.E.) used P.C.B.s to manufacture electrical transformers. Years of industrial chemical use with P.C.B.s and improper disposal led to extensive contamination around the G.E. Facility in Pittsfield, MA, and down the entire length of the Housatonic River.

Cleanup of P.C.B.s and other hazardous substances in Pittsfield and the Housatonic River has progressed under an October 2000 Consent Decree entered into by E.P.A., Massachusetts, Connecticut, the City of Pittsfield, the General Electric Company, and the Pittsfield Economic Development Authority. Cleanup was required for twenty contaminated areas outside the Housatonic River, five groundwater management areas, and three River segments—the Upper ½-Mile Reach, the 1.5 Mile Reach, and Rest of River.[xx] The cleanup process has been extensive and ongoing, involving the removal and containment of PCB-contaminated soil and sediment. The remediation efforts have focused on both immediate removal actions and long-term strategies to mitigate the impact of P.C.B.s on the environment and public health. According to the E.P.A., the remediation of the 20 non-river cleanup areas and the first two miles of the Housatonic River are complete. The remaining miles of cleanup will focus on the Rest of River (R.O.R.) section, including portions of the Housatonic that flow through the Town of Lee.

## *Vulnerability Assessment*

Hazardous materials always involve some risk, whether small or large. This section focuses on identifying vulnerabilities and what further mitigation strategies the Town can implement to protect its residents and infrastructure from the impacts of natural disasters.

### *Geographics Areas*

A release may occur at a fixed facility or in transit. Communities with large industrial bases, like Lee, may be more inclined to experience hazardous materials release due to the number of facilities using such materials in their manufacturing process. Communities with several major roadways may be at greater risk due to the number and frequency of trucks transporting hazardous materials passing through, with similar risks associated with the location of railways in a town.

Industrial Accidents – Transportation

The Town of Lee's transportation system includes primary road and rail. The Town of Lee has no airport, with the closest one being 10 miles in the City of Pittsfield; the small airport primarily services private charters, taxis, and a few military flights. Therefore, air transportation is not being evaluated in this plan. Accessible and efficient freight transportation is vital to the region's economy. Most freight and goods being transported to and from Berkshire County are by truck; however, a significant amount of freight that moves through the county is being hauled over 38 miles of the Housatonic Railroad, a freight railroad that connects to the national rail system through C.S.X. Transportation at Pittsfield, MA. It operates approximately 38 miles in Massachusetts, passing through Pittsfield, Lenox, Lee, Stockbridge, Housatonic, Great Barrington, and Sheffield. Approximately 6 miles of the Housatonic Railroad line runs through the Town of Lee.[xxi] Freight transportation is for various industries, including paper companies, a limestone quarry, a manufacturer of plastic sheeting, a distribution center, a public warehouse, a lumber shipper, a concrete manufacturer, and a fertilizer receiver. [xxii] The significant industrial presence along this route increases the potential impact of any derailments, as hazardous materials transported to and from these industries could be released into the environment in the event of an accident.

According to the U.S. Department of Transportation, Federal Highway Administration, the major trucking corridors for the Town of Lee are Interstate 90, running east to west, and a small segment

of Route 7 on the Town's western border, running north to south. Additionally, Route 20 runs north to south through Lee, providing a major route for trucks exiting Interstate 90. Route 102 also connects to Interstate 90 at its eastern terminus in Lee, making it a vital route for trucks moving between New York and Massachusetts. Route 102 traverses the industrial zone of the Town, where several manufacturers operate on Pleasant Street (Route 102), and this area is likely to see commercial traffic carrying hazardous materials.
Natural disasters such as snow, flooding, wind, and landslides increase the likelihood of hazardous materials being released from transportation routes. Heavy snow can cause road blockages and accidents, leading to spills.[xxiii] Flooding can wash contaminants from trucks and railcars into water bodies and surrounding land.[xxiv] Strong winds can topple trucks or cause derailments. [xxv]Landslides can obstruct rail lines, causing derailments and subsequent hazardous material spills. Ensuring the resilience and safety of transportation routes against these natural disasters is essential to prevent dangerous materials incidents and protect public health and the environment.[xxvi]

<u>Industrial Accidents - Fixed Locations</u>

Accidental hazardous material releases can occur wherever hazardous materials are manufactured, stored, transported, or used. Such releases can impact nearby populations and contaminate critical or sensitive environmental areas. Facilities that use, manufacture, or store toxic chemicals must report their locations and the quantities of chemicals stored on-site to state and local governments. Activity and Use Limitations (AULs) are legal restrictions on contaminated properties to manage residual contamination and mitigate risks to human health and the environment. These restrictions ensure that the use of the property remains safe by prohibiting or limiting activities that could disturb the contamination or increase exposure risks. The following locations have AULs:

| Table X: AULs in the Town of Lee | | |
|---|---|---|
| Facility Name | Location | Chemical Type |
| *Eagle Mill | 73 W. Center Street | Phase II - detailed assessment and characterization of contamination are still in progress or have not been completed yet. |
| Ma State Police Barracks | 215 Laurel St | Oil |
| *Schweitzer-Mauduit Fmr. Centennial Mill | 2 Mill St (Border Of Lenox/Lee) | Hazardous Material (specifics not noted on the report) |
| Diesel Dans | 10 Pleasant St Rte 102 | Oil |

* Denotes facility is within the floodplain. *Source:* EEA Data Portal Waste Site and Reportable Releases https://eeaonline.eea.state.ma.us/ Accessed 6/5/24

The Toxics Release Inventory (T.R.I.) tracks the management of over 650 toxic chemicals that threaten human health and the environment. U.S. facilities in various industry sectors that manufacture, process, or otherwise use these chemicals in amounts above established thresholds must report how each chemical is managed through recycling, energy recovery, treatment, and environmental releases. A "release" of a chemical means that it is emitted into the air or water or placed in some type of land disposal.

The information submitted by facilities to the E.P.A. and Massachusetts Department of Environment (MassDEP) is compiled annually into the Toxics Release Inventory (T.R.I.) and stored in a publicly accessible database. This T.R.I. data supports informed decision-making by industry, government, non-governmental organizations, and the public. However, it is important to note that the T.R.I. does not provide safety or health information about these chemicals and compounds. When used in conjunction with other information, T.R.I. data can serve as a starting point for evaluating exposures that may result from industrial activities involving toxic chemicals.[xxvii]

It is important to note that inclusion on the T.R.I. in no way indicates any issues with any of the sites; rather, it is an inventory of those facilities meeting T.R.I. reporting requirements.

| Table X: Toxics Release Inventory (T.R.I.) for Town of Lee | |
|---|---|
| Facility Name | Facility Location |
| Electronic Concepts Inc | 689 Greylock St |
| Lane Construction Corp | 1 Willow Hill Rd |
| Northeast Paving Lenoxdale Facility | 100 Willow Hill Rd |
| Schewitzer Mauduit International Inc * | 701 Greylock St |
| Schweitzer Mauduit International Inc. | Mill St (Niagara Mill) |

*Source: T.R.I. Search Results. EnviroFacts USPA. http://envior.epa.gov/enviro/ Accessed 6/5/2024*

*The Schweitzer Mauduit International Inc. owned and operated a total of four mills historically known for paper mill production: Niagara, Greylock, Columbia, and Eagle. These mills closed in 2008. In 2014, Niagara Worldwide purchased the Columbia, Greylock, and Niagara mills. The Eagle Mill was acquired in 2013 and is currently undergoing brownfield cleanup and revitalization for mixed-use development. These four mills are located within a mile and a half of each other along the Housatonic River and near residential homes, businesses, and Route 20. Given the industrial nature of pulp and paper mill production, these facilities often generate a variety of environmental contaminants, including but not limited to

- Sodium Hydroxide Residues
- Sulfuric/Sulfurous Acid Resin
- Hydrochloric Acid
- Hydrogen Sulfide
- Heavy Metals (lead, mercury, cadmium)
- Cyanide
- Asbestos
- PCBs
- Dioxins and Furans
- Resin
- Zinc
- Waste sludge
- SVOCs (from coatings)
- VOCs (from coatings)

Tier II facilities are locations that store or use significant quantities of hazardous chemicals and are required to report their chemical inventories under the Emergency Planning and Community Right-to-Know Act (EPCRA). This reporting ensures that state and local governments, including emergency response teams, have vital information on the presence of hazardous materials within their jurisdictions.
These facilities mu
st annually submit a Tier II Chemical Inventory Report detailing the types and amounts of hazardous chemicals they store on-site. This data helps local emergency planning committees (LEPCs) and state emergency response commissions (SERCs) develop comprehensive emergency response plans to protect public health and the environment in case of chemical spills or other hazardous material incidents.[xxviii]

Although this plan does not include an in-depth evaluation of hazardous materials related to farming, it is recognized that farmers often use and store pesticides, herbicides, and fertilizers on their land. Given that much farmland is located in or near floodplains and adjacent water bodies, there is a potential risk for accidental hazardous materials spills that could impact water quality as well as risk to the agricultural to transport hazardous materials contamination in agricultural products. Farmers typically follow best management practices (B.M.P.s) for the use and storage of these agricultural chemicals and have undergone the necessary training and licensing to apply these substances. Despite these precautions, accidental releases of hazardous materials can still occur, posing potential threats to human health and the environment.

Natural disasters pose risks to landfills. Flooding and severe storms can compromise landfill integrity, leading to contaminant release. Floodwaters infiltrate landfills, creating leachate that can contaminate groundwater and nearby water bodies. High winds and storms can damage landfill caps and liners, increasing contamination risk. Key contaminants can include but are not limited to[xxix]:

- Heavy Metals: Such as lead, mercury, and cadmium, primarily sourced from batteries, paints, industrial waste, fluorescent lights, and plastics.
- Volatile Organic Compounds (VOCs): Including benzene and toluene, common contaminants from the production of plastics, resins, solvents, and paint thinners.
- Inorganic Compounds: Such as ammonia and cyanide, which are often present in agricultural and industrial waste.
- Per- and Polyfluoroalkyl Substances (PFAS): Chemicals used in various industrial applications and consumer products, known for their persistence in the environment and potential health risks.
- Pharmaceuticals and Personal Care Products (PPCPs): Includes antibiotics, hormones, and other compounds
- Dioxins and Furans: Byproducts of industrial processes and combustion, these compounds are highly carcinogenic and can accumulate in the food chain.
- Leachate: The liquid that percolates through landfill waste, often containing a mix of the above contaminants

Landfills are designed with protective measures like composite liners, leachate collection systems, and gas collection systems to minimize environmental contamination. Additionally, stormwater management systems and regular groundwater monitoring help mitigate environmental damage during natural disasters. Table 3.21 shows the landfills or dumps filed with MassDEP within Lee.

Table 3.21 Inactive & Closed Landfills and Dumping Ground

| Facility Name | Location |
|---|---|
| All American Fence Co | 100 Marble St |
| Consolati Demolition Dump | Fairview St |
| Former Westfield River Paper Slf | 20 Forest St |
| Lee Fairmont Cemetery Dumping Ground | Fuller St |
| Lee Landfill | Willow Hill Rd |
| Ma Dot Lee Maintenance Facility | Rte 102 |
| Mw Custom Papers Llc | 1085 Rte 2 |
| Oldcastle Lawn & Garden Inc | 110 Marble St |
| Schweitzer Mauduit Intl Sludge Landfill | Willow Hill Rd |

*Source: Bureau of Waste Protection Solid Waste Program June 2023*

Hazardous materials are often found in various common locations within communities, which can increase the risk of accidental releases during natural disasters. Typically, these common places house smaller quantities of hazardous materials and are considered lower risk compared to large industrial sites or facilities specifically handling large volumes of hazardous substances. However, the widespread nature of these locations and the variability in how materials are stored and managed can still pose significant risks, especially during natural disasters. Unlike facilities required to report hazardous materials, these common locations often lack fixed inventories or clear identification of stored substances, making it difficult to manage and mitigate risks effectively. These locations can be but not limited to [xxx]:

- Small Businesses and Retail Stores: Hardware stores, auto repair shops, and dry cleaners frequently handle and store chemicals, solvents, and cleaning agents.
- Schools: Science laboratories and maintenance departments store chemicals used for educational experiments and building maintenance.
- Healthcare Facilities: Hospitals, dental, and veterinary clinics store pharmaceuticals, biomedical waste, and radioactive materials.
- Residential Properties: Garages, basements, and sheds often store pesticides, fertilizers, paints, solvents, and automotive fluids.

Facilities listed in the National Emissions Inventory (NEI), which tracks air emissions of pollutants, can be of particular concern during wildfires. These facilities may already release certain pollutants under normal operations, but a wildfire could exacerbate the situation by causing the uncontrolled release of on-site hazardous materials. The combined effect of regular emissions and additional releases due to wildfire can lead to severe air quality degradation. These emissions can travel short or long distances, affecting air quality far from the wildfire source. Poor air quality due to wildfire smoke poses respiratory health risks, particularly for vulnerable populations such as children, the elderly, and those with pre-existing respiratory conditions.[xxxi,xxxii] Table X displays the locations of facilities in Lee that are registered with the EPA under the National Emissions Inventory (NEI).

| Table X; Facilities in Lee registered with the EPA under the National Emissions Inventory (NEI) | | |
|---|---|---|
| Facility | Location | Facility Type & Pollutant |
| Essential Power Mass LLC | Woodland Rd | Electricity Generation Via Combustion, Pm2.5, PM10, Sulfur And Nitrogen Compounds |

| | | |
|---|---|---|
| Northeast Paving Lenoxdale Plant | 1 Willow Hill Rd | Hot Mix Asphalt Plant PM2.5, PM10, Sulfur and Nitrogen Compounds, VOCs |
| Oldcastle Lawn & Garden Inc | 110 Marble St | Mining, PM2.5, Heavy Metals, Carbon Compounds, VOCs, Nitrogen Compounds, Sulfur Compounds |
| Onyx Specialty Papers (Willow Mill) | 40 Willow St | Manufacturing, PM2.5, PM10, Heavy Metals, Carbon Compounds, VOCs, Nitrogen Compounds, Sulfur Compounds, PAHs |

*Source: EPA National Emissions Inventory 2020* https://www.epa.gov/air-emissions-inventories/national-emissions-inventory-nei

*Facilities Outside of Town*

Hazardous facilities outside town boundaries can potentially impact the Town of Lee. Nearby nuclear power plants include the Indian Point Energy Center in New York, approximately 100 miles southwest of Lee; the Seabrook Station Nuclear Power Plant in New Hampshire, about 150 miles east of Lee; and the Millstone Nuclear Power Station in Connecticut, approximately 120 miles south of Lee. While the Town of Lee is not within the emergency planning zones (E.P.Z.s) of these plants due to their distance, the probability of a significant incident at these plants is relatively low due to stringent safety protocols and regulatory oversight by agencies such as the Nuclear Regulatory Commission (N.R.C.).[xxxiii]
However, contamination could occur through the dispersion of radioactive materials by prevailing winds or through water bodies, especially if it reaches rivers. The extent of fallout travel is highly dependent on weather conditions. The most dangerous concentrations of fallout particles, which can cause potentially fatal external exposures to those outdoors, typically occur within 10 to 20 miles downwind of an explosion. The 2011 tsunami and earthquake in Japan that damaged the Fukushima Daiichi nuclear power plant demonstrate the potential vulnerability of these facilities to natural disasters and the geographic extent that could be impacted by an accident. Following the Fukushima incident, trace amounts of radioactive materials were detected in the United States, particularly on the West Coast. However, these levels were far below those considered harmful to human health due to atmospheric dispersion and dilution.[xxxiv, xxxv]

Chemical manufacturing plants in nearby cities such as Springfield, MA, and Albany, NY, also present potential risks. These facilities handle and store large quantities of hazardous chemicals, and accidents or equipment failures could lead to toxic releases. The likelihood of minor spills is higher, though major incidents are less common. Such events could result in air contamination from toxic fumes, water contamination if chemicals reach water bodies, and soil contamination from spills.

Westover Air Reserve Base in Chicopee, MA, is a critical facility located approximately 40 miles from the Town of Lee and is the largest air reserve base in the world. This military installation handles various hazardous materials, including fuels and chemicals. Although 40 miles is a considerable distance, certain conditions could lead to impacts on Lee in the event of a significant hazardous materials incident. Natural disasters such as severe storms, flooding, and snowstorms could damage storage facilities, leading to the release of hazardous materials, which could travel via air.

*Impact of Natural Disasters on Community and Infrastructure*

Based on historical climate data and future projections, Lee's greatest natural threat is flooding from increased precipitation. In addition to heavy rainfall, other sources of flooding exacerbated by climate change include freeze-thaw cycles, rapid snowmelt, hurricanes, and tropical depressions. Freeze-thaw cycles can cause ice jams in rivers, leading to sudden and severe flooding. Rapid snowmelt, particularly during unseasonably warm periods, can overwhelm water bodies and lead to flooding. Hurricanes and tropical depressions can bring intense rainfall and high winds, further heightening the risk of hazardous material mobilization and environmental contamination. Specific climate data and future projections are available under each specific natural disaster of this plan.
Flooding poses a significant concern regarding hazardous materials because it can lead to their unintentional release and spread. When floodwaters inundate areas where hazardous materials are present, they mobilize contaminants, dispersing them into the environment and potentially contaminating soil, water sources, and residential areas. This mobilization increases the risk of exposure to toxic substances for both the community and the ecosystem.
Populations living or working near facilities that store or use toxic substances face increased risk during natural disasters, which can trigger the release and spread of these materials.

- Residents Near Industrial Areas: People living close to industrial facilities (including unmitigated historically industrial facilities) are at heightened risk of chemical spills or leaks, especially during natural disasters like floods or severe storms.
- Vulnerable Groups: Children, the elderly, and individuals with pre-existing health conditions are particularly susceptible to the adverse health effects of hazardous material exposure.

People living close to railroad tracks are also at risk, particularly due to the potential for train derailments involving hazardous materials. A derailment could result in the release of toxic substances, which can pose health risks and environmental contamination. It's important to note that research indicates that the Town of Lee has had only one weather-related trail derailment. Additionally, safety and response planning are covered in Lee's Emergency Management Plan.

Residents near the Housatonic River, which has P.C.B. contamination, are at risk through either direct contact or ingesting P.C.B. contaminated fish, waterfowl, frogs, and/or turtles. Increased precipitation resulting in potential flood events can mobilize P.C.B.s, increasing exposure risks for those living, working, or engaging in recreation or agriculture near the river and its floodplain. Woods Pond Dam, Columbia Mill Dam, and Willow Pond Dam on the Housatonic hold a higher level of contamination by blocking sediment from moving downstream. Increased precipitation due to climate change can lead to the spread of contamination by overtopping and risk breaching, transporting hazardous materials downstream. For more information on dam risk and hazard mitigation of dams see *Inland Flooding and Dam Impacts* section.

P.C.B. remediation efforts are planned for portions of the Housatonic River in Lee and some contaminated sediments stored in a local Upland Disposal Facility (UDF). The removal of P.C.B.s from the Housatonic River will minimize direct exposure through floodplain and riverway transportation, particularly during heavy rainfall and/or flood events. However, the Town and community members have raised concerns regarding the plans for the UDF, particularly focusing on the potential impacts of increased precipitation and climate change affecting leaching, soil stability, and ground water quality. These concerns have been submitted to the EPA for consideration prior to the final acceptance of the UDF design.

*Future Conditions*

As climate change continues to influence weather patterns, the Town of Lee can expect more frequent and intense precipitation events. Summers are projected to see the greatest increase in the number of days with extreme precipitation, defined as more than two inches in one day. This trend, already observed in Massachusetts, underscores the necessity for infrastructure to be designed with the most current and comprehensive climate data available. Specific climate predictions are discussed more thoroughly in the *Inland Flooding* section of this plan.

Increased precipitation and extreme weather events pose a significant risk for hazardous materials incidents, particularly around poorly managed sites such as uncapped landfills and unmitigated historical industrial facilities (e.g., abandoned mills). Flooding, severe storms, and other climate-related events can mobilize hazardous substances, spreading them into the environment and potentially contaminating soil, water sources, and residential areas. These changes necessitate a proactive infrastructure and environmental management approach to mitigate potential risks.

Effective future preparation involves enhancing documentation and monitoring of hazardous materials, ensuring timely cleanup of contaminated sites, and periodically recharacterizing hazardous sites to reflect current conditions and potential risks. Maintaining and updating emergency response plans for hazardous material spills, as well as strengthening public education and infrastructure resilience, are also critical components of effective preparedness. Integrating these strategies helps the Town of Lee manage the risks associated with hazardous materials, protect its residents, and ensure a safer, more resilient future in the face of climate change.



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# Vector-borne Diseases

## *Hazard Profile*

Vector-borne diseases (VBD) are illnesses transmitted to humans and animals through vectors such as mosquitoes, ticks, and fleas. These vectors carry pathogens like bacteria, viruses, and parasites that can cause diseases such as Lyme disease, West Nile virus, eastern equine encephalitis (EEE), and babesiosis. Climate change, environmental factors, and human activity can influence these vectors' range, abundance, and behavior, increasing the likelihood of disease transmission (EOEEA ResilientMA Plan, 2023). VBDs are included in hazard mitigation planning because natural hazards like flooding can amplify vector risks, threatening public health and community resilience.

## *Likely Severity*

The severity of vector-borne diseases (VBDs) depends on several factors, including the type of vector, the prevalence of the disease, environmental conditions, and the vulnerability of the population. In Massachusetts, the most prevalent VBDs transmitted to humans are West Nile virus (WNV) and Eastern Equine Encephalitis virus (EEE), which are primarily spread by *Culex* spp. and *Culiseta* spp., respectively. Lyme disease and anaplasmosis, transmitted to humans by ticks (*Ixodes* spp.), are also among the most common VBDs in the state. These diseases cause significant morbidity and mortality both globally and within the densely populated state of Massachusetts, with regional variability in exposure risk.

EEE, while rare, has a high fatality rate of 30% and often results in permanent neurological damage among survivors (CDC, 2024). WNV is more common but generally less severe, with most cases being asymptomatic or presenting mild flu-like symptoms; however, severe neurological complications can occur in older adults and those with compromised immune systems. EEE or WNV outbreaks depend on favorable environmental conditions, such as warm, wet summers promoting mosquito breeding. The most important public health threat from ticks is Lyme disease. The severity of tick-borne illnesses, such as Lyme disease, anaplasmosis, and babesiosis, varies but can include chronic fatigue, joint pain, and, in some cases, life-threatening complications if untreated.

Overall, these diseases can substantially impact a community, leading to significant consequences that affect the quality of life, work capacity, loss of specific bodily functions, increased long-term illness, and mortality rates. For example, in 2022, the Center for Disease Control (CDC) estimated the total societal cost—costs incurred by patients, healthcare systems, or third-party payers—of diagnosed Lyme disease ranges from $345 million to $968 million (U.S DHHS & CDC, 2024). However, reported cases tell only a portion of the story as it’s is estimated that only one in ten West Nile virus cases are reported, and the number of treated Lyme disease cases is possibly 10 times higher than the number reported by CDC. (U.S DHHS & CDC, 2024).

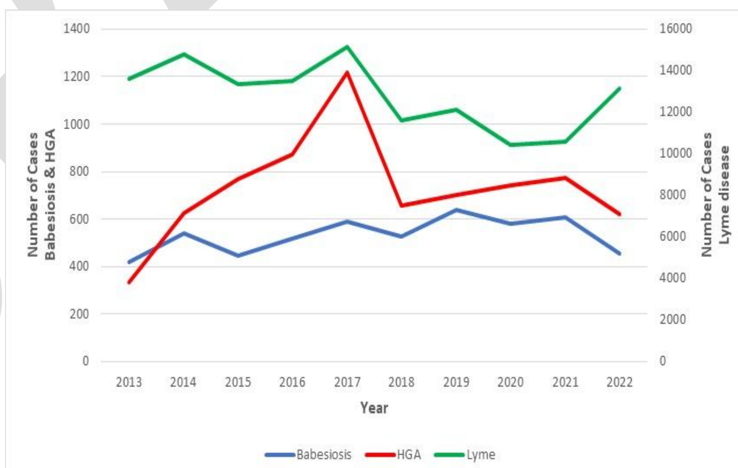
The Berkshires, including the Town of Lee, are particularly susceptible to tick-borne diseases due to the area's abundant forested landscapes, which provide ideal shelter and humidity for ticks, and high deer populations, serving as primary hosts for adult ticks and contribute to the proliferation of tick habitats. Tick populations also peak as people are more active outside furtherin increasing their exposure and risk. Additionally, certain invasive plants, such as barberry bushes and bush honeysuckle, create ideal microclimates for ticks, contributing to their population growth. Invasive plants can also alter microclimates, creating favorable conditions for adult mosquitoes to rest and breed. Specific invasive plants are discussed in greater detail in the *Invasive Species* section of this chapter. With climate change driving longer vector activity seasons and potential introductions of new vector species, the frequency and severity of vector-borne disease outbreaks are expected to increase, posing heightened risks to human health.

Authoritative organizations, such as The Massachusetts Department of Public Health (MDPH), carry out surveillance and reporting of these diseases, in collaboration with the State Reclamation and Mosquito Control Board (SRMCB) and The Northeast Massachusetts Mosquito Control and Wetlands Management District. The Regional Mosquito Control Districts (MCD), the Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA), and local health departments monitor vector populations and guide prevention and control measures.

## *Probability*

Various factors, including climate, land use, socioeconomic conditions, pest control efforts, healthcare access, and human behavior, influence the likelihood of vector-borne diseases. Climate change is particularly significant, driving shifts in the geographic range of vectors and pathogens, while local weather variations, animal host diversity, and human activities further shape disease dynamics and transmission patterns. Most mosquito-borne disease cases statewide occur between June and August.

Figure 3.27 Ten-trend of number of cases of babesiosis and anaplasmosis (HGA), and Lyme disease in Massachusetts, 2013-2022




*Babesiosis and HGA include confirmed and probable cases; Lyme includes confirmed, probable and suspect cases. Source: MDPH Bureau of Infectious Disease and Laboratory Sciences, 2022.

According to the CDC, mosquito, flea, and tick-borne illnesses in the U.S. tripled between 2004 and 2016.
During this period, at least seven new tickborne pathogens were identified in humans, and annual reported tickborne disease cases more than doubled. By 2019, tickborne diseases accounted for approximately 90% of all reported VBD cases nationwide (50,865 of 56,045 total cases).

In Massachusetts, Lyme disease remains the most reported vector-borne illness, with 5,113 probable cases recorded in 2022, representing an incidence rate of 72.7 cases per 100,000 residents (Bureau of Infectious Disease and Laboratory Sciences, 2022). Lyme disease risk peaks in late spring and summer when nymph-stage ticks are most active, although adult ticks can transmit the disease year-round when temperatures remain above freezing. Black-legged ticks, the primary Lyme disease vector, thrive in grassy and wooded environments with abundant deer and mice populations.

## Historic Data

Massachusetts has never had a state or federal emergency or disaster-related to vector-borne diseases (VBDs). However, the state has experienced periodic outbreaks of diseases like WNV and EEE, which have caused fatalities and heightened public health responses.

Between 2000 and 2019, Massachusetts reported 246 cases of WNV, resulting in 15 fatalities, and 43 cases of EEE, leading to 22 deaths. Historically, EEE cases have been sporadic, but in the summer of 2024, heightened mosquito populations prompted the first reported human EEE case in four years. This outbreak raised risk levels to "critical" in several eastern counties, leading towns to close parks from dusk to dawn to reduce exposure. In the same period, the Berkshires were elevated to "moderate" risk for WNV, with 18 human cases and 333 mosquito-positive samples reported. Additionally, the region documented 4 human EEE cases and 97 mosquito-positive samples.[i]

**Table 3.22** tick-borne disease-related emergency department (ED) visits in Berkshire County

| Year | Total Visits | Number of Tick Borne Disease Visits | Rate (Per 10,000) of Tick-borne Disease Visits |
|---|---|---|---|
| 2019 | 74,978 | 79 | 10.54 |
| 2020 | 62,6914 | 75 | 11.92 |
| 2021 | 67,626 | 128 | 18.93 |
| 2022 | 72,064 | 86 | 11.93 |
| 2023 | 71,688 | 82 | 11.4 |
| 2024 | 60,987 | 94 | 15.58 |

*Source: mass.gov/lists/monthly-tick-borne-disease-reports*

For tick-borne diseases, Berkshire County reported 87 cases of anaplasmosis, 52 cases of babesiosis, and 12 cases of Lyme disease to the CDC between 2016 and 2019. Tick-borne illnesses are a persistent concern in the region, with most cases occurring during the warm months when ticks are most active. The MDPH publishes an annual Tick Exposure and Tick-Borne Disease report to monitor trends and guide public health initiatives. Table 3.22 tick-borne disease-related emergency department (ED) visits in Berkshire County highlights tick-borne disease-related emergency department (ED) visits in Berkshire County.[ii]

## Vulnerability Assessment

### *Geographic area of concern*

The entire town is susceptible to vector-borne diseases, with exposure risks present in residential, recreational, and some commercial areas. Outdoor locations with tall grasses, standing water, wooded areas, and unmanaged properties pose the highest risk for exposure to vectors such as ticks and mosquitoes. Recreational spaces like parks, hiking trails, and open fields are particularly vulnerable during warmer months when vector activity peaks.

### *People*

The risk of VBDs in Lee varies by population demographics and behaviors. Children and older adults, particularly those aged 55 to 74, are more vulnerable to VBDs due to weaker immune systems or increased time spent outdoors for recreation or gardening. People with weakened immune systems, such as those undergoing medical treatments (e.g., chemotherapy) or with chronic illnesses, are more susceptible to severe complications from vector-borne diseases. Outdoor workers, including landscapers, construction workers, and farm laborers, are also at higher risk due to prolonged exposure to tick and mosquito habitats.

Residents who live near wooded areas, wetlands, or areas with tall grasses face greater exposure to ticks and mosquitoes. Additionally, seasonal visitors participating in outdoor activities like hiking or camping may be less familiar with preventative measures, further increasing their risk. Individuals in lower-income households may face financial barriers to accessing protective measures like repellents, protective clothing, or timely medical care, making them more vulnerable to the effects of VBDs. Those living in homes without proper window screens or air conditioning may be at increased risk of mosquito exposure indoors.

Potential chemical treatments to reduce insect populations may pose risks to public health through direct and indirect exposure. Acute exposure can cause toxicity, particularly among sensitive populations such as children and pregnant people.[iii] Additionally, bioaccumulation of pesticides in the food chain can increase human exposure, compounding these risks. Contamination of drinking water supplies through chemical runoff further exacerbates the potential health impacts.

*Built Environment*

VBDs can indirectly affect the built environment by straining healthcare facilities, increasing the demand for medical services, and necessitating upgrades to infrastructure for disease prevention and control. For instance, standing water in drainage systems, culverts, and retention basins can serve as breeding grounds for mosquitoes, prompting efforts to redesign or improve these systems to reduce risk. Public spaces, such as parks, playgrounds, and outdoor recreation areas, may also require modifications, such as enhanced maintenance or mosquito-control measures, to ensure public safety.

*Natural Environment*

The rise in vector-borne diseases often necessitates increased use of chemical pesticides and herbicides for intervention. While effective for vector suppression, this heightened chemical usage can have unintended consequences on the natural environment, including negative impacts on vegetation, soil, waterways, and wildlife. For example, wildlife that depends on ticks and mosquitoes as food sources may face population declines, disrupting food chains and ecological balance.

Diseases carried by insects, such as West Nile virus and Lyme disease, can directly affect wildlife populations, potentially causing declines in species health and diversity. Efforts to modify the environment to reduce vector habitats, such as draining wetlands or altering natural landscapes, may further disrupt ecosystems, potentially causing long-term harm to biodiversity and ecosystem health.

*Economy*

VBDs can impose significant economic burdens on communities. Direct costs include medical treatment, hospitalization, and preventive care, while indirect costs stem from lost productivity due to illness and absenteeism, as well as a potential decline in tourism. Public health departments and local governments may face increased expenditures for disease surveillance, vector control programs, and public education initiatives to mitigate the spread of diseases. Additionally, businesses reliant on outdoor recreation or tourism may experience revenue losses if disease prevalence discourages visitors or disrupts activities.

*Future Conditions*

Climate change is expected to expand the range and increase the prevalence of vector-borne diseases. Warmer temperatures, longer growing seasons, and increased precipitation create favorable conditions for ticks and mosquitoes, leading to earlier and longer breeding periods. Extreme weather events, like floods, may create mosquito habitats, while milder winters may only minimally reduce tick mortality. These shifts increase the risk of Lyme disease, WNV, and EEE, especially in areas where vector populations are vulnerable to growth.

As Lee's population ages, with more residents 55 and older, susceptibility to these diseases may rise. Older adults are more prone to severe health outcomes, and increased seasonal and recreational visitors may raise human-vector interactions, particularly during peak activity periods.

Lee has generally limited suburban sprawl and promoted revitalization in existing developed areas. Renovation projects, particularly near wooded lots or water bodies, may inadvertently disturb vector habitats, increasing human-vector interactions. Redevelopment of existing structures and infrastructure should consider measures to reduce potential breeding grounds, such as improving drainage to prevent standing water and incorporating landscaping practices that minimize tick habitats. Measures such as green infrastructure, improved drainage systems, and retention basins can help mitigate breeding habitats for vectors.

Ticks thrive in grassy and wooded areas where humans, deer, and mice interact. Land use changes, such as clearing vegetation or neglecting overgrown lots, can increase tick populations and heighten exposure risks. Promoting native plants and controlling invasive species can reduce tick habitats by eliminating the dense, humid environments they favor. Public education on maintaining native gardens can reduce exposure risks and enhance biodiversity. However, landscape management is lacking townwide, with many public spaces hosting invasive plants that support tick populations. While the town lacks a formal park commission, it is creating one as part of the Master Plan. The Tri-Town Health Department raises awareness of vector-borne diseases through its website, events, and tick ID card distribution. Further efforts may be needed as changing conditions support tick proliferation.

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[i] WNV and EEEV 2024 data retrieved from Department of Public Health. https://www.mass.gov/doc/2024-eee-and-wnv-risk-level-and-data/download

[ii] Data presented in this table were collected through the Massachusetts Syndromic Surveillance Program (MSSP), which monitors emergency department visits statewide. These figures are based on patient-stated reasons for visits and diagnostic codes, and should be interpreted as indicative of trends rather than comprehensive case counts.

[iii] Bassil KL, Vakil C, Sanborn M, Cole DC, Kaur JS, Kerr KJ. Cancer health effects of pesticides: systematic review. Can Fam Physician. 2007 Oct;53(10):1704-11. PMID: 17934034; PMCID: PMC2231435.

# Chapter 4 Capability Assessment

44 CFR § 201.6(c)(iii-iv)

## Purpose

The capability assessment evaluates a community's ability to address hazard risks and identifies opportunities to strengthen policies, programs, and activities. Along with the risk assessment (Chapter 3), it forms the foundation for an effective hazard mitigation strategy.

It is important to assess which hazard mitigation actions (listed in Chapter 5) are feasible based on the Town's capacity of staff and departments. This assessment identifies feasible measures aligned with the community's existing authorities, policies, programs, and resources while highlighting gaps that require attention and strengths that should be expanded.

The following sections review the Town's existing protections, beginning with an overview of major categories. Table 4.1 summarizes the Town's various regulations and resources, highlights identified gaps, and evaluates the potential to expand current capabilities, incorporating actionable goals outlined in the Master Plan and Open Space Recreation Plan. Table 4.1 was evaluated using the following Effectiveness Ratings matrix:

- Very Effective – Strong enforcement, widely used, significantly reduces risk.
- Effective – Works well but has minor gaps.
- Somewhat Effective – Benefits but has limitations.
- Ineffective – Fails to reduce risk or poorly implemented.
- Unknown – Needs further assessment.

Additional tables review the Town's administrative, technical, financial, and educational capabilities. Recommendations for strengthening each of these capacities are included to enhance hazard risk management. Some actions are critical to both improving capacity and achieving hazard mitigation goals, reinforcing the connection between capacity building and mitigation efforts. As such, some actions appear in both Chapter 4 and Chapter 5

## Existing Protections

Lee has a range of existing capabilities to support hazard mitigation efforts. These capabilities are the foundation for the Town's ability to reduce risks from natural hazards and adapt to future challenges.

### *Regulatory Framework for Land Use and Development*

The Town has adopted the Massachusetts Building Code (780 CMR), among the most stringent in the country. This code ensures structures meet high standards for resilience against snow loads, wind resistance, seismic activity, and flood risk. The building inspector and the planning board manage the enforcement of these standards and ensure compliance with state and local regulations. The state must certify local municipal building inspectors to be eligible for the position.

The Town's zoning bylaws also include provisions restricting development in high-risk areas. Overlay districts, such as the Smart Growth Overlay District and Adaptive Reuse Overlay District, encourage sustainable development by promoting redevelopment of existing structures and minimizing environmental impact in potentially hazard-prone areas. Additionally, the floodplain management bylaw, covering floodplain areas adjacent to the Housatonic River, Goose Pond, Laurel Lake, and all tributaries and drainage ways, requires special permits for any new construction, primarily prohibiting or limiting developments that could exacerbate flood risks. This regulatory framework is guided by FEMA's Flood Insurance Rate Maps (FIRM), which the Town adopted in 1982, though updated maps are needed to reflect current and future conditions.

Lee's zoning bylaws encourage environmentally sustainable development practices, including low-impact development techniques and best practices for stormwater management. However, a dedicated stormwater management bylaw is needed to mitigate runoff impacts further and ensure adequate measures are in place for land disturbance and new developments. The Town could also benefit from a comprehensive review of its regulations to identify areas where sustainable development, including green infrastructure, can be further encouraged. Tools like Mass Audubon's Local Bylaw Review Tool can assist in evaluating existing zoning, subdivision, and stormwater bylaws against best practices. This review can highlight opportunities to incorporate nature-based solutions, strengthen stormwater retention requirements, and enhance flood resilience measures.

### *National Flood Insurance Program*

The Town of Lee is also an active participant in the National Flood Insurance Program (NFIP), which requires communities to adopt and enforce floodplain management standards to mitigate flood risks. In exchange, property owners and renters gain access to federally backed flood insurance, reducing the socio-economic impacts of disasters. The Town has adopted FEMA's 1982 Flood Insurance Rate Maps (FIRMs), the latest issued for Berkshire County, to guide floodplain management decisions (refer to Figure 3.3 for Lee's floodplain areas). The Town's Floodplain Management Bylaw (Chapter 108) and Floodplain Overlay District provide a comprehensive regulatory framework to manage flood risks. Special permits are required for any new buildings or substantial improvements within the overlay district, aiming to prohibit or severely limit construction that could increase flood levels or exacerbate hazards. The Town is in good standing with the NFIP and has no recorded violations of floodplain management regulations.

New construction and substantial improvements in flood-prone areas require a special permit to ensure compliance with elevation, construction, and mitigation requirements. The Building Inspector, who serves as the Town's designated NFIP Coordinator, oversees permitting and enforcement of these regulations. Compliance is ensured through:

- Reviewing permit applications using a GIS floodplain overlay and FIRM data.
- Confirming finished floor elevations meet or exceed Base Flood Elevation
- Be designed and anchored to prevent the flotation, collapse or lateral movement of the structure or portions of the structure due to flooding.
- Use construction materials and utility equipment that are resistant to flood damage.
- Use construction methods and practices that will minimize flood damage.
- Provide adequate drainage to reduce exposure to flood hazards.

- Locate public utilities and facilities on the site in such a manner as to be elevated and constructed to minimize or eliminate flood damage, such utilities and facilities to include sewer, gas, electrical and water systems.

In the event of a disaster, the Town enforces Substantial Improvement (SI) and Substantial Damage (SD) provisions to bring damaged or significantly renovated structures into NFIP compliance. The Building Inspector assesses post-disaster damages to determine if the 50% market value threshold is met. If so, the property owner must retrofit, elevate, or floodproof the structure before rebuilding.

As of November 27, 2023, the community has:

- 33 active NFIP policies for properties within SFHAs
- total premiums and fees amounting to $85,440, averaging $2,589 per policy.
- 3 with repetitive losses account for 9 claims, with $43,305.33 paid for building damages and $8,373.46 for contents.

However, the number of NFIP policies is notably low compared to the estimated 200 properties located in the floodplain, as identified through FEMA's FIRMs. Several factors may contribute to this disparity. For instance, flood insurance is only required for properties with federally backed mortgages in SFHAs. Property owners who have paid off their mortgages or use other financing options are not obligated to purchase insurance. Additionally, property owners may underestimate flood risks, especially if there hasn't been a significant flood event in recent years. This perceived lack of risk may be challenging for property owners to justify, the expense of flood insurance policies which might deter participation, particularly among lower-income households. Lastly, some property owners might not realize their property is in a designated floodplain or understand the benefits of flood insurance.

To expand on this data, FEMA's HUDEX (Policy and Loss Data by Geography) report provides a broader perspective by including flood insurance participation and claims both within and outside SFHAs. This data highlights that the Town has a:

- total of 37 NFIP policies, which includes 4 policies for properties outside SFHAs where flood insurance is voluntary.
- These policies collectively amount to $115,145 in total premiums and fees, with total coverage of $12,639,000.
- Lee has reported 17 flood-related claims in total, resulting in $61,409 in net payments and $4,162 in adjuster expenses. This aligns with an average payout of $3,612 per claim.

While the average payout per claim is relatively low, this does not diminish the need for flood mitigation measures, especially considering the higher occurrence of precipitation events and future climate trends.

The inclusion of voluntary policies reflects an awareness of flood risks beyond the floodplain. Broader outreach and mitigation planning could further address underinsurance and build community resilience. Additionally, repetitive loss properties highlight the need for targeted interventions to curb recurring claims and associated costs. The Town does not currently participate in the Community Rating System (CRS) but is exploring its benefits. While CRS Activity 510 planning requirements are included in the plan, they will not be evaluated until the Town applies for CRS participation.

### *Natural Protection Systems*

The Town also benefits from natural mitigative infrastructure such as forests, wetlands, and open spaces, which provide essential ecosystem services, including floodwater absorption, stormwater filtration, and soil stabilization, many of which are not easily quantified. These areas are protected under the Massachusetts Wetland Protection Act and the Scenic Mountain Overlay District, which regulate land disturbance activities to prevent adverse effects on water resources and environmental degradation. Many large parcels within the Town are also subject to conservation restrictions, agricultural preservation programs, or land trust ownership, which exclude future development and ensure long-term protection. The Conservation Commission is critical in overseeing these protections, with the authority to apply special conditions to development projects to minimize environmental degradation and protect these resources. Conservation efforts strengthen the Town's resilience to disasters and provide a significant economic benefit. According to an economic analysis by the Trust for Public Land, every $1 invested in land conservation through Massachusetts state funding programs returns $4 in natural goods and services to the Commonwealth's economy (The Trust for Public Land, 2013).

### *Updated Planning Documents*

Recently developed planning documents, such as the Master Plan and Open Space and Recreation Plan, provide a strong foundation for expanding the Town's hazard mitigation capabilities. These plans propose actionable steps to address key vulnerabilities. For example, they recommend modernizing subdivision regulations to align with current best practices, enhancing stormwater infrastructure to adapt to climate change, and developing strategies to manage private wells and municipal water resources better. Additionally, the plans emphasize preserving wildlife habitats, improving invasive species management, and strengthening protections for natural resources and floodplains. Together, these initiatives form a comprehensive approach to increasing the Town's resilience against future hazards.

In February 2023, the Town of Lee adopted a "Complete Streets" policy, approved by MassDOT, to enhance safety and accessibility for all travel modes. Complete Streets can support hazard mitigation by improving stormwater management, reducing roadway flooding, and ensuring safe evacuation routes and emergency access. The Town's Tier 2 prioritization plan, currently in development, will identify key projects and position the Town for state funding eligibility by Fall 2025. Prioritizing climate resiliency in this plan can align transportation upgrades with hazard mitigation goals.

### *Capital Investments*

The Town of Lee has been actively investing in infrastructure improvements to enhance safety, reliability, and resilience across its critical systems. Recent investments include $6.3 million upgrade to the Wastewater Treatment Plant in 2005, $1.3 million Emergency Water Plant constructed in 2009-2010, and  $1.1 million allocation for fire and ambulance upgrades in 2021.

Ongoing efforts include road repairs, with major paving projects completed in the past three years on key streets such as Spring Street, Summer Street, West Road, and Main Street, among others. The Town has also prioritized water main replacements in critical areas, including Railroad, West

Center, Center, and East Center Streets, as well as portions of Greylock and Robert Streets. Several locations have replaced outdated hydrants, though nine still require replacement.

Over the next five years, planned projects include annual street paving and repairs, replacing aging DPW equipment, upgrading Fire/EMS vehicles and radios, and modernizing police communication systems. Sewer system improvements will address power outages and flooding vulnerabilities. Lastly, the elementary, middle, and high schools will have multi-phase roof replacements at schools, which also serve as emergency shelters.

The most significant investment for the Town includes the multimillion-dollar construction of a new safety Public Safety Complex, addressing long-standing inefficiencies in its fire, police, and EMS facilities. The current fire station, built in 1912 for horse-drawn equipment, cannot accommodate modern apparatus. The new facility will allow the Town to design equipment based on community needs rather than outdated infrastructure. Similarly, the 1600-square-foot police station, over 100 years old, is less than half the size needed to support the force's operations. Scheduled for completion in 2027, the safety complex will be a 37,661-square-foot facility located at 41 Railroad St, placing the fire, police, and EMS services in a more central location. The expanded space will enable departments to address staffing needs and meet increased public service demands, as highlighted during the Community Resilience workshop. It will also include a 75- 100-person community room, a personnel training tower, and enhanced operational space for faster response times and improved emergency services for residents. The additional space will also serve as temporary short stay shelter if needed.

Additionally, the Town faces challenges with aging infrastructure, including outdated culverts and water systems, some over a century old. These require significant investment to reduce flood risks, improve reliability, and prevent emergencies. While water line replacements are coordinated with road projects, a comprehensive assessment is needed to understand their condition better and reduce emergency repairs.

### *Emergency Response and Preparedness*

The Town has a solid foundation in emergency response through its fire, police, and EMS services. The Fire Department is a combination department, with full-time staff covering 24/7 shifts and two firefighters per shift. In addition to 10 full-time firefighters, the department relies on 37 total firefighters, many of whom commute long distances. Part-time staff are used for short-term staffing needs. The Police Department has 13 full-time staff and is currently short-staffed by 2 officers.

The Fire Department is part of the Berkshire County Fire Chiefs Mutual Aid Agreement, covering 32 towns, and the Western Massachusetts Fire Chiefs Association, which allows for support as far as Boston. The Police Department operates under mutual aid with other Berkshire County chiefs and state and federal agencies. EMS has backup agreements with the Office of Emergency Medical Services and can call upon MEMA when needed.

The Emergency Operations Plan (EOP) is regularly updated to address emerging risks and is reviewed annually by key departments. While effective, the EOP lacks Tri-Town Health’s involvement. A challenge for the Town is insufficient staffing to handle additional emergency preparedness duties, straining resources. The Police Department is also working on updating its procedural manual to meet certification standards.

Like many fire departments, recruiting and retaining volunteers remains a challenge. With only 12 active volunteers, the Fire Department struggles to meet staffing demands, especially as new development increases service needs. The Town faces challenges ensuring emergency services keep pace with population growth and increasing hazard risks. Staffing and outreach to vulnerable populations, such as non-English speakers and seniors, also remain ongoing concerns.

Table 4.1 Town of Lee's Existing Protections

| Type of Existing Protection | Description/Responsible Authority | Area Covered | Effectiveness | Improvements Needed | Ability to Expand/Implement |
|---|---|---|---|---|---|
| **Planning/Regulatory Tools** | | | | | |
| Bylaw- Flood Plain Management | Establishes zoning and permitting requirements for development in floodplain and wetland areas, ensuring flood damage is minimized through elevation, proper drainage, and flood-resistant materials. Supports compliance with NFIP requirements. | Floodplain areas adjacent to the Housatonic River, Goose Pond, Laurel Lake, and all tributaries and drainage ways | Effective | Update to FIRMs to reflect current conditions; provide more frequent training for the Building Inspector and Planning Board on flood resilience best practices. | Expand collaboration with FEMA and state agencies for mapping updates; educate property owners on flood-resistant construction practices; leverage the Master Plan recommendation to conduct a policy review of floodplain development restrictions and identify opportunities for stricter regulations |
| Bylaw- Uniform Building Numbering System | Establishes a consistent and clearly visible building numbering system for dwellings, businesses, and parcels of land that ensures efficient identification of properties for emergency services, aiding in quicker response times during disasters, evacuations, and emergencies. | Applies to all properties and parcels of land within the Town of Lee, including residential, commercial, and multi-unit buildings. | Effective | None | None |
| Bylaw- Alarm Systems Regulation | Establishes a system for registering, monitoring, and maintaining private intrusion, fire, and medical alarms. Seeks to ensure rapid emergency response, and enhance public safety by requiring operational reliability and maintenance of alarm systems | All private properties in the Town of Lee that have intrusion, fire, or medical alarms installed. Municipal buildings are exempt. | Effective | Potential gaps in compliance, particularly in rural or private properties. | None |

| Type of Existing Protection | Description/Responsible Authority | Area Covered | Effectiveness | Improvements Needed | Ability to Expand/Implement |
|---|---|---|---|---|---|
| Bylaw- Flexible Development | Preserves 50% of a parcel as protected open space, reducing environmental impacts and supporting agriculture, and conservation. | Applies to parcels undergoing flexible development | Somewhat effective – limited to new developments under flexible provisions. | Evaluate for effectiveness | Align with Master Plan goals to minimize land clearance. |
| Bylaw- Water use Restrictions and Emergency Management | Regulates water usage during periods of conservation or emergencies to ensure adequate water supply. | Entire Town applying to all public and private water uses on the municipal water system | Effective | The Town has never had to issue a water ban. | Use the Master Plan's guidance to survey private wells and plan for future connections to the municipal water system, ensuring access during emergencies. Develop additional conservation measures and incentives for water efficiency during non-emergency periods. |
| Zoning - Smart Growth Overlay District (SGOD) | Encourages resilient redevelopment by reusing underutilized buildings, reducing new construction in undeveloped areas, and minimizing flood risks through strategic land use, while supporting mixed-use development and affordable housing. | Defined overlay district within the Town, covering eligible properties Lee's Assessor's map 12A, Parcel 63, 64, 66, 67, 68, 69, 70, 71 and 72 | Effective though the only applicable scenario is the Eagle Mill Redevelopment | Evaluate the district's capacity to support climate-resilient designs, such as incorporating renewable energy, green infrastructure, and updated flood mitigation measure | Can be expanded by reviewing design standards, encouraging more robust hazard mitigation strategies, and ensuring alignment with other climate resilience initiatives |

| Type of Existing Protection | Description/Responsible Authority | Area Covered | Effectiveness | Improvements Needed | Ability to Expand/Implement |
|---|---|---|---|---|---|
| Zoning-Adaptive Reuse Overlay District (AROD) | Encourages the reuse of eligible large-scale buildings, such as municipal, private, and school buildings, that are at least 15 years old and 10,000 square feet in size. Promotes efficient land use, minimizes the need for new infrastructure, | Superimposed over underlying zoning districts across the entire Town. Site-specific to eligible buildings meeting the criteria in any zoning district. | Effective | Include more explicit hazard mitigation requirements (e.g., floodproofing for buildings in flood-prone areas or sustainability standards). | The Planning Board and Board of Selectmen can enhance implementation by streamlining permits, fostering collaboration, leveraging funding, and engaging developers and stakeholders. |
| Zoning-Scenic Mountain Overlay District (SMOD) | Regulates land disturbance activities in scenic and environmentally sensitive mountain areas to protect watershed resources and prevent water quality degradation. Minimize development on steep slopes providing protection against landslides | Applies to designated mountain and hillside areas defined in the overlay district. | Effective; enforcement depends on compliance with permitting processes and proper oversight by the Lee Conservation Commission. | Provide resources to support monitoring and enforcement of special conditions. | Expand coverage to other vulnerable or scenic areas as needed. Enhance educational efforts to increase compliance and awareness. Collaborate with state and regional conservation bodies for technical support and funding. Streamline NOI processes to maintain effective protection while encouraging sustainable development. |
| Wetlands Protection Act | The Conservation Commission administers the Act to protect Wetland Resources as defined, including floodplains | Wetland resources as designated by the Act | Effective | Improve enforcement and monitoring to ensure flood risk reduction and protection of wetland integrity; provide education on wetland importance and regulations. | Expand resources for enforcement and monitoring; collaborate with state agencies for technical and funding support |
| Subdivision Regulations | The Planning Board enforces subdivision regulations to ensure safe and sustainable land development. | Regulations apply to all land subdivisions | Effective; Ensures proper drainage, road access, and emergency | Regular updates to incorporate evolving best practices in hazard mitigation and to | The Planning Board has the authority to amend regulations, but additional staffing or |

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|---|---|---|---|---|---|
| | | within the Town's jurisdiction. | accessibility, reducing flood and hazard risks. | address emerging environmental concerns. | funding may be needed for enforcement |
| **Type of Existing Protection** | **Description/Responsible Authority** | **Area Covered** | **Effectiveness** | **Improvements Needed** | **Ability to Expand/Implement** |
| Emergency Management and Response | | | | | |
| Emergency Response Services (Police, Fire/EMS) | The Police Department, Fire/Rescue/EMS Department provide emergency services including fire protection, paramedic-level EMS, hazardous materials response, and water/ice rescue. | Entire Town | Effective | Complete construction of the new Public Safety Complex to address space and operational inefficiencies. Expand recruitment strategies to increase staffing | With the new complex approved, the Town can enhance facilities and coordination between services. Federal and state grants can support equipment, staffing expansions, and training programs. |
| Emergency Operation Plan (EOP) | Establishes procedures and protocols for responding to emergencies, coordinating resources, and ensuring public safety. Reviewed annually by all stakeholders. | Entire Town and surrounding areas | Effective | Ensure the EOP is reviewed and updated regularly to reflect current hazards, community needs, and available resources. Improve coordination be | Leverage state and federal grants for plan updates; increase collaboration with regional partners for mutual aid; follow master plan recommendation to establish a formal review schedule and engage relevant stakeholders to ensure alignment with evolving hazard mitigation and response needs |
| Emergency Shelters (Lee Public Schools) | Provides a safe place to go during a disaster or emergency for short-term stay. Director of Ground & Maintenance tests and maintains generators on a regular basis. The last time the shelter was used was 10 years ago but with successful execution. The Town has short-term/temporary shelter operations designated at the Council on Aging at Hyde Place | Entire Town | Effective | Increase public awareness of shelter locations and their purpose | Evaluate current shelter facilities for climate resiliency (e.g., backup power, insulation, cooling/heating systems); Incorporate demographic studies and regional planning data to assess future resource and infrastructure needs; leverage grants for upgrades, staff, training, and emergency supplies. |

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| | with options to expand to long-term sheltering at the Elementary School. Shelter operations are listed with the Town's Emergency Operation Plan. | | | | |
| Reverse 911 Emergency Notification System | Sends automated emergency alerts to residents. Residents must register for cell phone and email notifications; landlines are usually automatic. | Entire Town, based on registered numbers | Effective, but dependent on up-to-date contact lists | Increase outreach to inform new residents and ensure wider registration, including promoting the system during town events, on social media, and through local organizations. | Leverage Master Plan actions to improve digital access: expand high-speed internet, update wireless bylaws, and address service gaps to enhance emergency notification reach; Expand system integration with multilingual messaging and outreach campaigns; enhance registration accessibility for all populations, such as seniors or those without internet access. |

| Type of Existing Protection | Description/Responsible Authority | Area Covered | Effectiveness | Improvements Needed | Ability to Expand/Implement |
|---|---|---|---|---|---|
| **Infrastructure** | | | | | |
| Replacement of Culverts | The Town has replaced a number of culverts over the past few years as needed. | Entire Town applying to all public and private water uses on the municipal water system | Mostly effective | Culverts throughout Town need upsizing due to increase precipitation. Additional funding is needed to meet road stream crossing standards and due to rising material costs | The Complete Streets policy and Tier 2 prioritization plan provide an opportunity to integrate culvert upgrades into transportation improvements. A town-wide culvert assessment aligned with these efforts could help secure state funding and address key infrastructure needs. |
| Strom Drain Regulation | Ensures storm drainage systems are designed and maintained to handle 100-year storm events, prevent flooding, minimize | Town wide | Effective | Incorporate green infrastructure solutions and enhanced maintenance requirements; | Conduct a green infrastructure bylaw review using tools like Mass Audubon's Local Bylaw Review Tool to identify opportunities for enhancing |

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|---|---|---|---|---|---|
| | erosion, and effectively manage stormwater runoff | | | Incorporate Master Plan recommendations to ensure new public and private stormwater facilities are designed for climate resiliency | stormwater management practices |
| Infrastructure Investments (Roads, Water Systems, Hydrants) | Regular paving projects improve road safety and durability, ensuring reliable transportation during emergencies. Water main replacements reduce the risk of infrastructure failure and maintain consistent water supply, including for firefighting. Hydrant replacements enhance the Town's ability to respond to fires effectively. | Town-wide | Effective | Increase funding and staffing to accelerate infrastructure upgrades. Expand investment in resilient materials for paving and water systems to mitigate future hazards. | Leverage grants or state/federal funding to address budget constraints. |
| Dam Monitoring | High-hazard dams are required to be monitored and inspected per the Massachusetts Office of Dam Safety regulations. GE monitors dams under an EPA permit tied to PCB cleanup efforts on the Housatonic River. The Police and Fire Department also receive annual reports to integrate with the EOP. . | Housatonic River, Laurel Lake, Town-owned reservoirs | Effective | Develop local oversight for dam monitoring and ensure all inspections and emergency action plans are up-to-date. | Strengthen coordination with the Office of Dam Safety and EPA. Leverage state/federal funding for maintenance and repairs; Collaborate with private dam owners for proactive maintenance and hazard mitigation strategies. |

| Type of Existing Protection | Description/Responsible Authority | Area Covered | Effectiveness | Improvements Needed | Ability to Expand/Implement |
|---|---|---|---|---|---|
| Land and Natural Resource Management | | | | | |
| Protected Lands | Includes lands protected under Massachusetts General Laws | Over 600 acres of watershed lands | Effective | Enhance stewardship (e.g., invasive species | Potential to partner with land trusts, apply for state/federal |

| | | | | | |
|---|---|---|---|---|---|
| | Chapters 61, 61A, and 61B, Conservation Commission lands, and watershed lands. These lands preserve natural ecosystems, protect drinking water supplies, reduce flooding, and provide passive recreation. | in the eastern hills; 170+ acres under Conservation Commission management (e.g., Dunn Park Preserve, Ferncliff Reservation). Private open spaces protected by land trusts or agricultural conservation restrictions. | | control, erosion management). Increase public awareness through education programs; develop clear guidelines and strategies to ensure wildlife habitats and corridors are preserved in both public spaces and private property developments. | conservation grants, and expand conservation areas; .Consider corridors linking existing protected lands to improve resilience; Integrate wildlife habitat preservation into land use permitting processes as recommended in the Master Plan. |
| Invasive Species Control | Town operates a boat washing station at Laurel Lake for zebra mussels; periodic burning for phragmites; Laurel Lake and Goose Pond drawdowns for zebra mussel control; Lee Greener Gateway Committee removes invasives on town trails. DCR has been conducting control burn with phragmities in South Lee on the Hop Brook Conservation area with some success. | Wetlands, Laurel Lake, Goose Pond. Town Parks, and Forests | Somewhat effective; relies heavily on volunteer efforts and individual compliance. | Expand educational outreach to increase public participation in invasive control efforts; evaluate effectiveness of burning and drawdowns; increase resources for monitoring and removal; leverage Masterplan recommendation to develop a comprehensive inventory and management plan for invasive species to coordinate removal efforts more effectively. | Secure additional funding for invasive species management; partner with state and federal programs for broader control measures; recruit and train more volunteers. |
| Tree Trimming | The Highway Dept does tree trimming and fall tree removal when necessary. The Town also works with utilities to maintain overhead branches in utility corridors. | Town wide in public rights-of-way and utility corridors. | Effective | Expand proactive maintenance programs, prioritize high-risk areas | None |

*Safe Growth Survey*

The Town Planner administered a Safe Growth Survey to evaluate the Town's planning and regulatory frameworks. The safe growth audit aims to analyze the impacts of current policies, ordinances and plans on community safety from hazard risks due to growth. This survey was adapted from a framework originally designed by the American Planning Association. It examines six critical areas: 1) Land Use, 2) Transportation, 3) Environmental Management, 4) Public Safety and Zoning Ordinances, 5) Subdivision Regulations, and 6) Capital Improvement Programs along with Infrastructure Policies.

Although inherently subjective, the Safe Growth Survey was utilized as a tool to assess the effectiveness of the Town of Lee's current planning frameworks in promoting safe growth. The survey also aimed to incorporate hazard risk management more fully and to uncover potential new actions that align with existing or developing policies. Future plan updates will likely include repeated use of the Safe Growth Survey to track progress and identify ongoing mitigation strategies for future growth and community development. A summary of the survey results can be found in table 4.2 which shows the degree of agreement or disagreement from planning staff measured on a 5-point scale ranging from 1 valued at "Strongly Disagree" to 5 valued at "Strongly Agree."

Table 4.2 Safe Growth Survey Results

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Land Use and Zoning Ordinances (ZON) | | | | | |
| The future land-use map clearly identifies natural hazard areas. | | x | | | |
| The land-use policies discourage development or redevelopment within natural hazard areas. | x | | | | |
| The plan provides adequate space for expected future growth in areas located outside natural hazard areas. | | | x | | |
| The zoning ordinance conforms to the comprehensive plan in terms of discouraging development within natural hazard areas. | | x | | | |
| The ordinance contains natural hazard overlay zones that set conditions for land use within such zones. | x | | | | |
| Rezoning procedures recognize natural hazard areas as limits on zoning changes allowing greater intensity of use. | x | | | | |
| The ordinance prohibits development within, or filling of, wetlands, floodways, and floodplains. | x | | | | |
| Transportation | | | | | |
| The transportation plan limits access to hazard areas. | | x | | | |
| Transportation policy is used to guide growth to safe locations. | | x | | | |
| Movement systems are designed to function under disaster conditions (e.g., evacuation). | | x | | | |
| Environmental Management | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Environmental systems that protect development from hazards are identified and mapped. | | | x | | |
| Environmental policies maintain and restore protective ecosystems. | | | x | | |
| Environmental policies provide incentives to development located outside protective ecosystems. | | | x | | |
| Public Safety | | | | | |
| The goals and policies of the comprehensive plan are related to those of the FEMA Local Hazard Mitigation Plan. | | | x | | |
| Safety is explicitly included in the plan's growth and development policies. | | | x | | |
| The monitoring and implementation section of the plan covers safe growth objectives. | | | x | | |
| Subdivision Regulations (SUBDIV) | | | | | |
| The subdivision regulations restrict land subdivision within or adjacent to natural hazard areas. | | x | | | |
| The regulations provide for conservation or cluster subdivisions to conserve environmental resources. | | x | | | |
| The regulations allow density transfers where hazard areas exist. | | x | | | |
| Capital Improvements Program (CAPITAL MPR) | | | | | |
| The capital improvement program (CIP) limits expenditures encouraging development in areas vulnerable to natural hazards. | x | | | | |
| Infrastructure policies limit the extension of facilities/services, encouraging development in vulnerable areas. | x | | | | |
| The capital improvement program provides funding for hazard mitigation projects in the FEMA Mitigation Plan. | | | x | | |
| Comments: The CIP focuses on maintaining existing infrastructure, not extending it, so it doesn't push development into hazard-prone areas. Subdivision regulations require Planning Board approval for new development, ensuring projects prioritize community health and safety over risky expansions. The Town's Hazard Mitigation Plan is actively being drafted, with one of its key goals being to align it with the CIP so that identified hazard mitigation projects can secure funding. | | | | | |
| Additional Questions | | | | | |
| Small area or corridor plans recognize the need to avoid or mitigate natural hazards. | | | x | | |
| The building code contains provisions to strengthen/elevate construction to withstand hazard forces. | | | | x | |
| Economic development/redevelopment strategies include provisions for mitigating natural hazards. | | x | | | |
| There is an adopted evacuation and shelter plan for emergencies from natural hazards. | | | | x | |

## *Administrative and Technical Capabilities*

The Town of Lee benefits from a robust foundation of professional public services. Table 4.3 documents and review the current administrative and technical capabilities of the Town. These include staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions.

Table 4.3 Administrative and Technical Capabilities

| Administrative/Technical Resource | Full- Time (FT) Part- Time (PT) Volunteer (V) | General Description / Effectiveness for Hazard Risk Reduction |
|---|---|---|
| **Administrative** | | |
| Planning Board | FT | Staffing is adequate with strong institutional knowledge to administer and enforce. Effective with coordinating departments but training for hazards and mitigation is lacking. |
| Conversation Commission | V/PT | The commission is primarily composed of volunteers, many of whom have significant experience and institutional knowledge. However, fieldwork for permit enforcement, such as the Wetlands Protection Act (WPA) and Notices of Intent (NOIs), is currently limited. There is an opportunity to enhance field presence by hiring a dedicated staff member or agent. Exploring collaboration with neighboring towns to share resources is being considered as a potential solution. |
| Hazard Mitigation Planning Committee | V | Representatives include DPW Director and staff from multiple Town departments including Fire, Police, and Town Admin. Regularly review HMP and MVP plans and coordinate with other town planning efforts. Effective for sustaining long-term risk reduction efforts across multiple departments |
| Tri-Town Health | FT/PT | Operates as a regional health department serving Lee, Lenox, and Stockbridge. Staffing is adequate to administer and enforce, but training for hazards and mitigation is lacking. Coordination between departments is effective. |
| Maintenance Programs to Reduce Risk (e.g., tree trimming, drainage clearance) | FT (DPW) | Tree trimming and drain line clearing are part of the Highway Department staff's day-to-day duties. Lee maintains a cooperative relationship with Eversource, the Town's electricity provider. With the majority of the Town connected to Eversource, power outages are often resolved within a day, significantly reducing disruptions. The collaboration ensures seamless communication and coordination during emergencies, enhancing recovery efforts. |
| **Staff** | | |
| Town Administrator | FT | Staffing is adequate to administer and enforce. Effective for coordinating departments, and secures funding to reduce risks and enhance public safety. |

| | | |
|---|---|---|
| Chief Building Official | FT- shared services between Towns of Lee, Lenox, Great Barrington & Stockbridge | Staffing is adequate to administer and enforce, but training for hazards and mitigation is lacking. Coordination between departments is effective |
| Town Planner | FT | Staffing is adequate to administer and enforce, but training for hazards and mitigation is lacking. Coordination between departments is effective |
| Floodplain Administrator | FT (part of Building Inspector's duties) | Staffing is adequate to administer and enforce, but training for hazards and mitigation is lacking. Coordination between departments is effective. |
| Emergency Manager | FT | The Fire Chief is the acting manager, and the Police Chief serves as deputy. Staffing is adequate to administer and enforce, and coordination between departments is effective. |
| Resource Development Staff or Grant Writers | Mixed | The Town Administrator, Town Planner or Berkshire Regional Planning Commission secures grants and funding for projects |
| Public Information Officer | FT | Duties fall to Town Clerk. Staffing is adequate to administer and enforce. Effective with coordinating departments but training for hazards and mitigation is lacking. |
| GIS Coordinator | FT | Duties falls to Accessor's Office |
| Town Engineer | No | |
| Technical | | |
| Staff with knowledge of land development and land management practices | FT - Town Planner; V - Planning Board, V – Con Com | Staff not trained in hazard risk reduction. Awareness of hazards is through experiences and discussions with others |
| Staff trained in construction practices related to buildings and/or infrastructure | FT Building Inspector; FT DPW Director; | Staff not trained in hazard risk reduction. Awareness of hazards is through experiences and discussions with others |
| Staff with an understanding of natural hazards and risk mitigation | Fire Chief- FT | The fire department has a strong understanding of natural hazards within it's scope but recognizes the need for additional support in certain area. Specifically, there is a need for training in swift water rescue due to the risk of creeks swelling and overflowing during heavy rain events. Predicted hazards are part of the Emergency Operation Plan. |
| Hazards data and information | | No central repository for hazards data and information, though the Town does maintain some information as required (e.g., FEMA FIRM map products, technical studies, reports, etc.). Coordinates with Berkshire Regional Planning Commission. |

| | | |
|---|---|---|
| Warning systems/services (e.g., Reverse 911, outdoor warning signals, etc | FT | The Town's emergency notifications rely on 911 back calls, social media, and town administrator messages. MEMA's geo-fencing alerts are limited and delayed, and the Town is not a CodeRed community but is exploring better options, including outreach to non-English speakers. AI assistance is being used for language translation, and the Town is seeking grants to improve emergency communication. More support is needed to identify and assist Spanish- and Portuguese-speaking communities. |

### *Financial Capabilities*

Table 4.4 identifies the Town's eligibility and access to funding sources that can be used to support the implementation of hazard mitigation projects.

Table 4.4 Financial Capabilities

| Financial Tool/Source | Accessible Hazard Mitigation (yes/No) | General Description / Effectiveness for Hazard Risk Reduction |
|---|---|---|
| General Funds | Yes | Funds used to repair or replace aged and deteriorated culverts |
| Capital Improvement Program (CIP) Funding | Yes | Funds have been strategically used to address risks through infrastructure upgrades, enhanced emergency response, and strengthening of critical facilities. |
| Incur debt through general obligation bonds and/or special tax bonds | Yes | Bond is financing the construction of a new public safety complex. Additionally, outstanding water/sewer bonds from 2005 were issued for major system upgrades. |
| Community Preservation Act (CPA) Funds | No | The Town of Lee has not yet used CPA funds for hazard risk reduction projects. The CPA program was adopted only a few years ago, and funds have not yet been allocated to projects directly tied to reducing hazard risks. Opportunities could be explored as the program matures. |
| Special purposes taxes | No | |
| Fees for water, sewer, gas, or electrical services | Yes | Water fees are allocated for town own dam inspections and the operation of the water treatment facility |
| Stormwater utility fee | No | |
| Development impact fees | No | |
| Incur debt through private activities | No | |
| FEMA Hazard Mitigation Assistance (HMA) | Yes | The Town anticipates applying for HMCP grants once the HMP is fully accepted and adopted. FEMA's current HMA grant programs (BRIC, FMA, |

| | | |
|---|---|---|
| | | HMGP) remains a good source of external funding for the implementation of eligible and cost-effective mitigation projects through coordination with MEMA. |
| HUD Community Development Block Grant (CDBG) | Yes | The Town has participated in the CDBG program for one year, rehabilitating 16 homes. Fifteen focused on lead abatement, while one addressed structural issues, including replacing a rotted deck and adding gutters. This program can potentially support future resiliency efforts by funding repairs that mitigate risks from natural disasters, such as reinforcing structures or improving drainage systems. |
| Other federal funding Programs | Yes | EPA, USACE, and other federal agencies do make grant funding available for a variety of resilience-based projects and initiatives that the Town may be eligible to pursue in the future. |
| State Funding Programs | Yes | The Commonwealth makes a variety of funding programs available on a routine basis to support local risk reduction projects. Some of the most applicable opportunities for the Town include MVP Action Grants and other annual grant programs through EEA, such as the Culvert Replacement Municipal Assistance Grant Program. |

### *Education and Outreach Capabilities*

Table 4.5 identifies education and outreach programs that can be used to support mitigation.

Table 4.5 Education and Outreach Capabilities

| Program/Method | Yes/No | General Description / Effectiveness for Hazard Risk Reduction |
|---|---|---|
| Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access, and functional needs populations, etc. | Yes | The Town benefits from a rich network of community and business organizations, including the Lee Library, the First Congregational and St. Mary's Churches, the Senior Center/Council on Aging, Public and Private schools, the Cultural Council, Lions Club, and the only supermarket – Big Y Foods. The Kiwanis Club also hosts a public safety day. These groups provide diverse services and programs that enhance quality of life and serve as informal support systems during emergencies. These organizations also strengthen the Town's capacity to mobilize during crises, offering spaces for shelter, communication hubs, and a pool of volunteers ready to assist. |

| | | |
|---|---|---|
| Organizations that represent/advocate for/interact with underserved and vulnerable communities | Yes | The Housing Authority and The Council on Aging (COA) provides services and outreach to seniors, a particularly vulnerable population during extreme weather events. Programs like the Elder Well-Being Check ensure safety during emergencies. The Tri-Town Health District supports low-income and at-risk residents with public health resources, water conservation education, and emergency preparedness information. Lee Food Pantry distributes food, pet food, and diapers, which serve residents of Lee and its surrounding towns of Stockbridge, Tyringham, Lenox Dale, and Becket. The pantry is temporarily located and relies on a mix of volunteers. The Food Bank of Western Massachusetts Brown Bag: Food for Elders program provides a free bag of healthy groceries to eligible seniors monthly at the COA. |
| Social Networks or Social Infrastructure | Yes | Lee's identity is deeply rooted in its community spirit, pride, and strong social resilience. Regularly held events such as Founders Day Weekend, the Memorial Day Parade, and Sunday Concerts in the Park bring residents together, fostering a sense of belonging and connection. Seasonal initiatives like the Lee Farmers Market and Jazz Weekend draw local and regional visitors, while youth-focused programs, including Second Saturday events and sports camps sponsored by the Lee Youth Association, engage and nurture the younger generation.<br><br>Additionally, Lee's residents embody a Yankee spirit of resourcefulness, self-reliance, and generosity. The community's preparedness for harsh winters and frequent storms reflects a collective understanding of local hazards and a shared commitment to mutual aid and resilience. |
| Natural disaster or safety-related school program | Yes | Lee's Fire Department has an ISO Fire Protection Rating of 5/10, indicating a moderate level of fire protection with areas for improvement in areas like water supply, response times, or staffing.<br><br>The department also hosts Fire Education and Prevention Week with Lee Schools each October. |

| | | |
|---|---|---|
| *StormReady* | Yes- Lee Premium Outlet (supporter) | Lee Premium Outlets is one of the only two *StormReady Supporters* in the Berkshires. A StormReady Supporter is a facility that promotes severe weather safety by having emergency plans, monitoring weather, and ensuring public safety, supporting broader community preparedness. |
| Public-private partnership initiatives addressing disaster-related issues | In progress | Lee is working with Central Regional Emergency Planners on a family reunification plan in case schools need to be evacuated. |
| Other programs/methods | Yes | Town website, social media, cable access television |

## *Summary and Conclusions*

The capability assessment framework used in this plan is adapted from FEMA hazard mitigation planning guidance and best practices observed in state and local hazard mitigation plans. The opportunities below will assist the Town in enhancing its overall resilience and preparedness for hazards.

Outside funding resources to enhance these capabilities can include the Community Compact Grant, Community Preservation Act (CPA) Funds, Department of Housing and Community Development (DHCD), EEA Planning Assistance Program, EOEEA MVP Action Grant, EOEEA Technical Assistance Grants, Executive Office of Public Safety Development Grant, Massachusetts Clean Energy Center (MassCEC), and Rural Development Fund.

Some items marked with an asterisk (*) are actionable capabilities that can be implemented immediately. These will be carried over to Chapter 5's Mitigation Action Table as part of the Town's hazard mitigation strategy and are directly tied to immediate hazard risk reduction.
As the Town continues to build its capacity, it will be able to identify new risk reduction opportunities further and integrate them into its long-term hazard mitigation strategy.

This structured rating system provides a detailed evaluation of the Town's existing capabilities, identifying strengths, gaps, and areas for improvement for 1) Planning and Regulatory, 2) Administrative and Technical, 3) Financial, 4) Education and Outreach, and 5) Emergency Response and Preparedness.

- Well-developed – Policies, programs, and resources are effectively implemented with minimal gaps. Capabilities are actively maintained and enforced.

- Partially Developed – Some elements are in place, but there are gaps in implementation, enforcement, or sustainability. Improvements are needed to ensure effectiveness.
- Needs Improvement – Capabilities are limited due to outdated policies, lack of funding, insufficient staff, or operational constraints. Significant enhancements are required.

### *Planning and Regulatory Capabilities: Partially Developed*

The Town of Lee has robust planning and regulatory capabilities supporting hazard mitigation through zoning bylaws, subdivision regulations, and floodplain management policies. The Massachusetts Building Code (780 CMR) provides a strong foundation for construction standards, and the Smart Growth and Adaptive Reuse Overlay Districts encourage resilient redevelopment. Additionally, Lee has established floodplain management regulations that help guide development in flood-prone areas, ensuring that new construction is appropriately elevated and resilient to flood risks.

The Town has also made progressive efforts to update its planning documents, including the Master Plan and Hazard Mitigation Plan (HMP). These plans should be referenced and integrated into future regulatory updates and development processes. Additionally, the Town could benefit from a regular review and update on its bylaws to integrate the latest hazard risk reduction practices, enhancing long-term resilience.

The Subdivision Regulations do include provisions for stormwater management, but they could be strengthened to address current challenges and better integrate modern hazard mitigation practices. In the regulations, Section 241-21 covers Stormwater Management, but it mainly addresses the need for systems like storm drains, culverts, and detention basins, and outlines broad design requirements. While this provides some basic guidelines, there's room for improvements that would help reduce risks from more extreme weather events.

### *Planning and Capabilities Opportunities*

- Continue to update and maintain the Town's Master Plan to help further integrate long-term resilience to natural hazards and climate change as a guiding principle for future decisions related to managing future growth, land use, and community development. Incorporate cross-references with this Hazard Mitigation Plan as appropriate.
- Conduct regulatory reviews and updates to Town bylaws and regulations to require and/or promote hazard-resistant, climate-adaptive, and sustainable development standards.
- Explore a shared position with neighboring towns for a Conservation Agent to assist with enforcing the Wetlands Protection Act.
- Implement affordable housing strategies outlined in the Master Plan to address potential climate-induced migration and ensure housing availability for all income levels.
- Explore opportunities to partner with Lee Public Schools to support the development of a green building trades program that introduces students to energy-efficient and hazard-resilient construction techniques.

### Opportunities for Subdivision Regulations (General Bylaws-Chapter 241)

- *Amend subdivision and site plan review regulations to require NOAA Atlas 14 precipitation data when designing stormwater infrastructure, ensuring designs accommodate increasing storm intensity.
- Mandate that new developments be designed to handle peak runoff during intense future storms, ensuring no net increase in runoff compared to pre-development conditions
- Incorporate low-impact development (LID) techniques, such as bioswales, permeable pavement, and rain gardens, into all new developments.
- Require post-construction stormwater management plans to ensure ongoing runoff control and water quality protection.
- Require private developments to maintain stormwater infrastructure and provide periodic drainage system inspections to the Town.

### Opportunities for Other Bylaws

- *Adopt a dedicated stormwater bylaw to improve runoff management and require long-term maintenance of stormwater systems.
- Use Mass Audubon's Local Bylaw Review Tool to evaluate and improve existing bylaws for resilience.
- Enhance land-use planning by integrating climate adaptation strategies and considering projected risks like flooding, wildfires, and heat.
- Amend zoning bylaws to prohibit or limit construction in high-risk flood areas beyond NFIP minimums.
- *Incentivize or mandate the use of green infrastructure (e.g., green roofs, tree plantings, and infiltration basins) for large commercial and residential projects.

### Opportunities for NFIP Participation & Compliance

- * Review and update the Town's Floodplain District regulations (Zoning Bylaw, Chapter 108) in compliance with the State's Model Floodplain Bylaw to ensure alignment with current best practices and NFIP requirements. A model bylaw is included in the Appendices.
- Send information about flood hazards and promote the availability of flood insurance through regularly scheduled mailings (e.g., by including flood risk handouts with annual property tax notices, utility bills, or other mailings).
- Encourage community participation in the NFIP by providing clear guidance on flood insurance options and how residents can comply with floodplain management requirements

## Administrative and Technical Capabilities: Needs Improvement

In terms of administrative and technical capabilities, the Town is currently limited. The Town's staff consists of a mix of full-time and part-time employees who often face competing priorities on a daily operational basis. While staffing is generally considered adequate to administer and enforce the Town's planning and regulatory capabilities, training and expertise on natural hazard mitigation is lacking for most staff. There is no dedicated person for coordinating the Town's resilience or sustainability efforts, although some of these tasks are absorbed by existing departmental staff. The Town's many volunteers who serve on local boards and commissions help bolster existing capabilities in some areas. While the Town has a strong foundation in emergency response and public works, the lack of specific training in hazard mitigation best practices across key departments presents a gap in overall technical capacity.

### *Administrative and Technical Capabilities Opportunities:*

- Increase staff time and resources dedicated to community resilience, sustainability, and floodplain management. Consider creating new hires or converting part-time positions to full-time as needed.
- Provide training and professional development opportunities for Town staff involved in community resilience planning and project implementation to enhance their skills in hazard mitigation.
- Develop an information/knowledge management system that serves as a central repository for hazard and climate-related information to improve decision-making and coordination.
- Enhance access to GIS across departments for improved data accessibility and informed decision-making with risk reduction.
- Strengthen coordination between departments on resilience-themed projects or routine maintenance activities to ensure consistent implementation of hazard mitigation strategies.
- Continue to coordinate with BRPC for technical and administrative support related to resilience and hazard mitigation planning.

### *Financial Capabilities: Needs Improvement*

The Town of Lee has limited financial resources to support long-term hazard mitigation efforts. While there are some funding sources available, including general funds, Capital Improvement Program (CIP) funding, and state/federal grants, there is no dedicated, long-term funding stream for hazard mitigation. This makes it challenging to plan for and implement large-scale resilience projects. Budget constraints also limit the ability to address immediate needs, such as infrastructure upgrades to improve stormwater management, floodplain resilience, and climate adaptation.

While state and federal grant opportunities exist, competitive funding processes can make it difficult to secure enough resources for proactive hazard mitigation measures. Additionally, the lack of a dedicated funding source for ongoing maintenance and improvements in resilience infrastructure, such as stormwater systems and flood management, places pressure on the Town's general operating budget.

### *Financial Capabilities Opportunities:*

- Incorporate hazard/climate resilience considerations into the Town's annual budget and CIP process. Create set-aside funding to support long-term risk reduction projects as identified in this Hazard Mitigation Plan.
- Apply for CRS enrollment to receive discounts on flood insurance premiums and access funding incentives for flood mitigation efforts.
- Explore expanding CPA funds to support climate resiliency projects
- Continue to build and support the capacity of Town staff to identify and pursue external funding, especially those routinely made available through recurring state-level grant programs.
- Continue coordinating with the BRPC, neighboring communities, and others on regional resilience and risk reduction activities.

### *Education and Outreach: Partially Developed*

The Town of Lee has a strong community spirit and benefits from an existing network of community and business organizations. However, there are gaps in terms of consistent and widespread communication to vulnerable populations and the broader community about flood risks, climate change, and hazard mitigation strategies. While general public awareness exists, more targeted efforts to reach non-English speaking communities, seniors, and other vulnerable groups are necessary to ensure full participation in emergency preparedness and hazard mitigation programs.

There is also an opportunity to enhance the use of technology, such as websites, social media, and other digital platforms, to better engage residents and provide real-time updates on emergency alerts, weather forecasts, and mitigation opportunities.

### *Education and Outreach Opportunities:*

- Partner with local organizations to host hazard awareness workshops
- Engage the Chamber of Commerce in educating local businesses about hazard mitigation and preparedness by disseminating materials on flood risks, climate resilience, and emergency preparedness. Explore partnering with businesses to serve as information hubs for customers and tourists.
- Integrate hazard education into existing community events like Farmers' market
- Expand *Stormready* designation to other businesses and or schools, public facilities
- Provide a community education page on the Town Website for specific hazard specific resources and alerts
- Collaborate with schools, senior centers, and community organizations to disseminate hazard-related information and build a network of local resilience ambassadors who can help spread awareness.
- Investigate the feasibility of an app or notification service (e.g., CodeRed) to provide residents and visitors with reliable, real-time emergency alerts and hazard mitigation information.
- Identify and engage with non-English speaking communities to ensure hazard mitigation and emergency preparedness information reaches all residents. Partner with advocacy or cultural

groups, faith based groups or language/civic clubs at Lee High School to help with outreach to these populations.
- Apply for S.A.F.E  grants to teach fire and life safety to seniors and children in schools.

## *Emergency Response and Preparedness: Well Developed*

The Town of Lee has a strong foundation in emergency response, with well-established mutual aid agreements and a commitment to regional cooperation through BRPC and other state and federal agencies. The Town's fire, police, and EMS departments are equipped to respond to a variety of emergency situations, including flooding, wildfires, and severe weather events. These departments participate in regular training exercises and maintain up-to-date emergency response plans.

The Town also benefits from regional mutual aid agreements, allowing for additional support during large-scale emergencies. The Emergency Operations Plan (EOP) provides guidance for coordinating resources across departments, and emergency alerts are disseminated through various channels, though there is room for improvement in reaching certain populations.

However, there are still some gaps, particularly related to targeted outreach for vulnerable populations and ensuring timely communications for more remote areas (e.g., Goose Pond, Upper Goose Pond). Additionally, staffing shortages, especially for volunteers, could strain the Town's ability to handle multiple emergencies simultaneously.

Emergency access challenges related to new development were noted, particularly on Erskine Drive near Golden Hill. While the Planning Board and ZBA have effectively managed expansion, private communities present unique challenges due to their independent management. Areas such as Fox Hollow Road, October Mountain, and 850 Summer Street can be difficult to coordinate emergency response for, as they span multiple jurisdictions and frequently change management. Chanter Road, built on a hillside with a dirt surface, is inaccessible for larger emergency vehicles. In the Goose Pond area, narrow roads make water tanking difficult, and access is further limited by a washed-out bridge maintained by Tyringham. Upper Goose Pond and parts of the Appalachian Trail pose significant rescue challenges, as emergency response is limited to boat or foot access.

The Eagle Mill redevelopment will add 180 new homes in two phases, leading to an expected increase in call volume for police and fire services. However, both departments already face staffing challenges—police reform has added responsibilities, reducing the number of officers available for patrol, and increasing staff is cost-prohibitive. The fire department relies heavily on volunteers, and the police have lost their reserve force, further straining resources.

## *Emergency Response and Preparedness Opportunities:*

- Expand emergency notification systems to include text and voice messaging, ensuring effective outreach to seniors and non-digital populations. Develop a targeted outreach program to ensure seniors and other vulnerable populations register, using multilingual materials and community events to promote sign-ups.
- Review and update as needed the Town's Emergency Operations Plan (EOP) to ensure it reflects the latest hazard data, including climate projections and emerging risks (e.g., extreme heat, wildfires).

- Implement a targeted communication strategy to ensure remote and rural areas (e.g., Goose Pond, Upper Goose Pond) receive timely emergency alerts and can quickly access emergency resources.
- Conduct a comprehensive impact assessment for all major new developments (e.g Eagle Mill Development) to evaluate their effect on emergency response capacity. This includes analyzing population growth trends and projecting the demands on fire, police, and other essential services to ensure that infrastructure and staffing levels can accommodate future needs.
- Apply for grants such as FEMA Assistance to Firefighters Grant (AFG) and Staffing for Adequate Fire and Emergency Response (SAFER) and Emergency Management Performance Grants (EMPG) to support equipment upgrades, training, and emergency response resources for fire, police, and EMS departments.
- Build on the current volunteer base by formalizing and expanding volunteer programs, particularly for non-Emergency roles such as administrative support, community outreach, and disaster preparedness training.
- Create local neighborhood teams that can assist during non-critical events, perform basic emergency tasks, and help with evacuation plans or public information dissemination.
- Explore Recruitment Strategies to increase volunteers for fire service.
    - Partner with local high schools to create junior firefighter programs and introduce fire service careers to students.
    - Target new residents by including fire department volunteer information in welcome packets and property tax mailings.
    - Engage local businesses to promote volunteering by offering flexible schedules for employees interested in joining the fire department.
    - Expand online presence by updating the fire department's website and regularly posting on social media to recruit new volunteers.
    - Host community recruitment events at local fairs, job fairs, and fitness events to reach potential volunteers.
    - Create a dedicated volunteer recruitment page on the fire department's website, making it easy for potential volunteers to apply.
    - Work with retirement communities to recruit active seniors for non-emergency roles within the fire department.
    - Collaborate with veterans' groups to recruit military veterans who may be interested in volunteer fire service roles.

# Chapter 5 Mitigation Strategy

44 CFR § 201.6(c)(3)(i-iv)

## Purpose

A hazard mitigation strategy is a proactive plan designed to reduce the long-term risks from natural hazards, minimizing damage to people, property, and critical infrastructure. The Town of Lee's strategy builds upon the planning area profile, risk assessment, and capability assessment to develop targeted actions that enhance community resilience. It reflects input from stakeholder meetings and public outreach, ensuring that mitigation efforts align with community needs and priorities.

## Hazard Mitigation Goals

Mitigation goals represent broad statements that are achieved through the implementation of more specific mitigation actions. These actions include hazard mitigation policies (land use regulations) and hazard mitigation projects (structure or infrastructure projects). The HMPC established the following hazard mitigation goals to guide the Town of Lee's efforts in reducing risk and enhancing community resilience.

1. *Flood Risk Reduction:* mitigate flood risks through infrastructure upgrades, improved stormwater management, and preservation of natural flood buffers.
2. *Enhance Emergency Preparedness;* improve emergency response systems, communication networks, and community outreach to protect lives and property.
3. *Safeguard Natural Resources and Ecosystems;* enhance natural systems' ability to mitigate hazards while maintaining ecological health.
4. *Protect and Assist Vulnerable Populations*; build community capacity to withstand &recover from hazards, focusing on underserved/ vulnerable populations.
5. *Promote Public Awareness /Community Engagement*; equip residents & businesses with the knowledge and tools to participate in hazard mitigation efforts.

## Identifying and Evaluating Mitigation Actions

To develop an effective hazard mitigation strategy, the Town of Lee first identified a range of potential actions which were informed by Chapter 3's risk assessment data, public input (see Appendix A), and anticipated climate change impacts identified through the Massachusetts Municipal Vulnerability Preparedness (MVP) program. Once potential mitigation actions were identified, the HMPC conducted a structured evaluation to determine their feasibility, effectiveness, and alignment with the Town's long-term planning goals. Only actions that met key evaluation criteria were considered for prioritization.

*A MITIGATION ACTION is a measure, project, plan or activity proposed to reduce current and future vulnerabilities described in the risk assessment*

### *Evaluation Criteria*

The HMPC evaluated and ranked mitigation actions using the following criteria:

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| Cost-Benefit Analysis | Do the expected benefits (e.g., risk reduction, economic savings, life safety) justify the costs? |
| Feasibility | Are the actions technically, legally, and politically viable? |
| Impact on Vulnerable Populations | Does the action address equity and support underserved groups? |
| Alignment with Goals | Does the action align with the plan's mitigation goals and broader community objectives? |
| Urgency | How critical is the action in addressing immediate risks? |
| Resource Availability | Are funding and staffing available for timely implementation? |

### *Prioritization Categories*

Once mitigation actions were evaluated and deemed viable, the Town of Lee prioritized them based on urgency, impact, and feasibility for implementation. While hazard ranking listed in Table 3.2 played a role in prioritization, additional factors—such as funding availability, policy alignment, community needs, and disaster recovery priorities—were also considered.
Each mitigation action was assigned to one of three priority levels:

- *High-priority actions* addressed high-risk hazards, offered significant risk reduction benefits, and aligned with existing initiatives.
- *Medium-priority actions* supported long-term goals but required additional planning or resources for implementation.
- *Low-priority actions,* while valuable, addressed lower-risk hazards or offered more limited immediate benefits.

## Mitigation Action Table Explanation

Primary mitigation actions are categorized into one or more of the following categories:

Local Plans and Regulations; Government authorities, policies, or codes that shape how land and buildings are developed and maintained. Examples include plans, land use ordinances, subdivision regulations, building codes, master plans, and stormwater regulations.

Structure and Infrastructure: Projects modifying existing infrastructure to remove it from a hazard area or building new structures to reduce the impacts of hazards. Examples include structural retrofits, floodwalls and retaining walls, detention and retention structures, and culverts.

Natural Systems Protection: Actions that reduce damage and losses and preserve or restore natural systems' functions. Examples include sediment and erosion control, forest management, conservation easements, and wetland restoration.

Education and Awareness Programs; Actions that reduce damage and losses, and that preserve or restore the functions of natural systems. Examples include sediment and erosion control, forest management, conservation easements, and wetland restoration.

Each action includes the following components:

Problem Statement, which identifies the specific hazard or issue the action aims to address. It clearly defines the risk or vulnerability in the community that necessitates the proposed mitigation action, providing context and rationale for why the action is needed.

Description of Action provides a brief statement of the specific action or project. It describes what will be done to address the identified problem.

Lead Position identifies the agency or organization responsible for carrying out the action, including ownership and jurisdiction of the facility or action being mitigated or receiving funding.

Timeframes denote how long the project will take once initiated. Funding cycles can affect the start of an action. Ongoing is for multi-phased projects or projects that will be ongoing once implemented (e.g., a vegetation management program that has no end date).

Cost is the estimated cost of each action into three broad ranges:

- Less than $50,000: Low-cost actions, typically involving smaller-scale projects or initiatives.
- Between $50,000 - $499,999: Medium-cost actions, typically involving more extensive planning, resources, or infrastructure changes.
- Over $500,000: High-cost actions, typically involving large-scale projects with significant infrastructure changes or long-term investments.

Resources and Funding for each action are known or potential technical assistance, materials and funding for the type of project identified.

Table 5.1 is the Mitigation Action for the Town of Lee and provides a roadmap for the Town to increase resiliency. It will be updated with the new plan in five years.

The actions marked in **bold** are those identified by the committee as the highest priority for immediate attention.

Table 5.1 Mitigation Action Plan for the Town of Lee

| Category of Action (Hazard) | Problem Statement | Description of Action | Lead Position | Expected Timeframe | Priority | Cost | Resource/Funding |
|---|---|---|---|---|---|---|---|
| Flood/Storm Management | | | | | | | |
| Local Plans and Regulations (Flooding, Drought) | Heavy rainfall increases flooding, erosion, and water pollution, while impervious surfaces prevent infiltration, worsening riverine flooding. | Create a town-wide stormwater management and green infrastructure plan to increase pervious surfaces and infiltration throughout town. | Highway Dept/ Planning Board | 3 - 5 years | High | Between $50,000 - $499,999 | EOEEA MVP Action Grant, 319 Nonpoint Source Grants,604B Water Quality Management Planning Grants, FEMA Hazard Mitigation, Town General Budget |
| Structure and Infrastructure Project (Flooding) | High-hazard dams, including Woods Pond, Laurel Lake, and Columbia Mill, face overtopping and structural risks from increased flooding, which could result in downstream flooding, infrastructure damage, and the mobilization of PCB-contaminated sediments. | Develop and Implement Targeted Risk Reduction Measures for High-Hazard Dams (Woods Pond, Laurel Lake, Columbia Mill), including accelerating dam removal where feasible, addressing overtopping and structural risks, and ensuring robust emergency action plans with updated climate considerations. | Emergency Management Director, DCR Office of Dam Safety | 1-3 years | High | Less than $50,000 | FEMA National Dam Safety Program |

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| Structure and Infrastructure Project (Flooding, Hazardous Materials) | The Woods Pond impoundment is contaminated with PCBs and vulnerable to riverine flooding. Increased flood events or overtopping could mobilize contaminated sediments, threatening downstream communities and water quality. While the dam was recently inspected and found | Coordinate with GE/EPA and other relevant agencies to reduce the risk of PCB mobilization at Woods Pond Dam by:<br><br>1. Exploring various measures to reduce PCB mobilization in the event of high water or overtopping, including sediment stabilization, spillway enhancements, and flood management strategies.<br><br>2. Installing water quality monitoring systems to track contamination levels | Emergency Management Director, DCR Office of Dam Safety | 1-3 years | High | Less than $50,000 | FEMA National Dam Safety Program |

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| | structurally sound and will continue to be monitored for structural integrity, the Emergency Action Plan (EAP) lacks protocols for hazardous material containment or measures to reduce PCB exposure during high-water events. | and detect potential PCB mobilization during high-water events.<br><br>3. Updating the Emergency Action Plan (EAP) to include protocols for hazardous material containment and ensuring effective communication with downstream communities to reduce exposure during potential flooding events. | | | | | |
| Local Plans and Regulations (Flooding) | The Town lacks a dedicated stormwater management bylaw. Existing regulations do not sufficiently require stormwater retention or green infrastructure, limiting effective flood mitigation. | Develop and adopt a dedicated stormwater management bylaw to establish clear requirements for land disturbance and ensure new development mitigates runoff impacts. | Planning Board, Conservation Commission, Town Planner, DPW | 1-3 years | High | Less than $50,000 | FEMA BRIC, 319 Grants, FEMA Hazard Mitigation Grants |
| Local Plans and Regulations (Flooding, Drought) | The Town has significant areas of impervious surfaces, particularly in its downtown, which contribute to increased stormwater runoff and strain on existing drainage | Adopt a green infrastructure policy (e.g., green roofs, tree plantings, infiltration basins) for large-scale developments. | Town Planner/ Planning Board | 1- 3 years | Medium | Less than $50,000 | EOEEA MVP Action Grant, 319 Nonpoint Source Grants,604B Water Quality Management Planning Grants, Town General Budget |

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| | systems. The lack of comprehensive green infrastructure solutions exacerbates flooding risks | | | | | | |
| Local Plans and Regulations (Flooding, High Winds, Extreme Heat) | A number of the Town's bylaws and regulations have not been reviewed or updated in many years. | Conduct regulatory reviews and updates to Town bylaws and regulations to require/promote hazard-resistant, climate-adaptive, and sustainable development standards. | Town Planner/ Planning Board | 1 - 3 years /ongoing | Low | Less than $50,000 | EOEEA MVP Action Grant, FEMA Hazard Mitigation, Town General Budget |
| Local Plans and Regulations (Flooding, Drought) | The Town's Floodplain District regulations are outdated and may not align with current state guidelines or NFIP requirements. | Review and update the Town's Floodplain District regulations (Zoning Bylaw, Chapter 108) to comply with the State's Model Floodplain Bylaw | Town Planner/ Planning Board, Building Inspector | 1-3 years | Medium | Less than $50,000 | FEMA Hazard Mitigation, Town General Budget |
| Local Plans and Regulations (Flooding, Landslide) | The Town's current subdivision and site plan review regulations do not adequately account for increasing storm intensity, leading to potential stormwater runoff issues and inadequate post-construction runoff management, which | Amend subdivision and site plan review regulations to:<br>1. require NOAA Atlas 14 precipitation data when designing stormwater infrastructure<br>2. Mandate that new developments be designed to handle peak runoff during intense future storms, ensuring no net increase in runoff | Town Planner/ Planning Board | 1-3 years | Medium | Less than $50,000 | EOEEA MVP Action Grant, 319 Nonpoint Source Grants,604B Water Quality Management Planning Grants, Town General Budget |

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| | could worsen flooding, erosion, and water quality concerns. | compared to pre-development conditions.<br>3. Require post-construction stormwater management plans to ensure ongoing runoff control and water quality protection to account for increasing storm intensity. | | | | | |
| Natural Systems Protection and Nature-based Solution (Flooding) | Runoff increases flooding, erosion, cyanobacteria blooms, and water pollution in lakes and ponds. | Plant riparian buffers around lakes and ponds | Watershed organizations, HOAs, Greener Gateway | 3 - 5 years | Medium | Less than $50,000 | EOEEA MVP Action Grant, MassDEP 319 Grant |
| Structure and Infrastructure Project (Flooding) | Flooding has impacted road access and properties on Prospect and Meadow St. | Upsize culverts on Prospect and Meadow Streets to improve flood capacity, reduce roadway flooding, and enhance stormwater flow while adhering to stream crossing standards. | DPW | 3 - 5 years | High | Between $50,000 - $499,999 | EOEEA MVP Action Grant, |
| Structure and Infrastructure Project (Flooding) | Undersized pipes in flood-prone areas cannot handle heavy rainfall, leading to roadway flooding, erosion, and drainage failures. | Phase replacement of undersized pipes with larger capacity pipes, beginning with high-priority flood-prone areas | DPW | 10 + years | Medium | Over $500,000 | MassDEP State Revolving Loan Fund, Mass Clean Water Trust, Town Public Works General Budget, CIP |
| Local Plans and Regulations (Flooding) | Many of the Town's culverts were installed years ago and were not | Develop an inventory of culverts needing replacement, ranked by flood risk, structural | DPW | 1 -3 years | High | Less than $50,000 | EOEEA MVP Action Grant |

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| | designed to handle today's heavy rain events. | condition, and capacity to handle extreme precipitation, while identifying those that may require upgrades to meet stream crossing and environmental standards. | | | | | |
| Local Plans and Regulations (Flooding) | Flood maps are outdated and may not accurately represent current floodplain boundaries, increasing the risk of underestimating flood hazards in developed areas. | Collaborate with FEMA and/or the EEA office to update flood maps, prioritizing areas with vulnerable populations and critical infrastructure | FEMA/Planning Board/Public Safety | 3 - 5 years | Medium | Between $50,000 - $499,999 | EOEEA MVP Action Grant, FEMA Hazard Mitigation Grant funds, FEMA BRIC |
| Local Plans and Regulations (Flooding) | Existing policies may not adequately limit floodplain development or mitigate flood risks, increasing vulnerability to flooding and property damage. | Review and assess current policies on floodplain development and land disturbance to identify gaps and opportunities for stronger flood protection measures. Based on findings, develop recommendations for updated regulations that enhance flood risk reduction, such as stricter zoning, enhanced building requirements, or expanded floodplain protections. | Planning Board, Town Planner | 1-3 years | Medium | Less than $50,000 | EEA Planning Assistance Program, EOHLC Community Planning Grant, FEMA BRIC, 319 Grants, FEMA Hazard Mitigation Grants, MVP Action Grant |

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| Local Plans and Regulations (Flooding) | The Goose Pond area is a flood-prone hazard area, and existing water control structures may be insufficient. | Coordinate with the Goose Pond Maintenance District to assess and upgrade water control structures and flood mitigation measures | Goose Pond Maintenance District | 3 - 5 years | Low | Less than $50,000 | FEMA Hazard Mitigation, MassDEP State Revolving Loan Fund, Mass Clean Water Trust, Town General Budget |
| Local Plans and Regulations (Flooding, Enviro Health) | Runoff from various land uses, including farms, may contribute to nutrient loading and water quality concerns. Strengthening stormwater management practices can help protect local waterway during heavy rain events. | Partner with agricultural programs to improve stormwater management on farms, reducing runoff pollutants and protecting water quality.<br><br>Review and update as needed stormwater regulations to include BMPS for agricultural runoff | Local nonprofits & NRCS, Agricultural Commission | 3 -5 years / ongoing | Low | Less than $50,000 | MassDEP 604b and 319 Grant Program, NRCS |
| Structure and Infrastructure Project (Flooding, Hazardous Materials) | Several sites in the town, including former paper mills, landfills, and other contaminated areas, are vulnerable to flooding and hazardous material mobilization, posing a risk to downstream communities and | Develop a risk management plan for state-listed contaminated sites (e.g., former paper mills, landfills) to address hazardous material mobilization during flooding. The plan will include risk assessments to identify contaminants at each site, installation of water quality monitoring | MassDEP, Emergency Management Director, Town Planner | 1- 3 years | Medium | Less than $50,000 | FEMA Hazard Mitigation, MassDEP Technical Assistance Grants |

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| | water quality. These sites may contain state-listed contaminants that could be mobilized during extreme weather events, but no comprehensive plan is in place to address hazardous material containment or monitoring during flooding. | systems to detect contamination during high-water events, and the development of mitigation strategies such as sediment stabilization and hazardous material containment. An emergency response plan will also be created to ensure public health protection and effective containment during flooding events. | | | | | |
| Structure and Infrastructure Project (Flooding) | Laurel Lake Dam is a High Hazard dam. | Conduct a feasibility study to assess options for improving the condition of the dam at Laurel Lake focusing on enhancing resilience and addressing future risks associated with its High Hazard status. | Board of the Laurel Lake Dam Inc. | 1- 3 years | High | Over $500,000 | EOEEA Dam Removal, Mass DER Grants, FEMA National Dam Safety Program, U.S FWS National Fish Passage Program |
| Structure and Infrastructure Project (Flooding) | Flooding has been observed on Route 20 by Laurel Lake. | Review and update water levels devices at Laurel Lake | DPW | 1 -3 years /ongoing | High | Less than $50,000 | MassDEP water quality monitoring grant, EOEEA MVP and state planning grants |
| Emergency/Disaster Preparedness | | | | | | | |
| Structure and Infrastructure Project (General) | The Town's current fire, police, and EMS facilities are outdated and inadequate to | Site and build a Public Safety Complex. Expand to accommodate more staff. | Public Safety, Select Board | 5 - 10 years | High + | Over $500,000 | FEMA Emergency Operations Center Grant Program, EOEEA Grants and |

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| | support modern operations, staffing needs, and increasing service demands. The lack of space and resources hinders efficient emergency response and community resilience during crises. | Incorporate plans for heating and cooling centers equipped with charging areas for personal and/or medical devices.<br><br>Increase space to serve as an emergency shelter and crisis center. Incorporate carbon-neutral energy technologies where possible. | | | | | Technical Assistance, Town Capital Improvement Budget, Federal and State Tax Subsidies |
| Local Plans and Regulations (General, Extreme Temperatures) | Lee has an aging population and higher number of seasonal visitors in the summer making them prone to heat related illnesses. | Conduct feasibility of a heating/cooling center at Public Safety Complex. If heating/cooling center is not feasible in the Public Safety Complex, identify locations that can be deployed as cooling centers during heat waves | Public Safety, Select Board, Emergency Management | 1 -3 years | High | Less than $50,000 | EOEEA MVP Planning Grant |
| Local Plans and Regulations (Drought) | Berkshire County is experiencing more frequent and prolonged droughts. Increased summer tourism and new development will further demand on water supplies, | Evaluate the Town's current water storage infrastructure and explore enhancements to accommodate longer periods of drought | DPW/Select board/Planning Board | 3 - 5 years | Medium | Between $50,000-$499,999 | MassDEP State Revolving Loan Fund, FEMA Hazard Mitigation Program, Capital Improvement Budget |
| Local Plans and Regulations (Drought) | Several homes in South Lee and the Goose Pond area rely | Conduct a comprehensive inventory of households relying on private wells to | DPW/Tri-Town Health | 3- 5 years | Medium | Less than $50,000 | FEMA BRIC, EPA Drinking Water, |

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| | on private wells, but the total number is unknown, and many serve an aging population. Prolonged droughts or groundwater depletion could threaten water availability and reliability for these residents. | assess their vulnerability including water quality, quantity, and access during drought conditions. Explore the feasibility and costs of connecting private well users to the municipal water system to ensure reliable access. | | | | | MassDEP 319 Grant |
| Local Plans and Regulations (General) | Extreme weather disrupts food supply chains, limiting access to fresh food for seniors, low-income households, and those without transportation, increasing food insecurity. | Develop and implement a food security program to improve access to fresh, local food and enhance resilience during hazard events.<br><br>Collaborate with local schools, food banks, community gardens, and farmers to distribute excess production.<br><br>Include educational workshops on home gardening and food preservation for households at risk of food insecurity. Prioritize outreach to seniors, low-income households, or other population segements | Agricultural Commission/ Council on Aging, Food Pantry, Lee Community Gardens | 3 - 5 years | Medium | Between $50,000 - $499,999 | EOEEA Food Security Infrastructure Grant, USDA Community Food Projects, Mass - dese Grants, National Sustainable Agriculture Coalition |

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| | | without reliable transportation. | | | | | |
| Education and Awareness (Extreme Temperatures) | Seniors in public housing are especially vulnerable to extreme heat and winter events, facing risks from HVAC system failures, power outages, and limited access to emergency cooling and heating resources, which can be life-threatening for those relying on medical equipment. | Coordinate with property managers to address hazard-specific vulnerabilities of public housing, such as HVAC system failures or backup power needs. | Public Housing Authority, Tritown Health, COA | 1 -3 years / Ongo ing | Medium / Ongoin g | Less than $50,000 | Lee Public Housing and Berkshire Housing internal budgets, Community Compact Grant |
| Structure and Infrastructure Project (Energy) | The town's critical facilities are vulnerable to grid failure during extreme weather, risking disruptions to emergency response and essential services without reliable alternative energy sources. | Secure funding and technical assistance to conduct a suitability analysis of municipal properties for solar and wind energy installations. This analysis will help identify viable locations to improve energy resilience and reduce reliance on the grid during extreme weather events | Town Admin/ Planning Board/BRPC | 3 - 5 years | High | Less than $50,000 | EOEEA MVP Program, EOEEA Grants and Technical Assistance, District Local Technical Assistance |
| Structure and Infrastructure | Critical facilities are vulnerable to power | Purchase backup generators for critical | DPW/Select board | 3 - 5 years | High | Between $50,000 | FEMA Hazard Mitigation |

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| Project (General) | outages during extreme weather, jeopardizing essential services, especially for vulnerable populations. | facilities, including the DPW fueling station, schools, public housing, Fire Department, and Town Hall, to ensure operational continuity during power outages. Where feasible, incorporate battery backup systems powered by renewable energy to enhance long-term resilience. Implement in phases, prioritizing facilities with the highest risk of service disruption and those that serve vulnerable populations | | | | - $499,999 | Funding, MassDEP State Revolving Loan Fund, FEMA Pre-Disaster Mitigation Program, Federal and State carbon reduction funding. |
| Structure and Infrastructure Project (Extreme Heat, High Winds) | Extreme heat can increase energy demand, potentially overloading the grid and causing disruptions. High winds can down trees and power lines, leaving certain areas or critical services without power, | Explore Microgrid feasibility for improving energy and resilience and reducing dependency on centralized power grids. | Planning Board | 5-10 years | Medium | Over $500,000 | MVP Action Grant, DOER Grants, Mass |
| Structure and Infrastructure Project (Heat/Change in Average Temp.) | High-traffic public areas lack sufficient cooling and hydration resources, increasing the risk of | Install water bottle refill stations and shade structures, such as gazebos, in high traffic public areas to mitigate | Greener Gateway Committee | 3 - 5 years | Low | Less than $50,000 | FEMA Emergency Management Performance Grant, MVP Action Grant |

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| | heat-related health issues during extreme weather events. | heat impacts during extreme weather. | | | | | |
| Local Plans and Regulations (Earthquake) | Lee's critical and historic buildings are vulnerable to minor seismic activity, with outdated structures that may not withstand even small earthquakes, risking damage to infrastructure and cultural heritage | Conduct a structural assessment of Lee's critical and historic buildings to identify vulnerabilities to minor seismic activity. Develop a prioritized plan to retrofit these structures with modern reinforcements to protect against damage from small earthquakes | Building Inspector | 3- 5 years | Low | Less than $50,00 | FEMA Pre-Disaster Mitigation Program |
| Education and Awareness | Communities in the wildland-urban interface (WUI) are at high risk for wildfires. | Develop and launch a wildfire prevention and preparedness campaign, specifically targeting communities in the wildland-urban interface (WUI), focusing on fire-resistant landscaping and fire safety during dry seasons. Use workshops, community meetings, and educational materials to raise awareness. | Fire Department, Civic Organizations | 3- 5 years | Low | Between $50,000-$499,999 | FEMA Hazard Mitigation Grant Program Action Grant, Community Preservation Funds |
| Education & Training (Cybersecurity) | Municipal operations are vulnerable to cyber threats and data loss. | Implement regular cybersecurity training for town staff and strengthen system backup protocols to protect critical municipal | IT Contractor and Town Administrator | 1 -3 years /Ongoing | High | Less than $50,000 | Town General Budget; Office of Public Safety and Security - Municipal Local |

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| | | operations from cyber threats and data loss | | | | | Cybersecurity Grant Program |
| Natural Systems Protections | | | | | | | |
| Natural Systems Protection (Vector-Borne Diseases) | The town lacks a formal parks commission to oversee landscape management and reduce vegetation that supports mosquito and tick populations, increasing the risk of vector-borne diseases in high-traffic areas. | Establish a formal parks commission to manage landscapes in high-traffic areas, reducing mosquito and tick habitats. Develop a landscape plan for vector-borne disease prevention and increase public awareness through signs, workshops, and collaboration with Tri-Town Health, local nonprofits, and state landholders like DCR and BNRC | Town Planner, Greener Gateway Committee, Lee Land Trust, Tri-Town Health | 1-3 years /Ongoing | Med | Less than $50,000 | General Budget, MassDEP Wildlife Management Grant, Berkshire Taconic Community Foundation, EOEEA MVP Program |
| Natural Systems Protection and Nature-based Solution (High Wind, Winter Storms, Invasive Species) | Dead or dying trees, along with invasive species, risk critical infrastructure and utility lines during high winds and winter storms, causing power outages and damage. Poor tree management also increases vulnerability to heat stress and | Develop a prioritized tree management program to increase tree trimming around critical infrastructure and utility lines. Incorporate the planting of heat- and disease-resilient tree species, and remove dead or dying trees to mitigate risks. Engage the community to identify priority areas and align tree planting with native, | Town Planner, Eversource, Greener the Gateway, Lee Community Gardens | 5 - 10 years / Ongoing | High | Between $50,000 - $499,998 | EOEEA MVP Action Grant, MassDEP Wildlife Management Grant, Working Forest Initiative |

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| | environmental degradation. | pollinator and aesthetic goals. | | | | | |
| Natural Systems Protection and Nature-based Solution (Flooding, Landslides & Invasive Species) | Invasive pests and plants are damaging local ecosystems and infrastructure, with insufficient resources for monitoring and quick response in high-risk areas. | Develop a comprehensive invasive pest, plant, and beaver management plan with education and outreach programs to raise awareness and engage the community in preventing and managing invasives. | Town Planner, DPW, Greener the Gateway, Lee Community Gardens | 3 - 5 years / ongoing | High | Between $50,000 - $499,999 | MassWildlife Habitat Management Grant Program |
| Local Plans and Regulations (High Wind, Winter, Invasive Species, Drought, Wildfire) | Critical infrastructure is vulnerable to high winds, winter storms, invasive species, and wildfires, with insufficient natural area management to mitigate these risks. | Collaborate with state agencies, including DCR, to create a natural area management plan that focuses on improving forest stewardship, reducing wildfire risk, and preventing erosion. | Tree Warden, DCR, Town Planner, and MassWildlife | 3 - 5 years /Ongoing | Medium | Less than $50,000 | MassWildlife Habitat Management Grant Program, Working Forest Initiative, Town General Budget |
| Natural Systems Protection and Nature-based Solution (Enviro Health) | There are not enough community gardens or stormwater management solutions, which impacts food security and climate resilience. | Conduct a suitability analysis to identify optimal locations for new community gardens with pollinator-friendly plants and rain barrels. Based on | Town Planner/ Conservation Org, Community Partners | 1 -3 years / Ongoing | Low | Less than $50,000 | Mass Farm to School, Keep Massachusetts Beautiful, USDA, local volunteers, MVP Action Grant |

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| | | findings, establish additional gardens | | | | | |
| Miscellaneous Low Priority | | | | | | | |
| Structure and Infrastructure Project (Hazardous Materials) | Hazardous material is often transported by rail which goes through Lee's historic/business and neighborhoods. | Collaborate with state and federal agencies to advocate for rail line upgrades that enhance safety and improve hazardous material mitigation to reduce transportation-related risks | Department of Transportation | 5 - 10 years | Low | Over $500,000 | Federal DOT |

# Chapter 6 Plan Maintenance

44 CFR § 201.6(c)(4)(i-iii)

The Town of Lee's Hazard Mitigation and Climate Adaptation Plan (HMCAP) is a living document. To remain useful and relevant, it must be monitored, evaluated, and updated over time. This chapter outlines how the Town will track its progress on the plan's goals, review its effectiveness, and update the plan every five years. It also explains how this plan will be used alongside other planning tools and decisions in town.

## *Continued Public Participation*

The Town of Lee is committed to maintaining meaningful public engagement throughout the five-year life of this plan. Community members will be invited to provide feedback during regularly scheduled review meetings, particularly after major hazard events or when new risks emerge. The Town Administrator and Town Planner will lead efforts to engage the public and ensure transparency as the plan is implemented. Public participation will take multiple forms, including:

- Posting updates and announcements on the Town's website and social media platforms
- Keeping the plan accessible online and providing hard copies in the Select Board Office and Planning Office for public review
- Sharing any future plan updates through the Town's website and in local offices
- Collaborating with private industry, regional agencies, and neighboring communities to share information and strengthen implementation

Residents are encouraged to stay involved and to contact the Town Planner or the Hazard Mitigation Committee at any time with concerns, questions, or ideas.

## *Tracking Progress of Mitigation Actions*

The Town of Lee will track the status of mitigation actions using a spreadsheet system maintained by the Hazard Mitigation and MVP Planning Committee. This Committee—under the leadership of the Town Administrator and Select Board—will meet biannually to review the status of each action identified in the Mitigation Strategy. Tracking will include noting actions that have been completed, initiated, or delayed; identifying any new challenges or opportunities; and documenting new hazard events or risk areas. Progress will be informed by site visits, updates from responsible departments, and public feedback. As needed, the Town will share updates with the Berkshire Regional Planning Commission, which maintains a countywide GIS system that supports regional planning and resilience coordination.

## *Evaluating the Plan's Effectiveness*

The Hazard Mitigation and MVP Planning Committee will evaluate the plan's effectiveness annually by reviewing whether the goals outlined in Chapter 5 are being met and whether implemented actions are reducing hazard risk and improving community resilience. Evaluation criteria will include:

- The number of completed mitigation actions
- Progress on in-progress actions
- Lessons learned from recent hazard events
- Feedback from the public and responsible departments
- Whether goals and priorities remain relevant given current conditions

Results of the evaluation will inform whether mid-cycle adjustments to the plan's priorities are necessary and guide preparations for the five-year update.

## *Updating the Plan*

The plan will be updated at least once every five years, with technical support provided by the Berkshire Regional Planning Commission (BRPC). The Town will initiate the update process at least one year before the current plan expires. The Hazard Mitigation and MVP Planning Committee will reconvene to:

- Review the status of each action item
- Assess the continued relevance of goals and vulnerabilities
- Update hazard data and maps as needed
- Gather input from town departments, regional partners, and the public

Public outreach will be conducted through the Town's website, social media, public notices, and inserts in tax bills. Updates will be coordinated with regional planning efforts and integrated with other local plans such as the Master Plan and Capital Improvement Plan.

## *Integration Process*

The Town of Lee will integrate the goals, data, and recommended actions from this Hazard Mitigation and Climate Adaptation Plan (HMCAP) into other local planning mechanisms over the next five years. The Town Administrator and Town Planner will play a central role in identifying integration opportunities and ensuring that mitigation strategies are considered in land use decisions, infrastructure planning, and resource allocation.

The process will include:

- Using hazard data and identified vulnerabilities to prioritize capital investments and infrastructure upgrades, especially through the Town's Capital Improvement Plan
- Ensuring consistency between this HMCAP and the Town's Master Plan during future updates and implementation
- Applying risk and vulnerability assessments when developing or revising zoning bylaws, subdivision regulations, and stormwater management strategies
- Collaborating with Berkshire Regional Planning Commission and other regional partners to align this plan with regional and state resilience efforts

Integration will occur incrementally as opportunities arise through project development, permitting, and plan updates. The Planning Board, Conservation Commission, Department of Public Works, and Select Board will be involved as appropriate.

## *Specific Planning Mechanisms for Integration*

The following local planning mechanisms have been identified as appropriate avenues for integrating hazard mitigation principles, data, and actions from this HMCAP:

- Capital Improvement Plan to prioritize funding for mitigation-related infrastructure projects
- Master Plan to ensure alignment with long-term community goals and climate resilience priorities
- Zoning and Land Use Regulations to limit development in high-risk areas and promote resilient design
- Open Space and Recreation Plan to support land conservation as a tool for flood mitigation and habitat protection
- Town Budget Process in order to allocate local resources toward mitigation and preparedness activities
- Emergency Operations Plan to coordinate response and recovery efforts with long-term risk reduction, such as prevention and education.
- Floodplain Bylaw to guide safe building practices in flood-prone areas
- Municipal Vulnerability Preparedness (MVP) and Climate Resilience Planning, for which this HMCAP can be used to inform future MVP Action Grant applications, community resilience projects, and climate adaptation strategies.
- Annual Town Report and Town Meeting Warrant Process may highlight hazard mitigation goals and action items in the Town's annual report or cited in support of warrant articles related to infrastructure, land use, or public safety.

# Chapter 7 Plan Adoption

44 CFR § 201.6(c)(5)

The Town of Lee will formally adopt the Hazard Mitigation and Climate Adaptation Plan following receipt of FEMA and MEMA's Approval-Pending-Adoption (APA) letter. Once adopted by the Select Board, documentation of adoption (including a signed resolution and meeting minutes) will be inserted into the final plan and included in this section.

## *Signed Resolution of Adoption*

(To be inserted following formal adoption by the Lee Select Board

# Major References Cited


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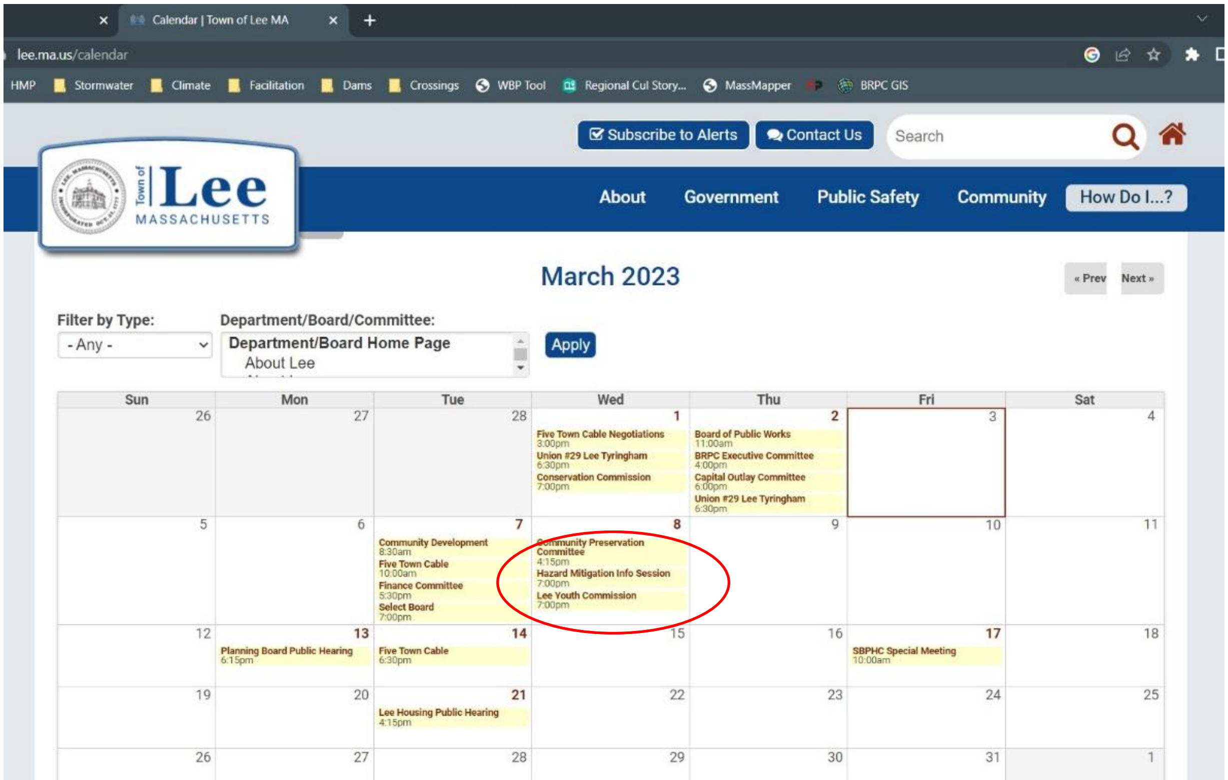
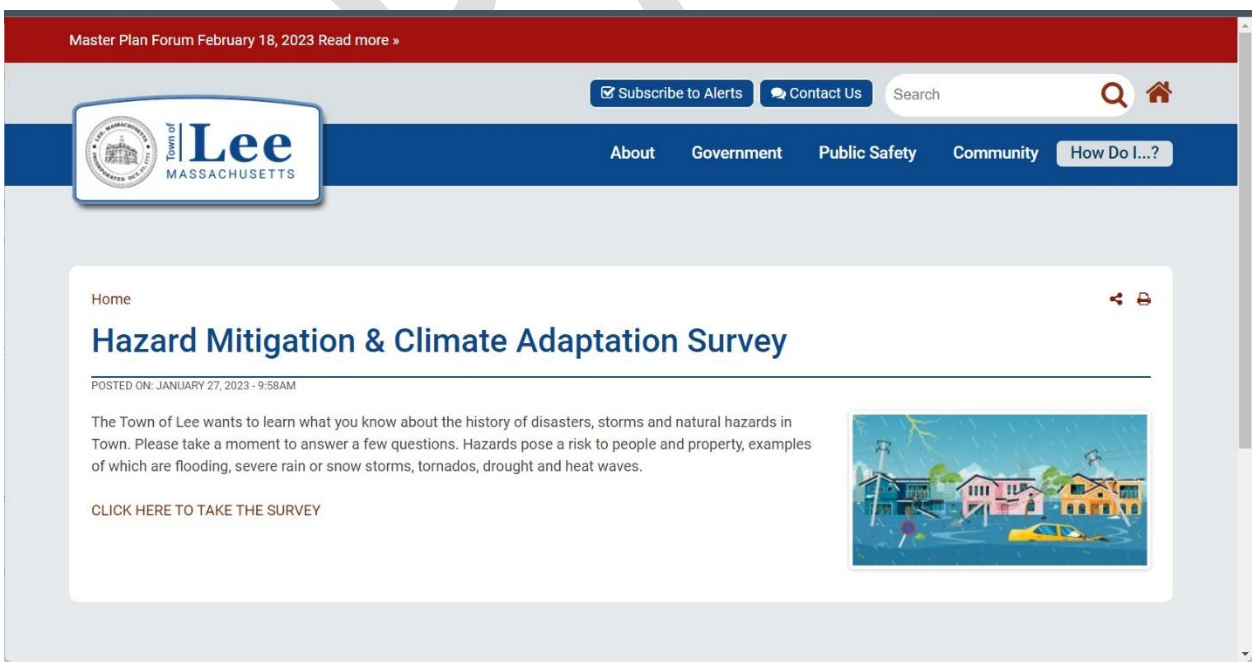
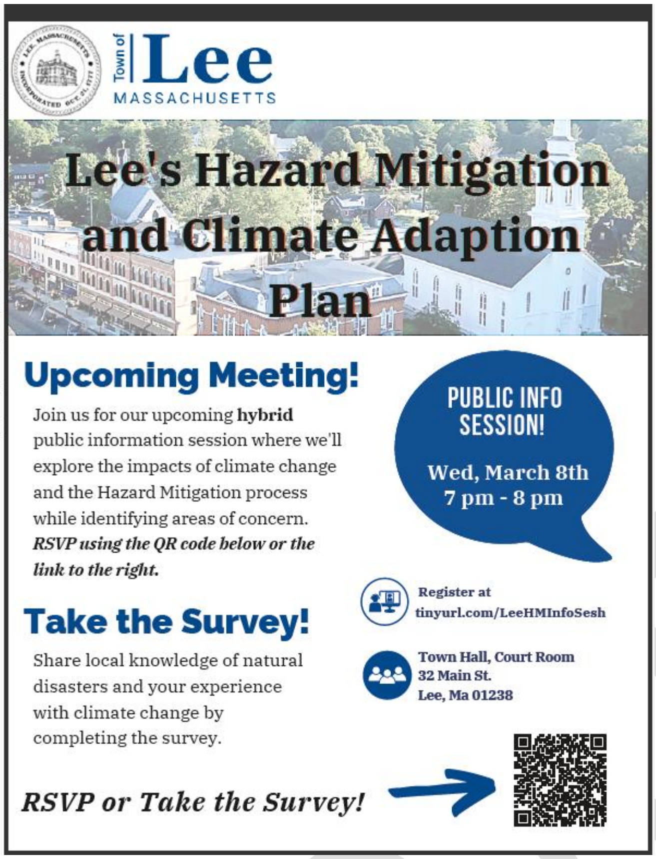
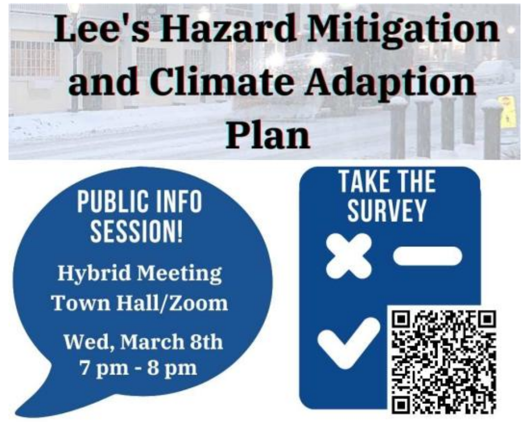
# APPENDIX A:  OUTREACH, PUBLIC PARTICIPATION & SURVEY RESULT

## *Outreach Methods*



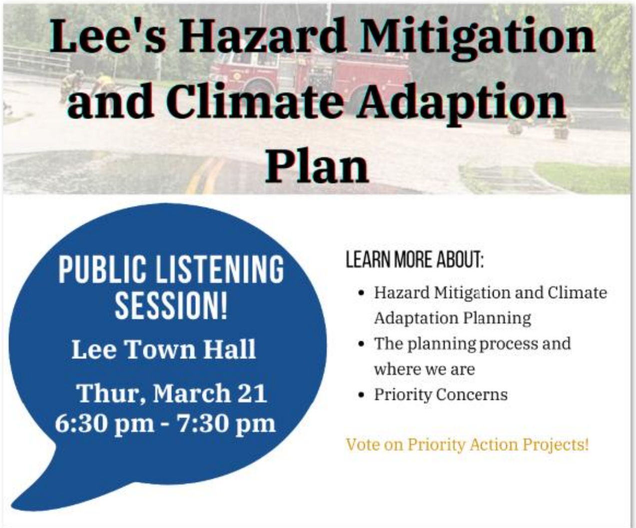



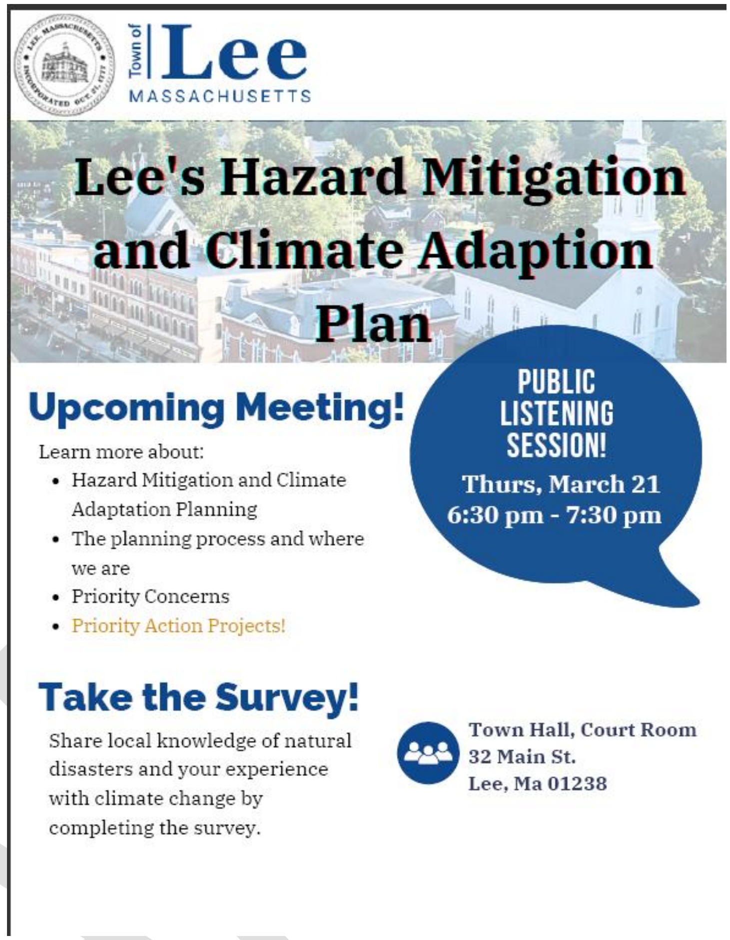

Town of Lee
MASSACHUSETTS
Lee's Hazard Mitigation and Climate Adaption Plan
Upcoming Meeting!
Join us for our upcoming hybrid public information session where we'll explore the impacts of climate change and the Hazard Mitigation process while identifying areas of concern. RSVP using the QR code below or the link to the right.
PUBLIC INFO SESSION!
Wed, March 8th
7 pm - 8 pm
Register at tinyurl.com/LeeHMInfoSesh
Take the Survey!
Share local knowledge of natural disasters and your experience with climate change by completing the survey.
Town Hall, Court Room
32 Main St.
Lee, Ma 01238
RSVP or Take the Survey!


Lee's Hazard Mitigation and Climate Adaption Plan
PUBLIC INFO SESSION!
Hybrid Meeting
Town Hall/Zoom
Wed, March 8th
7 pm - 8 pm
TAKE THE SURVEY


Lee's Hazard Mitigation and Climate Adaption Plan Info Session
PUBLIC INFO SESSION!
Wed, March 8th
7 pm - 8 pm
Join us for our upcoming hybrid public information session where we'll explore the impacts of climate change, and the Hazard Mitigation process while identifying areas of concern. Residents can participate on ZOOM or by coming in person to: Town Hall, Court Room 32 Main St.
Use the link below to RSVP for in-person or for ZOOM.


Take the Survey - Lee's Hazard Mitigation & Climate Adaptation Plan
The Town wants to learn what you know about the history of disasters, storms and natural hazards in Town. Please take a moment to answer a few questions in order for the Town to better prepare.
Scan the QR Code to take the survey!
To learn more check out: https://tinyurl.com/LeeHazardPlan


Lee's Hazard Mitigation and Climate Adaption Plan
PUBLIC LISTENING SESSION!
Lee Town Hall
Thur, March 21
6:30 pm - 7:30 pm
LEARN MORE ABOUT:
Hazard Mitigation and Climate Adaptation Planning
The planning process and where we are
Priority Concerns
Vote on Priority Action Projects!


Town of Lee MASSACHUSETTS
Lee's Hazard Mitigation and Climate Adaption Plan
Upcoming Meeting!
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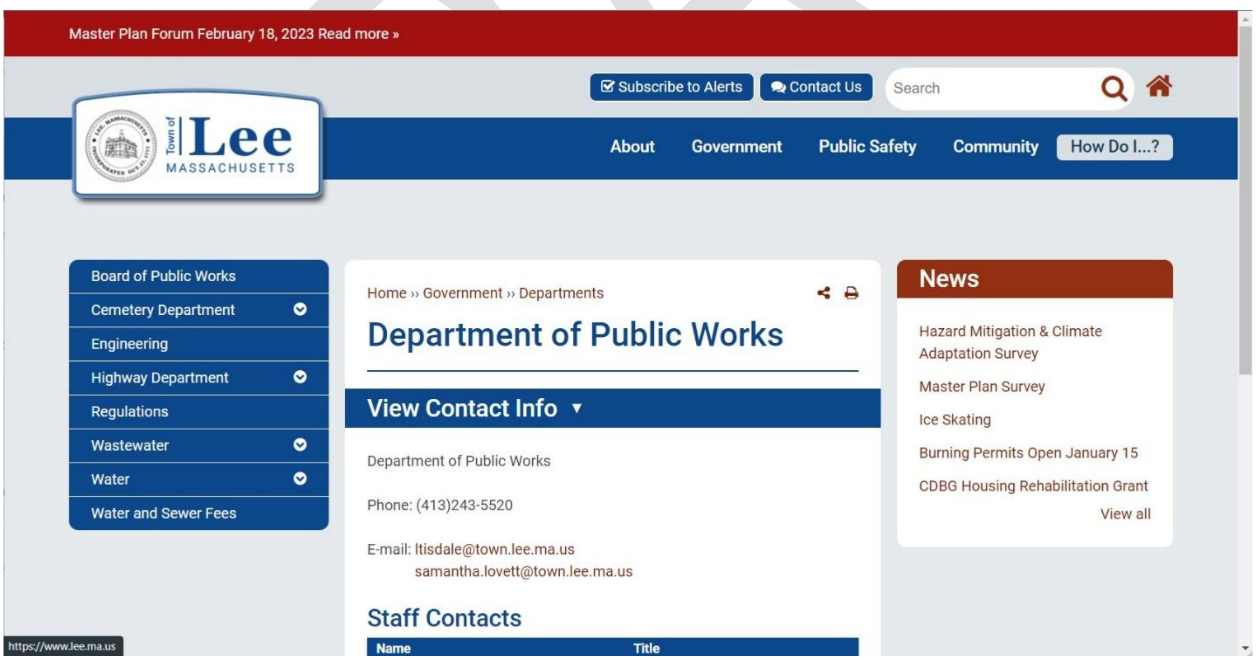
Master Plan Forum February 18, 2023 Read more »
Subscribe to Alerts
Contact Us
Search
Town of Lee MASSACHUSETTS
About
Government
Public Safety
Community
How Do I...?
Board of Public Works
Cemetery Department
Engineering
Highway Department
Regulations
Wastewater
Water
Water and Sewer Fees
Home » Government » Departments
Department of Public Works
View Contact Info
Department of Public Works
Phone: (413)243-5520
E-mail: ltisdale@town.lee.ma.us
samantha.lovett@town.lee.ma.us
Staff Contacts
Name
Title
News
Hazard Mitigation & Climate Adaptation Survey
Master Plan Survey
Ice Skating
Burning Permits Open January 15
CDBG Housing Rehabilitation Grant
View all
https://www.lee.ma.us

## Quick Write-up

Courteny Morehouse <cmorehouse@berkshireplanning.org>
Fri 2/17/2023 1:07 PM
To: Michael Richard <mjrichard@leepublicschools.net>
Cc: Jordan Meyer <jomeyer@leepublicschools.net>

1 attachments (86 KB)
Facebook Listening Session.jpg;

Hi Mike and Jordan,

Thanks for your time yesterday. It was incredibly helpful for the plan.

Mike, I imagine this is too late for this week, but if you could include the following write-up in your newsletter for next week/following weeks that would be great.

> Lee is working on a Town Hazard Mitigation and Climate Adaptation Plan. This is the first step to better prepare Lee for natural disaster and the threats of climate change. The committee is looking for your input and knowledge! Please consider participating. Use the QR Code or the link below to learn more, participate in the survey, and/or RSVP to the hybrid information session to be held on March 8th at 7pm. tinyurl.com/LeeHMPlan
> Thank you!

Attached is a small graphic to include in case it's helpful. The survey will be open until the end of March.

Jordan, I'll be in touch closer to the workshop with details and an invitation. Thanks for showing me around the school site and talking through the issues you're seeing.

Have a good, long weekend!
Courteny

BRPC
**Courteny Morehouse**
**Environmental & Energy Program Senior Planner**
1 Fenn St., Suite 201 | Pittsfield, MA 01201
O: 413.442.1521 x26
cmorehouse@berkshireplanning.org
www.berkshireplanning.org

## *Info Session- March 8th, 2023*

List of Attendees for March 8th Listening Session

| Online | | |
|---|---|---|
| Debra | Cranwell | resident |
| Christopher | Brittain | Town Admin, HMP/MVP Committee |
| Lisa | Hado-Mark | resident |
| Uli | Nagel | HMP/MVP Committee |
| Deborah | Kellogg | resident |
| Charlotte | Fairweather | resident |
| Toni | Thomas | resident |
| Sheila | Wood | resident |
| Robert | Heinzman | HMP/MVP Committee |
| Robert | Voss | resident |
| VERNA | HOUFF | resident |
| Christopher | Skelly | resident |
| sean | regnier | resident |
| Peter | Hofman | resident |
| Janice | Braim | resident |
| Katherine | Miller | HMP/MVP Committee |
| In- Person | | |
| Robert | Wright | HMP/MVP Committee |
| Caroline | Young | resident |
| Sal | Angela | resident |
| Nancy | Hoffmeier | resident |
| Gail | Ceresia | HMP/MVP Committee |
| Lenny | Tisdale | HMP/MVP Committee |
| Wren | Bernstein | resident |
| Josh | Bloom | resident |
| Joan | Angelo | HMP/MVP Committee |

## *Zoom Chat from March 8th listening session*

18:54:58 From Britney Danials, BRPC to Waiting Room Participants:
Thank you for joining. We'll begin in just a few minutes.
18:58:52 From Britney Danials, BRPC to Waiting Room Participants:
Thank you for joining. We'll begin in just a few minutes.
19:00:53 From Britney Danials, BRPC to Waiting Room Participants:
Welcome everyone. I am Britney from BRPC. I will be monitoring the chat and helping with any questions. We are going to get started with some basic Zoom Housekeeping.
1.) In lieu, of sign in-sheet, be sure to change your name so we know who attended tonight's meeting. 2.) be sure to mute yourself 3.) use the "Raise Hand" Feature if you have a question.
19:01:05 From Robert Heinzman to Everyone:
Katherine Miller and Robert Heinzman -n Resident
19:01:19 From Charlotte Fairweather to Everyone:
Charlotte Fairweather
19:01:39 From Britney Danials, BRPC to Waiting Room Participants:
Welcome! Thank you for attending tonight's meeting!
19:02:09 From Robert Heinzman to Everyone:
Courteny, hi, thanks for your leadership with this. Sorry I couldn't make it to the town hall tonight.
19:03:16 From Marilyn Wyatt to Everyone:
So glad to be here. Delighted that this event is taking place!
19:19:48 From Charlotte Fairweather to Everyone:
What does Lee do currently about invasive management?
19:20:20 From Robert Heinzman / Katherine Miller to Everyone:
very clear. all of us who have lived here for a while have seen these changes unfolding.
19:21:08 From Toni Thomas - Resident, East Lee to Everyone:
Will the presentation be available in pdf form...later? Sorry if you already mentioned.
19:22:52 From Marilyn Wyatt to Everyone:
Thanks for this interesting presentation This is no doubt jumping ahead, but I wonder if it would be possible to roll hazard mitigation into a larger movement to preserve our natural environment, such as light pollution and new green spaces downtown,
19:23:14 From Charlotte Fairweather to Everyone:
Would it be useful to distribute educational leaflets
19:25:20 From Britney Danials, BRPC to Everyone:
Charlotte, are you speaking about educational leaflets on invasive management?
19:25:42 From Charlotte Fairweather to Everyone:
yes
19:25:55 From Britney Danials, BRPC to Everyone:
Thank you!
19:29:19 From Lisa Hado-Mark to Everyone:
Great so far BUT is It too much to include Gt Barrington, Lenox, Stockbridge. Maybe Pittsfield

19:30:48 From Britney Danials, BRPC to Everyone:
If you haven't already, please consider taking the Hazard Mitgation survey. Your responses help to guide the Town's plan.
https://lee-ma.civilspace.io/en/projects/lee-hazard-mitigation-climate-adaptation-plan
19:40:03 From Britney Danials, BRPC to Everyone:
Feel free to unmute yourself or drop in the chat
19:46:12 From Toni Thomas - Resident, East Lee to Everyone:
Can we sdd?
19:46:19 From Toni Thomas - Resident, East Lee to Everyone:
Add
19:47:29 From Britney Danials, BRPC to Everyone:
Drop it in the chat and Courteny can add it
19:48:32 From Toni Thomas - Resident, East Lee to Everyone:
July 2021 rain storm caused parts of Tyringham Rd to flood, was a issue in a few places.
19:48:56 From Uli Nagel to Everyone:
we are not looking at algae growth due to warmer water in the lake and ponds?
19:49:14 From Britney Danials, BRPC to Everyone:
Algae growth is consider under invasive management
19:50:13 From Britney Danials, BRPC to Everyone:
Other things folks can think of ponding in your yard, dams breaking, invasive bugs, drought, ice etc.
19:53:24 From sean regnier to Everyone:
Are there any concerns about forest fires?
19:53:55 From Toni Thomas - Resident, East Lee to Everyone:
A few parcels down from Larsens garage... ice forms across RT20 from small strem flowing into Greenwater Brook
19:54:22 From Uli Nagel to Everyone:
do you have the flooding near East Center on Columbia? It's run off from somewhere?
19:54:52 From Deborah Kellogg - Resident to Everyone:
I live at October MT Village also on East St. I too had water in the basement in 2021
19:57:05 From Toni Thomas - Resident, East Lee to Everyone:
Did anyone mention the bittersweet that is overtaking our large trees along the river, Rt 102 and many wooded edges?
20:00:47 From Robert Heinzman / Katherine Miller to Everyone:
Just remembered, concerning invasives, there is a group of people that pull up garlic mustard in different forests in Lee
20:02:53 From Uli Nagel to Everyone:
those invasive covered trees are very prone to fall over in strong winds..
20:03:17 From Deborah Kellogg - Resident to Everyone:
With all the worries about flooding/water, we can't ignore that potential future PCB contaminated flooding
20:04:25 From Toni Thomas - Resident, East Lee to Everyone:
Our "Gateway to the Berkshires " exit/entrance to the Pike, bittersweet has killed off trees and shrubs

*Presentation Slides from March 8th Listening Session*


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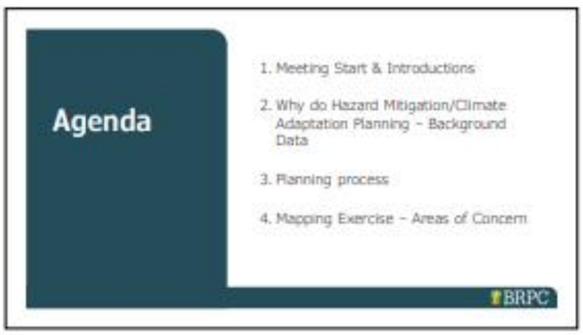


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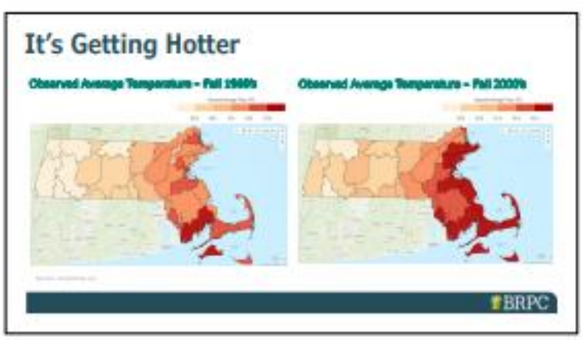


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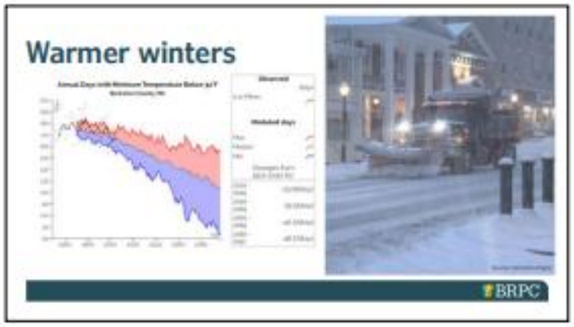

Warmer winters
BRPC

7


Changes to Winter Weather
Warmer temperatures lead to..
LESS SNOWPACK
MORE RAIN-ON-SNOW EVENTS
ICE RISKS
BRPC

8


Impact on People & Public Health
BRPC

9


Drought
MASSACHUSETTS DROUGHT STATUS
BRPC

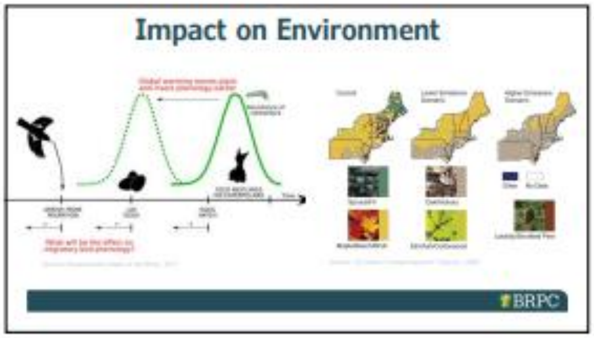
10


Flooding & Erosion
55% Increase in Extreme precipitation since 1950s
Becket Road Washout
BRPC

11


Massachusetts' Climate is Shifting "Southward"

12

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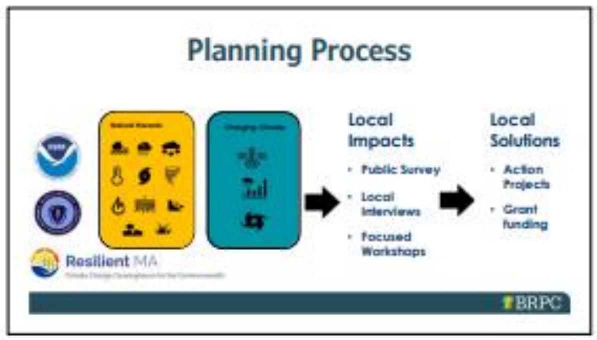


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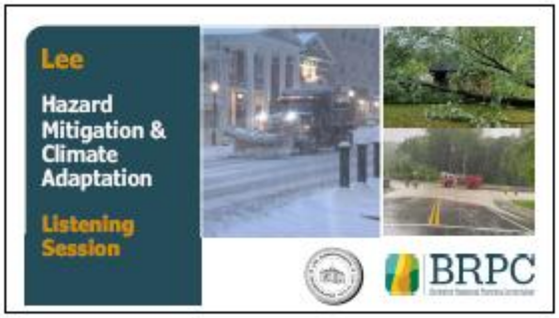
## Listening Session Sign-In

| NAME | EMAIL |
| --- | --- |
| Chris Brittain | cbrittain@town.lee.ma.us |
| Kathy Devarennes | director@leechamber.org |
| Emma Sass | emma.m.sass@mass.gov |
| Joan Angelo | CRONEJOAN1@gmail.com |
| Cary Tinker | ctinker@town.lee.ma.us |
| SARAH NAVIN | snavin@town.lee.ma.us |
| Craig DeSantis | CDESANTIS@TOWN.LEE.MA.US |
| Robert Wright | peck9mm@gmail.com |

*Listening Session Presentation- March 21st, 2023*

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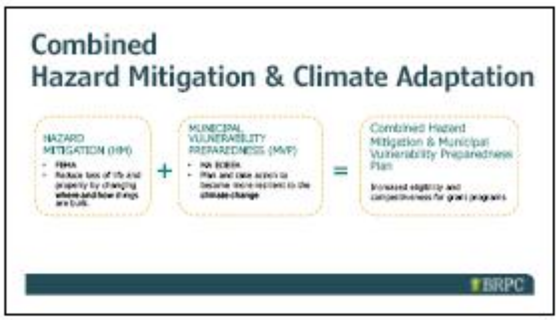


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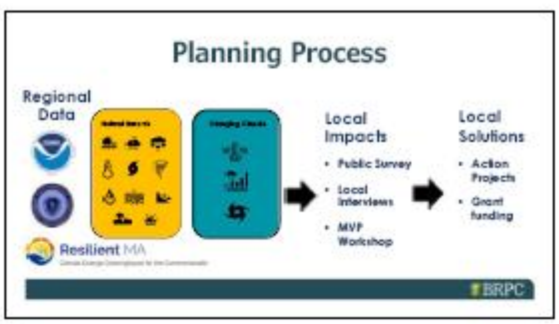


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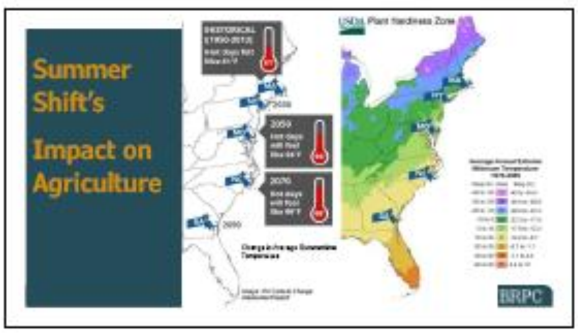
Notable
Berkshire Events
Hoosic River Floods – 100-year storms
Dam failures
Tornadoes
Tick-borne Lyme
Wildfires

7


What is Happening Now & in the Future?
Temperature
Growing Season
15 Days
Sea Level Rise
11 inches
Heavy Precipitation
Regional Climate Outlook
BRPC

8


Summer Shift's
Impact on Agriculture
Plant Hardiness Zone
BRPC

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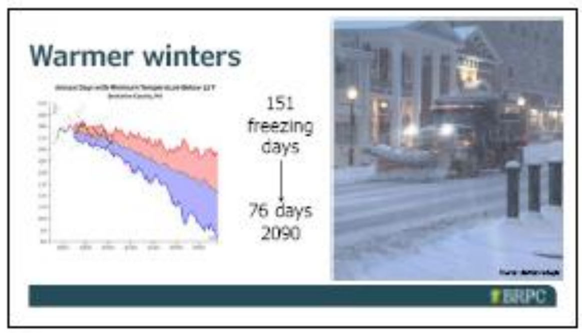

Warmer winters
151 freezing days
76 days 2090
BRPC

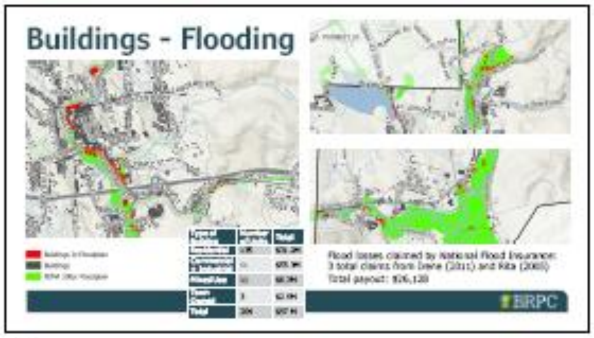
10


Housing Impacts
AGE OF HOUSING STOCK IN LEE
EAGLE MILL
Survey concern: Houses and rental properties are not built for new weather.
BRPC

11


Storms: More Extreme, More Frequently, and Lasting Longer
Precipitation Projections 2030 - 2090 for Lee, MA
55% Increase in Extreme precipitation since 1950s
BRPC

12

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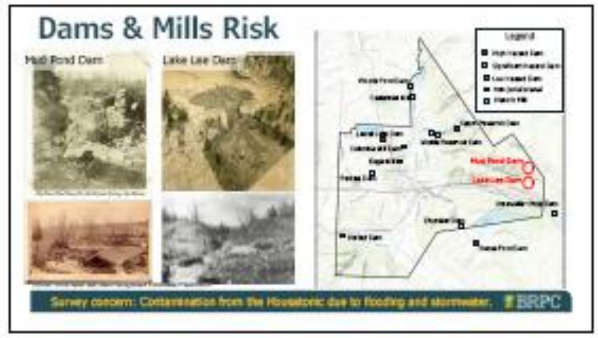


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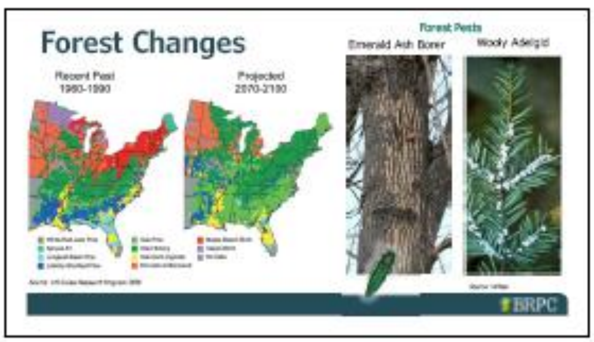


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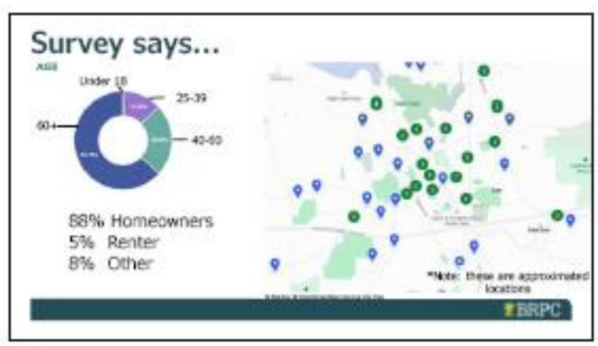


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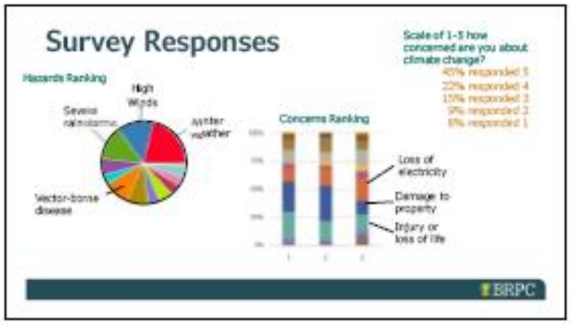


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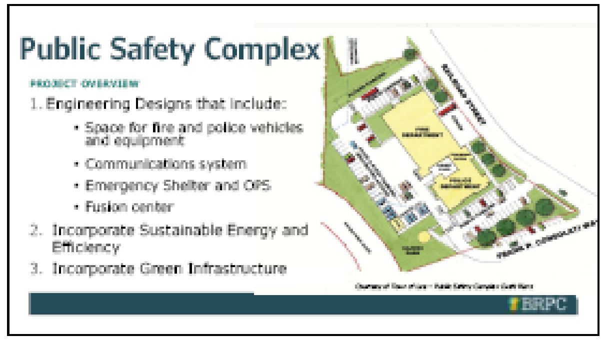


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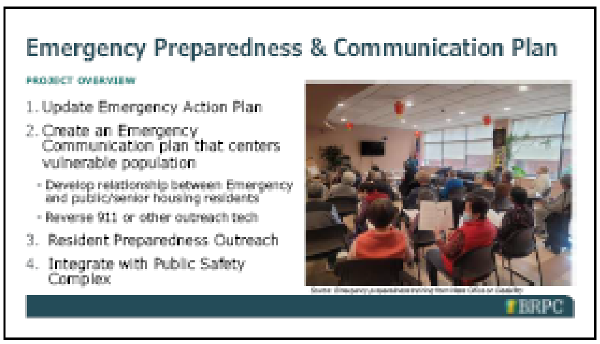


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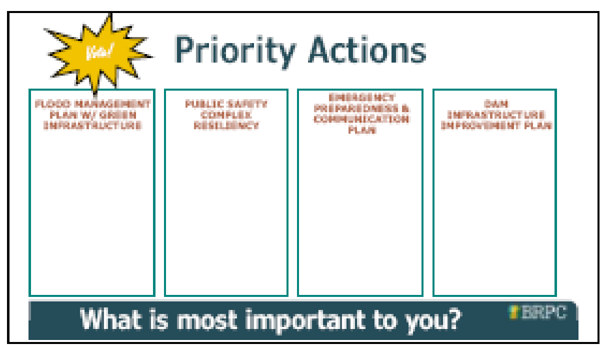


30

*Paper Survey Questions*

# Town of Lee Hazard Mitigation & Climate Adaptation Survey

Lee is developing a
Hazard Mitigation & Climate Adaptation Plan to identify risks, both man-made and natural; develop strategies to eliminate or reduce the potential for loss of life, property, and infrastructure from disasters; and develop sustainable, cost-effective action to mitigate risks and the impacts of climate change. As part of this process, the Town will analyze current risks through past hazards and future climate changes' ability to exacerbate those risks. Stakeholders and residents will then identify actions Lee can take to mitigate and address future risks. Your responses will help guide the Town through the planning process. In addition to this survey, there are multiple opportunities for you to participate, including attending public meetings and signing up for project notifications to stay informed.

*This survey can also be completed online! Use your smartphone to scan the QR code.*

Q1: What is your age? ______

Q2: I am a:

- ☐ Renter
- ☐ Homeowner
- ☐ Business Owner
- ☐ Student
- ☐ Retired
- ☐ Other: (please specify): ____________________________________________

Q3: Please list the street/area in which you reside: ______________________________

Q4: Which of the following have you experienced living in Lee?

- [ ] Flooding on your property
- [ ] Flooding or washout of roads
- [ ] Severe winter weather (snow, blizzard, ice storm, etc.)
- [ ] Severe rainstorms (hurricanes, tropical storms, etc.)
- [ ] Extreme heat
- [ ] Extreme cold
- [ ] Drought

- [ ] Tornado
- [ ] Landslide
- [ ] Earthquake
- [ ] Forest Fires
- [ ] Vector-borne disease (due to rodents, ticks, mosquitos, etc.)
- [ ] Poor forest health/invasive species
- [ ] High winds
- [ ] Other (Please specify): ___________ __________________________

Q5: On a scale of 1 - 3, rank your top 3 hazards of concern (1 being the topmost concern)

___ Flooding on your property
___ Flooding or washout of roads
___ Severe winter weather (snow, blizzard, ice storm, etc.)
___ Severe rainstorms (hurricanes, tropical storms, etc.)
___Extreme heat
___Extreme cold
___Drought
___Tornado
___Landslide
___Earthquake
___Forest Fires
___Vector-borne disease (due to rodents, ticks, mosquitos, etc.)
___Poor forest health/invasive species
___High winds

Q6: On a scale of 1 -3, rank your top greatest concern about these hazards (1 being the top most concern)
___Ground/surface water contamination
___Injury of loss of life

___Loss of Work
___Loss of native habitat
___Cyber-security/loss of internet access
___Loss of electricity
___Loss of economic opportunities
___Becoming isolated
___Damage to or loss of property
___Not being informed of impending disasters
___Other (please specify) ___________________________________________

Q7: What is your household water source?

☐ Town Water ☐ Private well

Q8: If you are on a private well, has it ever run dry?

☐ No
☐ Yes, please provide information on when and for how long:
__________________________________________________________________________
________________________________________

Q9: On a scale of 1 – 5, how concerned are you about climate change? (1 = not worried at all, 5 = extremely worried)

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Q10: What are some of your biggest concerns about climate change? (Please be as specific as possible. Example: I'm worried about drought's impact on farming in the area. My house isn't built for the amount of rain and heat.)

**Q11:** What is the greatest threat to your work regarding hazards, disasters, and/or climate change?

**Q12:** What solutions should we consider to any of the issues raised?

**Q13:** Would you like to stay in touch and/or receive updates about this project?

- ☐ Yes, please contact me about the issues I've raised in my response
- ☐ Yes, please add me to the email list with project updates and events
- ☐ No
- ☐ Other (please specify) ________________________________________

Please return this paper survey to any municipal building.

*Your input is valuable as we move forward with each of these projects and prepare The Town of Lee for the future. For questions about this process, you may contact Courteny Morehouse at cmorehouse@berkshireplanning.org*

*Thank you!*

# APPENDIX B: COMMUNITY RESILIENCE BUILDING WORKSHOP

## *Workshop Invitation List*

| Organization/Entity | Name | Email | RSVP |
|---|---|---|---|
| Lions | | | |
| Chamber of Commerce | Kathy Devarennes & Betty | director@leechamber.org | Yes |
| Goose Pond Maintenance District | John Philpott | paperjwp@mindspring.com | Yes |
| Kiwanis | Betty & Perry Flood | miminono1951@gmail.com | Yes |
| Open Door Church | Ali Zabian | | No |
| Agriculture Commission | Mary Brittain | | Yes |
| Board of Health/Tri-Town Health | Jim Wilucz & Ivy Goodwin (substance use) | | Yes |
| Canna Provisions | Eric | | |
| Community Preservation | Tom Logsdon | | |
| Con Com | Kathy Arment | | |
| Council on Aging | Pat Digrigoli | coa@town.lee.ma.us | Yes |
| DCR | Travis Clairemont | | Yes |
| Developer | Jeff Cohen | | |
| Exelsior | Crane | | |
| First Congregational | Garth Storey | | |
| Great Barrington | Select Board | | |
| Green Theory | | | |
| Historical Commission | Be | | Yes |
| Housing Authority | Deb Pedericini | | Yes |
| Katherine Warden (Kathe) | Town Administrator | administrator@townofbecket.org | Yes |
| Laurel Lake Association | Harold Sherman | | Yes |
| Lenox | Select Board | | |
| Select Board | Gordon Bailey | | Yes |
| Sons of Italy | Richard Brittain | | Yes |
| Stockbridge | Select Board | | |
| Suburban | | | |
| Washington | Select Board | | |
| Youth Comission | Kathy Hall | | Yes |
| Berkshire Housing | Eileen Peltier | | No |
| Greenock Country Club | Skye | | |
| Holiday Inn Vacation at Oak and Spruce | Brian or Steve Stiehwa | reservation@holidayinnclub.com | |
| Lee Public School | Jordan Meyers | | Yes |
| Mass DOT | Amer Raza | | Probably no |

| | | | |
|---|---|---|---|
| Mass DOT | Francesca Heming -head of district 1 | | Probably no |
| Mass DOT | Mike Fabiano | | Probably no |
| Ray Murrey | Cassandra Barry or Shaun Huggins (sales)<br>Scott Porter | cbarry@raymurray.com or shuggins@raymurray.com<br>sporter@raymurray.com | |
| Teachers | Erin Dufresne | | |
| The Village at October Mount Association | Alicia Graves, Tom Fusco<br>Board President Ellen Herman | office@villageatoctobermountain.com | |
| Berkshire Sterile | Travis Ruscio (or someone from safety) | | Yes |
| Big Y | | | No response |
| Boyd Biomedical | Stephen Boyd | | Yes |
| Spanish Festival | Liliana | | No response |
| Lee Family Medical | | | No response |
| Lee Land Trust | Linda Cysz | lindacysz@yahoo.com | Yes |
| Lee Outlets | Michael Cahalen | | Yes |
| Barrington Coffee | | | Probably a no |
| College Internship Program (CIP) | Matt Kosiorek | | Yes |
| Onyx | Andrew Begrowicz | | Yes |
| St. Mary's | Father Brian McGrath | | Yes |
| High Lawn Farm | Emily | | |
| Old Castle | | | Maybe |
| Stockbridge Terrace | Mark | | Probably a no |
| Board of Public Works | Rob Wright | | Yes |
| Fire - Rescue - EMS | Chief Brown | | Yes |
| Highway & Water | Lenny Tisdale | | Yes |
| Planning Board - Land Use | Beth Mead | | Yes |
| Police | Chief Desantis | | Yes |
| Recycling/Greener Gateway | Joan Angelo | | Yes |
| RW | | | Yes |
| Dresser Hull | Chris Shields | | Probably a yes |

| | | | |
|---|---|---|---|
| Housatonic River Initiative | Tim Gray | | Porabably yes |
| Mo's | Jeff Cohen | | No repsonse |
| Baptist | Doug Mann | | No repsonse |
| Jahovah Witness | Todd Sildania | | No repsonse |
| Liesure Lee | President | | No repsonse |
| Youth | Libby Mead & Nico | | Yes |
| Fox Hollow, Lakeside Condos, The Meadows | | | No |
| Manos Unidas | Analisa Vanegas | | Yes |
| Youth | Nico | | Yes |
| Lee Bank | Susie Brown | | Yes |

## *Workshop Invitation Example*

**From:** Courteny Morehouse <cmorehouse@berkshireplanning.org>
**Sent:** Monday, August 21, 2023 2:53 PM
**To:** office@villageatoctobermountain.com <office@villageatoctobermountain.com>
**Subject:** Lee Hazard Mitigation Workshop Invitation - Sept. 22

Hello Alicia,

I'm working with the Town of Lee to identify the impacts of natural disasters for residents and visitors. We have a workshop coming up and have invited a number of home associations and neighborhoods to participate in order to identify solutions to issues such as flooding, increasing rainstorms, snow hazards etc. This includes folks from around Laurel Lake, neighborhoods downtown, Goose Pond and more.

I'm writing to invite someone from your board or staff to attend. The workshop is scheduled for September 22nd at Greenock Country Club. This is an all-day event (9am – 3pm) with good food, great conversation, and important work.

The workshop will identify vulnerabilities and develop solutions for adapting to changing weather and related hazards. The resulting report makes Lee eligible for state and federal funding to implement these ideas – up to $3million per year.

Think: bridges, culverts, flood mitigation, road washouts. Think: nor'easters, heavy rain events, landslides, fires, emerald ash borers. Think: increase public health from pests and heat waves and impact of hazards to our businesses and economy.

If you or anyone on your board have any questions, please don't hesitate to reach out.
Thank you for your consideration.
Best,
Courteny

BRPC

**Courteny Morehouse**
**Environmental & Energy Program Senior Planner**
1 Fenn St., Suite 201 | Pittsfield, MA 01201
O: 413.442.1521 x26
cmorehouse@berkshireplanning.org
www.berkshireplanning.org

## Workshop Presentation Slides


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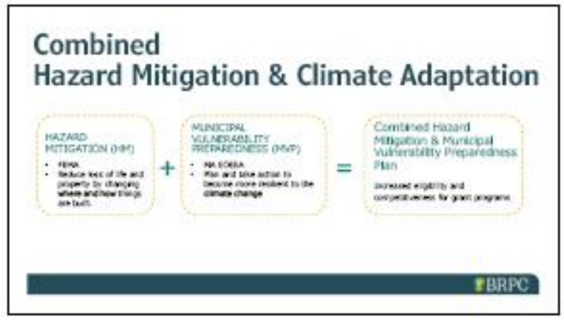


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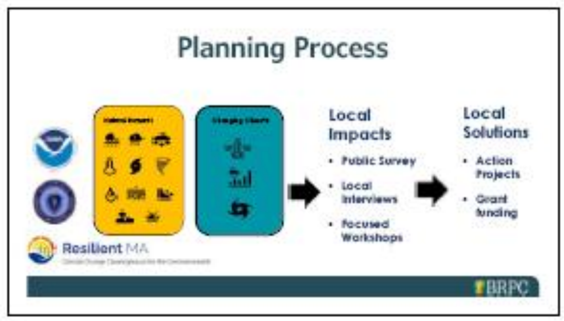


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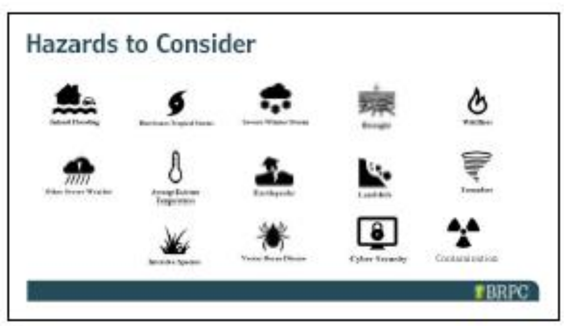


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What we've learned so far from Town survey
BRPC
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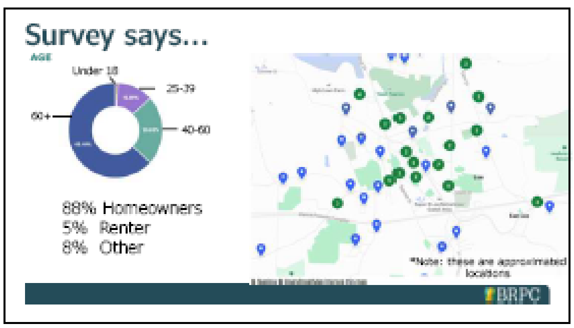
Survey says...
AGE
Under 18
25-39
40-60
60+
88% Homeowners
5% Renter
8% Other
*Note: these are approximated locations
BRPC
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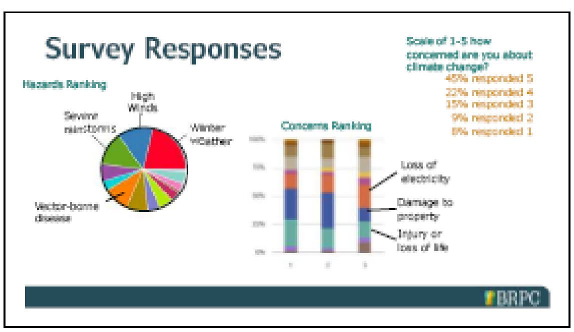
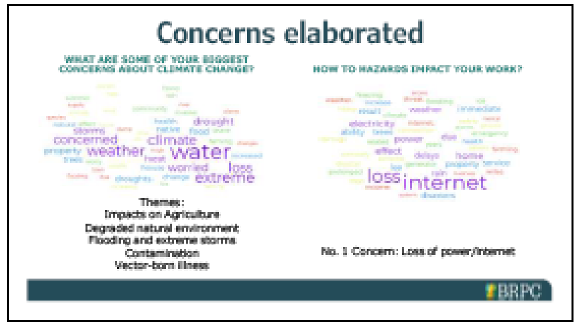
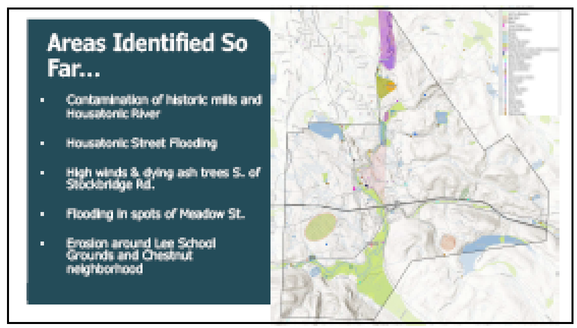
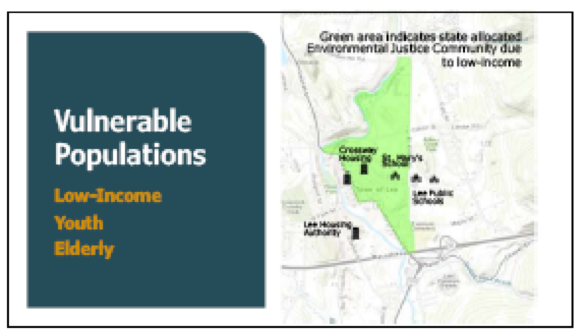

Survey Responses
Hazards Ranking
High Winds
Severe rainstorms
Winter weather
Vector-borne disease
Concerns Ranking
Loss of electricity
Damage to property
Injury or loss of life
Scale of 1-5 how concerned are you about climate change?
45% responded 5
22% responded 4
15% responded 3
9% responded 2
8% responded 1
BRPC
9


Concerns elaborated
WHAT ARE SOME OF YOUR BIGGEST CONCERNS ABOUT CLIMATE CHANGE?
HOW TO HAZARDS IMPACT YOUR WORK?
Themes:
Impacts on Agriculture
Degraded natural environment
Flooding and extreme storms
Contamination
Vector-born illness
No. 1 Concern: Loss of power/internet
BRPC
10


Areas Identified So Far...
Contamination of historic mills and Housatonic River
Housatonic Street Flooding
High winds & dying ash trees S. of Stockbridge Rd.
Flooding in spots of Meadow St.
Erosion around Lee School Grounds and Chestnut neighborhood
11


Vulnerable Populations
Low-Income
Youth
Elderly
Green area indicates state allocated Environmental Justice Community due to low-income
Crossway Housing
St. Mary's School
Lee Public Schools
Lee Housing Authority
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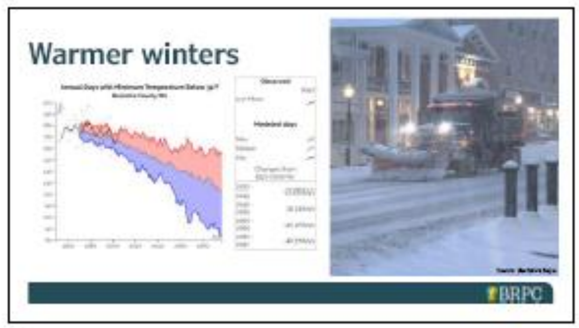


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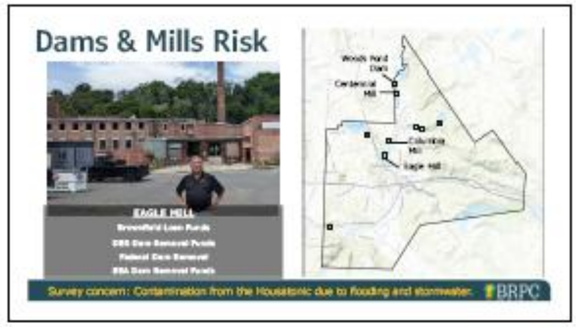


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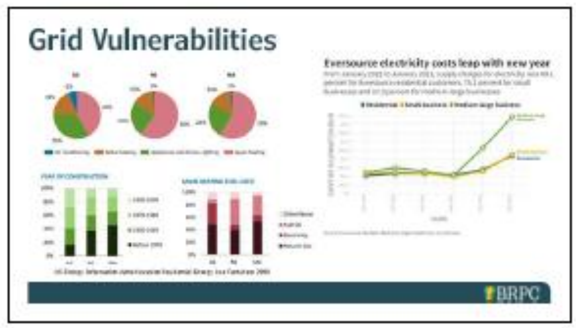


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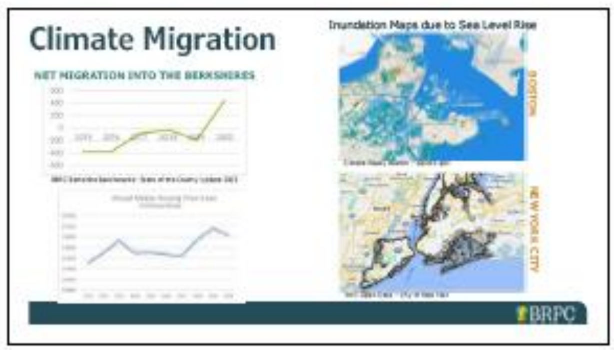

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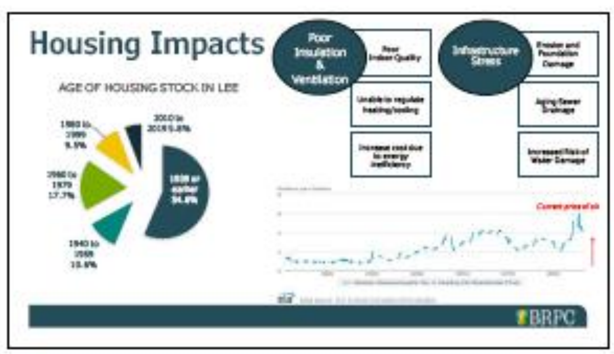

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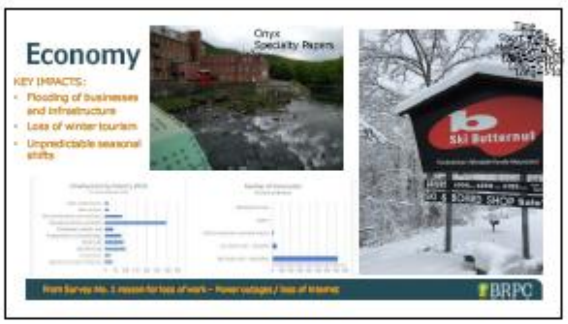


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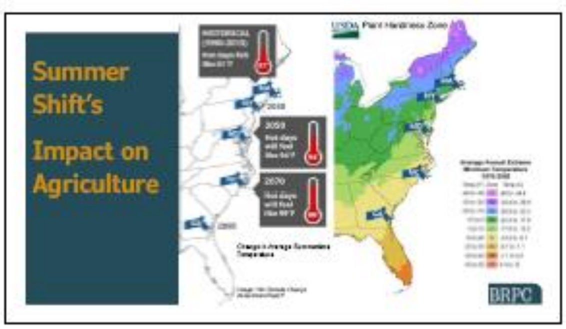


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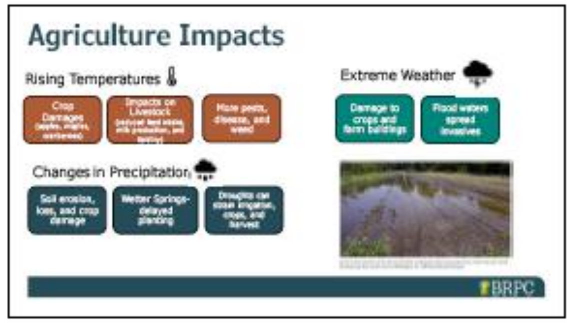


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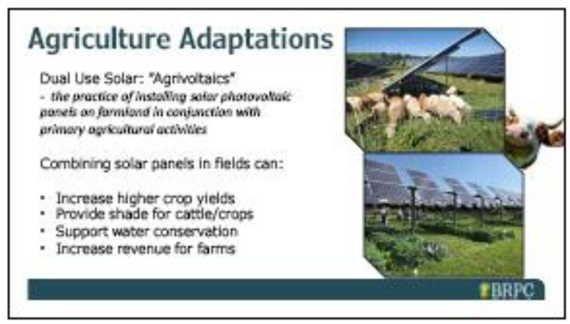


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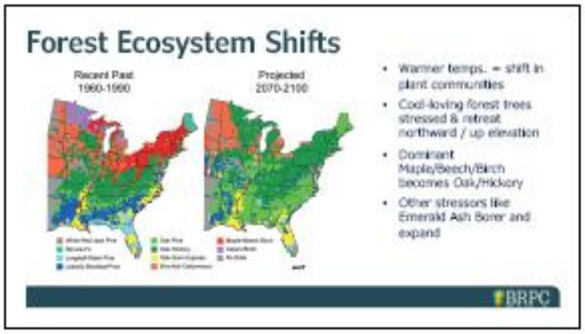


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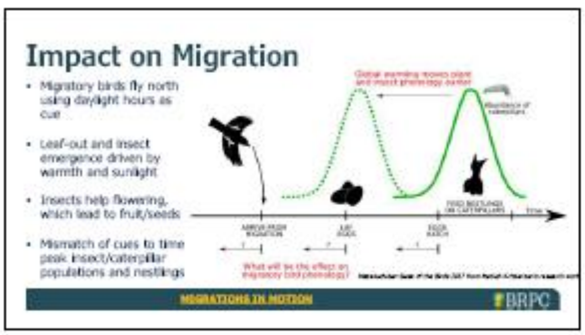


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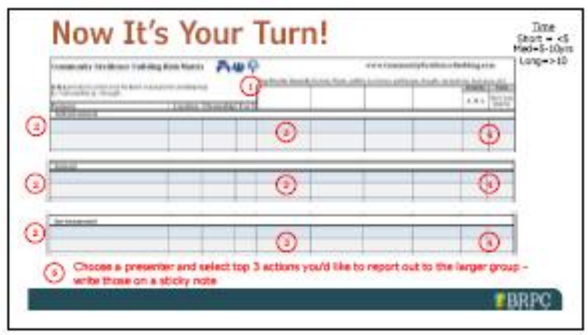


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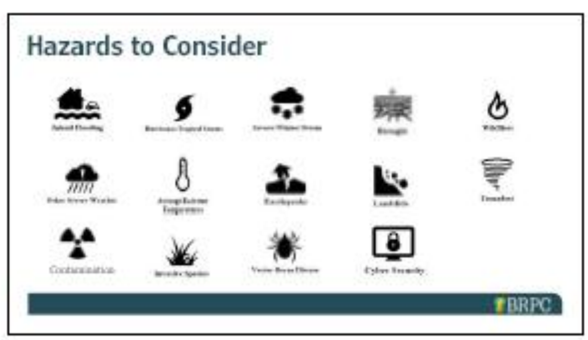


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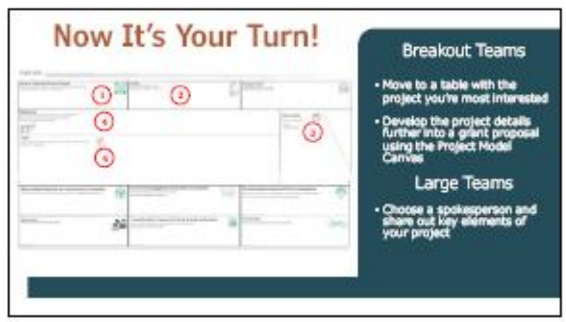


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Next Steps
1. Draft Hazard Mitigation Plan – Public Comment
2. Public Listening Session
3. Approval from MVP and MEMA/FEMA
4. Town Adoption of Plan

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Thank you!
Courteny Morehouse
cmorehouse@berkshireplanning.org
www.berkshireplanning.org

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**Town of Lee**
**Hazard Mitigation Workshop**
**September 22nd, 2023**
**~ Sign In ~**

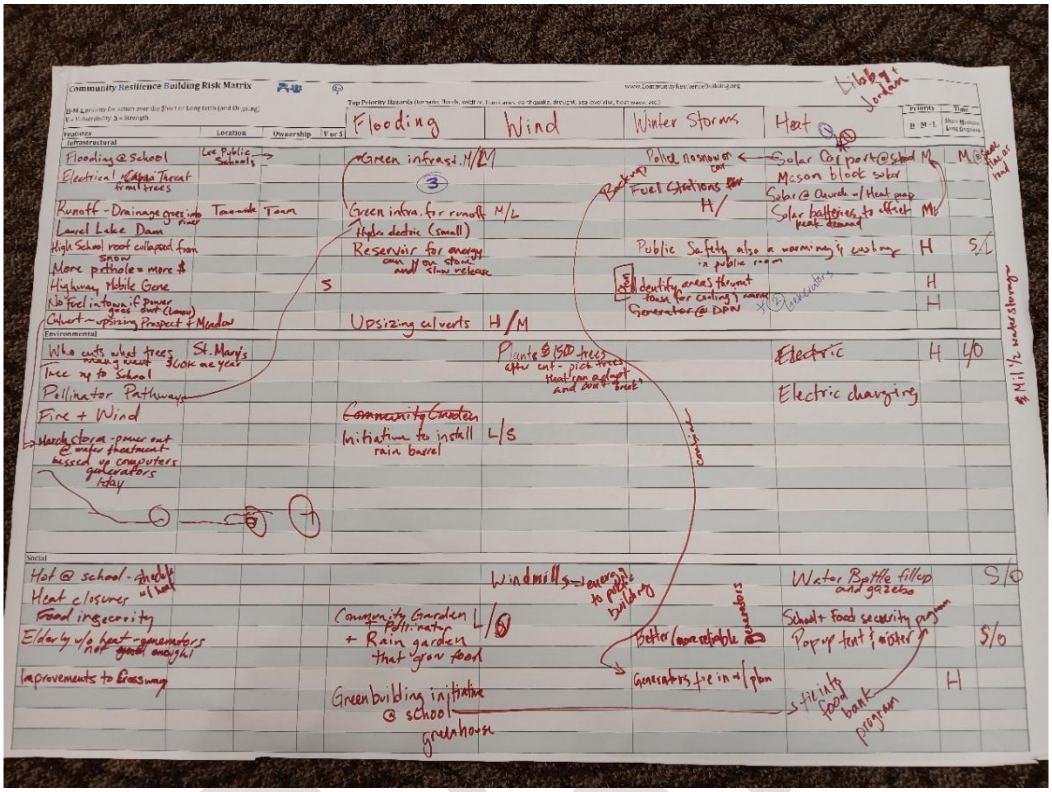
| Name | Title/ Affiliation |
|---|---|
| 1. Perry Flood | Kiwanis Club |
| 2. Sarah Navin | Admin Accessor |
| 3. Richard Brittain | Son of Italy |
| 4. Tom Swift | Lions Club |
| 5. Gail Ceresia | Resident/Wetland Scientist |
| 6. Joan Angelo | Greening the Gateway Community |
| 7. Lenny Tisdale | Lee Highway and Water Department |
| 8. Beth Mead | Planning, Zoning, and Land Use |
| 9. Adam Mead | Fire Captain |
| 10. Libby Mead | Youth Representative from Lee High School |
| 11. Father McGrath | St. Mary's Church |
| 12. Jordan Meyers | Lee Public School |
| 13. Lindsey Cysz | Lee Land Trust |
| 14. Travis Clairmont | DCR Forester |
| 15. James Wilusz | Tri-Town Health |
| 16. Deb Pedericini | Lee Housing Authority |
| 17. Chris Brittain | Town Administrator |
| 18. Pat Digrigoli | Council of Aging |
| 19. Chief DeSantis | Lee Police Department |
| 20. Chief Brown | Lee Fire Department |
| 21. Rob Wright | Board of Public Works |

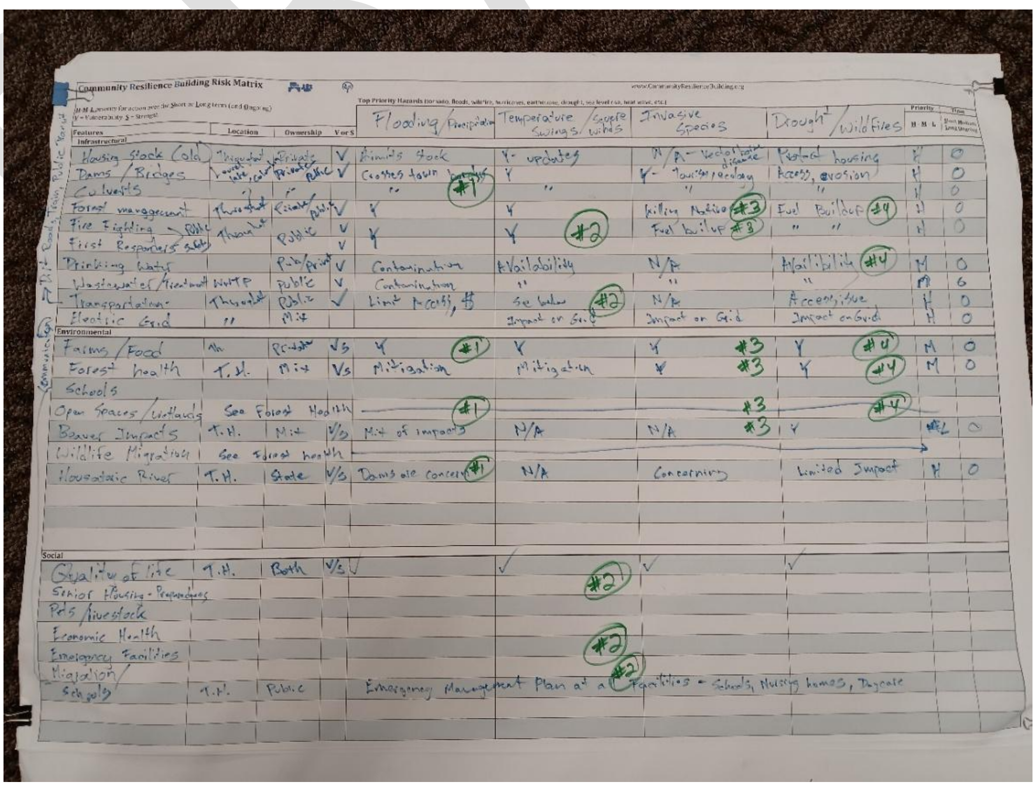
| | |
|---|---|
| 22. Susan Stone | Historical Commission |
| 23. Harold Sherman | Laurel Lake Commission |
| 24. Stephen Boyd | CEO Boyd Technologies |
| 25. Andrew Bergowicz | Onyx Papers |
| 26. Lee Donsbough | Lee Bank |
| 27. John Philpott | Goose Pond District/ Chamber of Commerce |
| 28. Nico | Youth Rep from Lee High School |
| 29. Gordon Bailey | Select Board |
| 30. Matt Kosiorek | College Internship Program |
| 31. Kathy Hall | Youth Commission |

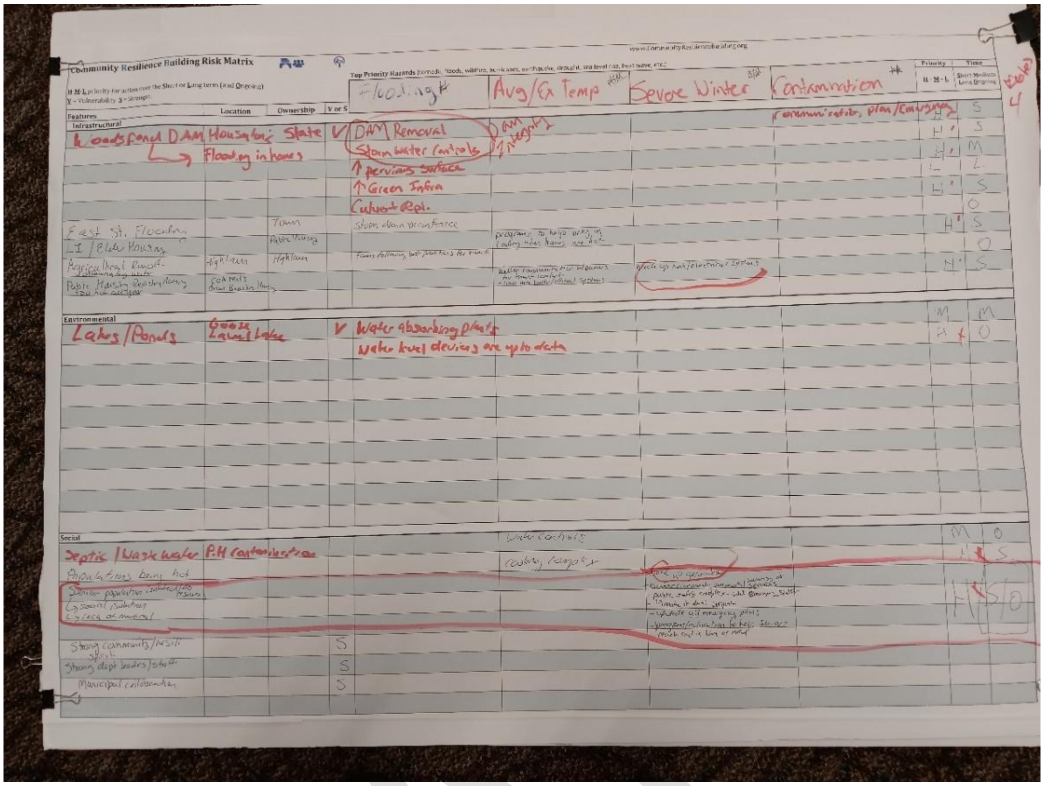
## *Workshop Photos*

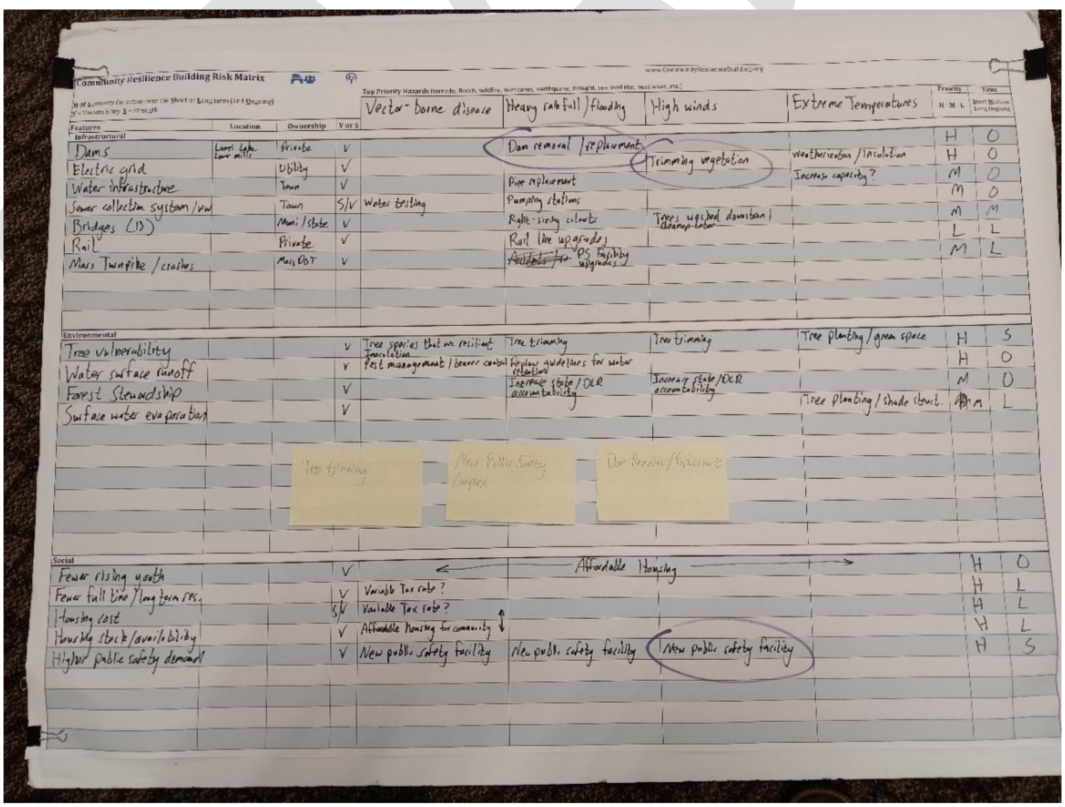


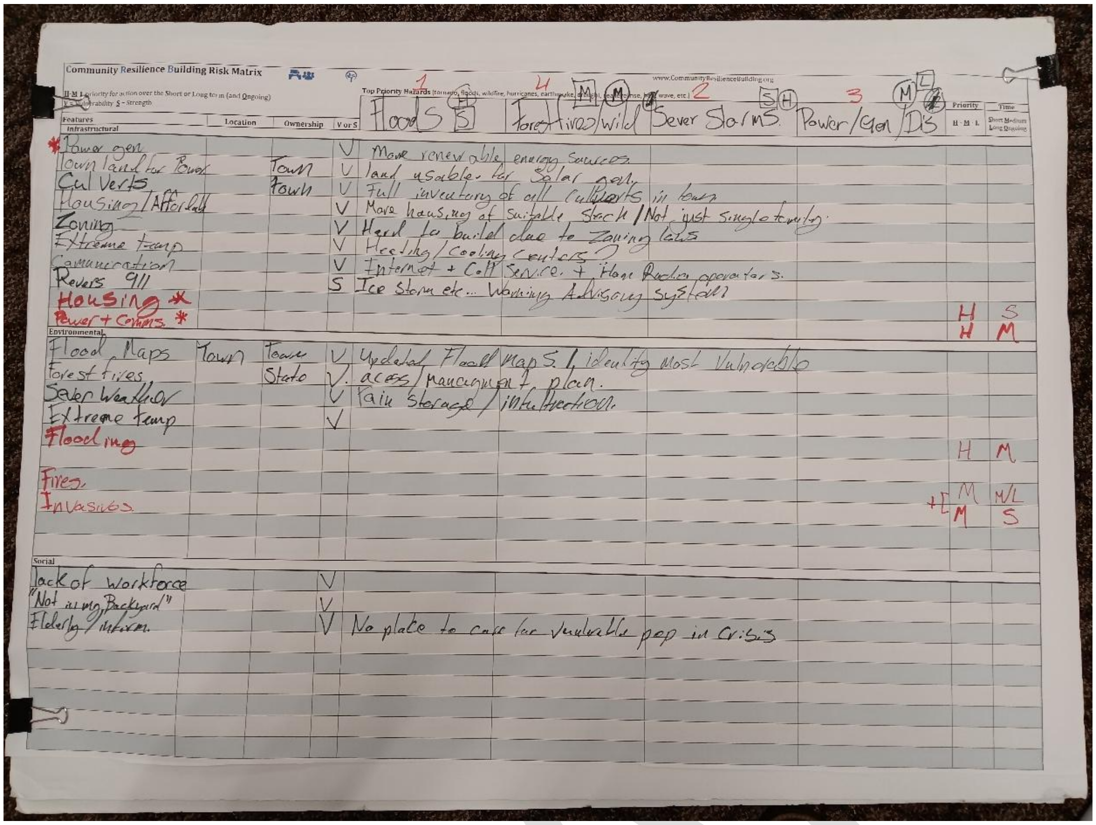
## *Workshop Matrices*




Community Resilience Building Risk Matrix
Flooding
Avg/Ex Temp
Severe Winter
Contamination
DAM Removal
Storm water Controls
Culvert Rpl.
Lakes/Ponds
Water absorbing plants


Community Resilience Building Risk Matrix
Vector-borne disease
Heavy rainfall/flooding
High winds
Extreme Temperatures
Dams
Electric grid
Water infrastructure
Dam removal / replacement
Trimming vegetation
Affordable Housing
New public safety facility


Community Resilience Building Risk Matrix
www.CommunityResilienceBuilding.org
Top Priority Hazards
Floods
Forest Fires/wild
Sever Storms
Power/Gen
Priority
Time
Features
Infrastructural
Location
Ownership
V or S
Power gen
Town land for Power
Cul Verts
Housing/Afford
Zoning
Extreme temp
Communication
Revers 911
Housing
Power + Comms
Town
Town
Move renewable energy sources
land usable for Solar only
Full inventory of all Culverts in town
More housing of suitable stock / Not just single family
Hard to build due to Zoning laws
Heating/Cooling centers
Internet + Cell Service. + Ham Radio operators.
Ice Storm etc... Warning Advisory System
Environmental
Flood Maps
Forest fires
Sever Weather
Extreme temp
Flooding
Fires
Invasives
Town
Town
State
Updated Flood Maps. / identify most Vulnerable
acess/management plan.
Rain storage / infiltration.
Social
lack of workforce
"Not in my Backyard"
Elderly / inform.
No place to care for Vulnerable pop in crisis