TOWN OF SOUTHWICK, MA HAZARD MITIGATION PLAN UPDATE

OCTOBER 2023

Town of Southwick

454 College Highway

Southwick, MA 01077

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https://www.southwickma.org/

Prepared by:

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Table of Contents

Table of Figures

Table of Tables

Acknowledgements

The Town of Southwick would like to thank the following people for supporting the development of this plan. This group was considered the Hazard Mitigation Planning Committee (HMPC) throughout the planning process.

- Russell Anderson, Director, Southwick Emergency Management Agency
- Rhett Bannish, Lieutenant, Southwick Police Department
- Jessica Bishop, Deputy Chief, Southwick Fire Department
- Randal Brown, DPW Director, Southwick Public Works Department
- John Francis Cain, Business Representative, Southwick Local Emergency Planning Committee
- Nadine Cignoni, Assistant Chief Administrative Officer, Town of Southwick
- Charles Dunlap, Director, Southwick Emergency Management Agency
- Diane Gale, Select Board Clerk, Town of Southwick
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- Paul Miles, Sergeant, Southwick Police Department
- Doug Moglin, Select Board Chairman, Town of Southwick
- Jason Perron, Select Board Vice Chairman, Town of Southwick
- Richard Stefanowicz, Chief, Southwick Fire Department
- Karl J. Stinehart, Chief Administrative Officer, Town of Southwick
- Cindy Sullivan, Director, Southwick Council on Aging
- Joshua Towse, Emergency Manager, Baystate Noble Hospital
- Joseph Turmel, Director of Finance and Operations, Southwick Regional School
- Iaian White, Radio Officer, Southwick Emergency Management Agency
- Jennifer Willard, Superintendent, Southwick Regional School
- Karen Wzorek, Transportation Supervisor, Southwick Regional School
- Jeffrey Zukowski, Hazard Mitigation Planner, MA Emergency Management Agency

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

Local Adoption Resolution

COMMONWEALTH OF MASSACHUSETTS

Town of Southwick

Office of the Select Board

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Doug Moglin, Chairman
Jason Perron, Vice Chair
Diane Gale, Clerk

Karl J. Stinehart,
Chief Administrative Officer
Lisa Anderson
Administrative Assistant

A RESOLUTION ADOPTING THE
TOWN OF SOUTHWICK, MA HAZARD MITIGATION PLAN - UPDATE 2023

WHEREAS the Town of Southwick recognizes the threat that natural hazards pose to people and property within the Town of Southwick; and

WHEREAS the Town of Southwick has prepared a multi-hazard mitigation plan, hereby known as TOWN OF SOUTHWICK, MA HAZARD MITIGATION PLAN UPDATE 2023 in accordance with federal laws, including the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended; the National Flood Insurance Act of 1968, as amended; and the National Dam Safety Program Act, as amended; and

WHEREAS the TOWN OF SOUTHWICK, MA HAZARD MITIGATION PLAN UPDATE 2023 identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the Town of Southwick from the impacts of future hazards and disasters; and

WHEREAS adoption by the Town of Southwick Select Board demonstrates its commitment to hazard mitigation and achieving the goals outlined in the TOWN OF SOUTHWICK, MA HAZARD MITIGATION PLAN UPDATE 2023.

NOW THEREFORE, BE IT RESOLVED BY THE TOWN OF SOUTHWICK, MA, THAT:

Section 1. In accordance with M.G.L. c. 40, the Town of Southwick Select Board adopts the TOWN OF SOUTHWICK, MA HAZARD MITIGATION PLAN UPDATE 2023. While content related to the Town of Southwick may require revisions to meet the plan approval requirements, changes occurring after adoption will not require Town of Southwick to re-adopt any further iterations of the plan. Subsequent plan updates following the approval period for this plan will require separate adoption resolutions.

ADOPTED AND SIGNED this Fourth day of March, 2024.

Doug Moglin, Chair

Jason Perron, Vice Chair

Diane Gale

Diane Gale, Clerk

ATTEST:

Jessica M Menzone

Record of Changes

This Town of Southwick, MA Hazard Mitigation Plan Update will be reviewed and approved on a biannual basis by the HMPC and following any major disasters. All updates and revisions to the plan will be tracked and recorded in the following table. This process will ensure the most recent version of the plan is disseminated and implemented by the Town.

Table 1. Summary of Changes.

Date of Change	Entered By	Summary of Changes

Chapter 1. Introduction

The Federal Emergency Management Agency (FEMA) defines hazard mitigation per the Code of Federal Regulations (CFR) 44 Section 201.2 as "any **sustained** action taken to reduce **or eliminate** the **long-term risk** to human life and property from hazards."

"Disaster Mitigation Act (DMA) 2000 (Public Law 106-390)[1] provides the legal basis for FEMA mitigation planning requirements for State, local and Indian Tribal governments as a condition of mitigation grant assistance. DMA 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act by repealing the previous mitigation planning provisions and replacing them with a new set of requirements that emphasize the need for State, local, and Indian Tribal entities to closely coordinate mitigation planning and implementation efforts."[2]

The Town of Southwick, Massachusetts created this plan as part of an ongoing effort to reduce the negative impacts and costs from damages associated with natural hazards, such as nor'easters, floods, and hurricanes. This plan meets the requirements of the Disaster Mitigation Act 2000. More importantly, the plan was created to reduce loss of life, land, and property due to natural hazards that affect the Town of Southwick. It is difficult to predict when natural hazards will impact the planning area, but it is accurate to say that they will. By implementing the mitigation actions listed in this plan, the impact of natural hazards will be lessened.

Local Mitigation Plans must be updated at least once every five years to remain eligible for FEMA hazard mitigation project grants. A local jurisdiction 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 within five (5) years to continue to be eligible for mitigation project grants.

Purpose of the Plan

The purpose of the Local Hazard Mitigation Plan is to provide the Town of Southwick with a comprehensive examination of all natural hazards affecting the area, as well as a framework for informed decision-making regarding the selection of cost-effective mitigation actions. When implemented, these mitigation actions will reduce the Town's risk and vulnerability to natural hazards.

This plan is a result of a collaborative effort between the Town of Southwick and several key stakeholders. Throughout the development of the plan, the Hazard Mitigation Planning Committee (HMPC) consulted the public and key stakeholders for input regarding identified goals, mitigation actions, risk assessment, and mitigation implementation strategy. A sample of key stakeholders who

[1] Disaster Mitigation Act of 2000, Pub. L. 106-390, as amended

[2] Disaster Mitigation Act of 2000. https://www.congress.gov/106/plaws/publ390/PLAW-106publ390.pdf

participated, included the Massachusetts Emergency Management Agency (MEMA) and Baystate Noble Hospital.

Guiding principles for plan development

The HMPC adhered to the following guiding principles in the plan's development.[3]

- Plan and invest for the future.
- Collaborate and engage early.
- Integrate community planning.

This plan update meets the requirements outlined 44 CFR § 201.6(d)(3). These requirements are included in the plan in the green call-out boxes, like the one below.

> A local jurisdiction 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 within 5 years in order to continue to be eligible for mitigation project grant funding.

Yellow call-out boxes like the one to the right, are definitions taken from the Federal Emergency Management Agency Local Policy Guide, April 2023. These are included throughout the plan for reference and explanation.

> ***COMMUNITY RESILIENCE*** *is the ability of a community to prepare for anticipated hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. Activities such as disaster preparedness (which includes prevention, protection, mitigation, response and recovery) and reducing community stressors (the underlying social, economic and environmental conditions that can weaken a*

The HMPC prioritized mitigating impacts of climate change, mitigating risk to vulnerable communities, and protecting the built environment both today and in the future.

The HMPC identified the following list of hazards to profile. They are shown in order of climate change interaction for consistency with the State Hazard Mitigation and Climate Adaptation Plan (SHMCAP).

[3] Federal Emergency Management Agency. (April 19, 2022). Local Mitigation Planning Policy Guide, p.13.

Table 2. Town of Southwick Hazards.

Primary Climate Change Interactions	Hazards
Changes in Precipitation	1. Flooding (including riverine, dam failures, ice jams, etc.) 2. Drought 3. Landslide
Rising Temperatures	4. Extreme Temperatures 5. Wildfires (including brush fires) 6. Infectious Disease 7. Invasive Species
Extreme Weather	8. Hurricanes/Tropical Storms 9. Severe Winter Storm/Nor'easter (including blizzard, ice storm, etc.) 10. Tornadoes 11. Other Severe Weather (including thunderstorms, etc.)
Non-Climate Influenced Hazards	12. Earthquake

Mitigation Strategy

C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))

The hazard mitigation strategy is the culmination of work presented in the Planning Area Profile (Chapter 2), Risk Assessment (Chapter 4), and Capability Assessment (Chapter 5). It is also the result of multiple meetings and sustained public outreach. The HMPC developed the goals shown below. The goals from the previous Town of Southwick, Hazard Mitigation Plan, 2017, and the Town's Municipal Vulnerability Preparedness Plan, 2020 were revised to develop this current list. Information about the goal development process is in Chapter 6: Mitigation Strategy. The goals are considered "broad policy-type statements"[4] that represent the long-term vision for mitigating risk to natural hazards in the Town of Southwick.

Reduce risk to people, property, infrastructure, natural and cultural resources from natural hazards and climate change.

Mitigate risk to public and private properties, new developments, and infrastructure from natural hazards and climate change.

Expand the Town's capacity to mitigate risk through local and regional collaboration, planning, and regulations.

Educate residents, business owners, and Town employees how to implement hazard mitigation measures and their value.

Figure 1. Mitigation Plan Goal Statements.

Land Use and Development

Changes in Development

E1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))

The Town of Southwick has experienced steady residential growth in recent years, including a resurgence of subdivision developments, but it has not seen any significant changes in development that have occurred in hazard-prone areas since the last plan update. While it is estimated that there is still more than 7,000 acres of developable land without constraints[5], the vast majority of these areas are not

[4] Federal Emergency Management Agency. (2013). *Local Mitigation Planning Handbook,* p. 6.

[5] Southwick Open Space and Recreation Plan. 2019. P. 28.

in proximity to the community's known hazard zones. Two minor exceptions to this are described below; however, for reasons stated these should have no or (limited) impact to community vulnerability.

- Development around the Congamond Lakes area continues as does redevelopment, but these projects are located outside of flood hazard areas and are in compliance with the existing Conservation and Planning/Zoning regulations described in Chapter 5 (Capability Assessment).
- Some work on 157 Feeding Hills Road, in the floodplain, was approved but what was constructed did not match the approved plans. The Planning Board and the Conservation Commission have yet to resolve the issue.

***CHANGES IN DEVELOPMENT** means recent development (for example, construction completed since the last plan was approved), potential development (for example, development planned or under consideration by the jurisdiction), or conditions that may affect the risks and vulnerabilities of the jurisdictions (for example, climate change, declining populations or projected increases in population, or foreclosures) or shifts in the needs of underserved communities or gaps in social equity. This can also include changes in local policies, standards, codes, regulations, land use regulations and other conditions.*

Floodplain development is essentially prohibited in Southwick for two reasons. First, as described in Chapter 5, the Town has adopted strict regulatory standards within its Flood Hazard and Wetland District which make the construction of new or substantially improved buildings difficult to get approved. Only "low flood damage potential" uses are allowed (only temporary, non-residential structure uses), and special permits are only issued by the Planning Board if the applicant can demonstrate their proposed use will not in fact increase the flood hazard potential of any area (among other requirements). Second is a more physical obstacle, as most of Southwick's floodplains are narrow corridors that follow very closely the paths of streams and brooks. While some older development and structures are located along these areas, the Town's floodplain regulations and other zoning bylaws have eliminated the potential for unsafe and unwise development.

Outside of these known flood hazard areas, the main concern for Southwick as it relates to changes in development has to do with stormwater drainage and nuisance flooding issues. Over time, population growth and urban development have increased the impervious surface cover in Southwick, thereby increasing stormwater runoff and contributing to flooding problems throughout Town. In addition, there is a general recognition that much of the Town's stormwater drainage system was designed to accommodate historic patterns of precipitation and runoff and may be undersized as climate and weather patterns continue to shift. Aging stormwater infrastructure and lack of maintenance funds exacerbates flooding potential during heavy rains. In response to these concerns, the Town of Southwick continues to make stormwater management a priority issue for local infrastructure maintenance (e.g., culvert replacements), but also through its local stormwater regulations. For example, these regulations were updated in 2021 to include higher standards for design flows (referencing NOAA Atlas 14 for rainfall data), as well as other components required in the Town's MS4 Stormwater permit.

It is expected that Southwick will continue to undergo strong pressures from residential growth, which is estimated to be outpacing commercial and industrial growth by six times the amount. Construction of new homes in subdivisions has replaced many areas of farmland and forested land, so as stated in the Town's Open Space and Recreation Plan, care must be taken to protect and manage remaining open space for water supply protection, habitat, and recreation.[6] However, in terms of natural hazard risks, it is expected that future changes in development will not negatively affect the community's overall vulnerability to hazards. In fact, it is anticipated that these some of changes may result in decreased vulnerability over time as more of Southwick's building stock is constructed in compliance with modern codes and regulations as described above.

Lastly, some of the larger anticipated/proposed developments for the Town of Southwick are listed below in Table 10. These potential future changes in development are not located in hazard-prone areas and are not expected to affect the overall risks and vulnerabilities of the community in any significant ways.

Table 3. List of Recent and Future Development (Large Projects Only)

Location	**Use**	**Description**	**Current Status**	**Construction Timeline (if not constructed)**
27 Hudson Drive	Commercial	Cannabis Grow	Approved by Planning Board - Construction Not Started	Construction anticipated completed by August 2024
Sunnyside Road and College Highway	Residential	22 Home Subdivision	Construction 100% Complete	Construction completed
74 College Highway	Commercial	Cannabis Grow	Approved by Planning Board - Construction Not Started	Construction anticipated completed by October 2024
772 College Highway	Mixed Use Development	Doctor's office, Retail, & Residential	Approved by Planning Board - Construction Not Started	Construction anticipated completed by October 2024
18 Hudson Drive	Commercial	Warehouse & Office Space	Construction started August 2023	Construction anticipated completed by August 2024

[6] Southwick Open Space and Recreation Plan. 2019. P. 28.

Location	Use	Description	Current Status	Construction Timeline (if not constructed)
Tannery Road	Residential	36 Home Subdivision	Construction 50% Complete	Construction anticipated completed by September 2024
217 College Highway	Commercial	Day Care	Approved by Planning Board - Construction Not Started	Construction anticipated completed by September 2024
Mort Vining Road	Residential	33 Home Subdivision	Preliminary Subdivision Plan being reviewed by Planning Board	TBD
Hudson Drive (Tilcon Property)	Commercial	Commercial Subdivision	Concept plan presented to Select Board	TBD

Progress in Mitigation Efforts

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

Priorities in Southwick have remained consistent since the previous plan was written in 2016. The 2016 plan was not specifically integrated throughout Town because staff were unaware of the plan and how to implement it. Some planning documents may have included similar content to the mitigation plan but this was not purposeful. However, a Master Plan update is underway which may shift priorities and will include concepts from this plan. This updated Hazard Mitigation Plan does reflect a status update on the previous plan's mitigation actions (included in Chapter 6). Even though significant priorities may not have changed, this plan does reflect the Town's current concerns with the health of their lakes and how invasive species impact lakes. The MVP plan called out the need for drought mitigation as well as tree and forest management from high winds. This plan update includes those priorities.

Authority and Assurances

The Town of Southwick will continue to comply with all applicable Federal laws and regulations during the periods for which it receives grant funding, in compliance with 44 CFR 201.6. It will amend its plan whenever necessary to reflect changes in Local, State or Federal laws and regulations, as required in 44 CFR 201.6. The list of laws and regulations the Town with adhere to is below.

- Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended.
- National Flood Insurance Act of 1968, as amended.
- National Dam Safety Program Act (Pub. L. 92-367), as amended.
- 44 CFR Part 201 Mitigation Planning.
- 44 CFR, Part 60, Subpart A, including § 60.3 Flood plain management criteria for flood-prone areas.
- 44 CFR Part 77 Flood Mitigation Grants[10].
- 44 CFR Part 206 Subpart N. Hazard Mitigation Grant Program.

Plan Adoption

The Town of Southwick will adopt the Plan when it has received "approved-pending adoption" status from the Federal Emergency Management Agency (FEMA). The Certificate of Adoption is included on page 7.

Document Overview

Below is a summary of the Town of Southwick, MA Hazard Mitigation Plan Update chapters, including appendices. The planning process closely adhered to FEMA guidelines and to the intent of those guidelines.

Chapter 2: Planning Area Profile
The Planning Area Profile chapter describes the Town of Southwick, including history, population, government, and infrastructure.

Chapter 3: Planning Process
The Planning Process chapter documents the methodology and approach of the hazard mitigation planning process. The chapter summarizes the HMPC meetings and the public outreach process (including public meetings). This chapter guides the reader through the process of generating this plan and reflects its open and inclusive public involvement process.

Chapter 4: Risk Assessment
The Risk Assessment identifies the natural hazard risks to the Town of Southwick and its residents. The risk assessment looks at current and future vulnerabilities based on land use development including structures and infrastructure. Included in this chapter is a list of critical facilities identified by the HMPC.

Chapter 5: Capability Assessment
The Capability Assessment looks at the Town's ability to mitigate risk prior to and following disaster. This chapter is structured around the following four categories: planning and regulatory, administrative, and

technical, financial, as well as education and outreach. The chapter concludes with information regarding the National Flood Insurance Program (NFIP).

Chapter 6: Mitigation Strategy

This chapter provides a blueprint for reducing losses identified in the Risk Assessment. The chapter presents the hazard mitigation goals and identifies mitigation actions in priority groupings. Each mitigation action includes essential details, such as Town lead, potential funding sources, and implementation timeframe.

Chapter 7: Plan Implementation and Maintenance

The Plan Implementation and Maintenance establishes a system and mechanism for periodically monitoring, evaluating, and updating the Town of Southwick Hazard Mitigation Plan Update. It also includes a plan for continuing public outreach and monitoring the implementation of the identified mitigation actions.

Appendices

The Appendices includes documentation regarding the planning process, the list of mitigation actions and the *Hazus* Reports.

Chapter 2: Planning Area Profile

Southwick, with a population of 9,232[7] is located in Hampden County along the western border of the Connecticut River Valley. The Town's varying terrain includes farmlands, mountains, a string of freshwater lakes, and rolling hillsides. Southwick was once completely under Lake Hitchcock and its rock gravel soil in the uplands and the sandy soil in the lowlands has impacted the Town's continued development. Southwick is characterized by its rural farms and residential communities that is becoming a suburb of the region surrounding Springfield, Westfield, and Hartford.[8]

The Town has a land area of 19,814 acres (31 square miles). It is bordered by Granville in the west, Westfield in the north, Agawam to the east, and Suffield and Granby, Connecticut in the south. Located 12 miles from Springfield and 22 miles from Hartford, Southwick has easy access to major metropolitan areas.[9]

Historically, Native Americans were said to concentrate their settlement around the Congamond Lakes in the eastern half of the Town due to the good soil and accessibility to fishing. Southwick was the "common land" for the City of Westfield during the early 18th century and the settlement began in the 1730s when Westfield opened it up for sale. Unlike many other early towns in the Connecticut River Valley, land was laid out in lots with room for houses, tilling, and pasture land rather than linear street villages. Settlement was slow with 34 families in 1754 and in two decades the population grew to 841. Southwick was settled later than many other areas in the region, so there was no "prolonged period" which the settlers focused on farming in the Town; however, farming was a continuous pursuit alongside the use of powder mills, saw mills, and grist mills on local rivers.[10]

The mills held a significant place in Southwick's history. It was said that "By 1775 Captain Matthew Laflin had built up to five powder mills on his property along Two Mile Brook in Southwick and into Westfield. Getting quickly to work, he sold his powder to the patriots throughout the Revolutionary War and local historians record that it was used specifically at the Battle of Bunker Hill. Reflecting its use, Two Mile Brook became known as Powder Mill Brook, later Great Brook."[11]

As Western Massachusetts became more "prosperous" after the Revolutionary War, Southwick did the same. Between 1776 and 1810, farmers continued to practice "mixed agriculture" and two developments improved their prosperity - first, broomcorn and tobacco were introduced as cash crops and second, the construction of a canal through Town that allowed produce to be shipped to Connecticut. Tobacco became a major economic contributor in the first half of the 19th century and

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[7] QuickFacts Southwick town, Hampden County, Massachusetts. (2022). United States Census Bureau.
[8] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.
[9] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.
[10] "Town of Southwick Community Development Plan." (2004). Town of Southwick, Massachusetts.
[11] "Town of Southwick Community Development Plan." (2004). Town of Southwick, Massachusetts.

many people began making cigars to supplement their incomes. Cigar-making then began to take place mostly in Westfield, but it remained a "cottage industry" in Southwick through the Civil War.[12]

Because the Town did not have a large river as a source of water power, Southwick did not become an industrial town like neighboring Westfield, so agriculture remained a top industry and is still knit into the economic fabric today. Southwick was also the "largest ice harvesting enterprise in New England with ice shipped out on the railroad year-round to New York, and from there by ship to places further south." Some ice house foundations are known to still be underwater at the Congamond Lakes. The Lakes were also home to several hotels and boarding houses for people that came from the cities to spend their summers in the Town.

After World War II, Southwick continued to grow, and commercial buildings were built alongside residences. With this growth, Southwick has been able to retain its historic features. Farms and farmland, sometimes located near commercial centers or residential subdivisions, continue to support the Town's unique character and rural feel.[13]

People

Southwick is popular for its single-family homes and this draw led to an increasing population. From 1980 to 2010, the Town's population grew from 7,382 to 9,502 people. Its population reached its estimated peak in 2017 at 9,711 people - a 31% increase in the last thirty-seven years.[14]

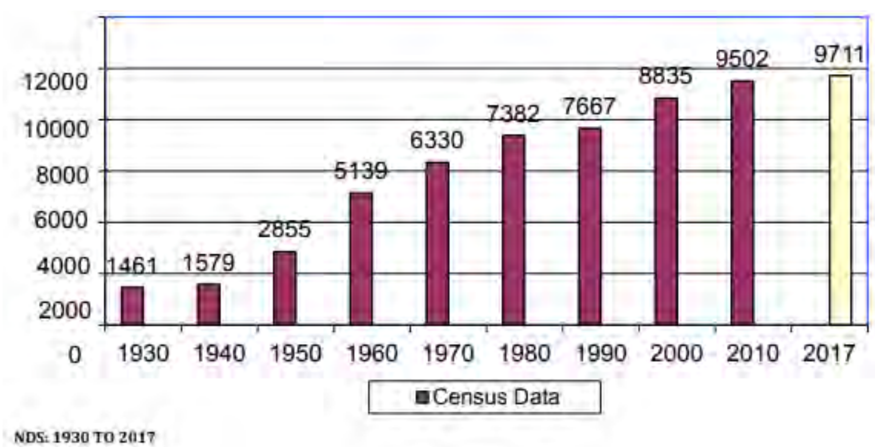

Figure 2. Southwick's Population Increase from 1930-2017.

[12] "Town of Southwick Community Development Plan." (2004). Town of Southwick, Massachusetts.
[13] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.
[14] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.

Table 4. Southwick Demographic Trends.

TABLE 2: SOUTHWICK DEMOGRAPHIC TRENDS SUMMARY

	1990	2010	2017(Est.)	Percent Change (1990- 2010)
Southwick Residents	7,667	9,502	9,711	24%
Southwick Households	2,713	3,710	3,750	37%
Southwick Households with Children	*1104*	*1072*	948	-3%
Average Household Size	2.83	2.56	2.59	-10%
Southwick Single Person Households	510	898	841	76%
Southwick-Tolland Regional School Student Enrollment	*1858*	1731		-7%

Source: U.S. Census Bureau, Decennial Census 1990 & 2010; Massachusetts Department of Education, 1995 & 2010 student enrollment data.
Source: 2017…

Population density has been increasing in Southwick and is projected to continue. There were 304 people per square mile in 1970 and in 2010 there were 300 people per square mile.[15] In 2020, this number was unchanged with approximately 300 people per square mile.[16]

The Town of Southwick is said to be a "primarily middle-class community of mixed religious affiliations."[17] According to the United States Census Bureau, 95.1% of the population identifies as White, 0.3% identify as American Indian and Alaskan Native, 0.8% identify as Asian, 2.8% identify as Two or More Races, and 4.6% identify as Hispanic or Latino. Approximately 3.1% of the population is foreign-born and 5.5% of the population lives below the poverty level. The median household income for the Town is $100,337.[18]

Environmental Justice Communities

There are zero Environmental Justice (EJ) Communities according to the 2020 updated Massachusetts Municipal Statistics.

Structures (Land Use & Development)

The Town of Southwick has one of the highest growth rates in the Pioneer Valley. According to the 2014 Community Development Plan, "Southwick is such an attractive place to live because it is a major recreational center with the Congamond Lakes and large open space areas combined with easy access to major highways and interstates and close proximity to the cities of Springfield, Massachusetts and Hartford, Connecticut."[19]

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[15] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.
[16] QuickFacts Southwick town, Hampden County, Massachusetts. (2022). United States Census Bureau.
[17] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.
[18] QuickFacts Southwick town, Hampden County, Massachusetts. (2022). United States Census Bureau.
[19] "Town of Southwick Community Development Plan." (2004). Town of Southwick, Massachusetts.

Though Southwick's roots were agricultural and land use prioritized that, the Town is now a residential community. Most of the residences are single-family homes on individual lots. Lot sizes vary from as small as 5,000 square feet for older lots to 60,000 square feet for newer lots approved since 1972.[20] Southwick's housing stock is relatively new with over 30% of all homes being built since 1990. In 2017, 81% of homes were owner-occupied, while 19% were renter occupied. There has also been a resurgence of subdivision development in the Town. Over 60 new homes have been built in the last five years. Building permits that include residential, commercial, sheet metal, signs, tents, solid fuel burning, and mechanical permits total 188 from January 1, 2019, to date.[21]

The table below shows land-use change in Southwick by category from their Community Development Plan. Active agriculture, forest, and residential lots of ¼-½ acre have decreased, while all other land uses have increased or stayed the same.[22]

Table 5. Land Use Changes in Southwick 1971-2005.

Category	1971	2005	Change (acres)	Change (percent)
Active Agriculture	3,835	2,659	-1,176	-31%
Pasture	817	635	-183	-22%
Forest	12,062	11,630	-433	-4%
Non-Forested Wetland	264	474	209	79%
Mining, gravel pit etc	112	128	16	14%
Open land, powerlines, no vegetation	355	387	31	9%
Participation Recreation	355	597	242	68%
Spectator Recreation	0	0	0	0%
Water Recreation	1	5	4	344%
Multi-Family	4	84	80	1,966%
Residential less than 1/4 acre lot	26	29	3	10%
Residential 1/4 - 1/2 acre lot	785	741	-44	-6%
Residential Greater than 1/2 acre lot	863	1,770	907	105%
Commercial	104	242	138	132%
Industrial	4	57	54	1,490%
Urban Open, parks, institutional, cemeteries	99	125	27	27%
Transportation	3	15	12	415%
Waste Disposal	9	40	32	358%
Water	498	540	41	8%
Woody Perennial, orchards, nurseries	56	62	6	11%
Total Acres	**20,254**	**20,236**	**-18**	**--**

Source: MassGIS McConnell Land Use data 1971, 1985, 1999, 2005. Due to technological advances, the spatial accuracy of the 2005 data is substantially more accurate than data for the years 1971, 1985, and 1999. Prior to 2005, the state manually interpreted land cover and land use categories based on aerial photos. In 2005, the land use map was derived directly from an ortho image. This new method maintains much compatibility with the older system. - Negative numbers mean loss of land

The zoning in Southwick includes 90% of land being zoned for residential uses, 8% being zoned for industrial uses, and only 2% being zoned for business. There is 19% of the Town that is zoned under an

[20] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.
[21] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.
[22] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.

Agricultural and Conservation District (AC) which was established in 1974. The AC covers the floodplains along the Great Brook as well as well fields, the Sodom Mountain Range, the Provin Mountain Range, Goose Pond Area, and prime agricultural areas. The purpose of the AC is "to protect natural drainage, flood retention areas and the natural water table, to prevent water pollution and soil erosion, and to continue and promote agricultural use." Residences can be constructed with a Special Permit.[23]

The Southwick Planning Board has implemented restrictions on residential homes and business or industrial uses that are located within the Wellhead Protection District. This District includes Zone I, Zone II, and Zone III Aquifer Recharge Areas. Some of the restrictions include "no underground storage tanks, limitations on pesticides and fertilizers, and specific restrictions on septic systems and periodic septic tank pumping."[24]

Business uses are dispersed throughout the Town. There is a Businesses Restricted Area in two sections of Routes 10/2020 where businesses are permitted with a Special Permit. However, other sections of Town are zoned Business and include an area on the southern part of Routes 10/2020 where the Big Y Supermarket and Ocean State Job Lot shopping center is located. A small shopping center is also located across the street where a McDonald's and small businesses are located. Residences were previously prohibited in Business zones, but as of December 6, 2016, the Planning Board revised regulations to allow residences in some zones with a Special Permit.[25]

The main industrial area in Southwick is located along Route 57 across from the High School and includes several manufacturing firms such as:

- Comark
- Whalley Precision
- Whalley Computer
- Westfield Gage
- Progressive Tool
- B&E Tool
- D & S. Manufacturing.[26]

There is also an industrial area located on the eastern side of Routes 10/202 near the Connecticut border, but that remains agricultural.[27]

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[23] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.
[24] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.
[25] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.
[26] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.
[27] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.

The Town has a Flood Hazard and Wetlands District that was established in 1978. It is based on the preliminary flood insurance mapping that was available from the National Flood Insurance Program (NFIP) at the time. The District Map was updated and revised in 1986 to include the Federal Emergency Management Agency (FEMA) Floodway maps dated to July 16, 1894.[28]

Natural Resources

Watersheds

Southwick is located within three watersheds. Most of the Town is located within the Westfield River Watershed and contains the Great Brook and the Munn Brook drainage basins. Small areas of Town fall within the Farmington River Watershed which contains the Bradley Brook and Palmer Brook drainage basins, and the Lower Connecticut River Watershed which contains the Still Brook drainage basin.[29]

Surface Water

Southwick does not have any major rivers flowing directly through it; however, over 2% of the Town's area is surface water coming from the Congamond Lakes alone. The Congamond Lakes are a chain of three connected lakes known as the North, Middle, and South Ponds. The lakes drain southward into Canal Brook and northward into Great Brook which is the Town's largest surface stream. The lakes are a "considerable recreational use" with boating, fishing, and swimming being very popular in the area. The lakes have 4 public access points that include "North and South Boat Ramps located on either end of Middle Pond (owned by the state and managed by the Lake Management Committee), South Pond Beach open to the public for swimming and recreational activities (managed by the Park and Recreation Commission), and the Fishing Pier and adjacent Gazebo which is used for fishing and picnicking (managed by the Lake Management Committee)."[30]

Canal Brook begins at the southern end of South Pond and flows south into Connecticut and eventually enters the Farmington River. The Great Brook comes from the southern end of Middle Pond and flows both west and north of the lakes, turning towards the Town Center and into Westfield. Both streams eventually flow into the Connecticut River.[31] Munn Brook, the Town's other major stream, is located in the northwest section and flows out of Granville into Town-owned conservation land. In addition to these streams, there are several smaller brooks, ponds, and impoundments throughout the Town that are "a valuable community resource that contributes greatly to the scenic and rural character of the town" and include:

- Pearl Brook
- Johnson Brook
- Tuttle Brook,

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28 "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.
29 "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.
30 "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.
31 "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.

- Shurtleff Brook
- White Brook
- Palmer Brook
- Bradley Brook
- Slab Brook.[32]

Wetlands and Aquifer

The Town has about 2,800 acres of wetlands and wet soils. The upland wetlands consist of wooded swamps, shrub swamp, marshes, and wet meadow. The most extensive wetland area runs along Palmer Brook, South Pond, Canal Brook, and Goose Pond. Another large wetland area borders Great Brook from Congamond Lakes north toward the center of Town. In addition to these larger areas, some “important wetlands'' can be found along Munn Brook and the Honey Pot wetland located on North Loomis Road and Honey Pot Road. This area is called the Loupinski Wildlife Management Area and is managed by the Massachusetts Department of Fish and Game. It is considered “one of the most important amphibian breeding sites in the state, hosting 15 of the state’s 22 amphibian species.” The Wildlife Management Area site is a 35-acre wetland that is comprised of 15 different wetland habitats that include vernal pools, swamps, bogs, and streams.[33]

Southwick also has a significant groundwater resource in the Great Brook Aquifer which is saturated year-round. The Aquifer provides water that does not require filtration or any chlorination. This regional resource serves Southwick, Westfield, and West Springfield with a total of 12.5 million gallons per day. The storage volume of the Aquifer is estimated to be 15 billion gallons.[34]

Forests

There has been a loss of forestland since the original resource inventory in the Town; however, Southwick still had 11,658 acres of forest land in 1985 across to the University of Massachusetts aerial photographic study. This number amounted to approximately 58% of the Town. As of 2005, MassGIS Land Use Data identified 11,630 acres of forest, which was only a slight decrease from earlier records.[35]

The Forest Land Assessment Act (M.G.L. Chapter 61) provides an incentive for good stewardship of forestlands and as of June 2019, there was approximately 954 acres of land enrolled in the Chapter 61 Forestry Program. The Town has a variety of tree species which include:

- Oak
- Hickory

[32] “Southwick Open Space and Recreation Plan.” (2020). Town of Southwick, Massachusetts.
[33] “Southwick Open Space and Recreation Plan.” (2020). Town of Southwick, Massachusetts.
[34] “Southwick Open Space and Recreation Plan.” (2020). Town of Southwick, Massachusetts.
[35] “Southwick Open Space and Recreation Plan.” (2020). Town of Southwick, Massachusetts.

- Maple
- Pine
- Hemlock.[36]

Agriculture

Due to its longstanding history, agriculture remains an important and changing industry in the Town. Agricultural productivity varies and includes dairy and beef cattle farms, horse farms, vegetable farms, orchards, Christmas tree farms, nurseries, and greenhouses. There has been a 30% decrease in cropland production since 1971 and a 22% decrease in pasture land. Overall acreage in orchards and nursery productions have increased slightly.[37]

In the Town's 2020 Open Space and Recreation Plan, it states that "Massachusetts General Laws Chapter 61A provides for tax assessment of agricultural lands based on the crops produced, rather than the development value of the land." As of September 1998, 4,453 acres of farmland was under the Chapter 61A Program (including land under Agricultural Preservation Restrictions). In 2010, there were 3,996 acres of farmland which then increased to 4,483 acres of farmland in 2012. The Program continues and is administered by the Southwick Conservation Commission.[38]

Critical Facilities and Infrastructure

Community Lifelines

Water

The Water Division services and maintains 51 miles of water mains, 2 wells, 4 pumping stations, and potable water services for approximately 2,680 service connections. The duties of the Water Division include:

- "Performing daily inspections of the Town wells and pump stations
- Install and oversee new water services and meters
- Repair water breaks
- Read meters
- Assist with winter snow plowing."[39]

The majority of the Town's population that is located east of Routes 10 and 202 alongside a small portion west of Routes 10 and 202 are supplied by the Town water drawn from the Great Brook Aquifer. Most of the western portion of Town does not have access to public water and relies on private wells.

[36] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.
[37] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.
[38] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.
[39] "Water Division." (n.d.) Town of Southwick, Massachusetts.

There are a few homes on the west side of Town that draw on a small aquifer (Loomis Ridge Aquifer) located at the base of the Drake and Sodom Mountains in Munn Brook Valley.[40]

In 1996, the water main on College Highway was replaced with a larger line and an extension on Depot Street that was constructed in 1997. The Congamond Road water line was replaced in 2003.[41] In addition, a water main replacement on College Highway (2019), new Jarry Drive Pump Station (2019), and Springfield Water & Sewer transmission main replacement (2022) were recently completed.

Sewer

The Town's Sewer Division services and maintains 14 miles of sewer main, 280 grinder pumps, 6 pumping stations, and 1 chemical feed building to serve approximately 840 service connections. The duties of the Sewer Division include "performing daily inspections of the pump stations and main trunk lines; servicing failed grinder pumps; inspect new sewer connections; grease trap inspections; repair sewer breaks; and assist with winter snow plowing." All of the Town's sewage flows to the Westfield Wastewater Treatment Plant. The total flow from the Town averages about 165,000 gallons per day.[42]

There is a limited sanitary sewer system in Southwick. The majority of the system that was installed in 2004 covers the center of town and the lakes area. Many homes, businesses, and industries still depend on individual septic systems and other means of on-site sewage disposal.[43]

Electric

The Town's electricity provider is Eversource.

Stormwater

The Southwick Public Works Department and Management Committee (LMC) began initial work in 1997 on a long-term plan to address stormwater management around the Congamond Lakes. The Lakes are a Category 4c Waters on the Massachusetts List of Impaired Waters for nuisance aquatic weeds. The Conservation Commission and the Town have undertaken several investments to improve the Congamond Lakes and the municipal infrastructure that exists within the watershed. The list of projects taken directly from the 2020 Southwick Open Space and Recreation Plan can be found below:

- Mapping all outfalls and catch-basins in Southwick with GIS and creating a database for their operation and maintenance.
- Installing ten deep-sump catch basins and four BaysaversTM for fine particulate and oil/grease removal.
- Performing annual street sweeping.
- Purchasing a vacuum truck for regular cleaning of catch-basin sumps.

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[40] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.
[41] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.
[42] "Sewer Division." (n.d.) Town of Southwick, Massachusetts.
[43] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.

- Installation of a detention basin and vegetated swale at a 42" outfall on Middle Pond.
- Eagle Street Restoration – Installed 3 catch basins, a Baysaver, restore outfall with grassed swale and macadam berm/road milling to road edge to redirect runoff.
- Castle Street Restoration – Installed 1 deep sump catch basin, 2 catchbasins, a Baysaver, restore outfall with grassed swale and macadam berm/road milling to road edge to redirect runoff.
- North Lake Avenue and Summer Street Restoration – Installed 8 deep sump catch basins; Stormtech Infiltration Chambers; macadam berm at road edge to redirect runoff, outfall restoration with grassed swale, in-lake sediment removal at outfall, grading and restoration of adjacent unpaved access road including installation of a vegetated trapezoidal channel.
- Lakemont and Veteran Street – Installed 4 deep sump catch basins, a Baysaver, restore outfall with grassed swale and macadam berm/road milling to road edge to redirect runoff.
- 136 Berkshire Avenue – Replaced 3 shallow catch basins with deep sump basins, a Baysaver, Stormtech Infiltration Chambers; macadam berm at road edge to redirect runoff.
- Lakemont Street - As part of a Community Development Block Grant (CDBG), a new water main and additional drainage with deep sump catch basins were installed, along with the road being widened to a consistent 20' paved width.
- Veteran Street - As part of a CDBG, a new water main and additional drainage with deep sump catch basins were installed, along with the road being widened to a consistent 20' paved width.
- Congamond Sanitary Sewers - The Town installed sewers to 95% of the Massachusetts waterfront (60% of total waterfront), with mandatory hookup. The remaining 5% of homes is being evaluated for the next phase of the sewer system.
- Canal Brook - Twin stainless-steel double-acting weir gates were installed in Canal Brook to replace batter boards formerly used to control and maintain the lake level during periods of heavy rainfall and drought.
- Lakes Area Weather Station - Lake Management Committee (LMC) and Southwick Emergency Management volunteers have been building a weather station with Town funding that will have remote monitoring of the level and temperature of Congamond Middle Pond, Canal Brook, and Great Brook.
- Lakes Water & Bottom Analysis - Lake Management volunteers have taken wet and dry weather samples of 10 of the stormwater outfalls in Congamond, along with lake and canal bottom (muck) samples and literally thousands of lake water samples that have been analyzed for various parameters. This data is tracked and trended by LMC volunteers and reported to the Town's consultant limnologist.
- Congamond Water Quality Improvements - Based on the above data, the Town's consultant limnologist has made recommendations for long-term "fixes" for the degraded water

quality, including a whole-lake alum treatment and selective dredging of the Canal, followed by selective dredging of shallow, muck-laden coves in these three hydraulically linked glacial age ponds.

- Dredging Congamond Lakes - The LMC has provided legislators with a 5-year plan and funding needed to address the accumulated muck in the rest of the shallow areas in this Commonwealth Great Pond.
- Stormwater Hazard Mitigation - The Town DPW has sought funding for, replaced and upgraded

two structures on Shurtleff Brook: (1) South Loomis Street Culvert (2) North Loomis Street Bridge. In addition, two more Shurtleff Brook structures are designed and permitted: Granville Road culvert by Hastings Road and Fred Jackson Road culvert by Granville Road. The Granville Road culvert was completed in October of 2019. In 2019 The DPW received funding from a Municipal Vulnerability Preparedness (MVP) grant for replacing the degraded Klaus Anderson Bridge on Tuttle Brook.[44]

Critical Facilities

The term "critical facilities" is often used to describe structures necessary for a community to respond and recover in emergency situations. These facilities often include emergency response facilities (fire stations, police stations, rescue squads, and emergency operation centers [EOCs]), custodial facilities (jails and other detention centers, long-term care facilities, hospitals, and other health care facilities), schools, emergency shelters, utilities (water supply, wastewater treatment facilities, and power), communications facilities, and any other assets determined by the community to be of critical importance for the protection of the health and safety of the population. The adverse effects of damaged critical facilities can extend far beyond direct physical damage. Disruption of health care, fire, and police services can impair search and rescue, emergency medical care, and even access to damaged areas.

> The Local Mitigation Planning Handbook (FEMA, 2013) explains that *"Critical facilities are structures and institutions necessary for a community's response to and recovery from emergencies. Critical facilities must continue to operate during and following a disaster to reduce the severity of impacts and accelerate recovery. When identifying vulnerabilities, it is important to consider both the structural integrity and content value of critical facilities and the effects of interrupting their services to the community."*

The number and nature of critical facilities in a community can differ greatly from one jurisdiction to another, and usually includes both public and private facilities. Each community needs to determine the relative importance of the publicly and privately owned facilities that deliver vital services, provide important functions, and protect special populations.

[44] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.

A list of the critical facilities in Southwick is provided in the table below. This list was obtained from the previous edition of the hazard mitigation plan and the MVP-funded Community Resilience Building (CRB) plan; and reviewed and amended by the HMPC throughout the planning process.

Department	Name	E911 Address	Map/Lot Number
Town Hall	Town Hall	454 College Highway	88-1
Police	Police Department	11 Depot Street	88-1
Fire	Fire Department	15 Depot Street	88-1
DPW	DPW Facility	661 College Highway	51-2
Water	College Highway Booster Pump	3 Granville Road	89-2
Water	Coes Hill Road Booster Pump	627R Granville Road	65-14
Water	Jarry Drive Pump Station	3 Jarry Drive	19-11
Water	North Longyard Road Pump Station	108 Noth Longyard Road	44-14
Water	Feeding Hills Road Wells 1&2	159R Feeding Hills Road	68-54 / 74-5
Water	Water Tanks 1&2	20 Juniper Road	77-3
Sewer	Berkshire Avenue Pump Station	160 Berkshire Avenue	124-11
Sewer	Depot Street Pump Station	7R Depot Street	89-50
Sewer	Echo Street Pump Station	10 Echo Street	Road ROW
Sewer	Powder Mill Road Pump Station	5 Powder Mill Road	89-31
Sewer	Point Grove Road Pump Station	91 Point Grove Road	114-175
Sewer	Island Pond Road Pump Station	17 Island Pond Road	Road ROW
Sewer	School Pump Station	78 Powder Mill Road	75-2
Sewer	Congamond Road Bioxide Building	111 Congamond Road	148-85
Solid Waste	Transfer Station	22 Industrial Road	112-2

Figure 3. Critical Facilities List.

Critical Transportation Infrastructure

Southwick's transportation connectivity contributed to its manufacturing industry development, and it also provides residents and visitors easy access to the region. The principal highways in Town include State Route 57 and U.S. Route 202 which connect with the Massachusetts Turnpike (Interstate Route 90) and U.S. Route 20 in the neighboring City of Westfield. The Massachusetts Turnpike offers connections through the region as well as to major cities like Boston and Albany, New York.[45]

Southwick is also a thirty-minute drive from both Barnes Municipal Airport in Westfield and Bradley International Airport in Windsor Locks.[46]

The Town does not have any form of public transportation, but services are available in the neighboring communities of Westfield, Springfield, or Windsor Locks, Connecticut. As a result, most traveling is done by car. Though there is a prevalence of vehicular transportation, bicycle use has increased in recent

[45] "Town of Southwick Community Development Plan." (2004). Town of Southwick, Massachusetts.
[46] "Town of Southwick Community Development Plan." (2004). Town of Southwick, Massachusetts.

years. A feasibility study conducted by the Pioneer Valley Planning Commission determined that “a fixed bus route on certain roads could not pay for itself.”[47]

Most roads within Southwick are in good to very good condition. There are a handful of unpaved roads. Many road improvements have been made and include widening of Route 57 from North Longyard Road to College Highway. The State has also completed the widening and repaving of Routes 10/202 from the Town Hall to Tannery Road. Sidewalks have also been incorporated into the design process. Overall, sidewalks continue to be underutilized, but “It is expected that the pedestrian traffic will increase as new businesses continue to open in Southwick.”[48]

Dams

There is one significant hazard dam in Southwick and twelve smaller dams with no hazard code. The table below identifies the dams within the town.

Table 6. Dams in Vicinity.

Name	Ownership	Hazard Type
Dr. Logie Pond Dam	Private	Significant
Ahrens Pond Dam	Private	N/A
Basil Tysz Dam	Private	N/A
Cigar Pond Dam #1 (Lower)	Private	N/A
Cigar Pond Dam #1 (Upper)	Private	N/A
Congamond Lake Outlet - Middle Pond	Public	N/A
Congamond Lakes \ South Dike	Public	N/A
Congamond Lakes North Dike	Public	N/A
Hathaway & Steane Pond Dam #1	Private	N/A
Hathaway & Steane Pond Dam #2	Private	N/A
Hathaway & Steane Farm Pond Dam	Private	N/A
Sackett District Reservoir Dam	Private	N/A
Unnamed dam below Cigar Dam 1	Private	N/A

Economy

Southwick’s top three industries by occupation according to the United States Census include:

1. Educational services, and health care and social assistance
2. Manufacturing

[47] “Southwick Open Space and Recreation Plan.” (2020). Town of Southwick, Massachusetts.
[48] “Southwick Open Space and Recreation Plan.” (2020). Town of Southwick, Massachusetts.

3. Retail trade.[49]

The Town's Community Development Plan states, "Even though most residents commute to regional employment centers such as Springfield, Holyoke, Windsor Locks, Enfield and Hartford, Southwick has an active manufacturing sector, which is important to the local economy."[50]

Historic and Cultural Resources

The Southwick Historical Society, Inc. was created in 1971 by a group of interested citizens. The Society's home now houses the Joseph Moore House and the Charles J. Gillett Cigar Factory. The Moore House was built in 1751 by Joseph More who served and passed away in the American Revolution. This home was the last known house in the Massachusetts-Connecticut line "jog," which was located in four towns, three counties, two colonies, and two states.

The Charles Gillett Cigar Factory was built in 1872 and is the only remaining building of its type in the Connecticut River Valley. It has been known for decades for the quality of its tobacco. The Gillett cigars were sold under various names and shipped across the United States.[51]

The Society also undertakes a Society-sponsored annual field trip around Town where youth are encouraged to explore the "unique features of Southwick and its history." The Society also has information and research relative to other parts of Southwick's rich history.[52]

In 2022, the Southwick Cultural Council announced that 12 local organizations received grants in the amount of $7,500 for the fiscal year. The Grants for 2022 went to:

- "Rotary Club of Southwick – The Club will host its free family–oriented annual summer concert series at Whalley Park starting July 13 through August 31 on Wednesday nights from 6 to 9 pm.
- Vincent Pagano – Vinnie, a local guitarist, vocalist, and songwriter of blues and classic rock music, will perform at the SCC Fine Art Show and Exhibition on April 23 from 12:00 noon until 3 pm. The Fine Art Show is open to the public and will be held at the Southwick Town Hall April 23 and 24 from 10 to 4 pm.
- Bad News Jazz and Blues Orchestra – Known to be the "busiest big band in Western Massachusetts," the 19-member band with trumpet, trombone, sax, guitar, piano, bass, drums, and vocalist Cindy Reed will present uptempo classics from the swing era as well as

[49] "Industry By Occupation for the Civilian Employed Population 2020 ACS 5-Year Estimates." (2022). United States Census Bureau.
[50] "Town of Southwick Community Development Plan." (2004). Town of Southwick, Massachusetts.
[51] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.
[52] "Southwick Open Space and Recreation Plan." (2020). Town of Southwick, Massachusetts.

arrangements from Bruno Mars, Earth Wind and Fire, Brian Setzer and more. The Orchestra will perform August 10 at the Rotary summer concert series from 6 to 9 pm.

- Mad Science Stage Show – The program is targeted for students from K through 12 who will enjoy a hands-on and challenging experience that foster creative and higher-level thinking and problem solving of science, technology, engineering, and math. The Southwick Park and Rec will host the program at Whalley Park during the summer months.
- Rhythmic Travel – The experience being offered is an interactive hand drumming circle with rhythms inspired by West Africa, Native America and more, and is targeted for students K through 12. The program will be hosted by the Southwick Public Library on July 14.
- Reptile Shows of New England – The show is targeted for students K through 12. Participants will enjoy interactions with reptiles while learning about the species. The first hour is a show and presentation of the animals, and the second hour is for hands-on experiences and picture taking. The program will be hosted by the Southwick Park and Rec at Whalley Park during the summer months.
- Magic – Scott Jameson is a magician who features magic, juggling, and other less definable bits of entertainment. He explores the vital role communication plays in a person's ability to express themselves, work with others, and explore the world around them. Additionally, the audience learns how to applaud, and say "Thank You" in American sign language. He will also create illusions to illustrate how innovations in technology, from the printing press to the radio, have allowed mankind to communicate over vast distances in space and time. The program is targeted for children K through 12 to senior citizens. The program is hosted by Southwick Council on Aging on June 30 at Whalley Park.
- Food for Thought – The program is targeted for students from K through 12 to learn about food, how it is grown, and how food can be enjoyed for more than just eating. It also will encourage children to think about the role of farming in the community, and to also learn about the value of food as there are people in our community who do not have enough to eat. Books about food will be presented to the students to help them learn through reading. The program is being hosted by Our Community Food Pantry at the Southwick Public Library on June 25.
- Felted Hedwig Owl – Students from grades 7 through 12 will be introduced to the craft of needle felting. The process allows one to make sculptural items using merino wool and a barbed needle. It is a novel and tactile craft, much easier than it looks, and is relaxing due to its repetitive nature of felting. Each student will complete their own felted owl inspired by Harry Potter's owl, HEDWIG. The project is hosted by the Southwick Public Library on July 28.
- Children and Teen Soap Making - Two programs are scheduled, one for students K through 6, and one for grades 7 through 12. The project will be hosted by the Southwick Public Library on July 20. The program will practice the safe process of soap making using glycerin.

Students will also learn the traditional method using lye. All participants will make their soapy creation using glycerin-based product and adding colors, glitter, and scents.

- Book Presentation – Author Michael Tougias will present a slideshow on his book entitled "There's a Porcupine in my Outhouse: The Vermont Misadventures of a Mountain Man Wannabe." A humorous and enlightening adventure, Author Tougias talks about his encounters with bear, moose, fishing spiders, and porcupines, and the history of Mountain Men. He also speaks on adventure and exploration while talking about conservation and the therapeutic aspects of nature. Hosted by the Southwick Public Library on June 29, the presentation is targeted for older children (teenagers) and adults.
- Laugh for the Fun of it! – Laughter wellness is a performance-based structured health and wellness program that engages people in laughter without using comedy and jokes. The program explores the use of laughter for stress management, community building, promotion of positive thoughts and feelings, and strengthening the immune system. The program is composed of segments that highlight breathing, stretching, spontaneous vocalizing, childlike laughter, and use of props. The audience will leave with tools to employ laughter and breathing techniques as self-care strategies. Targeted for all age groups, the program will be hosted by the Council on Aging, Southwick Town Hall, on April 22."[53]

[53] "2022 SCC Grants Awarded." (2022). Southwick Cultural Council.

Chapter 3. Planning Process

The planning process was developed in full compliance with the current planning requirements of the Federal Emergency Management Agency (FEMA) per the following rules and regulations:

- Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 93-288), as amended by the Disaster Mitigation Act of 2000
- Code of Federal Regulations – Title 44, Chapter 1, Part 201 (§201.6: Local Mitigation Plans)
- Federal Emergency Management Agency Local Mitigation Planning Policy Guide, (Released April 19, 2022, Effective April 19, 2023)
- In addition, the plan was prepared with the suggestions found in the Demonstrating Good Practices Within Local Hazard Mitigation Plans, FEMA Region 1, January 2017.

A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))

A priority through the planning process was equity, which FEMA defines as the "consistent and systematic fair, just and impartial treatment for all individuals." This was a central theme throughout the planning process and effort was made to develop an inclusive planning process. The whole community (individuals, communities, private and nonprofit sectors, faith-based organizations, and all levels of government) were given an opportunity to participate.

The planning process for this updated mitigation plan began in January 2023 and concluded in October 2023 (this does not include the months of plan review and adoption). The Town developed a Municipal Vulnerability Preparedness (MVP) Program summary of findings in 2018. This planning effort contributed to the update of the mitigation plan. Below is a graphical display of the plan development timeline. The months with one check mark indicate a Hazard Mitigation Planning Committee (HMPC) meeting was held and the months with two check marks indicate that a public meeting was also held. Randal Brown, Director of Public Works, was the Chair of the HMPC and the primary contact for the consulting team. Randal Brown facilitated all activities related to the mitigation plan update, including meeting logistics, data gathering, and public outreach. The Consulting Team met with Randal Brown on January 5, 2023, to review the planning process and timeline, and to discuss developing the HMPC, collecting GIS if possible, and determining the status of previously identified mitigation actions.

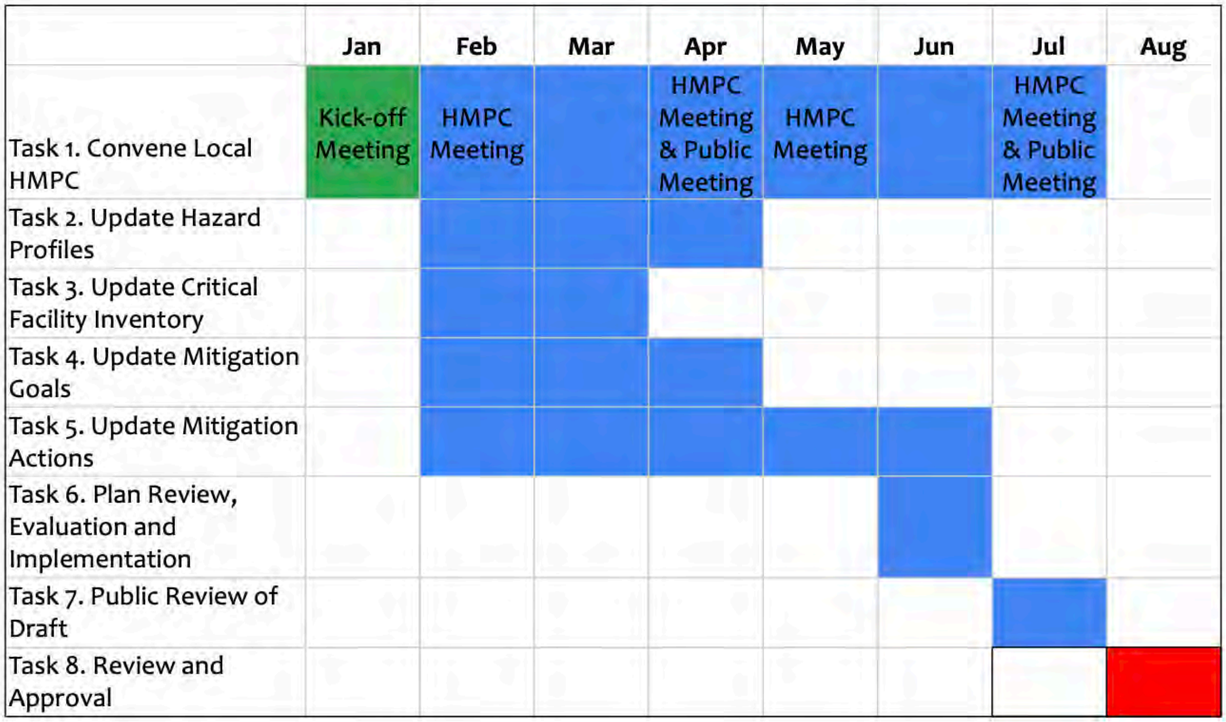

Figure 4. Planning Process Timeline.

Hazard Mitigation Planning Committee

The Director of Public Works developed the Hazard Mitigation Planning Committee (HMPC) to support the planning process. This team included Town employees and employees affiliated with a neighboring city's hospital who represented six sectors of the community shown in Table 5. A full list of HMPC members is shown in Table 6. The HMPC met four times, February 2, 2023, April 5, 2023, May 25, 2023, and July 13, 2023. All the meetings were conducted via Zoom due to the Covid-19 Pandemic, however sometimes Town employees gathered at the Town offices. A list of participants at each of these meetings is included in Appendix A.

Table 7. Sectors of the Community Represented on the HMPC.

Sectors of the Community	HMPC Members
• Emergency Management	• Fire Chief • Deputy Fire Chief • Police Sergeant • Police Lieutenant • Director, Southwick Emergency Management Agency • Radio Officer, Southwick Emergency Management Agency

Sectors of the Community	HMPC Members
	• Business Representative, Southwick Local Emergency Planning Committee
• Economic Development	• Chief Administrative Officer • Assistant Chief Administrative Officer • Selectboard Chairman • Selectboard Vice Chairman
• Land Use and Development	• Chief Administrative Officer • Assistant Chief Administrative Officer • Selectboard Chairman • Selectboard Vice Chairman • Director, Department of Public Works
• Health and Social Services	• Director, Southwick Council on Aging • Superintendent, Southwick Regional Schools • Transportation Supervisor, Southwick Regional Schools • Director of Finance and Operations, Southwick Regional Schools • Baystate Noble Hospital Employees • Health Director • Director, Department of Public Works
• Infrastructure	• Director, Department of Public Works • Transportation Supervisor, Southwick Regional Schools • Selectboard Chairman • Selectboard Vice Chairman
• Natural and Cultural Resources	• Director, Department of Public Works • Selectboard Chairman • Selectboard Vice Chairman

Table 8. HMPC Members.

First Name	Last Name	Title	Affiliation	Phone	Email
Russell	Anderson	Director	Southwick Emergency Management Agency	413-569-0308	ema@southwickma.gov
Rhett	Bannish	Lieutenant	Southwick Police Department	413-569-5348	274@swkpd.com
Jessica	Bishop	Deputy Chief	Southwick Fire Department	413-569-6363	jbishop@southwickfire.net
Randal	Brown	DPW Director	Southwick Public Works Department	413-569-6772	rbrown@southwickma.gov
John Francis	Cain	Business Representative	Southwick Local Emergency Planning Committee	413-569-8090	John@cainsmechanical.com
Nadine	Cignoni	Assistant Chief Administrative Officer	Town of Southwick	413-569-5995	ncignoni@southwickma.gov
Charles	Dunlap	Director	Southwick Emergency Management Agency	413-569-0308	ema@southwickma.gov
Diane	Gale	Select Board Clerk	Town of Southwick	413-569-5995	dgale@southwickma.gov
Thomas	Hibert	Health Director	Southwick Health Department	413-569-1212	thibert@southwickma.net
Cecil	Lewis	Security Professional	Baystate Noble Hospital	413-571-0000	cecil.lewis@baystatehealth.org
Paul	Miles	Sergeant	Southwick Police Department	413-569-5348	272@swkpd.com
Doug	Moglin	Select Board Chairman	Town of Southwick	413-569-5995	dmoglin@southwickma.gov

First Name	Last Name	Title	Affiliation	Phone	Email
Jason	Perron	Select Board Vice Chairman	Town of Southwick	413-569-5995	jperron@southwickma.gov
Richard	Stefanowicz	Chief	Southwick Fire Department	413-569-6363	rstefanowicz@southwickfire.net
Karl J.	Stinehart	Chief Administrative Officer	Town of Southwick	413-569-5995	kstinehart@southwickma.gov
Cindy	Sullivan	Director	Southwick Council on Aging	413-569-5498	csullivan@southwickma.gov
Joshua	Towse	Emergency Manager	Baystate Noble Hospital	413-571-0000	Joshua.Towse@baystatehealth.org
Joseph	Turmel	Director of Finance and Operations	Southwick Regional School	413-569-6171	jturmel@stgrsd.org
Iaian	White	Radio Officer	Southwick Emergency Management Agency	413-569-0308	ema@southwickma.gov
Jennifer	Willard	Superintendent	Southwick Regional School	413-569-6171	jwillard@stgrsd.org
Karen	Wzorek	Transportation Supervisor	Southwick Regional School	413-569-6171	kwzorek@stgrsd.org
Jeffrey	Zukowski	Hazard Mitigation Planner	MA Emergency Management Agency	508-820-1422	jeffrey.zukowski@state.mas.us

A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))

The first HMPC Meeting was held on February 2, 2023, provided an opportunity for the consulting team and the Director of Public Works to introduce the HMPC to the mitigation planning process. After an introduction to the plan, the HMPC identified natural hazards and critical facilities. They then discussed the Town's existing or in-progress plans which include an Open Space and Recreation Plan, an old Master Plan that is in the process of being updated, and a Housing Plan that is in development. They also mentioned that they do not have a watershed group, but the HMPC will reach out to adjacent communities who are also updating their Hazard Mitigation Plans at the same time.

The HMPC members noted that the Town has a small Eastern-European population that are independent, but important to reach out to. Additional community members include the elderly in housing communities like Rosewood, Depot Court, the Villages, and the American Inn. Additional conversations focused on preparing for future public meetings, which would be part of the Selectboard meetings.

The second HMPC meeting, held on April 5, 2023, began with a discussion on plan integration and how the previous plan was used. The HMPC mentioned that the previous plan, though important, was not used and the HMPC recognizes the need for such a plan to be put into practice. The conversation then moved to public engagement and outreach for the upcoming public meeting which included inviting local and regional stakeholders, advertising in the paper, on the local channel, internally, and posting flyers at the 3 facilities that house elderly populations. All the Town Boards were invited and outreach to the small Russian population through their local church.

The Town's capabilities were briefly discussed and the HMPC noted that the Master Plan that was in the process of being updated had a 19-person committee and much of the work and outreach had been completed, so connecting with that committee could be helpful in this plan's efforts and process. Resilience and climate change have been incorporated within the community and the stormwater regulations had just recently been updated. In addition to the Municipal Vulnerability Preparedness Program, Southwick had done a culvert replacement through an action grant and is applying for another.

The HMPC then discussed each natural hazard and reviewed impacts over the last five to ten years. The main hazards that were discussed included flooding, extreme heat and wildfires that lead to concerns for agricultural crops as the Town prides itself as an agricultural and farmland community. Additional concerns are ticks and heavy snow events that result in fallen trees and branches snapping. The Town does not have any high-hazard dams. The HMPC then planned to work on mitigation actions and goals.

The third HMPC meeting, held on May 25, 2023, began with a discussion about replaced culverts that were located on Klaus Anderson Road and Fred Jackson Road. The HMPC also noted that the Kline and Davis culverts were undersized, and a list of culverts would be created. Additional conversation about capabilities took place. The Town draws water from Springfield Water and Sewer, though they aim to draw more water from their own source. They noted that the schools do not have air conditioning, which is a concern. Regarding heating and cooling enters, the Town Hall has been used. As for emergency shelters, the Town Hall auditorium and the Regional High School can take on this role. Southwick also has an agreement with Westfield State University, a public university in the neighboring city of Westfield, to act as an emergency shelter for residents if needed.

The focus for the fourth HMPC meeting, held on July 13, 2023, was public outreach for the second public meeting. The HMPC aimed to email boards, committees, and neighboring communities. They also worked to contact the Pioneer Valley Planning Commission. The Town does not have a social media presence, but the Fire Department is trying to remedy this by working with the Selectboard to hire an intern so that outreach is more accessible and widespread. The conversation then went to discuss some of the mitigation actions and critical facilities. The Town has spent a lot of money on invasive species in its lakes and all critical facilities now have generators.

For the plan integration moving forward, the Director of Public Works aims to be more proactive with the plan, encourage responsible parties to be involved, hiring additional Town employees, and improving public communication.

The HMPC also participated in two public meetings, one on April 19, 2023, and one on July 19, 2023. Finally, the HMPC reviewed the draft Town of Swansea, MA Hazard Mitigation Plan Update prior to sending it to the Massachusetts Emergency Management Agency (MEMA) for their review in August 2023.

Public Outreach

A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))

The Public Outreach Strategy was designed to involve the whole community in the mitigation planning process. The public was engaged in the planning process during the drafting of the plan and prior to plan approval through two public workshops (a flyer for the first workshop is shown below). Each public meeting was held virtually due to the Covid-19 Pandemic. The public was also given a chance to review the plan prior to its review by MEMA or FEMA. The purpose of public engagement was to:

- Generate public interest in mitigation planning.
- Identify and accommodate special populations.

- Solicit public input.
- Engage local stakeholders.
- Create opportunities for public and local stakeholders to be actively involved in the mitigation planning process.

Each public meeting included a PowerPoint presentation and plenty of opportunity for questions and discussion. In addition, Mentimeter was used to facilitate input from meeting participants. This has proven to be an effective tool when engaging people who may not be comfortable speaking up in a virtual meeting. The HMPC participated in each meeting. Both meetings were recorded for posting on public broadcasting.

__COMMUNITY LIFELINES__ are the most fundamental services in the community that, when stabilized, enable all other aspects of society.

Representatives from all community lifelines were included in public engagement efforts. Community lifelines are a driving force behind FEMA's strategic goals for building a culture of preparedness and readying the nation for catastrophic disasters. The seven community lifelines can be a powerful tool for local governments when evaluating risk and developing mitigation actions. The HMPC considered the seven community lifelines when conducting outreach through this planning process. The seven community lifelines and their respective components are shown in the figure below.

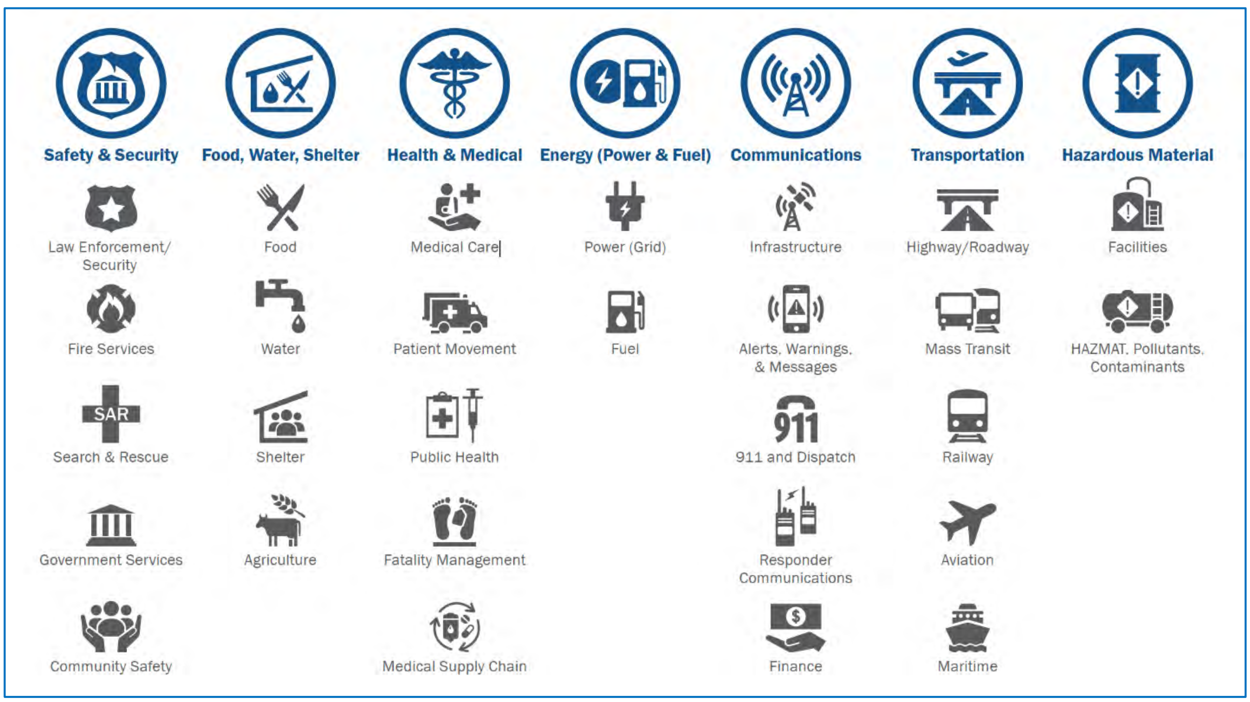

Figure 5. Community Lifelines.

Outreach for the public meetings and for plan review was sent via press release, email blasts, and reaching out to adjacent communities, senior living facilities, churches and to all Town Boards and Committees. The https://www.southwickma.org/ website included announcements for meetings, the press releases were sent to local organizations and posted around the Town at frequented buildings like the elderly housing facilities.

Figure 6. Public Meeting Flyer.

Information gathered during the public meetings contributed to the plan's development. The first public meeting was held both in-person and via Zoom on **April 19, 2023**. An accurate list of participants was not gathered due to the Zoom format. Meeting participants spoke about how the Town Hall, though under renovations currently, serves as the Emergency Operations Center alongside the Council on Aging. The Council on Aging has a backup generator, locker rooms, showers, and can maintain a large group of people for several days. The Public Works Garage serves as the back-up Emergency Operations Center. Participants noted that there are many stream and brook crossings throughout Southwick that should be considered. In regard to back-up elsewhere, the generator is said to be inadequate for emergency services since the Police and Fire Departments share one. Additionally, the school has an "insufficient" generator. Participants also noted that high-hazard areas include the brooks, particularly Great Brook.

The meeting asked participants a series of questions to engage them and help them understand the process of developing a hazard mitigation plan. The questions are listed below.

- Who lives and works in your community?

1. What buildings and infrastructure are critical to your community?
2. What weather related hazards can impact your community?
3. Name specific locations in your community that flood or are vulnerable to natural hazards.
4. What can be done to mitigate risks you have identified? Think of activities to protect the people, buildings, and infrastructure named previously.

Answers were given through Mentimeter and verbally. Key responses to the second question included the following responses:

- Sewer
- Water

- Internet
- Electrical
- Public Safety Buildings
- Medical
- Power

When asked about natural hazards that may impact the Town of Southwick, the following word cloud was created:

Figure 8. Word Cloud from Public Meeting.

When asked about what Southwick can do to mitigate risks of the hazards mentioned above, one participant suggested placing the power lines underground, building “new style” culverts, widening bridges, and balancing habitats. The meeting concluded with a discussion about these potential mitigation actions. The group offered a few suggestions for mitigation actions, but this will also be brought into more focus at the second public meeting.

The link to the meeting slideshow can be found here:
https://www.southwickma.org/sites/g/files/vyhlif1241/f/uploads/southwick_public_meeting_1_results_.pdf

The second public meeting was held on **July 25, 2023,** in a hybrid forum with some people in-person as well as virtually on Zoom. Participants emphasized that stabilizing internet connections during a natural hazard would be important. Additional mitigation actions discussed by participants included keeping lake outlets clear, offering severe weather notifications, conducting tree removal, and clearing dams created by beavers in the community.

When asked which areas of Southwick experiences damage from natural hazards, these were the following responses placed into a word cloud:

Figure 9. Mentimeter Result from Public Meeting.

When speaking to mitigation actions that the Town could undertake, the following was provided by meeting participants:

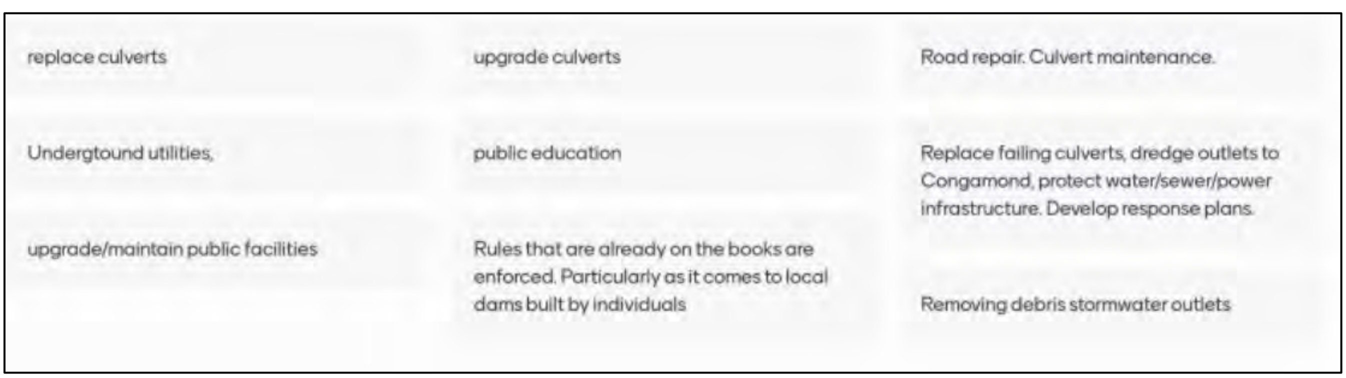

Figure 10. Mentimeter Result from Public Meeting.

Contributions from the HMPC and public engagement impacted the plan in multiple ways. The table below indicates some of the contributions, others are included above and throughout the plan.

Table 5. Where Public Engagement Informed the Plan.

Area of the Plan Impacted	Contributions
Planning Area Profile	• The HMPC updated the list of critical facilities, shown in Appendix B. They also contributed information regarding current land use practices.
Planning Process	• Participated in every aspect of the planning process and made recommendations regarding how to engage the public and key stakeholders.
Risk Assessment	• Described extent of hazard impacts based on previous events. • Offered first-hand insight and experiences of Town residents. • Added the qualitative review to the risk analysis for determination of the hazard risk ranking.
Capability Assessment	• Contributed plans, bylaws, and reports for review. • Completed three Capability Assessment questionnaires including the National Flood Insurance survey and the Safe Growth survey.
Mitigation Strategy	• Identified and prioritized mitigation actions based on their concerns. • Focused on the concerns raised by community members.
Implementation Plan	• Committed to integrating this plan more thoroughly throughout Town government and to posting the plan on the Town's website.

Review of Draft Plan

The Town made the plan available for public review in October 2023. A press release announcing the availability to review the plan was sent and the announcement was posted to the Town website. The HMPC sent emails to Town Board members and Committee members. They also sent emails invitations to local churches and senior living facilities. Copies of the plan were sent to the neighboring communities of Westfield, Suffield, Granville, and Granby. Hard copies of the plan were kept in the Director of Public Work's Office. The Director of Public Works did not receive any comments from the public.

Chapter 4. Risk Assessment

Hazard Identification

The first step in the risk assessment was to revisit and evaluate the hazards identified for study and inclusion in the Town's previous draft hazard mitigation plan. This was a key topic of discussion at the first Hazard Mitigation Planning Committee (HMPC) meeting, along with the consideration of any additional hazards to include in the updated risk assessment. While only natural hazards are required to be addressed by FEMA, other hazards such as technological and human-caused hazards may be included if they are of significant concern to the community and determined to be a mitigation priority.

In completing the updated hazard identification process, the HMPC considered the results of the Town's Municipal Vulnerability Preparedness (MVP) planning effort (completed in 2018), as well as the 2018 State Hazard Mitigation and Adaptation Plan (SHMCAP).[54] As a result of this process all hazards from the prior hazard mitigation plan (adopted in 2016) remain in this updated risk assessment. For this updated assessment, some hazards have been consolidated or renamed to be consistent with the SHMCAP, as further described below.

The top four natural hazards identified for the MVP effort are thoroughly covered in this assessment, which include flooding, wind, extreme heat, and ice/snow. In addition, infectious disease (somewhat broader than vector borne diseases) and invasive species are profiled as hazards. Infectious disease was added based on the impacts of the COVID-19 pandemic as well the Commonwealth's growing concern for the increased prevalence of vector-borne diseases. Invasive species as a hazard was added to reflect the concern for this becoming a more prevalent challenge with projected climate change; and to ensure that the risk assessment is aligned with the SHMCAP.

All relevant hazards as identified in the SHMCAP were therefore considered and addressed in this risk assessment. Due to the community's inland location, coastal hazards identified in the SHMCAP are not included (such as sea level rise, coastal flooding, coastal erosion, and tsunami).

The Town of Southwick has been subject to numerous federal disaster declarations along with the entirety of Hampden County. Some of these disaster declarations correspond to emergency declarations in portions of Massachusetts. The following table cross-references the 13 Massachusetts emergency declarations starting in 2011 with the corresponding federal disaster declarations. All the Massachusetts emergency declarations corresponding to Southwick have involved natural hazards addressed in this plan except for the shelter capacity crisis, which is not a natural hazard and not profiled in this plan. Hazards that do not appear in this table (i.e., earthquakes) have not been subject to Massachusetts emergency declarations.

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[54] Massachusetts State Hazard Mitigation and Climate Adaptation Plan. 2018.

Table 9. Massachusetts Emergency Declarations.

Massachusetts Emergency	Start	Termination	Corresponding Federal Disaster Declaration	FEMA Public Assistance Available	Applicable to Southwick?
Storm Lee	9/15/2023	9/16/2023	Not applicable	Not applicable	Yes
Severe Weather and Flooding	9/12/2023	9/16/2023	Not applicable	Not applicable	Yes
Shelter Capacity Crisis	8/8/2023	Pending	Not applicable	Not applicable	Yes, but not a natural hazard and not a FEMA declaration for Massachusetts
COVID-19	3/10/2020	5/11/2023	DR-4496-MA	All counties	Yes
Merrimack Valley Gas Explosion	9/14/2018	10/4/2018	Not applicable	Not applicable	No
Coastal Storm	3/3/2018	3/6/2018	DR-4372-MA	Essex, Norfolk, Plymouth, Bristol, Barnstable, and Nantucket Counties	No
Winter Storm	2/9/2015	2/25/2015	Not applicable	Not applicable	No
Winter Storm	1/26/2015	1/28/2015	DR-4214-MA	Worcester County and eastward	No
Winter Storm	2/8/2013	2/13/2013	DR-4110-MA	All counties	Yes
Hurricane Sandy	10/27/2012	11/1/2012	DR-4097-MA	Suffolk, Bristol, Plymouth, Barnstable, Dukes, and Nantucket Counties	No

Massachusetts Emergency	Start	Termination	Corresponding Federal Disaster Declaration	FEMA Public Assistance Available	Applicable to Southwick?
Nor'easter	10/29/2011	11/7/2011	DR-4051-MA	Berkshire, Franklin, Hampshire, Hampden, Worcester, and Middlesex Counties	Yes
Hurricane Irene	8/26/2011	9/6/2011	DR-4028-MA	Berkshire, Franklin, Hampshire, Hampden, Norfolk, Bristol, Plymouth, Barnstable, and Dukes Counties	Yes
Tornadoes	6/1/2011	6/19/2011	DR-1994-MA	Hampden and Worcester Counties	Yes

To better reflect the relationship between natural hazards and changing climate and weather patterns, each of the individual hazards identified for the updated risk assessment have been reorganized and categorized according to their primary interaction with climate change. These new categories are consistent with the SHMCAP and include the following:

- Changes in Precipitation
- Rising Temperatures
- Extreme Weather
- Non-Climate Influenced Hazards

Individual hazards are also grouped within each category according to their primary hazard (for example, all flooding-related hazards are listed under “Flooding” in the Changes in Precipitation category). This new classification for identified hazards was utilized for the plan update to consolidate and be consistent with the state's current hazard classification scheme per the SHMCAP.

Table 10 provides an abbreviated list of the 12 primary hazards included in the update risk assessment.

Table 10. Town of Southwick Hazards.

Primary Climate Change Interactions	Hazards
Changes in Precipitation	1. Flooding (including riverine, dam failures, ice jams, etc.) 2. Drought 3. Landslide
Rising Temperatures	4. Extreme Temperatures 5. Wildfires (including brush fires) 6. Infectious Disease 7. Invasive Species
Extreme Weather	8. Hurricanes/Tropical Storms 9. Severe Winter Storm/Nor'easter (including blizzard, ice storm, etc.) 10. Tornadoes 11. Other Severe Weather (including thunderstorms, etc.)
Non-Climate Influenced Hazards	12. Earthquake

Link to Massachusetts Climate Change Assessment

The *2022 Massachusetts Climate Change Assessment* report was issued in December 2022 (https://www.mass.gov/info-details/massachusetts-climate-change-assessment#read-the-report-). This report provided statements about the impacts of climate change in five sectors within each of seven designated regions of Massachusetts. Southwick is in the "Greater Connecticut River Valley" region shown in blue in the figure below. The table below lists the top two or three impacts of climate change in each of the five sectors within this region.

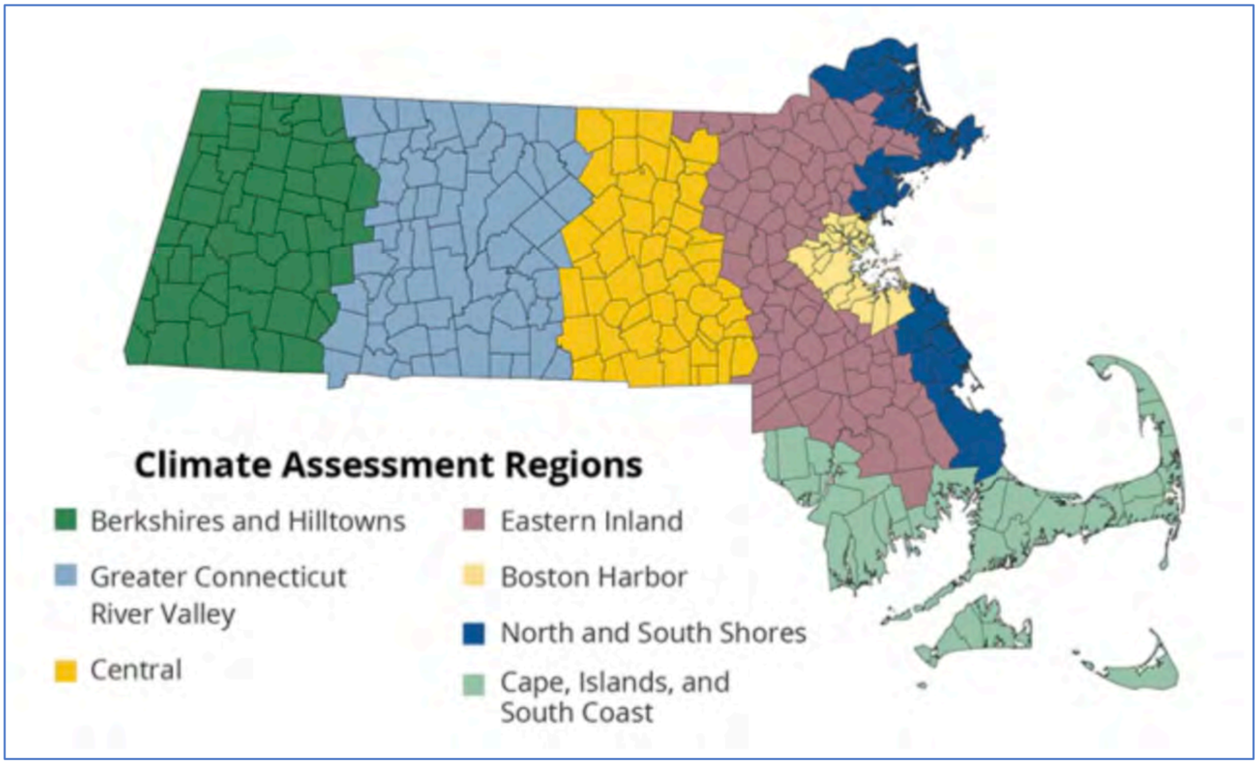


Figure 11. Climate Assessment Regions. Southwick is in the Greater Connecticut River Valley.

Table 11. Top Impacts of Climate Change per Sector in Greater Connecticut River Valley Region.

Sector	Top Impacts per Sector	Comments
Human	Health effects of extreme storms and power outages	Including injuries, food safety, and medical device failure
	Reduction in food safety and security	Causes are production and supply chain issues as well as spoilage during outages
Infrastructure	Damage to electric transmission and distribution	From heat stress and extreme storms
	Damage to buildings	Causes are heavy rainfall and overwhelmed drainage
Natural Environment	Freshwater ecosystem degradation	Causes are warming waters, drought, and runoff
	Forest health degradation	Causes are warming temperatures, changing precipitation, wildfire frequency, and increasing pests

Sector	Top Impacts per Sector	Comments
	Shifting distribution of native and invasive species	Changing conditions will favor some species
Governance	Increase in costs of responding to climate migration	Includes planning for abrupt increases in local populations
	Reduction in State and municipal revenues	Causes may include reduced property tax base due to floods
Economy	Decrease in agricultural productivity	Causes are crop yield impacts from precipitation patterns, extreme weather, and pests
	Reduction in availability of affordably priced housing	Causes are direct damage (floods) and scarcity caused by demand

Eventually, these impacts will be incorporated into the SHMCAP update scheduled for release in late 2023. The Town assumes that the SHMCAP will provide guidance about how to link the top climate impacts with the profiling of specific hazards. In the meantime, the Town proposes to incorporate these top climate change impacts in this edition of its plan as outlined below.

Table 12. How This Plan Addresses the Top Impacts of Climate Change per Sector.

Sector	Top Impacts per Sector	Approach to Incorporating Impacts
Human	Health effects of extreme storms and power outages	Severe weather events are hazards profiled in this plan.
	Reduction in food safety and security	Some of the hazards that affect food security (i.e., droughts) are profiled in this plan. However, Southwick also depends on food from other regions, and additional efforts beyond the scope of this plan will be needed to protect food safety and security.
Infrastructure	Damage to electric transmission and distribution	Severe weather events that damage transmission and distribution are hazards profiled in this plan.
	Damage to buildings	Severe weather events and floods that damage buildings are hazards profiled in this plan.
Natural Environment	Freshwater ecosystem degradation	Invasive species are addressed as a hazard profiled in this plan. Additional efforts beyond the scope of

Sector	Top Impacts per Sector	Approach to Incorporating Impacts
		this plan will be needed to protect freshwater ecosystems.
	Forest health degradation	Invasive species, droughts, wildfires, and severe weather events that damage forests are hazards profiled in this plan. Additional efforts beyond the scope of this plan will be needed to protect Forest health.
	Shifting distribution of native and invasive species	Invasive species is a hazard profiled in this plan.
Governance	Increase in costs of responding to climate migration	The capability assessment and related mitigation actions will help address increased costs related to responding to climate migration.
	Reduction in State and municipal revenues	The capability assessment and related mitigation actions will help address reduction in revenues.
Economy	Decrease in agricultural productivity	Causes are crop yield impacts from precipitation patterns, extreme weather, and pests; these are hazards profiled in this plan.
	Reduction in availability of affordably priced housing	The individual hazards addressed in this plan can reduce the availability of affordably priced housing, and the specific actions for each hazard will help protect housing options and opportunities.

Hazard Profiles

The risk assessment for the SHMCAP describes the natural hazards that have the potential to impact the Commonwealth and provides the underlying narrative for this hazard profile for the Town of Southwick. This section is organized by climate change interaction category, consistent with the SHMCAP. Because this section repeats information from the SHMCAP, some citations have been removed for brevity. The original citations can be found in the SHMCAP.

Profiles have been developed for each identified hazard, organized by primary climate change interaction. Hazard profiles include the following sections: Hazard Description, Location, Previous Occurrences, Extent, Probability of Future Events, and Vulnerability Assessment; these are described in the table below.

Table 13. Hazard Characterization.

Category/Method	Definition
Description	Description of hazard, its characteristics, and potential effects.
Location	Describes geographic areas within the town that are affected by the hazard.
Previous Occurrences	Provides information on the history of previous hazard events for the region, including their impacts on people and property.
Extent	Describes potential strength or magnitude of a hazard. Where possible, extent is described using established scales.
Probability of Future Events	Describes likelihood of future hazard occurrences in the town based on best available and climate-informed science.
Vulnerability Assessment	Describes potential impact on the community, including estimated potential losses and the anticipated effects of climate change.

To describe previous occurrences, this plan update highlights major events from history but relies primarily on a roughly ten-year lookback (2012 through 2022) ending with any events from the date of plan development (2023). This helps maintain a concise narrative. Where applicable, narratives about warning times (i.e., floods, heat advisories, and wildfires) are incorporated into the *"Extent"* subsections.

The vulnerability assessment characterizes how hazards have impacted and may impact the different aspects of the community. In the vulnerability assessment sub-sections, the magnitude and likelihood of a hazard event are evaluated, and impacts are quantified using hazard models. Some hazards, like earthquakes and winter storms, will impact the entire community while other hazards, like floods and landslides, impact specific locations in the community. The areas that could be impacted are defined as the community's exposure. The results of the vulnerability assessment are used to help identify mitigation measures the community may take to lessen the impact and better understand their benefits.

Primary Climate Change Interaction: Changes in Precipitation

Flooding Including Dam Failures and Ice Jams

Nationally, flooding causes more damage annually than any other severe weather event. Flooding in Massachusetts is often the direct result of frequent weather events such as coastal storms, nor'easters, tropical storms, hurricanes, heavy rains, and snowmelt. In an inland community such as Southwick, flooding is the result of moderate precipitation over several days, intense precipitation over a short period, or melting snowpack. Increases in precipitation and extreme storm events will result in increased inland flooding. Common types of flooding are described below.

> The Town of Southwick Community Resilience Building Workshop Summary of Findings (2018) lists "Flooding" as one of the top four hazards of concern.

Description

Riverine Flooding: Riverine flooding often occurs after heavy rain. Areas of the state with high slopes and minimal soil cover (such as found in western Massachusetts) are particularly susceptible to flash flooding caused by rapid runoff that occurs in heavy precipitation events and in combination with spring snowmelt, which can contribute to riverine flooding. Frozen ground conditions can also contribute to low rainfall infiltration and high runoff events that may result in riverine flooding. Some of the worst riverine flooding in Massachusetts' history occurred because of strong nor'easters and tropical storms in which snowmelt was not a factor. Tropical storms can produce very high rainfall rates and volumes of rain that can generate high runoff when soil infiltration rates are exceeded.

Floodplains are the low, flat, and periodically flooded lands adjacent to rivers, lakes, and oceans. These areas are subject to geomorphic and hydrologic processes. Floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined. These areas form a complex physical and biological system that supports a variety of natural resources and flood storage.

Drainage-Related Flooding: Drainage systems are designed to remove surface water from developed areas as quickly as possible to prevent localized flooding on streets and adjacent properties. They make use of a conveyance system that channels water away from a developed area to surrounding streams, bypassing natural processes of water infiltration into the ground, groundwater storage, and evapotranspiration. Flooding from overwhelmed drainage entails floods caused by increased water runoff due to development and drainage systems that are not capable of conveying high flows. Since drainage systems reduce the amount of time the surface water takes to reach surrounding streams, flooding can occur more quickly and reach greater depths than if there were no urban development at all. In almost any community with some degree of development, basement, roadway, and infrastructure flooding can result in significant damage due to poor or insufficient stormwater drainage.

Ice Jam: An ice jam is an accumulation of ice that acts as a natural dam and restricts the flow of a body of water. A freeze-up jam usually occurs in early winter to midwinter during extremely cold weather when super-cooled water and ice formations extend to nearly the entire depth of the river channel. This type of jam can act as a dam and begin to back up the flowing water behind it. A breakup jam, forms as a result of the breakup of the ice cover at ice-out, causing large pieces of ice to move downstream, potentially piling up at culverts, around bridge abutments, and at curves in river channels. Breakup ice jams occur when warm temperatures and heavy rains cause rapid snowmelt. The melting snow, combined with the heavy rain, causes frozen rivers to swell. The rising water breaks the ice layers into large chunks, which float downstream and often pile up near narrow passages and obstructions (bridges and dams). Ice jams may build up to a thickness great enough to raise the water level and cause flooding upstream of the obstruction.

Dam Overtopping: 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 one-third of all dam failures in the U.S. The two primary types of dam failure are catastrophic failure (characterized by the sudden, rapid, and uncontrolled release of impounded water) and design failure (which occurs as a result of minor overflow events).

There are a number of ways in which climate change could alter the flow behavior of a river, causing conditions to deviate from what the dam was designed to handle. For example, more extreme precipitation events could increase the frequency of intentional discharges. Many other climate impacts, including shifts in seasonal and geographic rainfall patterns, could also cause the flow behavior of rivers to deviate from previous hydrographs. When flows are greater than expected, spillway overflow events (often referred to as "design failures") can occur. These overflows result in increased discharges downstream and increased flooding potential. Therefore, although climate change will not increase the probability of catastrophic dam failure, it may increase the probability of design failures.

<u>Beaver Dams</u>: Additional causes of flooding include beaver dams. Beaver dams obstruct the flow of water and cause water levels to rise. Significant downstream flooding can occur if beaver dams break.

<u>Secondary Hazards</u>: The most problematic secondary hazards for flooding are fluvial erosion, riverbank erosion, and landslides affecting infrastructure and other assets located within floodplains. Without the space required along river corridors for natural physical adjustment, such changes in rivers after flood events can be more harmful than the actual flooding. The impacts from these secondary hazards are especially prevalent in the upper courses of rivers with steep gradients, where floodwaters may pass quickly and without much damage, but scour the banks, edging buildings, and structures closer to the river channel or cause them to fall in. Landslides can occur following flood events when high flows oversaturate soils on steep slopes, causing them to fail. These secondary hazards also affect infrastructure.

Roadways and bridges are impacted when floods undermine or wash out supporting structures. Dams may fail or be damaged, compounding the flood hazard for downstream communities. Failure of wastewater treatment plants from overflow or overtopping of hazardous material tanks and the dislodging of hazardous waste containers can occur during floods as well, releasing untreated wastewater or hazardous materials directly into storm sewers, rivers, or the ocean. Flooding can also impact public water supplies and the power grid in similar ways, through inundation and/or erosion.

Location

Heavy rainfall events occur regularly in Massachusetts. As a result, riverine flooding and drainage-related flooding affect most of the communities in the Commonwealth, including Southwick.

Southwick has 13 dams listed with the Massachusetts dam safety office. These dams range in size, height, impoundment volume and structural integrity. Dam failure has the potential to impact areas downstream of dams, including river corridors in and adjacent to Southwick.

Ice jams, if they occurred, would be limited to segments of the rivers with more modest changes in grade such as the downstream sections of Great Brook.

Previous Occurrences

Flooding is a concern in Southwick, and the previous edition of this plan includes detailed inventories about previous areas of concerns. For consistency, these have been repeated below with some material removed for brevity.

Town Hall
Southwick Town Hall abuts Great Brook, which is at risk of flooding during a major storm. This area is not within a FEMA mapped 100-year flood zone. The Town Hall was flooded in 1938 and 1955.

College Highway – from Granville Road to Feeding Hills Road
This area is partially within a FEMA mapped 100-year flood zone. Heavy rains in 1955 caused flooding in this area. During major storm events, water covers small stretches of College Highway. Approximately 20 residential or commercial structures in this area have been affected or could be affected by a flood incident. In addition, this is a primary evacuation route. Critical facilities are not located along this stretch of College Highway, except one daycare center. However, several are located nearby, just south of the intersection with Granville Road/Depot Street. Nearby critical facilities include Town Hall, a sewer pump station, a water pump station, the Fire Department, Police Department, Department of Public Works, and one group home. *According to the planning committee, a State culvert replacement has potentially helped alleviate some flooding at College Highway.*

Klaus Anderson Road/Curtis Road
There are no critical facilities located in this area that could be affected by a flood incident; however this is a key evacuation route in case of emergency. This area is partially within a FEMA mapped 100-year flood zone. During major storm events, water comes up to the bridge level where the road crosses Johnson Brook and Pearl Brook. *According to the planning committee, flood concerns have decreased along these roads.*

Sheep Pasture Road
Approximately three residential structures located in this area could be affected by a flood incident, however none are critical facilities. This area is partially within a FEMA mapped 100-year flood zone, and beaver activity backs up the culvert that underpasses the road at Great Brook.

Berkshire Avenue
Approximately five residential structures located in this area have been affected or could be affected by a flood incident, but no critical facilities. This area is partially within a FEMA mapped 100-year flood zone. Heavy rains can back up the culvert under the road at Great Brook.

Well Fields on Feeding Hills Road
Approximately three residential structures located in this area which could be affected by a flood incident; however none are critical facilities. This area is partially within a FEMA mapped 100-year flood zone. Heavy rains can back-up the culvert under the road at Great Brook.

Fernwood Road and Pinewood Road
This small subdivision has a history of flooding during heavy rains. Approximately five residential structures located in this area have been affected or could be affected by a flood incident, but no critical facilities.

Point Grove Road
Approximately five residential structures located in this area have been affected or could be affected by a flood incident, but no critical facilities. This area is in very close proximity to North Congamond Pond and can be impacted by the amount of water flowing out of the Lakes and into Great Brook. It can be susceptible to flash flooding.

Hunter Ridge Circle
A flood-prone detention pond was intended to serve the small subdivision located on Hunter Ridge Circle and Mallard Lane. Approximately three residential structures located in this area were potentially affected by a flood incident, however none are critical facilities. *According to the planning committee, flood concerns have decreased here, as they were primarily construction phase concerns.*

Granville Road by Hummell Lane
Approximately two residential structures located in this area could be affected by a flood incident.

<u>*North Loomis Street*</u>
Flooding has occurred at this spot on North Loomis Street where Shurtleff Brook crosses. One residential structure is located nearby which could be affected by a flood incident in this area.

Figure 12. Flooding on Industrial Road 2007.

According to the planning committee, Industrial Road can be added to the list of flood concerns. Great Brook crosses under this road.

The Southwick Open Space Plan (2020) explains that the floodplains of Great Brook and Munn Brook are the most prone to flooding. Smaller streams feed into these two and thus they experience the heaviest flooding and cause the most damage during prolonged rainfall. The areas along the Congamond Lakes are also cause for concern.

As noted earlier, this plan update relies primarily on a roughly ten-year lookback (2012 through 2022). From 2012 through 2022, none of the disaster declarations in Massachusetts that cover Hampden County were related to *flood impacts* in Hampden County. The NOAA Storm Events database (https://www.ncdc.noaa.gov/stormevents/) lists a few flood events affecting Southwick during the timeframe 2012-2022.

Table 14. NCEI Severe Storm Database Entries Covering Floods in Southwick.

Date	Description	Losses Reported
8/15/12	Portions of Route 10 in Southwick were flooded with six inches of water.	--
7/1/13	East Mountain Road was closed on the Westfield/Southwick line due to flooding.	--
10/24/17	Feeding Hills Road in Southwick near the Rail Trail was blocked due to flooding.	--
12/21/18	Kline Road in Southwick was closed due to flooding.	--

Figure 13. Flooding on Kline Road.

According to the previous edition of this plan and according to the local planning committee, dam failures and ice jams have not occurred in Southwick. Many streams within Southwick likely do not have the characteristics necessary for ice jams.

In summary, the most severe flooding in Southwick appears to be coincident with the watercourses and the FEMA mapping for the community.

Extent

The frequency and severity of flooding are measured using a discharge probability, which is the probability that a certain river discharge (flow) will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels. The flood frequency equals 100 divided by the discharge probability. For example, the "100-year discharge" has a 1 percent chance of being equaled or exceeded in any given year. The "annual flood" is the greatest flood event expected to occur in a typical year. These measurements reflect statistical averages only; it is possible for two or more floods with a 100-year or higher recurrence interval to occur in a short time period. The same flood can have different recurrence intervals at different points on a river.

The 1% annual chance flood is the standard used by most federal and state agencies. It is used by the National Flood Insurance Program (NFIP) to guide floodplain management and determine the need for flood insurance. The extent of flooding associated with a 1% annual probability of occurrence (the base flood or 100-year flood) is called the 100-year floodplain, which is used as the regulatory boundary by many agencies. Also referred to as the Special Flood Hazard Area (SFHA), this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. The term "500-year flood" is the flood that has a 0.2% chance of being equaled or exceeded each year. Base flood elevations and the boundaries of the 1% annual chance (100-year) and the 0.2% annual chance (500-year) floodplains are shown on Flood Insurance Rate Maps (FIRMs), which are the principal tools for identifying the extent and location of the flood hazard.

Both the 100-year and the 500-year floodplains are determined based on past events. As a result, the flood maps do not reflect projected changes in precipitation events.

Flooding in Massachusetts is forecast and classified by the National Weather Service (NWS) Northeast River Forecast Center as minor, moderate, or severe based upon the types of impacts that occur. Minor flooding is considered “disruptive” flooding that causes impacts such as road closures and flooding of recreational areas and farmland. Moderate flooding can involve land with structures becoming inundated. Major flooding is a widespread, life-threatening event. River forecasts are made at many locations in the state containing USGS river gauges with established flood elevations and levels that correspond to each of the degrees of flooding.

Due to the pattern of meteorological conditions needed to cause serious flooding, it is unusual for a flood to occur without warning. Flash flooding, which occurs when excessive water fills either normally dry creeks or riverbeds or dramatically increases the water surface elevation on currently flowing creeks and river, can be less predictable. However, potential hazard areas can be warned in advanced of potential flash-flooding danger. Flooding is more likely to occur due to a rainstorm when the soil is already wet and/or streams are already running high from recent previous rains. NOAA’s Northeast River Forecast Center provides flood warnings for Massachusetts, relying on monitoring data from the USGS stream gauge network. Notice of potential flood conditions is generally available several days in advance. State agency staff also monitor river, weather, and forecast conditions throughout the year. Notification of potential flooding is shared among state agency staff, including the Massachusetts Emergency Management Agency (MEMA) and the Office of Dam Safety. The NWS provides briefings to state and local emergency managers and provides notifications to the public via traditional media and social networking platforms.

Dams are a special consideration within the Extent characterization for floods. Many dams in Massachusetts were built in the 19th Century without the benefit of modern engineering design and construction oversight. Dams can fail because of structural problems due to age and/or lack of proper maintenance. Dam failure can also be the result of structural damage caused by an earthquake or flooding brought on by severe storm events. The Massachusetts Department of Conservation and Recreation (DCR) is the agency responsible for regulating dams in the state (M.G.L. Chapter 253, Section 44, and the implementing regulations 302 CMR 10.00). The DCR was also responsible for conducting dam inspections until 2002, when state law was changed to place the responsibility and cost of inspections on the owners of the dams. In accordance with the new regulations, which went into effect in 2005, dam owners must register, inspect, and maintain dams in good operating condition. Owners of High Hazard Potential dams and certain Significant Hazard Potential dams are also required to prepare, maintain, and update Emergency Action Plans. The state has three hazard classifications for dams:

1. High Hazard Potential: Dams located where failure or improper operation will likely cause loss of life and serious damage to homes, industrial or commercial facilities, important public utilities, main highways, or railroads.
2. Significant Hazard Potential: Dams located where failure or improper operation may cause loss of life and damage to homes, industrial or commercial facilities, secondary highways or railroads or cause interruption of use or service of relatively important facilities.

3. Low Hazard Potential: Dams located where failure or improper operation may cause minimal property damage to others. Loss of life is not expected.

Owners of dams are required to hire a qualified engineer to inspect and report results using the following inspection schedule:

- High Hazard Potential dams – 2 years
- Significant Hazard Potential dams – 5 years
- Low Hazard Potential dams – 10 years

The time intervals represent the maximum time between inspections. More frequent inspections may be performed at the discretion of the state. Owners of High Hazard Potential dams and certain Significant Hazard Potential dams are also required to prepare, maintain, and update Emergency Action Plans (EAPs). Dams and reservoirs licensed and subject to inspection by the Federal Energy Regulatory Commission (FERC) are excluded from the provisions of the state regulations provided that all FERC-approved periodic inspection reports are provided to the DCR. FERC inspections of high and significant hazard projects are conducted on a yearly basis. All other dams are subject to the regulations unless exempted in writing by DCR.

Probability of Future Events

The frequency of hazard events of disaster declaration proportions is defined by the number of federally declared disaster events for the Commonwealth over a specified period of time. The historical record indicates the Commonwealth has experienced 22 coastal and inland flood-related disaster declaration events from 1954 to 2017. In the northeast, precipitation has increased by 17% from the baseline level recorded in the period from 1901 to 1960 to present-day levels measured from 2011 to 2012. Therefore, based on these figures, the Commonwealth may experience a flood event of disaster declaration proportions approximately once every three years.

However, the frequency of flooding varies significantly based on watershed, riverine reach, and location along each reach. Additionally, it is important to note that floods of lesser magnitude occur at a much higher frequency. The SHMCAP notes that in the ten-year period 2007 to 2017, the NOAA Storm Events Database reports that there were 433 flood events in Massachusetts, which is an average of more than 43 floods per year. In addition, the Massachusetts Climate Change Assessment notes that flooding is likely to increase, with the 1% annual chance riverine flood three times more likely to occur by 2050; and the historical 10% annual chance daily rainfall event (2.6 to 4 inches) four times more frequent by 2090. The Town of Southwick should assume that the probability of future flood events is high.

The lack of any previous occurrences of ice jams supports a statement that the probability of ice jams is low in Southwick.

Overall, dam failure has a low probability of occurring in Southwick. Dams are described further in the vulnerability assessment below.

Vulnerability Assessment

Exposure

In Southwick, the 1% annual chance floodplain (100-year floodplain) covers about 1,477.4 acres, or approximately 7 percent of the Town. In addition to the 100- year floodplain, there is stormwater with the potential to cause localized flooding. These areas include Kline Road, Klaus Anderson Road (Johnson Brook crossing), Fred Jackson Road, and Davis Road.

There are no critical facilities located in the 100- and 500-year floodplain. There are 97 buildings in the 100-year floodplain and 210 buildings in the 500-year floodplain. There are no structures listed on the National Register of Historic Places in the FEMA 100-year floodplain. Table 15 shows the types of buildings exposed to the flood and their value. The number in parathesis shows the total number of buildings and building values for the town.

Table 15. Buildings in 100-Year Floodplain.

Building Type	Number of Buildings (Total in Town)	Building Value (Total in Town)
Single Family	67 (5,339)	$14,589,600 ($1,114,461,100)
Mobile Home	0 (7)	$0 ($226,500)
Multi-Family	3 (274)	$397,800 ($131,368,800)
Commercial	19 (376)	$4,818,100 ($98,419,300)
Industrial	0 (34)	$0 ($20,199,300)
Educational	0 (29)	$0 ($95,160,900)
Government	0 (61)	$0 ($93,120,700)
Religious/Non-Profit	0 (24)	$0 ($26,942,300)
Garage/Outbuilding	3 (128)	$13,500 ($7,399,600)
Vacant	5 (179)	$0 ($236,800)
Total	**97 (6,451)**	**$19,819,000 ($1,587,535,300)**

The population exposed to the 100-year floodplain is shown in Table 16. The column on the left shows the population in and around the floodplain (wherever the Census Block overlapped with the floodplain boundary) while the column on the right shows the total population numbers for the town. The population in the floodplain is similar to the overall population of the Town.

Table 16. Population Exposed to 100-Year Floodplain (2020 U.S. Census).

Demographics	Population in and Adjacent to Floodplain	Total Population
Population	4,796	9,232
Households	2,230	4,115

Demographics	Population in and Adjacent to Floodplain	Total Population
White	4,442 (92.6%)	8,527 (92.4%)
Black	19 (0.4%)	51 (0.6%)
American Indian	9 (0.2%)	17 (0.2%)
Asian	46 (1.0%)	87 (0.9%)
Pacific Islander	1 (0.0%)	4 (0.0%)
Other Race	43 (0.9%)	80 (0.9%)
Two or More Races	236 (4.9%)	466 (5.0%)
Hispanic or Latino:	152 (3.2%)	325 (3.5%)
Population under 18:	870 (18.1%)	1,657 (17.9%)
Population over 64:	1,048 (21.9%)	2,054 (22.2%)
Annual Income < $30K/year	306 (13.7%)	553 (13.4%)

Although dams and their associated impoundments provide many benefits to a community, such as water supply, recreation, hydroelectric power generation, and flood control, they also pose a potential risk to lives and property. Dam failure is not a common occurrence, but dams do represent a potentially disastrous hazard. When a dam fails, the potential energy of the stored water behind the dam is instantly released, oftentimes with catastrophic consequences as the water rushes in a torrent downstream flooding an area known as an "inundation area." The number of casualties and the amount of property damage will depend upon the timing of the warning provided to downstream residents, the number of people living or working in the inundation area, and the number of structures in the inundation area.

There is one significant hazard dam in Southwick and twelve smaller dams with no hazard code. Table 17 identifies the dams within the town.

Table 17. Dams in Vicinity.

Name	Ownership	Hazard Type
Dr. Logie Pond Dam	Private	Significant
Ahrens Pond Dam	Private	N/A
Basil Tysz Dam	Private	N/A
Cigar Pond Dam #1 (Lower)	Private	N/A
Cigar Pond Dam #1 (Upper)	Private	N/A
Congamond Lake Outlet - Middle Pond	Public	N/A
Congamond Lakes \ South Dike	Public	N/A
Congamond Lakes North Dike	Public	N/A
Hathaway & Steane Pond Dam #1	Private	N/A
Hathaway & Steane Pond Dam #2	Private	N/A

Name	Ownership	Hazard Type
Hathaway & Steane Farm Pond Dam	Private	N/A
Sackett District Reservoir Dam	Private	N/A
Unamed dam below Cigar Dam 1	Private	N/A

The 100-year Floodplain (FEMA) with the Town's critical facilities is shown in Figure 14. Southwick Critical Facilities and 100-Year Floodplain.. There are no critical facilities in the 100- and 500-year floodplain. Several roads cross the floodplain and may be subject to flooding.

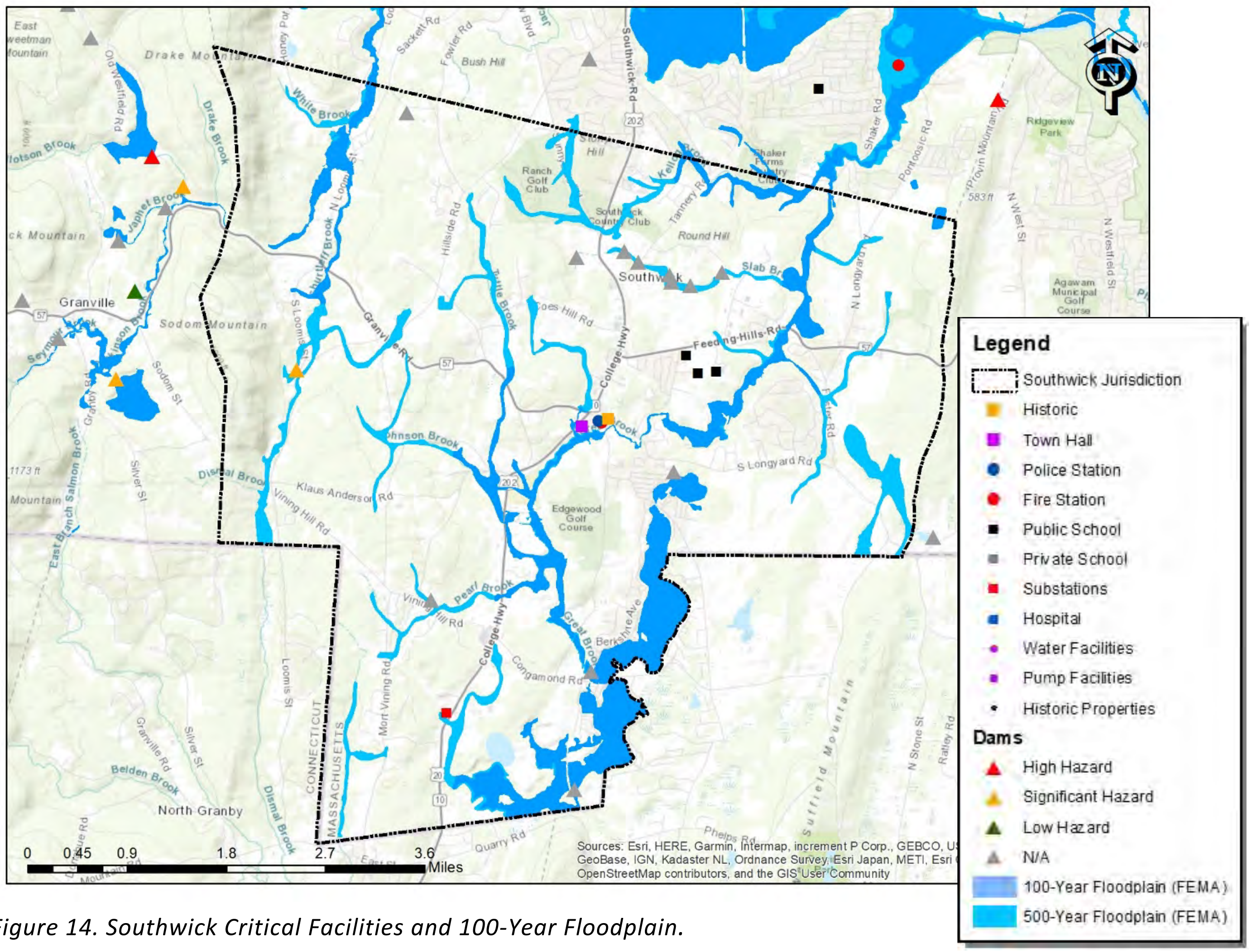


Figure 14. Southwick Critical Facilities and 100-Year Floodplain.

Built Environment Impacts

To identify built environment impacts to the town, FEMA's risk assessment software, Hazus, was implemented. Building footprint data and parcel data was used to update the model while the latest floodplain was also integrated into the software. The economic loss results of the 100-year event are shown in Table 18. The Town's Average Annual Loss (AAL) is calculated to be $167,100.

Climate change will increase the probability of additional flood impacts to the built environment. Future floodplains may be larger than the current FEMA modeled floodplain and new development should consider these projected conditions.

Table 18. Building Loss for the 100-Year Flood Scenario.

Loss Type	Residential ($Million)	Commercial ($Million)	Other Occupancy ($Million)	Total ($Million)
Building Loss	2.06	0.49	0.51	**3.06**
Content Loss	0.89	1.65	1.67	**4.21**
Business Inventory Loss	0.00	0.14	0.13	**0.27**
Business Income Loss	0.00	2.10	0.47	**2.57**
Business Relocation Loss	0.64	0.26	0.20	**1.1**
Rental Income Loss	0.21	0.19	0.01	**0.41**
Wage Loss	0.01	1.58	3.50	**5.09**
Total	**3.81**	**6.41**	**6.49**	**16.71**

Population Impacts

The Town should be aware that senior and low-income segments of Southwick's population may be more vulnerable to hazard events due to a number of factors. Senior and low-income populations may be physically or financially unable to react and respond to a hazard event and require additional assistance. Access to information about the hazard event may be lacking, as well as access to transportation in the case of an evacuation. The location and construction quality of housing can also pose a significant risk. Table 16 shows the number of senior and low-income residents in Southwick. The Town should be aware of the potential needs of residents within these population segments in the event of a hazard occurrence.

Using the Hazus software, the 100-year flood scenario results showed that there would be approximately 50 to 60 displaced households and 150 to 175 people seeking public shelter needs.

Climate change will increase the probability and magnitude of flood impacts to the population. Future floodplains may be larger than the current FEMA modeled floodplain and new development should consider these projected conditions. Vulnerable populations should be considered when development near the current floodplain is planned.

Environment Impacts

One of the major environmental impacts of a major flood would be the potential release of hazardous materials. Hazardous materials may be transported through Southwick on interstate 202 and route 57 both of which cross the floodplain.

Climate change will increase the probability and magnitude of flood impacts to the environment. Future floodplains may be larger than the current FEMA modeled floodplain and new development should consider these projected conditions including whether hazardous materials are stored there.

Problem Statements for Flood.

Problem statements summarize risk and vulnerability and are included following each hazard profile. The problem statements were developed to bridge the gap between identified hazard and development of the mitigation actions. Problem statements are included in each hazard profile section.

Table 19. Problem Statements Related to Flooding.

Assets	Problems Associated with Flood
People (including underserved communities and socially vulnerable populations)	• People living along Great Brook and its tributaries are more at risk in Southwick, though risks are believed relatively low. • An older population exposed to the floodplain may have difficulties evacuating. • The Town may encounter issues getting services to vulnerable populations if roadways are flooded. • Southwick Inn is located in a floodplain and may contain vulnerable visitors.
Structures (including facilities, lifelines, and critical infrastructure)	• Several homes and businesses are in the floodplain of Great Brook and its tributaries, and many of these buildings are older. • Some of the water supply infrastructure is located in low-lying and potentially flood-prone areas. • Undersized culverts at the Klaus Anderson Road, Fred Jackson Road, Kline road, and Davis Road are known issues. • Industrial Road and the adjoining area is located in floodplain including oil tank (with a berm around it) and gas station.

Assets	Problems Associated with Flood
Systems (including networks and capabilities)	• The Town is currently precluded from adopting higher regulatory standards to protect against flooding (must comply with State Building Code).
Natural, historic, and cultural resources	• Parts of the Town's cemetery are located in the floodplain.
Activities that have value to the community	• Activities conducted in downtown Southwick could be disrupted in a flood event since some of the streets there cross the floodplain. • Activities at the Congamond Lakes may be disrupted in a flood event.

Droughts

Droughts are typically defined as periods of deficient precipitation. How this deficiency is experienced can depend on factors such as land use change, the existence of dams, and water supply withdrawals or diversions. Droughts can vary widely in duration, severity, and local impact.

Description

The National Drought Mitigation Center references five common, conceptual definitions of drought:

1. Meteorological drought is a measure of departure of precipitation from normal.
2. Hydrological drought is related to the effects of precipitation shortfalls on stream flows and on reservoir and groundwater levels.
3. Agricultural drought links various characteristics of meteorological and hydrological drought to agricultural impacts and occurs when there is not enough water available for a particular crop to grow at a particular time.
4. Socioeconomic drought is associated with the supply and demand of economic goods with elements of meteorological, hydrological, and agricultural drought.
5. Ecological drought is an episodic deficit in water availability that drives ecosystems beyond thresholds of vulnerability and impacts ecosystem services.

Drought conditions can cause a shortage of water for human consumption and reduce local firefighting capabilities. Public water suppliers may struggle to meet system demands while maintaining adequate pressure for fire suppression and meeting water quality standards. The Massachusetts DEP requires all PWSs to maintain an emergency preparedness plan.

Private well owners can be vulnerable to droughts. With declining groundwater levels, well owners may experience dry wells or sediment in their water due to the more intense pumping required to pull water from the bedrock or overburden aquifer. Wells may also develop a concentration of pollutants, which may include nitrates and heavy metals depending on local geology.

The loss of clean water for consumption and for sanitation may be a significant impact depending on the affected population's ability to quickly drill a deeper or a new well or to relocate to unaffected areas. During a drought, dry soil and the increased prevalence of wildfires can increase the number of irritants (such as pollen or smoke) in the air. Reduced air quality can have widespread deleterious health impacts but is particularly significant to the health of individuals with pre-existing respiratory health conditions like asthma (CDC).

Lowered water levels can result in direct environmental health impacts, as the concentration of contaminants in swimmable bodies of water will increase when less water is present. Harmful algal blooms may occur, closing recreational areas.

One primary hazard in this plan that is commonly associated with drought is wildfire. A prolonged lack of precipitation dries out soil and vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends. A drought may increase the probability of a wildfire occurring.

Location

Parts of Massachusetts can experience significantly different weather patterns due to topography, distance from coastal influence, as well as a combination of regional, national, and global weather patterns. As a result, the Massachusetts Drought Management Plan (DMP) assesses drought conditions in six regions: Western, Connecticut River Valley, Central, Northeast, Southeast, and Cape and Islands. A regional approach allows customization of drought actions and conservation measures to address situations in each region; and allows for the determination of a drought on a watershed basis. Droughts have the potential to impact the entirety of Southwick.

Previous Occurrences

The Commonwealth of Massachusetts has never received a Presidential Disaster Declaration for a drought-related disaster. However, several substantial droughts have occurred over the past 100 years. Massachusetts experienced its most significant drought on record in the 1960s. The severity and duration of the drought caused significant impacts on both water supplies and agriculture.

Although short or relatively minor droughts occurred over the 50 years following the drought of the 1960s, the next long-term event began in March 2015 when Massachusetts began experiencing widespread abnormally dry conditions. In July 2016, based on a recommendation from the Drought Management Task Force (DMTF), the Secretary of the Executive Office of Energy and Environmental

Affairs (EOEEA) declared a Drought Watch for Central and Northeast Massachusetts and a Drought Advisory for Southeast Massachusetts and the Connecticut River Valley. Drought warnings were issued in five out of six drought regions of the state. Many experts stated that this drought was the worst in more than 50 years. DMTF declared an end to the drought in May 2017 with a return to wetter-than-normal conditions. The drought of 2015-2017 was a significant event relative to resources in Southwick.

USDA declares agricultural disasters as needed for a variety of hazards. Information can be found at https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index. The line items related to droughts in Hampden County are listed below.

Table 20. USDA Disasters Events That Refer to Drought.

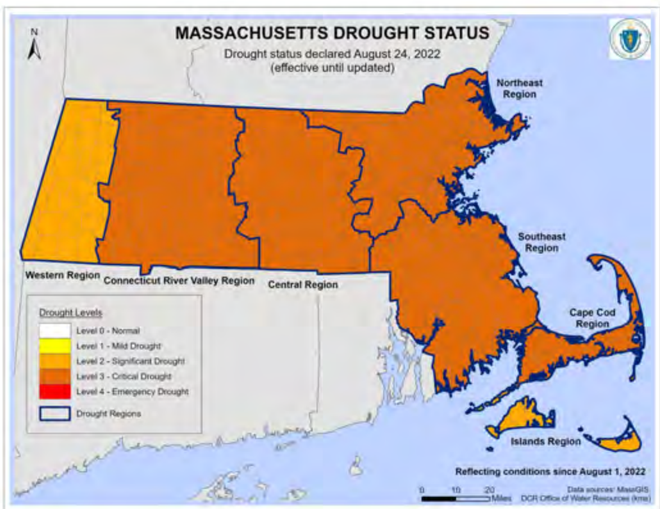
Year	Event	Event "Begin Dates"
2020	Drought	8/18/2020, 9/22/2020, 9/29/2020
2018	Drought	7/17/2018, 8/1/2018
2017	Drought	3/3/2017
2016	Drought, wildfire, excessive heat, high winds, insects	8/2/2016
2016	Drought	4/26/2016
2016	Drought, wildfire, excessive heat, high winds, insects	7/5/2016
2015	Drought	4/1/2015
2014	Drought	7/1/2014

The drought of 2020, a so-called "flashy drought" that impacted southern New England, was sufficiently impactful in Plymouth County to be included in the USDA data table. Flashy droughts are described below under *Extent*.

Applying the same ten-year lookback as the severe storms database review, USDA payments to Massachusetts agricultural sectors for drought impacts associated with events from 2012 through 2022 were reviewed. This timeframe includes the droughts of 2015-2017 and 2020. USDA payments to agricultural sectors in Southwick were $130,000 for the 2015-2017 and 2020 incidents, which is relatively high compared to many communities in Massachusetts.

The severity of a drought depends on the degree of moisture deficiency, duration, spatial extent, and location relative to resources or assets. The drought of the 1960s is the drought of record because duration, spatial extent, moisture deficiency, and impact all contributed to historic levels. In contrast, the severity of the 2016-2017 drought was due to impacts on natural resources (record low stream flows and groundwater levels), many water supplies, farms, and agriculture and to the swift onset of the drought.

The drought of 2022 was ongoing when this plan development commenced, but its severity was alleviated by rainfall in September 2022. At the present time, the drought of 2022 appears to be typical of a flashy drought.



While it did not emerge as one of the top four hazards in the CRB exercise in 2018, Southwick reportedly has concerns about drought. According to the CRB report, over one third of the Town is served by private water wells, many of which are older, shallow wells. The extended drought during summer 2016 led to a number of issues with private wells that went dry. During peak use days, Southwick's public water supply is reportedly insufficient, and the Town relies on supplemental water via a connection to Springfield Water and Sewer Commission.

Extent

Drought is defined by a combined look at several indices as detailed in the Massachusetts DMP (EOEEA and MEMA, 2013). The indices are:

- Standard Precipitation Index for 3-, 6-, and 12-month time periods
- Precipitation as a percent of normal (or historic average) for 2-, 3-, 6-, and 12-month time periods
- Crop Moisture Index
- Keetch-Byram Drought Index
- Groundwater levels
- Stream flow
- Reservoir levels

These indices are analyzed monthly to generate a hydrological conditions report and used to determine the onset, severity, and end of droughts. Five levels of increasing drought severity are defined in the DMP: *Normal, Advisory, Watch, Warning,* and *Emergency*. The drought levels are associated with actions outlined in the DMP. Recommendations of drought levels are made by the DMTF to the Secretary of the EOEEA, who then declares the drought level for each region of the state.

Other entities may measure drought conditions by these or other criteria more relevant to their operations. For example, water utilities may calculate the days of supply remaining. Farmers may assess soil moisture and calculate the water deficit for specific plants to determine irrigation needs or decide to change their crop based on the deficit or harvest early for non-irrigated crops.

The five drought levels in the 2013 DMP provide a basic framework for taking actions to assess, communicate, and respond to drought conditions. Under the "Normal" condition, data are routinely collected, assessed, and distributed. When drought conditions are identified, the four drought levels escalate moving to heightened action, which may include increased data collection and assessment, interagency communication, public education and messaging, recommendations for water conservation measures, and a state of emergency issued by the Governor. At the "Emergency" level, mandatory water conservation measures may be enacted. These regionally declared drought levels and associated state actions are intended to communicate and provide guidance to the public and stakeholders across industries to enable them to respond early and effectively and to reduce impacts. Individual public water suppliers may have their own drought management plan, drought levels, and associated actions, which they may follow at all levels except at the Emergency level when mandatory actions may be required.

Droughts develop over long periods of time relative to other hazards. However, flashy droughts are changing these norms (AMS, 2017). Flashy droughts may develop quickly or quickly intensify a developing or existing drought. The 2016-2017 drought is an example. Dry conditions from late 2015 lingered through the winter, with scattered groundwater levels reporting below normal and less than normal snowpack heading into spring 2016. Impacts were first seen in March 2016 in stream flows, groundwater levels, and reservoirs showing the long-term deficit. Then, as precipitation dramatically dropped below normal from June through September 2016, the entire state experienced record low stream flows and groundwater levels.

NOAA and others are advancing the science of early warning for droughts like the early warnings for floods and earthquakes to better project flashy droughts. Based on projected climate change, the distributions of precipitation events will continue to become more extreme, with periods of minimal rain alternating with extreme rain events. Therefore, developing ways to project and adapt to flash droughts may be critical for sectors such as agriculture and water supply.

The Massachusetts Water Resources Commission publishes the hydrologic condition report monthly, which includes the seven drought indices and the National Climate Prediction Center's U.S. Monthly and

Seasonal Drought Outlooks. The National Drought Mitigation Center produces a weekly Drought Monitor map. In accordance with the DMP, drought declarations are made monthly.

Probability of Future Events

Using data collected since 1850, the probability of the precipitation index of the DMP exceeding the threshold at each drought level was calculated. On a monthly basis over the 162-year period of record from 1850 to 2012, there is a 2% chance of being in a drought warning level.

Table 21. Frequency of Drought Events Exceeding the Precipitation Index of the DMP.

Level	Frequency Since 1850	Probability in Any Given Month
Emergency	5 occurrences	1% chance
Warning	5 occurrences	2% chance
Watch	46 occurrences	8% chance
Source: EOEEA and MEMA		

The likely range of consecutive dry days per year is projected to increase by up to nearly 20 days per year in 2090, compared to the annual statewide baseline of approximately 16 days per year from 1971 to 2001. Table 4-16 indicates the projected number of consecutive dry days according to the “high” and “low” limits of the Northeast Climate Adaptation Science Center (NE CASC) data.

Table 22. Projected Continuous Dry Days by Planning Year.

Planning Year	2030	2050	2070	2100
Projected Range of Consecutive Dry Days	16.44-17.94	16.34-18.64	15.94-18.94	16.34-19.64
Source: resilient MA, 2018				

These projections suggest that the average time between rain events is likely to remain fairly constant; however, individual drought events could still increase in frequency and severity. The incidence of droughts in 2015-2016, 2020, and 2022 certainly underscores that the probably of future droughts is high.

Vulnerability Assessment

Exposure

Drought is a gradual phenomenon, and its condition occurs naturally in a broad geographic area. The entire town would be exposed to drought conditions.

Built Environment Impacts

Major water users are more susceptible to drought, and these include water utilities and some commercial users.

With an increased probability of drought and drought magnitude, water utilities should consider reviewing or developing extreme drought scenarios.

Population Impacts

Populations considered most vulnerable to drought impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard. Table 16 summarizes the senior and low-income populations in Southwick. It should be noted that there may be overlap within the two categories, so that the total number of persons exposed may be lower than what is shown in the table. However, the town should be aware of the potential needs of residents within these population segments in the event of a hazard occurrence.

Socioeconomic impacts of the drought may also include anxiety and depression about economic impact, health problems associated with poor water quality, fewer recreational activities, higher incidents of heat stroke, and even loss of human life.

With an increased probability of drought and increased drought magnitude, and the potential of increased water costs, vulnerable populations may be more severely impacted in the future.

Environment Impacts

Agriculture in the Town would be impacted by drought conditions and there are some natural areas which may also be impacted. Drought amplifies the risk of loss of biodiversity and affects animal and plant species. Economic impacts include higher food and lumber prices. Drought can shrink the food supplies of animals and plants dependent on water and damage their habitats. Sometimes the environmental damage caused by a drought is temporary, and other times it is irreversible.

Over the last twenty years, the Town has had $130,000 in USDA payments due to drought. This comes to an average annual loss of $6,500.

Problem Statements for Drought

Table 23. Problem Statements for Drought.

Assets	**Problems Associated with Drought**
People (including underserved communities	• Vulnerable communities may have difficulty accessing potable water during an emergency drought event. If the well water

Assets	Problems Associated with Drought
and socially vulnerable populations)	levels are at emergency levels, having a plan to get vulnerable people water should be considered. If rates are increased to lower water demand, this may also adversely impact underserved and vulnerable communities.
Structures (including facilities, lifelines, and critical infrastructure)	• Water supply infrastructure may need to be shut down and water quality may become substandard. Businesses, including golf courses, requiring water for daily operations may have their operations limited due to water restrictions. • Many residents have older, shallow wells which may go dry during an event. • The Town's water supply is insufficient without drought conditions with a connection to Springfield Water and Sewer providing additional water during peak use days. Other sources should be considered.
Systems (including networks and capabilities)	• Outdoor water use restrictions and other water conservation measures during periods of extreme drought can be challenging to enforce, even when mandated through local declaration. • Agricultural systems and facilities in Southwick are significantly affected by droughts. Drought reimbursements and COVID reimbursements to agriculture have exceeded the figures in most other towns.
Natural, historic, and cultural resources	• Lakes and wetlands were adversely impacted by the drought of 2015-2017. • Younger trees and dwarf tree varieties may be adversely impacted since they have a smaller root system.
Activities that have value to the community	• Water activities on the lakes may be impacted if water levels are too low of if a drought contributes to harmful algal blooms and other water quality challenges.

Landslides

The term "landslide" includes a wide range of ground movements such as rock falls, deep failure of slopes, and shallow debris flows. The most common types of landslides in Massachusetts include translational debris slides, rotational slides, and debris flows. Most of these events are caused by a combination of unfavorable geologic conditions (silty clay or clay layers contained in glaciomarine, glaciolacustrine, or thick till deposits), steep slopes, and/or excessive wetness leading to excess pore pressures in the subsurface.

Description

Historical landslide data for the Commonwealth suggests that most landslides are preceded by higher-than-normal precipitation, followed by a single, high-intensity rainfall of several inches or more (Mabee and Duncan, 2013). This precipitation can cause slopes to become saturated. Landslides associated with slope saturation occur predominantly in areas with steep slopes underlain by glacial till or bedrock. Bedrock is relatively impermeable relative to the unconsolidated material that overlies it. Similarly, glacial till is less permeable than the soil that forms above it. Thus, there is a permeability contrast between the overlying soil and the underlying, and less permeable, unweathered till and/or bedrock. Water accumulates on this less permeable layer, increasing the pore pressure at the interface, leading to a failure or slide.

Occasionally, landslides occur as a result of geologic conditions and/or slope saturation. Adverse geologic conditions exist wherever there are lacustrine or marine clays, as clays have relatively low strength. These clays often formed in the deepest parts of the glacial lakes that existed in Massachusetts following the last glaciation. These lakes include Bascom, Hitchcock, Nashua, Sudbury, Concord, and Merrimack, among many other unnamed glacial lakes. When oversteepened or exposed in excavations, these vulnerable areas often produce classic rotational landslides.

Landslides can also be caused by external forces, including both undercutting (due to flooding or wave action) and construction. Undercutting of slopes during flooding or coastal storm events is a major cause of property damage. Streams and waves erode the base of the slopes, causing them to oversteepen and eventually collapse.

Location

In 2013, the Massachusetts Geological Survey and University of Massachusetts Amherst published a Slope Stability Map of Massachusetts. This project, funded by the FEMA Hazard Mitigation Grant Program, was designed to provide statewide mapping and identification of landslide hazards that can be used for community level planning as well as prioritizing high-risk areas for mitigation. The maps produced from this project should be viewed as a first-order approximation of potential landslide hazards across the state.

The Slope Stability Map categorizes areas of Massachusetts into stability zones, and the categorization is correlated to the probability of instability in each zone. The probability of instability metric indicates how likely each area is to be unstable, based on the parameters used in the analysis. According to the map, these unstable areas are located throughout the Commonwealth. Landslide risk is therefore assumed present in Southwick.

Previous Occurrences

Nationwide, landslides constitute a major geologic hazard because they are widespread, occur in all 50 states and cause approximately $1 billion to $2 billion in damages and more than 25 fatalities on average each year. In Massachusetts, landslides tend to be more isolated in size and pose threats to highways and structures that support fisheries, tourism, and general transportation.

Landslides commonly occur shortly after other major natural disasters, such as earthquakes and floods, which can exacerbate relief and reconstruction efforts. Many landslide events may have occurred in remote areas, causing their existence or impact to go unnoticed. Expanded development and other land uses may contribute to the increased number of landslide incidences and/or the increased number of reported events in the recent record. Notwithstanding these risks, very few landslides have been reported in Southwick.

Extent

Variables that contribute to the extent of potential landslide activity in any area include soil properties, topographic position and slope, and historical incidence. Predicting a landslide is difficult, even under ideal conditions. As a result, estimations of the potential severity of landslides are informed by previous occurrences as well as an examination of landslide susceptibility. Information about previous landslides, such as the information and images from landslides after Tropical Storm Irene can provide insight as to both where landslides may occur and what types of damage may result. It is important to note, however, that landslide susceptibility identifies only areas potentially affected and does not imply a time frame when a landslide might occur. The distribution of susceptibility across the Commonwealth is depicted on the Slope Stability Map, with areas of higher slope instability considered to also be more susceptible to the landslide hazard.

Characterizing the warning time before landslides can be challenging. Mass movements can occur suddenly or slowly. The velocity of movement may range from a slow creep of inches per year to many feet per second, depending on slope angle, material, and water content. Some methods used to monitor mass movements can provide an idea of the type of movement and the amount of time prior to failure. It is also possible to determine the areas that are at risk during general time periods. Assessing the geology, vegetation, and amount of predicted precipitation for an area can help in these predictions. However, there is no practical warning system for individual landslides. The current standard operating procedure is to monitor situations on a case-by-case basis and respond after the event has occurred. Generally accepted warning signs for landslide activity include the following:

- Springs, seeps, or saturated ground in areas that have not typically been wet before
- New cracks or unusual bulges in the ground, street pavements, or sidewalks
- Soil moving away from foundations

- Ancillary structures, such as decks and patios, tilting and/or moving relative to the main house
- Tilting or cracking of concrete floors and foundations
- Broken waterlines and other underground utilities
- Leaning telephone poles, trees, retaining walls, or fences
- Offset fence lines
- Sunken or down-dropped road beds
- Rapid increase in creek water levels, possibly accompanied by increased turbidity (soil content)
- Sudden decrease in creek water levels even though rain is still falling or has just recently stopped
- Sticking doors and windows, and visible open spaces indicating jambs and frames out of plumb
- A faint rumbling sound that increases in volume as the landslide nears
- Unusual sounds, such as trees cracking or boulders knocking together

Probability of Future Events

The probability of future occurrences is defined by the number of events over a specified period of time. The SHMCAP notes that from 1996 to 2012, eight noteworthy events triggered one or more slides in the Commonwealth. However, because many landslides are minor and occur unobserved in remote areas, the true number of landslide events is probably higher. The SHMCAP estimated that about 30 or more landslide events occurred in the period between 1986 and 2006. This roughly equates to one to three landslide events each year in Massachusetts. Given this information, the probability of a damaging landslide in Southwick is considered low. Nevertheless, climate change will increase the occurrence of intense precipitation and flooding while also increasing the likelihood of flashy droughts; this variability may contribute to unstable conditions where landslides are possible.

Vulnerability Assessment

Exposure

While landslides are rare, their impacts can be devastating, including loss of property, disruption to infrastructure, and injury and death. Continued development, particularly on steep slopes or unstable soils, increases the chances that landslides will be a danger. Other associated concerns are debris management issues including debris removal and identification of disposal sites.

To help identify potential landslide areas for the town, the slope stability index developed by the Massachusetts Geological Survey was used. The unstable and moderately unstable regions were queried out of the data and overlaid with the critical facilities and other buildings. There were no critical facilities found in the unstable or moderately unstable area.

The other building data was overlaid with the unstable and moderately unstable areas. There were 59 buildings found in the moderately unstable area and no buildings found in the unstable areas. Table 24 shows the result of this analysis. Fifteen buildings were found in the unstable and moderately unstable areas including single-family and multi-family homes.

Table 24. Buildings in Moderately Unstable Area.

Building Type	Number of Buildings (Total in Town)	Building Value (Total in Town)
Single Family	7 (5,339)	$2,284,600 ($1,114,461,100)
Commercial	11 (230)	$1,046,100 ($98,419,300)
Vacant	1 (179)	$0 ($236,800)

Figure 15 shows the landslide susceptibility map for the Town. The red and pink areas are more susceptible to landslides.

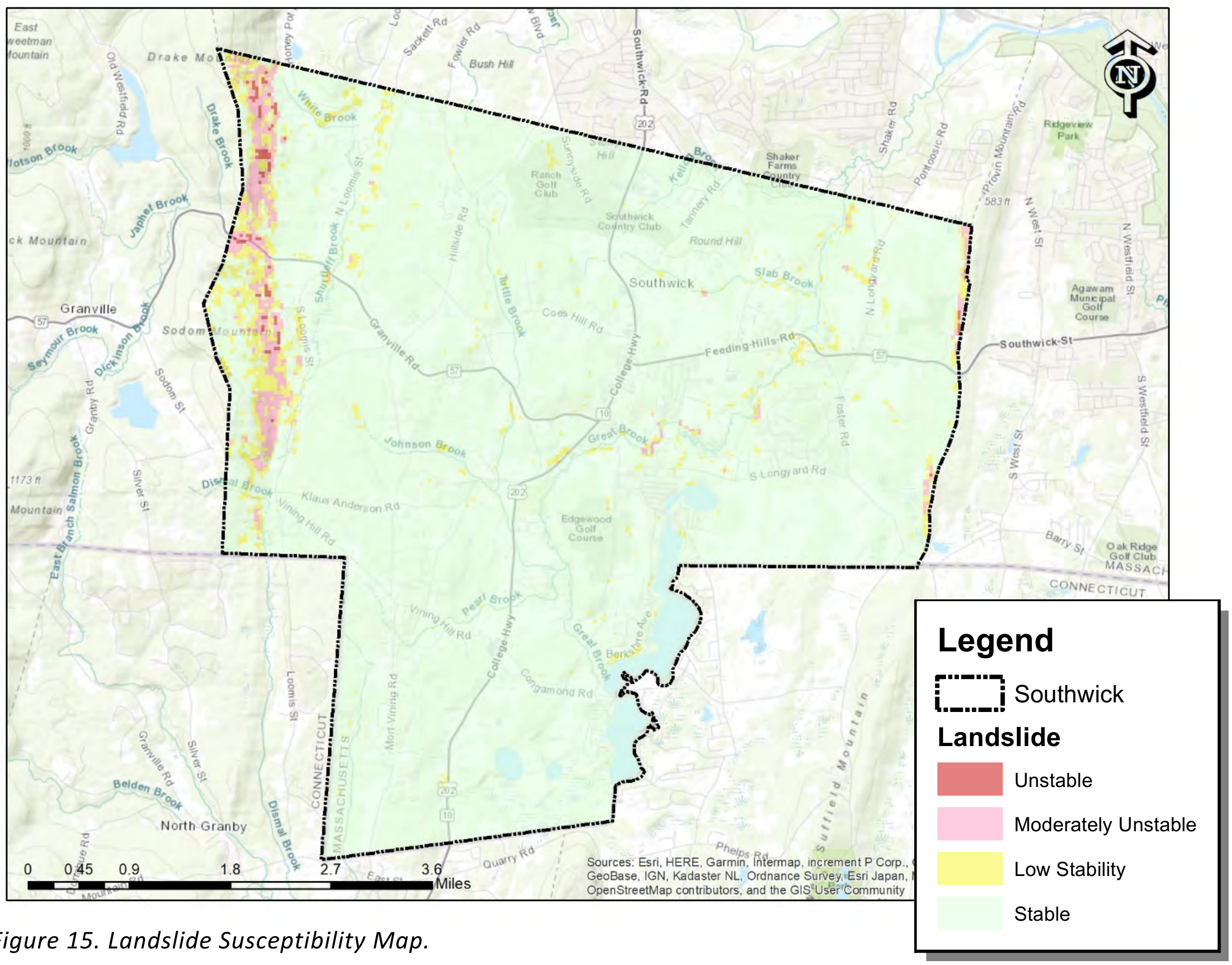


Figure 15. Landslide Susceptibility Map.

Built Environment Impacts

Historic data for landslide events indicate that between 1993 and 2022, no landslide events were recorded in Southwick. Still, there is a likelihood even if it's slight. We'll assume a total loss for a building due to a 100-year landslide event. The average value of a building in the moderately susceptible zone is $175,300. This would result in an AAL of $1,753.

With an increased probability of extreme rainfall events, landslides may also become more likely to occur and adjacent structures and infrastructure more likely to be impacted.

Population Impacts

Populations considered most vulnerable to landslide impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Table 16 summarizes the senior and low-income populations in Southwick. The town should be aware of the potential needs of residents within these population segments in the event of a hazard occurrence.

With an increased probability of extreme rainfall events, landslides may also become more likely to occur and people in the adjacent structures and roadways more likely to be impacted.

Environment Impacts

There are few unstable and moderately unstable areas around the transportation routes used to move hazardous materials.

With an increased probability of extreme rainfall events, landslides may also become more likely to occur and adjacent roadways more likely to be impacted. Those roadways may have hazardous materials transported on them.

Problem Statements for Landslides

Table 25. Problem Statements for Landslides.

Assets	Problems Associated with Landslides
People (including underserved communities and socially vulnerable populations)	• Vulnerable populations in isolated areas may be cut off if a landslide impacts specific roads.
Structures (including facilities, lifelines, and critical infrastructure)	• Some residential and commercial structures reside adjacent to moderately unstable areas and could be impacted.

Assets	Problems Associated with Landslides
Systems (including networks and capabilities)	• Roads may be impacted and could cause a hazardous material spill.
Natural, historic, and cultural resources	• No historical properties reside in the unstable or moderately unstable areas.
Activities that have value to the community	• None apparent or projected

Primary Climate Change Interaction: Changing Temperatures

Extreme Temperatures

According to the SHMCAP, extreme heat for Massachusetts is usually defined as a period of three or more consecutive days above 90 degrees Fahrenheit (°F), but more generally as a prolonged period of excessively hot weather which may be accompanied by high humidity. Extreme cold is also considered relative to the normal climatic lows in a region. Extreme cold temperatures are characterized by the ambient air temperature dropping to approximately 0°F or below.

The Town of Southwick Community Resilience Building Workshop Summary of Findings (2018) lists "Extreme heat" as one of the top four hazards of concern.

Description

Extreme cold is a dangerous situation that can result in health emergencies for susceptible or vulnerable people, such as those without shelter or who are stranded or who live in homes that are poorly insulated or without heat. Extreme cold events are events when temperatures drop well below normal in an area. When winter temperatures drop significantly below normal, staying warm and safe can become a challenge. Extremely cold temperatures often accompany a winter storm, which may also cause power failures and icy roads. During cold months, carbon monoxide may be high in some areas because the colder weather makes it difficult for car emission control systems to operate effectively, and temperature inversions can trap the resulting pollutants closer to the ground.

Likewise, extreme heat is a dangerous situation that can result in health emergencies for susceptible and vulnerable people, such as those without shelter or who are stranded or who live in homes that are poorly insulated or without adequate cooling.

A heat wave is defined as three or more days of temperatures of 90°F or above. A basic definition of a heat wave implies that it is an extended period of unusually high atmosphere-related heat stress, which causes temporary modifications in lifestyle, and which may have adverse health consequences for the affected population. Heat waves cause more fatalities in the U.S. than the total of all other meteorological events combined. According to the SHMCAP, more than 9,000 Americans have died from heat-related ailments (EPA, 2016) since the 1970s.

Heat impacts can be particularly significant in urban areas. Buildings, roads, and other infrastructure replace open land and vegetation. Dark-colored asphalt and roofs also absorb more of the sun's energy. These changes cause urban areas to become warmer than the surrounding areas. This forms "islands" of higher temperatures, often referred to as "heat islands." Heat islands can affect communities by increasing peak energy demand during the summer, air conditioning costs, air pollution and Green House Gas emissions, heat-related illness and death, and water quality degradation (EPA).

Many conditions associated with heat waves or more severe events (including high temperatures, low precipitation, strong sunlight, and low wind speeds) contribute to a worsening of air quality in several ways. High temperatures can increase the production of ozone from volatile organic compounds and other aerosols. Weather patterns that bring high temperatures can also transport particulate matter air pollutants from other areas of the continent. Additionally, atmospheric inversions and low wind speeds allow polluted air to remain in one location for a prolonged period of time.

Location

The Massachusetts Climate Assessment (2022) explains that recent efforts to characterize extreme heat have underscored that risks are present throughout the entire commonwealth. Therefore, the entire town of Southwick is subject to extreme heat. As with the entire commonwealth, Southwick is also exposure to extreme cold temperatures.

Previous Occurrences

Extreme Cold: The SHMCAP notes that since 1994, there have been 33 cold weather events within the Commonwealth, ranging from Cold/Wind Chill to Extreme Cold/Wind Chill events.

Extreme Heat: The SHMCAP notes that according to the NOAA's Storm Events Database (accessed in March 2018 for that planning process) there have been 43 warm weather events (ranging from Record Warmth/Heat to Excessive Heat events) since 1995. The most current event in the database occurred in July 2013. Excessive heat results from a combination of temperatures well above normal and high humidity. Whenever the heat index values meet or exceed locally or regionally established heat or excessive heat warning thresholds, an event is reported in the database.

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

Notwithstanding the occurrences of heat waves in the Southwick area, the NOAA Storm Events database (https://www.ncdc.noaa.gov/stormevents/) for Hampden County does not list any extreme heat events for Southwick in the timeframe 2012-2022. Evidence demonstrates that several extreme heat events occurred in Southwick in July and August 2022 and again in July 2023. The Town noted that its cooling center (the Town Hall) was opened a few times in summer 2022.

Cold events are typically reported with winter storms and will be described in the winter storm section of this chapter.

USDA declares agricultural disasters as needed for a variety of hazards. Information can be found at https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index. The events related to extreme temperatures in Hampden County are listed below.

Table 26. USDA Disasters Events That Refer to Extreme Temperatures.

Year	Event	Event "Begin Dates"
2016	Drought, wildfire, excessive heat, high winds, insects	8/2/2016
2016	Frost/freeze	2/12/2016, 2/14/2016
2016	Drought, wildfire, excessive heat, high winds, insects	7/5/2016
2013	Extreme heat, excessive humidity	5/8/2013

The Southwick CRB report (2018) includes an extensive discussion about the impacts of increasing heat events and decreasing cold events. The report explains that:

> *"The already-occurring impacts of climate change are also visible in the Congamond Lakes that run along a portion of Southwick's border with Connecticut. The lakes are an important aspect of the Town's cultural identity, and also used to be an important part of the economy, particularly as sources of ice which was sold to southern locales on the railroad. In the past, the three lakes, North, Middle, and South, would freeze over with 30 inches of solid ice. Today, because of the changing climate, there is only 12 inches of ice on the lake in a good year, seasons of no ice are common, and ice does not last as long into the spring as it once did. Instead of a source of income, the lakes have become an expensive liability, with new problems like algal blooms and cyanobacteria that are linked to the impacts of warmer temperatures."*

> *"At the same time that the lakes are experiencing challenges, they are also becoming more important to the Town in the summer. As days above 90°F increase, having water available to*

> *residents for recreation and cooling off is increasingly vital for keeping people comfortable and safe. A student intern from Southwick High School reported that his classmates are getting sick because of the heat, especially as the schools lack air conditioning."*

Extent

Extreme Cold: 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 more accurately calculate how cold air feels on human skin.

Extreme Heat: 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. Exposure to full sunshine can increase heat index values by up to 15°F. Also, strong winds, particularly with very hot, dry air, can increase the risk of heat-related impacts.

Probability of Future Events

The SHMCAP notes that Massachusetts averaged 2.4 declared cold weather events and 0.8 extreme cold weather events annually between January 2013 and October 2017. The year 2015 was a particularly notable one, with seven cold weather events, including three extreme cold/wind chill events, as compared to no cold weather events in 2012 and one in 2013. The SHMCAP notes that an average of between four and five heat waves occur annually in Massachusetts.

There are a number of climatic phenomena that determine the number of extreme weather events in a specific year. However, there are significant long-term trends in the frequency of extreme hot and cold events. In the last decade, U.S. daily record high temperatures have occurred twice as often as record lows (as compared to a nearly 1:1 ratio in the 1950s). Models suggest that this ratio could climb to 20:1 by midcentury, if GHG emissions are not significantly reduced (C2ES, n.d.).

The NE CASC data support the trends of an increased frequency of extreme hot weather events and a decreased frequency of extreme cold weather events. High, low, and average temperatures in Massachusetts are all likely to increase significantly over the next century as a result of climate change.

The graphics below (from resilient MA, 2018) show the projected annual days with maximum temperature above 90 degrees and projected annual days with minimum temperature below 32 degrees.

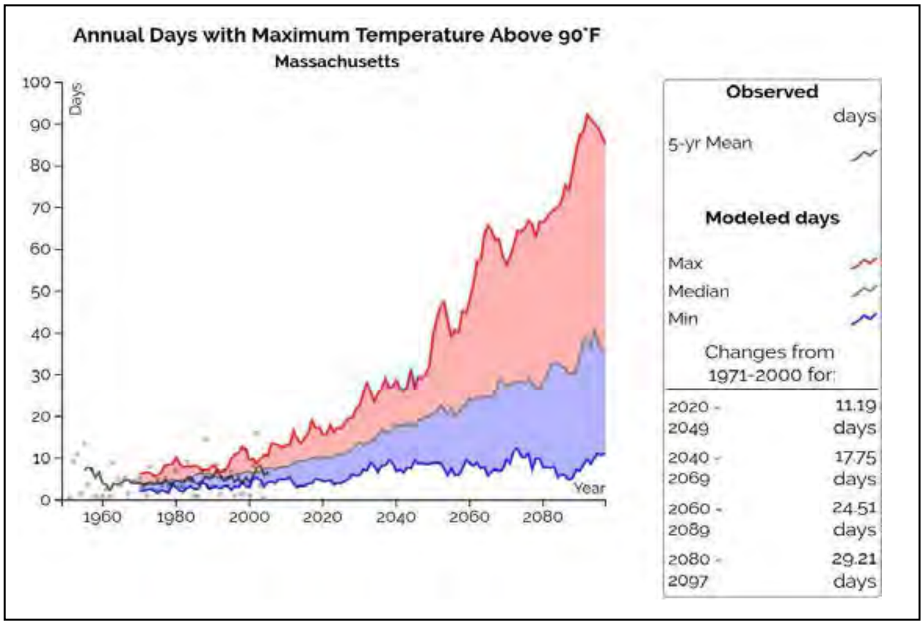


Figure 16. Annual Days with Maximum Temperature Above 90 F.

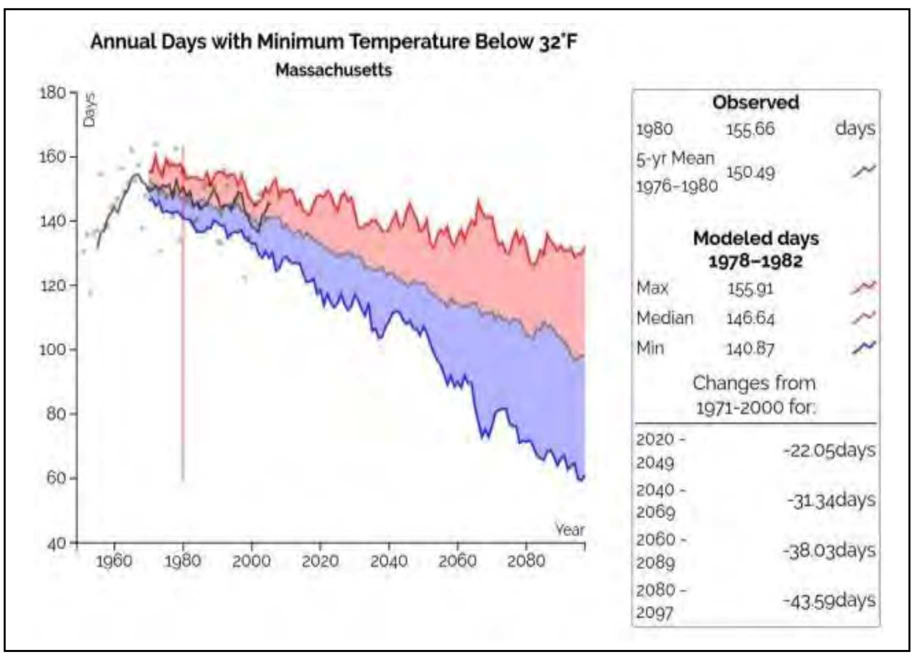


Figure 17. Annual Days with Minimum Temperature Below 32 F.

Vulnerability Assessment

Exposure

Extreme temperatures are not a hazard with a defined geographic boundary. The entire town should be considered exposed to the hazard. Excessive heat can occur at any time during the year, but is most dangerous during the summer between June and August when average temperatures are at their highest.

Built Environment Impacts

The impact of excessive heat is most prevalent in developed areas, where the town lacks a tree canopy. Secondary impacts of excessive heat are severe strain on the electrical power system and potential brownouts or blackouts. Extreme heat can have a negative impact on transportation. Highways and roads are damaged by excessive heat as asphalt roads soften and concrete roads expand and can buckle, crack, or shatter. Moreover, concrete has been known to "explode," lifting chunks of concrete and putting those nearby at serious risk. Stress is also placed on automobile cooling systems, diesel trucks, and railroad locomotives which lead to an increase in mechanical failures. Steel rails are at risk of overheating and warping which can lead to train derailments.

Extreme cold weather poses a significant threat to utility production, which in turn threatens facilities and operations that rely on utilities, specifically climate stabilization. As temperatures drop and stay low, increased demand for heating places a strain on the heating system, which can lead to temporary outages. These outages can impact operations throughout the campus, which can result in interruptions and delays in services. Broken pipes may cause flooding in buildings, causing property damage and loss of utility service. Some of the secondary effects presented by extreme/excessive cold include dangerous conditions to livestock and pets.

Climate change will increase the probability of extreme temperatures which may impact utilities, transportation, and especially older structures. Future development should consider keeping more mature trees, less dark asphalt areas, and more natural areas.

Population Impacts

Extreme cold events are predicted to decrease in the future, while extreme heat days, as well as average temperatures are projected to increase. The projected increase in extreme heat and heat waves is the source of one of the key health concerns related to climate change. Prolonged exposure to high temperatures can cause heat-related illnesses, such as heat cramps, heat exhaustion, heat stroke, and death. Heat exhaustion is the most common heat-related illness and if untreated, it may progress to heat stroke. People who perform manual labor, particularly those who work outdoors, are at increased risk for heat-related illnesses. Prolonged heat exposure and the poor air quality and high humidity that often accompany heat waves can also exacerbate pre-existing conditions, including respiratory illnesses, cardiovascular disease, and mental illnesses.

The greatest danger from extreme cold is to people, as prolonged exposure can cause frostbite or hypothermia, and can become life threatening. Body temperatures that are too low affect the brain, making it difficult for the victim to think clearly or move well. This makes hypothermia particularly dangerous for those suffering from it, as they may not understand what is happening to them or what to do about it. Hypothermia is most likely at very cold temperatures but can occur at higher temperatures (above 40 degrees Fahrenheit) if the person exposed is also wet from rain, sweat, or submersion. Warning signs of hypothermia include shivering, exhaustion, confusion, fumbling hands, memory loss, slurred speech, or drowsiness. In infants, symptoms include bright red, cold skin, and very low energy. A person with hypothermia should receive medical attention as soon as possible, as delays in medical treatment may result in death.

Older adults are often at elevated risk due to a high prevalence of pre-existing and chronic conditions. In Southwick, over 22% of the population is over age 64. People who live in older housing stock and in housing without air conditioning have increased vulnerability to heat-related illnesses. Power failures are more likely to occur during heat waves, affecting the ability of residents to remain cool during extreme heat. Individuals with pre-existing conditions and those who require electric medical equipment may be at increased risk during a power outage. Heat impacts are more likely to be felt by residents without air conditioning, by those who work outdoors, and those with underlying health conditions.

Extreme heat can pose severe and life-threatening problems for people. According to the NWS, it is one of the leading weather-related killers in the United States, resulting in hundreds of fatalities each year and even more heat-related illnesses. Extreme heat has a special impact on the most vulnerable segments of the population - the elderly, young children and infants, impoverished individuals, and persons who are in poor health. The high-risk population groups with specific physical, social, and economic factors that make them vulnerable include:

- Older persons (age > 65)
- Infants (age < 1)
- Homeless population
- Very low- and low-income persons
- People who are socially isolated
- People with mobility restrictions or mental impairments
- People taking certain medications (e.g., for high blood pressure, depression, insomnia)
- People engaged in vigorous outdoor exercise or work or those under the influence of drugs or alcohol.

Climate change will increase the rate of heat illness and need for cool spaces. Outdoor workers and vulnerable populations will need to be considered during extreme heat events.

Environment Impacts

The water temperatures elevated over a longer period of time will increase the number of times the town will need to treat for algae blooms. More harmful blooms could result in more potential for injuries and death for swimmers and pets.

Problem Statements for Extreme Temperatures.

Table 27. Problem Statements for Extreme Temperatures.

Assets	Problems Associated with Extreme Temperatures
People (including underserved communities and socially vulnerable populations)	• Extreme heat will be a significant public health threat to all residents, but especially for vulnerable populations living in older homes or homes without air conditioning. • The elderly and those with mobility issues may not be able to leave their homes and travel safely. • Schools without air conditioning (Southwick High School) pose a hazard to students. • People working in businesses without air conditioning may be at risk of heat illness. • First responders may also be impacted by extreme temperatures. • Pets may be adversely impacted by extreme heat.
Structures (including facilities, lifelines, and critical infrastructure)	• Older homes without insulation and single-pane glass are difficult to heat and cool and may not provide safe living conditions. • Businesses that require refrigerated trucks or refrigeration units may see business losses and increased utility costs.
Systems (including networks and capabilities)	• The Town believes that extreme heat is a significant concern for the agricultural sector. • The electric grid may become stressed and fail during extreme heat events. • Extreme heat mitigation and adaptation has not been fully integrated into existing local plans and regulations for new development, though progress is being made.

Assets	Problems Associated with Extreme Temperatures
Natural, historic, and cultural resources	• Extreme heat may lead to, or exacerbate, impacts to natural systems related to wildfires and invasive species (refer to the following sections). • Extreme heat may lead to algae blooms in lakes and ponds which would need to be treated *(see line below for more information).*
Activities that have value to the community	• Recreational activities may be adversely impacted by extreme heat. In particular, the Congamond Lakes are believed to be affected by a unique combination of hazards (less ice which impacts winter recreation, and more harmful algal blooms impacting summer recreation). Rephrased from the CRB report: *"The impacts of climate change are visible in the Congamond Lakes. The lakes are an important aspect of the Town's cultural identity, and also used to be an important part of the economy, particularly as sources of ice which was sold to southern locales on the railroad. In the past, the three lakes, North, Middle, and South, would freeze over with 30 inches of solid ice. Today, there is only 12 inches of ice on the lake in a good year, seasons of no ice are common, and ice does not last as long into the spring as it once did. Instead of a source of income, the lakes have become an expensive liability, with new problems like algal blooms and cyanobacteria that are linked to the impacts of warmer temperatures. At the same time that the lakes are experiencing challenges, they are also becoming more important to the Town in the summer. As days above 90°F increase, having water available to residents for recreation and cooling off is increasingly vital for keeping people comfortable and safe."*

Wildfires

A wildfire can be defined as any non-structure fire that occurs in vegetative wildland that contains grass, shrub, leaf litter, and forested tree fuels. Wildfires in Massachusetts are caused by natural events, human activity, or prescribed fire. Wildfires often begin unnoticed but spread quickly, igniting brush, trees, and potentially homes.

Description

The wildfire season in Massachusetts usually begins in late March and typically culminates in early June, corresponding with the driest live fuel moisture periods of the year. April is historically the month in which wildfire risk is the highest. Drought, snowpack level, and local weather conditions can impact the length of the fire season.

According to the National Fire Protection Agency, several elements (known as the fire tetrahedron) must be present to have any type of fire:

- Fuel: Without fuel, a fire will stop. Fuel can be removed naturally (when the fire has consumed all burnable fuel) or manually by mechanically or chemically removing fuel from the fire. In structure fires, removal of fuel is not typically a viable method of fire suppression. Fuel separation is important in wildfire suppression and is the basis for controlling prescribed burns and suppressing other wildfires. The type of fuel present in an area can help determine overall susceptibility to wildfires. According to the Forest Encyclopedia Network, four types of fuel are present in wildfires:
    - Ground Fuels: organic soils, forest floor duff, stumps, dead roots, buried fuels
    - Surface Fuels: the litter layer, downed woody materials, dead and live plants to 2 meters tall
    - Ladder Fuels: vine and draped foliage fuels
    - Canopy Fuels: tree crowns
- Heat: Without sufficient heat, a fire cannot begin or continue. Heat can be removed through the application of a substance, such as water, powder, or certain gases, that reduces the amount of heat available to the fire. Scraping embers from a burning structure also removes the heat source.
- Oxygen: Without oxygen, a fire cannot begin or continue. In most wildland fires, this is commonly the most abundant element of the fire triangle and is therefore not a major factor in suppressing wildfires.
- Uninhibited Chain Reaction: The chain reaction is the feedback of heat to the fuel to produce the gaseous fuel used in the flame. In other words, the chain reaction provides the sustained heat necessary to maintain the fire. Fire suppression techniques, such as dry chemical extinguishers, break up the uninhibited chain reaction of combustion to stop a fire.

Location

According to the SHMCAP, the ecosystems that are most susceptible to the wildfire hazard are pitch pine, scrub oak, and oak forests, as these areas contain the most flammable vegetative fuels. Other portions of the Commonwealth are also susceptible to wildfire, particularly at the urban-wildland interface.

Many parts of Southwick are therefore at risk of wildfires. The previous edition of this plan notes that moderate risk exists for potential wildfire incidents in the agricultural portions of town. Because agricultural land is scattered throughout Southwick, it is difficult to pinpoint exact locations which could be most susceptible.

Previous Occurrences

Several notable wildfires have occurred in Massachusetts history, although none has ever resulted in a FEMA disaster declaration. The previous edition of this plan notes that "One of the largest wildland fires on record was in Plymouth in May 1957. This catastrophic fire burned 15,000 acres and destroyed about 40 structures."

Smaller fires such as brush fires are somewhat easier to characterize. According to statewide data sets (https://www.mass.gov/service-details/fire-data-and-statistics), the number of brush fire events per year from 2012 through 2019 ranged from about 3,000 in 2019 to almost 8,000 in the drought year of 2016.

Table 28. Statewide Brush Fire Counts.

Year	Total # of Events	Injuries/deaths (civilians and fire service)	Losses
2019	2,974	12/0	$136,357
2018	3,253	1/5	$493,145
2017	4,206	20/0	$215,156
2016	7,834	40/0	$1,526,654
2015	6,962	35/0	$323,211
2014	4,627	25/0	$209,857
2013	4,968	31/3	$297,854
2012	5,857	38/0	$705,457

According to this statewide data set, fire event counts back to 2012 were as follows for Southwick:

Table 29. Outdoor and Total Fire Event Figures for Southwick.

Year	Total Outdoor Fires	Total Fire Events	Reported Losses for Outdoor Fires
2012	23	49	$142,281
2013	19	34	$11,568
2014	13	32	$110,297
2015	20	40	$183,800
2016	32	56	$331,429
2017	8	27	$136,504
2018	11	31	$186,894
2019	18	33	Note reported
2020	46	67	Note reported
2021	24	48	Note reported

Applying the fraction of outdoor fire incidents that are typically brush fires in Massachusetts (52%) and the fraction of fire losses that are typically from brush fires in Massachusetts (0.2%), an alternate set of figures for brush fires in Southwick is:

Table 30. Estimated Brush Fire Event Figures for Southwick.

Year	Estimated Brush Fires	Estimated Brush Fire Losses
2012	12	$576
2013	10	$39
2014	7	$516
2015	10	$698
2016	17	$1,102
2017	4	$875
2018	6	$1,001
2019	9	$0

Year	Estimated Brush Fires	Estimated Brush Fire Losses
2020	Could not be calculated	$1,708 based on total figure for the county
2021	Could not be calculated	$4,053 based on total figure for the county

The previous edition of this plan notes that Sodom Mountain/Campgrounds by Granville Gorge has been the location of several brushfires, primarily due to campers. Thus far, no structures have been damaged by the incidents, as most of the brushfires were reportedly suppressed quickly. Southwick has a mutual aid agreement with the neighboring town of Granville and has worked with them on several occasions to fight fires in this area.

Finally, USDA declares agricultural disasters as needed for a variety of hazards. Information can be found at https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index. The line items related to wildfires in Hampden County are listed below; these correspond to the drought of 2016.

Table 31. USDA Disasters Events That Refer to Wildfires.

Year	Event	Event "Begin Dates"
2016	Drought, wildfire, excessive heat, high winds, insects	8/2/2016
2016	Drought, wildfire, excessive heat, high winds, insects	7/5/2016

Extent

Unfragmented and heavily forested areas of the state are vulnerable to wildfires, particularly during droughts. The greatest potential for significant damage to life and property from fire exists in areas designated as wildland-urban interface areas. A wildland-urban interface area defines the conditions where highly flammable vegetation is adjacent to developed areas.

Fires can be classified by physical parameters such as their fireline intensity, or Byram's intensity, which is the rate of energy per unit length of the fire front (BTU [British thermal unit] per foot of fireline per second) (NPS, n.d.). Wildfires are also measured by their behavior, including total heat release during burnout of fuels (BTU per square foot) and whether they are crown-, ground-, or surface-burning fires. Following a fire event, the severity of the fire can be measured by the extent of mortality and survival of plant and animal life aboveground and belowground and by the loss of organic matter (NPS, n.d.).

The National Wildfire Coordinating Group defines seven classes of wildfires:

- Class A: 0.25 acre or less

- Class B: more than 0.25 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

Early detection of wildfires is a key part of the overall efforts of the Massachusetts Bureau of Fire Control. Early detection is achieved by trained Bureau observers who staff the statewide network of 42 operating fire towers. During periods of high fire danger, the Bureau conducts county-based fire patrols in forested areas. These patrols assist cities and towns in prevention efforts and allow for the quick deployment of mobile equipment for suppression of fires during their initial stage. If a fire breaks out and spreads rapidly, residents may need to evacuate within days or hours. A fire's peak burning period generally is between 1 p.m. and 6 p.m. Once a fire has started, fire alerting is reasonably rapid in most cases. The rapid spread of cellular and two-way radio communications in recent years has further contributed to a significant improvement in warning time.

Probability of Future Events

It is difficult to predict the likelihood of wildfires in a probabilistic manner because a number of factors affect fire potential and because some conditions (e.g., ongoing land use development patterns, location, and fuel sources) exert changing pressure on the wildland-urban interface zone. The Massachusetts Climate Change Assessment report suggests that wildfire risk will increase over time in association with extreme heat events and changing precipitation and droughts. The following discussion helps characterize the risk further for Southwick. Additionally, the concern related to agricultural fields could affect future wildfire probabilities.

Vulnerability Assessment

Exposure

To help identify potential wildfire areas for Southwick, the U.S. Forest Service's Wildfire Risk to Communities spatial data was downloaded. This data was developed in 2020 using the vegetation and wildland fuels from the LANDFIRE 2014 model with the burn probability coming from the Forest Service Fire Simulation System (FSim). To create a product with a finer resolution, the data was up sampled to the native 30m resolution of the LANDFIRE fuel and vegetation data spreading the values of the modeled burn probability into developed areas represented in LANDFIRE fuels as non-burnable. The areas with a 0.01% probability of burning were identified and overlaid with the critical facilities and other buildings. There were no critical facilities found in the 0.02% burn probability areas. There were 14 single-family homes, 8 multi-family homes, and 4 outbuildings/garages found in the .02% burn probability areas. Table 32 shows the result of this analysis.

Table 32. Buildings in 0.02% Annual Chance Area.

Building Type	Number of Buildings (Total in Town)	Building Value (Total in Town)
Single Family	14 (5,339)	$2,895,300 ($747,034,000)
Multi-Family	8 (274)	$736,000 ($131,368,800)
Outbuilding	4 (128)	$231,600 ($7,399,600)

The population exposed to the 0.02% probability area is shown in Table 16. The column on the left shows the population in and around the 0.02% probability wildfire area (wherever the Census Block overlapped with the wildfire area) while the column on the right shows the total population numbers for the town. There is a lower income population exposed to the wildfire hazard compared to the town average.

Table 33. Population Exposed to 0.02% Annual Chance Wildfire (2020 U.S. Census).

Demographics	Population in and Adjacent to 0.02% Wildfire Area	Total Population
Population	1,033	9,232
Households	416	4,115
White	990 (95.8%)	8,527 (92.4%)
Black	6 (0.6%)	51 (0.6%)
American Indian	1 (0.1%)	17 (0.2%)
Asian	11 (1.1%)	87 (0.9%)
Pacific Islander	0 (0.0%)	4 (0.0%)
Other Race	3 (0.3%)	80 (0.9%)
Two or More Races	22 (2.1%)	466 (5.0%)
Hispanic or Latino:	21 (2.0%)	325 (3.5%)
Population under 18:	203 (19.7%)	1,657 (17.9%)
Population over 64:	237 (22.9%)	2,054 (22.2%)
Annual Income < $30K/year	52 (12.5%)	553 (13.4%)

Figure 18 shows the burn probability map from the USFS overlaid on the town.

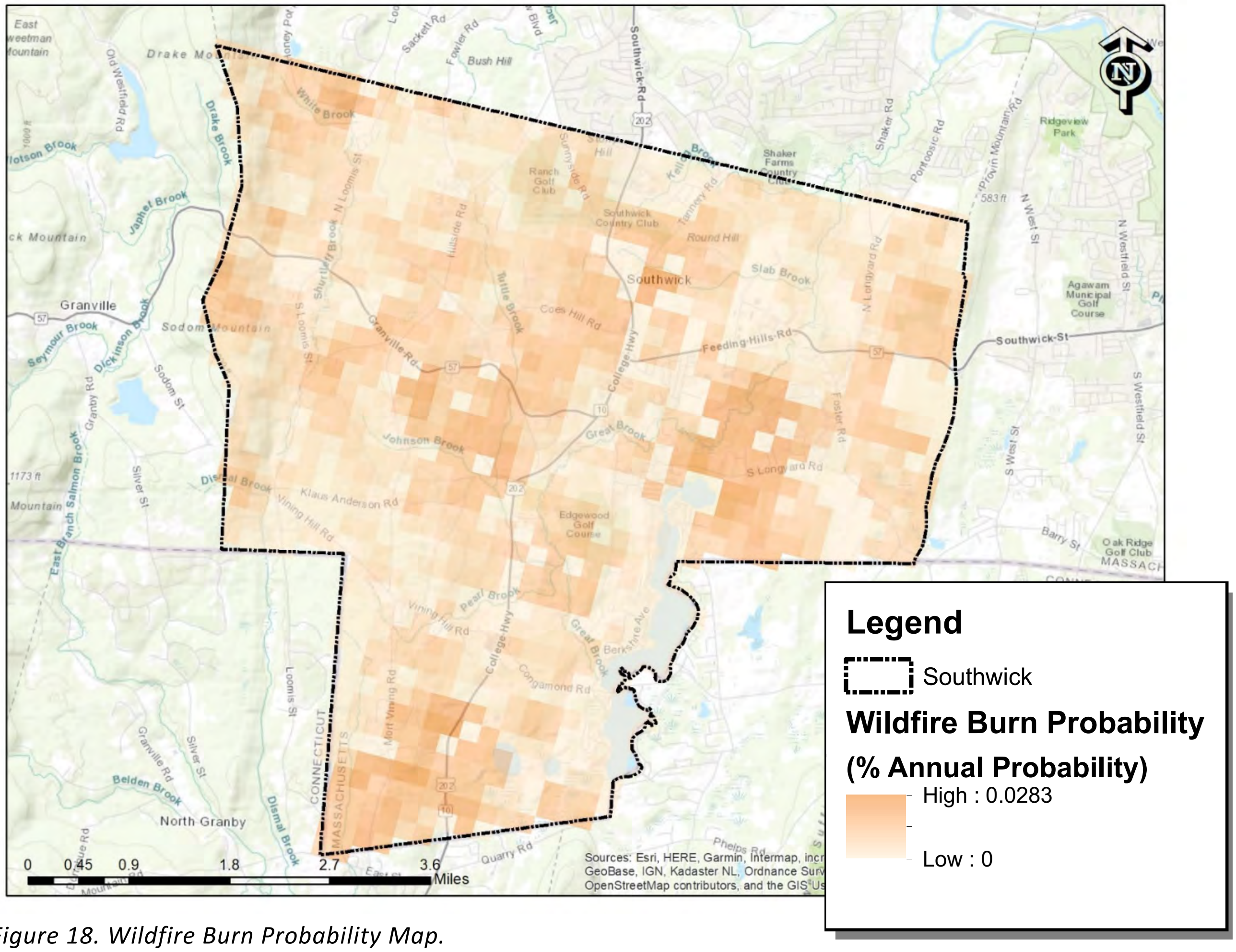


Figure 18. Wildfire Burn Probability Map.

Built Environment Impacts

A major out-of-control wildfire can damage property, utilities and forested land; create smoke that can cause breathing problems; and injure or kill people. Other associated concerns are debris management issues including debris removal and identification of disposal sites.

No property damage, injuries or deaths have been recorded for the reported for major wildfires in Southwick between 2004 and 2022. Using the wildfire probabilities and building values, a loss estimate was produced for the 0.02% scenario. The losses are $3,862,900 for the .02% event and the AAL will be $773.

Climate change will increase the probability of brushfires which could lead to additional property damage. Future development in forested and other high-fuel areas also could lead to additional increases in the probability of brushfires.

Population Impacts

Populations considered most vulnerable to wildfire impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Table 16 summarizes the senior and low-income populations in Southwick. The town should be aware of the potential needs of residents within these population segments in the event of a hazard occurrence.

With the increased probability of brushfires outside of the Town in the future due to climate change, populations may be impacted more often due to air quality issues.

Environment Impacts

Many of the natural features in the town are susceptible to wildfire including the trees and parks.

Problem Statements for Wildfires

Table 34. Problem Statements for Wildfires.

Assets	Problems Associated with Wildfires
People (including underserved communities and socially vulnerable populations)	• Populations with severe asthma may be adversely impacted by wildfires in the vicinity. • Lower income families are found in the higher wildfire probability areas. Evacuating and recovering from a wildfire may be difficult for them.
Structures (including facilities, lifelines, and critical infrastructure)	• Several residential structures are found in the higher probability burn areas. Structures without defensible zones are more susceptible to wildfires and brush fires.
Systems (including networks and capabilities)	• Wildfires often cause roads to be closed requiring detours.
Natural, historic, and cultural resources	• Wildfires may adversely impact agricultural, forested, and other vegetated areas of Southwick.
Activities that have value to the community	• Recreational activities may be adversely impacted by wildfires, depending on location.

Infectious Diseases

The SHMCAP does not address infectious diseases as a profiled hazard. While major disease outbreaks are uncommon, public health emergencies can become standalone disasters that compound the threat of other natural hazards and exceed local and state capacity. Precedent for federal assistance due to public health emergencies has been set including West Nile Virus (2000), a mosquito-borne disease, for which a federal emergency declaration was made in New York and New Jersey; and the COVID-19 pandemic, which resulted in a major disaster declaration in all states, territories, and the District of Columbia as well as an emergency declaration in Massachusetts. Given that COVID-19 has resulted in excessive public expenditures and resulted in a disaster declaration, and in light of heightened concerns about tick and mosquito-borne illnesses, this plan addresses infectious diseases.

Description

Public health risks, such as those presented by infectious diseases and vector-borne illnesses, are present within every community. An infectious disease is one that is caused by micro-organisms, such as bacteria, viruses, and parasites. A vector-borne illness is an infectious disease that is transmitted to humans by blood-feeding arthropods, including ticks, mosquitoes, and fleas, or in some cases by mammals (e.g., rabies). Infectious diseases cause illness, suffering and even death, and place an enormous financial burden on society.

Most infectious diseases are caused by pathogens that can be spread, directly or indirectly, from person to person. Such diseases may be seasonal (seasonal influenza) or result, in the case of new diseases, result in a global pandemic. Infectious disease dynamics depend on a range of factors, including land use, human behavior, climate, efficacy of healthcare services, population dynamics of vectors, population dynamics of intermediate hosts and the evolution of the pathogens themselves. Many of these diseases require continuous monitoring, as they present seasonal threats to the general population.

In Massachusetts, state public health officials rely on local boards of health, healthcare providers, laboratories, and other public health personnel to report the occurrence of notifiable diseases as required by law. An epidemic emerges when an infectious disease occurs suddenly in numbers that are more than normal expectancy. Infectious disease outbreaks put a strain on the healthcare system and may cause continuity issues for local businesses. These outbreak incidents are a danger to emergency responders, healthcare providers, schools, and the public. This can include influenza (e.g., H1N1), pertussis, West Nile virus, and many other diseases. A pandemic is an epidemic that has spread over a large area, that is, it is prevalent throughout an entire country, continent, or the whole world.

On March 11, 2020, the World Health Organization (WHO) officially declared the Coronavirus disease 2019 (COVID-19) outbreak a pandemic due to the global spread and severity of the disease. COVID-19 is a respiratory illness that can spread from person to person. COVID-19 is a highly contagious, viral upper respiratory illness that was first detected in China in late 2019. The virus quickly spread throughout the world and has resulted in a global pandemic ongoing at the time of this plan. COVID-19 symptoms include cough, difficulty breathing, fever, muscle pain, and loss of taste or smell. Severe cases may result in death, especially in individuals over the age of 65 or with underlying medical conditions, such as diabetes, lung disease, asthma, obesity, or those who are immunocompromised. COVID-19 spreads from person to person through respiratory droplets in the air or on surfaces.

Location

The entire Commonwealth of Massachusetts and Town of Southwick are considered at risk to the infectious diseases addressed in this chapter.

Previous Occurrences

Pandemic influenza episodes that were global outbreaks spread were observed in 1918, 1957, 1968, and in 2009 with the novel H1N1 strain. The 2009 H1N1 outbreak, though not considered a serious threat, still affected some residents in Massachusetts with nearly 2,000 confirmed cases and 33 deaths. The great influenza epidemic of 1918 killed millions worldwide and would likely cause hundreds to thousands of deaths in Massachusetts should a similar outbreak occur today. It is anticipated that a more serious strain of the usual flu will occur some year and that vaccines might not be ready in time to combat rapid spread.

The most significant recent occurrence of infectious disease for Southwick is that of COVID-19. Approximately 2.2 million cases and 24,000 deaths have been reported in Massachusetts. As of June 2023, approximately 173,000 cases were reported for Hampden County. The federal designation for the Massachusetts COVID-19 Pandemic is DR-4496-MA, with incident period January 20, 2020, and continuing through May 2023. The Major Disaster Declaration was issued March 27, 2020.

According to the CRB report (2018), "Climate change is affecting pests and disease vectors both through changing precipitation conditions and changing temperature conditions. Warmer, wetter conditions lead to increased mosquito populations, while the absence of sufficient periods of cold means that pest populations, especially ticks, that would historically have been killed off or reduced are able to survive the winter and emerge in greater numbers the following season. A recent CDC report showed that vector-borne diseases tripled between 2004 and 2016, with approximately 75% of cases being related to tick-borne disease. Further, as the Massachusetts climate begins to look more like the climate of the mid-Atlantic and southern states, we are seeing new types of diseases show up in existing pests, and new species of disease-carrying ticks and other pests moving into the New England states (e.g., mosquitoes carrying West Nile Virus or Zika and ticks carrying Rocky Mountain Spotted Fever). These changes present a major public and animal health challenge in terms of education, prevention, and treatment."

In Southwick, COVID-19 reimbursements from FEMA have totaled about $60,000. Food assistance payments to agricultural sectors under COVID-19 programs have exceeded $1,000,000 in Southwick. This is the reverse of what is observed in most communities, where public assistance typically exceeds USDA payments for COVID-19.

Vector-borne diseases continue to pose a significant threat to communities across Massachusetts. Blacklegged (deer) ticks and dog ticks are found throughout Massachusetts and may spread different diseases. The most common tick-borne diseases in Massachusetts are Lyme Disease, Babesiosis, and Anaplasmosis. Other diseases that are rare, but still occur, are Tularemia, Rocky Mountain spotted fever, Borrelia miyamotoi, and Powassan virus. Tickborne figures for Hampden County are available at https://www.mass.gov/lists/monthly-tick-borne-disease-reports; a summary for the last few calendar years is provided below.

Table 35. Tick-Borne Illness Figures for Hampden County.

Year	Emergency Department Visits	Number of Tick-Borne Disease Visits	Rate (per 10,000) of Tick-borne Disease Visits
2021	32,684	61	18.66
2020	225,537	73	3.24
2019	274,666	118	4.3

Mosquito-borne diseases are also a seasonal threat. West Nile Virus (WNV) and Eastern Equine Encephalitis (EEE or “Triple E”) are viruses that occur in Massachusetts and can cause illness ranging from a mild fever to more serious disease like encephalitis or meningitis. Other diseases spread by mosquitoes may affect people when traveling in other regions of the world such as Zika virus, Dengue fever, and Chikungunya.

Extent

Well-established scales for characterizing total impacts of infectious diseases are not present for applied uses such as a hazard mitigation plan. Nevertheless, commonly accepted methods are in place for characterizing active transmission, such as color scales (yellow, orange, red). Future editions of this plan will provide updates to measures of extent. Johns Hopkins continues to provide a very comprehensive dashboard of information for all regions of the U.S. including Massachusetts. County-level data can also be accessed (https://coronavirus.jhu.edu/region/us/massachusetts).

Probability of Future Events

Probability of infectious disease in the planning area is extremely variable. Many public health risks occur seasonally and are ongoing, such as the common cold and influenza. Major disease outbreaks such as the current COVID-19 pandemic are much less common but can last for long periods. Based on the information available regarding occurrences of greatest concern, the infectious disease hazard has been assigned a probability of likely for the foreseeable future.

The COVID-19 pandemic has the potential to continue to some degree over the next several years, even as vaccines continue to be developed are distributed. The Town of Southwick is continually updating community mitigation measures and guidance in close consultation with Massachusetts Department of Public Health and based on new information from the CDC.

The effects of climate change will result in an increase in the probability and/or frequency of some infectious diseases. Those infectious diseases that are currently present in Massachusetts and which may be exacerbated by climate change are already exhibiting increased prevalence in New England. For example, with both temperature and precipitation expected to increase in Massachusetts, West Nile Virus mosquito vector activity will likely increase, as well as the vector's period of activity. Similarly, between 1964 and 2010, counts of Eastern Equine Encephalitis (EEE) have continued to rise in New England, though they remain constant in the southeastern states. The Massachusetts Climate Change Assessment predicts that increases in vector-borne disease incidence and bacterial infections will occur in the region, including West Nile Virus and Lyme disease, due to more favorable conditions for ticks and mosquitoes; and explains that 65 fewer days below freezing could occur by 2070, increasing the chance of ticks overwintering and reducing winter recreation opportunities.

The United States is already seeing a significant increase in vector-borne infectious diseases. According to the CDC, the number of reported disease cases from mosquito, tick, and flea bites tripled from 2004 to 2016, and mosquito-borne disease epidemics are happening more frequently. Annual cases of Lyme disease have increased over the last decade, and with shrinking winters, the potential for infection through tick bite continues to grow. Given increasing trends for global travel, several other diseases not typically observed in Massachusetts could continue to make their way back to the state through infected travelers. COVID-19 is the most recent and severe example of this threat. Another example is the Zika virus, transmitted from infected mosquitoes to humans, which received international attention during an outbreak in 2015 and persists today.

Vulnerability Assessment

Exposure

The risk associated with communicable disease in the region has not been formally quantified, due to the difficulty in predicting specific occurrences, and the lack of complete data on impacts. However, the potential risk and impact of communicable diseases is often presumed to be very high in the chaos that follows natural disasters (WHO, 2006).

Natural disasters, particularly meteorological and geological events such as hurricanes, floods and earthquakes, can bring about serious health consequences. These disasters can affect vector breeding sites and vector-borne disease transmission. In a flood hazard area, initial flooding may wash away existing mosquito breeding sites, but standing-water caused by heavy rainfall or overflow of rivers can create new breeding sites. This can result (with typically some weeks delay) in an increase of the vector population and potential for disease transmission, depending on the local mosquito vector species and its preferred habitat. The crowding of infected and susceptible hosts, a weakened public health infrastructure and interruptions of ongoing control programs are all risk factors for vector-borne disease transmission.

The major causes of communicable disease from natural disasters can be categorized into four areas: Infections due to contaminated food and water, respiratory infections, vector and insect borne diseases, and infections due to wounds and injuries. The most common causes of morbidity and mortality in this situation are diarrheal disease and acute respiratory infections.

- Waterborne diseases: Diarrheal disease outbreaks can arise subsequent to drinking-water contamination, and have been reported after flooding and related movement. Hepatitis A and E have fecal-oral transmission in areas with poor water sanitation.
- Diseases associated with crowding: Acute respiratory infections are the main cause of morbidity and mortality among unsettled people and are seen predominantly in children less than 5 years old.
- Vector-borne diseases: The most common vector-borne diseases are carried by mosquitoes and ticks and include Lyme Disease, Rocky Mountain Spotted Fever, West Nile Virus, and Eastern equine encephalitis. Environmental changes after disaster could increase vector breeding sites and proliferation of disease vectors.
- Infections due to wounds and injuries: The potentially significant threats to persons suffering a wound are tetanus, staphylococci, and streptococci.

Built Environment Impacts

All human-occupied critical facilities are assumed to be at risk of contamination from a communicable disease. If facilities supporting emergency response lost their functionality because of contamination, delays in emergency services could result. Additionally, with a significant human disease outbreak, resources of health care systems such as ambulance services, hospitals, and medical clinics could quickly become overwhelmed. In most cases, critical infrastructure would not be affected by communicable disease. Scenarios that would affect infrastructure include the contamination of the water supplies and diseases that require special provisions in the treatment of wastewater. Should an epidemic necessitate quarantine or incapacitate a significant portion of the population, support of and physical repairs to infrastructure may be delayed, and services may be disrupted for a time due to limitations in getting affected employees to work.

Population Impacts

High death counts during a natural disaster (either human or animal) can indicate an increased risk of outbreaks associated with the size, health status, and living conditions of the population displaced by the natural disaster. Crowding, inadequate water and sanitation, and poor access to health services, often characteristic of sudden population displacement, increase the risk of communicable disease transmission.

Populations that are vulnerable to communicable diseases include the economically disadvantaged, racial and ethnic minorities, the uninsured, low-income children, the elderly, the homeless, and those with other chronic health conditions, including severe mental illness. It may also include rural residents, who often encounter barriers to accessing healthcare services, transportation, or the internet.

With climate change increasing the probability of infectious diseases with additional mosquito and tick activity occurring longer during the year, populations will be more at risk in the future.

Environment Impacts

Infectious diseases can also impact livestock and other animals. Some of the most common communicable diseases include Eastern Equine Encephalitis, Equine Herpes Virus, West Nile Virus, and Avian Influenza. While Zoonotic diseases (those transmissible between humans and animals or via an animal vector) are also a concern for the region, those events are best addressed in a pandemic or contagious disease plan rather than this hazard mitigation plan.

Problem Statements for Infectious Disease

Table 36. Problem Statements for Infectious Disease.

Assets	Problems Associated with Infectious Diseases
People (including underserved communities and socially vulnerable populations)	• Future flu pandemics may adversely impact all residents and present additional complications to the elderly and those with pre-existing conditions. • Tickborne and mosquito-borne infection rates are expected to increase as winter seasons become less severe and shorter in duration.
Structures (including facilities, lifelines, and critical infrastructure)	• Not applicable.
Systems (including networks and capabilities)	• May impact medical and response services. • Large scale closures/shutdowns due to pandemic response can negatively impact the Town's ability to deliver routine government operations and services. • COVID-19 reimbursements from FEMA totaled about $60,000. Food assistance payments to agricultural sectors under COVID-19 programs exceeded $1,000,000 in Southwick. This is the reverse of what is observed in most communities, where public assistance

Assets	Problems Associated with Infectious Diseases
	typically exceeds USDA payments for COVID-19. This demonstrates that the agricultural sector is highly vulnerable to disease impacts that reduce workforce capabilities and disrupt the supply chain.
Natural, historic, and cultural resources	• Not applicable.
Activities that have value to the community	• May impact in-person social events and the agricultural sector as noted above.

Invasive Species

According to the SHMCAP, invasive species are defined as non-native species that cause or are likely to cause harm to ecosystems, economies, and/or public health (NISC 2006). The focus of this section is on invasive terrestrial plants, as this is the most studied and managed typed of invasive; information for invasive aquatic flora and fauna (including marine species) is also provided when relevant.

Description

The Massachusetts Invasive Plant Advisory Group (MIPAG), a collaborative representing organizations and professionals concerned with the conservation of the Massachusetts landscape, is charged by EOEEA to provide recommendations to the Commonwealth to manage invasive species. MIPAG defines invasive plants as "non-native species that have spread into native or minimally managed plant systems in Massachusetts, causing economic or environmental harm by developing self- sustaining populations and becoming dominant and/or disruptive to those systems." These species have biological traits that provide them with competitive advantages over native species, particularly because in a new habitat they are not restricted by the biological controls of their native habitat. As a result, these invasive species can monopolize natural communities, displacing many native species and causing widespread economic and environmental damage.

MIPAG recognized 69 plant species as "Invasive," "Likely Invasive," or "Potentially Invasive." The criteria for an “Invasive” species are listed below; the other assigned categories are associated with lower scores on the criteria checklist. The criteria for invasive animal species are less well-defined, but many of the same characteristics (including a non-Massachusetts origin and the ability to out-compete native species) are similar. In order to be considered “Invasive” by MIPAG, a plant species must meet the following criteria:

- Be nonindigenous to Massachusetts.
- Have the biologic potential for rapid and widespread dispersion and establishment in minimally managed habitats.

- Have the biologic potential for dispersing over spatial gaps away from the site of introduction.
- Have the biologic potential for existing in high numbers away from intensively managed artificial habitats.
- Be naturalized in Massachusetts (persists without cultivation in Massachusetts).
- Be widespread in Massachusetts or at least common in a region or habitat in the state.
- Have many occurrences of numerous individuals in Massachusetts that have high numbers of individuals forming dense stands in minimally managed habitats.
- Be able to outcompete other species in the same natural plant community.
- Have the potential for rapid growth, for high seed or propagule production and dissemination, and for establishment in natural plant communities.

Some examples of invasive insect species include:

- Nantucket Pine Tip Moth (native pest) is a moth with heads, bodies, and appendages covered with gray scales with mottled rusty-red markings. Larvae causes damage to young trees (up to five years old) by feeding inside growing shoots, buds, and conelets. The preferred host is the loblolly pine.
- Bark Beetles (native pest) include more than 600 species of beetles which serve in important ecological roles in small numbers where they live in dead, weakened, and dying host conifer trees.
- Forest Tent Caterpillar (native pest) has the biggest footprint of any indigenous tent caterpillar in North America (Furniss and Carolin 1977) and is a major defoliator of a variety of deciduous hardwood trees. The caterpillars spin silken mats on the trunks and large branches of trees where they molt and feed. Forest Tent Caterpillars can reach outbreak proportions causing massive defoliation of host trees and becoming a nuisance to people.
- Pine Reproduction Weevils (native pest) is a very dark, elongate, oval insect up to 1/2 inch long with indistinct to distinct gray or pale orange spots of scales on the wings and thorax. They feed at night on the conifer seedlings or near the tips of branches of larger plants. Females lay their eggs on the roots of these trees. The weevils breed in all species of pines, hemlocks, junipers, spruces, firs, and cedars.
- Hardwood Borers (native pest) usually attack hardwoods experiencing some kind of stress although the clear-wing moths attack healthy trees. These insects attack the tree year after year and may eventually weaken it enough that it is prone to wind breakage. Some borers develop in the root system damaging young trees.
- Hemlock Wooly and Balsam Wooly Adelgid (non-native pest) is a very small, invasive, aphid-like insect that attacks North American hemlocks (Hemlock Wooly) and firs (Balsam Wooly). They can be identified by the white woolly masses that form on the underside of branches at the base

of the tree's needles. They stay at this location for the rest of their lives. Their feeding disrupts the flow of nutrients to the tree twigs and needles leading to a decline in tree health and mortality in 4 to 10 years.

- Gypsy Moth (non-native pest) is an insect which feeds on a large variety of tree leaves from oak, maple, apple, crabapple, hickory, basswood, aspen, willow, birch, pine, spruce, hemlock, and others. It does prefer oak tree leaves, however. Periodically, large populations can cause defoliation damaging and killing trees they are feeding on.
- Spotted Lanternfly (non-native pest) is an invasive insect first detected in the U.S. in 2014. It feeds on a variety of fruit, ornamental, and wood trees and could seriously impact the grape, orchard, and logging industries.

Location

The damage rendered by invasive species is significant. Experts estimate that about 3 million acres within the U.S. are lost each year to invasive plants (Pulling Together, 1997, from Mass.gov "Invasive Plant Facts"). The massive scope of this hazard means that the entire Commonwealth experiences impacts from these species. Furthermore, the ability of invasive species to travel distances (either via natural mechanisms or accidental human interference) allows these species to propagate rapidly over a large geographic area. Similarly, in open freshwater and marine ecosystems, invasive species 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). The entire geographic area of Southwick is believed at risk for invasive species propagation.

Previous Occurrences

Invasive species do not represent a singular event but rather an ongoing or emerging problem, so it is difficult to measure the frequency of occurrences. Invasives of current concern to forest health (https://www.mass.gov/service-details/current-forest-health-threats) in Hampden County are reportedly:

- Beech Leaf Disease
- Gypsy Moth
- Hemlock Woolly Adelgid
- Southern Pine Beetle
- Emerald Ash Borer
- White Pine Needlecast

The annual budget to address invasive species in Massachusetts has fluctuated over time but, in general, appears to have decreased. This likely implies a lack of resources rather than a decrease in risk. The following figures are from https://budget.digital.mass.gov/summary/fy22/enacted/energy-and-environmental-affairs/environmental-affairs/20000100.

Table 37. Statewide Budgets for Addressing Invasive Species.

FY Year	Budget
2022	$277,838
2021	$146,348
2020	$4,150,000
2019	$3,831,135
2018	$4,347,000
2017	$6,046,870

Specific occurrences of invasive species in Southwick have been documented in several reports and plans, underscoring a trend of increasing concern. The CRB report (2018) explains that *"Invasive plants and animals are already a source of concern in Southwick, as they are throughout the Commonwealth. Forest and upland ecosystems are threatened by a variety of invasive plants, including plants such as oriental bittersweet, multiflora rose, two types of swallowwort, and several non-native honeysuckles. Riparian and aquatic habitats are severely threatened by common reed, Japanese knotweed, invasive water chestnut, hydrilla, purple loosestrife, and Eurasian milfoil. Critical invasive insect pests already in the area include the Asian Longhorned Beetle and Emerald Ash Borer, both of which have the potential to do serious damage (both environmental and economic) to Massachusetts' forests and trees. These and other species already pose a significant challenge and have serious consequences for ecosystem health and resilience, and these impacts are likely to increase in response to climate change. Warming temperatures will also bring new invasives to the area, and these will have an easier time gaining a foothold if the Town's natural ecosystems are simultaneously weakened due to changes in climatic conditions."*

The Open Space and Recreation Plan (2020) notes that the Town "continues to reduce invasive aquatic weed populations in the Congamond Lakes."

Extent

The MIPAG has developed a list of Early Detection plant species according to an established set of criteria that includes MIPAG classification as an *invasive, likely invasive,* or *potentially invasive* ecological threat and one of these three criteria: *limited prevalence in Massachusetts, partial containment potential,* or *public health threat.* The Early Detection table includes the documented distribution of a species by county.

Once established, invasive species often escape notice for years or decades. Introduced species that initially escaped many decades ago are only now being recognized as invasives. Because these species can occur anywhere (on public or private property), new invasive species often escape notice until they are widespread, and eradication is impractical. As a result, early and coordinated action between public and private landholders is critical to preventing widespread damage from an invasive species.

Probability of Future Events

The USDA Animal and Plant Health Inspection Service (APHIS) manages the Plant Protection and Quarantine (PPQ) Program which safeguards U.S. agriculture and natural resources from the introduction, establishment, and spread of plant pests and noxious weeds. PPQ is the lead federal agency for plant health emergencies and works closely with federal, state, and local agencies; universities; industries; and private entities in developing and implementing science-based framework designed to protect against invasive pests and diseases.

Massachusetts has a variety of laws and regulations in place that attempt to mitigate the impacts of these species. The Department of Agricultural Resources (DAR) maintains a list of prohibited plants for the state, which includes federally noxious weeds as well as invasive plants recommended by MIPAG and approved for listing by DAR. Species on the DAR list is regulated with prohibitions on importation, propagation, purchase, and sale 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.

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 and CZM are 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 on the management of aquatic invasive species. The Commonwealth also has several resources pertaining to terrestrial invasive species, such as the Massachusetts Introduced Pest Outreach Project, although a strategic management plan has not yet been prepared for these species. All these efforts are aimed at reducing the probability of future occurrences.

Notwithstanding the above efforts, the presence of invasive species is ongoing, and it is difficult to quantify the future frequency of these occurrences. Increased rates of global trade and travel have created many new pathways for the dispersion of exotic species. As a result, the frequency with which these threats have been introduced has increased significantly. Increased international trade in ornamental plants is particularly concerning because many of the invasive plants species in the U.S. were originally imported as ornamentals. Furthermore, they are expected to be an increasing problem due to a changing climate and projected increases in non-native plant and animal infestations. For this reason and based on the fact invasive species are already an ongoing issue for the region, this hazard has been assigned a probability of highly likely.

Vulnerability Assessment

Exposure

The entire Town of Southwick has the potential to be exposed to invasive pests. Climate change will make the area more attractive to pests who have not been found there traditionally.

Built Environment Impacts

Although the built environment is not as susceptible to pests as the natural environment, it can help spread the invasive species. This includes trains and vehicles that could move the species from one location to another. Trees, which are damaged or killed by invasive pests, can become hazards to people, property, utility lines, and roadways when they fall. Many dead trees in one area can also become fuel for wildfires interconnecting the two hazards.

Population Impacts

The direct population impacts are minimal. However, the indirect impacts could destroy livelihoods.

Environment Impacts

Most of the natural features in the town have some susceptible pests including the parks and other forested areas. Trees that have been damaged by other events such as fire, wind, flooding, and animal browsing are more susceptible to diseases and pests. Certain species of trees are more susceptible based on the need of the damaging organism.

Climate change will increase the probability of invasive pests which will pose increased environmental impacts in the future.

Problem Statements for Invasive Species

Table 38. Problem Statements for Invasive Species.

Assets	**Problems Associated with Invasive Species**
People (including underserved communities and socially vulnerable populations)	• None apparent or projected.
Structures (including facilities, lifelines, and critical infrastructure)	• None apparent or projected.

Assets	Problems Associated with Invasive Species
Systems (including networks and capabilities)	• Town capabilities are overtaxed to deal with aquatic invasive vegetation and algae, especially in the Congamond Lakes.
Natural, historic, and cultural resources	• Invasive species challenges are being tackled by DPW crews as their budgets and work schedules permit. • Forest and upland ecosystems are threatened by a variety of invasive plants, including plants such as oriental bittersweet, multiflora rose, two types of swallowworts, and several non-native honeysuckles. • Riparian and aquatic habitats are severely threatened by common reed, Japanese knotweed, invasive water chestnut, hydrilla, purple loosestrife, and Eurasian milfoil. • Invasive insect pests already in the area include the Asian Longhorned Beetle and Emerald Ash Borer.
Activities that have value to the community	• Recreational activities may be adversely impacted.

Primary Climate Change Interaction: Extreme Weather Events

Hurricanes and Tropical Storms

Flooding in Massachusetts is often the direct result of tropical storms and hurricanes. These powerful storms can also cause significant widespread damage due to high winds.

> The Town of Southwick Community Resilience Building Workshop Summary of Findings (2018) lists "Wind" as one of the top four hazards of concern.

Description

Tropical cyclones (tropical depressions, tropical storms, and hurricanes) that affect New England form over the warm, moist waters of the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico. Tropical systems customarily come from a southerly direction and when they accelerate up the East Coast of the U.S., most take on a distinct appearance that is different from a typical hurricane. Although rain is often limited in the areas south and east of the track of the storm, these areas can incur the worst winds and storm surge. Dangerous flooding occurs most often to the north and west of the track of the storm. An additional threat associated with a tropical system making landfall is the possibility of tornado generation. Tornadoes would generally occur in the outer bands to the north and east of the storm, a few hours to as much as 15 hours prior to landfall.

Hurricane season runs from June 1 to November 30. In New England, these storms are most likely to occur in August, September, and the first half of October. The SHMCAP notes that this is due in large part to the fact that it takes a considerable amount of time for the waters south of Long Island to warm to the temperature necessary to sustain the storms this far north. Also, as the region progresses into the fall months, the upper-level jet stream steering winds might flow from the Great Lakes southward to the Gulf States and then back northward up the eastern seaboard. This pattern is conducive for capturing a tropical system over the Bahamas and accelerating it northward.

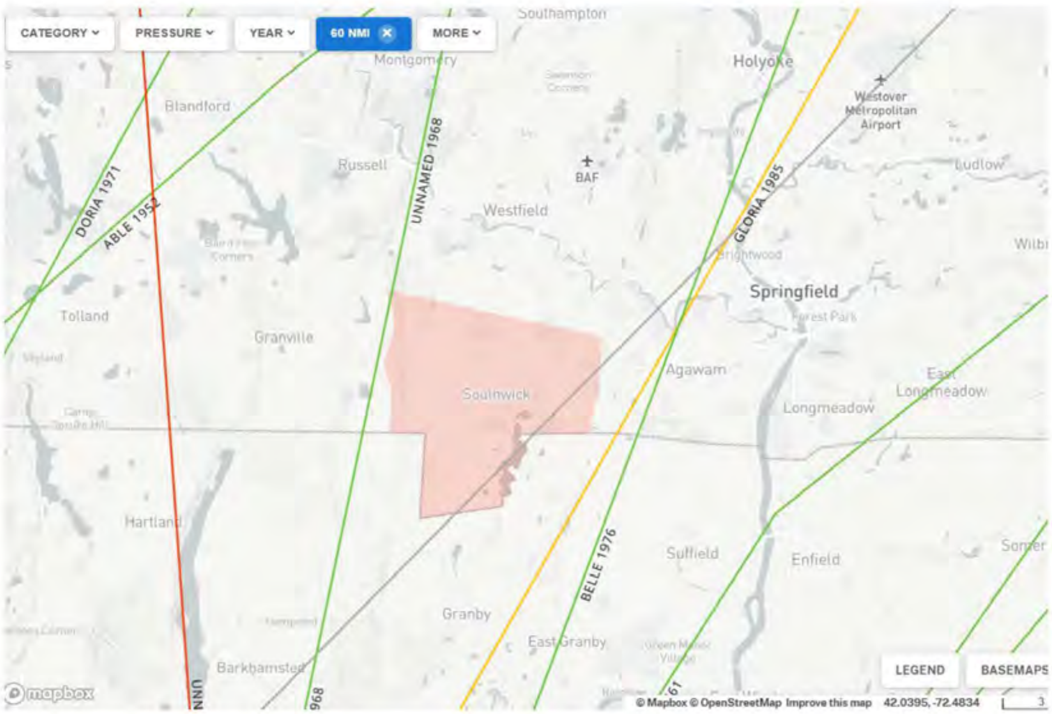
Location

Tropical storms and hurricanes can affect the entirety of Massachusetts, including the geographic extent of Southwick.

Previous Occurrences

The SHMCAP notes that hurricanes and tropical storms occur somewhat regularly in Massachusetts. Historical tropical system tracks near and through Southwick are depicted on the following page. This mapping is available from NOAA and updated continuously.

Historical Tropical Storm Tracks in the Town of Southwick



Graphic courtesy of NOAA

A handful of tropical storms and hurricanes have passed near Southwick or crossed over the town since recordkeeping began. Unnamed storms skirted the town in 1945 and 1968. T.S. Belle (1976) and Hurricane Gloria (1985) passed immediately to the east. Overall, impacts from T.S. Belle were less than expected and attributed to flooding in New England, as almost seven inches of rain were recorded. During Hurricane Gloria, rainfall in the region peaked at 6.9 inches at Borden Brook Reservoir in Springfield.

Figure 19. Historical Tropical Storm Tracks In Southwick.

As noted elsewhere, this plan update relies primarily on a ten-year lookback (2012 through 2022) ending with the date of plan development. During that ten-year period, only one declared disaster in Massachusetts (SuperStorm Sandy of October 2012) was associated with a tropical system, and the impacts to the Southwick region were significant. The NOAA Storm Events database for Hampden

County (https://www.ncdc.noaa.gov/stormevents/) provided the following description of impacts from Storm Sandy in Southwick:

- "Easterly winds gusted to 50 to 60 mph for interior southern New England; 55 to 65 mph along the eastern Massachusetts coast and along the I-95 corridor in southeast Massachusetts and Rhode Island; and 70 to 80 mph along the southeast Massachusetts and Rhode Island coasts. A few higher gusts occurred along the Rhode Island coast. A severe thunderstorm embedded in an outer band associated with Sandy produced wind gusts to 90 mph and concentrated damage in Wareham early Tuesday evening. **In Southwick, a tree was downed on Congamond Road."**

The Storm Events database described the impacts of Tropical Storm Isaias in August 2020:

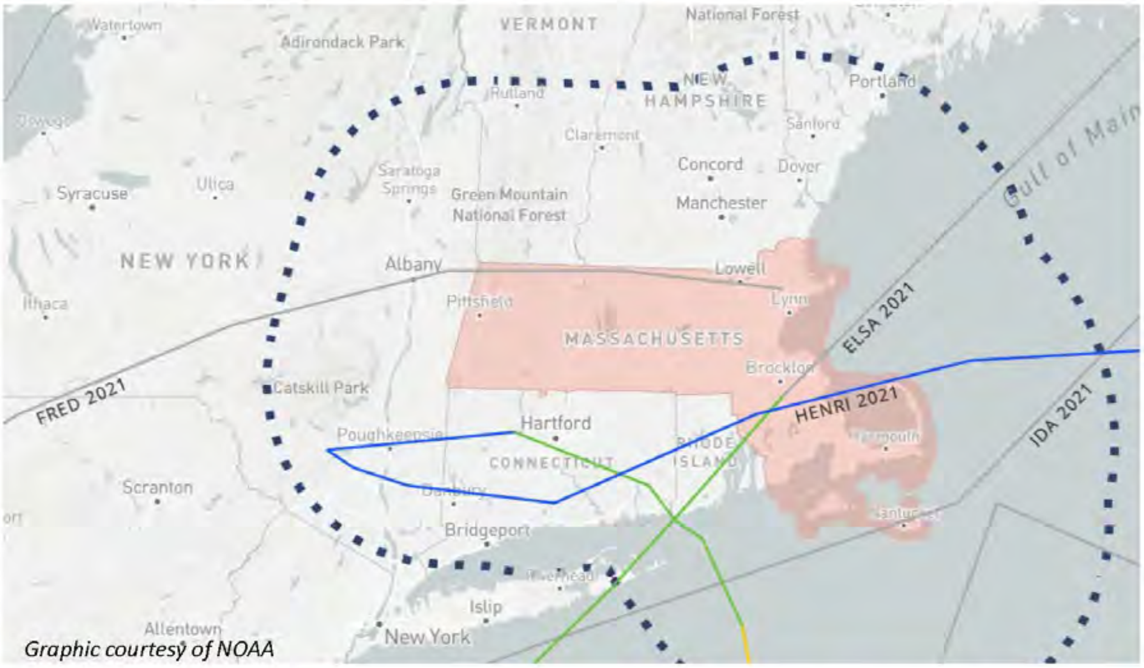
- "Tropical Storm Isaias moved from coastal Virginia eastern New York state, near the Connecticut/Massachusetts border on Tuesday, August 4. As the storm reached the New York City area, southerly winds were maximizing across southern New England, causing widespread wind damage. There was widespread damage, mainly between 3 PM and 530 PM. Numerous trees were downed, as well as power lines, causing power outages. At 420 PM, the ASOS at KBAF in Westfield, MA measured a wind gust to 62 mph (54 kt). **In Southwick, a tree was down on College Highway and another tree was down on Berkshire Avenue. Also in Southwick, wires were down on Granville Road."**

Southwick was impacted by the series of tropical and post-tropical storm systems that affected Massachusetts in 2021. These storms occurred in July, August, and September 2021 as follows:

- T.S. Elsa - July 9, 2021
- T.S. Fred - August 19, 2021
- T.S. Henri - August 22-23, 2021
- T.D. Ida - September 1, 2021

Figure 20. Flooding on College Highway Covered Bridge.

Impacts of the 2021 Hurricane Season on Massachusetts



T.S. Elsa crossed eastern Massachusetts on July 9, delivering wind and flooding rains while transitioning to an extratropical storm later that day. Approximately 2 to 4 inches of rain were recorded in many towns. MBTA commuter rail trains were delayed on the Worcester line due to flooding, and Route 146 was flooded. About 11,000 Eversource customers in Massachusetts lost power.

Extratropical Storm Fred crossed northern Massachusetts lengthwise on August 19 and 20, delivering flooding rains to parts of southern New England. Flooding in Massachusetts was worst in the Worcester area. Approximately 2 to 4 inches of rain were recorded in many towns.

T.D. Henri crossed eastern Massachusetts on August 24, delivering flooding rains to parts of southern New England. Prior to crossing Massachusetts, the storm looped through Connecticut and New York on August 22-24. The path and slow movement of the storm contributed to widespread flooding in all three states, made worse due to the conditions caused by storm Fred only a few days before. Approximately 1 to 4.5 inches of rain were recorded in many towns. About 12,000 Eversource customers in Massachusetts lost power.

Extratropical Storm Ida passed south of New England and crossed Nantucket on September 2, delivering flooding rains to parts of southern New England. The precipitation from Ida was more intense than expected, and it caused widespread flooding. Approximately 2 to 6 inches of rain were recorded in many towns. About 4,000 people in Massachusetts lost power.

Figure 21. Tracks for Tropical Storms that Impacted Massachusetts 2021.

Southwick experienced heavy precipitation impacts from at least two of these events. The NOAA Storm Events database noted the following:

- "Tropical Storm Henri made landfall in southwest Rhode Island around noon on August 22nd, then moved slowly northwestward and westward across northern Connecticut and weakened. Henri brought strong wind gusts and flash flooding. The strongest gusts -- to 70 mph -- occurred along the Rhode Island coast. The worst flash flooding occurred in northeast Connecticut. As the remnants of Henri moved eastward across southern New England on August 23rd, it spawned three tornadoes and a waterspout in MA and also it caused some renewed flooding. The highest rainfall totals over the two-day period ranged from 5 to 6 inches in Hartford and Tolland Counties in northern Connecticut and in Franklin, Hampshire, and Hampden Counties in western Massachusetts. **In Southwick at 227 PM, trees and wires were down on Klaus Anderson Road."**

- "Tropical Depression Ida tracked northeastward from the central Appalachians and arrived in southern New England late in the day as a remnant low. The low moved rather swiftly across southern New England, reaching the coastal waters east of Massachusetts by 7 AM on Sept. 2. One to three inches of rain fell in northwest Massachusetts, but heavy amounts of 4.0 to 6.5 inches fell south of the Mass Pike, with the heaviest amounts, near 7 inches, in the upper portion of Cape Cod. The most intense rain fell from the evening on the 1st to the early morning on the 2nd. There was widespread street flooding and some flash flooding. **In Southwick, the intersection of U.S. Route 202 and State Highway 168 was flooded and impassable."**

Extent

Hurricanes are measured according to the Saffir-Simpson scale, which categorizes or rates hurricanes from 1 (minimal) to 5 (catastrophic) based on their intensity. This is used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall. Wind speed is the determining factor in the scale, inherently leaving out any measure of precipitation and flooding.

Table 39. Saffir-Simpson Scale.

Saffir-Simpson Hurricane Wind Scale

	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph 64-82 kt 119-153 km/h	**Damaging winds will produce some damage:** Well-constructed framed homes could have damage to roof, shingles, vinyl siding, and gutters. Large branches of trees will snap, and shallow-rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph 83-95 kt 154-177 km/h	**Very strong, damaging winds will cause widespread damage:** Well-constructed framed homes could sustain major roof and siding damage. Many shallow-rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111-129 mph 96-112 kt 178-208 km/h	**Dangerous winds will cause extensive damage:** Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130-156 mph 113-136 kt 209-251 km/h	**Extremely dangerous winds will cause devastating damage:** Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157 mph or higher 137 kt or higher 252 km/h or higher	**Catastrophic damage will occur:** A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Source: National Hurricane Center, NOAA

Tropical storms and tropical depressions, while generally less dangerous than hurricanes, can be deadly. The winds of tropical depressions and tropical storms are usually not the greatest threat; rather, the rains, flooding, and severe weather associated with the tropical storms are what customarily cause more significant problems. Nevertheless, serious power outages can also be associated with these types of events.

The NWS issues a hurricane warning when sustained winds of 74 mph or higher are expected in a specified area in association with a tropical, subtropical, or post-tropical cyclone. A warning is issued 36 hours in advance of the anticipated onset of tropical-storm-force winds. A hurricane watch is announced when sustained winds of 74 mph or higher are possible within the specified area in association with a tropical, subtropical, or post-tropical cyclone. A watch is issued 48 hours in advance of the anticipated onset of tropical-storm-force winds (NWS, 2013).

Probability of Future Events

The SHMCAP notes that Massachusetts experiences an average of one storm every other year or 0.5 storms per year. Storms severe enough to receive FEMA disaster declarations are far rarer, occurring every 9 years on average. According to NOAA, a Category 1 hurricane can be expected to make landfall in/near southern New England once every 17 years. A Category 2 hurricane could be expected to make landfall once every 39 years, and a Category 3 hurricane has a calculated return period of 68 to 70 years.

Some researchers have suggested that the intensity of tropical cyclones has increased over the last 40 years, with some believing that there is a connection between this increase in intensity and climate change. While most climate simulations agree that greenhouse warming enhances the frequency and intensity of tropical storms, models of the climate system are still limited by resolution and computational ability. However, given the history of major storms and the possibility of increased frequency and intensity of tropical storms due to climate change, it is prudent to expect that there will be hurricanes impacting Southwick in the future that may be of greater frequency and intensity than in the past.

Vulnerability Assessment

Exposure

High winds and heavy rain and/or hail associated with hurricanes and tropical storms can cause damage to utilities, structures, roads, trees (potentially causing vehicle accidents) and injuries and death. Other associated concerns are debris management issues including debris removal and identification of disposal sites. All assets in Southwick should be considered exposed to high winds while specific areas are exposed to hurricane surge. Figure 22 shows the 100-year windspeeds identified in the ASCE 7-98 publication.

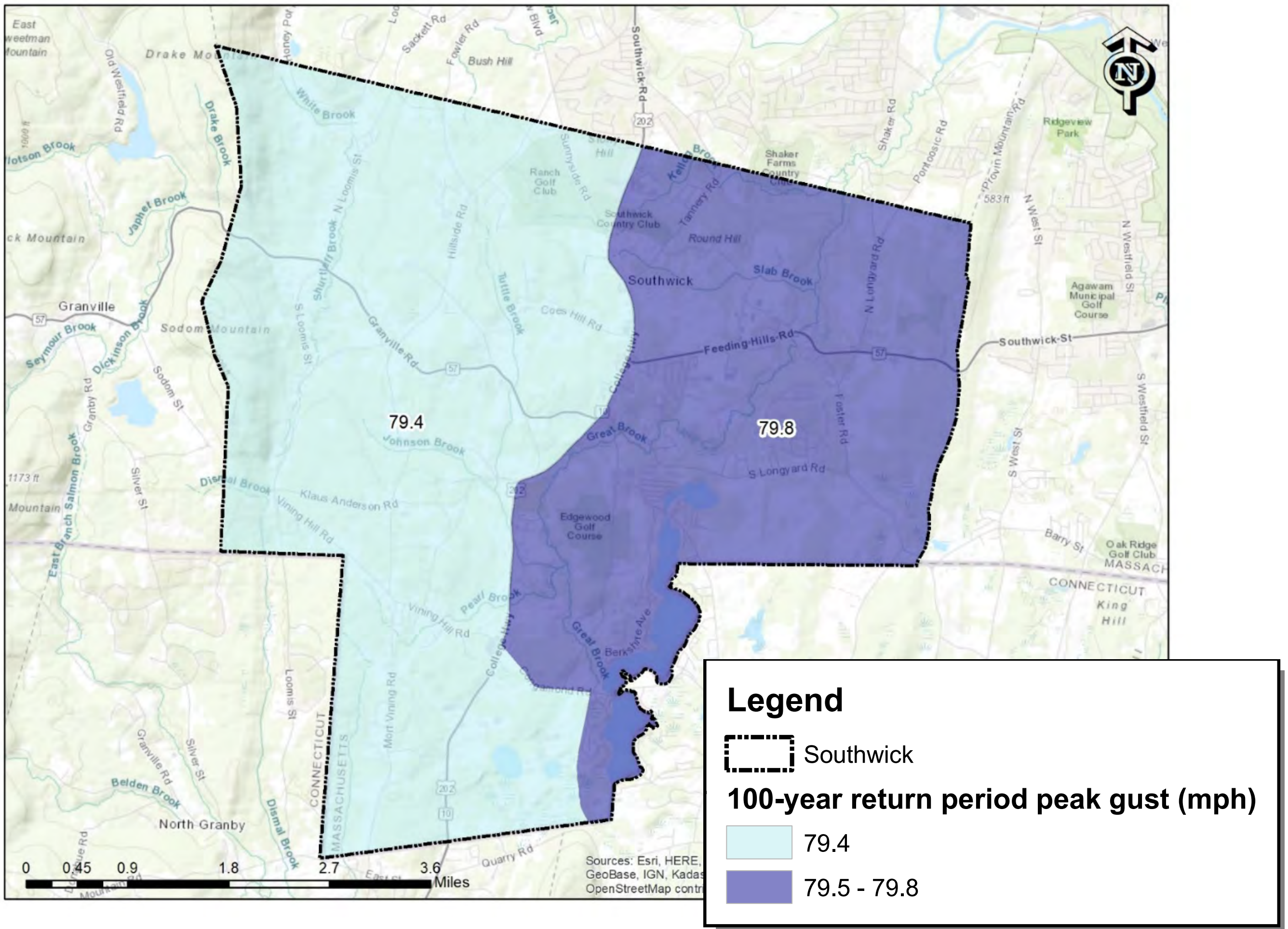


Figure 22. 100-Year Windspeeds (ASCE 7-98)

Built Environment Impacts

To identify built environment impacts to the town resulting from wind damage, FEMA's risk assessment software, Hazus, was implemented. The economic loss results of the 500-year event are shown in Table 40 while the results for the 1000-year event are shown in Table 41. The town's Average Annual Loss (AAL) is calculated to be $489,769.

Table 40. Building Losses Due to Wind for a 500-Year Scenario.

Loss Type	Residential ($Million)	Commercial ($Million)	Other Occupancy ($Million)	Total ($Million)
Building Loss	24.8	1.4	1.2	**27.4**
Content Loss	10.0	0.4	0.5	**10.9**
Business Inventory Loss	0.0	0.1	0.1	**0.2**
Business Income Loss	0.0	0.2	0.0	**0.2**
Business Relocation Loss	1.2	0.2	0.1	**1.5**
Rental Income Loss	0.5	0.1	0.0	**0.6**
Wage Loss	0.0	0.1	0.6	**0.7**
Total	**36.5**	**2.5**	**2.5**	**41.5**

Table 41. Building Losses Due to Wind for a 1000-Year Scenario.

Loss Type	Residential ($Million)	Commercial ($Million)	Other Occupancy ($Million)	Total ($Million)
Building Loss	36.3	2.6	2.2	**41.1**
Content Loss	15.0	0.8	1.1	**16.9**
Business Inventory Loss	0.0	0.2	0.2	**0.4**
Business Income Loss	0.0	0.3	0.1	**0.4**
Business Relocation Loss	2.3	0.5	0.3	**3.1**
Rental Income Loss	0.9	0.2	0.1	**1.2**
Wage Loss	0.0	0.3	1.2	**1.5**
Total	**54.5**	**4.9**	**5.2**	**64.6**

Population Impacts

Populations considered most vulnerable to hurricane and tropical storm impacts in Southwick are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. For high windspeeds, it's important to maintain the building envelope during the event. If a window or door fails, damage to the structure will be much greater. Table 16 summarizes the senior and low-income populations in Southwick. It should be noted that there may be overlap within the two categories, so that the total number of persons exposed may be lower than what is shown in the table. However, the town should be aware of the potential needs of residents within these population segments in the event of a hazard occurrence.

For the 500-year event, Hazus predicts that there will be up to 10 to 20 displaced households with 0 to 10 people seeking public shelter from the high windspeeds alone. However, if the rainfall leads to flooding, families may be displaced (see flood section). For the 1000-year event, Hazus predicts 20 to 40 displaced households with 5 to 15 people seeking public shelter.

Environment Impacts

Hurricanes can cause damage to parks, and other, natural areas. Some areas of the town may be out of service until trees are removed.

Problem Statements for Hurricanes/Tropical Storms

Table 42. Problem Statements for Hurricanes/Tropical Storms.

Assets	**Problems Associated with Hurricanes and Tropical Storms**
People (including underserved communities and socially vulnerable populations)	• Vulnerable populations may need to be evacuated and could be displaced from their homes.
Structures (including facilities, lifelines, and critical infrastructure)	• Wind may cause trees to fall into structures and infrastructure, and roadways. Storms Sandy (2012), Isaias (2020), Henri (2021), and Ida (2021) all brought trees down onto roads in Southwick. • Wind damage to wind-susceptible buildings such as carports, greenhouses, and open-walled recreational buildings. Additional damage to commercial buildings with HVAC located on roofs.
Systems (including networks and capabilities)	• Electric grid may go down during high wind event.
Natural, historic, and cultural resources	• Historic buildings may experience damage during high wind events, especially the roofing and windows. Water entering these buildings could impact important historic and cultural artifacts.
Activities that have value to the community	• A severe hurricane wind and rain event could negatively impact outdoor activities in the Town.

Severe Winter Storms

Severe winter storms include ice storms, nor'easters, heavy snow, blowing snow, and other extreme forms of winter precipitation. These are often accompanied by very low temperatures which were previously addressed.

> The Town of Southwick Community Resilience Building Workshop Summary of Findings (2018) lists "Ice and Snow" as one of the top four hazards of concern.

Description

Blizzard: A blizzard is a winter snowstorm with sustained or frequent wind gusts to 35 mph or more, accompanied by blowing snow that reduces visibility to or below a quarter of a mile (NWS, 2018). These conditions must be the predominant condition over a 3-hour period. Extremely cold temperatures are often associated with blizzard conditions but are not a formal part of the definition. However, the hazard created by the combination of snow, wind, and low visibility increases significantly with temperatures below 20ºF. 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.

Storm systems powerful enough to cause blizzards usually form when the jet stream dips far to the south, allowing cold air from the north to clash with warm air from the south. Blizzard conditions often develop on the northwest side of an intense storm system. The difference between the lower pressure in the storm and the higher pressure to the west creates a tight pressure gradient, resulting in strong winds and extreme conditions due to the blowing snow. Blowing snow is wind-driven snow that reduces visibility to 6 miles or less, causing significant drifting. Blowing snow may be snow that is falling and/or loose snow on the ground picked up by the wind.

Ice Storms: Ice storm conditions are defined by liquid rain falling and freezing on contact with cold objects, creating ice buildups of one-fourth of an inch or more. These can cause severe damage to vegetation, utilities, and structures. An ice storm warning, which is now included in the criteria for a winter storm warning, is issued when a half inch or more of accretion of freezing rain is expected. This may lead to dangerous walking or driving conditions and the pulling down of power lines and trees. Ice pellets are another form of freezing precipitation, formed when snowflakes melt into raindrops as they pass through a thin layer of warmer air. The raindrops then refreeze into particles of ice when they fall into a layer of subfreezing air near the surface of the earth. Finally, sleet occurs when raindrops fall into subfreezing air thick enough that the raindrops refreeze into ice before hitting the ground. The difference between sleet and hail is that sleet is a wintertime phenomenon whereas hail falls from convective clouds (usually thunderstorms), often during the warm spring and summer months.

Nor'easters: A nor'easter is a storm that occurs along the East Coast of North America. A nor'easter is characterized by a large counterclockwise wind circulation around a low-pressure center that often results in heavy snow, high winds, and rain. A nor'easter gets its name from its continuously strong northeasterly winds blowing in from the ocean ahead of the storm and over the coastal areas.

Nor'easters are among winter's most ferocious storms. These winter weather events are notorious for producing heavy snow, rain, and oversized waves that crash onto Atlantic beaches, often causing beach erosion and structural damage. These storms occur most often in late fall and early winter. The storm radius is often as much as 100 miles, and nor'easters often sit stationary for several days, affecting multiple tide cycles and causing extended heavy precipitation. Sustained wind speeds of 20 to 40 mph are common during a nor'easter, with short-term wind speeds gusting up to 50 to 60 mph.

Location

Although the entire Commonwealth may be considered at risk to the hazard of severe winter storms, higher snow accumulations appear to be prevalent at higher elevations in Western and Central Massachusetts, and along the coast where snowfall can be enhanced by additional ocean moisture. Ice storms occur most frequently in the higher-elevation portions of Western and Central Massachusetts. Overall, winter storms can affect the entirely of Massachusetts, including the geographic extent of Southwick.

Previous Occurrences

Winter storms occur somewhat regularly in Massachusetts. While several of the disasters declared in Massachusetts from 2012 through 2022 were associated with winter storms, only one covered Hampden County and therefore the Town of Southwick:

- Massachusetts Severe Winter Storm, Snowstorm, and Flooding (DR-4110-MA)

  Incident Period: February 8, 2013 – February 9, 2013
  Major Disaster Declaration declared on April 19, 2013
  Public Assistance (PA) reimbursements eligible for entire state

The 2013 storm event was subject to an emergency declaration in Massachusetts, as well. The PA assistance reimbursements associated with the winter storms of 2013 for the Town totaled about $1.5 million. This indicates that severe winter storms can be a substantial expenditure for Southwick.

The previous edition of this plan identified two recurring areas of challenges:

- Granville Road (Rt 57) - Any severe winter weather incident can cause critical snow and ice hazard at the crossing of Granville Road (Rt 57) as it travels over Sodom Mountain and Shurtleff Brook into Granville. As this is the major thoroughfare into Granville, it is a trouble spot, often the site of accidents.
- Lake Roads - The roads around Congamond Lakes can be extremely dangerous during large snow events. Many of the roads are very narrow, and more importantly, most of the roads have steep embankments which do not allow room for plowed snow. This impairs visibility and clogs driveways.

The NOAA Storm Events database (https://www.ncdc.noaa.gov/stormevents/) for Hampden County lists five severe winter storm events impacting Southwick for the period 2012-2022.

Table 43. NCEI Severe Storm Database Entries Covering Winter Storms in Southwick.

Date	Description	Losses Reported
11/26/14	*Heavy Snow:* Heavy wet snow brought trees down in Holyoke, Southwick, and Springfield.	$30,000 among several towns.
3/14/17	*Heavy Snow:* 18.0 inches in Southwick	--
12/30/19	*Hail*:* Quarter size hail fell in Southwick from an isolated severe thunderstorm; *"This was a very unusual event for late December. It was definitely bona fide hail, not related to the ongoing sleet/freezing rain event."*	--
3/4/20	*Strong Wind:* A tree was down on Route 202 near the Westfield town line.	$500 among several towns.
2/1/21	*Heavy Snow:* The highest report was 13.3 inches in Southwick.	--

*Hail would typically be profiled under other severe storms, but the NOAA NCEI report made a point to characterize this as a winter-related event.

Extent

Snowfall is a component of multiple hazards, including nor'easters and severe winter storms. Two scores, the *Regional Snowfall Index (RSI) and the NESIS*, are described in this section.

Since 2005, the RSI has become the descriptor of choice for measuring winter events that impact the eastern two-thirds of the U.S. The RSI ranks snowstorm impacts on a scale system from 1 to 5. The RSI is like the Fujita scale for tornadoes or the Saffir-Simpson scale for hurricanes, except that it includes an additional variable: population. The RSI is based on the spatial extent of the storm, the amount of snowfall, and population (NOAA, n.d.).

The RSI is a regional index. Each of the six climate regions (identified by the NOAA National Centers for Environmental Information) in the eastern two-thirds of the nation has a separate index. The RSI incorporated region-specific parameters and thresholds for calculating the index. The RSI is important because, with it, a storm event and its societal impacts can be assessed within the context of a region's historical events. Snowfall thresholds in Massachusetts (in the Northeast region) are 4, 10, 20, and 30 inches of snowfall, while thresholds in the Southeast U.S. are 2, 5, 10, and 15 inches.

Table 44. RSI Scale.

Category	RSI Value	Event Description
1	1 to 3	Notable
2	3 to 6	Significant
3	6 to 10	Major
4	10 to 18	Crippling
5	18+	Extreme

Source: NOAA

Prior to the use of the RSI, the Northeast Snowfall Impact Scale, developed by Paul Kocin of The Weather Channel and Louis Uccellini of the NWS, was used to characterize, and rank high- impact northeast snowstorms with large areas of 10-inch snowfall accumulations and greater. In contrast to the RSI, which is a regional index, NESIS is a quasi-national index that is calibrated to Northeast snowstorms. NESIS has five categories. The RSI and NESIS approaches do not include separate scales for ice storms; in general, ice storm extent is expressed on a case-by-case basis, and forecasts will provide the information needed to determine how to prepare and respond.

Meteorologists can often predict the likelihood of a severe storm or nor'easter. This can give several days of warning time. The NOAA's NWS monitors potential events and provides extensive forecasts and information several days in advance of a winter storm to help the state to prepare for the incident.

Probability of Future Events

The SHMCAP notes that Massachusetts experiences high-impact snowstorms at approximately the rate of one per year, although there is significant interannual variability in the frequency and severity of winter storms. The Town of Southwick should assume that winter storms are likely, even if the impacts of climate change will shift the timing to a shorter winter season. Heavy wet snowfall may be more common in the future. The overall probability of winter storms of all kinds, including blizzards and ice storms, is believed high.

Vulnerability Assessment

Exposure

Heavy snowfall coupled with low temperatures often results in increases in traffic accidents; disruptions in transportation, commerce, government, and education; utility outages due to falling trees, branches, and other objects; personal injuries associated with slippery surfaces and freezing temperatures; and numerous other problems. Specific damages associated with severe winter storm (snow) events include:

- Injuries and fatalities associated with accidents, low temperatures, power loss, falling objects and accidents associated with frozen and slippery surfaces and snow accumulation
- Increases in the frequency and impact of traffic accidents, resulting in personal injuries
- Ice-related damage to trees, building and infrastructure inventory, and utilities (power lines, bridges, substations, etc.)
- Roads damaged through freeze and thaw processes
- Stress on the local shelters and emergency response infrastructure
- Lost productivity that occurs when people cannot go to work, school, or stores due to inclement conditions

The entire town should be considered exposed to the severe winter storm hazard.

Built Environment Impacts

The entire built environment of Southwick is vulnerable to a severe winter storm. New England's climate offers no immunity to the potential damaging effects of severe winter storms. Some minimum damage is anticipated annually, with potential extensive damage occurring about once every 10 years.

Since Hazus doesn't support severe winter storms and there aren't other readily available severe winter storm models, historical data was used to determine potential losses and probabilities. From 2005 until 2022, there was $275,000 in storm damage to Southwick. This equates to an AAL of $15,278.

Population Impacts

As discussed above, some traffic accidents associated with storm events include injuries and in limited cases, deaths. However, the number of injuries and deaths reported for accidents is generally low. Populations considered most vulnerable to severe winter storm impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Table 16 summarizes the senior and low-income populations in Southwick. It should be noted that there may be overlap within the two categories, so that the total number of persons exposed may be lower than what is shown in the table. However, the town should be aware of the potential needs of residents within these population segments in the event of a hazard occurrence.

Environment Impacts

Severe winter storms can cause damage to parks and other, natural areas. Some areas of the town may be out of service until roads are cleared and trees are removed.

Problem Statements for Severe Winter Storms

Table 45. Problem Statements for Severe Winter Storms.

Assets	Problems Associated with Severe Winter Storms
People (including underserved communities and socially vulnerable populations)	• Vulnerable populations may be stranded during a winter storm event and may not be able to travel to emergency services.
Structures (including facilities, lifelines, and critical infrastructure)	• Roof ice dams may cause damage to structures.
Systems (including networks and capabilities)	• Electrical grid and roadways are susceptible to failure during storms.
Natural, historic, and cultural resources	• Severe storms may damage trees in natural areas, and historical and cultural sites.
Activities that have value to the community	• Outdoor activities may be adversely impacted by severe winter storms.

Tornadoes

Tornadoes are a relatively infrequent occurrence but can be very destructive when they occur. While small tornadoes in outlying areas cause little to no damage, larger tornadoes in populated sections of Massachusetts have historically caused significant damage, injury, and death through the destruction of trees, buildings, vehicles, and power lines.

The Town of Southwick Community Resilience Building Workshop Summary of Findings (2018) lists “Wind” as one of the top four hazards of concern.

Description

A tornado is a narrow rotating column of air that extends from the base of a cumulonimbus cloud to the ground. The observable aspect of a tornado is the rotating column of water droplets, dust, and debris caught in the column. Tornadoes are the most violent of all atmospheric storms.

Tornadoes can form from individual cells within severe thunderstorm squall lines. They can also form from an isolated supercell thunderstorm. They can be spawned by tropical cyclones or the remnants thereof, and weak tornadoes can even occur from little more than a rain shower if air is converging and spinning upward.

Most tornadoes occur in the late afternoon and evening hours when the heating is the greatest. The most common months for tornadoes to occur are June, July, and August, although the Great Barrington tornado (1995) occurred in May.

A waterspout is a rapidly rotating column of air extending from the cloud base (typically a cumulonimbus thunderstorm) to a water surface, such as a bay or the ocean. They can be formed in the same way as regular tornadoes or can form on a clear day with the right amount of instability and wind shear. Tornadic waterspouts can have wind speeds of 60 to 100 mph, but since they do not move very far, they can often be navigated around. They can become a threat to land if they drift onshore.

Location

The U.S. experiences an average of 1,253 tornadoes per year, more than any other country (NOAA, n.d.). Because Massachusetts experiences fewer tornadoes than other parts of the country, residents may be less prepared to react to a tornado. The SHMCAP notes that the area at greatest risk for a tornado touchdown runs from central to northeastern Massachusetts. Southwick is inside this area.

Previous Occurrences

The most devastating tornado to occur in New England was the Worcester Tornado of July 9, 1953, a category F4 tornado. The tornado passed through Barre, Rutland, Holden, Worcester, Shrewsbury, Westborough, and Southborough causing 90 deaths and over 1,300 injured. Damage estimates were placed more than $52 million. The National Storm Prediction Center has ranked this as one of the deadliest tornados in the nation's history.

The most recent severe tornado to impact Massachusetts occurred June 1, 2011, affecting communities in Hampden and Worcester Counties. The EF3 tornado touched down in Westfield just north of Southwick and traveled through West Springfield, Springfield, Wilbraham, Monson, Brimfield, and Sturbridge. The tornado caused extensive property damage and resulted in a FEMA disaster declaration.

The previous edition of this plan stated that in 1992, an F0 touched down in Southwick; and explained that in western Massachusetts, the majority of sighted tornadoes have occurred in a swath east of Southwick, known as “tornado alley.”

Extent

The NWS rates tornadoes using the Enhanced Fujita scale (EF scale), which does not directly measure wind speed but rather the amount of damage created. This scale derives 3-second gusts estimated at the point of damage based on the assignment of 1 out of 8 degrees of damage to a range of different structure types. These estimates vary with height and exposure. This method is considerably more sophisticated than the original Fujita scale, and it allows surveyors to create more precise assessments of tornado severity.

Table 46. Enhanced Fujita Scale.

EF Rating	Wind Speeds	Expected Damage	
EF-0	65-85 mph	'Minor' damage: shingles blown off or parts of a roof peeled off, damage to gutters/siding, branches broken off trees, shallow rooted trees toppled.	
EF-1	86-110 mph	'Moderate' damage: more significant roof damage, windows broken, exterior doors damaged or lost, mobile homes overturned or badly damaged.	
EF-2	111-135 mph	'Considerable' damage: roofs torn off well constructed homes, homes shifted off their foundation, mobile homes completely destroyed, large trees snapped or uprooted, cars can be tossed.	
EF-3	136-165 mph	'Severe' damage: entire stories of well constructed homes destroyed, significant damage done to large buildings, homes with weak foundations can be blown away, trees begin to lose their bark.	
EF-4	166-200 mph	'Extreme' damage: Well constructed homes are leveled, cars are thrown significant distances, top story exterior walls of masonry buildings would likely collapse.	
EF-5	> 200 mph	'Massive/incredible' damage: Well constructed homes are swept away, steel-reinforced concrete structures are critically damaged, high-rise buildings sustain severe structural damage, trees are usually completely debarked, stripped of branches and snapped.	

Source: National Weather Service

Tornado watches and warnings are issued by the local NWS office. 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. The current average lead time for tornado warnings is 13 minutes. Occasionally, tornadoes develop so rapidly that little, if any, advance warning is possible.

Probability of Future Events

According to the SHMCAP, the Commonwealth experienced 171 tornadoes from 1950 to 2017, or an average annual occurrence of 2.6 tornado events per year. In the last 20 years, the average frequency of these events has been 1.7 events per year (NOAA, 2018). 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 (NOAA, n.d.). As highlighted in the National Climate Assessment, tornado activity in the U.S. has become more variable, and increasingly so in the last two decades. While the number of days per year that tornadoes occur has decreased, the number of tornadoes on these days has increased. Climate models show projections that the frequency and intensity of severe thunderstorms (which include tornadoes, hail, and winds) will increase (USGCRP, 2017).

Vulnerability Assessment

Exposure

High winds, heavy rain, lightning and/or hail associated with tornados, thunderstorms and microbursts can cause damage to utilities, structures, roads, trees (potentially causing vehicle accidents) and injuries and death. The entire town should be considered exposed to the tornado hazard.

Built Environment Impacts

Since Hazus doesn't support tornadoes and there aren't other readily available tornado models, historical data will be used to determine potential losses and probabilities. From 1956 until 2022, there have been 15 tornado events in Hampden County with one event (F0) impacting Southwick. In June 2011, a tornado destroyed 77 buildings in the town and caused two fatalities in Hampden County east of Southwick. Hampden County has sustained 38.5M in damage since 1956. To get to the potential risk at Southwick, the Town geographic size was divided by the County's geographic size resulting in a factor of 0.05. The AAL for the County was calculated and multiplied by .05 resulting in an AAL of $29,167.

Population Impacts

Populations considered most vulnerable to tornado impacts in Southwick are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Table 16 summarizes the senior and low-income populations in Southwick. It should be noted that there may be overlap within the two categories, so that the total number of persons exposed may be lower than what is shown in the table. However, the town should be aware of the potential needs of residents within these population segments in the event of a hazard occurrence. Mobile home parks are especially susceptible to tornadoes. Although there are less than ten mobile homes in the Town, homes without basements are also more susceptible to social impacts.

Environment Impacts

Tornadoes can cause damage to parks, and other, natural areas. Some areas of the Town may be out of service until trees are removed.

Problem Statements for Tornadoes

Table 47. Problem Statements for Tornadoes.

Assets	**Problems Associated with Tornadoes**
People (including underserved communities and socially vulnerable populations)	• Vulnerable populations may need support seeking protected shelter. Those without cell phones may not get weather alerts. • People without basements are susceptible to tornado impacts. Mobile home communities are very susceptible to tornado

Assets	Problems Associated with Tornadoes
	impacts. Those communities should have plans in place to get people to safe locations.
Structures (including facilities, lifelines, and critical infrastructure)	• Structures and critical infrastructure can all be impacted by tornadoes. • Roadways may be blocked due to downed trees and other debris.
Systems (including networks and capabilities)	• Electric grid may be impacted by winds and downed trees.
Natural, historic, and cultural resources	• Historic and cultural resources may be impacted by tornado winds. • Winds may damage trees and cause natural areas to close for cleanup.
Activities that have value to the community	• Outdoor events could be impacted by potential tornado activity.

Other Severe Weather

Several frequent natural hazards in Massachusetts – particularly strong winds and extreme precipitation events – occur outside of notable storm events. This section discusses the nature and impacts of these hazards, as well as ways in which they are likely to respond to climate change.

> The Town of Southwick Community Resilience Building Workshop Summary of Findings (2018) lists "Wind" as one of the top four hazards of concern.

Description

Thunderstorms: A thunderstorm is a storm originating in a cumulonimbus cloud. Cumulonimbus clouds produce lightning, which locally heats the air to 50,000 degrees Celsius, which in turn produces an audible shock wave known as thunder. Frequently during thunderstorm events, heavy rain and gusty winds are present. Less frequently, hail is present, which can become very large in size. Tornadoes can also be generated during these events. An average thunderstorm is 15 miles across and lasts 30 minutes, but severe thunderstorms can be much larger and longer.

Three basic components are required for a thunderstorm to form: moisture, rising unstable air, and a lifting mechanism. The sun heats the surface of the earth, which warms the air above it. If this warm surface air is forced to rise, it will continue to rise as long as it weighs less and stays warmer than the air around it. As the warm surface air rises, it transfers heat from the surface of the earth to the upper levels of the atmosphere (the process of convection). The water vapor it contains begins to cool, releasing the heat, and the vapor condenses into a cloud. The cloud eventually grows upward into areas where the temperature is below freezing. Some of the water vapor turns to ice, and some of it turns into water droplets. Both have electrical charges. When a sufficient charge builds up, the energy is discharged in a bolt of lightning, which causes the sound waves we hear as thunder.

Downbursts: A downburst is a severe localized wind blasting down from a thunderstorm. They are more common than tornadoes. Depending on the size and location of downburst events, the destruction to property may be significant. Downbursts fall into two categories:

1. Microbursts affect an area less than 2.5 miles in diameter, last 5 to 15 minutes, and can cause damaging winds up to 168 mph.
2. Macrobursts affect an area at least 2.5 miles in diameter, last 5 to 30 minutes, and can cause damaging winds up to 134 mph.

An organized, fast-moving line of microbursts traveling across large areas is known as a “derecho.” These occasionally occur in Massachusetts. Downburst activity is, on occasion, mistaken for tornado activity. Both storms have very damaging winds (downburst wind speeds can exceed 165 mph) and are very loud. These "straight line" winds are distinguishable from tornadic activity by the pattern of destruction and debris such that the best way to determine the damage source is to fly over the area.

Hail: Hailstones are chunks of ice that grow as updrafts in thunderstorms keep them in the atmosphere. Most hailstones are smaller in diameter than a dime, but stones weighing more than 1.5 pounds have been recorded. NOAA has estimates of the velocity of falling hail ranging from 9 meters per second (m/s) (20 mph) for a 1-centimeter (cm)-diameter hailstone to 48 m/s (107 mph) for an 8 cm, 0.7 kilogram stone.

Lightning: Lightning is a discharge of electricity that occurs between the positive and negative charges within the atmosphere or between the atmosphere and the ground. According to NOAA, the creation of lightning during a storm is a complicated process that is not fully understood. In the initial stages of development, air acts as an insulator between the positive and negative charges. However, when the potential between the positive and negative charges becomes too great, a discharge of electricity (lightning) occurs. In-cloud lightning occurs between the positive charges near the top of the cloud and the negative charges near the bottom. Cloud-to-cloud lightning occurs between the positive charges near the top of the cloud and the negative charges near the bottom of a second cloud. Cloud-to-ground lightning is the most dangerous. In summertime, most cloud-to-ground lightning occurs between the negative charges near the bottom of the cloud and positive charges on the ground.

Location

High wind events, thunderstorms, lightning, and hail can affect the entirely of Massachusetts, including the geographic extent of Southwick. However, the previous edition of this plan clarifies that risks within Southwick may vary:

- Sodom/Drake Mountains - The higher elevations near the tops of the mountains on the western portion of town can generate severe wind incidents, especially during intense thunderstorms, hurricanes, or blizzards.
- Granville Gorge - The topography of the road traveling through the gorge creates a wind tunnel, creating hazardous conditions for travelers.

Previous Occurrences

The NOAA Storm Events database (https://www.ncdc.noaa.gov/stormevents/) for Hampden County lists numerous severe storms affecting Southwick from 2012 through 2022. The individual damage figures for these events appear nominal but given the frequency of events, the overall losses from severe storms are striking. Some of these events were associated with winter storms, but the lack of snowfall contributed to them being classified as high wind events by NOAA.

Table 48. NCEI Severe Storm Database Entries Covering Other Severe Storms in Southwick.

Date	Description	Losses Reported
9/8/12	Trees, wires, and tree limbs were downed by thunderstorm winds, including on Sheep Pasture Road.	$15,000 among all affected towns
9/18/12	A tree and wires were downed on Feeding Hills Road.	$5,000 among all affected towns
7/3/14	Many trees and wires were downed on Concord Road.	--
7/27/14	Large branches along Route 202 were downed by thunderstorm winds.	Damage of $2,000.
10/8/14	Large trees were down on Route 202 and Feeding Hills Road: Rt 202 was blocked by the downed tree, and the tree on Feeding Hills Road fell onto wires.	$10,000 among all affected towns
8/12/16	Multiple trees on Eagle Street and Point Grove Road were downed by thunderstorm winds.	Damage of $15,000 among all affected towns.
5/31/17	Nickel size hail was reported in Southwick.	--

Date	Description	Losses Reported
8/2/17	A tree was downed at 454 College Highway, and a tree was down on wires at Sam West Road.	Damage of $2,000.
5/15/18	Walnut-size hail fell on Southwick.	--
6/18/18	Lightning caused a structure fire at 58 Congamond Road in Southwick. The fire started in the attic and then spread. Two residents were able to escape without injury.	Damage of $30,000.
5/19/19	Trees and wires down on Rising Corner Road.	Damage of $2,000
8/8/19	Trees and power lines were down near Route 202 and Bugbee Road.	--
10/31/19	Tree down on South Loomis Street and a tree down on Mort Vining Road; trees, wires, and utility poles were down on Sheep Pasture Road.	Damage of $5,000 among all affected towns.
4/13/20	Tree down on Klaus Anderson Rd and tree and wires down on George Loomis Rd.	Damage of $2,500 among all affected towns.
10/7/20	Multiple reports of trees down. on Ed Holcomb Road, Hillside Road, at the Ranch Golf Club, Miller Road, and at the Southwick Acres Campground.	Damage of $5,000.
4/21/21	In Southwick, trees and a transformer were down on Sheep Pasture Rd. Utility poles were down on South Longyard Rd.	Damage of $10,000
6/29/21	A large tree and wires were down on South Longyard Road. A tree was down on Sheep Pasture Road. A one-foot diameter tree was down on Rising Corner Road at the Agawam town line.	Damage of $2,300
7/6/21	Multiple trees and wires were down on Industrial Road and Mort Vining Road.	Damage of $2,500
7/12/22	A tree was down on wires near the 50 block of College Highway.	Damage of $500

USDA declares agricultural disasters as needed for a variety of hazards. Information can be found at https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index. The line items for events related to severe winds and hail in Hampden County are listed below.

Table 49. USDA Disasters Events That Refer to Severe Storms.

Year	Event	Event “Begin Dates”
2016	Drought, wildfire, excessive heat, high winds, insects	8/2/2016
2016	Drought, wildfire, excessive heat, high winds, insects	7/5/2016
2012	High Winds, excessive rains	8/10/2012

Extent

The strength of thunderstorms is typically measured in terms of its effects, namely the speed of the wind, the presence of significant lightning, and the size of hail. High winds are defined by the NWS as sustained non-convective winds of 35 knots (40 mph) or greater lasting for 1 hour or longer, or gusts of 50 knots (58 mph) or greater for any duration (NCDC, 2018). A thunderstorm is classified as “severe” when it produces damaging wind gusts in excess of 58 mph (50 knots), hail that is 1 inch in diameter or larger (quarter size), or a tornado (NWS, 2013).

Probability of Future Events

According to the NWS, an average of 100,000 thunderstorms per year occur in the United States. The SHMCAP notes that over the ten-year period between January 1, 2008, and December 31, 2017, a total of 435 high wind events occurred in Massachusetts on 124 days, and an annual average of 43.5 events occurred per year. This is consistent with the figure from the SHMCAP that thunderstorms typically occur on 20 to 30 days each year in Massachusetts, which is a subset of the 43.5 high wind event days.

NOAA reports that there are ten downburst reports for every tornado report in the United States. This implies that there are approximately 10,000 downbursts reported in the United States each year and further implies that downbursts occur in approximately 10% of all thunderstorms in the United States annually. This figure suggests that downbursts are a relatively uncommon yet persistent hazard.

An average of 33 people per year died from lightning strikes in the United States from 2004 to 2013. Most lightning deaths and injuries occur outdoors, with 45% of lightning casualties occurring in open fields and ballparks, 23% under trees, and 14% involving water activities. The SHMCAP notes that 8 fatalities and 145 injuries have occurred in Massachusetts as a result of lightning events between 1993 and 2017 (NCDC, 2017).

According to NOAA's National Weather Service, hail caused two deaths and an average of 27 injuries per year in the United States from 2004 to 2013.

Climate models show projections that the frequency and intensity of severe thunderstorms (which include tornadoes, hail, and winds) will increase (USGCRP, 2017).

Vulnerability Assessment

Exposure

The entire built environment of Southwick is vulnerable to the high winds and/or flooding from a severe weather event.

Built Environment Impacts

Severe thunderstorms, and their associated hail and lightning events, brought about property damage in Southwick in previous years. From 2012 until 2021, there was $103,100 in property damage to Southwick. This equates to an AAL of $10,100.

Population Impacts

Some traffic accidents associated with storm events include injuries and deaths. However, the number of injuries and deaths reported for accidents is generally low. Populations considered most vulnerable to tornado, microburst and thunderstorm impacts in Southwick are identified based on a number of factors including their physical and financial ability to react or respond during a hazard. Table 16 summarizes the senior and low-income populations in Southwick. It should be noted that there may be overlap within the two categories, so that the total number of persons exposed may be lower than what is shown in the table. However, the town should be aware of the potential needs of residents within these population segments in the event of a hazard occurrence.

Environment Impacts

Thunderstorms and microbursts can cause damage to parks and other, natural areas. Some areas of the town may be out of service until trees are removed.

Problem Statements for Other Severe Weather

Table 50. Problem Statements for Other Severe Weather.

Assets	**Problems Associated with Other Severe Weather**
People (including underserved communities and socially vulnerable populations)	• People in Southwick have been disrupted by severe weather events and other more frequent wind and thunderstorm events. • Vulnerable people living in isolated areas may be more susceptible to severe weather impacts. • Large hail has been reported at least three times in the last decade, which is an unusually high number of reports for one community.

Assets	Problems Associated with Other Severe Weather
Structures (including facilities, lifelines, and critical infrastructure)	• Downed trees can cause damage to structures, utilities (especially electric), and critical infrastructure. • As noted above, large hail has been reported at least three times in the last decade, which is an unusually high number of reports for one community.
Systems (including networks and capabilities)	• Downed trees and powerlines can cause a disruption to the power grid and transportation routes (roads and rail).
Natural, historic, and cultural resources	• These can be adversely impacted depending on the specific locations of damage.
Activities that have value to the community	• These can be adversely impacted depending on the specific locations of damage.

Non Climate-Induced Hazards

Earthquakes

An earthquake is the vibration of the Earth's surface that follows a release of energy in the Earth's crust. New England experiences intraplate earthquakes because it is located within the interior of the North American plate. Although damaging earthquakes are rare in Massachusetts, low-magnitude earthquakes occur regularly in the state.

Description

An earthquake is a sudden rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. Earthquakes can cause buildings and bridges to collapse; disrupt gas, electric, and telephone lines; and often cause landslides, flash floods, fires, avalanches, and tsunamis. Earthquakes can occur at any time without warning.

The underground point of origin of an earthquake is called its focus; the point on the surface directly above the focus is the epicenter. Earthquakes are described based on their magnitude and intensity as explained below under *Extent*.

New England's earthquakes appear to be the result of the cracking of the crustal rocks due to compression as the North American Plate is being very slowly squeezed by the global plate movements. As a result, New England epicenters do not follow the major mapped faults of the region, nor are they confined to particular geologic structures or terrains. Because earthquakes have been detected all over New England, seismologists suspect that a strong earthquake could be centered anywhere in the region.

Furthermore, the mapped geologic faults of New England currently do not provide any indications detailing specific locations where strong earthquakes are most likely to be centered.

In addition to earthquakes occurring within the Commonwealth, earthquakes in other parts of New England can impact widespread areas. Large earthquakes in Canada, which is more seismically active than New England, can affect buildings Massachusetts. This is due in part to the fact that earthquakes in the eastern U.S. are felt over a larger area than those in the western U.S. The difference between seismic shaking in the East versus the West is primarily due to the geologic structure and rock properties that allow seismic waves to travel farther without weakening (USGS, 2012).

In some places in New England, including locations in Massachusetts, small earthquakes seem to occur with some regularity. For example, since 1985 there has been a small earthquake approximately every 2.5 years within a few miles of Littleton. It is not clear why some localities experience such clustering of earthquakes, but clusters may indicate locations where there is an increased likelihood of future earthquake activity.

Location

Given the above discussion, the potential exists for earthquakes to occur within Southwick or to occur elsewhere and be felt anywhere in Southwick.

Previous Occurrences

According to the previous edition of this plan, no documented earthquakes have been centered in the Town of Southwick.

To determine whether earthquakes have occurred more recently near or in Southwick, all events listed by Weston Observatory were reviewed for all towns in Massachusetts and Connecticut for a five-year lookback. Listed earthquakes above magnitude 2.0 include:

- 12/21/18 – 3 km WSW of Gardner, MA, 2.1/2.1 [Mn*/Mc**]
- 7/27/19 – 6 km S of Middletown, CT, 2.0/2.2
- 8/21/19 – 2 km SSE of Wareham, MA, 1.7/2.4
- 12/3/19 – 4 km SSE of Plymouth, MA, 1.6/2.2
- 11/8/20 – 11 km SW of New Bedford, MA, 3.8/3.4
- 11/22/20 – 12 km WSW of New Bedford, MA, 1.7/2.6
- 7/25/21 – 5 km W of Peabody, MA, 1.4/2.5
- 1/1/22 – 13 km N of Rockport, MA, 2.3/3.0
- 3/4/22 – 5 km WSW of Orange, MA, 2.2/2.7

- 3/19/22 – 36 km ENE of Rockport, MA, 1.4/2.2

*Mn is the Nuttli Magnitude (see *Extent* below)
**Mc is the Coda Duration Magnitude (see *Extent* below)

These are very minor earthquakes.

Extent

Magnitude is an estimate of the relative size or strength of an earthquake and is related to the amount of seismic energy released at the hypocenter of the earthquake. It is based on the amplitude of earthquake waves recorded on instruments that have a common calibration. The magnitude of an earthquake is thus represented by a single instrumentally determined value recorded by a seismograph, which records the varying amplitude of ground oscillations.

The Richter scale was developed in 1935 and was used exclusively until the 1970s. The scale set the magnitude of an earthquake based on the logarithm of the amplitude of recorded waves. Being logarithmic, each whole number increase in magnitude represents a tenfold increase in measured strength. Earthquakes with a magnitude of about 2.0 or less are usually called "microearthquakes" and are generally only recorded locally. Earthquakes with magnitudes of 4.5 or greater are strong enough to be recorded by seismographs all over the world.

As more seismograph stations were installed around the world following the 1930s, it became apparent that the method developed by Richter was valid only for certain frequency and distance ranges, particularly in the southwestern United States. New magnitude scales that are an extension of Richter's original idea were developed for other areas. In particular, the Moment magnitude scale (Mw) was developed in the 1970s to replace the Richter scale and has been in official use by the USGS since 2002.

According to USGS, these multiple methods are used to estimate the magnitude of an earthquake because no single method is capable of accurately estimating the size of all earthquakes. Some magnitude types are calculated to provide a consistent comparison to past earthquakes, and these scales are calibrated to the original Richter scale. However, differences in magnitude of up to 0.5 can be calculated for the same earthquake through different techniques. In general, Moment magnitude provides an estimate of earthquake size that is valid over the complete range of magnitudes and so is commonly used today.

Although Moment magnitude is the most common measure of earthquake size for medium and larger earthquakes, the USGS does not calculate Mw for earthquakes with a magnitude of less than 3.5 which is the more common situation for Massachusetts. Localized Richter scales or other scales are used to calculate magnitudes for smaller earthquakes.

Regionally, the Weston Observatory utilizes two scales to track the magnitude of earthquakes. These include the Nuttli magnitude (Mn) for North America east of the Rocky Mountains and is more appropriate for the relatively harder continental crust in Connecticut compared to California. Weston Observatory also utilizes the Coda Duration magnitude (Mc), which is based on the duration of shaking at a particular station. The advantages of the Coda Duration magnitude are that this method can quickly estimate the magnitude before the exact location of the earthquake is known.

The effect of an earthquake on the earth's surface is called the intensity. The Modified Mercalli Intensity Scale consists of a series of key responses such as people awakening, movement of furniture, damage to chimneys, and total destruction. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It is an arbitrary ranking based on observed effects.

Table 51. Modified Mercalli Intensity.

Modified Mercalli Intensity	Description
I	Not felt except by a very few under especially favorable conditions
II	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
III	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. Vibration similar to the passing of a truck. Duration estimated.
IV	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	Felt by nearly everyone; many awakened. Some dishes and windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	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	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	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	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI	Few, if any (masonry), structures remain standing. Bridges destroyed. Rails bent greatly.
XII	Damage total. Lines of sight and level are distorted. Objects thrown in the air.

Source: USGS

A comparison of Richter magnitude to typical Modified Mercalli intensity is presented below.

Table 52. Modified Mercalli Intensity and Moment Magnitude.

Moment Magnitude	Typical Maximum Modified Mercalli Intensity
1.0 to 3.0	I
3.0 to 3.9	II to III
4.0 to 4.9	IV to V
5.0 to 5.9	VI to VII
6.0 to 6.9	VII to IX
7.0 and above	VIII or higher

Source: USGS

Probability of Future Events

Earthquake location and magnitude probabilities are exceptionally difficult to predict in Massachusetts. Minor earthquakes are relatively common in New England, but damaging earthquakes are not. Therefore, USGS instead characterizes the probability of ground acceleration rather than estimating a probability of magnitude. The Seismic Hazard Map for the state of Massachusetts (USGS) shows a peak ground acceleration of 8% to 10% of gravity in Southwick having a 2% probability of being exceeded in 50 years.

Vulnerability Assessment

Exposure

A major earthquake could cause severe damage to Southwick buildings, including older structures that were built before a 1975 law requiring new buildings to withstand earthquakes. Other associated concerns are debris management issues including debris removal and identification of disposal sites.

Built Environment Impacts

Historic data for earthquake events indicate that between 1991 and 2022, no major (>5.0 magnitude) earthquakes were recorded in Hampden County during this period, causing no damage to property. The entire built environment of Southwick is vulnerable to earthquakes. Older, unreinforced masonry buildings are very susceptible to earthquakes.

To identify built environment impacts to the town, FEMA's risk assessment software, Hazus, was implemented. The economic loss results of the 1500-year event are shown in Table 53 while the results for the 2500-year event are shown in Table 54. The town's Average Annual Loss (AAL) is modeled to be $14,038.

Table 53. Building Loss for a 1500-Year Scenario.

Loss Type	Residential ($Million)	Commercial ($Million)	Other Occupancy ($Million)	Total ($Million)
Building Loss	2.1	1.0	0.8	**3.9**
Content Loss	0.5	0.4	0.3	**1.2**
Business Inventory Loss	0.0	0.1	0.0	**0.1**
Business Income Loss	0.0	0.2	0.0	**0.2**
Business Relocation Loss	0.2	0.2	0.1	**0.5**
Rental Income Loss	0.1	0.2	0.0	**0.3**
Wage Loss	0.0	0.2	0.1	**0.3**
Total	**2.9**	**2.2**	**1.4**	**6.5**

Table 54. Building Loss for a 2500-Year Scenario.

Loss Type	Residential ($Million)	Commercial ($Million)	Other Occupancy ($Million)	Total ($Million)
Building Loss	4.3	2.0	1.5	**7.8**
Content Loss	1.1	0.8	0.7	**2.6**
Business Inventory Loss	0.0	0.2	0.1	**0.3**
Business Income Loss	0.0	0.4	0.0	**0.4**
Business Relocation Loss	0.3	0.4	0.3	**1.0**
Rental Income Loss	0.2	0.3	0.1	**0.6**
Wage Loss	0.0	0.3	0.2	**0.5**
Total	**5.9**	**4.4**	**2.9**	**13.2**

Population Impacts

Populations considered most vulnerable to earthquake impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Table 16 summarizes the senior and low-income populations in Southwick. It should be noted that there may be overlap within the two categories, so that the total number of persons exposed may be lower than what is shown in the table. However, the town should be aware of the potential needs of residents within these population segments in the event of a hazard occurrence.

Hazus was used to model injuries and fatalities for the 1500- and 2500-year events. For the 1500-year event, there are up to 5 minor injuries not requiring medical attention with no injuries requiring medical attention. For the 2500-year event there are up to 5 minor injuries not requiring medical attention with no injuries requiring medical attention.

Environment Impacts

The environment may be impacted by cascading impacts from the earthquake, such as a truck accident caused by road damage, landslide, or dam breach. This could result in a hazardous material release.

Problem Statements for Earthquakes

Table 55. Problem Statements for Earthquakes.

Assets	Problems Associated with Earthquakes
People (including underserved communities and socially vulnerable populations)	• Vulnerable populations located in unreinforced masonry structures may sustain injuries. • Elderly population falls during event.
Structures (including facilities, lifelines, and critical infrastructure)	• Unreinforced masonry and utility lifelines impacted.
Systems (including networks and capabilities)	• Utility systems impacted.
Natural, historic, and cultural resources	• Historical buildings constructed out of unreinforced masonry are susceptible and may be impacted.
Activities that have value to the community	• None apparent or projected.

National Flood Insurance Repetitive Loss Properties

B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))

According to FEMA, repetitive loss properties are those for which two or more losses of at least $1,000 each have been paid under the National Flood Insurance Program (NFIP) within any 10-year period since 1978. Severe repetitive loss properties are residential properties that have at least four NFIP payments over $5,000 each and the cumulative amount of such claims exceeds $20,000, or at least two separate claims payments with the cumulative amount exceeding the market value of the building.

According to data provided by MEMA, there are no repetitive loss properties and no severe repetitive loss properties present in the Town. A summary of the Town's participation and compliance with the NFIP, including current policy and historical claims statistics, is provided in Table 7 of Chapter 5 (Capability Assessment).

Hazard Ranking

Ranking hazards helps the Town set goals and mitigation priorities. To compare the risk of different hazards, and prioritize which are more significant, requires a scoring system for equalizing the units of analysis. As not all hazards assessed in this plan have precisely quantifiable probability or impact data, a scoring system based on multi-criteria decision analysis (MCDA) methodology was developed to rank all the hazards. This multi-criteria ranking analysis approach prioritizes hazard risk based on a blend of quantitative factors from the available data, such as historical data, local knowledge, public survey, and Hazus assessment. This hazard ranking analysis assigns varying degrees of risk to five categories for each of the hazards, including: probability (how often it can occur), impact (economic, social, and environmental loss), spatial extent (the size of the area affected), warning time (how long does a community have to prepare for the event), and duration. Each degree of risk was assigned a value ranging from 1 to 4. The weighting factor derived from a review of best practice plans. Some of these hazard characteristics, like probability and impact, are more important than others and are weighted more heavily.

To calculate a rank score value for a given hazard, the assigned risk value for each category was multiplied by the weighting factor. The sum of all five categories represents the final rank score, as demonstrated in the following equation:

Hazard Score Value = [(Probability x 30%) + (Impact x 30%) + (Spatial Extent x 20%) + (Warning Time x 10%) + (Duration x 10%)]

Table 56 provides the hazard characteristic, level description, level criteria, level index value, and weighting value.

Table 56. Hazard Ranking Criteria.

Hazard Characteristic	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
Probability	Unlikely	Less than 1% annual probability	1	30%
	Possible	Between 1 and 10% annual probability	2	
	Likely	Between 10 and 100% annual probability	3	
	Highly Likely	100% annual probability	4	
Impact	Minor	Very few injuries, if any. Only minor property damage and minimal disruption to quality of life. Temporary shutdown of critical facilities.	1	30%
	Limited	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one day.	2	
	Critical	Multiple deaths/injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one week.	3	
	Catastrophic	High number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.	4	
Spatial Extent	Negligible	Less than 1% of area affected	1	20%
	Small	Between 1 and 10% of area affected	2	
	Moderate	Between 10 and 50% of area affected	3	
	Large	Between 50 and 100% of area affected	4	
Warning Time	Long	More than 24 hours	1	10%
	Moderate	12 to 24 hours	2	
	Short	6 to 12 hours	3	
	Very short or no warning	less than 6 hours	4	
Duration	Very short	Less than 6 hours	1	10%
	Short	Less than 24 hours	2	

Hazard Characteristic	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
	Moderate	Less than one week	3	
	Long	More than one week	4	

Table 57 provides the final hazard ranking for Southwick. Each hazard characteristic is assigned a value between 1 (lowest value) and 4 (highest value). When the risk values were calculated, if the value was greater than 3, it was assigned as a high risk hazard. If the value was greater than 2 and less than or equal to 3, it was assigned as a moderate risk. If the value was less than or equal to 2, it was assigned as a low risk hazard. The flood, extreme temperatures, and severe winter storms hazards were ranked highest. The drought, wildfires/brushfires, infectious disease, invasive species, hurricanes/wind, tornadoes, and other severe weather are all ranked as moderate. The landslide and earthquake hazards are ranked as low.

Table 57. Final Hazard Ranking of Hazards for Southwick.

Hazards	Probability	Impact	Spatial Extent	Warning Time	Duration	Value	Rank
Severe Winter Storms	4	3	4	1	3	3.3	High
Extreme Temperatures	4	2	4	1	3	3	High
Flood	4	3	2	3	2	3	High
Drought	2	3	4	1	4	2.8	Mod
Infectious Disease	3	2	4	2	2	2.7	Mod
Hurricanes/Wind	2	3	4	1	2	2.6	Mod.
Invasive Species	3	2	2	3	4	2.6	Mod
Other Severe Weather	4	1	4	2	1	2.6	Mod.
Tornadoes	2	4	1	3	1	2.4	Mod.
Wildfires/Brushfires	2	1	3	3	3	2.1	Mod.
Earthquakes	1	1	4	4	1	1.9	Low
Landslide	1	2	1	4	1	1.6	Low

The following table summarizes changes in population patterns and land use and development and how those impact hazards.

Table 58. Impacts from Population and Land Use.

Hazards	Changes in Population Patterns	Changes in Land Use and Development
Flooding Including Dam Failures and Ice Jams	There is a growing elderly population exposed to the floodplain: • Around White Brook and Shurtleff Brook in the northwest. Also, includes a growing population living below the poverty line. • Slab Brook and Kellog Brook in the northeast.	Existing codes and regulations in the SFHA will help to keep flood impacts low. New development areas may produce additional flooding due to the addition of impervious surfaces.
Droughts	The town's elderly population has increased from 13.6% in 2010 to 22.3% in 2020. The number of people living below the poverty line has increased from 2.6% in 2010 to 4.6% in 2020.	All new developments will create more demand for limited water resources.
Landslides	There is a growing elderly and low-income population on and adjacent to Drake Mountain.	Existing land use regulations will help to keep development out of landslide-prone areas.
Extreme Temperatures	The town's elderly population has increased from 13.6% in 2010 to 22.3% in 2020. The number of people living below the poverty line has increased from 2.6% in 2010 to 4.6% in 2020.	All new developments will exacerbate heat island effect if the development includes tree removal and adding black surfaces such as asphalt and roofs.
Wildfires	There is a growing low-income and elderly population in the northwest part of the town.	Development in or adjacent to a forested or brushland area can lead to a higher risk of wildfire.
Infectious Diseases	The town's elderly population has increased from 13.6% in 2010 to 22.3% in 2020. The number of people living below the poverty line has increased from 2.6% in 2010 to 4.6% in 2020.	Shouldn't be impacted by changes in land use and development.
Invasive Species	Shouldn't be impacted by population changes.	Shouldn't be impacted by changes in land use and development.

Hazards	Changes in Population Patterns	Changes in Land Use and Development
Hurricanes and Tropical Storms	The town's elderly population has increased from 13.6% in 2010 to 22.3% in 2020. The number of people living below the poverty line has increased from 2.6% in 2010 to 4.6% in 2020.	Shouldn't be impacted by changes in land use and development.
Severe Winter Storms	The town's elderly population has increased from 13.6% in 2010 to 22.3% in 2020. The number of people living below the poverty line has increased from 2.6% in 2010 to 4.6% in 2020.	Shouldn't be impacted by changes in land use and development.
Tornadoes	The town's elderly population has increased from 13.6% in 2010 to 22.3% in 2020. The number of people living below the poverty line has increased from 2.6% in 2010 to 4.6% in 2020.	Shouldn't be impacted by changes in land use and development.
Other Severe Weather	The town's elderly population has increased from 13.6% in 2010 to 22.3% in 2020. The number of people living below the poverty line has increased from 2.6% in 2010 to 4.6% in 2020.	Shouldn't be impacted by changes in land use and development.
Earthquakes	Not considered.	Not considered.

Problem Statements Summary

The following problem statements reflect a summary of the problem statements included at the end of each hazard profile. They were designed to briefly summarize the key hazard risks and vulnerabilities to the community based on potential impacts and losses from future events. They are among the issues of greatest concern and were used to assist in the identification and analysis of potential mitigation actions for Chapter 6 (Mitigation Strategy). These problem statements will be reviewed and revised as needed during plan updates to reflect the most current information resulting from the risk assessment.

Table 59. Problem Statements Summary.

Hazard	Problem Summary
Severe Winter Storms	• Severe storms may damage trees in natural areas, and historical and cultural sites.
Extreme Temperatures	• Extreme heat will be a significant public health threat to all residents, but especially for vulnerable populations living in older homes or homes without air conditioning.
Flood	• Several homes and businesses are in the floodplain of Great Brook and its tributaries, and many of these buildings are older. • Some of the water supply infrastructure is located in low-lying and potentially flood-prone areas. • Undersized culverts at the Klaus Anderson Road, Fred Jackson Road, Kline road, and Davis Road are known issues. • Industrial Road and the adjoining area is located in floodplain including oil tank (with a berm around it) and gas station.
Drought	• Agricultural systems and facilities in Southwick are significantly affected by droughts. Drought reimbursements and COVID reimbursements to agriculture have exceeded the figures in most other towns.
Infectious Disease	• Future flu pandemics may adversely impact all residents and present additional complications to the elderly and those with pre-existing conditions. • Tickborne and mosquito-borne infection rates are expected to increase as winter seasons become less severe and shorter in duration.
Hurricanes/Wind	• Vulnerable populations may need to be evacuated and could be displaced from their homes. • Wind may cause trees to fall into structures and infrastructure, and roadways. Storms Sandy (2012), Isaias (2020), Henri (2021), and Ida (2021) all brought trees down onto roads in Southwick. • Wind damage to wind-susceptible buildings such as carports, greenhouses, and open-walled recreational buildings. Additional damage to commercial buildings with HVAC located on roofs.

Hazard	Problem Summary
Invasive Species	• Riparian and aquatic habitats are severely threatened by common reed, Japanese knotweed, invasive water chestnut, hydrilla, purple loosestrife, and Eurasian milfoil. • Invasive insect pests already in the area include the Asian Longhorned Beetle and Emerald Ash Borer.
Other Severe Weather	• Downed trees can cause damage to structures, utilities (especially electric), and critical infrastructure. • As noted above, large hail has been reported at least three times in the last decade, which is an unusually high number of reports for one community.
Tornadoes	• Structures and critical infrastructure can all be impacted by tornadoes. • Roadways may be blocked due to downed trees and other debris.
Wildfires/Brushfires	• Populations with severe asthma may be adversely impacted by wildfires in the vicinity. • Lower income families are found in the higher wildfire probability areas. Evacuating and recovering from a wildfire may be difficult for them.
Earthquakes	• Historical buildings constructed out of unreinforced masonry are susceptible and may be impacted.
Landslide	• Some residential and commercial structures reside adjacent to moderately unstable areas and could be impacted

Chapter 5: Capability Assessment

Capability Assessment Purpose

The purpose of conducting a capability assessment is to determine the ability of a community to mitigate hazard risks and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs, projects, or other activities. Coupled with the risk assessment, the capability assessment serves as the foundation for designing an actionable and effective hazard mitigation strategy.

As in any planning process, it is important to establish which goals or actions are feasible based on the organizational capacity of those agencies or departments tasked with their implementation. A capability assessment helps to determine which types of mitigation actions are practical and likely to be implemented over time based on a community's existing authorities, policies, programs, and resources available to support such implementation. This analysis will identify any critical capability gaps or limitations to address through corrective actions, as well the key strengths or positive measures in place that should continue to be supported and/or expanded upon to improve local mitigation capabilities.

This capability assessment was completed to not only help establish the goals and actions for the Town of Southwick's hazard mitigation plan, but to also help ensure that those goals and actions are realistically achievable under current local conditions. As highlighted in FEMA's 2022 Local Mitigation Planning Policy Guide, *"describing the current capabilities provides a rationale for which mitigation projects can be undertaken to address the vulnerabilities identified in the Risk Assessment."*[55]

The capability assessment for the Town of Southwick includes a comprehensive examination of several components as summarized in Table 10.

Table 60. Capability Assessment Components.

Components	Description
Planning and Regulatory Capabilities	Local plans, policies, codes, and ordinances that are relevant to reducing the potential impacts of hazards.
Administrative and Technical Capabilities	Local human resources and their skills/tools that can be used to support mitigation activities.
Financial Capabilities	Fiscal resources the community has access to for helping to fund hazard mitigation projects.

[55] Local Mitigation Planning Policy Guide. FEMA. April 2022. P. 25.

Components	Description
Education and Outreach Capabilities	Local programs and methods already in place that can be used to support mitigation activities.
NFIP Participation and Compliance	Summary of information relevant to the community's participation in the NFIP and continued compliance with NFIP requirements.

Review and Incorporation of Existing Plans, Studies, and Reports

A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))

The first step in completing the updated capability assessment was to gather and review any relevant local plans, studies, or reports completed or updated since the previous hazard mitigation plan was adopted in 2016. This information was used to help gain a current understanding of the Town's current ability to mitigate risk, and how local capabilities may have changed over the past 6-7 years. The 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan, as well as other plans adopted by the Town of Southwick in the recent past, were reviewed for consistency as well as opportunities for plan integration. The goal of this review was to support updates to this plan that easily align with and possibly incorporate key aspects of relevant plans at the state and local level.

Table 61 provides a summary of the most relevant plans, studies, reports, or sources of other technical information consulted as part of this process and how they were incorporated into this plan update.

Table 61. Relevant Plans, Studies, and Reports for Incorporation.

Plan / Study / Report	Summary Description / Incorporation
Massachusetts State Hazard Mitigation and Climate Adaptation Plan (2018)	The SHMCAP is an innovative, first-of-its-kind statewide plan that fully integrates a traditional hazard mitigation plan with a climate change adaptation plan. The SHMCAP fulfills two important requirements, including (1) updating the 2013 State Hazard Mitigation Plan as required by Federal regulations (44 CFR Part 201.4); and (2) fulfilling requirements for a state climate adaptation plan per Massachusetts Executive Order 569. The SHMCAP has five goals as shown below: 1. Enhance the Commonwealth's resiliency to natural hazards and climate change by integrating programs and building institutional capacity.

Plan / Study / Report	Summary Description / Incorporation
	2. Reduce the impacts of natural hazards and climate change with forward-looking policies, plans, and regulations. 3. Understand our vulnerabilities and risks and develop immediate and long-term risk reduction strategies for current and future conditions using the best available science. 4. Increase the resilience of State and local government, people, natural systems, the built environment, and the economy by investing in performance-based solutions. 5. Support implementation of this plan through increased education, awareness, and incentives for action for state agencies, local governments, private industry, non-profits, and the public. The SHMCAP was incorporated as a key source of information for this plan update. The Town of Southwick's Hazard Mitigation Plan was also updated to be consistent and aligned with the SHMCAP. For example, the goals and actions identified in Chapter 6 address several of the key themes identified in the SHMCAP, including the integration of hazard mitigation and climate adaptation strategies in local policies, plans, and regulations; improving public education and awareness; building local capacity; and reducing risk to people, property, and infrastructure to natural hazards and climate change. In addition, as seen in Chapter 4, the risk assessment has been updated to be organized using the same hazard classification scheme as used for the SHMCAP.
Town of Southwick Municipal Vulnerability Preparedness (MVP) / Community Resilience Building (CRB) Summary of Findings Report (2018)	The Commonwealth's Municipal Vulnerability Preparedness (MVP) program provides support for cities and towns in Massachusetts to plan for resiliency and implement key climate change adaptation actions for resiliency. In 2018, Southwick was awarded an MVP Planning Grant to assess its vulnerability to and prepare for climate change impacts, build community resilience, and receive designation from the Executive Office of Energy and Environmental Affairs (EEA) as an MVP Community. Communities with this designation become eligible for MVP Action Grant funding and other opportunities to support the implementation of priority climate adaptation actions. In completing the MVP planning process, the Town of Southwick followed the Community Resilience Building (CRB) framework with technical assistance provided by a state-certified MVP Provider, Fuss & O'Neill. The CRB methodology is an "anywhere at any scale" format that draws on stakeholders' wealth of information and experience to foster dialogue about

Plan / Study / Report	Summary Description / Incorporation
	a community's strengths and vulnerabilities. A day long CRB Workshop was held on October 2, 2018, with the following central objectives: 1. Define top local natural and climate-related hazards of concern. 2. Identify existing and future strengths and vulnerabilities. 3. Develop prioritized actions for Southwick. 4. Identify immediate opportunities to collaboratively advance actions to increase resilience. The resulting Summary of Findings Report and supporting materials served as a primary source of information and community-based inputs for incorporation into the update of this plan. These inputs include the identification of top climate-influenced hazards (ice and snow, wind, flooding, and extreme heat) and vulnerable areas or community assets (infrastructural, societal, and environmental), current community concerns and challenges presented by these hazards, current strengths and assets, and specific, prioritized recommendations to improve resilience in Southwick.
Southwick Open Space and Recreation Plan (2020)	The Southwick Open Space and Recreation Plan (OSRP) is a comprehensive guide for the protection of natural resources and environmental quality for town-owned lands. The primary purpose of the Town's OSRP is to provide for the protection of open space, remaining farmlands, aquifer recharge areas, and sensitive habitats and to promote awareness and appreciation of conservation and recreational areas while still allowing for controlled, responsible development. The 2020 OSRP established the following four goals to guide its Seven-Year Action Plan: 1. Maintain the ecological integrity of aquatic ecosystems and protect the quality and quantity of surface and groundwater drinking water supplies. 2. Permanently protect important open space and ensure conservation areas are appropriately managed for flora and fauna habitat integrity and resiliency. 3. Preserve working farms and forests in support of an agricultural way of life in Southwick. 4. Improve and expand recreational and environmental education opportunities for people of all ages while preserving Southwick's scenic, cultural, and historic character.

Plan / Study / Report	Summary Description / Incorporation
	The 2020 OSRP served as a key source of information related to the community's natural and built environment, with specific content regarding natural hazards, growth and development patterns, and mitigation-related activities being incorporated into this updated plan. This includes details on environmental challenges such as chronic flooding and the impacts of climate change, and the various solutions the Town has already identified that are relevant to the hazard mitigation plan update i.e., stormwater management, invasive species treatment, etc.). It also includes information related to community needs, goals and objectives, and recommended actions that may help Southwick to mitigate hazards or adapt to climate change for the mitigation strategy. The OSRP helped inform the risk assessment process as well possible new mitigation actions that can accomplish not only risk reduction and climate adaptation, but also provide the co-benefits of open space preservation, natural resource protection, and the creation of new recreation opportunities for Southwick.
FEMA Flood Insurance Study for Hampden County (2023)	Last published by FEMA on June 7, 2023, this report constitutes the currently effective Flood Insurance Study (FIS) report for Hampden County. This latest FIS revises and updates information on the existence and severity of flood hazards for the study area, which includes the Town of Southwick. The studies described in this report provide flood hazard data that are used to establish actuarial flood insurance rates and to assist communities in efforts to implement sound floodplain management. The FIS and accompanying Flood Insurance Rate Maps (FIRMs) include relevant data and information on flood hazards for Southwick, including but not limited to descriptions of principal flood problems, flooding sources, FEMA flood zone designations, base flood elevations, and discharge rates of flooding sources. This data and information were reviewed and incorporated into the plan update process by informing the risk assessment, especially as it relates to the hazard profile and vulnerability assessment that was prepared for the flood hazard.

In addition to the above plans which were determined to be most relevant for incorporation into the hazard mitigation plan update, the following plans, studies, reports, and other technical documents were reviewed to gain a clearer understanding of local capabilities and their existing or potential effects on hazard risk reduction. More information on some of these documents is provided in Table 62 in the next section.

- ***Climate Change and Sustainability Technical Paper (2022)*** – This report, prepared by the Town's Climate Change and Sustainability focus group in support of the ongoing Master Plan

Update process (Southwick 2040), introduces how Southwick intends to address climate resilience and sustainability in the new Master Plan. It provides an inventory of existing climate resilience and sustainability characteristics of the community, a review of existing plans and an analysis of zoning and other regulations related to the topic, as well as a summary of projected and future climate and sustainability-related trends. This information along with the specific issues and opportunities identified in this technical paper were incorporated into the hazard mitigation plan update process as deemed appropriate by the HMPC. The concurrent update of both plans was recognized as a tremendous opportunity to facilitate integrated planning through the adoption of consistent goals, objectives, and actions to promote a resilient future.

- ***Stormwater Management Plan (2021)*** – The Town's SWMP is maintained in compliance with MS4 permit requirements as administered by the U.S. Environmental Protection Agency and Massachusetts Department of Environmental Protection (MassDEP). The SWMP describes and details the activities and measures that will be implemented to meet the terms and conditions of the MS4 permit. It is focused on reducing pollutants in stormwater runoff versus mitigating flood hazards. The main elements of the Town's stormwater management program are (1) a public education program in order to affect public behavior causing stormwater pollution, (2) an opportunity for the public to participate and provide comments on the stormwater program, (3) a program to effectively find and eliminate illicit discharges within the MS4 (4) a program to effectively control construction site stormwater discharges to the MS4, (5) a program to ensure that stormwater from development projects entering the MS4 is adequately controlled by the construction of stormwater controls, and (6) a good housekeeping program to ensure that stormwater pollution sources on municipal properties and from municipal operations are minimized.
- ***Water Conservation Plan (2005) –*** This plan outlines water conservation and demand management strategies and tools that the Town can implement to further its efforts toward water conservation at the municipal level and by consumers. Recommendations for effective efficiency technologies and practices can achieve substantial water savings and benefits in homes, on lawns and landscapes, at businesses, institutions, factories, and farms.
- ***Southwick Community Development Plan (2004)*** – This plan was developed by the Southwick Community Development Planning Committee, with technical assistance provided by the Pioneer Valley Planning Commission (PVPC) and Dodson and Associates. The plan refers to and seeks to realize the vision and goals from the Master Plan completed in the late 1990s but was never adopted. Although much of the content is outdated, the plan addressed many community issues for Southwick at the time through the following plan elements: Open Space and Resource Protection; Housing; Economic Development; and Transportation.

Planning and Regulatory Capabilities

C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))

Table 62 is based off Worksheet 4.1 from FEMA's *Local Mitigation Planning Handbook*.[56] It was used by the HMPC to document and review the current planning and regulatory capabilities of the Town including local plans, policies, codes, and ordinances that are relevant to reducing the potential impacts of hazards. Some additional information on how effectively these plans and regulatory tools are being used for hazard mitigation purposes can be found under the Safe Growth Survey and NFIP Participation and Compliance sections of this chapter.

Table 62. Planning and Regulatory Findings.

Planning/Regulatory Tool	Responsible Authority	General Description / Effectiveness for Hazard Risk Reduction
Plans		
Comprehensive/Master Plan	Planning Board	Under development. Currently the Town has an outdated Master Plan that was adopted in 1967. There was a planning process conducted in the late 1990's that was intended to update the Master Plan, but no official plan was adopted. Since then, various functional plans have been prepared to meet the planning needs of specific Departments, Boards, Committees and Commissions. This includes a Community Development Plan completed in 2004. In late 2021, the Town created a Master Plan Advisory Committee (MPAC) to oversee the development of a new master plan. This project, named "Southwick 2040," will continue through late 2023. The new plan will address natural hazards and climate change and will cross-reference the HMP to integrate mitigation more effectively across different community plans.
Open Space & Recreation Plan	Open Space & Recreation Planning Committee	Last updated in 2020. The plan identifies areas that are susceptible to overflow of streams during periods of heavy flooding including the 500-year storm event. The plan identifies several culverts that were recently

[56] Local Mitigation Planning Handbook. FEMA. March 2013.

Planning/Regulatory Tool	Responsible Authority	General Description / Effectiveness for Hazard Risk Reduction
		replaced or were in the process of being replaced. The plan is further described in Table 61.
Housing Production Plan	Planning Board	No current plan, but a new plan is currently being drafted in conjunction with the Master Plan
Economic Development Plan	Economic Development Commission	No current plan. The 2004 Community Development Plan served as the Town's economic development plan which will be updated as part of the Master Plan update process now underway and scheduled for completion in late 2023.
Capital Improvements Plan	Buildings and Grounds	The plan is called a Building Needs Forecast. Flood hazards are identified, and the plan provides recommendations for rehabilitation and/or replacement.
Emergency Operations Plan	Emergency Management	The Town's Comprehensive Emergency Management Plan (CEMP) covers mitigation, response, and recovery for all hazards for Public Safety.
Continuity of Operations Plan	Emergency Management	The Town's COOP and Continuity of Government (COG) plans cover all Town departments for contingency planning.
Stormwater Management Plan	Public Works	Created in support of NPDES Permit. Stormwater-related hazards are addressed; mitigation strategies include stormwater infrastructure maintenance and improvements through BMPs and similar activities. The plan is further described in the previous section following Table 2.
Building Code, Permitting, and Inspections		
Building Code		Version/Year: MA State Building Code (780 CMR), Ninth Edition, 2017 The Town enforces the most current version of the Massachusetts State Building Code (MSBC), which includes numerous provisions for reducing risks posed by natural hazards (e.g., flood-resistant construction, seismic design standards, wind and snow load requirements, etc.). This includes a requirement for the design and construction of structures located in flood hazard areas to be in accordance with American Society of Civil Engineers

Planning/Regulatory Tool	Responsible Authority	General Description / Effectiveness for Hazard Risk Reduction
		(ASCE) standards, which are consistent with, and in some cases, exceed minimum NFIP requirements. * *More detailed information on the MSBC is provided below this table.*
Building Code Effectiveness Grading Schedule (BCEGS)	Building Department	BCEGS Commercial Score: Class 6 BCEGS Residential Score: Class 6 * *Last BCEGS classifications were issued by ISO in 2013; an updated reevaluation is needed.*
ISO Fire Protection Rating	Fire Department	Public Protection Classification: 04/04Y The Town's PPC rating improved in 2022 based on the implementation of new programs and systems, including public education, the Town's new live-fire training facility, and career staffing 24 hours/day.
Site Plan Review Requirements	Planning Board / Multiple Departments	No building permit shall be issued for any new structure except single-family residence and accessory buildings or similar structures without first submitting a plan of the proposed work to the Planning Board for site plan review. Effectively administered and enforced.
Land Use, Zoning, and Development Regulations		
Zoning Bylaws/Ordinances	Planning Board	Adopted via Chapter 185 of the Town Code. Includes specific chapters and articles that support risk reduction as described below (i.e., floodplain management, stormwater management, etc.). Also includes Flexible Residential Developments, with the ability for a project to "earn" points through preservation of open space, or protection of forests, wildlife habitats, old growth trees, views, rural corridors, steep slopes, or historic sites. Effectively administered and enforced.
Subdivision Regulations	Planning Board	Adopted via Chapter 315 of the Town Code. Not specific to hazard risk reduction but does address securing adequate stormwater drainage and safety in the case of fire, flood, and other emergencies. Effectively administered and enforced.
Floodplain Regulations	Planning Board	Adopted via Zoning Bylaw Chapter 185, Section 20 (Flood Hazard and Wetlands District) to follow FEMA's NFIP regulations and compliance with the State Building Code. Very effective at reducing flood

Planning/Regulatory Tool	Responsible Authority	General Description / Effectiveness for Hazard Risk Reduction
		risks to new and improved construction in high risk areas.
Stormwater Management Regulations	Public Works	Adopted via Chapter 183 of the Town Code. Effectively regulates land development and redevelopment by establishing minimum requirements and procedures to control the adverse impacts associated with stormwater runoff. These regulations were updated in 2021 to include higher standards for design flows (referencing NOAA Atlas 14 for rainfall data), as well as other components required in the MS4 Stormwater permit. Effective at reducing flood risk in combination with other rules and regulations noted above.
Wetlands Protection	Conservation Commission	Adopted via Chapter 182 of the Town Code. Effectively protects the wetlands, related water resources, and adjoining land areas in the community by controlling activities deemed by the Conservation Commission likely to have a significant or cumulative effect upon wetland values, including but not limited to flood control, erosion, and storm damage prevention. Very effective and supportive of hazard risk reduction.

Massachusetts State Building Code

All municipalities in the state must adopt and enforce the current Massachusetts State Building Code (MSBC). The MSBC consists of a series of international model codes and any state-specific amendments adopted by the Board of Building Regulations and Standards (BBRS). The BBRS regularly updates the state building codes as new information and technology becomes available and change is warranted.

The MSBC is separated into two distinct volumes: The Residential volume regulates all one- and two-family structures and townhouses that are three stories or less, as well as their accessory structures. The Base volume regulates all structures that are not covered by the Residential regulations.

The current version of the MSBC is the Ninth Edition, which became effective on October 20, 2017. The Town of Southwick began enforcing the Ninth Edition for all applicable projects as required by January 1, 2018. The Ninth Edition code is based on modified versions of the following 2015 codes as published by the International Code Council (ICC).*

- The International Building Code (IBC)

- International Residential Code (IRC)
- International Existing Building Code (IEBC)
- International Mechanical Code (IMC)
- International Energy Conservation Code (IECC)
- International Swimming Pool and Spa Code (ISPSC)
- Portions of the International Fire Code (IFC)

** Although the Ninth Edition of the code is still in effect, members of the BBRS have voted that the next edition of the MSBC will be based on modified versions of the 2021 International Codes. The content of these codes is still under review by the BBRS, but it is anticipated that the Tenth Edition of the code will be available for use in 2023.*

The Commonwealth of Massachusetts requires mandatory enforcement of the MSBC and does not allow local amendments to the residential code. In addition, the Commonwealth adopts a plumbing and electrical code. The Commonwealth also has a program in place for code official certification, which includes taking code classes prior to examination and certification, requires continuing education, and allows consumers to file complaints against inspectors. Massachusetts also requires licensing of general, plumbing, electrical, and roofing contractors; requires licensing candidates to pass an examination prior to licensing; and requires continuing education.

Massachusetts continues to perform well in terms of objective assessments of the MSBC. For example, in its most recent "Rating the States" report, the Insurance Institute for Business and Home Safety (IBHS) ranked Massachusetts 9th (scoring 78 out of a possible 100 points on the IBHS scale). Now in its fourth edition, IBHS's 2021 report evaluates the 18 states along the Atlantic and Gulf coasts, all vulnerable to catastrophic hurricanes, based on building code adoption, enforcement, and contractor licensing.

Lastly, as noted in the table above, the MSBC contains a series of requirements for flood-resistant design and construction that are in accordance with the ASCE 24 standard, which incorporates—and in certain areas exceeds—FEMA's NFIP construction standards. Highlights of ASCE 24 that complement the NFIP minimum requirements include requirements for building performance; flood-damage-resistant materials, utilities and service equipment, and siting considerations. Specific requirements for design flood elevations and the use of flood-resistant materials may be found in the ASCE Tables included in 780 CMR Section 1612.4. For example, a higher regulatory standard that affects development and redevelopment in the Town's mapped special flood hazard areas include a requirement that new or substantially improved buildings must be elevated so that the lowest floor surface is at least 1 foot above the FEMA base flood elevation.

Safe Growth Survey

As part of the assessment for planning and regulatory capabilities, the Town Planner completed a *Safe Growth Survey*. This unique survey instrument was drawn from the Safe Growth Audit concept developed for the American Planning Association (APA) to help communities evaluate the extent to which they are positioned to grow safely relative to natural hazards. The survey covered six topic areas including the following:

- Land Use
- Transportation
- Environmental Management
- Public Safety, Zoning Ordinance
- Subdivision Regulations
- Capital Improvement Program and Infrastructure Policies

While somewhat of a subjective exercise, the Safe Growth Survey was used to provide some measure of how adequately existing planning mechanisms and tools for the Town of Southwick were being used to address the notion of safe growth. In addition, the survey instrument was aimed at further integrating the subject of hazard risk management into the dialogue of local community planning and to possibly consider and identify new actions as it relates to those local planning policies or programs already in place or under development. It is anticipated that the Safe Growth Survey will be used again during future plan updates to help measure progress over time and to continue identifying possible mitigation actions as it relates to future growth and community development practices, and how such actions may better be incorporated into local planning mechanisms.

The results of the Safe Growth Survey are summarized in Table 63. This includes describing how strongly the Town's planning staff agrees or disagrees with 25 statements as they relate to Southwick's current plans, policies, and programs for guiding future community growth and development, according to the following scale:

1=Strongly Disagree 2=Somewhat Disagree 3=Neutral 4=Somewhat Agree 5=Strongly Agree

Table 63. Safe Growth Survey Results.

COMPREHENSIVE/MASTER PLAN	
Land Use	
1. The comprehensive/master plan includes a future land use map that clearly identifies natural hazard areas.	$\boxed{1}$ 2 3 4 5

2. Current land use policies discourage development and/or redevelopment within natural hazard areas. ** Administered through Zoning Bylaw*	1 2 3 $\boxed{4}$* 5
3. The comprehensive/master plan provides adequate space for expected future growth in areas located outside of natural hazard areas.	1 2 3 4 $\boxed{5}$
Transportation	
4. The transportation element limits access to natural hazard areas.	1 $\boxed{2}$ 3 4 5
5. Transportation policy is used to guide future growth and development to safe locations.	1 2 $\boxed{3}$ 4 5
6. Transportation systems are designed to function under disaster conditions (e.g., evacuation, mobility for fire/rescue apparatus, etc.).	1 2 3 4 $\boxed{5}$
Environmental Management	
7. Environmental features that serve to protect development from hazards (e.g., wetlands, riparian buffers, etc.) are identified and mapped.	1 2 3 $\boxed{4}$ 5
8. Environmental policies encourage the preservation and restoration of protective ecosystems.	1 2 3 $\boxed{4}$ 5
9. Environmental policies provide incentives to development that is located outside of protective ecosystems.	1 2 3 $\boxed{4}$ 5
Public Safety	
10. The goals and policies of the comprehensive/master plan are related to and consistent with those in the hazard mitigation plan.	$\boxed{1}$ 2 3 4 5
11. Public safety is explicitly included in the comprehensive/master plan's growth and development policies.	1 $\boxed{2}$ 3 4 5
12. The monitoring and implementation section of the comprehensive/master plan covers safe growth objectives.	$\boxed{1}$ 2 3 4 5
ZONING BYLAWS	

13. The zoning bylaws conform to the comprehensive/master plan in terms of discouraging development and/or redevelopment within natural hazard areas.	1 $\boxed{2}$ 3 4 5
14. The bylaws contain natural hazard overlay zones that set conditions for land use within such zones.	1 2 3 $\boxed{4}$ 5
15. Rezoning procedures recognize natural hazard areas as limits on zoning changes that allow greater intensity or density of use.	$\boxed{1}$ 2 3 4 5
16. The bylaws prohibit development within, or filling of, wetlands, floodways, and floodplains.	1 $\boxed{2}$ 3 4 5
SUBDIVISION REGULATIONS	
17. The subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas.	$\boxed{1}$ 2 3 4 5
18. The regulations provide for conservation subdivisions or cluster subdivisions to conserve environmental resources. ** Administered through Zoning Bylaw*	1 2 3 4 $\boxed{5}$*
19. The regulations allow density transfers where hazard areas exist.	$\boxed{1}$ 2 3 4 5
CAPITAL IMPROVEMENT PROGRAM AND INFRASTRUCTURE POLICIES	
20. The capital improvement program limits expenditures on projects that would encourage development and/or redevelopment in areas vulnerable to natural hazards.	$\boxed{1}$ 2 3 4 5
21. Infrastructure policies limit the extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards.	$\boxed{1}$ 2 3 4 5
22. The capital improvements program provides funding for hazard mitigation projects identified in the hazard mitigation plan.	$\boxed{1}$ 2 3 4 5
OTHER	
23. Small area or corridor plans recognize the need to avoid or mitigate natural hazards.	1 2 3 $\boxed{4}$ 5

24. The building code contains provisions to strengthen or elevate new or substantially improved construction to withstand hazard forces.	1 2 $\boxed{3}$ 4 5
25. Economic development and/or redevelopment strategies include provisions for mitigating natural hazards or otherwise enhancing social and economic resiliency to hazards.	1 2 $\boxed{3}$ 4 5

Administrative and Technical Capabilities

Table 64 is based off Worksheet 4.1 from FEMA's *Local Mitigation Planning Handbook*. It was used by the HMPC to document 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 64. Administrative and Technical Findings.

Administrative/Technical Resource	Full-time (FT) / Part-time (PT) / Volunteer (V)	General Description / Effectiveness for Hazard Risk Reduction
Administration		
Planning Board	PT/V	The Planning Board consists of five volunteer members, who are elected to a five-year term. They are responsible for overseeing land use within the town to ensure that the residents live in a safe and healthy environment. They do this through the review of plans on the division of land for both residential and commercial developments. The Planning Board also reviews site plans for large additions to existing businesses and new signs. The Planning Board's day to day activities are handled by the Town Planner (PT) who has no specific duties for hazard risk reduction tasks.
Conservation Commission	PT/V	The Southwick Conservation Commission's mission is to serve as the conservation conscience of the Town, providing leadership for natural resources planning. The Commission works to protect, and where possible enhance plant and wildlife habitat to maintain Southwick's natural resources. The Conservation Office personnel

Administrative/Technical Resource	Full-time (FT) / Part-time (PT) / Volunteer (V)	General Description / Effectiveness for Hazard Risk Reduction
		consist of a part-time Coordinator. This is an annually appointed position by the Select Board. The Commission is also comprised of seven members who are appointed by the Select Board for a three-year term to oversee the requirements of the Massachusetts Wetland Protection Act, and other activities that potentially impact the environment.
Hazard Mitigation Planning Committee	Mix of FT/PT	Representatives include DPW Director (chair) and staff from multiple Town departments including Fire, Police, and Emergency Management. Regular review of HMP and MVP plans and coordination with other Town planning efforts. Effective for sustaining long-term risk reduction efforts across multiple departments.
Local Emergency Planning Committee	Mix of FT/PT	The Local Emergency Planning Committee (LEPC) is comprised of fourteen represented affiliations of the Town which are appointed by the Board of Selectmen. Their primary mission is addressing hazardous materials that are stored in and transported through Southwick. To better achieve their mission, the committee operates with four basic functions, one of which is to develop a Comprehensive Emergency Management Plan (CEMP for the Town and to keep the plan up to date. The LEPC has attained the status of Full Certification from the State Emergency Response Commission (SERC). The LEPC is a very active group and effectively coordinates in support of hazard risk reduction.
Maintenance Programs to Reduce Risk (e.g., tree trimming, drainage clearance)	FT (DPW)	Tree trimming and drain line clearing is performed as part of the day-to-day duties of Highway Department staff. Prescribed burns are performed by the Fire Department on an annual basis to minimize risk to wildfire.
Staff		

Administrative/Technical Resource	Full-time (FT) / Part-time (PT) / Volunteer (V)	General Description / Effectiveness for Hazard Risk Reduction
Chief Building Official	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	PT	Staffing is adequate to administer and enforce, but training for hazards and mitigation is lacking. Coordination between departments is effective.
Community Planner	PT	The Town Planner is a part time position who works under the Planning Board and Select Board and reports to the Chief Administrative Officer. Duties include but are not limited to assisting with the Planning Board application review & approval process; conducting site visits; coordinating with other town officials and boards; and reviewing/recommending options for land use regulations and bylaws. Staffing is adequate to administer and enforce, but training for hazards and mitigation is lacking. Coordination between departments is effective.
Town Engineer	PT	Staffing is adequate to administer and enforce, but training for hazards and mitigation is lacking. Coordination between departments is effective.
GIS Coordinator	No	GIS services for the Town are contracted out to a third party vendor, overseen by the Assessor's Office and Town Engineer (stormwater mapping).
Resource Development Staff or Grant Writers	No	N/A
Public Information Officer	No	N/A
Technical		
Staff with knowledge of land development and land management practices	PT Conservation Coordinator; PT Town Planner	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.

Administrative/Technical Resource	Full-time (FT) / Part-time (PT) / Volunteer (V)	General Description / Effectiveness for Hazard Risk Reduction
Staff with an understanding of natural hazards and risk mitigation	FT DPW Director; PT Stormwater Coordinator	Staff not trained in hazard risk reduction. Awareness of hazards is through experiences and discussions with others.
Hazards data and information	N/A	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.).
Warning systems/services (e.g., Reverse 911, outdoor warning signals, etc.)	FT and PT department heads	Department heads trained to use Code Red (reverse 911 system)

Financial Capabilities

Table 65 is based off Worksheet 4.1 from FEMA's *Local Mitigation Planning Handbook*. It was used by the HMPC to identify the Town's eligibility and access to funding sources that can be used to support the implementation of hazard mitigation projects.

Table 65. Financial Findings.

Financial Tool/Source	Accessible for 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	No	Managed individually by each Town department and large capital projects are mostly limited to priority building and infrastructure improvements identified in Building Needs Forecast and approved at Annual Town Meeting. The Capital Expenditures Committee reviews projects greater than $25,000.
Special purpose taxes	No	N/A
Fees for water, sewer, gas, or electric services	No	N/A
Stormwater utility fee	No	N/A
Development impact fees	No	N/A

Financial Tool/Source	Accessible for Hazard Mitigation (Yes/No)	General Description / Effectiveness for Hazard Risk Reduction
Incur debt through general obligation bonds and/or special tax bonds	Yes	Funds used to repair or replace aged and deteriorated culverts
Incur debt through private activities	No	Funds used to repair or replace aged and deteriorated culverts
FEMA Hazard Mitigation Assistance (HMA)	Yes	The Town has applied for HMGP grants in the past with some success, including for the update to this hazard mitigation plan. FEMA's current HMA grant programs (BRIC, FMA, HMGP) remain 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	Funds used to replace old and deteriorated drainage systems on various private roads.
Other federal funding programs	Yes	EPA, USACE, and other federal agencies do make grant funding available for a variety of resilience-themed 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. The Town has been successful in leveraging MVP Action Grants and Small Bridge Program funds used to replace aged and deteriorated culverts.

Education and Outreach Capabilities

Table 66 is based off Worksheet 4.1 from FEMA's *Local Mitigation Planning Handbook*. It was used by the HMPC to identify education and outreach programs that can be used to support mitigation activities.

Table 66. Education and Outreach Findings.

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 Community Emergency Response Team under FEMA/Citizen Corps is sponsored by the Southwick Emergency Management Agency. The mission is to support a community emergency response team with trained volunteers to aid in shelter operations, emergency communications, and provide assistance to public safety during major emergencies and disaster events.
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Yes	Fire prevention education programs are routinely delivered by the Fire Department, including those delivered to seniors and in partnership with school and the Southwick Public Library (Storytime, aimed at 1-5 year olds and their caregivers).
Natural disaster or safety-related school programs	Yes	Fire prevention education remains one of the Fire Department's top goals, and school programs are supported through available state grants, such as the Student Awareness of Fire Education (S.A.F.E.) program.
StormReady certification	Yes	Southwick was the first StormReady community in Massachusetts as certified by the National Weather Service, and currently one of only 21 communities across the state.
Firewise USA® certification	No	N/A
Public-private partnership initiatives addressing disaster-related issues	No	N/A
Other programs/methods?	Yes	Town website, social media, cable access television, etc.

National Flood Insurance Program (NFIP) Participation and Compliance

C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))

The National Flood Insurance Program (NFIP) is a program created by the United States Congress in 1968. The NFIP has two purposes: to share the risk of flood losses through flood insurance and to reduce flood damages by restricting floodplain development. The program enables property owners in participating communities to purchase insurance protection, administered by the government, against losses from flooding, and requires flood insurance for all federally backed loans or lines of credit that are secured by existing buildings, manufactured homes, or buildings under construction, that are located in FEMA-mapped special flood hazard areas in a community that participates in the NFIP. The availability of NFIP policy coverage is limited to communities that adopt adequate land use and control measures with effective enforcement provisions to reduce flood damages by restricting development in areas exposed to flooding. There are now more than 20,000 participating communities across the United States and its territories.

The Town of Southwick has participated in the NFIP since 1975. As summarized in Table 67, the HMPC used Worksheet 4.3 from FEMA's *Local Mitigation Planning Handbook* to collect information regarding the Town's participation in and compliance with the NFIP. This worksheet, in addition to a separate *NFIP Survey* for the Town's designated Community Floodplain Administrator, helped the HMPC to identify areas for improvement and other ideas that could be potential mitigation actions. These actions, including those related to continued compliance with NFIP requirements, are identified and further discussed in Chapter 6 (Mitigation Strategy).

Table 67. NFIP Participation and Compliance Findings.

NFIP Topic	Source of Information	Comments
Insurance Summary		
How many NFIP policies are in the community? What is the total premium and coverage?	FEMA NFIP Services, Flood Insurance Data and Analytics; State NFIP Coordinator	As of May 31, 2023, a total of 14 NFIP policies are in force. The total premium is $9,511 for a total of $3,535,000 in coverage. The average annual premium paid is $679 per policy.
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	FEMA NFIP Services, Flood Insurance Data and Analytics (HUDEX report)	There has been a total of 14 claims paid since 1975, totaling $30,698 in losses. There has been one paid claim for substantial damage.
How many structures are exposed to flood risk within the community?	GIS analysis (FEMA FIRMs + building footprint data)	It has been estimated that 97 structures are at risk to the 1-percent annual chance flood, and 210 are at risk to the 0.2 percent annual chance flood for a combined total of 307 structures exposed to flood risk.

NFIP Topic	Source of Information	Comments
Describe any areas of flood risk with limited NFIP policy coverage	HMPC	No address-specific data has been made available by FEMA, but it is generally assumed that owners of property located in special flood hazard areas are underinsured when it comes to flood insurance coverage (based on only 14 current policies under the NFIP in comparison to more than 300 structures estimated to be exposed to moderate to high flood risk).
Staff Resources		
Is the Community FPA or NFIP Coordinator certified?	Community FPA	No
Is floodplain management an auxiliary function?	Community FPA	Yes, for the Town's Building Commissioner.
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Community FPA	The Town complies with the NFIP by enforcing floodplain regulations, maintaining up-to-date floodplain maps, and providing information to property owners and builders regarding floodplains and building requirements.
What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	Staff time and resources that can be dedicated to floodplain management activities.
Compliance History		
Is the community in good standing with the NFIP?	Community FPA, State NFIP Coordinator, FEMA	Yes
Are there any outstanding compliance issues (i.e., current violations)?	Community FPA	No
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	State NFIP Coordinator, FEMA (CIS)	Most recent CAC was on 9/15/2006. Most recent CAV was on 9/17/1998.
Is a CAV or CAC scheduled or needed?	Community FPA	No
Regulation		

NFIP Topic	Source of Information	Comments
When did the community enter the NFIP?	State NFIP Coordinator, FEMA (CIS)	7/16/1984 (Regular Entry) 12/29/1975 (Emergency Entry)
Are the FIRMs digital or paper?	Community FPA	Digital (updated as of 9/17/2014)
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	Community FPA	Floodplain regulations are administered through the enforcement of the Town's Zoning Bylaws by the Planning Board and Conservation Commission. This includes requirements which exceed current FEMA/NFIP minimum requirements. These regulations will be routinely updated as necessary to maintain compliance with existing NFIP and State minimum standards for floodplain management. As described earlier in this chapter, higher regulatory standards are also met through the Town's enforcement of the Massachusetts State Building Code. Other NFIP development requirements are included in the Town's administration of the Commonwealth's Wetlands Protection Act Regulations (CMR 10) and Title V (310 CMR 15) requirements for sewage treatment and disposal.
Provide an explanation of the permitting process.	Community FPA, community records	Process described in Bylaw Chapter 185, Section 20 (Flood Hazard and Wetlands District). Permitting reviews required by Planning Board and Conservation Commission. In addition, all subdivision proposals must be designed to assure that such proposals minimize flood damage, and that adequate drainage is provided to reduce exposure to flood hazards.
Community Rating System (CRS)		
Does the community participate in CRS?	Community FPA	No, however the Town will continue to explore the benefits of CRS participation as Risk Rating 2.0 goes into effect and as updates to the CRS program are made by FEMA.
What is the community's CRS Class Ranking?	N/A	N/A

NFIP Topic	Source of Information	Comments
What categories and activities provide CRS points and how can the class be improved?	N/A	N/A
Does the plan include CRS planning requirements	Yes	Yes, many of the planning requirements under CRS Activity 510 are included in the plan but will not be evaluated or scored for credit until if/when the Town decides to apply for CRS participation.

Table 68 provides some additional information in response to the updated requirements included in FEMA's 2022 Local Mitigation Planning Policy Guide:[57]

Table 68. Additional NFIP Participation and Compliance Information.

Required Information	Response
Adoption of NFIP minimum floodplain management criteria via local regulation.	Zoning Bylaw Chapter 185, Section 20 (Flood Hazard and Wetlands District).
Adoption of the latest effective Flood Insurance Rate Map (FIRM), if applicable.	Zoning Bylaw Chapter 185, Section 20.B (District Boundaries), establishes the Flood Hazard and Wetlands District as shown on the official Flood Insurance Rate Map (FIRM) for the Town of Southwick dated September 17, 2014.
Implementation and enforcement of local floodplain management regulations to regulate and permit development in SFHAs.	See explanation of the Town's permitting process provided in Table 67.
Appointment of a designee or agency to implement the addressed commitments and requirements of the NFIP.	The Town's Building Commissioner has been appointed as the Community Floodplain Administrator.
Description of how participants implement the substantial improvement/substantial damage provisions of their floodplain management regulations after an event.	The Town implements the SI/SD provisions of its floodplain management regulations as required per the NFIP (CFR Title 44, Parts 59 thru 65) and Massachusetts State Building Code (780 CMR). The Town will also coordinate with State Flood Hazard Management Program staff to assure that proper practices are followed and that a post-disaster plan will be in place to implement all SI/SD provisions.

[57] Local Mitigation Planning Policy Guide. FEMA. April 2022. P. 26.

Summary and Conclusions

The Town of Southwick is a small, rural community with moderate capabilities and resources to support the implementation of hazard mitigation actions. This chapter provides documentation on the existing local authorities, policies, programs, and resources to support hazard mitigation.

In summary, the Town has strong planning and regulatory capabilities, including zoning bylaws, subdivision regulations, and stormwater regulations that promote public safety and hazard risk reduction through the Town's approval processes for new construction and development. The Town continues to review and consider updates to these regulations and procedures as needed. For example, in 2021, the Town updated its stormwater regulations to require the use of NOAA Atlas 14 precipitation data for determining peak stormwater runoff rates. The Town has also been effective in terms of maintaining and/or improving flood control structures across the community, including multiple culvert replacements and stormwater infrastructure projects designed to minimize flood damage and control stormwater flow.

In terms of administrative and technical capabilities, the Town is more limited. Existing Town staff are made up of a mix of full-time and part-time employees who often have many competing priorities on a daily operational basis. While staffing is generally considered adequate to administer and enforce the above referenced planning and regulatory capabilities, and interdepartmental coordination is effective, training and expertise on natural hazards mitigation is considered lacking for most. There is no one person dedicated to the coordination of the Town's resilience or sustainability efforts, though some associated tasks are part of the normal duties of existing departmental staff. The Town's many volunteers who serve on existing local boards and commissions do help bolster existing capabilities in many ways, including providing more focus on climate resilience and hazard mitigation as part of the Town's ongoing Master Plan Update process. In terms of emergency preparedness and response, the Town has excellent capabilities through adequate department staffing and training, a very active Local Emergency Planning Committee (LEPC) and a Community Emergency Response Team (CERT), strong administration of fire protection and prevention activities, and notably as demonstrated through designation as the state's first "StormReady" community as designated by the National Weather Service.

The Town is somewhat limited in terms of financial capabilities for implementing hazard mitigation projects, though it has been more active and successful in leveraging local funds in combination with external grant funds to address priority infrastructure improvements. This includes making investments in the repair or replacement of aged and deteriorated culverts or other improvements to stormwater drainage systems on various roads across the community. These financial investments are supported by various low-cost public outreach and educational efforts in support of stormwater management, fire prevention safety, climate resilience, and other topics on an as needed or recurring basis, such as the Fire Department's ongoing educational programs for seniors and children through their partnership with the Council on Aging, schools, the public library, and other organizations.

While the Town of Southwick has a moderate degree of capabilities and resources to support hazard mitigation activities, it can expand and improve on the capabilities described in this chapter. Some general and specific opportunities to address existing gaps or limitations in local capabilities to reduce risk have been identified for each capability type and are further described below. Each of these opportunities were then considered by the HMPC during the plan update process as potential new mitigation actions to be included in the Mitigation Strategy.

Opportunities to Expand and Improve on Capabilities to Reduce Risk

Planning and Regulatory Capabilities

- 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.
- Integrate the Town's community resilience planning efforts (HMP, MVP, Master Plan, and other resilience-themed plans/reports) into a consolidated document, website/dashboard, etc. This includes integrating future iterations of its MVP plans and reports (for example, under EEA's rollout of MVP Planning 2.0) into this Hazard Mitigation Plan through amendments or revisions that can occur before the next 5-year plan update.
- Conduct regulatory reviews and updates to the following Town bylaws and regulations to require and/or promote hazard resistant, climate-adaptive, and sustainable development standards. Use existing methods or tools for incorporating green infrastructure, low impact development, and other nature-based solutions (such as Mass Audubon's Bylaw Review Tool).
    - Floodplain District (Zoning, Chapter 185-20)
    - Site Plan Review (Zoning, Chapter 185-37)
    - Stormwater Regulations (Chapter 183)
    - Subdivision Regulations (Chapter 315)
    - Wetlands Protection (Chapter 450)
- Develop methods to help ensure the Town's capital projects do not encourage development and/or redevelopment in hazard areas.

Administrative and Technical Capabilities

- Increase staff time and resources that can be dedicated to community resilience, sustainability, and floodplain management activities. Create new hires (or convert PTEs to FTEs) as needed.
- Provide more training and professional development opportunities for Town staff who are engaged in community resilience planning and project implementation.
- Develop information/knowledge management system(s) to:
    - Serve as a central repository for hazard/climate-related information.

  - Help maintain coordination between departments on resilience-themed projects or routine maintenance activities.
  - Better cope with staff turnover or other disruptions to routine government functions.
- Continue to coordinate with PVPC for assistance as it relates to administrative and technical support.

Financial Capabilities

- 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.
- 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.
- Consider the designation or hiring of a dedicated resource development director / grants administrator for the Town to provide support across multiple departments that pursue their own external funding opportunities.
- Continue coordinating with the PVPC, neighboring communities, and others on regional resilience and risk reduction activities.

Education and Outreach Capabilities

- Increase use of the Town's website, social media, and other readily available methods to support low-cost public education initiatives on building community resilience to hazards through individual mitigation actions for homeowners, business owners, etc.
- Incorporate resilience-themed topics into existing or new education programs to increase community understanding of risk and opportunities to reduce risk through community, neighborhood, and individual actions.
- Identify and seek to address unmet needs through targeted outreach and education for the community's more vulnerable populations (i.e., environmental justice, residents with special needs, property owners in high-risk hazard areas, those who are homebound, etc.).

Possible New Actions Related to NFIP Participation and Compliance

- Review and update the Town's Floodplain District regulations (Zoning Bylaw, Chapter 185-20) in compliance with the State's Model Floodplain Bylaw.
- Evaluate permit application forms to determine possible modifications focused on flood hazard prevention. Develop a checklist for review of building/development permit plans and for inspection of development in floodplains (a model is available).
- Send information about the flood hazard and promote the availability of flood insurance through regularly scheduled mailings (such as the dissemination of handouts with annual property tax notices, utility bills, etc.).

- Maintain supplies of FEMA/NFIP materials to help property owners evaluate measures to reduce potential hazard damage. Make available in the Southwick Public Library, Town Hall, the Town's website, etc. and inform people who they can call to learn more information.

Develop a local Post-Disaster Substantial Damage Plan to assist with implementing substantial damage provisions of the NFIP, the State Building Code, and local floodplain regulations (guidance available).

Chapter 6. Mitigation Strategy

The hazard mitigation strategy is the culmination of work presented in the planning area profile, risk assessment and capability assessment. It is also the result of multiple meetings and thorough public outreach. The work of the Hazard Mitigation Planning Committee (HMPC) was essential in developing the mitigation goals and actions included in this chapter. As described in Chapter 3 Planning Process, the HMPC worked in a consistent, coordinated manner to identify and prioritize the goals and mitigation actions for this Plan.

Mitigation Goals

C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))

***GOALS** are broad, long-term policy and vision statements that explain what is to be achieved by implementing the mitigation strategy.*

Mitigation goals represent broad statements that are achieved through the implementation of more specific mitigation actions. These actions include both hazard mitigation policies (such as land use regulations) and hazard mitigation projects (such as structure or infrastructure projects). To develop goals for this Town of Southwick, MA Hazard Mitigation Plan the HMPC reviewed the 2016 Town of Southwick Hazard Mitigation Plan's goal statements, the Municipal Vulnerability Preparedness (MVP) Plan 2018 goal statements, and the goals of the State's Hazard Mitigation and Climate Adaptation Plan (SHMCAP).

The HMPC developed the goal statements in the figure below to represent their vision and priorities for the Town of Southwick in terms of hazard mitigation. All the hazards identified in this plan, while not named specifically in the goals, are implied and many are named specifically in the mitigation actions. When achieved by way of implementing the mitigation actions identified in this plan, the Town will mitigate risk posed by all identified hazards.

Reduce risk to people, property, infrastructure, natural and cultural resources from natural hazards and climate change.

Mitigate risk to public and private properties, new developments, and infrastructure from natural hazards and climate change.

Expand the Town's capacity to mitigate risk through local and regional collaboration, planning, and regulations.

Educate residents, business owners, and Town employees how to implement hazard mitigation measures and their value.

Figure 23. Mitigation Plan Goal Statements.

The 2016 Town of Southwick Hazard Mitigation Plan included thirty-three mitigation actions. For the purposes of this plan, all the actions were reviewed for their status and relevance. The following table shows the previous plan's thirty-three actions and the status of each. In addition to their status, if an action was moved forward to this plan the final column indicates the title of the new action.

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

Table 69. Status of 2016 Hazard Mitigation Actions.

Action #	Action Title/Location	Current Status	Current Status Description/Explanation	Keep for Updated Plan?	Updated Action Title/Description (if applicable)
1	Culvert Replacement	Partially Completed / In Progress	The following culverts are constructed - Shurtleff Brook Culvert on Granville Road, Shurtleff Brook Culvert on Fred Jackson Road, Shurtleff Brook Culvert on North Loomis Street, Johnson Brook Culvert on Klaus Anderson Road (not listed in last report). Kline Road culvert (small one near S. Loomis Street) has been designed and permitted. Tuttle Brook culvert on Granville Road is currently being designed and permitted. No action on the following culverts - Pearl Brook Culvert on College Highway, Munn Brook Bridge on North Loomis Street, Kline Road Culvert (large one near #35), Davis Road Culvert.	YES - updated/revised description provided at right, if applicable	Address top priorities on culvert replacement list, pending availability of funding. Culverts should be replaced to accommodate higher stormwater flows.
2	Dam Owner Education	Delayed	Delayed due to lack of resources and staff availability.	YES - updated/revised description provided at right, if applicable	Work with state to ensure dam owners understand their responsibility to inspect the dams regularly.
3	NFIP Education	Delayed	Delayed due to lack of resources and staff availability.	YES - updated/revised description	Educate citizens living in the floodplain about the NFIP.

Action #	Action Title/Location	Current Status	Current Status Description/Explanation	Keep for Updated Plan?	Updated Action Title/Description (if applicable)
				provided at right, if applicable	
4	Site Plan and Subdivision Review Training	Delayed	Delayed due to lack of resources and staff availability.	YES - updated/revised description provided at right, if applicable	Conduct site plan and subdivision review training to address topographic change, removal of cover vegetation, risk of erosion or siltation, and increase stormwater runoff.
5	Emergency Information	Delayed	Delayed due to lack of resources and staff availability.	YES - updated/revised description provided at right, if applicable	Collect, update, disseminate emergency information to the public ('home survival kit'; home preparation for natural disasters, evacuation procedures, etc.)
6	Community Rating System	Cancelled	The Town has decided not to pursue this action due to a lack of insurance policies and repetitive flooding.	NO - explanation provided at left	
7	Open Space and Recreation Plan	Partially Completed / In Progress	Objective 1-1: Alum treatment completed in 2021; Lake dredging not completed (still seeking funds). Objective 1-2: Lake treatments performed nearly every year. Objective 1-3:	YES - updated/revised description	Implement goals and strategies in Open Space and Recreation Plan.

Action #	Action Title/Location	Current Status	Current Status Description/Explanation	Keep for Updated Plan?	Updated Action Title/Description (if applicable)
			No actions taken. Objective 1-4: Fred Jackson Road and Klaus Anderson Road culverts completed. Objective 2-1: Preliminary discussions, but no formal actions taken. Objective 2-2: Some bylaw and regulation updates to promote green infrastructure, but no other actions taken on incentives to developers. Objective 2-3: No actions taken. Objective 3-1: CPA funds periodically being used to preserve farmland and open space. Objective 3-2: No actions taken. Objective 3-3: No actions taken. Objective 4-1: ConCom created a Town map listing and summarizing all Town-owned open spaces (parks, rail trail, hiking paths, lake destinations, etc.). No other actions taken. Objective 4-2: No actions taken. Objective 4-3: No actions taken. Objective 4-4: No actions taken.	provided at right, if applicable	
8	Earthquake Evaluation	Delayed	Delayed due to lack of resources and staff availability.	YES - updated/revised description provided at right, if applicable	Evaluate the older structures to be used as emergency shelters to determine if they are earthquake resistant.

Action #	Action Title/Location	Current Status	Current Status Description/Explanation	Keep for Updated Plan?	Updated Action Title/Description (if applicable)
9	Fire Safety and Education	Delayed	Delayed due to lack of resources and staff availability.	YES - updated/revised description provided at right, if applicable	Education action
10	Underground Power Lines	Delayed	Delayed due to lack of resources and staff availability.	YES - updated/revised description provided at right, if applicable	Work with Eversource Energy to facilitate the underground placement of new utility lines in general and existing utility lines in locations where repetitive outages occur.
11	Debris Management	Partially Completed / In Progress	SEMA has participated in several debris training courses and meetings.	YES - updated/revised description provided at right, if applicable	Participate in the creation of a Regional Debris Management Plan.
12	Drinking Water Supplies	Completed + To Be Continued	A new pump station on Jarry Drive was constructed in 2020 which increased the amount of water that can be pumped from the Springfield Water & Sewer connection. This connection will be able to independently	YES - updated/revised description provided at right, if applicable	Drought Plan.

Action #	Action Title/Location	Current Status	Current Status Description/Explanation	Keep for Updated Plan?	Updated Action Title/Description (if applicable)
			supply water to the Town during periods of normal water demand.		

The 2018 Municipal Vulnerability Preparedness (MVP) Plan includes thirty-six recommendations. The MVP is part of a Massachusetts state-wide initiative through the Executive Office of Energy and Environmental Affairs (EEA) to provide support to cities and towns to plan for resiliency and implement climate change adaptation actions. The recommendations identified in Southwick's MVP were reviewed and considered when developing mitigation actions for this plan update. Below is the list of MVP Recommendations with notes regarding their status and relevance in the Hazard Mitigation Plan.

Table 70. Status of MVP Recommendations.

MVP Recommendation	Notes / Comments
Highest Priority	
Build on the Town's existing field inventory of culverts, and bridges to rank and prioritize projects for increased flooding resiliency and storm-hardening, followed by design and implementation of priority re-sizing or replacement projects. Green infrastructure, Low-Impact Design, and other nature-based solutions will be integrated with hard-infrastructure improvements to establish approaches that will be robust in the face of natural hazards and climate-change scenarios. Incorporate specific design and permitting for the culvert at Klaus Anderson Road and Johnson Brook that includes upstream stormwater management and flood resiliency improvements. Pursue funding and implementation for the already-permitted culvert replacement at Fred Jackson Road and pay particular attention to known problem areas on Davis Road and Kline Road.	Town's stormwater mapping continually being updated. Town bylaws currently being reviewed to incorporate a promotion of green infrastructure and other low impact designs for new developments and re-developments. The culvert at Klaus Anderson Road was reconstructed using MVP funds and included a step pool and vegetated coir log systems. The culvert at Fred Jackson Road was reconstructed using Chapter 90 and local funds.
Implement existing designs for an emergency outlet from North Pond to Great Brook near South Longyard Road in order to provide flood protection and limit the potential for erosion and damage to nearby properties.	Seeking funding. No actions taken.
Develop and implement a weir or sluice gate system on Great Brook to prevent backflow during heavy precipitation events.	Delayed due to lack of resources and staff availability.

Organize an inter-Town action to restore Canal Brook and Great Brook to their original depths by conducting dredging and by clearing both channels of debris and blockages, including beaver dam obstructions.	Seeking funding. No actions taken.
Install cisterns in the northwest portion of town in order to provide water supply storage, especially for use in firefighting. Locations need to be chosen for two cisterns, with each having a capacity of at least 20,000 gallons.	Cisterns being required for new subdivisions in areas without municipal water.
Raise road levels and rebuild road bases in critical low-lying or wetland areas.	Delayed due to lack of resources and staff availability.
Increase enforcement of regulations related to maintenance of detention ponds. Ensure that the zoning enforcement officer has a list of all privately and publicly owned structures.	Delayed due to lack of resources and staff availability.
Review Town regulations and make improvements, where applicable, to encourage maintenance of privately-owned structures by property owners.	Delayed due to lack of resources and staff availability.
Perform a risk assessment of the wastewater pump stations and establish priority actions for reducing potential flooding impacts, including consideration of nature-based solutions or green infrastructure approaches. Establish plans to implement emergency back-up power for the pump stations.	Delayed due to lack of resources and staff availability.
Assess cost-effective green infrastructure opportunities to develop a list of specific priority projects where reduction of stormwater runoff could mitigate flooding risk without the need to conduct expensive culvert replacement and resizing projects. Assess feasibility and cost, rank priority projects in terms of climate resilience potential, and develop concept designs for key projects. Review Town regulations and update as	Town bylaws currently being reviewed to incorporate edits to promote green infrastructure.

necessary to support green infrastructure and low-impact development approaches.	
Conduct robust education and outreach to build awareness of town resources and make Town residents aware of the many planning efforts, agreements, shelters, evacuation routes, etc. which are focused on making the Town more resilient to climate change impacts. Ensure that all residents know how to access these resources when they are needed.	Delayed due to lack of resources and staff availability.
Prioritize expansion and reliability of gas mains serving Southwick to ensure that the Town is not cut off from gas supply during hazard events.	Several discussion and requests made to Columbia Gas, but no commitments given.
Eliminate dead spots in the Town's communications infrastructure, with particular attention to ensuring that the schools can communicate with emergency services personnel.	Delayed due to lack of resources and staff availability.
Establish a formal drought plan to detail appropriate actions to be taken during times of extended drought, with particular attention to developing alternate water supply sources for farmers, and providing for high water use events, such as Motocross events.	Delayed due to lack of resources and staff availability.
Moderate Priority	
Assess mosquito/ tick/ pest control options, including viability study of joining existing mosquito control district versus options for the town to manage control independently, determination of future risks due to increase in type and quantity of pests/ disease vectors due to climate change, and development of an education and outreach program.	Delayed due to lack of resources and staff availability.
Post emergency evacuation routes with clear signage. Routes currently exist but are not marked or well known.	Delayed due to lack of resources and staff availability.

Assemble an emergency response trailer, including temporary signage to mark non-permanent evacuation routes, barricades, and other equipment to facilitate efforts to re-route traffic and keep residents out of hazard areas.	Police Department has a emergency response trailer for this use
Conduct a study to identify alternate sources of tourism funding in order to ensure that the Town's economy does not suffer as changing climatic conditions increasingly impact recreation opportunities in Town.	Delayed due to lack of resources and staff availability.
Increase the efficiency of enforcement and inspections, including providing sufficient numbers of inspectors to effectively monitor and enforce regulations at the Congamond Lakes, including traffic management. Ensure that businesses are able to be inspected and reopen in timely fashion after hazard events.	The lake is periodically patrolled by Police Department staff.
Educate owners of private septic systems about the importance of having systems pumped out and keeping them in good working condition in order to prevent risks to public health and the environment from systems that become overwhelmed during periods of heavy precipitation.	Delayed due to lack of resources and staff availability.
Increase coordination and cooperation with Suffield, Connecticut to protect the Congamond Lakes and address issues with erosion, algal blooms, waterfowl, and septic systems.	Several discussions with Suffield regarding them hooking up to the Town's municipal sewer system. Suffield ultimately determined the cost was too great at the time to pursue.
Develop partnerships with local businesses to distribute information and help facilitate outreach efforts, particularly to vulnerable populations such as senior residents.	
Pursue public facilities upgrades that would increase resiliency, including long-term planning for relocation of the DPW garage to a location that would allow for multiple points of access. Install	A back-up generator was installed at the DPW facility. No further actions taken.

back-up power systems for the DPW garage and other critical facilities.	
Lower Priority	
Develop a Town-wide plan to limit human/ animal conflict, with a focus on maintaining open space corridors and appropriate habitat for large mammals (coyotes, bears, fisher cats), and establishing plans for beaver management.	Delayed due to lack of resources and staff availability.
Update the Town's 2003 flyover at improved resolution to provide better, more detailed information for resilience planning.	Delayed due to lack of resources and staff availability.
Encourage good building practices that minimize fire risk through minimization of vegetation at close range to structures, and use of non-combustible materials, such as concrete and aluminum siding.	Delayed due to lack of resources and staff availability.
Develop a comprehensive tree and forests management program to identify, remove, and replace problem trees, preserve intact forests and street tree cover, provide guidance and resources for gradually moving toward more climate-resilient trees and forest communities (e.g., species that will tolerate warmer temperatures).	Delayed due to lack of resources and staff availability.
Develop comprehensive invasive species management from inventory stage through management planning and implementation to address existing invasive populations that threaten features such as open space or forests, both of which contribute to resiliency,	Delayed due to lack of resources and staff availability.

Comprehensive Range of Mitigation Actions

C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))

***A MITIGATION ACTION** is a measure, project, plan or activity proposed to reduce current and future vulnerabilities described in the risk assessment.*

Identifying a range of mitigation actions was a process that included identifying and analyzing a potential list of natural hazards (described in Chapter 4), then a list of problem statements was developed describing the impacts of each hazard and specific areas of high hazard and specific vulnerable assets. Following, the work done in the Risk Assessment, the HMPC considered possible solutions or actions for each problem identified.

These actions included recommendations from the Capability Assessment (described in Chapter 5), and review of potential actions in each of FEMA's mitigation action categories (plans and regulations, structure and infrastructure, natural resources protection, and education and awareness). This process is illustrated in the figure below. The first column Hazards, indicates four areas of climate change interaction which is how the hazards were reviewed in the Risk Assessment (Chapter 4). The second column, Problems, indicates that the hazards caused problems in the categories of risk, geographic area, and vulnerable asset. The third column, Actions, shows the four categories of mitigation action.

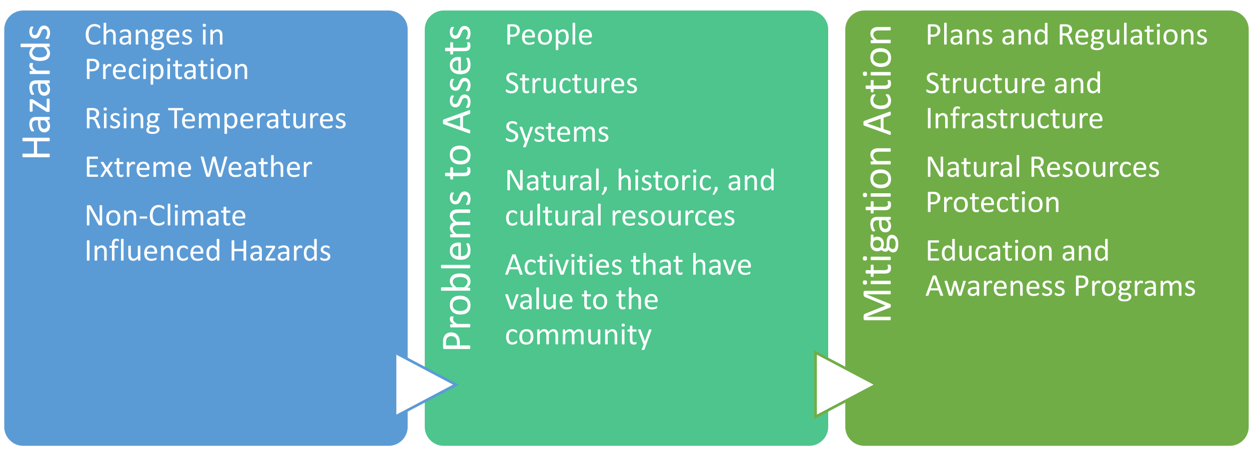


Figure 24. Process of Identifying a Range of Mitigation Actions.

The identified problems were detailed in the Risk Assessment (Chapter 4). The HMPC considered a variety of mitigation actions to address each identified problem. These ranged within the four mitigation action categories defined in Figure 25 below.

Local Plans and Regulations
- Government authorities, policies, or codes that shape how land and buildings are developed and maintained.

Structure and Infrastructure
- Projects modifying existing infrastructure to remove it from a hazard area, or building new structures in ways that reduce the impacts of hazards.

Natural Systems Protection
- Actions that reduce damage and losses, and that preserve or restore the functions of natural systems.

Education and Awareness Programs
- Sustained programs to teach the public and decision makers about hazard risks and community mitigation programs.

Figure 25. Four Types of Mitigation Actions.

Examples of actions in each of the above categories are shown in the table below.

Table 71. Examples of Mitigation Actions.

Mitigation Action Category	Examples of Mitigation Actions
Local Plans and Regulations	• Comprehensive plans • Land use ordinances • Subdivision regulations • Development review • Building codes and enforcement • NFIP Community Rating System • Capital improvement programs • Open space preservation • Stormwater management regulations and master plans
Structure and Infrastructure Projects	• Acquisitions and elevations of structures in flood-prone areas • Utility undergrounding • Structural retrofits • Floodwalls and retaining walls • Detention and retention structures • Culverts

Mitigation Action Category	Examples of Mitigation Actions
Natural Systems Protection	• Sediment and erosion control • Stream corridor restoration • Forest management • Conservation easements • Wetland restoration and preservation
Education and Awareness Programs	• Radio or television spots • Websites with maps and information • Real estate disclosure • Presentations to school groups or neighborhood organizations • Mailings to residents in hazard-prone areas

Potential mitigation actions for each identified hazard and problem identified in the Risk Assessment are shown Table 72 below. Hazards are listed in order of risk. Some of these mitigation actions are included in the Action Plan; some were not included because of cost-benefit-analysis outcomes or inconsistency with Town priorities. This table represents a sample of the types of actions the Town considered.

Table 72. Possible Mitigation Actions.

Hazard	Possible Mitigation Action(s)
Severe Winter Storms	• Underground power lines.
Extreme Temperatures	• Plant shade trees.
Flood	• Replace culverts. • Educate dam owners.
Drought	• Develop a drought plan.
Infectious Disease	• Dispense emergency information.
Hurricanes/Wind	• Develop a tree and forest management program.
Invasive Species	• Develop a debris management plan that includes handling quantities of diseased trees.

Hazard	Possible Mitigation Action(s)
Other Severe Weather	• Underground power lines. • Replace inadequate culverts.
Tornadoes	• Create a Debris Management Plan.
Wildfires/Brushfires	• Provide fire safety education
Earthquakes	• Evaluate buildings for earthquake vulnerability.
Landslide	• Provide landslide education to homeowners.

Mitigation Action Plan

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

The HMPC then had the job to identify cost-effective mitigation actions; projects to address the identified hazards, areas of risk and vulnerable assets. An online Mitigation Action Tracker was developed for the Town to track the implementation of each mitigation action. The Mitigation Action Tracker was an online spreadsheet with separate cells showing each action's essential details. These column labels listed below are included to facilitate the Town's ability to sort through the actions as well as to apply for grant funding.

- Action Title
- Action Description
- Responsible Lead
- Supporting Agencies
- Potential Grant Funding Sources
- Implementation Schedule
- Estimated Cost
- Hazard(s) Addressed

The HMPC considered each of the types of mitigation actions for each of the identified problems. Mitigation actions supporting underserved communities and environmental justice communities were specifically considered by the HMPC. They also focused on actions to the built environment both buildings and infrastructure as well as future development or redevelopment. The resulting list of mitigation actions includes at a minimum one action for hazard identified. In several instances multiple actions address an identified hazard and problem. For instance, flooding is addressed through multiple actions as shown in the table below.

The priority order was chosen based on weighing costs versus benefits. It was imperative for the Town to determine if the costs associated with an action were reasonable compared to the corresponding benefits. To do this, the HMPC developed a prioritization table that included seven categories of criteria; these are detailed in the table below. Each category was assigned points with priority criteria given the highest points. The most points an action could earn was 19. Actions that scored 12 points or more were given High priority, actions with a score of 10-11 were given medium priority, and actions with a score of 9 or less were given low priority. The complete breakdown of points is shown in Appendix B.

Table 73. Priority Ranking System.

	Criteria Category	**Description**	**Detailed Ranking and Associated Points**
1	Hazards Addressed	What level of hazards does the measure provide protection against?	High (Severe Winter Storm/Nor'easter, Extreme Temperatures, Flood) = 3 Medium (Drought, Infectious Disease, Hurricane/Wind, Invasive Species, Other Severe Weather, Tornado, Wildfire/Brushfire) = 2 Low (Earthquake, Landslide) = 1
2	Approximate Cost	How much will the measure cost to implement?	Low (Under $50k) = 3 Medium ($50k - $250k) = 2 High over $250k) = 1
3	Equity Focus	Does the measure provide support to Environmental Justice (EJ) and other Vulnerable Populations?	Direct Support = 3 Indirect Support = 2 No Support = 0
4	Protection of Lives	How effective is the measure in protecting lives and mitigating injuries resulting from the targeted hazard(s)?	Direct Support = 3 Moderate Indirect Support = 2

	Criteria Category	Description	Detailed Ranking and Associated Points
			Minor Indirect Support = 1 None = 0
5	Protection of Critical Facilities or Infrastructure	Does the measure provide protection of critical facilities and infrastructure?	Yes = 3 No = 0
6	Natural Resource Protection	Does the measure provide protection of natural resources and no touch zones?	Yes = 2 No = 0
7	Alignment with Objectives	Does the measure align with the HMP objectives?	Yes =2 No =0

All the actions are listed in Table 74 in order of priority with the actions corresponding details. Additional tables are included in Appendix B. The breakdown of priority ranking points for each action is included in Appendix B. Readers of this plan must understand that the mitigation action list is aspirational, it does not mean that the HMPC is confident that all actions may be implemented in the span of five years.

Table 74. Southwick Hazard Mitigation Actions.

1	Dam Owner Education	
High	**Action Description**	Work with state to ensure dam owners understand their responsibility to inspect the dams regularly.
	Lead Position	Chairman, Agriculture Commission
	Supporting Agencies	Agriculture Commission, Conservation Commission
	Cost	Low
	Potential Funding Sources	Conservation Commission Education Budget
	Hazards	Flood (Dam Failure)
	Implementation Schedule	2024-2028

2	Culvert Replacements	
High	Action Description	Address top priorities on culvert replacement list, pending availability of funding. Culverts should be replaced to accommodate higher stormwater flows.
	Lead Position	Department of Public Works Director
	Supporting Agencies	Conservation Commission
	Cost	$400,000 to $500,000 per culvert
	Potential Funding Sources	FEMA BRIC, Chapter 90, Municipal Vulnerability Preparedness, Culvert Replacement Municipal Assistance, Small Bridge Program
	Hazards	Flood (Flash Flooding)
	Implementation Schedule	2023-2028

3	Open Space and Recreation Plan	
High	Action Description	Implement goals and strategies in Open Space and Recreation Plan.
	Lead Position	Conservation Committee Chairman
	Supporting Agencies	Planning Board, AgCom, Select Board
	Cost	Low
	Potential Funding Sources	Conservation Commission Education Budget, Park and Recreation Commission Operations Budget
	Hazards	Flood (Flash Flooding), Drought
	Implementation Schedule	2025-2028

4	Earthquake Evaluation	
High	Action Description	Evaluate the older structures to be used as emergency shelters to determine if they are earthquake resistant.
	Lead Position	Building Inspector
	Supporting Agencies	SEMA
	Cost	Low
	Potential Funding Sources	Planning Board Operations Budget, DPW Operations Budget
	Hazards	Earthquake
	Implementation Schedule	2025-2027

5	Site Plan and Subdivision Review Training	
Medium	Action Description	Conduct site plan and subdivision review training to address topographic change, removal of cover vegetation, risk of erosion or siltation, and increase stormwater runoff.
	Lead Position	Planning Board Chairman
	Supporting Agencies	Conservation Commission
	Cost	Low
	Potential Funding Sources	Emergency Management Education Budget
	Hazards	Flood (Flash Flooding)
	Implementation Schedule	2025-2026

6	**Emergency Information**	
Medium	**Action Description**	Collect, update, disseminate emergency information to the public ('home survival kit'; home preparation for natural disasters, evacuation procedures, etc.)
	Lead Position	SEMA
	Supporting Agencies	
	Cost	Low
	Potential Funding Sources	DPW Operations Budget
	Hazards	All Hazards
	Implementation Schedule	2025-2028

7	**NFIP Participation and Compliance**	
Medium	**Action Description**	Educate citizens living in the floodplain about the NFIP; Review and update the Town's Floodplain District regulations (Zoning Bylaw, Chapter 185-20) in compliance with the State's Model Floodplain Bylaw; Evaluate permit application forms to determine possible modifications focused on flood hazard prevention; Send information about the flood hazard and promote the availability of flood insurance through regularly scheduled mailings (such as the dissemination of handouts with annual property tax notices, utility bills, etc.); Maintain supplies of FEMA/NFIP materials to help property owners evaluate measures to reduce potential hazard damage. Make available in the Southwick Public Library, Town Hall, the Town's website, etc. and inform people who they can call to learn more information.; and Develop a local Post-Disaster Substantial Damage Plan to assist with implementing substantial damage provisions of the NFIP, the State Building Code, and local floodplain regulations.
	Lead Position	Floodplain Coordinator
	Supporting Agencies	SEMA
	Cost	Low
	Potential Funding Sources	DPW Operations Budget
	Hazards	Flood (Flash Flooding)
	Implementation Schedule	2025-2028

8	Underground Power Lines	
Medium	Action Description	Work with Eversource Energy to facilitate the underground placement of new utility lines in general and existing utility lines in locations where repetitive outages occur.
	Lead Position	Department of Public Works Director
	Supporting Agencies	
	Cost	Low
	Potential Funding Sources	DPW Operations Budget
	Hazards	Severe Winter Storms, Other Severe Weather, Hurricanes/Wind, Tornados, Earthquakes
	Implementation Schedule	2026-2028

9	Tree and Forest Management Program	
Medium	Action Description	Develop a comprehensive tree and forests management program to identify, remove, and replace problem trees, preserve intact forests and street tree cover, provide guidance and resources for gradually moving toward more climate-resilient trees and forest communities (e.g. species that will tolerate warmer temperatures).
	Lead Position	Conservation Committee Chairman
	Supporting Agencies	Open Space and Recreation Committee; Park and Rec Commission; Department of Public Works
	Cost	Low
	Potential Funding Sources	DPW Operations Budget, Conservation Commission Operating Budget
	Hazards	Wildfires/Brushfires
	Implementation Schedule	2026-2028

10	Fire Safety and Education	
Low	**Action Description**	Educate residents and business owners about fire safety.
	Lead Position	Fire Chief
	Supporting Agencies	
	Cost	Low
	Potential Funding Sources	Fire Department Education Budget
	Hazards	Wildfires/Brushfires, Extreme Temperatures
	Implementation Schedule	2025-2028

11	Debris Management	
Low	**Action Description**	Participate in the creation of a Regional Debris Management Plan.
	Lead Position	Department of Public Works Director
	Supporting Agencies	
	Cost	Low
	Potential Funding Sources	DPW Operations Budget, Western Regional Homeland Security Advisory Council Grant
	Hazards	All Hazards
	Implementation Schedule	2026-2027

12	Drought Plan	
Low	Action Description	Establish a formal Drought Plan to detail appropriate actions to be taken during times of extended drought, with particular attention to developing alternate water supply sources for farmers and providing for high water use events.
	Lead Position	SEMA
	Supporting Agencies	
	Cost	Medium
	Potential Funding Sources	Emergency Management Operations Budget
	Hazards	Drought
	Implementation Schedule	2026-2027

13	Canal Brook and Great Brook Dredging	
Low	Action Description	Organize an inter-Town action to restore Canal Brook and Great Brook to their original depths by conducting dredging and by clearing both channels of debris and blockages, including beaver dam obstructions.
	Lead Position	Lake Management Committee
	Supporting Agencies	Citizens Restoring Congamond, Conservation Commission
	Cost	High
	Potential Funding Sources	Lake Management Committee Operations Budget
	Hazards	Flood (Flash Flooding)
	Implementation Schedule	2028-2030

14	Shade Trees	
Low	Action Description	Plant shade trees at select locations on Town properties and rights-of-way to offset heat island effects during high temperatures.
	Lead Position	Department of Public Works Director
	Supporting Agencies	
	Cost	Medium
	Potential Funding Sources	DPW Operations Budget
	Hazards	Extreme Temperatures
	Implementation Schedule	2026-2028

15	Earthquake and Landslide Education	
Low	Action Description	Educate residents and business owners about earthquake and landslides.
	Lead Position	SEMA
	Supporting Agencies	
	Cost	Low
	Potential Funding Sources	Emergency Management Operations Budget
	Hazards	Earthquakes, Landslides
	Implementation Schedule	2025

Table 75 shows the mitigation actions that specifically target vulnerable populations and Table 76 shows the mitigation actions that specifically target buildings and infrastructure. Each table lists the actions in order of priority.

Table 75. Actions that Target Vulnerable Populations.

Action #	Action Title
6	Emergency Information
7	NFIP Participation and Compliance
10	Fire Safety and Education

Action #	Action Title
12	Drought Plan

Table 76. Actions that Target Buildings and Infrastructure.

Action #	Action Title
2	Culvert Replacements
4	Earthquake Evaluation
8	Underground Power Lines
14	Shade Trees

Possible Funding Sources

All the mitigation actions included in this plan have identified one or more potential funding sources. The HMWG focused on projects eligible for MVP Grant funding and FEMA BRIC funding. Below is a list of some of the federal and state funding mechanisms that may assist in implementing mitigation actions.

Federal Emergency Management Agency (FEMA) Mitigation Grants
The Federal Emergency Management Agency (FEMA) makes grant funding available for a range of mitigation activities via several Hazard Mitigation Assistance (HMA) programs. These grant programs provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages. They are not intended to fund repair, replacement, or deferred maintenance activities but are rather designed to assist in developing long-term, cost-effective improvements that will reduce risk to natural hazards.

- **Building Resilient Infrastructure and Communities (BRIC)**
  BRIC is a new FEMA hazard mitigation program designed to replace the agency's former HMA Pre-Disaster Mitigation (PDM) grant program, aiming to categorically shift the federal focus away from reactive disaster spending and toward research-supported, proactive investment in community resilience. It is a result of recent amendments made to Section 203 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) by Section 1234 of the Disaster Recovery Reform Act of 2018 (DRRA). BRIC will support states, local communities, tribes, and territories as they undertake hazard mitigation projects reducing the risks they face from natural hazards. The BRIC program's guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency.

- **Hazard Mitigation Grant Program (HMGP)**
  The HMGP is authorized under Section 404 of the Stafford Act. The HMGP provides grants to states, tribes, and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. A key purpose of the HMGP is to ensure that any opportunities to take critical mitigation measures to protect life and property from future disasters are not lost during the recovery and reconstruction process following a disaster. HMGP is typically available only in the months after a federal disaster declaration, as funding amounts are determined based on a percentage of the funds spent on FEMA's Public and Individual Assistance programs.
- **Flood Mitigation Assistance (FMA) Program**
  The FMA program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the NFIP. FEMA provides FMA funds to assist states and communities with implementing measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. The long-term goal of FMA is to reduce or eliminate claims under the NFIP through mitigation activities. One limitation of the FMA program is that it is generally used to provide mitigation for structures that are insured or located in Special Flood Hazard Areas (SFHAs) as mapped by FEMA. Federal funding for this nationally competitive grant program is generally an annual allocation (subject to Congressional appropriation) and eligibility is linked to a community's good standing in the NFIP.

Municipal Vulnerability Preparedness Action Grants[58]
The MVP Action Grant offers financial resources to municipalities seeking to advance priority climate adaptation actions to address climate change impacts resulting from extreme weather, sea level rise, inland and coastal flooding, severe heat, and other climate impacts.

Responses to the RFR may be submitted by municipalities who have received designation from the Executive Office of Energy and Environmental Affairs (EEA) as a Climate Change Municipal Vulnerability Preparedness (MVP) Community, or "MVP Community." All projects are required to provide monthly updates, project deliverables, a final project report, and a brief project summary communicating lessons learned. The municipality is also required to match 25% of total project cost using cash or in-kind contributions. All proposals must include the following:

- Completed application template
- Project budget and deliverables
- MVP yearly progress report describing any relevant work toward advancing community priorities since earning MVP designation

[58] State of Massachusetts. *MVP Action Grant.* https://www.mass.gov/service-details/mvp-action-grant.

- Statement of match
- Letters of support from landowner (if applicable), partners, and the public

Project types include:

- ***Detailed Vulnerability and Risk Assessment*** – In-depth vulnerability or risk assessment of a particular sector, location, or other aspect of the municipality.
- ***Public Education and Communication*** – Projects that increase public understanding of climate change impacts within and beyond the community and foster effective partnerships to develop support.
- ***Local Bylaws, Ordinances, Plans, and other Management Measures*** – Projects to develop, amend, and implement local ordinances, bylaws, standards, plans, and other management measures to reduce risk and damages from extreme weather, heat, flooding, and other climate change impacts.
- ***Redesigns and Retrofits*** – Engineering and construction projects to redesign, plan, or retrofit vulnerable community facilities and infrastructure (e.g., wastewater treatment plants, culverts, and critical municipal roadways/evacuation routes) to function over the life of the infrastructure given projected climate change impacts.
- ***Energy Resilience Strategies*** — Projects that incorporate clean energy generation and that are paired with resilience enabling technology to maintain electrical and/or heating and cooling services at critical facilities.
- ***Chemical Safety and Climate Vulnerabilities*** — Projects that seek to engage the business and manufacturing community through assistance or training on identifying vulnerabilities to chemical releases due to severe weather events, reducing use of toxic or hazardous chemicals, outreach to improve operations and maintenance procedures to prevent chemical releases and accidents, outreach to improve emergency and contingency planning, and/or identifying existing contaminated sites that pose chemical dispersion risks during flood events.
- ***Nature-Based Storm-Damage Protection, Drought Mitigation, Water Quality, and Water Infiltration Techniques*** – Projects that utilize natural resources and pervious surfaces to manage coastal and inland flooding, erosion, and other storm damage, such as stormwater wetlands and bio-retention systems, and other Smart Growth and Low Impact Development techniques.
- ***Nature-Based, Infrastructure and Technology Solutions to Reduce Vulnerability to Extreme Heat and Poor Air Quality*** – Projects that utilize natural resources, vegetation, and increasing pervious surface to reduce ambient temperatures, provide shade, increase evapotranspiration, improve local air quality, and otherwise provide cooling services within the municipality.
- ***Nature-Based Solutions to Reduce Vulnerability to other Climate Change Impacts*** – Nature-based projects that address other impacts of climate change such as extreme weather, damaging wind and power outages, and increased incidence of pests and vector-borne illnesses and other public health issues.

- ***Acquisition of Land to Achieve a Resiliency Objective*** — Land purchases are eligible for grant funding if the parcel has been identified through a climate vulnerability assessment as an appropriate location for a specific eligible adaptation activity to occur, such as accommodating an infrastructure or facility redesign or retrofit project, providing natural flood storage to reduce downstream flooding, or removal of pavement and planting of trees to reduce flooding and heat island effects.
- ***Ecological Restoration and Habitat Management to Increase Resiliency*** — Projects that repair or improve natural systems for community and ecosystem adaptation, such as right-sizing culverts, dam removal, restoration of coastal wetlands, etc.
- ***Subsidized Low Income Housing Resilience Strategies*** — Investments in resiliency measures for affordable housing to protect vulnerable populations that may not have the resources to recover from an extreme climate event.
- ***Mosquito Control Districts*** — Projects to reduce the risk to public health from mosquito-borne illness and to increase mosquito surveillance and control capacity by incentivizing municipalities not in an organized mosquito control project or district to form a new mosquito control district or join an existing mosquito control district. Also funding for municipalities currently in a mosquito control district for new or proactive mosquito control measures.

Chapter 7. Plan Integration and Maintenance

The Hazard Mitigation Planning Committee (HMPC) will implement the mitigation strategy and specific mitigation actions outlined in this plan, and update and maintain the plan according to the guidelines below. The HMPC includes key stakeholders in the Town, who will use the plan's goals, as well as continued analysis of hazard risks and capabilities, to weigh the available resources against the costs and benefits for each mitigation action. The Town understands the value of this plan and its positive mitigation impact and intend to continue updating this plan and implementing the plan's strategies.

Continued Public Participation

D1. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))

Public participation is an integral component of the mitigation planning process and will continue to be essential as this plan is implemented and updated over time. Based on the high level of interest in the mitigation planning process and in the Municipal Vulnerability Preparedness project, Town residents and stakeholders are interested in mitigation. The HMPC included several education and outreach mitigation actions designed to engage the public. The Town intends to involve the public throughout the five-year implementation of this plan, as well as in the reviewing and updating processes. The Department of Public Works Director will take the lead in soliciting participation from the public. This participation will take multiple forms, including all of those outlined in the Chapter 3: Planning Process of this plan. Efforts to involve the public include:

- Advertising on the Town's website and posting news and announcements on the Town's social media pages.
- The Town will record with closed captioning all meetings to air on the public television station.
- Copies of this plan will remain on the Town's website; and a hard copy will be kept in the Selectboard Office and the Planning Office for public review. Updates to the plan will also be posted on the Town's website.
- The Town of Southwick will continue to work with private industry, regional agencies, and adjacent communities as this plan is implemented.

Method and Schedule for Keeping the Plan Current

D2. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))

The HMPC and the Town of Southwick recognize the importance of keeping the mitigation plan up to date. Keeping the plan current includes monitoring, evaluating, and updating the plan over a five-year period. The overall responsibility for monitoring the implementation of the plan rests with the HMPC members, led by the Department of Public Works Director.

Process to Track Actions

Together the Department of Public Works Director and the HMPC will maintain the Mitigation Action Tracker (a tool to record the status of each mitigation action). They will send a reminder email with a link to the web-based Mitigation Action Tracker on a semi-annual basis (January and July) to all Department Heads responsible for a mitigation action and to relevant Town committees. They may also distribute the Mitigation Action Progress Worksheet (shown in Appendix C) for Department Heads who prefer a form over a digital spreadsheet.

If the Town experiences a large-scale disaster, the Department of Public Works Director will assemble a HMPC meeting to update the list of mitigation actions and review their order based on current priorities.

Process to Evaluate Effectiveness of the Plan

The HMPC has agreed to meet on a semi-annual basis to review the implementation of the mitigation plan. The first meeting will take place in June; the second, in January.

At the first meeting (June 2023), the HMPC will review the effectiveness of the planning process, public and stakeholder engagement, risk analysis, and the mitigation strategy, including its implementation. It is recommended that the HMPC use the worksheet provided in Appendix C. Beyond considering the planning process, the HMPC will seek to answer the following questions to determine if the plan is effective at mitigating risk to Town residents, the built environment, and the natural environment.

- Can the HMPC identify success stories of losses avoided because of hazard mitigation measures implemented? Can the HMPC identify political, social, and economic successes?
- Have the mitigation actions implemented achieved benefits beyond the cost of mitigation?
- Have the implemented mitigation actions saved lives or protected property?
- Does the list of mitigation actions coincide with the Town's priorities? Do additional actions need to be added?

Process to Update the Plan

At each semi-annual meeting, the HMPC will review the plan's goal statements and mitigation action status. If necessary, the goal statements and mitigation actions may be revised to reflect current Town priorities. In addition, the HMPC will discuss methods for continuing to integrate the mitigation plan with other plans, processes, and projects in the Town.

They will prepare a one-page brief regarding each semi-annual HMPC meeting to share with the Select Board and to post on the Town website. The HMPC recognizes the value in keeping the public and key stakeholders informed about the implementation and status of the mitigation plan.

HMPC members will continue to participate in regional and state-based meetings to stay current with best risk-mitigation practices. Such meetings may include the Massachusetts Emergency Management Agency (MEMA), the Pioneer Valley Planning Commission (PVPC), and Baystate Noble Hospital. The HMPC will also participate in land use planning and mitigation planning meetings with their neighbors, Westfield, Granville, and Agawam within the State of Massachusetts and its neighbors in Connecticut which include Suffield, Granby, and Hartland.

The Town of Southwick agrees to update and adopt this mitigation plan on a five-year basis. The update will include a comprehensive review and planning process like the one used to develop this mitigation plan update. It will update the mitigation action list, current land use practices, collect and review best available data, review the capability assessment, and engage the public and stakeholders. This process will occur according to FEMA guidelines. The HMPC will seek funding for the development of the plan update **two years** before the plan expires. The plan update process gives the Town the chance to add and/or re-prioritize mitigation actions based on current risk, capabilities, and public/stakeholder suggestions. The Department of Public Works Director will serve as the Project Manager for the update process. The figure below illustrates the update timeline.

Plan Integration

D3. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))

For the Town of Southwick to succeed in reducing hazard risks over the long term, the information, ideas, conclusions, and strategic recommendations of this hazard mitigation plan should be integrated throughout government operations. Effective integration means to include mitigation principles, vulnerability information, and mitigation actions into other existing community planning mechanisms to leverage activities that have co-benefits, reduce risk, and increase resilience. Many other local plans and processes will present opportunities to address hazard mitigation in a way that can support multiple community objectives, so an important part of maintaining and implementing this hazard mitigation plan will be to identify and capitalize on these opportunities to leverage activities that have co-benefits (including but not limited to risk reduction). The Town's recent updates to its stormwater regulations in 2021 to require higher standards for design flows (referencing NOAA Atlas 14 for rainfall data) demonstrates this type of integration by stressing the importance of community sustainability and climate resilience strategies across various elements of the local planning and regulatory framework.

The HMPC will remain tasked with helping to ensure that all new or updated local plan documents are informed by and consistent with the goals and actions of this hazard mitigation plan and will not contribute to increased hazard vulnerability in Southwick. Specifically, this includes but is not limited to the implementation or future updates to the following local plans as identified and further described in Chapter 5 (Capability Assessment):

- Master Plan (Southwick 2040)
- Stormwater Management Plan (2021)
- Southwick Open Space and Recreation Plan (2020)
- Municipal Vulnerability Preparedness (MVP) / Community Resilience Building (CRB) Summary of Findings Report (2018)
- Water Conservation Plan (2005)

Additional opportunities to integrate the requirements of this plan into other local planning mechanisms shall continue to be identified through future meetings of the HMPC and through the five-year review process described in this chapter. Other planning mechanisms include local regulations and existing code enforcement procedures (i.e., zoning bylaws, site plan review, etc.), internal municipal policies, special projects or initiatives, and other routine government or community decision-making activities such as capital improvement planning and the Town's annual budget process. Emphasis for identifying these integration opportunities will be placed on those governance structures used to manage local land use and community development in both the pre-disaster and post-disaster environment. Also, as it relates to implementing specific mitigation actions identified in this plan, it will be the responsibility of each assigned lead department to determine additional measures that can support action completion or enhancement. This includes integrating mitigation actions from this plan into other local planning documents, processes, or mechanisms as deemed appropriate and most effective.

While it is recognized that there are many possible benefits to integrating components of this plan into other local planning mechanisms, the routine maintenance of this stand-alone plan is considered by the Town to be the most effective and appropriate method to identify, prioritize, and implement local hazard mitigation actions. In moving forward, however, the Town will consider the incorporation of some other plan documents into the hazard mitigation plan, such as any future iterations of the Town's MVP Plan or related climate adaptation planning efforts.

Appendix A. Planning Process Supporting Materials

Hazard Mitigation Planning Committee Meetings

HMPC Meeting Participants

First Name	Last Name	Title	Affiliation	Phone	Email	#1 2/2/2023	#2 4/5/2023	#3 5/25/2023	#4 7/13/2023
Russell	Anderson	Director	Southwick Emergency Management Agency	413-569-0308	ema@southwickma.gov	☐	☐	☐	☐
Rhett	Bannish	Lieutenant	Southwick Police Department	413-569-5348	274@swkpd.com	☑	☑	☑	☑
Jessica	Bishop	Deputy Chief	Southwick Fire Department	413-569-6363	jbishop@southwickfire.net	☐	☐	☑	☑
Randal	Brown	DPW Director	Southwick Public Works Department	413-569-6772	rbrown@southwickma.gov	☑	☑	☑	☑
John Francis	Cain	Business Representative	Southwick Local Emergency Planning Committee	413-569-8090	John@cainsmechanical.com			☐	☐
Nadine	Cignoni	Assistant Chief Administrative Officer	Town of Southwick	413-569-5995	ncignoni@southwickma.gov			☐	☐
Charles	Dunlap	Director	Southwick Emergency Management Agency	413-569-0308	ema@southwickma.gov	☑	☐	☑	☐
Diane	Gale	Select Board Clerk	Town of Southwick	413-569-5995	dgale@southwickma.gov			☑	☐
Thomas	Hibert	Health Director	Southwick Health Department	413-569-1212	thibert@southwickma.net			☐	☐
Cecil	Lewis	Security Professional	Baystate Noble Hospital	413-571-0000	cecil.lewis@baystatehealth.org	☐	☐	☑	☐
Paul	Miles	Sergeant	Southwick Police Department	413-569-5348	272@swkpd.com	☐	☑	☐	☐
Doug	Moglin	Select Board Chairman	Town of Southwick	413-569-5995	dmoglin@southwickma.gov	☐	☐	☐	☐
Jason	Perron	Select Board Vice Chairman	Town of Southwick	413-569-5995	jperron@southwickma.gov	☐	☐	☑	☐
Richard	Stefanowicz	Chief	Southwick Fire Department	413-569-6363	rstefanowicz@southwickfire.net	☐	☐	☑	☑
Karl J.	Stinehart	Chief Administrative Officer	Town of Southwick	413-569-5995	kstinehart@southwickma.gov			☐	☐
Cindy	Sullivan	Director	Southwick Council on Aging	413-569-5498	csullivan@southwickma.gov	☐	☐	☐	☐
Joshua	Towse	Emergency Manager	Baystate Noble Hospital	413-571-0000	Joshua.Towse@baystatehealth.or	☐	☐	☐	☐
Joseph	Turmel	Director of Finance and Operations	Southwick Regional School	413-569-6171	jturmel@stgrsd.org			☐	☐
Iaian	White	Radio Officer	Southwick Emergency Management Agency	413-569-0308	ema@southwickma.gov	☐	☐	☑	☐
Jennifer	Willard	Superintendent	Southwick Regional School	413-569-6171	jwillard@stgrsd.org			☐	☐
Karen	Wzorek	Transportation Supervisor	Southwick Regional School	413-569-6171	kwzorek@stgrsd.org	☐	☐	☐	☐
Jeffrey	Zukowski	Hazard Mitigation Planner	MA Emergency Management Agency	508-820-1422	jeffrey.zukowski@state.mas.us	☐	☐	☐	☐

Public Outreach Materials Sample

Disaster Mitigation Public Meeting

March 29, 2023

6:00pm - 7:00pm

Zoom Link on Town Website https://www.southwickma.org

Share your ideas to make Town more resilient to natural hazards such as floods, drought, high winds, and winter storms.

APRIL 19, 2023

PUBLIC MEETING ON ZOOM

The Town of Southwick is updating the Town's Hazard Mitigation Plan. This plan serves as a strategy for reducing current and future risks of natural hazards and climate change. The public as well as regional and local stakeholders are invited to learn about the Hazard Mitigation Plan and share their ideas for reducing impacts associated with natural hazards. Approved by FEMA, the plan allows the Town to apply for pre-disaster mitigation grant funding.

FOR MORE INFORMATION CONTACT

Randal Brown
Department of Public Works
Director

Town of Southwick

(413) 569-6772
rbrown@southwickma.net

Disaster Mitigation Public Meeting

July 19, 2023

11:00am - 12:00pm

Zoom Link on Town Website https://www.southwickma.org

Share your ideas to make Town more resilient to natural hazards such as floods, drought, high winds, and winter storms.

JULY 19, 2023

PUBLIC MEETING ON ZOOM

Southwick's Hazard Mitigation Planning Committee needs the Public's help completing the Town's Hazard Mitigation Plan. This plan serves as a strategy for reducing current and future risks of natural hazards and climate change. The public is invited to share their ideas for reducing impacts associated with natural hazards and to learn about the updated plan. Approved by FEMA, the plan allows the Town to apply for pre-disaster mitigation grant funding.

FOR MORE INFORMATION CONTACT

Randal Brown
Department of Public Works
Director

Town of Southwick

(413) 569-6772
rbrown@southwickma.net

Appendix B. Mitigation Actions.

Priority Ranking Points

Table 77. Priority Ranking Data for Mitigation Actions.

Action #	Action Title	Hazards Addressed	Approximate Cost	Equity Focus	Protection of Lives	Protection of Critical Facilities or Infrastructure	Protection of Natural Resources	Alignment with Objectives	Total
1	Dam Owner Education	3	3	0	1	3	2	2	14
2	Culvert Replacements	3	1	0	2	3	2	2	13
3	Open Space and Recreation Plan	3	3	0	2	0	2	2	12
4	Earthquake Evaluation	2	3	0	2	3	0	2	12
5	Site Plan and Subdivision Review Training	3	3	0	1	0	2	2	11
6	Emergency Information	3	3	2	3	0	0	2	11

Action #	Action Title	Hazards Addressed	Approximate Cost	Equity Focus	Protection of Lives	Protection of Critical Facilities or Infrastructure	Protection of Natural Resources	Alignment with Objectives	Total
7	NFIP Participation and Compliance	3	3	2	2	0	0	2	10
8	Underground Power Lines	3	3	0	2	0	0	2	10
9	Tree and Forest Management Program	2	3	0	1	0	2	2	10
10	Fire Safety and Education	2	3	2	2	0	0	2	9
11	Debris Management	3	3	0	1	0	0	2	9
12	Drought Plan	2	2	2	1	0	0	2	9
13	Canal Brook and Great Brook Dredging	3	1	0	0	0	2	2	8
14	Shade Trees	2	2	0	1	0	0	2	7
15	Earthquake and Landslide Education	1	3	0	1	0	0	2	7

Types of Mitigation Actions

Table 78. Types of Mitigation Actions.

Mitigation Action Type	Priority	Action #	Action Title
Education and Awareness	High	1	Dam Owner Education
	Medium	6	Emergency Information
		7	NFIP Participation and Compliance
	Low	10	Fire Safety and Education
		15	Earthquake and Landslide Education
Local Planning and Regulations	High	3	Open Space and Recreation Plan
	Medium	5	Site Plan and Subdivision Review Training
	Low	11	Debris Management
		12	Drought Plan
Natural Systems Protection	Medium	9	Tree and Forest Management Program
	Low	13	Canal Brook and Great Brook Dredging
Structure and Infrastructure	High	2	Culvert Replacements
		4	Earthquake Evaluation
	Medium	8	Underground Power Lines
	Low	14	Shade Trees

Actions Sorted by Goal Statement

Table 79. Actions Sorted by Goal Statement.

Mitigation Goal	Priority	Action Title
Capacity	Medium	Site Plan and Subdivision Review Training
		Underground Power Lines
	Low	Debris Management
		Drought Plan
Education	High	Dam Owner Education
	Medium	Emergency Information
		NFIP Participation and Compliance
	Low	Earthquake and Landslide Education
		Fire Safety and Education
Infrastructure	High	Culvert Replacements
		Earthquake Evaluation
	Low	Shade Trees
Natural Resources	High	Open Space and Recreation Plan
	Medium	Tree and Forest Management Program
	Low	Canal Brook and Great Brook Dredging

Actions Sorted by Hazard

Table 80. Actions Sorted by Hazard.

Hazard(s) Addressed	Priority	Action #	Action Title
All Hazards	Medium	6	Emergency Information
	Low	11	Debris Management
Drought	Low	12	Drought Plan
Earthquake	High	4	Earthquake Evaluation
Earthquakes, Landslides	Low	15	Earthquake and Landslide Education
Extreme Temperatures	Low	14	Shade Trees
Flood (Dam Failure)	High	1	Dam Owner Education
Flood (Flash Flooding)	High	2	Culvert Replacements
	Medium	5	Site Plan and Subdivision Review Training
		7	NFIP Participation and Compliance
	Low	13	Canal Brook and Great Brook Dredging
Flood (Flash Flooding), Drought	High	3	Open Space and Recreation Plan
Severe Winter Storms, Other Severe Weather, Hurricanes/Wind, Tornados, Earthquakes	Medium	8	Underground Power Lines
Wildfires/Brushfires	Medium	9	Tree and Forest Management Program
Wildfires/Brushfires, Extreme Temperatures	Low	10	Fire Safety and Education

Actions Sorted by Lead Position

Table 81. Actions Sorted by Lead Position.

Lead Position	Action #	Action Title
Building Inspector	4	Earthquake Evaluation
Conservation Committee Chairman	3	Open Space and Recreation Plan
	9	Tree and Forest Management Program
Department of Public Works Director	2	Culvert Replacements
	8	Underground Power Lines
	11	Debris Management
	14	Shade Trees
Fire Chief	10	Fire Safety and Education
Floodplain Coordinator	7	NFIP Participation and Compliance
Lake Management Committee	13	Canal Brook and Great Brook Dredging
Planning Board Chairman	5	Site Plan and Subdivision Review Training
SEMA	6	Emergency Information
	12	Drought Plan
	15	Earthquake and Landslide Education
Chairman, Agriculture Commission	1	Dam Owner Education

Actions Sorted by Implementation Schedule

Table 82. Actions Sorted by Implementation Schedule.

Implementation Schedule	Action #	Action Title
2025	15	Earthquake and Landslide Education
2023-2028	2	Culvert Replacements
2024-2028	1	Dam Owner Education
2025-2026	5	Site Plan and Subdivision Review Training
2025-2027	4	Earthquake Evaluation
2025-2028	3	Open Space and Recreation Plan
	6	Emergency Information
	7	NFIP Participation and Compliance
	10	Fire Safety and Education
2026-2027	11	Debris Management
	12	Drought Plan
2026-2028	8	Underground Power Lines
	9	Tree and Forest Management Program
	14	Shade Trees
2028-2030	13	Canal Brook and Great Brook Dredging

Appendix C. Plan Implementation and Review Supporting Materials.

Plan Update Evaluation Worksheet

Plan Section	Considerations	Explanation
Planning Process	Should the town invite any additional stakeholders to participate in the planning process? What public outreach activities have occurred? How can public involvement be improved?	
Risk Assessment	What disasters has the town, or the region experienced? Should the list of hazards be modified? Are new data sources, maps or studies available? If so, what have they revealed, and should the information be incorporated into the plan update? Has development in the region occurred and could it create or reduce risk?	
Capability Assessment	Has the town adopted new policies, plans, regulations, or reports that could be incorporated into this plan? Are there different or additional administrative, human, technical, and financial resources available for mitigation planning? Are there different or new education and outreach programs and resources available for mitigation activities?	
Mitigation Strategy	Is the mitigation strategy being implemented as anticipated? Were the cost and timeline estimate accurate? Should new mitigation actions be added to the Action Plan? Should existing mitigation actions be revised or removed from the plan? Are there new obstacles that were not anticipated in the plan that will need to be considered in the next plan update? Are there new funding sources to consider? Have elements of the plan been incorporated into other planning mechanisms?	
Implementation Plan	Was the plan monitored and evaluated as anticipated? What are needed improvements to the plan implementation procedures?	

Mitigation Action Progress Worksheet

<table>
<tr><th colspan="5">Mitigation Action Progress Worksheet</th></tr>
<tr><td>Progress Report Period</td><td colspan="2">From Date</td><td colspan="2">To Date</td></tr>
<tr><td>Action/Project Title</td><td colspan="4"></td></tr>
<tr><td>Responsible Department</td><td colspan="4"></td></tr>
<tr><td>Contact Name</td><td colspan="4"></td></tr>
<tr><td>Contact Phone/Email</td><td colspan="4"></td></tr>
<tr><td>Project Description</td><td colspan="4"></td></tr>
<tr><td>Project Goal</td><td colspan="4"></td></tr>
<tr><td>Project Objective</td><td colspan="4"></td></tr>
<tr><td>Project Cost</td><td colspan="4"></td></tr>
<tr><td colspan="5">Project Status</td></tr>
<tr><td>Date of Project Approval</td><td>Date of Project Start</td><td>Anticipated Date of Completion</td><td>Project Canceled</td><td>Project Delayed</td></tr>
<tr><td colspan="5">Explanation of Delay or Cost Overruns</td></tr>
<tr><td colspan="5">Project Report Summary</td></tr>
<tr><td colspan="5">What was accomplished for this project during this reporting period?</td></tr>
<tr><td colspan="5">What obstacles, problems, or delays did the project encounter?</td></tr>
<tr><td colspan="5">Plans for next reporting period.</td></tr>
</table>

Appendix D. Hazus Reports

Hazus: Flood Global Risk Report

Region Name: Southwich_FL

Flood Scenario: 100Year

Print Date: Thursday, April 27, 2023

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

Table of Contents

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Massachusetts

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is approximately 4 square miles and contains 141 census blocks. The region contains over 4 thousand households and has a total population of 9,232 people. The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 3,885 buildings in the region with a total building replacement value (excluding contents) of 1,907 million dollars. Approximately 87.62% of the buildings (and 68.43% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 3,885 buildings in the region which have an aggregate total replacement value of 1,907 million dollars. Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,304,912	68.4%
Commercial	342,840	18.0%
Industrial	100,107	5.2%
Agricultural	10,559	0.6%
Religion	22,667	1.2%
Government	100,241	5.3%
Education	25,631	1.3%
Total	**1,906,957**	**100%**

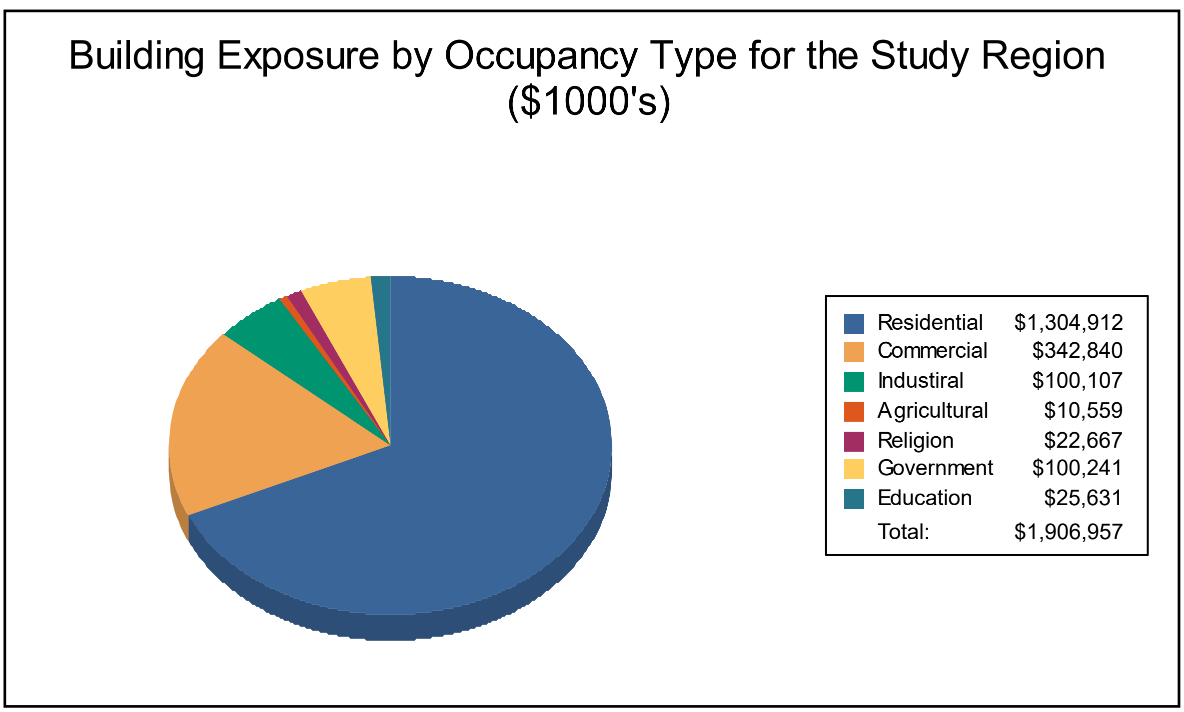
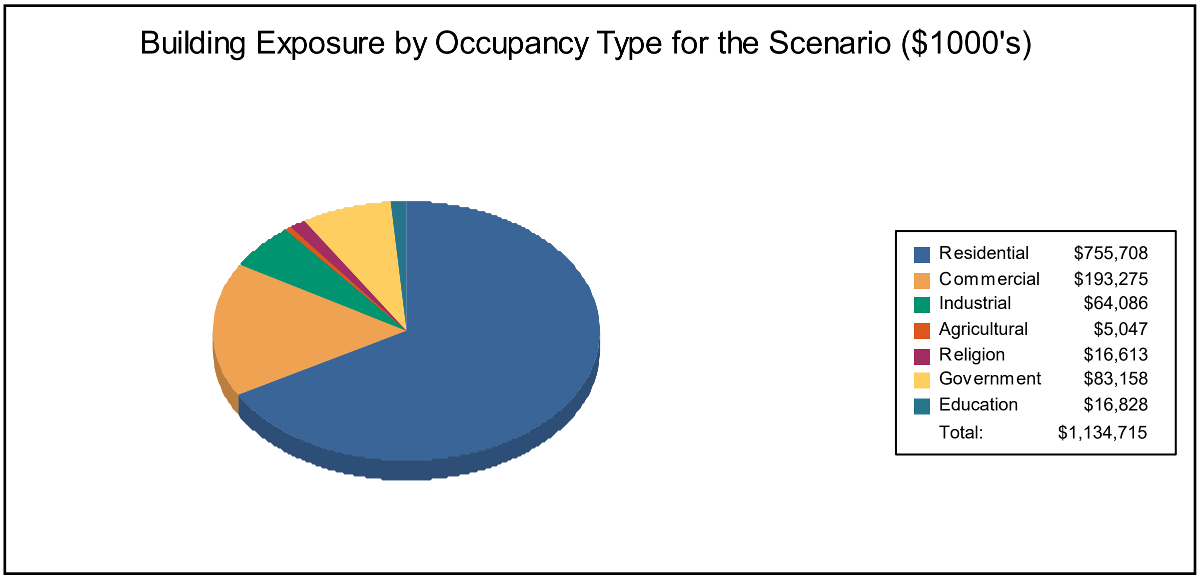


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	755,708	66.6%
Commercial	193,275	17.0%
Industrial	64,086	5.6%
Agricultural	5,047	0.4%
Religion	16,613	1.5%
Government	83,158	7.3%
Education	16,828	1.5%
Total	**1,134,715**	**100%**



Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 1 fire station, 1 police station and 2 emergency operation centers.

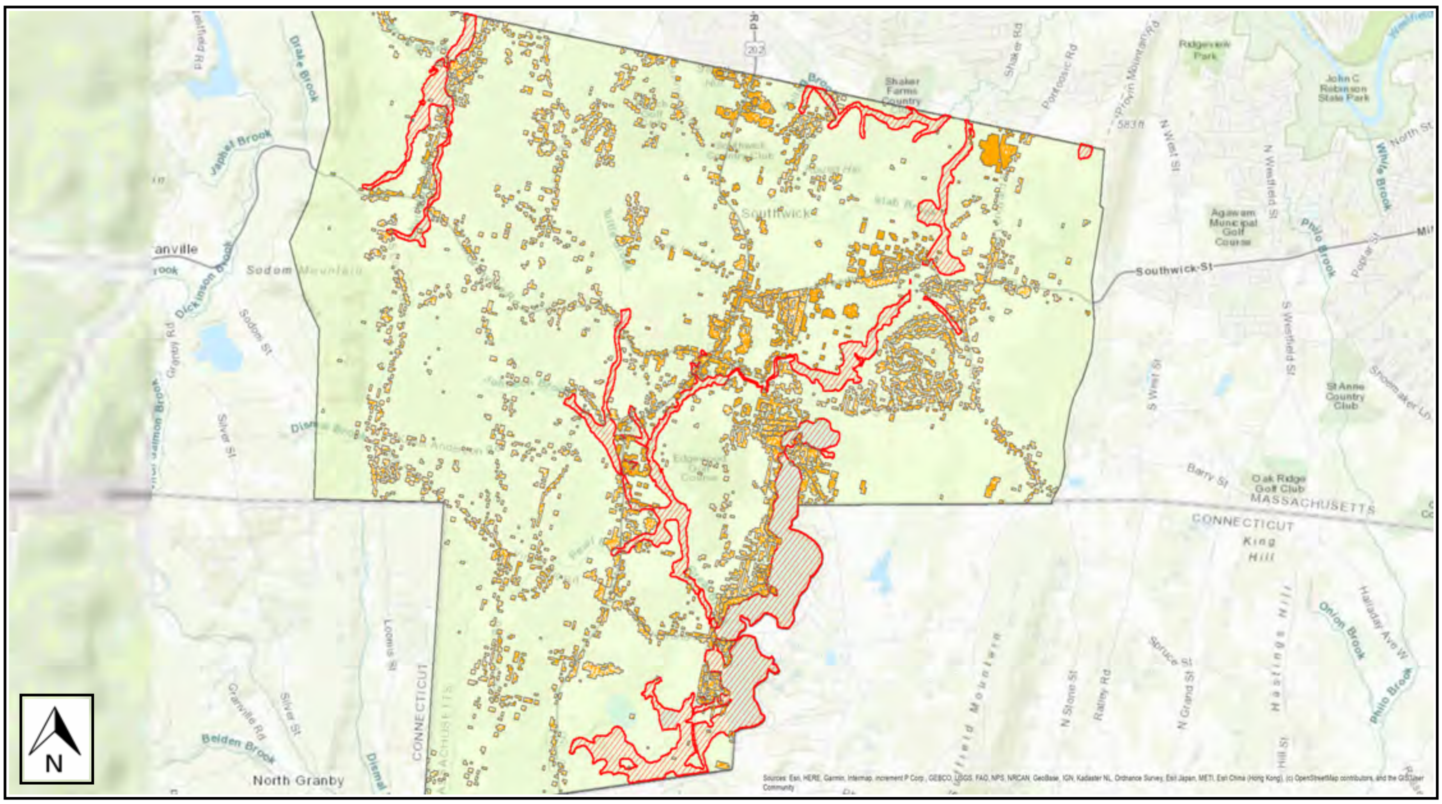
Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	Southwich_FL
Scenario Name:	100Year
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 8 buildings will be at least moderately damaged. This is over 100% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

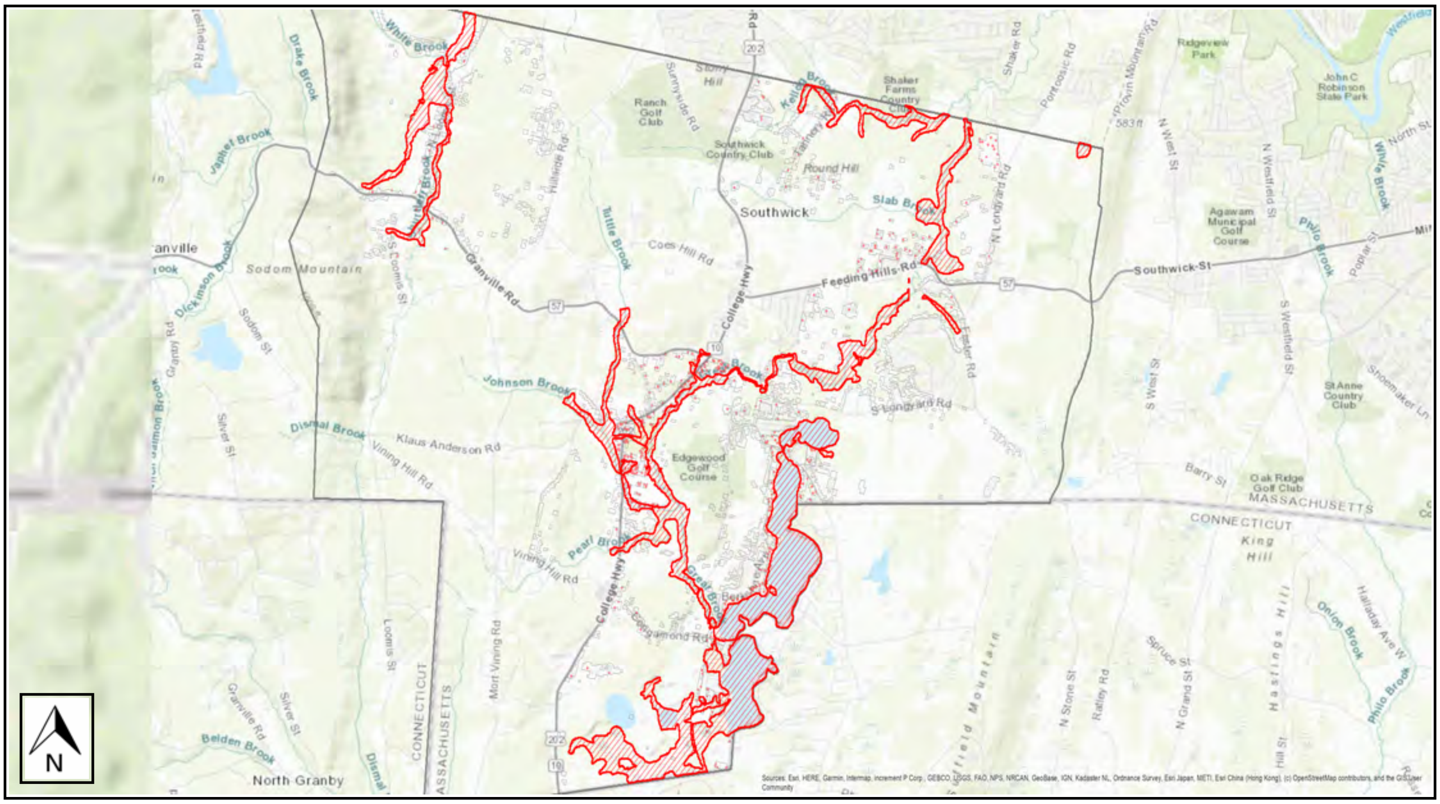


Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		>50	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0	0	0	0	0
Residential	5	38	8	62	0	0	0	0	0	0	0	0
Total	**5**		**8**		**0**		**0**		**0**		**0**	

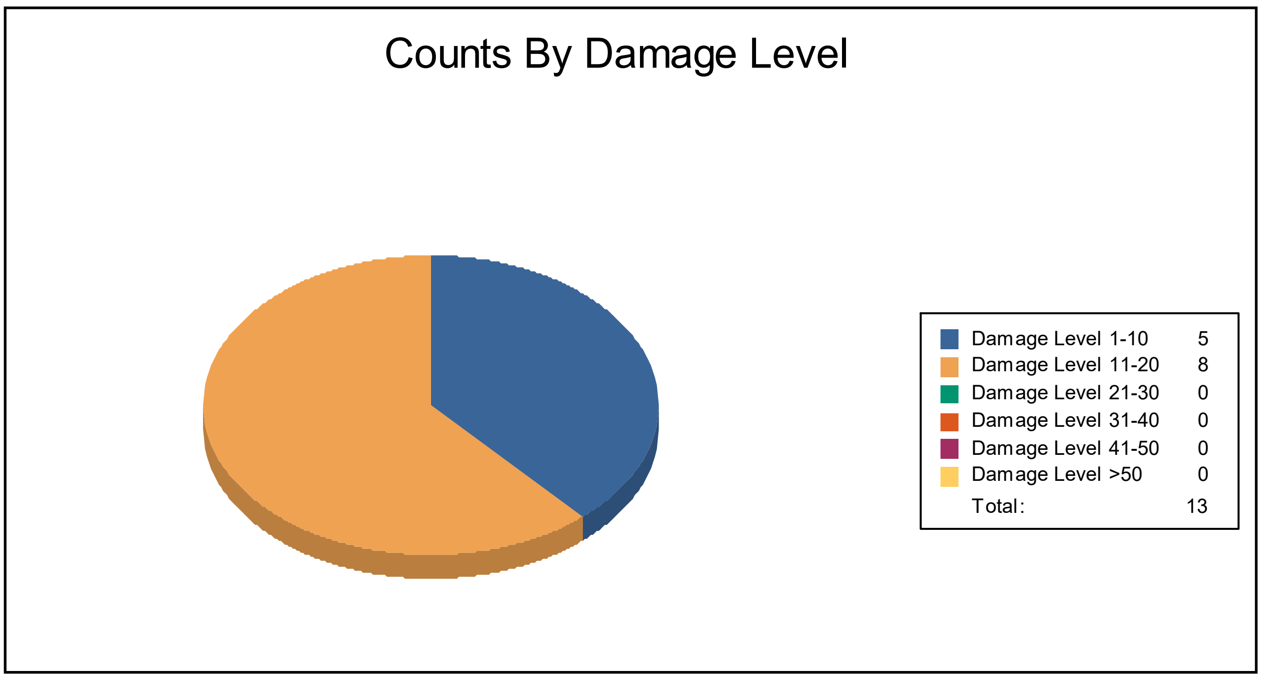


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	0	0	0	0	0	0	0	0	0	0	0	0
Steel	0	0	0	0	0	0	0	0	0	0	0	0
Wood	5	38	8	62	0	0	0	0	0	0	0	0

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Emergency Operation Centers	2	0	0	0
Fire Stations	1	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	3	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

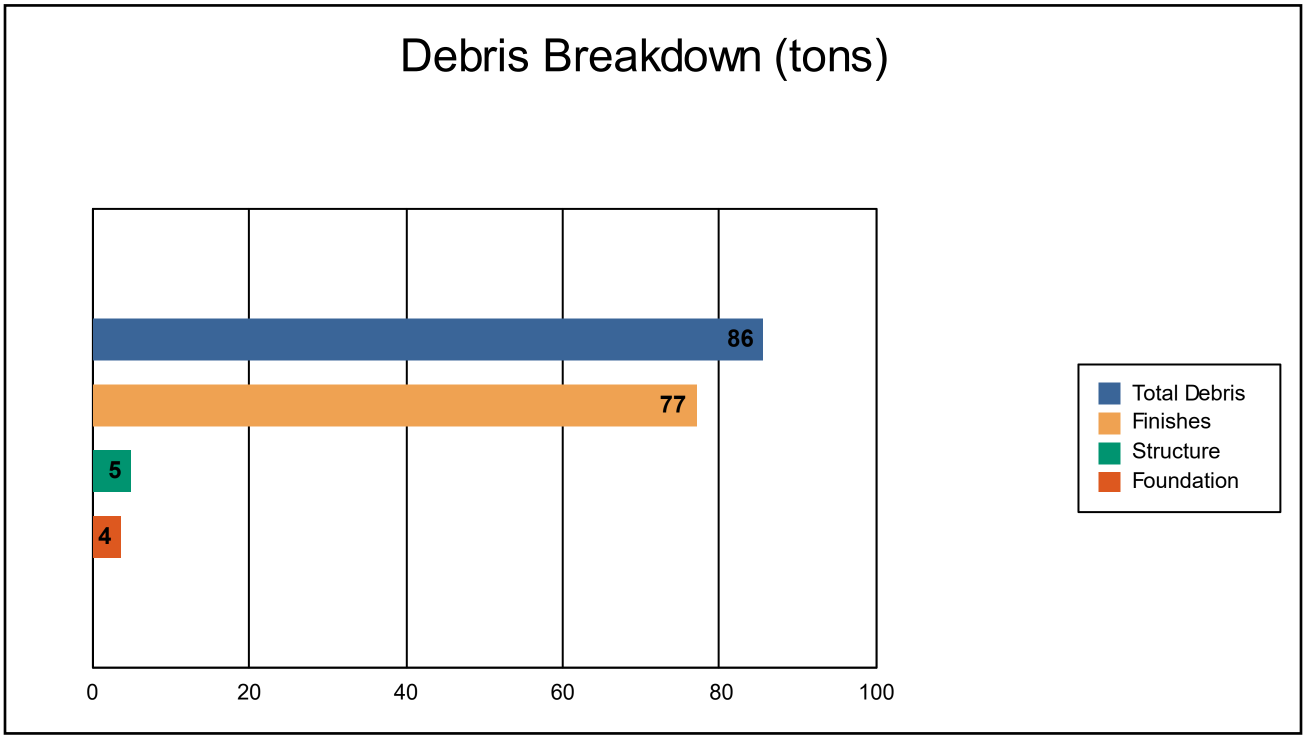
(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

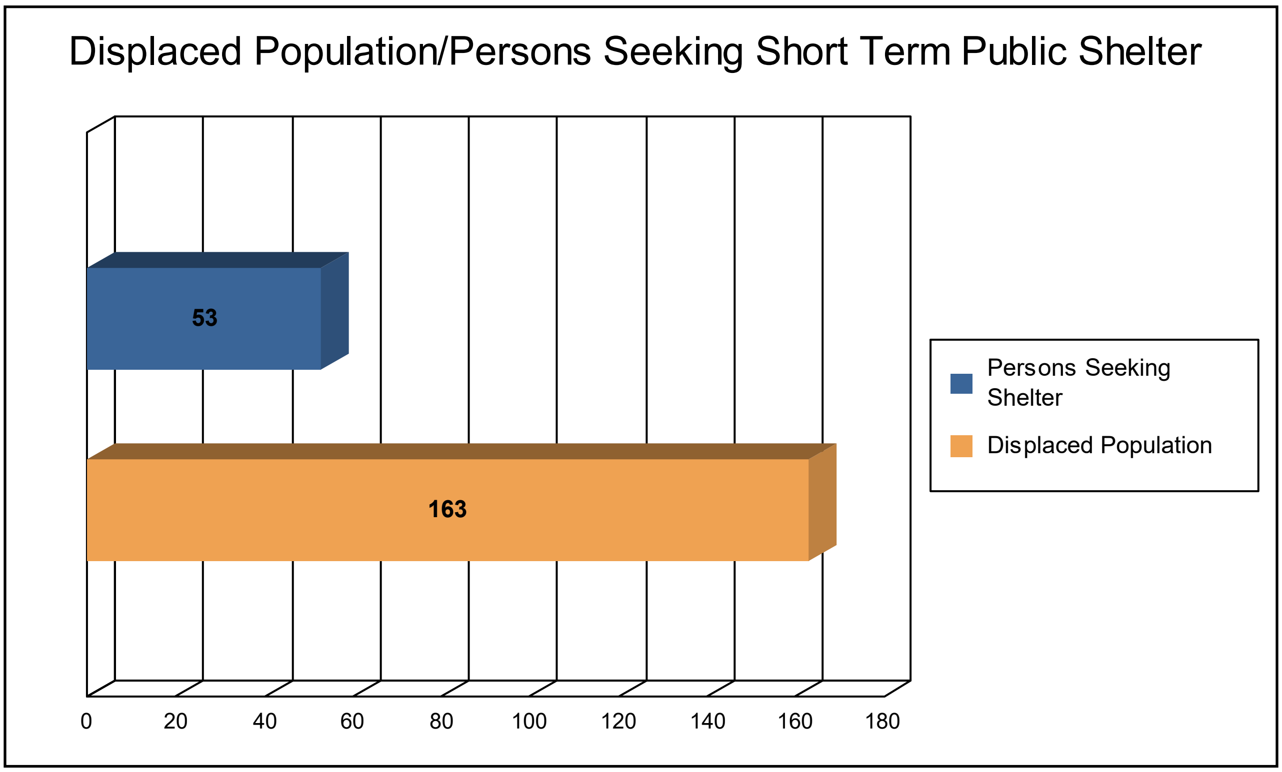


The model estimates that a total of 86 tons of debris will be generated. Of the total amount, Finishes comprises 90% of the total, Structure comprises 6% of the total, and Foundation comprises 4%. If the debris tonnage is converted into an estimated number of truckloads, it will require 4 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 54 households (or 163 of people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 53 people (out of a total population of 9,232) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 16.70 million dollars, which represents 1.47 % of the total replacement value of the scenario buildings.

Building-Related Losses

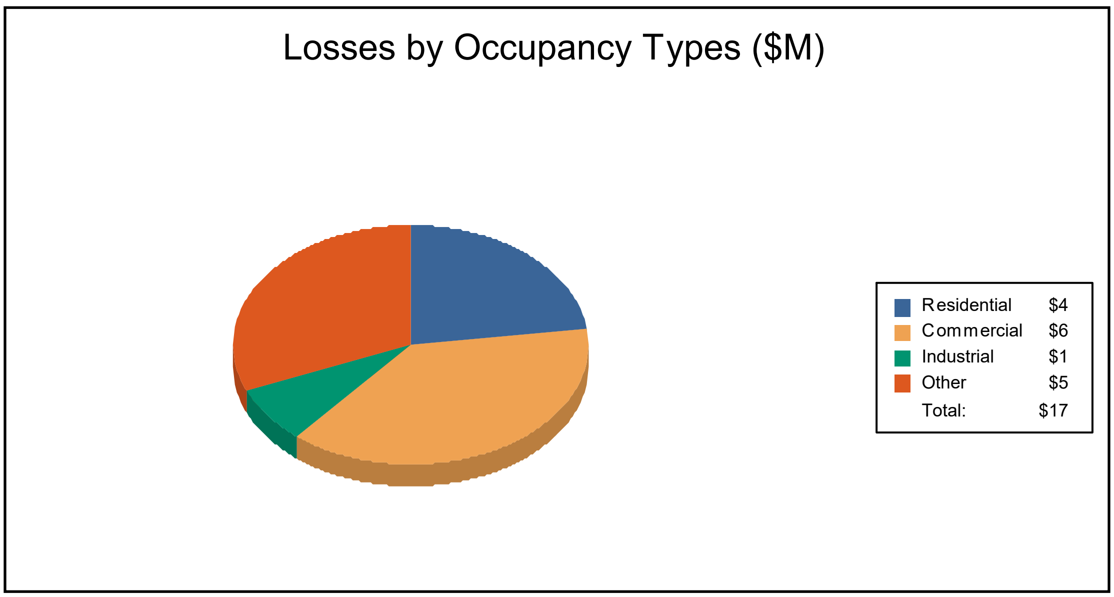
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 7.53 million dollars. 55% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 22.77% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	2.06	0.49	0.37	0.14	3.05
	Content	0.89	1.65	0.73	0.94	4.21
	Inventory	0.00	0.14	0.10	0.03	0.27
	Subtotal	**2.95**	**2.27**	**1.20**	**1.11**	**7.53**
Business Interruption						
	Income	0.00	2.10	0.02	0.45	2.57
	Relocation	0.64	0.26	0.02	0.18	1.10
	Rental Income	0.21	0.19	0.00	0.01	0.41
	Wage	0.01	1.58	0.03	3.47	5.09
	Subtotal	**0.85**	**4.13**	**0.08**	**4.11**	**9.17**
ALL	**Total**	**3.80**	**6.40**	**1.27**	**5.22**	**16.70**



Appendix A: County Listing for the Region

Massachusetts

- Hampden

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Massachusetts				
Hampden	9,232	1,304,912	602,045	1,906,957
Total	**9,232**	**1,304,912**	**602,045**	**1,906,957**
Total Study Region	**9,232**	**1,304,912**	**602,045**	**1,906,957**

Hazus: Hurricane Global Risk Report

Region Name: Southwick_Wind

Hurricane Scenario: Probabilistic 500-year Return Period

Print Date: Wednesday, April 26, 2023

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Table of Contents

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Massachusetts

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 31.70 square miles and contains 2 census tracts. There are over 3 thousand households in the region and a total population of 9,232 people. The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 1,907 million dollars. Approximately 88% of the buildings (and 68% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 3,885 buildings in the region which have an aggregate total replacement value of Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provi distribution of the building value by State and County.

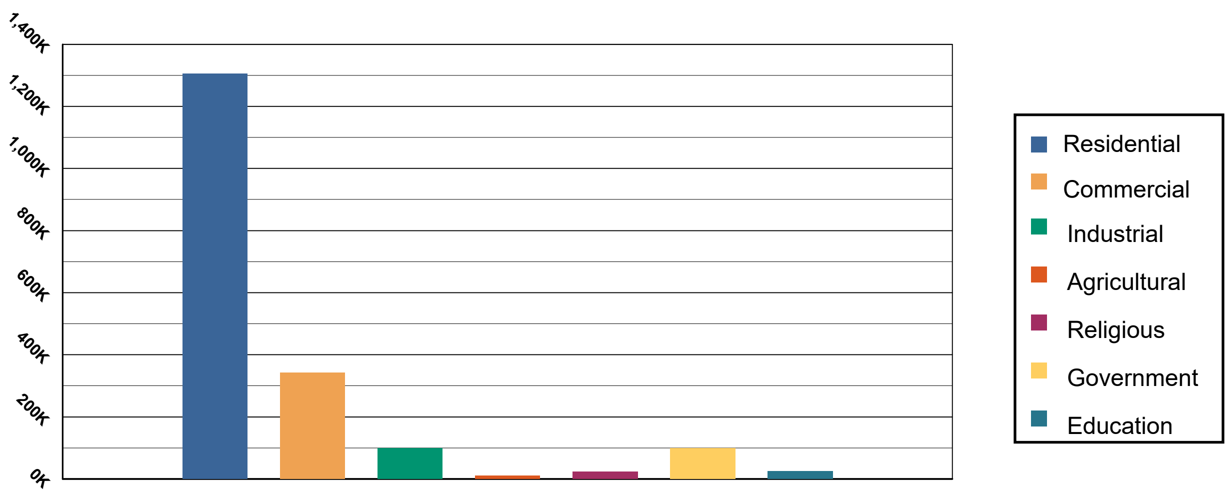


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	1,305,005	68.43%
Commercial	342,910	17.98%
Industrial	100,125	5.25%
Agricultural	10,567	0.55%
Religious	22,672	1.19%
Government	100,252	5.26%
Education	25,637	1.34%
Total	**1,907,168**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 1 fire stations, 1 police stations and 2 emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 116 buildings will be at least moderately damaged. This is over 3% of the total number of buildings in the region. There are an estimated 3 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

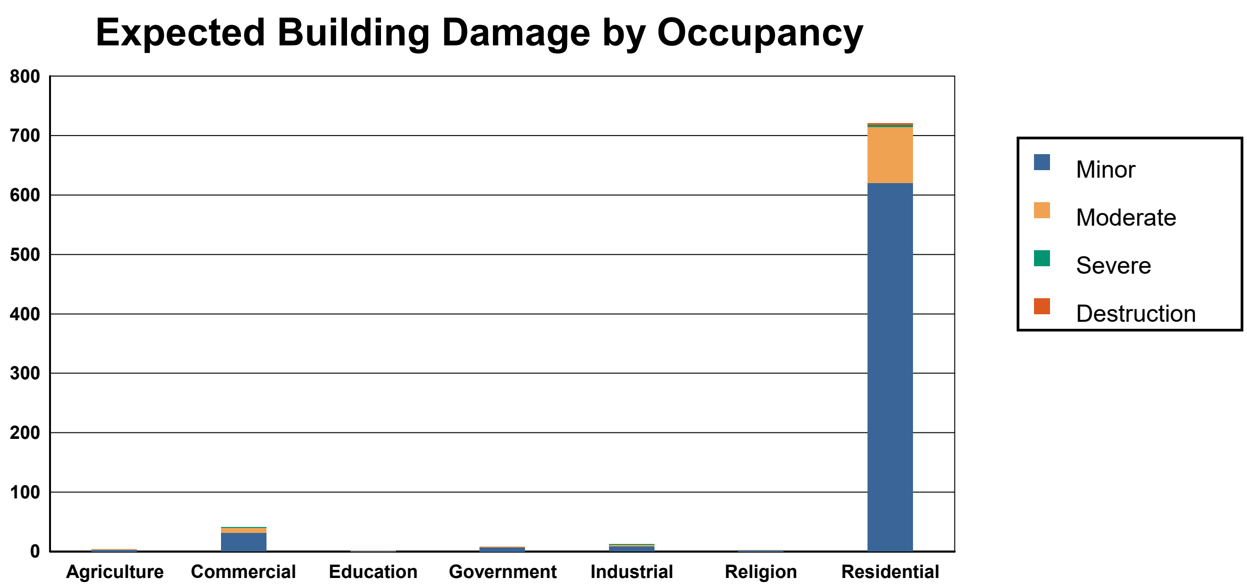


Table 2: Expected Building Damage by Occupancy : 500 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	18.11	82.34	2.85	12.96	0.68	3.09	0.32	1.47	0.03	0.14
Commercial	243.72	85.51	31.44	11.03	8.41	2.95	1.43	0.50	0.00	0.00
Education	9.53	86.59	1.23	11.16	0.24	2.14	0.01	0.11	0.00	0.00
Government	55.37	86.51	7.06	11.03	1.49	2.33	0.08	0.12	0.00	0.00
Industrial	68.88	85.03	8.95	11.05	2.48	3.06	0.64	0.80	0.05	0.07
Religion	15.42	85.68	2.23	12.41	0.33	1.82	0.02	0.09	0.00	0.00
Residential	2,683.25	78.83	620.74	18.24	94.22	2.77	2.85	0.08	2.94	0.09
Total	**3,094.27**		**674.51**		**107.84**		**5.35**		**3.03**	

Table 3: Expected Building Damage by Building Type : 500 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	47	86.26	6	11.03	1	2.58	0	0.12	0	0.00
Masonry	257	79.90	44	13.57	19	6.01	2	0.47	0	0.05
MH	2	93.78	0	3.75	0	1.75	0	0.04	0	0.68
Steel	199	86.44	23	9.82	7	3.11	1	0.63	0	0.00
Wood	2,605	79.53	597	18.22	68	2.09	2	0.08	3	0.08

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

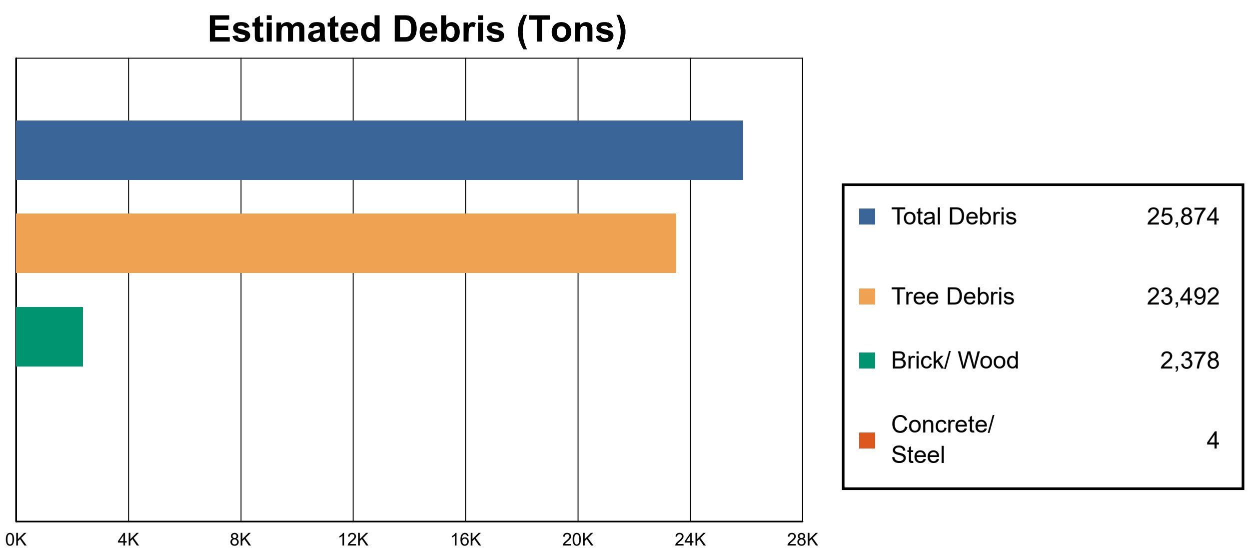
Thematic Map of Essential Facilities

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
EOCs	2	0	0	2
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	3	0	0	3

Induced Hurricane Damage

Debris Generation

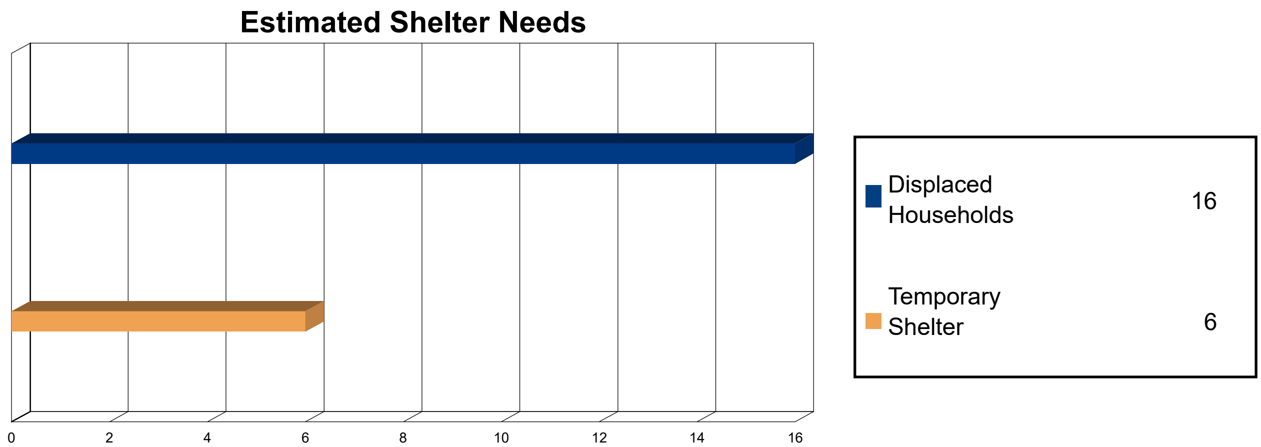


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 25,874 tons of debris will be generated. Of the total amount, 19,188 tons (74%) is Other Tree Debris. Of the remaining 6,686 tons, Brick/Wood comprises 36% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 95 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 4,304 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement



Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 16 households to be displaced due to the hurricane. Of these, 6 people (out of a total population of 9,232) will seek temporary shelter in public shelters.

Economic Loss

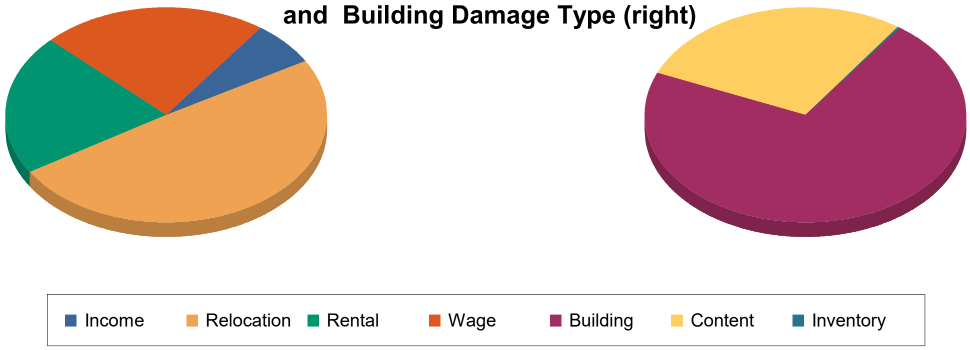
The total economic loss estimated for the hurricane is 41.7 million dollars, which represents 2.18 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 42 million dollars. 7% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 88% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.

Loss by Business Interruption Type (left) and Building Damage Type (right)



Loss Type by General Occupancy

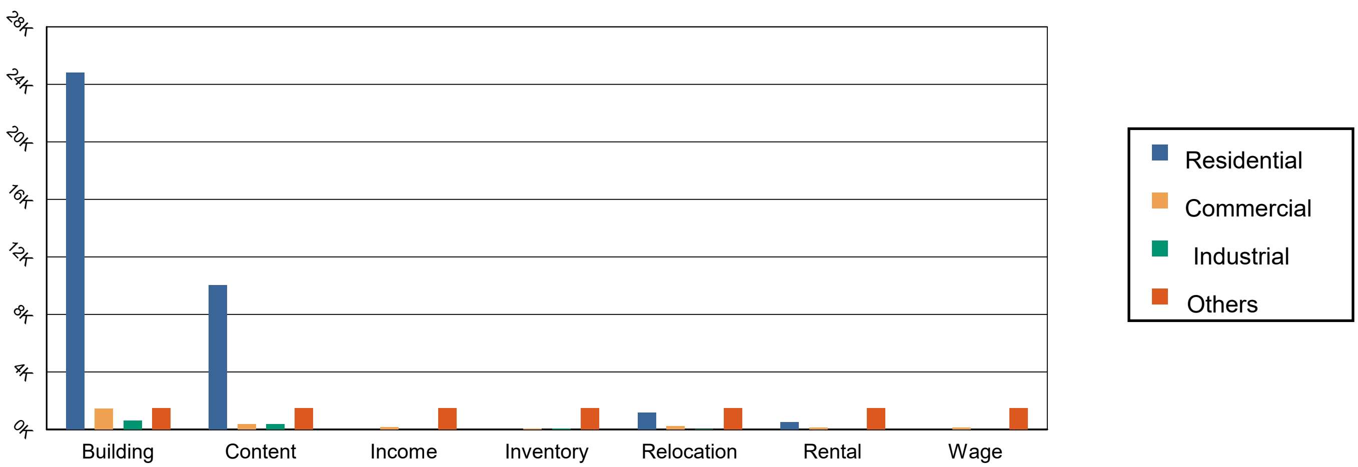


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	24,827.61	1,445.08	626.29	603.94	27,502.91
	Content	10,032.41	363.31	391.95	151.88	10,939.54
	Inventory	0.00	70.42	53.06	30.76	154.24
	Subtotal	**34,860.03**	**1,878.80**	**1,071.29**	**786.57**	**38,596.69**
Business Interruption Loss						
	Income	0.00	162.58	6.89	35.00	204.48
	Relocation	1,167.15	215.48	31.24	101.65	1,515.52
	Rental	515.28	104.52	4.94	19.88	644.62
	Wage	0.00	130.68	11.60	555.82	698.10
	Subtotal	**1,682.44**	**613.26**	**54.68**	**712.35**	**3,062.72**

<u>Total</u>

	Total	**36,542.46**	**2,492.06**	**1,125.97**	**1,498.92**	**41,659.42**

Appendix A: County Listing for the Region

Massachusetts

- Hampden

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Massachusetts				
Hampden	9,232	1,305,005	602,163	1,907,168
Total	**9,232**	**1,305,005**	**602,163**	**1,907,168**
Study Region Total	**9,232**	**1,305,005**	**602,163**	**1,907,168**

Hazus: Hurricane Global Risk Report

Region Name: Southwick_Wind

Hurricane Scenario: Probabilistic 1000-year Return Period

Print Date: Wednesday, April 26, 2023

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

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The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Massachusetts

Note:
Appendix A contains a complete listing of the counties contained in the region.

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There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 1,907 million dollars. Approximately 88% of the buildings (and 68% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

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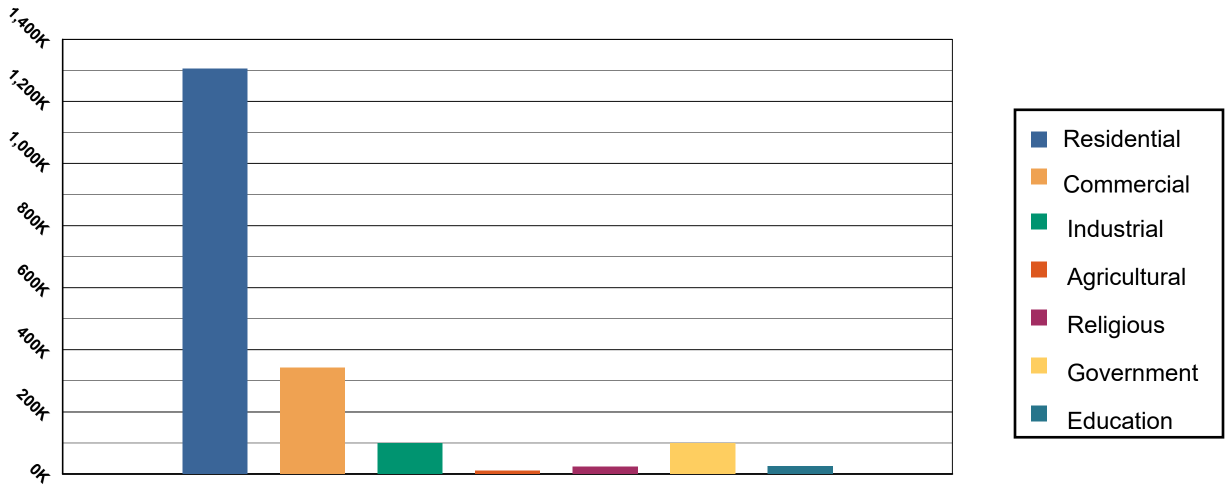
Building Exposure by Occupancy Type



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Religious	22,672	1.19%
Government	100,252	5.26%
Education	25,637	1.34%
Total	**1,907,168**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 1 fire stations, 1 police stations and 2 emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 210 buildings will be at least moderately damaged. This is over 5% of the total number of buildings in the region. There are an estimated 8 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

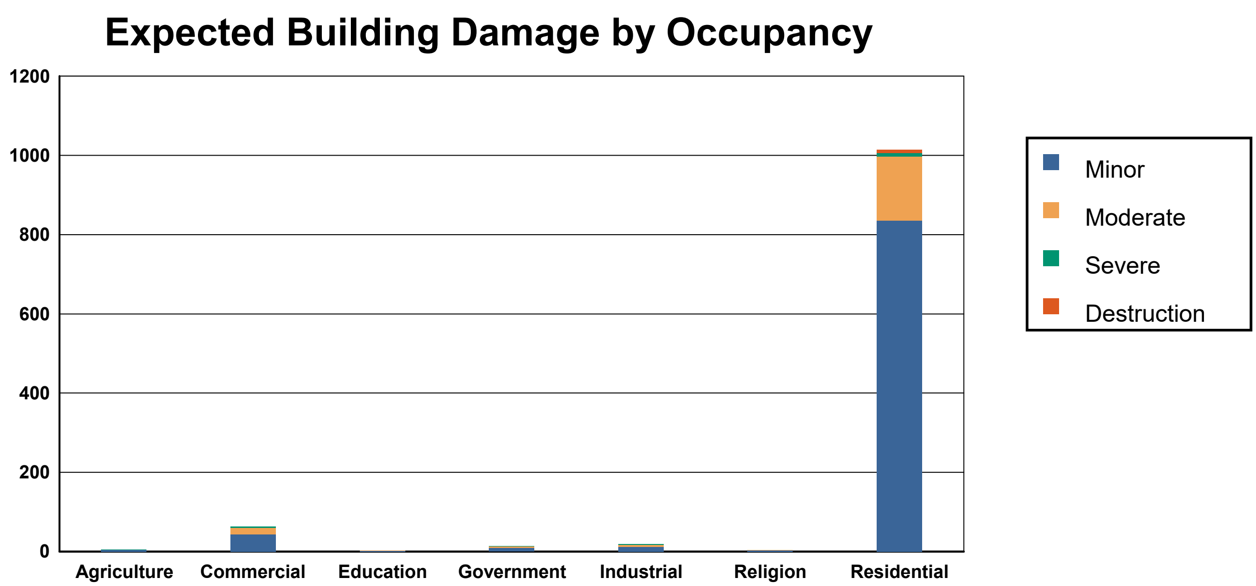


Table 2: Expected Building Damage by Occupancy : 1000 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	16.28	74.01	3.97	18.04	1.13	5.15	0.55	2.49	0.07	0.31
Commercial	222.44	78.05	44.25	15.53	15.33	5.38	2.96	1.04	0.02	0.01
Education	8.73	79.34	1.73	15.77	0.50	4.51	0.04	0.38	0.00	0.00
Government	50.71	79.23	9.91	15.48	3.11	4.86	0.27	0.43	0.00	0.00
Industrial	62.74	77.46	12.31	15.20	4.61	5.69	1.22	1.51	0.11	0.14
Religion	14.05	78.07	3.19	17.74	0.70	3.91	0.05	0.28	0.00	0.00
Residential	2,389.65	70.20	835.15	24.53	162.56	4.78	8.50	0.25	8.14	0.24
Total	**2,764.60**		**910.52**		**187.94**		**13.60**		**8.35**	

Table 3: Expected Building Damage by Building Type : 1000 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	43	78.92	8	15.33	3	5.34	0	0.41	0	0.00
Masonry	231	71.88	57	17.72	30	9.39	3	0.90	0	0.12
MH	2	89.15	0	5.89	0	3.46	0	0.14	0	1.36
Steel	182	79.20	32	13.74	13	5.74	3	1.31	0	0.01
Wood	2,324	70.93	811	24.75	127	3.87	7	0.22	8	0.23

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

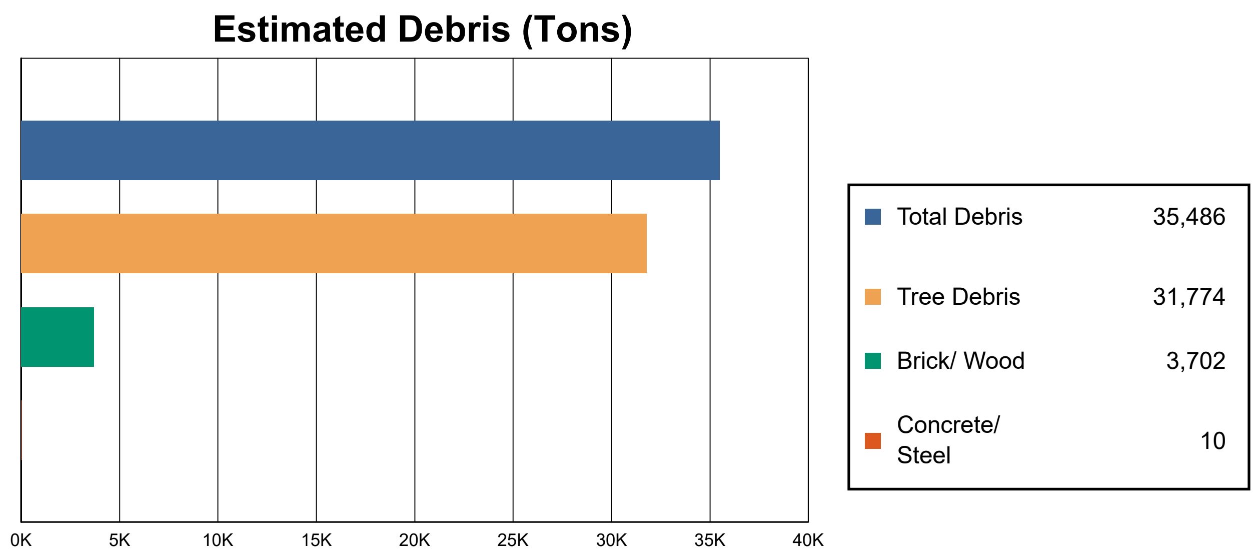
Thematic Map of Essential Facilities

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
EOCs	2	0	0	2
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	3	0	0	0

Induced Hurricane Damage

Debris Generation

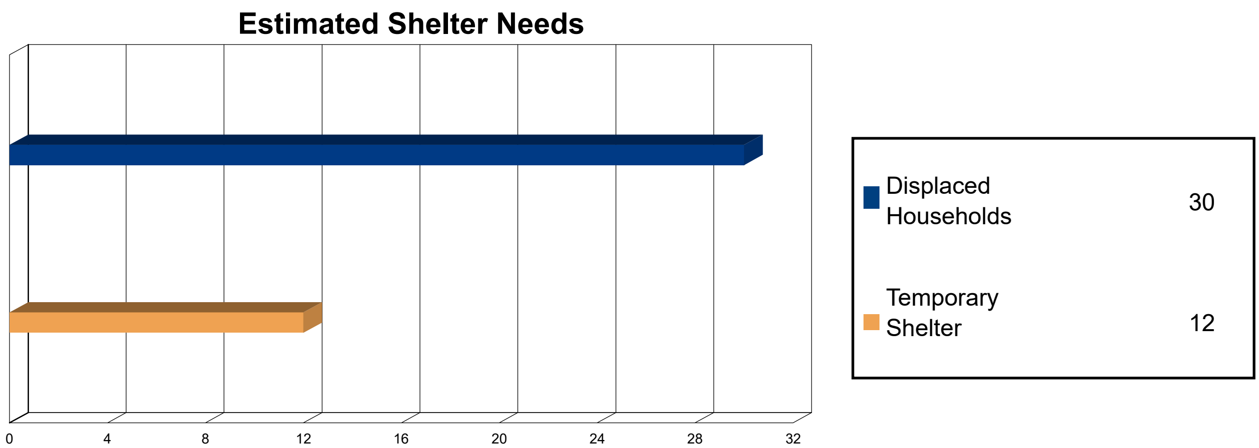


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 35,486 tons of debris will be generated. Of the total amount, 26,004 tons (73%) is Other Tree Debris. Of the remaining 9,482 tons, Brick/Wood comprises 39% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 148 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 5,770 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement



Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 30 households to be displaced due to the hurricane. Of these, 12 people (out of a total population of 9,232) will seek temporary shelter in public shelters.

Economic Loss

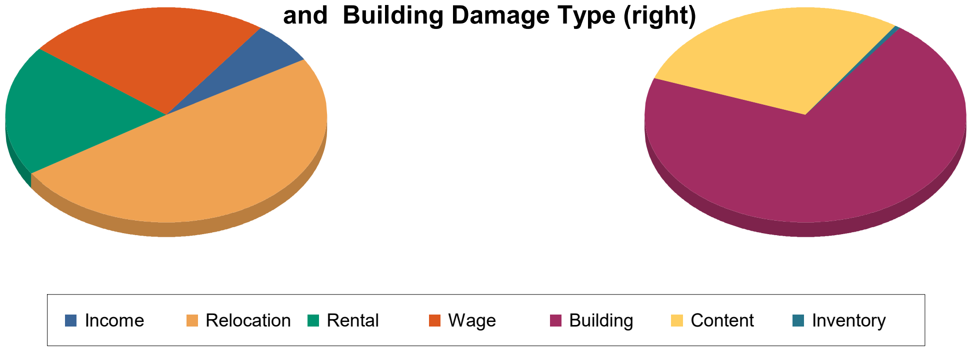
The total economic loss estimated for the hurricane is 64.6 million dollars, which represents 3.39 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 65 million dollars. 10% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 84% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.

Loss by Business Interruption Type (left) and Building Damage Type (right)



Loss Type by General Occupancy

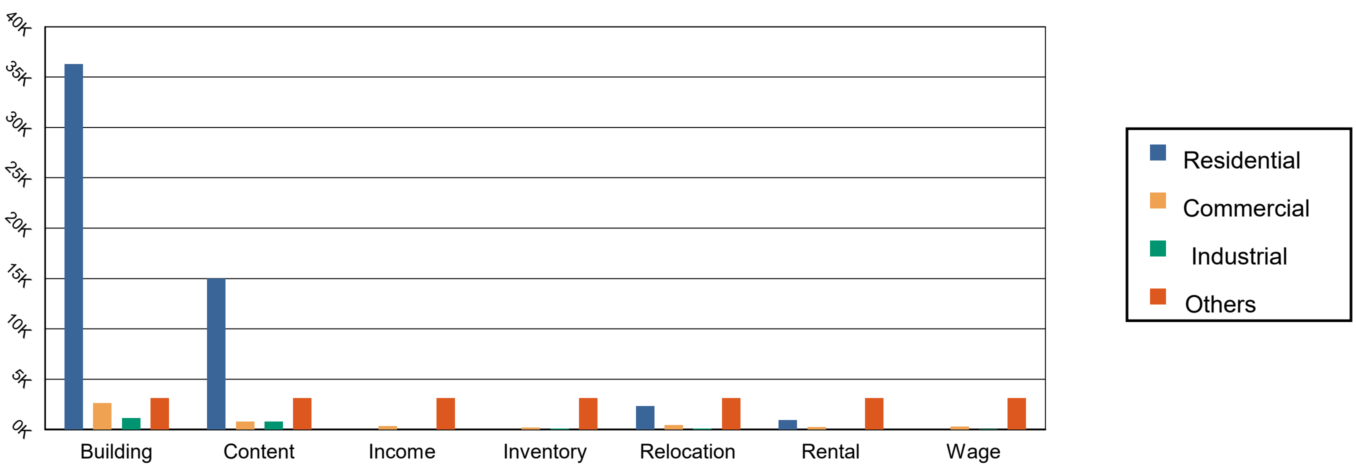


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	36,295.97	2,595.47	1,129.09	1,106.71	41,127.23
	Content	14,969.73	813.51	771.59	361.83	16,916.66
	Inventory	0.00	158.03	103.64	57.62	319.30
	Subtotal	**51,265.70**	**3,567.01**	**2,004.31**	**1,526.16**	**58,363.19**
Business Interruption Loss						
	Income	0.00	324.53	12.51	67.30	404.34
	Relocation	2,306.27	451.60	62.73	232.22	3,052.82
	Rental	931.72	233.79	9.58	50.39	1,225.48
	Wage	0.00	273.67	21.15	1,225.43	1,520.25
	Subtotal	**3,237.99**	**1,283.59**	**105.97**	**1,575.34**	**6,202.90**

Total

Total	**54,503.69**	**4,850.60**	**2,110.28**	**3,101.51**	**64,566.09**

Appendix A: County Listing for the Region

Massachusetts
- Hampden

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Massachusetts				
Hampden	9,232	1,305,005	602,163	1,907,168
Total	**9,232**	**1,305,005**	**602,163**	**1,907,168**
Study Region Total	**9,232**	**1,305,005**	**602,163**	**1,907,168**

Hazus: Earthquake Global Risk Report

Region Name: Southwick_EQ

Earthquake Scenario: 1500-year

Print Date: April 26, 2023

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Table of Contents

General Description of the Region

Hazus-MH is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Massachusetts

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 31.69 square miles and contains 2 census tracts. There are over 3 thousand households in the region which has a total population of 9,232 peopleF. The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 1,907 (millions of dollars). Approximately 88.00 % of the buildings (and 68.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 1,350 and 173 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 3 thousand buildings in the region which have an aggregate total replacement value of 1,907 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region and County.

In terms of building construction types found in the region, wood frame construction makes up 84% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of beds. There are 3 schools, 1 fire stations, 1 police stations and 2 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes no hazardous material sites, no military installations and no nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 1,523.00 (millions of dollars). This inventory includes over 43.50 miles of highways, 4 bridges, 183.30 miles of pipes.

Table 1: Transportation System Lifeline Inventory

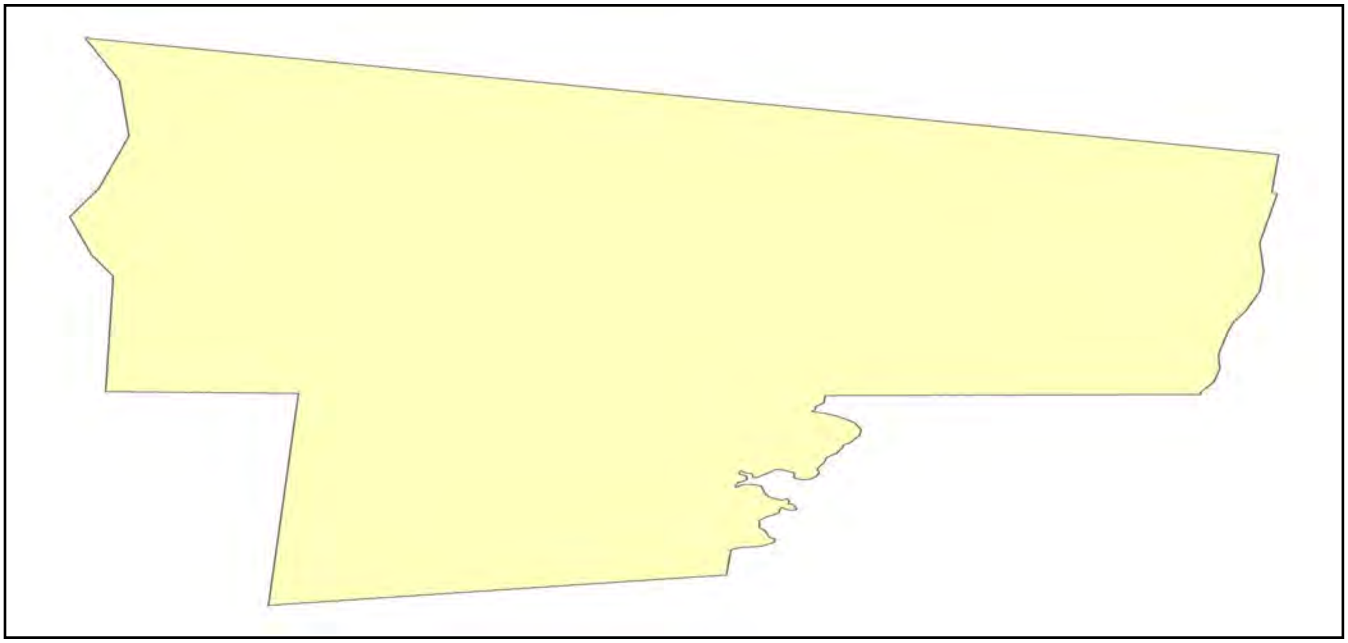
System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	4	2.4063
	Segments	13	297.7810
	Tunnels	0	0.0000
		Subtotal	**300.1873**
Railways	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	1	1050.1109
	Tunnels	0	0.0000
		Subtotal	**1050.1109**
Light Rail	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
		Subtotal	**0.0000**
Bus	Facilities	0	0.0000
		Subtotal	**0.0000**
Ferry	Facilities	0	0.0000
		Subtotal	**0.0000**
Port	Facilities	0	0.0000
		Subtotal	**0.0000**
Airport	Facilities	0	0.0000
	Runways	0	0.0000
		Subtotal	**0.0000**
		Total	**1,350.30**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	3.4150
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**3.4150**
Waste Water	Distribution Lines	NA	2.0490
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**2.0490**
Natural Gas	Distribution Lines	NA	1.3660
	Facilities	1	7.2080
	Pipelines	1	139.5340
		Subtotal	**148.1080**
Oil Systems	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**0.0000**
Electrical Power	Facilities	2	20.2174
		Subtotal	**20.2174**
Communication	Facilities	0	0.0000
		Subtotal	**0.0000**
		Total	**173.80**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.



Scenario Name	1500-year
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	1,500.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	6.00
Depth (km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

HAZUS EARTHQUAKE · WIND · FLOOD · TSUNAMI

FEMA

Direct Earthquake Damage

Building Damage

Hazus estimates that about 27 buildings will be at least moderately damaged. This is over 1.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage Categories by General Occupancy Type

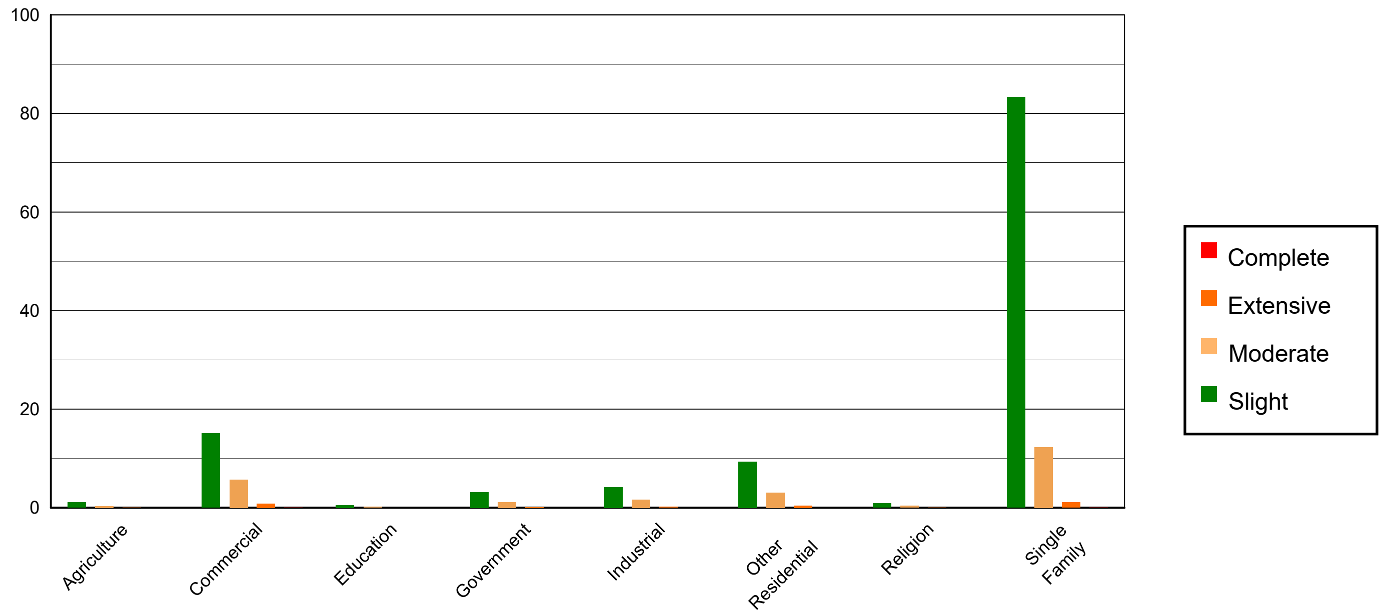


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	20.53	0.55	1.09	0.92	0.33	1.32	0.05	1.63	0.00	0.94
Commercial	263.35	7.04	15.10	12.83	5.68	22.81	0.82	28.68	0.05	23.14
Education	10.22	0.27	0.55	0.47	0.20	0.82	0.03	0.95	0.00	0.95
Government	59.50	1.59	3.17	2.70	1.18	4.73	0.15	5.12	0.01	3.34
Industrial	74.84	2.00	4.23	3.59	1.69	6.78	0.23	8.13	0.01	5.01
Other Residential	210.09	5.62	9.33	7.92	3.10	12.45	0.44	15.48	0.04	18.00
Religion	16.63	0.44	0.93	0.79	0.38	1.51	0.06	2.13	0.00	2.44
Single Family	3084.16	82.48	83.31	70.77	12.35	49.57	1.08	37.88	0.09	46.19
Total	**3,739**		**118**		**25**		**3**		**0**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	3187.86	85.25	79.62	67.64	7.98	32.03	0.19	6.56	0.00	0.00
Steel	216.86	5.80	10.00	8.49	3.64	14.62	0.37	13.01	0.00	0.00
Concrete	36.16	0.97	1.85	1.57	0.65	2.62	0.03	1.14	0.00	0.00
Precast	12.93	0.35	0.90	0.77	0.63	2.51	0.13	4.37	0.00	0.33
RM	52.37	1.40	2.27	1.93	1.29	5.17	0.19	6.80	0.00	0.00
URM	231.45	6.19	22.86	19.42	10.62	42.65	1.95	68.01	0.20	99.67
MH	1.68	0.04	0.22	0.18	0.10	0.41	0.00	0.12	0.00	0.00
Total	**3,739**		**118**		**25**		**3**		**0**	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had hospital beds available for use. On the day of the earthquake, the model estimates that only hospital beds (%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, % of the beds will be back in service. By 30 days, % will be operational.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**At Least Moderate Damage > 50%**	**Complete Damage > 50%**	**With Functionality > 50% on day 1**
Hospitals	0	0	0	0
Schools	3	0	0	3
EOCs	2	0	0	2
PoliceStations	1	0	0	1
FireStations	1	0	0	1

Transportation Lifeline Damage

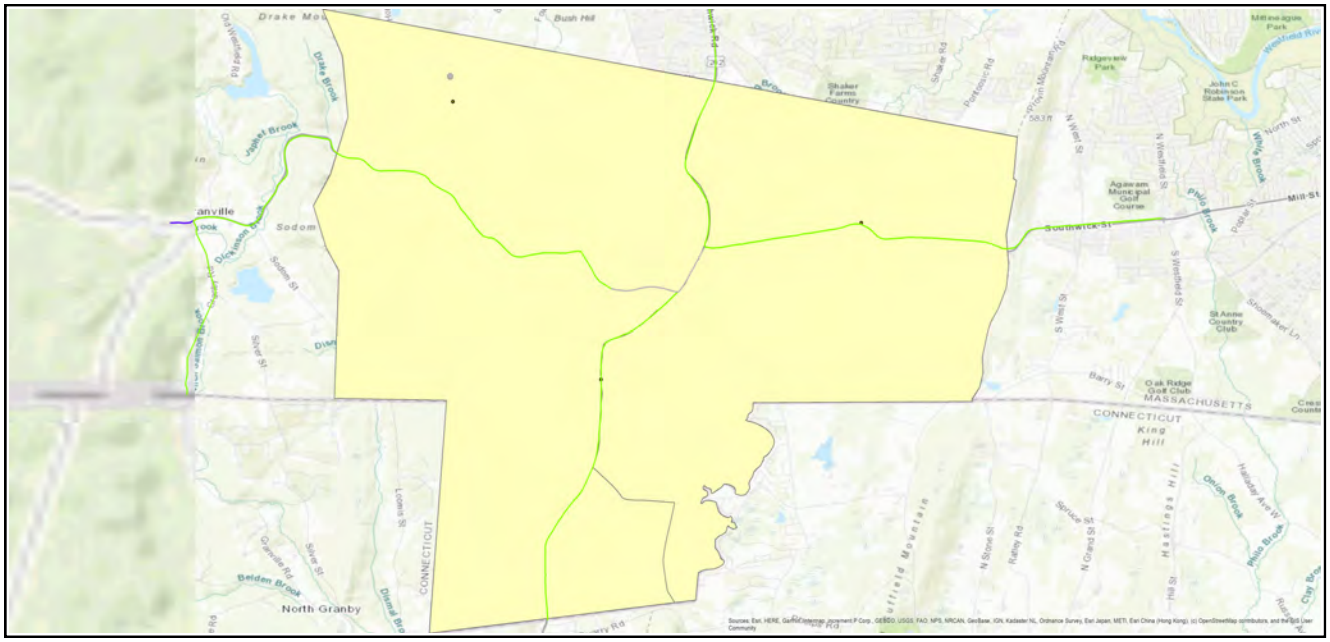


Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	13	0	0	11	11
	Bridges	4	0	0	4	4
	Tunnels	0	0	0	0	0
Railways	Segments	1	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Table 6 provides damage estimates for the transportation system.

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	0	0	0	0	0
Natural Gas	1	0	0	1	1
Oil Systems	0	0	0	0	0
Electrical Power	2	0	0	2	2
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	106	0	0
Waste Water	64	0	0
Natural Gas	14	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	3,825	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

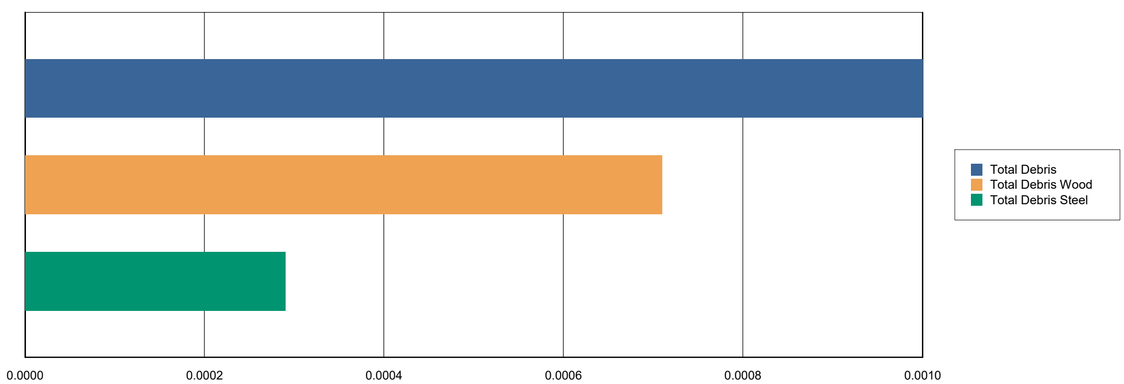
Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 1,000 tons of debris will be generated. Of the total amount, Brick/Wood comprises 71.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 40 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



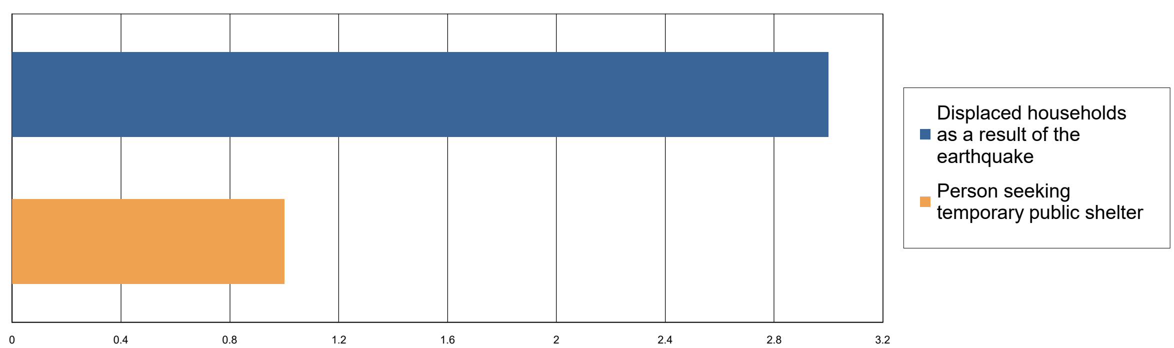
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.00	0.00	0.00	40 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 3 households to be displaced due to the earthquake. Of these, 1 people (out of a total population of 9,232) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
3	1

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0.01	0.00	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.01	0.00	0.00	0.00
	Other-Residential	0.16	0.02	0.00	0.00
	Single Family	0.28	0.03	0.00	0.00
	Total	**0**	**0**	**0**	**0**
2 PM	Commercial	0.58	0.07	0.01	0.01
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.22	0.03	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.07	0.01	0.00	0.00
	Other-Residential	0.05	0.01	0.00	0.00
	Single Family	0.08	0.01	0.00	0.00
	Total	**1**	**0**	**0**	**0**
5 PM	Commercial	0.41	0.05	0.00	0.01
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.04	0.00	0.00	0.00
	Other-Residential	0.06	0.01	0.00	0.00
	Single Family	0.11	0.01	0.00	0.00
	Total	**1**	**0**	**0**	**0**

Economic Loss

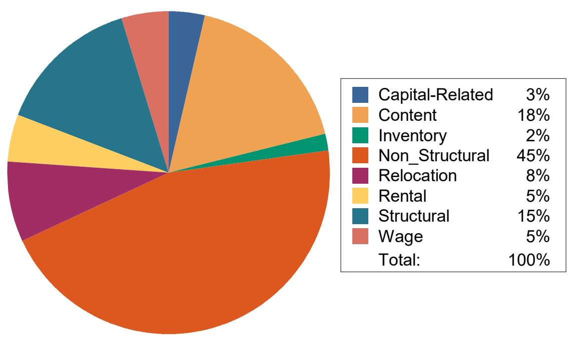
The total economic loss estimated for the earthquake is 7.35 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 6.56 (millions of dollars); 21 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 45 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

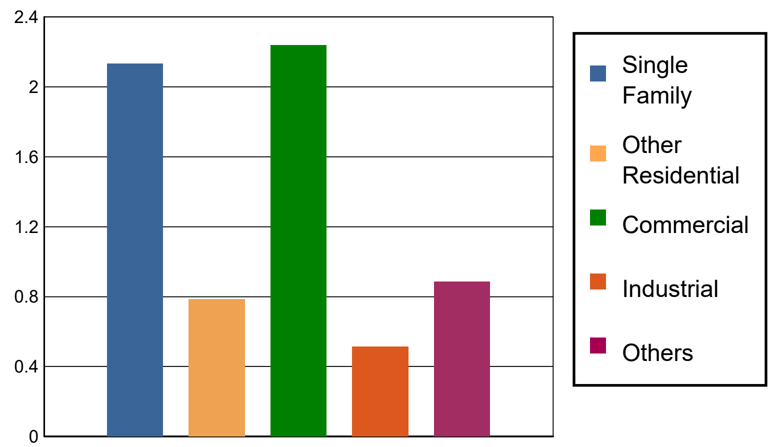


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	0.0211	0.1962	0.0116	0.0775	0.3064
	Capital-Related	0.0000	0.0089	0.2084	0.0068	0.0048	0.2289
	Rental	0.0377	0.0708	0.1570	0.0046	0.0332	0.3033
	Relocation	0.1249	0.0466	0.2091	0.0258	0.1184	0.5248
	Subtotal	**0.1626**	**0.1474**	**0.7707**	**0.0488**	**0.2339**	**1.3634**
Capital Stock Losses							
	Structural	0.2938	0.1084	0.3358	0.0785	0.1350	0.9515
	Non_Structural	1.2798	0.4307	0.7005	0.2212	0.3382	2.9704
	Content	0.3962	0.0991	0.3502	0.1413	0.1709	1.1577
	Inventory	0.0000	0.0000	0.0804	0.0244	0.0088	0.1136
	Subtotal	**1.9698**	**0.6382**	**1.4669**	**0.4654**	**0.6529**	**5.1932**
	Total	**2.13**	**0.79**	**2.24**	**0.51**	**0.89**	**6.56**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	297.7810	0.0000	0.00
	Bridges	2.4063	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Subtotal	**300.1873**	**0.0000**	
Railways	Segments	1050.1109	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**1050.1109**	**0.0000**	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Bus	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Ferry	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Port	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Airport	Facilities	0.0000	0.0000	0.00
	Runways	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
	Total	**1,350.30**	**0.00**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	3.4150	0.0021	0.06
	Subtotal	**3.4150**	**0.0021**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	2.0490	0.0010	0.05
	Subtotal	**2.0490**	**0.0010**	
Natural Gas	Pipelines	139.5340	0.0000	0.00
	Facilities	7.2080	0.0461	0.64
	Distribution Lines	1.3660	0.0004	0.03
	Subtotal	**148.1080**	**0.0465**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Electrical Power	Facilities	20.2174	0.7383	3.65
	Subtotal	**20.2174**	**0.7383**	
Communication	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
	Total	**173.79**	**0.79**	

Appendix A: County Listing for the Region

Hampden,MA

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Massachusetts					
	Hampden	9,232	1,305	602	1,907
Total Region		**9,232**	**1,305**	**602**	**1,907**

Hazus: Earthquake Global Risk Report

Region Name: Southwick_EQ

Earthquake Scenario: 2500-year

Print Date: April 26, 2023

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Table of Contents

General Description of the Region

Hazus-MH is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Massachusetts

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 31.69 square miles and contains 2 census tracts. There are over 3 thousand households in the region which has a total population of 9,232 peopleF. The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 1,907 (millions of dollars). Approximately 88.00 % of the buildings (and 68.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 1,350 and 173 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 3 thousand buildings in the region which have an aggregate total replacement value of 1,907 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region and County.

In terms of building construction types found in the region, wood frame construction makes up 84% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of beds. There are 3 schools, 1 fire stations, 1 police stations and 2 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes no hazardous material sites, no military installations and no nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 1,523.00 (millions of dollars). This inventory includes over 43.50 miles of highways, 4 bridges, 183.30 miles of pipes.

Table 1: Transportation System Lifeline Inventory

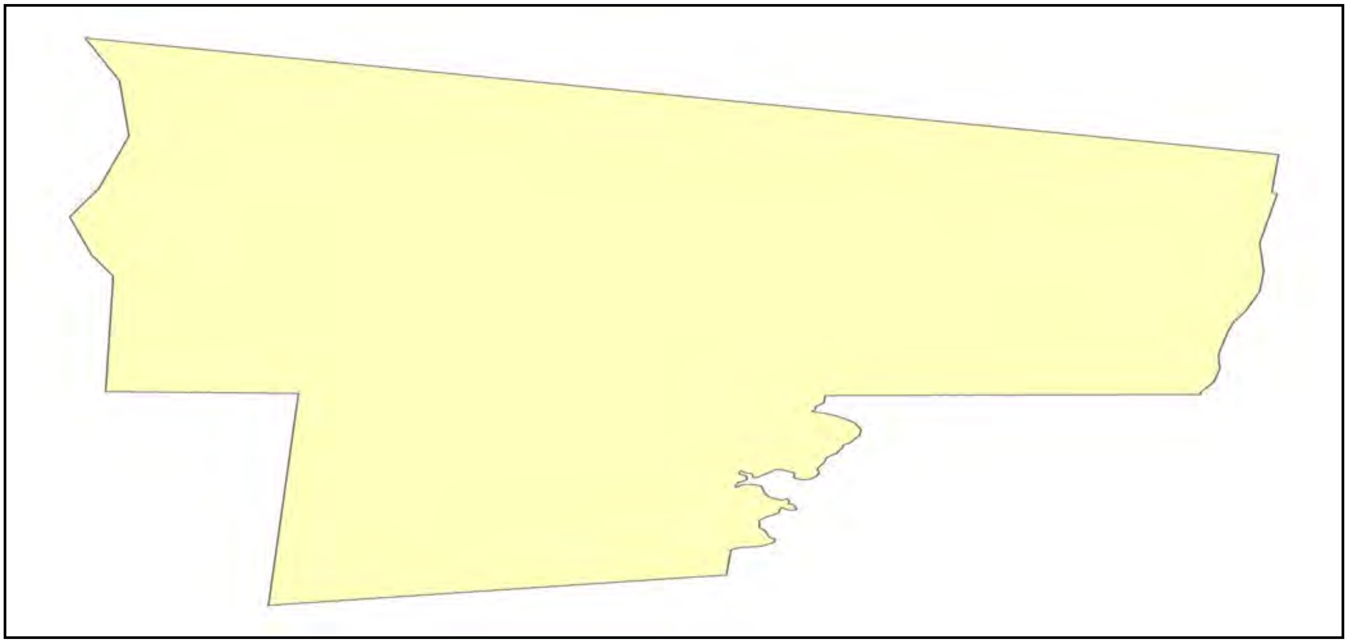
System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	4	2.4063
	Segments	13	297.7810
	Tunnels	0	0.0000
		Subtotal	**300.1873**
Railways	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	1	1050.1109
	Tunnels	0	0.0000
		Subtotal	**1050.1109**
Light Rail	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
		Subtotal	**0.0000**
Bus	Facilities	0	0.0000
		Subtotal	**0.0000**
Ferry	Facilities	0	0.0000
		Subtotal	**0.0000**
Port	Facilities	0	0.0000
		Subtotal	**0.0000**
Airport	Facilities	0	0.0000
	Runways	0	0.0000
		Subtotal	**0.0000**
		Total	**1,350.30**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	3.4150
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**3.4150**
Waste Water	Distribution Lines	NA	2.0490
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**2.0490**
Natural Gas	Distribution Lines	NA	1.3660
	Facilities	1	7.2080
	Pipelines	1	139.5340
		Subtotal	**148.1080**
Oil Systems	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**0.0000**
Electrical Power	Facilities	2	20.2174
		Subtotal	**20.2174**
Communication	Facilities	0	0.0000
		Subtotal	**0.0000**
		Total	**173.80**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.



Scenario Name	2500-year
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	2,500.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	7.00
Depth (km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Direct Earthquake Damage

Building Damage

Hazus estimates that about 51 buildings will be at least moderately damaged. This is over 1.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage Categories by General Occupancy Type

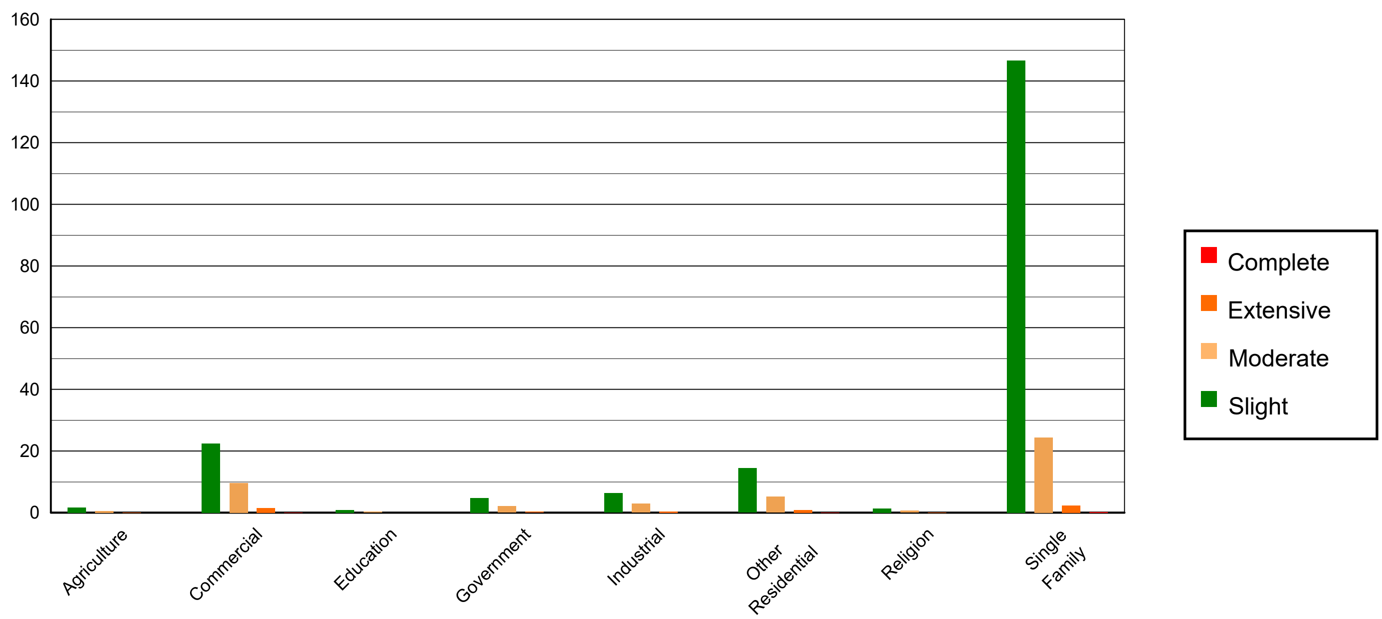


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	19.67	0.54	1.66	0.84	0.57	1.25	0.09	1.63	0.00	0.98
Commercial	251.32	6.91	22.38	11.28	9.62	21.08	1.58	27.80	0.11	24.06
Education	9.77	0.27	0.82	0.41	0.35	0.76	0.05	0.91	0.00	0.98
Government	56.84	1.56	4.77	2.41	2.08	4.56	0.29	5.17	0.02	3.85
Industrial	71.29	1.96	6.29	3.17	2.93	6.43	0.46	8.18	0.03	5.61
Other Residential	202.51	5.57	14.41	7.27	5.17	11.33	0.82	14.53	0.08	17.66
Religion	15.91	0.44	1.36	0.69	0.60	1.32	0.11	1.95	0.01	2.39
Single Family	3007.57	82.74	146.65	73.94	24.32	53.27	2.26	39.83	0.20	44.46
Total	**3,635**		**198**		**46**		**6**		**0**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	3112.52	85.63	144.29	72.75	18.14	39.75	0.70	12.31	0.00	0.00
Steel	207.74	5.72	15.43	7.78	6.84	14.99	0.84	14.83	0.01	2.92
Concrete	34.39	0.95	2.91	1.47	1.30	2.84	0.09	1.59	0.00	0.54
Precast	12.14	0.33	1.23	0.62	0.98	2.14	0.23	4.05	0.00	0.52
RM	50.41	1.39	3.23	1.63	2.11	4.61	0.38	6.65	0.00	0.00
URM	216.16	5.95	30.95	15.60	16.10	35.28	3.43	60.39	0.44	95.98
MH	1.51	0.04	0.30	0.15	0.18	0.39	0.01	0.17	0.00	0.03
Total	**3,635**		**198**		**46**		**6**		**0**	

*Note:

RM	Reinforced Masonry
URM	Unreinforced Masonry
MH	Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had hospital beds available for use. On the day of the earthquake, the model estimates that only hospital beds (%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, % of the beds will be back in service. By 30 days, % will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	0	0	0	0
Schools	3	0	0	3
EOCs	2	0	0	2
PoliceStations	1	0	0	1
FireStations	1	0	0	1

Transportation Lifeline Damage

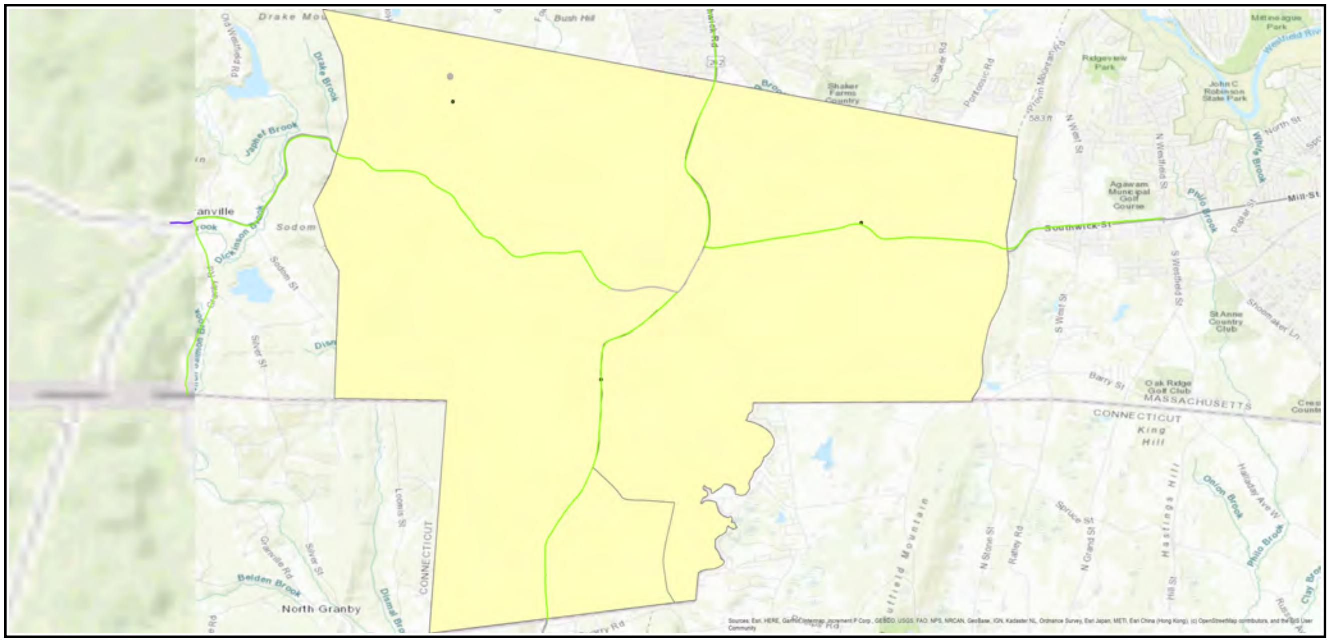


Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	13	0	0	11	11
	Bridges	4	0	0	4	4
	Tunnels	0	0	0	0	0
Railways	Segments	1	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Table 6 provides damage estimates for the transportation system.

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	0	0	0	0	0
Natural Gas	1	0	0	1	1
Oil Systems	0	0	0	0	0
Electrical Power	2	0	0	2	2
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	106	1	0
Waste Water	64	0	0
Natural Gas	14	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	3,825	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

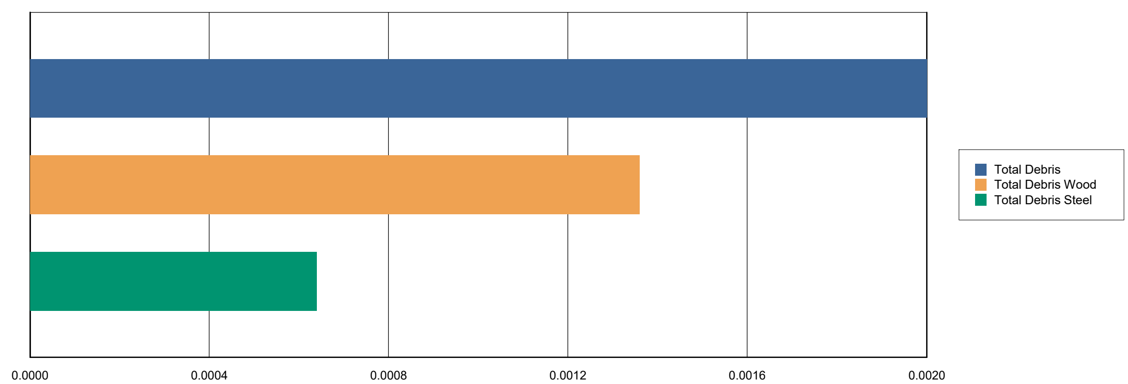
Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 2,000 tons of debris will be generated. Of the total amount, Brick/Wood comprises 68.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 80 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



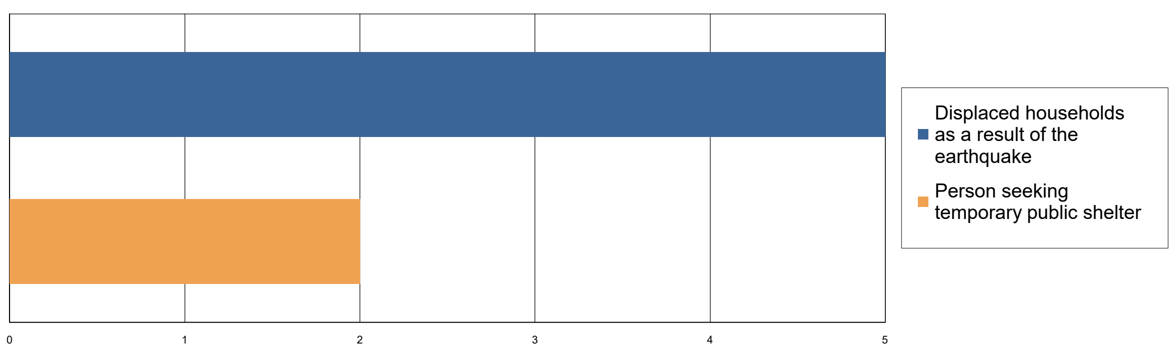
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.00	0.00	0.00	80 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 5 households to be displaced due to the earthquake. Of these, 2 people (out of a total population of 9,232) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
5	2

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

· Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
· Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
· Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
· Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0.02	0.00	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.02	0.00	0.00	0.00
	Other-Residential	0.29	0.04	0.00	0.01
	Single Family	0.52	0.05	0.00	0.01
	Total	**1**	**0**	**0**	**0**
2 PM	Commercial	1.03	0.14	0.01	0.02
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.39	0.06	0.01	0.01
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.12	0.02	0.00	0.00
	Other-Residential	0.08	0.01	0.00	0.00
	Single Family	0.15	0.02	0.00	0.00
	Total	**2**	**0**	**0**	**0**
5 PM	Commercial	0.74	0.10	0.01	0.02
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.08	0.01	0.00	0.00
	Other-Residential	0.11	0.02	0.00	0.00
	Single Family	0.20	0.02	0.00	0.00
	Total	**1**	**0**	**0**	**0**

Economic Loss

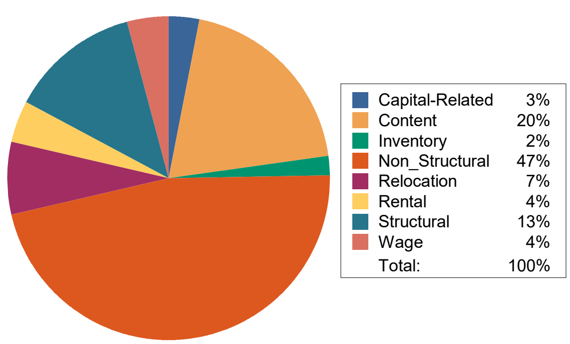
The total economic loss estimated for the earthquake is 14.81 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 13.04 (millions of dollars); 19 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 46 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

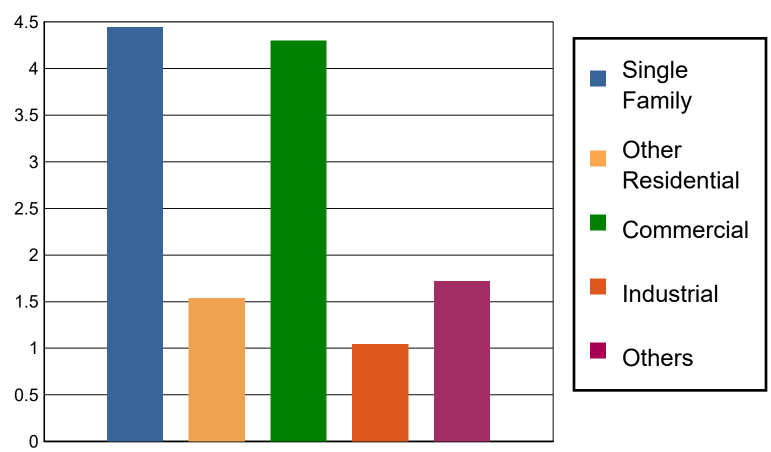


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	0.0387	0.3480	0.0211	0.1311	0.5389
	Capital-Related	0.0000	0.0164	0.3690	0.0124	0.0082	0.4060
	Rental	0.0737	0.1230	0.2681	0.0081	0.0596	0.5325
	Relocation	0.2489	0.0807	0.3691	0.0461	0.2144	0.9592
	Subtotal	**0.3226**	**0.2588**	**1.3542**	**0.0877**	**0.4133**	**2.4366**
Capital Stock Losses							
	Structural	0.5543	0.1859	0.5851	0.1387	0.2387	1.7027
	Non_Structural	2.6516	0.8706	1.4157	0.4600	0.6753	6.0732
	Content	0.9190	0.2239	0.7688	0.3023	0.3685	2.5825
	Inventory	0.0000	0.0000	0.1747	0.0524	0.0206	0.2477
	Subtotal	**4.1249**	**1.2804**	**2.9443**	**0.9534**	**1.3031**	**10.6061**
	Total	**4.45**	**1.54**	**4.30**	**1.04**	**1.72**	**13.04**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	297.7810	0.0000	0.00
	Bridges	2.4063	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Subtotal	**300.1873**	**0.0000**	
Railways	Segments	1050.1109	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**1050.1109**	**0.0000**	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Bus	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Ferry	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Port	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Airport	Facilities	0.0000	0.0000	0.00
	Runways	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
	Total	**1,350.30**	**0.00**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	3.4150	0.0041	0.12
	Subtotal	**3.4150**	**0.0041**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	2.0490	0.0021	0.10
	Subtotal	**2.0490**	**0.0021**	
Natural Gas	Pipelines	139.5340	0.0000	0.00
	Facilities	7.2080	0.1104	1.53
	Distribution Lines	1.3660	0.0007	0.05
	Subtotal	**148.1080**	**0.1111**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Electrical Power	Facilities	20.2174	1.6482	8.15
	Subtotal	**20.2174**	**1.6482**	
Communication	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
	Total	**173.79**	**1.77**	

Appendix A: County Listing for the Region

Hampden,MA

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Massachusetts					
	Hampden	9,232	1,305	602	1,907
Total Region		**9,232**	**1,305**	**602**	**1,907**