



February 2020

TOWN OF HADLEY

COMMUNITY RESILIENCE BUILDING WORKSHOP SUMMARY OF FINDINGS (Draft)



Prepared for:



Town of Hadley
Town Hall, 100 Middle Street
Hadley, MA 01035

Contents

1. Background Information	1
1.1 MVP Program Overview.....	1
1.2 Community Resilience Building Workshop	1
1.3 Workshop Preparation	2
1.4 Workshop Process	2
2. Top Hazards and Vulnerable Areas.....	4
2.1 Summary of Top Hazards	4
2.2 Areas of Concern.....	4
3. Current Concerns and Challenges Presented by Hazards	6
3.1 Categories of Concerns and Challenges	6
3.1.1 Infrastructure Concerns	6
3.1.2 Societal Concerns.....	7
3.1.3 Environmental Concerns	8
4. Current Strengths and Assets	10
5. Recommendations to Improve Resilience	11
5.1 Top Three Recommendations.....	11
5.2 Other Prioritized Recommendations	12
6. Report Citation	16

Appendices

Appendix A: Introductory Presentation Materials

Appendix B: Completed Risk Matrices

Appendix C: Base Maps

Note: *This report has been prepared in accordance with the Community Resilience Building (CRB) Guide and Municipal Vulnerability Program (MVP) “Summary of Findings Template Guidance” provided by the Massachusetts Executive Office of Energy and Environmental Affairs (MA EEA).*

1. Background Information

1.1 MVP Program Overview

In 2016, Massachusetts Governor Charles Baker issued Executive Order 569 (2016) to establish a comprehensive statewide approach to reduce greenhouse gas emissions and prepare for the impacts of climate change. As part of this initiative, the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) administers the Municipal Vulnerability Preparedness (MVP) Program. The MVP Program provides communities with funding to identify vulnerabilities and develop plans to increase climate change resilience. In 2018, a \$2.4 billion Environmental Bond Bill authorized over \$200 million to fund climate change adaptation, including both planning and implementation aspects of the MVP Program.

To date, 249 of the Commonwealth's 351 municipalities (71%) have participated in the MVP Program. This has resulted in more than \$17 million dollars in Planning Grants and Action Grants to implement high priority actions identified during the planning process. Projects funded through Action Grants are wide ranging, including the following priority project categories:

- More detailed vulnerability and risk assessments;
- Community outreach and education projects;
- Local bylaw updates;
- Redesign and retrofits of infrastructure;
- Nature-based solutions for flood protection, drought mitigation, and water quality improvements;
- Nature-based infrastructure and technology solutions for extreme heat and poor air quality.

1.2 Community Resilience Building Workshop

The Town of Hadley (Town) received funding through an MVP Planning Grant to compile data for and conduct a Community Resiliency Building (CRB) workshop. The goal of the CRB workshop was to have community stakeholders work collaboratively to complete a climate change and natural hazard vulnerability assessment and develop prioritized actions to address vulnerabilities and improve strengths throughout town. Upon completion of the CRB workshop process, Hadley will become an "MVP Community" and will be eligible to apply for MVP Action Grant funding from the Commonwealth.

An interdisciplinary team of Town staff (i.e., "Core Team") worked to implement the CRB process with consulting support from Comprehensive Environmental, Inc. (CEI), a certified MVP provider. The Town's MVP Core Team included the following:

Town of Hadley – MVP Core Team
Chris Okafor, Director of Public Works
Janice Stone, Conservation Commission
William Dwyer, Planning Department
Tim Neyhart, Building Inspector
David Nixon, Town Administrator

1.3 Workshop Preparation

The following tasks were performed to prepare for the CRB workshop:

- The Core Team and CEI held a kickoff meeting on August 7, 2019 to plan for the workshop.
- CEI conducted interviews with Core Team members to identify potential areas of concern, strengths, and vulnerabilities.
- CEI prepared presentation materials and Town-wide maps to guide the workshop.
- The Core Team scheduled the workshop, invited stakeholders, and handled logistics.

1.4 Workshop Process

A full-day MVP planning workshop was held on January 7, 2020 in accordance with CRB guidance¹. The workshop participants are listed below.

Name	Department/Committee	Team
Edwin Matuszko	Conservation Commission	Red
Michael Spanknebel	Fire Department Chief	
Chris Okafor	Dept. of Public Works Director	
Amy Fyden	Finance Committee	
Toni Lyn Morelli	Conservation Commission/UMass	
David Nixon	Town Administrator	
Jennifer Sanders James	Conservation Commission	
Jim Maksimoski	Planning Board	Yellow
Anne McKenzie	School Department	
Molly Keegan	Select Board	
Janice Stone	Conservation Commission	
Michael Romano	Police Department	
Hayley Wood	Council on Aging	
Drew Hutchinson	Hadley Media	
Bob Hartzel	CEI	Facilitators
Elisha Musgraves	CEI	
David Roman	CEI	

The workshop was initiated with introductory presentation materials. Presentation materials included:

- Description of the MVP program and CRB process;
- Summary of Hadley’s emergency management procedures;
- Introduction to climate change, including Hadley-specific climate change projections²;
- Introduction to nature-based solutions (i.e., green infrastructure);
- Summary of stakeholder interview results.

¹ CRB Guidance: www.communityresiliencebuilding.com
² Climate projections obtained from: www.resilientma.org

Stakeholders were then split into diversified sub-groups (7 people per group, see assigned teams in table above) to conduct concurrent guided exercises. As listed below, the exercises solicit and organize input from stakeholders through use of the Risk Matrix presented in Appendix B.

Workshop Exercises

Exercise 1: Identify the Town's top local natural and climate-related hazards of concern.

Exercise 2: Identify the Town's strengths and vulnerabilities relative to top hazards.

Exercise 3: Identify and prioritize actions to reduce vulnerabilities or improve strengths.

Exercise 4: Determine the Town's overall top priority actions.

Note: Exercises 1 and 4 were conducted with all workshop participants. Exercises 2-3 were conducted simultaneously by the sub-groups (red team and yellow team).

To help generate ideas and discussion during the planning exercises, each sub-group was provided a series of base maps (Appendix C) with information such as FEMA flood hazard areas, critical habitat areas, and conservation land within Hadley.

This report provides an overview of workshop findings, including a summary of the Town's top hazards related to climate change, current climate resiliency strengths and vulnerabilities, and potential actions to improve the community's resilience to natural and climate-related hazards. The summary of findings described in this report are compiled from workshop stakeholder feedback.

2. Top Hazards and Vulnerable Areas

2.1 Summary of Top Hazards

During Exercise 1, stakeholders discussed and reached consensus on Hadley's top natural hazards and areas of concern.

The following three hazards were identified as presenting the highest direct and indirect risks to Hadley's infrastructure, societal, and environmental resources:



Red team workshop participants



1. **Flooding:** Flooding was the hazard of highest concern to Hadley. Historical flooding has caused property damage and has led to closures of critical roads.



2. **Severe Storms:** Extreme weather events such as strong winter storms and heavy rainfall with high winds were another concern due to their potential for damage to infrastructure and other physical, social, and environmental consequences.



3. **Drought:** Future occurrences of drought are predicted to increase. Workshop stakeholders identified drought as a top concern for its potential to disrupt agriculture operations.

2.2 Areas of Concern

Prior to the workshop, interviews were conducted with key stakeholders to develop a preliminary list of Hadley's primary climate resiliency vulnerabilities and strengths. Interviewees indicated that, as a riverside community, flooding and stormwater hazards were the primary concerns for Hadley. Environmental impacts to agriculture and farming was also a concern of those interviewed.

The table below lists areas of concern that were identified based on stakeholder interviews and feedback during the CRB workshop. Subsequent sections of this report provide more details on strengths and vulnerabilities (and potential solutions to increase resilience) relative to these areas of concern.

Category	Areas of Concern
 <p>Infrastructure</p>	<ul style="list-style-type: none"> • Stormwater conveyance network • Hadley Dike • Major transportation corridors (Route 9, Route 47 South, Rocky Hill Road, Bay Road, River Drive, Maple Street) • Public water supply
 <p>Communities and Agriculture</p>	<ul style="list-style-type: none"> • Farms throughout town • Senior Living Communities • Hadley Housing Authority • Hadley Safety Complex • Public schools
 <p>Environmental</p>	<ul style="list-style-type: none"> • Unprotected / undeveloped agricultural parcels • Critical habitat areas • Lake Warner Watershed • Fort River Watershed • Chmura Road (wildfires)

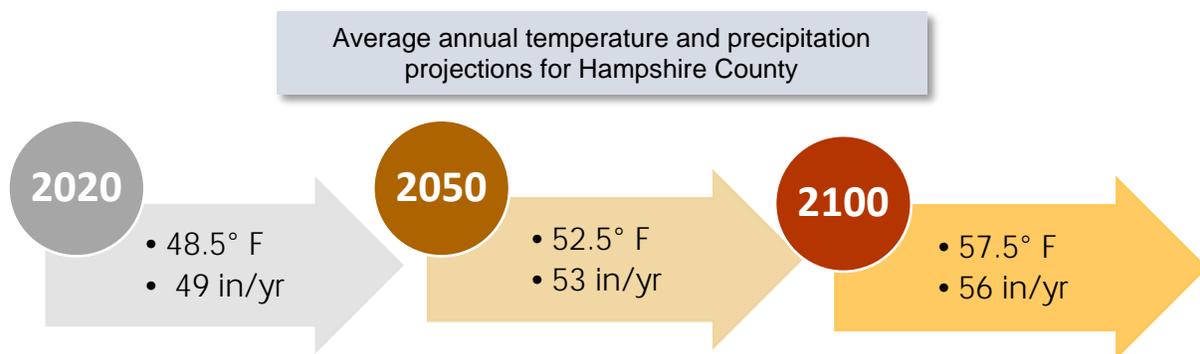
3. Current Concerns and Challenges Presented by Hazards

Hadley faces multiple challenges related to potential impacts from natural hazards. In recent years, the Town has experienced disruptive and damaging weather events, including Tropical Storm Irene (August 2011), Tropical Storm Sandy (October 2012), winter Nor'easter Nemo (February 2013), winter Nor'easter Quinn (March 2018), and Hurricane Barry (August 2019). These storms brought heavy rain-induced inland flooding, wind damage to trees, and snow that caused widespread damage to Hadley and many other Massachusetts communities. Additionally, Hadley was impacted by the drought conditions experienced across the state throughout 2016.

The intensity and frequency of extreme weather events has increased awareness of Hadley's natural hazards and risks associated with climate change, while motivating communities throughout Massachusetts to comprehensively assess and improve resilience at the local level.

The following is a summary of climate change projections for Hampshire County, Massachusetts from the Climate Change Clearinghouse (CCC) for the Commonwealth (www.resilientma.org):

Note: Climate change projections below are based on median modeled results – some models predict higher and lower outcomes.



3.1 Categories of Concerns and Challenges

During the guided exercises, workshop participants identified Hadley's vulnerabilities and strengths to natural hazards. As in any community, Hadley is not uniformly vulnerable to potential hazards and climate change impacts – certain locations, resources, and populations will be affected to a greater degree than others. Workshop participants identified the following as key areas of concern across three categories – infrastructure, societal, and environmental.

3.1.1 Infrastructural Concerns

- **Stormwater Infrastructure:** Workshop participants expressed concerns about the Town's stormwater management system. Specific areas of concern included the following:

- Aging and undersized culverts causing severe flooding in roadways (e.g., Mill Valley Road, Bay Road, Route 9, River Road, North Chmura Road, Laurel Street, Hockanum Road, Knightly Road, Sunrise Avenue, and Moody Bridge Road).
- Conveyance capacity of open drainage channels throughout Town are impacted by sedimentation from nearby agricultural fields. Many of the conveyance channels are



located on private land. Maintenance of these channels is challenging as the Town does not currently have maintenance easements in place for most locations.

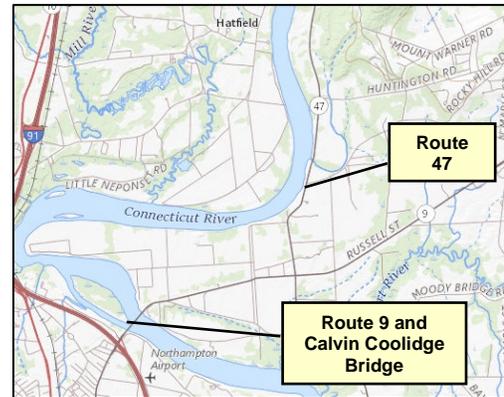
- Leaching catch basins installed in poorly drained soils pose a potential flood hazard from frequent clogging (e.g., Knightly Road).
- **The Hadley Dike:** Hadley Dike, which extends for roughly 2 miles along Hadley's western boundary, was built in the 1930s by the Army Corps of Engineers to protect the vulnerable bordering area along the Connecticut River. The following dike-related issues were identified by stakeholders:
 - Based on previous assessments and inspections, multiple sections of the Hadley Dike are in poor condition and require repair.
 - Multiple portions of the dike are located on private property and therefore cannot be accessed to make repairs.
 - The dike was not built-out for the entirety of Bay Road and therefore does not provide potential flood mitigation benefits to infrastructure northeast of Bay Road.
- **Water Supply Redundancy and Fire Protection:** The Town's only Water Treatment Plant (WTP) is located within the Fort River floodplain. The Town does not currently have an alternative WTP and is therefore vulnerable to any outages caused by future storms. In addition, an approximately 10,000 linear foot section of 6-inch cast iron water main on South Maple Street is undersized and does not have adequate capacity to pass flows required for fire control. Further, the Town's Wastewater Treatment Plant (WWTP) is located within the Zone II Wellhead Protection Area for public drinking supply.
- **Wastewater Treatment Plant Capacity and Zone II Proximity:** The Town's Wastewater Treatment Plant (WWTP) frequently operates near capacity, is located within the Zone II Wellhead Protection Area for public drinking water supply, and is located within the Fort River floodplain. The Town does not currently have an alternative WTP and is therefore vulnerable to any outages or increases in influent. Stakeholder participants indicated that some of the WWTP's capacity issues are likely caused by illegal sump sumps installed by residents and expressed concerns over the potential contamination risks posed by increased flooding. Many areas in Town routinely flood due to the high groundwater water table and proximity to the Connecticut River Floodplain. Localized flooding has increased in recent years as a result of more frequent, higher intensity precipitation events. Residents throughout town are impacted by localized flooding and the high groundwater table (i.e., flooded basements and property). To combat this issue, stakeholder participants indicated that some homeowners have installed illegal sump pumps that discharge to the Town's Wastewater Treatment Plant (WWTP).

3.1.2 Societal Concerns

- **Bylaw Enforcement in Floodplains and Vulnerable Areas:** Stakeholders expressed concerns over the frequency with which development proposals have been granted waivers to wetland and floodplain restrictions and buffer setbacks. Some stakeholders expressed concern that Town bylaws are not being effectively enforced in areas where wetland and floodplain impacts occur.



- **Isolation Risks to Major Transportation Corridors:** Some of the Town's primary roads serve both inter-municipal and intra-municipal purposes, with neighboring communities using Route 47, Route 9, and the Calvin Coolidge Bridge to access other towns and I-91. Additionally, Route 9 serves as a major economic hub for Hadley. These areas, as well as other main roads in town, are identified as having existing flooding issues, often due to undersized culverts. This flooding can result in lane closures and potentially limits access to critical transportation corridors.



- **Vulnerable Communities:** Several vulnerable, densely populated areas were identified during the workshop. Hadley has several senior and low-income living facilities, in addition to an aging town-wide population. Stakeholders expressed concerns that emergency alerts and planning information may not be fully reaching disabled and elderly populations (i.e. groups that may not have cell phones to access CodeRED alerts). Further, vulnerable populations at some housing complexes do not have access to central air conditioning. The Town Safety Complex, which houses multiple departments involved in emergency response and management, presents an additional vulnerability, as it is located in a floodplain. If the Complex experienced significant flooding, it could impair the emergency responders' ability to function effectively.
- **Agricultural Drought Irrigation:** Stakeholders indicated that farms throughout Hadley were significantly impacted by the 2016 drought. Drought conditions forced farmers to pump directly from surface waters for irrigation, resulting in unintended water quantity, quality, and ecological impacts. The potential long-term viability of farms in Hadley could be compromised without a reliable and equitable source of irrigation water during future droughts.
- **Seasonal Use of Connecticut River Bank:** Stakeholders indicated that Hadley has an issue with unpermitted campsites in the vicinity of Sandy Beach on the southern bank of the Connecticut River. An estimated 100 or campsites are located in this area on private properties, with many of these only seasonally occupied during summer and early fall. The Town has identified several environmental hazards and Town bylaw violations associated with these camps, including sanitary concerns and tree clearing in flood and erosion prone areas. Having unpermitted populations in active floodplains presents additional risks related to emergency response and notification in the event of a natural hazard.

3.1.3 Environmental Concerns

- **Forest and Wetland Management:** Workshop participants noted that brush fires in conservation areas and near Chmura Road have posed problems. An increase in invasive pests (i.e., ticks, Asian long-horned beetle, etc.) were also discussed as risks relative to increasing temperatures. Invasive pests also pose risks relative to loss of crops.
- **Land Conservation / Habitat Protection:** Currently, roughly one third of Hadley is identified by the Massachusetts Natural Heritage and Endangered Species Program as Estimated and Priority Habitat for rare species, or as Critical Natural Landscape that supports vital ecological processes for the region. The Town's northern and southern borders are dominated by such habitat areas



for protected, rare species, and several certified vernal pools are also present within these areas. Stakeholders expressed concern over development in critical green corridor areas and water quality issues as threats to vulnerable species in the region.

- **Lake Warner Water Quality Impairments:** Lake Warner has increasingly suffered from nutrient impairments and associated algal blooms, with watershed nutrient sources from surrounding agricultural areas and other land uses. It is possible that these impairments are accelerating from increases in precipitation which in turn produce more nutrient-laden runoff. According to the *Massachusetts 2016 Integrated List of Waters*, the lake has multiple impairments including total phosphorus, turbidity, algal growth, and dissolved oxygen.
- **Development of Unprotected Parcels:** Hadley still contains many unprotected and undeveloped parcels that are privately owned, particularly in agricultural areas (e.g., farm fields). Many of these parcels are located within the Connecticut River floodplain, and as such, provide natural floodplain storage benefits. These parcels also contain natural riparian buffers which limit nutrient-laden runoff from entering the Connecticut River. Stakeholders indicated that future development of these parcels could compromise the benefits that these parcels currently provide.
- **Air Quality / Dust Issues:** Workshop participants indicated that farmers commonly don't implement cover crops on fallow fields. This practice can lead to significant air quality and dust issues, particularly during dry periods or drought.

4. Current Strengths and Assets

Due to recent experiences with extreme weather, workshop participants were aware of Hadley's strengths and how they relate to its vulnerabilities. It was a clear priority to continue to reinforce and expand these strengths, to increase preparedness and resiliency in the community, and to adapt these strengths to address potential impacts of climate change. Key Town strengths are as follows:

- **Emergency Services and Town Hall:** The Town currently has an excellent emergency response track record. Town Hall department heads frequently communicate with one another, and the Conservation Commission and the Planning Board work collaboratively with local farmers and other key interest groups. The Fire Chief and Emergency Management Director works with CodeRED and other emergency alerting services.
- **Conservation Areas:** Hadley has approximately 2,471 acres of municipal- or state-owned conservation land and protected open space and 3,259 acres of protected farmland, with no public access or recreation. Much of this protected land contains wetlands and natural floodplains. The Kestrel Land Trust recently acquired additional parcels to mitigate floodplain loss and green corridor extension. The Norrotuck Rail Trail connects citizens with recreation areas and provides riparian connectivity throughout Hadley.
- **Local Partnerships:** The Town has partnered with the Pioneer Valley Planning Commission (PVPC) in the past, including recent work on the Hazard Mitigation Plan (HMP) Update, completed in 2016. The communities within the Pioneer Valley often work in close cooperation with one another, particularly as it pertains to inter-municipality connectivity and regional planning. The presence of UMass Amherst facilities within the Town serves as a major source of public education and outreach for the Town, as partnering with the college may be a necessity in some circumstances. Continuing to participate in regional partnerships will serve as a major strength for Hadley.

5. Recommendations to Improve Resilience

As summarized below, the final step of the workshop was to develop recommended actions to address identified vulnerabilities (i.e., concerns and challenges) and to improve strengths.

- Each workshop sub-group identified potential actions and assigned each action a priority (i.e., high, medium, low), then differentiated them as short-term, long-term, or ongoing efforts.
- Each small group selected their top five potential actions, then reported out to the overall stakeholder group.
- The overall stakeholder group then voted to collectively determine the top three actions.

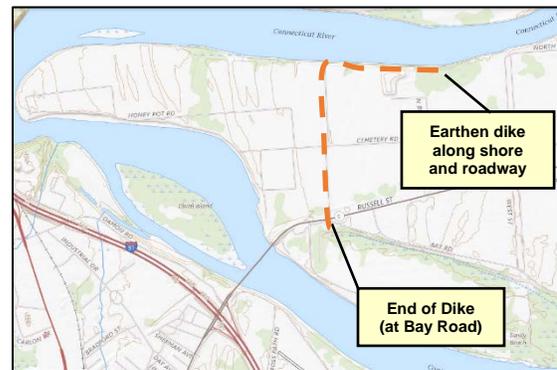
The sections below provide a description of prioritized recommendations developed from the workshop.

5.1 Top Three Recommendations

1. Hadley Dike – Repair, Maintain, and Expand

The Hadley Dike, which extends for roughly 2 miles along Hadley's western boundary, was built in the 1930s by the Army Corps of Engineers to protect the vulnerable bordering area along the Connecticut River. The following dike-related issues were identified by stakeholders:

- Based on previous assessments and inspections, multiple sections of the Hadley Dike are in poor condition and require repair.
- Multiple portions of the dike are located on private property and therefore cannot be accessed to make repairs.
- The dike was not built-out for the entirety of Bay Road and therefore, the dike does not provide potential flood mitigation benefits to infrastructure behind Bay Road.



In order to mitigate potential flooding risks, it is recommended that the Town obtain permanent easements for dike repairs and maintenance in accordance with recommendations from previous studies. A study could be performed to determine the feasibility of extending the dike along Bay Road. Expected components of the feasibility study include: 1) conceptual design, 2) hydraulic modeling relative to current and potential future storm events to enable quantification of potential performance / benefits of the expanded dike; 3) a discussion of potential design constraints, including required permits, 4) preliminary cost estimate and discussion of potential funding sources.

2. Assess, Maintain, and Replace Key Stormwater Infrastructure

Hadley's stormwater infrastructure generally results in flooding due to underperforming structures (i.e. siltation, undersized, poor condition). To compound this issue, maintenance of drainage ditches and select culverts can be problematic when located on private land. Culverts resulting in the most frequent flooding were identified by stakeholders as: Mill Valley Road, Bay Road, Route 9, River Road, North

Chmura Road, Laurel Street, Hockanum Road, Knightly Road, Sunrise Avenue, and Moody Bridge Road.

To begin addressing these issues, the Town previously performed a study to prioritize and rank a subset of culverts and drainage channels in need of repairs and/or replacements. The Town is also currently working to obtain approval to access and maintain key drainage ditches.

It is recommended that the Town implement a phased plan to assess, replace, and maintain key stormwater drainage infrastructure. Given past efforts, it is recommended that phases within this plan be performed concurrently.



- **Assess:** Expand the previous study to include a comprehensive vulnerability / resiliency assessment of all Town drainage infrastructure (i.e., drainage pipes, remaining culverts, remaining drainage ditches). The assessment could include any or all of the following components: interviews with Town personnel, condition inspections, flood modeling relative to potential future higher intensity storms, identification of areas of concern, and prioritized recommendations for repairs / replacements.
- **Replace:** Replace previously identified key culverts. Replacement steps would include: engineering feasibility analysis (i.e., modeling, conceptual design), permitting, engineering design, and construction.
- **Maintain:** Obtain approvals to enable maintenance of key stormwater infrastructure as identified by the vulnerability assessment. Expected approvals include maintenance easements from private landowners and various permitting approvals, such as requirements covered by the Massachusetts Wetlands Protection Act and the Hadley Wetlands Bylaw.

3. Connecticut River Banks – Assessment of Alternatives to Unpermitted Campsites

Hadley currently has an issue with unpermitted campsites in the vicinity of Sandy Beach during the summer and early fall. There are approximately 100 trailers or campsites located in this area along the Connecticut River banks, many of which are only seasonally occupied on private property. The Town has identified several environmental hazards and Town bylaw violations associated with these camps, including sanitary concerns and tree clearing in flood and erosion prone areas.



View of the Connecticut River and farmland in Hadley

The first steps to addressing this concern are to (1) develop an understanding of the population that is using these unpermitted campsites and (2) assess possible alternative locations to accommodate this mostly seasonal population safely (i.e., not at risk of flood impacts), legally, and without environmental impacts. It is recommended that the Town establish an interdepartmental committee to collaborate with area land owners, migrant farm worker representatives and other community stakeholders. This committee, with key stakeholder input, could develop equitable solutions that prevent further environmental damages, without displacing socially vulnerable populations in Hadley.

5.2 Other Prioritized Recommendations

Professional judgement was used to reach consensus on priority for cases in which a recommendation was assigned different priority levels by the workshop sub-groups.

Higher Priority

- The Town's only Water Treatment Plant (WTP) and Wastewater Treatment Plant (WWTP) is located within the Fort River floodplain. The Town does not currently have an alternative WTP or WWTP and is therefore vulnerable to any outages caused by future storms. The following actions are recommended to increase the resiliency of the existing WTP and WWTP while evaluating the potential for a redundant/alternate supply source:
 1. Perform engineering design and installation for floodproofing measures to be deployed around the perimeter WTP and WWTP. Potential floodproofing measures could include temporary deployable flood barriers or elevation of key infrastructure (e.g., pumps, controls, utilities).
 2. There are two existing wells located on Town Well Road (Mt. Warner Wells). The Mt. Warner Wells have documented water quality impairments for perchlorate and other contaminants, potentially due to surrounding agricultural practices. It is recommended that a feasibility study be performed to determine if the Mt. Warner Wells could be a suitable alternative supply source. Key steps of the study would include: 1) pump testing, 2) water quality testing, 3) conceptual design, and 4) treatment piloting.
 3. Perform feasibility study to determine if a viable alternative WWTP option exists. One option could be coordination with regional partners to shift load to an alternative WWTP source such as Amherst WWTP.
- An approximately 10,000 linear foot section of 6-inch cast iron water main on South Maple Street is undersized and does not have adequate capacity to pass fire flows. It is recommended that the undersized water main be replaced with an 8" to 12" ductile iron pipe capable of accommodating fire flows. Replacement steps would include: 1) engineering design, 2) permitting, 3) construction.
- The Town's WWTP is within its own Zone II wellhead protection area, which presents contamination risk. It is recommended that the Town perform a vulnerability assessment to determine potential water quality impacts and other risks. Results from the vulnerability assessment would include recommendations to address identified risks.
- Communications to vulnerable populations (i.e. elderly, deaf, blind) are currently implemented through a number of methods, including robocalls, but there is no unified communications plan amongst all departments in town. It is recommended that Hadley develop a comprehensive interdepartmental emergency communication plan.

Moderate Priority

- The capacity of the Town's WWTP is potentially being compromised by illicit sump connections installed by homeowners to alleviate localized flooding impacts (i.e., flooded basements / properties). It is recommended that a study be performed to locate and correct illicit connections. Potential corrections could include nature-based solutions or other Best Management Practices (BMPs) to capture and minimize runoff at areas of localized flooding.

- As previously indicated, there are a number of locations in town that can be isolated during a flood (including a majority of the Town if the Route 9 bridge were compromised). Other areas include Hockanum Road, River Drive, Bay Road, etc. Emergency responders have already developed evacuation/emergency access plans and protocols; however, many departments lack strong implementation tools. It is recommended that the Town develop tools to better prepare residents for evacuation/emergency situations. Potential emergency responder tools could include: improved signage to mark evacuation routes, portable electronic signage to display critical messages during emergencies, and public education and outreach materials.
- There are multiple senior/assisted living facilities, low-income housing, and large housing complexes in town that present planning and coordination risks. It is recommended that the Town develop a bylaw that mandates housing complex emergency plans be provided to Town emergency management officials to better support town-wide emergency responses. Additionally, this bylaw could mandate all privately owned housing complexes and living facilities within floodplains perform flood risk assessments for their properties and incorporate the findings into emergency planning.
- Vulnerable populations at public housing complexes either don't have access to central air conditioning or rent prices are rising as a result of landlords installing central air. This can be problematic with low income and elderly residents. It is recommended that the Town perform an assessment of public housing and develop a plan to ensure that vulnerable populations have access to affordable air conditioning.
- Stakeholders indicated that farms throughout Hadley were significantly impacted by the 2016 drought. Drought conditions forced farmers to pump directly from surface waters for irrigation, resulting in unintended water quantity, quality, and ecological impacts. The potential long-term viability of farms in Hadley could be compromised without a reliable and equitable source of irrigation water during future droughts. It is recommended that the Town develop a drought/irrigation management plan with stakeholder input. The drought management plan could include some or all of the following components:
 1. Identification of vulnerable locations.
 2. Evaluation of potential alternative irrigation water supply sources. For example, extension of the Town's water supply system to include metered hydrants at strategic locations.
 3. Implementation of a streamflow monitoring and alerting network at key surface waters.
 4. Development of public educational materials relative to water conservation.
- Lake Warner has increasingly suffered from nutrient impairments and associated algal blooms, with watershed nutrient sources from surrounding agricultural areas and other land uses. It is possible that these impairments are accelerating from increases in precipitation which in turn produce more nutrient-laden runoff. According to the Massachusetts 2016 Integrated List of Waters, the lake has multiple impairments including total phosphorus, turbidity, algal growth, and dissolved oxygen. It is recommended that the Town develop a watershed-based plan to determine causes and sources of pollution and develop a plan to mitigate these sources (e.g., green infrastructure implementation).
- Farmers typically don't implement cover crops on fallow fields which can lead to significant air quality and dust issues, particularly during dry periods or drought. It is recommended that the Town develop a public education program on best management practices to mitigate this issue, including implementation of appropriate cover crops.

- Hadley still contains many unprotected and undeveloped parcels that are privately owned, particularly in agricultural areas. Many of these parcels are located within the Connecticut River floodplain, and as such, provide natural floodplain storage. These parcels also provide natural riparian buffers which limit nutrient-laden runoff from entering the Connecticut River. Stakeholders indicated that future development of these parcels could compromise the benefits that these parcels currently provide. It is recommended that the Town prevent development along the riverfront either by acquiring land, protecting land under the agricultural preservation restriction program, or other means such as implementing Conservation Restrictions (CRs).
- Hadley has experienced issues with invasive species, crop blight, and other environmentally influenced pest risks. Due to the importance of agriculture in the economic success of the Town, it is recommended that the Town partner with UMass to develop targeted public education and outreach materials and programs, focused on synthetic pesticide and fertilizer alternatives. Additionally, the Town may want to partner with UMass forestry programs to conduct ecological surveys of invasive and nuisance pests.

Lower Priority

- Hadley's topography is generally flat, which causes excessive snow drifting. It is recommended that the town install snow fences or vegetative barriers near critical roadways and access points to prevent drifting.
- Many of the Town's catch basins are designed to leach (i.e., allow infiltration through the bottom); However, they are commonly installed in poorly drained soils (e.g., clay) which pose a potential flood hazard from frequent clogging. One area of particular concern is Knightly Road. It is recommended that the Town perform a study to prioritize replacement of problematic leaching catch basins based on past history, anecdotal information, soils type, or other information. These structures have the potential to be replaced with deep sump catch basins, hydrodynamic separators, or other proprietary mechanisms which provide pollutant removal benefits.
- The Hopkin's School is located within the 100-yr floodplain. Stormwater controls for the area are mostly comprised of agricultural drainage ditches. The school has 7 acres of adjacent open space off of Middle Street. It is recommended that the Town develop a plan to design and implement stormwater BMPs to provide flood mitigation in this area. The plan could assess the potential of installing a rainwater harvesting system to encourage irrigation and water conservation.
- The Town Safety Complex houses emergency response departments and Town offices. However, it is located in a floodplain. It is recommended that the Town make use of pervious surrounding land and design and implement stormwater BMPs to provide flood mitigation benefits in this area.
- There are a series of dams upstream of Hadley along the Connecticut River. Based on input from stakeholders, water levels historically risen quite rapidly with minimal warning time, presumably from upstream releases. It is recommended that the Town identify and partner with the managers of neighboring upstream dams to develop enhanced communications and a plan for controlling and alerting downstream communities of impending releases.
- Due to previous occurrences of brush fires near Chmura Road, it is recommended that the Town partner with the Department of Conservation and Recreation (DCR) to develop a brush-burning control plan for high-risk areas.

This list of prioritized recommendations was developed by workshop stakeholders based on identified vulnerabilities.

It is recommended that the Town create a committee or working group to implement recommendations from this plan. Specifically, the committee or working group would develop an anticipated timeline, determine potential funding requirements, then apply for local, state or federal grant funding to implement prioritized recommendations.

It is also recommended that this report be reviewed and updated annually as actions are completed and/or new needs are identified

6. Report Citation

CEI Consultants (2020). Community Resiliency Building Workshop Summary of Findings. Town of Hadley, Massachusetts.

APPENDIX A

INTRODUCTORY PRESENTATION MATERIALS



Town of Hadley
Municipal Vulnerability Preparedness Program
Community Resiliency Workshop




1

Welcome!



Opening remarks

- Chris Okafor, Department of Public Works
- Bob Hartzel, CEI
- Andrew Smith, EOEEA MVP Regional Coordinator

2

Introductions

- Name
- Organization



3

MVP Regional Coordinator Overview

Andrew Smith
EOEEA MVP Regional Coordinator



4

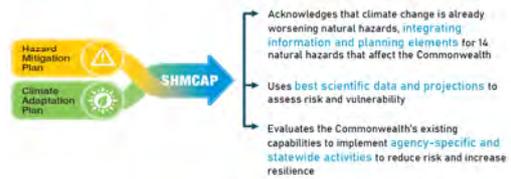
MVP Regions & Regional Coordinators



Region	Regional Coordinator	Contact
Berkshires & Westchester	Debra Niles	Pinfield
Greater CT River Valley	Andrew Smith	DEP Springfield andrew.smith@mass.gov
Central	Hilary King	DEP Worcester hilary.king@mass.gov
Greater Boston	Carolyn Melkerburg	EPA Boston carolyn.melkerburg@mass.gov
Northeast	Michelle Rowden	DEP Lawrence michelle.rowden@mass.gov
Southeast	Courtney Rocha	DEP Lakeville courtney.rocha@mass.gov

5

Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) - September 2018



The diagram shows a flow from Hazard Mitigation Plan and Climate Adaptation Plan to SHMCAP. A bracket on the right lists three key features:

- Acknowledges that climate change is already worsening natural hazards, integrating information and planning elements for 14 natural hazards that affect the Commonwealth
- Uses best scientific data and projections to assess risk and vulnerability
- Evaluates the Commonwealth's existing capabilities to implement agency-specific and statewide activities to reduce risk and increase resilience

6

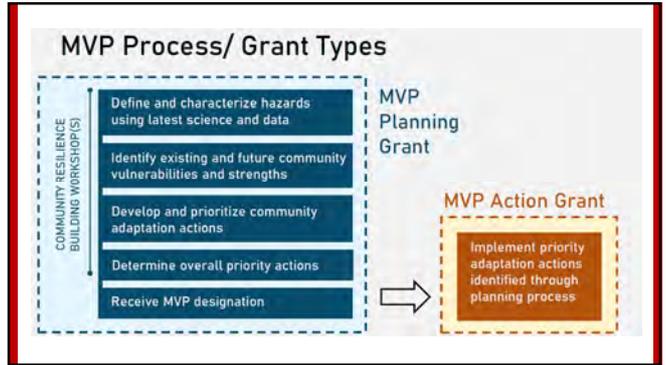
MVP Principles

A community-led, accessible process that

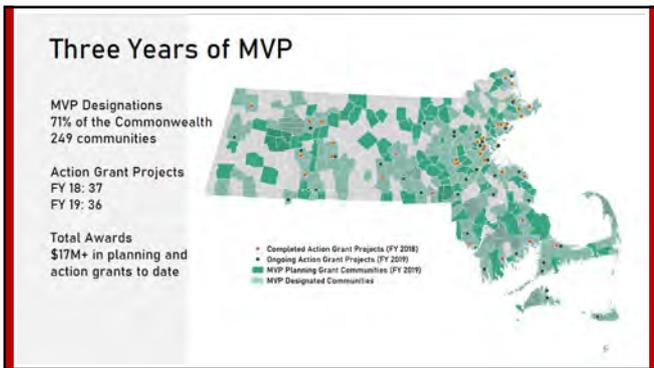
- Employs local knowledge and buy-in
- Utilizes partnerships and leverages existing efforts
- Is based in best available climate projections and data
- Incorporates principles of nature-based solutions
- Demonstrates pilot potential and is proactive
- Reaches and responds to risks faced by EJ communities and vulnerable populations

Why nature-based?
Where appropriate, nature-based solutions can be more cost-effective, protect water quality and quantity, sustain lands that provide food and recreation opportunities, reduce erosion, and minimize temperature increases associated with developed areas and climate change.

7



8



9

MVP Action Grants: Project Types

- Detailed Vulnerability and Risk Assessment*
- Community Outreach and Education
- Local Bylaws, Ordinances, Plans, and Other Management Measures
- Redesigns and Retrofits***
- Nature-Based Flood Protection, Drought Mitigation, Water Quality, and Water Infiltration Techniques**
- Nature-Based, Infrastructure and Technology Solutions to Reduce Vulnerability to Extreme Heat and Poor Air Quality

* Most common project type
** Second-most common project type
***Third-most common project type

10

MVP Action Grants: Project Types (cont.)

- Nature-Based Solutions to Reduce Vulnerability to other Climate Change Impacts
- Ecological Restoration and Habitat Management to Increase Resiliency

NEW IN 2019

- Energy Resilience
- Chemical Safety
- Land Acquisition for Resilience
- Subsidized Low-Income Housing Resilience Strategies
- Mosquito Control Districts
- + Expanded eligibility of project location

11



12

Example Action Grant Projects
Land Acquisition for Resilience

Mattapoisett Purchasing 120 acres of forest, streams, freshwater wetlands and coastal salt marsh as conservation land to prevent development in vulnerable areas



Data utilization
Proactive

13

Example Action Grant Projects
Nature-Based Flood Protection, Drought Prevention, Water Quality, and Water Infiltration Techniques

Millbury Utilizing green infrastructure like stormwater planters, bioretention bump outs, rain gardens, and other measures like porous pavers and pervious pavement to reduce heat island effects and stormwater runoff into the Blackstone River.



Nature-based solutions

14

Example Action Grant Projects
Local Bylaws, Ordinances, Plans, and Other Management

Boston Developing its first ever resilient building code so that development in the future floodplain is prepared for at least three feet of sea level rise, the likely scenario by late century.

Retrofitting a major waterfront park into a legacy park that uses nature-based solutions to address climate vulnerabilities while providing important access to recreation for residents.




Proactive
Pilot potential

Nature-based solutions
Community co-benefits

15

Example Action Grant Projects
Nature-Based Flood Protection, Drought Mitigation, Water Quality, and Water Infiltration Techniques

Belchertown Designing and permitting for a replacement water storage tank that would increase storage capacity and resiliency to drought, and completing a feasibility/ concept design of a rainwater harvesting system at Belchertown High School to irrigate the athletic fields.



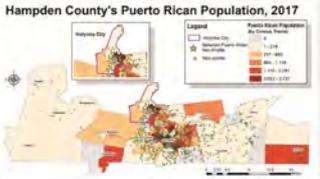
Nature-based solutions
Pilot potential

16

FY18 Action Grant Projects
Detailed Vulnerability and Risk Assessment, Further Planning

Holyoke Conducted a detailed demographic analysis of individuals who arrived in Holyoke from Puerto Rico as a result of Hurricane Maria and develop recommendations for planning for future climate change migrants in Holyoke

Hampden County's Puerto Rican Population, 2017



Informational graphics from Holyoke's final report

Area	Pop.	Percent
Area 1	100	100%
Area 2	100	100%
Area 3	100	100%
Area 4	100	100%
Area 5	100	100%
Area 6	100	100%
Area 7	100	100%
Area 8	100	100%
Area 9	100	100%
Area 10	100	100%

17

Example Action Grant Projects
Redesigns and Retrofits

Salisbury Increasing the resilience of the neighborhood of Ring's Island by raising its access/egress roads and by improving tidal flushing through culvert replacements



Vulnerable communities

18

Next Steps: Climate Change & the Commonwealth

Bill S.10:

An Act for Climate Change Adaptation Infrastructure Investments in the Commonwealth

- Building on success of existing programs like MVP: Proposed new source of revenue for loans, grants, and technical assistance to municipalities and regional partnerships for priority adaptation projects
 - Proposed deeds excise increase → est. \$137M annually (\$1B in ten years)
 - Recurring, long-term revenue stream for multi-year project feasibility



19



MA 2050 Decarbonization Plan



EEA is conducting an **80x50 Study** to identify the strategies, policies, and implementation pathways for MA to achieve at least 80% Greenhouse Gas reductions by 2050.

The results of that research will be published in a **2050 Roadmap report** and will inform the setting of a **2030 GHG emissions limit** and the development of the **Clean Energy and Climate Plan for 2030**.

More information and opportunities to get involved:
www.mass.gov/2050Roadmap



20




Andrew.B.Smith@mass.gov
<https://www.mass.gov/municipal-vulnerability-preparedness-program>



21

MVP Process



Obtain Planning Grant

Complete Workshop

- Identify Actions to Address Vulnerabilities
- Write Report

Become Certified MVP Community

- Eligible for Grant Funding to Implement Actions

22

Workshop Purpose

Use **Community Resilience Building Workshop Guide** to:

- Complete **baseline assessment** of climate change and natural hazard vulnerability
- Develop **specific actions** to address priority hazards/vulnerabilities



23

Workshop Agenda

- > **Workshop Overview** ✓
- > **Overview Presentations on Science and Resources**
- > **Exercises**
 - Identify Top Hazards
 - Identify Vulnerabilities and Strengths
 - Identify Actions to Reduce Vulnerabilities and Strengths
 - Identify Top Actions

24

Hazard Mitigation / Emergency Response Overview

Michael Spanknebel
Hadley Fire Chief and Emergency Management Director

25

Climate Change 101

26

WEATHER vs CLIMATE

Atmospheric observations down to the minute	Weather statistics over a period of time (30 years)
Weather is what you get	Climate is what you expect
EX: Nor'easter, hurricane, heat wave	EX: Average high and low temperatures

https://www.youtube.com/watch?v=cBdxDFpDp_k

27

How Does Climate Change Work?

The heat-trapping blanket metaphor

- The atmosphere is like a blanket that surrounds the earth.
- Burning fossil fuels adds more carbon dioxide to the atmosphere and makes the blanket thicker.
- The blanket has become too thick. It's trapping in too much heat, and the planet is warming up too fast.

28

Rising Temperatures Cause More Precipitation Events

29

Massachusetts Observed Climate Changes

- Temperature:** ↑ 2.9°F Since 1895 (Statewide)
- Growing Season:** ↑ 15 Days Since 1950
- Sea Level Rise:** ↑ 11 inches Since 1922 (Boston)
- Heavy Precipitation:** ↑ 55% Since 1958

Source: Climate Science Special Report, 2017; NOAA NCEI nCEIPnv; NOAA Ocean Service

30

Consequences



Changes in precipitation

- Inland flooding
- Drought



Rising Temperatures

- Wildfires
- Invasive species/pests



Extreme Weather

- Hurricanes/tornadoes
- Severe winter storms

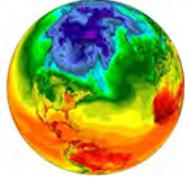


Human-induced hazards

- Loss of habitat/floodplains
- Overuse of fertilizers/pesticides

31

Hadley Climate Projections



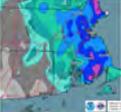
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<http://resilientma.org/>

Climate Change Clearinghouse for the Commonwealth

Maps



Use maps to identify climate change impacts and assess vulnerabilities in Massachusetts.

[More >](#)

Data



Explore Massachusetts climate science and data through interactive charts.

[More >](#)

Documents



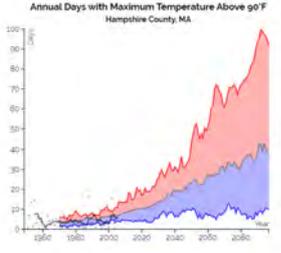
Discover reports, articles, plans, and other climate-related resources relevant to Massachusetts.

[More >](#)

33

Hotter...by 2040, days per year over 90 F will almost double

TEMPERATURE

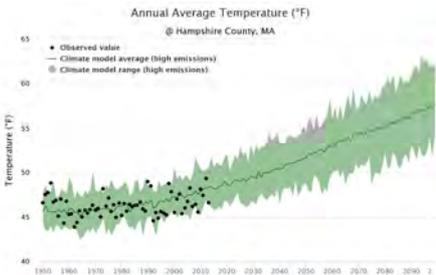


Observed Data	
5-yr Mean	0 days
Max	0 days
Median	0 days
Min	0 days
Modeled days	
2020 -	12.48 days
2040 -	20.15 days
2060 -	28.71 days
2080 -	33.82 days
2097 -	40.00 days

34

Hotter...average annual temperature steadily increasing

TEMPERATURE

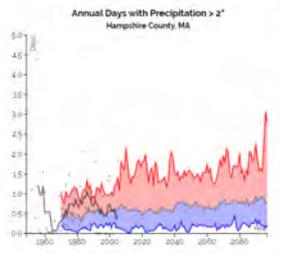


<http://climateactionforminn.org/blog/04-county-climate-change/>

35

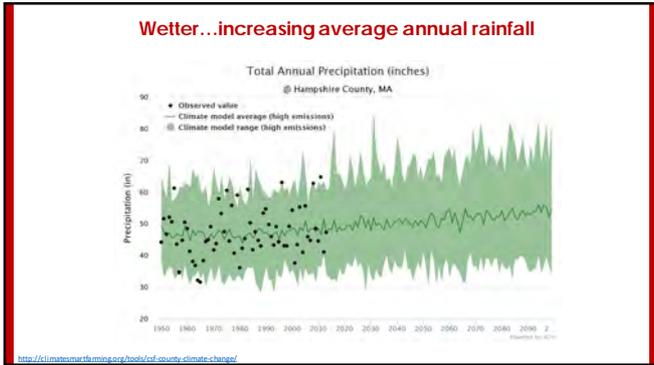
Wetter...more frequent intense precipitation events

PRECIPITATION

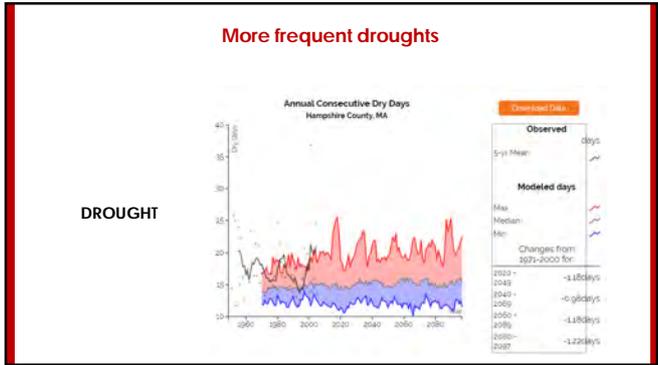


Observed Data	
5-yr Mean	0 days
Max	0 days
Median	0 days
Min	0 days
Modeled days	
2020 -	0.04 days
2040 -	0.05 days
2060 -	0.14 days
2080 -	0.17 days
2097 -	0.17 days

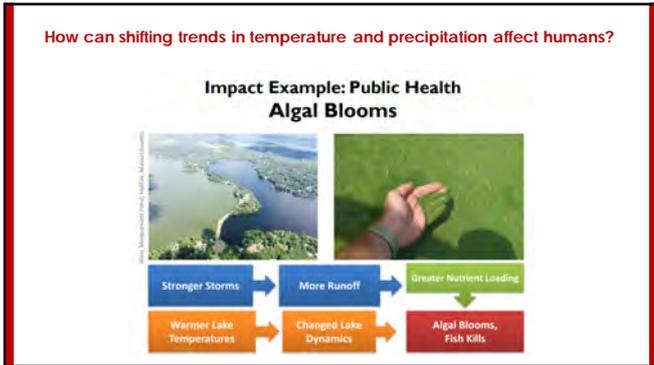
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37



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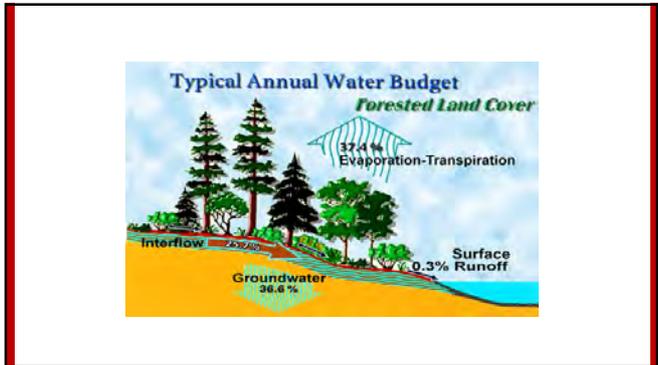
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Low Impact Development (LID)

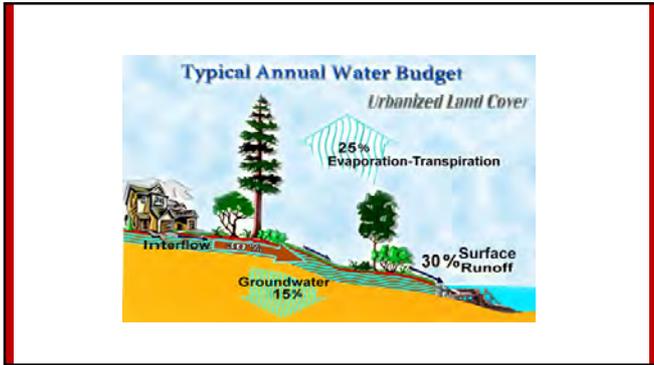
An ecosystem-based approach to land development and stormwater management

Mimic pre-development site hydrology!

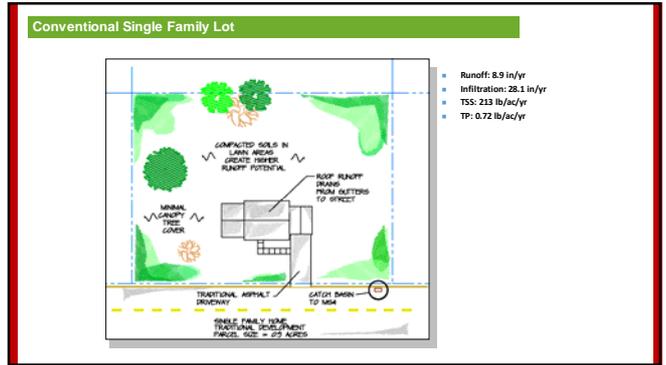
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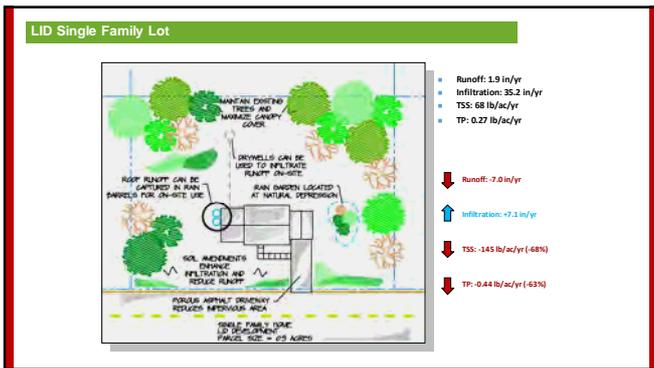
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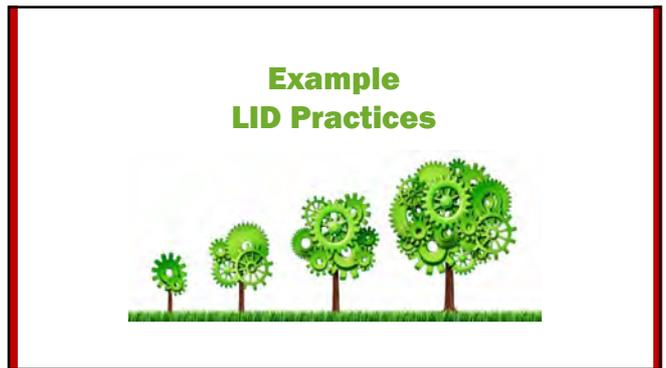
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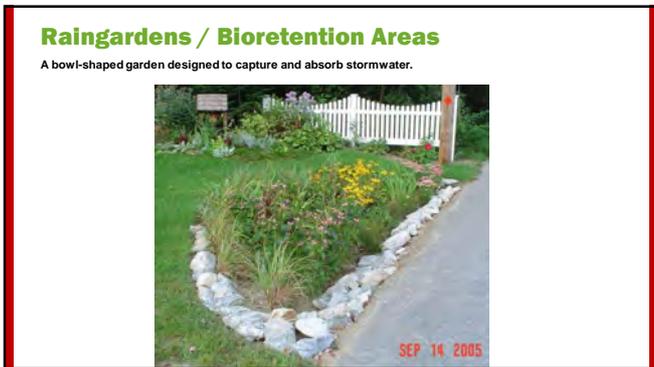
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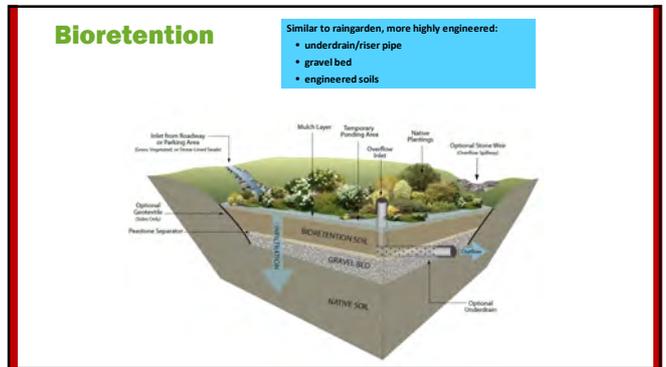
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46



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48



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51



52



53

Rain Barrels

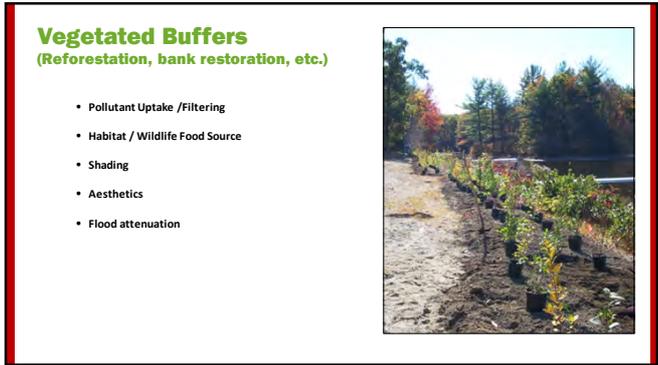
- For capture/re-use of roof runoff
- Most barrels average 60 gallons and cost \$75 - \$125
- Cisterns are much larger systems, often involving pumps and drywell structures.

Shown here with optional second top tank.

54



55



56



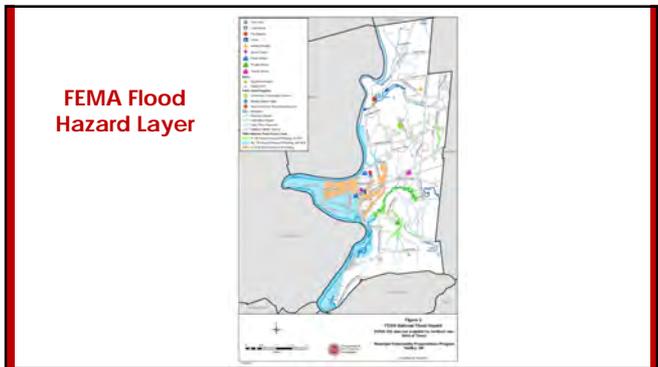
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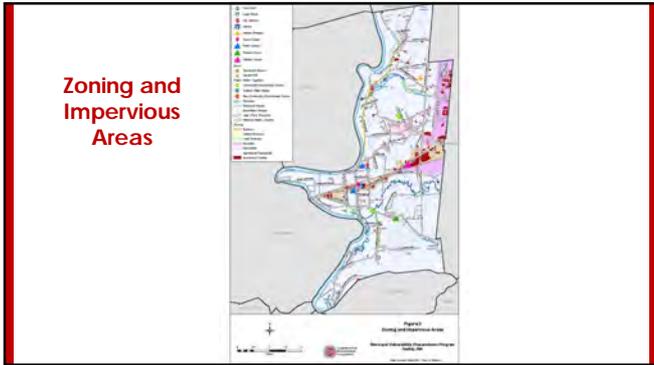
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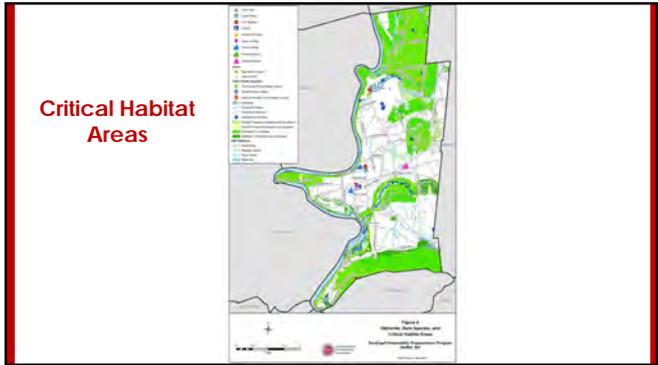
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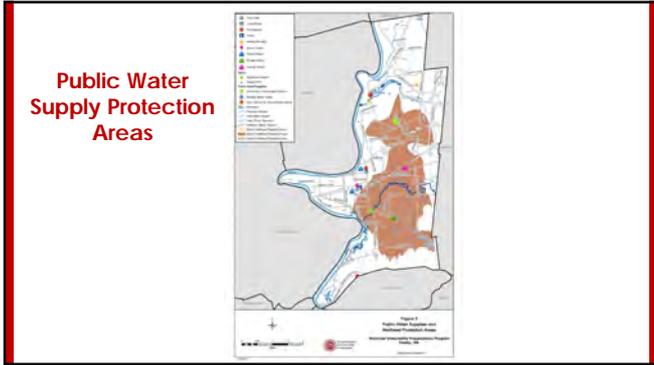
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61



62



63

Stakeholder Interview Results



64

Stakeholder Interview Results



VULNERABILITIES

Infrastructure <ul style="list-style-type: none"> • Drainage • Critical facilities • Historical assets 	Environmental Damages <ul style="list-style-type: none"> • Loss of floodplains • Development in hazard areas • Agriculture 	Public Utilities <ul style="list-style-type: none"> • Water supply • Power outages • Emergency services
--	--	---

Primary concern: *Flooding*

65

Stakeholder Interview Results



STRENGTHS

Fire Department/Emergency Services <ul style="list-style-type: none"> • Great track record of response 	Communication <ul style="list-style-type: none"> • Town Hall works well as a unit
--	---

66

Group Exercises

- 1: Characterize Hazards
- 2: Identify Community Vulnerabilities and Strengths
- 3: Identify and Prioritize Community Actions
- 4: Determine the Overall Priority Actions

Table Facilitators:

- Bob Hartzel, CEI
- David Roman, CEI
- Elsha Musgraves, CEI

67

Ground Rules

- Contribute
- Let everyone participate
- Listen with an open mind
- Stay on point and on time
- Attack the problem, not the person!



68

Ground Rules



69

Group Exercise #1

1: Characterize Hazards

Objective: Develop **top 3 Hazards** for facilitated discussions on vulnerabilities and strengths of Hadley (infrastructure, natural resources, people, supply chain, etc.)

1. Table introductions, identify team spokesperson, review Risk Matrix and maps
2. Identify Top 3 Hazards (10-15 mins)
3. Report out to large group (10-15 mins)

70

Example Hazards:

- Intense freezes – ice storms
- Wind events – high gusts, tornadoes
- Drought – wildfire, high temperatures
- Extreme precipitation events
- Flooding
- Nor'easters



71

Group Exercise #2

2: Identify Community Vulnerabilities and Strengths

Objective: Develop a **profile** of Hadley's infrastructural, societal, and environmental components **that are impacted by the Top 3 Hazards.**

1. Begin in first column of the matrix and identify **vulnerabilities (V)** and **strengths (S)**.
2. Determine location of V/S and list it on the Risk Matrix and mark it on the Base Map
3. Identify ownership of issue/asset/location
4. Time: Appx. 60-90 Minutes

72

Example Vulnerabilities:

- Main road floods, blocking emergency response
- Power outage during heat waves lead to health concerns
- Wildfire and high winds cause supply chain interruptions
- Sewer pump stations become inoperable
- Compromised rail system due to heat-related track warping



73

Example Strengths:

- Main road elevated and passable by emergency vehicles
- Hurricane roof installed at school – improved sheltering capacity
- Hardened utility lines reduce ice storm outages
- Undersized culver replaced – reduces flooding at key intersection
- Improvement to communications system during extreme weather



74

Lunch!



75

Group Exercise #3

3: Identify and Prioritize Community Actions

Objective: Identify and prioritize **actions** to help **reduce vulnerability** or **reinforce strengths** for each of the Top 3 Hazards

1. Begin on right side of the Matrix – “Actions”
2. Under the “Hazards” column, identify the actions needed to reduce **V** or reinforce **S** represented by each feature/asset
3. After completing “Hazards” column, consider Priority (**High, Medium, Low**) and Urgency (**Ongoing, Short-term, Long-term**) of each action
4. Identify 3-4 Priority Actions per team

76

Example Actions:

- Improved access to high-risk locations
- Reduce housing stock in vulnerable areas
- Prioritize development in low-risk areas
- Integrate future risks in capital improvement plans
- Flood-proof manhole covers
- Secure new generators for critical facilities



77

Group Exercise #4

4: Determine Overall Priority Actions

Objective: Present the findings of each group and collectively discuss identified opportunities to reduce current and future hazard risks and improve resilience

1. Spokesperson from each team presents findings to Large Group
2. Spokesperson presents 3-4 priority action cards to Lead Facilitator
3. Large Group Discussion to further define Highest Priority action list:
 - i. **Top 3-5 actions** to implement for Town of Hadley

78

Prioritization Factors

Consider factors such as:

- Funding availability / terms
- Agreement on outstanding impacts from recent hazard
- Necessity for advancing long-term outcomes
- Contribution to meeting existing local /regional planning objectives

Examples of urgency:

- Current project to install hurricane-proof roof on school is ongoing **(O)** action.
- Ensuring evacuation procedures are updated annually is considered a short-term **(S)** action.
- Reducing housing stock in high-risk areas, elevating a road, or replacing a bridge are long-term **(L)** actions.

79

Wrap-Up

Next Steps:

- Develop Report
- Hold Listening Session
- Become MVP Community

 Apply for Action Grant Funding!

80

Thank you for your time!

Town of **HADLEY**
Massachusetts

81

APPENDIX B

COMPLETED RISK MATRICES

Community Resilience Building Risk Matrix



www.CommunityResilienceBuilding.org

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

H - M - L priority for action over the **S**hort or **L**ong term (and **U**ngoing)

V = Vulnerability **S** = Strength

Features	Location	Ownership	V or S	Flooding	Drought	Strong Storms		Priority	Time
								H - M - L	Short Long Ongoing
Infrastructural									
Hadley Dike	Aqua Vitae	Public Access: Private	V/S	Repair existing issues (i.e. widen base); extend dike structure up unprotected shore				H	S/L
Aging culverts	Multiple	Both	V	Redesign and retrofit failing culverts				H	O
Major transportation corridor	Rt-9, 47s, Rocky Hill Road	Public	V	Town-wide vulnerability analysis on stormwater drainage and potential solutions along Rt 9 and Rt 47				H	O
Water treatment plants and pumping stations	Bay Road, West, Middle, Rt-9	Town	S	Assessment on floodproofing feasibility	Feasibility assessment for alternative water source			M	O
Wastewater treatment plant in wellhead protection zone	Middle	Town	V/S	Assesment to: Redesign pumping stations to be above flood levels, move treatment facility, etc.				H	L
UMass Facilities and Amherst WWTP within Hadley	Stockbridge St	Private	V/S	Continue to coordinate with Umass and Amherst Town				M	O
North Hadley Fire Station	River Dr	Town	S	Redundant 911 coverage; keep as emergency shelter					O
Commerce/Industry	Russell St	Private	V/S	Partner with industry on Rt 9 as potential alternative emergency shelters/ community assistance				M	O
Societal									
Senior housing / nursing home	Golden Court	State	V	Work with owners to develop/assimilate site evacuation plans				M	O
Greenleaves Retirement Community	Greenleaves Drive	Private	V	Temporary floodproofing measures				M	O
Windfield Apartments	Greenleaves Drive	Private	V/S	Temporary floodproofing measures				M	O
Schools (Emergency Shelters) -Hartsbrook, Hopkins, Elementary, PVCICS	Multiple	Both	V/S	7 acres available for stormwater retrofit feasibility study behind Middle Street (i.e. water harvesting for sport fields)				L	L
Safety complex - flood risks	15 East Street	Town	V/S	Publicly owned open space in proximity, evaluate stormwater controls and potential retrofit				L	L
Mountain View Apartments (75 Units, HUD)	21 Campus Plaza Rd	Private	V/S	Revisit potential town-wide mandate for private housing complexes to develop emergency plans				M	O
Environmental									
Connecticut River banks - illegal seasonal camping		Both	V/S	Enforce bylaws along bank (i.e. tree clearing)	Form interdepartmental coalition to understand/manage situation			H	S
Norrotuck rail tail	Russell St	State DCR	V/S	Address issues with intersection w/West St; retrofit roadway with speed humps				M	S
Upstream river control communication			V	Contact neighboring communities with upstream/downstream dams about a regional dam control program				L	O
Kestral land acquisition		State	S	Stay on task to continue identifying and acquiring key parcels, especially near waterfront				L	O
Brush fires --> wildfires (Chmura Road)	Moutains (Mt Holyoke)	Private	V		Develop brush burning management plan with DCR			L	O
Invasives (oriental bittersweet)			V	Work with Umass to develop content for education/outreach/connection - citizens, high school, undergrad				M	O

Community Resilience Building Risk Matrix



www.CommunityResilienceBuilding.org

H-M-L priority for action over the **Short** or **Long** term (and **Ongoing**)

V = Vulnerability **S** = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Flooding	Drought	Strong Storms	Priority		Time	
							H - M - L	Short Long Ongoing		
Infrastructural										
Route 9 Bridge flooding and land closures	Route 9/CT Rive	Town	V	Perform feasibility study to design and construct secondary bridge nearby			L	L		
Flat topography - snow drifting	Town-wide	Both	V			Install snow fences or vegetative barriers near critical roadways and access points	L	L		
Hadley Dike - repairs	Aqua Vitae	Public Access-Pr	V	Obtain permanent easements for dike repairs / maintenance; then obtain funding to perform repairs (i.e., permitting, engineering design, construction)			H	O		
Clogged catch basins	Town-wide	Town	V	Perform study to prioritize replacement of problematic leaching CBs			L	L		
Moody Street Bridge Closed - culvert failure	Moody St	Town	V	Assess and replace culverts (design, permit, replace)			L	L		
Stormwater infrastructure - town-wide	Town-wide	Town	V	Complete ongoing prioritization study (and expand to other stormwater infrastructure such as pipes), obtain permanent easements, then replace (permitting, engineering, construction)			H	O		
WWTP Capacity compromised by illegal sump pumps	Town-wide	Both	V	Perform study to locate illegal connections, then correct issues. i.e. nature based solutions or other BMPs to capture and minimize runoff at localized areas.			M	O		
Water Treatment Plant in flooding risk area	Fort River	Town	V	Install floodproofing measures around WTP (e.g., temporary flood barrier) or elevate key features; Develop alternative water supply source			H	S		
Undersized water main on South Maple Street (6" cast iron)	S. Maple St	Town	V	Replace with larger water main (i.e., 8" or 12" ductile iron pipe)			H	L		
Societal										
Flood isolation risks	Hockanum Rd, Police Dept	Both	V	Purchase tools to prep for evacuation / access (i.e., signage)			M	S		
No unified plan for communicating EM to vulnerable pops.	Town-wide	Both	V	Develop a communication plan			H	S		
Housing Complexes - access to A/C	Town-wide	Both	V		Assess the current status of cooling subsidized housing		M	S		
Farm irrigation demands	Town-wide	Private	V		Develop a drought/irrigation management plan; implement streamflow monitoring / alerting		M	L		
Trailers/Campsites along CT River Bank - Seasonal Housing			V	Establish a committee to enforce existing bylaws that cover these areas			M	O		
Environmental										
Lake Warner nutrient impairments	Both	Town	V/S	Develop a watershed based plan to determine causes and sources of pollution and develop a plan to mitigate these sources (e.g., green infrastructure implementation)			M	L		
Backup Water Supply		Town	V/S		Perform a feasibility study to develop Mt. Warner wells		H	S		
Lack of cover-crop practice-poor air quality	Town-wide	Private	V		Public education program on best management practices to mitigate this issue, including implementation of appropriate cover crops		M	L		
Unprotected/Undeveloped parcels along CT River		Private	S	Acquire land or implement land-use restrictions			M	L		
Agricultural pests/blight	Town-wide	Both	V		Public education program on alternatives for integrated pest management to pesticides		L	O		

APPENDIX C

BASE MAPS AND WORKSHOP MAP RESOURCES

TOWN OF HADLEY

MUNICIPAL VULNERABILITY PREPAREDNESS PROGRAM

Climate Change and Natural Hazard Vulnerability Assessment

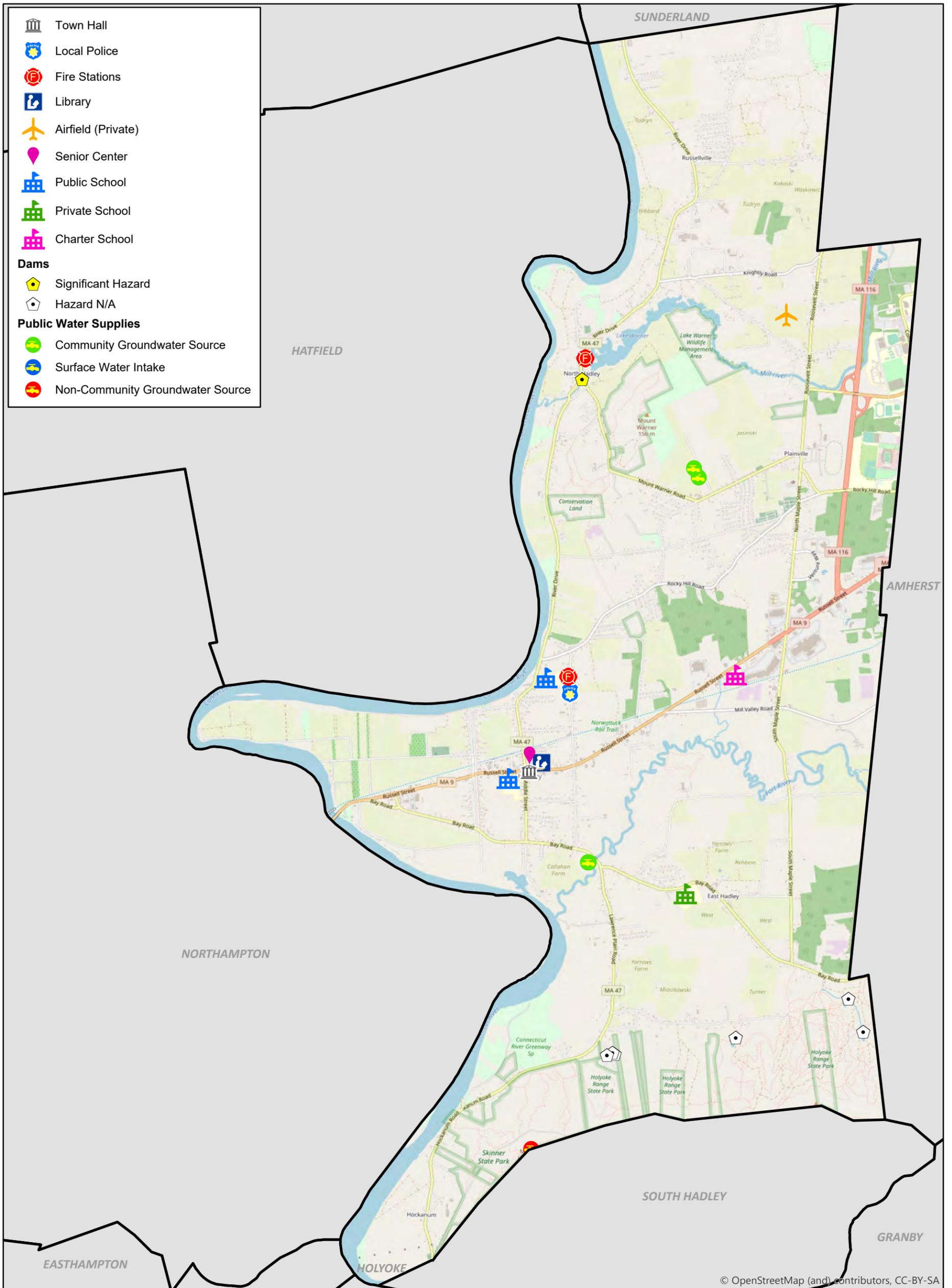
WORKSHOP MAP PACKAGE – JANUARY 2020



List of Maps:

- Town Base Map 24x36
- Town Base Map 11x17
- FEMA National Flood Hazard
- Impervious Surfaces and Zoning
- Wetlands and Critical Habitats
- Public Water Supplies and Wellhead Protection Areas

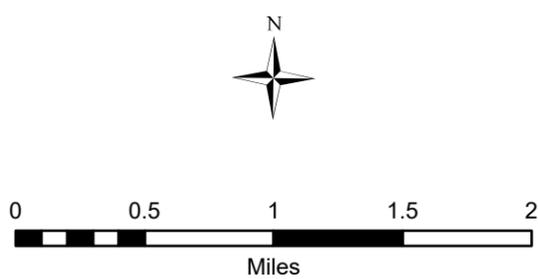
Map Layer:	Source:
Hadley Zoning	MassGIS, Town of Hadley
Hadley Senior Center	CEI
Hadley Airfield	MassGIS
Town Hall	MassGIS
Fire Stations	MassGIS
Police Stations	MassGIS
Library	MassGIS
Schools	MassGIS
Dams	MassGIS
Public Water Supplies	MassGIS
Certified Vernal Pools	MassGIS
FEMA National Flood Hazard	MassGIS
DEP Wetlands	MassGIS
NHESP Estimated Habitats of Rare Wildlife	MassGIS
NHESP Priority Habitata of Rare Species	MassGIS
BioMap2 Core Habitat	MassGIS
BioMap2 Critical Natural Landscape	MassGIS
Zone I Wellhead Protection Areas	MassGIS
Zone II Wellhead Protection Areas	MassGIS
Interim Wellhead Protection Areas	MassGIS
Impervious Surfaces	MassGIS
Hydrography	MassGIS
Roads	MassGIS



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**Figure 1
Town Base Map**

**Municipal Vulnerability Preparedness Program
Hadley, MA**



Data Source: MassGIS

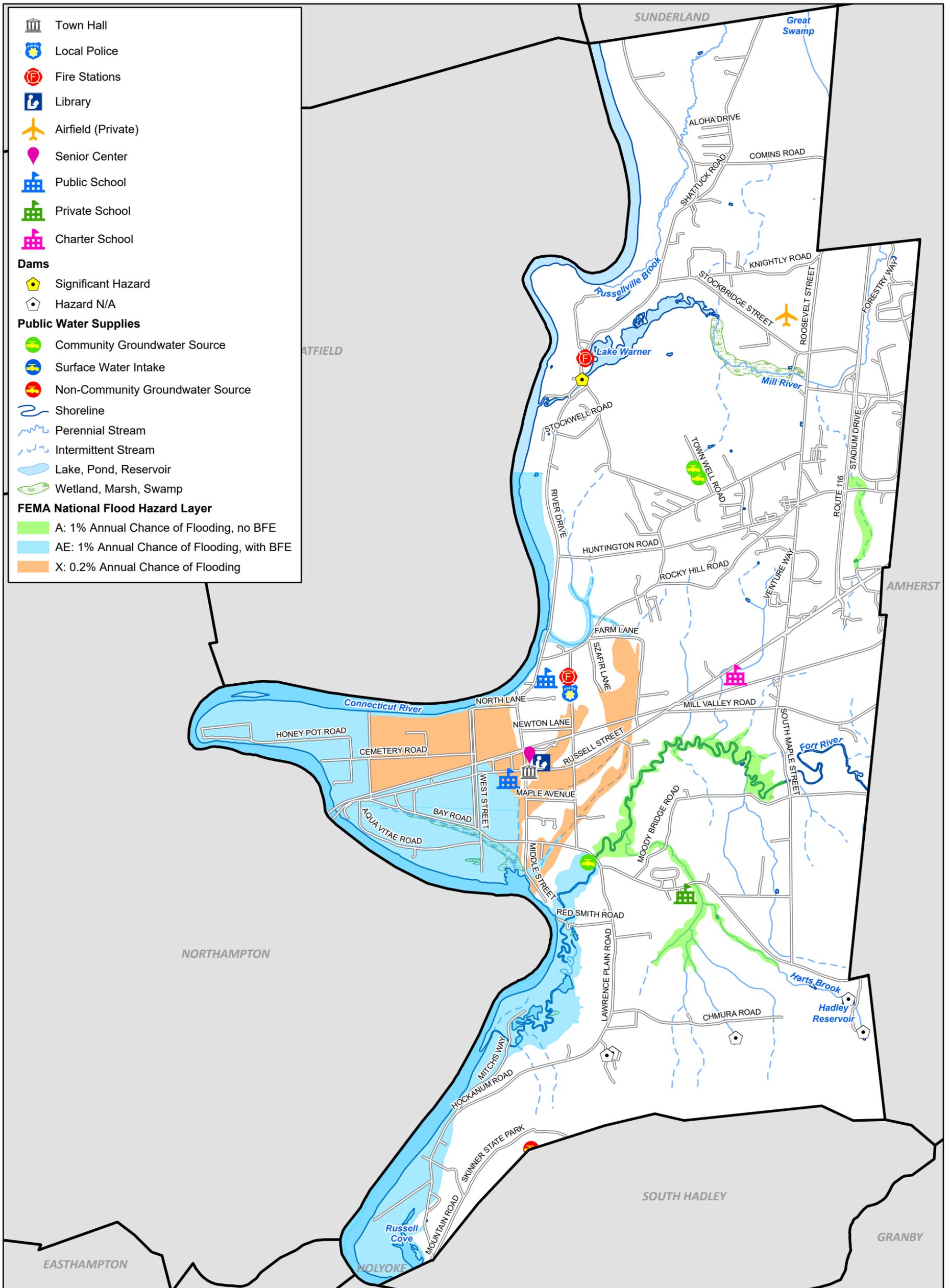


Figure 2
FEMA National Flood Hazard
 (FEMA GIS data not available for northern one-third of Town)

Municipal Vulnerability Preparedness Program
Hadley, MA

Data Source: MassGIS



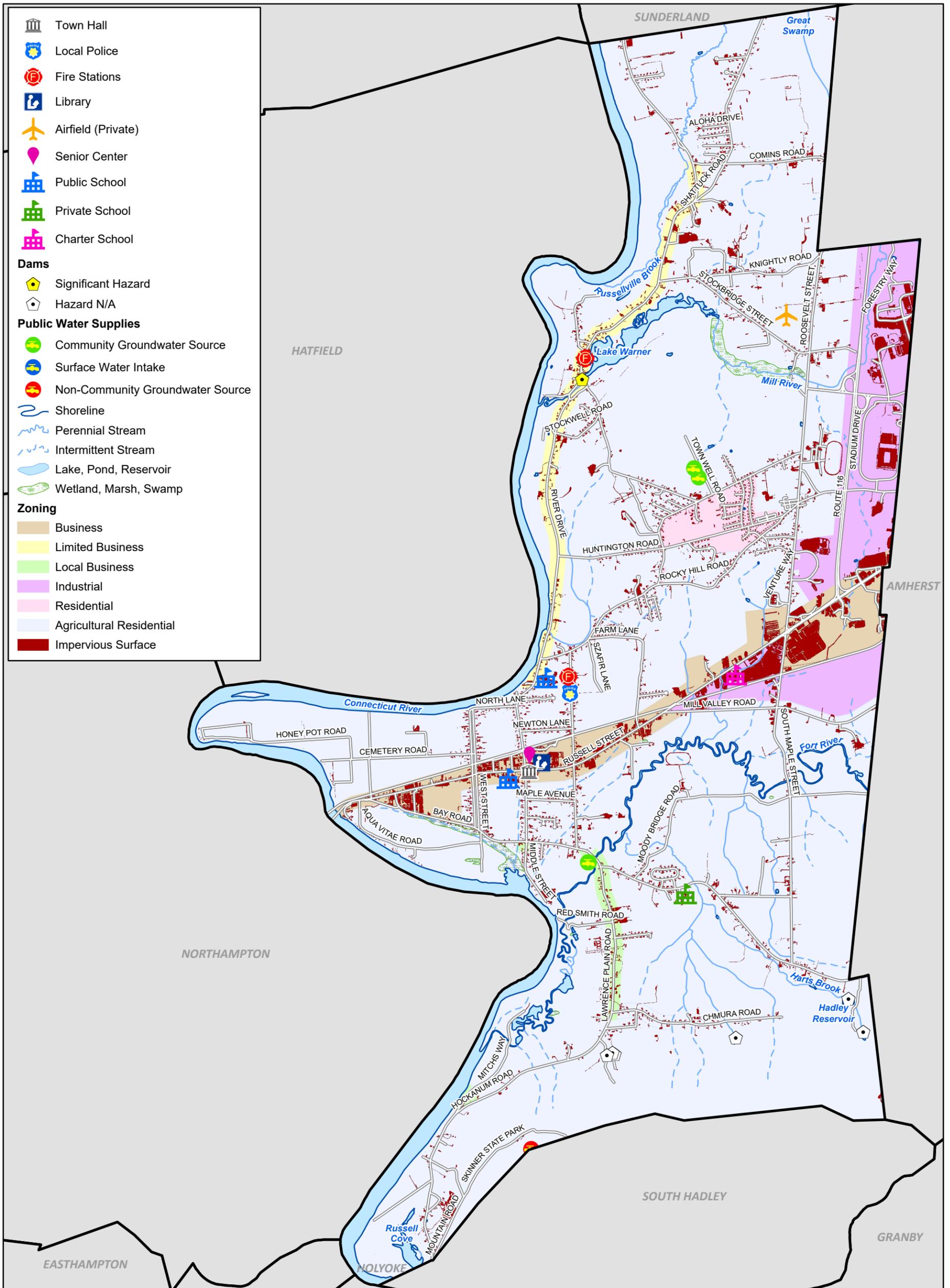


Figure 3
Zoning and Impervious Areas

Municipal Vulnerability Preparedness Program
Hadley, MA

Data Source: MassGIS, Town of Hadley



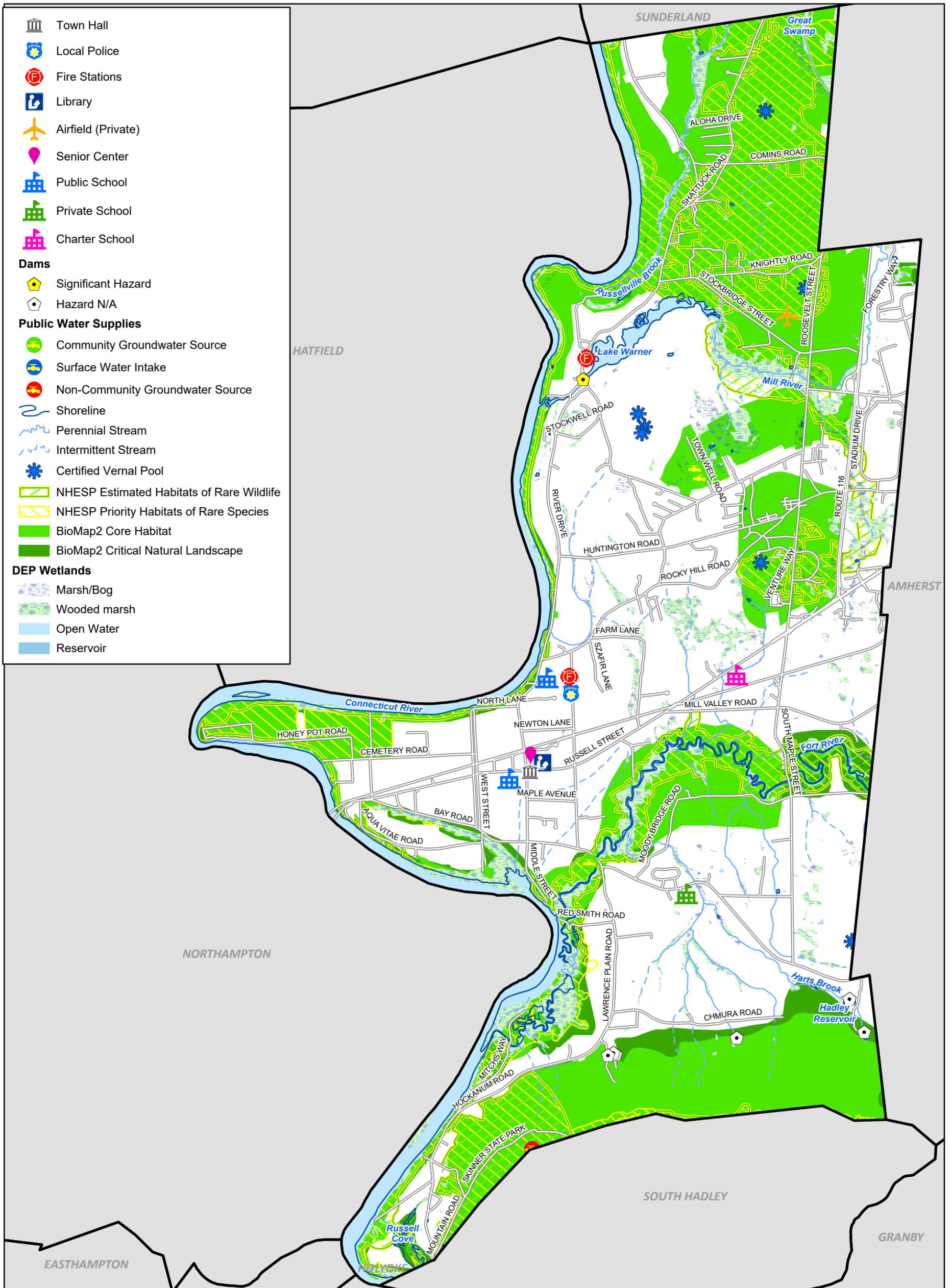


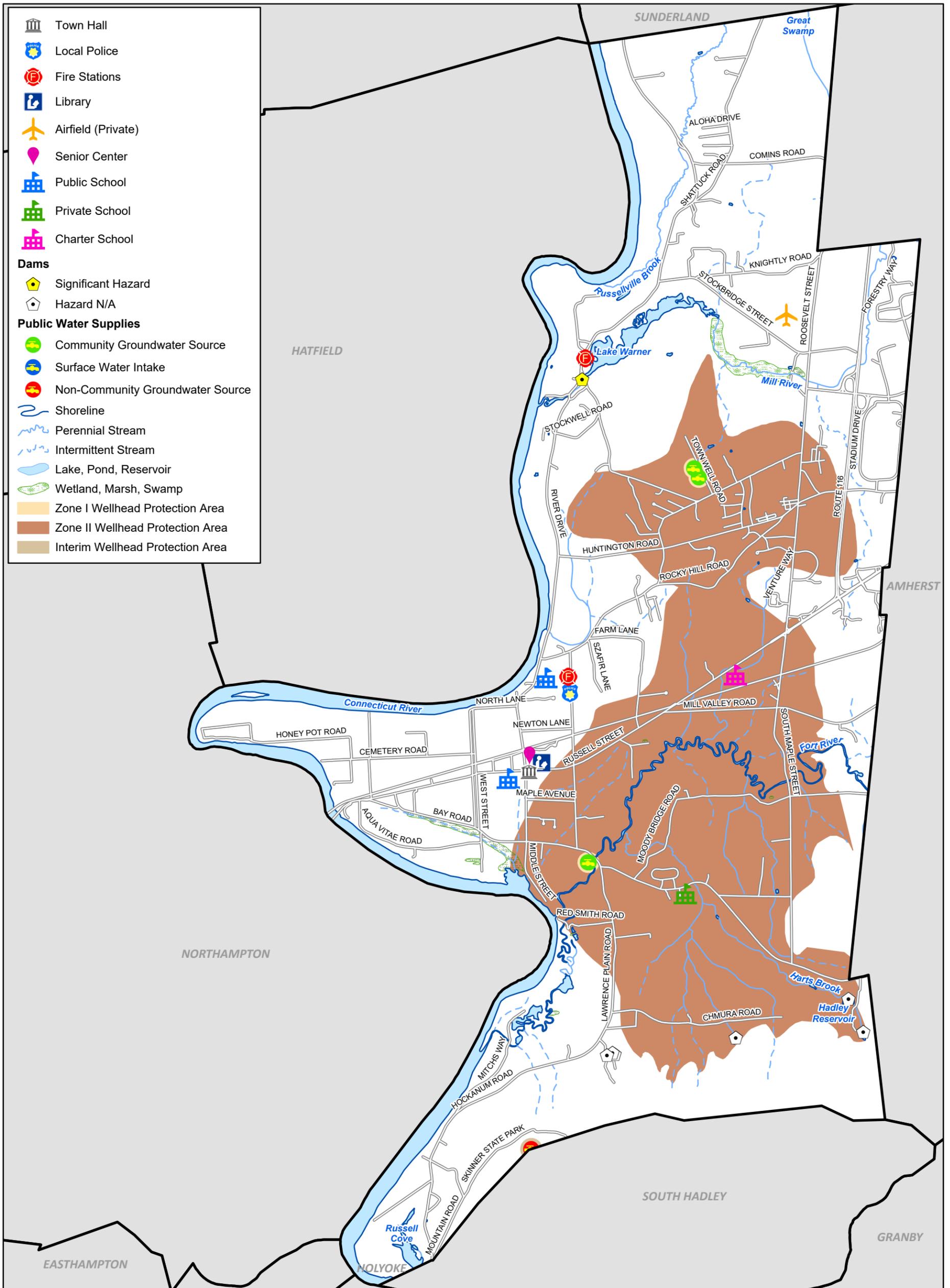
Figure 4
Wetlands, Rare Species, and
Critical Habitat Areas

Municipal Vulnerability Preparedness Program
Hadley, MA

Data Source: MassGIS



Comprehensive
 Environmental
 Incorporated



**Figure 5
Public Water Supplies and
Wellhead Protection Areas**

**Municipal Vulnerability Preparedness Program
Hadley, MA**

Data Source: MassGIS

