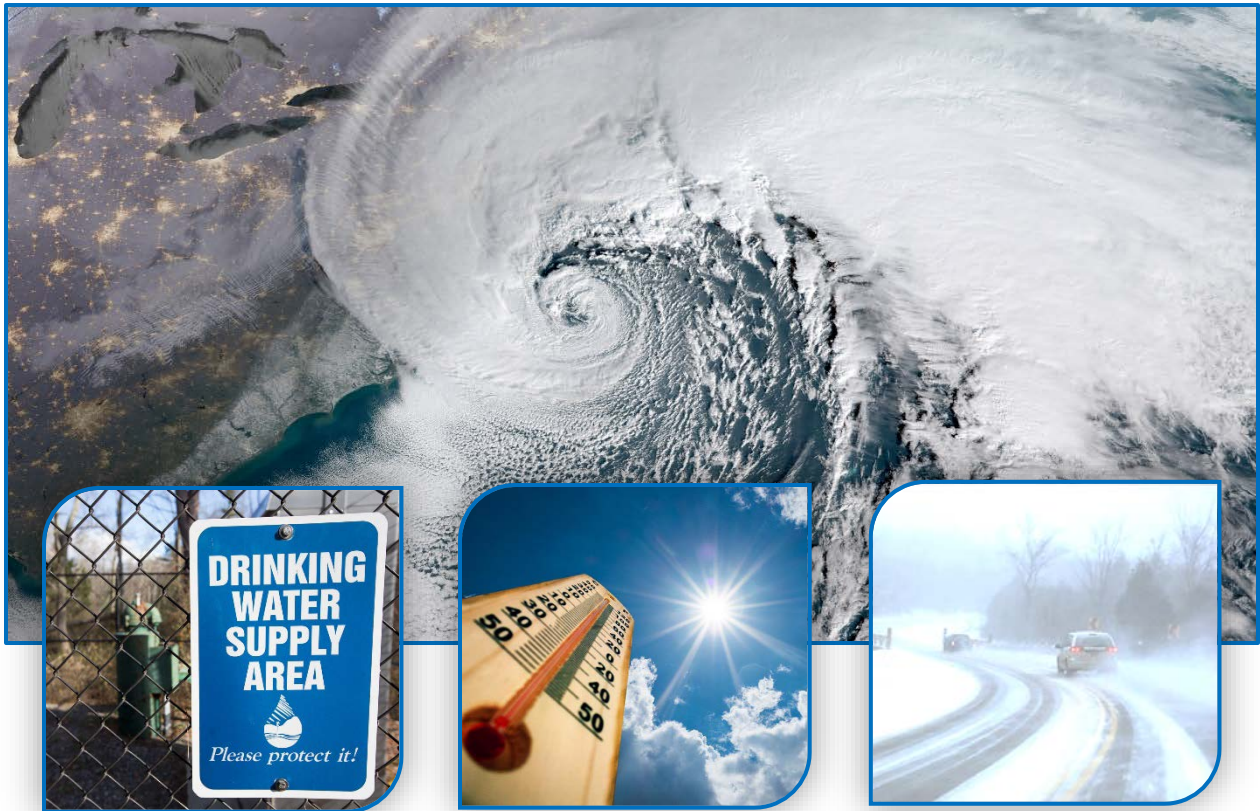




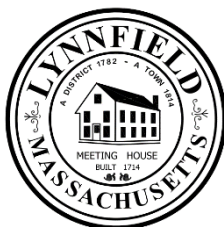
March 2020

TOWN OF LYNNFIELD

## COMMUNITY RESILIENCE BUILDING WORKSHOP SUMMARY OF FINDINGS



Prepared for:



Town of Lynnfield  
Town Hall, 55 Summer Street  
Lynnfield, MA 01940

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**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

### Municipal Vulnerability Preparedness Program

In 2016, Massachusetts Governor Charles Baker issued Executive Order 569 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 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 Lynnfield (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. Upon completion of the CRB workshop process, Lynnfield 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 Lynnfield – MVP Core Team
Charles Richter, PE, Town Engineer
Kristin McRae, RS, Health Director (Board of Health)
Emilie Cademartori, Director of Planning and Conservation
Glenn Davis, Fire Chief / Emergency Management Director
John Tomasz, DPW Director
Jennifer Welter, Planning and Conservation
John Scenna, Superintendent, Lynnfield Center Water District
Robert Dolan, Town Administrator
Steven deBettencourt, Assistant Director of Facilities

### 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 December 12, 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 February 5, 2020 in accordance with CRB guidance<sup>1</sup>. The workshop participants are listed below.

Name	Department/Committee	Team
Kate Flaws	Planning Board	Red
Emilie Cademartori	Director of Planning and Conservation	
Jennifer Welter	Conservation Commission Staff	
Jim Finegan	Superintendent, Lynnfield Water District	
Michelle Pacillo	Office of State Representative Brad Jones	
Steve Rogers	Kinder-Morgan	
John McDonagh	Reading Municipal Light District	
Glenn Davis	Fire Chief/Emergency Management Director	Blue
Brian Shaffer	Zoning Board of Appeals	
John Tomasz	Director, Department of Public Works	
John Scenna	Lynnfield Center Water District	
Susan Lambe	Planning Board Staff	
Kirk Mansfield	Conservation Commission	
Patrick McDonald	GIS Coordinator and Field Inspector	Green
Charlie Richter	Town Engineer	
Kristin McRae	Health Director (Board of Health)	
Brian Abcunas	Peabody Municipal Light Plant	
Cory Diehl	Kinder-Morgan	
Steve deBettencourt	Assistant Director of Facilities (DPW)	
Bob Hartzel	CEI	Facilitators
Elisha Musgraves	CEI	
David Roman	CEI	

<sup>1</sup> CRB Guidance: [www.communityresiliencebuilding.com](http://www.communityresiliencebuilding.com)

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

- Description of the MVP program and CRB process;
- Summary of Lynnfield's emergency management procedures;
- Introduction to climate change, including Lynnfield-specific climate change projections<sup>2</sup>;
- Introduction to nature-based solutions (i.e., green infrastructure);
- Summary of stakeholder interview results.

Workshop participants were then split into three diversified sub-groups (6-7 people per group, see assigned teams in table above) to conduct concurrent guided exercises. As listed below, the exercises solicit and organize input from workshop participants through use of the Risk Matrix presented in Appendix B.

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 Lynnfield.

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 feedback from the workshop participants.

#### **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, blue, and green teams).*

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<sup>2</sup> Climate Projections obtained from: [www.resilientma.org](http://www.resilientma.org)

## 2. Top Hazards and Vulnerable Areas

### 2.1 Summary of Top Hazards

During Exercise 1, workshop participants were divided into two groups to discuss Lynnfield's top natural hazards and areas of concern. The groups then shared their conclusions and reached consensus on these topics.

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



*Workshop participants discuss top priority hazards and actions.*



1. **Flooding:** Flooding was the hazard of highest concern to Lynnfield. There are several areas in town that have experienced historical flooding.



2. **Strong 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 & Extreme Temperatures:** As global temperatures continue along a long-term warming trend, local occurrences of drought and extreme temperature events are predicted to increase (i.e., days greater than 90° F). Drought conditions have the potential to limit water supply availability. Extreme temperatures have the potential to impact vulnerable populations without access to air conditioning.

## 2.2 Areas of Concern

Prior to the workshop, interviews were conducted with key stakeholders to develop a preliminary list of Lynnfield’s primary climate resiliency vulnerabilities and strengths. Interviewees were primarily concerned with vulnerabilities relative to flooding and storm induced hazards. Vulnerabilities of concern included economic disruption from emergency road closures, potential culvert failures, and loss of floodplain storage from ongoing development.

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><b>Infrastructure</b></p>	<ul style="list-style-type: none"> <li>• Stormwater management system (town-wide)</li> <li>• Dam management (e.g., Saugus River, Pillings Pond)</li> <li>• Arterial roads (e.g., Salem Street, Summer Street)</li> <li>• Public water supply</li> </ul>
 <p><b>Societal</b></p>	<ul style="list-style-type: none"> <li>• Senior Housing Centers and Elderly Housing Zoning Districts: Sunrise Assisted Living, Colonial Gardens, Heritage Woods, L.I.F.E properties.</li> <li>• Public Amenities: Schools, Housing Authority, Emergency Services, Emergency Sheltering</li> <li>• Regional partnerships/management</li> </ul>
 <p><b>Environmental</b></p>	<ul style="list-style-type: none"> <li>• Beaverdam Brook Watershed</li> <li>• Saugus River Corridor</li> <li>• Pillings Pond</li> <li>• Reedy Meadow wetlands</li> <li>• Ipswich River Watershed</li> <li>• Hawkes Pond/Brook</li> </ul>

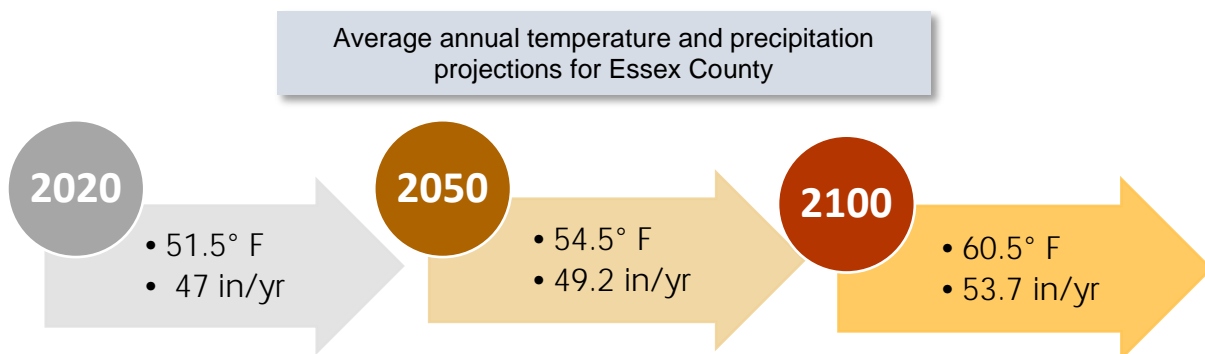
### 3. Current Concerns and Challenges Presented by Hazards

Lynnfield faces multiple challenges related to potential impacts from natural hazards. In recent years, the Town has experienced multiple 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 Lynnfield and many other Massachusetts communities. Lynnfield was also impacted by the drought conditions experienced across the state in 2016.

The intensity and frequency of extreme weather events has increased awareness of Lynnfield'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 Essex County, Massachusetts from the Climate Change Clearinghouse (CCC) for the Commonwealth ([www.resilientma.org](http://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 Lynnfield's vulnerabilities and strengths to natural hazards. As in any community, Lynnfield 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 Infrastructure Concerns

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



- There are several aging and undersized culverts and pipes throughout town that pose flooding risks (e.g., Hawkes Brook corridor). Multiple culvert/stormwater infrastructure improvement areas have already been studied by the Town and are ready for implementation, including: Ledge Road/Hawkes Brook, Timberhill Lane, Fletcher Road, Rourke Lane.



- The Route 1 underpass at Salem Street and Summer Street have a history of flooding. The Town is currently undertaking a study to determine potential solutions to alleviate flooding at the route 128 underpass at Summer Street.
- Localized flooding historically occurs at the intersection of Tophet Road and Chestnut Street, presumably caused by a low spot in the road.
- **Pillings Pond Dam:** Low lying areas surrounding Pillings Pond are at flood risk. The outlet control structure of the pond's dam was recently rebuilt. A detailed management plan is currently in place, but the plan does not include real-time decision support for flow management, lake drawdown, flood risk reduction, and other operational goals.
- **Saugus River:** Lynn Water and Sewer controls the downstream dam on the Saugus River to supply a series of interconnected reservoirs, including Hawkes Pond. Among other contributing factors, controls have historically caused flooding within the Beaverdam Brook Watershed (i.e., water levels are kept as high as feasible to enable reliable water supply).
- **Electrical Power Lines:** Power lines have historically experienced storm damage which has led to localized outages. The primary cause of damage is fallen limbs from surrounding trees.

### 3.1.2 Societal Concerns

- **Vulnerable Communities:** Several densely populated areas with vulnerable populations were identified during the workshop as identified by the 'areas of concern' table. Concerns related to these areas included:
  - Emergency alerts and planning information may not be fully reaching disabled and elderly demographics (i.e. groups that may not have cell phones to access CodeRED alerts).
  - Workshop participants indicated that emergency responders are not always aware of hazards unique to each complex.
- **Emergency Shelters:** Workshop participants expressed concern that current emergency shelters do not have adequate capacity. In addition, some existing facilities are not equipped with central air conditioning or "clean energy" generators (e.g., powered by photovoltaic panels with battery storage, Black Start technology, etc.). The Town is currently in the process of evaluating potential locations to expand capacity and improve amenities. Potential locations include the Senior Center (top location), Summer Street School, and Huckleberry School.
- **Evacuation Routes:** Flooding of key arterial streets such as the Route 1 underpass at Salem Street and the section of Summer Street under Route 128 have the potential to impede emergency responders. The Town does not currently have formalized evacuation routes or alternative emergency response routes.
- **Air Conditioning at Public Schools:** A portion of public schools in town are not air conditioned and are therefore vulnerable to extreme heat.



### 3.1.3 Environmental Concerns



- **Ongoing and Future Development:** Workshop participants expressed concern at the pace with which new developments and subdivisions are being built in town. New development can lead to increases in energy usage (and associated greenhouse gas emissions), water quality impairments from increases in impervious surface, and loss of floodplain storage.
  - Town officials have been working to pass an Open Space Residential Development (OSRD) bylaw to help guide this development in a way that balances land development rights and environmental considerations. The Town is also working to pass a Tree Preservation Bylaw. Increased outreach and community engagement in environmental planning and regulations is an area for improvement in Lynnfield.
  - Lynnfield still contains a limited number of undeveloped/open space parcels that are privately owned and have limited or no restrictions to future development. These parcels could serve as an extension of habitat, conservation land, and floodplains in critical areas. Workshop participants expressed concerns about development slated to occur in some of these areas, particularly in the northern half of Town.
- **Vegetation Management:**
  - Workshop participants indicated that trees are increasingly falling during storms, presumably because they are all approximately the same age (i.e., mature).
  - Workshop participants noted that a 2015 brush fire occurred in the conservation area of Reedy Meadow.
  - An increase in invasive pests (i.e., ticks, knotweed, phragmites, etc.) were also discussed as risks related to increasing temperatures which require forest management measures.
- **Public Drinking Water Supply:** Water is currently supplied to residents from two entities: 1) The Lynnfield Water District (LWD) obtains its water from an interconnection with the Massachusetts Water Resources Authority (MWRA), 2) The Lynnfield Center Water District (LCWD) obtains its water from groundwater wells in town. The following concerns related to public water supply were identified by workshop participants:
  - LCWD water supply wells are impacted by water quality issues (e.g., iron and manganese), and DEP mandated withdrawal limits.
  - LCWD water supply wells are at risk of running low during drought conditions as a result of increasing demands. Irrigation water usage has historically been problematic and contributes to a high proportion of demands in the summer months.
  - LCWD water supply sources are at risk from new development in the northern portion of town. New development would potentially be located in the Zone II Wellhead Protection Area and could lead to decreased recharge and water quality concerns associated with increased impervious area (e.g., road salt, etc.).
  - The Town has no public water supply north of Lowell Street. This unserved area is susceptible to fire risk.

- **Surface Water Impairments:** Workshop participants were concerned with water quality impairments throughout town. The following waterbodies in Lynnfield are listed for impairments<sup>3</sup>.

Waterbody	Impairment
Pillings Pond	algae, chlorophyll-a, dissolved oxygen, total phosphorus, water clarity
Hawkes Pond	turbidity
Beaverdam Brook	dissolved oxygen, E. coli, fecal coliform
Hawkes Brook	E. coli, fecal coliform
Saugus River	Dewatering, E. coli, fecal coliform, fish passage barrier, algae, total nitrogen, total phosphorus, turbidity

Some of these impairments may be worsened by the effects of climate change. For example, increased temperatures during the growing season can exacerbate impairments associated with biological productivity (e.g. algae blooms, low dissolved oxygen), and increased amounts of intense precipitation can increase nutrient loading and turbidity. Specific concerns include:

- Septic systems in some areas of Town are at risk of failure from high groundwater tables associated with localized flooding. Areas of particular concern include properties near Hawkes Brook and surrounding Reedy Meadow.
- Pillings Pond is increasingly impacted by harmful algal blooms (i.e. cyanobacteria).

## 4. Current Strengths and Assets

Workshop participants identified the following as Lynnfield’s key climate change resiliency strengths:

- **Emergency Services and Town Hall Resources:** The Town has a good emergency response track record. Town department heads frequently communicate with one another, and the Emergency Management Department meets regularly to address ongoing issues. A Hazard Mitigation Plan update was completed in 2018, addressing and updating plans for mitigating a wide range of hazards.
- **Conservation Areas:** The Town includes approximately 1,663 acres of municipal or state-owned conservation land and protected open space. This includes public drinking supply protection areas with no public access or recreation. Much of this protected land overlaps with wetlands and regulated floodways, which provide natural flood storage and resiliency to flooding events. The Town has the option to consider purchase of additional open space along Upper Main Street.
- **Strong Bylaws and Regulatory Mechanisms:** The Town has enacted or revised two environmentally focused bylaws in recent years. In 2015, the Town passed a Scenic Road Bylaw (Article 6 – 217-36 to 217-42) that protects designated roadways in town from unapproved cutting or removal of trees. In 2017, the Town updated Article 8 – 375-8.3 to address stormwater concerns for all new developments and subdivisions, requiring detailed stormwater management design to attenuate peak flows from the 2-, 10-, and 100-year storm events. In 2005, Lynnfield adopted its local environmental bylaw to provide further protection for the town’s water supplies, flood control, wetlands and wildlife. Recently, Town officials have been working to pass an Open Space Residential Development (OSRD) bylaw and a Tree Preservation Bylaw to help guide development and balance environmental considerations.

<sup>3</sup> MA Year 2016 List of Integrated Waters: <https://www.mass.gov/files/documents/2020/01/07/16ilwplist.pdf>.

## 5. Recommendations to Improve Resilience

As summarized below, the final step of the workshop was to develop recommended actions to address identified vulnerabilities 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. Aging and Undersized Culverts – Redesign and Retrofit

Lynnfield's stormwater infrastructure includes many aged and undersized structures that can contribute to flooding. Key low-lying roads such as Summer Street under Route 128 were also noted for frequent flooding, forcing road closures and detours.

Multiple culvert/stormwater infrastructure improvement areas have already been studied by the Town and are ready for implementation, including: Ledge Road/Hawkes Brook, Timberhill Lane, Fletcher Road, Rourke Lane, and Summer Street/Rt. 128 overpass. Flooding in these areas also increases the health risks associated with flooded septic systems and potential surface outbreak of bacteria and pathogens. Maintenance and repair of some culverts is complicated by their location on private land.



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

- **Assess:** Expand previous study areas to include a comprehensive vulnerability / resiliency assessment of all Town drainage infrastructure (i.e., drainage pipes, culverts, open channels). 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 infrastructure. Replacement steps would include: engineering feasibility analysis (i.e., modeling, conceptual design), permitting, engineering design, and construction.
- **Maintain and Restore:** Obtain approvals to enable maintenance and restoration of key stormwater infrastructure as identified by the vulnerability assessment (e.g., silted in conveyance channels). Expected approvals include maintenance easements from private landowners and various permitting approvals, such as requirements covered by the Massachusetts Wetlands Protection Act.

## 2. Reedy Meadow/Beaverdam Brook Management

Reedy Meadow is a large freshwater emergent marsh on the western border of Lynnfield. It is located at the confluence of several waterways, including the Saugus River, Beaverdam Brook and the outlet stream from Pillings Pond. Reedy Meadow is listed by the Massachusetts Natural Heritage and Endangered Species Program as Priority Habitat of Rare Species, and is a federally listed National Natural Landmark (NNL) as designated by the U.S. Park Service.



Reedy Meadow

Parcels adjacent to Reedy Meadow and Beaverdam Brook have been periodically impacted by flooding, due to both high water levels and beaver dams. Water levels in Beaverdam Brook and in the Saugus River are influenced by siltation of these waterways, beaver dams, and operations of the Lynn Water and Sewer Commission (LWSC) Water Department. LWSC manages nearby surface waters for public drinking supply (i.e., diverts water from the Saugus River to a series of interconnected reservoirs).

Reedy Meadow has also been impacted by brush fires and the presence of invasive species such as common reed (*Phragmites australis*).

For over a decade, stakeholders have pursued the potential construction of a rail trail through Reedy Meadow, which would provide a recreational corridor connecting Wakefield and Lynnfield. A feasibility study and initial design was conducted in 2007.

It is recommended that the Town conduct the following actions to address concerns:

- Conduct an ecological inventory of invasive species in the area. Develop a management plan for existing invasive species and recommended response actions for new invasive species threats. The inventory and management plan will establish a baseline and point of reference for comparing future changes in Reedy Meadow that are associated with a changing climate, including in species distribution, habitat types, and the presence/distribution of invasive species.
- Conduct a study for the Saugus River corridor to identify key thresholds for operating dams in response to both flooding and drought conditions. A primary concern is balancing the need to protect ecology (i.e., wetlands, rare species habitat, regionally important bird nesting area) and maintain water supply during drought. The study could identify needs for an upgraded outlet structure/spillway.

Potential actions of this study would include coordination with LWSC and other relevant regional stakeholders to implement a decision support system to provide alerts when flood risk is increasing in the Beaverdam Brook Watershed a result of flow diversions (or lack of diversions) from the Saugus River. Implementation of a decision support system would entail development of a hydrologic and hydraulic model, installation of real-time water level monitoring equipment, and development of an alerting protocol.

- Perform a feasibility study to identify other potential mitigation measures that may be implemented to reduce flood risk along Beaverdam Brook such as implementation of beaver deceiver(s) or restoration of channel capacity from sedimentation.

### 3. Evaluation of Town-wide Water Supply Resiliency

As previously indicated, the Lynnfield Center Water District (LCWD) is currently impacted by water quality issues (e.g., iron and manganese) and water quantity issues (i.e., increased demands). LCWD is currently performing a study to develop a solution to address elevated iron and manganese levels at its source supply wells.

In addition to concerns related to publicly-supplied water, there are also concerns with regard to private wells in areas that do not have the option to tie into municipal water. These concerns include the potential comingling of well water and wastewater during floods and loss of water supply during drought.

To address the concerns described above, it is recommended that the Town conduct an evaluation of Town-wide water supply resiliency to include the following:

- Evaluate potential alternative supplemental supply sources, including an interconnection with the Lynnfield Water District (which obtains its water from MWRA).
- Evaluate the feasibility of expanding the distribution network north of Lowell Street to provide fire protection to unserved areas. This evaluation may be performed based on the existing distribution network and under potential alternative scenarios such as an interconnection with Lynnfield Water District. Other alternatives could also be evaluated, such as implementation of firefighting cisterns.
- Develop long-term water conservation program to decrease overall system demands.
- Evaluate options to provide municipal water to areas where it is currently not available, and related options to mitigate the impacts of drought and potential well water/wastewater comingling during floods.

## 5.2 Other Prioritized Recommendations

### Higher Priority

- Update the Pillings Pond management plan to implement a decision support system to actively manage the new Pillings Pond Dam outlet structure based on real-time forecast information and pond response predictions. Decision support could be provided for flow management, lake drawdown, flood risk reduction, and other operational goals. Development of a management plan would include hydraulic modeling, installation of a monitoring network, and stakeholder engagement relative to operational goals.
- Conduct a study to evaluate needs for expanded sheltering capacity, including assessment of energy requirements and other amenities such as beds, etc. *Note:* Locations to expand capacity have already been identified as the Council on Aging (top location), Summer Street School, and Huckleberry School. Assess the need for an Emergency Operations Center. Obtain funding to implement recommendations from study.
- Continue efforts to pass Open Space Residential Development (OSRD) and Tree Preservation bylaws through increased public outreach and education and engagement with key community leaders to reach specific groups.
- Storm events are increasingly bringing down trees and impacting emergency response times. It is recommended that the Town write a tree preservation bylaw, remove hazardous trees identified by a previous hazardous tree evaluation, and replant trees in accordance with the bylaw.

## Moderate Priority

- Prepare watershed-based plans for impaired waterbodies in Town, including detailed evaluation of potential sources from septic systems. Consider nature-based solutions to decrease pollutant influx into impaired waterbodies. Waterbodies of particular concern include Pillings Pond, Hawkes Brook, and Beaverdam Brook.
- Lynnfield Center Water District sources are at risk from new development. It is recommended that the Town seek to acquire the Sagamore Spring Golf Club and the 22-acre lot adjacent to the golf course (often referred to as the Richardson forestry parcel), or, work to limit the footprint of development on both properties.
- To increase the resiliency of power lines during snow/ice storms, it is recommended that the Town request the utilities to assess new technologies (e.g., improved brackets) to reduce damage from downed trees/limbs; install retrofits on an ongoing basis.
- Conduct a study on the potential use of micro-grids and implementation of battery storage for critical Town facilities to offset potential impacts from power outages.
- Install and/or expand central air conditioning at all public schools in town. Develop school-specific renewable energy plans to offset potential increases in greenhouse gas emissions. Potential plan components could include solar panels on roof, green roofs, sun shading, and other strategies.

## Lower Priority

- Coordinate/collaborate with Massachusetts Department of Transportation on potential solutions to alleviate flooding at the Route 1 underpass at Salem Street (i.e., design, permit, build).
- Development in Town is leading to increases in energy usage. It is recommended that the Town develop a renewable energy bylaw as a means to reduce greenhouse gas emissions.
- Health issues associated with a steadily warming climate (e.g., insect-borne illnesses from ticks and mosquitos) are increasing. It is recommended the Town develop a public education campaign for awareness and prevention. Coordinate with Essex County Mosquito Control District to develop long term preventative maintenance program.
- Coordinate with the Fire Chief/Emergency Management Director to determine if any modifications are needed to the Code Red emergency notification network, or other tools to provide assistance to at-risk populations during emergencies. Continue to work with housing complex owners to develop better emergency plans, evacuation routes, etc. The Town could strengthen requirements for private complex emergency planning with additional bylaws.

As previously discussed, this list of prioritized recommendations was developed by workshop participants 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**

Comprehensive Environmental, Inc. (2020). Community Resiliency Building Workshop Summary of Findings. Town of Lynnfield, Massachusetts.



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# APPENDIX A

## INTRODUCTORY PRESENTATION MATERIALS

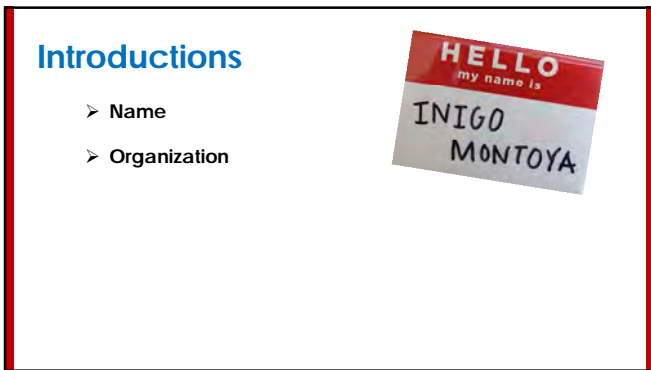
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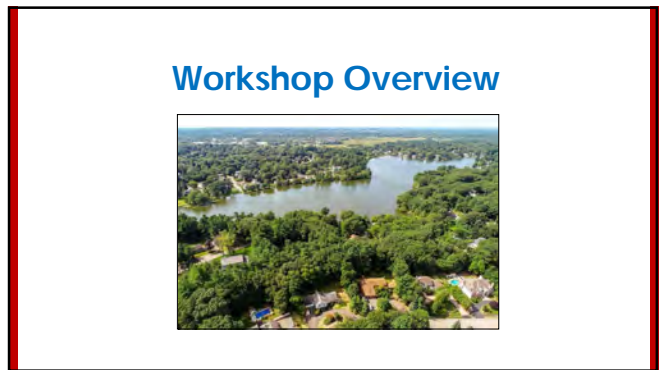
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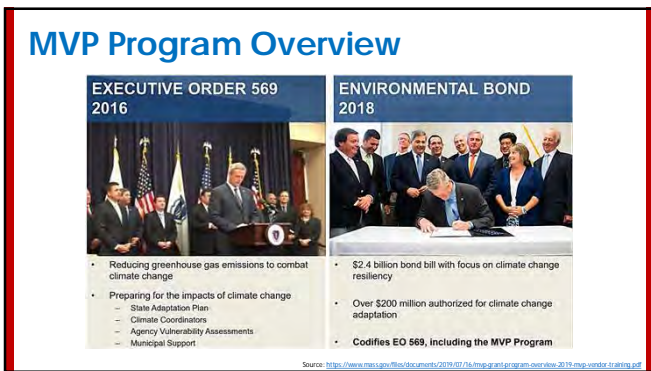
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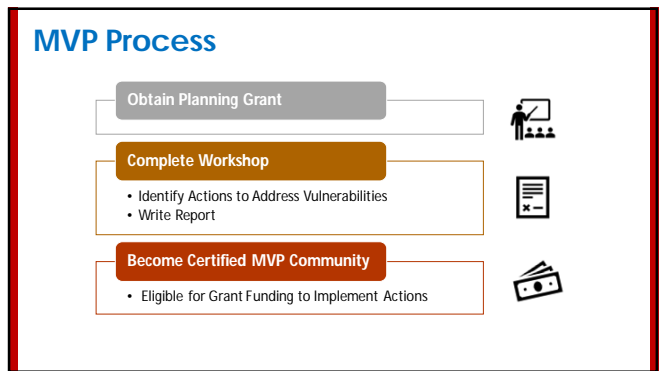
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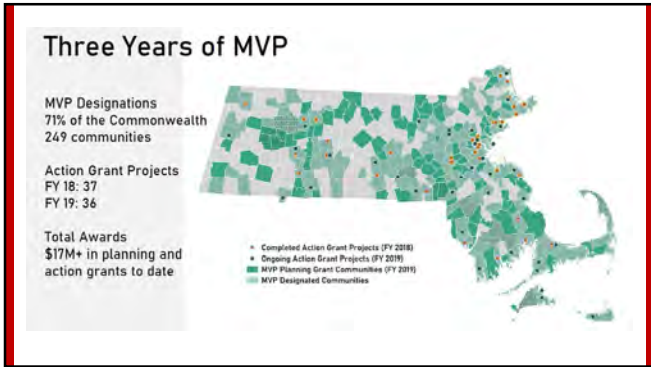
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### Workshop Purpose

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

Community Resilience Building  
**WORKSHOP GUIDE**

infrastructure    social    environmental

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### Action Categories:

*Hypothetical Example:*  
Fire Department floods during extreme storm events

Resiliency	Mitigation	Adaptation
<ul style="list-style-type: none"> <li>Improve floodplain function:                             <ul style="list-style-type: none"> <li>riparian land conservation</li> <li>green stormwater infrastructure</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Flood-proof building</li> </ul>	<ul style="list-style-type: none"> <li>Relocate facility outside of 500-yr floodplain</li> </ul>

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- ### Workshop Agenda
- > Workshop Overview
  - > Overview Presentations on Science and Resources
  - > Group Exercises
    - Identify Top Hazards
    - Identify Vulnerabilities and Strengths
    - Identify Actions to Reduce Vulnerabilities and Strengths
    - Identify Top Actions

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## Overview Presentations and Resources

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## Hazard Mitigation Plan and Emergency Preparedness Overview

**Glenn Davis**  
Fire Chief / Emergency Management Director

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## MVP Regional Coordinator Overview

**Michelle Rowden**  
EOEEA MVP Regional Coordinator

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## MVP Regions & Regional Coordinators

Region	Regional Coordinator	Contact
Berkshire & Hills	(to be filed) - Pittsfield	
Greater CT River Valley	Andrew Smith - DEP Springfield	andrew.b.smith@mass.gov
Central	Hilary King - DEP Worcester	hilary.king@mass.gov
Greater Boston	Carolyn Maklenburg - EEA Boston	carolyn.maklenburg@mass.gov
Northeast	Michelle Rowden - DEP Lawrence	michelle.rowden@mass.gov
Southeast	Courtney Rocha - DEP Lawrence	courtney.rocha@mass.gov

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## 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.

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

**SHMCAP**

- 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

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## MVP Process/ Grant Types

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### 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

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### 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



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### Nature-Based Solutions



Southwick: Stream crossing replacement with upstream nature-based flood mitigation measures

Northampton: Detaining, retaining, treating stormwater with green infrastructure

Milbury: Green infrastructure in downtown revitalization

Oak Bluffs: Beach nourishment

Falmouth: River restoration

Concord: Reforestation and municipal tree resilience

Essex, Ipswich, Newbury (Regional): Sedimentation study


Legend:  
 ● MVP Projects using Nature-Based Solutions  
 ■ MVP Planning Grant/Designated Communities (2017-2019)  
 □ MVP Regional Designation

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### 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

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### Example Action Grant Projects

Nature-Based Flood Protection, Drought Prevention, Water Quality, and Water Infiltration Techniques

**Milbury** 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

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### 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

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**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

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**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

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**FY18 Action Grant Projects**  
 Detailed Vulnerability and Risk Assessment, Facility Planning

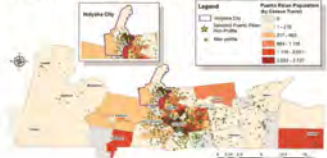
**Holyoke** Conducted a detailed demographic analysis of individuals who arrived in Holyoke from Puerto Rico as a result of Hurricane Maria and develop recommendations for planning for future climate change migrants in Holyoke



Informational graphics from Holyoke's final report

Area	2010	2017	Percent
Total	46	60	130%
Male	21	28	133%
Female	25	32	128%

**Hampden County's Puerto Rican Population, 2017**



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**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



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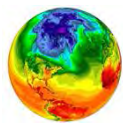
**Climate Change 101**



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**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](https://www.youtube.com/watch?v=cBdxDFpDp_k)

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### How Does Climate Change Work?

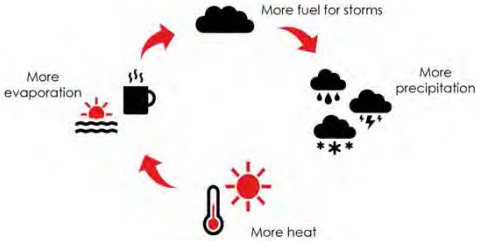
The heat-trapping blanket metaphor



- 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.

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### Rising Temperatures Cause More Precipitation Events




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### 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


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### Consequences




**Changes in precipitation**

- Inland flooding
- Drought




**Rising Temperatures**

- Wildfires
- Invasive species/pests



**Extreme Weather**

- Hurricanes/tornadoes
- Severe winter storms

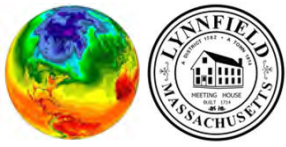


**Human-induced hazards**

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

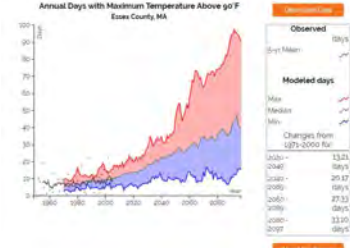
34

### Lynnfield Climate Projections



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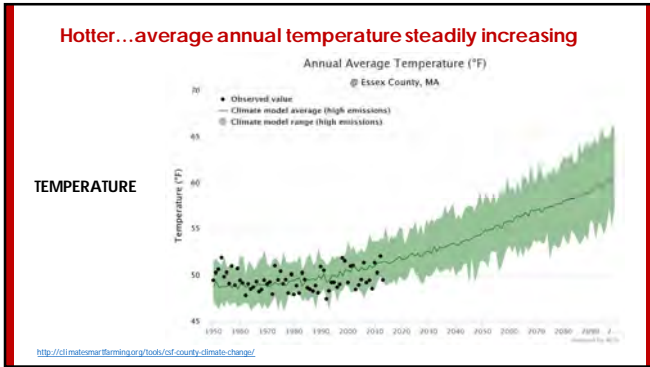
### Hotter...by 2040, days per year over 90 F will almost double



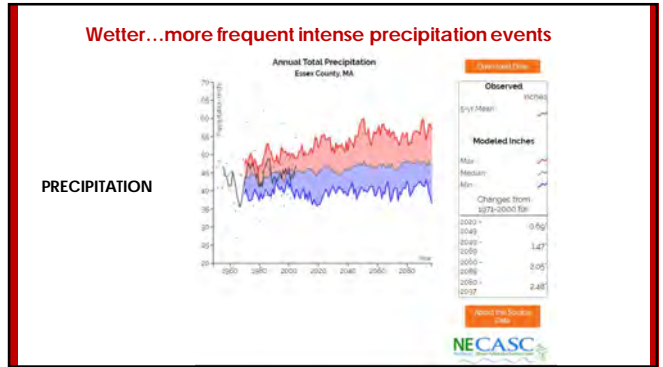
Year	Observed	Modeled days
1980	13.21	
2040	27.33	
2040		27.33
2040		27.33
2040		27.33
2040		27.33
2040		27.33
2040		27.33
2040		27.33
2040		27.33

NECASC

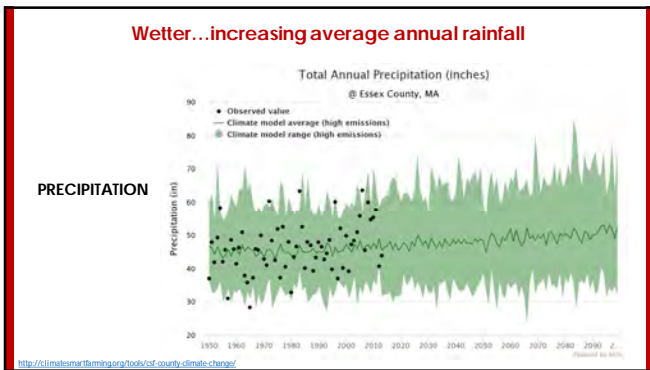
36



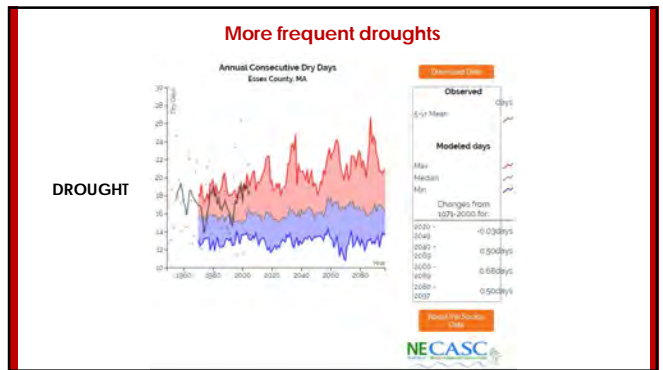
37



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**resilient MA**  
Climate Change Clearinghouse for the Commonwealth  
<http://resilientma.org/>

**Maps**  
From National Science Foundation 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 »

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### Vegetated Buffers

(Reforestation, bank restoration, etc.)

- Pollutant Uptake /Filtering
- Habitat / Wildlife Food Source
- Shading
- Aesthetics
- Flood attenuation



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### Land Protection

(acquisition, conservation easements, etc.)



BEAVER DAM BROOK RESERVATION

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### Improved Stream Crossings

- Flood flow passage
- Streambank stability
- Wildlife passage



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### Low Impact Development (LID)

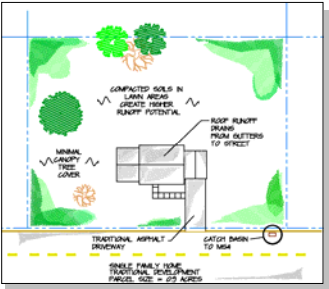
An ecosystem-based approach to land development and stormwater management

*Mimic pre-development site hydrology!*



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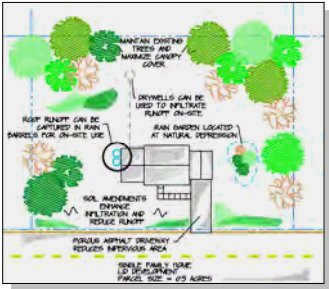
### Conventional Single Family Lot



- Runoff: 8.9 in/yr
- Infiltration: 28.1 in/yr
- TSS: 213 lb/ac/yr
- TP: 0.72 lb/ac/yr

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### LID Single Family Lot



- Runoff: 1.9 in/yr
- Infiltration: 35.2 in/yr
- TSS: 68 lb/ac/yr
- TP: 0.27 lb/ac/yr

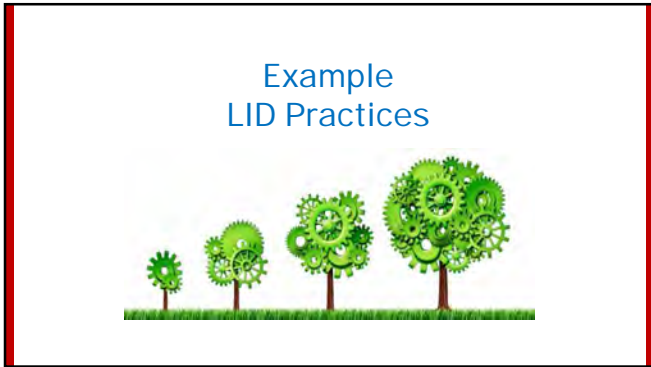
↓ Runoff: -7.0 in/yr

↑ Infiltration: +7.1 in/yr

↓ TSS: -145 lb/ac/yr (-68%)

↓ TP: -0.44 lb/ac/yr (-63%)

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**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.

Slows down water with special second top layer.

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**Porous Pavements (Wilmington MA)**

- Interlocking Concrete Pavers
- Porous Asphalt / Concrete
- Flexpave

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**Workshop Map Resources**

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**Basemap**

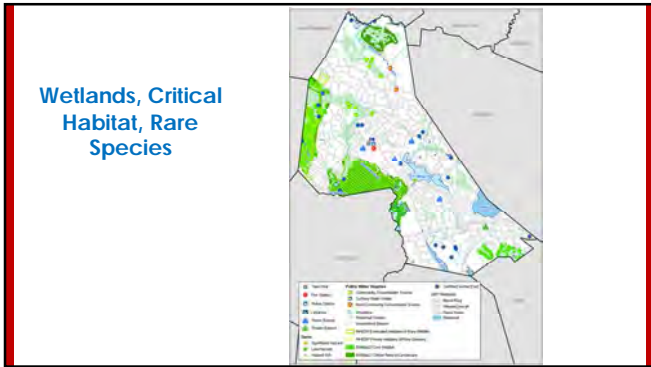
58

**FEMA Flood Zones**

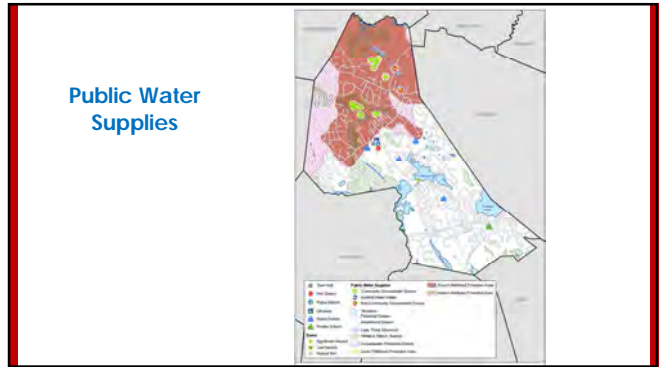
59

**Impervious Surface & Zoning**

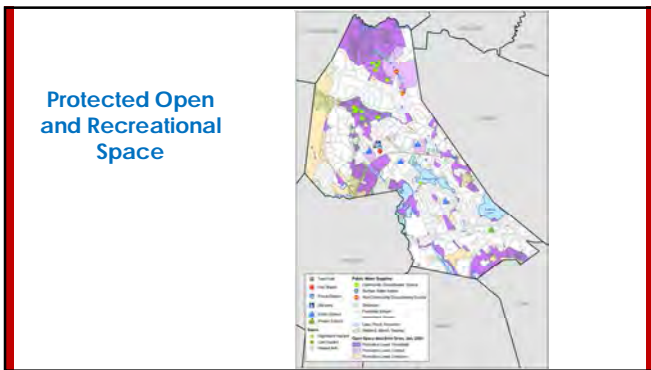
60



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## Stakeholder Interview Results

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## Stakeholder Interview Results

### VULNERABILITIES

<b>Business/Economic Disruption</b> <ul style="list-style-type: none"> <li>• Emergency road closures</li> <li>• Cooperation between public and private entities</li> </ul>	<b>Infrastructure</b> <ul style="list-style-type: none"> <li>• Culvert failure</li> <li>• Roadway hazards due to storms</li> </ul>	<b>Environmental Damage</b> <ul style="list-style-type: none"> <li>• Development in critical areas</li> <li>• Loss of floodplains/in-town flooding</li> </ul>
--	--	---

**Primary concern: Flooding**

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## Stakeholder Interview Results

### STRENGTHS

<b>Emergency Management Department</b> <ul style="list-style-type: none"> <li>• Work together well and meet regularly</li> </ul>	<b>Ongoing Regulatory Management</b> <ul style="list-style-type: none"> <li>• Created bylaws to strengthen stormwater controls related to development</li> </ul>
--	--

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## Group Exercises

- B: Characterize Hazards
- C: Identify Community Vulnerabilities and Strengths
- D: Identify and Prioritize Community Actions
- E: Determine the Overall Priority Actions


**Table Facilitators:**

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

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## Ground Rules

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



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## Ground Rules






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## Group Exercise #1: Characterize Hazards

**Objective:** Develop **top 3 Hazards** for facilitated discussions on vulnerabilities and strengths of Lynnfield (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)

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	<b>Hazard:</b> ultraviolet radiation	}	<ul style="list-style-type: none"> <li>• Extreme precipitation</li> <li>• Drought</li> <li>• Sea level rise</li> <li>• Extreme temps.</li> </ul>
	<b>Vulnerability:</b> exposed skin		<ul style="list-style-type: none"> <li>• Undersized culverts</li> <li>• Crop failure</li> <li>• Low-lying properties</li> <li>• Vulnerable population health</li> </ul>
	<b>Actions:</b> <ul style="list-style-type: none"> <li>• apply sunscreen</li> <li>• seek shade</li> </ul>	}	<ul style="list-style-type: none"> <li>• Upgrade culverts</li> <li>• Irrigation improvements</li> <li>• Floodproofing</li> <li>• Cooling stations</li> </ul>

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## Group Exercise #2: Identify Community Vulnerabilities and Strengths


**Objective:** Develop a **profile** of Lynnfield'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. Report out to large group

*Time: Appx. 60-90 Minutes*

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### 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

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### 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

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### Lunch!



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### Group Exercise #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

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### Action Categories:

Hypothetical Example:  
Fire Department floods during extreme storm events



Resiliency	Mitigation	Adaptation
<ul style="list-style-type: none"> <li>▪ Improve floodplain function:                             <ul style="list-style-type: none"> <li>➢ riparian land conservation</li> <li>➢ green stormwater infrastructure</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ Flood-proof building</li> </ul>	<ul style="list-style-type: none"> <li>▪ Relocate facility outside of 500-yr floodplain</li> </ul>

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### 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

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### 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

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### Group Exercise #4: Determine the 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 Lynnfield

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### 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.

IMPORTANT AND URGENT	IMPORTANT BUT NOT URGENT
NOT IMPORTANT AND URGENT	NOT IMPORTANT NOT URGENT

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### Wrap-Up

**Next Steps:**




- Develop Report
- Hold Listening Session
- Become MVP Community

 **Apply for Action Grant Funding!**



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**Thank you for your time!**

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# APPENDIX B

## COMPLETED RISK MATRICES

---



# Community Resilience Building Risk Matrix



BLUE TEAM<sup>1</sup>

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 Short or Long term (and Ongoing)  
 V = Vulnerability S = Strength

Features	Location	Ownership	V or S	Flooding	Strong Storms	Drought	Priority	Time
							H - M - L	Short Long Ongoing
<b>Infrastructural</b>								
Summer Street and 128 Underpass	Summer St	Town	V	Feasibility assessment for stormwater system redesign			H	S
Pillings Pond Dam - Rebuilt	Pillings Pond	Town	V/S	Continue to support ongoing and planned maintenance tasks; enhance controls system upgrades			L	O
Failing Culverts	Timberhill, Fletcher, Chestnut	Town	V	Redesign and retrofit previously identified failing culverts			M	S
Schools - 4 public, 1 private	Summer St, Main St, Essex St, Salem St	Both	V/S	Most on/near high ground; Middle School is Emergency Shelter		Feasibility analysis on rain harvesting for field irrigation	L	L
Spetic not sewer	Town-wide	Both	V	Connect citizens to low interest septic loan programs; develop program to identify private critically failing septic. Potential town escrow account for emergency repairs?			M	O
Town common flooding	Main st and Summer St	Both	V	Conduct vulnerability assessment, design and install green infrastructure in critical areas			L	S
Public utilities - good in emergencies		Town	S	Continue to work collaboratively with town departments and regulatory bodies				
<b>Societal</b>								
Senior Housing - Ross Drive and other areas	Life Village, Lynnfield Housing Authority	Both	V/S	Continue to work with private entities to develop emergency planning, evacuation routes, etc. Strengthen requirements for emergency planning with bylaws			L	O
Lynn water keeps Beaver Brook High for water supply		City of Lynn	V	Partner with local communities to develop a Regional Water Management Plan; acquire key parcels for groundwater protection			H	O
Council of Aging - TBD Emergency shelter	Salem St	Town	S	Assessment to determine feasibility of creating new shelter with solar power and storage.			H	S
Potential MWRA interconnection		Multiple	S	Regional water management planning		Feasibility of sharing water from Santuag Lake/Hawkes Pond	H	O
New developments with no fire controls	Upper Main St	Private	V		Feasibility assessment for install of firefighting cisterns - filled via rain harvesting		M	L
OSRD bylaw in process to get enacted	Town-wide		S	Increased public outreach and education; engage with key community leaders to reach specific groups			H	S
Market Square - good stormwater controls	Market St	Private	S					
Scenic Road Bylaw - protects trees	Town-wide		S					
<b>Environmental</b>								
Beaver dams	Reedy Meadow	Town	V	Invest in and install more beaver deceivers			L	O
Water quality issues - iron and manganese	Public wells	Town	V		Continue working with outside consultants for feasible solutions, develop solution within 12 months		H	O/S
Lake and Pond water quality issues	Pillings Pond, etc	Both	V	Dredge Pillings Pond north area for invasive plants; Vulnerability assessment for shoreline LID solutions to prevent NPS runoff			M	O
Reedy Meadow - brush fires, interconnectivity: Rail Trail	Beaverdam Brook	Town	V/S	Conduct vulnerability assessment and ecological survey to determine best and highest use and management plan for area			H	O
Invasive species	Reedy Meadow, Pillings Pond	Town	V	Dredge affected waterbodies; continue to monitor high-risk areas for invasive presence			L	O
High water demand	Town-wide		V	MWRA potential, regional water management plan			H	O
Good tree stewardship	Town-wide		S					
Snow/ice - salt and sand impairments	Town-wide		V	Alternative snow and ice treatment methods assessment to determine least environmentally damaging protections			H	O

Notes:  
 1. Blue team participants: Glenn Davis (Fire Chief), Brian Shaffer (Zoning Board of Appeals), John Tomasz (DPW Director), John Scenna (Lynnfield Center Water District.), Susan Lambe (Planning Board), Kirk Mansfield (Conservation Commission), Elisha Musgraves (CEI)



				Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)			Priority	Time
H-M-L priority for action over the Short or Long term (and Ongoing)				Flooding	Strong Storms	Drought; Extreme/Increasing Temperatures	H - M - L	Short Long Ongoing
V = Vulnerability S = Strength							H - M - L	Short Long Ongoing
Features	Location	Ownership	V or S	Proposed Actions				
<b>Infrastructural</b>								
Undersized culverts and stormwater infrastructure	multiple locations <sup>2</sup>	mostly town-owned	V	a. Multiple culvert/stormwater infrastructure improvement areas have already been studied and are ready for implementation (see Note 2 for list). b. Flooding impact study of Route 1/Salem Street intersection to recommend improvements			H	S - L
Saugus River/Beaverdam Brook corridor	Saugus River/Beaverdam Brook	multiple mgt. entities	V	Conduct study to evaluate system weaknesses and potential improvements. This area has multiple management entities (Lynnfield, Wakefield, Lynn Water & Sewer), requiring a balancing of flood concerns, ecological concerns, and the need to impound water for water supply.			H	L
Hawkes Brook / Carpenter Road area	Hawkes Brook / Carpenter Road	Town and private	V	Culverts undersized and septic systems at risk of failure during flood events. Conduct study of flooding/water supply concerns.			M	S
Power lines	town-wide	Peabody Municipal Light Plant; National Grid	V	a. To increase resiliency of power lines to snow/ice storms, assess new technologies (e.g., improved brackets) to reduce damage from downed trees/limbs; install retrofits on an ongoing basis.			M	O
				b. Conduct study of potential use of micro-grids and battery storage for critical Town facilities			M	S
Private wells/septic systems	town-wide	private	V (but S for infiltration)	Concern with regard to comingling of water supply and wastewater during floods and loss of water supply during drought - some areas do not have option to tie into municipal water. Conduct town-wide evaluation of water supply resiliency			M	S
Flow management infrastructure	Pillings Pond; Saugus River	Town	S	New Pillings Pond dam could be enhanced with instrumentation to provide real-time data and decision support for flow mgt., lake drawdown, etc. Sam approach could be used to better manage flows in Saugus River			H	S
<b>Societal</b>								
Sheltering capacity for extreme weather events	Middle School ; High School	Town	V	Conduct study to evaluate needs for expanded sheltering capacity, including assessment of generators (size/type), and other amenities such as beds, etc. Include evaluation of needs associated with treatment for insect-borne illnesses (e.g. Zika virus, etc.) Note: Locations to expand capacity have already identified as the Senior Center (top location), Summer St. School, and Huckleberry School. Assess need for an Emergency Operations Center.			M	O
At-risk populations	town-wide	N/A	V	Coordinate with Fire Chief/Emergency Management Director to determine if any modifications are needed to the Code Red emergency notification network or other tools to provide assistance to at-risk populations during emergencies.			L	L
Evacuation routes	Rt. 128; Rt.1	State	V	Coordinate with Fire Chief/Emergency Management Director to determine potential alternative evacuation routes. Flooding impacts to the primary routes is a low-level concern, except for Summer St./Rt. 128 (see Note 2).			L	L
<b>Environmental</b>								
Saugus River corridor	Saugus River corridor	multiple mgt. entities	V	Conduct watershed study to identify key thresholds for operating dam in response to both flooding and drought conditions. A primary concern is balancing the need to protect ecology (i.e., wetlands, rare species habitat, regionally important bird nesting area) and maintain water supply during drought. Study should identify needs for an upgraded outlet structure/spillway.			M	L
Reedy Meadow - invasive species	Reedy Meadow		V	Conduct ecological inventory and invasive species management plan to establish baseline and actions to respond to new invasive species threats			L	S
Increased occurrence of harmful algal blooms (cyanobacteria)	Pillings Pond	State-listed Great Pond	V	Septic systems: conduct homeowner education/outreach; funding mechanisms for septic upgrades; identify failing septic. Reduce nutrient sources through green infrastructure, LID retrofits			L	L
Ipswich River habitat loss/impact due to water supply withdrawals	Ipswich River	multiple	V	Assess potential additional land protection in Ipswich River watershed, including Sagamore golf course planned for redevelopment. Protected land in Lynnfield Center Water District is a strength.			M	S

Notes:

1. Green team participants: Charlie Richter (Town Engineer), Kristin McRae (Board of Health), Patrick McDonald (GIS Coordinator), Brian Abcunas (Peabody Municipal Light Dept.), Carey Diehl (Kinder Morgan), Steve DeBettencourt (DPW), Bob Hartzel (CEI)

2. Multiple culvert/stormwater infrastructure improvement areas have already been studied and are ready for implementation, including: Ledge Road/Hawkes Brook area (privately owned), Timberhill Lane, Fletcher Road, Rourke Lane, and Sumer Street/Rt. 128 overpass.

**Community Resilience Building Risk Matrix**



**RED TEAM**

www.CommunityResilienceBuilding.org

**H-M-L** priority for action over the **S**hort or **L**ong term (and **O**ngoing)  
**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	Strong Storms	Drought / Extreme Temperatures	Priority	Time
							H - M - L	Short Long Ongoing
<b>Infrastructural</b>								
Summer Street Flooding - Cuts Town in Half, FD Isolated	Summer St.	Town	V	Engineering design underway - implement once completed			H	S
Salem St. (Rt. 1) Flooding	Salem St.	DOT	V	Coordinate / collaborate with DOT on potential solution (i.e., design, permit, build)			L	L
Localized flooding at intersection of Tophet Road and Chestnut Street caused by low spot in road	Tophet Rd	Town	V	Perform engineering analysis and design for potential solution			M	L
Area surrounding Pillings Pond is at flood risk. Dam outlet structure was recently rebuilt.	Pillings Pond	Town	V/S	Implement decision support system to actively manage dam outlet structure based on real-time forecast information and pond response predictions.			H	S/O
Lynn Water District's control of Saugus River causes flooding within Beaver Dam Brook watershed	Saugus River Dam	Lynn	V	Coordinate with Lynn Water Dept. to implement decision support system to provide alerts when flood risk is increasing with the Beaver Dam Brook Watershed.			H	S/O
Undersized culverts within Hawkes Brook cause flooding	Hawkes Bk.	Town	V	Perform detailed hydrologic/hydraulic study to evaluate culverts and prioritize for replacement			H	S
Undersized culverts within Beaver Dam Brook Watershed	Rail Trail Area	Town	V	Integrate culvert replacements into Rail Trail Design			M	S
<b>Societal</b>								
Public schools don't have air conditioning	Town-wide	Town	V			- Install A/C at schools, then develop renewable energy plan to offset increased GHG emissions (e.g., solar panels on roof).	H	S
Development in Town is leading to increases in energy usage	Town-wide	Town	V			- Develop Town renewable energy bylaw to reduce GHG emissions	L	L
Trees are increasingly falling during storms and impacting emergency response times (trees are all same age)	Town-wide	Town	V		Write tree preservation bylaw, hire dedicated Town tree warden, perform hazardous tree evaluation study, remove hazardous trees, and replant in accordance with bylaw.		M	L
Private irrigation wells are depleting Town aquifers, particularly in Lynnfield Center Water District Area	North Town	Town	V			Implement public education campaign to decrease irrigation water usage	L	L
Town has no public water supply north of Lowell Street (fire hazard)	North Town	Town	V			Perform feasibility study for expansion of water supply distribution network	L	L
Suburban coyote populations are increasing					Implement public education campaign		L	L
<b>Environmental</b>								
Septic systems throughout Town are at risk from flooding / high GWT. Leads to potential water quality impairments to Beaver Dam Brook, Pillings Pond, and other waterbodies.	Town-wide	Town	V	Prepare watershed based plans for impaired waterbodies in Town, including detailed evaluation of potential sources from septic systems. Consider nature based solutions to decrease pollutant influx into impaired waterbodies.			M	L
Lynnfield Center Water District water supply wells are impacted by water quality (e.g., Fe, Mn) and water quantity issues	North Town	Town	V			- Perform study to identify potential alternative sources or treatment options. - Evaluate potential supplemental water supply through interconnection with Lynn water District (MWRA water)	H	S
Lynnfield Center Water District sources are at risk from new development	Golf Club	Private	V			Acquire Sagamore Spring Golf Club property (and/or 22 acre lot adjacent to Golf Club) and turn into conservation land.	M	L
Reedy Meadow is periodically impacted by brush fires	Reedy Meadow	Town	V		Integrate emergency preparedness into ongoing Rail Trail Design (i.e., improved access for fire department).		M	S
Health issues from steadily increasing temperatures (ticks, poison ivy, mosquitos)	Town-Wide	-	V			Perform public education campaign for prevention. Coordinate with Essex County Mosquito Control District to develop long term preventative maintenance program.	L	L
Invasive species influx into protected Reedy Meadow Habitat (i.e., bittersweet, knotweed etc.)	Reedy Meadow	Town	V			Perform study to identify invasive species, then develop management plan	M	L

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## APPENDIX C

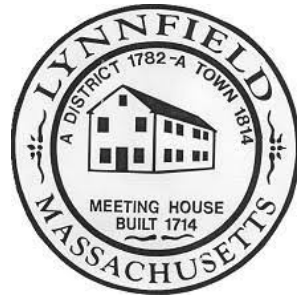
### BASE MAPS AND WORKSHOP MAP RESOURCES

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# TOWN OF LYNNFIELD MUNICIPAL VULNERABILITY PREPAREDNESS PROGRAM

Climate Change and Natural Hazard Vulnerability Assessment

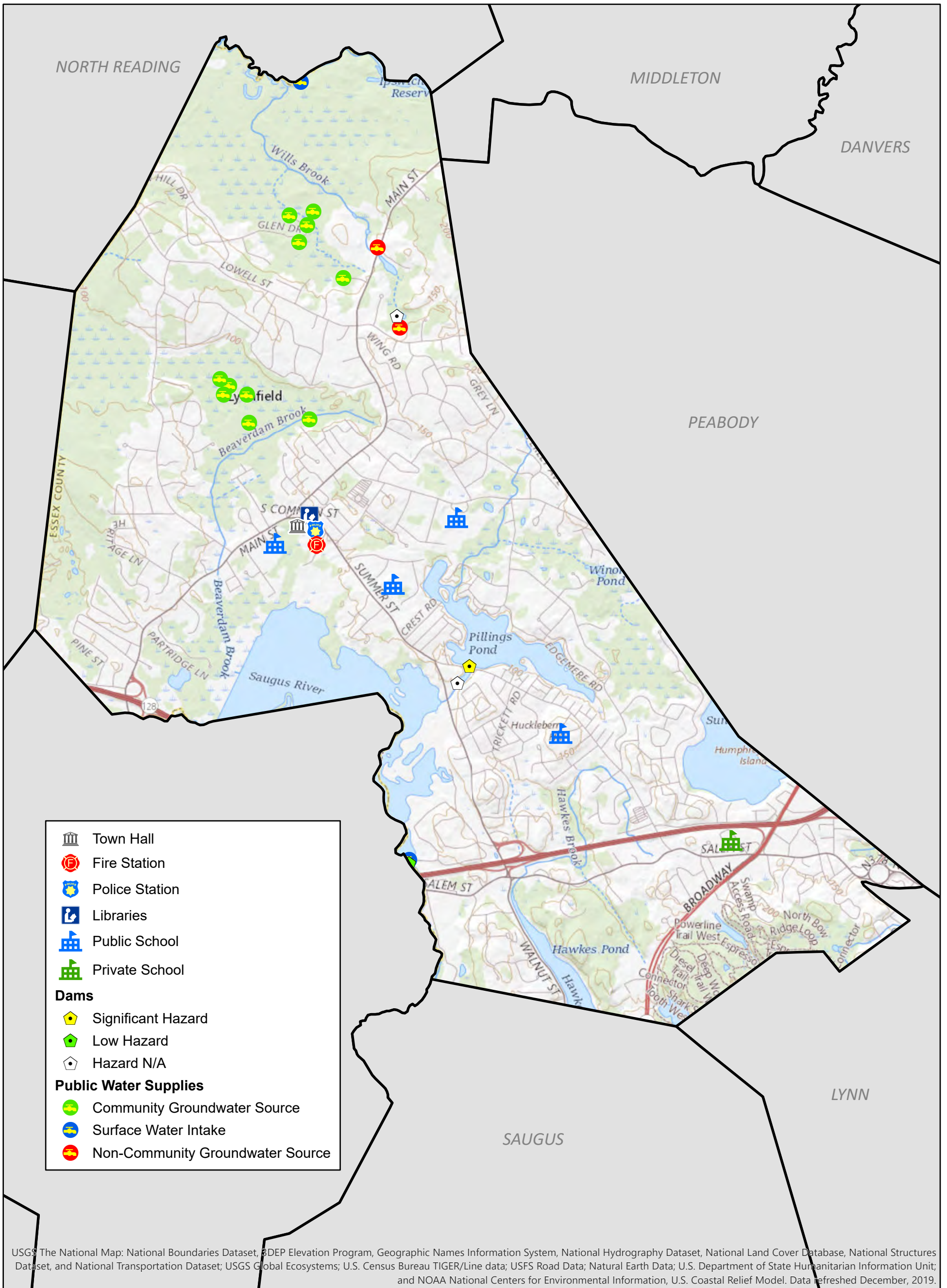
## WORKSHOP MAP PACKAGE – FEBRUARY 2020



**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 Protection Areas
- Protected and Recreational Open Space

<b>Map Layer:</b>	<b>Source:</b>
Zoning	Town of Lynnfield
Groundwater Protection District	Town of Lynnfield
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
Protected and Recreational Open Space	Town of Lynnfield
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

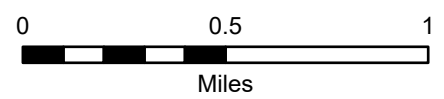


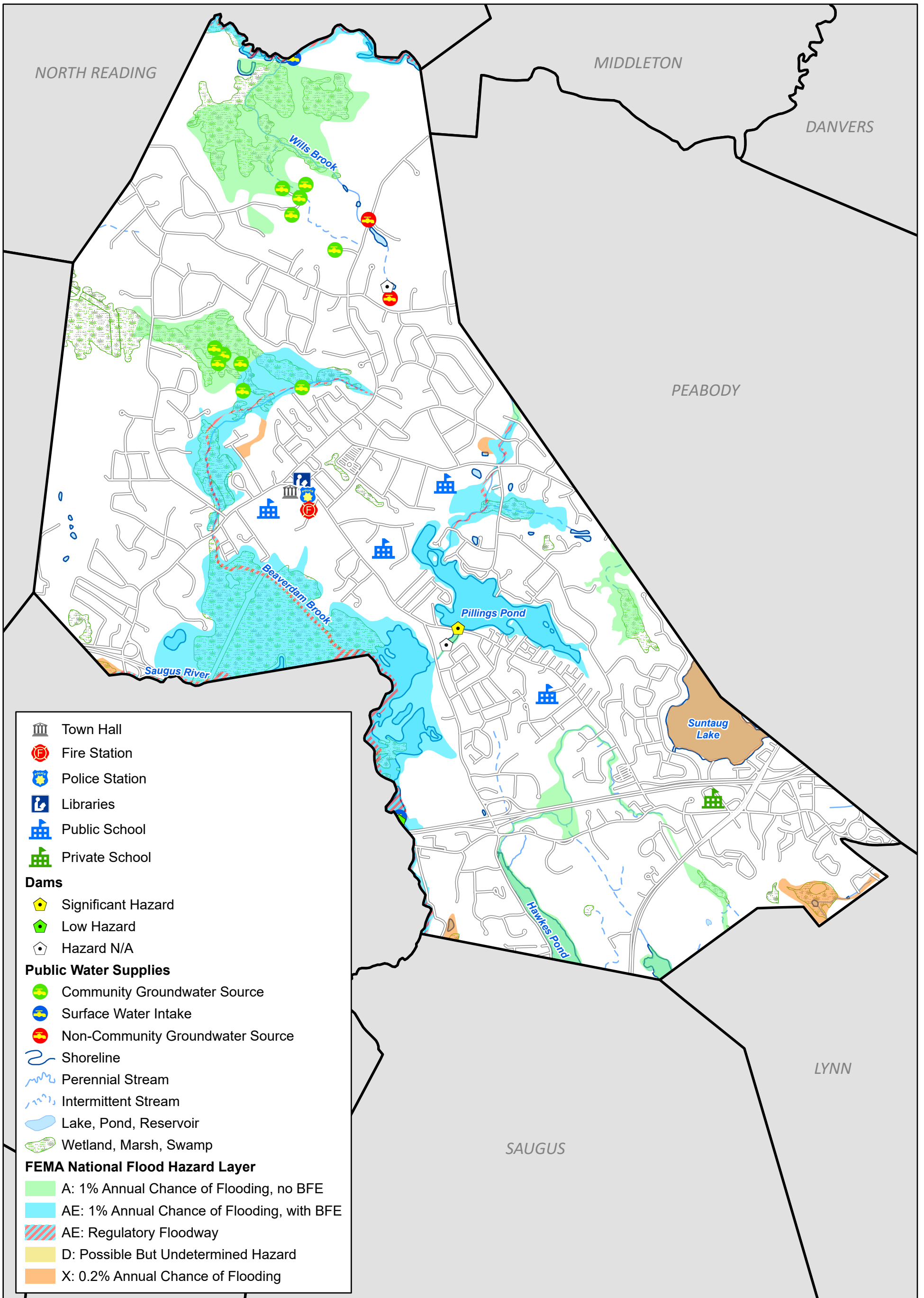
USGS The National Map: National Boundaries Dataset, 3-DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road Data; Natural Earth Data; U.S. Department of State Humanitarian Information Unit; and NOAA National Centers for Environmental Information, U.S. Coastal Relief Model. Data refreshed December, 2019.

**Figure 1**  
**Town Base Map**

**Municipal Vulnerability Preparedness Program**  
**Lynnfield, MA**

Data Source: MassGIS



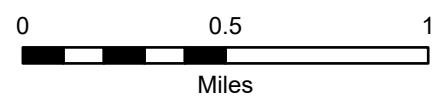


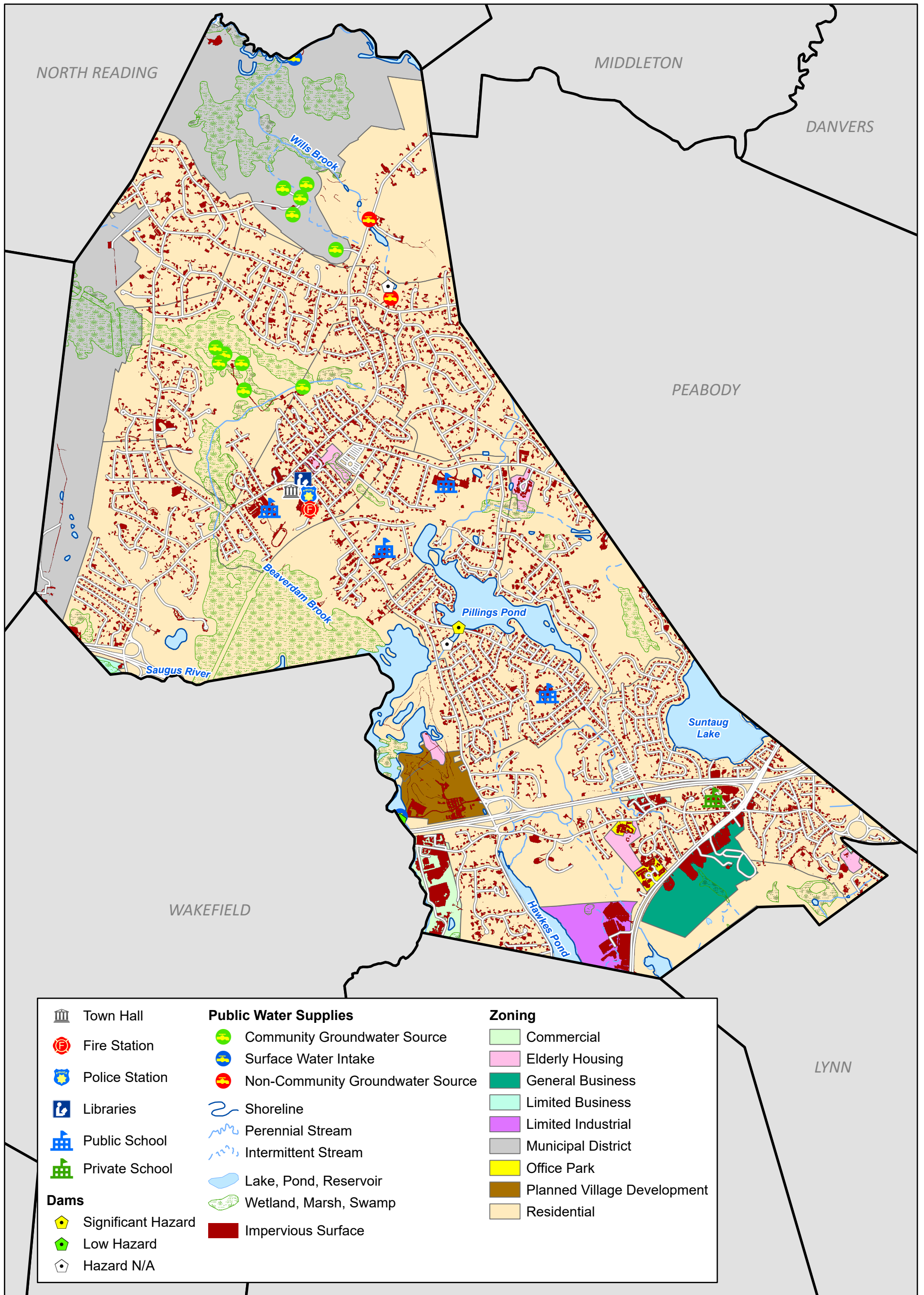
**Figure 2**  
**FEMA National Flood Hazard**

**Municipal Vulnerability Preparedness Program**  
**Lynnfield, MA**



Data Source: MassGIS



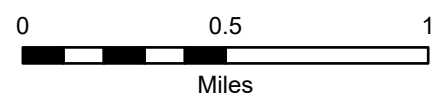


**Figure 3**  
**Impervious Surfaces and Zoning**

**Municipal Vulnerability Preparedness Program**  
**Lynnfield, MA**

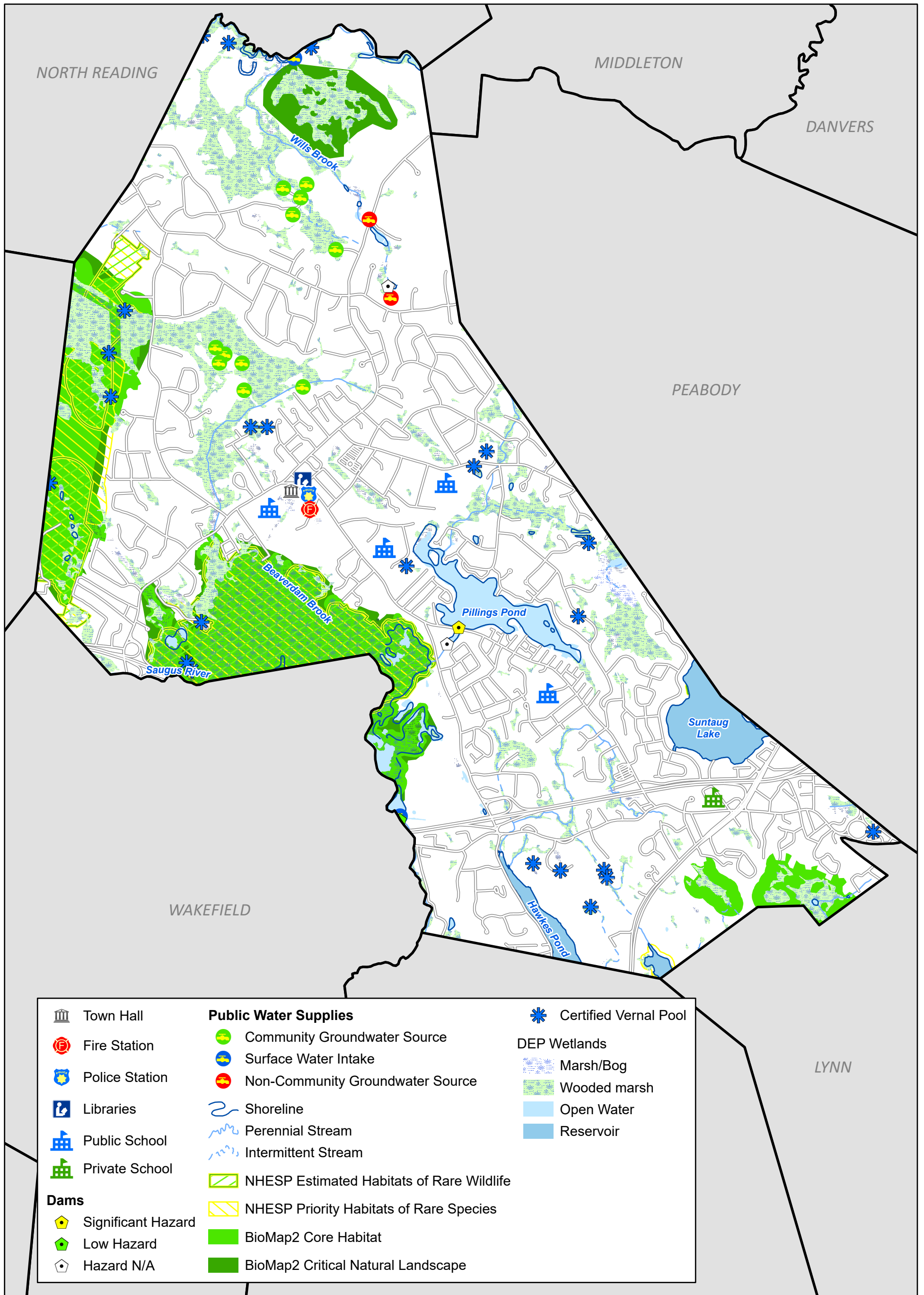


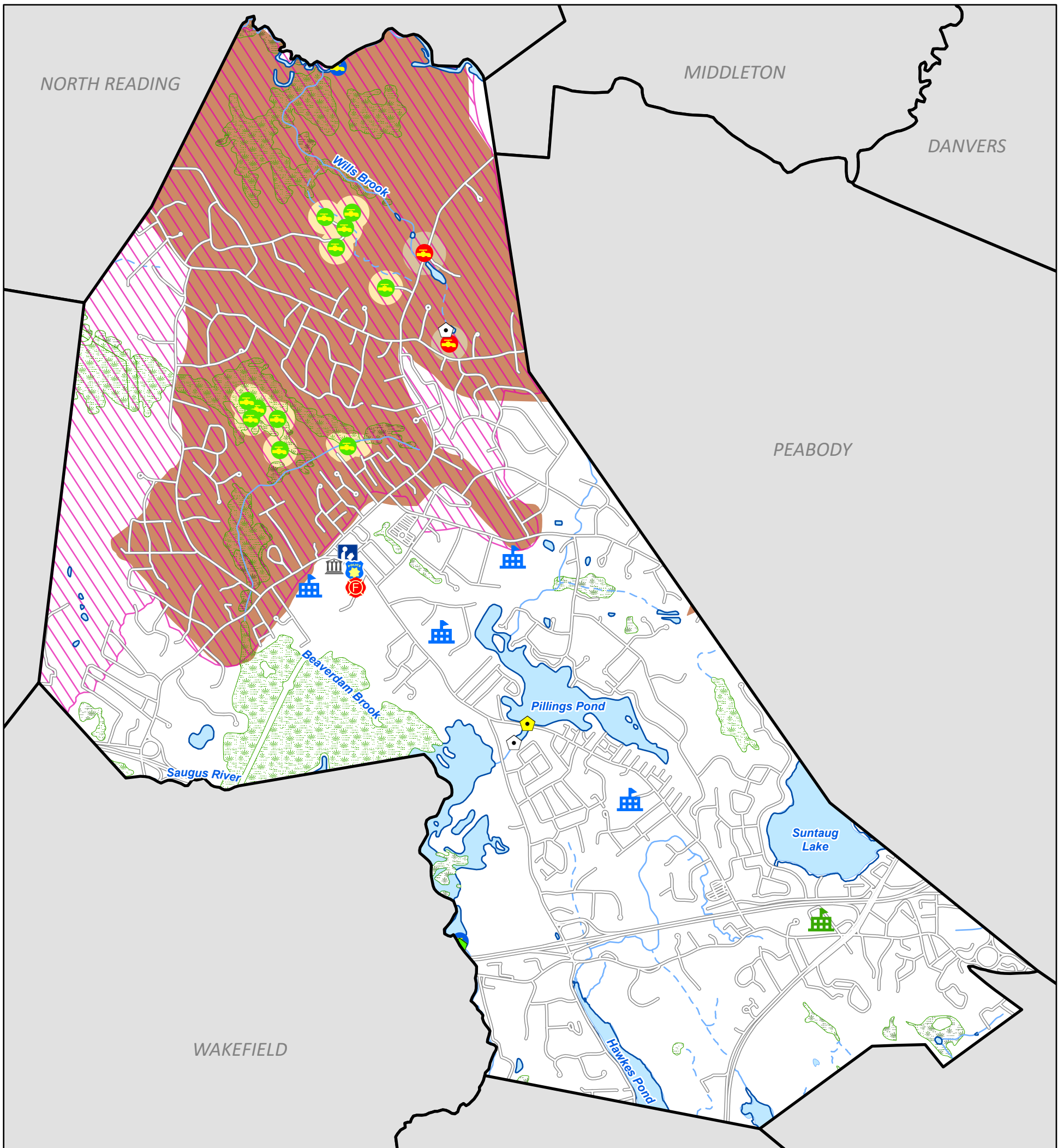
Comprehensive  
Environmental  
Incorporated



Data Source: MassGIS, Town of Lynnfield







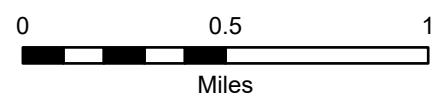
Town Hall	<b>Public Water Supplies</b>	Zone II Wellhead Protection Area
Fire Station	Community Groundwater Source	Interim Wellhead Protection Area
Police Station	Surface Water Intake	
Libraries	Non-Community Groundwater Source	
Public School	Shoreline	
Private School	Perennial Stream	
<b>Dams</b>	Intermittent Stream	
Significant Hazard	Lake, Pond, Reservoir	
Low Hazard	Wetland, Marsh, Swamp	
Hazard N/A	Groundwater Protection District	
	Zone I Wellhead Protection Area	

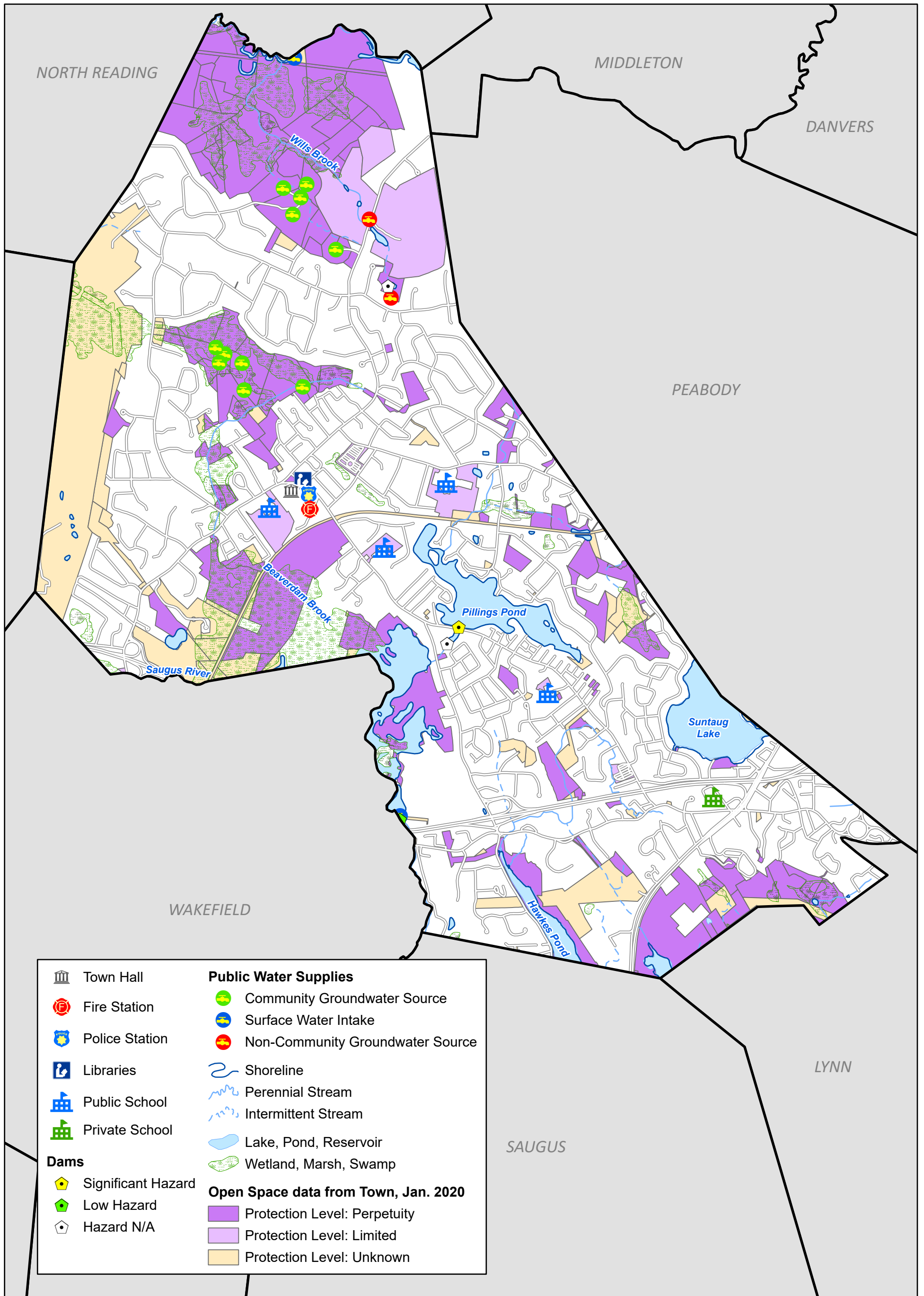
**Figure 5**  
**Public Water Supplies and**  
**Protection Areas**

**Municipal Vulnerability Preparedness Program**  
**Lynnfield, MA**



Data Source: MassGIS, Town of Lynnfield



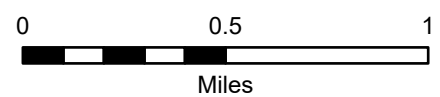


**Figure 6**  
**Protected and Recreational**  
**Open Space**

**Municipal Vulnerability Preparedness Program**  
**Lynnfield, MA**



Comprehensive  
 Environmental  
 Incorporated



Data Source: MassGIS, Town of Lynnfield