June 2020

TOWN OF LUNENBURG

COMMUNITY RESILIENCE BUILDING WORKSHOP SUMMARY OF FINDINGS

Prepared for:

Town of Lunenburg
17 Main Street
Lunenburg, MA 01462

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Appendices

Appendix A: Introductory Presentation Materials (PowerPoint slides and Maps)

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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

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 (EOEEA) 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, 285 of the Commonwealth's 351 municipalities (81%) 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 Lunenburg (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, Lunenburg 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 Lunenburg – MVP Core Team
Adam Burney, Land Use Director
James Marino, Police Chief
Patrick Sullivan, Fire Chief
Jack Rodriquenz, Director of Public Works
Susan Doherty, Council on Aging
Heather Lemieux, Town Manager
Matt Marro, Conservation 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 March 9, 2020 to plan for the workshops.
- CEI worked with Core Team members to identify potential areas of concern, strengths, and vulnerabilities.
- CEI prepared presentation materials and a set of maps to guide the workshop (Appendix A).
- The Core Team scheduled the workshops, invited stakeholders, and handled logistics.

1.4 Workshop Process

The MVP Planning Workshop was conducted as two web-based virtual meetings due to COVID-19 limitations in accordance with guidance from EOEEA. The workshop sessions followed the format as presented in the CRB Guidance[1]. The workshop participants are listed below.

		Workshop Dates	
Name	Department/Committee	Part 1 May 6, 2020	Part 2 May 21, 2020
Adam Burney	Land Use Director	x	x
James Marino	Police Chief	x	x
Jack Rodriquenz	Director of Public Works	x	x
Susan Doherty	Council on Aging	x	x
Heather Lemieux	Town Manager	x	x
Matt Marro	Conservation Administrator	x	x
Patrick Sullivan	Fire Chief	x	x
Scott Farrar	National Grid		x
Matthew Allison	Planning Board Chair		x
John DiNapoli	Municipal and Community Services Manager, Unitil		x
Hillary King	Central Region MVP Coordinator, EOEEA		x
Bob Hartzel	CEI	x	x
Emily DiFranco	CEI	x	x

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, workshop attendees were provided with a series of maps (Appendix A) with information such as FEMA flood hazard areas, critical habitat areas, and conservation land within Lunenburg. This information was emailed to the group before the webinars.

Introductory information included:

- Description of the MVP program and CRB process.

[1] CRB Guidance: www.communityresiliencebuilding.com

- Introduction to climate change, including climate change projections for Massachusetts and Worcester County[2;]
- Introduction to nature-based solutions (i.e., green infrastructure).

Upon completion of the second part of the workshop, an email was sent to the group with the vulnerabilities and actions identified as high priority. The workshop attendees responded by email to vote on their top three priority actions for Lunenburg. The votes were then tallied to determine the Town's three top priority climate resiliency actions as presented in Section 5.1 of this report.

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 2 were conducted during Part 1 of the workshop held on May 6, 2020. Exercises 3-4 were conducted during Part 2 of the workshop held on May 21, 2020.

[2] Climate Projections obtained from: www.resilientma.org

2. Top Hazards and Vulnerable Areas

Lunenburg Town Hall

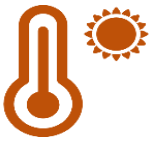
2.1 Summary of Top Hazards

During Exercise 1, workshop participants discussed Lunenburg's top natural hazards and areas of concern related to climate change. The group then 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 Lunenburg:

1. **Flooding:** Flooding was a hazard of concern to Lunenburg. There are multiple areas in town that have experienced historical flooding and others that would be expected to flood under future climate change projections.

2. **Strong Storms:** Extreme weather events, including strong winter storms, heavy rainfall with high winds, and ice storms, were a top concern due to their potential for damage to infrastructure and other physical, social, and environmental consequences.



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

2.2 Areas of Concern

Key stakeholders developed a preliminary list of Lunenburg's primary climate resiliency vulnerabilities and strengths. These stakeholders were primarily concerned with vulnerabilities relative to flooding and storm induced hazards. Vulnerabilities of concern included potential culvert and bridge failures, roadway flooding, electrical power supply infrastructure, and access to key critical facilities during an emergency.

The table below lists areas of concern that were identified based on stakeholder feedback. 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
Infrastructure	• Stormwater management system (town-wide) • Bridge maintenance/repairs needed • Electrical power supply infrastructure (town-wide) • Septic system management • Sump pumps (town-wide) • Critical facilities with only one egress (DPW, Public Safety) • Sewer pump stations
Societal	• Senior Housing Centers • Schools • Critical facilities with only one egress • Emergency services access
Environmental	• Lake Shirley and Hickory Hills Lake • Agricultural lands (town-wide) • Key lands for conservation • Wind fetch (road safety issue) • Cold-water fisheries

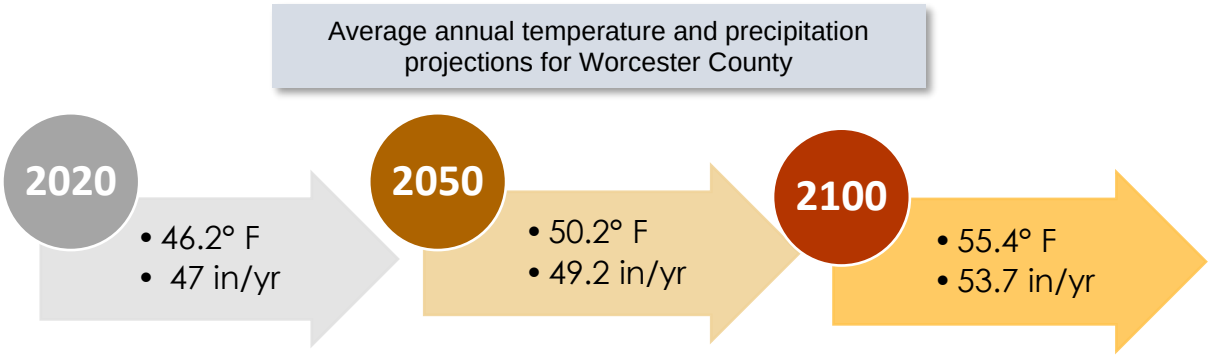
3. Current Concerns and Challenges Presented by Hazards

Lunenburg 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 Lunenburg and many other Massachusetts communities. Lunenburg also experienced extensive damage and power outages from the ice storm in 2008.

The intensity and frequency of extreme weather events has increased awareness of Lunenburg'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 Worcester 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 Lunenburg's vulnerabilities and strengths to natural hazards. As in any community, Lunenburg 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:
    - Localized flooding historically occurs on Route 13/Electric Avenue due to low spots in the roads and proximity to adjacent wetlands.
    - Culverts throughout town are undersized, damaged, and have been identified as at risk of failure due to high flows from high intensity storms. Priority locations include the Flat Hill Road culvert (at confluence of Catacoonamug Brook/Lake Shirley), a culvert on Lancaster

Road (the Flats), and others as listed in the *Town of Lunenburg Small Bridge Program - Eligibility Assessment* (February 2020).

- **Bridges**: Workshop participants expressed concerns about bridges requiring repair associated with flooding and damage from high peak flows during strong storms. High priority bridges include the Townsend Harbor Dam Bridge and Youngs Road Bridge.

- **Ice Build-up from Sump Pumps**: Sump pumps are widely used throughout town and many homeowners discharge water onto roadways, causing ice build-up in the winter months.

- **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.

- **Access to Critical Facilities**: The Public Safety Building and DPW Facility at 520 Chase Road have only one egress. This creates a risk to emergency services if the primary egress becomes blocked, including impeded emergency response vehicles (Public Safety Building) and impeded access to key vehicles, equipment, and fueling (DPW Facility).

- **Sewer Pump Stations:** Multiple sewer pump stations throughout town are located in low areas that have a history of flooding, creating a risk wastewater management infrastructure and potential groundwater contamination that is projected to worsen with climate change.

- **Septic Systems:** Septic systems in low-lying areas are at risk to flooding and contaminating private wells and surface waters. This risk is projected to worsen with climate change.

3.1.2 Societal Concerns

- **Air Conditioning at Public Schools:** The Turkey Hill Elementary School and Lunenburg Primary School are not air conditioned and are therefore vulnerable to extreme heat.

- **Elderly Population**: Senior housing facilities are vulnerable to extreme heat and impacts from power outages due to strong storms. These facilities are also at risk of impeded access for emergency services due to flooding. Specific concerns related to this population include:

  - The Pearl Brook Apartments do not have central air conditioning or an auxiliary generator. Many residents are reliant on oxygen and other medical equipment that requires electricity and may be impacted by power outages.

  - The elder housing facility on White Street has only one egress. Emergency access may be impeded during periods of flooding.

  - The Baker Brook Apartments are currently being built in a flood-prone area and have only one egress into the facility. Emergency access may be impeded during periods of flooding.

  - The Senior Center has air conditioning but does not have an auxiliary generator. Installation of an auxiliary generator could allow for use of this facility as an emergency shelter and/or cooling station for the elderly population.

- **Emergency Services Access**: Flooding in some areas of town may limit emergency services and isolate neighborhoods for extended periods. Specific areas of concern include multiple roads in the vicinity of Lake Shirley and Hickory Hills Lake, and the trailer park communities at 1790 and 1990 Massachusetts Avenue.

3.1.3 Environmental Concerns

- **Phosphorus Loading to Lakes:** Workshop participants expressed concern about increased phosphorus loading to Lake Shirley and Hickory Hills Lake and the associated potential for increased nuisance algal blooms and other nuisance vegetation.

- **Conservation Land**: Workshop participants stated the need to add climate resiliency to the Town's criteria for open space and land acquisition.

- **Forest Land Management**: Not all Town-owned forest lands have forestry/cutting plans, which are needed to reduce fire risk, promote forest health, and improve wildlife habitat.

- **Agricultural Lands**: Workshop participants expressed concern about the potential for impacts to agricultural lands due to projected increases in drought, dramatic temperature fluctuations, and flooding.

- **Wind Fetch:** Workshop participants were concerned with vehicles drifting on roads due to increased wind fetch from strong storms.

- **Cold-Water Fisheries:** Workshop participants expressed concern about potential impacts to cold-water fisheries due to climate change.

4. Current Strengths and Assets

Workshop participants identified the following as Lunenburg's key climate change resiliency strengths:

- **Open Space Planning:** The Town has recently completed an update to the Lunenburg Open Space and Recreation Plan that identifies priority parcels for conservation and includes criteria for open space protection and land acquisition.

- **Riverine Flooding:** Riverine flooding in the Town is mostly limited to forested areas around Catacoonamug Brook and Mulpus Brook, which represents a nature-based climate resiliency strength that the Town can build upon with continued land conservation efforts.

- **Tree-Trimming Program:** The Town's electrical power utility, Unitil, has an aggressive tree trimming program in place to protect power lines from outages due to storm damage.

5. Recommendations to Improve Climate Resiliency

As summarized below, the final step of the workshop was to develop recommended actions to address identified vulnerabilities and to build upon strengths.

- The workshop participants 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.

- After the workshop, a list of the actions identified as "high priority" were sent by email to the workshop participants. The workshop participants then submitted votes by email for their top three priority actions. The votes were then tallied to determine the Town's three top priority climate resiliency actions as presented in Section 5.1.

5.1 Top Three Recommendations

1. Aging and Undersized Culverts – Redesign and Retrofit

Lunenburg's stormwater infrastructure includes many aged and undersized structures that can contribute to flooding and are not properly sized to pass the flow rates and volumes anticipated based on climate change projections. Multiple culvert/stormwater infrastructure improvement areas have already been studied by the Town and are ready for implementation, including culverts on Flat Hill Road and Lancaster Road. The *Town of Lunenburg Small Bridge Program – Eligibility Assessment* (2020) identifies additional culverts and structures at risk of failure due to high flows.

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 the following phases within this plan be performed concurrently.

- Assess: Expand previous studied 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 of the Massachusetts Wetlands Protection Act.

2. Electrical Power Supply Infrastructure

Lunenburg's electrical power supply lines have the potential to cause power outages due to damage from downed trees and limbs from strong storms. The electrical infrastructure is also aging and may need to be upgraded. Unitil, the electrical supply company responsible for maintaining these lines, has adopted an aggressive tree trimming program in recent years in response to extensive damage from an ice storm in 2008.

An area of concern is the Unitil substation at 934 Massachusetts Avenue (Rear) and associated electrical lines along Lancaster Road and Leominster Road. The Town has historically limited the extent of Unitil's tree trimming program in this area based on Scenic Road designation and related aesthetic concerns.

To improve the resiliency of the electrical power supply infrastructure to strong storms, it is recommended that the Town conduct the following actions:

- Conduct a town-funded tree survey by a certified arborist to develop a tree/limb removal prioritization plan. This survey should focus on the Lancaster Road/Leominster Road area serviced by the Unitil substation at 934 Massachusetts Avenue (Rear).

- Continue to discuss adaptive management with Unitil, including options for improved brackets, additional re-closures, upgrading wiring etc.

3. Public Safety Building - Provide a Second Egress

Lunenburg Public Safety Building

The Public Safety Building (656 Massachusetts Avenue) houses Lunenburg's Police and Fire Departments. Access to and from the facility is limited to one egress off of Massachusetts Avenue through a long driveway to the east of an abandoned business. The area surrounding the building to the north, east, and west is primarily wooded with a few residential properties on Beal Street and Massachusetts Avenue. If the driveway or Massachusetts Avenue becomes impassable due to flooding or storm debris, emergency services to the Town would be at risk.

To address this concern, it is recommended the Town develop a second route of egress to the Public Safety Building to allow for uninterrupted emergency services if the primary access becomes blocked. This additional egress could be acquired through the purchase of the parcel directly in front of the building or the development of an access easement. Purchase of the property is estimated to cost approximately $700,000. It is also recommended to evaluate the surrounding parcels for other egress options.

5.2 Other Prioritized Recommendations

Higher Priority

- To improve nature-based resiliency to climate change, continue to protect key lands through fee acquisition, conservation restrictions, and other real estate tools. Work towards adding climate resiliency to Town list of criteria for open space and land acquisition.
- Conduct a study to determine the potential location for a second egress to the DPW Facility at 520 Chase Road. Access is currently limited to a driveway off of Chase Road that has historically flooded due to a culvert in need of repair under. This facility provides critical emergency services, including fueling for all town vehicles.
- Install central air conditioning and an auxiliary generator at the Pearl Brook Apartments (elder housing).
- Install a generator at the Senior Center to allow building to serve as a warming/cooling station for the elderly population.

Moderate Priority

- Evaluate options for providing stormwater treatment and reducing adjacent upland impervious cover to prevent road flooding on Route 13/Electric Avenue.
- Assess magnitude of ice build-up on the roads due to use of sump pumps by residents and determine specific areas of town most affected. Determine solutions such as reviewing bylaws for updates and/or changes or requiring homeowners to redirect sump pump flow onto property.
- Repair Townsend Harbor Dam Bridge as determined by MassDOT. Estimated cost of repairs are $60,000-$70,000.

- Conduct a detailed engineering assessment to assess repairs need on Youngs Road Bridge.
- Assess, design, and implement improvements to mitigate flooding at sewer pump stations. High priority sites include the Dana Street Pump Station (Route 13 swamp) and West Street.
- Install and auxiliary generator and central air conditioning at the elementary and primary school.
- Conduct a study to determine a potential location for a second egress to the Baker Brook Apartments for emergency access through land purchase or easements. A second egress would ensure access by emergency services if Summer Street is flooded.
- Conduct a study to determine a potential location for a second egress to the elder housing facility on White Street for emergency access.
- Continue to address watershed management to reduce phosphorus loads to Lake Shirley and Hickory Hills Lake. Conduct recommended in-lake actions to reduce algal blooms and invasive species.
- Conduct a study to evaluate the potential impacts of climate change on cold-water fisheries throughout town.
- Develop forestry and cutting plans for all Town conservation lands that currently lack one to reduce fire risk, improve forest health, and improve wildlife habitat.

Lower Priority

- Conduct a town-wide assessment of septic systems to:
  - Determine areas of greatest risk to private wells and contamination of surface waters; and
  - Identify potential wastewater treatment options to improve flood resiliency.
- Assess potential of using the Senior Center for emergency overnight sheltering for the elderly.
- Conduct a town-wide assessment of barriers to emergency services to lake communities (Lake Shirley and Hickory Hills Lake) related to flooding and other impacts of strong storms. This study should include (1) an and evaluation of the previously used access road from the Town Forest to Townsend Harbor Road, to determine feasibility of using it as an emergency access road. This study should also evaluate the potential for second access to Hemlock Drive via the Woodland development off of Northfield Road.
- Conduct a study to determine potential locations for a second egress for emergency access to the trailer park communities at 1790 and 1990 Massachusetts Avenue.

This list of prioritized recommendations was developed by workshop participants based on identified climate resiliency vulnerabilities and strengths.

- 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. Public Listening Session

Workshop findings were presented to the general public during a listening session held during the Lunenburg Board of Selectmen meeting on June 16, 2020. Input received based on the listening session was compiled and is included as Appendix C to this report.

In addition to the public listening session, all materials from the MVP Planning Grant project have been made available on the Town of Lunenburg website.

7. Report Citation

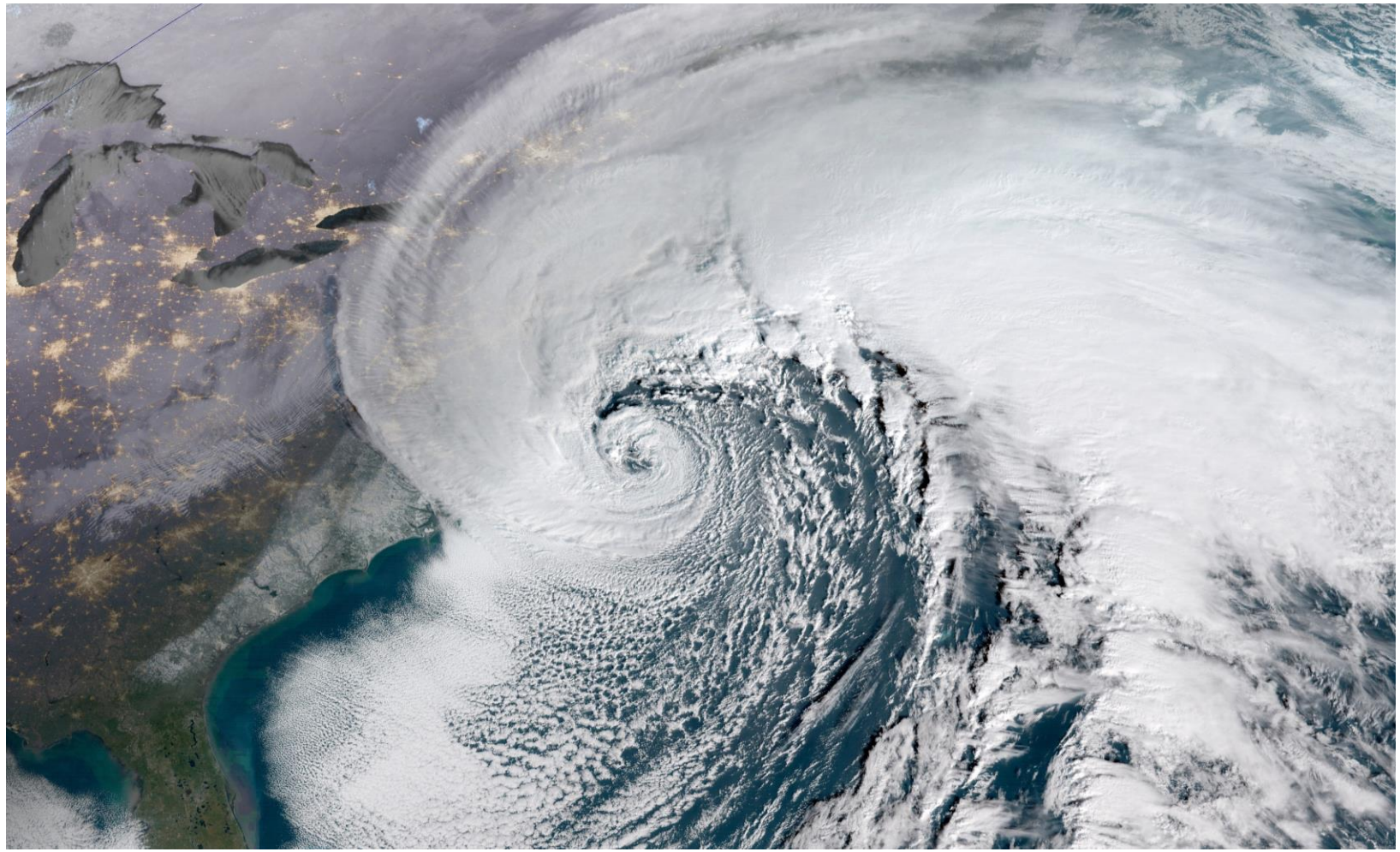
Comprehensive Environmental, Inc. (2020). Community Resiliency Building Workshop Summary of Findings. Town of Lunenburg, Massachusetts.

APPENDIX A

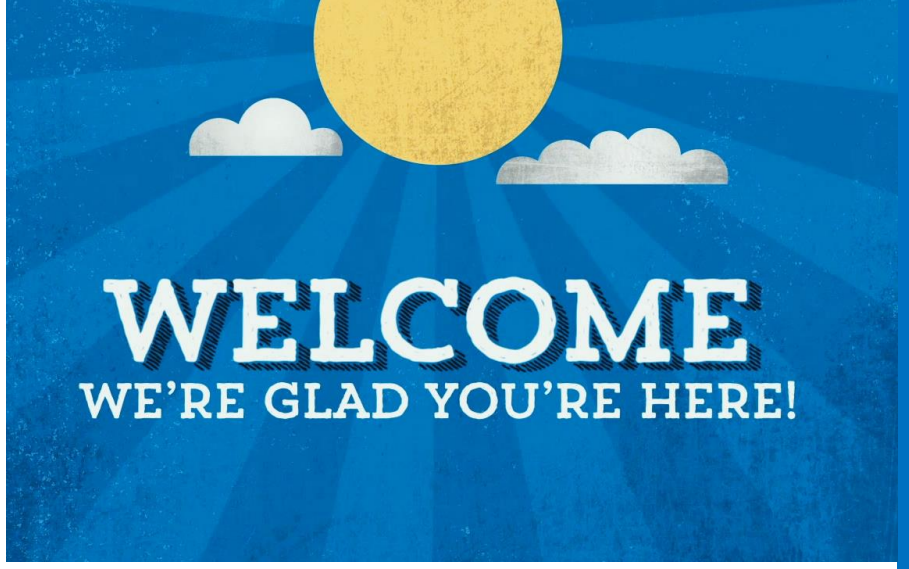
INTRODUCTORY PRESENTATION MATERIALS

Town of Lunenburg

Municipal Vulnerability Preparedness Program
Community Resiliency Building Workshop



Introductions



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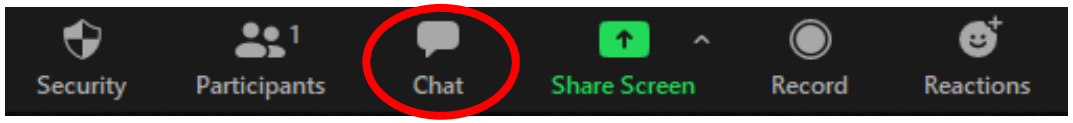

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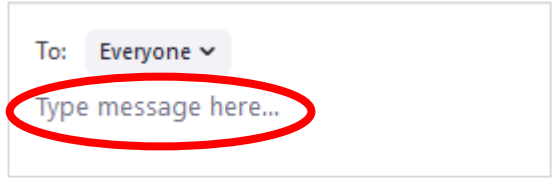


3. Use chat to ask questions during intro presentation…group discussion at end of presentation

In case of Zoom problems: edifranco@ceiengineers.com or 603-343-6311

Workshop Agenda

- Introductory Presentations
- Group Exercises

  1: Identify Top Hazards

  2: Identify Vulnerabilities and Strengths

  3: Identify Actions to Reduce Vulnerabilities

  4: Prioritize Top Actions

Workshop Overview

MVP Program Summary

EXECUTIVE ORDER 569
2016

- Reducing greenhouse gas emissions to combat climate change
- Preparing for the impacts of climate change
  - State Adaptation Plan
  - Climate Coordinators
  - Agency Vulnerability Assessments
  - Municipal Support

ENVIRONMENTAL BOND
2018

- $2.4 billion bond bill with focus on climate change resiliency
- Over $200 million authorized for climate change adaptation
- **Codifies EO 569, including the MVP Program**

Source: https://www.mass.gov/files/documents/2019/07/16/mvp-grant-program-overview-2019-mvp-vendor-training.pdf

MVP Process

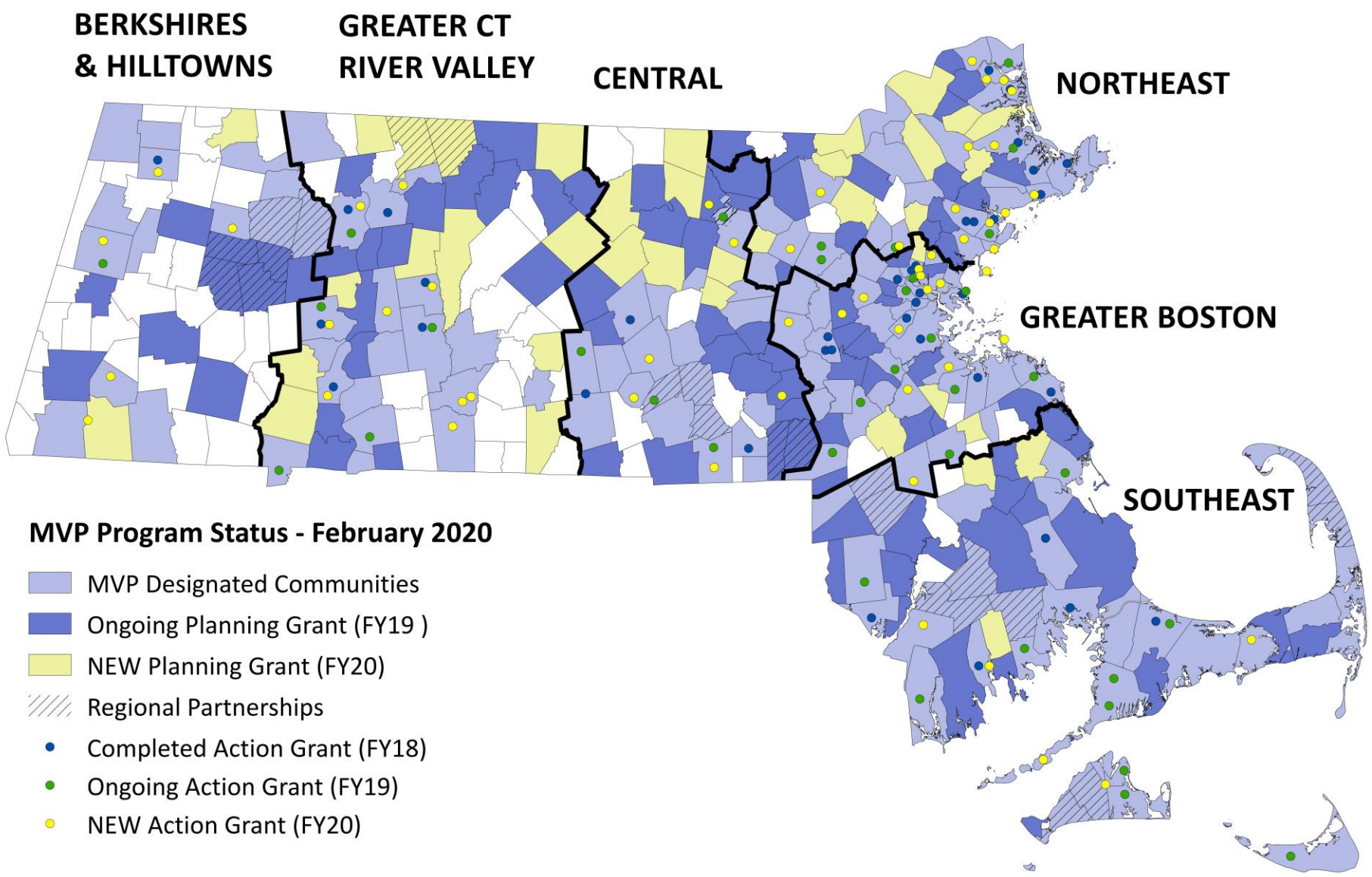
Obtain Planning Grant

Complete Workshop

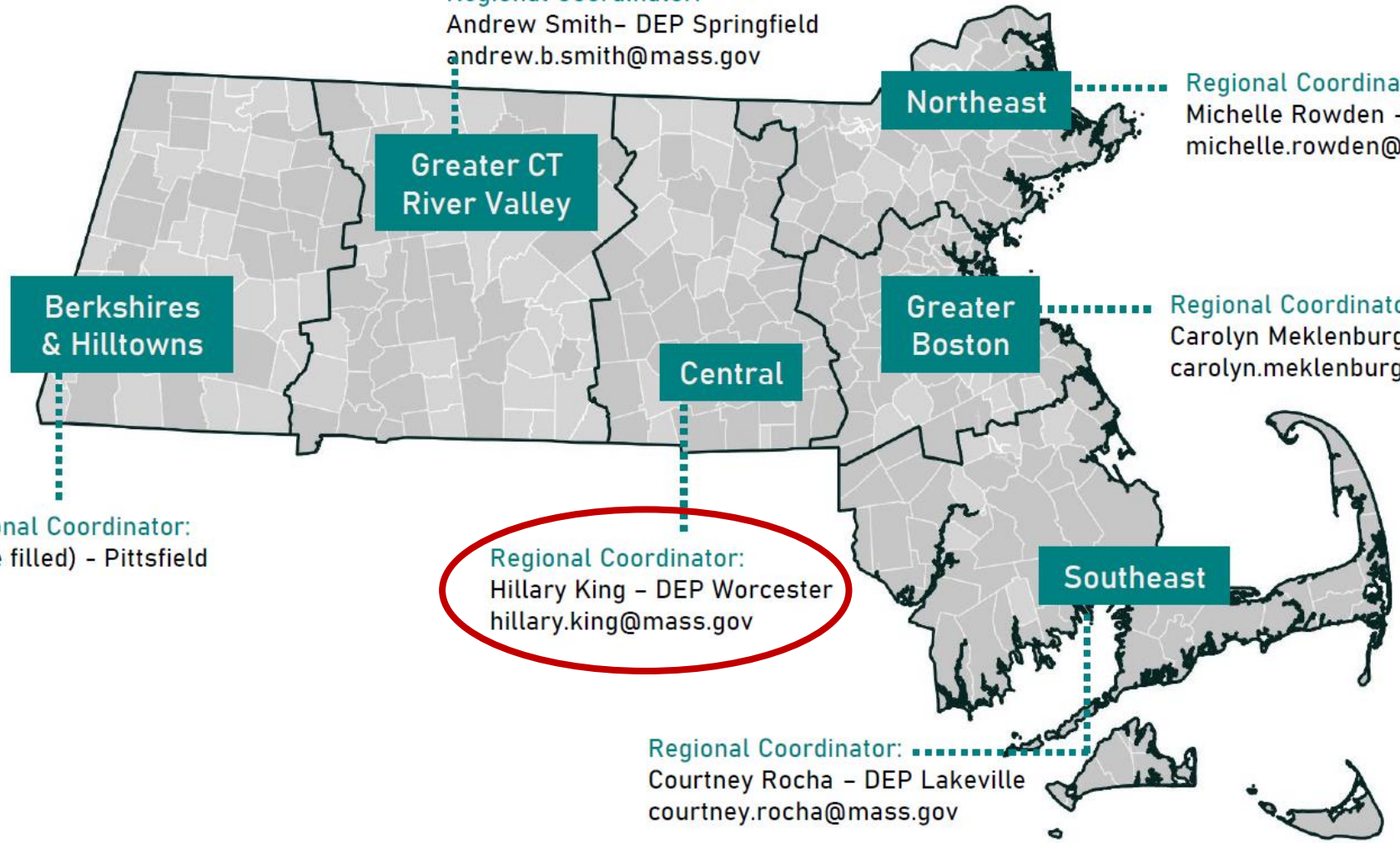
- Identify Actions to Address Vulnerabilities
- Write Report

Become Certified MVP Community

- Eligible for Grant Funding to Implement Actions


BERKSHIRES & HILLTOWNS
GREATER CT RIVER VALLEY
CENTRAL
NORTHEAST
GREATER BOSTON
SOUTHEAST
MVP Program Status - February 2020
MVP Designated Communities
Ongoing Planning Grant (FY19)
NEW Planning Grant (FY20)
Regional Partnerships
Completed Action Grant (FY18)
Ongoing Action Grant (FY19)
NEW Action Grant (FY20)

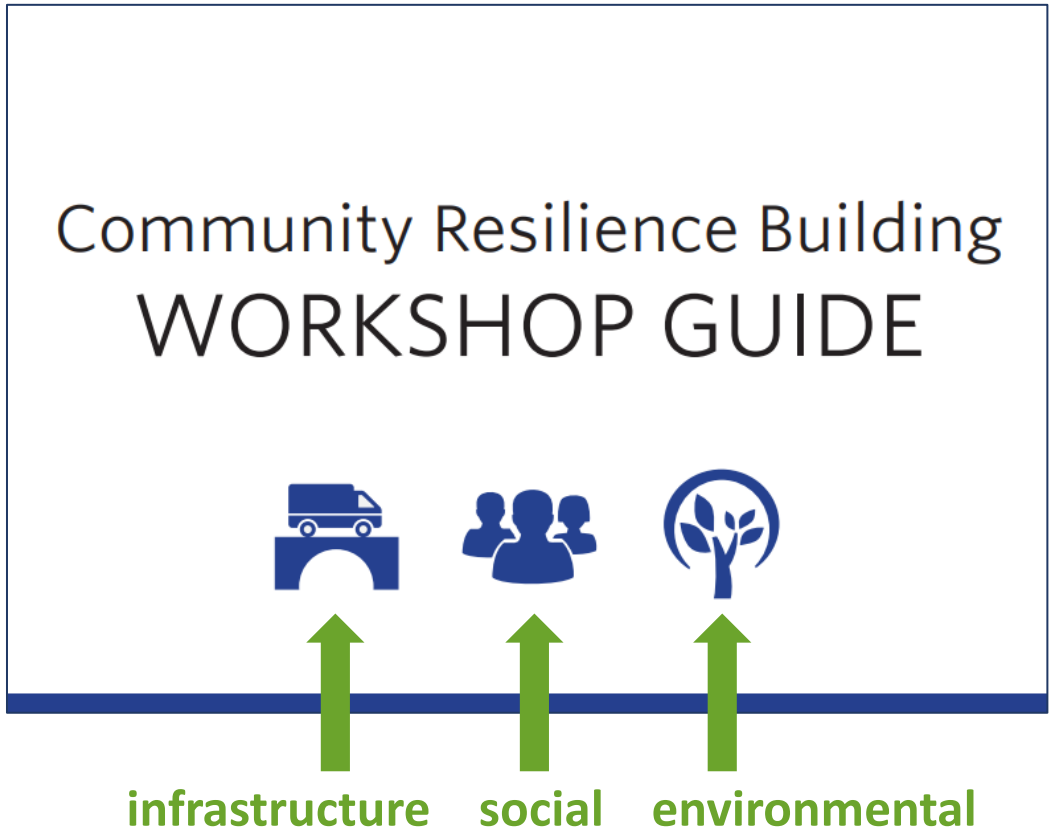
MVP Regions & Regional Coordinators



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



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

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

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

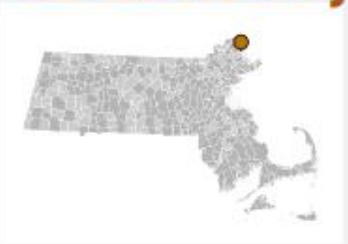
Data utilization

Proactive

Example Action Grant Projects

Redesigns and Retrofits

Salisbury



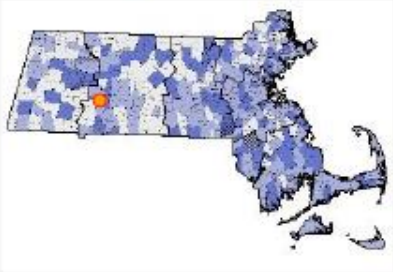
Increasing the resilience of the neighborhood of Ring's Island by raising its access/egress roads and by improving tidal flushing through culvert replacements

Vulnerable communities

FY18 Action Grant Projects

Detailed Vulnerability and Risk Assessment, Further Planning

Holyoke

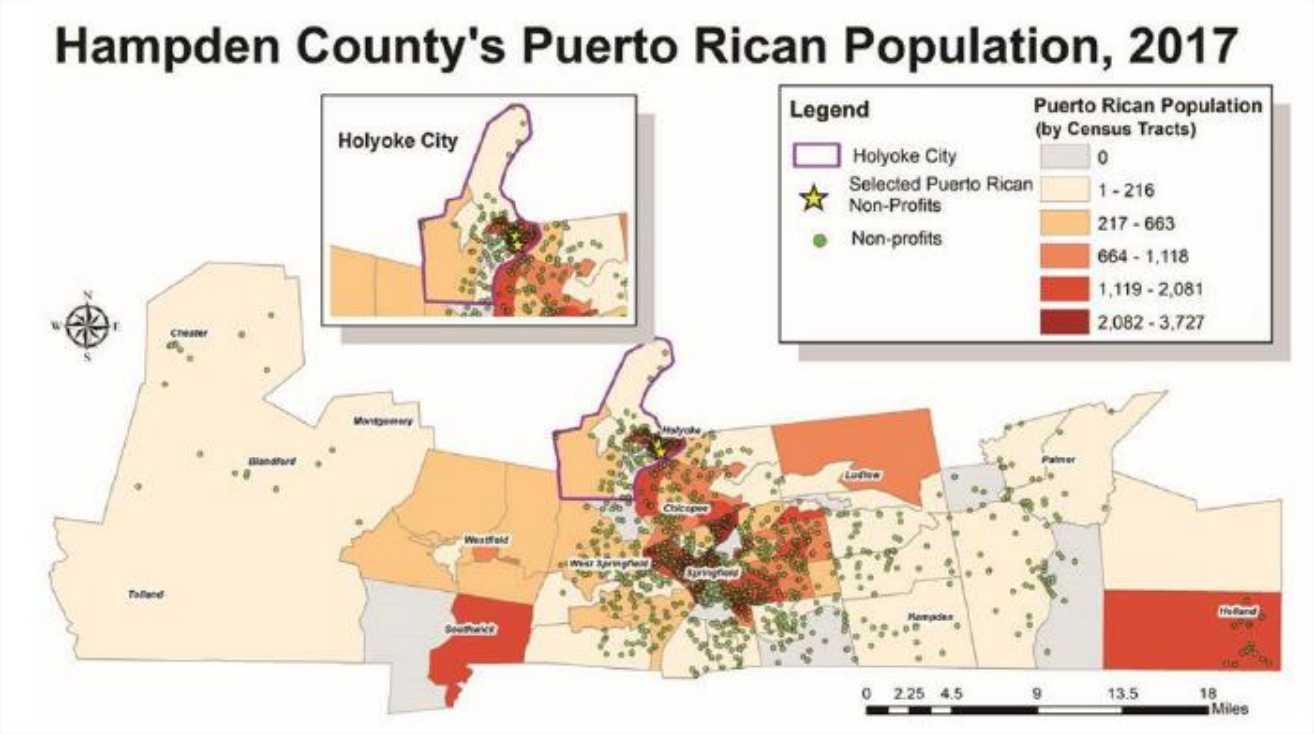


Conducted a detailed demographic analysis of individuals who arrived in Holyoke from Puerto Rico as a result of Hurricane Maria and develop recommendations for planning for future climate change migrants in Holyoke

Informational graphics from Holyoke's final report

Table 12

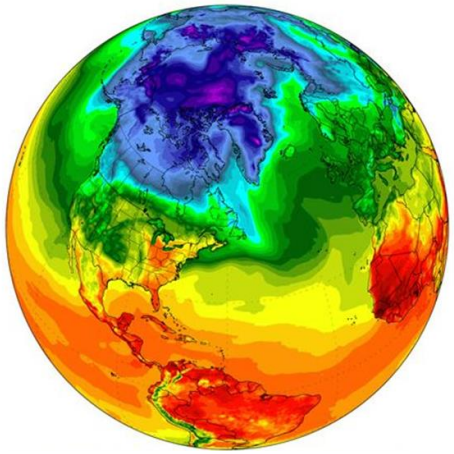
How did the Holyoke municipal government respond to your needs? Was the response...	Freq.	Percent
Helpful	26	63.4
I don't know	7	17.1
Neither helpful nor unhelpful	2	4.9
There was no response from this resource	6	14.6
Total	**41**	**100**



Climate Change 101

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



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.

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 nClimDiv; NOAA Ocean Service

Consequences

Changes in precipitation

- Inland flooding
- Drought

Rising Temperatures

- Wildfires
- Invasive species/pests

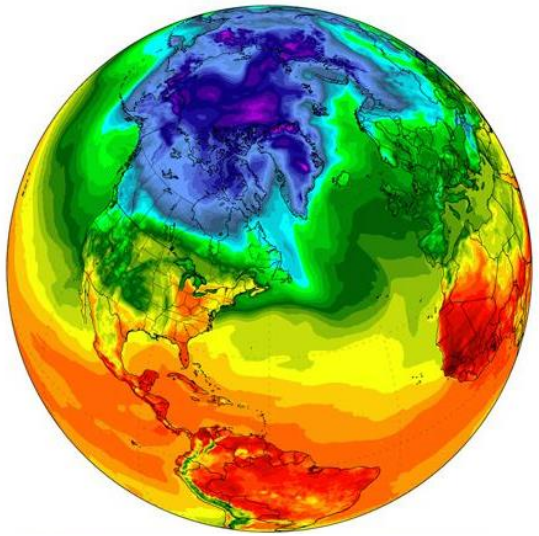
Extreme Weather

- Hurricanes/tornadoes
- Severe winter storms

Human-induced hazards

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

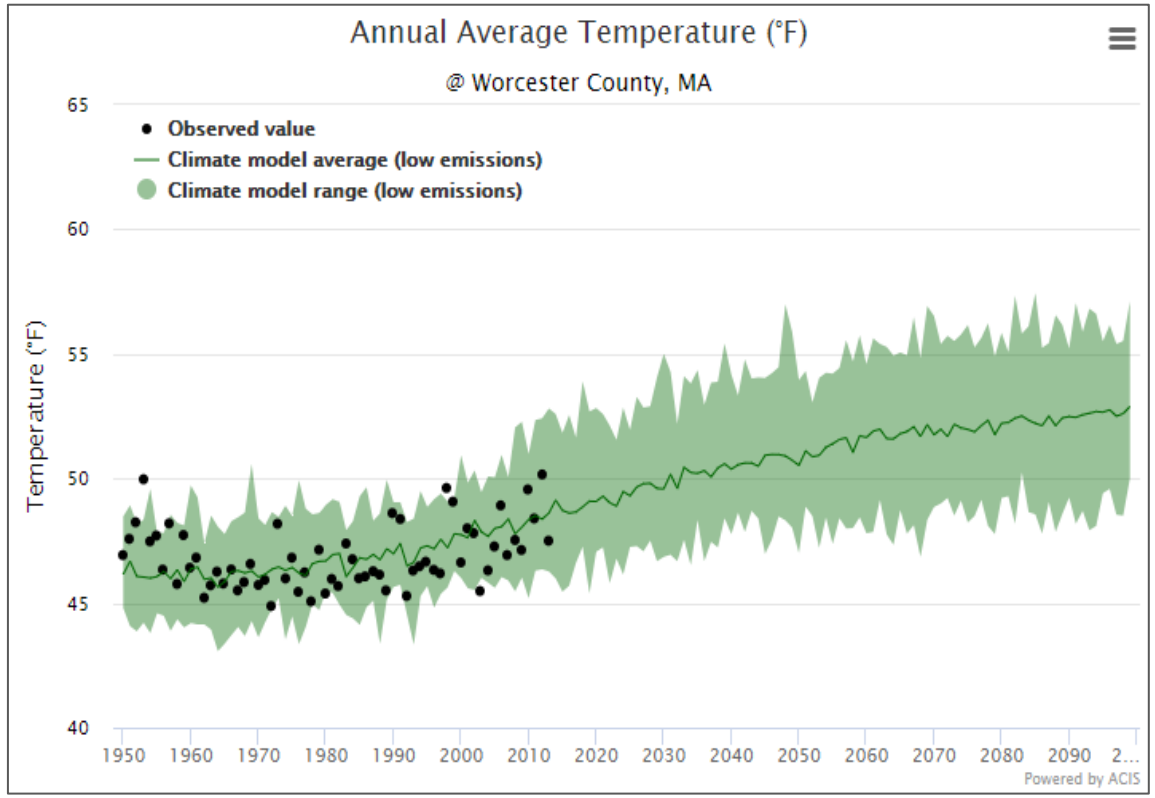
Lunenburg
Climate Projections



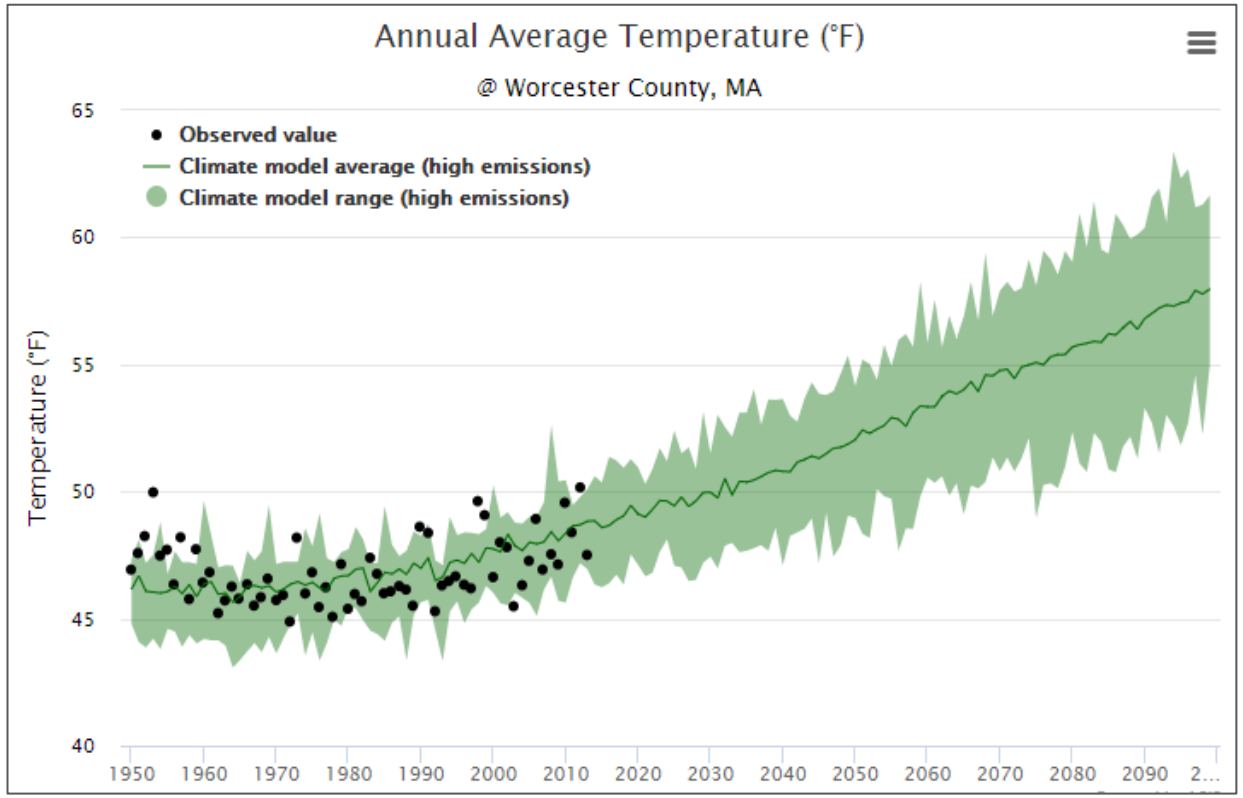
Hotter…average annual temperature steadily increasing

Worcester County Projections

Low Emissions Scenario

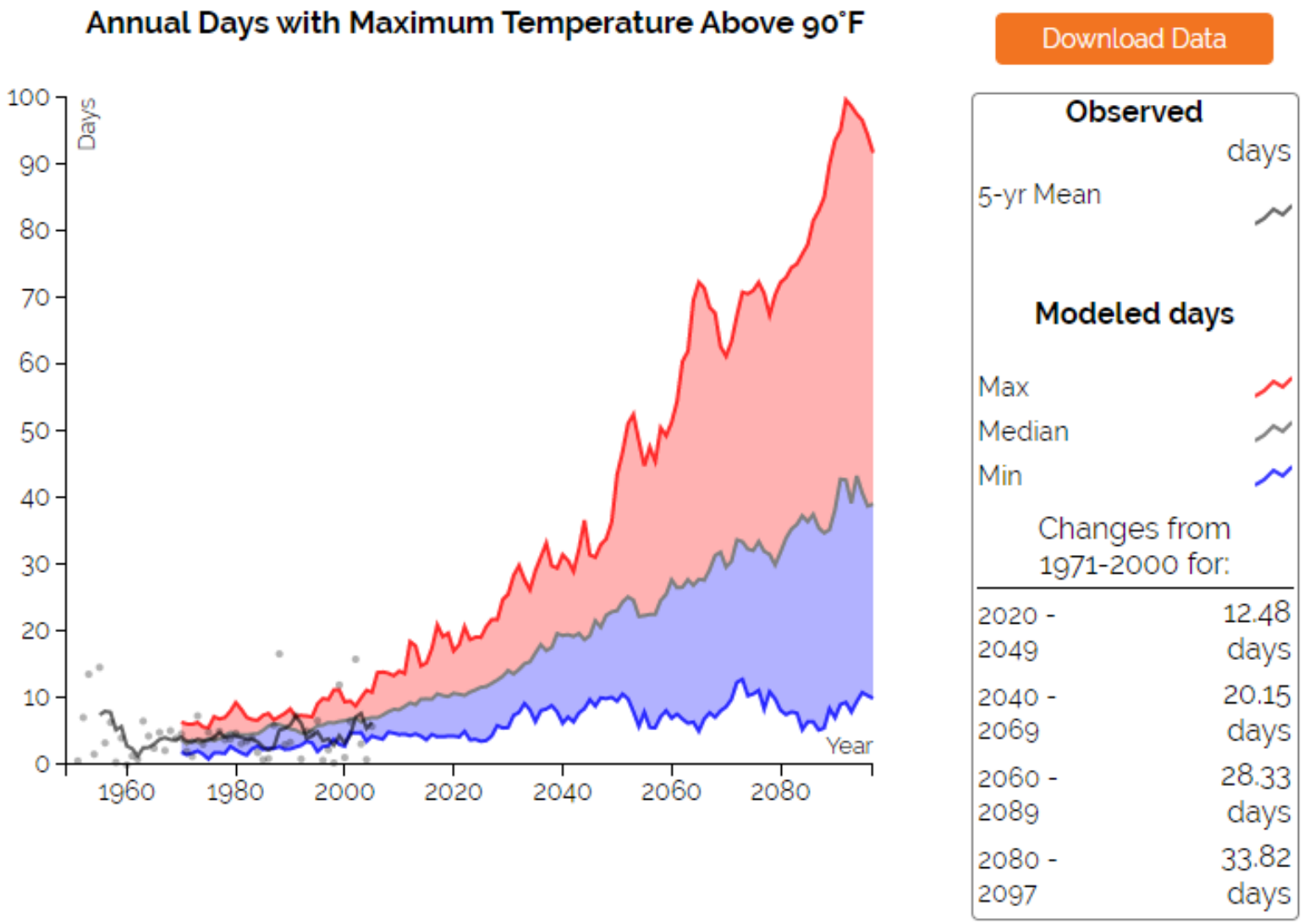


High Emissions Scenario



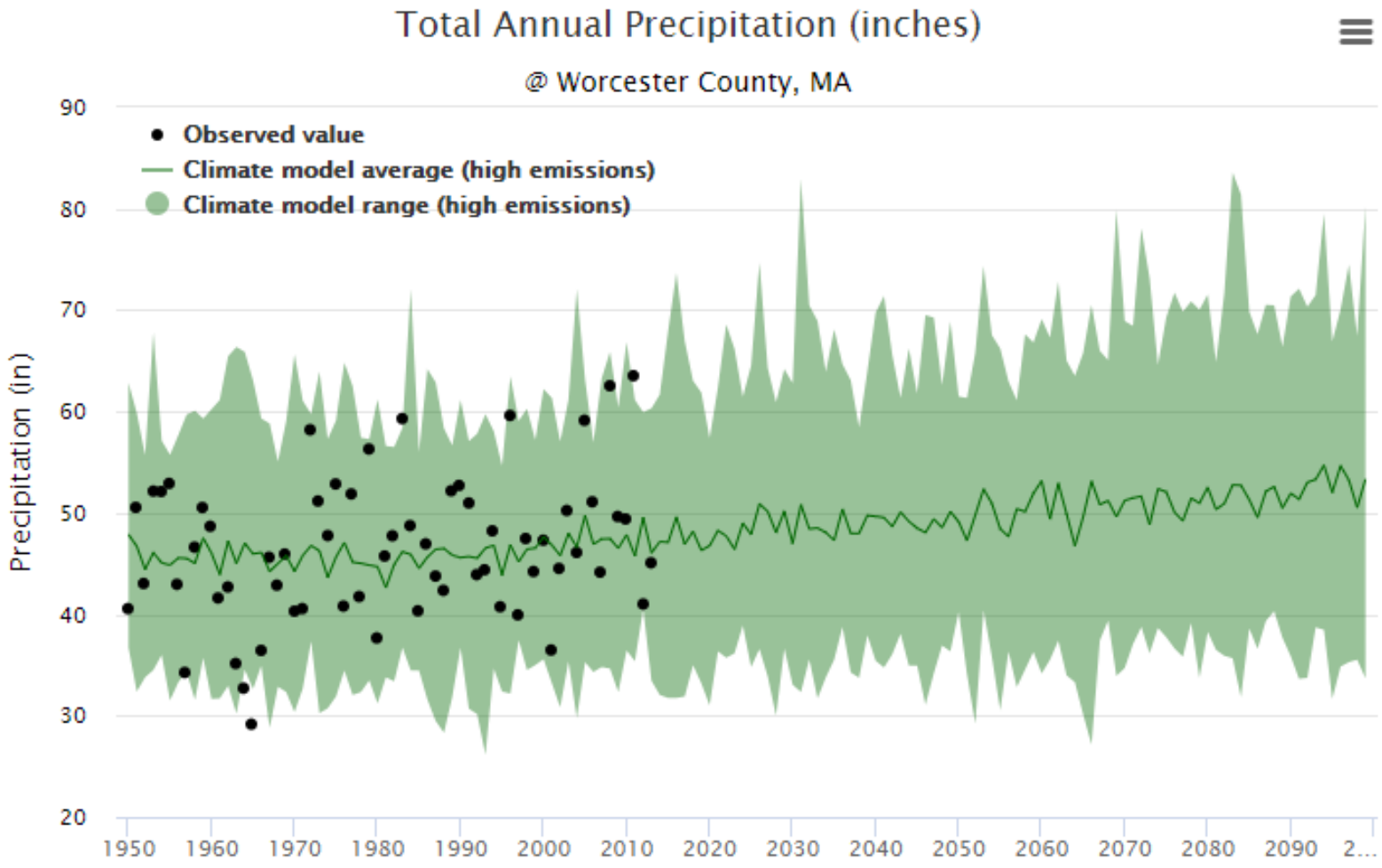
Hotter…by 2040, days per year over 90 F will almost double

TEMPERATURE



Wetter…increasing average annual rainfall

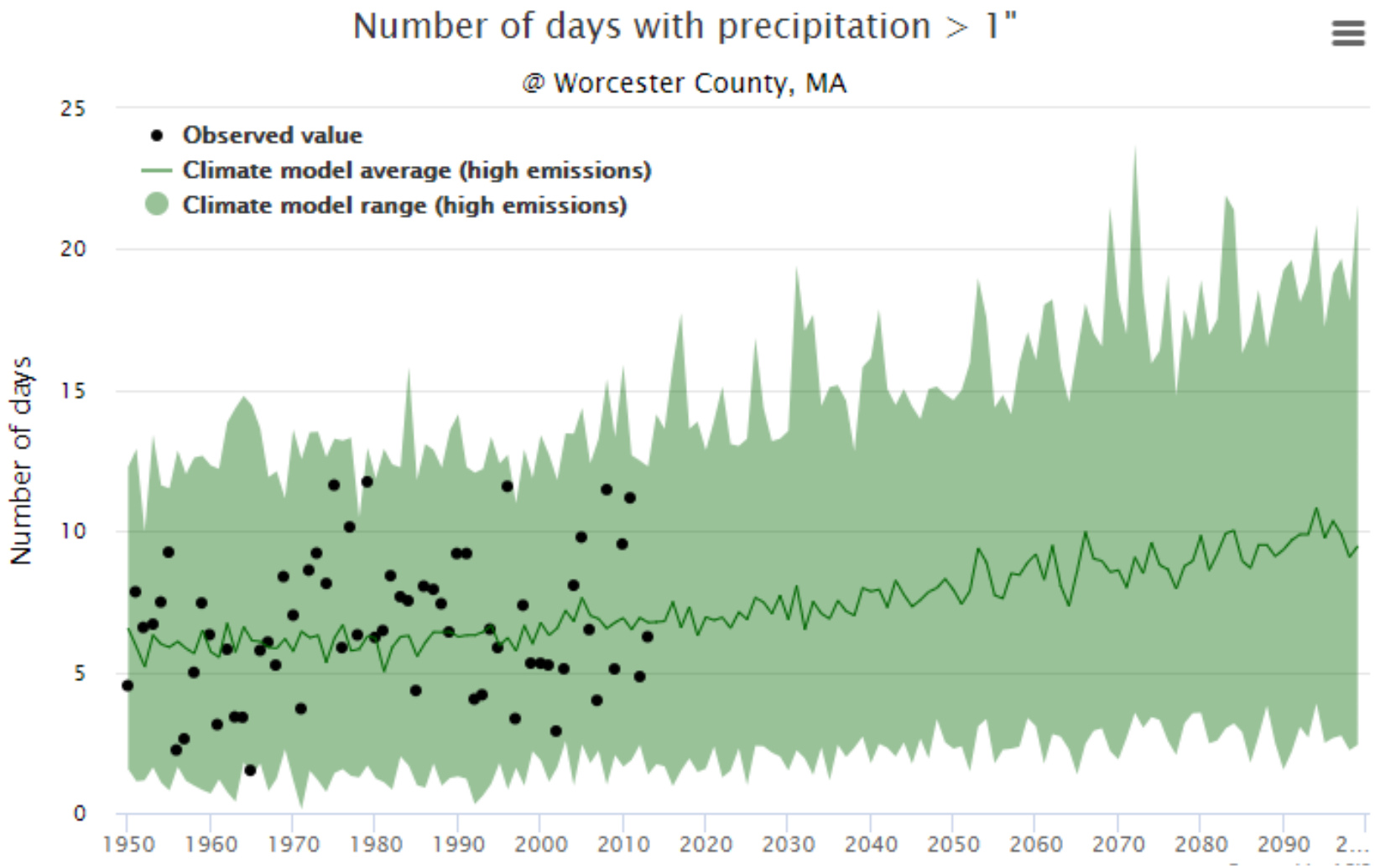
PRECIPITATION



http://climatesmartfarming.org/tools/csf-county-climate-change/

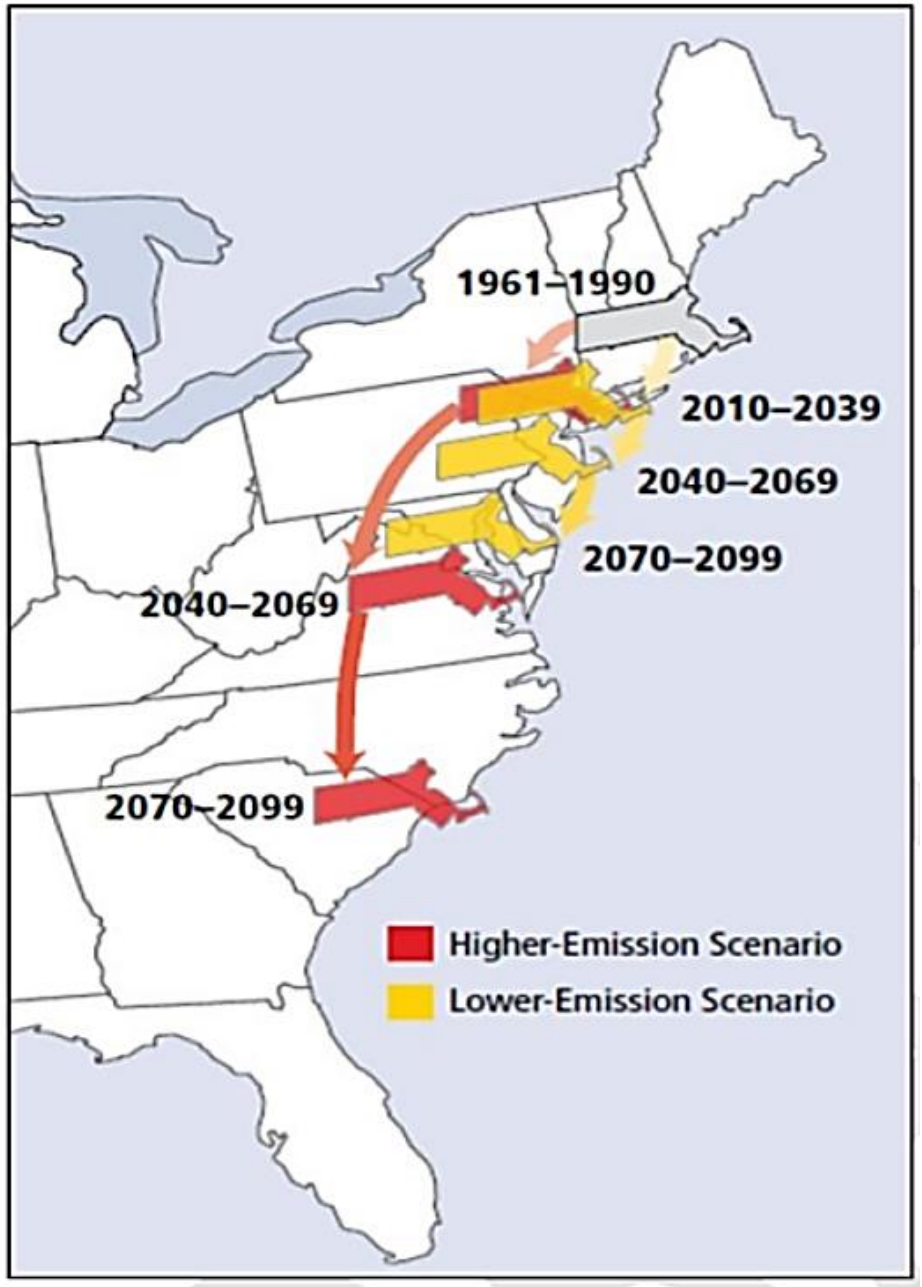
Wetter…more frequent intense precipitation events

PRECIPITATION



What do these Projections Mean?

(relative to temperature)



Source: https://www.yarmouth.ma.us/DocumentCenter/View/11769/MVP-Listening-Session-Presentation?bidId=

Nature Based Green Infrastructure

Vegetated Buffers
(Reforestation, bank restoration, etc.)

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

Land Protection (acquisition, conservation easements, etc.)

Improved Stream Crossings

- Flood flow passage
- Streambank stability
- Wildlife passage

Low Impact Development (LID)

An ecosystem-based approach to land development and stormwater management

Mimic pre-development site hydrology!

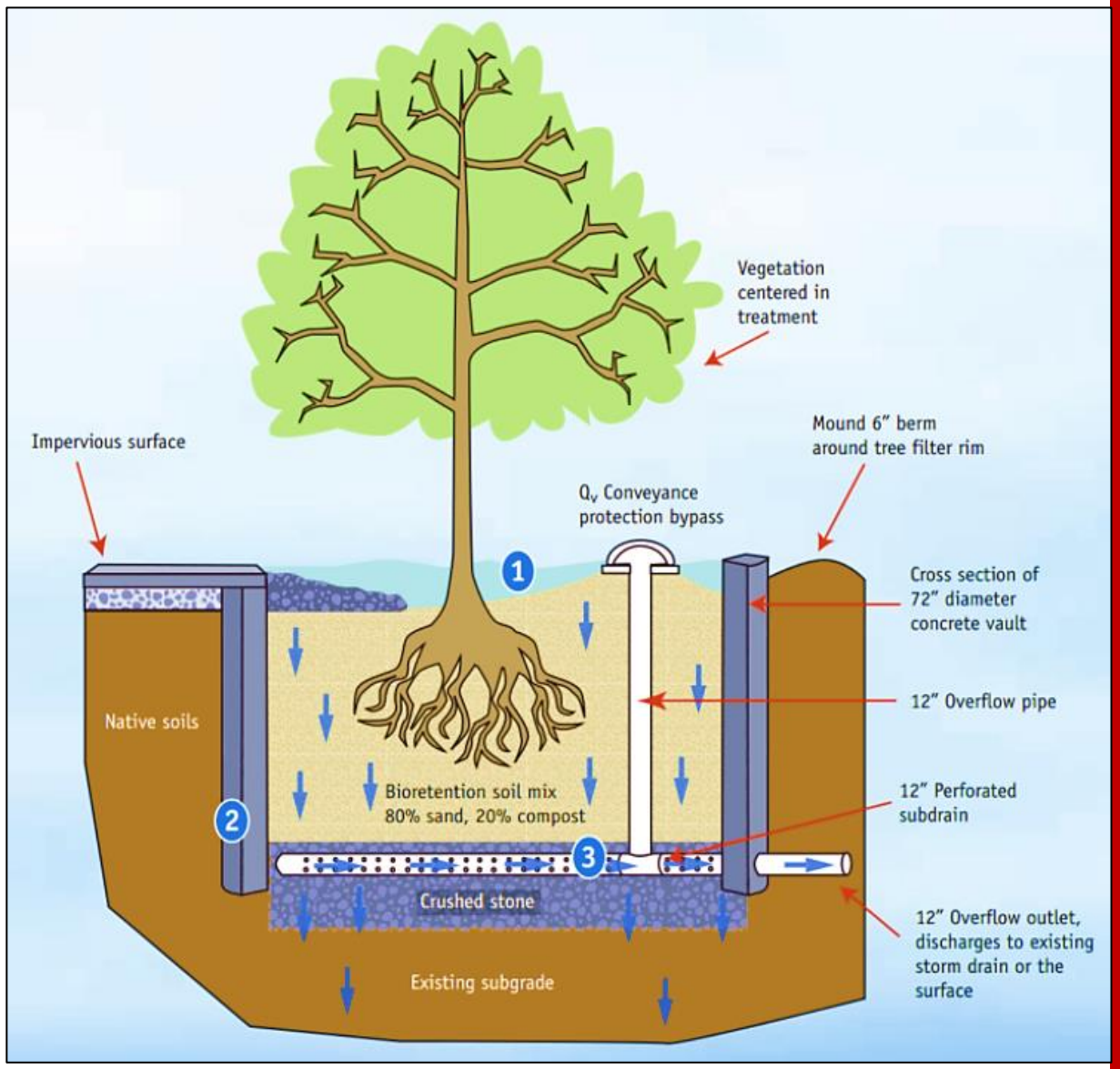
Example
LID Practices

Raingardens / Bioretention Areas

A bowl-shaped garden designed to capture and absorb stormwater.

Lake Shirley Bioretention Cell
Lesson: *Small is beautiful!*

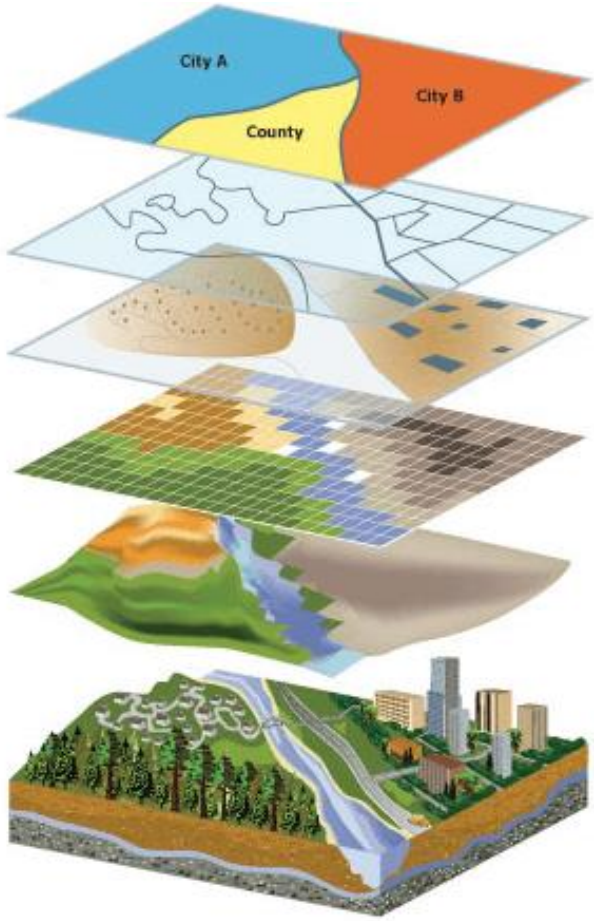
Tree Box Filter (bioretention)



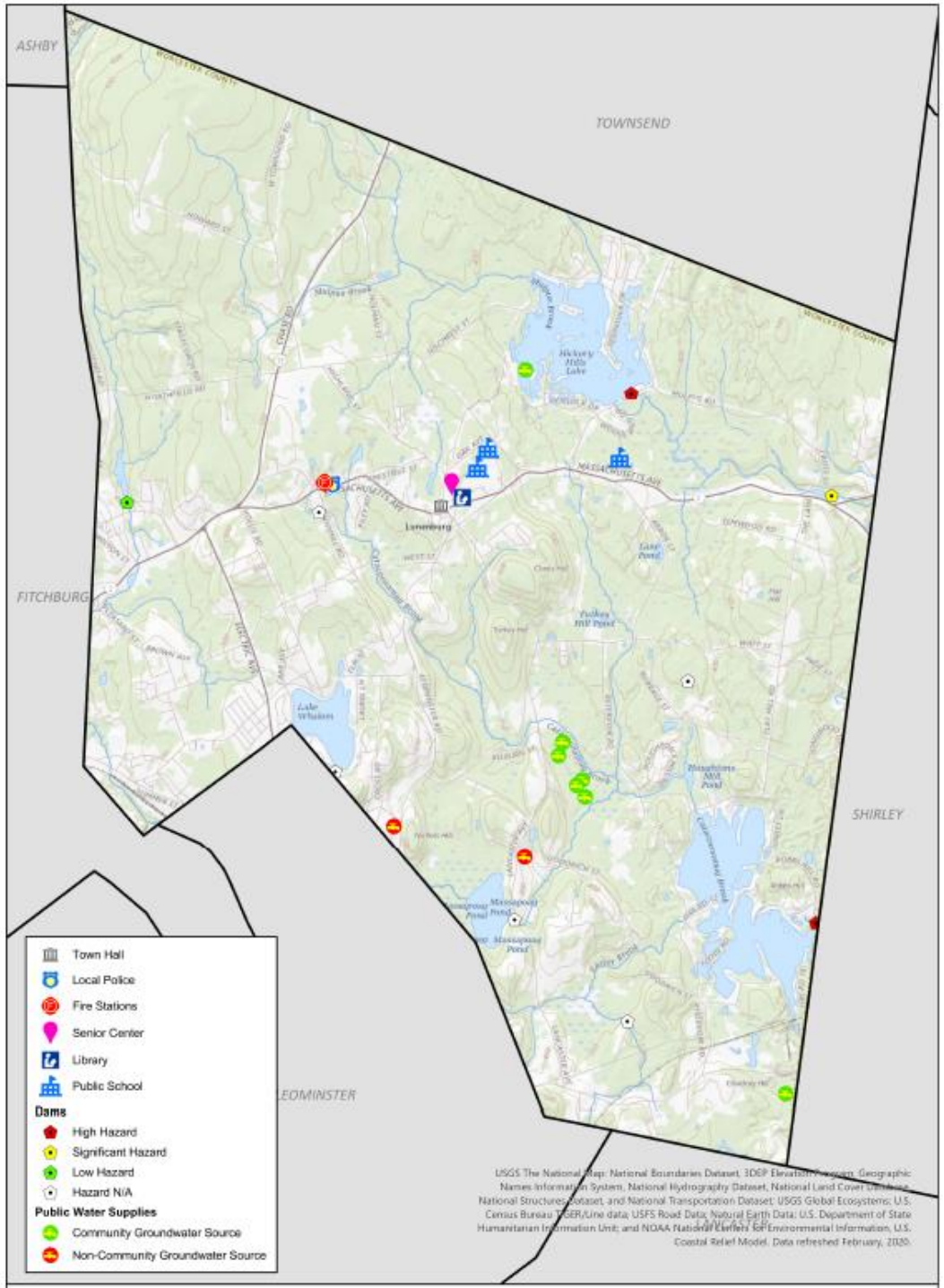
Porous Pavements (Wilmington MA)

- Interlocking Concrete Pavers
- Porous Asphalt / Concrete
- Flexipave

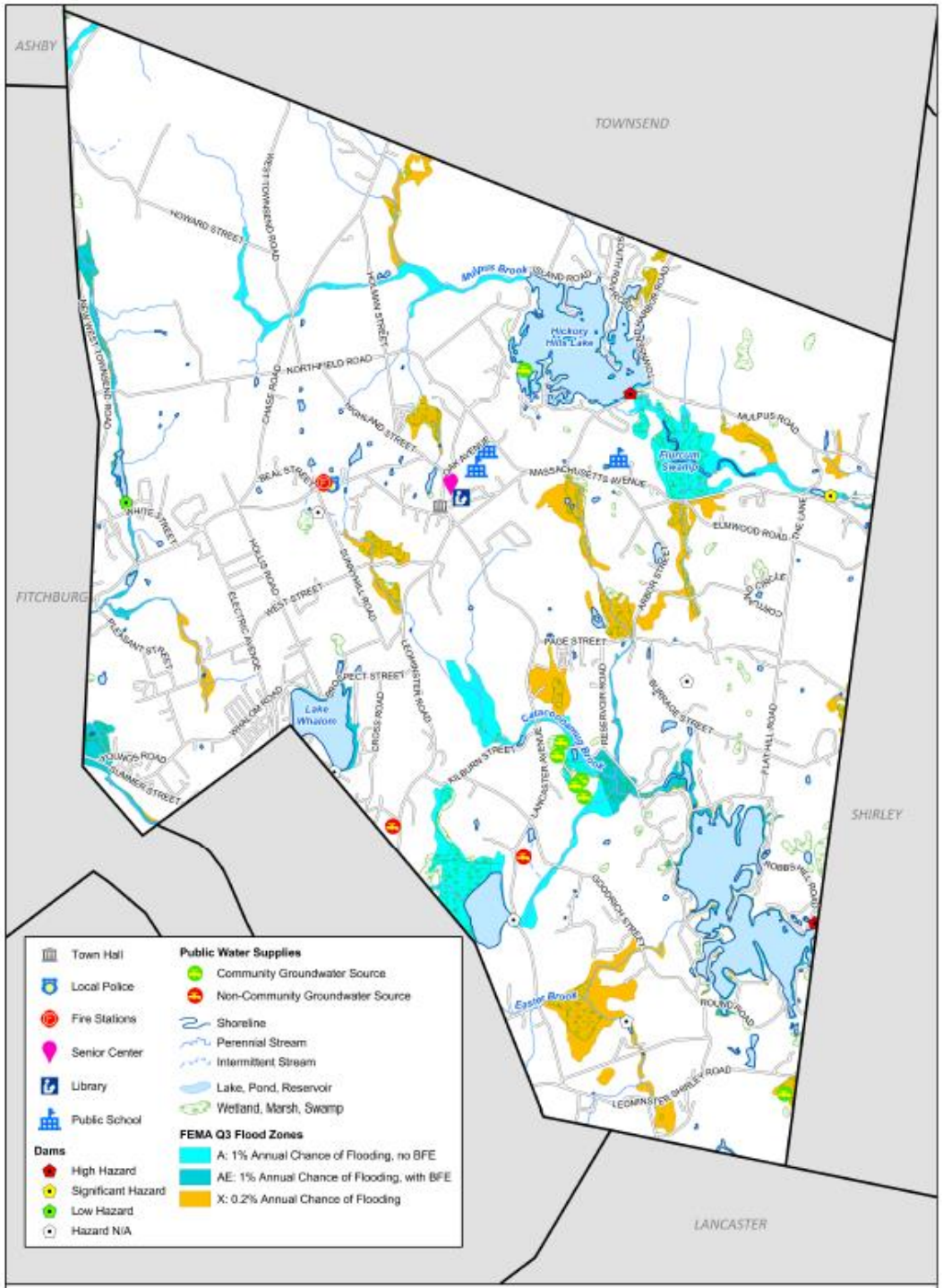
Workshop Map Resources



Basemap


ASHBY
TOWNSEND
FITCHBURG
SHIRLEY
LEOMINSTER
Lunenburg
Town Hall
Local Police
Fire Stations
Senior Center
Library
Public School
Dams
High Hazard
Significant Hazard
Low Hazard
Hazard N/A
Public Water Supplies
Community Groundwater Source
Non-Community Groundwater Source

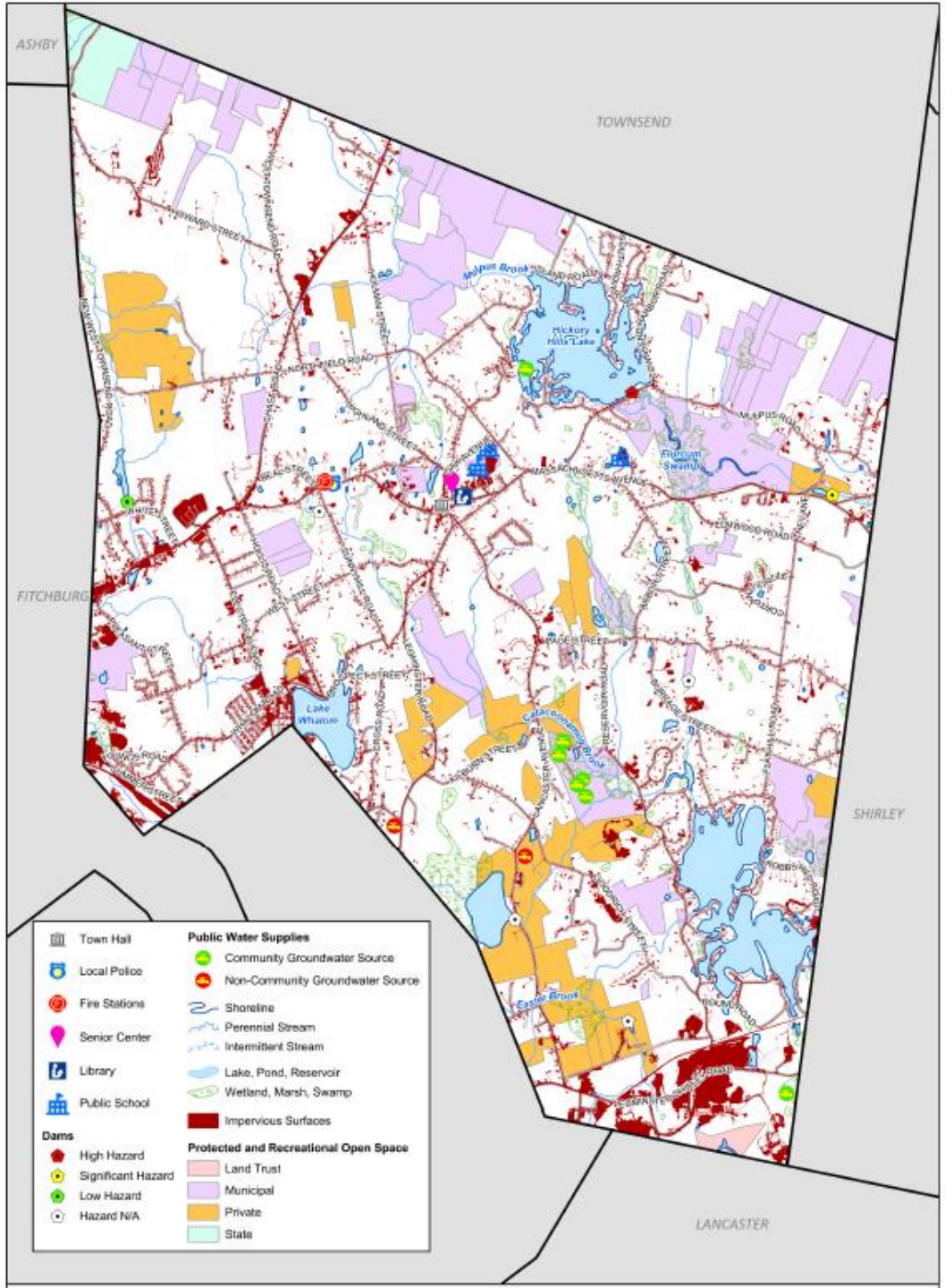
FEMA Flood Zones



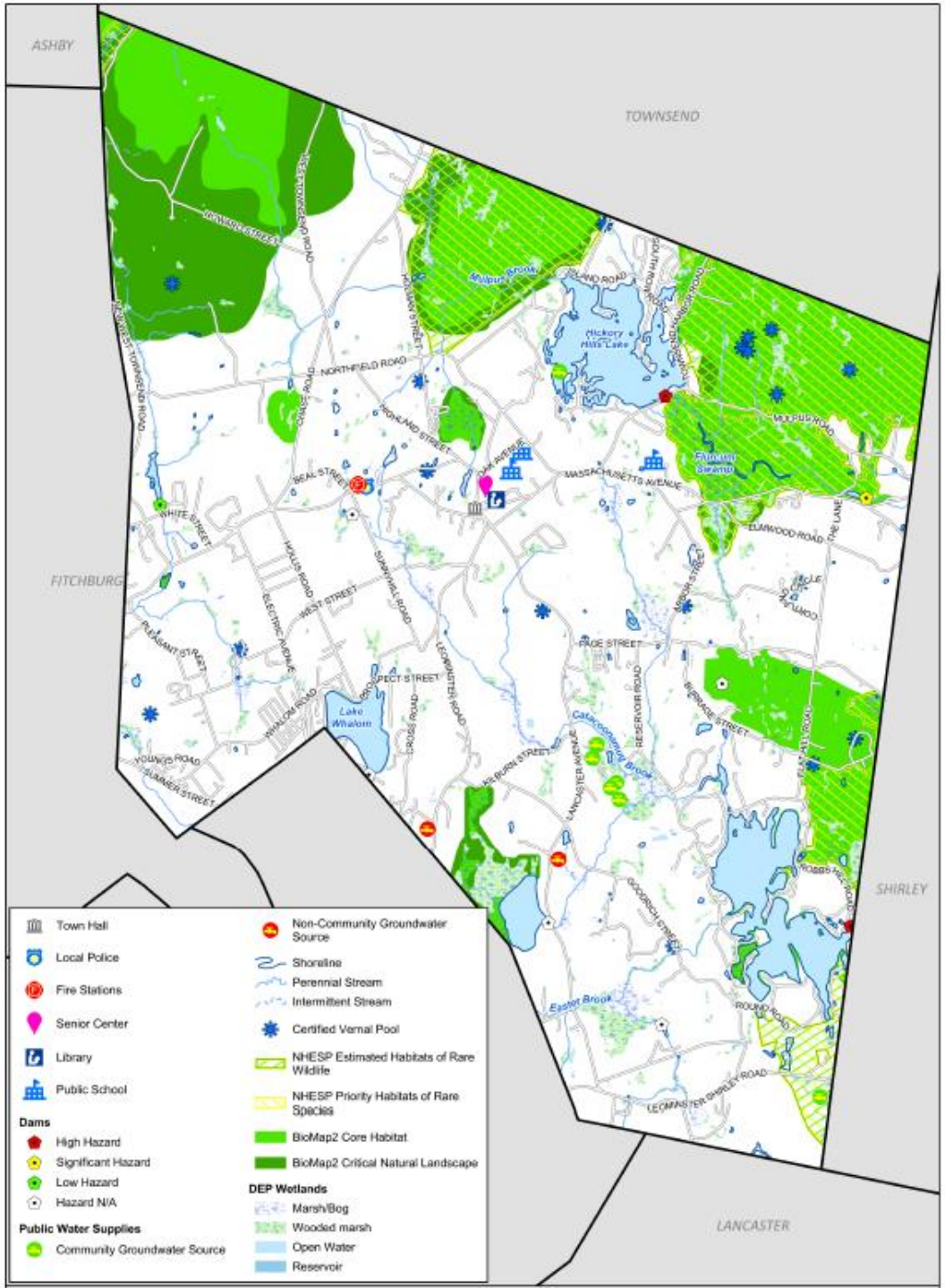
Impervious Surfaces

and

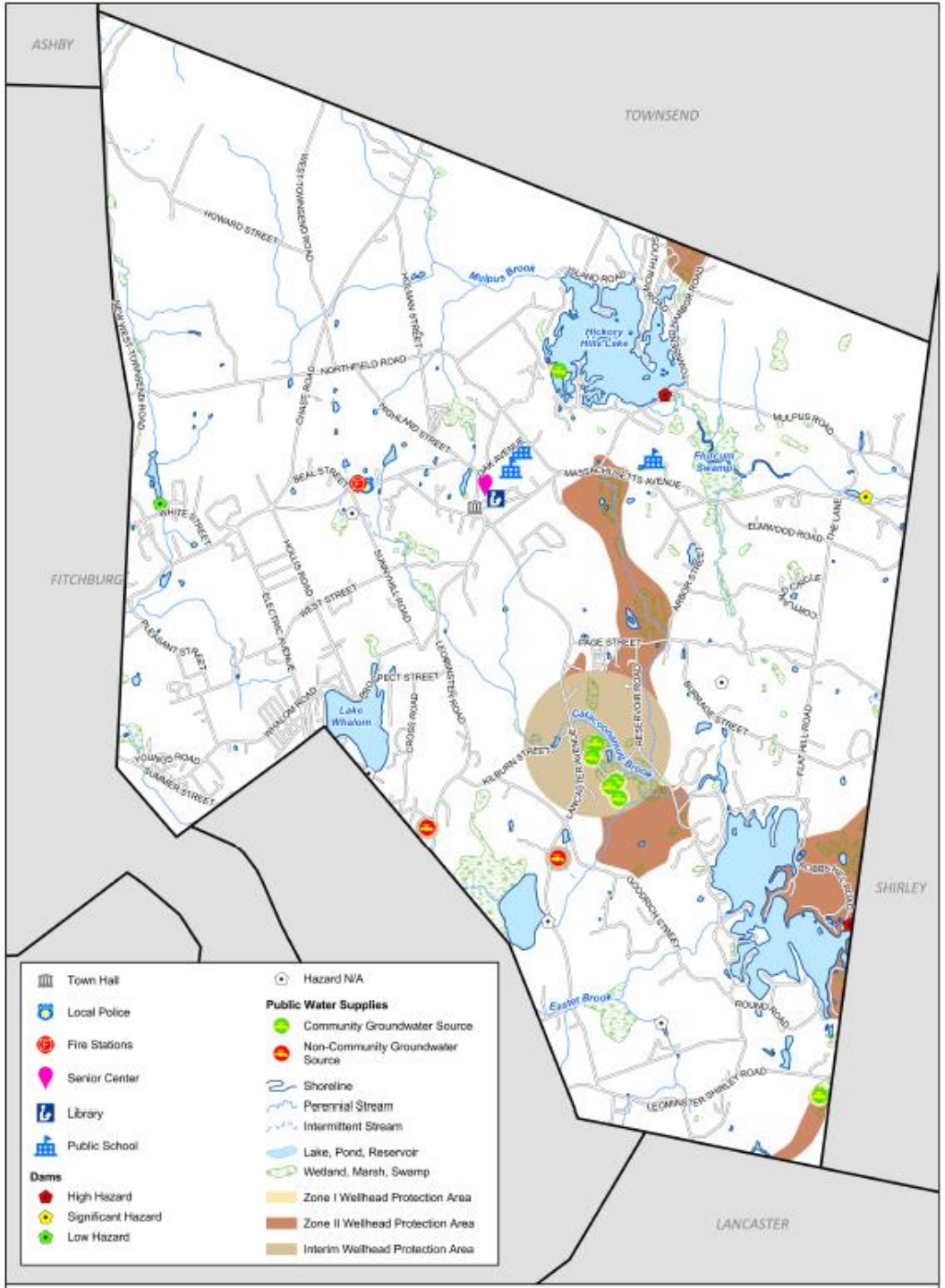
Protected/Recreational Open Space



Wetlands, Critical Habitat, Rare Species



Public Water Supplies



Group Exercises

1: Characterize Hazards

2: Identify Community Vulnerabilities and Strengths

3: Identify and Prioritize Community Actions

4: Determine the Overall Priority Actions

Facilitators:

- Bob Hartzel, CEI
- Emily DiFranco, CEI

Group Exercise #1: Characterize Hazards

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

Hazard:
ultraviolet radiation

- Strong Storms
- Flooding
- Drought
- Sea level rise
- Extreme temps

Vulnerability: exposed skin

- Undersized culverts
- Crop failure
- Low-lying properties
- Vulnerable population health

Actions:

- apply sunscreen
- seek shade

- Upgrade culverts
- Irrigation improvements
- Floodproofing
- Cooling stations

Action Categories:

Hypothetical Example:
Fire Department floods during extreme storm events

Resiliency	Mitigation	Adaptation
• **Improve floodplain function**: ➢ riparian land conservation ➢ green stormwater infrastructure	• **Actions to reduce GHG** ➢ convert to electric municipal vehicles ➢ install solar panels on municipal buildings	• Flood-proof building • Relocate facility outside of 500-yr floodplain

Potential Natural Hazards - Vote on the Top 4!

- Strong Storms
  - Hurricanes
  - Nor'Easters
  - Ice
  - Thunder
- Flooding
  - Inland
  - Storm Surge
- Sea Level Rise
  - Water Table Rise
- Extreme Temperatures
- Drought
- Other Hazards
  - Coastal Erosion
  - Wildfire
  - Tornadoes
  - Geologic

Group Exercise #2:
Identify Community Vulnerabilities and Strengths

Objective: Develop a **profile** of Lunenburg'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

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

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

Community Resilience Building Risk Matrix

Lunenburg, Massachusetts

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				
				Strong Storms	Flooding	Extreme Temperatures / Drought	Priority	Time
Features	Location	Ownership	V or S	Proposed Actions			H - M - L	Short Long Ongoing
INFRASTRUCTURE								
SOCIETAL								
ENVIRONMENTAL								

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 Hazards

Action Categories:

Hypothetical Example:
Fire Department floods during extreme storm events

Resiliency	Mitigation	Adaptation
• **Improve floodplain function**: ➢ riparian land conservation ➢ green stormwater infrastructure	• **Actions to reduce GHG** ➢ convert to electric municipal vehicles ➢ install solar panels on municipal buildings	• **Flood-proof building** • **Relocate facility outside of 500-yr floodplain**

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

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

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

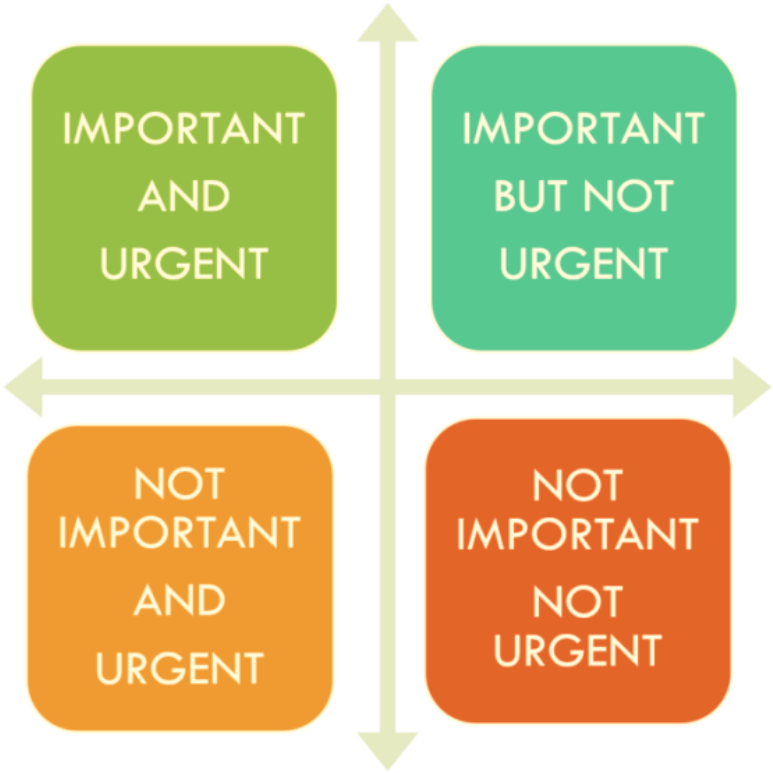
Prioritization Factors

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.



Wrap-Up

Next Steps:

- **Develop Report**
- **Hold Listening Session**
- **Become MVP Community**

Apply for Action Grant Funding!

Thank you for your time!

TOWN OF LUNENBURG
MUNICIPAL VULNERABILITY PREPAREDNESS PROGRAM

Climate Change and Natural Hazard Vulnerability Assessment

WORKSHOP MAP PACKAGE – MARCH 2020

List of Maps:

- Town Base Map 24x36
- Town Base Map 11x17
- FEMA Q3 Flood Zones
- Impervious Surfaces and Open Space
- Wetlands and Critical Habitats
- Public Water Supplies and Wellhead Protection Areas

Map Layer:	Source:
Town Hall	MassGIS
Fire Stations	MassGIS
Police Stations	MassGIS
Library	MassGIS
Senior Center	CEI
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 Habitats 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
Protected and Recreational Open Space	MassGIS

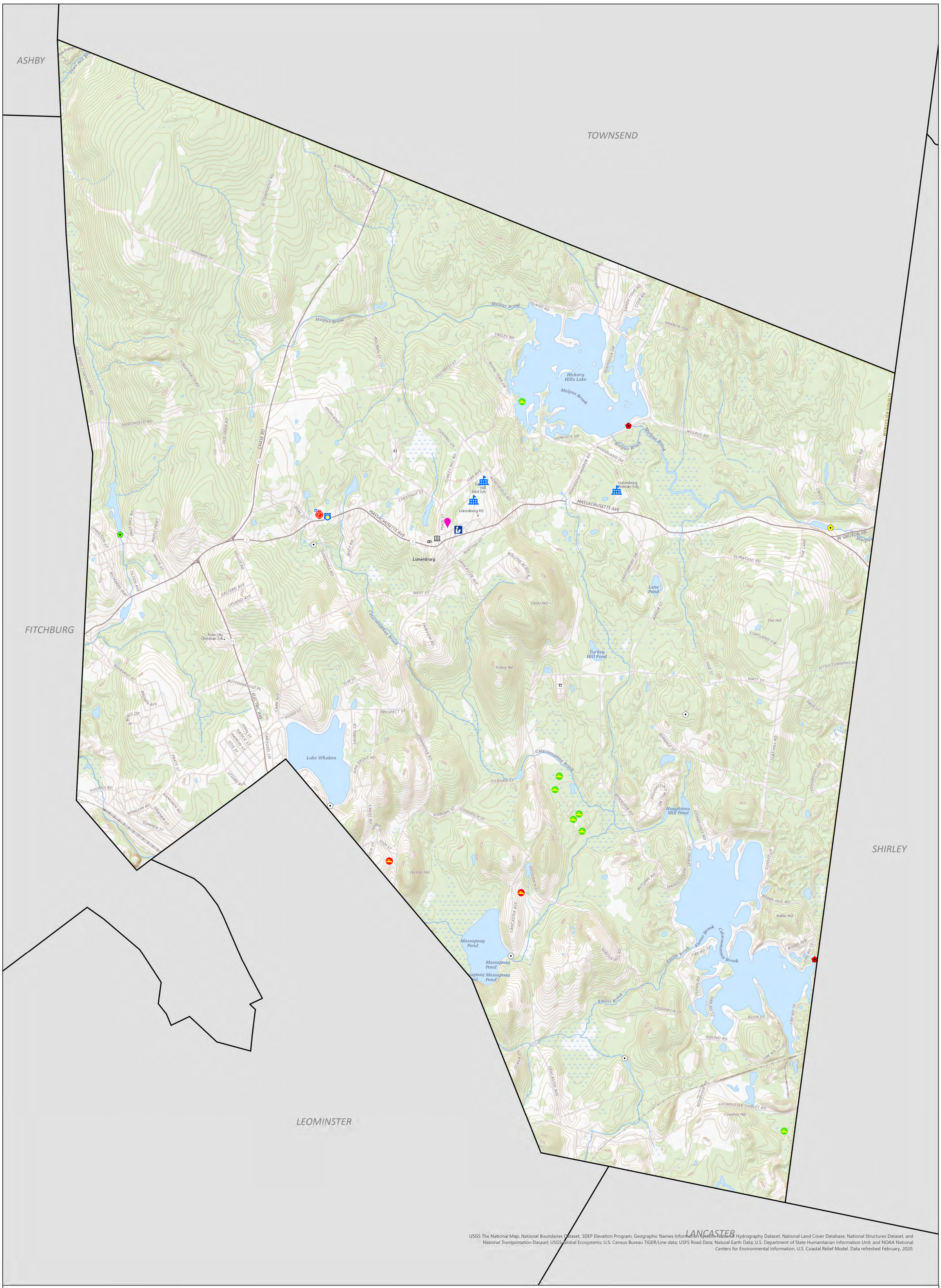


Figure 1
Town Base Map

Municipal Vulnerability Preparedness Program
Lunenburg, MA

Comprehensive Environmental Incorporated

N

0 0.25 0.5 0.75 1
Miles

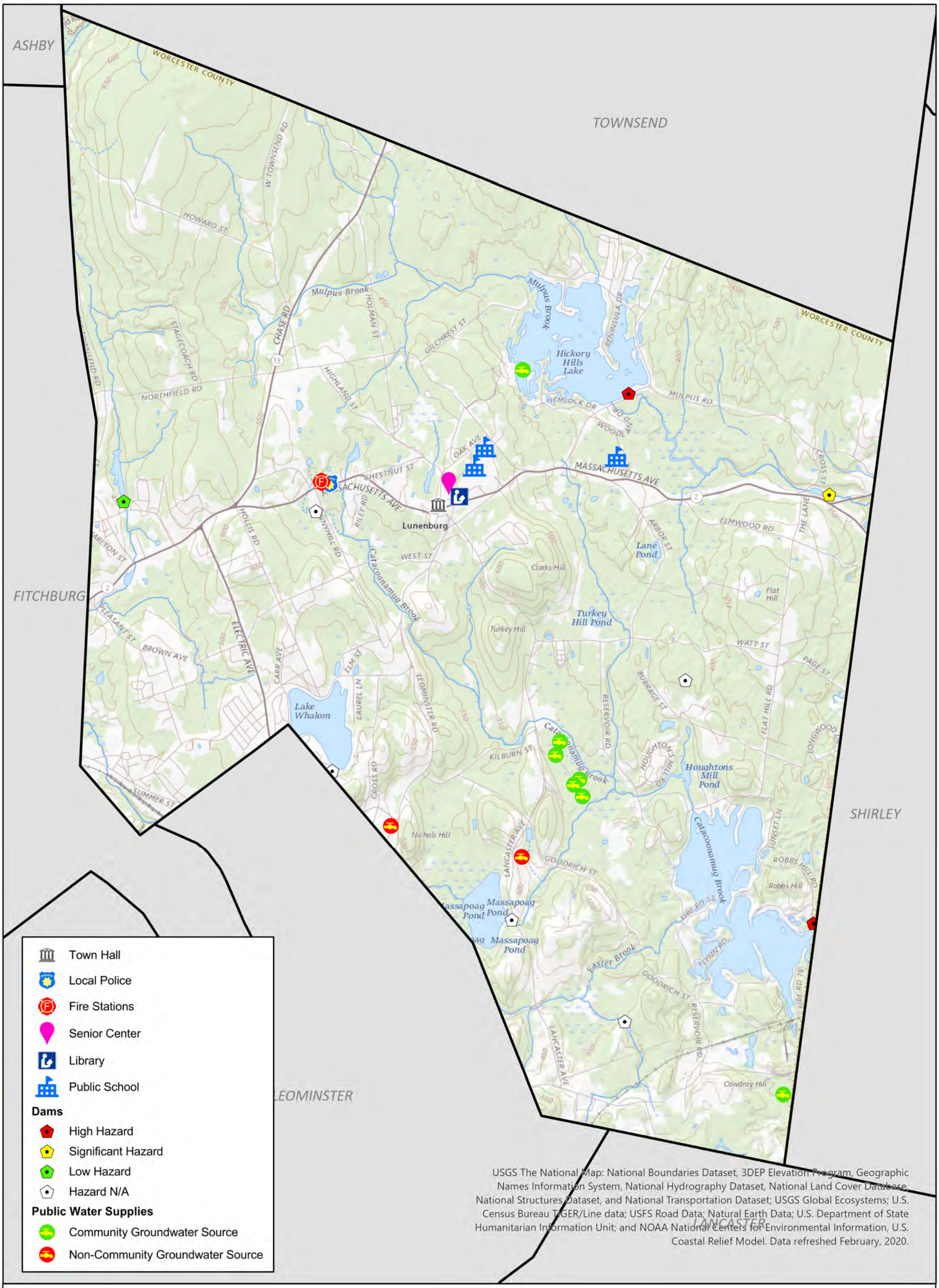
Data Source: MassGIS, CEI

- Town Hall
- Local Police
- Fire Stations
- Library
- Senior Center
- Public School

Dams
- High Hazard
- Significant Hazard
- Low Hazard
- Hazard N/A

Public Water Supplies
- Community Groundwater Source
- Non-Community Groundwater Source

3/6/2020



USGS The National Map: National Boundaries Dataset, 3DEP 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 February, 2020.

Figure 1
Town Base Map

Municipal Vulnerability Preparedness Program
Lunenburg, MA

Comprehensive Environmental Incorporated

Data Source: MassGIS, CEI

N

0 0.5 1
Miles

3/6/2020

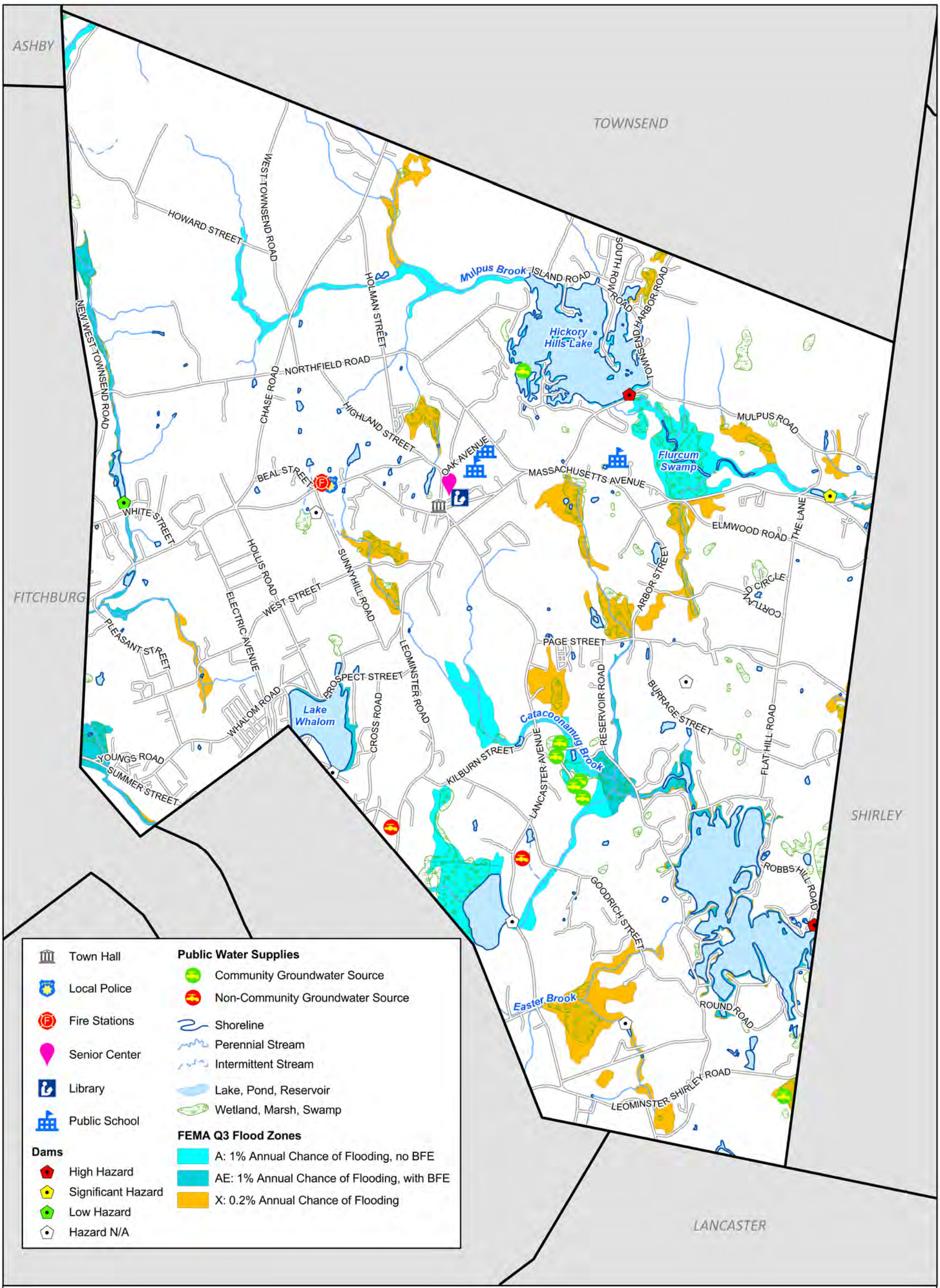


Figure 2
FEMA Q3 Flood Zones

Municipal Vulnerability Preparedness Program
Lunenburg, MA

Comprehensive Environmental Incorporated

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0 0.5 1
Miles

Data Source: MassGIS, CEI

3/6/2020

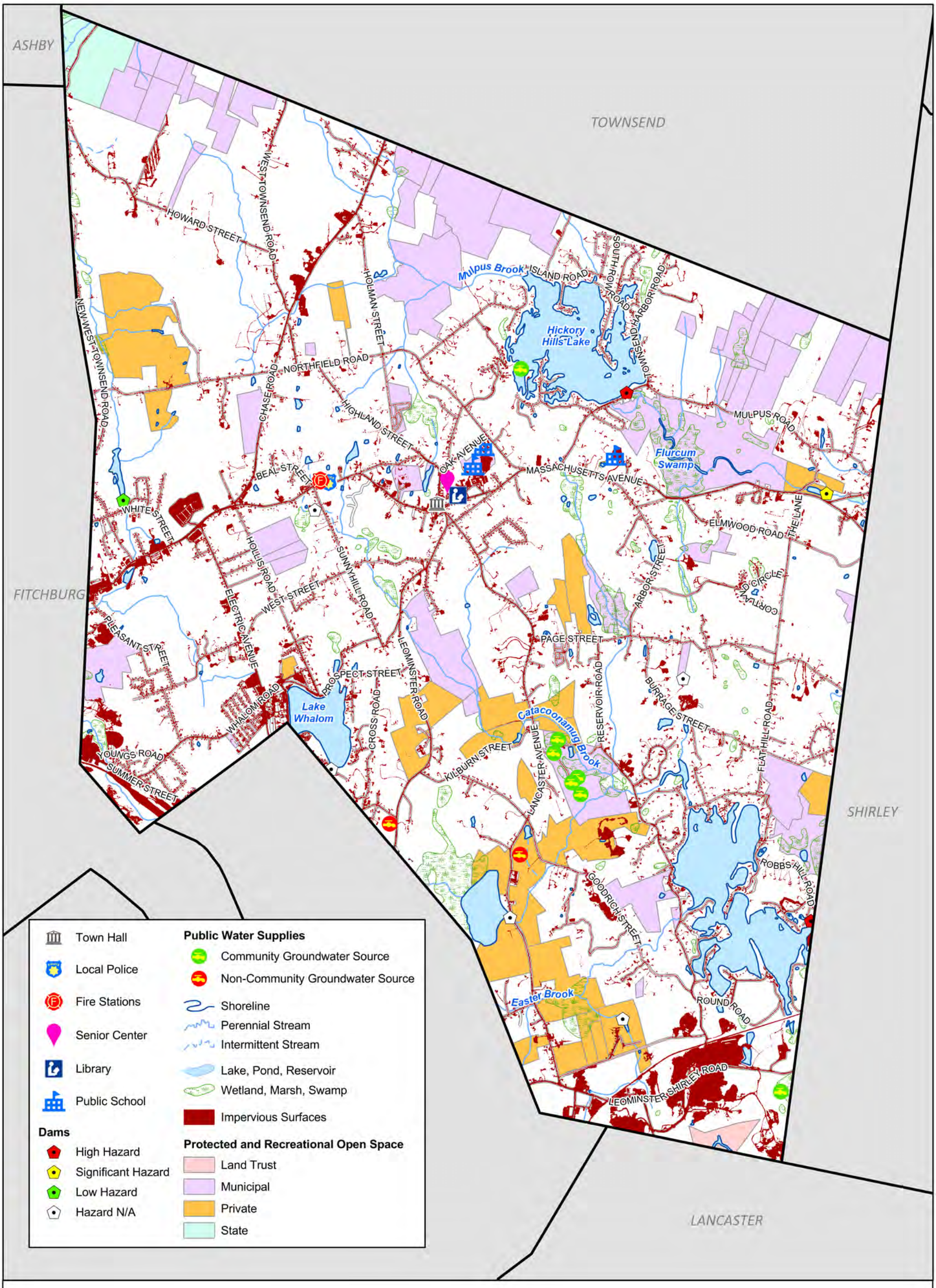

Figure 3
Impervious Surfaces and
Protected and Recreational Open Space

Municipal Vulnerability Preparedness Program
Lunenburg, MA

Comprehensive Environmental Incorporated

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0 0.5 1
Miles

Data Source: MassGIS, CEI

3/6/2020

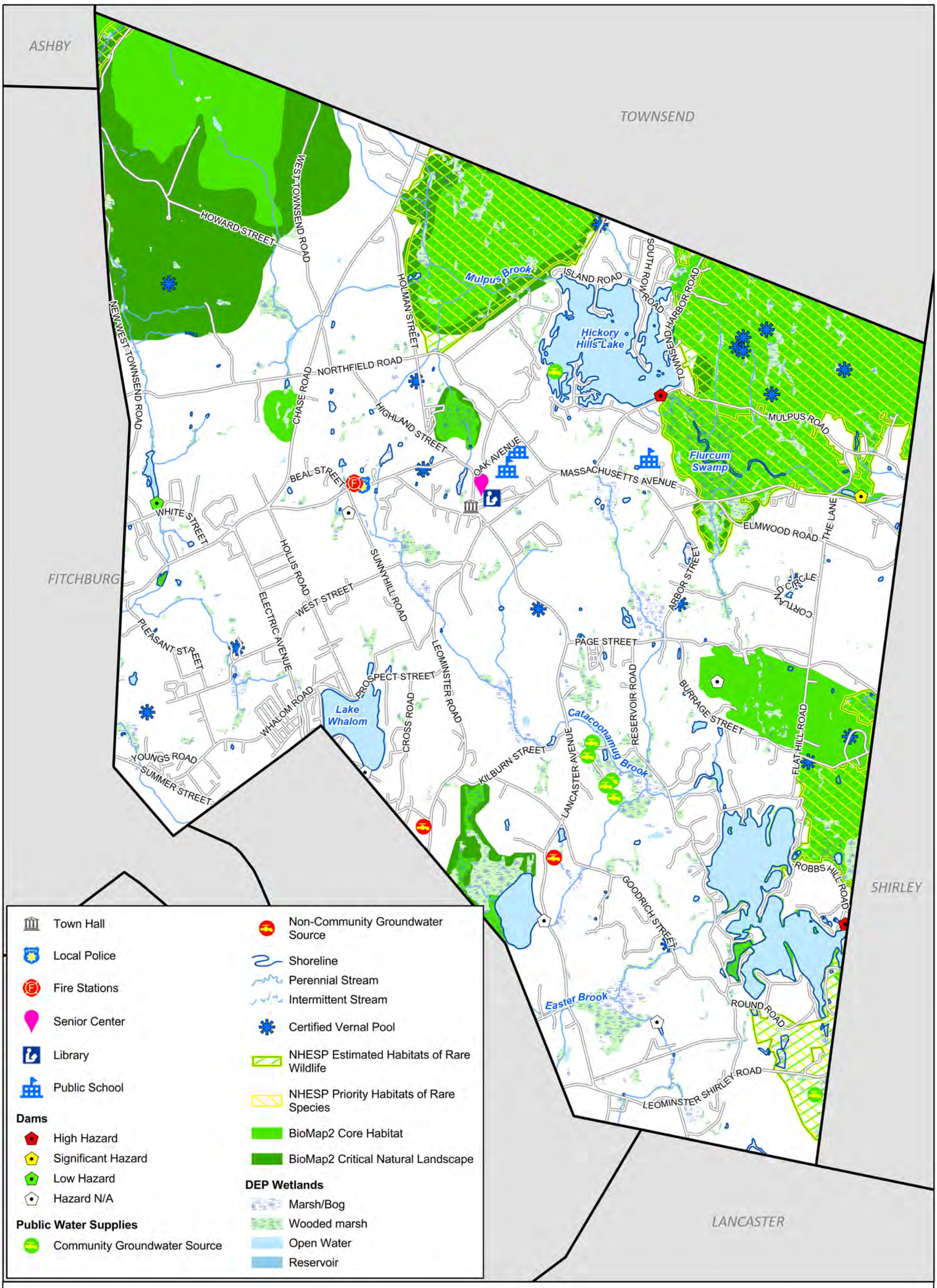

Figure 4
Wetlands, Rare Species, and Critical Habitat Areas

Municipal Vulnerability Preparedness Program
Lunenburg, MA

Comprehensive Environmental Incorporated

Data Source: MassGIS, CEI

3/6/2020

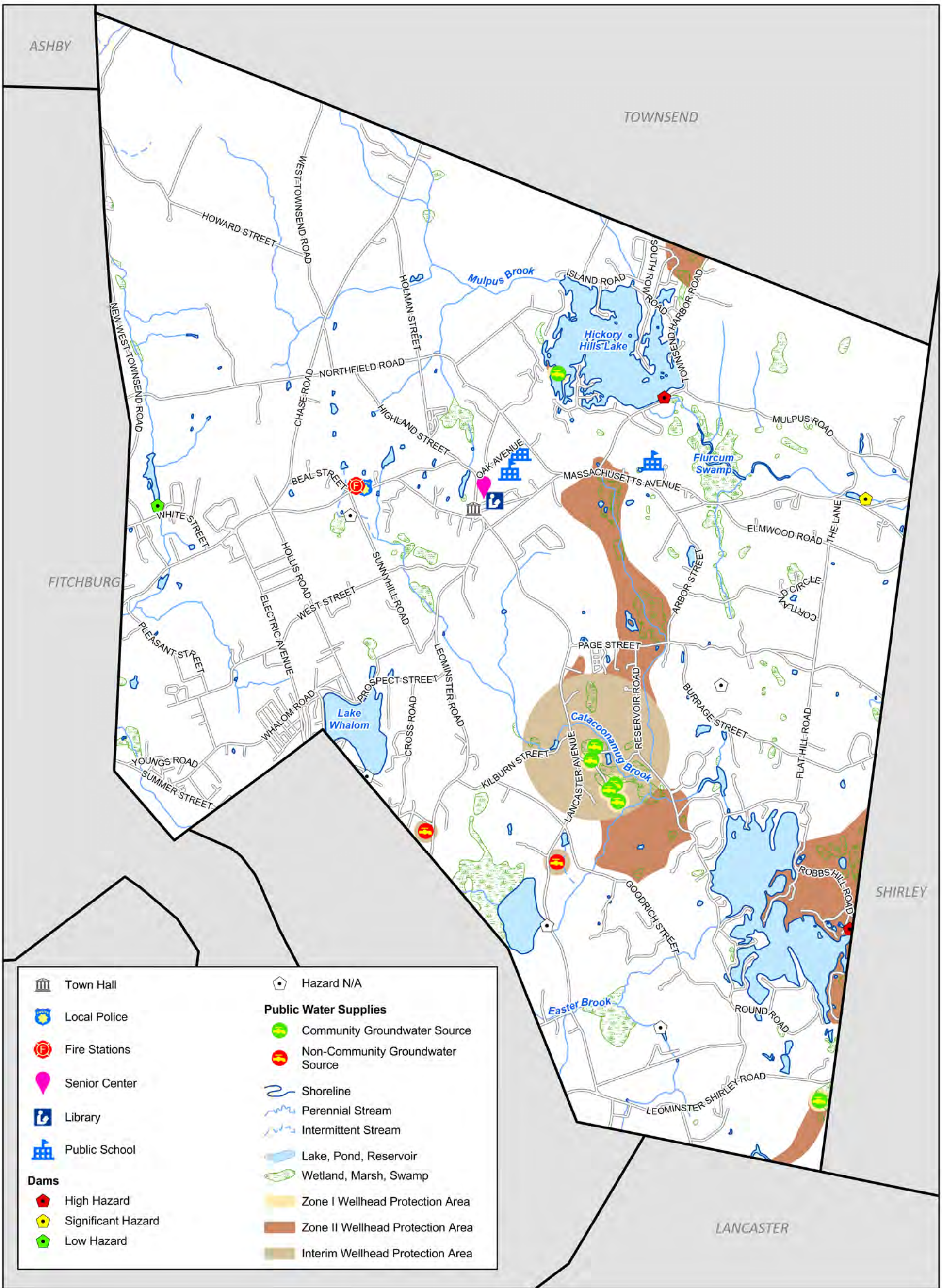

Figure 5
Public Water Supplies and Wellhead Protection Areas

Municipal Vulnerability Preparedness Program
Lunenburg, MA

Comprehensive Environmental Incorporated

Data Source: MassGIS, CEI

N

0 0.5 1
Miles

3/6/2020

APPENDIX B

COMPLETED RISK MATRIX

Community Resilience Building Risk Matrix **Lunenburg, Massachusetts** www.CommunityResilienceBuilding.org

H-M-L priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

Features	Location	Ownership	V or S	Top Priority Hazards: Strong Storms	Flooding	Extreme Temperatures / Drought	Priority (H - M - L)	Time (Short Long Ongoing)
				Proposed Actions				
INFRASTRUCTURE								
Culverts - undersized, damaged, requiring replacement and increased size to safely pass higher predicted flood flows	Town-wide	Town	V	Repair/replace culverts and structures identified as at risk of failure due to high flows from high intensity storms. Priority locations include the Flat Hill Road culvert (at confluence of Catacoonamug Brook/Lake Shirley), a culvert on Lancaster Road (the Flats), and others as listed in the Town of Lunenburg Small Bridge Program - Eligibility Assessment (February 2020).			H	S
Roadway flooding due to low-points in road or proximity to surface waters	Rt. 13/Electric Avenue	Town	V	Evaluate options for providing stormwater treatment and reducing adjacent upland impervious cover to prevent road flooding. Raising road (2-2.5 ft) may not feasible due to grades of adjacent properties.			M	O
Riverine flooding mostly limited to forested areas	Catacoonamug Brook; Mulpus Brook	Town	S	Continue to acquire and protect key lands, such as recent conservation restriction on nearby 40-ac parcel. A co-benefit of flood resiliency is protection of the Mulpus Brook cold water fishery. Continue to follow procedures outlined in the Open Space Plan for protecting lands. Most of these lands are protected or have significant regulatory barriers to development (e.g., wetlands). Town is currently working to protect 300 acres of land in vicinity of Mulpus Brook.			H	O
Electrical power supply lines - potential for power outages from strong storms (downed trees and limbs)	Town-wide	Unitil	S	Unitil has had an aggressive tree trimming program in recent years, in response to major outages from an ice storm in 2008.				
	Unitil substation at 934 Massachusetts Avenue (Rear); Leominster Road/Lancaster Ave.	Unitil	V	To improve resiliency of the Town's electrical power supply to strong storms, conduct a town-funded tree survey by a certified arborist to develop a tree/limb removal prioritization plan. This survey should focus on the Lancaster Road/Leominster Road area serviced by the Unitil substation at 934 Massachusetts Avenue (Rear). Continue to discuss adaptive management for this issue with Unitil, including options for improved brackets, additional re-closures, etc.			H	O
Ice build up on low points in road during shoulder season and times of high water table	Leominster Road, several others	Town	V	Assess magnitude of the problem throughout town to identify and prioritize problem areas. Determine fixes such as reviewing bylaws for update/changes or requiring homeowners to redirect sump pump flow onto property. Assess funding options for stormwater retention, infiltration, and drainage structures (e.g., French drains) on private properties.			M	L
Bridges requiring repair associated with flooding and/or damage from high peak flows during/following strong storms	Townsend Harbor Dam Bridge	Town	V	Repair Townsend Harbor Dam Bridge, documented as a hazard by MassDOT. Estimated cost $60-70K.			M	L
	Youngs Road Bridge	Town	V	Conduct a detailed engineering assessment to assess repairs needed on Youngs Road Bridge.			M	L
Septic systems in areas with high water table	Town-wide	Private	V	Conduct a town-wide assessment to (1) determine areas of greatest risk to private wells and potential contamination of surface waters, and (2) identify potential wastewater treatment options to improve flood resiliency. Town has a town-wide wastewater management plan that identifies areas of town that may be viable to connect to municipal sewer.			L	L
Critical facilities with only one egress - risk to emergency services if flooded or blocked by felled tree during a storm	Public Safety Building	Town	V	Develop a second route of egress to the Public Safety Building (to allow for uninterrupted emergency services if the primary access becomes blocked), either through purchase of the adjacent parcel or development of an access easement.			H	S
	DPW Facility (520 Chase Road)	Town	V	The DPW Facility at 520 Chase Road provides critical emergency services, including fueling for all town vehicles. This facility has a failed culvert at the entrance, with design for replacement currently underway. Assess options and feasibility for second egress, which would require a crossing of Mulpus Brook.			H	S
Sewer pump stations in low areas at increased flood risk	multiple locations	Town	V	Assess, design, and implement improvements to mitigate flooding at sewer pump stations. High priority sites include the Dana Street Pump Station (Route 13 swamp) and West Street (in swamp).			M	O
SOCIETAL								
Lack of air conditioning in key facilities for vulnerable populations	Elementary School and Primary School	Town	V	Install auxiliary generator.		Install central air conditioning	M	L
	Pearl Brook Apartments (elder housing)	Town	V	Install central air conditioning and an auxiliary generator at the Pearl Brook Apartments (elder housing).			H	S
Elder housing facility to be built near flood-prone area; limited emergency access if Summer Street is flooded	Baker Brook Apartments (Tri-Town complex elder housing)	Private	V	Conduct a study to determine potential location for a second egress to the Baker Brook Apartments for emergency access through land purchase, easement, etc.			M	L
Elder housing facility with one egress.	Elder Housing Facility (White St.)	State	V	Conduct a study to determine potential location for a second egress to the elder housing facility on White Street for emergency access.			M	L
Lack of generator at Senior Center	Senior Center	Town	V			Install generator at the Senior Center to allow building to serve as a warming/cooling station for seniors.	H	S
Assess Senior Center for shelter	Senior Center	Town	V	Assess potential to use this building to provide overnight capacity for emergency sheltering.			L	L
Emergency services access to lake communities	Town-wide		V	Conduct a town-wide assessment of barriers to accessibility for lake communities, particularly around Lake Shirley and Hickory Hills Lake.			L	L
	Hickory Hills Lake (Townsend Harbor Road; Hemlock Road)		V	Evaluate previously used access road from Town Forest to Townsend Harbor Road to determine feasibility of using it as an emergency access roadway. Also evaluate potential for second access to Hemlock Drive via Woodland development off of Northfield Road.				
Emergency services access to trailer park communities	2 properties on Massachusetts Avenue (1790, 1990)		V	Conduct a study to determine potential location for a second egress to the trailer park communities on Mass Avenue for emergency access.			L	L
ENVIRONMENTAL								
Lakes: Increased phosphorus loads to TMDL waters associated with increased precipitation; Higher temps. and longer warm season increases frequency of nuisance algal blooms and abundance of nuisance vegetation.	Lake Shirley (TMDL); Hickory Hills Lake	Private	V	Continue to address watershed management to reduce phosphorus loading to these lakes and in lake actions to reduce algal blooms and invasive species.			M	O
New Lunenburg Open Space Plan identifies priority parcels for conservation	Town-wide	Private	S	To improve nature-based resiliency to climate change, continue to protect key lands through fee acquisition, conservation restrictions, and other real estate tools. Work towards adding climate resiliency to Town list of criteria for open space and land acquisition.			H	O
Increased drought, temperature fluctuations, and flood risk to agricultural lands	Town-wide	Private	V	Assess additional funding and support options for preparing a climate resiliency action plan with a focus on over 1000 acres of agricultural lands in Lunenburg, which include orchards, dairy farming, and crop farming.			M	O
Excessive wind fetch causing drifting on roads.	multiple locations	Town	V	Evaluate specific areas in town (Fish St. and Leominster Rd.; Sunnyhill Rd. and Elm St; Townsend Harbor Rd. at Hickory Hills Lake Dam; the Flats on Lancaster Ave.) where wind fetch is a risk to traffic. Evaluate potential solutions, including planting tree wind buffers or snow fencing to mitigate impacts.			L	O
Cold-water fisheries	Town-wide	Town	V	Evaluate cold-water fisheries to determine potential impacts from climate change.			M	O
Protected lands at risk to wildfires	Town-wide	Town	V			Develop forestry/cutting plans for all Town conservation lands that currently lack one, to reduce fire risk, improve forest health, and improve wildlife habitat.	M	O

APPENDIX C

LISTENING SESSION RESULTS