Lancaster, Massachusetts

MVP Community Resilience Program

Resilience Building Report

February 2020

SUMMARY OF FINDINGS - DRAFT

BETA

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MVP Community Resilience Program
Lancaster, Massachusetts
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Prepared by: BETA GROUP, INC.
Prepared for: Town of Lancaster, MA

February 2020

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1.0 OVERVIEW

The Town of Lancaster is located in Northern Worcester County in the Nashua River Watershed. Lancaster is a mostly rural town with population less than 9,000 as of the 2010 census and large areas of wetlands and forests. There are several water bodies, including the Nashua and North Nashua Rivers that run through town.

Over the past several years there have been an increasing number of impacts due to climate change that have affected the Town of Lancaster. Extreme flooding in 2010 flooded homes and closed roads; there was so much water that some residents were seen kayaking down Bolton Rd. Storm events in 2016 led to issues with flooding and downed trees and wires throughout Town. In more recent years the town has experienced a variety of environmental hazards from winter storms, as well as increasing rain and flooding, especially from the Nashua River. To begin to address these climate related concerns, the Town was awarded a $20,000 grant from the Massachusetts Executive Office of Energy and Environmental Affairs to conduct Community Resilience Building (CRB) workshops as part of the State's Municipal Vulnerability Preparedness Program (MVP).

The MVP Program is a state program designed to provide support for cities and towns in Massachusetts to begin the process of planning for climate change resiliency and implementing priority projects. Involving the municipalities of Massachusetts to address natural hazards being amplified by climate change allows more targeted solutions to these problems. This program is designed to encourage discussion in order to help municipalities identify the vulnerabilities, strengths, and opportunities to take action to reduce risk and build resilience in their communities. Conducting the CRB workshops allows Lancaster to achieve "MVP" designation from the Commonwealth which provides the Town access to funding for action grants.

This report documents the results of the CRB workshop, following the program's framework, for the Town of Lancaster.

1.1 COMMUNITY RESILIENCE BUILDING WORKSHOP

The CRB framework is a system of discussions and note taking in a workshop format developed by The Nature Conservancy and prescribed by the MVP Program. The goal of the workshop is to further investigate the Town's prior planning efforts and resiliency measures and to develop a list of strengths, as well as priority actions to focus on in the immediate future. To assist with the process and facilitate the workshop, the Town selected BETA Group (BETA) as its state-certified MVP planning grant provider.

The Workshop's central objectives were to:

- Define top local natural and climate-related hazards of concern;
- Identify existing and future strength and vulnerabilities;
- Develop prioritized actions for the Community;
- Identify immediate opportunities to collaboratively advance actions to increase resilience.

1.1.1 PARTICIPANTS AND PLANNING

Planning began with a meeting between BETA and the Town Administrator to identify the core team and participant invite list which was selected with guidance from the CRB Workshop Participant Worksheet. An effort was made to invite participants from several different areas of town involvement in order to have a broad range of perspectives on how climate change would affect the Town. There were 9 participants representing 8 different departments or boards across town. This was crucial to the success

of the program, as the Police noticed different hazards than the Highway department, and the Board of Health representative. This diversity of thought and perspective allowed the workshop to be highly informative and an overall success. The list of participants is attached in Appendix A. The core planning team for the CRB Workshop consisted of Orlando Pacheo, Town Manager, Michael Antonellis, Planning Director, and representatives from each Town Department and Board affected by the process, including: Police, Fire, Planning Board, Board of Health, Building Department, Highway Department and the Conservation Commission.

The workshop participants were divided into two groups, distinguished by the colors green and blue, as noted on the maps and matrices. These teams were intentionally made up of people from different departments in order to enhance different perspectives and identify resiliency opportunities that solved multiple vulnerabilities across sectors.

It was decided that the workshop should be divided into two, four-hour sessions, held on Monday October 7 and Wednesday October 9, 2019. Both workshops were held from 10 am to 2 pm at the Lancaster Town Hall. BETA led this workshop with multiple CRB-trained individuals. They provided an overview of climate change in the area as well as climate observations and projections from the Northeast Climate Science Center research, and implications that these changes will have on Lancaster's infrastructure, society, and environment so participants could have a more informed discussion throughout the rest of the workshop. The presentations are attached in Appendix B.

1.1.2 Workshop Process

1.1.2.1 Day 1

The first four-hour session was held on October 7, 2019 and began with an overview of the CRB Workshop, the goals of this session, and climate change predictions for the Nashua River Basin by BETA MVP-Certified facilitators Andrew Dennehy, P.E. and Kendra Martin, P.E. Some of the research and projects presented were that precipitation is projected to increase 8%, there will be 20% fewer days below freezing, and up to 5 times as many days over 90º F by 2050. A summary of this information, which was given to participants as a handout, is attached in Appendix C. A map of the town overlaid with FEMA flood zones was provided to each small group and a map depicting critical facilities in town was also displayed for reference. These maps can be found in Appendix D.

The participants then broke out into their designated small groups for further discussion. Small group discussions began by discussing hazards affecting Lancaster and developing a list of the top four hazards of concern each group felt Lancaster was most impacted by. Groups were made up of a facilitator (a member of the BETA team), a scribe/spokesperson, and three or four other workshop participants.

The participants then returned to the larger group to discuss and come to a consensus on the top four hazards moving forward. After a discussion of the hazards brought up by both groups, the top 4 agreed upon hazards were identified as, Inland Flooding, Severe Winter Storms, Invasive Species and Other Severe Weather. After a brief recess for lunch, groups annotated maps to highlight vulnerable infrastructure, flood zones, and community resources in order to fill in the "Features" column in the Ranking Matrix. Looking at the map allowed the participants to more clearly see the flood risk areas as well as remember what community assets are in that flood zone; this was very helpful in discussion of which features were most important. Participants also identified who owned that feature and categorized it as vulnerability or strength. These matrices can be found in Appendix D.

1.1.2.2 DAY 2

The second four-hour session began with a brief presentation and overview of day one, before groups moved on to fill in the Ranking matrix. In order to fill in the Ranking Matrix groups discussed action items that address the vulnerability and the feature by either posing a solution to a hazard/feature or enhancing the strengths of a feature against a specific hazard identified in the previous session. Some common action items included increasing culvert capacity, updating zoning bylaws, emergency management plans and procedures, feasibility studies to assess facility capacity and location as well as providing shelter in case of emergencies. Throughout the small group discussions, the BETA facilitators stayed with groups to ask questions and provide guidance.

After actions had been identified, the small groups decided whether each action was a high, medium, or low priority and if the time frame was short term, long term, or ongoing action. Using this information each small group determined their top five priority actions to present to the large group.

After all groups had completed the above tasks individually, participants reconvened to discuss, rank and prioritize together in order to come to a consensus on the highest priority actions to be taken across Lancaster. Each group stated the features they focused on in all three categories as well as their top five actions. These sheets where each group contributed their ideas during large group discussion can be found in Appendix E. A discussion followed in which the group at large deliberated why some items should or shouldn't be included in the priority actions. The results and any other notable information throughout the process of the workshop are described in the following sections of this report.

2.0 SUMMARY OF FINDINGS

2.1 CURRENT CONCERNS & CHALLENGES PRESENTED BY HAZARDS AND CLIMATE CHANGE

2.1.1 TOP HAZARDS OF CONCERN

During the individual group discussion, the following hazards were identified as being most prevalent and/or impactful in the Town of Lancaster, and were brought up for discussion in the larger group.

- Inland Flooding
- Severe winter storms
- Drought
- Invasive Species
- Tornadoes
- Hurricanes/Tropical Storms

Lancaster has experienced a number of weather-related events in recent years, and these events are expected to increase due to climate change. The small groups shared concerns about the hazards of inland flooding due to large rain events and storms that had been recently experienced by the town. For example, major flooding in 2010 caused the banks of the Nashua River to overflow and flood residents' yards and basement and major roadways like Route 117 to be closed due to flooding. This is a major concern as emergency vehicle routs are not accessible. The Highway Department noted that they have had seven inches of flood water in the highway barn during flood events. At times the Wachusett Reservoir Dam needs to be open upstream of the Town to prepare for large rain events which causes inundation of neighborhoods in Lancaster downstream.

The small groups also shared concerns of severe weather, both winter storms and wind storms such as nor'easters, ice storms, tornadoes and hurricanes. These weather events have increased in frequency

and severity. The high winds and snowfall associated with this weather leads to fallen trees and downed power lines. Concern was expressed about the railway that crosses major roads in Town posing an additional challenge for emergency access across town if routes are not available during severe weather events. Participants identified loss of power as a high risk for the community and its elderly, disable and low income population. The Town is particularly vulnerable to loss of power during these storms because of its location with large wooded areas and difficulties with the utility companies that take a long time to restore power to the area.

Drought and invasive species were brought up as top hazards but not thought to be an issue in the other. Drought it's a concern for the agricultural sector of Town which is a significant portion of land ownership however it was identified that drought does not affect the drinking water supply for the general public and therefore this hazard was dropped from the top hazards list. Discussions among the large group considered invasive species and the negative effect that they are expected to have long term on the agricultural community as well as the large forested areas and waterbodies in Town.

Some of these hazards related to storm events could be grouped together into one category and through the discussion there was group consensus on the following hazards as the top four:

Top Hazards

- Inland Flooding
- Severe Winter Storms
- Invasive Species
- Other Severe Weather

2.1.2 Important Features Related to Identified Hazards

Based on these experiences and the expectation of increased frequency and severity, the groups discussed which areas, communities and systems would be most affected by the occurrence of these hazards. Three categories of town features were discussed: infrastructural, societal and environmental. Below is a list of all of the community features the groups identified:

- Infrastructural
    - Culverts
    - Bridges
    - Sewer Pump Stations
    - Highway Department
    - Major Roads
    - Wells & Storage Tanks
    - Long-term Emergency Shelter
    - Railroad Crossings
    - Municipal Buildings
- Societal
    - Low-income Population
    - Elderly Population
    - Code Red
    - Town Communications
    - Evacuation Plan
    - Regional Emergency Communications Center
    - River Terrace
    - Housing Authority

    - Schools
    - Agricultural Properties
- Environmental
    - Nashua River
    - Town Forest and Open Space
    - Still River
    - Brooks and Ponds
    - Wetlands
    - Drinking-water Protection Area
    - Conservation area adjacent to Rt 70

It is important to note that not all these features were considered vulnerabilities. Some of these features are strengths and as the small groups began to think about ranking, the greatest vulnerabilities were identified and prioritized.

2.1.3 Prioritizing Actions

Action items that were identified in small groups and further discussed in the large group to address hazards facing town features are described below. This list identifies general concerns addressing the top four hazard categories facing Lancaster and was used to determine the top five priority action items.

- Shelter Facility: Both small groups discussed the need for a shelter facility in Town in case of emergencies and identified this as a top priority. Lancaster is in a rural area where downed trees and powerlines are common problems, and there are currently no shelter facilities established. In the event of large storms, especially winter storms resulting in power outages, there is a risk that Lancaster residents would be left without suitable shelter during storm events. Additionally, being such a rural community means it often takes longer for power to be restored to all facilities and residents than other communities in the State.
- Assessment and improvement of culverts, drainage system and low-lying roadways town-wide: Much of town flooding is due to the capacity of the Nashua River as well as the culverts and bridges in need of maintenance or resizing. The town is also impacted when the MWRA releases water from its dam upstream of the Town. These releases are done with limited notice to the Town and result in surcharge of the Town's waterways, in some cases requiring evacuation of streets. There is concern about impacts of flooding in the event of localized dam failure. Considering the flooding already occurs in much of town, especially Route 117 near the South of Main St, the Town is worried about what will happen in the event of more intense and frequent storms that are projected with climate change. Looking into ways to mitigate flooding through cleaning and maintaining the stormwater conveyance system and resizing culverts and bridges, were the main focus of discussion on this topic.
- Review Bylaws: "Maintain and update town zoning bylaws" was a common theme in the discussions which occurred between the two days of workshops. Much of the area that floods, as described above, is in the Nashua River Regulatory Floodway, and many of the Workshop participants thought it could be helpful to re-examine the zoning bylaws and how they allow or prohibit people to live and build in those areas to prevent damage in the coming years as flooding events occur more often. This could also include purchasing or protecting land in this area in order to maintain and/or increase flood storage.
- Evaluate Invasive Species: There are several types of invasive species that affect the condition of the Town's forests and farming community. In order to address this, it was suggested to update the forest management plan and open space plan to include invasive species management.

Additionally, implementation of the open space plan could protect critical habitats and agricultural areas that exist in Lancaster in conjunction with the U.S. Fish and Wildlife Services. Discussion included evaluating the health of ponds and brooks would be a necessary step in developing a weed maintenance program for White's Pond and other water bodies.

- Evaluate Purchase of Generators: In case of power outages caused by natural hazard events, generators would provide a way for facilities to have power and to operate normally. Facilities that were mentioned as potentially in need of a generator or generator upgrades include schools that may act as shelter facilities, the town hall, the senior center, wells/storage tanks, pump stations, municipal facilities, and the housing authority. The need for generators is related to the need for sheltering facilities mentioned above, as well as other facilities that could be affected by loss of power. Wells are critical to the town's water supply and currently have generators however they are ageing and will need to be upgraded at some point in time. This is important because a loss of power could also cause loss of water supply if pumps are not functioning. These generators could be in use regardless of the need for additional shelter facilities so while they are related, they are also distinct issues facing the Town of Lancaster.

Some of these items became incorporated into the top six priority action items, while the rest of that list came from more general concerns addressed in the top four hazard categories.

2.2 Strengths and Assets

Workshop participants noted that the town has strengths in each of the three feature categories: societal, environmental, and infrastructural. Some of the features were noted as both a strength and a vulnerability, for example municipal buildings and wells. The participants agreed that the existing condition of generators at some of those locations is a strength, however, in the long term there is vulnerability because of the generator's age. Municipal buildings were considered a strength because they have the potential to be a sheltering facility, even though the Town has not designated one as such yet. They also saw Route 70 as a strength because it is build above flood levels and provides access through town during flood events.

Many participants thought that while the communication techniques could be improved through more targeted and intentional public outreach, the system itself was in good working order, especially the "Code Red" system, an emergency notification system that allows for high-speed emergency notifications to the whole town, and the Regional Emergency Communications Center at Fort Devens. Regional coordination and continued support of these systems is important to maintain this strength. Another strength identified in the Town are the conservation areas. These areas of forest, wetlands and undeveloped floodplain are critical to avoid flooding because the natural landscape has been preserved. Having this land is a strength in that it preserves the open space and prevents anyone from building on it. Additionally, there is already an established drinking water protection area which, combined with other conservation areas, provides an easy avenue for the strengthening of zoning bylaws and other measures in order to protect from the current issues facing Lancaster. Appendix D has a more detailed description for reference.

2.3 Future Actions and Resolutions to Improve Community Resilience

2.3.1 Highest Priority Actions

The top actions determined by each small group are listed below. As in other categories there was overlap in the findings and opinions of the groups.

- Repair Sterling Rd. culvert

- Develop general maintenance Order of Conditions with Conservation Commission
- Drainage improvements on South Main St.
- Increase outreach to low income and elderly populations
- Find a location in town to serve as shelter and install generator as necessary
- Backup generator for Town Hall
- Upgrade highway radio
- Culverts
    - Town-wide mapping and assessments
    - Acquire funds to repair
    - Develop a beaver plan
    - Maintain culverts through staffing increase
- Evaluate municipal buildings' need for generator and ability to function as shelter
- Secure reliable power for housing authority
- Assess schools as shelters and conduct long-term feasibility study of shelter options
- Assess runoff at storage tanks and update backup power supply

After each group presented their proposed top action items there was a large group discussion about the merits of each in order to ensure that the top overall actions that the participants prioritized for the Town were not only important, but also feasible and pertinent to the priority hazards listed earlier. In general, the participants recognized each action as important to the town and the discussion proceeded to come up with consensus on the top priority actions to be taken as a result of the Municipal Vulnerability Preparedness Workshop. The results are as follows:

Highest Priority Actions

- Feasibility study to find location for shelter facility in Town
- Assessment and replacement of culverts town-wide
- Maintenance program for culverts & securing funds for increased staffing to perform maintenance
- Create elderly and disabled outreach and emergency action plan
- Evaluate generators at all municipal buildings and facilities
- Raise Route 117 with cross drains

There are also several actions which would create opportunities to invest in Low Impact Development (LID) or Nature Based Solutions to address some of these vulnerabilities. Several people in the workshop were interested in Lancaster acquiring more open space inside of the flood plain and changing building bylaws to protect this land by prohibiting building on that site. This would encourage the maintenance of the natural flood plain and would reduce property damage during storms. Additionally, there are several areas that flood in town and the recommended action is "Study too alleviate flooding." A study of this kind could include nature-based solutions as options to this flooding by investigating the potential for roadside swales or rain gardens, permeable pavement, leaching catch basins to restore groundwater, as well as other LID stormwater mitigation measures.

2.3.2 RECOMMENDED ACTIONS

Participants at the workshop identified a number of recommended actions to address vulnerabilities and increase resiliency. The following is a complete list of these recommendations listed by priority but not ranked with the priority category. See Appendix D: Maps and Matrices for a list of all the actions and assets whether it was considered a strength or vulnerability, and Appendix E: Top Priority Voting Results for list of all priority hazards and priority actions.

High Priority

- Culverts: Upsize culverts on Rt 117 & Rt 110; Repair Sterling Rd. culvert; Culvert cleaning program; OOC maintenance w Conservation Commission
- Major Roads (Rt 117 & Rt 70): Raise Rt 117; drainage improvements on South Main; Evaluate drainage town-wide; update zoning & stormwater bylaws; install permanent signage advising of flooding
- Culverts throughout town undersized and in bad shape: Conduct town-wide culvert mapping & assessment; Pursue grants & funding for culvert upgrades; Conduct preventative maintenance - increase staff; Beaver Plan
- Shelter Facility/Long-term Emergency Shelter: Study to find location for shelter; communicate with neighboring towns for short-term shelter available options; generator for senior center; Feasibility study to explore regional & local shelter opportunities & plans
- Shelter
- Low Income Population: Targeted study to alleviate flooding impacts; translation services; increase outreach
- Municipal Buildings: Evaluate needs for upgrades & additional generators, Ensure buildings can function as winter & summer shelters
- Elderly Population: Provide transportation; targeted study to alleviate flooding; provide targeted info on evacuation
- Town Communications: Backup generator for town hall; increase communication prior & during hazard events; upgrade highway radio
- Excavation Plan: Create emergency management committee; post signage on roads; post route on town website; broadcast route on local cable; maintain and upgrade as needed
- Housing Authority (Elderly & Low Income): Ensure reliable power source is available
- Schools: Assess whether schools (middle & elementary) can be used as emergency shelter

Medium Priority

- Bridges: Replace bridge on Rt 117 @ Bolton Line; Evaluate condition of bridges town-wide
- Pump Stations (sewer): Evaluation of pump stations with options to fortifying against flooding
- Highway Department: Feasibility study to relocate; Develop options for reuse of highway facility; raise salt out of flood zone
- Wells: Relocate salt shed out of flood plain; maintain use restrictions; Review & update well bylaw as necessary, Purchase generators; Study to evaluate adequacy of water system for future development
- Water Storage Tanks: Assess runoff from tank site to maintain integrity off site; upgrade back-up generators
- Rt 117 Bridge over Nashua and Culvert: Design Bridge to accommodate drainage for current & future storm forecast & traffic loads; Conduct Annual Inspection
- Railroad Crossings: Improve communications & understanding of protocols with rail companies
- Code Red: Maintain and upgrade as needed; Provide information to residents on availability
- Nashua River and Still River: Update zoning bylaw for building in flood plains; Purchase land along river for flood storage; Study to determine location to potentially reduce flooding through river improvements
- Wetlands: Maintain, review and update wetlands bylaw as necessary; Investigate mosquito control options

- Drinking Water Protection Area: Relocate salt shed out of flood plain; maintain use restrictions; Review & update well bylaw as necessary
- Town Forest: Update forest management plan; Include invasive species in scope of plan updates

Low Priority

- Regional Emergency Communications Center: Consistent evaluation of center to ensure needs are met; Review Devens MVP for areas of collaboration
- River Terrace: Ensure reliable power source is available
- Agricultural Properties: Assess ability to deal with vulnerabilities on these properties (i.e. hydrant availability); Management Plan for Invasive Species
- Town Forest and Open Space: Maintain open space; Review open space plan & update as needed; Secure funding to purchase additional open space; Annual brush cleaning programs; Evaluate condition of trees and susceptible to invasive species; develop program to combat invasive species
- Brooks and Ponds: Evaluate health of ponds & brooks; develop weed maintenance program for White's Pond
- Conservation Area adjacent to Rt 70: Evaluate erosion potential; Identify additional land to expand
- Open Space: Strategic application of the open space plan in acquisition of priority parcels; Coordinate with Fish & Wildlife & Mass Department of Fish & Game to protect critical habitat areas

2.4 PUBLIC LISTENING SESSION

Lancaster presented the CRB process and summary of findings at a Public Listening Session at the Lancaster Town Offices on November 18, 2020. This meeting was held before a regularly schedule Board of Selectmen Meeting and was advertised on the Town's website and residents and interested parties were encouraged to attend. The Listing Session provided an opportunity for any member of the interested public to learn, ask questions, and provide feedback about the workshop and the results that emerged. The following topics were discussed during the Listening Session:

- Overview of the Municipal Vulnerability Preparedness Program
- Nature Based Solutions and their role in the Program
- Climate data and projections
- Impacts from Climate Change
- Workshop overview
- Hazards, features and actions identified during the workshop
- Priority Actions developed during the workshop
- The next steps for the Town in the program

Input from the attendees of the workshop was focused on the large environmental areas and the flooding associated with these areas. In particular, attendees were most concerned with:

- The Nashua River
- The Still River
- Town Forests and Open Space
- Wetlands

All of their concerns had previously been captured in the Workshop and are included in the Summary of Findings.

3.0 Next Steps

3.1 Continuing with the MVP Program

Conversations held through the MVP CRB Workshop and listening session highlighted climate related challenges facing Lancaster and enlightened participants and the public to the importance of preparing for and addressing them. Participants identified many short and long term strategies for adapting to the changing climate.

The findings will serve as a basis for Lancaster's MVP Action Grant application, providing an opportunity to take the community's ideas and turn them into actions. Priority actions identified during the workshop will also be integrated into local planning efforts to improve the town's resiliency to the effects of climate change.

4.0 Citation

BETA Group (2020, February). MVP Community Resilience Building Workshop Summary of Findings, Lancaster, MA.

5.0 Acknowledgements

Many thanks to the MVP Core Team members and CRB workshop participants. Thank you to the Town of Lancaster for providing and coordinating a space to host the workshop and listening session and for making the workshop a priority for town staff to take part in.

Funding for the CRB workshop was provided through a Massachusetts MVP Planning Grant.

APPENDIX A

List of Participants

Appendix A: List of Participants

10/7/2019	10/9/2019	First	Last	Town Department/ Role
x	x	Mike	Antonellis	Planning Director
x	x	Kevin	Bartlett	DPW Superintendent
x	x	Edwin	Burgwinkel	Police
x	x	Katherine	Holden	Board of Health
x	x	Rick	Krafve	Facilities Supervisor
x	x	Scott	MacDonald	Highway Department Foreman
x	x	Orlando	Pacheco	Town Administrator
x	x	Robin	Zagwyn	Police
x	x	Tony	Zahariadis	Building Department

10/7/2019	10/9/2019	Name	BETA Group Title
x	x	Andrew Dennehy, PE	Project Manager
x	x	Kendra Martin, PE	Engineer
x	x	Melissa Recos, PE	Project Manager

APPENDIX B

- Community Resilience Building Workshop Presentation
  Lancaster, MA

Municipal Vulnerability Program (MVP)

Lancaster, MA

October 7th, 2019

BETA

Welcome and Introductions

- Andy Dennehy, Associate, BETA Group, Inc.
- Melissa Recos, Project Manager, BETA Group, Inc.
- Kendra Martin, Engineer, BETA Group, Inc.

Municipal Vulnerability Program Agenda

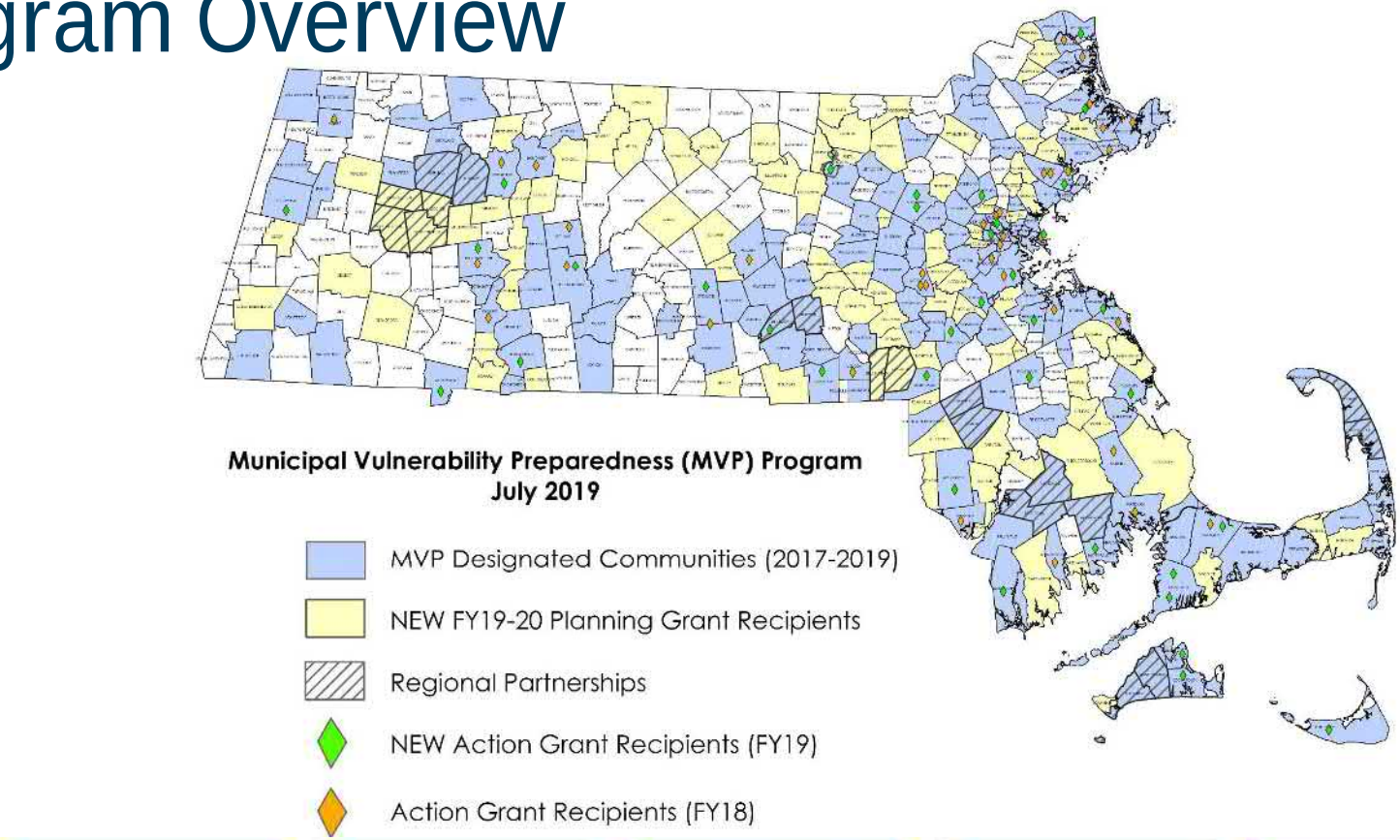
- Program Overview
- Workshop Overview
- Science and Resources Information
- Introduction to Small Team Exercise
- Reporting Small Team Findings
- Summary Discussion
- Wrap-up and Introduce Workshop #2 (Wednesday)

Program Overview

EXECUTIVE ORDER 569: AN INTEGRATED CLIMATE CHANGE STRATEGY FOR THE COMMONWEALTH 9.16.16

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

Program Overview



1. Engage Community
2. Identify CC impacts and hazards
3. Complete assessment of vulnerabilities & strengths
4. Develop and prioritize actions
5. Take Action

Program Overview

Two MVP Grant Opportunities

RFR 1: MVP Planning Grant

RFR 2: MVP Action Grant

Nature Based Solutions

Nature-Based

Nature-Based Solutions *use* natural systems, *mimic* natural processes, or *work in tandem with* traditional approaches to address natural hazards like flooding, erosion, drought, and heat islands.

Green Infrastructure

Low Impact Development (LID

Nature Based Solutions

Floodwater Detention and Retention Basins

Daylighting Rivers and Streams

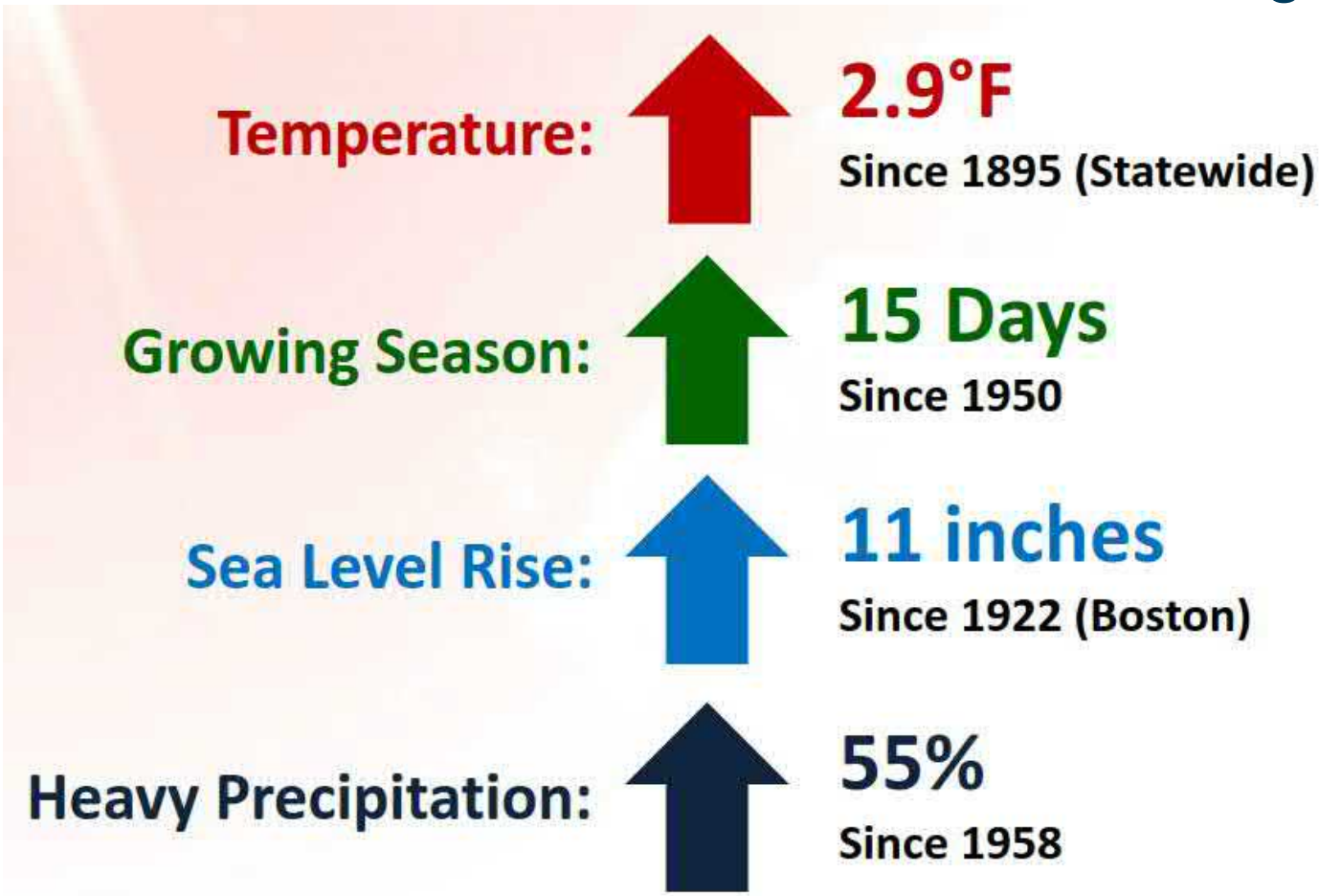
Open Space Preservation through Land Acquisition

Green Streets

Flood Friendly Culverts

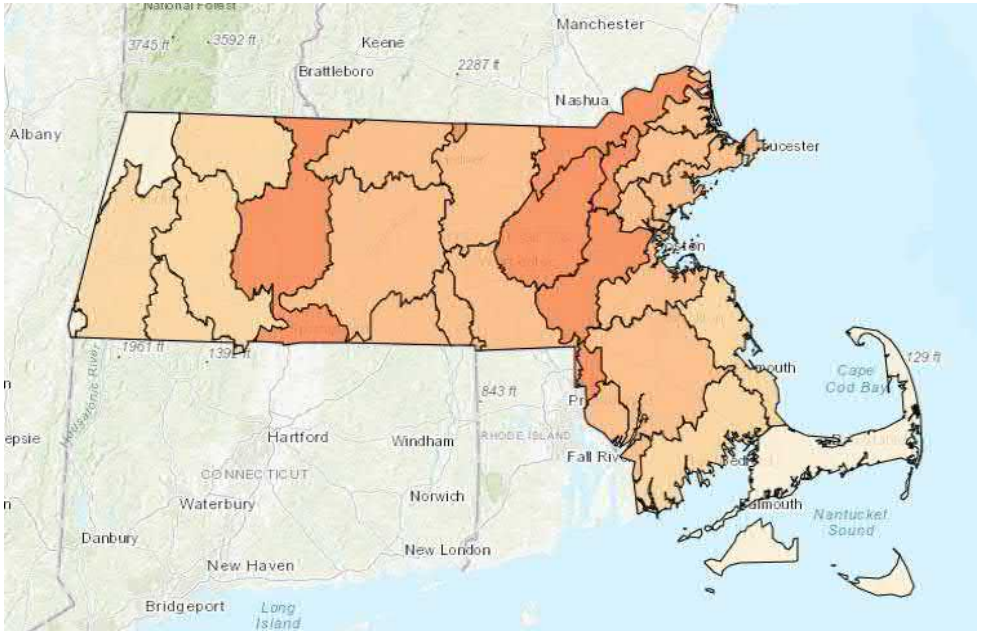
Regulatory and Policy Approaches to Address Hazards

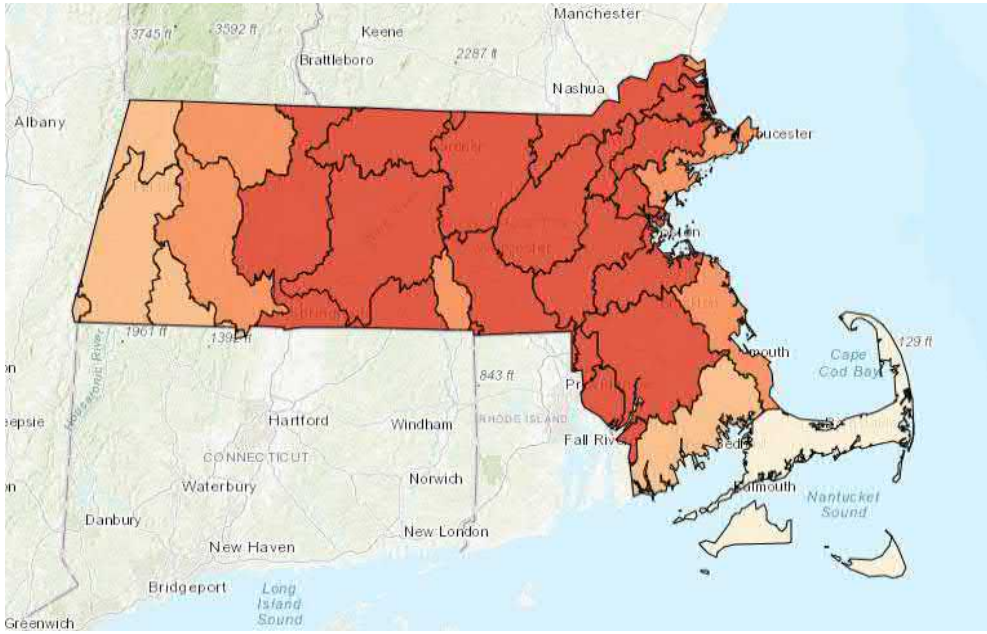
Massachusetts Observed Climate Changes



Massachusetts Projected Climate Changes

Change in # of Days above 90°F – 2050 Scenarios





Projected change in # days above 90°F

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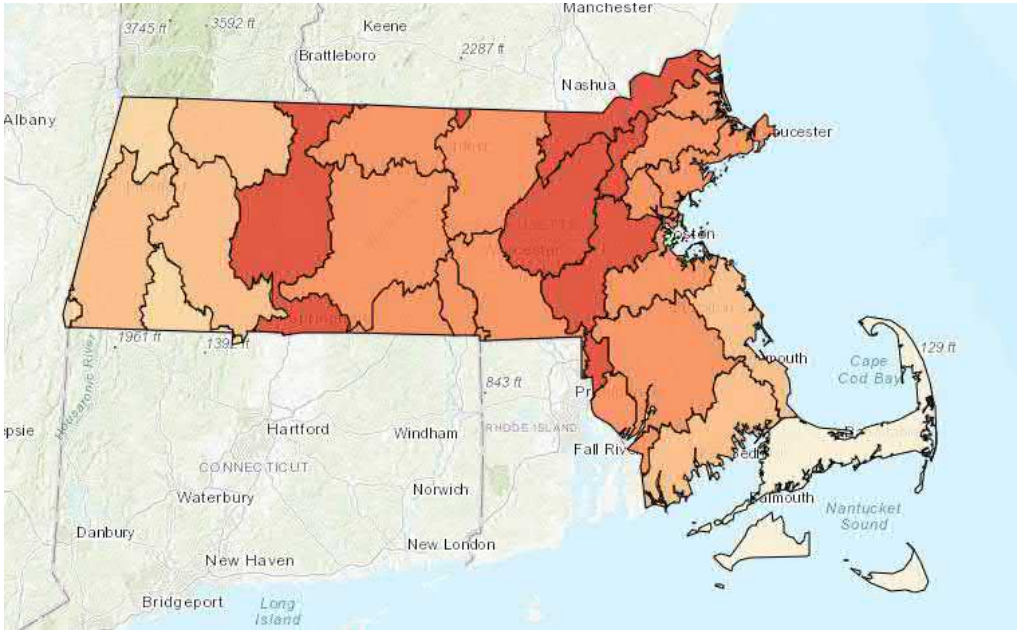
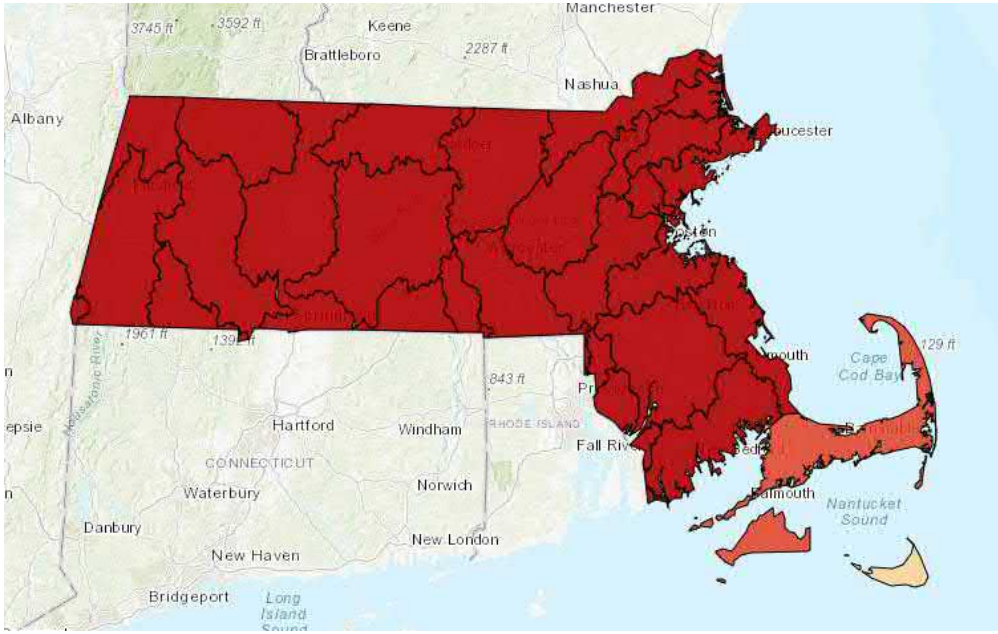
Massachusetts Projected Climate Changes

Change in # of Days above 90°F – 2090 Scenarios





Projected change in # days above 90°F

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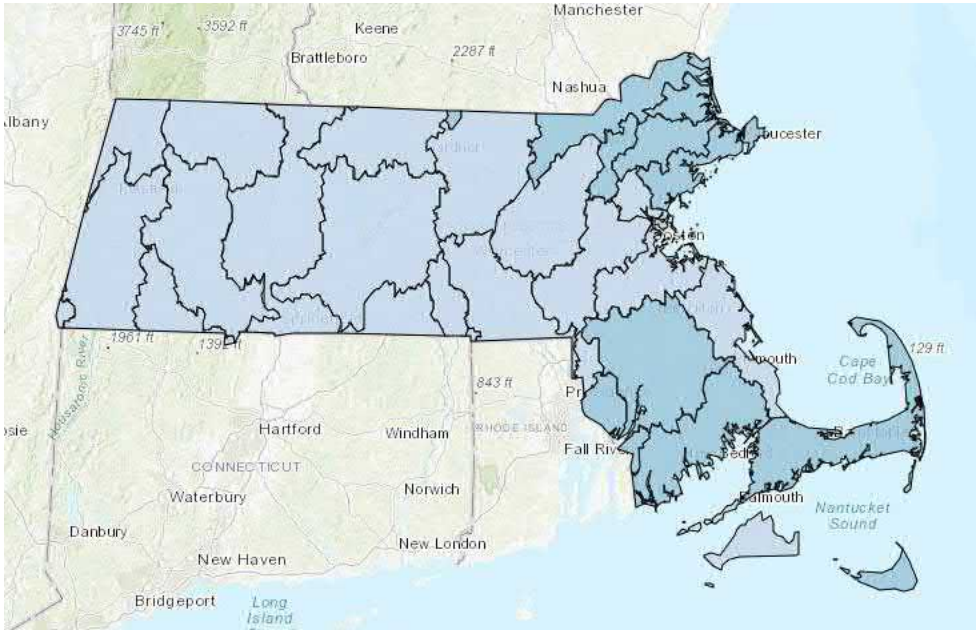
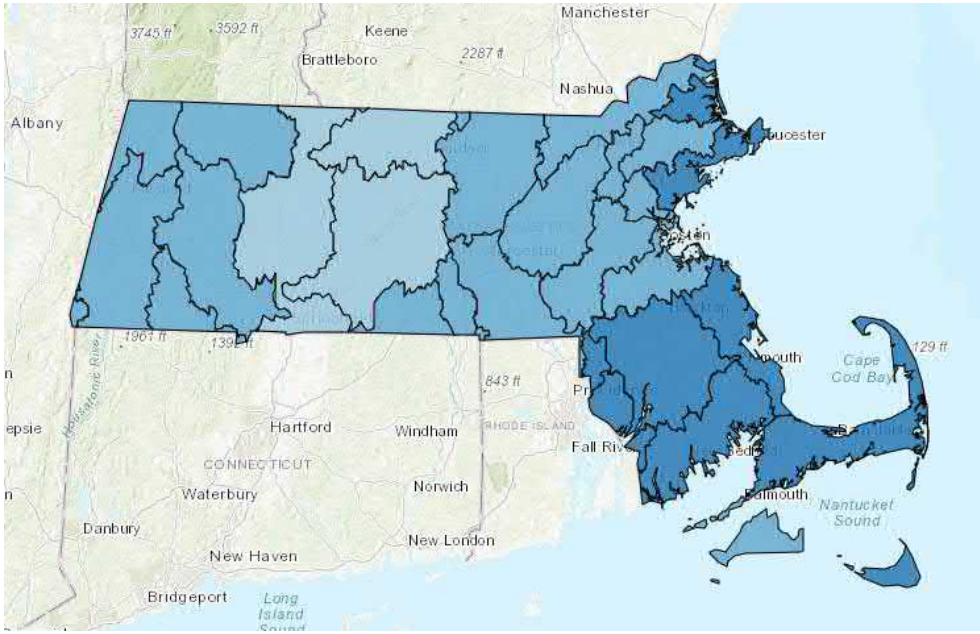
BETA

Massachusetts Projected Climate Changes

Change in # of Days below 32°F – 2050 Scenarios



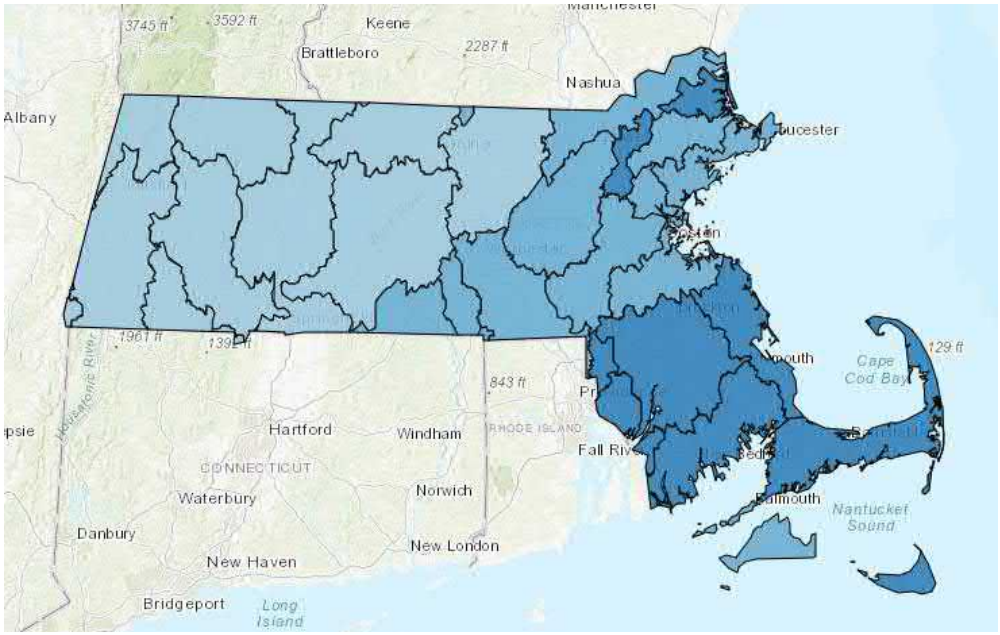


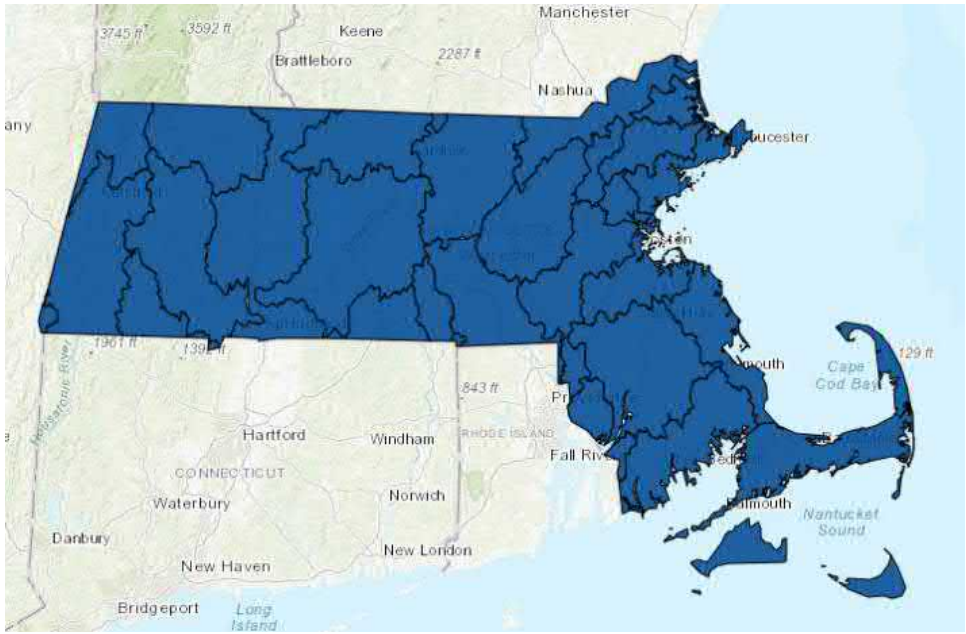
Projected change in # days below 32 °F

-20.6 -25.6 -30.8 -33.9 -47.3

Massachusetts Projected Climate Changes

Change in # of Days below 32°F – 2090 Scenarios



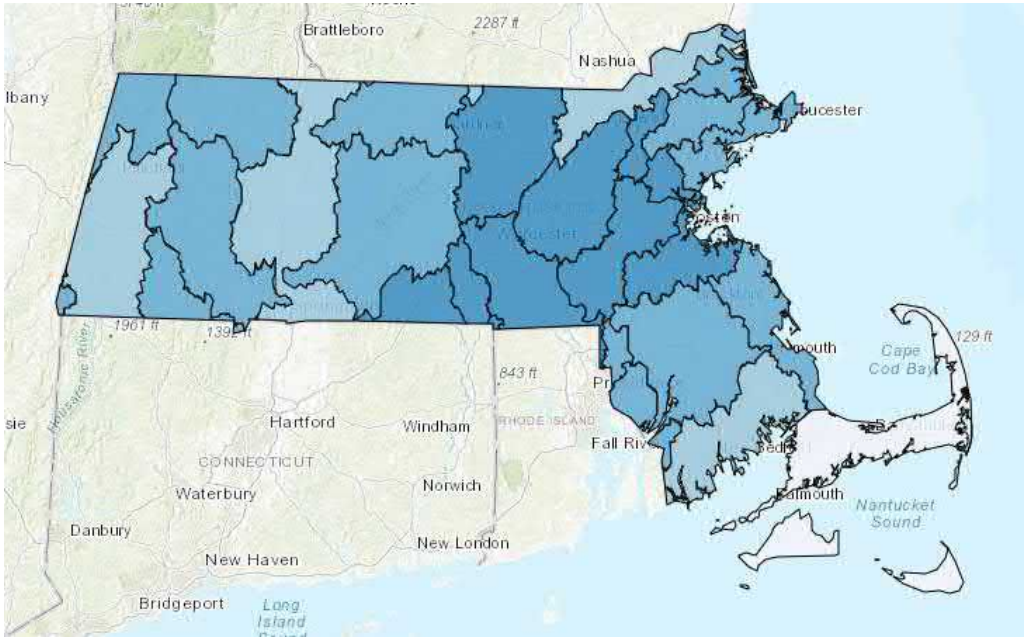


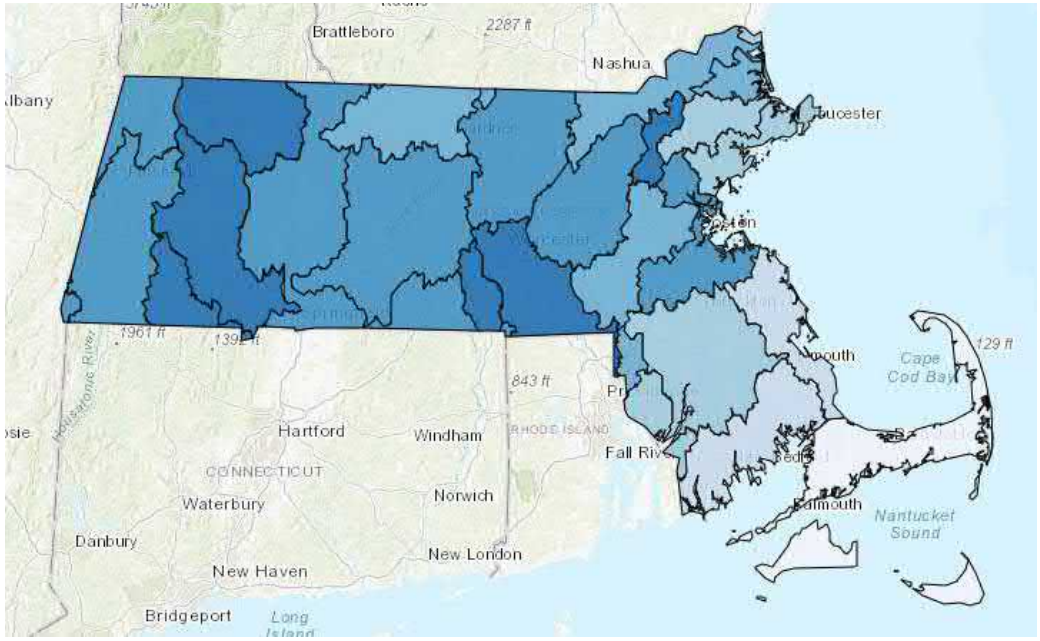
Projected change in # days below 32 °F

-20.6 -25.6 -30.8 -33.9 -47.3

Massachusetts Projected Climate Changes

Change in Inches of Precipitation– 2050 Scenarios





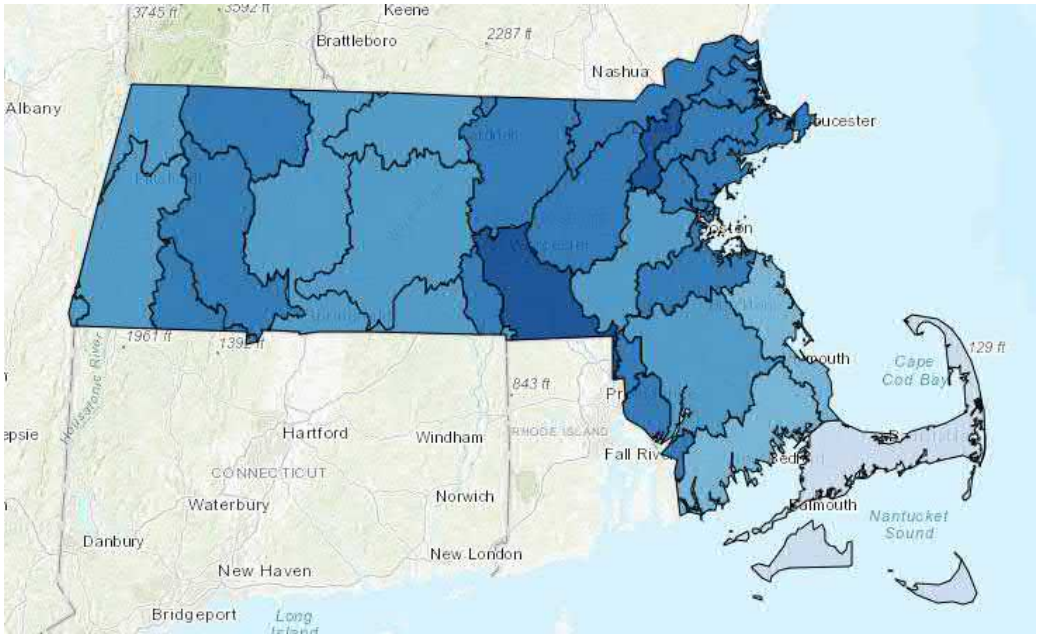
Projected change in inches of total precipitation

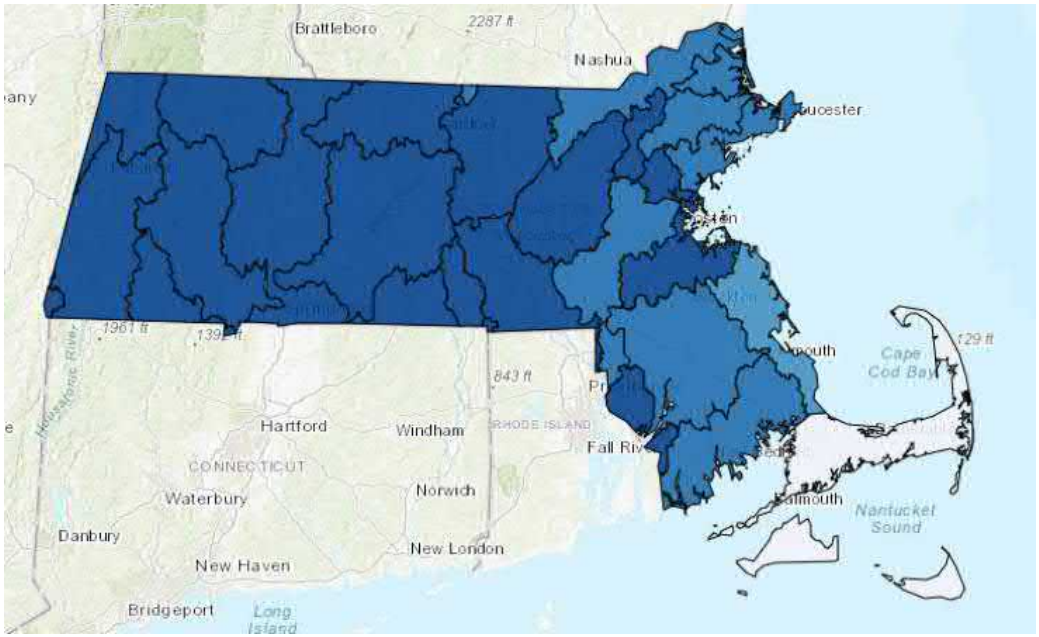
+1.9 +2.5 +3 +3.4 +3.9 +4.5

BETA

Massachusetts Projected Climate Changes

Change in Inches of Precipitation– 2090 Scenarios





Projected change in inches of total precipitation

+1.9 +2.5 +3 +3.4 +3.9 +4.5

Massachusetts Projected Climate Changes

Variable	Observed Value (1971-2000 average)	Change by 2050s	Change by 2090s
Annual average temperature	47.5 °F	Increase by 2.8-6.2 °F	Increase by 3.8-10.8 °F
Number of days per year with daily Temp > 90°F	5 days	Increase by 7-26 days	Increase by 10-63 days
Number of days per year with daily Temp < 32°F	146 days	Decrease by 19-40 days	Decrease by 24-64 days
Heating degree-days per year (HDD)	6839 Degree-Day °F	Decrease by 773-1627	Decrease by 1033-2533
Cooling degree-days per year (CDD)	457 Degree-Day °F	Increase by 261-689	Increase by 356-1417
Growing degree-days per year (GDD)	2344 Degree-Day °F	Increase by 531-1210	Increase by 702-2347
Total Precipitation per year	47 inches	Increase by 0.9-6 inches	Increase by 1.2-7.3 inches
Number of days with precip > 1 in	7 days	Increase by 0-3 days	Increase by 1-4 days

Impacts from Climate Change

- Increasing Temperatures
  - Increase in heat-related illnesses
  - Changes to growing seasons
  - Larger demands on energy systems
- Increased Precipitation and Downpour Intensity
  - Increased risk of flooding
  - Water quality impacts
  - Impact on agriculture and natural ecosystems
- Changes to Rain and Snow Patterns
  - Reduced snow cover
  - Potential increase in drought events
  - Impacts to habitats and species

Workshop Overview

- Characterize Hazards (Workshop #1)
- Identify Community Vulnerabilities and Strengths (Workshop #1)
- Identify and Prioritize Community Actions (Workshop #2)
- Determine the Overall Priority Actions (Workshop #2)
- Develop Comprehensive Summary Products (Workshop #2)

Workshop Overview

Community Resilience Building Risk Matrix 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					Priority H - M - L	Time Short Long Ongoing
Infrastructural									
Societal									
Environmental									

Characterize Hazards

Identify past, current, and future hazards (large team).

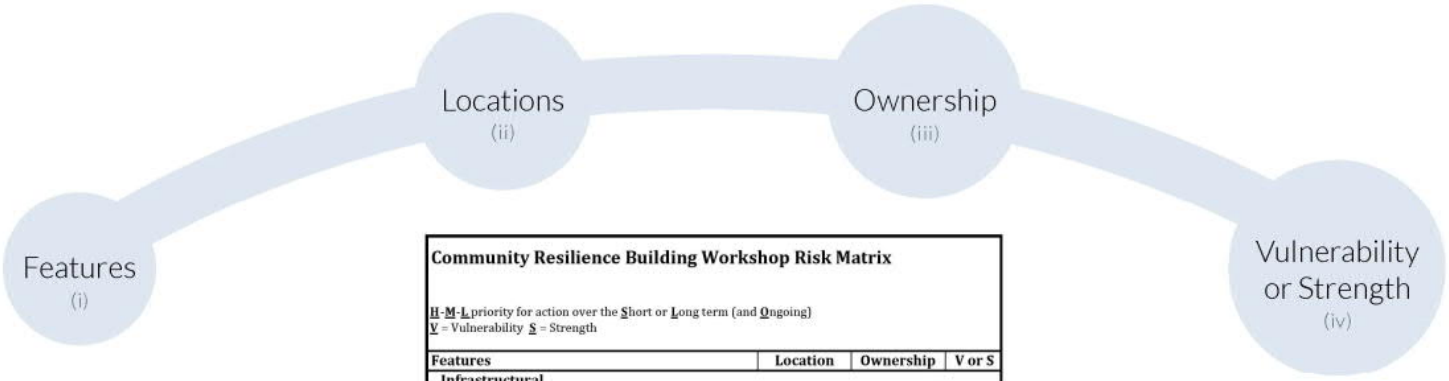
Direct participants to make a list of hazards (causes of impacts) that the community has dealt with, currently faces, and anticipates experiencing in the future (i.e., tornados, ice/wind storms, drought, wildfire, tsunamis, sea level rise, landslides, earthquakes, etc.). Utilize the following triggering questions to accelerate dialogue and surface initial agreement on top four hazards.

- What hazards have impacted your community in the past? Where, how often, and in what ways?
- What hazards are impacting your community currently? Where, how often, and in what ways?
- What effects will these hazards/changes have on your community in the future (5, 10, 25 years)?
- What is exposed to hazards and climate threats within your community?
- What have been the impacts to operations and budgets, planning and mitigation efforts?
- Others concerns or considerations related to impacts?

A **Hazard** is like the sun. The **Risk** from that hazard is sunburn. The **Vulnerability** includes the length of **Exposure** of skin to the sun. The **Action** to reduce risk from the hazard is to apply sunscreen or seek shade.

Top to bottom: © Rich Reid/TNC, © Devan King/TNC, © Jay Harrod/TNC

Identify Community Vulnerabilities and Strengths



Community Resilience Building Workshop Risk Matrix

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Societal			
Environmental			

Steps C1, C2 and C3 below focus on identifying intrastructural, societal and environmental vulnerabilities and strengths. Each step requires three tasks to complete the Risk Matrix: **(i)** identify features, **(ii)** describe feature locations, **(iii)** identify feature ownership, and **(iv)** identify each feature as a vulnerability or strength, or both.

Hazard Characterization

- Inland Flooding
- Tsunami
- Severe Winter Storm
- Drought
- Extreme Temperatures
- Tornadoes
- Landslide
- Wildfires
- Coastal Flooding
- Invasive Species
- Earthquakes
- Coastal Erosion
- Hurricanes/Tropical Storms
- Other Severe Weather (strong wind, extreme precipitation)

Introduction to Small Team Exercise

- Team Facilitators
- Introductions
- Choose Team Spokesperson and Scribe
- Discuss 4 Top Hazards

Hazard Characterization

- Inland Flooding
- Tsunami
- Severe Winter Storm
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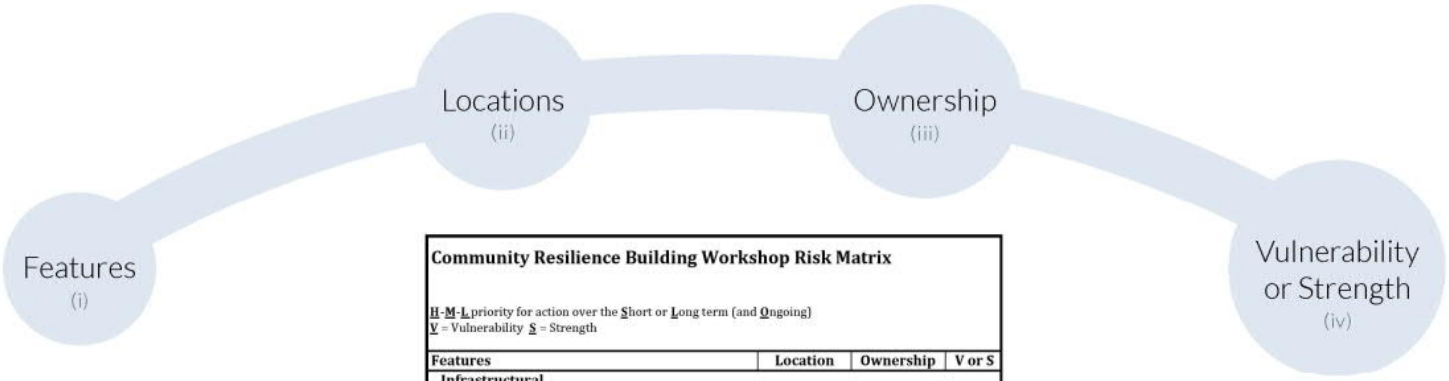
- Coastal Erosion
- Hurricanes/Tropical Storms
- Other Severe Weather (strong wind, extreme precipitation)

Reporting Small Team Findings

Small Group Breakout #1

- Spokesperson to present findings on hazards to full group
- Full group develops top 4 hazards

Identify Community Vulnerabilities and Strengths



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Reporting Small Team Findings

Small Group Breakout #2

- Spokesperson to present findings on features to full group
- Full group discusses findings

Wrap-up and Introduce Workshop #2

- Consensus on hazards
- Discussion of assets
- Any questions from today's workshop
- Workshop #2
  - Identify and Prioritize Community Actions
  - Determine the Overall Priority Actions

Municipal Vulnerability Program (MVP)

Lancaster, MA

October 9th, 2019

BETA

Welcome and Introductions

- Andy Dennehy, Associate, BETA Group, Inc.
- Melissa Recos, Project Manager, BETA Group, Inc.
- Kendra Martin, Engineer, BETA Group, Inc.

Municipal Vulnerability Workshop Agenda

- Reporting Small Team Findings on Assets
- Summary Discussion on Assets
- Small Group Breakout
  - Develop Actions
  - Prioritize Actions
  - Urgency of Actions
- Reporting Small Team Findings on Priority Actions
- Consensus on Priority Actions
- Wrap-up

Workshop Overview

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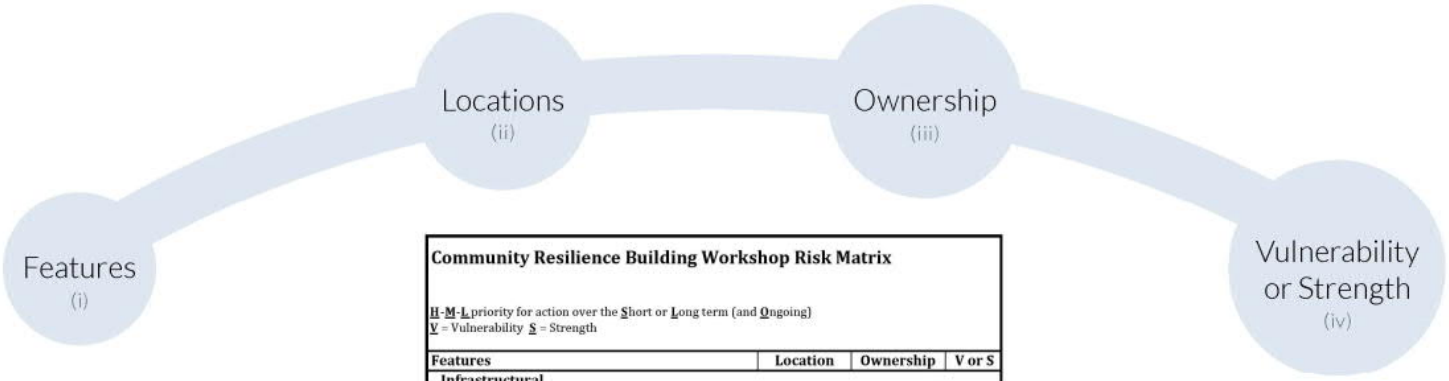

Community Resilience Building Workshop Risk Matrix

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Societal			
Environmental			

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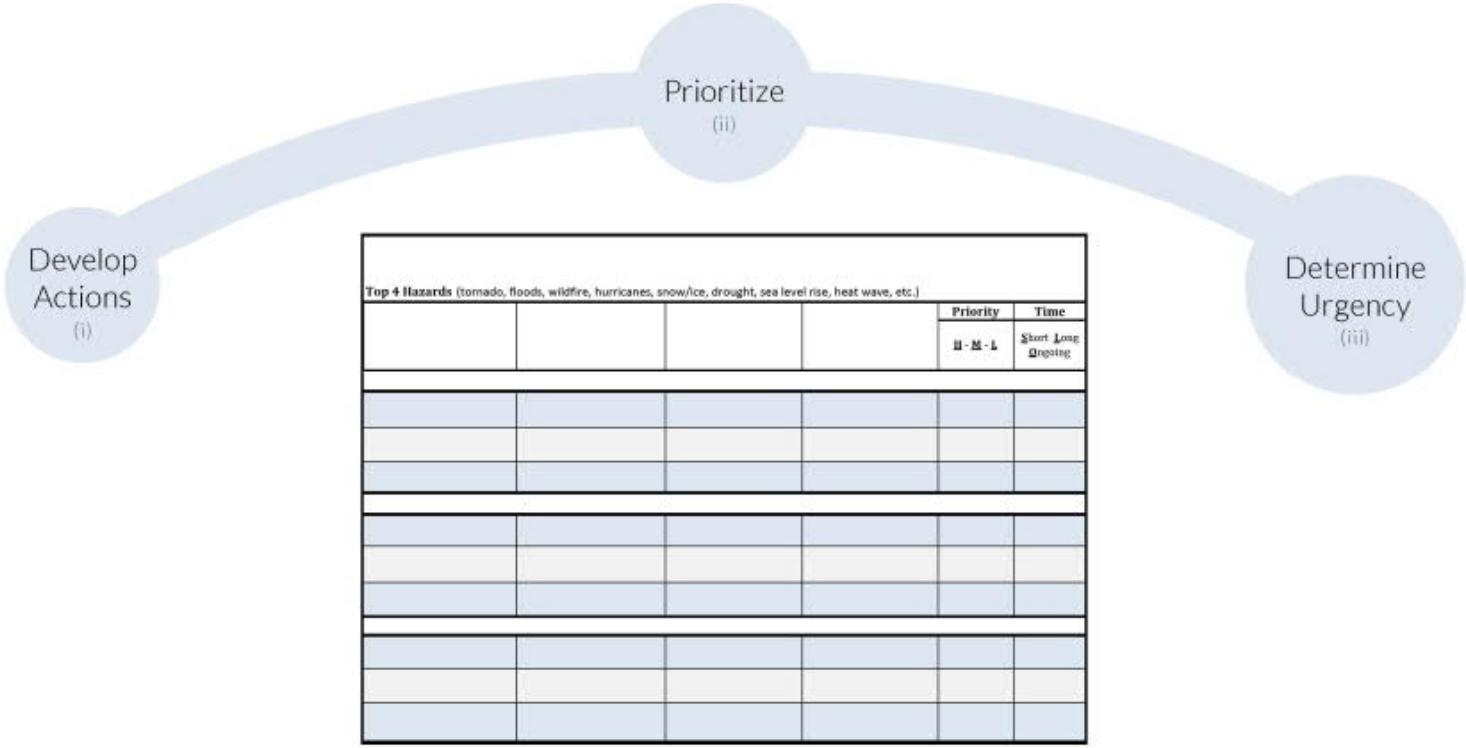
Introduction to Small Team Exercise

- Team Facilitators
- Introductions
- Choose Team Spokesperson and Scribe
- Develop Actions
- Prioritize Actions
- Develop Urgency

Introduction to Small Team Exercise



Steps D1, D2 and D3 below focus on identifying and prioritizing intrastructural, societal and environmental actions. Each step requires three tasks to complete the Risk Matrix: **(i)** develop actions, **(ii)** prioritize actions (**H**igh, **M**edium, **L**ow), and **(iii)** determine urgency (**O**ngoing, **S**hort-term, **L**ong-term).

Introduction to Small Team Exercise

Community Resilience Building Workshop Risk Matrix

H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength

Top 4 Hazards (tornado, floods, wildfire, hurricanes, snow/ice, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Coastal Flooding SLR/Storm Surge	Inland Flooding and Rain Events	Ice and Snow	Wind	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
Town Campus	Specific	Town	V	Verify risk from flooding events; Identify alternative locations during peak flooding; Verify maintenance plan annually				H	S
Evacuation Routes - Roads	Town-wide	Town/State	V	Install highly visible signage for evacuation routes; Develop and implement communication program				H	S
Electrical Distribution System	Multiple	CL&P/Town	V	Within floodplain area, establish plan to address protection and long-term relocation of equipment		Upgrade transformers; Maintain power line protection zone (tree trimming)		H	O-L
Dams (inland and coastal)	Multiple	Private	V	Prevent possibility of catastrophic dam failure; Identify and remove dams to minimize downstream flooding due to failure				H	L
Railway and State Bridges	Multiple	Amtrak/State	V	Improve communications between parties; Expand green/gray infrastructure and improve bridge structures; Assess vulnerability and prioritize infrastructure improvement list				M	S
State Roads/Intersections	Town-wide	State/Town	V	Coordinate with DOT, volunteers, public works to improve response; Need signage to warn of flooding risk in critical intersections				M	L
Wharves and Shore Infrastructure	Shore	Town-State-Private	V	Pursue comprehensive shoreline management plan; Establish community dialogue on retaining/relocating infrastructure				L	S
Waste Water Treatment Facility	Specific	Town	V	Conduct alternative siting feasibility study; Relocate to low risk area within next 25 years.				L	L
New Ambulance Center	Specific	Town	S	Continue to support services in budget; Add additional staff and vehicle in next annual cycle					Ongoing
Zoning Regulations (maintain large lot size)	Multiple	Town	S	Current building codes control development in risky areas; Consider additional zoning incentives (TDRs) to reduce risk to residential units					Ongoing

More examples of actions:

- Improved access in 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

When prioritizing, consider factors such as:

- Funding availability and terms
- Agreement on outstanding impacts from recent hazard events
- Necessity for advancing longer term outcomes
- Contribution towards meeting existing local and regional planning objectives

Examples of urgency:

- Current project to install hurricane-proof roof on school is an 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.

Reporting Small Team Findings

Small Group Breakout

- Spokesperson to present findings on priority actions
- Full group develops top five priority actions

Wrap-up

- Discuss actions and priorities
- Consensus on top five priority actions
- Questions?
- Next Steps
- Wrap-up

APPENDIX C

- **CR**B Wor**k**sho**p** H**an**do**ut**s

Lancaster Municipal Vulnerability Preparedness (MVP) Program Workshop

NASHUA RIVER BASIN CLIMATE CHANGE PROJECTIONS (TEMPERATURE)[1]

SUMMARY OF MODELING RESULTS

- By 2050, average temperatures could increase by 18%. By 2090, average temperatures could increase by 20%.
- Number of days with temperatures +90 °F could increase by almost 5 times as today by 2050. By 2090, there could be almost 15 times as many +90 °F than today.
- Number of days with temperatures below freezing could drop by 20% by 2050 and almost 35% by 2090.
- Less energy is expected to be spent on heating in the winter, but more energy is expected to be spent on cooling in the summer.

TEMPERATURE PROJECTIONS

Variable	Baseline (1971-2000)	Mid-Century (2050s)	End of Century (2090s)
Average Annual Temperature (°F)	46.78	50.83 – 55.22	51.9 – 56.14
Maximum Annual Temperature (°F)	57.77	61.72 – 63.17	62.88 – 66.93
Minimum Annual Temperature (°F)	35.78	39.82 – 41.35	40.92 – 45.47
Annual Days with Max Temp over 90°F	4.37	19.65 – 29.59	24.39 – 63.20
Annual Days with Min Temp below 32°F	156.40	132.30 – 124.91	126.09 – 102.07
Annual Heating Degree-Days (Base 65°F)	7,092	6,014 – 5,682	5,732 – 4,881
Annual Cooling Degree-Days (Base 65°F)	433	821 – 998	919 – 1,629
Annual Growing Degree-Days	2,270	3,010 – 3,341	3,166 – 4,241

[1] Source: Northeast Climate Science Center, 2018. Massachusetts Climate Change Projections. University of MA Amherst. Published by MA Executive Office of Energy and Environmental Affairs. Available at: http://resilientma.org/data/datamajor-river-basins.

IMPROVING COMMUNITIES TOGETHER

Lancaster Municipal Vulnerability Preparedness (MVP) Program Workshop

NASHUA RIVER BASIN CLIMATE CHANGE PROJECTIONS (PRECIPITATION)[1]

SUMMARY OF MODELING RESULTS

- Average annual precipitation could increase 8% by 2050s and 12% by 2090s.
- Greatest increase in precipitation will occur during winter months.
- Greatest increase in consecutive dry days will occur during fall months.

PRECIPITATION PROJECTIONS

Climate Parameter	Baseline (1971-2000)	Mid-Century (2050s)	End of Century (2090s)
Annual Precipitation (inches)	45.89	49.54 – 49.63	50.11 – 51.45
Winter Precipitation (inches)	10.98	11.77 – 12.30	12.52 – 13.69
Spring Precipitation (inches)	11.82	12.79 – 13.45	13.13 – 14.21
Summer Precipitation (inches)	11.27	12.04 – 12.19	12.58 – 11.79
Fall Precipitation (inches)	11.83	12.41 – 12.51	11.60 – 12.02
Annual Days with Precipitation over 1 inch	7.34	8.71 – 9.19	9.05 – 10.64
Annual Days with Precipitation over 2 inches	0.70	0.93 – 1.02	1.03 – 1.10
Annual Days with Precipitation over 4 inches	0.02	0.03	0.02 – 0.04
Annual Consecutive Dry Days	16.21	16.87 – 17.34	16.69 – 17.95

[1] Source: Northeast Climate Science Center, 2018. Massachusetts Climate Change Projections. University of MA Amherst. Published by MA Executive Office of Energy and Environmental Affairs. Available at: http://resilientma.org/data/datamajor-river-basins.

Lancaster Municipal Vulnerability Preparedness (MVP) Program Workshop

EXAMPLES OF STRENGTH AND VULNERABILITIES[1]

INFRASTRUCTURE

Examples of Vulnerabilities:

- Main road floods during storms, blocking emergency response.
- Power outages during heat waves lead to health concerns.
- Wildfire and high winds resulting in supply chain interruptions.
- Sewer pump stations become submerged and inoperable.
- Compromised rail system due to heat-related warping of tracks.

Examples of Strengths:

- Critical road elevated and passable by emergency management
- Hurricane roof installed at school with improved sheltering capacity.
- Hardened utility lines reduce outages due to ice storms.
- Undersized culvert replaced to reduce flooding in key intersection.
- Improvement to communication systems during extreme weather.

SOCIETAL

Examples of Vulnerabilities:

- Senior housing without backup generators during heat waves.
- Residents without access to transportation during hurricane evacuation.
- Household contamination and sewage mobilization during flooding.
- Limited areas of refuge in elementary schools during tornados.

Examples of Strengths:

- Reliable communications protocols across departments for all employees.
- “Neighbor-helping-neighbor” program aligned with emergency operations.
- Well-supported volunteer organizations (fire, ambulance, CERTs).
- Faith-based and civic groups with hazard preparedness plans.

ENVIRONMENTAL

Examples of Vulnerabilities:

- Proliferation of subdivisions in wildfire and flood prone areas.
- Lack of urban tree canopy increasing heat island effect.

Examples of Strengths:

- Forested watersheds maintain drinking water supply during droughts.
- Native, vegetated slopes remain stable after intense 24hr rain events.
- Floodplains provide stormwater storage and downstream flood reduction.

[1] Source: Community Resilience Building Workshop Guide, communityresiliencebuilding.com

IMPROVING COMMUNITIES TOGETHER

Lancaster Municipal Vulnerability Preparedness (MVP) Program Workshop

DEMOGRAPHIC DATA[1]

Parameter	Breakdown
Total Area	28.1 square miles
% of Land Use	Agriculture = 8.5% Forest = 60.5% Open Space = 6.2% Recreation = 0.8% Urban = 22.1% Water = 2.0%
Population	8,052
Age	0-19 = 22% 20-34 = 23% 35-64 = 40% 65+ = 15%
Household Income	<$40,000 = 18% $40,000 - $60,000 = 15% $60,000+ = 68%
% Below Poverty Line	8%
Race	Asian = 2% Black = 6% White = 89% Other = 4%
Ethnicity	Hispanic = 6% Not Hispanic = 94%
Environmental Justice	23.6%
% Population Over 65 Living Alone	2.1%
Asthma Emergency Visits	43.9 (age-adjusted rate per 10,000 people)
Pediatric Asthma Prevalence	9.8% of all children enrolled in grades K-8

[1] Source: MA Dept of Public Health, 2018. MA Environmental Public Health Tracking Community Profile for Lancaster. Report Created on October 3, 2019.

APPENDIX D

- Workshop Matrices and Maps

Town of Lancaster, Massachusetts

Municipal Vulnerability Preparedness Program

Community Resilience Building Workshop Map

N

MCI-Shirley (Minimum)
Souza-Baranowski Correctional Center
Fort Pond Dam
White Dam
Spectacle Pond Dam
Bartlett Pond Dam
Old Turnpike Rd
Lunenburg Rd
Shirley Rd
Shoefelt Rd
Brockelman Rd
Main St
Ponakin Rd
Hilltop Rd
Sterling Rd
Packard St
Old Common Rd
Mill Street Extension
LANCASTER POLICE DEPARTMENT
Mary Rowlandson Elementary School
Luther Burbank Middle School
LANCASTER FIRE DEPARTMENT Headquarters
Trivium School
Dr. Franklin Perkins School
THAYER MEMORIAL LIBRARY
LANCASTER TOWN HALL
Browning Elementary School / South Lancaster Academy
LANCASTER FIRE DEPARTMENT South Station
RFK Lancaster School
Four Ponds Dam
Old Ice Bond Dam
2
70
117
190
62
110

1 0.5 0 1 Miles

BETA

Legend

- High Hazard Dam
- Significant Hazard Dam
- Low Hazard Dam
- Private Dam
- Prisons
- Fire Stations
- Libraries
- Town and City Halls
- Local Police
- State Police
- County Sheriff
- Public School
- Private School
- Charter School
- Special Education School
- Assisted Living Facility
- Nursing Home
- Rest Home
- Community Groundwater Source
- Surface Water Intake
- Non-Community Groundwater Source
- Emergency Surface Water
- Waterbody
- River/ Stream

FEMA National Flood Hazard Layer Flood Zone Designations

- A: 1% Annual Chance of Flooding, no BFE
- AE: 1% Annual Chance of Flooding, with BFE
- AE: Regulatory Floodway
- X: 0.2% Annual Chance of Flooding

Town of Lancaster, Massachusetts

Municipal Vulnerability Preparedness Program

Community Resilience Building Workshop Map

N

MCI-Shirley (Minimum)

Souza-Baranowski Correctional Center

Fort Pond Dam

White Dam

Spectacle Pond Dam

Old Turnpike Rd

Lunenburg Rd

Shirley Rd

Shoefelt Rd

Bartlett Pond Dam removed

Brockelman Rd

Main St

Ponakin Rd

LANCASTER POLICE DEPARTMENT

Mary Rowlandson Elementary School

Luther Burbank Middle School

LANCASTER FIRE DEPARTMENT Headquarters

Dr. Franklin Perkins School

Thayer School

Packard St

THAYER MEMORIAL LIBRARY

LANCASTER TOWN HALL

Hillton Rd

Browning Elementary School / South Lancaster Academy

LANCASTER FIRE DEPARTMENT South Station

Old Common Rd

Mill Street Extension

Sterling Rd

Four Ponds Dam

Old Ice Pond Dam

1 0.5 0 1 Miles

BETA

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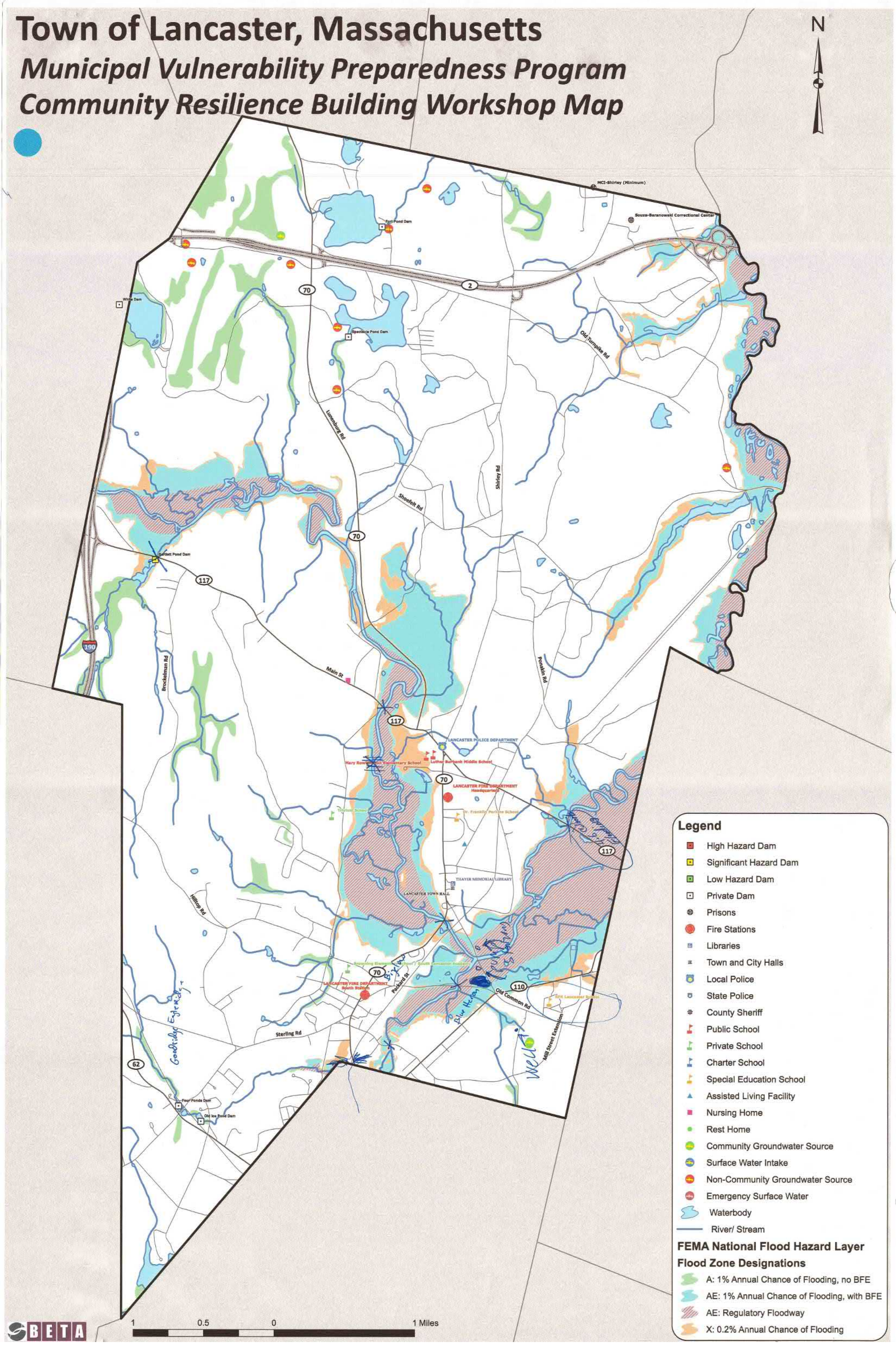

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Features	Location	Ownership	V or S	Inland Flooding	Severe Winter Storms	Invasive Species	Other Severe Weather	Priority H-M-L	Time S Long O
Infrastructural									
Culverts	Multiple	Town	V	Upsize culverts on 117 + 110; Repair Stirling Rd culvert; culvert cleaning program; DOC maintenance w/ ConCom	Upsize culverts on 117 + 110; Repair Stirling Rd culvert; culvert cleaning program; DOC maintenance w/ ConCom		Upsize culverts on 117 + 110; Repair Stirling Rd culvert; culvert cleaning program; DOC maintenance	H	L+O
Bridges	Bolton Flats (117)	Town	V	Replace bridge on 117 @ Bolton line Evaluate condition of bridges townwide			Replace bridge on 117 @ Bolton line; Evaluate condition of bridges townwide	M	L
Pump Stations (sewer)	Center Bridge Road	Town	V	Evaluation of pump stations w/ options to fortify against flooding			Evaluate pump stations w/ options to fortify against flooding	M	S
Highway Department	Center Bridge Road	Town	V+S	Feasibility study to relocate; Develop options for reuse of highway facility; raise salt out of flood zone	→		Feasibility study to relocate, develop options for reuse, raise salt out of flood zone	M	L+S
Major Roads (117 & 70)	117 + 70	Town	V	Raise 117; drainage improv. on South Main; Evaluate drainage town-wide; update zoning & stormwater bylaws; install perm. signage advising of flooding	→		→	H	L+S
Wells	Bolton Station	Town	V+S	Relocate salt shed	Purchase generators; Study to evaluate adequacy of water system for future development		Purchase generators; study to evaluate adequacy of water system for future development	M/L	L
Societal									
Low income population	South Lancaster	N/A	V	Targeted study to alleviate flooding impacts; translation services; increase outreach	→	→	→	H	S
Elderly population	Multiple	N/A	V	Provide transportation; targeted study to alleviate flooding; provide targeted info on evacuation	→	→	→	H	S
Code Red	town-wide	Lancaster Fire	S	Maintain + upgrade as needed; Provide information to residents on availability		→	→	M	O
Shelter Facility	None	N/A	V	Study to find location for shelter; communicate w/ neighboring towns for short-term shelter available options; generator for senior center		→	→	H	S
Town Communications	town-wide	Town	S	Backup generator for town hall; increase communication prior + during hazard events; upgrade highway radio		→	→	H	S
Evacuation Plan	town-wide	Town	V+S	Create emergency management committee on Town website; post signage on roads; post route broadcast route on local cable; maintain + upgrade as needed		→	→	H/M	S
Environmental									
Nashua River	town-wide	State	V+S	Update zoning bylaw for purchase land along river for river improvements	building in flood plains; flood storage; study to determine locations to primarily reduce flooding through	→	→	M/L	L
Town Forest + Open Space	multiple	Town	V+S	Maintain open space; review open space plan + update as needed; secure funding to purchase additional open space		evaluate condition of trees + susceptibility to more spaces; develop program to combat invasive species	Annual brush clearing program	L	L+O
Still River	town-wide	State	V+S	→		→	→	M/L	L
Brooks + Ponds	multiple	Town	V+S			Evaluate health of ponds + brooks; develop weed maintenance program for White's Pond		L	L
Wetlands	multiple	Town/ Private	V+S	Maintain; review + update wetlands bylaw as necessary; investigate mosquito control options		→	→	M	S+O
Drinking Water Protection Area	Bolton Station	Town	V+S	Relocate salt shed out of flood plain; maintain use restrictions; review + update well bylaw as necessary		→	→	M	O

Community Resilience Building Risk Matrix

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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	Inland Flooding	Severe Winter Storms	Invasive Species	Other Severe Weather	Priority H-M-L	Time S L O
Infrastructural									
⑤★ Wells & Storage tanks	Bolton Station (wells) Tanks Winter	Town	V (wells) S (tanks)	—	Tanks → assess runoff from tank site to maintain integrity of site Upgrade back-up generators (both)			M	O
117 Bridge over Nashua & culvert	117	Town	V	Design Bridge to accomodate drainage for current & future storm forecast & traffic loads			Annual Inspection	M	S
①★ Culverts throughout town undersized and/or in bad shape	townwide	Town	V	•Conduct townwide culvert mapping & assessment, •Purse grants & funding for culvert upgrades •conduct preventative maintenance - increase staff •Prepare Plans				H	S & O
★ Long-term Emergency Shelter	NONE	None at this time	V		Feasibility Study to explore) regional & local shelter opportunities & plans (both)			H	L
Railroad crossings	Multiple	Private	V	•Improve communications & understandings of protocals with rail companies				M	O
⑥★ Municipal Bldgs	Multiple	Town	V & S		•evaluate needs for upgrades & additional generators		•ensure bldgs can function as winter & summer shelters	H	S
Societal									
Regional Emergency Communications Center	Devens	Regional, Fed, US Army	S		•Consistent evaluation of centers to ensure needs are met (both) •Review Devens MJP for areas of collaboration			L	O
River Terrace	Main St	Private	V		•ensure reliable power source is available (both)			L	O
②★ Housing Authority (elderly & low income)	Main St	Commonwealth	V		•ensure reliable power source is available (both)			H	S, O
★ Schools	various	Public & Private	V		•assess whether schools (with backup power) can be used as emergency shelter			H	S
Agricultural Properties	various	Private	S & V			•Management Plan	•Asses ability to deal with vulnerabilities/liabilities on these properties (i.e. hydrant availability)	L	S
Environmental									
Conservation area adjacent to 70	between 70 & Nashua River	Multiple Town, Fed gov, Priv. non-profit	S	•evaluate erosion potential •identify additional land to expand				L	L, O
Town Forest	off Brockton Rd	Town	S		•Update Forest management Plan → Include IS in scope of Plan updates			M	O
Open Space	throughout town		V, S	•Strategic application of the open space plan in aquisition of priority parcels •coordinate with Fish & Wildlife and Mass Dept Fish & Game to protect critical habitat areas				L	L, O

continued ⑤

Appendix D: Compiled Ranking Matrix

Community Resilience Building Risk Matrix

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

V = Vulnerability S = Strength

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

Features	Location	Ownership	V or S	Inland Flooding	Severe Winter Storms	Other Severe Weather	Invasive Species	Priority H - M - L	Time Short Long Ongoin
Infrastructural									
Culverts	Multiple	Town	V	Upsize culverts on Rt 117 & Rt 110; Repair Sterling Rd. culvert; Culvert cleaning program; OOC maintenance w Conservation Commission				H	L & O
Bridges	Bolton Flats (Rt 117)	Town	V	Replace bridge on Rt 117 @ Bolton Line; Evaluate condition of bridges town-wide				M	L
Pump Stations (sewer)	Center Bridge Road	Town	V	Evaluation of pump stations with options to fortifying against flooding				M	S
Highway Department	Center Bridge Road	Town	V & S	Feasibility study to relocate; Develop options for reuse of highway facility; raise salt out of flood zone				M	S & L
Major Roads (Rt 117 & Rt 70)	Rt 117 & Rt 70	Town	V	Raise Rt 117; drainage improvements on South Main; Evaluate drainage town-wide; update zoning & stormwater bylaws; install permanent signage advising of flooding				H	S & L
Wells	Bolton Station	Town	V & S	Relocate salt shed out of flood plain; maintain use restrictions; Review & update well bylaw as necessary	Purchase generators; Study to evaluate adequacy of water system for future development			M/L	L
			V					M	O
[Water] Storage tanks	Bolton Station Tanks Windsor	Town	S		Tanks assess runoff from tank site to maintain integrity off site; upgrade back-up generators			M	O
Rt 117 Bridge over Nashua & culvert	Route 117	Town	V	Design Bridge to accommodate drainage for current & future storm forecast & traffic loads		Annual Inspection		M	S
Culverts throughout town undersized and/or in bad shape	Town-wide	Town	V	Conduct town-wide culvert mapping & assessment; Pursue grants & funding for culvert upgrades; Conduct preventative maintenance - increase staff; Beaver Plan				H	S & O
Long-Term Emergency Shelter	None	None at this time	V		Feasibility study to explore regional & local shelter opportunities & plans			H	L
Railroad Crossings	Multiple	Private	V	Improve communications & understanding of protocals with rail companies				M	O
Municipal Buildings	Multiple	Town	V & S		Evaluate needs for upgrades & additional generators	Ensure buildings can function as winter & summer shelters		H	S
Societal									
Low Income Population	South Lancaster	N/A	V	Targeted study to alleviate flooding impacts; translation services; increase outreach				H	S
Elderly Population	Multiple	N/A	V	Provide transportation; targeted study to alleviate flooding; provide targeted info on evacuation		Provide transportation; targeted study to alleviate flooding; provide targeted info on evacuation		H	S
Code Red	Town-Wide	Lancaster Fire	S	Maintain and upgrade as needed; Provide information to residents on availability				M	O
Shelter Facility	None	N/A	V	Study to find location for shelter; communicate with neighboring towns for short-term shelter available options; generator for senior center				H	S
Town Communications	Town-Wide	Town	S	Backup generator for town hall; increase communication prior & during hazard events; upgrade highway radio				H	S
Evacuation Plan	Town-Wide	Town	V & S	Create emergency management committee; post signage on roads; post route on town website; broadcast route on local cable; maintain and upgrade as needed				H/M	S
Regional Emergency Communications Center	Devens	Regional, Federal & US Army	S		Consistent evaluation of center to ensure needs are met; Review Devens MVP for areas of collaberation			L	O
River Terrace	Main St	Private	V		Ensure reliable power source is available			L	O
Housing Authority (elderly & low income)	Main St	Commonwealth	V		Ensure reliable power source is available			H	S & O
Schools	Various	Public & Private	V		Assess whether schools (middle & elementary) can be used as emergency shelter			H	S
Agricultural Properties	Various	Private	V & S			Assess ability to deal with vulnerabilities on these properties (i.e. hydrant availability)	Management Plan	L	S
Environmental									
Nashua River	Town- wide	State	V & S	Update zoning bylaw for building in flood plains; Purchase land along river for flood storage; Study to determine location to potentially reduce flooding through river improvements				M/L	L
Town Forest & Open Space	Multiple	Town	V & S	Maintain open space; Review open space plan & update as needed; Secure funding to purchase additional open space		Maintain open space; Review open space plan & update as needed; Secure funding to purchase additional open space; Annual brush cleaning programs	Evaluate condition of trees and susceptible to invasive species; develop program to combat invasive species	L	L & O
Still River	Town- wide	State	V & S	Update zoning bylaw for building in flood plains; Purchase land along river for flood storage; Study to determine location to potentially reduce flooding through river improvements				M/L	L & O
Brooks & Ponds	Multiple	Town	V & S				Evaluate health of ponds & brooks; develop weed maintenance program for White's Pond	L	L & O
Wetlands	Multiple	Town/ Private	V & S	Maintain , review and update wetlands bylaw as necessary; Investigate mosquito control options		Maintain , review and update wetlands bylaw as necessary; Investigate mosquito control options		M	S & O
Drinking Water Protection Area	Bolton Station	Town	V & S	Relocate salt shed out of flood plain; maintain use restrictions; Review & update well bylaw as necessary				M	O
Conservation area adjacent to Rt 70	Between Rt 70 & Nashua River	Multiple	S	Evaluate erosion potential; Identify additional land to expand				L	L & O
Town Forest	Off Brookline Rd	Town	S		Update forest management plan		Update forest management plan; Include invasive species in scope of plan updates	M	O
Open Space	Town- wide		V & S	Strategic application of the open space plan in acquisition of priority parcels; Coordinate with Fish & Wildlife & Mass Department of Fish & Game to protect critical habitat areas				L	L & O

APPENDIX E

- **Top Priority Voting Results**

Inland flooding

Severe winter storms

Drought

Invasive species

Inland flooding

Severe winter storms

Tornadoes

Hurricanes/Tropical Storms

Inland flooding

Severe winter storms

Invasive Species

Other severe weather

- Repair Stirling Rd culvert
- Develop general maintenace OOC w/ ConCom
- Drainage improvements on S. Main St
- Increase outreach to low income + elderly populations
- Find location in town to serve as shelter + install generator as necessary
- Backup generator for town hall
- Upgrade highway radio

- Culverts - townwide mapping + assessments
  - funds to repair
  - beaver plan
  - maintenance/staffing increase

Municipal Buildings - generator evaluate
  - Capability as winter Shelter/ Summer cooling stations

Housing Authority - reliable power

Long term Shelter/schools - assess schools as shelters
  long term feasibility study shelter options

Wells/storage tanks - Assess runoff @ tanks
  upgrade backup power supply

- Feasibility study to find location for shelter facility in town
- Assessment + replacement of culverts town wide
- Maintenance program for culverts + securing funds for increased staffing
- Elderly + disabled outreach + emergency action plan
- Evaluate generators at all Municipal Buildings + Facilities
- Raise 117 w/ cross drains