Lakeville, MA

Municipal Vulnerability Preparedness (MVP) and Community Resilience Building (CRB) Workshop Summary of Findings

March 2019

Submitted by:

Resilient Taunton Watershed Network (RTWN)

SRPEDD

The Nature Conservancy

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Overview

Lakeville is a town of approximately 11,400 residents located in southeastern Massachusetts' Plymouth County. Located 40 miles south of Boston and 30 miles east of Providence, RI, the majority of Lakeville is located within the Taunton River Watershed. Its location has played a role in the significant expansion of its transportation infrastructure over the last 50 years. Interstate Route 495, together with a dense network of state highways and the MBTA commuter rail, make Lakeville easily accessible to all of southeastern Massachusetts, Boston and Cape Cod.

For decades Lakeville has consistently been among the fastest growing towns in the region. Between 1970 and 2000, Lakeville's population increased by 124%, compared to Plymouth County's 90%, the Southeast Regional Planning and Economic Development District's regional community average of 25%, and the state's 12%. This population increase has been accompanied by an increase in development: over 400 acres of land were developed between 1999 and 2005, including the 200+ acre Le Baron Estates, 100+ acre Woodland Ridge, and new apartment complexes adjacent to the town's train station.

Over 3,417 acres in Lakeville are protected by Conservation Restrictions, supporting the preservation of Lakeville's rural character. Lakeville's natural resources and landscapes are among its most important assets and provide clean drinking water and flood control, among other ecosystem services. These include the Assawompset Pond Complex - one of the most productive Bald Eagle nesting sites in the state - along with large blocks of intact woodland, farms, fields, and cranberry bogs. Lakeville's rural character is increasingly rare for the region, and residents have expressed strong support for careful growth management to ensure preservation of this character and of natural resources.

Lakeville is especially rich in water resources. Assawompset Pond is the largest natural freshwater lake in Massachusetts, and the Assawompset Pond Complex serves as the public water supply for New Bedford and Taunton. Despite their location within Lakeville, the Town had not been permitted by the state to withdraw surface water from the Ponds until 2002, when they became eligible to withdraw one million gallons per day from New Bedford's water allotment. Lakeville's water supply comes primarily from individual or small community groundwater wells. Strong water resource protection is therefore critical for ensuring a safe and affordable water supply for Lakeville and the surrounding region.

Past **flooding** in Lakeville's shorefront communities has created concerns about dense development with inadequate septic management, and about water level control in local ponds. These concerns led to plans for hydrology studies of the ponds and of the Nemasket River, which town officials hope will lead to better septic management of rebuilt properties, scientifically sound safe-yields for water withdrawals, and stormwater management

strategies that include preservation of natural vegetated buffers and protection of remaining open space adjacent to water resources.

Facilitator Ariel Maiorano (Mass Audubon) explains workshop strengths and vulnerabilities identification process to attendees

Another important hazard that Lakeville has identified is **severe storms**, and the high winds that they bring. Despite increasing development, Lakeville's landscape is still dominated by forests, and increasingly severe storms in combination with an exacerbated flood/**drought** cycle have led to concerns around tree fall and fire hazard management. Further, invasive insects have impacted forest health in the region, leading to increased risk of tree fall and resulting impacts to roadways and power lines. However, workshop participants also felt it was important to recognize the ways in which the town's abundant forests act as a strength in the face of climate change, providing many benefits including air filtration, wind breaking, water absorption, and mitigation of **extreme temperatures** that are increasingly impacting local public and environmental health, and further exacerbating existing fire hazards.

To support the community in considering and prioritizing actions to improve its climate resilience, the Town of Lakeville applied for and received a grant from the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) to become a Designated Municipal Vulnerability Preparedness (MVP) Community. Core members of the Resilient Taunton Watershed Network (RTWN) were tasked with coordinating the workshop, specifically the Southeast Regional Planning and Economic Development District (SRPEDD), who acted as Lakeville's Certified MVP Provider. Staff from The Nature Conservancy, Manomet, and Mass Audubon supported the Community Resilience Building (CRB) workshop process as Certified MVP Providers and members of RTWN. These planning workshops took place on two consecutive Wednesdays, March 20 and 27, 2019 at the Lakeville Public Library.

Stakeholders from Lakeville were present as workshop participants, including representatives from many of Lakeville's municipal boards and departments. Also in attendance were

representatives from the Lakeville Public Library, the Middleborough Gas and Electric Department, local businesses, state agencies, and more (see p. 15 for a full listing). Attendees were divided into two distinct groups that remained consistent in both workshops. Each group identified features in Lakeville visually with a map (Appendix A), and verbally on a matrix (Appendix B). Each feature was related to hazards that the town is concerned about and participants determined whether a particular feature was considered vulnerable to those hazards or a strength that helps Lakeville mitigate them. Each item listed on a group's matrix was numbered, and corresponded to a numbered dot they placed on their map. Three colors used on the map visually represent the different feature categories of infrastructural (red), environmental (green), and societal (blue).

Through facilitated discussion, workshop attendees:

- Defined top local natural and climate-related hazards of concern;
- Identified existing and future strengths and vulnerabilities;
- Developed prioritized actions for the community;
- Identified immediate opportunities to collaboratively advance actions to increase resilience

Three striking themes that emerged from the discussion included the need for **Integrated Water Resources Management**, complemented by **Infrastructure Assessments and Culvert Replacement** to improve flood resiliency, and the importance of cultivating **Strong Communications Networks and Protocols** to ensure that critical emergency management procedures and resiliency-relevant messages are delivered efficiently and reach all populations in Lakeville, especially the most vulnerable ones. Specifically, workshop participants cited improved communications around emergency evacuation routes/procedures, and proper well and septic management, as important topics for all residents, but particularly newcomers to town. Awareness-raising around public health risks associated with mosquito spraying and vector-borne illness were also seen as critically important for enhancing local resiliency.

Top Hazards and Vulnerable Areas

Participants discussed past impacts from natural hazards that they have experienced, and came to consensus on the top four concerns to their community, which were identified as:

- Flooding
- Extreme storms/winds
- Extreme temperatures
- Drought/fire

Flooding is a primary concern in Lakeville because of the town's abundant water resources and recent experience with intense flooding, particularly along the Nemasket River, in 2010. During strong storm events (see below), flooding can cut off access to major thoroughfares, damage shorefront property (of which there is also an abundance in Lakeville), and contribute to concerns around water quality. Many shoreline property owners have experienced repeated damages and losses due to flooding, which will become an even greater risk as the impacts of climate change are increasingly felt.

Workshop participants identify geographic locations of infrastructural, environmental, and societal features relevant to resilience in Lakeville

Extreme storms/winds are a key concern because of the many, interconnected impacts they have in Lakeville. As noted above, during strong storm events, flooding can cut off access to major thoroughfares, and trees frequently fall, further limiting road access for residents and emergency personnel. High winds also threaten existing power infrastructure, and most electric power infrastructure is located above ground in Lakeville. Additionally, Lakeville residents rely on private well pumps and septic systems for drinking water and sanitation, meaning that prolonged power outages can create issues around access to clean drinking water, both in the immediate and longer term if septic systems are impacted.

Extreme temperatures present real risks to public and environmental health in Lakeville, and often coincide with other hazards such as extreme storms and winds during colder months (see above), and drought and fire in warmer months (see below). Furthermore, warmer temperatures overall contribute to proliferating tick and mosquito populations, presenting additional risks to public health. Reaching vulnerable populations with critical information and services during extreme temperature situations is a challenge that workshop participants pointed to as critical to more equitable vulnerability preparedness in Lakeville.

Drought/fire are priority hazards to be mitigated in Lakeville because of the increased risk of wildfire due to forest health impacts from drought, as well as invasive insects and other forest stressors that have resulted in more tree death and consequently more fodder for forest fires. Drought is also a major concern when it comes to fire suppression, as hydrants are relatively limited in town, and droughts can further reduce local capacity to respond to fire. Drought also directly impacts residential water supply, since most Lakeville residents are reliant on private wells, and has the potential to impact nearby municipalities that rely on the Assawompset Pond Complex for drinking water, including the cities of New Bedford and Taunton.

Town Coordinator and MVP Core Team member Lorraine Carboni welcomes CRB workshop participants to the Lakeville Public Library, March 20, 2019

Areas of Concern

Several locations in town were identified as important strengths or notable vulnerabilities, and some, because of their complex nature, were considered to be both strengths *and* vulnerabilities. The top four natural hazards identified by Lakeville workshop attendees were **flooding**, **strong storms/winds**, **extreme temperatures**, and **drought/fire**. Prioritization (high, medium, low) and time anticipated to complete each action is indicated in the digitized matrices (*Appendix C*).

Infrastructural concerns centered around water resource management and power line infrastructure. Lakeville's many shorefront communities face particular vulnerabilities due to limited access via narrow, privately-owned dirt roads that are subject to routine flooding. Newer, denser developments, including the Riverside Commercial Drive property, were also concerns due to limited access and the presence of vulnerable populations. Issues with undersized culverts contributing to localized flooding were particularly prominent during discussion. Power outages have become more frequent and sometimes last for days, and response times from area utility providers are highly variable. Stronger storms combined with above-ground power lines have led to more downed trees, further contributing to this issue.

Undersized Culverts and Flooding

Numerous culverts were specifically identified as problematic features in town. Undersized culverts along Taunton Street, Cross Street, Pickens Street, Route 19, Snake River, Route 105, County Road, and Pierce Avenue were also mentioned by name. The Route 105 culvert was identified as a top priority since nearby roadway elevation is very low, and when this road floods, it cuts off one side of town from the other. Regulating levels in the Assawompset Pond Complex was seen as a need into the future, to protect drinking water supply and shorefront property, which has experienced significant flooding and resulting damages in recent years.

Roadways and Power Lines

Power infrastructure in Lakeville is vulnerable to stronger storms and winds, due to their direct impacts and their relationship to increased tree fall. Most power infrastructure in Lakeville is located above ground and along major roadways, increasing risks associated with downed power lines during emergencies, when residents may also be trying to evacuate. Roadways within shorefront neighborhoods were brought up as major concerns because many are narrow, privately-owned and maintained dirt roads, which presents potential limitations for emergency vehicle access. The Fire and Police Departments in Lakeville do own boats that can help reach these residents in cases of flooding, though not all shorefront properties are easily accessible by boat, either.

Environmental concerns centered around water quality and quantity management in relation to potential sources of contamination (snow storage, improperly maintained septic systems, invasive plants, silting and stormwater runoff) and flood risks, especially along the Nemasket River and around the Ponds. Existing hazards related to tree death and tree fall, as well as future climate-related risks to overall forest health, were secondary concerns that came up frequently during discussion.

Water Resources Management

The Assawompset Pond Complex was a central topic of discussion when it comes to Lakeville's local resilience. Land use along the shoreline of the Ponds has changed significantly in recent decades, transitioning from recreational hunting lodges to year-round residential properties, with accompanying concerns around flooding and water quality management. The Nemasket River has also been a major local concern, particularly since 2010, when shorefront properties were devastated by severe flooding following sustained torrential rainfall. Several dams and culverts along the river further contribute to regular flooding concerns. Both the Pond Complex and the Nemasket face additional challenges due to silting, invasive vegetation, and water quality impacts from failing septic systems and stormwater runoff. Opportunities exist to address these multiple concerns simultaneously through integrated restoration and management planning, discussed further below (see "Top Recommendations to Improve Resilience," p. 12-14).

Tree Health and Forestry Management

Lakeville's forests were viewed by workshop participants as both a strength, providing numerous ecosystem services such as flood mitigation, air purification, habitat, shade and cooling, but also as vulnerabilities. Impacts from invasive insects, an exacerbated flood-drought cycle, and overall extreme temperatures have led to increased tree death and tree fall, creating concerns for public safety related to power outages. Not only does tree fall frequently result in downed power lines, it can also result in blocked access for emergency services, putting vulnerable populations who do not have backup generators at even greater risk from identified hazards, particularly extreme temperatures. A proactive approach to regional forestry management was a recurring theme throughout group discussion, and is elaborated upon below (see "Top Recommendations to Improve Resilience," p. 12-14).

Snow Removal and Storage

Snow removal and storage were brought up in relation to extreme storms and potential water quality impacts. Because snow is considered a contamination risk due to contact

with road salts, there are strict limitations on potential storage locations in order to protect Lakeville's water resources and agricultural lands. Under conditions of extreme snowfall, storage has already been an issue in town, sometimes requiring that snow be pushed into local forests because there was nowhere else suitable to put it. Planning for appropriate snow removal and storage in light of anticipated extremes will enable Lakeville to be ready when extreme storms hit.

Societal vulnerabilities identified included specific vulnerable communities, risks to public health from environmental contamination and vector-borne illness, and the impacts of rapid population growth in town. Between 1980 and 2000, Lakeville's population grew by 26%, after the construction of the Lakeville T-Station brought an influx of new residents seeking affordable housing on a transit line. As new homeowners navigate their new rural lifestyle, concerns about proper well and septic maintenance have also arisen, and a need for improved outreach and support for new residents on these topics was identified.

Vulnerable Populations

Lakeville is home to many diverse populations, including several private over-55 communities, low-income communities, and school-aged children. Several of these populations are concentrated in locations where emergency access may be limited due to localized flooding and inadequate roadways, including Riverside Drive/Commercial Drive, and Cicero Road at Blueberry Road. The Council on Aging retains a list of vulnerable seniors in town, especially those reliant on life support, so that they can be prioritized during emergency situations, but emergency vehicle access is still a critical issue that needs to be addressed.

Public Health Risks

Several cases of eastern equine encephalitis have occurred in Lakeville in recent years, some of them fatal, and concerns were raised during discussion about communicating public health risks associated with increased vector populations (particularly mosquitos) to those who are most vulnerable. In addition to vector-borne illness, increased mosquito spraying can have negative health consequences, and workshop participants expressed concerns here as well. Finally, potential for both ground and surface water contamination from improper septic management and stormwater runoff containing silt and sediment from roadways were noted as potential risks to public health in Lakeville.

Current Strengths and Assets

Lakeville is well acquainted with the many strengths it leverages to manage the risk that natural hazards pose. Supporting and enhancing existing strengths and assets into the future will complement strategies identified to address current vulnerabilities, further helping to build local resilience. The following strengths and assets were identified as essential for adapting to the impacts of **flooding**, **extreme storms/winds**, **extreme temperatures**, and **drought/fire**.

Workshop participants discuss local strengths and vulnerabilities, marking geographic locations on a map.

Infrastructural Strengths

- The flood remediation project on Highland Road at Shaw Park was given as a successful example of local hazard mitigation. This project involved elevating the roadway and installing a culvert.
- Local Emergency Planning Committees for all Assawompset Pond communities (users and hosts) were seen as an important regional strength. Updating the Pond Complex Management Plan to include climate change resilience considerations will further contribute to resilience for all Pond communities.
- Middleborough Gas and Electric District, one of three local utility providers, was seen as particularly responsive within the community, especially after outages. This was seen as a strength.
- The Lakeville Commuter Rail T-Station was noted as a strength in town, giving Lakeville residents more sustainable transportation options as well as evacuation options during emergencies.
- The Howland Road school campus was perceived as an important strength, since the school buildings act as emergency shelters. They are located at higher elevation and

so are resilient to flooding, and there is a backup generator on site. Making shelters pet-friendly can help increase the number of residents who make use of them.

Environmental Strengths

- Protected open space in Lakeville was seen as a strength:
    - Cedar Swamp, a property protected by Mass Audubon, offers water retention and filtration, and can absorb additional floodwaters.
    - Betty's Neck, a town-owned park, was also noted as a beneficial recreational amenity and flood storage resource.
- Similarly, unprotected open spaces were seen as strengths, though concerns about future development were also expressed. These included:
    - Cranberry bogs, occupying 10-15% of local land area, provide flood storage and filtration.
    - Four golf courses in town provide some ecosystem service benefits in addition to recreational amenities, but these were seen as particularly vulnerable to future development.
- The Assawompset Pond Complex was viewed as both a strength and a vulnerability in the face of climate change, but in terms of strengths, it provides high-quality drinking water supply to many local municipalities, and is protected as such.
- Despite their frequent appearing during discussion of hazards and vulnerabilities, workshop participants also felt it important to acknowledge the many benefits provided by Lakeville's ubiquitous trees and forests, including air purification, cooling, and flood mitigation.

Societal Strengths

- Emergency response systems were seen as current strengths, including ongoing upgrades to radio and telecommunications infrastructure, in conjunction with the construction of the new police station in the center of town.
- The Lakeville Board of Health was seen as a real strength in the community, particularly due to its ongoing emergency response preparedness and training activities.

A complete list of strengths and assets can be found in *Appendix C* in the digitized feature matrices.

Top Recommendations to Improve Resilience

Two days' worth of discussion was whittled down into three thematic priorities that workshop participants agreed were urgent for Lakeville's resilience. Once actions were generated related to the list of strengths and vulnerabilities, all attendees came together to share their actions and discuss emergent themes. Facilitators then led the group in a voting exercise whereby each participant allocated three votes to their top priorities, and the three priorities with the highest number of total votes were identified. Additional discussion followed to ensure that the top priorities were consistent with overall workshop themes and small group conversations.

Facilitator Sara Burns (The Nature Conservancy) describes an example of Low-Impact Development (a category of Nature-Based Solutions) using bioretention located at Bridgewater State University.

Participants were encouraged to consider action items that mitigated hazards through strengthening natural systems and processes, to complement technological or built fixes. An action that limits damage of natural hazards through conserving existing lands, integrating benefits of nature where they are critically needed (i.e. flood storage, water quality improvement) into ongoing construction, or restoring an ecosystem where it has been disrupted is referred to as a **Nature-based solution**. Nature-based solutions (NBS) are a category of emerging strategies in climate adaptation and their exploration is of interest to the Commonwealth of Massachusetts as a national leader in comprehensive hazard mitigation planning. Effective implementation of NBS means designing a community whose built infrastructure is reinforced by its natural environment and vice versa.

The workshops' three emergent themes centered around stewardship of Lakeville's water resources, including **integrated water resources planning** for the Assawompset Pond Complex and Nemasket River, town-wide **infrastructure (culvert, dam and power line) assessment** and priority removal or replacement, and **communications best practices** to ensure that all Lakeville residents are prepared for emergencies and informed about local hazards, emergency infrastructure, and resources for resilience.

Nemasket River & Assawompset Pond Complex Stewardship

Integrated Water Resources Management Planning

- Develop and implement a Nemasket River Restoration Plan to address issues of silting, invasive species, water quality, dams and herring passage.
- Apply for Priority Project status with the Division of Ecological Restoration to remove/replace dams and culverts along the river.
- Conduct a feasibility study to assess invasive species removal in the Pond Complex and Nemasket River.
- Request a boat-washing station for Long Pond from the Department of Conservation and Recreation, to reduce spread of invasives througout Lakeville's waterways.
- Daylight Squam Brook, a former emergency outfall of Long Pond that is no longer in use.

Town-Wide Infrastructure Assessment & Priority Replacement

Flood Resilience and Emergency Response

- Conduct a town-wide assessment of all culverts, prioritizing right-sizing and replacement in locations where flooding is already a serious issue.
- Specific culverts noted include: Taunton Street (Poquoy Brook), Cross Street, Pickens Street, Route 18, Snake River, Route 105, Pierce Avenue at Bittersweet Road, and County Road by the Eagles.
- Consider strategic property acquisition for flood storage in order to mitigate flood-related property damages and emergency risks, particularly to shoreline properties.
- Conduct a town-wide fire vulnerability assessment, and consider siting a new substation near Howland Street school campus to increase area resilience.
- Support capital planning for improved telecommunications infrastructure, particularly around radio and cellular service to school campus.
- Consider Low-Impact Development approaches to stormwater management for flood resilience and water quality.

Power Lines and Forestry Management

- Implement proactive removal of hazardous trees in coordination with the Taunton Municipal Light Plan, Eversource, and Middleborough Gas and Electric District.

- Underground power lines wherever feasible, prioritizing strategically where elevated risks currently exist, and acting opportunistically in conjunction with ongoing road reconstruction work.
- Consider adoption of a Regional Forestry Management Plan, in light of multiple large landowners whose properties abut critical power infrastructure (e.g. WaterWorks, Town of Rochester, City of New Bedford).

Communications Processes & Protocols

Emergency Communications Practices

- Increase coordination with Eversource to expedite power restoration after outage events – currently, residents served by Eversource experience longer delays than residents served by other local utilities (Middleborough Gas & Electric District, Taunton Municipal Light Plant).
- Improve communications processes & protocols between Local Emergency Planning Committees for all Assawompset Pond Complex communities (hosts and recipients). This can include:
    - Regional hazard vulnerability and emergency management plans
    - Discussion of water rights and access during drought and other emergencies
    - Collaborative preparation for predicted weather impacts

Public Education and Outreach

- Improve local digital communications capabilities to keep all residents informed about local concerns and events.
- Improve evacuation route signage and communicate relevant evacuation routes to all residents based on location in town.
- Improve public education and outreach around mosquito spraying and vector-borne illness risks to public health, especially for vulnerable (elderly and school-aged) populations.
- Improve public education and outreach around proper well and septic maintenance, especially for new residents in town.

In making these recommendations, this cohort generated an array of potential actions that related back to the identified top priority hazards and how they impact Lakeville's infrastructure, environment, and society. A complete list of actions generated by the groups, along with their prioritization (high, medium, low) and time-frame (short-term, long-term, or ongoing) can be found in *Appendix B*.

CRB Workshop Participants

Name	**Affiliation**
Lorraine Carboni	Lakeville Town Coordinator
Richard Velez	Lakeville Energy Advisory Committee
Cindy Velez	Lakeville Energy Advisory Committee
William Purcell	Lakeville Fire Department
Kelly Howley	Lakeville Council on Aging
Nancy Yeatts	Assawompset Pond Complex
Robert Bouchard	Lakeville Conservation Commission
Matthew J. Perkins	Lakeville Police Department
Franklin Moniz	Lakeville Highway Department
Jennie Arruda	Office of Senator Michael Rodrigues
Tom Parenteau	Cold Storage Solution
Jayme Viveiros	Lakeville Public Library
Nancy A. Johnson LaFave	Lakeville Historical Commission / Public Library
Normal Orrall	State Representative
Sandy Richter	Middleborough Gas and Electric Department
Rita A. Garbitt	Lakeville Town Administrator
Nathan P. Darling	Lakeville Building Commissioner
Kevin Bernardo	Lakeville Board of Health
Lia Fabian	Lakeville Board of Assessors

Citation

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Acknowledgements

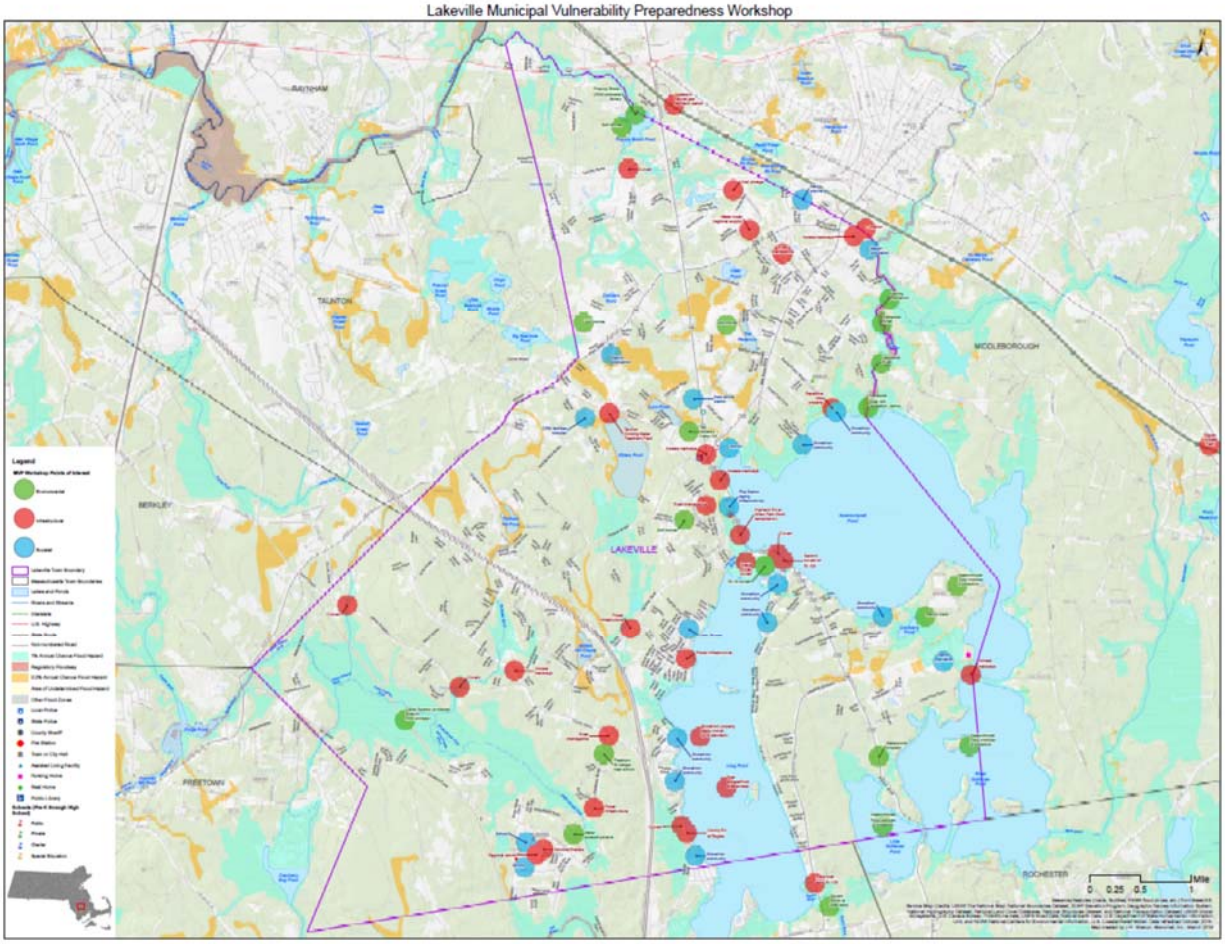
The Lakeville Core Team and Facilitation Team would like to thank the following for their contributions to the MVP Workshop process: the Commonwealth of Massachusetts, EEA, Municipal Vulnerability Preparedness Program for their funding support for these workshops, and; all of those who participated in the workshops and contributed to the plan resulting from these workshops.

Appendices *show different methods of recording the same vulnerabilities and strengths named by workshop participants through mapping and prioritized lists. Small groups recorded infrastructural, environmental, and societal features in Lakeville and which hazard(s) they relate to. Each feature category (infrastructure, environment, society) was documented on a separate matrix (see Appendix B complete lists). On these short lists, or matrices, action items were identified corresponding to each feature that was named. Each action was then assigned a high, medium, or low priority value and expected short-term, long-term, or ongoing time frame to complete. Completed matrices were then digitized and are found in Appendix C.*

To account for spatial relationships between features, participants simultaneously placed points on a map that corresponded to items they named on the different matrices. Infrastructural features are indicated with a red point, environmental with a green point, and societal with a blue point. Items on the map are also labeled for what they represent from the written list, but do not represent prioritization or associated action(s).

Appendix A: Strengths and Vulnerabilities Map

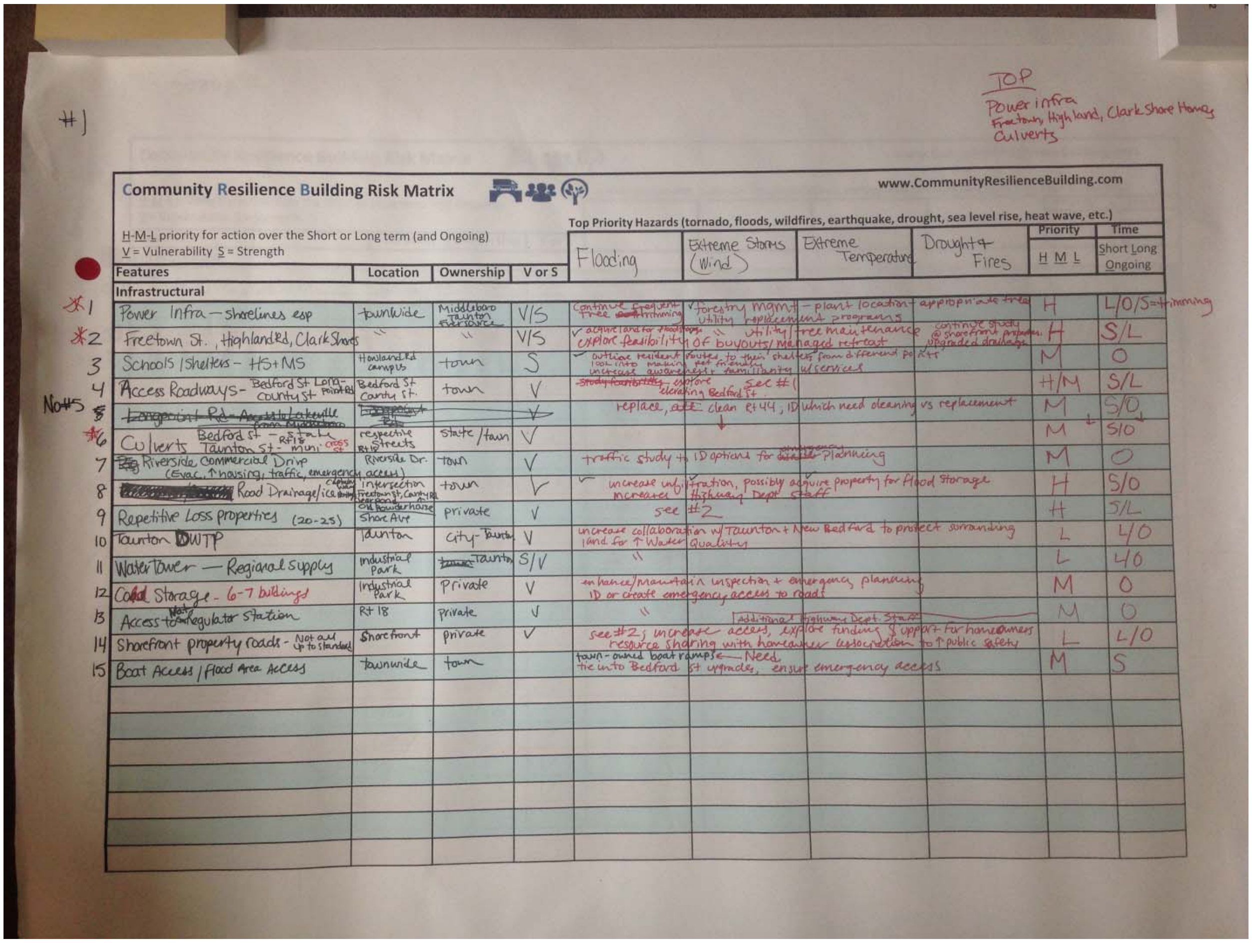
Map of Lakeville. Red dots indicate infrastructural features, green dots indicate environmental features, and blue dots indicate societal features. This map combines points identified by both small working groups.



Appendix B: Original Risk Matrices

Group 1

Infrastructural



#1

TOP
Power infra
Freetown, Highland, Clark Shore Homes
Culverts

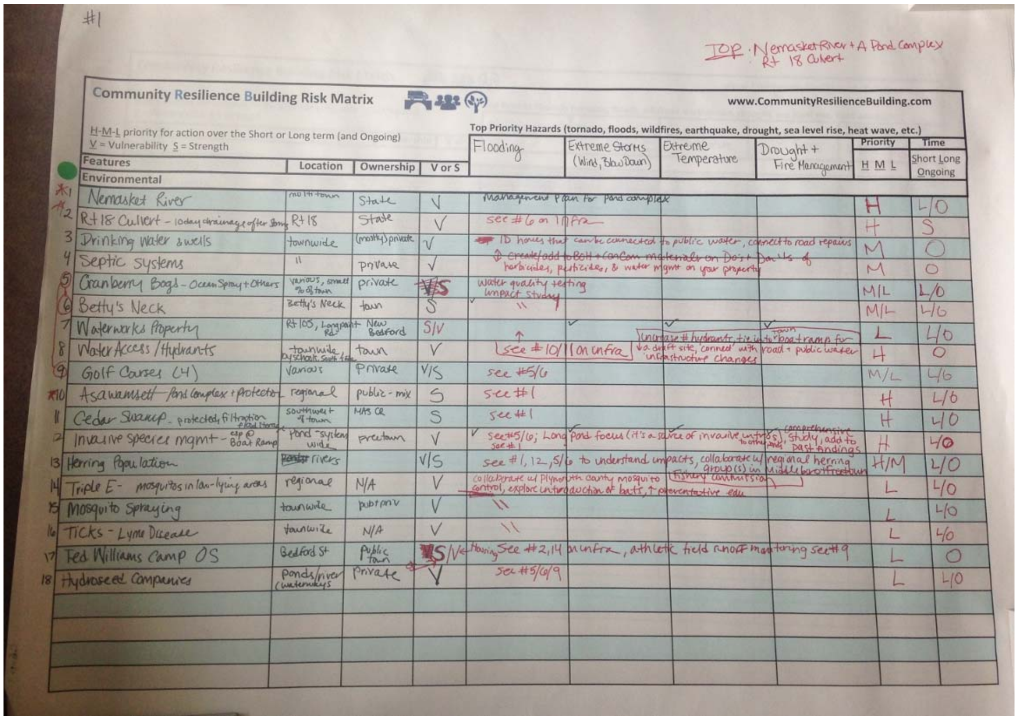
Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.com

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

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

	Features	Location	Ownership	V or S	Flooding	Extreme Storms (Wind)	Extreme Temperature	Drought + Fires	Priority H M L	Time Short Long Ongoing
	Infrastructural									
*1	Power Infra – shorelines esp	townwide	Middleboro Taunton Eversource	V/S	Continue frequent tree trimming; forestry mgmt – plant location appropriate trees; utility replacement programs				H	L/O/S=trimming
*2	Freetown St., Highland Rd, Clark Shores	"	"	V/S	acquire land for flood storage; explore feasibility of buyouts/managed retreat; " utility/tree maintenance; continue study @ shorefront properties upgraded drainage				H	S/L
3	Schools/Shelters – HS+MS	Howland Rd campus	town	S	outline resident routes to their shelters from different points; look into making pet friendly; increase awareness + familiarity w/services				M	O
4	Access Roadways – Bedford St Long-point Rd, County St	Bedford St County St	town	V	~~study feasibility~~ explore elevating Bedford St; see #1				H/M	S/L
No #5	~~Longpoint Rd – Access to Lakeville from Middleboro~~	~~Longpoint Rd~~		~~V~~	replace, clean Rt 44, ID which need cleaning vs replacement				M	S/O
*6	Culverts Bedford St – Rt 18 state; Taunton St – muni. cross st	respective streets Rt 18	state/town	V					M	S/O
7	Riverside Commercial Drive (Evac., ↑housing, traffic, emergency access)	Riverside Dr.	town	V	traffic study + ID options for emergency planning				M	O
8	[redacted] Road Drainage/ice	intersection Freetown St, County Rd	town	V	increase infiltration, possibly acquire property for flood storage; increase Highway Dept staff				H	S/O
9	Repetitive Loss properties (20-25)	Old Powderhouse, Shore Ave	private	V	see #2				H	S/L
10	Taunton DWTP	Taunton	City-Taunton	V	increase collaboration w/Taunton + New Bedford to protect surrounding land for ↑ Water Quality				L	L/O
11	Water Tower – Regional supply	industrial Park	~~town~~ Taunton	S/V	"				L	L/O
12	Cold Storage – 6-7 buildings	Industrial Park	Private	V	enhance/maintain inspection + emergency planning; ID or create emergency access to roads				M	O
13	Access to Nat. Regulator Station	Rt 18	private	V	"				M	O
14	Shorefront property roads – Not all up to standard	Shorefront	private	V	see #2; increase access, explore funding & support for homeowners; resource sharing with homeowner association to ↑ public safety; Additional Highway Dept. Staff				L	L/O
15	Boat Access / Flood Area Access	townwide	town		town-owned boat ramps ← Need tie into Bedford St upgrades, ensure emergency access				M	S

Environmental



#1

TOP: Nemasket River + A Pond Complex, Rt 18 Culvert

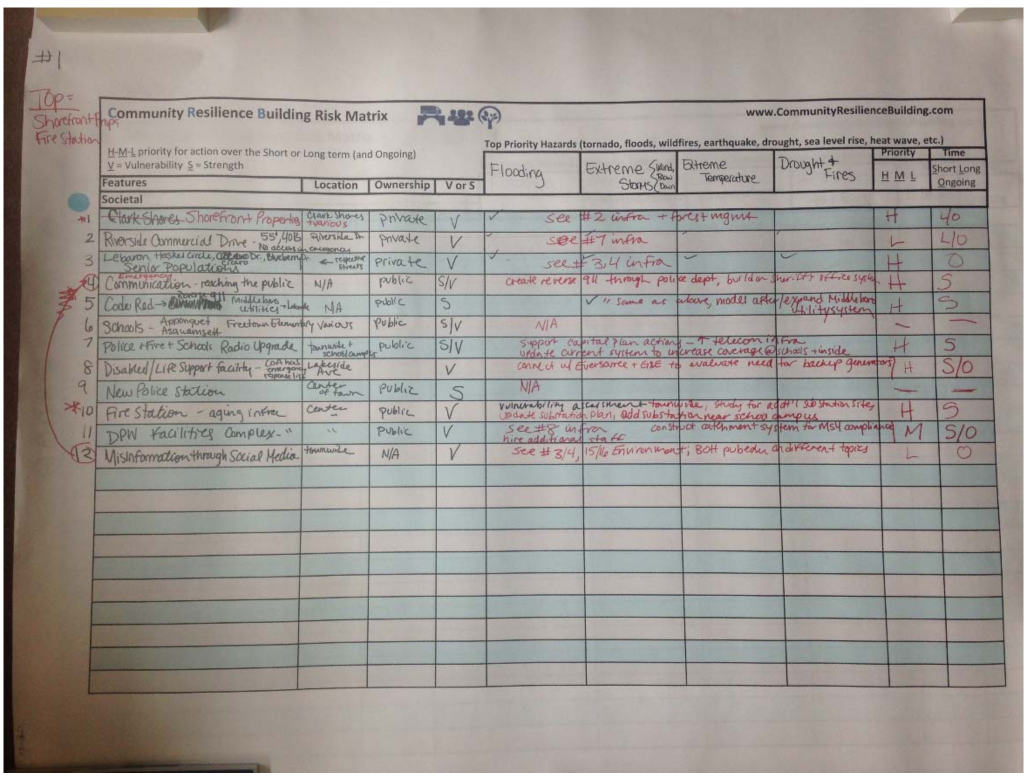
Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.com

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

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

#	Features: Environmental	Location	Ownership	V or S	Flooding	Extreme Storms (Wind, Blow Down)	Extreme Temperature	Drought + Fire Management	Priority H M L	Time Short Long Ongoing
*1	Nemasket River	most of town	State	V	Management plan for pond complex				H	L/O
*2	Rt 18 Culvert - 10 day drainage after storm	Rt 18	State	V	see #6 on infra				H	S
3	Drinking water & wells	townwide	(mostly) private	V	15 homes that can be connected to public water, connect to road repairs				M	O
4	Septic systems	"	private	V	create/add to BoH + ConCom materials on Do's + Don'ts of herbicides, pesticides, & water mgmt on your property				M	O
5	Cranberry Bogs - Ocean Spray + Others	various, small % of town	private	V/S	water quality testing impact study				M/L	L/O
6	Betty's Neck	Betty's Neck	town	S	"				M/L	L/O
7	Waterworks Property	Rt 105, Long Point Rd	New Bedford	S/V	✓	✓	✓	✓	L	L/O
8	Water Access / Hydrants	townwide, by schools, South [illegible]	town	V	see #10/11 on infra	Increase # hydrants, tie into a draft site, connect with infrastructure changes		town boat ramp for road + public water	H	O
9	Golf Courses (4)	various	Private	V/S	see #5/6				M/L	L/O
*10	Asawamsett Pond Complex + protection	regional	public - mix	S	see #1				H	L/O
11	Cedar Swamp - protected, filtration, flood storage	southwest of town	MAS CR	S	see #1				H	L/O
12	Invasive species mgmt - esp @ Boat Ramp	Pond - system wide	Freetown	V	see #5/6; see #1; Long Pond focus (it's a source of invasive intros to other ponds)			comprehensive study, add to past findings	H	L/O
13	Herring Population	rivers		V/S	see #1, 12, 5/6 to understand impacts, collaborate w/ regional herring group(s) in Middleboro/Freetown Fishery Commission				H/M	L/O
14	Triple E - mosquitos in low-lying areas	regional	N/A	V	collaborate w/ Plymouth County mosquito control, explore introduction of bats, ↑ preventative edu				L	L/O
15	Mosquito Spraying	townwide	pub + priv	V	"				L	L/O
16	Ticks - Lyme Disease	townwide	N/A	V	"				L	L/O
17	Ted Williams Camp OS	Bedford St	Public town	S/V	Housing See #2, 14 on infra, athletic field runoff monitoring see #9				L	O
18	Hydroseed Companies	ponds/river (waterways)	Private	V	see #5/6/9				L	L/O

Societal



#1

Top = Shorefront Props, Fire Station

Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.com

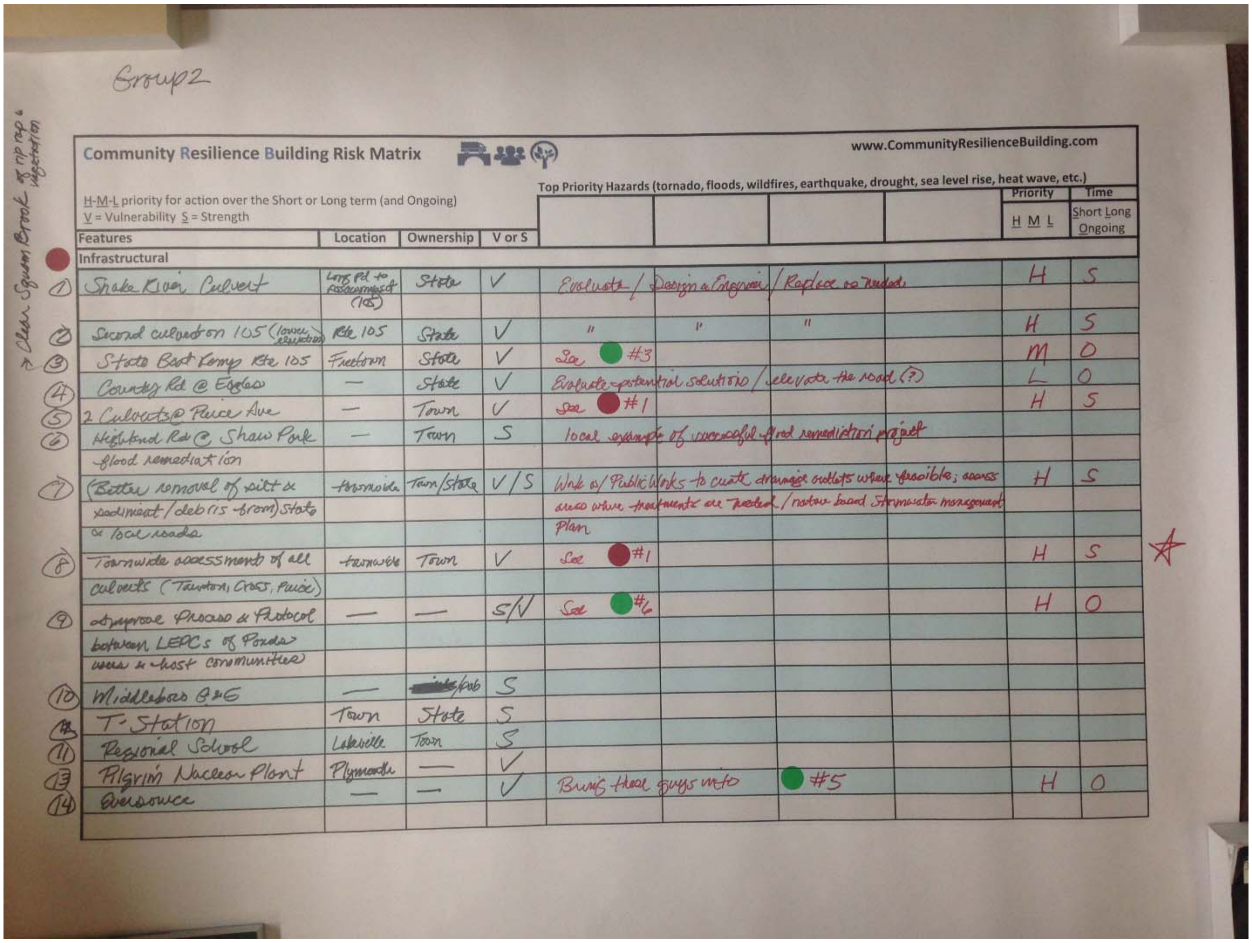
H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength

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

#	Features: Societal	Location	Ownership	V or S	Flooding	Extreme Storms (Wind, Blow Down)	Extreme Temperature	Drought + Fires	Priority H M L	Time Short Long Ongoing
*1	Clark Shores Shorefront Properties	Clark Shores + various	private	V	✓ see #2 infra + forest mgmt				H	L/O
2	Riverside Commercial Drive - 55', 40B, No access in emergency	Riverside Dr	private	V	✓ see #7 infra				L	L/O
3	Lebaron, Haskel Circle, [illegible] Dr., Blueberry Dr. - Senior Populations	← respective streets	Private	V	✓ see # 3, 4 infra	✓	✓		H	O
4	Emergency Communication - reaching the public	N/A	public	S/V	create reverse 911 through police dept, build on sheriff's office system				H	S
5	Code Red → Reverse 911, Middleboro utilities + Lakeside	N/A	public	S		✓ " same as above, model after/expand Middleboro utility system			H	S
6	Schools - Apponequet, Asawamsett, Freetown Elementary	various	public	S/V	N/A				—	—
7	Police + Fire + Schools Radio Upgrade	townwide + school campus	public	S/V	support capital plan action - ↑ telecom infra, update current system to increase coverage @ schools + inside				H	S
8	Disabled/Life Support facility - COA has emergency response list	Lakeside Ave		V	connect w/ Eversource + G&E to evaluate need for backup generators				H	S/O
9	New Police Station	Center of town	public	S	N/A				—	—
*10	Fire Station - aging infra	Center	public	V	vulnerability assessment townwide, study for add'l substation sites, update substation plan, add substation near school campus				H	S
11	DPW Facilities Complex - "	"	Public	V	see #8 infra, hire additional staff; construct catchment system for MS4 compliance				M	S/O
12	Misinformation through Social Media	townwide	N/A	V	see # 3/4, 15/16 Environment; BoH pub edu on different topics				L	O

Group 2

Infrastructural



Group2

→ Clean Squam Brook of rip rap & vegetation

Community Resilience Building Risk Matrix

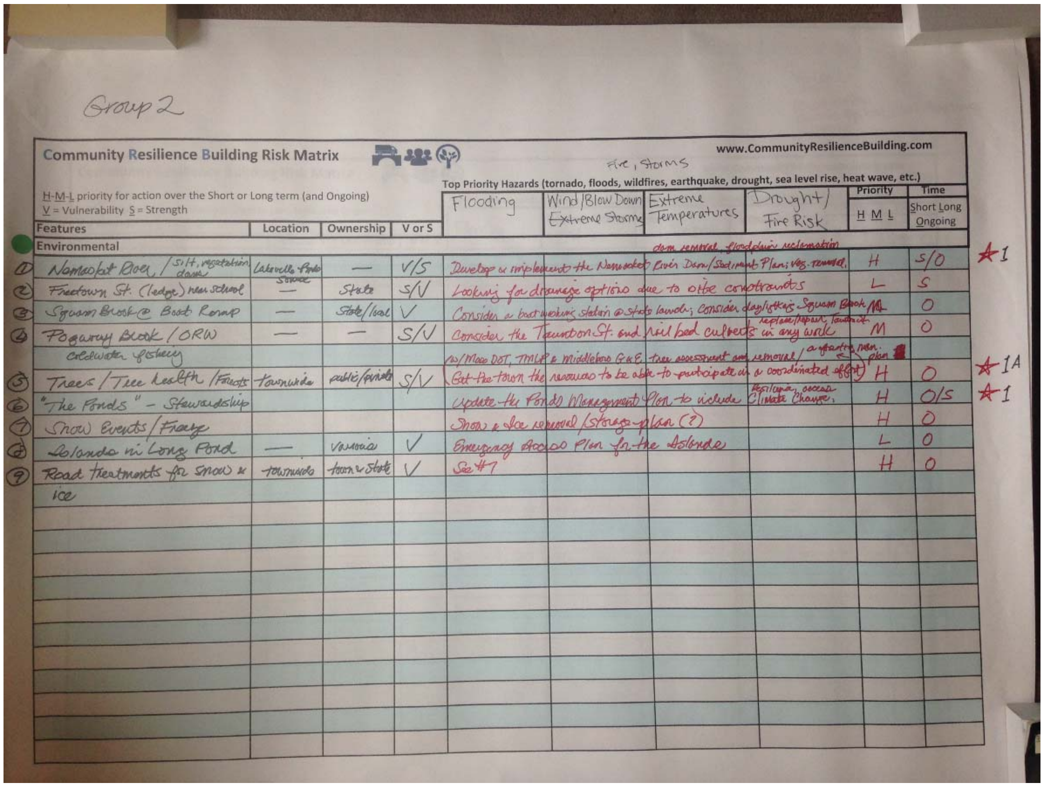
www.CommunityResilienceBuilding.com

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

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

#	Features	Location	Ownership	V or S					Priority H M L	Time Short Long Ongoing
	Infrastructural									
1	Snake River Culvert	Long Pd to Assawompsett (105)	State	V	Evaluate /	Design & Engineer /	Replace as needed.		H	S
2	Second culvert on 105 (lower elevation)	Rte 105	State	V	"	"	"		H	S
3	State Boat Ramp Rte 105	Freetown	State	V	See ● #3				M	O
4	County Rd @ Eagles	—	State	V	Evaluate potential solutions /	elevate the road (?)			L	O
5	2 Culverts @ Pierce Ave	—	Town	V	See ● #1				H	S
6	Highland Rd @ Shaw Park flood remediation	—	Town	S	local example of successful flood remediation project					
7	(Better removal of silt & sediment / debris from) State & local roads	townwide	Town/State	V / S	Work w/ Public Works to create drainage outlets where feasible; assess areas where treatments are needed / nature based Stormwater management Plan				H	S ☆
8	Townwide assessment of all culverts (Taunton, Cross, Pierce)	townwide	Town	V	See ● #1				H	S
9	Approve Process & Protocol between LEPCs of Ponds users & host communities	—	—	S/V	See ● #6				H	O
10	Middleboro G&E	—	[illegible]/pub	S						
12	T-Station	Town	State	S						
11	Regional School	Lakeville	Town	S						
13	Pilgrim Nuclear Plant	Plymouth	—	V						
14	Eversource	—	—	V	Bring these guys into		● #5		H	O

Environmental



Group 2

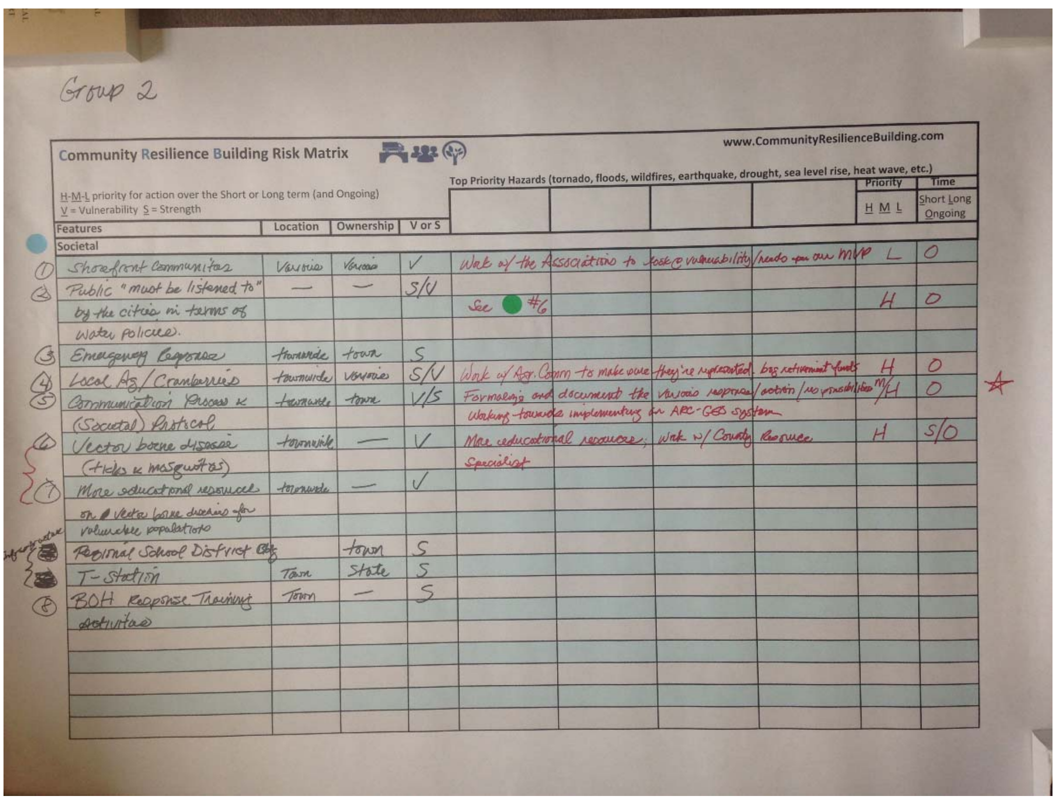
Community Resilience Building Risk Matrix — www.CommunityResilienceBuilding.com

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

Top Priority Hazards (tornado, floods, wildfires, earthquake, drought, sea level rise, heat wave, etc.) Fire, Storms

Features	Location	Ownership	V or S	Flooding / Wind/Blow Down Extreme Storms / Extreme Temperatures / Drought/ Fire Risk	Priority H M L	Time Short Long Ongoing
Environmental						
① Nemasket River / Silt, vegetation, dams	Lakeville Pond Source	—	V/S	dam removal, floodplain reclamation; Develop & implement the Nemasket River Dam/Sediment Plan; veg. removal	H	S/O ★1
② Freetown St. (ledge) near school	—	State	S/V	Looking for drainage options due to site constraints	L	S
③ Squam Brook @ Boat Ramp	—	State/local	V	Consider a boat washing station @ state launch; consider daylighting Squam Brook	M	O
④ Poquoy Brook / ORW coldwater fishery	—	—	S/V	Consider the Taunton St. and rail bed culverts in any work; replace/repair Taunton St.	M	O
⑤ Trees / Tree health / Forests	townwide	public/private	S/V	w/ Mass DOT, TMLP & Middleboro G&E tree assessment and removal / a forestry man. plan; Get the town the resources to be able to participate in a coordinated effort	H	O ★1A
⑥ "The Ponds" – Stewardship				Update the Ponds Management Plan to include Resilience, access, Climate Change	H	O/S ★1
⑦ Snow Events / Freeze				Snow & ice removal / storage plan (?)	H	O
⑧ Islands in Long Pond	—	Various	V	Emergency Access Plan for the Islands	L	O
⑨ Road treatments for snow & ice	townwide	town & State	V	See #7	H	O

Societal



Group 2

Community Resilience Building Risk Matrix — www.CommunityResilienceBuilding.com

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

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

Features	Location	Ownership	V or S	Hazards / Actions	Priority H M L	Time Short Long Ongoing
Societal						
① Shorefront Communities	Various	Various	V	Work w/ the Associations to look @ vulnerability/needs per our MVP	L	O
② Public "must be listened to" by the cities in terms of water policies.	—	—	S/V	See ● #6	H	O
③ Emergency Response	townwide	town	S			
④ Local Ag / Cranberries	townwide	Various	S/V	Work w/ Ag. Comm to make sure they're represented, bog retirement funds	H	O
⑤ Communication Process & (Societal) Protocol	townwide	town	V/S	Formalize and document the various response/action/responsibilities; Working towards implementing an ARC-GIS system	M/H	O ★
⑥ Vector borne disease (ticks & mosquitoes)	townwide	—	V	More educational resources; work w/ County Resource Specialist	H	S/O
⑦ More educational resources on vector borne diseases for vulnerable populations	townwide	—	V			
Infrastructure: Regional School District Bldg		town	S			
T-Station	Town	State	S			
⑧ BOH Response Training activities	Town	—	S			

Appendix C: Digitized Risk Matrices

Group 1

	Features	**Location**	**Ownership**	**V or S** (vulnerability or strength)	**Flooding**	**Extreme storms (wind)**	**Extreme temperature**	**Drought + fires**	**Priority** HML (high, med, low)	**Time** SLO (short, long, ongoing)
	Infrastructural									
1	Power infra - shorelines esp	townwide	Middleboro/ Taunton/ Eversource	V/S	Continue frequent tree trimming	forestry mgmt - plant location - appropriate trees; utility replacement programs			H	L/O/S = trimming
2	Freetown St., Highland Rd., Clark Shores	townwide	Middleboro/ Taunton/ Eversource	V/S	acquire land for flood storage; explore feasibility of buyouts/managed retreat	forestry mgmt; utility/tree maintenance		continue study at shore front properties, upgraded drainage	H	S/L
3	Schools/shelters - HS + MS	Howland Rd campus	town	S	Outline resident routes to their shelters from different points; look into making pet friendly; increase awareness/familiarity w/ services				M	O
4	Access roadways - Bedford St Longpoint Rd County St	Bedford St County St.	town	V/S	explore elevating Bedford St., See #1				H/M	S/L

5	Culverts - Bedford St - state Rt 18 - Taunton St - muni - Cross st.	respective streets, Rt 18	state/town	V/S	replace, clean Rt 44; ID which need cleaning vs replacement	M	S/O
6	Riverside Commercial Drive (evac, increased housing, traffic, emergency access)	Riverside Dr.	town	V	traffic study to ID options for emergency planning	M	O
7	Road drainage/ice	intersection (Captain's Way, heritage, Freetown St, County Rd., Old Powder House)	town	V	increase infiltration, possibly acquire property for flood storage, increase Highway Dept staff	H	S/O
8	Repetitive Loss properties (20-25)	Shore Ave	private	V	see #2	H	S/L
9	Taunton DWTP	Taunton	city - Taunton	V	increase collaboration w/ Taunton + New Bedford to protect surrounding land for increased water quality	L	L/O
10	Water tower - Regional supply	industrial park	Taunton	S/V	"	L	L/O
11	Cold storage - 6-7 buildings	industrial park	private	V	enhance/maintain inspection + emergency planning; ID or create emergency access to roads	M	O

12	Access to Nat. Regulator station	Rt 18	private	V	"				M	O
13	Shorefront property roads - not all up to standard	Shorefront	private	V	see #2; increase access, explore funding support for homeowners, resource sharing with homeowner association to increase public safety, additional highway dept. staff				L	L/O
14	Boat access/flood area access	townwide	town		town-owned boat ramps (need); tie into Bedford St upgrade, ensure emergency access				M	S
	Environmental									
1	Nemasket River	multi-town	state	V	management plan for pond complex				H	L/O
2	Rt 18 culvert - 10 day drainage after storms	Rt 18	state	V	see #6 on Infra				H	S
3	Septic systems	townwide	private	V	create/add to BOH + ConCom materials on Do's and Don'ts of herbicides, pesticides, and water mgmt on your property				M	O
4	Drinking water and wells	townwide	(mostly) private	V	" ; ID homes that can be connected to public water, connect to road repairs				M	O
5	Cranberry bogs - Ocean Spray and others	various, small % of town	private	S	water quality testing impact study				M/L	L/O
6	Betty's Neck	Betty's Neck	town	S	"				M/L	L/O
7	Waterworks property	Rt 105, Longpoint Rd.	New Bedford	S/V	see #10 on Infra				L	L/O
8	Water access/hydrants	townwide, by schools, South side	town	V	"	Increase # hydrants, tie into town boat ramps for a draft site, connect with road + public water infrastructure changes			H	O

9	Golf courses (H)	various	private	V/S	see #5&6				M/L	L/O
10	Asawam-sett Pond Complex + protection	regional	public - mix	S	see #1				H	L/O
11	Cedar Swamp - protected, filtration flood stor-age	south-west of town	MAS CR	S	see #1				H	L/O
12	Invasive species mgmt - esp @ boat ramp	Pond - sys-temwid e	Free-town	V	see #5&6; see #1; Long Pond focus (it's a source of invasive intros to other ponds); comprehensive study, add to past findings				H	L/O
13	Herring popula-tion	rivers		V/S	see #1, 12, 5/6 to understand impacts, collaborate w/ regional herring group(s) in Middleboro + Freetown				H/M	L/O
14	Triple E - mosqui-toes in low-lying areas	regional	N/A	V	collaborate w/ Plymouth county mos-quito control, explore introduction of bats, increase preventative edu				L	L/O
15	Mosquito spraying	town-wide	pub + priv	V	"				L	L/O
16	Ticks - Lyme dis-ease	town-wide	N/A	V	"				L	L/O
17	Ted Wil-liams camp OS	Bedford St	pub-lic/town	S(OS)/V(h ousing)	see #2, 14 on infra, athletic field runoff monitoring see #9				L	O
18	Hydroseed companies	ponds/r iver (water-ways)	private	V	see #5/6/9				L	L/O
	<u>Societal</u>									
1	Shorefront properties	Clark Shores + vari-ous	private	V	see #2 infra + forest mgmt				H	L/O

2	Riverside Commercial Drive - 55+, 40B, no access in emergency	Riversude Dr.	private	V	see #7 infra				L	L/O
3	Lebanon Hasket Circle, Cicero Dr. Blueberry Dr. Senior populations	respective streets	private	V	see #3,4 infra				H	O
4	Emergency communication - reaching the public	N/A	public	S/V	create reverse 911 through police dept, build on Sheriff's office system				H	S
5	Code Red - Reverse 911, Middleboro utilities -> Lakeville	N/A	public	S		same as above, model after/expand Middleboro utility system			H	S
6	Schools - Apponequet, Asawamsett, Freetown elementary	various	public	S/V	N/A				N/A	N/A
7	Police + fire + schools radio upgrade	townwide + schools /campus	public	S/V	support capital plan actions - increase telecom infra; update current system to increase coverage @ schools + inside				H	S
8	Disabled/life support facility - COA has	Lakeside Ave		V	Connect w/ Eversource + G&E to evaluate need for backup generators				H	S/O

	emergency response list									
9	New police station	center of town	public	S	N/A				N/A	N/A
10	Fire station - aging infra	center of town	public	V	vulnerability assessment town-wide, study for addt'l substation sites, update substation plan, add substation near school campus				H	S
11	DPW facilities compex - aging infra	center of town	public	V	see # infra, hire additional staff, construct catchment system for MS4 compliance				M	S/O
12	Misinformation through social media	town-wide	N/A	V	see #3/4, 15,/16 in Environmental, BOH pub edu on different topics				L	O

Group 2

	Features	**Location**	**Ownership**	**V or S**	**Flooding**	**Extreme storms (wind)**	**Extreme temperature**	**Drought + fires**	**Priority** HML (high, med, low)	**Time** SLO (short, long, ongoing)
	Infrastructural									
1	Snake River culvert	Long Pd to Assawompset (105)	state	V	Evaluate/design and engineer/replace as needed				H	S
2	second culvert on 105 (lower elevation)	Rte 105	state	V	"				H	S
3	State boat ramp Rte 105	Freetown	state	V	see #3 Environmental				M	O
4	County Rd @ Eagles		state	V	Evaluate potential solutions/evaluate the road (?)				L	O
5	Culverts @ Peirce Ave		town	V	see #1				H	S
6	Highland Rd @ Shaw Park flood remediation		town	S	local example of successful flood remediation project					
7	(Better removal of silt and sediment/debris from) state and local roads	town-wide	town/state	V/S	Work w/ public works to create drainage outlets where feasible; assess areas where treatments are needed/nature based stormwater manegement plan					
8	Town-wide assessment of all culverts (Taunton,	town-wide	to	V	see #1				H	S

	Cross, Peirce)									
9	Improve process and protocol between LEPCs of ponds - users and host communities			S/V	see #6 Environmental				H	O
10	Middleboro G&E		public	S						
11	T station	town	state	S						
12	Regional school	Lakeville	town	S						
13	Pilgrim nuclear plant	Plymouth		V						
14	Eversource			V	Bring these guys info		see #5 Enviromental		H	O
	Environmental									
1	Nemasket River/silt, vegetation, dams	Lakeville ponds source		V/S	Develop and implement the Nemasket River Dam/Sediment Plan; veg. removal, dam removal, floodplain reclamation				H	S/O
2	Freetown St. (ledge) near school		state	S/V	Looking for drainage options due to site constraints				L	S
3	Squam Brook @ boat ramp		state/local	V	Consider a boat washing station @ state launch; consider daylighting Squam Brook				M	O
4	Poquoy Brook/ORW coldwater fishery			S/V	Consider the Taunton St and rail bed culverts in any work; replace/repair Taunton St				M	O
5	Trees/tree health/forests	townwide	public/private	S/V	Get the town the resources to be able to participate in a coordinated effort w/ MassDOT, TMLP, and Middleboro G&E tree assessment and removal/a forestry man. plan					
6	"The Ponds" -				Update the Ponds Management Plan to include climate change, resilience, access				H	O/S

	steward-ship									
7	Snow events/free ze				Snow and ice removal/storage plan (?)				H	O
8	Islands in Long Pond		various	V	Emergency access plan for the islands				L	O
9	Road treat-ments for snow and ice	town-wide	town & state	V	see #7				H	O
	Societal									
1	Shorefront communi-ties	various	various	V	Work w/ the Associations to look at vulnera-bility/needs per our MVP				L	O
2	Public "must be listened to" by the cit-ies in terms of water policies			S/ V	See #6 En-vironmen-tal					
3	Emergency responses	town-wide	town	S/ V						
4	Local Ag/cran-berries	town-wide	various	S/ V	work w/ Agr. Comm to make sure they're represented; bog retirement funds				H	O
5	Communi-cation pro-cess & (so-cietal) pro-tocol	town-wide	town	V/ S	Formalize and document the various re-sponses/actions/responsibilities working to-ward implementing an ARC-GEO system				M/H	O
6	Vector borne dis-ease (ticks and mos-quitoes)	town-wide		V	More educational resources; work w/ County resource specialist				H	S/O
7	More edu-cational re-sources on vector borne dis-eases for vulnerable populations	town-wide		V						

8	Regional school district bldg		town	S						
9	T station	town	state	S						
10	BOH response training activities	town		S						