Town of Charlton

Community Resilience Building Workshop

Summary of Findings

May, 2018

FUSS & O'NEILL

Project No. 20170390.C50

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Town of Charlton

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Summary of Findings

Overview

Extreme weather and natural and climate-related hazards are an increasing concern for the communities of Massachusetts, and there is a clear need to involve municipalities, corporations, organizations, and the State in increasing resilience at all levels. Recent storm events affecting the region have highlighted many of the vulnerabilities that towns and cities face. Hurricane Irene and Superstorm Sandy brought intense flooding to many municipalities and threatened (or destroyed) infrastructure across the state. Extreme temperatures at both ends of the spectrum have pushed the limits of communities' preparedness to protect both infrastructure and people. In coastal communities, the impacts of sea level rise are felt daily and further exacerbate the impacts of other extreme events. Current climate modeling indicates that all of these hazards are expected to increase in frequency and scale over the coming decades. The Municipal Vulnerability Preparedness (MVP) program provides support and a prescribed process for cities and towns in Massachusetts to plan proactively for resiliency and implement key climate change adaptation actions.

In 2017, the Town of Charlton was awarded a $15,000 MVP grant to fund the planning stage of this process. The Town partnered with Fuss & O'Neill, a state certified MVP Provider, to complete a comprehensive, baseline climate change and natural hazard vulnerability assessment and develop a list of priority actions for the Town. This process involved the development of an MVP Core Team, which met on January 8, 2018 to determine initial concerns and worked to identify stakeholders within the municipality and set goals for the process. Those stakeholders were then invited to participate in a Community Resilience Building (CRB) workshop on April 7, 2018, engaging in a day-long, tried and tested process developed by The Nature Conservancy. The CRB methodology is an "anywhere at any scale" format that draws on stakeholders' wealth of information and experience to foster dialogue about the strengths and vulnerabilities within the Town. Workshop participants interacted at both large and small group levels, using an iterative process to gather input, synthesize ideas across groups, and ultimately develop a set of priority resilience and adaptation actions.

The CRB workshop's central objectives were to:

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

Top Hazards and Vulnerable Areas

During the Community Resilience Building workshop, participants were asked to identify the top four natural hazards of concern for the Town of Charlton. Discussion of the top hazards built on earlier conversations that took place at the MVP Core Team Meeting, as well as ongoing Town conversations that have formed the basis for the Town's Hazard Mitigation Planning. Flooding was identified as one of the Town's top hazards. Storm events and associated wind, ice, and snow were identified as a second hazard. Impacts of extended drought, such as those seen during summer 2016 were identified as a third hazard. Finally, extreme temperatures, including the increase in both extremely hot days (over 90 degrees F) and extremely cold weather, were seen as a fourth major hazard. These four hazards have already had demonstrated impacts on the Town, and as climate change progresses, these hazards are expected to have ever greater consequences for infrastructure and environment, as well as for various societal elements. Specific areas of concern are identified below.

Top Hazards

- Flooding
- Storm Events/Wind/Ice/Snow
- Drought
- Extreme Temperatures

Areas of Concern

While many impacts are expected to be felt Town-wide, certain elements, locations, or community groups present particular concerns.

Neighborhoods/Communities
Residents/families using the food bank, elderly population, The Overlook retirement community

Ecosystems
Beaver-influenced areas near Guelphwood Road, Dresser Hill Road, and North Sturbridge Road, wetlands in the vicinity of the un-capped landfill on Flint Road

Infrastructure
Buffumville Dam, Stafford Street culvert, Brookfield Road Bridge, sewer pumpstations, public safety complex, un-capped landfill on Flint Road

Current Concerns and Challenges Presented by Hazards

Flooding is a major challenge in Charlton, and the threat from flooding has been growing with the increasing frequency of major storm events that deliver large amounts of precipitation over a short time period. In 2011, Charlton experienced three back-to-back 100 year storm events, and the Town has had several more 100 year storms during the last few years.

Stormwater management is important to Charlton, and the Town recognizes that successful future stormwater management must consider the impacts of climate change, including increased precipitation and temperature extremes. More intense storms delivering higher volumes of precipitation in a single event are expected to put significant pressure on dams, culverts, and other drainage infrastructure that were designed to handle smaller storms with more consistent distributions of precipitation. The Town is particularly concerned with replacement or resizing of culverts and other infrastructure to adapt to these precipitation changes, reduce flooding risk, and make the Town more resilient.

Another key factor that influences flooding in Charlton during major precipitation events is beaver activity. The Town has identified three known locations where flooding of roads is caused by beaver dams, and where failure of these dams could have catastrophic effects. During Charlton's CRB Workshop, the Building Commissioner also noted that mapped flood zones are no longer adequate for assessing safe locations for development. Changes in precipitation and flood patterns have meant an increase in his need to rely on boots-on-the-ground experience to help ensure that people in the Town are making sound building decisions in an increasingly unpredictable landscape.

While excess water is an obvious problem in Charlton, too little water is equally concerning. Charlton has concerns about water supply both for drinking water and firefighting. The extended drought during summer 2016 emphasized the need to increase the public water supply to ensure adequate access during longer droughts.

Intense storms have become increasingly problematic for the Town, in large part because storms now tend to bring a combination of precipitation types (ice, rain, and snow) all in one storm event. This complicates the effort to maintain access and provide services. Extreme temperatures at both ends of the spectrum have also posed occasional challenges for Charlton, especially for the Town's more vulnerable populations.

Specific Categories of Concerns and Challenges

Infrastructural

Culverts and Bridges

Culverts and bridges are recognized as a potential concern town-wide. Workshop participants noted, in particular, that the Brookfield Road Bridge is already compromised by a partial blockage which restricts flow. The Stafford Street culvert is another known area of concern, where outflow from Little Nugget Lake causes flooding. No detailed inventory has cataloged the size and condition of culverts town-wide. Regardless of condition, culvert and bridge structures were designed to accommodate historic patterns of precipitation and runoff, which are rapidly transforming as a result of climate change. As precipitation events become more intense and less predictable, undersized culverts are expected to pose a greater threat of failure and flooding.

Beavers

Concerns about beavers were discussed as an environmental issue, but also, and more critically, as an infrastructure problem. Whereas the town generally has some record of and control over man-made stream crossings or impoundments, beaver activity is often known only anecdotally, if at all, and can cause unpredictable problems during heavy precipitation, when flooding occurs in unexpected locations. Beaver dams are known to be problematic and to cause flooding in the vicinity of Guelphwood Road in the southwest corner of Charlton near the Town's border with Southbridge, near Dresser Hill Road in the south-central portion of the Town, and near North Sturbridge Road, in the northwest corner of Town. Two of these three beaver dams are located on private property, which makes it difficult for the Town to take action. Charlton's Conservation Agent has had reasonable success with outreach and education within the Town, but the Town's beaver problems are further complicated by inter-town politics around the issue of beaver control. Participants expressed that they felt both creative engineering solutions and legislative action might be required to address the impacts of beavers, especially as flooding is expected to worsen with climate change.

Dams

While beaver dams dominated conversation at the CRB Workshop, man-made dams and debris dams are an additional source of concern in Charlton. Most town-owned dams are regulated under State dam safety regulations, and most are known quantities. Less information exists about many of the small dams in Town, particularly private dams. In some cases, it is not even known which dams still exist, let alone their condition or risk potential. There is concern that problems may exist that the Town does not know about, or that unknown debris dams may have developed that could cause flooding during a major storm event, with unforeseen results.

Drinking Water Supply

The Town's public water supply is currently obtained through a single line that enters Charlton via the Town of Southbridge. This poses a concern in terms of possible contamination or the risk of supply being cut off by a major hazard. Town officials also see a need to increase water supply to ensure adequate supply during longer droughts, which are expected to increase as a result of climate change.

Transportation Vulnerabilities

Charlton is divided into four quadrants by Route 20, which runs east-west across Town, and by Route 31, which runs north-south through Town. Both of these routes are at risk of flooding, which could effectively cut off one or more sections of Town. There is also a known bottleneck at Route 20 and 169, which could pose public safety concerns in the case of an event that required evacuation or critical materials delivery.

There is also an expectation that these traffic problems would be greatly exaggerated in the case of a regional hazard event that closed down the Massachusetts Turnpike and forced additional traffic onto Route 20.

Sewer System
Only 25% of the Town's approximately 12 sewer pump stations currently have a back-up power supply. Power outages could thus lead to failures at these pump stations, resulting in discharges of raw sewage with environmental and health impacts. The Town also has suspected infiltration and inflow problems in its sewer system, which need to be assessed and corrected in order to prevent sewage overflows during periods of heavy precipitation.

Environmental

Hazardous Materials Transport
A major freight rail line runs through the northern portion of the Town, passing in close proximity to several sensitive environmental areas, including lakes, streams, and wetlands. Trains passing through the Town are known to carry a variety of hazardous materials that could pose a significant threat to people or the environment in the event of a spill. Similarly, Route 20 and the Massachusetts Turnpike both bisect the town in an east-west direction, and Route 20 in particular passes near several ground water supply wells (both Town-owned and private), as well as the Town's wastewater treatment plant. It is unknown specifically what the risk could be to the rail line or roadways due to climate change, but it is known that both flooding and extreme temperatures can affect the safe operation of trains, and that safe road travel is impacted by flooding and storm events.

Trees and Forests
Forests provide critical ecosystem services that help buffer the effects of climate change, from sequestering carbon, to increasing groundwater recharge, to modulating local temperature. Street trees are likewise critical for infiltration of rainwater and provision of shade. However, trees and forests are also threatened by climate change. Wind and storms cause blowdowns, drought can contribute to die-off, new invasive pests (e.g., Emerald Ash Borer, Asian Longhorned Beetle) are eliminating certain tree species, and others are in decline due to shifting temperature and precipitation regimes that favor more southerly species. In Charlton, forest management is also linked to concerns over wildfire risk, which is increased by the build-up of fuel that results from die-offs and a lack of informed forest management.

Uncapped Landfill
Charlton has an uncapped landfill on low-lying land on Flint Road. The proximity of the landfill to wetlands raises concerns of contamination which could be triggered by flooding and heavy precipitation. Such contamination would have significant impacts for wetland ecosystems, and could potentially impact groundwater as well, with corresponding public health impacts.

Invasive Species
Invasive plants and animals are already a source of concern in Charlton, as they are throughout the Commonwealth. Forest and upland ecosystems are threatened by a variety of invasive plants, including plants such as oriental bittersweet, multiflora rose, two types of swallowwort, and several non-native honeysuckles. Riparian and aquatic habitats are severely threatened by common reed, Japanese knotweed, invasive water chestnut, hydrilla, purple loosestrife, and Eurasian milfoil. Critical invasive insect pests already in the area include the Asian Longhorned Beetle and Emerald Ash Borer, both of which have the potential to do serious damage (both environmental and economic) to Massachusetts' forests and trees. These and other species already pose a significant challenge and have serious consequences for ecosystem health and resilience, and these impacts are likely to increase in response to climate change. Warming temperatures will also bring new invasives to the area, and these will have an easier time gaining

a foothold if the Town's natural ecosystems are simultaneously weakened due to changes in climatic conditions. Charlton noted that invasives are especially hard to manage due to the fact that much of the open space and forest property in Town is privately-owned.

Societal

Pests and Disease Control
Climate change is affecting pests and disease vectors both through changing precipitation conditions and changing temperature conditions. Warmer, wetter conditions lead to increased mosquito populations, while the absence of sufficient periods of cold means that pest populations that would historically have been killed off or reduced are able to survive the winter and emerge in greater numbers the following season. Further, as the Massachusetts climate begins to look more like the climate of the mid-Atlantic and southern states, we are seeing new types of diseases show up in existing pests (e.g. mosquitoes carrying West Nile Virus or Zika and ticks carrying Rocky Mountain Spotted Fever). These changes present a major public and animal health challenge in terms of education, prevention, and treatment.

Emergency Communications and Vulnerable Populations
Workshop participants acknowledged the challenges of identifying and reaching vulnerable individuals, especially those who may no longer have a land-line telephone, or who may not self-identify as vulnerable. Moreover, certain populations, including seniors and the homeless, are known to be at higher risk during hazard events and may require support beyond emergency notifications. Understanding what these needs are and how the Town can best prepare to proactively support its entire population are areas that require more exploration.

Public Safety Complex
Charlton's existing public safety complex is located in a low-lying area, which makes it vulnerable to flooding. This could impact the ability of police and fire to provide services at the times when they are most needed, such as during a flooding event or major storm. The location also leaves expensive public safety equipment vulnerable to loss and damage.

Current Strengths and Assets

While the Town recognized a number of vulnerabilities, workshop participants identified key strengths as well. Charlton has a Master Plan, last updated in 2008, which serves to guide development and decision-making for the Town. The Town has also invested in Open Space Planning and Hazard Mitigation Planning, the latter of which parallels the MVP process in many important ways. Key institutions in Town provide support to potentially vulnerable populations and are well positioned for resilience. Charlton also benefits from a partnership with National Grid, which is taking steps to make their electrical infrastructure more robust and resilient.

- The Town has **strong leadership** that is proactively engaged in resilience-building.
- Charlton already has a robust **reverse 911 system** which can be used to alert residents town-wide or by groups in case of a hazard.
- **The Overlook retirement community** serves a large and potentially vulnerable population. The community is located on high ground near the center of town, is equipped with generators and on-site care staff, and has expressed willingness to serve as a shelter if necessary.
- The **Chip in Food Pantry** serves an average of 125 regular family clients per month and additional clients during periods of crisis or catastrophe. The food pantry provides primarily non-perishable goods and typically has a supply stock of approximately 3 months' worth of food.

- The **REAS Foundation** also serves vulnerable populations, providing heating and cooling assistance to local seniors.

- The Town has **numerous resources for rebuilding** due to a high number of construction contractors in town, each with its own equipment and labor force that could contribute to clean-up and reconstruction efforts.

- The Town's **existing planning efforts** include an Open Space and Recreation Plan (2017), Hazard Mitigation Plan (currently being developed by the Central MA Regional Planning Commission), Community Development Plan (2004), and Master Plan (2008).

- Additional **hazard planning** has included table top exercises with the Army Corps of Engineers to address a catastrophic situation at the Buffumville Dam, drills focused on the elderly rehabilitation center, and efforts to practice preparations for mass casualty events.

- Charlton has a **shelter trailer** which contains blankets, cots, and other necessities and is pre-positioned at an appropriate shelter in advance of big storms.

- The Town benefits from the efforts of **National Grid** which has invested time and money into clearing hazard trees and improving the robustness of the electrical system through grid modernization.

- The Town has an immense amount of accumulated **staff knowledge** about the Town, its systems, needs, and strengths, all of which is attributable to many accumulated years of dedicated service.

- Town citizens have responded well to **public education efforts around beavers** and the need to manage beaver populations.

Top Recommendations to Improve Resilience in Charlton

Participants at the CRB workshop identified a number of recommendations to address vulnerabilities and increase resiliency in three main topic areas: infrastructure, environment, and society. Management of water, primarily dealing with excesses of water due to flooding, was a primary concern that emerged in both the small and large group discussions. Beaver activity is a key contributor to existing flooding in Charlton, and beavers are expected to adapt to increasing precipitation by building higher dams, further increasing the risk and extent of flooding. Maintaining sufficient, safe water supply during drought or other hazards was a second water-related theme. Many of the top recommendations to improve resilience in Charlton therefore revolve around an "All Waters" approach—prioritizing beaver dams, man-made dams, bridges, culverts, water supply, and wastewater infrastructure to identify potential implementation projects throughout the Town.

Highest Priority

- **Conduct field inventory of culverts and bridges** to rank and prioritize projects for increased flooding resiliency and storm-hardening, followed by design and implementation of priority re-sizing or replacement projects. Green infrastructure, Low-Impact Design, and other nature-based solutions will be integrated with hard-infrastructure improvements to establish approaches that will be robust in the face of natural hazards and climate-change scenarios. Known problem areas, such as the Stafford Street Culvert and Brookfield Road Bridge should be areas of focus.

- **Develop comprehensive plan for beaver dam management** to mitigate against unpredictable flooding/impoundment impacts. Establish creative engineering solutions, identify suitable areas for beaver relocation, and consider the development of special legislation to give the Town authority to address problematic beaver dams on private property. Focus on known problem dams in the vicinity of Guelphwood Road, Dresser Hill Road, and North Sturbridge Road.

- **Conduct sewer infiltration and inflow study** to determine likely problem areas and establish a priority list of next steps for reducing flooding impacts related to infiltration and inflow.

- **Assess public and private dams** including town-wide survey to update information on which small dams still exist, establish ownership and an understanding of condition, and determine risks and priority projects.

- **Cap the Flint Road landfill** to reduce risk of wetland contamination or health impacts from leaching during flooding events.

- **Develop a comprehensive tree and forests management program** to identify, remove, and replace problem trees, preserve intact forests and street tree cover, provide guidance and resources for gradually moving toward more climate-resilient trees and forest communities (e.g. species that will tolerate warmer temperatures), limit wildlfire risk, and develop guidelines to manage conversion of forest land.

- **Analyze hazardous materials risk** to develop an understanding of how climate-change induced hazards (especially flooding or extreme temperatures) could potentially increase the risk of accidents or spills involving Route 20 or the major freight railroad line that runs through the northern portion of Town and quantify the potential risks to the Town that could result from accidents involving various classes and types of materials.

- **Study traffic flow** at the Route 20/Route 169 bottleneck to establish evacuation plans and strategies for materials or supplies deliveries in the case of a hazard event.

- **Identify vulnerable populations and foster a communications network** in advance of a hazard event to facilitate communication efforts and outreach to those most in need of information and assistance. Utilize networks of existing groups to encourage communication efforts led by churches, schools, social groups, or town agencies. Focus should be on populations that may be more vulnerable to climate-induced risks, such as extreme temperatures, may lack appropriate shelter during increasingly intense storms, or that may be unprepared if stranded or cut off from supplies due to flooding or storm events.

- **Assess disease risk and economic impacts from pests** such as mosquito-borne diseases, tick-borne diseases, disease vectors (e.g., mice and deer), and invasive species such as Asian longhorn

beetle and emerald ash borer. Include determination of future risks due to increase in type and quantity of pests/disease vectors due to climate change, and develop an education and outreach program.

Moderate Priority

- **Assess and improve sewer pump stations** to determine vulnerabilities and lessen potential impacts, including making pump stations more resilient to power outages through the implementation of a back-up power supply.

- **Establish a redundant public water supply** for the Town to guard against shortages due to drought or hazards that cut off supply via the existing water line from Southbridge.

- **Construct a new public safety complex** to relocate combined police and fire operations in an area that is less prone to hazard impacts, especially flooding. Siting the new facility near The Overlook retirement community would place the complex on high ground and also facilitate timely day-to-day emergency response for a vulnerable population.

- **Assess hard infrastructure and/or green infrastructure solutions** to address flooding on Route 20 and Route 31 to ensure that these key routes are kept open for people and emergency services during hazard events.

- **Develop education and outreach efforts** to establish citizen support for and participation in the Town's efforts to manage forests and beavers. Involve neighboring towns in these efforts to increase success rates.

- **Create partnerships**, especially with the gas pipelines, to ensure cooperation in resiliency building and hazard mitigation efforts.

Lower Priority

- **Update Town Master Plan** to integrate with other planning efforts, including the Hazard Mitigation Plan and MVP priorities.

- **Develop information technology resources** Town-wide to facilitate communications and hazard management.

CRB Workshop Participants

All workshop invitees are listed below; attendees are indicated with an asterisk.

Name	Position/Organization
Robin Craver*	Charlton Town Administrator
Kevin Shaughnessy*	Community and Customer Manager/National Grid
Jayne Vranos*	Millennium Power Plant, Talen Energy
Mark Winne*	Millennium Power Plant, Talen Energy
Robert Bucknell	Director of Facilities/The Overlook
Terek Mroczkowski	Ted's Package Store
Lt. Michael Smith	Lieutenant, State Police
Janet Pierce	Executive Director/Central MA Regional Planning Commission
Michael Lundquist	Owner/Boomba's Towing
Peter J Durant	State Representative, 6th Worcester District
Paul K Frost	State Representative, 7th Worcester District
Joseph Szafarowicz	Selectman/Town of Charlton
Frederick Swensen	Selectman/Town of Charlton
David Singer	Selectman/Town of Charlton
John McGrath	Selectman/Town of Charlton
Deborah Noble	Selectman/Town of Charlton
Ann Sellew	Animal Control Officer/Charlton Animal Control
Carl Ekman*	Emergency Management Director
Todd Girard*	Conservation Agent
Jim Philbrook	Director/Charlton Board of Health
Gerald Doble*	Chair/Charlton Finance Committee
Peter Boria*	Water-Sewer Superintendent/Town of Charlton
Curtis Meskus*	Building Commissioner/Town of Charlton
Bill Scanlan*	Interim Town Planner/Town of Charlton
Terri Gough	Administrative Assistant/Charlton Fire Dept.
Graham Maxfield	Chief of Police/Town of Charlton
Donna Foglio	Finance Director/Town of Charlton
Gerry Foskett*	Highway Superintendent/Town of Charlton
Alex MacKenzie	Water/Sewer Commission/Town of Charlton
Edward Knopf	Fire Chief/Charlton Fire Dept.
Bob Howard	WRTA
Colleen	Overlook Transport
Mary Devlin	Board of Selectman Administrative Assistant
Adam Menard*	Central MA Regional Planning Commission

* indicates attendees

Citation

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CRB Workshop Project Team: Organization, Name, Role

Name	Organization	Role
Robin Craver	Town Administrator	Project Coordinator/Core Team Member
Peter Boria	Water-Sewer Superintendent	Core Team Member
James Philbrook	Health Director	Core Team Member
Kara Hmielowski	Town Administrator's Office	CRB Workshop Coordination
Ed Knopf	Fire Chief	Core Team Member
Carl Ekman	Emergency Management Director	Core Team Member
Todd Girard	Conservation Agent	Core Team Member
Mary Monahan	Fuss & O'Neill	MVP Lead Facilitator
Adam Menard	Central MA Regional Planning Commission	Core Team Member
Gerry Foskett	Highway Superintendent	Core Team Member
Leah Stanley	Central MA Regional Planning Commission	Core Team Member
Julianne Busa	Fuss & O'Neill	Facilitator/Scribe

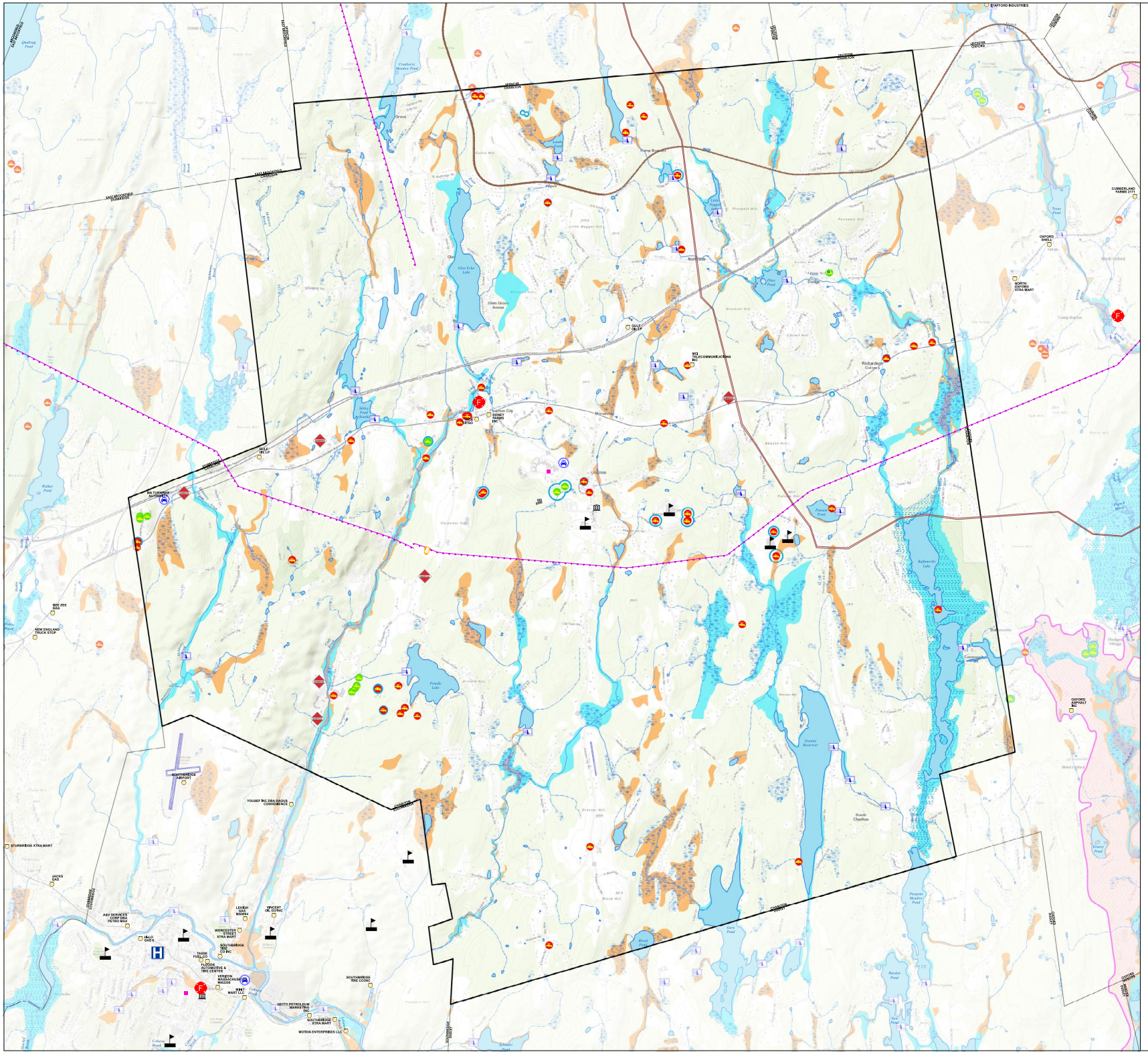
Acknowledgements

Many thanks to the MVP Core Team members, CRB workshop participants. and to Robin Craver who acted as the local Project Coordinator. Thanks to the Town of Charlton for providing a meeting space for the Core Team Meeting and CRB Workshop and to Kara Hmielowski who coordinated the CRB Workshop. Breakfast and Lunch for the CRB Workshop were generously donated by Anne Lindem at Dad's Diner.

Funding for the CRB Workshop was provided through a Massachusetts MVP grant.

Appendix A

CRB Workshop Base Map



CHARLTON, MA

MUNICIPAL VULNERABILITY PREPAREDNESS PROGRAM

- Town Hall
- School
- Police Station
- Fire Station
- Hospital
- Community Groundwater Source
- Non-Community Groundwater Source
- Dams
- MassDEP Major Facilities
- Underground Storage Tanks
- Nursing Home
- Rest Home
- Pipeline
- Powerline
- Substation
- Landing Strip/Airport
- Railroads - Active Service
- Perennial Stream
- Intermittent Stream
- Shoreline
- Intermittent Shoreline
- Manmade Shoreline
- Ditch/Canal
- Pond, Lake, Ocean
- Wetland
- Inundated Area
- Wellhead Protection Zone I
- Wellhead Protection Zone II

Flood Zone Designations

- 1% Annual Chance of Flooding
- Regulatory Floodway
- 0.2% Annual Chance of Flooding
- Reduced Flood Risk due to Levee

N W E S

0 0.5 1 2

Miles

Data sources:
MassGIS - Infrastructure, Hydrology, and Administrative Data
ESRI - World Topographic Map - Base Map

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Appendix B

CRB Workshop Outputs:
Participatory Mapping Exercise & Risk Matrices

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School
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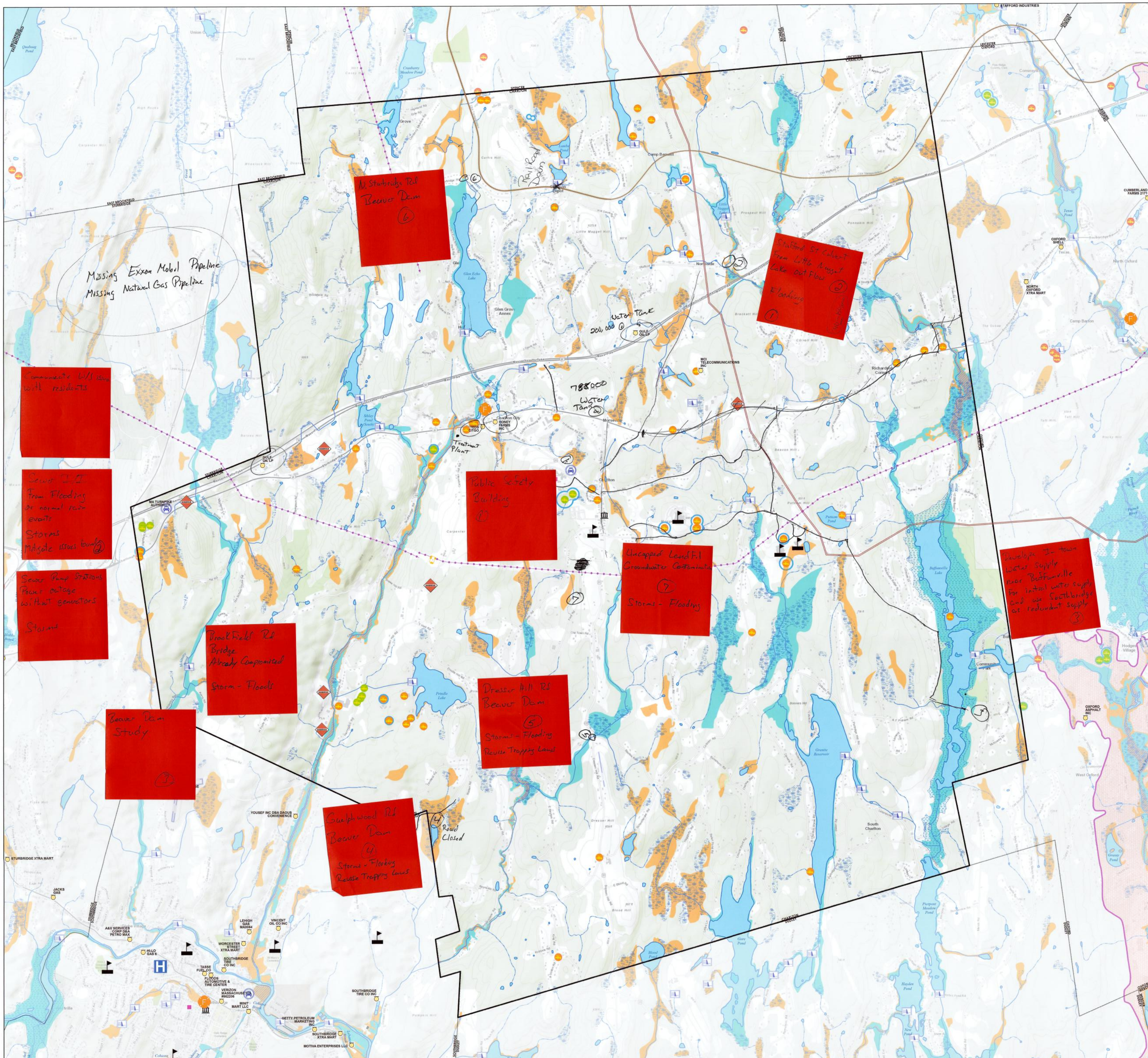

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Community Resilience Building Risk Matrix

www.CommunityResilienceBuilding.com

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	FLOODS	STORMS	DROUGHT	TEMPS	Priority H-M-L	Time S Long O ngoing
Infrastructural									
Rt. 20 + 31			V	✓ maintaing routes for	✓ people + emergency access		✓		
Societal									
Lots of Construction Companies	town-wide	Private	S	Equipment to do repairs →	← Develop MOU's w/ companies			M	
Overlook Senior Community			S	generators + staff-on-site	← on a hill, protected.			M	
								H	
Environmental									
FLOODING from Dams	town-wide	private	V						
Potential Railroad/Roads Spills	NW Quadrant		V	Unknown impacts →		FLOODING	→	H	
Education → Beavers + Forests		private	V	Need to convince people to allow management of forests + removal of beavers.					
PESTS - lyme, mice, deer, asian longhorn emerald ashborer		private	V						
Inter-town education/cooperation			V						
LANDFILL CAP								H	

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, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	FLOOD	NOR EASTER WIND	DROUGHT	TEMP	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
Rte 20/169 Bottleneck	town/state→		V	Area of (1) lane cause severe traffic back-up			impedes evacuation - affects area neighborhoods		
Societal									
ID Vulnerable Population	town	town/ Private	S/V	to ID vulnerable	residents,	Create connection between groups for greater communication -ie network between schools/churchs/social grps		H	
& Develop Network Communication	town	town/ private	S	to create network		& town agencies		H	
TRAFFIC FLOW STUDY STUDY EVAC & MATERIAL DELIVERY								H	
Environmental LEGISLATIVE									
Beavers OVERPROTECTIVE PRIVATE PROPERTY	Guelfwood	town-?	V	Map & identify	areas to relocate to benefit		animal & town	H (ie fire pond)	
Dam Mediation TOWN WIDE	town	town	V	pre-storm prep				H	
OWNERSHIP/CONDITION STATUS PRIVATE/PUBLIC									
HAZARDOUS TREE STUDY FOREST MGT								H	

MOVE TO INFRASTRUCTURE

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, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Floods	Storm/Wind Snow/Ice	Drought	Extreme Temp	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
Stafford St Culvert	Specific	Town	V	Replace Culvert	Assess Vulnerability make improvements			H	S
Sewer I/I	Townwide	Town	V	" "	Assess Vulnerability perform improvements			H	O
Brookfield Rd Bridge	Specific	Town	V	" "	" "			H	S
Beaver Dam Study - 3 Catastrophic possibilities	Multiple	Town	V	Identify main areas of concern perform study to create solution				H	O
Sewer Pump Stations - Back up power supply	Multiple	Town	V	Assess Vulnerability	Perform Improvements			M	O
Public Water Supply - Buffumville	Specific	Town	V	Create Redundant	Water Supply for all	Hazards		M	O
~~Societal~~									
Public Safety Building	Specific	Town	V					M	L
Uncapped Land Fill - Flint Rd	Specific	Town	V					~~M~~ H	L
Information Technology	Townwide	Town/Private	V					M	L
Master Plan	Townwide	Town	S					M	L
Env									
CREATE PARTNERSHIPS (PIPELINE, GAS)								M	

ENV

1 Stafford St Culvert
2 Sewer I/I
3 Brookfield Rd Bridge
4 Beaver Dam Study
5 Sewer Pump Station Power outage
6 PWS Buffumville
7 Public Safety Building & Uncapped Land Fill

Appendix C

CRB Workshop Presentation Materials

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Boston Firefighters, January 4, 2018 (Reuters)

Cambridge Reservoir, Lincoln, MA (Boston Globe)

Municipal Vulnerability Protection Program
Community Resilience Building Workshop
Town of Charlton

April 7, 2018

Fuss & O'Neill Overview

At Fuss & O'Neill, we place great emphasis on collaboration; both within the company and with our clients. We are guided by what is best for the client and the project – in identifying client champions, naming project leaders, building project teams, and providing responsive service and quality deliverables.

We strive to partner with our clients to understand their businesses and to be stewards of their resources as if they were our own, and aim to develop services and solutions that anticipate evolution of their unique business needs.

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MVP Project Team

Mary Monahan

Mary is a municipal public works specialist well-versed in issues related to stormwater management; wastewater collection and treatment; drinking water supply, treatment, and distribution; solid waste management; and sustainable operations. Mary serves as a liaison between the public works project owner and the design team.

Julie Busa

Julie is an environmental scientist in the Water Environment and Natural Resources group of Fuss & O'Neill. She has over 10 years of experience in the areas of global biodiversity and forest conservation, sustainability, and ecological modelling.

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Community Resilience Building Workshop

Agenda

- CRB Team and participant introductions
- Introduction to Massachusetts Municipal Vulnerability Preparedness Program (MVP)
- Introduction to Climate Change and the Town of Charlton
- Discussion by Charlton representatives on status of current planning
- Introduction to CRB Workshop process
- Large group
  - Determine top four hazards
- Small work groups (Using Risk Matrix)
  - Identify Charlton's vulnerabilities and strengths
  - Prioritize response actions
- Lunch
- Large group
  - Report out from small groups
  - Determine overall priority actions for the Town
- Discussion on next steps
- Conclusion

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Charlton MVP Program - $15,000

- Grant Supports Climate Change Vulnerability Assessments and Resiliency planning
  - Comprehensive Approach
    - o Infrastructure
    - o Society
    - o Environment
  - Scope and Process Use the Guidance in the Community Resilience Building Workshop Guide
  - Municipalities That Complete This Process Will Be Designated Municipal Vulnerability Preparedness (MVP) Municipalities

MVP Designation May Lead to Enhanced Standing in Future Funding Opportunities

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MVP Action Grant NEW

- Grant supports priority actions identified at Community Resilience Building Workshop
- $10,000 - $400,000 available
- Local match of 25% - can be in-kind
- Request for Responses anticipated in a few weeks
- Application deadline projected for mid-May
- Project award early June
- Next funding round anticipated Fall 2018

Only those communities which have completed the CRB workshop are eligible to apply

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Terminology

Climate Change

The Change in Usual Climate Conditions

- Rising Temperature
- Changing Precipitation/ Rainfall Amount and Intensity
- Sea Level Rise

Town of Charlton – French and Quinebaug River Basin

Rising Temperature

French Basin Quinebaug Basin	Observed Baseline 1971-2000	Projected Change in 2030s			Projected Change in 2050s			Projected Change in 2070s			Projected Change in 2090s		
Average Annual Temperature (°F)	47.07 46.86	2.16 2.17	to	4.35 4.32	2.99 2.98	to	6.40 6.37	3.59 3.57	to	9.16 9.03	3.92 3.92	to	11.17 11.07
Annual Days with Maximum Temperature over 90°F (Days)	3.05 3.28	4.10 4.45	to	13.36 13.91	6.51 7.24	to	24.86 26.64	8.36 9.13	to	45.40 46.88	10.33 10.86	to	64.16 65.64
Annual Days with Minimum Temperature below 0°F (Days)	8.70 10.37	-2.54 -3.17	to	-5.13 -5.85	-3.31 -3.98	to	-5.78 -6.78	-3.87 -4.53	to	-6.64 -7.56	-3.69 -4.26	to	-6.77 -7.76

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Town of Charlton – French and Quinebaug River Basin

Changing Precipitation

French Basin Quinebaug Basin	Observed Baseline 1971-2000	Projected Change in 2030s			Projected Change in 2050s			Projected Change in 2070s			Projected Change in 2090s		
Total Annual Precipitation (Inches)	47.44 48.56	-0.33 0.03	to	5.44 4.98	1.31 1.19	to	6.89 6.55	2.68 1.96	to	8.56 7.74	1.98 1.74	to	9.27 8.90
Annual Consecutive Dry Days (Days)	16.82 16.11	-0.99 -0.76	to	1.54 1.25	-0.80 -0.88	to	1.94 1.91	-1.20 -1.38	to	2.38 1.92	-0.77 -0.64	to	2.76 2.53

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Climate Change Impacts - Temperature

- Economic
  - Winter Recreation
  - Snow and Ice
- Agricultural
  - Longer Growing Season
- Health
  - Increased Pests
  - Heat Stroke
- Infrastructure
  - Road Buckling
  - More Potholes
  - Power Outages
- Environment
  - Change in Habitat

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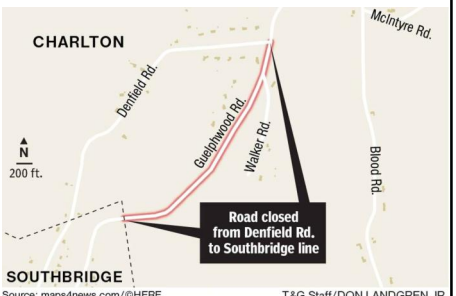
Climate Change Impacts - Precipitation

- Economic
  - Dangerous Floods
  - Lost work time
- Agricultural
  - Excessively Wet Spring
  - Drought
- Health
  - Flood/High Water-related Deaths
  - Emergency Response Delays
- Infrastructure
  - Road Washout
  - Environment
  - Sewer System Overflows
  - Compromised Bridges
- Changes in Habitat



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Local Mitigation Plan Review with Cross-Walk to Community Resilience Building Workshop

Local Mitigation Plans can utilize the Community Resilience Building Workshop to ensure that local plans go above and beyond minimum requirements for certain elements during the review process by Federal and State officials. FEMA regulations require additional documentation and dialogue with community members beyond the CRB process.
al Leaders

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Stakeholder Updates

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Risk Matrix

Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.com

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 S Long O
Infrastructural									
Societal									
Environmental									

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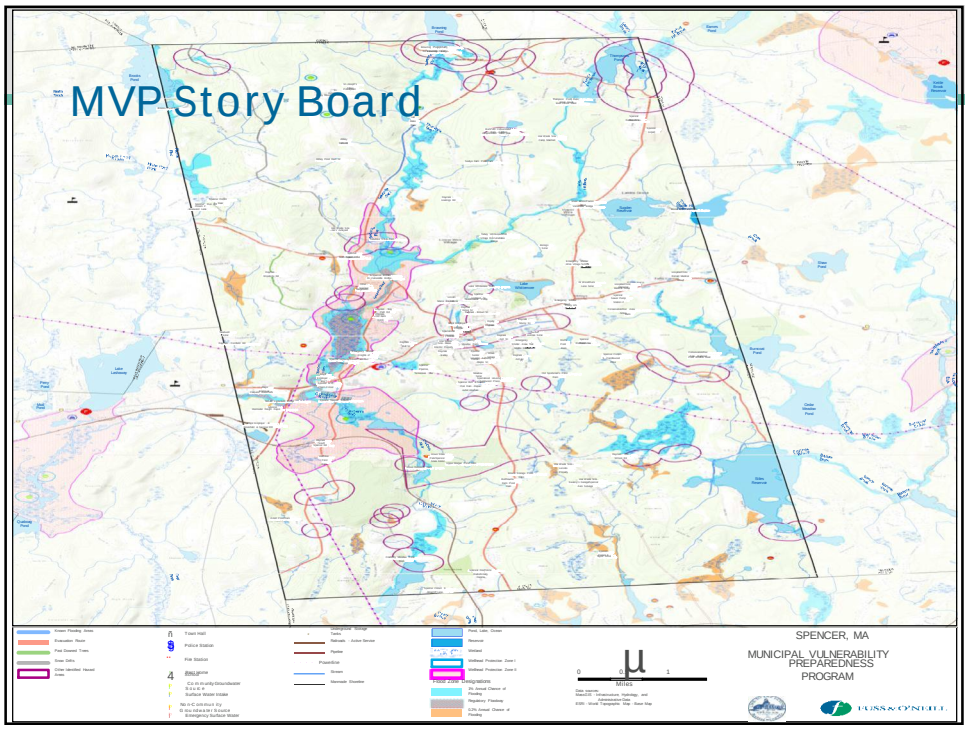

MVP Program

- Identify Top Four Hazards
  - Review MVP Sectors
  - Maps as tool
  - List infrastructure, societal, environmental feature
  - Determine whether a vulnerability or strength
  - Identify actions to reduce vulnerability or reinforce strength
  - Prioritize actions
  - Report Out
- Finalize Prioritization Plan

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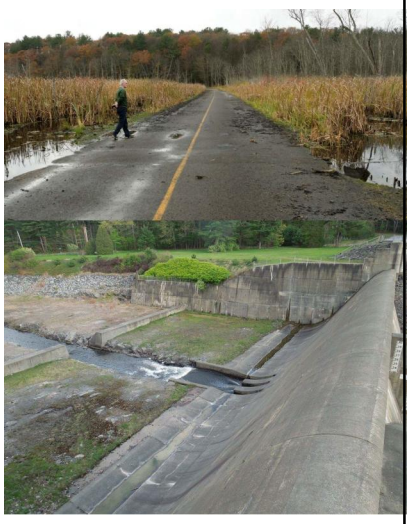
Climate Change Hazards

- Flooding
- Extreme Precipitation Events
- Heat Waves
- Drought
- Snow/Ice
- Wildfire
- Tornadoes
- Hurricanes
- Nor'easters
- Other



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MVP Sectors

- Infrastructure
  - Evacuation routes
  - Schools
  - Roads, bridges, dams
  - Water and wastewater
  - Septic systems
  - Hospitals
  - Commercial Buildings, churches
  - Utilities: electric, gas
  - Factories
  - Emergency management facilities

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MVP Sectors

- Societal
  - Emergency shelters
  - Senior housing
  - Schools and campuses
  - Economically challenged populations
  - Evacuation plans
  - Animal shelters
  - Hospitals, pharmacies
  - Grocery stores
  - Utilities: electric, gas
  - Homeless
  - Other

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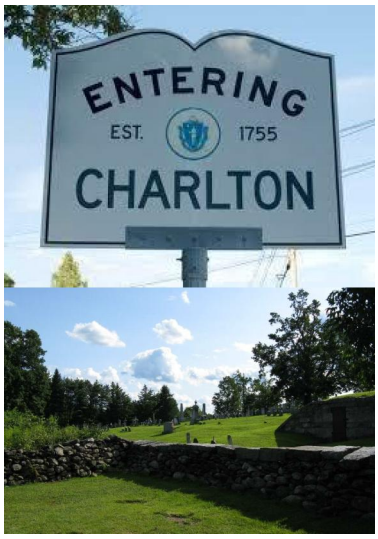
MVP Sectors

- Environmental
  - Drinking water supply
  - Rivers and streams
  - Parklands
  - Agriculture
  - Title V systems
  - Stormwater management
  - Open spaces
  - Flood plains
  - Forest
  - Other



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Next Steps:

- Public Review of Priorities
- Monitor and Update
- Annual Review

Community Resilience Building Workshop

Questions?