MUNICIPAL VULNERABILITY PREPAREDNESS PROGRAM

Community Resilience Building Workshops

Dedham, MA

PREPARED FOR

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Overview

Located in Norfolk County, on Boston's southwest border, the Town of Dedham ("Dedham") offers urban amenities but also hosts significant natural and recreational resources. In 2008, a Sustainability Advisory Committee was formed, supported by the Environmental Department, to provide recommendations to the Board of Selectmen, municipal departments, and residents on strategies for advancing the Town's sustainability commitment. To date, Dedham has engaged in various planning efforts and educational initiatives to address the impact of pollution and climate change, and to ensure that its businesses and residents can continue to live, work, and play in the most sustainable manner.

In 2018, Dedham was selected by the Commonwealth of Massachusetts to participate in the Municipal Vulnerability Preparedness (MVP) Program to assess potential climate change impacts, vulnerabilities, and to prioritize actions for enhanced short- and long-term community sustainability and resiliency.

1.1 Community Resilience Building Workshops

The MVP Program provides technical assistance to communities across Massachusetts to assess potential impacts from climate change, to identify the communities' vulnerabilities to those impacts, and to prioritize resiliency actions using the Community Resilience Building (CRB) framework. Under this framework, a "community-driven process" is designed to foster engagement and collaboration among community stakeholders. For the Town of Dedham, the Environmental Department led the MVP planning efforts and hosted two stakeholder workshops and a public listening session, with support from consulting firms, VHB and KLA (both are State-certified MVP providers).

Two (2) half-day stakeholder workshops were held on December 5 and December 12, 2018. See **Appendix A** for the workshop presentation and attendance sign-in sheets. The workshops' central objectives were to:

- Introduce the MVP Program process
- Define climate-related hazards in the Town of Dedham
- Identify existing and future vulnerabilities and strengths
- Develop and prioritize actions for the community to take today in preparation for tomorrow
- Identify opportunities for the community to advance these actions, including through leveraging the MVP Action Plan Grants

During the two half-day workshops, participants identified climate vulnerabilities and opportunities, as well as potential resiliency actions for the Town of Dedham to consider and implement. Photo credit: KLA.

1.1.1 Pre-Workshop Coordination

On November 8, 2018, Dedham's MVP Core Team ("the Core Team") convened to kick off the preparation for the stakeholder workshops. The Core Team consists of the following representatives:

- Virginia LeClair, Coordinator, Environmental Department
- Jim Kern, Town Manager
- William Spillane, Fire Chief, Head of Emergency Management Group
- Michael D'Entremont, Police Chief, Police Department
- Joe Flanagan, Director, Department of Public Works (DPW)
- Jason Mammone, Director, Engineering Department
- Cathy Cardinale, Director, Board of Health
- Elissa Brown, Conservation Agent, Conservation Department

During this pre-workshop meeting, the Core Team discussed workshop logistics and timeline, anticipated workshop goals and outcomes, and how to leverage the MVP process for deeper engagement and climate action activity in Dedham. The Team also discussed preparation of workshop materials with the Consultant Team, including the review of maps that laid out critical facilities, natural resources and open space, and vulnerable populations.

Data Collection: Climate Literature Review & Identification of Critical Assets

To prepare for the workshops and develop appropriate materials, the Core Team reviewed the following resources:

- MA Executive Office of Energy and Environmental Affairs and the Department of Energy Resources' *Massachusetts Climate Change Clearinghouse (resilient MA)*[1] – This website houses data, maps and resources relevant to climate change in Massachusetts. As part of this website, the *resilient MA Datagrapher*, prepared by the Northeast Climate Adaptation Science Center provides the latest data and summary information on climate projections at state and local levels. For this Project, the Core Team reviewed climate data specifically for Norfolk County, in which the Town of Dedham is located.
- *Town of Dedham Hazards Mitigation Draft Plan* (2011) – This draft plan identifies hazards along with specific locations and levels of vulnerability for the Town of Dedham.
- Town of Dedham Parks and Recreation[2] - This webpage provides information related to parks, fields, and facilities operated and maintained by the Town of Dedham.

The Consultant Team developed a summary of historic trends and future climate scenarios and implications for Dedham, as well as a preliminary list of critical assets and infrastructure to be reviewed with participating stakeholders at the workshops. Based on the available data, the Consultant Team also produced a base map, inclusive of layers of current Dedham demographics (with particular focus on the vulnerable populations), identified critical assets and resources, and future flood projection. See **Appendix B** for a summary on climate data and preliminary identification of critical assets and resources in Dedham.

Community Resilience Building Risk Matrix

Based on projected climate conditions and potential impacts to critical assets and resources in Dedham, the Consultant Team collaborated with the Core Team to set up a Risk Matrix to further analyze community vulnerabilities and strengths and to prioritize actions. The Risk Matrix was utilized to facilitate break-out sessions during the workshops. See **Appendix C** for the complete Risk Matrix for Dedham.

As per the CRB Workshop Guide, and to assist with the group discussions, the Risk Matrix was divided among three community components – infrastructural, societal, and environmental. With each of these groupings, workshop participants identified vulnerabilities and strengths, as well as prioritized actions. Examples for each of the community components include:

1 http://resilientma.org/

2 http://www.dedham-ma.gov/departments/parks-recreation/parks-fields-facilities

Infrastructure	Societal	Environmental
Roads and bridges	Public facilities and institutions	Parks and open space
Utilities	Recreational facilities and areas	Forests and wetlands
Stormwater infrastructure	Vulnerable and special needs populations	Waterbodies
Dams	Commercial and Business Areas/Clusters	
Buildings		
Railroads		

1.1.2 Workshop Follow-Up

It will be important to build on the momentum garnered through the work of the Core Team, the stakeholder workshops, and the public listening session, by continuing to engage these participants in the implementation of the actions identified and prioritized through this MVP process. The Town of Dedham's Sustainability Advisory Committee will also be a key resource to help drive this effort forward, particularly with regard to developing messages for and engaging with the public. The Town is interested in leveraging the work already accomplished through the MVP process to develop a more comprehensive plan on climate preparedness, with a primary focus on an equitable engagement process.

1.2 Public Listening Session

Town of Dedham's Sustainability Advisory Committee held the first public listening session on the MVP process on December 12, 2018. Photo credit: KLA.

The first public listening session was held on December 12, 2018, from 7:30 PM to 8:30 PM. Approximately 40 members of the public attended this meeting. As the first part of the meeting, an overview of the MVP process as well as the potential climate impacts on Dedham were introduced. Key outcomes of the stakeholder workshops were also presented. After the presentation, community members were then invited to travel to four stations, each representing one of the top four hazards (identified and discussed at the stakeholder workshops). At each station, participants were asked for feedback related to their concerns about the hazards as well as recommended actions that should be taken both at the community and individual levels to mitigate and adapt to the potential impacts of these hazards. See **Appendix C** for images of the posters presented as well as a summary of key outcomes of this public listening session. Overall, the participants were very engaged in the activity and many requested additional meetings and engagement opportunities. As such, the Town of Dedham's Sustainability

Advisory Committee held the second public listening session on February 13, 2019, from 7:30 PM to 8:30 PM. During this meeting, the Project Team presented the final findings from the MVP workshops and key recommendations to improve Dedham's resiliency, and provided an opportunity for additional input and feedback from community members.

2

Climate Projections and Top Priority Hazards

Communities across the Commonwealth have experienced changing climate conditions. For instance, between 1900 and 2014, the state's average annual temperatures have increased by approximately 3°F. The number of hot days with maximum temperatures above 90°F has been consistently above average since the 1990s. The state has also experienced above-average precipitation in the last ten years, averaging approximately 51 inches per year (compared to the overall long-term average of 45 inches per year between 1895-2009). Furthermore, since 2005, there have reportedly been about 30 percent more extreme precipitation events (days with rainfall above two inches).[3]

Similar to other communities across Massachusetts, Dedham has been impacted by these changing conditions through flooding from more frequent extreme rainfall and/or winter storm events and increased exposure to heat-related illnesses due to more extreme hot days, among other things. Unfortunately, these impacts will likely intensify as future projections indicate.

Appendix B provides a summary of historical trends and projected changes in weather and climate in Dedham. Baseline information provided in the summary and referenced in this report pertain to observed trends from the years 1971-2000, mid-century projections for the years 2040-2069, and end of century projections for the years 2080-2097.

Based on the Town of Dedham's *2011 Hazard Mitigation Draft Plan* as well as other regional and Commonwealth resources, and with feedback from the Core Team, the following four

3 MA Executive Office of Energy and Environmental Affairs. 2017. *Massachusetts Climate Change Projections Report*.

hazards have been identified as top priorities for Dedham, and were the focus for more in-depth discussions during the stakeholder workshops:

1. **Drought** –More short- and long-term droughts and low stream flows, as well as increased potential for brush fires;
2. **Flooding** –More flash and prolonged flooding due to heavy rain and rivers overtopping their banks;
3. **Heat Waves**— Increased number of very hot days over 90 °F, and they may also occur consecutively (i.e., heat waves); and
4. **Intense Storms** –Increased frequency and severity of rain events as well as an elevated risk of high winds during these extreme storm events (i.e., Nor'easters).[4]

2.1 Drought & Dedham

While the average annual precipitation is projected to increase overall, it is anticipated that this increase will come in fewer, more intense storm events (especially in the winter and spring) rather than in lighter events throughout the year. This means that there will be longer periods of time between rain events, which can lead to drought. The most severe drought recently experienced across the state was over several months in 2016. During the week of October 4, 2016, 52 percent of Massachusetts was considered to be in "Exceptional Drought," the highest level of drought on the U.S. Drought Monitor scale.[5]

Workshop participants were concerned about drought in relation to the town's environmental resources. Areas of concern included the impacts of drought on water supply as well as the increased potential for brush fires. As the town relies on groundwater as its main water supply, dry spells may cause many complications with meeting water demand. Drought may also impact soil moisture and water depth, which can weaken tree root systems, making trees less stable during extreme precipitation and high wind events. Furthermore, the potential for brush fires also increases as a result of drought, and there are several sites in Dedham with elevated risk of a fire.[6]

2.2 Flooding & Dedham

Dedham has seen an increase in annual rainfall over the past several decades and more is falling at once, meaning storm events are heavier. These heavy rain events may overwhelm the existing stormwater system and overtop Dedham's riverbanks, leading to flash flooding.

4 MA Executive Office of Energy and Environmental Affairs and the Department of Energy Resources. 2018. Massachusetts Climate Change Clearinghouse. Retrieved from http://resilientma.org/.

5 National Oceanic and Atmospheric Administration. 2018. Retrieved from https://www.drought.gov/drought/massachusetts.

6 Metropolitan Area Planning Council. 2011. *Town of Dedham Hazard Mitigation Plan (Draft)*.

They may also lead to dam failure, causing significant flooding downstream. According to FEMA record, from 1996-2016, Norfolk County, in which Dedham is located, has experienced approximately 38 flooding events (Figure 1). Dedham has seen a significant increase in average number of flood events over the past couple decades, averaging two events per year from 1996-2005 to 2.7 events per year from 2006-2016.[7]

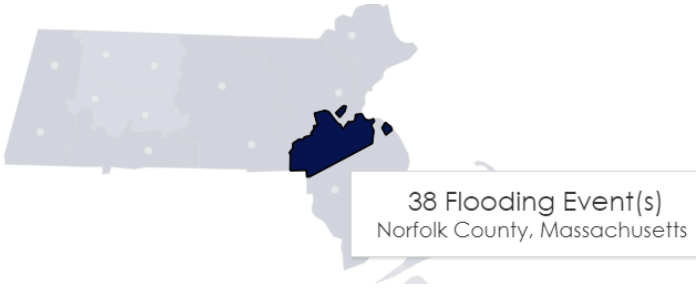

Figure 1. Number of flooding events in Norfolk County, MA from 1996-2016. Source: Federal Emergency Management Agency. (2018). Data Visualization: Historical Flood Risk and Costs. Retrieved from https://www.fema.gov/data-visualization-floods-data-visualization.

Additionally, using the Federal Emergency Management Agency (FEMA)'s Flood Insurance Study (FIS) for Middlesex County and the Boston Research Advisory Group (BRAG)'s *2016 Climate Change and Sea Level Rise Projections for Boston Report*, it is projected that what is considered the current 0.2-percent flood event (i.e. 500-year flood) will likely become the one-percent flood event (i.e. 100-year flood) by 2085. Maps in Appendix C illustrate the future flood projections and how they might impact the existing critical assets, infrastructure, and environmental resources in Dedham.

Workshop participants noted a multitude of concerns related to flooding in the town. A major concern is the potential damages to homes and critical infrastructure. Stakeholders pointed out that periodic flooding already occurs in "the manor area" below Sprague Street. While there has not reportedly been an issue to date, several participants raised some concerns regarding certain utilities and critical facilities that are currently located in areas prone to flooding and/or in proximity to the flood plain (e.g., the Department of Public Works facility, the fire station in East Dedham, and an Eversource power station), which could potentially hinder servicing residents during and after extreme weather events. Concerns were also raised about aging stormwater infrastructure and the potential need to assess whether Dedham's current stormwater culvert size is appropriate. Finally, there were various discussions about the potential limitations of current emergency management plans, concerns over some areas of town (e.g. Riverdale) becoming islands during flood events, and the need for evacuation plans, more shelter locations fully stocked with emergency resources, and backup power at critical facilities.

Members of the public at the listening session were also concerned about the potential "islanding" of some parts of town during extreme events, as well as more basement water,

7 Federal Emergency Management Agency. 2018. *Data Visualization: Historical Flood Risk and Costs*. Accessed December 20, 2018. https://www.fema.gov/data-visualization-floods-data-visualization.

and contamination of the town's water resources from runoff. Impacts from flooding may also have disproportionate negative effects on vulnerable populations (e.g., low income individuals, the elderly, etc.), who may have more trouble evacuating and/or accessing resources during and after flood events.

2.3 Heat Waves & Dedham

Heat is one of the leading weather related cause of fatalities in the US and this risk is only expected to grow.[8] Additionally, new temperature patterns have the potential to impact our ecosystems and food supply, as well as lead to increased prevalence of vector-borne diseases and invasive species. In terms of vector-borne diseases, warming conditions increase populations of pathogen-transmitting species like mosquitos and ticks, leading to an uptick in diseases. In terms of invasive species, warmer temperatures and longer seasons allow for new types of invasive species to move into an area and also make those that are already in Dedham less likely to die off during winter months.[9] Hot weather also causes the demand for air conditioning to rise, which increases energy use and utility bills during the summer.[10] The reduced demand for heat in warmer winters is not expected to offset the increase in energy consumed for cooling in the summer.[11]

Dedham has experienced both an increase in annual temperatures and an increase in the number of heat waves, generally defined in Massachusetts as three or more days in a row that reach temperatures of 90°F.[12] Dedham is expected to see an increase in the number of days with temperatures above 90°F in the summer and a decrease in the number of days below 32°F in winter. Figure 2 demonstrates the observed trends and projected changes for the average number of days above 90°F and below 32°F in Norfolk County, in which Dedham is located, by mid- and end of the century.[13]

All workshop participants highlighted potential impacts of heat on vulnerable populations, noting that these groups tend to be more exposed to heat-related and respiratory illnesses during extreme hot days and heat waves (i.e. due to existing respiratory illnesses, poor air quality, lack of cooling mechanisms, etc.). For instance, low-income residents are less likely to have access to air conditioning. Young children, seniors, those with existing respiratory conditions, as well as those working outside for extended periods of time without shelter, may experience more stress due to heat waves and/or more frequent poor air quality days. Several also noted the importance of installing air conditioning in school facilities, as many of them do not currently have adequate accommodation.

8 National Weather Service 2017. *Weather Fatalities 2017*. Retrieved from http://www.nws.noaa.gov/om/hazstats.shtml

9 International Union for Conservation of Nature. *Invasive alien species and climate change*. Retrieved from: https://www.iucn.org/resources/issues-briefs/invasive-alien-species-and-climate-change

10 MA Executive Office of Energy and Environmental Affairs and the Department of Energy Resources. 2018. Massachusetts Climate Change Clearinghouse. Retrieved from http://resilientma.org/

11 Clarke et al. 2018. *Effects of long-term climate change on global building energy expenditures*. Energy Economics, 72, 667-677.

12 Commonwealth of Massachusetts. 2019. *Extreme Heat Safety Tips*. Retrieved from https://www.mass.gov/service-details/extreme-heat-safety-tips

13 Northeast Climate Adaptation Science Center. 2019. Resilient MA Datagrapher. Retrieved from: http://resilientma.org/datagrapher/

Also related to potential public health issues, workshop participants emphasized concern about an increase in the prevalence of vector borne diseases and invasive species in town, noting that problems with invasive species have been getting worse in recent years (e.g., presence of Milfoil in Mother Brook and mile-a-minute vine).

Norfolk County	Observed Baseline 1971-2000	Mid-Century Projected Change	End of Century Projection
Average Number Days Below 32° F	131	105	91
Average Number Days Above 90° F	8	30	44

Figure 2. Observed and projected changes on the number of cold and hot days in Norfolk County, MA. Source: Massachusetts Executive Office of Energy and Environmental Affairs and the Department of Energy Resources. (2017). Massachusetts Climate Change Clearinghouse. http://www.resilientma.org/.

2.4 Intense Storms & Dedham

Projections suggest that Dedham can anticipate an increase in the amount of precipitation, intensity, and duration of storm events. The town is likely to face more Nor'easters, stronger winds, increased winter cold spells, and heavier snow. But these hazards are not just relegated to the future; the Northeast ranked first in the U.S. for observed increase in very heavy precipitation from 1958 to 2012 (see Figure 3).

In 2018, Dedham experienced four Nor'easters in three weeks.[14] Consequently, high winds produced by these extreme storms may threaten Dedham's tree-lined streets, which, according to stakeholders, are a defining characteristic of the town. Flooding, snow, and ice can disrupt transportation patterns and hinder the flow of goods and services, leading to impacts on the local economy. In addition, these hazards can damage infrastructure and cause problems for emergency routes, including those used for evacuation and rescue services.

Workshop participants raised concerns about the impacts of intense storms on vulnerable populations, particularly for those who are dependent on consistent power supply for things like medication and heating/cooling and those who may have a harder time evacuating and finding a place to stay during and after extreme weather. Additionally, the aftermath of these intense storms may also pose financial burdens on those who have fewer resources to recover from damages, including businesses (particularly the local "mom and pop" shops) and certainly on those who may have a hard time paying bills if their places of work are closed for prolonged periods.

14 U.S. Global Change Research Program. 2014. National Climate Assessment. Retrieved from https://www.globalchange.gov/nca3-downloads-materials

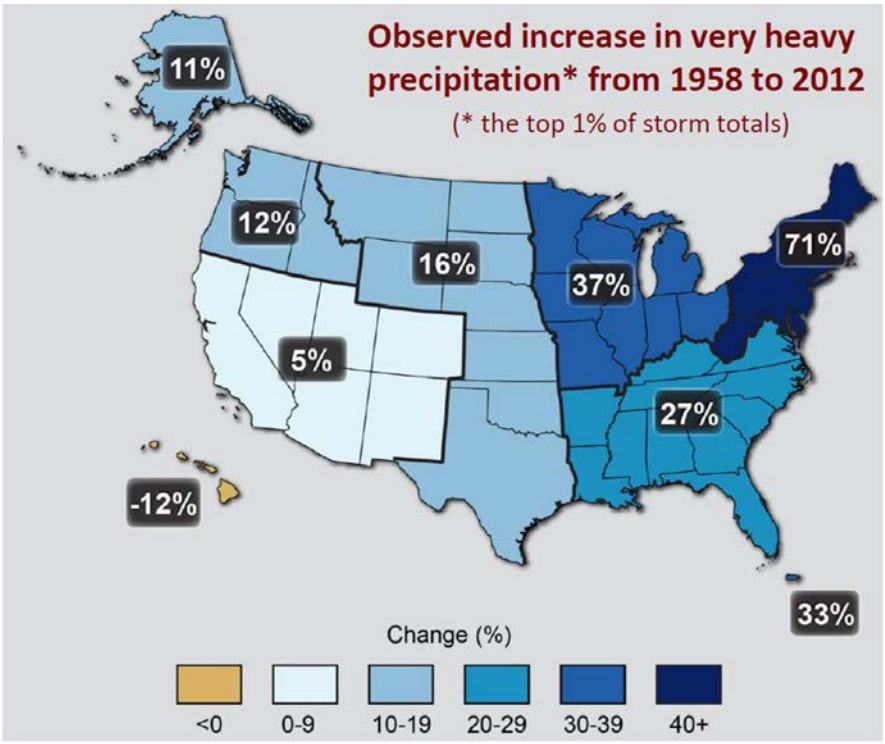

Figure 3. Observed increase in heavy precipitation from 1958-2012. Source. U.S. Global Change Research Program. (2014). National Climate Assessment. Retrieved from https://www.globalchange.gov/nca3-downloads-materials.

3

Current Strengths and Assets

The following section highlights Dedham's current strengths and assets identified for the three resource areas: infrastructure, social & economic, and environmental. Refer to Appendix B for maps of identified critical assets and infrastructure in Dedham. Based on feedback from the Core Team, stakeholders at the workshops, and members of the public at the listening session, these assets have been assessed for their vulnerabilities and strengths in response to the identified top priority hazards (described in previous chapter). Dedham's ability to address and/or expand upon these existing resources and programs will strengthen its capacity to plan for and bounce back from future climate change impacts.

3.1 Infrastructure

Through the MVP Process, the Town of Dedham and its stakeholders identified the power & telecommunications systems, flood control measures (dams, etc.), and the transportation system as the greatest strengths and assets under infrastructure.

3.1.1 Power & Communications Network

Participants at the stakeholder workshops noted that Dedham's power and communications networks generally rebounded from stressors quickly. System redundancies also exist; major public service centers, including the Department of Public Works (DPW), have backup generators that enable continued operation in the case of severed connections to the local/regional power grid. Dedham's public schools' internet access also operates on a closed fiber loop. The redundant nature of this technology ensures that backup capability exists for all schools in the system. Workshop participants described having experienced

minimal power or telecommunications loss during storms, and quick restoration of power in the case of loss throughout the town. Representatives of Eversource and the Town indicated that generally there are measures in place for determining priority areas, facilities, and buildings with the greatest need for rapid power restoration. It was noted that all power stations were either elevated above flood levels or slated for upgrades to address flooding issues. Furthermore, Eversource is currently undertaking a project to replace a double-circuit that runs from West Roxbury to Needham (and passes through Dedham) with an independent transmission circuit.[15] The separation and replacement of the transmission lines, which includes the construction of new underground transmission lines, will prevent potential load loss caused by both rising energy needs and higher demand on the grid. The project will provide security for customers in the face of extreme heat and/or storm events.

3.1.2 Flood Control Measures

Dedham also benefits from several flood control mechanisms, including recently updated culverts and protected flood protection areas. The Mother Brook Dam, cited as a huge flood control asset for both Dedham and the surrounding communities during extreme storm events, was recently raised to accommodate 500-year flood events. Climate change impacts like drought and more frequent and intense storm events render even more important the environmental services that these natural assets already provide.

3.1.3 Transportation System

In terms of transportation infrastructure, workshop participants generally considered access to and from surrounding communities via roadways as crucial to past and future emergency response. They also noted that the Route 1 corridor (also known as the Boston-Providence Highway) facilitates the flow of resources in and out of community and also serves as a designated evacuation route for Boston communities. It is critical to maintain the navigability of this route and roadways leading to it to ensure prompt emergency response and evacuation for Dedham and surrounding communities. Fortunately, workshop participants noted that immediately following recent major storm events, businesses along the Route 1 corridor were able to quickly restock and reopen to serve the town.

Additionally, workshop participants viewed public transit in Dedham as an important, though often underutilized asset. Dedham also operates its own bus service, though it is a service that is not often used. Three MBTA commuter rail stations—Endicott and Dedham Corporate Center/128 in Dedham, and Readville Station in nearby Readville—also provide access for workers traveling to-and-from Dedham. At the same time, feedback from the workshops raised a concern that aside from these public transit services, alternative transportation modes (as well as connectivity among these modes) are fairly limited in Dedham. For instance, for those who are transit dependent, once they are dropped off at a bus or train station, it is often challenging for them to continue traveling to their final destination as they

15 Commonwealth of Massachusetts Energy Facilities Siting Board. 2018. *Petition of NSTAR Electric Company d/b/a Eversource Energy for Approval to Construct a New Overhead/Underground 115 kV Transmission Line EFSB 16-02 in Boston, Dedham, and Needham, Massachusetts*. Accessed December 20, 2018. https://www.eversource.com/content/docs/default-source/tranmission/w-roxbury-to-needham-project---efsb-16-02-final-decision-5-17-18.pdf?sfvrsn=14aec262_2.

don't have the appropriate infrastructure to walk or bike safely the rest of the way. This is an existing asset the Town will want to focus on enhancing to fully reap the benefits.

3.2 Social and Economic Features

In a poll during the first stakeholder workshop, participants identified Dedham's people as one of the greatest assets in the town. There is a sense of community cohesion that can serve as a strength to Dedham when it faces extreme events. And those working in Dedham are what keeps their economy going. Stakeholders expressed general confidence in their public safety personnel, facilities, and residents. Following a major flooding event in 2010, workshop participants noted that response from emergency teams was rapid, with no lasting damage to flooded facilities.

3.2.1 Local Businesses

The Route 1 corridor and its diverse group of businesses has demonstrated an ability to be a strength for Dedham, ensuring access to services and resources. The highway in this sense represents a social as well as infrastructural asset, facilitating closer ties to neighbors and expanding Dedham's networks. Workshop participants indicated that the businesses and employment centers along this corridor are important to the Dedham community, specifically because of their strategic location. Legacy Place, located off I-95, is a frequented shopping center with grocery stores and retail that are typically the first businesses to restock and open after major storms. The majority of grocery stores are usually able to restock quickly as well. And in advance of major storm events, residents take preparation seriously, stocking up on food and other supplies.

Legacy Place, a major shopping center for Dedham residents as well as neighboring communities. Photo credit: Legacy Place.

3.2.2 Emergency Shelters

Currently, in response to potential impacts of extreme weather and emergency events, Dedham has three officially designated emergency shelters with generators and cots: Dedham Middle School, Dedham High School, and Avery Elementary School. While these resources have not required full use to date, they have capacity to shelter significant portions of Dedham's population. Several municipal facilities, including Dedham's Town Hall, also serve as "unofficial" emergency shelters.

Workshop participants mentioned that Town Hall's central location and politically significant role in Dedham make it the go-to space for residents to gather or seek information in the case of an emergency. Generally, Dedham also has several community centers and resources that provide a variety of services. The Dedham Community House provides affordable

recreational and educational opportunities, including a pre-school and after school programs and summer camps for kids. The Dedham Public Library offers a free breakfast and lunch program. Additional community assets include several active churches and the Dedham Food Pantry. Many of these programs and services are important for low-income populations without access to private educational and recreational programs, as well as food insecure families or individuals that struggle to pay for meals. These resources can be crucial for responding to a hazard-related event that provokes resource scarcity and compounds that challenges that vulnerable populations already face.

3.2.3 Communal Housing

There are several assisted or independent senior living facilities, retirement communities, and medical centers within the town. Residences are a mix of public, operated by the Dedham Housing Authority (e.g., Doggett Circle, O'Neil Drive), and private (e.g., Brookdale Dedham, Hebrew Senior Life Home Center). Several facilities are constructed on higher ground to prevent flooding damage and are newer facilities (e.g., New Bridge on the Charles) with structures better equipped to withstand extreme storms and temperatures. Most communal living facilities have cooling centers or air-conditioned community rooms that can keep residents cool during extreme heat events. Dedham's Council on Aging has a free senior transport service to help disabled residents and residents over 55 run errands, travel to medical appointments, and obtain food at the grocery stores or local food pantry. Advocacy groups in Dedham connect Dedham's aging populations with many of these resources. Livable Dedham was referenced as an organization that advocates for elder care and support. These services are crucial during and after extreme weather events that make travel even more difficult for elderly and disabled populations.

3.3 Environmental Features

Dedham is home to a wealth of environmental resources from state and local parks, open spaces, recreational areas, wetlands, waterways, and tree canopy. A number of MVP Workshop participants were there representing the environmental resources within Dedham, including members of the Conservation Commission, the Charles River Watershed Association, and Neponset River Watershed Association. Workshop participants repeatedly acknowledged the value of these resources and the benefits they provide Dedham.

3.3.1 Wetlands

Wetlands represent nearly 20 percent of the Town's total area. Wetlands provide habitat for animals, and flood mitigation and control that prevents damage during flooding and rainfall events. Regional coordination exists, which provides an additional layer of planning and protection for these ecological resources. Under the Town of Dedham General Wetlands Protection Bylaw, Dedham has a 2:1 replacement policy, requiring that the ratio of compensatory to altered resource area be 2:1.

Workshop participants noted this as a strength in Dedham and most of the solutions were focused on maintaining the good work that is already happening and educating the public on the true value these wetlands bring to the town, particularly as it relates to their resilience.

3.3.2 Open Space & Tree Canopy

Dozens of publicly owned and operated open spaces provide recreational opportunities and environmental services to the community. Public open spaces include both Massachusetts Department of Conservation Resources (DCR) conservation areas such as Cutler Park Reservation, Wilson Mountain Reservation, and Neponset River Reservation, as well as Town holdings like Dedham Town Forest and Barnes Memorial Park. Dedham has received Tree City USA designation for maintenance of its urban tree canopy. Having these open spaces and a robust inventory of urban trees also help mitigate flooding during intense rainfall events, facilitate groundwater recharge for the wells that supply the Dedham's water, and provide cooling and shade during times of extreme heat. At the same time, the potential for brush fires also increases as a result of drought, and there are several sites in Dedham with elevated risk.

Workshop participants recognized the value that their open spaces and parks and tree canopy provide for cooling, stormwater management, and recreation. They have experienced increased challenges in managing pests/invasive species in its urban trees and recognize the need to maintain and enhance the Town's urban tree planting and maintenance, as well as invasive species management.

Dedham contains valuable natural and recreational resources, offering miles of hiking and walking trails as well as various points of access to water activities. Photo credit: Dedham Trails.

3.3.3 Water Supply & Quality

Dedham's drinking water is uniquely provided strictly by a groundwater system. The Dedham-Westwood Water District has fourteen wells in Dedham and in Westwood and two water treatment plants. There are also several water control measures in place to help minimize Dedham's use of water and protect its water supply, which are increasingly important environmental services in the face of climate change impacts like more frequent drought and more extreme precipitation events. Mother Brook is a DCR protected waterway and the oldest manmade canal in U.S. It serves as spillover for the Charles River, making it a

regional strength for flooding resilience. The Town also has some water reuse technology in place upon which it hopes to expand. Currently, the Middle School has a grey water system for its toilets. The Town is also using drought resistant plants on its fields where possible. When asked about the Town's response to a potential drought-related water shortage or water emergency, residents responded that they felt secure in the District's ability to tap into Massachusetts Water Resources Authority (MWRA), City of Boston, Norwood, and Needham water supplies.[16]

Workshop participants expressed confidence in Dedham's system redundancies that protect water supply and quality. Participants also referenced aggressive sewer infiltration requirements and recent repairs that protect water quality during extreme rainfall events. In 2016, the Town of Dedham Engineering Department carried out a rehabilitation project to prevent approximately 530,000 gallons of daily infiltration.[17] At the same time, workshop participants also acknowledged the need and benefit of increasing green infrastructure and natural spaces throughout town to enhance the town's resiliency, particularly to flooding and extreme storm events.

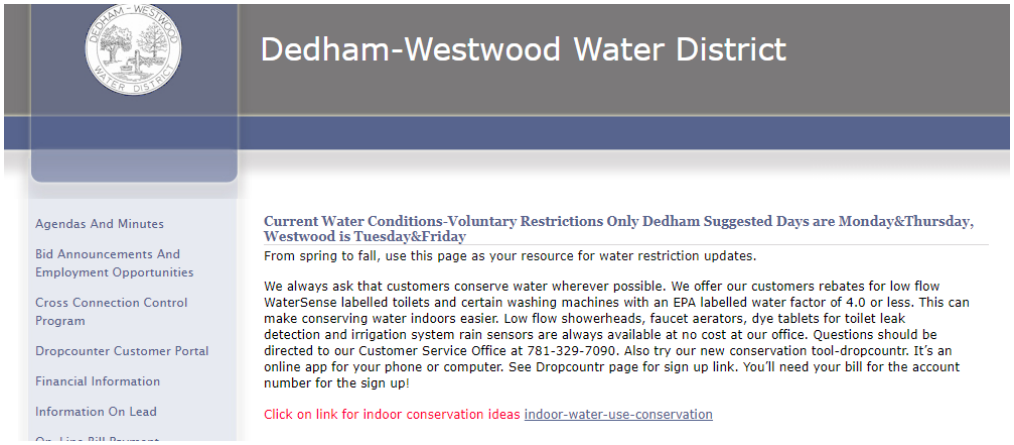

Figure 4. Dedham-Westwood Water District website outlines the protocols for water use and offers resources for water conservation. Source: Dedham-Westwood Water District. (2018). Current Water Conditions. Retrieved from http://www.dwwd.org.

16 Dedham-Westwood Water District. 2018. Frequently Asked Questions. Accessed December 19, 2018. http://www.dwwd.org/frequently-asked-questions.

17 Town of Dedham. 2016. *2016 Infiltration Rehabilitation Project*. Accessed December 19, 2018. http://www.dedham-ma.gov/Home/ShowDocument?id=1727.

4

Recommendations to Improve Resilience

Based on the discussion around existing vulnerabilities and strengths in terms of Dedham's assets and resources, the Core Team worked with workshop participants to develop a list of recommendations to help Dedham prioritize its planning efforts for resiliency. This section highlights some of the actions presented in the Community Resilience Building Risk Matrix (see **Appendix C**).

Top 10 Priority Actions:

One outcome of the Community Resilience Building Workshop was a set of priority actions. At the end of the second workshop day, participants in each workshop group voted on 1-2 top priority actions within the three feature areas, producing a list of 10 top priority actions listed below (actions are listed in no particular order). From this full list of top 10 actions, all workshop participants then voted for their single highest priority action. Actions indicated with an asterisk (*) represent the three actions with the most votes.

Infrastructure

- Upgrade stormwater infrastructure
- Install back-up generators and/or storage systems for critical facilities (and incorporate renewable energy where feasible)*
- Explore potential for water reuse/recharge/recycling

Environmental

- Educate residents and businesses on water conservation and our water supply
- Allocate more funding for natural resources and natural resources education

› Coordination among Parks and Rec, Conservation Commission, and Public Health for long term planning
› Identify sites for protecting recharge / water resources, wells

Societal

› Education for all on preparedness and existing available resources including how to get on "check on me" lists*
› Create a comprehensive municipal emergency plan*
› Explore zoning for mitigation of development impacts as it relates to climate change

4.1 Identified Priority Actions

The following sections summarize and highlight key priority actions that came out of the stakeholder workshops. The actions are categorized as high, moderate, and lower priority. Workshop participants also discussed the implementation timeframe for each of the priority actions: short-term, long-term, and/or ongoing. See **Appendix C** for the complete Risk Matrix, which detailed all actions identified at the workshops.

4.1.1 High Priority Actions

	Identified Action	Timeframe
Infrastructure		
	› Upgrade stormwater infrastructure (sizing/systems) to handle more extreme events, including 500-year flood or greater. o More specifically, ensure culverts are sized appropriately at Rustcraft Road and West Jersey Street.	Short-term
	› Develop electric vehicle (EV) infrastructure, including: o Establish guidelines/standards for installation of electric vehicle infrastructure. o Explore grant opportunities to retrofit existing municipal facilities with electric vehicle charging stations.	Short-term
	› Upgrade DPW facility and identify back-up locations for equipment to mitigate flood risk.	Short-term
	› Promote development of green infrastructure to manage stormwater.	Long-term
	› Review and update stormwater bylaws.	Long-term
	› Enact zoning that's forward thinking to accommodate and/or control denser development, specifically with regard to water/sewer provision.	Long-term
	› Explore potential for water reuse, recharge, and recycling, expanding and improving upon existing programs.	Long-term
	› Invest in strategic evaluation and improvements to aging stormwater infrastructure.	Long-term
	› Minimize impervious areas by reviewing and revising relevant bylaws, zoning, and parking requirements,	Long-term

	Identified Action	Timeframe
	specifically requiring new development to maintain a certain percentage of property as pervious.	
	› Adopt bylaw on lawncare to restrict water use.	Long-term
	› Install back-up generators and storage systems at critical facilities (such as school buildings, Housing Authority senior facilities, etc.), o Also, consider utilizing solar and other renewable options for these systems where feasible.	Short and Long-term
	› Require new developments to protect utilities by placing them underground.	Short- and Long-term
	› Expand Wi-Fi access throughout Dedham, particularly in limited-access and low-income neighborhoods.	Short- and Long-term
	› Continue tree trimming program, providing education and training on how to manage trees and when to contact utility companies.	Ongoing
	› Provide energy efficiency and weatherization training for homeowner, landlords, and residents.	Ongoing
	› Clarify public versus private management of roads to ensure emergency access and road clearance during emergency and/or extreme weather events (i.e. snow removal, debris removal, etc.).	Ongoing
	› Maintain database of bridge and dam inspections.	Ongoing
	› Invest in improvements to and creative use of public transit. o For example, coordinate/explore more options for use of Dedham buses.	Ongoing
Societal		
	› Increase public education and outreach program regarding climate change as well as communication related to emergency preparedness. For example: o Promoting and providing residents with more information regarding existing resources such as "check on me" and "code/red emergency lists. o Continue educational outreach on climate change and potential impacts (i.e. expand on educational program for youth, small businesses, and others on climate change preparedness/specific resiliency actions). o Provide emergency response training for school staff. o Ensure that emergency centers/shelters are prepared with sufficient training and resources for responding to disasters (i.e., CPR training, emergency preparedness kit). o Improve communication channels with vulnerable populations, ensuring that the existing emergency alert system is reaching these groups and that those on medically vulnerable lists are updated and broadly distributed.	Ongoing

	Identified Action	Timeframe
	› Install spray parks for low-income neighborhoods to ensure both cooling and recreation are available for children during heatwaves.	Short-term
	› Develop a system or mechanism to identify locations of vulnerable populations for support services during emergency events.	Short-term
	› Recommission school buildings/introduce a preventative maintenance program for school buildings.	Short-term
	› Identify opportunities to ensure students on free-lunch program are provided meals when schools are closed.	Ongoing
	› Create a comprehensive municipal emergency plan and consider adding a Community Emergency Response Team (CERT) program.	Short-term
	› Create evaluation and shelter plans for specific vulnerable, at-risk neighborhoods (or neighborhoods without easy access to designated emergency shelters). For example: o For the Manor area, retrofit the old Early Childhood and Education Center (to include back-up generators and cots) and designate the building as the area's emergency shelter. o For Riverdale, designate the area's shelter at St. Suzanne's or Riverdale School.	Short-term
	› Floodproof building and town assets that are prone to flooding, or in floodplain.	Short-term
	› Ensure adequate cooling and heating of facilities in public buildings, particularly emergency shelters and critical facilities.	Ongoing
	› Ensure key businesses and major employers have emergency responses plans in place. o Also, consider coordination with businesses (such as Showcase Cinemas, Whole Foods, and others at Legacy Place) as potential back-up emergency shelters and resources during emergency and/or extreme weather events.	Ongoing
Environmental		
	› Improve coordination among town departments and agencies, including Parks and Recreation, the Conservation Commission, and Public Health, for long-term planning and clarification of responsibilities related to natural resources management and funding.	Ongoing and Long-term
	› Allocate more funds for natural resources management and education.	Ongoing
	› Address conflicting regulations to protect groundwater supplies and water quality. o For example: ensure drought-resistant vegetation and/or relax vegetation requirements.	Short-term

	Identified Action	Timeframe
	› Consider stormwater management strategies specifically to reduce runoff into the Charles and Neponset Rivers.	Short-term
	› Identify sites for protecting recharge/water resources.	Ongoing
	› Educate residents and businesses on water supply and water conservation measures, especially for lawn management.	Ongoing
	› Launch a public education campaign to prevent water pollution related to runoff and pet waste disposal.	Ongoing
	› Increase public access to green and open space (especially for inaccessible parks).	Long-term
	› Develop a dedicated land management plan for open space and parks.	Ongoing and Long-term
	› Increase maintenance of parks and green space. For example: o Improve Cutler Park by planting more shade trees, installing irrigation systems at fields, and putting in spray parks/cooling features. o Introduce green infrastructure and habitat protection at Fowl Meadow to reduce flood risk of surrounding neighborhoods from the Neponset River. o Undertake invasive species management at all parks and open space (i.e. emerald ash bore). o Consider brushfire risks in times of drought.	Ongoing and Long-term
	› Increase tree planting around parks and fields to provide relief from heat, and also, consider planting a variety of tree species that are wind, storm, drought, and/or pest-resistant.	Ongoing
	› Protect and promote wetlands, including measures such as: o Undertake more structured outreach and scheduling for wetland clean-ups. o Conduct more regular coordination and planning efforts with watershed organizations (as well as with other town departments) to implement wetland protection measures. o Hire additional staff to manage wetlands and stormwater-related issues.	

4.1.2 Moderate Priority Actions

	Identified Action	Timeframe
Infrastructure		
	› Introduce enforcement mechanisms for failure to clear pathways to schools, especially during winter seasons and/or after major winter storms.	Short-term
	› Promote continual and improved communication with state authorities regarding dam maintenance and operations.	Ongoing
	› Upgrade or reconstruct the East Dedham Fire House, ensure it has a back-up generator.	Long-term

	Identified Action	Timeframe
	› Fortify or consider relocating DPW facility.	
	› Explore back-up/decentralized wastewater treatment infrastructure.	Long-term
	› Promote and implement transit-oriented development in Town.	Ongoing
	› Upgrade poles and power lines, develop alternative power back-up systems (i.e., solar, etc.).	Ongoing
	› Prevent location of utilities in areas vulnerable to underground flooding.	Ongoing
	› Encourage low-impact development. o Consider developing a set of best practices to share with developers and builders on sustainable building and development measures.	Ongoing
	› Enhance signage for emergency evacuation routes.	Short-term
	› Model stormwater infrastructure system to provide more technical information about how it performs with hazards.	Long-term
	› Increase funding for stormwater management.	Long-term
	› Introduce flood protections at Bridge Street.	Ongoing
Societal		
	› Explore bus rapid transit program to promote access, social equity, and economic development opportunities (while promoting alternative transportation option).	Ongoing
	› Identify a location and develop model for a resilience hub, potentially developed through public/private partnership.	Long-term
	› Pursue public/private partnerships for emergency response and resiliency planning.	Short-term and Ongoing
	› Install signage on designated emergency shelters.	Ongoing
	› Provide digital/remote learning opportunities to ensure continued learning during extreme event-related shutdowns.	Ongoing
Environmental		
	› Coordinate with surrounding towns and state agencies (including DCR) around management of waterbodies. More specifically: o Continue to monitor water levels and quality of Mother Brook. o Conduct research on flood risks as part of Wigwam Pond planning.	Ongoing
	› Engage volunteers and education the public around river clean-up (for example, hosting a high school "green day").	Ongoing
	› Implement a beaver control plan to protect dams.	Long-term
	› Map base flood elevation through a detailed engineering study.	Long-term

	Identified Action	Timeframe
	› Conduct outreach to homeowners in the Charles and Neponset River areas about flood risks (groundwater, riverine flooding, etc.).	Long-term
	› Revisit potential future uses of Manor Fields.	Long-term
	› Adopt a Community Preservation Act.	Short-term
	› Explore zoning changes to assist in tree planting and/or preventing tree removal.	Short-term
	› Plant more trees on Route 1 (similar to VFW Parkway).	Short-term
	› Develop strategies to ensure newly built parks and fields have flood control measures incorporated.	Long-term
	› Restore filled wetlands/floodplain areas.	Long-term

4.1.3 Lower Priority Actions

	Identified Action	Timeframe
Infrastructure		
	› Equip all public transit stations (train, bus, etc.) with covered/protected and ADA-accessible waiting areas.	Short-term
	› Coordinate with the MBTA to use commuter rail trains for evacuation.	Long-term
	› Identify alternative/backup locations for fire engines and equipment.	Short-term
	› Increase water pumping infrastructure at Bryan Street Public Safety Facility.	Short-term
	› Maintain regular tree trimming at Wigwam Pond to prevent downed trees/power outages	Ongoing
Societal		
	› Coordinate with food pantry to develop a plan for emergency support.	Long-term
	› Coordinate with Dedham Medical to develop emergency healthcare plan.	Long-term
Environmental		
	› Daylight smaller streams.	Long-term
	› Develop a town-wide policy to manage aquatic invasive species.	Long-term
	› Loosen requirements to connect to MWRA to encourage water conservation.	Long-term
	› Support Dedham Land Trust and help promote its work to protect water and land resources.	Ongoing
	› Promote historic value of wetlands.	Ongoing
	› Promote Tree City designation and host more tree-related public events.	Ongoing
	› Find ways to celebrate large trees on private property (i.e., plaques).	Ongoing

Identified Action	Timeframe
› Implement tree bylaw.	Long-term
› Start a local tree farm.	Long-term
› Develop public shade tree policy on private land.	Long-term

5

Conclusion and Next Steps

5.1 Summary of Findings

From the lively stakeholder discussions and feedback during the two CRB workshops, the following key cross-cutting themes have emerged. These themes serve as the overarching next steps that can help Dedham's ongoing efforts to promote sustainability and enhance resiliency in the response to climate change.

1. Fortify Critical Assets and Improve Emergency Response

Workshop participants discussed the benefits of having access via Route 1 to a strong network of surrounding towns. Examples of emergency response unsurprisingly involved significant reliance on neighbors for resources. At the same time, participants acknowledged that the widespread, regional nature of climate change impacts could threaten the Town's ability to rely on neighboring towns/cities for support. Several action items focus on fortifying or protecting critical assets within Dedham and preparing infrastructure for changing and intensifying hazards. These actions reflect a need for greater emphasis on local resiliency efforts that not only make Dedham better equipped to respond to hazards internally; they also render Dedham an important resource to other towns in need of support.

2. Invest in Education on Climate Change Impacts and Promote Existing Resources

Dedham already has a wealth of natural assets, support services, and opportunities for getting involved in community planning efforts. Individuals may not be aware of these

resources, or they may not fully understand climate change risks and therefore feel less compelled to engage. Several actions identified during the workshops seek to increase outreach to residents to inform them of existing resources, as well as to invest in additional education on climate change impacts and emergency preparedness, for both residents and leaders. These actions include promoting community involvement in natural resource management.

Local students talked about their work through Project PREP at the second public listening session on February 13, 2019. Led by a group of young individuals, this community outreach initiative aims to "better prepare residents for extreme weather events and equip them with the knowledge needed to act quickly and confidently." For more information about Project PREP, check out www.weatherprep.org. Photo credit: KLA.

3. Provide Additional Resources for Vulnerable Populations

Workshop participants recognized that vulnerable communities including elderly, young, disabled, low-income, minority, and immigrant groups have a harder time preparing for and responding to the impacts of climate change. Participants identified specific actions that would provide additional protections and resources for these groups as part of emergency preparedness and climate change resiliency efforts.

4. Improve Planning and Coordination for Resiliency

Throughout Dedham, individual departments and organizations have capacity to contribute to the Town's response to climate change impacts and vulnerabilities. A lack of coordination among these groups, however, inhibits a more unified response. Recognizing that a piecemeal effort to improved Dedham's resiliency will not suffice in the face of systemic changes, several actions identified below speak to the need for comprehensive planning or regulatory changes.

5.2 Next Steps

Dedham is committed to leveraging its strengths and addressing its vulnerabilities in preparing for the impacts of climate change. The MVP process was a great first step to bring together key stakeholders as well as the larger community to express concerns, identify strengths and vulnerabilities, and brainstorm ways to take action. The Town of Dedham is ready to build on the momentum started through the MVP process and continue to engage with community members on the topic of resiliency. The Town plans to seek funding to implement some of the high priority actions identified through the MVP process and incorporate these actions into a robust plan.

6

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The Dedham Municipal Vulnerability Preparedness (MVP) planning process was compiled by the Core Team, which consists of the following staff from Dedham:

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