Town of Georgetown

Community Resilience Building-Summary of Findings

Hazard Mitigation Plan Update 2020

Georgetown Town Hall
Source: Town of Georgetown

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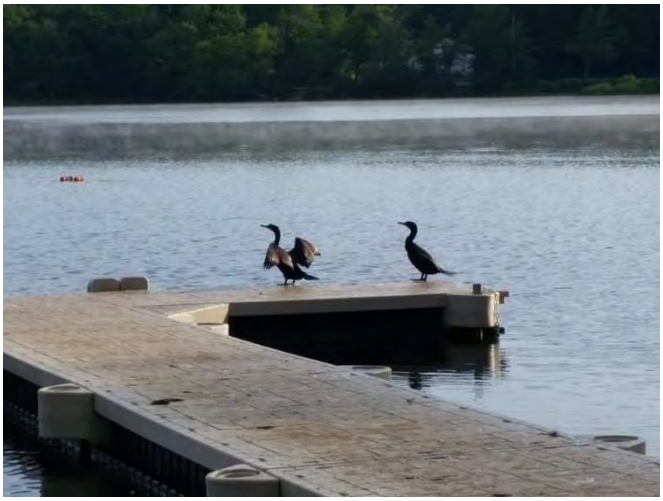
EXECUTIVE SUMMARY

In accordance with Executive Order 569, which seeks to build resilience and adapt to the impacts of climate change, the Town of Georgetown, Massachusetts is pleased to submit this Summary of Findings Report. In 2019 - 2020, the Town of Georgetown applied for and received a Municipal Vulnerability Preparedness (MVP) program grant from the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) to (1) complete a vulnerability assessment and action-oriented resilience plan (Findings Report) and (2) update its Hazard Mitigation Plan. Collectively these efforts followed the Community Resilience Building (CRB) framework developed by The Nature Conservancy. The CRB framework uses a community-driven workshop process to identify climate-related hazards, community strengths and vulnerabilities, and develop solutions to address these considerations. Completion of the CRB process enables the Town to achieve MVP community designation status from the EEA and receive preference for future state grant under the MVP program or other participating funding entities. Georgetown was also granted EEA funds to conduct a Natural Resources Infrastructure Assessment (NRIA) project, which entailed assessing the existing natural resource infrastructure assets within Georgetown and evaluating their climate vulnerability and/or resiliency and their capacity to contribute to Georgetown climate resiliency goals. Results of this NRIA project were shared with CRB Workshop attendees at the Workshop and are reported in the Georgetown Natural Resources Infrastructure Assessment Report (Georgetown NRIA Report).

As climate change continues to alter the way municipalities evaluate risk and manage resources, it is important to evaluate the effects of climate change and the solutions to address these challenges in a manner that assesses the interdependency of Georgetown's infrastructural, societal, and environmental features. The Findings Report and HMP Update support Georgetown's continued effort to establish climate resiliency within the community.

MVP Core Team Meeting



American Legion Park; Source: Georgetown Parks & Recreation

COMMUNITY RESILIENCE BUILDING HAZARD MITIGATION PLAN UPDATE, PLANNING AND WORKSHOP

The CRB/HMP update process began with the establishment of a Core Team comprised of Town Staff from a variety of departments and three Community Members. The Core Team held an in-person strategic planning session on March 5, 2020 at the Georgetown Town Hall. The Core Team meeting involved developing a broad understanding of the Hazards, Vulnerabilities, Strengths that characterize the Town of Georgetown, identifying a list of Preliminary Resilience Actions that the community could consider at the CRB Workshop, and developing Core Team understanding of the CRB process. The Core Team meeting was used to prepare for the upcoming CRB Workshop and to identify the goals of the workshop within the context of community interests and needs. The Core Team decided that it was important to use the workshop as a mechanism to engage with the community using interactive media platforms, including an ESRI GIS community data viewer prepared specifically for the workshop and interactive demonstrations of the Massachusetts Data Clearinghouse Website, resilientma.org and The Nature Conservancy's Resilient Land Mapping Tool Website, http://maps.tnc.org/resilientland/ .

COVID-19 RESILIENCY

Due to the global COVID-19 pandemic and the Massachusetts Non-Essential Business Order and Stay-at-Home Advisory that went into effect on March 24, 2020, no additional in-person meetings or workshops were feasible following the March 5, 2020 Core Team Meeting. BSC Group, Inc., Georgetown's MVP certified provider, hosted all further meetings, the CRB Workshop, and will host the Listening Sessions via the Zoom platform. Additional online platforms and formats were and are being used to provide information to participants and to solicit feedback. These include: a Georgetown-specific ESRI GIS Data Viewer, ESRI Storymap, Georgetown Community Television, the Georgetown website, a Google Docs online survey, and the Zoom platform.

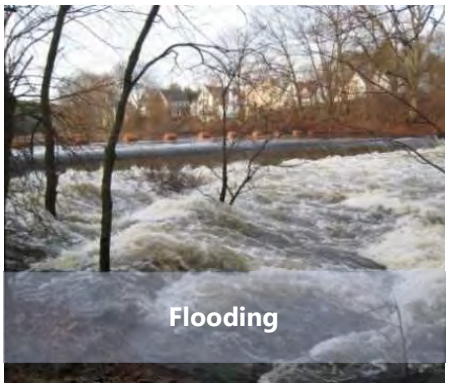
An invitation to participate in the HMP listening session/discussion was e-mailed to the safety, planning, land health, and land and emergency management personnel from neighboring communities including: Boxford, Groveland, Haverhill, Rowley, West Newbury and Newbury. Invitation to participate in the HMP listening session/discussion was also e-mailed to the Merrimack Valley and Greater Haverhill Chambers of Commerce, state land management agencies including DCR, MassDOT and MEMA, and local non-profits including the Boxford Open Land Trust, the Essex County Greenbelt and the Parker River Clear Water Association. The meeting flyer with links to the Georgetown project website was distributed with the e-mail invitation.

The Community Resilience Building Workshop was held on April 14, 2020. Due to presenting the workshop via Zoom, the workshop was provided as a two-session event, with a morning session and an afternoon session, to give participants a lunch break and a break from screen. Workshop participants included a diverse set of community stakeholders from a variety of municipal departments and boards, the MVP Regional Coordinator, the Director of the Parker River Clean Water Association, and the Assistant Director

of Land Conservation for the Essex County Greenbelt Association. The CRB Workshop followed the format outlined in the "Community Resilience Building Workshop Guide". The workshop started with a presentation by BSC Group to introduce the concept of the CRB process and the agenda for the workshop, after which the attendees identified the top 4 – 5 Hazards facing Georgetown. BSC Group then presented 1) the Hazard Mitigation Plan Update project and solicited additional Hazards from the participants, 2) ecological climate resiliency and natural resource mapping generated during the Georgetown Municipal Vulnerabilities Preparedness Natural Resources Infrastructure Assessment project, 3) a slide show of various approaches to Nature Based Solutions, and 4) the Georgetown Data Viewer. Participants then identified Vulnerabilities, Strengths, and associated resiliency Actions and completed a CRB Workshop Risk Matrix. Participants ranked and prioritized Action items as High, Medium or Low priority, and determined whether the timeframe for accomplishing the Action item is Short-term, Long-term, or Ongoing. Climate resilience planning requires an ongoing effort by community stakeholders. Workshop attendees and other interested stakeholders are encouraged to provide comments, corrections, updates, or additional information of findings transcribed in this report to Steve Przyjemski at sprzyjemski@georgetownma.gov. The success of climate resilience planning in Georgetown is contingent upon ongoing participation of community stakeholders.

TOP HAZARDS WITHIN GEORGETOWN

Natural disasters caused by climate hazards can result in the loss of life, damage to infrastructure and have negative consequences for a community's economic, social and environmental well-being. Hazard mitigation planning is the process used by state and local leaders to understand risks from natural hazards and develop long-term strategies to reduce or eliminate the long-term impact and risks to people, infrastructure and the environment from hazards. (FEMA, Local Hazard Mitigation Planning Worksheet 2016).



The Town of Georgetown faces several challenges related to establishing resilience to the effects of climate change. For example, over the past couple of decades, Essex County experienced more than 20 extreme weather-related events that triggered federal or state disaster relief. Climate change is expected to increase the occurrence and intensity of natural-hazard related weather events. Identifying and preparing for the hazards most prevalent within Georgetown is the first step to prepare for the effects of climate change.

During the Core Team and CRB planning efforts, stakeholders identified the top climate hazards for the Town of Georgetown. Flooding from extreme precipitation events, extreme and variable weather such as extreme snow, ice and freezing rain events, drought, extreme heat, and increased disease vectors (emerald ash borer, ticks, Eastern equine encephalitis, gypsy moths, blue-green algae, etc.) were identified as the top climate exposure hazards and were highlighted as significant concerns for the Town. Flooding, winter storms and northeasters were also identified as the top hazards in Georgetown's 2015 Hazard Mitigation

Plan Update[1]. Additional climate hazards previously incorporated in the HMP were reviewed and ranked by level of risk to the community during the planning process. Moderate hazards were identified and include beavers, wildfires, dam failure and power outages. Low risk natural hazards include earthquakes, tornadoes and landslides.

Since the 2015 HMP, Georgetown has elevated the risk ranking for drought, and has incorporated disease vectors as a new community risk resulting from climate change. Although not explicitly listed as a natural hazard, impacts associated with beavers were incorporated as part of the flooding natural hazard during the 2015 HMP Update.

2020 HMP Hazard Ranking Table:

NATURAL HAZARD	COMMUNITY RISK RANKING
Flooding	High
Extreme and Variable Weather (Snow, Ice, Wind, Rain, etc.)	High
Drought/Extreme Heat	High
Disease Vectors (Mosquitos/EEE; Ticks/Lymes Disease; Forest Pests; Crop Pests and Pathogens; Blue Green Algae, etc.)	High
Beavers	Moderate
Wildfires	Moderate
Dam Failure	Moderate
Power Outages	Moderate
Tornadoes	Low
Earthquakes	Low
Landslides	Low

FLOODING

Flooding remains a concern for the Georgetown community. Increase flooding has been observed in areas mapped as part of the 100-year floodplain as well as areas near the 100 -year floodplain. Based on land use maps, there are large areas of impermeable surfaces included buildings, roads and parking roads in or near the 100-foot floodplain. However, there are also large areas of open space and undeveloped land in and near the floodplain as well as adjacent to waterways and wetlands. Georgetown attributes flooding to an increase of rainfall in a short time frame, undersized or unmaintained infrastructure such as culverts, filling of riverways and waterbodies with sediment from eroding banks and stormwater and dense invasive species, and damning of streams by beaver.

[1] Merrimack Valley Region, Mullti Hazard Mitigation Plan Update (2016) available https://mvpc.org/wp-content/uploads/April-2016-MV-Multi-Hazard-Mitigation-Plan-Update.pdf

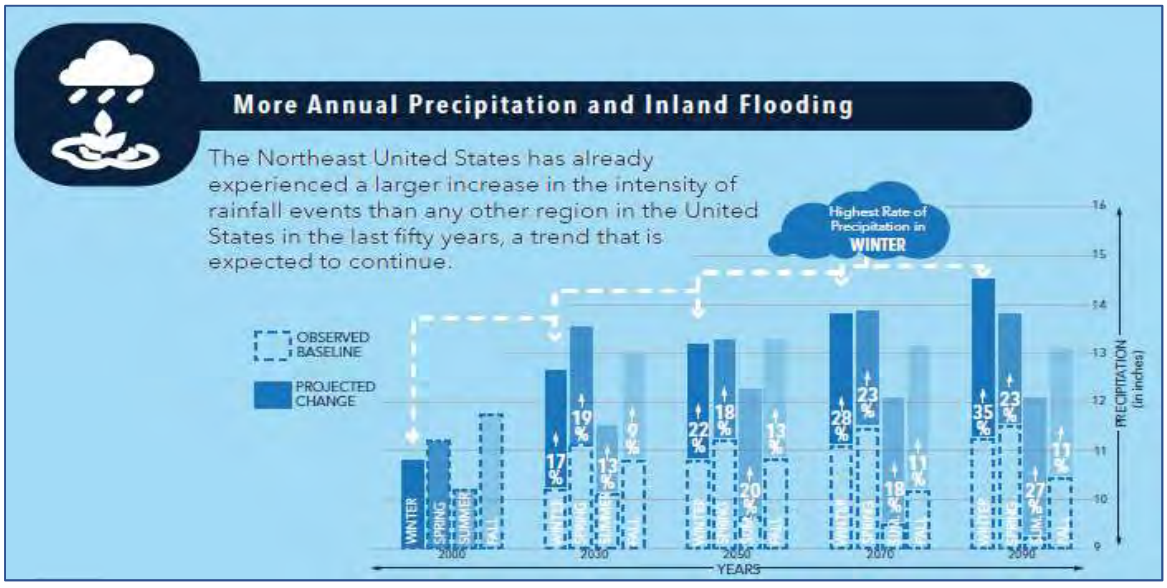
Since the 2015 HMP an increase in roadway flooding has been observed in the following areas:

- West Street and Bailey Lane
- Areas between Rock, Pentucket and Crane Ponds

Additional facilities experiencing flooding include:

- Facilities with hazardous material storage (e.g. gas stations and car repair shops)
- Critical Facilities offering services to the community's most vulnerable populations including senior citizens, individuals with disabilities and children (e.g. childcare centers, senior living/support activities, health care facilities, etc.)
- Perley Elementary School (gymnasium continues to experience flooding despite multiple upgrades)
- Decommissioned Landfill
- Water Treatment Facility
- Searles Street Substation
- Private wells/potable water resources

According to the Climate Change Clearinghouse, over the past 50 years, New England has experienced a larger increase in the intensity of rainfall events than any other region in the United States. The Commonwealth receives approximately 48 inches of rain per year on average, with average monthly rainfall between 3 and 4 inches for all regions of the state. These precipitation patterns are changing. The changes are likely to become more pronounced in the years ahead. We can expect to see more intense spring downpours, drier summers and more intermittent droughts, increased inland and coastal flooding, diminishing snowfall and higher precipitation in winter and spring months. The following graphic shows precipitation predictions for the Merrimack River basin over the next seven decades.



EXTREME AND VARIABLE WEATHER

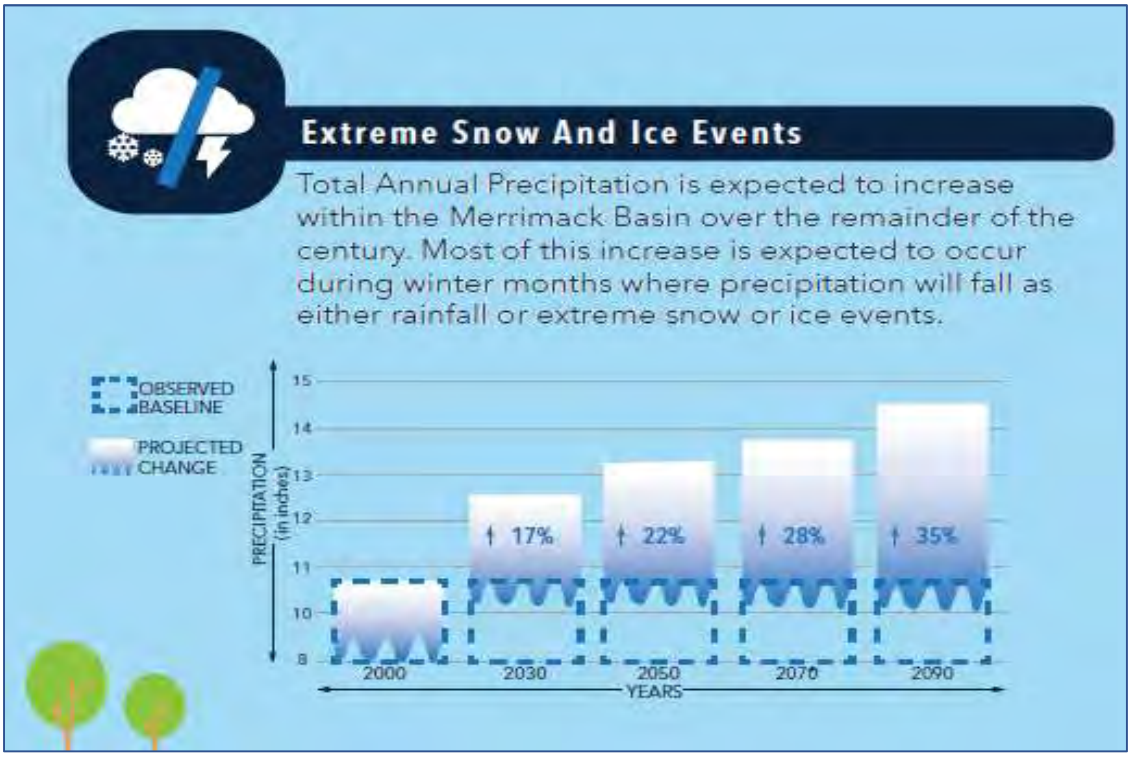
According to FEMA, Essex County experienced more than 20 extreme weather-related events that triggered federal or state disaster relief. Climate change is expected to increase the occurrence and intensity of natural-hazard related weather events. Identifying and preparing for the hazards most prevalent within Georgetown is the first step to prepare for the effects of climate change.

The following information is based on the Climate Change Clearinghouse for the Commonwealth Website:

BLIZZARDS, BOMBOGENESIS AND EXTREME ICE EVENTS

According to Resilient MA, while the frequency of future blizzards is extremely hard to project, climate scientists have indicated that warmer air currents holding increased levels of moisture are moving north over the Atlantic Ocean. As the warm fronts moving north collide with colder air systems from the north, Massachusetts and other northeastern states are likely to see very intense blizzard events with high levels of snow. Increased snow and ice events have resulted in power outages in Georgetown. Many of the residents of Georgetown obtain water through private wells. Power outages put them at risk of limited access to potable water.

The following graphic shows extreme snow and ice events predictions for the Merrimack River Basin over the next seven decades:



HURRICANES AND NOR'EASTERS

According to a 2017 U.S. Climate Science Special Report and Resilient MA, there has been an upward trend in North Atlantic hurricane activity since 1970[12]. The report forecasts that future hurricanes forming in the North Atlantic will drop more rain and may have higher wind speeds. This is because a warmer atmosphere will hold more water, and hurricanes are efficient at wringing water out of the atmosphere and dumping it on land.

Scientists are also studying whether nor'easters along the Atlantic coast are increasing in frequency and intensity, and again there is some evidence of a growing trend. In the future, nor'easter events may become more concentrated in the coldest winter months when atmospheric temperatures are still low enough to result in snowfall rather than rain.

CRB Workshop participants identified the need to review road and emergency facility access to ensure that emergency facilities are accessible during extreme weather events. Extreme weather events have resulted in power outages in Georgetown. Many of the residents of Georgetown obtain water through private wells. Power outages put them at risk of limited access to potable water.

DROUGHT/EXTREME HEAT

According to the Climate Clearinghouse, a small projected decrease in average summer precipitation in Massachusetts could combine with higher temperatures to increase the frequency of episodic droughts. According to the U.S. Drought Monitor, since 2000, the longest duration of drought in Massachusetts lasted 48 weeks beginning on June 7, 2016 and ending on May 2, 2017. The most intense period of drought occurred during the week of September 1, 2017, leading to major crop losses and widespread water shortages and use restrictions.

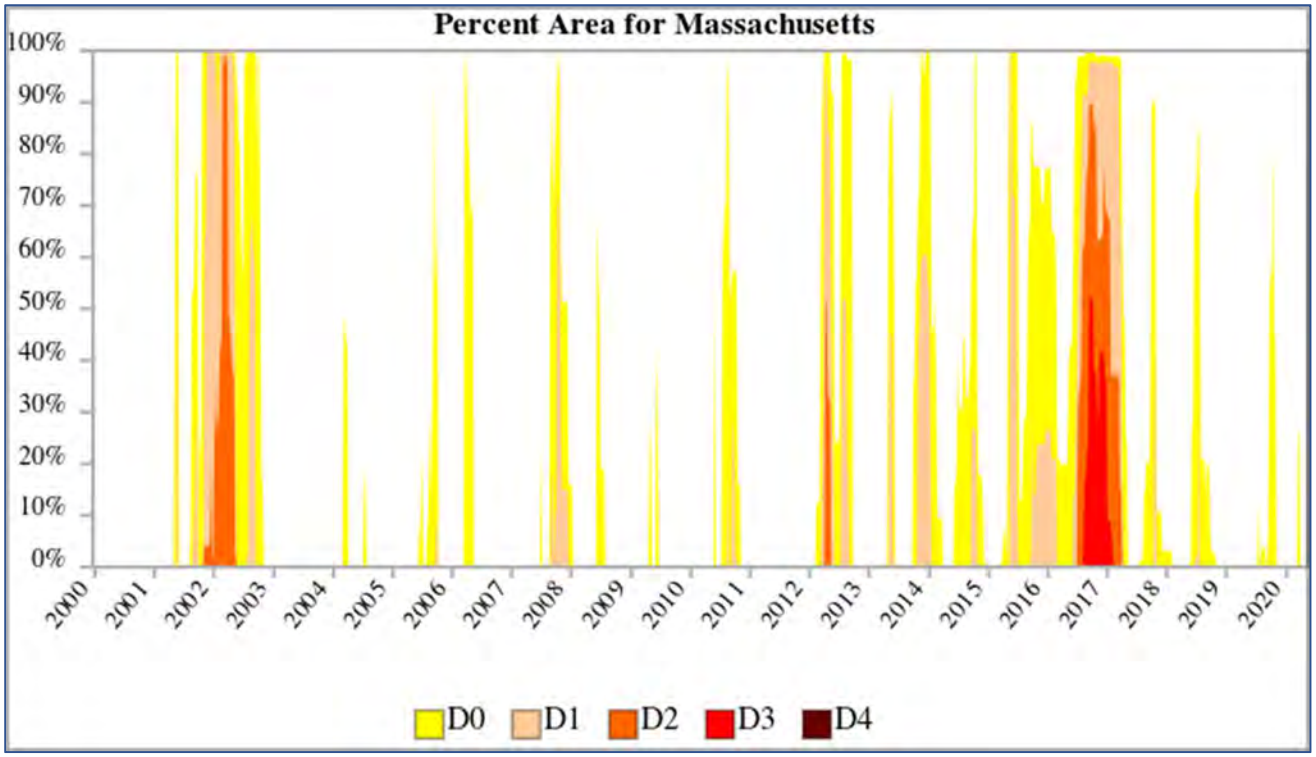
Droughts will create challenges for local water supply by reducing surface water storage and the recharge of groundwater supplies, including private wells. More frequent droughts could also exacerbate the impacts of flood events by damaging vegetation that could otherwise help mitigate flooding impacts. Droughts may also weaken tree root systems, making them more susceptible to toppling during high wind events.

CRB workshop participants identified a reduction in water levels in the Parker River, its tributaries and associated ponds. Reduction in the water table has also led to requests for increasing private well depths. A decrease in water table and increase in heat has resulted in algae blooms, higher concentrations of nutrients and low concentration of oxygen in the water and an increase in aquatic invasive plants.

[2] Climate Science Special report, Fourth National Climate Assessment (NCA4), Volume prepared by the U.S. Global Chance Research Program (USGCRP). Cited on Resilient MA, Climate Change Clearinghouse for the Commonwealth, https://resilientma.org/changes/extreme-weather#fn_1

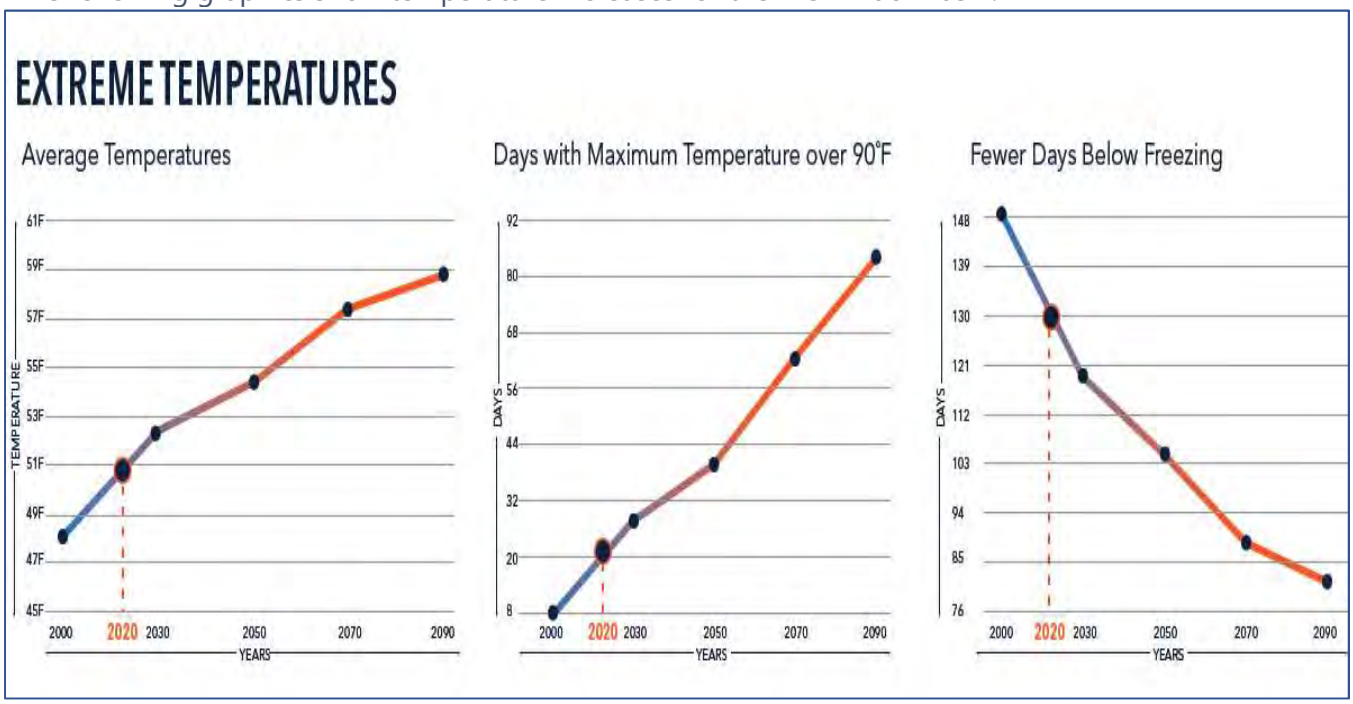
Although fish kills have not been observed, these can result from the reduced water levels and increase in temperatures.

CRB workshop participants identified a lack of cooling centers within Georgetown. Opportunities for cooling centers include the library and other town buildings as well as the addition of trees and benches in known areas of gathering such as parks, plazas, markets and bus stops.



https://www.drought.gov/drought/data-gallery/us-drought-monitor

The following graphics show temperature increases for the Merrimack Basin:



DISEASE VECTORS, BLUE/GREEN ALGAE AND INVASIVE PESTS

According to the CDC, Climate is one of the factors that influences the distribution of diseases borne by vectors (such as fleas, ticks, and mosquitoes, which spread pathogens that cause illness). Daily, seasonal, or year-to-year climate variability can sometimes result in vector/pathogen adaptation and shifts or expansions in their geographic ranges. Such shifts can alter disease incidence depending on vector-host interaction, host immunity, and pathogen evolution. North Americans are currently at risk from numerous vector-borne diseases, including Lyme, dengue fever, West Nile virus disease WNV), Easter, Equine Encephalitis (EEE), Rocky Mountain spotted fever, plague, and tularemia. Vector-borne pathogens not currently found in the United States, such as chikungunya, Chagas disease, and Rift Valley fever viruses, are potential future threats.

Mosquitos Borne Diseases

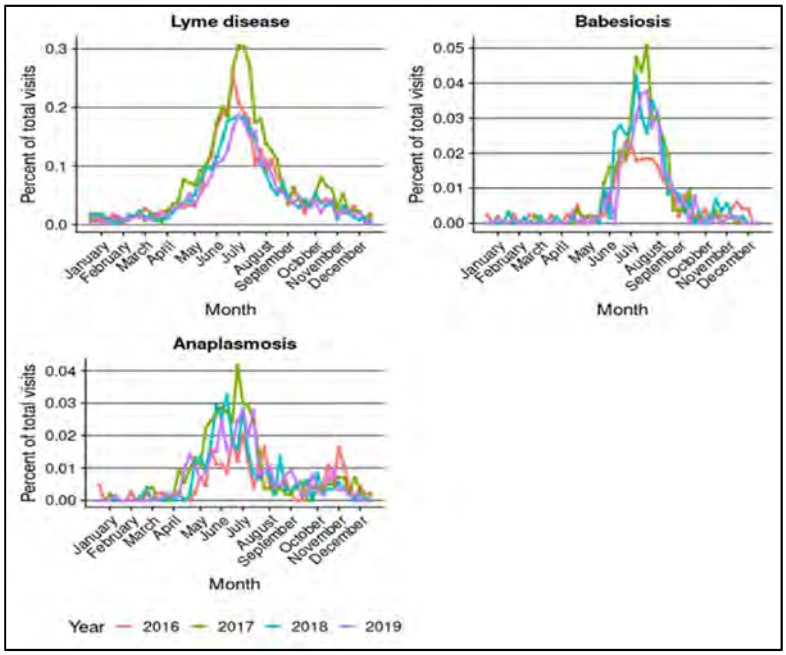
The Massachusetts Department of Public routinely tests mosquitoes for WNV and EEE. Routine mosquito testing is typically reported June-October. During 2019, there were 12 reported human cases of Eastern equine encephalitis (EEE), including three deaths. According to the DPH risk level mapper, on October 21, 2019, Georgetown was in a moderate risk level for EEE and at a low risk level for WNV. According to DPH, a moderate risk level means that EEE has occurred in the area within the last year and/or EEE is in mosquitoes are in the area as of the map date. The online mapper is updated frequently, especially during the mosquito season and is available at https://georgetown.wickedlocal.com/news/20190822/interactive-map-find-out-risk-level-for-eee-or-west-nile-in-your-massachusetts-community.

Tick Borne Diseases

Ongoing research suggests that shorter winters and warmer winter temperatures may result in earlier tick emergence. As the climate continues to warm and precipitation increases, so will the tick population. According to the Canadian National Health Institute, rising temperatures in Canada have led to improved conditions for survival and reproduction of ticks and faster development leading to an acceleration of the tick lifecycle. This has resulted in an increase tick abundance, has enabled ticks to spread to higher latitudes, and longer seasonal tick activities[3].

According to the Massachusetts DPH, tick activity and tick-borne diseases like Lyme diseases, anaplasmosis, babesiosis, Borrelia miyamotoi and Powassan virus, occur year-round in Massachusetts. According to the December 2019, Tick Exposure and Tick-Borne Disease Syndromic Surveillance Report, there were 133 diagnosed tick-borne diseases in Essex County. Based on the number of patients who were diagnosed with a tick-borne disease during the same time frame, children ages 5- 14 and older adults are more frequently diagnosed with tick-borne diseases. Children are more frequently diagnosed with Lyme disease while older adults are more commonly diagnosed with Lyme disease, anaplasmosis or babesiosis. Based on overall results between 2016 and 2019, the prevalence of tick-borne illnesses appears to be less than in 2017.

The following graphics show the percent of total doctor's visits that resulted in a diagnosis of Lyme disease, babesiosis or anaplasmosis in 2019:



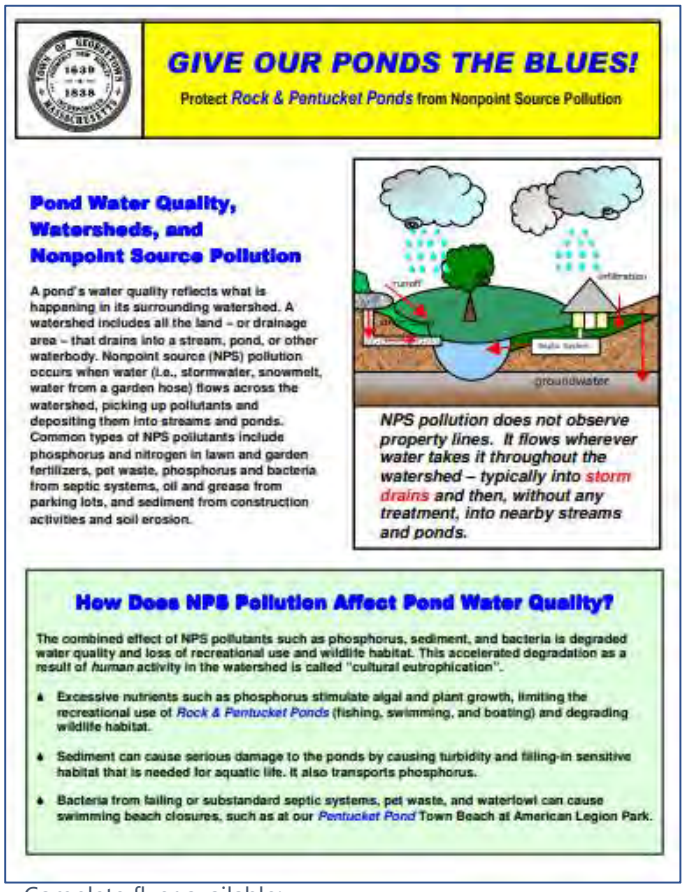
[3] Bouchard, Dibernardo, Koffi, Wood, Leighton and Lindsay. N Increased risk of tick-borne diseases with climate and environmental changes. Canada Communicable Diasease Report (2019), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6587693/

To review the DPH Tick-Borne Diseases Year End Summary Report for 2019, please visit https://www.mass.gov/lists/monthly-tickborne-disease-reports#2020-. A 2020 report is also available covering the period between January 1, 2020 and February 18, 2020. Town specific exposure levels are not available.

Blue/Green Algae

According to the EPA, scientists predict that climate change will have many effects on freshwater and marine environments. These effects, along with nutrient pollution, might cause harmful algal blooms to occur more often, in more waterbodies and to be more intense. Algal blooms endanger human health, the environment and economies across the United States. According to the EPA, algae blooms may be triggered by several climate hazards:

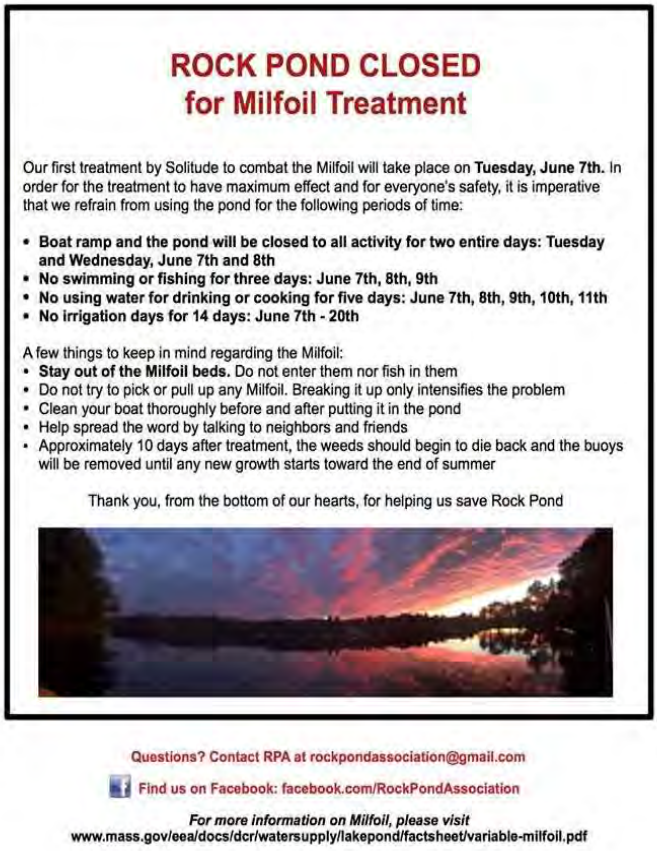
- Warmer water temperatures
- Increased carbon dioxide in the atmosphere
- Changes in rainfall and volume of rainfall in short events leading to erosion and sedimentation of waterways, and stormwater inputs
- Periods of drought



Complete flyer available: https://www.georgetownma.gov/sites/georgetownma/files/uploads/georgetown_ponds_nps_bulletin_2-08.pdf

During the summer of 2019, the DPH warned dog owners and pond goers to stay away from ponds across the Commonwealth with reported blue algae/cyanobacteria outbreaks. Notices were posted on DPH's website and across freshwater swimming areas indicating the specific locations were toxic algae blooms had been identified.

According to the CRB participants, algae blooms also occurred at Pentucket and Rock Ponds. These may not be the result of cyanobacteria but are still of concern to the Community. Outreach efforts have begun to educate pond goers and abutters about the potential causes of algae blooms. For example, the Georgetown Stormwater Management Program with the assistance of the Merrimack Valley Planning Commission provided outreach and education to Pond abutters about the causes of algae blooms and how to mitigate future blooms.



Invasive Species

According to the International Union for Conservation of Nature (IUCN), invasive species may be compounded by climate change. Extreme climatic events resulting from climate change, such as hurricanes, floods and droughts can transport these pests to new areas and decrease the resistance of habitats to invasions. Many invasive pests can expand rapidly to higher latitudes and altitudes as the climate warms, out-pacing native species. Increase in the presence of invasive species may affect environmental, societal and infrastructural resources.[4] For example, invasive species such as common reed, *Phragmites asutralis* may affect wetland hydrology and habitat quality; toxic invasive plants such as Giant Hogweed, *Heracleum mantegazzianum* affect the health and safety people; invasive insects such as the Emerald Ash Borer, *Agrilus planipennis,* affect tree livelihood leading to tree falls, infrastructural damage, sun exposed and reduced wildlife habitat; and brown marmorated stinkbugs, *Halyomorpha halys,* affect the quality and survival of crops consumed by people.

In Massachusetts, an emerging initiative of the Northeast Climate Science Center aims to develop management-relevant research to improve invasive species management in the face of climate change. Through working groups, information sharing and targeted research, this project addresses the information needs of invasive species managers in the context of climate change. For more information, please visit https://necsc.umass.edu/projects/regional-effort-invasive-species-and-climate-change-riscc-management

The CRB team expressed concerns over the increased presence of invasive species in Georgetown. Town volunteers and staff have initiated outreach campaigns associated with aquatic invasive species in Pentucket and Rock Ponds. Both ponds are treated for aquatic invasive plant management. The Emerald Ash Borer was found in Georgetown in 2016.

[4] https://www.iucn.org/resources/issues-briefs/invasive-alien-species-and-climate-change

Collectively, it was agreed upon by the group that the Town of Georgetown's top hazards present ongoing and cumulative adverse impacts on the community's most important infrastructural, societal, and environmental resources. The Appendix for this report includes Merrimack River basin climate projections and associated graphic showing anticipated climate changes for Georgetown over the coming decades.

CHARACTERIZING A CLIMATE RESILIENT GEORGETOWN

The CRB process involves a robust stakeholder engagement effort and can be used to characterize the vulnerabilities and strengths unique to a given community. The Georgetown CRB process revealed important characteristics that broadly represent the identity and culture of the community. Collectively, these characteristics provide a *snapshot* of the community's vulnerabilities and strengths and is an important starting point to identify community features most at risk to the effects of climate change. The Appendix includes the CRB Workshop Risk Matrix which lists 15 specific climate vulnerabilities and strengths in Georgetown, each of which includes related sub-categories of vulnerability and risk, and also includes base maps used in the CRB Workshop. The vulnerabilities and strengths can be discussed in broad categories as noted below. Most of the vulnerabilities and strengths could be categorized in more than one sectoral grouping (Infrastructure, Societal, and Environmental). For this reason, the Core Team members requested that the MVP Provider (BSC) modify the CRB Workshop Matrix to allow selection of more than one sectoral grouping.

A FEMA Capability Assessment Worksheet was developed utilizing the information collected during the CRB workshop The FEMA Capability Assessment Worksheet is incorporated and discussed in the HMP section of this report.

Critical Facilities

According to FEMA, for some activities and facilities, even a slight chance of flooding is too great a threat. These facilities should be given special consideration when formulating regulatory alternatives and floodplain management plans. Constructing a critical facility in a floodplain should be avoided to ensure access to and functionality of the facility and its offered services. According to FEMA, if a critical facility must be located in a floodplain it should be provided a higher level of protection so that it can continue to function and provide services after the flood. In addition to flooding, critical facilities are also impacted by all climate hazards. Typical critical facilities include hospitals, fire stations, police stations, storage of critical records, and similar facilities as determined by the community. An updated list of the critical facilities in Georgetown is provided in the following table. The following Climate hazard maps showing the location of critical facilities with respect to climate hazards have been provided in the Appendix. Critical facilities are referenced by the map reference number included in the table below.

- Flooding: 100 and 500-year FEMA Floodplains (MassGIS)
- Population density (2019 MassGIS census blocks)
- Average snow fall (1981-2010- average of reports from Weather Channel Weather Stations)
- Land use and floodplains (2019 Mass GIS
- Past Hurricane and Tornado Trajectories (MassGIS)
- Landslide Incident Areas and Earthquakes (USGS) have been included in the appendix to this report

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Map Reference	ASSET NAME	ASSET TYPE	ADDRESS	FLOODPLAIN / AREAS PRONE TO FLOODING
1	Georgetown Town Hall	Municipal Building	1 Library Street	
2	Georgetown/Peabody Library	Municipal Building	2 Maple Street	
3	Georgetown Highway Department, Field Yard	Municipal Building	203 East Main Street	*
4	Georgetown Fire Station	Emergency Response	474 North Street	
5	Police/Fire/Emergency Response Facility	Emergency Response	47 Central Street	
6	Mello Transfer Station	Municipal Facility	203 East Main Street	Portions w/n 100-year floodplain
7	Water Treatment Facility	Municipal Facility	75 West Street	100-year floodplain
8	Baldpate Road Water Storage Tanks	Municipal Facility	Baldpate Road	
9	Black Swan Country Club Water Storage Tank	Municipal Facility	Baldpate Road	
10	Searle Street Electrical Substation Electric Department Office	Municipal Facility	94 Searle Street	*
11	Moulton Street Electrical Substation	Municipal Facility	1 Moulton Street	
12	Baldpate Treatment Center	Healthcare Facility	83 Baldpate Road	
13	Fidelity House Human Services	Healthcare Facility	294 Andover Street	
14	Group Home	Healthcare Facility	8 Ordway Street	
15	Bradstreet	Healthcare Facility	111 Jewett Street	
16	Pentucket Pond Dam	High Hazard Dam	Pond Street	100-year floodplain
17	Perley Elementary School	School	51 North Street	Portions w/n 100-year floodplain
18	Georgetown High School	School	11 Winter Street	Portions w/n 100-year floodplain

Map Reference	ASSET NAME	ASSET TYPE	ADDRESS	FLOODPLAIN / AREAS PRONE TO FLOODING
19	Georgetown Middle School	School	11 Winter Street	Portions w/n 100-year floodplain
20	Penn Brook School	School	68 Elm Street	
21	Georgetown High School	Emergency Shelter	11 Winter Street	Portions w/n 100-year floodplain
22	Georgetown Middle School	Emergency Shelter	11 Winter Street	Portions w/n 100-year floodplain
23	Penn Brook School	Emergency Shelter	68 Elm Street	
24	Housing Facility	Housing	23 Trestle Way	Portions w/n 100-year floodplain

Built Infrastructure

The built infrastructure within Georgetown is characterized by an interdependent network of roads, bridges, dams, municipal buildings (including schools that serve as community shelters), and privately-owned buildings. State and local roadways within Georgetown are often vulnerable to flooding, some of which are located along important local emergency evacuation routes or provide access to community shelters. CRB Workshop participants identified the need to review road and emergency facility access to ensure that emergency facilities are accessible during extreme weather events. Publicly and privately-owned buildings, roads and parking lots in the downtown business district are a source of urban heat island effect. Privately owned buildings throughout the community provide homes to residents. Existing facilities with hazardous materials are located within the 100-year and 500-year floodplains. The municipally owned Searle Street substation is located in a wet area just outside of the historical 100-year floodplain, an area with potential for flooding as storm intensity and flooding increase. Additional details on critical facilities and their location within potential hazard areas has been provided in the HMP section of this report.

Built Infrastructure

- Roads
- Bridges
- Private Buildings
- Evacuation Routes
- Critical Facilities
  - Municipal Buildings
  - Schools
  - Shelters/Assembly Areas

Water Management (stormwater, wastewater, drinking water)

Flooding in much of Georgetown is primarily a result of precipitation and storm water runoff overwhelming the capacity of natural and structured drainage systems to convey water. Under extreme precipitation the drainage system becomes overburdened and street and property flooding result. In some cases, roads that serve as evacuation routes, routes to community shelters, or routes of egress from specific neighborhoods are already experiencing flooding, and this is anticipated to worsen as the climate changes. Workshop participants agreed that the stormwater drainage structures throughout the community are likely undersized and often cannot meet the demands of runoff from extreme precipitation and/or inland and coastal flooding events. Additionally, there was concern that portions of evacuation routes and routes to shelters that are vulnerable to current and future flooding events haven't been fully identified, or if they have been identified, planning to address the flooding problem has not been completed or integrated into emergency response plans.

A dam, owned by Georgetown, is located at Pentucket Pond. According to the Office of Dam Safety, Georgetown's only dam, **Pentucket Pond**

Water Management

- Stormwater Drainage/MS4
- Natural Infrastructure
- Septic Systems/ Wastewater Treatment Package Plan
- Drinking Water/Water Towers
- Private Wells
- Culverts
- Dams

Outlet Dam, is classified as a high Hazard Dam. Pentucket Pond Dam is located where Pond Street borders the pond. All aspects of the dam are accessible from Pond Street. A locked gate in the fence on the upstream side of the road provides access to the top logs, trash rack and fish ladder. An Emergency Action Plan has been developed for the dam (most recent version date December 30, 2019). The plan defines responsibilities and provides procedures for identifying usual and unlikely conditions, which may endanger the Pentucket Pond Outlet Dam and infrastructure downstream of the dam, in time to take mitigated action and to notify appropriate emergency management officials of possible, impending, or actual failure to the dam in order to minimize property damage and loss of life.

This dam contributes to water quality and flood control issues across the community. CRB Workshop participants noted that the number of beaver dams has increased over the past several years, creating additional flooding issues at a number of locations.

Private septic systems and one private wastewater treatment package plant exacerbate water quality issues, particularly since some of the privately owned septic systems occur within the 100-year and 500-year floodplains.

Repetitive Loss Structures

Six repetitive loss structures (RL Structures) were identified based on records from the National Flood Insurance Program (NFIP). The following table provides the number of repetitive loss structures by flood zone in Georgetown and the payments received in insurance claims under the NFIP.

RL Structure	Flood Areas			**Total**
	AE, A1-30, AO, AH, A	VE, V1-30, V	B,C, X	
building	4	0	2	**6**
RL Payment (building)	$143, 096	0	$47,247.73	**$198,850.37**

What do the Flood Area letters mean? Each flood zone is type is categorized by a letter that describes the flood risk for a particular area, and those flood zones are used to determine insurance and costs.

- Moderate to Low Risk: flood areas beginning with the letters Letters B, C, and X on FEMA Flood maps. In these areas, the risk of being flooded is reduced, but not completely removed.
- High Risk: flood areas beginning with the Letters A or V on FEMA Flood maps. These areas face the highest risk of flooding.

Emergency Preparedness/Community Preparedness/Vulnerable Populations

Emergency management for the Town of Georgetown entails coordination between the Police Department, Fire Department, and the Department of Public Works, as well as other departments such as the Health Department as needed. Public Safety services are housed at the Georgetown Public Safety Complex. Georgetown Connect and social media allow emergency communication during public safety events. Community and town services communicate well during emergencies. Georgetown has a Community Emergency Management Plan that is updated every year, as well as a Seabrook Evacuation Plan. As part of this MVP Planning Grant project, Georgetown is integrating climate resiliency into, and updating the Hazard Mitigation Plan. Continuing to build upon established decision-making processes and operations is an important aspect of ongoing climate resilience efforts.

Additionally, CRB workshop participants identified the lack of community education, outreach and awareness about climate resiliency as a vulnerability in the Town of Georgetown. While significant work has been done to promote civic engagement across the public, private, and non-profit sectors in Georgetown, workshop participants viewed the absence of community outreach and education about climate resiliency as a limitation to achieving its climate resilience goals. While there are many community-centric public, private, and non-profit entities engaged in community issues, there is a recognized lack of climate change preparedness and social networks to address the challenges presented.

Emergency and Community Preparedness

Centralized Emergency Communications

Evacuation Plan

Communication Plan

Emergency & Non-Emergency Outreach

Community Networks and Education

Informational Technology (cellular applications and websites)

Regional Coordination

Coordination with State Agencies

Shelters

Backup Fuel Resources

Natural Resources Management

Workshop participants identified the many natural resources in Georgetown that contribute to water management (both quantity and quality), storm damage prevention and heat mitigation, including the Parker River, Pentucket Pond, Rock Pond, Crane's Pond Wildlife Management Area, Georgetown-Rowley State Forest, Camp Denison, as well as smaller parks, downtown trees, privately held forested land, wetlands, floodplains and approximatley 1,000 acres of conservation land as community strengths, and in some cases, also as vulnerabilities. As a result of the Core Team meetings, Natural Resources Infrastructure Assessment meetings and site walk, and the CRB Workshop, members of the Georgetown community gained a greater understanding of the relationship between these natural resources, the threats from climate change, and community climate resilience.

Natural Resource Management

- Zoning Ordinance Updates
- Wetland & Floodplain Conservation and Restoration
- Increase Tree Canopy
- Bank Erosion
- Water Quality
- Dam Management
- Open Space Connectivity
- Invasive Species/Algal Blooms
- Low-Flow Conditions

Local Regulatory Structure & Planning

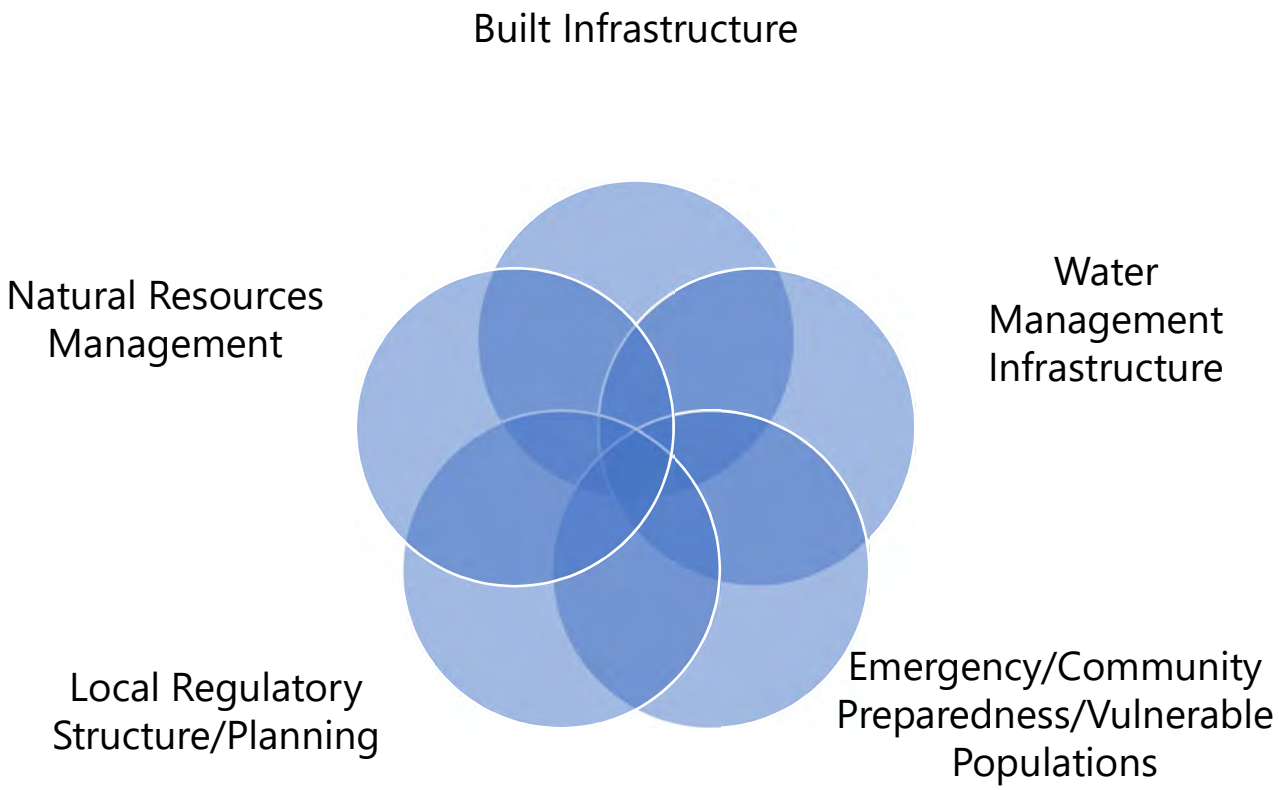
- Open Space Plan
- Master Plan
- Hazard Mitigation Plan
- Climate-Resilient Ordinances & Policies: Zoning, Wetlands, Floodplain
- Invasive Species
- Cross Departmental Planning
- Partnerships

Local Regulatory Structure/Planning

The Town of Georgetown has a variety of bylaws and policies that serve to direct and guide planning and development throughout the municipality, to protect natural resources such as wetlands and waters, and to plan for hazard mitigation. These existing regulatory and planning instruments represent a strength, but one that can be further strengthened by incorporating climate change, and by updating.

CATEGORIZING AND PRIORITIZING CHALLENGES

Workshop participants identified 15 action topics (each of which included sub-category actions) as part of the CRB process. These actions can be considered in five categories based on a combination of community characteristics (i.e. strengths and vulnerabilities) and solutions/actions identified by workshop participants. During the Core Team and Natural Resource Infrastructure Assessment Team meetings, the HMP Draft Listening Session and the CRB workshop, an emphasis was placed on the interdependence of these categories that allowed for the development of climate resilience solutions that span infrastructural, societal, and environmental features. Through this lens, overlapping solutions that provide co-benefits were identified and prioritized.



Built Infrastructure

Georgetown High School; Source: John Phelan

When developing a prioritized list of climate resilient actions, CRB Workshop participants and Core Team members supported initiatives that incorporate green infrastructure, low-impact design, energy efficiency, renewable energy, and avoidance of use of power that derives from fossil fuels or from tree cutting. The Town of Georgetown feels strongly about increasing the climate resiliency of the built infrastructure in town. This category excludes the town's water management infrastructure because of the unique challenges related to the many aspects of water management within the community. Electricity services are municipally owned. Participants of the CRB Workshop and Core Team meeting identified the following high priority resiliency actions pertaining to built infrastructure (excluding water management):

- Review open space parcels or parcels in the vicinity of the Searle Street substation and implement NBS to minimize flooding risks in the Searle Street area.
- Investigate electrical redundancy and assess upgrade needs with regard to predicted future demands.
- Invest in renewable energy initiatives (car charging stations, hybrid vehicles, solar power, solar power battery cells, wind power, geothermal, etc.).
- Avoid energy sources that involve cutting forests (such as wood-based biofuels) or use of fossil fuels.
- Prioritize locating solar and wind power projects on land that has already been developed and avoid locating solar and wind power projects in forested areas.
- Study possible solutions for Parcel 10_45 Capped Landfill and Highway Department Facility on-site flooding problems as well as downstream impacts associated with materials storage/leaching/pollution.
- Consider relocating municipal Highway Department's garage and salt shed to an area less prone to flooding.

Water Management (stormwater, wastewater, drinking water)

Through the CRB planning and workshop process, participants gained a new understanding of the connection between natural infrastructure and worsening flooding problems. In particular, there is a new appreciation of the flood storage and water quality ecosystem services provided by wetlands and floodplains in numerous locations in town (see discussion in Natural Resources Management section below), as well as recognition that the increasing number of beaver dams may be exacerbating flooding in some locations. However, it should be noted that by creating areas that store water in the upstream locations, beaver dams and ponds help reduce peak flow volumes further downstream. Natural infrastructure can relieve some of the flooding and water quality pressure on the built infrastructure, and participants saw the value of integrating Nature Based Solutions into climate resiliency plans. Water quality issues were a concern for workshop participants, with concern expressed about nutrient loading in town waterways and water bodies. Some of the privately owned septic systems occur within the 100-year and 500-year floodplains, thus posing a risk to water quality.

During the prioritization of actions at the CRB Workshop, one of the top priorities that CRB Workshop participants identified was the need to plan for and implement projects that address existing and future water management infrastructure and flooding issues at numerous locations. Core Team and NRIA Team meeting participants also identified this as a top priority. High priorities included:

- Coordinate with Massachusetts EEA Office of Technical Assistance to address hazardous materials that are located within floodplains (future predicted floodplains as well as historic 100-year and 500-year floodplains).
- Address septic system issues at Pentucket Pond, Rock Pond, and in floodplains.
- Work with Water Department to conduct community education and outreach regarding water conservation.
- Identify potential Nature Based Solutions that would ensure a more plentiful water supply.
- Identify locations for bank stabilization and tree planting that could enhance water quality.
- Engage in public education and outreach to prevent nutrient releases into waterways, water bodies, and wetlands.
- Continue culvert replacement and upgrades to reduce flooding and meet future flood conditions, rather than historical conditions. Implement Massachusetts Stream Crossing Standards/ design for future storms when replacing culverts whenever possible. Coordinate culvert replacements and stormwater management with MassDOT on MassDOT roads and at the MassDOT Park n Ride.

- Prepare MS4 updated inventory/ mapping of catch basins and outfalls and prepare an Illicit Discharge Detection Elimination (IDDE) Plan.
- Increase infiltration of water and improve stormwater management by implementing Nature Based Solutions, green infrastructure, and community education and outreach. Seek implementation assistance and partner with Merrimack Valley Planning Commission.
- Implement erosion control projects, particularly along the banks of waterways, ponds and wetlands.
- *Pentucket Pond Dam*: Emergency Action Plan/ O & M updated in 2019. Ensure Action Plan has been approved by the Office of Dam Safety. Continue implementing O & M plan. Implement an Emergency Action Plan.
- *Baldpate Dam*: Continue outreach efforts to the Office of Dam Safety regarding Baldpate Dam. The Dam is under the care and control of Boxford and National Grid and not Georgetown. Request inspection reports from the Office of Dam Safety. Ensure O & M plan is implemented.

Emergency/ Community Preparedness/Vulnerable Populations

Participants felt strongly that an effort should be undertaken to provide more education and outreach for community members and municipal staff, and particularly for the most vulnerable, such as the elderly, English language learners, the very young, transient populations/ homeless people/ new arrivals who may not be as familiar with Georgetown, LGBTQ people, the disabled, and veterans about climate change vulnerability, preparedness, resources and response. Emergency response plans should include planning for vulnerable populations. Regional coordination should also occur with neighboring communities, and the Town should draw upon the capacity provided by state agencies to enhance its overall capacity to address the needs of climate preparedness.

At the CRB Workshop participants also identified the need to address social vulnerabilities as a priority, such as engaging in actions that will prevent future climate-related events from disproportionately impacting vulnerable populations and proactively providing education and outreach to vulnerable populations. Specific high priority actions that could be taken included:

- Integrate vulnerable population concerns into future MVP Action Grant proposals.
- Integrate climate resiliency information into future Housing Production Plan Updates.
- Work with the state to try to relocate low income, elderly, handicapped living facilities from floodplain areas to higher ground,

Source: Bryan McGonigle, Wicked Local

using mapping based on floodplains predicted for the future rather than historical floodplains.
- Assist vulnerable population facilities with preparation of emergency management plans.
- Expand senior transportation to other vulnerable populations during emergency situations.

Local Regulatory Structure/Planning

Workshop participants felt that many of the ordinances and policies that serve to direct and guide planning and development throughout the municipality to protect natural resources and to plan for hazard mitigation could be updated to incorporate climate resiliency and to improve emergency response. During the prioritization of actions at the CRB Workshop, participants identified the following high priority actions:

Camp Denison; Source: Essex National Heritage Area

- Update local zoning and other bylaws/ regulations to incorporate climate resiliency (use updated/ projected rainfall and flooding data/ modeling, encourage Nature Based Solutions, etc.) and ensure sustainable development.
- Incorporate climate resiliency into updates of the Open Space and Recreation Plan, Master Plan, and Housing Production Plan.
- Consider implementing additional Low Impact Development techniques and require Nature Based Solutions rather than gray infrastructure solutions.
- Advocate for cross committee and board communication and implementation of municipal climate resiliency objectives.
- Partner with state (e.g. DCR/ MassWildlife), non-profit (e.g. land trust, Parker River Clean Water Association, Essex County Greenbelt), & private land managers (golf course, Ch. 61 landowners), volunteers and stakeholders to coordinate and implement town wide projects that increase use of NBS as well as provide community education and outreach.
- Conduct climate resiliency outreach and education.
- Continue to support use of CPA funds to improve Georgetown's climate resiliency.

Natural Resources Management

Participants at the CRB Workshop, at the Core Team meeting, and at NRIA meetings recognized that the significant natural resource assets in town, including Crane Pond Wildlife Management Area, Georgetown-Rowley State Forest, Baldpate Pond State Park, the Parker River and its shoreline (where undeveloped), Camp Denison, approximately 1,000 acres of conservation land, Pentucket Pond, Rock Pond, and other

Open Space, while assets, also face challenges related to climate change, and identified the following high priority actions:

- Expansion of conservation purchases, easements, and conservation restrictions.
- Integrate Essex County Greenbelt parcel prioritization matrix into MVP/ NRIA planning and mapping.
- Complete ecological reviews of open spaces (such as for forests and wetlands) and draft/ prioritize management recommendations and actions such as Nature Based Solutions that increase climate resilience.
- Implement the recommendations from the Natural Resources Infrastructure Assessment report, and use as a model for Nature Based Solutions implementation, public outreach and education.
- Improve universal access to open spaces and recreational facilities including auxiliary structures.
- Incorporate climate adaptation and MVP findings into the next Open Space and Recreation Plan update.
- Address nutrient loading of water bodies and waterways, as well as invasive species and algal blooms. Consider and implement management practice alternative solutions to reducing phosphate loads within the Parker River and the ponds.
- Improve the capacity of the trees in the downtown area to absorb flood waters and to provide shade.
- Use floating islands/ coir logs to help with nutrient removal and bank protection/ restoration along the Parker River and the two ponds.
- Assess river and pond hydrology and bathymetry, and determine whether barriers (culvert, dam, walls, sedimentation, dense invasive species, etc.) can be upgraded/managed to increase water flow, water capacity and decrease channelization. Update flood maps in the vicinity of the Parker River by integrating Cornell and National Weather Service Data.
- Partner with Mosquito Control to identify areas that may serve as disease vector breeding habitats. Develop and implement management recommendations such as ecological restoration projects that reduce the risk of exposure to mosquito borne illnesses.
- Conduct outreach and education to inform landowners regarding reducing risks of vector-borne diseases. Develop/ enhance partnerships between Georgetown, state and local organizations.
- Implement best management practices for vegetation management (tree diseases/invasive species).

CRB Workshop Matrix and Prioritization of Actions

Climate Resiliency Actions to address the concerns and vulnerabilities identified through the workshop process, and build upon existing strengths, were prioritized through workshop activities and coordination with Core Team leadership. Climate Resilience Actions listed in the tables below are organized as High Priority (H), Medium Priority (M), and Low Priority (L) Actions. During the Core Team meeting prior to the CRB Workshop, Core Team members expressed preference for a modified CRB Workshop Risk Matrix spreadsheet to improve clarity and to allow for actions and features to be placed in more than one category, if applicable. The table below and the CRB Workshop Risk Matrix included in the Appendix reflect these modifications. CRB Workshop participants voted on their top priorities, ranking Actions as High, Medium, or Low Priority.

High Priority Actions

Priority	Categories			Action
	Infra-structure	Social	Environ-mental	
H	X	X	X	**Private Septic/ Hazardous Materials Storage in Floodplain -** Coordinate with state program to identify existing facilities with hazardous materials located within the 100- and 500- year floodplain and establish protocols/bylaws for secondary containment and other protective measures. Limit the establishment of such facilities through zoning. Access state support for addressing these issues. Consider extending Board of Health septic disposal regulations to all floodplains. Regulations and requirements currently in place for septic systems within 300-feet of Pentucket and Rock Pond. Identify septic systems located in floodplain and provide incentive for upgrades. Map and plan using predicted floodplain, rather than historical floodplains.
H	X	X	X	**Pentucket Pond and Baldpate Pond Dams –** Emergency Action Plan/O&M updated in 2019. Ensure Action Plan has been approved by the Office of Dam Safety. Continue implementing O&M plan. Implement an Emergency Action Plan. *Baldpate Dam*: Continue outreach efforts to the Office of Dam Safety regarding Baldpate Dam. The Dam is under the care and control of National Grid and not Georgetown. Request inspection reports from the Office of Dam Safety. Ensure O&M plan is implemented.

Priority	Categories			Action
	Infra-structure	Social	Environ-mental	
H	X	X	X	**Open Space & Natural Resources Protection, Restoration, Enhancement and Climate Resiliency -** Research actions for property acquisition/easements/conservation restrictions to expand open space/conservation land opportunities and climate resiliency in town. Integrate Essex County Greenbelt parcel prioritization matrix into MVP/NRIA mapping. Consider using the TNC Ecological Climate Resiliency Mapping provided as part of the NRIA as well as the Essex County Greenbelt matrix as a tool to prioritize land protection. Complete ecological reviews of open spaces and draft/ prioritize management recommendations and actions such as NBS that increase climate resilience. For example, in large patches of forests- Forest diversity and health assessment with recommendations on how to improve forest health (e.g. diversified plantings, invasive species removal, forest management, prescribed fires, etc.); in wetlands- wetland assessments with recommendations on how to improve functions and values, etc.) Implement NRIA recommendations and use as a model for NBS solutions implementation, and public outreach and education. Improve universal access to open spaces and recreational facilities including auxiliary structures (parking lots, sanitary facilities, etc.). Incorporate climate adaptation and MVP findings in the next Open Space and Recreation Plan update. Dying and sick trees can create hazards via falling branches and trees. Complete a tree health assessment.

Priority	Categories			Action
	Infra-structure	Social	Environ-mental	
H				**Municipal Utilities Water and Electricity- Resiliency, Enhancement and Conservation –** *Water* - Work with the water department to set aside funding for water conservation outreach/education on a yearly basis. Incorporate NBS and outreach to reduce water use and increase water infiltration as part of the water conservation program implementation process. *Electricity* - Review open space parcels or parcels in the vicinity of the substation and implement NBS to minimize flooding risks in the Searle Street area. Investigate electrical redundancy and assess upgrade needs with regard to predicted future demands. Invest in renewable energy initiatives (car charging stations, hybrid vehicles, solar power, solar power battery cells, wind power, geothermal, etc.). Avoid energy sources that involve cutting forests (such as wood-based biofuels) or use of fossil fuels. Prioritize locating solar and wind power projects on land that has already been developed and avoid locating solar and wind power projects in forested areas.

Priority	Categories			Action
	Infra-structure	Social	Environ-mental	
H	X	X	X	**Parker River, Rock Pond and Pentucket Pond - Water Quality/Water Flow/Ecological Integrity -** Assess river and pond hydrology and bathymetry, and determine whether barriers (culvert, dam, walls, sedimentation, dense invasive species, etc.) can be upgraded/managed to increase water flow, water capacity and decrease channelization. Update flood maps in the vicinity of the Parker River by integrating Cornell and National Weather Service Data. Implement use of floating islands/coir logs to help with nutrient removal and bank protection/restoration along the Parker River and the two ponds. Consider and implement management practice alternative solutions to reducing phosphate loads within the Parker River and the ponds. Implement erosion control projects along the banks of waterways, ponds and wetlands. Review river and pond banks to determine where improvements such as NBS (bank stabilization, tree planting, waterway/corridor alterations) could assist with overall water improvements. Partner with MS4 to stress public outreach on preventative steps that homeowners can take to lower nutrient releases into waterways, wetlands and ponds. Increase infiltration of water and improve storm water management by implementing NBS, green infrastructure, and community outreach and education. Implement erosion control projects.
H		X	X	**Partnerships, Volunteers and Community Education/Engagement -** Engage in a climate resiliency focused public outreach and education campaign. Incorporate solutions that reduce the N and P load into the wetlands, rivers and ponds. Integrate public education component in all future MVP action grants. Partner with state (e.g. DCR/ MassWildlife), non-profit (e.g. land trust, PRCWA, Essex County Greenbelt), & private land managers (golf course, Ch. 61 landowners), volunteers and stakeholders to coordinate and implement town wide projects that increase use of NBS as well as provide community education and outreach.

Priority	Categories			Action
	Infra-structure	Social	Environ-mental	
H	X		X	**Road Infrastructure and MS4 -** Continue replacing/upgrading culverts to reduce flooding. Implement the Stream Continuity Guidance/design for future storms when replacing culverts whenever possible. Coordinate culvert replacements with MassDOT on MassDOT roads. Coordinate storm water management improvements along roads and at the park and ride. MS4: Prepare MS4 updated inventory/mapping of catch basins and outfalls. Prepare IDDE (illicit discharge detection elimination) Plan. Seek implementation assistance and partner with MVPC.
H	X		X	**Parcel 10_45 Capped Landfill and Highway Department Facility, Flooding -** Study possible solutions to mitigate for impacts associated with site flooding as well as downstream impacts associated with materials storage/leaching/pollution. Consider relocating municipal Highway Department's garage and salt shed to an area less prone to flooding.
H		X	X	**Diseases, Pests, Invasive Species & Mosquito Control Collaboration/Assistance -** Partner with Mosquito Control to identify areas that may serve as disease vector breeding habitats. Develop and implement management recommendations such as ecological restoration projects that reduce the risk of exposure to mosquito borne illnesses. Outreach and education- what can landowners do to reduce the risk of vector diseases? Partnership between municipality, state and local organizations. Vegetation management (tree diseases/invasive)/ implementation of best management practices.

Medium Priority Actions

Priority	Categories			Action
	Infra-structure	Social	Environ-mental	
M	X	X	X	**Vulnerable Populations- Housing, Child Care Centers, Senior Living Facilities -** Integrate vulnerable population concerns into future MVP action grant proposals. Integrate MVP information in future Housing Production Plan Updates (Georgetown Affordable Housing Trust). Continue assisting facilities with preparation of emergency management plans. Work with the state to try to relocate facility to location away from the 100- and 500- year floodplain. Map and plan using predicted floodplain, rather than historical floodplains.
M	X	X	X	**Public Safety Complex/ Town Campus Drainage Improvements/NBS & Community Emergency Management Plan -** Drainage/run off issues at the Public Safety/Town Campus: Public Safety Building under the review w.r.t. renovations/relocation due to age and access issues. Consider NBS (invasive species management, tree planting, rain gardens, permeable pavers, etc.) to improve drainage within the complex. Expand on public outreach efforts initiated during the COVID 19 emergency (Emergency Management Director Updates). Publicize sections of the town's Emergency Management Plan (those pertaining to shelters, evacuation routes, cooling centers, etc.). Provide maps and wayfinding for evacuation routes and shelters. Continue public engagement regarding vector diseases, etc. through the Board of Health. Consider expanding outreach and education through town partners/volunteers.
M	X	X		**Emergency Preparedness - Evacuation Routes, Emergency Shelters, Medical Facilities, Food Pantries and Cooling Centers –** Identify evacuation routes and communicate these with the public. Identify emergency equipment needs (cots, back up energy, fuel) for shelters and emergency facilities. Seek funding to fulfill these needs. Consider expanding Senior transportation to other vulnerable populations in emergency situations. Identify options for alternative transportation/cost share (town owned vans). Investigate possibility of using Green Communities funding. Develop alternative cooling facilities: planting of shade trees and installation of benches in high use pedestrian areas (e.g. across high school, commercial areas, bus stops, etc). Review road and facility infrastructure to ensure that emergency facilities are

Priority	Categories			Action
	Infra-structure	Social	Environ-mental	
				accessible in extreme weather events. For example: the main access to the High School/Middle School is in the Penn Brook floodplain. High School is on high ground, generator-powered, has EMD equipment. Schools have crisis plans. Consider additional shelter in strategic locations outside of the downtown area.
M	**X**	**X**	**X**	**Local Zoning Overlays, Bylaws, Committees and CPA-Incorporating Climate Resiliency -** Update open space plan with climate resiliency in mind (discuss option of doing this during the current update). Update local zoning and other bylaws/regulations to incorporate climate resiliency (projected rainfall data, NBS solutions, etc.) Continue implementing, reviewing and updating (as needed) local zoning and other bylaws to ensure sustainable development and resource protection in light of climate change. Consider implementing additional low impact development techniques and require NBS rather than gray infrastructure solutions. Advocate for cross committee and board communication and implementation of municipal climate resiliency objectives. Continue to support use of CPA funds to improve Georgetown's climate resiliency. Consider expanding the existing local vernal pool habitat buffer/set back to 125-feet.

Low Priority Actions

Priority	Categories			Action
	Infra-structure	Social	Environ-mental	
L	**X**	**X**	**X**	**Increased Beaver Dams & Associated Flooding (many locations) -** Inventory beaver dams and prioritize locations for beaver management. Provide public education and outreach regarding beaver management, including awareness of, and planning for, ecosystem services provided by beaver dams and ponds, such as flood control for downstream properties, fish and wildlife habitat. Partner with MassWildlife and National Grid.
L	**X**	**X**	**X**	**Baldpate Hill Complex and Long Hill Road –** Baldpate Hill - Erosion along the access road impeding emergency access to the tower and water tanks (secondary issues with sediment migration into wetlands as a result of the eroding

				access). Additional property ownership issues (multiple owners) impacting access and upgrades. Continue working on access and maintenance plan. Highway Department has re-graded the road in order to secure access for emergency communications and access to water tower. Road plowed by NH Cable Access. Long Hill Road: Future T-1 project on the water tower to enhance radio communications.

HAZARD MITIGATION GOALS

These goals build upon the 2016 Merrimack Region Hazard Mitigation Plan and are based upon findings from the Municipal Vulnerability Preparedness planning process. Each goal statement is followed by the related Administrative Review Actions identified by the community during its integrated MVP/HMP Planning Process:

- To continue to participate in the National Flood Insurance Program, and to have the flood map periodically update using additional climate projection tools such as the National Weather Service Climate Prediction Center Data.
- To develop a priority list and seek funding through the Hazard Mitigation Grant Program (HMGP) for the replacement of undersized culverts throughout the Town.
- To identify additional funding resources to assist with the implementation of mitigation actions.
- To organize and prepare to provide adequate shelter, water, food and basic first aid to displaced residents, evacuation procedures and route, etc. to residents in the event of a natural disaster.
- To inventory supplies at existing shelters and develop a needs list; and to establish arrangements with local or neighboring vendors for supplying shelters with food and first aid supplied in the event of a natural disaster.
- To increase awareness of hazard mitigation among town officials, private organizations, businesses and the public.
- To continue to assist facilities that provide services to vulnerable populations with the development of independent emergency management plans.
- To increase awareness of critical facilities located within the 100-and 500- year floodplain and work to relocate such facilities. In the future, ensure that critical facilities and hazards materials storage areas are not sited or located in vulnerable locations in the future.
- To study the Parker River, its tributaries and ponds and develop solutions that improve water flow, volume and quality.
- To increase awareness of vector borne diseases and work with state and local organizations to implement ecological restoration projects that reduce the risk of exposure and site vulnerability to vector borne diseases.
- To evaluate and update goals as they implemented and evaluate strategies to continue to reduce climate vulnerabilities.

The Hazard Mitigation Action Plan/Capability Assessment Worksheet was developed with information collected during the CRB Workshop and the HMP Listening Session. The Plan/Worksheet has been provided in the Appendix. For each mitigation measure, the geographic extent of the potential benefiting area is identified as is an estimate of the overall benefit and cost of the measures. The benefits, costs, and overall priority were evaluated in terms of: Estimated Benefits. A "High" priority action will result in a significant reduction of hazard risk to people and/or property from a hazard event. A "Medium" priority action will likely result in a moderate reduction of hazard risk to people

and/or property from a hazard event. A "Low" priority action will result in a low reduction of hazard risk to people and/or property from a hazard event. With respect to costs, a "High" estimated costs was assigned to actions with an estimated cost greater than $100,000. A "Medium" estimated cost applies to actions with a potential implementation cost ranging from $10,000 to $100,000 A "Low" estimated costs was assigned to those actions with an estimated cost of less than $10,000 and/or staff time.

REVIEW AND APPROVAL PROCESS

After the public listening session, the plan is submitted electronically to MEMA at mitigation@mass.gov and to the MVP Portal on the resilientMA.com Climate Change Clearing House. The Integrated MVP/HMP Plan is reviewed by FEMA and final copies are sent to the MVP Regional Coordinator and MVP Manager. After this, the municipality will be designated as a "Municipal Vulnerability Preparedness Program Climate Community," or "MVP Climate Community." (Source Municipal Vulnerability Preparedness (MVP) award: MVP/HMP Combined Scope Update dated November 23, 2019).

Following approval by FEMA, the Town's MVP Core team will periodically review the plan. The Core Team will have at least one pubic review session by the end of 2022 to review the plan and update the actions table. The meetings will be posted publicly in accordance with the Town and State open meetings laws.

The plan is approved for five years (2025) by which time an updated plan must be reviewed and approved by FEMA. The Hazard Mitigation Team will begin to prepare an update in the spring of 2024. They will use the information gathered from the periodic meetings to implement and update the Hazard Mitigation plan. Once the new plan has been drafted, it will be submitted to FEMA/MEMA for review and approval prior to the date of approval of this document.

Community Resilience Building Workshop Participants

Name	Affiliation
Mike Farrell	Town of Georgetown, Town Administrator
Steve Przyjemski	Town of Georgetown, Conservation Agent
Donald Cudmore	Town of Georgetown, Chief of Police
Carol Jacobs	Town of Georgetown, Superintendent of Georgetown Public Schools
Michelle Rowden	EEA MVP Regional Coordinator
Rebecca Chane	Georgetown Conservation Commission Member
Harry LaCortiglia	Georgetown Planning Board Chair, Community Preservation Committee
Dave Schofield	Georgetown Municipal Light Department, Light Plant General Manager
George Comiskey	Parker River Clean Water Association, Director
Vanessa Johnson-Hall	Essex County Greenbelt Association, Ass't Director of Land Conservation

LISTENING SESSIONS

Due to the COVID-19 pandemic, the DRAFT Hazard Mitigation Plan Listening Session was held via Zoom on Tuesday, April 28, 2020 from 7:00pm – 8:00pm. This session was recorded and the recording published on the Georgetown Community Television's website. Following the session, a survey was published to solicit additional public feedback. Below are snapshots of the Public Listening Session and Survey Flyers. These were both posted on the Town Website and shared with community members, including stakeholders from Georgetown's abutting municipalities:

A final MVP Community Resilience Building (CRB) Summary of Findings and Hazard Mitigation Plan (HMP) Update Report Listening Session was held via Zoom on Thursday, May 21, 2020 from 7 pm – 8:30 pm (see invitation below). This session allowed members of the public to hear presentations on the MVP CR and HMP Update process in Georgetown, and to provide feedback to Georgetown leaders that can further inform the Community Resilience Building process. No additional feedback was received. The final MVP Natural Resources Infrastructure Assessment (NRIA) Listening Session was held via Zoom on Tuesday, May 26, 2020 from 7 pm – 8 pm, allowing members of the public to hear presentations on the NRIA and to provide feedback to Georgetown leaders. No additional feedback was received. One additional Listening Session will be scheduled within the next few weeks as an added opportunity for members of the public to comment on both the MVP CRB/ HMP Update Report and the NRIA Report.

Invitation to MVP Community Resilience Building and Hazard Mitigation Planning Public Listening Session and Invitation to the Natural Resources Infrastructure Assessment Listening Session

Citation

Georgetown (2020) Community Resilience Building Workshop Summary of Findings and Hazard Mitigation Plan Update, BSC Group, Inc. and Town of Georgetown. Georgetown, Massachusetts

MVP Core Team Working Group

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Steve Przyjemski, Conservation Agent, Town of Georgetown
John Cashell, Town Planner, Town of Georgetown
Peter Durkee, Supervisor, Department of Public Works, Town of Georgetown
Donald Cudmore, Chief of Police, Town of Georgetown
Scott Hatch, Police Department, Town of Georgetown
Suzanne Sutherland, Supervisor, Water Department, Town of Georgetown
Bret Moyer, Town of Georgetown
David Schofield, Light Plant General Manager, Municipal Light Department, Town of Georgetown
Marlene Ladderbush, Town of Georgetown
George Comiskey, Director, Parker River Clean Water Association
Vanessa Johnson, Ass't Director of Land Conservation, Essex County Greenbelt Association
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Ale Echandi, Ecologist, BSC Group, Inc.

Workshop Facilitators

Gillian T. Davies, BSC Group, Inc.
Ale Echandi, BSC Group, Inc.
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Acknowledgements

This project was made possible through funding from the Massachusetts Executive Office of Energy and Environmental Affairs' Municipal Vulnerability Preparedness (MVP) Grant Program. Thank you for providing the leadership and funds to support this process. The Town of Georgetown values your partnership.

Thank you to the community leaders within Georgetown who attended the Georgetown CRB Workshop. The institutional knowledge provided by workshop participants was essential to the success of this process.

APPENDIX

MVP CRB & HMP

MVP CRB Workshop Base Maps
Climate Infographic
CRB Workshop Risk Matrix
Essex County Greenbelt Parcel Prioritization
Merrimack River Basin Climate Projections
Hazard Mitigation Plan (2020 Update) Maps
Hazard Mitigation Work Sheet & Action Plan

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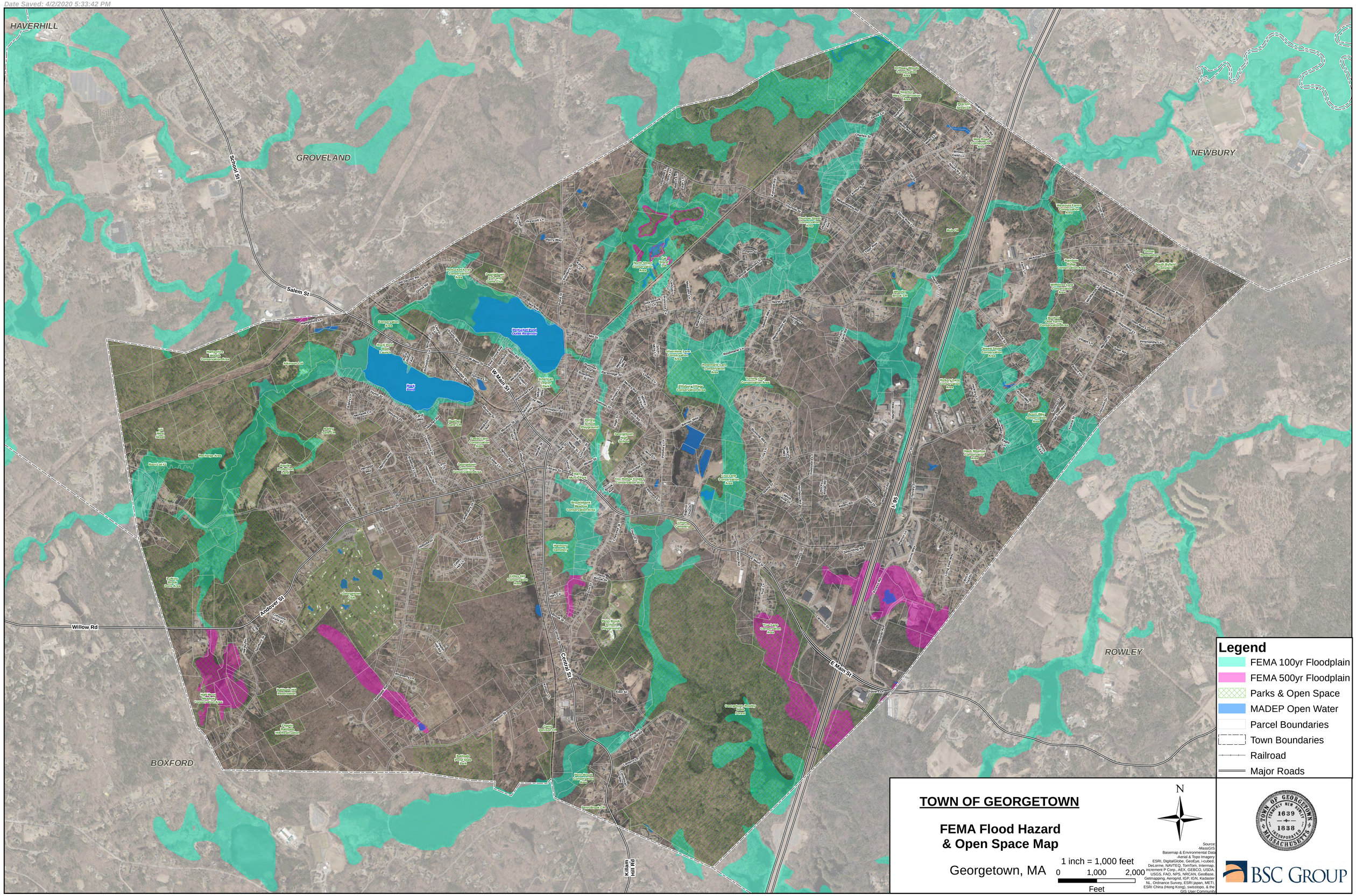

TOWN OF GEORGETOWN

FEMA Flood Hazard & Open Space Map

Georgetown, MA

N

1 inch = 1,000 feet

0 1,000 2,000

Feet

Source:
MassGIS
Basemap & Environmental Data
Aerial & Topo Imagery
ESRI, DigitalGlobe, GeoEye, i-cubed, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., AEX, GEBCO, USDA, USGS, FAO, NPS, NRCAN, GeoBase, Getmapping, Aerogrid, IGP, IGN, Kadaster NL, Ordnance Survey, ESRI japan, METI, ESRI China (Hong Kong), swisstopo, & the GIS User Community

BSC GROUP

THIS DOCUMENT IS INTENDED FOR GENERAL PLANNING & INFORMATION PURPOSES ONLY. ALL MEASUREMENTS & LOCATIONS ARE APPROXIMATE

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HAVERHILL

GROVELAND

NEWBURY

ROWLEY

BOXFORD

Pentucket Pond
Public Reservoir

Rock Pond

Legend

- MADEP Open Water
- Parcel Boundaries
- Town Boundaries
- Railroad
- Major Roads

Final Resilience Score (Stratified by Setting and Ecoregion with Regional Override)

- Far Above Average (>2
- Above Average (1 SD to 2
- Slightly Above Average (0.5 to 1 SD)
- Average (-0.5 to 0.5 SD)
- Slightly Below Average (-0.5 to -1
- Below Average (-1 to -2
- Far Below Average (<-2
- Developed

TOWN OF GEORGETOWN

Ecological Climate Resiliency Map

(Based on The Nature Conservancy's Resilient & Connected Landscapes)

Georgetown, MA

N

1 inch = 1,000 feet

0 1,000 2,000

Feet

Source:
-MassGIS, UMASS CAPS, Mass Audubon, The Nature Conservancy
Basemap & Environmental Data
-Aerial & Topo Imagery
ESRI, DigitalGlobe, GeoEye, i-cubed, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., AEX, GEBCO, USDA, USGS, FAO, NPS, NRCAN, GeoBase, Getmapping, Aerogrid, IGP, IGN, Kadaster NL, Ordnance Survey, ESRI japan, METI, ESRI China (Hong Kong), swisstopo, & the GIS User Community

TOWN OF GEORGETOWN FORMERLY NEW ROWLEY 1639 — 1838 INCORPORATED MASSACHUSETTS

BSC GROUP

CLIMATE CHANGE

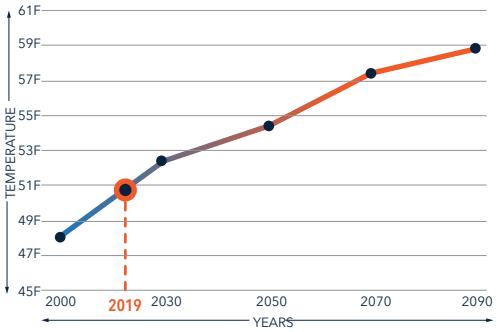
Georgetown, Massachusetts
Merrimack Watershed Basin

Amesbury, Andover, Ashburnham, Ashby, Ayer, Boxborough, Boxford, Chelmsford, Dracut, Dunstable, Georgetown, Groton, Groveland, Harvard, Haverhill, Lawrence, Littleton, Lowell, Merrimac, Methuen, Newbury, Newburyport, North Andover, Salisbury, Tewksbury, West Newbury, and Westford

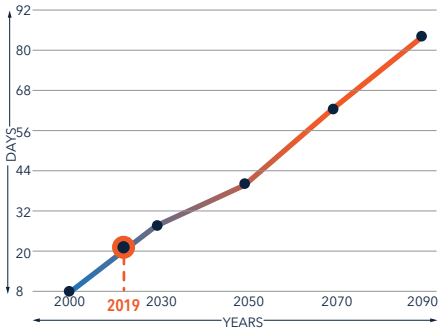
Global warming is caused by the accumulation of greenhouse gases within the atmosphere. Gases that contribute to the greenhouse effect include water vapor, carbon dioxide, methane, and nitrous oxide. On earth, human activities such as burning fossil fuels, land deforestation and wetland loss/conversion have altered the delicate balance of atmospheric conditions that regulate our climate. The effect of these changes cause global climate change that are likely to be significant and to increase over time.

EXTREME TEMPERATURES

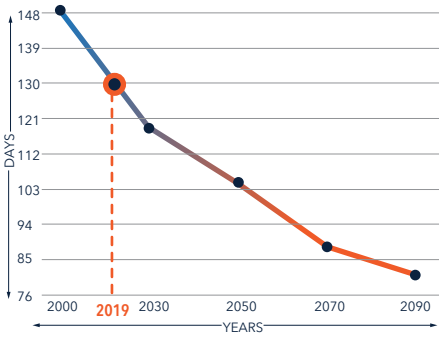
Average Temperatures



Days with Maximum Temperature over 90˚F



Fewer Days Below Freezing

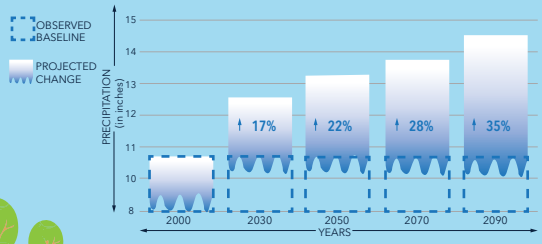


What can GEORGETOWN expect as CLIMATE CHANGES?

Climate change has already had observable effects on the environment. Rising temperatures, changes in precipitation patterns, droughts and heat waves, sea-level rise, and extreme storm events have **altered the distribution of risk and how resources are managed.**

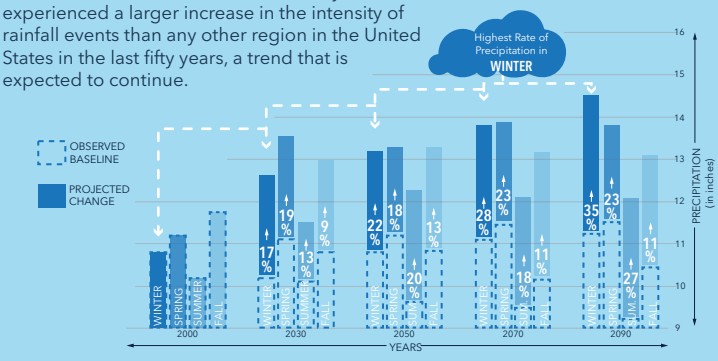
Extreme Snow And Ice Events

Total Annual Precipitation is expected to increase within the Merrimack Basin over the remainder of the century. Most of this increase is expected to occur during winter months where precipitation will fall as either rainfall or extreme snow or ice events.



More Annual Precipitation and Inland Flooding

The Northeast United States has already experienced a larger increase in the intensity of rainfall events than any other region in the United States in the last fifty years, a trend that is expected to continue.



Blizzards, Nor'Easters and Hurricanes

Storm events fueled by higher temperatures, increased evaporation, and atmospheric moisture leads to stormy weather of increased duration and intensity.

Wind / Microbursts

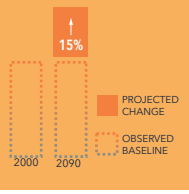
Hazardous wind conditions most commonly accompany extreme storm events. High winds and microburst conditions present unique hazards to infrastructure, public safety and important natural resources.

Heatwaves

Extreme heat events are expected to become more frequent and intense. Socially vulnerable populations are particularly vulnerable to the dangers related to extreme temperature conditions.

Drought Conditions

Due to the combined effects of higher temperatures, reduced groundwater recharge from extreme precipitation events, earlier snowmelt, summer and fall droughts may become more frequent.



Sources: Massachusetts Executive Office of Energy and Environmental Affairs; ResilientMA.org

BSC GROUP

Community **R**esilience **B**uilding Risk Matrix

www.CommunityResilienceBuilding.org

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

Flooding	Extreme & Variable Weather (Storms, Ice, Snow, Freezing Rain & Heat)	Drought and Extreme Heat	Increased Disease Vectors (emerald ash borer, ticks, EEE, gypsy moths, blue/green algae, etc.)	

Vulnerabilities (V) and/or Strengths (S)	V / S	Location	Owner	Solutions	Infrastructural	Societal	Environmental	**H**ight, **M**edium or **L**ow priority for action over the **S**hort or **L**ong term and **O**ngoing: H/M/L	S/L/O
Increased beaver population changing the landscape and making more areas prone to flooding. Ponding of water potentially causing increase in flooding and mosquito borne illnesses.	V	Town Wide	Private/State/Municipality	Inventory beaver dams and prioritize locations for beaver management. Public education and outreach regarding beaver management. Partner with MassWildlife and National Grid.	X	X	X	L	O
Private septic systems and hazardous material storage located in the floodplain.	V	100- and 500- year floodplain as well as other areas prone to flooding	Private/Municipality	Coordinate with state program to identify existing facilities with hazardous materials located within the 100- and 500- year floodplain and establish protocols/bylaws for secondary containment and other protective measures. Limit the establishment of such facilities through zoning. Access state support for addressing these issues. Consider extending Board of Health septic system regulations to all floodplains. Regulations and requirements currently in place for septic systems within 300-feet of Pentucket and Rock Pond. Identify septic systems located in floodplain and provide incentive for upgrades. Map and plan using predicted floodplain, rather than historical floodplains.	X	X	X	H	O
Georgetown Housing Authority: High concentrations of vulnerable populations (low income elderly, handicapped, families) living in the floodplain. Infrastructure in need of repair. Homebound vulnerable population. Senior Living Facilities Child Care Centers	V	23 Trestle Way 111 Jewett Street 294 Andover Street 83 Baldpate Road 8 Ordway Street	State/Municipal	Integrating vulnerable population concerns into future MVP action grant proposals. Integrate MVP information in future Housing Production Plan Updates (Georgetown Affordable Housing Trust) Continue assisting facilities with preparation of emergency management plans. Work with the state to try to relocated facility to location away from the 100- and 500- year floodplain. Map and plan using predicted floodplain, rather than historical floodplains.	X	X	X	M	O
Baldpate Hill Complex- communications tower , fire tower, water tanks and open space Long Hill Road Water Tank/ T-1 Project.	V/S	Baldpate Hill Long Hill Road	Private, Municipal, State, Non Profit	Baldpate Hill: Erosion along the access road impeding emergency access to the tower and water tanks (secondary issues with sediment migration into wetlands as a result of the eroding access). Additional property ownership issues (multiple owners) impacting access and upgrades. Continue working on access and maintenance plan. Highway Department has re-graded the road in order to secure access for emergency communications and access to water tower. Road plowed by NH Cable Access. Long Hill Road: Future T-1 project on the water tower to enhance radio communications.	X	X	X	L	O

Community **R**esilience **B**uilding Risk Matrix

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Flooding	Extreme & Variable Weather (Storms, Ice, Snow, Freezing Rain & Heat)	Drought and Extreme Heat	Increased Disease Vectors (emerald ash borer, ticks, EEE, gypsy moths, blue/green algae, etc.)	

Vulnerabilities (V) and/or Strengths (S)	V / S	Location	Owner	Solutions	Infrastructural	Societal	Environmental	**H**ight, **M**edium or **L**ow priority for action over the **S**hort or **L**ong term and **O**ngoing	
								H/M/L	**S/L/O**
Public Safety Complex/ Georgetown Community Emergency Management Plan (updated every year) / Board of Health/ Seabrook Evacuation Plan/ Town Campus Georgetown Connect/Social Media: Hazard Dependent Emergency Action Plan Georgetown community/town services communicate well during crises/emergencies, and Georgetown has a communication center.	S/V	Town Wide	Municipal	Drainage/run off issues at the Public Safety/Town Campus: Public Safety Building under the review w.r.t. renovations/relocation due to age and access issues. Consider NBS (invasive species management, tree planting, rain gardens, permeable pavers, etc.) to improve drainage within the complex. Expand on public outreach efforts initiated during the COVID 19 emergency (Emergency Management Director Updates). Publicize sections of the town's Emergency Management Plan (those pertaining to shelters, evacuation routes, cooling centers, etc.). Provide maps and wayfinding for evacuation routes and shelters. Continue public engagement regarding vector diseases, etc. through the Board of Health. Consider expanding outreach and education through town partners/volunteers.	X	X	X	M	O
Dam at Pentucket Pond - Significant Hazard Dam Dam at Baldpate Pond- Low Hazard (GIS shows Georgetown as owner) - - Boxford ownership and control ; could be related to land swap- owned by NG.	S/V	Pentucket Pond, Pond Street	Municipal	Pentucket Pond Dam: Emergency Action Plan/O&M updated in 2019. Ensure Action Plan has been approved by the Office of Dam Safety. Continue implementing O&M plan. Continue outreach efforts to the Office of Dam Safety regarding Baldpate Dam. The Dam is under the care and control of National Grid and not Georgetown. Request inspection reports from the Office of Dam Safety. Implement an Emergency Action Plan for Pentucket Pond. Implement a dam operations and maintenance plan.	X	X	X	H	O

Community Resilience Building Risk Matrix

www.CommunityResilienceBuilding.org

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

Flooding	Extreme & Variable Weather (Storms, Ice, Snow, Freezing Rain & Heat)	Drought and Extreme Heat	Increased Disease Vectors (emerald ash borer, ticks, EEE, gypsy moths, blue/green algae, etc.)	

Vulnerabilities (V) and/or Strengths (S)	V / S	Location	Owner	Solutions	Infrastructural	Societal	Environmental	**H**ight, **M**edium or **L**ow priority for action over the **S**hort or **L**ong term and **O**ngoing: H/M/L	S/L/O
Large open spaces as a source of respite, recreation, habitat, flood mitigation but also prone to brush/forest fires, diseases, invasive species, storm damage and other climate impacts provide recreational, wildlife habitat, carbon sequestration, flood storage, water quality, localized cooling/climate resiliency resources; mental and physical health resources especially during crises such as COVID-19 pandemic. Crane Pond Wildlife Management Area, Georgetown-Rowley State Forest, Parker River and shoreline (where undeveloped) and watershed (Class B- 401), its tributaries (Camp Denison), Baldpate Pond State Park, Pentucket Pond, Rock Pond and other Open Space and Conservation Land. Georgetown has approximately 1,000 acres of Conservation Land.	S/V	Town Wide	State/Municipal/Private/Non Profit	Research actions for property acquisition/easements/conservation restrictions to expand open space/conservation land opportunities and climate resiliency in town. Integrate Essex County Greenbelt parcel prioritization matrix into MVP/NRIA mapping. Consider using the TNC Ecological Climate Resiliency Mapping provided as part of the NRIA as well as the Essex County Greenbelt matrix as a tool to prioritize land protection. Complete ecological reviews of open spaces and draft/ prioritize management recommendations and actions such as NBS that increase climate resilience. For example, in large patches of forests- Forest diversity and health assessment with recommendations on how to improve forest health (e.g.. diversified plantings, invasive species removal, forest management, prescribed fires, etc.); in wetlands- wetland assessments with recommendations on how to improve functions and values, etc.) Implement NRIA recommendations and use as a model for NBS solutions implementation, and public outreach and education. Improve universal access to open spaces and recreational facilities including auxiliary structures (parking lots, sanitary facilities, etc.). Incorporate climate adaptation and MVP findings in the next Open Space and Recreation Plan update. Dying and sick trees can create hazards via falling branches and trees. Complete a tree health assessment. Engage in public education and outreach to ensure the protection of Georgetown's state listed species and vernal pools. Encourage vernal pool certification and protection when permitted by landowner.	X	X	X	H	O
Municipally owned utilities- water and electric. Currently updating water withdrawal permit for the next 20 years. Shorter electrical outages. Planning for an in town micro-grid power (this is in progress and the state is included). Searle Street substation located in a potentially wet area (just outside of 100-year floodplain).	S/V	Town Wide	Municipal	Review open space parcels or parcels in the vicinity of the substation and implement NBS to minimize flooding risks in the Searle Street area. Work with the water department to set aside funding for water conservation outreach/education on a yearly basis. Incorporate NBS and outreach to reduce water use and increase water infiltration as part of the water conservation program implementation process. Investigate electrical redundancy and assess upgrade needs in light of predicted future demands. Invest in renewable energy initiatives (car charging stations, hybrid vehicles, solar power, solar power battery cells, wind power, geothermal, etc.). Avoid energy sources that involve cutting forests (such as wood-based biofuels) or use of fossil fuels. Prioritize locating solar and wind power projects on land that has already been developed and avoid locating solar and wind power projects in forested areas.	X	X	X	H	O

Community **R**esilience **B**uilding Risk Matrix

www.CommunityResilienceBuilding.org

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

Flooding	Extreme & Variable Weather (Storms, Ice, Snow, Freezing Rain & Heat)	Drought and Extreme Heat	Increased Disease Vectors (emerald ash borer, ticks, EEE, gypsy moths, blue/green algae, etc.)	

Vulnerabilities (V) and/or Strengths (S)	V / S	Location	Owner	Solutions	Infrastructural	Societal	Environmental	**H**ight, **M**edium or **L**ow priority for action over the **S**hort or **L**ong term and **O**ngoing: H/M/L	S/L/O
Parker River, Rock Pond and Pentucket Pond- great recreational, wildlife, respite and flood storage resources. However, water and oxygen levels continue to drop as nutrient inputs and sedimentation increase, resulting in warmer waters, algae blooms and increased invasive species infestations. Invasive species and debris in rivers and streams may be contributing to stagnation of water bodies and waterways.	S/V	Town Wide	Municipal/Private	Assess river and pond hydrology and bathymetry, and determine whether barriers (culvert, dam, walls, over sedimentation, dense invasive species, etc.) can be upgraded/managed to increase water flow, water capacity and decrease channelization. Update flood maps in the vicinity of the Parker River by integrating Cornell and National Weather Service Data. Implement use of floating islands/coir logs to help with nutrient removal and bank protection/restoration along the Parker River and the two ponds. Consider and implement management practice alternative solutions to reducing phosphate loads within the Parker River and the ponds. Implement erosion control projects along the banks of waterways, ponds and wetlands. Review river and pond banks to determine where improvements such as NBS (bank stabilization, tree planting, waterway/corridor alterations) could assist with overall water improvements. Partner with MS4 to stress public outreach on preventative steps that homeowners can take to lower nutrient releases into waterways, wetlands and ponds. Increase infiltration of water and improve storm water management by implementing NBS, green infrastructure, and community outreach and education. Implement erosion control projects.	X	X	X	H	O
Evacuation Routes Emergency Shelters: Georgetown Middle School/High School; Penn Brook School; all have crisis plans) Health and Medical Facilities: Four hospitals within 5, 9, and 12 miles. One is a Level 2 trauma center. Senior Center & Van/Transportation Food Pantries Cooling Centers: Tressle Way Community Center; COA; American Legion Beach (public beach); ponds	S/V	Town Wide	Municipal/Private	Identify evacuation routes and communicate these with the public. Identify emergency equipment needs (cots, back up energy, fuel) for shelters and emergency facilities. Seek funding to fulfill these needs. Consider expanding Senior transportation to other vulnerable populations in emergency situations. Identify options for alternative transportation/cost share (town owned vans). Investigate possibility of using Green Communities funding. Develop alternative cooling facilities: planting of shade trees and installation of benches in high use pedestrian areas (e.g. across high school, commercial areas, bus stops, etc.) Road and facility infrastructure review to ensure that emergency facilities are accessible in extreme weather events. For example: the main access to the High School/Middle School is in the Penn Brook floodplain. High School is on high ground, generator-powered, has EMD equipment. Schools have crisis plans. Consider additional shelter in strategic locations outside of the downtown area.	X	X		M	O

Community **R**esilience **B**uilding Risk Matrix

www.CommunityResilienceBuilding.org

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

Flooding	Extreme & Variable Weather (Storms, Ice, Snow, Freezing Rain & Heat)	Drought and Extreme Heat	Increased Disease Vectors (emerald ash borer, ticks, EEE, gypsy moths, blue/green algae, etc.)	

Vulnerabilities (V) and/or Strengths (S)	V / S	Location	Owner	Solutions	Infrastructural	Societal	Environmental	**H**ight, **M**edium or **L**ow priority for action over the **S**hort or **L**ong term and **O**ngoing: H/M/L	S/L/O
Local Zoning Overlays, and Bylaws; Committees and CPA	S	Town Wide	Municipal	Update open space plan with climate resiliency in mind (discuss option of doing this during the current update). Update local zoning and other bylaws/regulations to incorporate climate resiliency (projected rainfall data, NBS solutions, etc.) Continue implementing, reviewing and updating (as needed) local zoning and other bylaws to ensure sustainable development and resource protection in light of climate change. Consider implementing additional low impact development techniques and require NBS rather than gray infrastructure solutions. Advocate for cross committee and board communication and implementation of municipal climate resiliency objectives. Continue to support use of CPA funds to improve Georgetown's climate resiliency. Consider expanding the existing local vernal pool habitat buffer/set back to 125-feet.	X	X	X	M	O
Partners, stakeholders and volunteers eager to assist in improving Georgetown's climate resiliency	S	Town and Regional	Municipal/State/Private/Non Profit	Engage in a climate resiliency focused public outreach and education campaign. Incorporate solutions that reduce the N and P load into the wetlands, rivers and ponds. Integrate public education component in all future MVP action grants Partner with state (e.g.. DCR/ MassWildlife), non-profit (e.g.. land trust, PRCWA, Essex County Greenbelt), & private land managers (golf course, Ch. 61 landowners), volunteers and stakeholders to coordinate and implement town wide projects that increase use of NBS as well as provide community education and outreach.		X	X	H	O
Engaged Municipal Highway Department - flooding, already proactive with regard to storm water management and culvert replacement. Municipal Stormwater Sewer Systems (MS4)	S/V	Town Wide and Regional	Municipal	Continue replacing culverts to assist in areas prone to flooding. Implement the Stream Continuity Guidance/design for future storms when replacing culverts whenever possible. Coordinate culvert replacements with MassDOT on MassDOT roads. Coordinate storm water management improvements along roads and at the park and ride. MS4: Prepare MS4 updated inventory/mapping of catchbasins and outfalls. Prepare IDDE (illicit discharge detection elimination) Plan. Seek implementation assistance and partner with MVPC.	X		X	H	O

Agriculture Prioritization Results

- Critical Priority
- High Priority
- Priority
- Protected Open Space

Groveland

Newbury

Rowley

Boxford

Crane Pond WMA

Upper Parker River WMA

Lufkins Brook Conservation Area

Georgetown-Rowley State Forest

Pentucket Pond Outlet Reservoir

Rock Pond

95

This analysis evaluates the conservation value of a farm based on a variety of factors. These include soil quality, overall farm size, and the size of the area actively farmed. In addition, road frontage, structures, and adjacency to existing protected land increase the score of a farm.

This map represents the results of the agriculture analysis with rankings calculated at a county scale.

These prioritization results reflect work performed by Greenbelt to assess land in Essex County on a parcel by parcel basis. Results should be viewed within the context of individual analyses and do not represent the entirety of priority land in the town or county.

Greenbelt
Essex County's Land Trust

0 0.25 0.5 Miles

N

Habitat Prioritization Results

- Critical Priority
- High Priority
- Priority
- Protected Open Space

Groveland

Crane Pond WMA

Newbury

Pentucket Pond Outlet Reservoir

Rock Pond

Upper Parker River WMA

Lufkins Brook Conservation Area

Georgetown-Rowley State Forest

Rowley

Boxford

95

This analysis assesses parcels based on their ability to preserve critical habitat lands. Parcels are calculated for coverage of a number of datasets, including The Nature Conservancy's Terrestrial and Coastal Resilience, UMass Amherst's CAPS (Conservation Assessment and Prioritization System), Priority Habitats of Rare Species, BioMap2, and Department of Fisheries and Wildlife's Coldwater Fisheries Resources.

This map represents the results of the habitat analysis with rankings recalculated at a county scale.

These prioritization results reflect work performed by Greenbelt to assess land in Essex County on a parcel by parcel basis. Results should be viewed within the context of individual analyses and do not represent the entirety of priority land in the town or county.

Greenbelt
Essex County's Land Trust

0 0.25 0.5 Miles

N

Inland Flood Mitigation Prioritization Results

Critical Priority
High Priority
Priority
Protected Open Space

Groveland
Newbury
Rowley
Boxford

Crane Pond WMA
Upper Parker River WMA
Lufkins Brook Conservation Area
Georgetown-Rowley State Forest
Pentucket Pond Outlet Reservoir
Rock Pond

95

This analysis evaluates parcels on the natural qualities they possess that help to mitigate the threats of inland flooding. These include resilient wetlands (saltmarsh excluded), large forest blocks (greater than 100 acres), and the soil's ability to absorb water. Risk is evaluated using FEMA National Flood Hazard zones.

This map represents the results of the inland flood mitigation analysis with rankings calculated at a county scale.

These prioritization results reflect work performed by Greenbelt to assess land in Essex County on a parcel by parcel basis. Results should be viewed within the context of individual analyses and do not represent the entirety of priority land in the town or county.

Greenbelt
Essex County's Land Trust

0 0.25 0.5 Miles

N

Natural Resilience Prioritization Results

- Critical Priority
- High Priority
- Priority
- Protected Open Space

Groveland
Newbury
Rowley
Boxford
Crane Pond WMA
Upper Parker River WMA
Lufkins Brook Conservation Area
Georgetown-Rowley State Forest
Pentucket Pond Outlet Reservoir
Rock Pond
95

This analysis assesses parcels based on their ability to preserve biodiversity into the future accounting for the impacts of climate change. Parcels are calculated for coverage of a number of resilience datasets, including The Nature Conservancy's Terrestrial and Coastal Resilience, and BioMap2. High scoring parcels reflect those which contain biodiversity and will continue to do so in a changing climate.

This map represents the results of the natural resilience analysis with rankings calculated at a county scale.

These prioritization results reflect work performed by Greenbelt to assess land in Essex County on a parcel by parcel basis. Results should be viewed within the context of individual analyses and do not represent the entirety of priority land in the town or county.

0 0.25 0.5 Miles

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Drinking Water Prioritization Results

- Critical Priority
- High Priority
- Priority
- Protected Open Space

Groveland

Newbury

Rowley

Boxford

Crane Pond WMA

Upper Parker River WMA

Lufkins Brook Conservation Area

Georgetown-Rowley State Forest

Pentucket Pond Outlet Reservoir

Rock Pond

95

This analysis evaluates parcels on their impact to public drinking water sources. Taken into account are presence of regulatory areas, such as wellhead and surface water protection zones, as well as watershed analysis. Individual watersheds were analyzed for each public surface water body, and parcels were awarded value for their proximity to intakes as well as the proportion of the watershed they accounted for. High scoring parcels reflect those of high regulatory importance and/or have significant ecological impacts on critical watersheds.

This map represents the results of the drinking water analysis with rankings calculated at a county scale.

These prioritization results reflect work performed by Greenbelt to assess land in Essex County on a parcel by parcel basis. Results should be viewed within the context of individual analyses and do not represent the entirety of priority land in the town or county.

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MERRIMACK BASIN

MUNICIPALITIES WITHIN MERRIMACK BASIN:

Amesbury, Andover, Ashburnham, Ashby, Ayer, Boxborough, Boxford, Chelmsford, Dracut, Dunstable, Georgetown, Groton, Groveland, Harvard, Haverhill, Lawrence, Littleton, Lowell, Merrimac, Methuen, Newbury, Newburyport, North Andover, Salisbury, Tewksbury, West Newbury, and Westford

Many municipalities fall within more than one basin, so it is advised to use the climate projections for the basin that contains the majority of the land area of the municipality.

MERRIMACK BASIN

Merrimack Basin		Observed Baseline 1971-2000 (°F)	Projected Change in 2030s (°F)	Mid-Century Projected Change in 2050s (°F)	Projected Change in 2070s (°F)	End of Century Projected Change in 2090s (°F)
Average Temperature	Annual	48.09	+2.24 to +4.44	+2.96 to +6.39	+3.56 to +9.13	+3.90 to +10.94
	Winter	26.83	+2.45 to +5.27	+3.18 to +7.77	+3.99 to +9.50	+4.27 to +10.83
	Spring	46.06	+1.72 to +3.47	+2.55 to +5.37	+2.71 to +7.70	+3.29 to +9.43
	Summer	68.79	+2.08 to +4.33	+2.81 to +6.67	+3.23 to +9.92	+3.75 to +12.47
	Fall	50.3	+2.30 to +5.02	+3.25 to +6.70	+3.52 to +9.57	+4.02 to +11.78
Maximum Temperature	Annual	59.14	+2.14 to +4.20	+2.74 to +6.30	+3.26 to +9.12	+3.58 to +10.87
	Winter	36.74	+2.13 to +4.83	+2.78 to +7.26	+3.42 to +8.80	+3.78 to +9.97
	Spring	57.46	+1.60 to +3.40	+2.21 to +5.48	+2.63 to +7.90	+3.23 to +9.35
	Summer	80.47	+1.85 to +4.36	+2.66 to +6.70	+3.11 to +10.15	+3.62 to +12.75
	Fall	61.48	+2.43 to +4.89	+3.54 to +6.93	+3.43 to +9.85	+3.93 to +12.19
Minimum Temperature	Annual	37.04	+2.33 to +4.76	+3.21 to +6.54	+3.86 to +9.09	+4.23 to +11.02
	Winter	16.93	+2.73 to +5.76	+3.57 to +8.28	+4.62 to +10.21	+4.77 to +11.56
	Spring	34.65	+1.85 to +3.79	+2.73 to +5.70	+2.86 to +7.47	+3.35 to +9.25
	Summer	57.1	+2.19 to +4.47	+2.97 to +7.06	+3.35 to +9.68	+3.96 to +12.18
	Fall	39.13	+2.18 to +5.17	+3.54 to +6.62	+3.61 to +9.38	+4.11 to +11.59

- The Merrimack basin is expected to experience increased average temperatures throughout the 21st century. Maximum and minimum temperatures are also expected to increase throughout the end of the century. These increased temperature trends are expected for annual and seasonal projections.
- Seasonally, maximum summer and fall temperatures are expected to see the highest projected increase throughout the 21st century.
    - Summer mid-century increase of 2.7 °F to 6.7 °F (3-8% increase); end of century increase of 3.6 °F to 12.8 °F (4-16% increase).
    - Fall mid-century increase of 3.5 °F to 6.9°F (6-11% increase); end of century increase by and 3.9 °F to 12.2 °F (6-20% increase).
- Seasonally, minimum winter and fall temperatures are expected to see increases throughout the 21st century.
    - Winter mid-century increase of 3.6 °F to 8.3 °F (21-49% increase); end of century increase by 4.8 °F to 11.6 °F (28-68% increase).
    - Fall mid-century of 3.5 °F to 6.6 °F (9-17% increase); end of century increase of 4.1°F to 11.6 °F (11-30% increase).

MERRIMACK BASIN

Merrimack Basin		Observed Baseline 1971-2000 (Days)	Projected Change in 2030s (Days)	Mid-Century Projected Change in 2050s (Days)	Projected Change in 2070s (Days)	End of Century Projected Change in 2090s (Days)
Days with Maximum Temperature Over 90°F	Annual	7.43	+7.35 to +20.01	+10.5 to +33.34	+12.50 to +54.70	+14.93 to +73.79
	Winter	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00
	Spring	0.4	+0.16 to +0.81	+0.44 to +1.56	+0.40 to +2.95	+0.26 to +4.65
	Summer	6.71	+6.40 to +16.92	+8.55 to +27.76	+10.9 to +44.02	+12.75 to +58.04
	Fall	0.32	+0.50 to +2.50	+0.78 to +5.27	+0.79 to +9.33	+1.35 to +12.68
Days with Maximum Temperature Over 95°F	Annual	0.68	+2.39 to +8.26	+3.34 to +15.95	+4.33 to +31.40	+5.88 to +48.56
	Winter	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00
	Spring	0.00	+0.03 to +0.27	+0.05 to +0.44	+0.09 to +1.05	+0.07 to +2.07
	Summer	0.67	+2.11 to +7.55	+2.89 to +14.18	+3.76 to +27.12	+5.39 to +41.58
	Fall	0.00	+0.13 to +0.80	+0.22 to +1.91	+0.23 to +4.44	+0.40 to +6.05
Days with Maximum Temperature Over 100°F	Annual	0.04	+0.30 to +2.26	+0.43 to +4.91	+0.77 to +11.36	+0.67 to +21.83
	Winter	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00
	Spring	0.00	+0.00 to +0.02	+0.00 to +0.04	+0.00 to +0.19	+0.00 to +0.61
	Summer	0.04	+0.28 to +2.14	+0.37 to +4.66	+0.69 to +10.41	+0.62 to +19.98
	Fall	0.00	+0.00 to +0.16	+0.01 to +0.37	+0.00 to +0.98	+0.00 to +1.57

- Due to projected increases in average and maximum temperatures throughout the end of the century, the Merrimack basin is also expected to experience an increase in days with daily maximum temperatures over 90 °F, 95 °F, and 100 °F.
    - Annually, the Merrimack basin is expected to see days with daily maximum temperatures over 90 °F increase by 11 to 33 more days by mid-century, and 15 to 74 more days by the end of the century.
    - Seasonally, summer is expected to see an increase of 9 to 28 more days with daily maximums over 90 °F by mid-century.
    - By end of century, the Merrimack basin is expected to have 13 to 58 more days.

MERRIMACK BASIN

Merrimack Basin		Observed Baseline 1971-2000 (Days)	Projected Change in 2030s (Days)	Mid-Century Projected Change in 2050s (Days)	Projected Change in 2070s (Days)	End of Century Projected Change in 2090s (Days)
Days with Minimum Temperature Below 0°F	Annual	6.82	-1.96 to -4.03	-2.18 to -4.56	-2.53 to -5.04	-2.51 to -5.21
	Winter	6.66	-1.83 to -3.79	-2.09 to -4.27	-2.42 to -4.8	-2.45 to -5.01
	Spring	0.16	-0.34 to +0.02	-0.04 to -0.38	-0.04 to -0.42	-0.04 to -0.39
	Summer	0.00	-0.00 to -0.00	-0.00 to -0.00	-0.00 to -0.00	-0.00 to -0.00
	Fall	0.03	-0.00 to -0.00	-0.00 to -0.00	-0.00 to -0.00	-0.00 to -0.00
Days with Minimum Temperature Below 32°F	Annual	148.02	-11.77 to -29.91	-19.48 to -42.17	-23.32 to -56.29	-25.48 to -66.09
	Winter	83.44	-2.34 to -7.11	-3.47 to -12.22	-5.12 to -20.48	-6.10 to -25.25
	Spring	37.47	-4.06 to -11.56	-7.16 to -15.46	-7.95 to -19.35	-8.84 to -20.82
	Summer	0.00	-0.09 to -0.00	-0.13 to -0.00	-0.13 to -0.00	-0.10 to -0.00
	Fall	27.08	-4.77 to -11.20	-8.54 to -14.50	-8.73 to -18.31	-8.66 to -20.26

- Due to projected increases in average and minimum temperatures throughout the end of the century, the Merrimack basin is expected to experience a decrease in days with daily minimum temperatures below 32 °F and 0 °F.
- Seasonally, winter, spring and fall are expected to see the largest decreases in days with daily minimum temperatures below 32 °F.
    - Winter is expected to have 3 to 12 fewer days by mid-century, and 6 to 25 fewer days by end of century.
    - Spring is expected to have 7 to 15 fewer days by mid-century, and 9 to 21 fewer by end of century.
    - Fall is expected to have 9 to 15 fewer days by mid-century, and 9 to 20 fewer days by end of century.

MERRIMACK BASIN

Merrimack Basin		Observed Baseline 1971-2000 (Degree-Days)	Projected Change in 2030s (Degree-Days)	Mid-Century Projected Change in 2050s (Degree-Days)	Projected Change in 2070s (Degree-Days)	End of Century Projected Change in 2090s (Degree-Days)
Heating Degree-Days (Base 65°F)	Annual	6692.63	-571.53 to -1185.29	-769.13 to -1620.80	-913.69 to -2135.09	-1031.63 to -2502.63
	Winter	3449.54	-217.49 to -492.24	-281.99 to -714.36	-353.03 to -864.63	-395.32 to -997.11
	Spring	1761.74	-143.65 to -291.13	-213.01 to -449.17	-224.61 to -613.27	-289.89 to -720.43
	Summer	106.18	-34.36 to -62.23	-43.41 to -78.59	-53.81 to -90.09	-54.15 to -92.13
	Fall	1380.99	-160.47 to -374.20	-279.24 to -463.14	-265.99 to -648.86	-284.96 to -735.43
Cooling Degree-Days (Base 65°F)	Annual	525.67	+208.98 to +444.39	+282.60 to +736.76	+340.96 to +1153.77	+398.86 to +1517.97
	Winter	nan	+0.63 to +2.38	+0.24 to +3.63	+1.29 to +4.22	+1.50 to +3.41
	Spring	19.61	+10.42 to +29.56	+18.86 to +51.44	+20.25 to +90.43	+15.98 to +126.25
	Summer	454.57	+156.46 to +337.24	+199.35 to +541.85	+236.07 to +827.70	+278.39 to +1057.10
	Fall	42.93	+31.41 to +93.67	+47.53 to +166.50	+54.92 to +258.13	+77.96 to +334.79
Growing Degree-Days (Base 50°F)	Annual	2465.75	+406.48 to +811.95	+548.63 to +1226.38	+640.53 to +1922.61	+730.40 to +2412.64
	Winter	5.68	-0.54 to +11.38	+1.96 to +14.51	+4.57 to +23.80	+3.40 to +32.10
	Spring	275.92	+63.21 to +136.48	+89.34 to +238.57	+110.31 to +362.33	+116.40 to +471.38
	Summer	1728.52	+191.00 to +398.24	+257.83 to +613.64	+296.73 to +912.00	+344.12 to +1146.51
	Fall	441.6	+108.94 to +295.58	+179.07 to +415.16	+168.86 to +622.47	+214.22 to +778.86

- Due to projected increases in average, maximum, and minimum temperatures throughout the end of the century, the Merrimack basin is expected to experience a decrease in heating degree-days, and increases in both cooling degree-days and growing degree-days.
- Seasonally, winter historically exhibits the highest number of heating degree-days and is expected to see the largest decrease of any season, but spring and fall are also expected to see significant change.
    - The winter season is expected to see a decrease of 8-21% (282 -714 degree-days) by mid-century, and a decrease of 11-29% (395 -997 degree-days) by the end of century.
    - The spring season is expected to decrease in heating degree-days by 12-25% (213-449 degree-days) by mid-century, and by 16-41% (290 -720 degree-days) by the end of century.
    - The fall season is expected to decreases in heating degree-days by 20-34% (279 -463 degree-days) by mid-century, and by 21-53% (285 -1518 degree-days) by the end of century.
- Conversely, due to projected increasing temperatures, summer cooling degree-days are expected to increase by 44-119% (199 -542 degree-days) by mid-century, and by 61-233% (278-1027 degree-days) by end of century.
- Seasonally, summer historically exhibits the highest number of growing degree-days and is expected to see the largest decrease of any season, but the shoulder seasons of spring and fall are also expected to see an increase in growing degree-days.

- The summer season is projected to increase by 15-36% (258 -614 degree-days) by mid-century, and by 20-66% (344 -1147 degree-days) by end of century.
- Spring is expected to see an increase by 32-86% (89 -239 degree-days) by mid-century and 42-171% (116 -471 degree-days) by end of century.
- Fall is expected to see an increase by 41-94% (179 -415 degree-days) by mid-century and 49-176% (214 -779 degree-days) by end of century.

MERRIMACK BASIN

Merrimack Basin		Observed Baseline 1971-2000 (Days)	Projected Change in 2030s (Days)	Mid-Century Projected Change in 2050s (Days)	Projected Change in 2070s (Days)	End of Century Projected Change in 2090s (Days)
Days with Precipitation Over 1"	Annual	6.72	+0.19 to +1.61	+0.38 to +2.58	+1.05 to +2.52	+0.95 to +3.51
	Winter	1.58	-0.09 to +0.69	+0.12 to +1.03	+0.19 to +1.33	+0.27 to +1.59
	Spring	1.52	-0.11 to +0.64	-0.05 to +0.92	+0.01 to +1.10	+0.10 to +1.21
	Summer	1.42	-0.12 to +0.46	-0.15 to +0.69	-0.09 to +0.61	-0.14 to +0.52
	Fall	2.19	-0.26 to +0.58	-0.05 to +0.74	-0.15 to +0.78	-0.23 to +0.72
Days with Precipitation Over 2"	Annual	0.76	+0.01 to +0.42	+0.00 to +0.50	+0.11 to +0.61	+0.11 to +0.70
	Winter	0.09	-0.04 to +0.08	-0.02 to +0.08	-0.01 to +0.13	+0.00 to +0.17
	Spring	0.12	-0.05 to +0.15	-0.03 to +0.16	-0.07 to +0.21	+0.00 to +0.23
	Summer	0.18	-0.06 to +0.16	-0.02 to +0.16	-0.03 to +0.14	-0.01 to +0.17
	Fall	0.36	-0.06 to +0.31	-0.08 to +0.22	-0.04 to +0.23	-0.08 to +0.29
Days with Precipitation Over 4"	Annual	0.07	-0.01 to +0.10	-0.02 to +0.10	-0.02 to +0.09	-0.02 to +0.16
	Winter	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.01
	Spring	0.00	-0.01 to +0.02	+0.00 to +0.03	-0.01 to +0.03	-0.01 to +0.04
	Summer	0.02	-0.01 to +0.03	-0.01 to +0.04	-0.01 to +0.02	-0.01 to +0.05
	Fall	0.04	-0.03 to +0.11	-0.02 to +0.06	-0.03 to +0.07	-0.05 to +0.09

- The projections for expected number of days receiving precipitation over one inch are variable for the Merrimack basin, fluctuating between loss and gain of days.
  - Seasonally, the winter season is generally expected to see the highest projected increase.
  - The winter season is expected to see an increase in days with precipitation over one inch of 0-1 days by mid-century, and of 0-2 days by the end of century.
  - The spring season is expected to see an increase in days with precipitation over one inch of 0-1 days by mid-century, and of an increase of 0-1 days by the end of century.

MERRIMACK BASIN

Merrimack Basin		Observed Baseline 1971-2000 (Inches)	Projected Change in 2030s (Inches)	Mid-Century Projected Change in 2050s (Inches)	Projected Change in 2070s (Inches)	End of Century Projected Change in 2090s (Inches)
Total Precipitation	Annual	44.21	+0.12 to +4.54	-0.02 to +5.82	+0.89 to +6.93	+0.91 to +7.57
	Winter	10.79	-0.46 to +1.85	-0.03 to +2.41	+0.36 to +3.01	+0.41 to +3.79
	Spring	11.27	-0.13 to +2.24	-0.09 to +2.08	+0.13 to +2.64	+0.24 to +2.54
	Summer	10.32	-0.15 to +1.31	-0.64 to +2.04	-0.75 to +1.83	-1.06 to +1.78
	Fall	11.85	-1.14 to +1.06	-1.14 to +1.49	-1.60 to +1.36	-1.39 to +1.26

- Similar to projections for number of days receiving precipitation over a specified threshold, seasonal projections for total precipitation are also variable for the Merrimack basin.
    - The winter season is expected to experience the greatest change with an increase of 0-22% by mid-century, and of 4-35% by end of century.
    - Projections for the summer and fall seasons are more variable, and could see either a drop or increase in total precipitation throughout the 21st century.
        - The summer season projections for the Merrimack or basin could see a decrease of 0.6 to an increase of 2.0 inches by mid-century (decrease of 6% to increase of 20%) and a decrease of 1.1 to an increase of 1.8 inches by the end of the century (decrease of 10% to increase of 17%).
        - The fall season projections for the Merrimack basin could see a decrease of 1.1 to an increase of 1.5 inches by mid-century (decrease of 10% to increase of 13% and a decrease of 1.4 to an increase of 1.3 inches by the end of the century (decrease of 12% to increase of 11%).

Merrimack Basin		Observed Baseline 1971-2000 (Days)	Projected Change in 2030s (Days)	Mid-Century Projected Change in 2050s (Days)	Projected Change in 2070s (Days)	End of Century Projected Change in 2090s (Days)
Consecutive Dry Days	Annual	17.41	-0.66 to +1.21	-0.42 to +2.01	-0.88 to +2.42	-0.44 to +2.66
	Winter	12.12	-0.79 to +1.14	-0.63 to +1.57	-0.94 to +1.50	-0.95 to +1.60
	Spring	11.74	-0.94 to +0.68	-1.39 to +1.30	-1.69 to +1.14	-1.29 to +0.81
	Summer	13.32	-0.81 to +1.38	-0.53 to +1.73	-0.90 to +2.39	-1.02 to +2.35
	Fall	12.23	-0.13 to +1.80	-0.48 to +2.47	-0.44 to +3.02	-0.21 to +2.63

- Annual and seasonal projections for consecutive dry days, or for a given period, the largest number of consecutive days with precipitation less than 1 mm (~0.04 inches), are variable throughout the 21st century.
    - For all the temporal parameters, the Merrimack basin is expected to see a slight decrease to an increase in consecutive dry days throughout this century.
    - Seasonally, the fall and summer seasons are expected to continue to experience the highest number of consecutive dry days.
        - The summer season is expected to experience a decrease of 1 day to an increase of 2 days in consecutive dry days by the end of the century.

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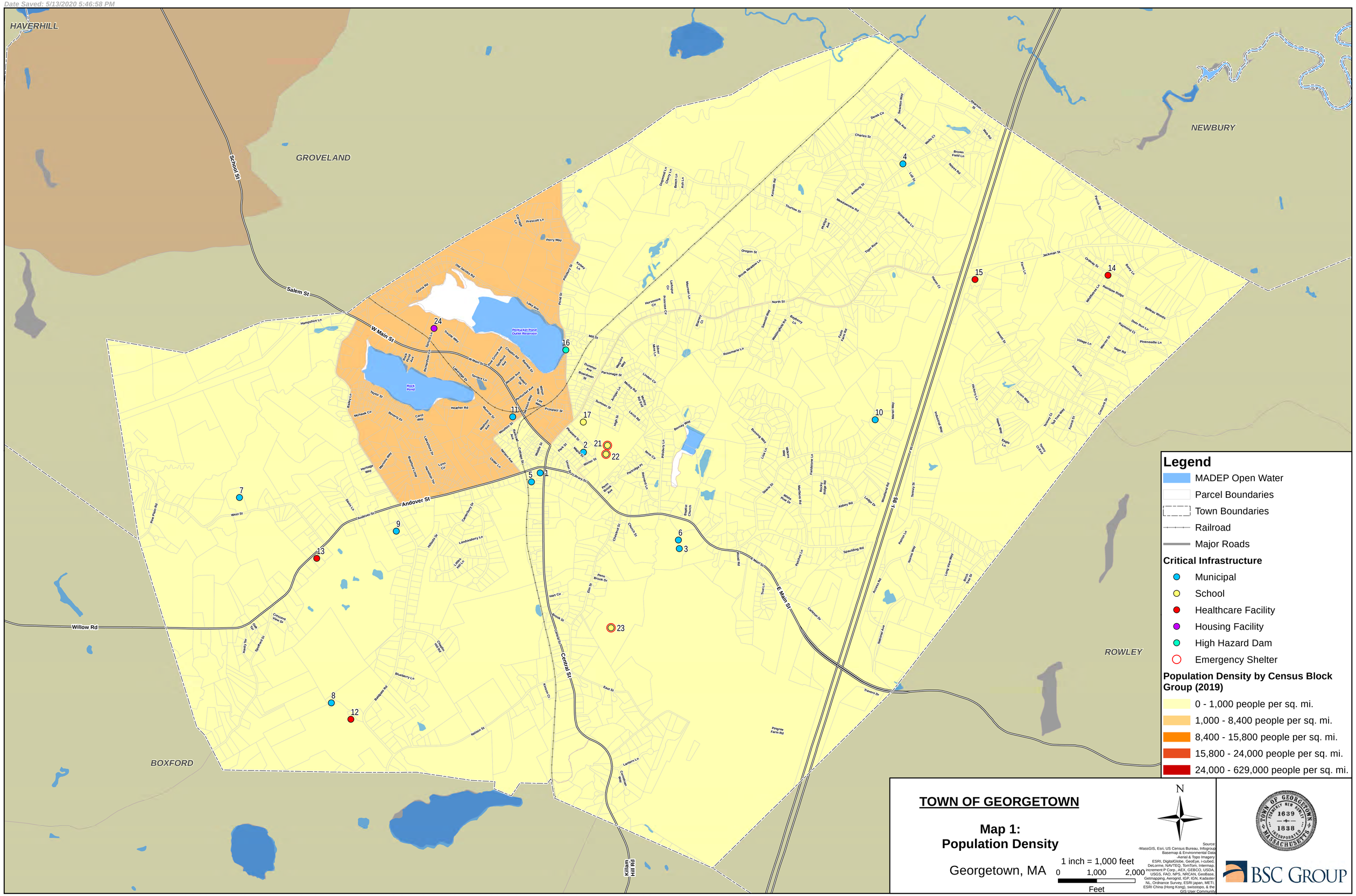

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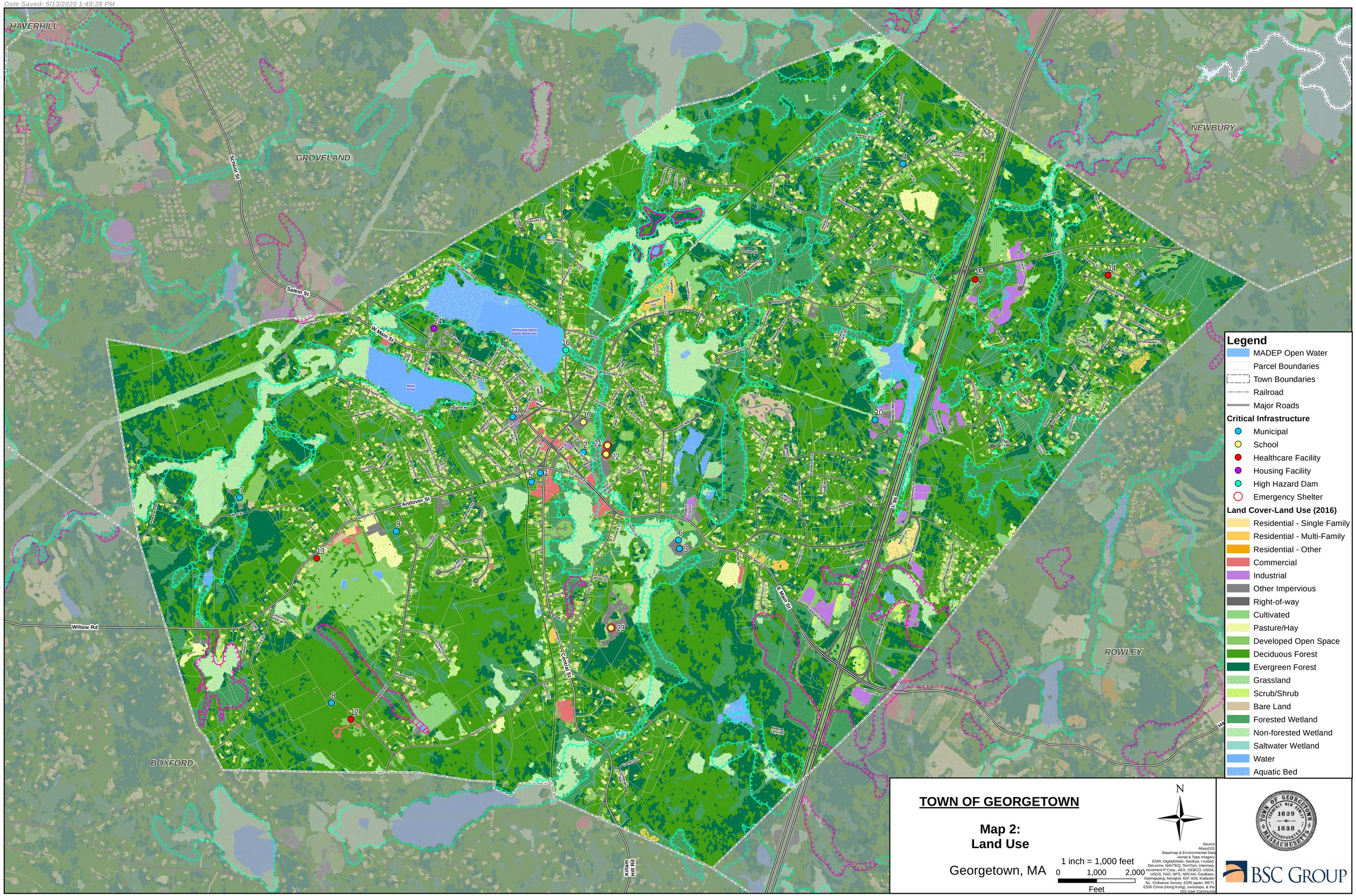

Legend

- MADEP Open Water
- Parcel Boundaries
- Town Boundaries
- Railroad
- Major Roads

Critical Infrastructure

- Municipal
- School
- Healthcare Facility
- Housing Facility
- High Hazard Dam
- Emergency Shelter

Land Cover-Land Use (2016)

- Residential - Single Family
- Residential - Multi-Family
- Residential - Other
- Commercial
- Industrial
- Other Impervious
- Right-of-way
- Cultivated
- Pasture/Hay
- Developed Open Space
- Deciduous Forest
- Evergreen Forest
- Grassland
- Scrub/Shrub
- Bare Land
- Forested Wetland
- Non-forested Wetland
- Saltwater Wetland
- Water
- Aquatic Bed

TOWN OF GEORGETOWN

Map 2: Land Use

Georgetown, MA

N

1 inch = 1,000 feet

0 1,000 2,000

Feet

Source:
MassGIS
Basemap & Environmental Data
Aerial & Topo Imagery
ESRI, DigitalGlobe, GeoEye, i-cubed, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., AEX, GEBCO, USDA, USGS, FAO, NPS, NRCAN, GeoBase, Getmapping, Aerogrid, IGP, IGN, Kadaster NL, Ordnance Survey, ESRI japan, METI, ESRI China (Hong Kong), swisstopo, & the GIS User Community

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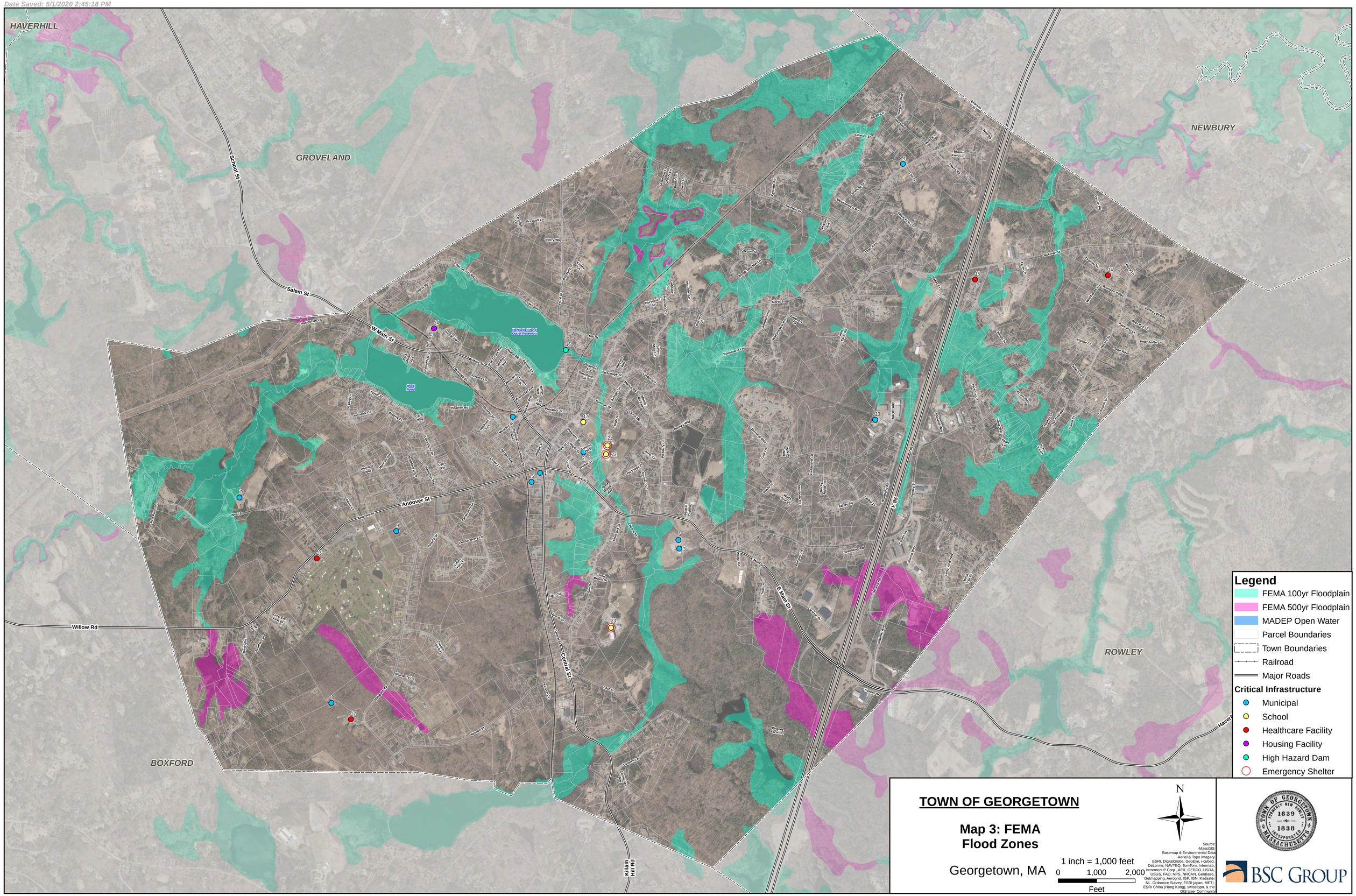

TOWN OF GEORGETOWN

Map 3: FEMA Flood Zones

Georgetown, MA

N

1 inch = 1,000 feet

0 1,000 2,000

Feet

Source:
-MassGIS
Basemap & Environmental Data
-Aerial & Topo Imagery
ESRI, DigitalGlobe, GeoEye, i-cubed, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., AEX, GEBCO, USDA, USGS, FAO, NPS, NRCAN, GeoBase, Getmapping, Aerogrid, IGP, IGN, Kadaster NL, Ordnance Survey, ESRI japan, METI, ESRI China (Hong Kong), swisstopo, & the GIS User Community

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HAVERHILL
GROVELAND
NEWBURY
ROWLEY
BOXFORD
School St
Salem St
W Main St
Andover St
Willow Rd
Central St
E Main St
I- 95
Killam Hill Rd
Rock Pond
Pentucket Pond Outlet Reservoir
Legend
MADEP Open Water
Parcel Boundaries
Town Boundaries
Railroad
Major Roads
Significant Earthquake Epicenter
Critical Infrastructure
Municipal
School
Healthcare Facility
Housing Facility
High Hazard Dam
Emergency Shelter
Landslides
High landslide incidence (greater than 15% of the area is involved in landsliding)
High susceptibility to landsliding and moderate incidence
High susceptibility to landsliding and low incidence
Moderate susceptibility to landsliding and moderate incidence
Moderate susceptibility to landsliding and low incidence
Low landslide incidence (less than 1.5% of the area is involved in landsliding)
TOWN OF GEORGETOWN
Map 4:
Earthquakes and Landslides
Georgetown, MA
1 inch = 1,000 feet
0 1,000 2,000
Feet
N
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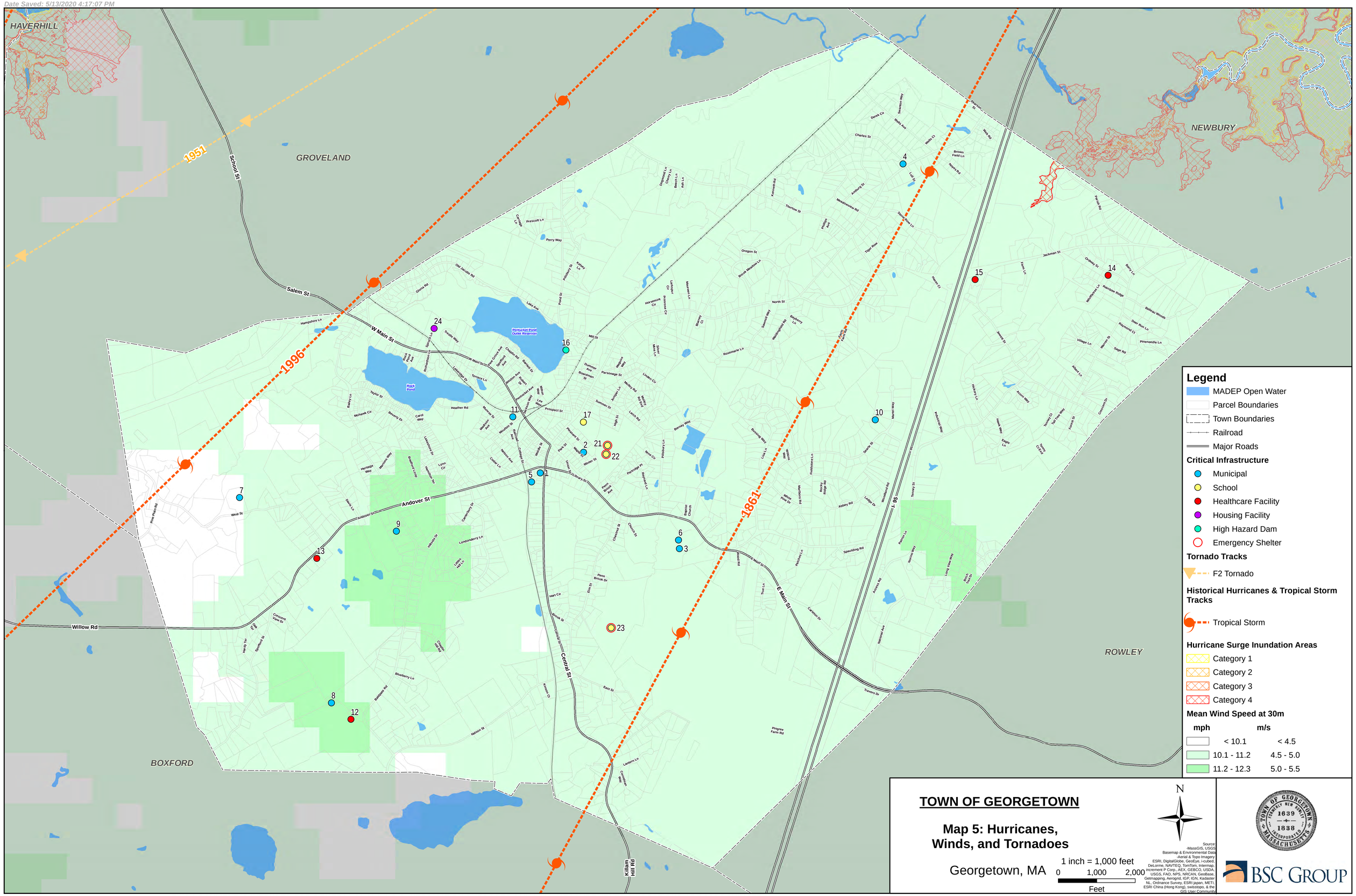

Legend

- MADEP Open Water
- Parcel Boundaries
- Town Boundaries
- Railroad
- Major Roads

Critical Infrastructure

- Municipal
- School
- Healthcare Facility
- Housing Facility
- High Hazard Dam
- Emergency Shelter

Tornado Tracks

- F2 Tornado

Historical Hurricanes & Tropical Storm Tracks

- Tropical Storm

Hurricane Surge Inundation Areas

- Category 1
- Category 2
- Category 3
- Category 4

Mean Wind Speed at 30m

mph	m/s
< 10.1	< 4.5
10.1 - 11.2	4.5 - 5.0
11.2 - 12.3	5.0 - 5.5

TOWN OF GEORGETOWN

Map 5: Hurricanes, Winds, and Tornadoes

Georgetown, MA

N

1 inch = 1,000 feet

0 1,000 2,000

Feet

Source:
-MassGIS, USGS
Basemap & Environmental Data
-Aerial & Topo Imagery
ESRI, DigitalGlobe, GeoEye, i-cubed, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., AEX, GEBCO, USDA, USGS, FAO, NPS, NRCAN, GeoBase, Getmapping, Aerogrid, IGP, IGN, Kadaster NL, Ordnance Survey, ESRI japan, METI, ESRI China (Hong Kong), swisstopo, & the GIS User Community

TOWN OF GEORGETOWN FORMERLY NEW ROWLEY 1639 INCORPORATED 1838 MASSACHUSETTS

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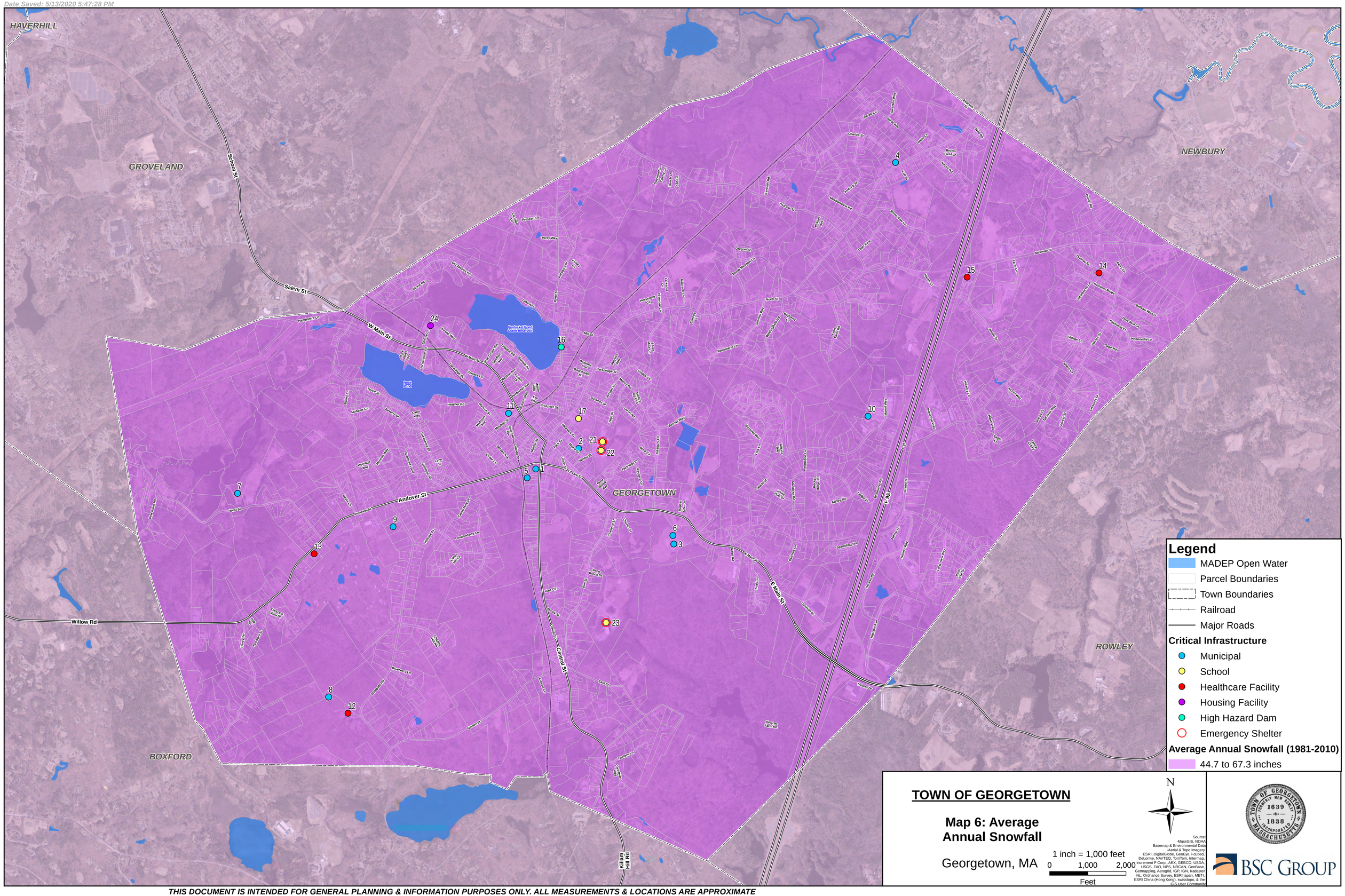
File Location: \\bscbos\wor\GIS-WOR\GISPrj\8950933\Output\Maps\MXD\ReportMaps\Georgetown_24x36_Map6_AvgSnowfall_20200513.mxd
Date Saved: 5/13/2020 5:47:28 PM



Legend

- MADEP Open Water
- Parcel Boundaries
- Town Boundaries
- Railroad
- Major Roads

Critical Infrastructure

- Municipal
- School
- Healthcare Facility
- Housing Facility
- High Hazard Dam
- Emergency Shelter

Average Annual Snowfall (1981-2010)

- 44.7 to 67.3 inches

TOWN OF GEORGETOWN

Map 6: Average Annual Snowfall

Georgetown, MA

N

1 inch = 1,000 feet

0 1,000 2,000

Feet

Source:
-MassGIS, NOAA
Basemap & Environmental Data:
-Aerial & Topo Imagery
ESRI, DigitalGlobe, GeoEye, i-cubed, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., AEX, GEBCO, USDA, USGS, FAO, NPS, NRCAN, GeoBase, Getmapping, Aerogrid, IGP, IGN, Kadaster NL, Ordnance Survey, ESRI japan, METI, ESRI China (Hong Kong), swisstopo, & the GIS User Community

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THIS DOCUMENT IS INTENDED FOR GENERAL PLANNING & INFORMATION PURPOSES ONLY. ALL MEASUREMENTS & LOCATIONS ARE APPROXIMATE

HAZARD MITIGATION ACTION PLAN/ CAPABILITY ASSESSMENT WORKSHEET

Category of Action	Description	Area Covered	Hazards Address	Implementation Resources and Funding	Improvements/Opportunities/Actions	Summary of Evaluations	2015 HMP Action?/ Updates	2022 Actions Review/ Updates
Infrastructure Protection/ Prevention/ Public Safety/Education and Outreach	Undersized, plugged and /or crushed municipal drainage systems such as culverts have exacerbated flooding. Ponding associated with flooding has the capacity to increase disease vector populations such as mosquitos.	Town Wide	Flooding & Vector Diseases	Highway Department/Conservation Commission. Potential funding through MS4, DER Municipal Culvert Replacement Program, MPO Transportation Funding.	Continue culvert replacement and upgrades needs assessment. Base assessment to meet future flood conditions, rather than historical. Implement Massachusetts Stream Crossing Standards/ design for future storms when replacing culverts whenever possible. Coordinate culvert replacements and stormwater management with MassDOT on MassDOT roads and at the park and ride. Prepare MS4 updated inventory/ mapping of catch basins and outfalls and prepare an Illicit Discharge Detection Elimination (IDDE) Plan. Increase infiltration of water and improve stormwater management by advocating for the implementation of Nature Based Solutions, Green Infrastructure, and community education and outreach. Seek implementation assistance and partner with Merrimack Valley Planning Commission	Reduced flooding, infrastructural damage and improved waterflow. Co benefits: wildlife habitat continuity, improved water quality (less algae blooms in the ponds) and increase water levels along river, streams and water bodies. Updated MS4 and culvert mapping. Submittal of IDDE plan. Place value on nature based solutions and green infrastructure for new construction and/or updates. Make NBS/Green Infrastructure socially and politically acceptable.	Yes/ This is a continuous effort and i part of routine maintenance by the Town.	
Infrastructure Protection/Prevention/ Public Safety/Education and Outreach	State law implemented by municipal Board of Health Department relative to public health and safety. Recognition that the increasing number of beaver dams	Town Wide	Flooding & Vector Diseases	Board of Health, Conservation Commission and Highway Department	Inventory beaver dams and prioritize locations for beaver management particularly when these are negatively affective evacuation/emergency access routes and critical infrastructure. Continue issuing trapping and removal permits, and authorizing the installation of beaver deceivers (as necessary). Education and outreach to local landowners regarding beaver management opportunities.	Reduced flooding, infrastructural damage and improved waterflow. Co benefits: wildlife habitat continuity, improved water quality (less algae blooms in the ponds) and increase water levels along river, streams and water bodies.	Yes/ This is a continuous effort and is part of routine maintenance by the Town.	

Category of Action	Description	Area Covered	Hazards Address	Implementation Resources and Funding	Improvements/Opportunities/Actions	Summary of Evaluations	2015 HMP Action?/ Updates	2022 Actions Review/ Updates
	may be exacerbating flooding in some locations.							
Regulatory Protection/Prevention/Public Safety	State regulations under the Wetlands Protection Act to regulate stormwater and other point source discharges. Stormwater Management is also regulated under local bylaws.	Town Wide	All Hazards	Georgetown Conservation Commission / Planning Board	Continue to enforce and review stormwater standards/bylaws. Advocate for the use of low impact development, Nature Based Solutions, Green Infrastructure, and community education and outreach. Coordinate with state program to identify existing facilities with hazardous materials located within the 100- and 500- year floodplain and establish protocols/bylaws for secondary containment and other protective measures. Limit the establishment of such facilities through zoning. Access state support for addressing these issues. Consider extending Board of Health septic disposal regulations to all floodplains. Regulations and requirements currently in place for septic regulations to all floodplains. Regulations and requirements currently in place for septic systems within 300-feet of Pentucket and Rock Pond. Identify septic systems located in floodplain and provide incentive for upgrades. Map and plan using predicted floodplain, rather than historical floodplains.	Reduction in stormwater impacts should result in healthier waterbodies and wetlands and community buy in. Updated stormwater standards /bylaws based on needs.	Yes/ 2016 Erosion and Stormwater Control Bylaw Amendment; 2016-2019 – multiple Zoning Amendment including land use designation districts.	

Category of Action	Description	Area Covered	Hazards Address	Implementation Resources and Funding	Improvements/Opportunities/Actions	Summary of Evaluations	2015 HMP Action?/ Updates	2022 Actions Review/ Updates
Prevention/Protection/Public Safety/Education and Outreach	Master Plan, Land Use Plan, Transportation Plans, Housing Plan, Capital Improvement Plan,Economic Development Plan, Local Emergency Operations Plan, Transportation Plan, Open Space and Recreation Plan, and other special plans	Town Wide	All Hazards	All Municipal Departments – CPA/MVP	Review all plans to ensure that climate hazards and climate projections are incorporated in the documents. Plans should identify projects that incorporate actions and solutions highlighted in the MVP/HMP and NRIA documents. Plans should discourage building new critical facilities within the FEMA floodplains.	Increased municipal climate resiliency and emergency preparedness.	Yes/ expanded to incorporate all hazards and all project types	
Prevention/Protection/Public Safety	Building Code, Building Permits	Town Wide	All Hazards	Building Official and Building Inspections	Review and update building code based on the MVP/HMP and climate projection (increased rain, wind, snow, etc.). Build to ensure sustainability based on future climate projections.	Increased municipal climate resiliency and emergency preparedness.	Yes/ expanded to incorporate all hazards and all project types	
Prevention/Protection/Technical	FEMA Mapping	Town Wide	Flooding	Planning, Conservation Commission, Highway Department	Work to ensure FEMA maps are up to date. Consider seeking funding to do additional flood mapping based on climate projections. MVP funding. Prioritize evacuation routes and main arteries as well as areas in close proximity to critical facilities.	Accurate flood maps; increased municipal climate resiliency and emergency preparedness.	No	
Financial	Funding Sources	Town Wide	All Hazards	Planning Department with assistance of all municipal departments	Identify and seek funding for actions and projects that reduce the cost and increase resiliency to climate hazards. FEMA, MVP, DER, CPA.	Implement improvement projects that reduce the costs/impacts associated with climate hazards.	Yes/ expanded to incorporate all hazards and all project types	

Category of Action	Description	Area Covered	Hazards Address	Implementation Resources and Funding	Improvements/Opportunities/Actions	Summary of Evaluations	2015 HMP Action?/ Updates	2022 Actions Review/ Updates
Technical/Education and Outreach/Public Safety	Hazard Data and Information	Town Wide	All Hazards	Planning, Conservation, Police/Fire, Merrimack Valley Planning Commission, MA DPH	Continue working with the Merrimack Valley Planning Commission and MA DPH to ensure up to date climate hazard information, including critical facilities and evacuation routes area available on the GIS Online viewer.	All climate hazard information available online.	Yes/ Expanded Scope	
Technical/Public Safety	Emergency Notification System / Town Website	Town Wide	All Hazard	Police/Fire/Emergency Response/ MEMA	Continue updating the emergency notification system and town website to ensure communication, public outreach and feedback to Georgetown residents for emergency preparation and during emergencies.	Informed, prepared and proactive community.	Yes/ Expanded Scope	
Prevention	Funding Sources	Town Wide	All Hazards	Planning Department with assistance of all municipal departments	Identify and seek funding for actions and projects that reduce the cost and increase resiliency to climate hazards. FEMA, MVP, DER, CPA.	Implement improvement projects that reduce the costs/impacts associated with climate hazards.	Yes/ expanded to incorporate all hazards and all project types	