Brewster, MA
Multi-Hazard Mitigation Plan

Prepared by:

Horsley Witten Group
Sustainable Environmental Solutions
55 Dorrance Street • Suite 200 • Providence, RI 02903
401-272-1717 • horsleywitten.com

Town of Brewster Multi-Hazard Mitigation Plan
Brewster, Massachusetts

Acknowledgements
Charlie Baker – *Governor*

Massachusetts Emergency Management Agency
Samantha Phillips – *Director*

Members of the Brewster Local Hazard Mitigation Workgroup

Paul Anderson – Brewster Water Department Superintendent

Ryan Bennett – Town Planner (former)

Conor Kenny – Project Manager (Town of Brewster)

Heath Eldredge – Police Chief

Patrick Ellis – DPW Director (former)

Pat Hughes – Coastal Committee

Don Labonte – Resident/CERT

Peter Lombardi – Town Administrator

Donna Kalinick – Assistant Town Administrator

Chris Miller – Natural Resources Director

Robert Moran – Fire Chief

Griffin Ryder – DPW Director (present)

Victor Staley – Building Commissioner (former)

Davis Walters – Building Commissioner (present)

Amy von Hone – Health Department Director

Jeff Zukowski – MEMA Representative

Craig Pereira – Consultant, Horsley Witten Group, Inc.

A TOWN OF BREWSTER RESOLUTION
IN RECOGNITION OF

Brewster's Multi-Hazard Mitigation Plan

WHEREAS A Town Multi-Hazard Mitigation Plan preserves the health, safety, and welfare of the citizens of Brewster and their property; and

WHEREAS, The 2021 Multi-Hazard Mitigation Plan is a new stand-alone plan; and

WHEREAS, The Town of Brewster Local Hazard Mitigation Workgroup, and along with its contractor, the Horsley Witten Group, Inc. composed the plan and held a series of advertised and noticed public meetings from February 2020 through November 2021 on drafting the plan; and

WHEREAS, Adoption of this plan is a federal requirement for the Town to be eligible for federal hazard mitigation grants as a result of a disaster or major mitigation planning project; and

WHEREAS, FEMA Region 1 has completed its review of the 2021 Town of Brewster Multi-Hazard Mitigation Plan and approved it subject to approval by the Select Board; and

WHEREAS, Select Board approval will allow the Town to meet its local hazard mitigation planning requirements pursuant to 44 C.F.R. Section 201 (the Disaster Mitigation Act),

NOW, THEREFORE, BE IT RESOLVED that the Select Board of the Town of Brewster do hereby accept and approve the Town of Brewster 2021 Multi-Hazard Mitigation Plan as presented.

IN WITNESS WHEREOF, we have hereunto set our hands and caused the Seal of the Town of Brewster to be affixed on this day of March 21, 2022.

CA Bingham

Cynthia Bingham — Chair, Select Board

David Whitney — Vice Chair, Select Board

Ned Chatelain — Clerk, Select Board

Mary Chaffee — Member, Select Board

Kari Hoffmann — Member, Select Board

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Section 1 Introduction

1.1 Overview

Each year in the United States, disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially reflect the true cost of disasters because additional expenses to insurance companies and nongovernmental organizations are not reimbursed by tax dollars. Many disasters are predictable, and much of the damage caused by these events can be alleviated or even eliminated.

Hazard mitigation is defined by the Federal Emergency Management Agency (FEMA) as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." The results of a three-year, congressionally mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation saves society an average of $4 in avoided future losses in addition to saving lives and preventing injuries (National Institute of Building Science Multi-Hazard Mitigation Council 2005).

Natural hazard mitigation planning is the process of determining how to reduce or eliminate the loss of life and property damage resulting from natural hazards such as floods, earthquakes and hurricanes. Hazard mitigation means to permanently reduce or alleviate the losses of life, injuries and property resulting from natural hazards through long-term strategies. These long-term strategies include planning, policy changes, programs, projects and other activities.

This plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the *Federal Register* on February 26, 2002 (44 CFR §201.6) and finalized on October 31, 2007 (hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act). While the act emphasized the need for mitigation plans and more coordinated mitigation planning and implementation efforts, the regulations established the requirements that local hazard mitigation plans must meet in order for a local jurisdiction to be eligible for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288). Because the Town of Brewster is subject to many kinds of hazards, access to these programs is vital.

Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to the community and its property owners by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruption. The Town of Brewster has been affected by hazards in the past and

is thus committed to reducing future disaster impacts and maintaining eligibility for federal funding.

This 2021 plan represents a local jurisdiction plan that will serve as a stand-alone document relative to just the Town of Brewster (with references to the State Hazard Mitigation Plan for consistency). The Town received a FEMA grant to develop a local hazard mitigation plan (HMP).

1.2 What Hazard Mitigation Can Do for the Town of Brewster

A primary benefit of hazard mitigation is that preventative measures taken now can significantly reduce the cost of post-disaster cleanup tomorrow. In addition, mitigation actions conducted before hazards occur greatly reduces the impact and costs associated with the aftermath of a hazard event. By planning ahead, Brewster will minimize the economic and social disruption that can result from floods, snowstorms, and hurricanes and other natural disasters.

The plan is intended to promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the natural environment. This can be achieved by increasing public awareness, documenting resources for risk reduction and loss-prevention, and identifying activities to guide the community towards the development of a safer, more sustainable community.

The adoption and implementation of this plan will assist Brewster in remaining eligible to receive assistance from FEMA in both pre- and post-disaster assistance such as: FEMA's Community Rating System (CRS), FEMA's Building Resilient Infrastructure and Communities (BRIC), Flood Mitigation Assistance (FMA) Program, and FEMA's Post-Disaster Hazard Mitigation Grant Program (HMGP).

1.3 Brewster's Mission Statement

The purpose of the Brewster Multi-Hazard Mitigation Plan is to reduce future damages to life, property, infrastructure, and natural, cultural, and economic resources from natural hazards and to decrease the number of hazard areas and impediments to rescue/evacuation and clean-up that currently exist in the Town.

1.4 Goals

The primary goals of the Brewster HMP plan are to substantially and permanently reduce the Town's vulnerability to natural hazards by creating a program of activities to address natural hazard impacts potential. The Town has identified goals intended to be general and broad in nature and can only be achieved through the long-term implementation of more specific objectives. Each goal listed below will be more specifically addressed and realized through the implementation of a Mitigation Strategy Action Plan, and defining short-term mitigation objectives and actions. In addition, the Town of Brewster is committed

to coordinating local hazard mitigation planning and activities with those of Barnstable County and neighboring towns (Harwich, Dennis and Orleans). The goals of the Brewster HMP include:

1. To reduce the potential for loss of life, property, critical facilities, infrastructure, environmental resources and landforms and cultural resources from natural disasters.
2. To educate residents and policy makers about natural hazard risk and vulnerability, so as to encourage hazard mitigation planning as part of the municipal planning process.
3. To implement cost effective and feasible mitigation projects, funded whenever possible with grant programs.
4. To coordinate Brewster hazard mitigation planning with neighboring towns in the mid and lower Cape Cod Region and Barnstable County.
5. To reduce potential financial losses incurred by municipal, residential and commercial establishments due to disasters.
6. To ensure that mitigation measures are context-sensitive to natural features, historic resources and community character.

1.5 Planning Process

A hazard mitigation plan should be considered a living document that must grow and adapt, keeping pace with a community's growth and change. The DMA of 2000 places high priority on the continuation of the planning process after the initial submittal, requiring communities to seek and receive re-approval from FEMA in order to remain eligible for assistance. The evaluation, revision and update process is also a means to create an institutional awareness and involvement in hazard mitigation as part of daily activities.

The Town of Brewster, with the assistance of the Horsley Witten Group, Inc. (HW) developed this HMP. In 2016, the Brewster LHMW made a concerted effort to develop an HMP at that time, however, a final draft plan was never completed or submitted to MEMA or FEMA. The Brewster LHMW from 2016 was again, re-energized and enhanced to provide a broad spectrum of local knowledge and experience to complete this 2021 plan.

Members of the Brewster LHMW include:

- Paul Anderson – Brewster Water Department Superintendent
- Ryan Bennett – Town Planner (former)
- Conor Kenny – Project Manager (Town of Brewster)
- Heath Eldredge – Police Chief
- Patrick Ellis – DPW Director (former)
- Griffin Ryder – DPW Director (present)
- Pat Hughes – Coastal Committee
- Don Labonte – Resident/CERT
- Peter Lombardi – Town Administrator

- Donna Kalinick – Assistant Town Administrator
- Chris Miller – Natural Resources Director
- Robert Moran – Fire Chief
- Victor Staley – Building Commissioner (former)
- Davis Walters – Building Commissioner (present)
- Amy von Hone – Health Department Director
- Craig Pereira – Consultant, Horsley Witten Group, Inc.

The Horsley Witten Group, Inc. conducted a series of meetings from February 2020 through November 2021 with the Brewster LHMW, municipal officials, the community, and representatives of MEMA. The public workshops were held in an open public forum and in accordance with M.A.G.L. c. 30A, Sections 18 - 25 in complying with the requirements of the Federal Disaster Mitigation Act of 2000 (DMA 2000). Due to the onset of the COVID-19 Pandemic, meetings were held both in-person and virtually.

A project webpage was designed and hosted on the Town's municipal website to announce the project, inform and engage the community before, during and after plan development, and to serve as a repository of project documents, presentations, and summaries. A PDF of the project webpage layout is included in Appendix B.

A series of Municipal Interviews (in-person, telephone and email correspondence) were conducted early in the update process (as part of the MVP process) for the development of the draft 2016 Plan Report Card (Table 1-1), identification of accomplishments since the 2016 Plan, and preliminary identification of mitigation measures for consideration in the plan update.

<u>Interviews:</u>

- Heath Eldredge – Police Chief
- Robert Moran – Fire Chief
- Victor Staley – Building Commissioner
- Ryan Bennett – Town Planner
- Pat Hughes – Coastal Committee
- Amy von Hone – Health Director

Representation from municipal officials/departments with the authority to regulate development (Planning Dept./Board, Conservation Commission, Building Department, and Select Board) as well as other interests participated on the LHMW, in the municipal interview series, and were invited to comment during the public comment period as discussed later in this section.

Table 1-1
2016 Draft Plan Report Card (2021 Update) Brewster, MA

Mitigation Measure	*Location*	*Ownership*	*Natural Hazard*	*Primary Problem/Effect*	*Mitigation Objective*	*Risk H-Historical P- Potential*	*2021 Status*
Create a standing Multi-Hazard Mitigation Committee.	Town-wide	Public	All Hazards	Limited funding opportunities for mitigation/ Compromised public health, safety and welfare	Eligibility for funding opportunities/Improved public health, safety and welfare	H and P	Completed
Join the NFIP's Community Rating System.	Town-wide	Public and Private	Flooding; Sea Level Rise; Storm Surge; Hurricanes	Public/Private property damage/cost of cleanup	Reduced damages/costs to public/private property	H and P	Ongoing, move to Capability Assessment
Increase protection of the floodplain by amending the current Floodplain District Bylaw.	Town-wide	Public and Private	Flooding; Sea Level Rise; Storm Surge; Hurricanes	Public/Private property damage/cost of cleanup	Reduced damages/costs to public/private property	P	Ongoing, move to Capability Assessment
Use the Town's evolving GIS to maintain current building and parcel data for the purpose of conducting more detailed hazard risk assessments and for tracking permitting/land use.	Town-wide	Public and Private	All Hazards	Public/Private property damage/cost of cleanup/ compromised public safety	Reduced damages/costs to public/private property/improved public safety	P	Ongoing, move to Capability Assessment

Table 1-1
2016 Draft Plan Report Card (2021 Update) Brewster, MA

Mitigation Measure	*Location*	*Ownership*	*Natural Hazard*	*Primary Problem/Effect*	*Mitigation Objective*	*Risk H-Historical P- Potential*	*2021 Status*
Conduct a thorough investigation of the Town's most at-risk locations identified in the Vulnerability Analysis and evaluate potential mitigation techniques for protecting each location to the maximum extent possible.	Town-wide	Public and Private	All hazards	Public/Private property damage/cost of cleanup/ compromised public safety/impacts to natural resources	Reduced damages/costs to public/private property/improved public safety/limited impacts to natural resources	H and P	Ongoing, move to Capability Assessment
Develop a list of mitigation projects, including but not limited to: snow fencing in areas prone to blowing and drifting snow, and regarding improved drainage in areas prone to flooding.	Town-wide	Public and Private	All hazards	Public property damage/cost of cleanup/ compromised public safety/Impacts to natural resources	Reduced damages/costs to public property/improved public safety/limited impacts to natural resources	H and P	Ongoing, move to Capability Assessment
Conduct a Needs Assessment of privately-owned facilities that have regional importance (medical centers/day care centers).	Town-wide	Public and Private	All hazards	Disruptions to emergency services/ Compromised public safety	Continued emergency services/Improved public safety	P	Not completed… carry forward to 2021 plan update

Table 1-1
2016 Draft Plan Report Card (2021 Update) Brewster, MA

Mitigation Measure	*Location*	*Ownership*	*Natural Hazard*	*Primary Problem/Effect*	*Mitigation Objective*	*Risk H-Historical P- Potential*	*2021 Status*
Conduct a Needs Assessment of mitigation activities that should be undertaken to prepare and protect Brewster's cultural resources from the damaging effects of natural hazards.	Town-wide	Public and Private	All hazards	Public property damage/cost of cleanup/ compromised public safety/Impacts to cultural resources	Reduced damages/costs to public property/improved public safety/limited impacts to cultural resources	P	Ongoing, move to Capability Assessment
Quantify potential losses by estimating such losses at varying degrees of storm surge, wind and stormwater hazard severity, as well as specific impacts on critical facilities.	Town-wide	Public and Private	Flooding/Wind	Public property damage/cost of cleanup/ compromised public safety	Reduced damages/costs to public property/improved public safety	P	Ongoing, move to Capability Assessment
Develop a map indicating hazard sensitive parcels acquired by Brewster.	Town-wide	Public and Private	All hazards	Public property damage/cost of cleanup/ compromised public safety	Reduced damages/costs to public property/improved public safety	P	Ongoing, move to Capability Assessment
Incorporate the inspection and management of hazardous trees/limbs into the Town's routine monitoring process.	Town-wide	Public and Private	Wind/Snow/Ice	Public property damage/cost of cleanup/ compromised public safety	Reduced damages/costs to public property/improved public safety	P	Not completed… carry forward to 2021 plan update

Table 1-1
2016 Draft Plan Report Card (2021 Update) Brewster, MA

Mitigation Measure	*Location*	*Ownership*	*Natural Hazard*	*Primary Problem/Effect*	*Mitigation Objective*	*Risk H-Historical P- Potential*	*2021 Status*
Monitor the Town's emergency services to identify needs in terms of personnel, equipment, and/or required resources.	Town-wide	Public and Private	All hazards	Public property damage/cost of cleanup/ compromised public safety	Reduced damages/costs to public property/improved public safety	P	Ongoing, move to Capability Assessment
Review of ditch systems and old bogs for preventative maintenance to increase flood capacity.	Town-wide	Public and Private	Flooding	Public property damage/cost of cleanup/ compromised public safety	Reduced damages/costs to public property/improved public safety	H and P	Not completed… carry forward to 2021 plan update
Mitigate impacts of blowing/drifting snow.	Town-wide	Public and Private	Wind/Snow/Ice	Compromised emergency response/public safety	Continued emergency services/Improved public safety	H and P	Not completed… carry forward to 2021 plan update
Infrastructure: Route 6A at Drummer Boy Park: Drainage study and re-design to eliminate flooding.	Route 6A	Public	Flooding	Compromised emergency response/public safety	Continued emergency services/Improved public safety	H and P	Ongoing, move to Capability Assessment
Infrastructure: Underpass Road: Drainage study and Re-design to eliminate roadway flooding.	Underpass Road	Public	Flooding	Compromised emergency response/public safety	Continued emergency services/Improved public safety	H and P	Completed

Table 1-1
2016 Draft Plan Report Card (2021 Update) Brewster, MA

Mitigation Measure	*Location*	*Ownership*	*Natural Hazard*	*Primary Problem/Effect*	*Mitigation Objective*	*Risk H-Historical P- Potential*	*2021 Status*
Continue to participate in marsh restoration projects to remediate tidally-restrictive infrastructure which affects the retention time of floodwaters or impound stormwater.	Sea St./Quivett Creek/Clarke 1/Clarke 2/Paine's Creek Rd./Freeman's Pond/Route 6A/Stony Brook/Channel off Stony Brook/Cape Cod Rail Trail/Namskaket Creek	Public and Private	Flooding/Fire/Coastal Erosion/Sea Level Rise	Impacts to natural resource areas	Preserved natural resource areas	H and P	Not completed… carry forward to 2021 plan update
Develop/distribute education material concerning care of animals during hazard emergencies.	Town-wide	Private	All hazards	Impacts to social distress	Minimized social distress	H and P	Ongoing, move to Capability Assessment
Develop a program to train emergency responders and residents in management of domestic animals, horses, sheep, goats, dogs, cats, birds, as well as wild animals, during emergencies such as flood, fires, winds, etc.	Town-wide	Public and Private	All hazards	Impacts to social distress	Minimized social distress	H and P	Not completed… carry forward to 2021 plan update

Table 1-1
2016 Draft Plan Report Card (2021 Update) Brewster, MA

Mitigation Measure	*Location*	*Ownership*	*Natural Hazard*	*Primary Problem/Effect*	*Mitigation Objective*	*Risk H-Historical P- Potential*	*2021 Status*
Conduct an educational workshop for coastal and riverfront landowners and contractors on hazard mitigation.	Town-wide	Public and Private	Flooding/Wind/Coastal Erosion/Sea Level Rise	Public property damage/cost of cleanup/ compromised public safety	Reduced damages/costs to public property/improved public safety	H and P	Not completed… carry forward to 2021 plan update
Supply educational materials on preparedness/ mitigation for property owners, for distribution and display at Town Hall, Brewster Ladies Library, Council on Aging.	Town-wide	Public and Private	All hazards	Public property damage/cost of cleanup/ compromised public safety	Reduced damages/costs to public property/improved public safety	P	Ongoing, move to Capability Assessment
Annually host a public hazards display for the residents of Brewster, in combination with the 'Brewster in Bloom' festival or another appropriate community event. Ensure that such a	Town-wide	Public and Private	All hazards	Public property damage/cost of cleanup/ compromised public safety	Reduced damages/costs to public property/improved public safety	P	Not completed… carry forward to 2021 plan update
Incorporate natural hazard mitigation and best planning practices into Brewster's planning work.	Town-wide	Public and Private	All hazards	Public property damage/cost of cleanup/ compromised public safety	Reduced damages/costs to public property/improved public safety	P	Ongoing, move to Capability Assessment

Table 1-1
2016 Draft Plan Report Card (2021 Update) Brewster, MA

Mitigation Measure	*Location*	*Ownership*	*Natural Hazard*	*Primary Problem/Effect*	*Mitigation Objective*	*Risk H-Historical P- Potential*	*2021 Status*
Participate in Cape Cod Cooperative Extension's Wildfire Assessment and Preparedness Program.	Town-wide	Public and Private	Wildfire	Public property damage/cost of cleanup/ compromised public safety	Reduced damages/costs to public property/improved public safety	H and P	Ongoing, move to Capability Assessment
Establish an MOU/MOA with the Town of Harwich, and other adjacent towns, regarding the coordinated opening of storm shelters and to ensure adequate shelter capacity for the area.	Town-wide	Public	All hazards	Compromised emergency response/public safety	Continued emergency response/improved public safety	H and P	Ongoing, move to Capability Assessment
Coordination with Nickerson State Park, Towns of Orleans (Baker's Pond, Harwich/Harwich Water Dept. (Punkhorn Parklands), and Dennis/Dennis Water Dept. (Punkhorn Parklands and Ellis Farm) on fuel reduction programs and response.	Town-wide	Public and Private	Wildfire	Compromised emergency response/public safety	Continued emergency response/improved public safety	H and P	Not completed… carry forward to 2021 plan update
Promote remote access for Channel 18.	Town-wide	Public	All hazards	Compromised emergency response/public safety	Continued emergency response/improved public safety	P	Completed

Table 1-1
2016 Draft Plan Report Card (2021 Update) Brewster, MA

Mitigation Measure	*Location*	*Ownership*	*Natural Hazard*	*Primary Problem/Effect*	*Mitigation Objective*	*Risk H-Historical P- Potential*	*2021 Status*
Identify and seek public/private sector funding for residents, businesses and the Town that will allow the implementation of sound hazard mitigation measures.	Town-wide	Public and Private	All hazards	Compromised public safety	Improved public safety	H and P	Ongoing, move to Capability Assessment

The Brewster LHMW first met (in-person) on March 13, 2020 to kick-off the project. At this meeting, the LHMW confirmed its membership, reviewed the project scope and revised schedule, discussed project coordination, reviewed the proposed revisions to the plan's layout (utilization of hazard mitigation categories) and identification of risks content (to include climate change), and discussed the logistics for the first Public Workshop. A complete set of meeting materials is included in Appendix B. At this meeting, HW agreed to expand the scope of work to include human-caused and technological hazards.

The Brewster LHMW met for a second time (virtually) on July 15, 2020 to discuss elements of Section 1 Introduction, including the plan's mission statement and goals. Next, a discussion of Section 2 Risk Assessment elements, including GIS mapping in collaboration with the Cape Cod Commission (CCC), development trends, NFIP property data update and FEMA grant assistance. The meeting concluded with a final discussion on the 2016 draft Mitigation Plan Report Card. It is noted that the 2016 draft plan was never formally submitted to MEMA or FEMA, however, it reflects a mitigation strategy the Town continued to make progress on and therefor has been included as such. A complete set of meeting materials is included in Appendix B.

The first Public Workshop was held on January 30, 2021. Announcements were posted on the project webpage, and emailed to Brewster Boards, Commissions and interested citizens. The presentation included an overview of the mitigation process, goals and measures, followed by a review of the 2016 draft Plan Report Card, and preliminary revisions to the plan (based on personal interviews with municipal officials, boards, and commissions). The Workshop flyer, PowerPoint Presentation and Sign-In Sheet are included in Appendix B.

The Brewster LHMW met for a third time (virtually) on July 16, 2021 to conduct a follow up to content needed for the update, review the updated risk maps, complete the actions for continued NFIP compliance table and review mitigation actions for consideration. The meeting concluded with an overview of Section 4 Mitigation Strategy to inform the LHMW what they needed to consider for the upcoming meeting. A complete set of meeting materials is included in Appendix B.

The Brewster LHMW met for a fourth time on September 27, 2021 to conduct the Benefit Cost Analysis (BCA review) for the mitigation actions under consideration. The Project Consultant reviewed the draft 2021 Mitigation Actions (Table 4-2) which identified those actions: Ongoing – initially addressed but requires ongoing maintenance/attention, therefore, carried forward from the 2016 plan; Not addressed/partially addressed - revised from the 2016 plan; and, New - completely new action items. The Brewster LHMW completed the BCA review to prioritize/rank the action items, assigned time frames and responsible parties, and agreed on the proposed methodology/schedule for plan maintenance and plan update (based on FEMA requirements). A complete set of meeting materials is included in Appendix B.

A second Public Workshop/Public Hearing was held November 30, 2021 virtually. Announcements were posted on the project webpage, and emailed to Brewster Boards, Commissions and interested citizens, copies have been included in Appendix B. The presentation included list of accomplishments to date, overview of preliminary mitigation actions, questions from the audience, and identification of next steps. The Workshop agenda, PowerPoint Presentation and Sign-In Sheet are included in Appendix B.

Online Survey

The survey link was opened and available January 29, 2021 through the end of August 2021 and included a total of 80 responses. A brief summary of responses collected is included below. The full Survey Summary is included in Appendix B.

- Most residents/businesses have experienced winter, wind, communicable/infectious, and temperature-related hazard events in the past 20 years;
- Almost half (45%) of respondents feel they are at least adequately prepared to deal with a natural hazard event, with most getting their information from the internet (81%) and/or social media/cell phone apps. (69%) with one or more natural hazards;
- Most respondents are 'Very Concerned' with climate change projections (48%) and communicable/infectious disease-related hazards (41%) followed by wind-related hazards (30%);
- 80% of respondents know for sure whether or not their property is located in/near a FEMA –designated floodplain;
- Just over (70%) of respondents are interested in making their home, business or neighborhood more resilient, with 60% willing to spend their own money to do so; and
- The top four choices to reduce damage/destruction of natural hazards in Brewster include:
    - Work to improve utility resilience: electric; communications; water/wastewater facilities (89%)
    - Retrofit public infrastructure, such as elevating roadways and improving drainage systems (58%)
    - Inform property owners of ways they can reduce the damage caused by natural events (52%)
    - Provide better information about hazard risks and high hazard areas (52%).

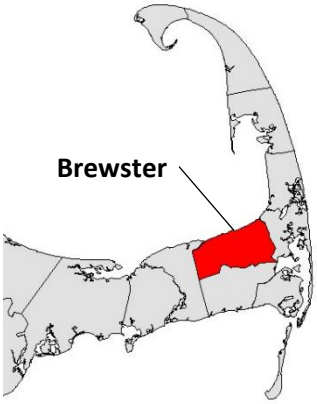
With this information, the project consultant prepared the draft Hazard Mitigation Plan update which was available for public comment from November 8, 2021 through December 3, 2021 (online, on the Town's website and hard copies available at the Town Hall (see Appendix C for Notice of Availability of draft) with no comments returned.

This plan update was also forwarded to the neighboring communities of: Orleans, George Meservey – Director of Planning and Community Development; Harwich, Jonathon Idman – Director of Planning and Community Development; and Dennis, Dan Fortier – Town Planner. All received notice of the draft update availability on the Town of Brewster's website, with no comments returned. The draft was submitted to the Brewster Select Board for approval to forward on up to MEMA, then forwarded to MEMA for consideration. It is the intention of the Brewster LHMW that the Hazard Mitigation Plan be an available and pertinent source of information to a wide variety of individuals and interests. The plan update also has a specific and pragmatic function. By identifying and prioritizing local mitigation needs, the plan update has already served, and will continue to serve, as a basis for amendments to local policies and regulations.

State authorities will incorporate information compiled in this document into the State Hazard Mitigation Plan, to strengthen the statewide knowledge and idea-base for mitigation planning. A well-prepared and locally adopted plan can demonstrate understanding and commitment, two important variables when vying for limited, high-demand resources.

1.6 Environmental Setting

Brewster is a seaside community located on the inner curve of Cape Cod Bay in Barnstable County, Massachusetts. Brewster is bordered by Cape Cod Bay to the north, the Town of Dennis to the west, the Town of Orleans to the east, the Town of Harwich to the South, with a small point of land extending to the south east to separate Chatham and Harwich and touch Pleasant Bay…Map 1-1 Locus Map



Approximately 28% of the population of Brewster is over 65 years of age (2018 Census), creating many challenges during storm events, especially among those who are mobility impaired. In addition, the Town's population (9,806/ 2018 Census) more than doubles every summer from an influx of second homeowners and tourists who may not be familiar with the area or with the severe weather that can occur in this region.

Since not all severe weather occurs in the summer months, it is also important to consider the more than 1,400 students in the Nauset regional school system. There are two public elementary schools in Brewster, the Stony Brook School and the Eddy School (both of which are also shelters for the Town). There are also several private schools, private day care and pre-school facilities in Brewster.

The Town is governed by a five-member Select Board with a Town Administrator. The Town operates under the representative Town Meeting format.

1.7 History of Disaster Declarations

Since 1953, FEMA Region 1 (the New England States) has endured more than 150 federal emergency (EM) and major disaster declarations (DR), 28 of which impacted Massachusetts. The following information (Table 1-2 below) gives an overview of the most significant past federal emergency and major disaster declarations for Massachusetts (and in particular Barnstable County, and including Brewster):

Table 1-2 Significant Federal Emergency and Major Disaster Declarations, Barnstable County

ID Number	Type	Date
DR-751	Hurricane Gloria	September 1985
DR-790	Severe Storms/Flooding	April 1987
DR-914	Hurricane Bob	August 1991
DR-920	Severe Coastal Storm	October 1991
DR-975	Winter Coastal Storm	December 1992
EM-3103	Blizzard/High Winds	March 1993
DR-1090	January Blizzard	January 1996
DR-1142	Severe Storm/Flooding	October 1996
DR-1224	Heavy Rain/Flooding	June 1998
EM-3153	Fire	December 1999
EM-3165	Snowstorm	March 2001
DR-1364	Severe Storms/Flooding	April 2001
EM-3191	Snow	January 2004
DR-1512	Flooding	April 2004
EM-3201	Snow	February 2005
EM-3252	Hurricane Katrina Evacuation	September 2005
DR 1614	Severe Storms/Flooding	May 2006
DR-1701	Severe Storms/Flooding	April 2007
EM-3296	Sever Winter Storm	December 2008
DR-1813	Severe Winter Storm/Flooding	January 2009
DR-1895	Severe Storms/Flooding	March 2010
EM-3312	Water Main Break	May 2010
EM-3315	Hurricane Earl	September 2010
EM-3330	Hurricane Irene	August 2011
EM-3343	Severe Storm	November 2011
EM-3350	Hurricane Sandy	October 2012
DR-4097	Hurricane Sandy	October 2012

DR-4110	Severe Winter Storm/Snow/Flooding	February 2013
DR-4214	Severe Winter Storm/Snow/Flooding	January 2015
DR-4372	Severe Winter Storm/Flooding	March 2018
DR-4379	Severe Winter Storm/Snow	March 2018
DR-4496	Covid-19 Pandemic	March 27, 2020

Sources: 2019 Hazard Identification and Risk Assessment (HIRA), Commonwealth of Massachusetts, *NOAA National Centers for Environmental Information,* www.ncdc.noaa.gov.

1.8 Recent Disaster Declarations

The communities of Barnstable County (including Brewster) have experienced significant losses during several recent storms that have warranted FEMA to declare these storms as disasters. The following are descriptions of each of the recent storms that have been declared as disasters by FEMA and which have affected the Town of Brewster.

1.8.1 Hurricane Storm Irene – August 2011 (FEMA EM-3330)

Hurricane Irene formed east of the Caribbean Island of Dominica, part of the Lesser Antilles region, on the afternoon of August 20, 2011. Irene moved through the Caribbean and up the east coast of the United States making landfall twice. She first made landfall as a Category 1 Hurricane near Cape Lookout, North Carolina around 7:30 am on August 27th, then moved offshore again during the evening. She then made a 2nd landfall, again as a Category 1 Hurricane at 5:40 am on August 28th near Little Egg Inlet in New Jersey. She moved over New York City and then into southeastern New York State and Connecticut as a Tropical Storm a few hours later. By the end of the evening of the 28th, Irene was crossing the U.S./Canada border having produced significant amounts of rain, storm surge, inland and coastal flooding, and wind damage across southern New England and much of the east coast of the United States.

The collective effects of Tropical Storm Irene on August 28th, resulted in 1 fatality, 0 injuries, and $127.3M in property damage in the following counties: Barnstable, Cumberland, Essex, Franklin, Hampden, Hampshire, Middlesex, Nantucket, Norfolk, Plymouth, Suffolk, and Worcester (all in MA), Hartford, Tolland, and Windham (all in CT), Cheshire and Hillsborough (all in NH), and Providence, Kent, Washington, and Newport (all in RI).[1]

1.8.2 Hurricane Sandy - October 2012 (FEMA DR-4097)

Sandy, a hybrid storm with both tropical and extra-tropical characteristics, brought high winds and coastal flooding to southern New England. Easterly winds gusted to 50 to 60 mph for interior southern New England; 55 to 65 mph along the eastern Massachusetts coast and along the I-95 corridor in southeast

[1] National Centers for Environmental Information, www.ncdc.noaa.gov

Massachusetts and Rhode Island; and 70 to 80 mph along the southeast Massachusetts and Rhode Island coasts. A few higher gusts occurred along the Rhode Island coast. A severe thunderstorm embedded in an outer band associated with Sandy produced wind gusts to 90 mph and concentrated damage in Wareham early Tuesday evening, a day after the center of Sandy had moved into New Jersey. In general, moderate coastal flooding occurred along the Massachusetts coastline, and major coastal flooding impacted the Rhode Island coastline. The storm surge was generally 2.5 to 4.5 feet along the east coast of Massachusetts, but peaked late Monday afternoon in between high tide cycles. Seas built to between 20 and 25 feet Monday afternoon and evening just off the Massachusetts east coast. Along the south coast, the storm surge was 4 to 6 feet and seas from 30 to a little over 35 feet were observed in the outer coastal waters. The very large waves on top of the storm surge caused destructive coastal flooding along stretches of the Rhode Island exposed south coast.

Sandy grew into a hurricane over the southwest Caribbean and then headed north across Jamaica, Cuba, and the Bahamas. As Sandy headed north of the Bahamas, the storm interacted with a vigorous weather system moving west to east across the United States and began to take on a hybrid structure. Strong high pressure over southeast Canada helped with the expansion of the strong winds well north of the center of Sandy. In essence, Sandy retained the structure of a hurricane near its center (until shortly before landfall) while taking on more of an extra-tropical cyclone configuration well away from the center. Sandy's track was unusual. The storm headed northeast and then north across the western Atlantic and then sharply turned to the west to make landfall near Atlantic City, NJ during Monday evening. Sandy subsequently weakened and moved west across southern Pennsylvania on Tuesday before turning north and heading across western New York state into Quebec during Tuesday night and Wednesday.[2]

1.8.3 Severe Winter Storm/Snow/Flooding – February 2013 (FEMA DR-4110)

An historic winter storm deposited tremendous amounts of snow over all of southern New England, mainly from the mid-afternoon on Friday, February 8 and lasting into the daylight hours of Saturday, February 9. What made this an amazing storm was the widespread coverage of heavy snowfall. Most locations received 2 to 2.5 feet of snow. A stationary band of even heavier snowfall persisted from southwest NH through central MA and on to the southwest across central and western CT. In those areas, reports averaged closer to 2.5 to 3 feet. Along the southeast MA coast, average amounts ranged from 1 to 2 feet. Only on Martha's Vineyard and Nantucket were snowfall totals less than 1 foot (6 to 12 inches). Isolated thunderstorms were common across the entire region during the height of the storm.

[2] Ibid.

A low pressure system advancing from the Great Lakes region combined forces with a very moist low pressure system moving northeast from the Gulf Coast states. Explosive deepening took place Friday evening, February 8, as a low center moved from the North Carolina coast to south of Nantucket. Strong high pressure to the north of New England helped ensure that cold air remained in place over the area. Snowfall gained intensity during the afternoon, but during the night, 2 to 3 inch per hour amounts were common throughout the region. The band of heaviest snowfall, with 3 to 5 inches per hour for several hours, extended from southwest NH to central and western CT. The precipitation started as mainly snow, although a brief period of rain at the onset was common on the Islands. Snow ended in the morning in western and central MA, southwest NH, most of CT and RI, and in the early afternoon across eastern MA. It lingered during the whole afternoon over Cape Cod and Nantucket, aided by some ocean-effect bands of snowfall.

1.8.4 Severe Winter Storm/Snow/Flooding – January 2015 (FEMA DR-4214)

An historic winter storm brought heavy snow to southern New England with blizzard conditions to much of Rhode Island and Massachusetts, beginning during the day on Monday, January 26, 2015 and lasting into the early morning hours of Tuesday, January 27th. The highest snowfall totals, averaging two to three feet, extended from extreme northeast Connecticut and northwest Rhode Island into much of central and northeast Massachusetts, including greater Boston. Much of southeast Massachusetts and the rest of Rhode Island received one to two feet of snow. Totals dropped off dramatically west of the Connecticut River Valley where totals of 4 to 8 inches were observed.

The storm was well-forecast, with Blizzard Watches and Winter Storm Watches issued 2 days before the snow began. Low pressure tracked northeast from the Carolinas and strengthened rapidly as it slowly passed southeast of Nantucket on Monday evening, January 26. All of the precipitation fell as snow with this storm. At its peak, snowfall rates of 2 to 3 inches per hour were common.

Daily snowfall records were set for January 27th in Boston (22.1 inches, previous record 8.8 inches in 2011), Worcester (31.9 inches, previous record 11.0 inches in 2011), and Providence (16.0 inches, previous record 6.7 inches in 2011). In Providence, the total of 19.1 inches was the fourth highest on record (dating back to 1904), while in Boston the total of 24.6 inches was the sixth highest on record (dating back to 1872).

The Blizzard of January 2015 produced very strong winds late Monday into Tuesday near the Massachusetts and Rhode Island coasts where gusts of 50 to 65 mph were common.

1.8.5 Severe Winter Storm/Snow – March 2018 (FEMA DR-4372)

Low pressure moving out of the Ohio Valley passed south of Southern New England on the 2nd and moved out to sea on the 3rd. This storm brought heavy snow to northwest Massachusetts, heavy rain and strong winds to central and eastern Massachusetts, and coastal flooding to the coastline. Moderate to major coastal flooding took place over three tide cycles due to astronomically high tides and a persistent northeast wind. This built a storm surge of two to four feet along the Massachusetts East Coast.[3]

1.8.6 Severe Winter Storm/Flooding – March 2018 (FEMA DR-4379)

Low pressure along the Carolina coast March 12 moved up the coast and passed offshore of Southern New England on March 13, moving off through the Maritimes on March 14. The storm brought snow accumulations of one to two feet across Eastern Massachusetts and wind gusts of seventy to eighty miles per hour to Cape Cod and the Islands. Blizzard conditions were observed at Boston's Logan International Airport, Marshfield, Plymouth, Hyannis, and Martha's Vineyard.[4]

1.8.7 Covid-19 Pandemic – March 2020 (FEMA DR-4496)

The President declared a major disaster on March 27, 2020 as a result of COVID-19 that occurred from January 20, 2020 and continuing pursuant to his authority under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Pub. L. No. 93-288 (1974) (codified as amended at 42 U.S.C. § 5121 et seq.) ("Stafford Act"). This declaration, designated FEMA-4496-DR-MA, authorized Public Assistance Category B and the Crisis Counseling Program statewide. Authorized by Section 403 of the Stafford Act, FEMA may provide financial and/or direct assistance under Public Assistance Category B for emergency protective measures taken to respond to COVID-19 that are not authorized under other federal statutes. State, tribal, and local government entities and certain private nonprofit organizations throughout the entire state are eligible to apply for Public Assistance Category B. Authorized by Section 416 of the Stafford Act, FEMA may provide financial assistance under the Crisis Counseling Program to the state to provide professional counseling services or training of disaster workers to victims of COVID-19 in order to relieve mental health problems caused or aggravated by COVID-19 or its aftermath.[5]

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[3] Ibid.
[4] Ibid.
[5] https://www.fema.gov/disaster-federal-register-notice/dr-4496-ma-public-notice-001

Section 2 Risk Assessment

2.1 Introduction

Identifying potential hazards is the first step in any effort to reduce community vulnerability. The subsequent identification of the risk and vulnerability for a community are the primary factors in determining how best to allocate finite resources to address what mitigation might take place. The FEMA document titled Plan Review Guide, dated October 1, 2011 was used in developing this strategy plan as a basic template to identify the various natural hazard types. The hazard identification and analysis involve all of those hazards that potentially threaten the Town of Brewster, also consistent with the State Hazard Mitigation Plan.

By collecting and analyzing information for each potential hazard that may affect Brewster, several determinations have been made:

- Which hazards merit special attention
- What actions might be taken to reduce the impact (s) of those hazards
- What resources are likely to be needed

2.2 Hazard Identification

The Brewster LHMW evaluated each of the hazard types that may affect Brewster, with the addition of climate change. For the purposes of the 2021 plan, and for consistency with the State Hazard Mitigation Plan, the Brewster LHMW decided to organize natural hazards into the following categories:

Natural Hazards

- Flood-Related Hazards
    - Riverine/Flash Flooding
    - Inland/Urban Flooding/Heavy Rain
    - Dam Failures
    - Coastal Flooding
    - Sea Level Rise
    - Storm Surge
    - Coastal Erosion/Shoreline Change
- Winter-Related Hazards
    - Blizzards/Heavy Snow/Nor'easter
    - Extreme Cold
- Wind-Related Hazards
    - Hurricanes
    - Tornadoes/High Winds
    - Lightning/Thunderstorms
    - Hail
    - Tropical Storm

- Geologic-Related Hazards
    - Earthquakes
    - Landslides
- Drought/Extreme Heat-Related Hazards
    - Drought
    - Extreme Heat
- Urban Fire/Wildfire-Related Hazards
    - Urban Fire/Wildfire
- Invasive Species-Related Hazards
    - Multiple Invasive Species
- Public Health Emergency-Related Hazards
    - Infectious Disease

Under separate agreement with the Town, the CCC developed town-wide Geographical Information Systems (GIS) mapping including Map 2-1 Shoreline Change, Map 2-2 Sea Level Rise Scenarios, Map 2-3 FEMA Flood Hazard Areas, Map 2-4 Critical Facilities, and Map 2-7 Storm Surge Scenarios. HW also developed hazard-specific mapping, including Map 2-5 Average Annual Snowfall, Map 2-6 Hurricanes, and Map 2-8 Earthquakes.

Similarly, the Brewster LHMW also evaluated each of the human-caused and technological hazard types that may affect Brewster. For the purposes of the 2021 plan, and for consistency with the State Hazard Mitigation Plan, the Brewster LHMW decided to organize human-caused and technological hazards into the following categories:

Human-Caused Hazards

- Cyber Incident
- Terrorism
    - Improved Explosive Devices (IEDs)
    - Vehicle-Borne Improved Explosive Devices (VBIEDs)
    - Active/Mass Shootings
    - Drones
- Civil Unrest
- Chemical/Biological/Radiological/Nuclear (CBRN)

Technological Hazards

- Infrastructure Failure
    - Power
    - Water Supply
    - Transportation Systems
    - Communications
    - Information Technology
    - Emergency Services
- Hazardous Materials Accident/Spill
- Major Aircraft Crash

- Catastrophic Dam Failure

2.3 Hazard Profiles: Location, History and Probability of Future Occurrence

In assessing the hazards to a community, both the risk and the vulnerability must be taken into account. A hazard is the actual event that poses the danger to the community, (e.g. the hurricane, tornado, earthquake, etc. that threatens the Town). The term “risk” refers to the predicted impact that a hazard would have on people, services, specific facilities and structures in the community. The term “vulnerability” refers to the characteristics of the society or environment affected by the event that resulted in the costs from damages (Heinz Center Report, 1999, p. 105). The vulnerability of an area refers to its susceptibility to a hazard. The areas of the town affected by extreme natural events are identified by the hazard risk assessment. In determining the risk and vulnerability of the town, the likelihood, frequency and magnitude of damage from identified hazards are assessed.

In developing the Risk Assessment, the Brewster LHMW defined the risks that the Town could face and followed up with an assessment of the vulnerability of the at-risk areas, and the implications of experiencing natural, human-caused and technologic disasters (e.g., loss of life, damage to the natural environment, property damage, and economic losses). Risk assessment is the determination of the likelihood of adverse impacts associated with specific hazards, and vulnerability assessment is concerned with the qualitative or quantitative examination of the exposure of some societal component (i.e. economy, environment). The result of this process was the preparation of a Risk Assessment Matrix (Table 2.1 Risk Assessment Matrix 2021) that lists the vulnerable areas and the primary effects from an event on these areas. The matrix was then used to establish mitigation benefits and develop mitigation strategies (Section 4).

Hazard Index – Natural Hazards

The Brewster LHMW evaluated each of the flood, winter, wind, drought, urban/wildfire, invasive species, geologic, and public health emergency-related hazards and collectively determined the likelihood of occurrence, locations affected, and potential impacts of each. The LHMW evaluated and recorded Public Health Emergency-related hazards along with the human-caused and technological hazards in Table 2-3 for consistency with the standard methodology employed by the state, as discussed later in this section. This information was used to establish a Hazard Index (HI) value (HI=1 being lowest impact and HI=10 being highest impact) for each of the types of natural hazards and is presented in the Table 2-2. The highest hazard index values were assigned to those natural hazards that were deemed to have the highest level of impact to the community. These hazards include wind-related hazards such as hurricanes (HI=8), high winds and tropical storms (HI= 7), and flood-related

hazards such as coastal flooding, storm surge and coastal erosion/shoreline change (HI=7)

Table 2-2 Hazard Index – Natural Hazards for this 2021 plan utilizes language used in the FEMA State and Local Mitigation Planning How-to-Guide Series for frequency and severity categorization, including:

Criteria for Frequency Categorization:

Very low frequency: events that occur less frequently than once in 1,000 years (less than 0.1% per year).
Low frequency: events that occur from once in 100 years to once in 1,000 years (0.1% to 1% per year).
Medium frequency: events that occur from once in 10 years to once in 100 years (1% to 10% per year).
High frequency: events that occur more frequently than once in 10 years (greater than 10% per year).

The criteria used for severity categorization, based on past hazard events includes:

Criteria for Severity Categorization (based on past hazard events):

Minor: Limited and scattered property damage; no damage to public infrastructure; contained geographic area; essential services not interrupted; no injuries or fatalities.
Serious: Scattered major property damage; some minor infrastructure damage; wider geographic area; essential services are briefly interrupted; some injuries/fatalities.
Extensive: Consistent major property damage; major damage to public infrastructure; essential services are interrupted for several hours to several days; many injuries and fatalities.
Catastrophic: Property and public infrastructure destroyed; essential services stopped; thousands of injuries and fatalities.

Table 2-1
Risk Assessment Matrix, Brewster, MA

Vulnerable Area	Location	Ownership	Natural Hazard	Primary Problems/Effects	Mitigation Benefits	Risk H-Historical P- Potential
Emergency Response/ Public Health, Safety and Welfare	Town-wide	Public	All Hazards	Compromised emergency response/public health, safety and welfare	Continued emergency response/improved public health, safety and welfare	H and P
Repetitive Loss Properties	Town-wide	Public and Private	Flooding; Sea Level Rise; Storm Surge; Hurricanes	Damage to public and private property; Cost of cleanup; Compromised public safety	Reduced damages to public/private property; Minimized cleanup costs; Improved public safety	H and P
Floodplains	Town-wide	Public and Private	Flooding; Sea Level Rise; Storm Surge; Hurricanes	Damage to public and private property; Cost of cleanup; Compromised public safety	Reduced damages to public/private property; Minimized cleanup costs; Improved public safety	P
Public and Private Property	Town-wide	Public and Private	All hazards	Damage to public and private property; Cost of cleanup; Compromised public safety	Reduced damages to public/private property; Minimized cleanup costs; Improved public safety	H and P
Cultural Resources	Town-wide	Public and Private	All hazards	Public property damage/cost of cleanup/ compromised public safety/Impacts to cultural resources	Reduced damages/costs to public property/improved public safety/limited impacts to cultural resources	P
Municipally-owned Buildings	Town-wide	Public	Flooding/Wind	Public property damage/cost of cleanup/ compromised public safety	Reduced damages/costs to public property/improved public safety	P

Table 2-1
Risk Assessment Matrix, Brewster, MA

Vulnerable Area	Location	Ownership	Natural Hazard	Primary Problems/Effects	Mitigation Benefits	Risk H-Historical P- Potential
Municipally-owned Infrastructure	Town-wide	Public	Flooding	Compromised emergency response/public safety	Continued emergency services/Improved public safety	H and P
Social Distress	Town-wide	Public and Private	All Hazards	Impacts to social distress	Minimized social distress	H and P
Fire Management/ Response	Town-wide	Public and Private	Wildfires	Public/Private property damage/cost of cleanup/ compromised public safety	Reduced damages/costs to public/private property/improved public safety	H and P

Table 2-2 Natural Hazard Index Brewster, Massachusetts

Natural Hazard	*Frequency (i.e. Very Low, Low, Medium, High)*	*Location (i.e. small/local, medium/regional, large/multiple communities)*	*Severity (i.e. minor, serious, extensive, catastrophic)*	*Hazrd Index (i.e. ranked by combining frequency and severity; 10 - high, 1 - low)*
Flood-Related Hazards				
- Riverine/Flash Flooding	High	Medium/Regional	Serious	6
- Inland/Urban Flooding/Heavy Rain	High	Medium/Regional	Serious	6
- Climate Change	Medium	Large/Multiple	Serious	6
- Dam Failures[1]	N/A	N/A	N/A	5
- Coastal Flooding	High	Medium/Regional	Extensive	7
- Sea Level Rise	High	Large/Multiple	Serious	6
- Storm Surge	High	Medium/Regional	Serious	6
- Coastal Erosion/Shoreline Change	High	Medium/Regional	Extensive	7
Winter-Related Hazards				
- Blizzards/Snow/Nor' easter	High	Large/Multiple	Serious	6
- Extreme Cold	Low	Small/Local	Minor	2
Wind-Related Hazards				
- Hurricanes	High	Large/Multiple	Extensive	8
- Tornadoes[2]/High Winds	High	Medium/Regional	Extensive	7
- Lightning/Thunderstorms	High	Small/Local	Serious	6
- Hail	High	Small/Local	Serious	6
- Tropical Storm	High	Large/Multiple	Serious	7
Geologic-Related Hazards				
- Earthquakes	Very Low	Small/Local	Serious	3
- Landslides	Very Low	Small/Local	Minor	2
Drought				
- Drought	High	Medium/Regional	Minor	5
- Extreme Heat	High	Small/Local	Minor	5
Urban Fire/Wildfire				
- Urban Fire/Wildfire[3]	N/A	N/A	N/A	7
Invasive Species				
- Multiple	Low	Small/Local	Minor	2

1: Hazard Index ranking taken from Massachusetts Hazard Index and Risk Assessment (Feb. 2019).

2: Tornadoes not a major issue for Brewster.

3: Hazard Index ranking taken from Barnstable County Wildfire Preparedness Plan.

For the purposes of this 2021 plan, based on Table 2-2 Hazard Index – Natural Hazards, the Brewster LHMW determined that the Town is most at risk to the following natural hazards (and has advanced the assessment of the vulnerability of the at-risk areas, and the implications of experiencing these natural disasters):

- ✓ Riverine/Flash Flooding
- ✓ Heavy Rain/Inland and Urban Flooding
- ✓ Climate Change
- ✓ Coastal Erosion/Shoreline Change
- ✓ Coastal Flooding
- ✓ Storm Surge
- ✓ Dam Failure
- ✓ Sea Level Rise
- ✓ Blizzards/Heavy Snow/Winter Weather/Nor'easters
- ✓ Ice Storms
- ✓ Extreme Cold
- ✓ Hurricanes
- ✓ Tornadoes/High Winds
- ✓ Lightning/Thunderstorms
- ✓ Hail
- ✓ Tropical Storms
- ✓ Earthquakes
- ✓ Landslides
- ✓ Drought
- ✓ Extreme Heat
- ✓ Urban Fire/Wildfires
- ✓ Invasive Species

It should be noted that the above hazards are not a complete listing of hazards that may impact Brewster. The Brewster LHMW agreed that this listing accurately represents those hazards that impact the Town most frequently and have the potential to cause fatalities, injuries, property and infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm of loss. The following natural hazards will not be addressed in this 2021 plan:

- Avalanche
- Expansive Soils
- Land Subsidence
- Volcanoes
- Tsunamis

These hazards were considered and discussed during LHMW meetings, where it was determined these hazards would not be considered for the following reasons:

- Lack of frequency in which they occur;
- The minimal probability of their occurrence; and/or
- The lack of resources to devote any amount of time to further research the likelihood or potential occurrence or impact.

The hazard-specific tables that follow after each section represent the various significant natural hazard events that have occurred in and around the Town of Brewster, utilizing National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (http://www.ncdc.noaa.gov/). All events are county wide (Barnstable), unless otherwise noted.

Climate Change

Climate change is one of the most pressing issues of our time and its effects are increasingly impacting Massachusetts. Since climate change has both direct and indirect impacts on the range of natural hazards that Brewster is vulnerable to, the LHMW determined it was most appropriate to include a 'climate change impacts on' section to each natural hazard profiled in this plan.

Municipal Vulnerability Preparedness Program

In 2019, the Town of Brewster completed the Municipal Vulnerability Preparedness (MVP) program through a planning grant provided by the Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs. The goal of the planning grant was to identify hazards that Brewster faces that are being exacerbated by climate change, and to prioritize actions the Town can take to prepare for identified hazards. The Town became an MVP-Designated community in 2019.

The Commonwealth of Massachusetts has established a Massachusetts-specific climate data clearing house, resilientma.org, to easily enable municipalities and stakeholders to access regional data for use in climate preparedness planning. Overall, an emphasis on future projections for temperature and precipitation served as the two primary focus areas under this program. Similar to the approach with incorporating climate change into this plan, projections for temperature and precipitation have also been incorporated into the appropriate hazard profiles in this plan update.

Hazard Index – Human Caused and Technological Hazards

The Brewster LHMW also considered each of the human-caused and technological hazards, however, utilized the standard methodology developed by the State of Massachusetts for scoring risks associated with the identified hazards due to data limitations. The State's standard methodology considers risk on a county basis and utilizes a range of stakeholders and data sources. Three ranking components were used to identify hazard rankings, including: Likelihood of hazard occurrence (probability); Likely range of impact (predicted location of impact); and Commonwealth Consequence Analysis (estimated effect including damage outcome potential. The Consequence Analysis categories include:

- Population (injuries, deaths, impacts to first responders and access/functional needs populations)
- Government (impacts to municipal buildings/assets, lifeline services and confidence ratings)
- Built Environment (impacts critical facilities/infrastructure and private property)
- Natural Resources and the Environment (impacts to the environment)
- Economy (impacts to economic conditions, business interruption, and economic viability)

Table 2-3 Hazard Index – Human Caused and Technological Hazards for this 2021 plan utilizes criteria from the State's HIRA, including:

Criteria for Probability and Likelihood of Hazard Occurrence:

Unlikely:	less than one percent probability in the next 12-60 months, or less than one chance in the next 100 years.
Potential:	between one percent and 10 percent probability in the next 12-60 months, or one incident during the next 100 years.
Likely:	Between 10 percent and 100 percent probability in the next 12-60 months and one incident during the next 10 years.
Highly Likely:	near 100 percent probability within the next 12-60 months.

Criteria for Likely Location and Extent:

Small:	10 percent or less of the total jurisdictional boundaries.
Medium:	10 percent to 40 percent of the total jurisdictional boundaries
Large:	40 percent to 100 percent of the total jurisdictional boundaries.

Criteria for Consequence Analysis:

Negligible:	Minor or no injuries including first responders, minor or no impacts to municipal operations (minutes to several hours), no shutdown of critical infrastructure and scattered private property damage, less than 5 percent impact to natural resources, and minor or no impacts to business sector/very little recovery needed.
Limited:	Some injuries including first responders, small impacts to municipal operations (several hours to several days), short shutdown of some critical infrastructure and less than 10 percent private property damage, 5 to 20 percent impact to natural resources, and some impacts to business sector/recovery lasts weeks.

Significant: Multiple deaths and severe injuries including first responders, large impacts to municipal operations (multiple days to weeks), medium/significant shutdown of some critical infrastructure and 20 – 50 percent damage to residential property and 10 – 25 percent damage to commercial private property damage, more than 20 percent impact to natural resources, and serious impacts to business sector/recovery lasts months.

For the purposes of this 2021 plan, based on Table 2-3 Hazard Index – Human Caused and Technological Hazards, the Brewster LHMW determined that the Town is most at risk to the following hazards (and has advanced the assessment of the vulnerability of the at-risk areas, and the implications of experiencing these hazards):

- ✓ Cyber Incident
- ✓ Terrorism
- ✓ Civil Unrest
- ✓ Chemical/Biological/Radiological/Nuclear
- ✓ Infrastructure Failure
- ✓ Hazardous Materials Accident/Spill
- ✓ Major Aircraft Crash
- ✓ Catastrophic Dam Failure

The Brewster LHMW formed the consensus that public health emergency-related hazards such as infectious diseases (high) and human-caused hazards such as cyber incidents (high) are the major causes of risk to the community.

It should be noted that the above hazards are not a complete listing of human-caused and technological hazards that may impact Brewster. The Brewster LHMW agreed that this listing accurately represents those hazards that have the potential to impact the community most frequently and have the potential to cause fatalities, injuries, property and infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm of loss. The following technological hazard will not be addressed in this 2021 plan:

- Nuclear Power Plant Event

This hazard was considered and discussed during LHMW meetings, where it was determined it would not be considered for the following reasons:

- The Town of Brewster is outside the 10-mile Pilgrim Nuclear Power Plant's Emergency Planning Zone (EPZ) and is therefore not considered a risk to the community.

Table 2-3 Human-Caused and Technological Hazard Index Brewster, Massachusetts

Hazard	***Likelihood***	***Range***	***Consequence Analysis***					***Hazard Index***
			Population	**Government**	**Built Environment**	**Natural Resources/ Environment**	**Economy**	
Natural Hazards								
Infectious Disease[1]	Highly Likely	Medium	Significant	Significant	Negligible	Negligible	Significant	High
Human-Caused Hazards[2]								
Cyber Incident	Likely	Medium	Negligible	Limited	Significant	Limited	Limited	High
Terrorism	Likely	Medium	Significant	Negligible	Negligible	Limited	Negligible	Moderate
Civil Unrest	Potential	Small	Negligible	Negligible	Limited	Negligible	Limited	Low
Chemical, Biological, Radiological, Nuclear	Unlikely	Small	Significant	Limited	Limited	Limited	Limited	Moderate
Technological Hazards[2]								
Infrastructure Failure	Potential	Small	Limited	Negligible	Limited	Negligible	Limited	Moderate
Hazardous Materials Accident/Spill	Likely	Small	Significant	Negligible	Negligible	Limited	Negligible	Moderate
Major Aircraft Crash	Unlikely	Small	Significant	Negligible	Negligible	Negligible	Negligible	Low
Catastrophic Dam Failure	Unlikely	Small	Negligible	Negligible	Negligible	Limited	Negligible	Moderate

1: Hazard index ranking determined by LHMW.

2: Hazard ranking taken from Massachusetts Hazard Index and Risk Assessment (Feb. 2019).

2.3.1 Flood-Related Hazards

Flooding is the accumulation of water within a water body and the overflow of excess water onto adjacent floodplain lands (FEMA, Multi Hazard Identification and Risk Assessment, 1997). The floodplain is the land adjoining the river/stream channel, ocean or other watercourse or water body that is susceptible to flooding.

Flooding results from: large-scale weather systems generating prolonged rainfall; on-shore winds; locally intense thunderstorms; dam failures; or significant snow melt. Floods are capable of undermining buildings and bridges, eroding shorelines and stream banks, uprooting trees, washing out access roads, and causing loss of life and injuries. Also, flash floods (characterized by rapid onset and high velocity waters) carry large amounts of debris that further exacerbate conditions.

In Brewster, flooding is often caused by inadequate or poorly functioning drainage systems. Historically, Brewster has been subject to coastal as well as inland flooding. Such flooding is one of the major risks faced by Brewster's residents and visitors during a serious weather event such as a hurricane or torrential downpour. This results in impacts that can range from street flooding to serious flooding resulting in damage to public and private property.

Under the NFIP, FEMA is required to develop flood risk data for use in both insurance rating and floodplain management. FEMA develops this data through Flood Insurance Studies (FIS). Detailed analyses are used to generate flood risk data only for developed or developing areas of communities. For undeveloped areas FEMA uses approximate analyses to generate flood risk data. Flood hazard areas are identified in the FEMA FIRMs. Flood hazard areas are divided into zones (V, X, A, etc.) depending on the severity and type of flood threat. These zones are those areas subject to inundation (shallow or deep) by a flood (and/or velocity wave action) that has a 1 percent chance of occurring during any given year.

Floodplains in Brewster include ‘AE’, ‘VE’, and ‘X’ Zones (Map 2-3 FEMA Flood Hazard Areas). ‘AE’ Zones are areas that would be inundated by the 100-year flood. The 100-year flood is a regulatory standard used by federal agencies and most states to administer floodplain management programs and is also used by the NFIP as the basis for insurance requirements nationwide. ‘VE’ Zones are velocity zones that are subject to breaking wave action where waves greater than 2.9 feet are forecasted during a 100-year flood or storm surge. ‘X’ Zones are areas that would be inundated by the 500-year flood.

Table 2-4 below represents the various significant flood-related hazard events that have occurred in and around the Town of Brewster over time, utilizing NOAA’s National Centers for Environmental Information (http://www.ncdc.noaa.gov/). All events are county wide (Barnstable County), unless otherwise noted.

Table 2-4 Significant Flood-Related Events, Barnstable County

Hazard Type	Date	Level/Description	Damages
Flood			
	3/5/2001	15" to 30"	Downed trees and wires; transportation disruptions
	6/7/2006	3" to 5"	$10 K
	4/16/2007	60 mph wind gusts	$10 K; downed trees and power lines
	9/3/2010		
	4/13/2011	2" to 6"	$40 K
	9/3/2013	5" to 6"	
	11/17/2014		$10 K
	7/1/2015		West Brewster
	8/11/2015		
	1/10/2016		Scattered trees and power line damage
	7/7/2017		
	9/6/2017		
	10/25/2017	2" to 6.5"	
	10/25/2017		West Brewster
	10/30/2017		
	1/23/2018	50 - 55 mph wind gusts	
	8/4/2018	6.5"	$5 K
	8/9/2018	4.5"	$15 K; South Brewster
	8/18/2018	1" to 3"	$15 K
	10/29/2018		
	7/22/2019		
	9/7/2019	40-60 mph wind gusts	
Riverine/Flash Flooding			
	9/15/2005		Cars stuck, Sagamore bridge partially closed; $7K
	9/12/2009		Route 130 flooded; businesses and basements flooded; several cars stuck; $5K
	9/3/2013		Route 6A, 28, 151 flooded; basements flooded
	7/7/2017		Road closures; vehicle flooding

	8/18/2017		Several cars stuck; flooded basements; $50K; South Brewster
	8/19/2017		Cars stuck; parking lots flooded; $7K
Inland/Urban Flooding/Heavy Rain			
	9/2/1996		
	9/18/1996		
	10/8/1996		
	10/20/1996		
	12/7/1996	1.5" to 2"	Downed trees and power lines; 500,000 people lost power; wind gust to 64 mph; $4 M
	3/29/1997	1 to 3"	
	7/25/1997	3" +	Wind gusts to 30 to 50 mph;
	11/1/1997	2" to 3.6"	Wind gust 50 to 65 mph; $32 K; power outages
	2/18/1998	2" to 3.37"	Wind gusts 44 to 54 mph
	2/23/1998	3" to 4.26"	Wind gusts 40 to 63 mph; loss of 20ft of dunes; basements flooded
	3/8/1998	2" to 5.44"	Basements flooding; road closures; wind gusts 74 mph
	3/18/1998	2"+	
	4/1/1998	2"+	
	5/6/1998	2" to 4"	Basements flooded; road damage; Route 186 flooded; stranded cars
	6/13/1998	6" to 12"	$64 M; MBTA flooded; transportation disruption; power outages; bridges knocked out; road closures
	8/29/1998	1.23" to 4"	Wind gust 25 to 52 mph; 1 fatality
	9/22/1998	2.75" to 4.13"	
	10/8/1998	4" to 6"	Route 18 flooded
	9/16/1999	6" to 13"	Wind gusts 60 to 70 mph; downed trees; power lines
	10/18/1999	2" to 5.37"	Wind gusts 45 to 55 mph, downed trees; power line; minor injuries
	3/30/2001	3" to 5.74"	Wind gusts 40 to 50 mph; road closures

	9/22/2002	2.25" to 3.04"	
	3/29/2003	2" to 4"	Drainage flooding
	4/11/2003	1" to 3"	
	3/8/2008	2" to 3"	$50 K
Coastal Flood			
	2/24/1998	3"	Loss of 20ft of dunes
	1/4/2003		$50 K
	12/6/2003		$50 K
	1/23/2005		$125 K
	1/31/2006		$20 K
	4/15/2007	1-3"	$5 K
	4/16/2007	1-3"	$5 K
	4/17/2007	1-3"	$10 K
	11/3/2007		
	1/28/2008		$30 K
	6/22/2009		$3 K; transportation disruptions
	8/28/2011		
	10/30/2011	18-24"	6 fatalities
	6/3/2012		$50 K; cars stranded
	6/4/2012	2.5' to 4.55'	Wind gusts 90 mph
	10/29/2012		$435 K
	12/27/2012		
	3/7/2013		$250 K; road flooding
	1/3/2014	6"	
	1/3/2014		
	3/26/2014		
	11/2/2014	1" to 2"	
	1/27/2015		$750 K; wind gusts 50 to 65 mph; two fatalities
	2/15/2015		
	1/4/2018		$200 K
	1/30/2018		
	3/2/2018		
	10/27/2018		

Source: NOAA National Centers for Environmental Information, www.ncdc.noaa.gov.
Data current through December 2019.

Riverine/Flash Flooding

Riverine or inland flooding often occurs after heavy rain, particularly in areas of the state with high water tables. These areas are also particularly susceptible to flash flooding caused by rapid runoff occurring after heavy precipitation events, and in combination with spring snowmelt. Frozen ground conditions can also

contribute to low rainfall infiltration and high runoff events that sometimes result in river flooding.

Flood magnitude increases with increasing recurrence interval. The Town of Brewster can be uniformly affected by riverine/flash flooding events, dependent upon the location (amount of impervious surfaces within the area), existing/incoming weather conditions, and time of year (frozen ground conditions exacerbate flooding). Based on the high frequency and serious severity of riverine/flash flooding events, as reported by the National Centers for Environmental Information and indicated in Table 2-4, the Town is considered at high risk for future riverine/flash flooding events.

Climate Change Impacts on Riverine/Flash Flooding
Riverine flooding will likely be exacerbated by increased storm intensity, as well as by increased precipitation. The Intergovernmental Panel on Climate Change (IPCC) identifies inland flooding in some urban regions as a “key risk” in North America, which may result disrupt people’s livelihood and result in severe health risks. It is also important to note that riverine flooding and coastal flooding due to SLR can have a coupling effect. Rising seas can set a new flood stage in riverine systems, thus increasing flood risk in inland areas adjacent to rivers.

Heavy Rain/Inland and Urban Flooding
Heavy rains that cause inland and urban flooding are often exacerbated by stormwater-related issues. Thunderstorms, winter storms, coastal storms and nor’easters, and hurricanes all contribute to interior flood related hazards due to the large amounts of precipitation associated with them. Development often compounds the magnitude and frequency of urban flooding by increasing impervious surfaces, also increasing the rate of drainage collection, reducing the carrying capacity of the land, and often overwhelming sewer system infrastructure. Based on the high frequency and serious severity of heavy rain and inland/urban flooding events, as reported by the National Centers for Environmental Information and indicated in Table 2-4, the Town is considered at high risk for future heavy rain/inland and urban flooding events.

Climate Change Impacts on Heavy Rain/Inland and Urban Flooding
Heavy precipitation events are becoming more frequent and intense. Whether a hurricane, tropical storm, or extra-tropical storm (e.g. a nor’easter), there has been a global increase in both the frequency and the intensity of heavy precipitation events. This trend is consistent with physical responses to a warming climate, such as an increased amount of moisture in the atmosphere.

MVP Climate Change Projections on Heavy Rain
The average annual precipitation in Brewster is projected to increase up to 10% by 2030s, and similar for 2050s. The largest increases in precipitation are projected to occur during winter months. Table 2-5 below includes precipitation projections beginning with a Baseline (1971 – 2000) through mid-century (2050s) for the Cape Cod Basin.

Table 2-5 Precipitation Projections, Cape Cod Basin

Climate Parameter	Baseline 1970 - 2000	Projected Change in 2030s	Mid-Century 2050s
Total Precipitation (inches):			
Annual	44.9	43.8 – 48.4	44.5 – 49.4
Winter	11.6	11.2 – 12.9	11.4 – 13.2
Spring	11.5	11.5 – 13.0	11.2 – 13.2
Summer	10.2	9.3 – 11.4	9.1 – 11.9
Fall	11.6	10.7 – 12.5	10.6 – 12.7
Annual Days with Precipitation over 1 inch	7.0	7 - 9	8 – 10
Annual Days with Precipitation over 2 inches	1.0	1 - 2	1 - 2
Annual Days with Precipitation over 4 inches	0.0	0 - 0	0 – 0.2

Source: MVP Program, www.resilientma.org.

Dam Failure

A dam is any artificial barrier with the ability to impound water, wastewater, or any liquid-borne material for the purpose of storage or water control. Dam failure can be a catastrophic type of failure characterized by the sudden, immediate, and uncontrolled release of impounded water, or the likelihood of such an uncontrolled release with secondary impacts to downstream structures within the inundation zone.

Inventoried dams are classified by the hazard, which relates to the probable consequences of failure or mis-operation of the dam; it does not relate to the current condition or the likelihood of failure of the dam. A three-tiered hazard classification rates each dam based upon the probable consequences of failure or miss operation of the dam. This system includes:

- **High Hazard** – means a dam where failure or miss operation will result in a probable loss of human life.
- **Significant Hazard** – means a dam where failure or miss operation results in no probable loss of human life but can cause major economic loss, disruption of lifeline facilities, or impact other concerns detrimental to the public's health, safety, or welfare. Examples of major economic loss include but are not limited to washout of a state of federal highway, washout of two or more municipal roads, loss of vehicular access to residences (e.g. a dead-end road whereby emergency personnel could no longer access residences beyond the washout area), or damage to a few structures.
- **Low Hazard** – means a dam where failure or miss operation results in no probable loss of human life and low economic losses.

On February 10, 2017 Massachusetts Dam Safety Regulations were modified to require owners of significant hazard dams to prepare Emergency Action Plans (EAP) for their dams. This requirement became effective on February 10, 2017 when the Department of Conservation & Recreation (DCR), Office of Dam Safety (ODS) promulgated regulatory changes mandated by amended General Laws Part 1-Title II, Chapter 21, Section 65 (b)-Emergency Action Plans for high and significant hazard dams.

There is only one inventoried dam located within the Town of Brewster, Lower Mill Pond Dam which is owned by the Town (Table 2-6).

Table 2-6 Inventoried Dams in Brewster, MA

Name	MA ID #	Ownership	Hazard
Dams			
Lower Mill Pond Dam	01076	Town of Brewster	Low

Source: Brewster LHMW

Lower Mill Pond Dam (a.k.a. Stony Brook Dam)
Lower Mill Pond Dam impounds the Lower Mill Pond, a 51-acre pond used for recreation and owned by the Town of Brewster. The construction date for the dam is unknown but is likely prior to 1900. Due to deficiencies identified from the September 29, 2010 Phase 1 Inspection, the dam was constructed in 2013. An Operations and Maintenance Manual was developed in 2013, following reconstruction of the dam. The dam is considered to be a low downstream hazard risk, and thus, an EAP is not required.

Owner: Town of Brewster
National Inventory #: MA01076
Type: Earthen embankment with concrete and masonry wall
Tributary: Lower Mill Pond
Height: 6.5 feet
Storage Capacity: 690 acres/feet (includes in Upper Mill Pond/Walkers Pond)
Last Inspection: September 29, 2010
Hazard Classification: Low Hazard
EAP: Not required
O & M: Yes

Should there be a dam breach, the immediate areas surrounding the structure, as well as properties located downstream (within the inundation zone) of the structure are most vulnerable. There have been no recorded dam failures in Brewster. Based on the hazard index ranking taken from the Massachusetts Hazard Index and Risk Assessment, the Town is considered at medium risk for future dam failure events.

Climate Change Impacts on Dams
The increase in precipitation and frequency of intense rainfall events, which will cause an increase in river discharge and peak flows, may also lead to overtopping and damage of aging dams or structures in need of repair and maintenance.

Coastal erosion is another hazard that occurs during large coastal storm events and through natural processes. Shorelines change constantly in response to wind, waves, tides, sea level fluctuation, seasonal and climatic variations, human interaction, and other factors that move sand and material within a coastal shoreline system.

Coastal erosion is expected to increase due to the increase in storm intensity and associated flooding. The IPCC found that coastal and low-lying areas have been experiencing increased erosion, and will continue to do so, due to SLR, in North America and throughout the world. Erosion has been noted to be of concern in the northeastern U.S. and in their study of climate change impacts in the northeastern U.S., Horton et al. (2014) noted that increased rates of coastal erosion are likely to compromise aging coastal infrastructure, including transportation, communications, and energy infrastructure.

At the Massachusetts Office of Coastal Zone Management (CZM), through the Shoreline Change Project, ocean-facing shorelines along the Massachusetts coast were delineated and analyzed to illustrate trends from the mid-1800s to 2009. Offered for the general public's use through the Massachusetts Ocean Resource Information System (MORIS), the U.S. Geological Survey (USGS), the Woods Hole Oceanographic Institution Sea Grant Program, and Cape Cod Cooperative Extension calculated shoreline change rates, then CZM incorporated the shorelines and shore-perpendicular transects with the change rates. The CCC developed Map 2-1 Shoreline Change which depicts the change in shoreline over time.

The rate of erosion along the Atlantic shore is about 3.1 feet per year and somewhat less along Cape Cod Bay. Most changes in the shoreline resulting from erosion and deposition occur primarily during storm events coupled with "spring" tides. Brewster's ongoing shoreline erosion unrelated to storm damage also has potential to create small scale critical impacts in Brewster.

Tidal Restrictions
In December 2001, the Cape Cod Commission completed the *Cape Cod Atlas of Tidally Restricted Salt Marshes*. This atlas presented the findings of a study undertaken to identify salt marsh systems impaired by the restriction of tidal flow along the coast of Cape Cod, Massachusetts. The scope of the work was limited to sites where salt marshes have been impacted by transportation related facilities such as roads, railroads, causeways, and footpaths, as well as cranberry bog infrastructure. The Atlas was designed to help the region identify

and target funds to those projects that best address specific community or regional salt marsh restoration goals.

The Cape Cod Atlas identifies seven sites in Brewster, a number of which have since been remediated (see Capability Section). Typically, this means that these are sites at which culverts are not properly sized to accommodate natural tidal flow, or such infrastructure is broken, collapsed, or otherwise unable to function properly.

The locations of these tidal restrictions are important to hazard mitigation planning because they indicate where flooding can occur during a storm event. The tidal restrictions constrain the natural flow of tidal waters; as a result, these locations are subject to flooding when tidal waters "back up" on one side of the culvert, overflowing channel banks. In the context of hazard mitigation, all of these remaining locations should be considered for infrastructure resizing and/or repair/replacement to eliminate their potential for causing flooding. There are of course salt marsh and other wetland impacts (either positive or negative) that will result from such work that must be factored into the permitting and construction of these infrastructure improvement projects. Restoration of these tidal flows will also allow for re-establishment of normal salt marsh vegetation and will quickly kill off the massive beds of invasive *Phragmites* that have made these areas their home.

There are two large marsh systems in Brewster, Quivett Creek/Paine's Creek Marsh (Brewster/Dennis) and Namskaket Marsh (Brewster/Orleans). Sites with remaining work needed include:

A. **Site BR-2: Brewster - Cranberry Bog Berm Restriction of Channel off Quivett Creek (Privately Owned):** Inactive cranberry bogs dot this marsh. Berms built to support the past cranberry farming are still in place, severing the tidal flow. A six-inch pipe forms the only connection from the bogs to the marsh, allowing in only a fraction of the tidal flow to pass upstream. The scour, bank erosion and vegetation die-off are each evident and are among the worst observed.

B. **Site BR-3: Brewster - Cranberry Bog Berm Restriction of Channel off Quivett Creek** (**Privately Owned):** This site also involves another pipe designed to allow under an old cranberry bog berm. This pipe prevents any waters from naturally flushing the upstream affected area. The upstream effected area is dominated by *Phragmites.*

At the Massachusetts Office of Coastal Zone Management (CZM), through the Shoreline Change Project, ocean-facing shorelines along the Massachusetts coast were delineated and analyzed to illustrate trends from the mid-1800s to 2009. Offered for the general public's use through the Massachusetts Ocean Resource Information System (MORIS), the U.S. Geological Survey (USGS), the Woods Hole Oceanographic Institution Sea Grant Program, and Cape Cod

Cooperative Extension calculated shoreline change rates, then CZM incorporated the shorelines and shore-perpendicular transects with the change rates. Map 2-1 (Appendix A) shows the entire coastline of Brewster in a series of transects from west to east, as vulnerable to shoreline change representing shorelines from 1868 through 2009.

Based on the high frequency and extensive severity of coastal erosion/shoreline events, as reported by the Massachusetts Ocean Resource Information System (MORIS), the U.S. Geological Survey (USGS), the Woods Hole Oceanographic Institution Sea Grant Program, and Cape Cod Cooperative Extension, the Town is considered at high risk for future coastal erosion/shoreline change events.

Sea Level Rise

Sea level is the level of the sea's surface relative to the land. Sea level changes can be caused by absolute changes of the sea level and/or by absolute movements of the land either through post glacial isostatic re-adjustment of the lithosphere, the rigid upper layers of the earth, or by extraction of water or other resources that cause the land to sink.

The IPCC continues to better understand the science and implications of climate change and SLR. Rising sea levels, as a direct result of warmer temperatures and glacial ice melt, threaten low-lying coastal areas through coastal flooding, coastal erosion, wetland inundation and saltwater intrusion. Localized land subsidence, also on the rise, also contributes to accelerated impacts of SLR. Over the last 100 years, sea levels have risen 0.56 feet globally. The average rate of rise between 1961 and 2003 was 0.07 inches per year; however, that rate nearly doubled to 0.12 inches per year between 1993 and 2003.[6] Although the rate of SLR is accelerating, it is not expected to be globally uniform, where some areas will be more substantially inundated than others.

Over the last several years, the incidence of coastal damage caused by storm-driven tides has increased. After spending money year after year to repair this damage and restore the Town's beaches to their previous status, the Town has started altering beaches to better weather these storms and their associate tides. As recently as the winter of 2013, winter storms and their high tides have been responsible for the erosion of large areas of beach, as well as the destruction of staircases, walkways and other beach-related structures.
Brewster is also incorporating sea level rise into their Integrated Water Resources Management Plan as a means to anticipate issues with septic systems and appropriate separation to groundwater as sea level rises, particularly in coastal areas already known for high groundwater.

[6] IPCC. (2007). *Climate Change 2007: The Physical Science Basis. Summary for Policymakers. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Geneva, Switzerland: UNEP.

NOAA's Office of Coastal Zone Management – Digital Coast developed a series of sea level rise data layers under various scenarios. The CCC developed Map 2-2 Sea Level Rise Scenarios which depicts projected SLR increases for one-foot, three-feet, five-feet, and seven-feet.

Based on the high frequency and serious severity of SLR observed and projected, the Town is considered at high risk for continued future SLR impacts.

Coastal Flooding

Coastal storm surge is typically defined as the abnormal rise in water level caused by the wind and pressure forces of a hurricane and/or nor'easter. Brewster experiences coastal flooding several times per year due to coastal storm surges resulting mainly from winter storms and nor'easters.

Storm Tide Pathways[7]

Coastal tourism, recreational use and enjoyment of natural, coastal resources, and the ecosystem services these resources provide are large contributors to the State's economy. To sustain activities such as these, managers, first responders, and public works professionals in low-lying coastal communities need information in real-time, and for future planning purposes, that is responsive to the threats posed by coastal hazards such coastal storms and related flooding on a scale commensurate with their responsibilities. Presently, many low-lying coastal areas flood regularly during high water storm events with some beginning to flood during monthly spring tides. Storm tide pathways (STPs) describe spatially how coastal waters will flow inland during a flooding event associated with storm surge, extreme high tides, or sea level rise. Independent of long-term sea level rise projections, storm surge projections considered in the context of contemporary storms of record and accurate ground elevation data can be used to map the location of storm tide pathways with a high degree of certainty.

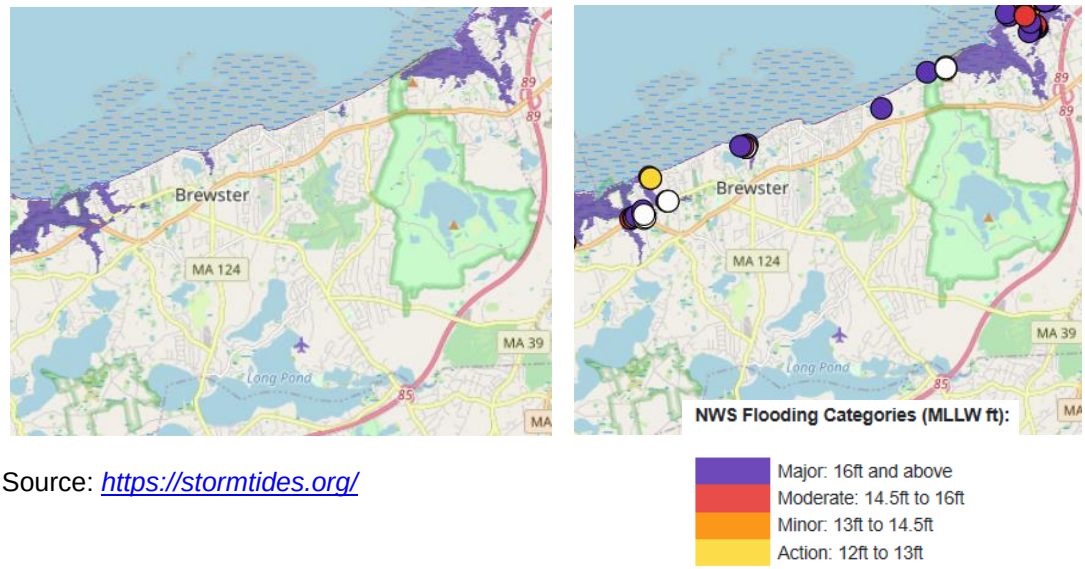
In 2019, the Center for Coastal Studies worked with ten Cape communities (including Brewster) to identify 1,505 pathways from the Cape Cod Canal to Race Point Lighthouse. Based on the desktop analysis and the field verification, a total of 74 storm tide pathways were identified in the Brewster area. Of that total 20 were identified as potentially tidally restricted (i.e., subject to potentially restricted flow conditions due to the presence of culverts and other flow limiting structures or conditions). The project storm of record used for Brewster is the January 27, 2015 storm. This study has identified 12 pathways in Brewster that are 12 inches above the water level recorded by the USGS Sesuit Harbor tide gauge (16.4 ft Mean Lower Low Water: Average of the lowest low water of each tidal day observed at a specific location/MLLW). Such a 1-foot increase in total water level is likely to flood approximately 49 acres of land and represent new areas of flooding that town staff may not be aware of but might want to consider for future planning (Figure 2-1). The National Weather Service provides

[7] Mapping Storm Tide Pathways in Cape Cod Bay, MA.

descriptions of the likely impacts associated with approaching storm tides characterized by general categories with suggested action levels or stages for communities threatened by approaching storms:

- Action Stage: The water level at which some mitigation action should be considered in preparation for an approaching coastal storm tide.
- Minor Flooding Stage: The water level at which some public threat, such as minor flooding of low-lying roads and infrastructure may be anticipated although minimal or no property damage is expected.
- Moderate Flooding Stage: The water level at which some inundation of structures and roads and possibly some evacuation of people and/or transfer of property to higher elevations can be anticipated.
- Major Flooding Stage: The water level at which extensive inundation of structures, properties and roads and significant evacuation of people to higher elevations can be anticipated.

Figure 2-1 Storm Tide Pathways and Inundation Extent, Brewster



Source: *https://stormtides.org/*

There are a number of STPs identified for Brewster that should be examined further (and perhaps periodically within dynamic settings) on a case-by-case basis to monitor the risk associated with them (Table 2-7).

Table 2-7 Storm Tide Pathways, Brewster

Storm Tide Pathway ID	Location
Major Flooding Stage STPs	
41-68	Terminus of Linnell Landing Rd.
41-60	Chapman Lane
41-44	Breakwater Beach
41-50	Breakwater Rd. at approach to Breakwater Landing
41-33	Lower Rd. east of Bloomer Path

41-31	Lower Rd. east of Bloomer Path
41-18	Paine's Creek Rd. north of Lower Rd.
41-17	Lower Rd./Paine's Creek Rd.
41-16	Lower Rd./Main Street
Moderate Flooding Stage STPs	
41-70	Terminus of Crosby Lane at Town Landing
41-49	Breakwater Road
41-8	Robbins Hill Beach parking lot
41-14	Main St. east of Lower Rd.
41-13	Main St. east of Lower Rd.
Minor Flooding Stage STPs	
41-45	Breakwater Road
41-46	Breakwater Road
41-2	Main St. north of Candlestick Lane
41-1	Sea St. north of Main Street
Action Stage STPs	
41-71	Crosby Lane
41-9	Warrens Rd./Robbins Hill Rd.
41-10	Warrens Rd./Robbins Hill Rd.

Source: https://stormtides.org/

Based on the high frequency and extensive severity of coastal flooding events, as reported by the National Centers for Environmental Information and indicated in Table 2-4, the Town is considered at high risk for future coastal flooding events.

Climate Change Impacts on Coastal Flooding

Future increases in relative sea level will intensify coastal flooding and will ultimately lead to the loss of recreation areas, public space, and wetlands along the coast. Residential and commercial structures, roads, and bridges on or near the coast will be more prone to flooding. SLR will also reduce the effectiveness and integrity of existing seawalls and revetments, which were designed for historically lower water levels. Lower elevations will become increasingly susceptible to flooding as storm surge reaches further inland due to both SLR in concert with a probable increase in the frequency and intensity of storms predicted from climate change.

The future rise in relative sea level will increase the extent of flood damage over time. Importantly, increased flooding means both an increase in the areas that are flooded and an increase in the depth of floodwaters. This is because SLR will expand existing floodplains, causing flooding in places which have not previously experienced flooding, as well as result in deeper floodwaters in previously flooded areas.

Nuisance flooding, also referred to as high tide flooding, increasingly occurs in coastal locations both locally and globally as a result of SLR, which causes high tides that are higher than they were historically. Nuisance flooding may affect individual coastal properties, as well as roads, parking lots, and other public or commercial infrastructure in low-lying areas. This type of flooding has increased five- to ten-fold since the 1960s in several U.S. coastal cities, and rates of increase are accelerating in dozens of cities on the U.S. Atlantic and Gulf coasts. Like other types of coastal flooding, nuisance flooding will continue increasing in depth, frequency and extent over the 21st century.

Flood Hazard Areas

FEMA Flood Zones

Inland flooding caused by major rainstorms combined with stormwater related issues and increasing development and impervious surfaces has been determined as one of the highest risk of natural disaster to the community. HW performed a Vulnerability Analysis that considered those areas in Town impacted by the various flood zones according to land use type, critical facilities, and critical infrastructure. An Economic Analysis of the impacts based on FEMA's flood zones follows later in this section (Tables 2-19 through 2-21).

VE/Velocity Flood Zone

The VE Zones are velocity zones that are subject to breaking wave action where waves greater than 2.9 feet are forecasted during a 100-year flood or storm surge. Below is a breakdown of the number of parcels (by land use type), critical facilities, and vulnerable populations susceptible to inundation in the VE/Velocity Flood Zone:

Parcels affected: (410 parcels in total)

- Charitable: 8
- Commercial: 1
- Hotel/Motel/Inn: 1
- Improved – Selectmen (Town): 1
- Multiple Use Property: 2
- Other Land: 23
- Outdoor Recreation: 3
- Public Service: 1
- Residential: 320
- Vacant – Developable: 6
- Vacant – Undevelopable: 12
- Vacant – Conservation (Town): 10
- Vacant – Selectmen (Town): 14

AE/100-Year Flood Zone

The AE zone or 100-year flood zone (has a 1% chance of flooding occurring each year) is a regulatory standard used by federal agencies and most states to administer floodplain management programs and is also used by the NFIP as the

basis for insurance requirements nationwide. Below is a breakdown of the number of parcels (by land use type), critical facilities, and critical infrastructure susceptible to inundation in the AE/100-Year Flood Zone:

Parcels affected: (1,680 parcels in total)

- Charitable: 57
- Commercial: 5
- Electric Generation: 1
- Hotel/Motel/Inn: 4
- Improved - Selectmen (Town): 4
- Mining/Quarrying: 1
- Multiple Use Property: 12
- Office: 3
- Other Land: 38
- Outdoor Recreation: 7
- Productive Land: 1
- Residential: 1,344
- State: 13
- Storage/Warehouse:1
- Utility: 2
- Vacant – Developable: 37
- Vacant – District: 1
- Vacant – Undevelopable: 49
- Vacant – Conservation (Town): 66
- Vacant – Conservation (other Town): 1
- Vacant – Selectmen (Town): 33
- Vacant – Tax/Title (Town): 1

Critical Facilities affected:

- Brewster Well #4/Greensand Filtration Treatment Facility
- Lower Mill Pond Dam/Stony Brook Dam
- MA-6A/Stony Brook Tributary Culvert (2)

X/500-Year Flood Zone

The X zone or 500-year flood zone is a flood that has a 0.2% chance of occurring each year. Below is a breakdown of the number of parcels (by land use type), critical facilities, and critical infrastructure impacted by the X flood zone:

Parcels affected: (1,087 parcels in total)

- Charitable: 29
- Hotel/Motel/Inn: 1
- Multiple Use Property: 6
- Office: 4
- Other Land: 11
- Outdoor Recreation: 1

- Productive Land: 8
- Religious: 1
- Residential: 981
- Vacant – Developable: 3
- Vacant – District: 1
- Vacant – Undevelopable: 22
- Vacant – Conservation (Town): 9
- Vacant – Selectmen (Town): 9
- Vacant – Tax/Title (Town): 1

Property at Risk from Flood-Related Hazards

While the Town has done extensive work to improve flooding risks in many areas, there are still places where flooding can occur even after a brief downpour. Flooding in several locations has been serious enough to make travel hazardous, both within Brewster and when travelling between Brewster and adjacent towns. Increases in intensity of rainfall caused by climate change have exacerbated flooding issues in Brewster.

Critical Facilities

Critical facilities are those public or private facilities that possess added value to the community and deserve additional consideration when determining mitigation strategies to protect these resources from natural hazard risks.

A list of critical facilities provided by the Town was reviewed and approved with modifications by the Brewster LHMW. 46 critical facilities have been identified and are presented in Map 2-4 Critical Facilities (Appendix A). A number of the Town's critical facilities are located in high hazard areas, including the Brewster Well #4/Greensand Filtration Treatment Facility, Lower Mill Pond Dam/Stony Brook Dam, and the MA 6A/Stony Brook Tributary Culvert, all located in the 100-Year flood zone. Floodplains in Brewster include 'VE', 'AE' and 'X' Zones, Map 2-3 FEMA Flood Zones (Appendix A).

Locally Identified Areas of Flooding

Information on flood hazard areas was taken from several sources. Originally were the National Flood Insurance Rate Maps (FIRMs), then FEMA Flood Zones, shown on Map 2-3 Flooding in Appendix A. The second was discussions with local officials and finally from review of existing plans, studies and reports. Some of these areas do not necessarily coincide with the flood zones, they may be areas that flood due to inadequate drainage systems (throughout the community) or other local conditions such as storm tide pathways.

Locally identified areas include portions of Route 6A (Lower Road and sections adjacent to the Dennis and Orleans town lines), Underpass Road and Drummer Boy Park, Tidally-restricted areas (Sea Street and Paine's Creek Road), and the roadways/areas identified in the storm tide pathways discussion earlier in this section.

Probability of Future Occurrence of Flood-Related Hazards
As new development and urbanization continues, with the increase of impervious surfaces increasing the rate of drainage collection and reducing the carrying capacity of the land, it is likely urban flooding and stormwater runoff events will also increase on a more frequent basis with even lower storm events. With the continuing increase in frequency and severity of events, the Town will continue to be at high risk for extensive damages at a medium/regional level for flood-related events (Table 2-2 Hazard Index).

2.3.2 Winter-Related Hazards

Winter weather events can include heavy snows, ice, and extreme cold and can affect the entire Town of Brewster. Heavy snow can bring the community to a standstill by inhibiting mobility (transportation networks, pedestrian travel), knocking down trees and utility lines, and cause structural collapses in older buildings. Ice buildup can down utility lines and communication towers. The impacts of both events can cause indirect issues such as freezing/rupturing pipes from lack of heat, while also changing the ground's frost level, creating problems for underground infrastructure.

Table 2-8 below represents the various significant winter-related hazard events that have occurred in and around the Town of Brewster over time, utilizing NOAA's National Centers for Environmental Information (http://www.ncdc.noaa.gov/). All events are county wide (Barnstable County), unless otherwise noted.

Table 2-8 Significant Winter-Related Events, Barnstable County

Hazard Type	Date	Level/Description	Damages
Heavy Snow			
	1/7/1996	15-25"	$8 M; roof collapsed; 10 animal fatalities
	1/10/1996	4-8"	
	2/2/1996	1ft	Schools/business/civic cancellations
	2/16/1996	3-5"	
	3/2/1996	6-12"	Transportation disruptions
	4/7/1996	6-10"	Power outages
	1/11/1997	6-9"	Transportation disruptions
	2/16/1997	6-7"	Wind gusts 30-40 mph
	4/1/1997	20-30"	Wind gusts 30- 50 mph; power outages; roofs collapsed; transportation disruptions
	12/24/1998	9 " +	
	2/25/1999	2ft	Wind gusts 67 mph; 1 fatality

	3/15/1999	11"	Transportation disruptions; schools closed
	1/13/2000	4-6"	
	1/20/2000	5-7"	
	1/20/2001	10"	
	3/26/2001	5-10"	
	12/5/2002	2-5"	
	1/23/2003	2-7"	
	2/24/2005	4-8"	
	1/27/2008		$20 K; transportation disruptions
	12/19/2008	8-12"	$5 K; wind gusts of 30-40 mph; 1 fatality; trees and wires down
	12/20/2010	2-4"	
	1/21/2012	8-12"	
	2/8/2013	8-17"	Wind gusts of 74 mph; trees down; power outages;
	1/2/2014	7-16"	
	1/21/2014	3-12"	
	2/15/2014	5-15"	
	3/5/2015	6-2"	
	2/5/2016	4-8"	$15 K; downed trees
Winter Storm			
	2/7/2003	12-16"	Transportation disruptions
	2/17/2003	1 to 2ft	
	3/6/2003	5-10"	$50 K; transportation disruptions
	12/5/2003	1-2ft	Wind gusts of 58 mph
	2/18/2004	4-8"	
	12/26/2004	10-18"	Wind gusts 55 mph; power outages
	1/22/2005	1-3ft	Wind gusts of 65 mph
	3/1/2005	5-10"	$75 K; downed wires; transportation disruptions
	10/29/2005	1-3"	$35 K: downed trees; scattered power outages
	2/12/2006	6" +	$10 K; downed trees and wires
	12/19/2009	18-20"	$25 K; travel disruptions; wind gusts of 44 mph
	2/10/2010	2-9"	$15 K; downed trees; power outages
	1/7/2017	8-15"	
	2/9/2017	5-10"	
	3/10/2017	6-9"	
Blizzards			
	2/8/13	2-2.5"	Wind gusts between 72 and 83 mph

	1/3/2014	6-2"	35 mph wind gusts
	3/26/2014	4-6"	$65 K; downed wires and trees
	1/26/2015	2-3ft	2 fatalities; wind gusts of 50-65 mph
	2/14/2015	7-4"	Wind gusts of 64 mph
	1/23/2016	6-16"	$70 K; wind gusts 63 mph; downed transformers, wires, limbs
	2/8/2016	5-11"	
	3/13/2018	5-15"	$25 K; wind gusts of 70-80 mph
Extreme Cold/Wind Chill			
	2/14/2016	32 degrees below 0	
Winter Weather			
	3/3/1996		
	11/30/1999	1-3"	Transportation disruptions
	2/25/2001		2 fatalities
	2/17/2013	3-6"	
	3/21/2013	2-10"	
	2/2/2015	2-4"	
	2/8/2015	1-7"	Several roof collapses
	2/25/2015	2-5"	
	3/1/2015	1-5"	Several roof collapses
	4/4/2016	2-4"	
	12/17/2016	2-3"	
	1/30/2018	1-6"	

Source: NOAA National Centers for Environmental Information, www.ncdc.noaa.gov., current through December 2019.

Snow/Blizzards/Winter Storms/Nor'easters

Winter storms often include natural hazards such as extreme winds, coastal erosion and flooding. Utility and power lines can break from the weight of snow or ice coupled with strong winds. This could put residents at risk of losing heat, electricity, and water (if using well water). Snow melting poses problems as well such as road flooding in low lying areas.

The Town has experienced heavy snow and winter storms which have become more frequent over the past several years. Over the weekend of January 23, 2005, one of the worst blizzards in recent memory occurred. With a total of almost 36'' of snow falling in Brewster in 24 hours and wind gusts up to 75 mph, this storm brought Brewster to a standstill, with the exception of the Brewster Fire and Rescue which made 92 fire and rescue calls during this storm event. Roads were hazardous and drifts of up to ten feet greatly reduced driving sight lines and visibility. Two weeks later, roads were still not completely cleared and significantly drifts still remained, making it hard to see approaching vehicles at driveways or intersections. The blizzard helped to identify areas subject to excessive blowing and drifting snow as well as issues regarding resident

notifications, coordination of snow removal and access to community facilities and shelters.

A line squall on December 9, 2005 lasted only a few minutes but caused extensive damage from hurricane force winds and blowing snow. Numerous trees were uprooted, limbs snapped, power lines downed and roads blocked by trees, limbs and other debris. The storm took place as the school day was ending, adding school buses and walking students to the mix of vehicles and pedestrians caught in the storm. Power was out for over 24 hours and shelters were opened. Despite the progress of this storm from town to town across the Cape, towns did not warn other towns about the severity of the storm. In addition, since many local radio stations are automated, there were no warnings given on the radio concerning the severity of the storm. This storm event brought to light the need for improved communication between towns, and improved weather alerts from local radio stations.

Heavy snow affects the entire state, but the highest amounts typically occur in the northern and northwestern areas of the state. Usually, the impact and vulnerability of winter weather is measured in terms of the financial costs associated with preparing for, responding to, and recovering from the event. The Town uniformly continues to experience heavy snow and winter storms with greater frequency and severity, as reported by the National Centers for Environmental Information and indicated in Table 2-8. The Town is considered at high risk for heavy snow/blizzards/winter storms/nor'easters.

Climate Change Impacts on Heavy Snow Events
Climate change will result in increased average global temperatures. These impacts are already being felt in New England, as average winter temperatures in the region have risen 3.8°F in the last 30 years. Although at first glance this would appear to make winters less severe the Northeast has experienced the largest increase in extreme precipitation events in the country, which often fall as heavy wet snow in the winter.

Extreme Cold
Extreme cold events often accompany winter storms, may be left in their wake, or occur without any associated storm activity, and can lead to hypothermia and frostbite. Extreme cold temperatures vary dependent on the normal climate of the region however, Brewster can expect to be uniformly affected. For Massachusetts, extreme cold typically means temperatures below zero degrees Fahrenheit. Extreme cold can adversely affect people - some more than others, infants and residents 65 years of age or more are especially vulnerable. Based on the low frequency and minor severity of extreme cold events over time, as reported by the National Centers for Environmental Information and indicated in Table 2-8, the Town is considered at low risk to extreme cold.

Climate Change Impacts on Extreme Cold Temperatures
Climate change will result in increased average global temperatures, which will likely decrease the number of extreme cold days. This decrease in extreme cold days has already been documented and is expected to continue.

MVP Climate Change Projections on Extreme Cold Temperatures
As mentioned above, climate change impacts will result in increased average temperatures so the number of extreme cold days is expected to decrease. Brewster should experience far fewer days with temperatures below freezing, and thus, will expend less energy on heating in the winter months. Table 2-9 below includes temperature projections (Annual and Winter) with a Baseline (1971 – 2000) through mid-century (2050s) for the Cape Cod Basin.

Table 2-9 Extreme Cold Temperature Projections, Cape Cod Basin

Climate Parameter	Baseline 1970 - 2000	Projected Change in 2030s	Mid-Century 2050s
Average Annual Temperature (°F)	49.9	51.7 – 53.3	52.3 – 55.3
Average Winter Temperature (°F)	31.9	49.5 – 35.6	34.4 – 37.6
Minimum Annual Temperature (°F)	42.1	44.0 – 45.6	44.8 – 47.6
Minimum Winter Temperature (°F)	24.1	26.1 – 28.1	27.0 – 30.2
Annual Days with Minimum Temperature Below 32 (°F)	105	91 – 77	86 - 63
Winter Days with Minimum Temperature Below 32 (°F)	71	65 - 59	64 - 51
Annual Heating Degree-Days (Base 65 °F)	5,957	5,482 – 6,648	5,271 – 4,583
Winter Heating Degree-Days (Base 65 °F)	2,996	2,832 – 2,649	2,776 – 2,476

Source: MVP Program, www.resilientma.org

Property at Risk from Winter-Related Hazards

New England experiences winter storms in more extreme ways than most of the rest of the country. The average annual snowfall for the entire town is 24.1 – 36.0 inches (Map 2-5 Average Annual Snowfall, Appendix A). The most dangerous hazard associated with winter storms, is the possibility of citizens losing power due to downed trees and utility lines (loss of heat, electricity and water). Other minor hazards include flooding during snow melt and treacherous roadways due to ice, snow and downed wires/trees making roadways impassable, particularly for emergency vehicles.

Probability of Future Occurrence of Winter-Related Events

According to past history and climatic conditions, and the inability to predict extreme snow and temperature events, the Town will continue to be at high risk

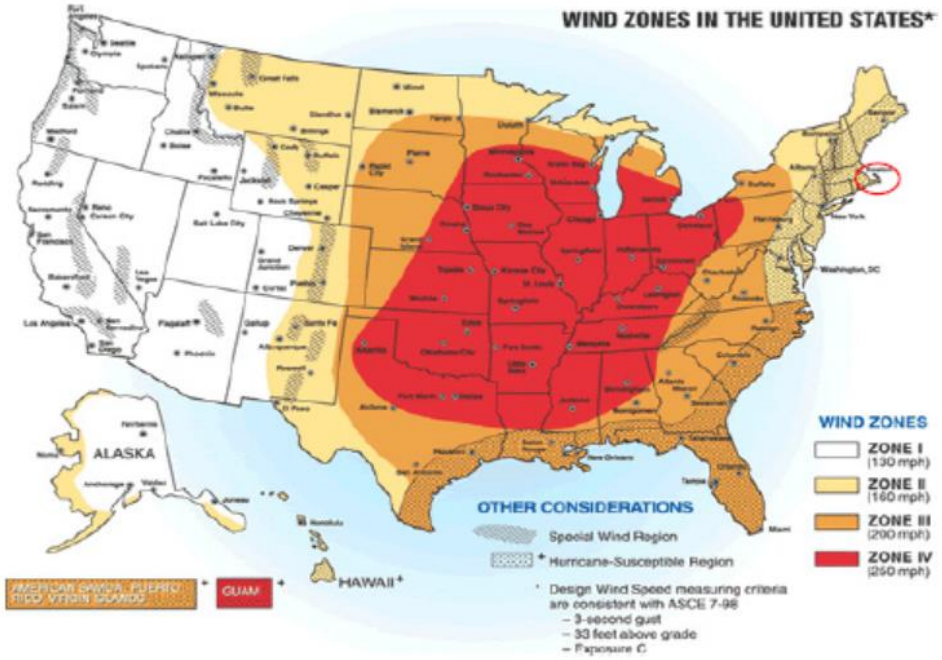
for extensive damages at a large/multiple community level for blizzard/snow/nor'easter events, and low risk for minor impacts for extreme cold events (Table 2-2 Hazard Index).

2.3.3 Wind-Related Hazards

Wind is the movement of air caused by a difference in pressure from one place to another. Local wind systems are created by the immediate geographic features in a given area, such as mountains, valleys, or large bodies of water. Wind effects can include blowing debris, interruptions in elevated power and communications utilities, and intensification of the effects of other hazards related to winter weather and severe storms.

Massachusetts is susceptible to high wind from several types of weather events: before and after frontal systems, hurricanes and tropical storms, severe thunderstorms and tornadoes, and Nor'easters. Sometimes, wind gusts of only 40 to 45 mph can cause scattered power outages from trees and wires being downed.[8] Based on historical tornado and hurricane data, FEMA has produced a map that depicts maximum wind speeds for design of safe rooms. The Commonwealth is located within Wind Zone II, with speeds up to 180 mph (Figure 2-2). The entire Commonwealth is also located within the hurricane-susceptible region. Massachusetts wind events can produce damage often associated with thunderstorms or tornadoes.

Figure 2-2 Wind Zones in the United States



Source: FEMA

[8] 2018 State Hazard Mitigation and Climate Adaptation Plan, Commonwealth of Massachusetts.

Table 2-10 below represents the various significant wind-related hazard events that have occurred in and around the Town of Brewster over time, utilizing NOAA's National Centers for Environmental Information (http://www.ncdc.noaa.gov/). All events are county wide (Barnstable County), unless otherwise noted.

Table 2-10 Significant Wind-Related Events, Barnstable County

Hazard Type	Date	Level/Description	Damages
Hurricanes			
	9/1/1938	Category 3	
	9/1/1944	Category 4	
	8/31/1954	Carol	
	9/11/1954	Edna	
	9/12/1960	Donna	
	9/27/1985	Gloria	
	8/19/1991	Bob	
	9/1/2010	Earl	
	8/28/2011	Irene	$3.7 M; Tropical Storm
	10/29/2012	Sandy	
Tornadoes			
	8/9/1968	F1	$2.5 K
	8/22/1977	F1	$25 K
	10/29/2018	EF0	$30 K
	7/23/2019	EF1	$1.2M; downed trees
Strong Winds			
	12/7/1996		$4 M; downed trees and wires; power outages
	12/24/1996	40-50 mph	Power outages
	1/10/1997	47-55 mph	
	2/17/1997	30-40 mph	
	2/18/1997	35-45 mph	
	3/6/1997	50-77 mph	Power outages
	3/26/1997	50-55 mph	Scattered power outages
	3/31/1997	60-64 mph	Downed trees; power outages
	4/1/1997	30-50 mph	$6-7 M; power outages
	7/25/1997	70 mph	
	8/21/1997	40-45 mph	Trees downed; $9 K
	10/20/1997	60 kts	
	11/1/1997	81 mph	Power outages; $3.13 K
	11/27/1997	71 mph	$22 K; power outages
	12/2/1997	35-45 mph	
	12/14/1997	62 mph	

	12/29/1997	68 mph	$31 K; downed trees and wires
	1/28/1998	45 mph	
	2/4/1998	44-58 mph	
	2/18/1998	65 mph	
	2/24/1998		$1.25 K
	3/9/1998		
	3/21/1998		
	3/26/1998		
	4/9/1998		
	4/23/1998		Trees/phone lines downed
	5/9/1998		
	6/27/1998		$2 K
	11/11/1998		Power outages
	11/26/1998		1 fatality
	12/1/1998		
	12/18/1998		
	12/22/1998		
	12/30/1998		
	1/3/1999		Downed trees and wires; power outages
	1/15/1999		
	1/18/1999		downed wires; power outages; lighting fire in home
	1/24/1999		
	2/2/1999		
	2/25/1999		1 fatality;
	3/4/1999		Power outages; downed wires
	3/8/1999		
	3/22/1999		Downed trees; power outages; transportation disruptions
	9/30/1999		
	10/14/1999		Downed tree branches; power outages
	10/18/1999		Downed trees and powerlines
	11/2/1999		Downed trees
	12/30/1999		
	1/10/2000		
	1/12/2000		Downed trees

	1/16/2000		
	1/21/2000		
	2/14/2000		
	3/17/2000		
	3/28/2000		
	4/4/2000		Downed trees
	4/8/2000		
	5/18/2000		Power outages
	6/6/2000		Power outages
	10/28/2000		Power outages
	10/31/2000		
	12/25/2000		
	12/30/2000		
	2/10/2001		
	2/11/2001		
	2/17/2001		
	3/30/2001	50-55 kts	
	12/16/2005	50 kts.	$40 K: downed trees and wires
	1/15/2006	31 kts.	$5 K; downed trees
	1/18/2006	47 kts.	$5 K; downed trees; 1 fatality
	2/17/2006	50 kts.	$10 K; 1 fatality; downed trees
	11/23/2006	30 kts.	$2 K; downed trees
	10/28/2008	44 kts.	$50 K; downed trees
	1/28/2009	46 kts.	$5 K;
	6/22/2009	40 kts.	$5 K; downed utility poles
	4/29/2010	40 kts.	$5 K; downed trees on power lines
	8/23/2010	42 kts.	$20 K; downed trees and wires
	1/12/2011	48 kts.	$15 K; power outages
	7/4/2014	39 kts.	$2 K; trees downed
	12/7/2014	40 kts.	Scattered power outages
	1/10/2016	40 kts.	$5 K; downed trees
	9/5/2016	40 kts.	$70 K; downed trees
	12/18/2016	44 kts.	$10 K;
	1/23/2017	36 kts.	$2 K; downed trees
	1/24/2017	36 kts.	$1 K; downed trees
	3/2/2017	45 kts.	$10 K; downed trees and wires
	3/5/2018	43 kts.	$2 K

	3/7/2018	35 kts.	$2 K; downed trees and wires
	4/16/2018	46 kts.	$3 K
	10/15/2018	45 kts.	$1 K; downed trees
	12/18/2018	40 kts.	$1 K; downed trees
	4/15/2019	43 kts.	$1 k; downed trees, wind gusts to 40 to 50 mph
	10/16/2019		$50k; downed trees
	10/17/2019		$50k; downed trees
Lightning/Thunderstorms			
	7/26/1999		Downed trees; house fires; power outages
	5/8/2000		1 injury
	5/27/2001		2 injuries
	4/17/2002		1 injury
	8/5/2002		$5 K; power outages
	8/16/2003		$2.5 M; downed trees
	7/2/2004		$20 K; downed trees and power lines; house fires
	11/10/2005	38 kt	$5 K; power outages
	6/20/2006		$100 K
	7/18/2006		$15 K; downed wires and trees
	1/11/2008		$2 K
	8/12/2008		$5 K
	8/16/2008		$10 K; downed trees; house fire
	7/1/2009		1 fatality
	7/2/2009		1 injury
	9/8/2011		$15 K; house fire
	7/18/2012		$10 K; downed trees; power outages
	8/28/2012		2 injuries
	7/3/2014		$75 K
	7/1/2016		$15 K
	8/9/2018		$5 K; West and East Brewster
	8/18/2018		$5 K
	7/17/2019		$2k; flooding; house fire
	7/22/2019		$5k; house fire; flooding
High Winds			
	1/19/1996		
	1/24/1996	50 Kts	
	1/27/1996		

	3/3/1996	54 Kts	
	7/13/1996	50 Kts	
	9/2/1996	67 Kts	Downed trees
	10/8/1996	50 Kts	Scattered power outages
	12/6/1996	56 Kts	Power outages
	1/28/1997	54 Kts	
	3/6/1997	55 Kts	$13.33 K; power outages
	3/12/1997	50 Kts	
	3/26/1997	54 Kts	Power outages
	4/19/1997	58 Kts	$16.67 K; power outages
	11/1/1997	67 Kts	Downed trees; power outages
	11/27/1997	59 Kts	Power outages: downed trees
	12/30/1997	56 Kts	Downed trees; power outages
	11/11/1998	50 Kts	Power outages
	1/3/1999	62 Kts	Sscattered power outages
	9/16/1999	63 Kts	Downed trees
	12/1/1999	35 Kts	
	12/10/1999	35 Kts	Downed trees and wires
	12/12/2000	50 Kts	Downed trees and powerlines
	12/17/2000	53 Kts	Downed trees and wires; power outages
	2/6/2001	50 Kts	
	3/5/2001	50 Kts	Power outages; $10 M +
	1/22/2003	52 Kts	
	10/15/2003	52 Kts	$25 K; power outages; 2 injuries
	11/13/2003	50 Kts	$50 K; downed trees and power lines
	12/7/2003	50 Kts	
	3/8/2005	56 Kts	Power outages; downed trees
	5/7/2005	50 Kts	$50 K; downed trees and power lines
	5/25/2005	50 Kts	$15 K; downed trees and power lines
	10/16/2005	58 Kts	$5 K; downed trees; power outages
	10/25/2005	58 Kts	$15 K; downed trees and power lines

	11/10/2005	38 Kts	Power outages
	12/9/2005	58 Kts	$50 K; downed trees
	1/18/2006	61 Kts	$100 K; downed wires and trees
	2/12/2006	69 Kts	$10 K; downed wires
	10/28/2006	57 Kts	$8 K;
	10/29/2006	50 Kts	$5 K;
	12/1/2006	54 Kts	$10 K; downed trees
	4/15/2007	58 Kts	$30 K; downed trees and power lines
	11/3/2007	77 Kts	$50 K; downed trees and power lines; fire
	3/8/2008	66 Kts	$10 K; downed wires
	12/25/2008	52 Kts	$5 K
	10/18/2009	36 Kts	$20 K; downed trees
	10/24/2009	52 Kts	$10 K
	1/25/2010	58 Kts	$5 K; downed trees
	2/25/2010	50 Kts	$25 K; transportation disruptions; downed trees and wires
	3/13/2010	50 Kts	$50 K; downed trees and wires
	11/4/2010	35 Kts	
	12/26/2010	70 Kts	
	2/25/2011	52 Kts	
	10/30/2011	54 Kts	$30 K; power outages
	1/13/2012	51 Kts	$2 K
	2/25/2012	52 Kts	
	10/29/2012	69 Kts	$500 K; downed trees
	11/7/2012	52 Kts	$65 K; trees down
	12/27/2012	52 Kts	$3 K; downed trees
	1/31/2013	56 Kts	Downed trees and powerlines
	2/9/2013	50 Kts	$15 K; downed trees and wires
	2/17/2013	36 Kts	
	3/7/2013	53 Kts	
	11/27/2013	50 Kts	$5 K; downed telephone poles
	2/15/2014	50 Kts	$60 K; downed trees and wires
	11/2/2014	53 Kts	$100 K; downed trees
	12/9/2014	50 Kts	$15 K
	1/9/2015	36 Kts	

	1/27/2015	65 Kts	$50 K; downed trees and wires
	3/17/2015	50 Kts	$10 K; downed trees
	6/28/2015	50 Kts	$20 K; down trees and wires
	1/13/2016	50 Kts	$7.50 K
	4/3/2016	58 Kts	
	4/7/2016	52 Kts	
	10/9/2016	36 Kts	$1.50 K; downed trees
	10/22/2016	50 Kts	$1 K
	10/28/2016	50 Kts	
	12/15/2016	56 Kts	$1 K
	12/27/2016	50 Kts	$100
	1/23/2017	51 Kts	$2.50 K; downed trees and wires
	2/13/2017	50 Kts	$2.50 K; downed trees and wires
	3/2/2017	50 Kts	Downed trees and wires
	3/14/2017	69 Kts	$2 K; downed trees
	4/1/2017	54 Kts	
	9/20/2017		$15 K; Tropical Storm
	10/25/2017	50 Kts	$1 K
	10/29/2017	81 Kts	$12 K
	12/25/2017	66 Kts	$20 K; trees and wires down
	1/4/2018	65 Kts	$8 K; downed trees
	1/12/2018	57 Kts	$5 K; trees down
	1/30/2018	36 Kts	
	3/2/2018	84 Kts	$40 K; trees and wires down
	10/16/2018	50 Kts	$1 K; downed trees and wires
	10/27/2018	56 Kts	Downed trees
	11/3/2018	51 Kts	$9 K; downed trees and wires
	11/13/2018	50 Kts	$500; trees downed
	11/16/2018	56 Kts	
	1/24/2019	52 Kts	
	1/30/2019	54 Kts	
	2/9/2019	50 Kts	$1 K
	2/25/2019	55 Kts	
	9/6/2019	35 kts.	wind 40-60 mph; Tropical Storm; $15 K

	9/7/2019	36 kts.	wind 40-60 mph; Tropical Storm; $15 K
	10/9/2019	52 kts	gust to 60 mph
	10/10/2019	50 kts.	Downed tree
	10/11/2019	50 kts.	$3k; downed trees
	10/16/2019	51 kts.	$.50k; gust 59 mph
	10/17/2019	50 kts.	$.50k; gust 66 mph
	10/31/2019	51 kts.	Downed trees; downed power lines
	11/1/2019	56 kts.	gust to 61 mph
	11/24/2019	50 kts.	Wind gusts of 40 to 58 mph
Hail			
	5/24/1962		
	7/13/1981		
	5/28/1986		
	5/25/1994	.75in	
	7/3/1997	.75 in	Scattered power outages
	7/18/1997	1.75 in.	1 injury
	11/4/1997	1.5 in	
	6/26/1998	.75 in	
	6/30/1998	1.00 in.	Downed trees; wind gusts 75 to 85 mph
	5/8/2000	0.88 in.	1 injury
	5/10/2000	0.88 in.	
	7/17/2001		
	5/24/2004	0.75 in.	House fires
	7/22/2005	0.75 in.	$5 K; downed trees and power lines
	6/20/2006	0.75 in.	Downed trees
	7/18/2006	0.75 in.	Downed trees
	7/6/2007	0.75 in.	
	8/18/2007	0.75 in.	
	4/12/2008	0.75 in.	
	6/24/2008	0.75 in.	
	8/16/2008	1.00 in.	$1 K; downed trees
	8/19/2008	0.75 in.	
	7/1/2009	0.75 in.	1 fatality
	7/2/2009	0.75 in.	$1 K
	6/9/2011	0.75 in.	Brewster
	8/2/2011	0.75 in.	
	7/24/2012	0.75 in.	
	8/7/2014	0.88 in.	

	6/22/2019	0.88 in.	Wind gust of 47 mph

Source: NOAA National Centers for Environmental Information, www.ncdc.noaa.gov. Data current through December 2019.

Hurricanes

Hurricanes are defined as a large circulating windstorm covering hundreds of miles that forms over warm ocean water. To be officially classified as a hurricane, the wind speeds must exceed 74 miles per hour. In the northern hemisphere winds circulate in a counterclockwise direction. A great dome of water as much as fifty miles in diameter (called the "storm surge") is pushed ahead of the storm by its winds. In some coastal locations, this can result in tides 20 feet higher than usual. Occasionally, storm surge is responsible for damage to property and potential deaths.

The winds that accompany hurricanes have the potential to cause serious damage. Downed power lines leave residents without electricity and can impede business for days. Fallen trees can damage buildings and block roadways. Unsecured building components including gutters, screened enclosures, roof coverings, shingles, car ports, porch coverings, overhangs, siding, decking, windows, walls, gables can be blown off structures and carried by the wind to cause damage in other places. Wind driven rain often causes water damage in roof and wall envelopes.

Measuring the Intensity of a Hurricane

Hurricane damages come from wind, rain, tornadoes, floods/storm surge, and the effects of very low air pressure. The Saffir-Simpson Hurricane Wind Scale (SSHWS) intensity category system was developed in the 1970's to characterize a hurricane's destructive potential by indicating wind speeds and range of damage, see Table 2-11 below. The SSHWS category system measures sustained wind speed, central pressure, storm surge height, and coastal damage potential within five intensity categories.

Table 2-11 Saffir-Simpson Hurricane Wind Scale

Scale No. (Category)	Wind (mph)	Potential Damage
1	74 - 95	Minimal: Damage is primarily to shrubbery and trees, mobile homes, and some signs. No real damage is done to structures.
2	96 – 110	Moderate: Some trees topple, some roof coverings are damaged, and major damage is done to mobile homes.
3	111 – 130	Extensive: large trees topple, some structural damage is done to roofs, mobile homes are destroyed, and structural damage is done to small homes and utility buildings.
4	131 – 155	Extreme: Extensive damage is done to roofs, windows and doors; roof systems on small buildings completely fail; and some curtain walls fail.
5	> 155	Catastrophic: Roof damage is considerable and widespread, window and door damage is severe, there are extensive glass

		failures, and entire buildings could fail.
Additional Classifications: Tropical Storm 39 – 73, Tropical Depression < 38		

Source: NOAA.

The National Weather Service (NWS) will issue a hurricane warning when sustained winds of 74 mph or higher are reached and expected within a coastal area within 24 hours. On average, there are approximately 10 named tropical storms along the east coast of the U.S. each year, six of which are likely to develop into hurricanes, with only two or three likely to reach category 3 on the SSHWS. The SSHWS has undergone a minor modification for 2012 in order to resolve awkwardness associated with conversions among the various units used for wind speed in advisory products. The change broadens the Category 4 wind speed range by one mile per hour (mph) at each end of the range, yielding a new range of 130-156 mph.

Brewster has had one hurricane make landfall in the last 25 years – Hurricane Bob in 1991 and several that have passed close to Cape Cod, including Hurricane Eduard in 1996, Tropical Storm Irene in 2011 and Hurricane Sandy in 2012. In 1991, Hurricane Bob caused extensive damage in Brewster in the form of downed trees, downed power lines, flooding and power outages impacting the entire town. Tropical Storm Irene went over Brewster in the summer of 2011. A number of trees and limbs came down in the heavy wind, with crews working to remove downed limbs and trees from roadways and other public areas. Power was lost in some areas and restored within several days. Hurricane Sandy passed west of the Cape in 2012 after causing devastation in other areas of the northeast.

Based on the high frequency and extensive severity of hurricane events over time, as reported by the National Centers for Environmental Information and indicated in Table 2-10, Brewster is considered at high risk to hurricanes.

Storm Surge

Of additional concern is hurricane storm surge. Storm surge refers to the rise of water levels caused explicitly by a storm and is measured as the height above the normal predicted tide. The combination of SLR and increased storm intensity will result in higher storm surges characterized that will extend further inland, potentially causing greater damage to property and infrastructure. The IPCC in 2014 found that increasing storm surges and other forms of coastal flooding have the potential to disrupt livelihoods and create severe health risks across various sectors.

Over time, as sea levels rise, water levels associated with what is thought of as today's 100-year return period storm will increase, because a higher base sea level will increase the extent and depth of storm-related flooding. As a result, the 100-year return period storm of the future could result in much more flood-related damage than the 100-year return period storm of today. Additionally, from the

perspective of water levels, SLR will cause the flooding that would occur with today's 100-year return period storm to become a more regularly occurring event. For example, a future 20-year return period storm on top of a two-foot SLR will have the same water level and depth as today's 100-year return period storm.

Hurricane surge inundation areas for Categories 1 through 4 hurricanes striking the coast were developed by the National Oceanic Atmospheric Administration (NOAA) using the Sea Lake and Overland Surge from Hurricanes (SLOSH) Model. Map 2-7 Storm Surge Scenarios (Appendix A) shows those areas expected to be inundated by Categories 1 through 4 hurricanes.

Based on the high frequency and serious severity of storm surge events as observed and reported over time, Brewster is considered at high risk to future storm surge events.

Climate Change Impacts on Hurricanes
Climate change is expected to result in the increased frequency and intensification of hurricanes and tropical storms worldwide. Rising sea levels, coupled with potentially higher hurricane wind speeds, rainfall intensity, and storm surges will combine to create more intense hurricanes, resulting in increased impacts to coastal communities. Research predicts a global increase in the intensity of such storms on average, by 2% to 11%, based on the IPCC mid-range emission scenario projections, as well as a poleward expansion in the latitude at which storms will reach their highest intensity. Some experts have noted that the three massive storms from the 2017 hurricane season (Harvey, Irma, and Maria) are consistent with this expected intensification.

Hurricanes and tropical storms are expected to result in more rainfall. This increase has been observed and is expected both globally (IPCC 2014) and for the Atlantic basin, including the U.S. east coast. Based on a synthesis of current science, NOAA predicts that Atlantic hurricanes and tropical storms in the coming century will have higher rainfall rates than present storms, especially near the center of the storm. Hurricane Harvey, which resulted in a record 51.9 inches of rainfall at one station west of Houston, Texas, is one recent example of this trend.

Tornadoes/High Winds
Tornadoes are violently rotating columns of air in contact with and extending between a cloud and the surface of the earth. Generally, winds in most tornadoes are 100 mph or less, but can exceed 250 mph in the most violent and least frequent tornadoes. Several conditions are required for the development of tornadoes and associated thunderstorm clouds, including abundant low-level moisture to contribute to the development of a thunderstorm, along with a trigger/cold front to lift the moist air. Tornadoes usually form in areas where strong winds are turning in a clockwise direction and can be in the traditional funnel shape, or in a slender rope-like form. They typically begin in a supercell (severe thunderstorm), primarily in the month of May.

Measuring the Intensity of a Tornado
Typically, tornadoes are categorized by frequency values from historic data and area impacted based on the length and width of the damage path. Tornado damage severity is measured by the Fujita Tornado Scale, where wind speed is estimated from the amount of damage. As of February 1, 2007, the National Weather Service began rating tornadoes using the Enhanced Fujita-scale (Table 2-12). The Enhanced Fujita scale is more complicated than the original F-scale, allowing for more precise assessments of tornado severity.

Table 2-12 Enhanced Fujita Scale

Fujita Scale			Derived		Operational EF Scale	
F Number	**Fastest ¼ mile (mph)**	**3-second gust (mph)**	**EF Number**	**3-second gust (mph)**	**EF Number**	**3-second gust (mph)**
0	40 - 72	45 - 78	0	65 - 85	0	65 - 85
1	73 - 112	79 - 117	1	86 - 109	1	86 - 110
2	113 - 157	118 - 161	2	110 - 137	2	111 - 135
3	158 - 207	162 - 209	3	138 - 167	3	136 - 165
4	208 - 260	210 - 261	4	168 - 199	4	166 - 200
5	261 - 318	262 - 317	5	200 - 234	5	Over 200

Source: NOAA.

Based on the high frequency and extensive severity of tornadoes over time as reported by the National Centers for Environmental Information and indicated in Table 2-10, Barnstable County is considered at high risk to future tornadoes, although no tornadoes have actually touched down in Brewster.

Lightning/Thunderstorms
Thunderstorms are formed when the right atmospheric conditions combine to provide moisture, lift, and warm unstable air that can rise rapidly. Thunderstorms occur any time of the day and in all months of the year but are most common during summer afternoons and evenings and in conjunction with frontal boundaries. Thunderstorms affect a smaller area compared with winter storms or hurricanes, but they can be dangerous and destructive for a number of reasons. Storms can form in less than 30 minutes, giving very little warning; they have the potential to produce lightning, hail, tornadoes, powerful straight-line winds, and heavy rains that produce flash flooding.

All thunderstorms produce lightning, and therefore all thunderstorms are dangerous. Lightning often strikes outside of areas where it is raining and may occur as far as 10 miles away from rainfall. It can strike from any part of the storm and may even strike after the storm has seemed to pass. Hundreds of people across the nation are injured annually by lightning, most commonly when

they are moving to a safe place but have waited too long to seek shelter. The Town of Brewster can be uniformly affected by lightning and thunderstorms, dependent upon the time of day, existing/incoming weather conditions, and time of year.

Building construction, location, and nearby trees or other tall structures will have a large impact on how vulnerable an individual facility is to a lightning strike. A rough estimate of a structure's likelihood of being struck by lightning can be calculated using the structure's ground surface area, height, and striking distance between the downward-moving tip of the stepped leader (negatively charged channel jumping from cloud to earth) and the object. In general, buildings are more likely to be struck by lightning if they are located on high ground or if they have tall protrusions such as steeples or poles which the stepped leader can jump to. Electrical and communications utilities are also vulnerable to direct lightning strikes. Damage to these lines has the potential to cause power and communications outages for businesses, residencies, and critical facilities.

Lightning strikes in Brewster have caused damage to homes as recently as this spring and the scale at the transfer station on Run Hill Road has been hit several times. Based on the high frequency and serious severity of lightning/thunderstorm events over time, as reported by the National Centers for Environmental Information and indicated in Table 2-10, the risk of lightning/thunderstorms is considered high in Brewster.

Hail

Hail is formed in towering cumulonimbus clouds (thunderheads) when strong updrafts carry water droplets to a height at which they freeze. Eventually, these ice particles become too heavy for the updraft to hold up, and they fall to the ground at speeds of up to 120 MPH. Hail falls along paths called swaths, which can vary from a few square acres to up to 10 miles wide and 100 miles long. The Town of Brewster can be uniformly affected by hail, dependent upon the existing/incoming weather conditions, and time of year.

The Tornado and Storm Research Organisation (TORRO) developed the TORRO Hailstorm Intensity Scale in 1986 to measure the intensity of hail storms. Table 2-13 categorizes hail by size code, description and typical damage.

Table 2-13 TORRO Hail Intensity Scale

Scale	Intensity Category	Description	Typical Diameter (inches)	Typical Damage Impacts
H0	Hard Hail	Pea	0.25	No damage
H1	Potentially Damaging	Mothball	0.50	Slight general damage to plants, crops
H2	Significant	Marble/Grape	0.75	Significant damage to fruit, crops, vegetation

H3	Severe	Walnut	1.25	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	Pigeon's egg > Squash ball	1.50	Widespread glass damage, vehicle bodywork damage
H5	Destructive	Golf ball > Pullet's egg	1.75	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	Hen's egg	2.0	Bodywork of grounded aircraft dented, brick walls pitted
H7	Destructive	Tennis ball > Cricket ball	2.5	Severe roof damage, risk of serious injuries
H8	Destructive	Large orange > softball	2.75	Severe damage to aircraft
H9	Super Hailstorms	Grapefruit	3.0	Extensive structural damage. Risk of seven even fatal injuries to persons caught in the open
H10	Super Hailstorms	Melon	4.0	Extensive structural damage. Risk of seven even fatal injuries to persons caught in the open

Source: TORRO.

Structure vulnerability to hail is determined mainly by construction and exposure. Metal siding and roofing is better able to stand up to the damages of a hailstorm than many other materials, although it may also be damaged by denting. Exposed windows and vehicles are also susceptible to damage. Crops are extremely susceptible to hailstorm damage, as even the smallest hail stones can rip apart unsheltered vegetation. Based on the high frequency and serious severity of hail events over time, as reported by the National Centers for Environmental Information and indicated in Table 2-10, the risk of hail is considered high in Brewster.

Property at Risk from Wind-Related Events

Wind events are quite normal in New England and happen regularly each year. In the winter months, the Town of Brewster is susceptible to high winds from nor'easters and winter storms (both high frequency). Spring and summer seasons usually bring a number of severe thunderstorms to the region (high frequency). During the late summer and fall seasons, the area is at risk from a hurricane or tropical event (high frequency).

Probability of Future Occurrence of Wind-Related Hazards

As previously stated, wind events are quite normal in New England, as evidenced throughout the year. Given the increase in frequency and severity of high wind events realized over the last several years, the Town will continue to be at high risk for extensive damages at an average medium/regional level for wind-related events (Table 2-2 Hazard Index).

2.3.4 Geologic-Related Hazards

Earthquakes

An earthquake is the sudden release of strain energy in the Earth's crust, resulting in energy waves that radiate outward from the earthquake source. The point on the Earth's surface directly above the focus is called the earthquake epicenter. The severity of earthquake effects is dependent upon: magnitude of energy released; proximity to the epicenter; depth to the epicenter; duration; geologic characteristics; and, type of ground motion.

When earthquakes occur, much of the damage is a result of structures falling under the stress created by the ground movement. Another significant effect is damage to the public and private infrastructure (i.e. water service, communication lines, drainage system). Because earthquakes are highly localized it is difficult to assign regional boundaries that share the same relative degree of risk.

Measuring the Intensity of an Earthquake

An earthquake's severity can be expressed in terms of intensity and magnitude. Intensity is defined by the observed effects of ground shaking on people, buildings, and the natural environment, which varies dependent upon the location of the observer with respect to the epicenter. Currently in the U.S., the Modified Mercalli (MMI) Intensity Scale is used to evaluate the effects of earthquakes – specifically, it describes how strongly an earthquake was felt at a particular location, Table 2-14 below. Magnitude is defined by the amount of seismic energy released at the hypocenter of the earthquake, based on the amplitude of the earthquake waves recorded on seismographs (using the Richter Magnitude Scale, Table 2-15). Another measure of the relative strength of an earthquake is the expanse of area the shaking is noticed**.**

Table 2-14 Modified Mercalli Intensity Scale

Mercalli Intensity	Description
I	Felt by very few people, barely noticeable.
II	Felt by few people, especially on upper floors.
III	Noticeable indoors, especially on upper floors, but may not be recognized as an earthquake.
IV	Felt by many indoors, few outdoors. May feel like passing truck.
V	Felt by almost everyone, people have trouble standing. Small objects move, trees and poles may shake.
VI	Felt by everyone, people have trouble standing. Heavy furniture can move, plaster can fall off walls. Chimneys may be slightly damaged.
VII	People have difficulty standing. Drivers feel cars shaking. Some furniture breaks. Loose bricks fall from buildings. Damage is slight to moderate in well-built buildings; considerable in poorly built buildings.

VIII	Buildings suffer slight damage if well-built; severe damage if poorly built. Some walls collapse.
IX	Considerable damage to specially built structures; buildings shift off their foundations. The ground cracks. Landslides may occur.
X	Most buildings and their foundations are destroyed. Some bridges are destroyed. Dams are seriously damaged. Large landslides occur. Water is thrown on the banks of canals, rivers, lakes. The ground cracks in large areas.
XI	Most buildings collapse. Some bridges are destroyed. Large cracks appear in the ground. Underground pipelines are destroyed.
XII	Almost everything is destroyed. Objects are thrown into the air. The ground moves in waves or ripples. Large amounts of rock may move.

Source: USGS, 2012.

Table 2-15 Richter Magnitude Scale

Richter Magnitude	Earthquake Effects
2.5 or less	Not felt or felt mildly near the epicenter, but can be recorded by seismographs
2.5 to 5.4	Often felt, but only causes minor damage
5.5 to 6.0	Slight damage to buildings and other structures
6.1 to 6.9	May cause a lot of damage in very populated areas
7.0 to 7.9	Major earthquake; serious damage
8.0 or greater	Great earthquake; can totally destroy communities near the epicenter

Source: USGS, 2012.

There have been no recorded earthquakes in Brewster. The last earthquake experienced in the area was a 2.8 magnitude earthquake 30 miles outside of town in 1976. Based on the very low frequency and serious severity of earthquake events over time, the risk of earthquakes is considered low in Brewster.

Landslides

Landslides include a wide range of ground movements, including rock falls, deep failure of slopes, and shallow debris flows. Often caused by a combination of unfavorable geologic conditions (silt clay or thick till deposits), the most common types in Massachusetts include transitional debris slides, rotational slides, and debris flows. Historical landslide data for the Commonwealth suggests that most landslides are preceded by 2 or more months of higher than normal precipitation, followed by a single, high-intensity rainfall of several inches or more.[9] The highest prevalence of unstable slopes is generally found in the western part of the Commonwealth. The entire Town of Brewster has been classified as having a very low risk for landslides, with no recorded landslides in Brewster to date.

[9] Massachusetts Hazard Identification and Risk Assessment, 2019, p. 161.

Property at Risk from Geologic-Related Hazards

Because earthquakes have been detected all over New England, seismologists suspect that a strong earthquake could be centered anywhere in the region (Map 2-8 Earthquakes (Appendix A). Furthermore, the mapped geologic faults of New England currently do not provide any indications detailing specific locations where strong earthquakes are most likely to be centered.[10]

All structures in Brewster are potentially vulnerable to seismic ground shaking. The most vulnerable are historic buildings constructed of unreinforced masonry. Other critical facilities or infrastructure at risk are unknown; their construction determines their ability to withstand seismic shaking. The Town has only experienced secondary effects from both regional events and longer-distance events emanating from the northeast in general. However, since building codes do not require seismic proofing, the impact would be expected to be severe if an earthquake were to hit the Town of Brewster.

The Town of Brewster can be uniformly affected by landslides, dependent upon the existing/incoming weather conditions, saturation of the ground, and topography of where the event occurs.

Probability of Future Occurrence of Geologic-Related Hazards

The Commonwealth has a 2% chance that an earthquake with a peak horizontal acceleration of 50 km above magnitude will occur within the next 50 years. A 'G' is the average acceleration produced by gravity at the earth's surface (9.80665 meters per second squared). This measurement describes ground shake during earthquakes. New England is not considered to be a hot spot for earthquakes, especially when compared to the western United States. Given the historic pattern of earthquakes, or more specifically the secondary impacts of earthquakes felt across the region (which has been the historic pattern), the Town will continue to be at low risk for shaking, although serious damage (Table 2-2 Hazard Index).

Because landslides are often triggered by other natural hazard events, their frequency is also related to the frequency of those other hazards. The Town continues to be at very low risk for landslides.

2.3.5 Extreme Heat-Related Hazards

Extreme heat occurs when a system of high atmospheric pressure moves into an area. In such a high-pressure system, air from upper levels of our atmosphere is pulled toward the ground, where it becomes compressed and increases temperatures. This high concentration of pressure makes it difficult for other weather systems to move into the area, which is why periods of extreme heat can last for several days, or even weeks. The longer the system stays in an area, the hotter temperatures become. The high pressure inhibits winds, making them faint to almost non-existent. Because the high-pressure system also prevents clouds from entering a region, sunlight can become punishing, increasing

[10] 2018 State Hazard Mitigation and Climate Adaptation Plan, Commonwealth of Massachusetts.

temperatures even more. The combination of all these factors come together to create what is known as a heat wave. Typically, a heat wave can last two or more days with significant impacts on human health and/or infrastructure. Heat waves can also cause catastrophic crop failures, cause roads to crumble, and can cause the ground around residences to dry out, leaving them susceptible to subsidence.

The Town of Brewster can expect to be uniformly affected by extreme heat-related conditions. Table 2-16 below represents the significant extreme heat-related hazard events that have occurred in and around the Town of Brewster over time, utilizing NOAA's National Centers for Environmental Information (http://www.ncdc.noaa.gov/). All events are county wide (Barnstable County), unless otherwise noted.

Table 2-16 Significant Extreme Heat-Related Events, Barnstable County

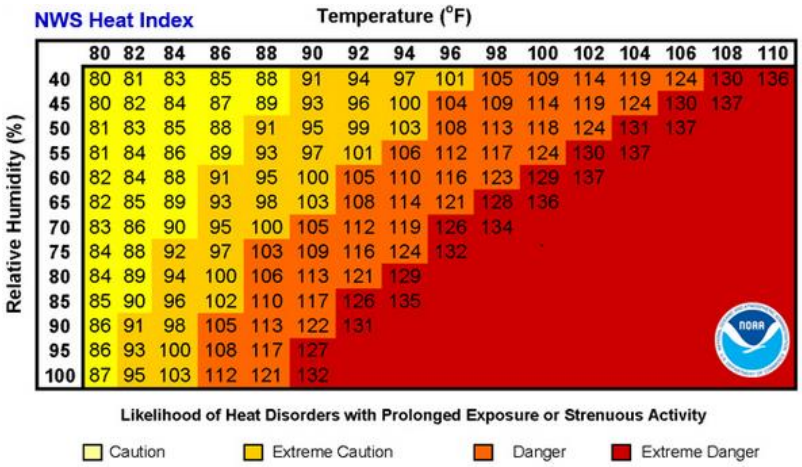
Hazard Type	Date	Level/Description	Damages
Extreme Heat			
	7/22/2011		

Source: NOAA National Centers for Environmental Information, www.ncdc.noaa.gov.
Data is current through December 2019

NOAA's NWS maintains a Heat Index (Figure 2-3), which is a measure of how hot it really feels when relative humidity is also factored in with actual air temperatures. As an example, if the air temperature is 96°F and the relative humidity is 65%, the heat index, how hot it feels, is 121°F. The NWS also initiates alert procedures when the Heat Index is expected to exceed 105°-110°F (depending on local climate) for at least two consecutive days:

1. Caution – fatigue possible,
2. Extreme Caution – sunstroke, muscle cramps, and/or heat exhaustion possible,
3. Danger – sunstroke, muscle cramps, and/or heat exhaustion likely, and
4. Extreme Danger – heat stroke or sunstroke highly likely.

Figure 2-4 NOAA's National Weather Service Heat Index



Source: https://www.weather.gov/phi/heatcond

Based on the high frequency and minor severity of extreme heat events, as reported by the National Centers for Environmental Information and indicated in Table 2-16 and confirmed by the LHMW, the risk of future extreme heat events is considered moderate in Brewster.

Climate Change Impacts on Extreme Heat

More intense and prolonged heat waves are predicted with climate change. The frequency of days with high temperatures at or above 90°F has already increased (Vallee and Giuliano, 2014). The average number of days expected to be above 90°F in 1950 was about seven, while the new normal is 12.

MVP Climate Change Projections on Extreme Heat

As mentioned previously, climate change impacts will result in increased average temperature so the number of extreme heat days is expected to increase. Brewster should experience more days with warmer temperatures, particularly days over 90 degrees, and thus, will expend more energy on cooling. Table 2-17 below includes temperature projections (Annual and Summer) with a Baseline (1971 – 2000) through mid-century (2050s) for the Cape Cod Basin.

Table 2-17 Extreme Heat Temperature Projections, Cape Cod Basin

Climate Parameter	Baseline 1970 - 2000	Projected Change in 2030s	Mid-Century 2050s
Average Annual Temperature (°F)	49.9	51.7 – 53.3	52.3 – 55.3
Average Summer Temperature (°F)	68.2	69.7 – 71.8	70.2 – 73.8
Maximum Annual Temperature (°F)	57.7	59.3 – 61.2	59.9 – 62.9
Maximum Summer Temperature (°F)	76.0	77.3 – 79.4	77.9 – 76.6

Annual Days with Maximum Temperature Over 90 °F	1	2 - 5	3 - 10
Summer Days with Maximum Temperature Over 90 °F	1	2 - 4	3 - 9
Annual Cooling Degree-Days (Base 65 °F)	436	581 – 800	660 – 1,037
Summer Cooling Degree-Days (Base 65 °F)	384	491 - 663	533 - 841

Source: MVP Program, www.resilientma.org

Property/People at Risk from Extreme Heat-Related Hazards

Extreme heat-related conditions can have both short- and long-term impacts on a community, including:

Social Impacts

Increased demand on emergency, health, and social services and support:

- Impacts to vulnerable populations (elderly, homeless, special needs, and those with chronic health conditions) will be exacerbated (potential for cardiovascular and respiratory complications).
- Can endanger those who work outdoors.
- Increased demand for comfort/cooling stations (emergency services).
- Stressors (mental health) on those who do not have/can't afford air conditioning.
- Increased demands on emergency personnel and medical facilities.

Infrastructure Impacts

Disruptions to critical infrastructure with cascading effects:

- Increased electricity demand for cooling which can lower the ability of transmission lines to carry power.
- Impacts on transportation systems:
    - Higher temperatures can cause pavement to soften and expand causing rutting/potholes, stress bridge joints, and limit construction activities outdoors.
- Disruptions to water distribution systems:
    - Limited supply of water sources and quality of water sources.

Environmental/Built Environment Impacts

Compromised environmental conditions:

- Particularly damaging to agriculture (crops/livestock) stressing water supply sources (economic impacts and food security).
- Excessively dry ground conditions can be susceptible to subsidence and exacerbate stormwater runoff.
- Compromised air quality conditions can result in increased hospital admissions for heat-related illness.
- Potential for drought (s) to exacerbate conditions for wildfires.

Probability of Future Occurrence of Drought-Related Hazards

Although Massachusetts is relatively small, it has a number of distinct regions that experience significantly different weather patterns and react differently to the amounts of precipitation they receive.[11] Brewster is considered at moderate risk with minor expected damages for and extreme heat-related events (Table 2-2 Hazard Index).

2.3.6 Drought - Related Hazards

Drought is a temporary irregularity characterized by long durations of below normal precipitation. Drought occurs in virtually all climatic zones yet varies significantly from one region to another, due to its relationship to normal precipitation in that specific region. Drought can affect agriculture, water supply, aquatic ecology, wildlife, and plant life.

Drought can be defined or grouped by the following:

- Meteorological drought is a measure of departure of precipitation from normal, defined solely on the degree of dryness.
- Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts with a focus on precipitation shortages, differences between actual and potential evapo-transpiration, soil water deficits, reduced groundwater or reservoir levels, etc.
- Hydrological drought is associated with the effects of precipitation (including snowfall) shortfalls on surface or subsurface water supply and when water supplies are below normal.
- Socioeconomic drought is associated with the supply and demand of some economic goods with elements of meteorological, hydrological, and agricultural drought.

Based on past events and current criteria outlined in the Massachusetts Drought Management Plan, it appears that western Massachusetts may be more vulnerable than eastern Massachusetts to severe drought conditions.[12] That being said, many factors, such as water supply sources, population, economic factors (i.e., agriculture based economy), and infrastructure, contribute to the severity and length of a drought event. The Town of Brewster can expect to be uniformly affected by drought conditions. Table 2-18 below represents the significant drought-related hazard events that have occurred in and around the Town of Brewster over time, utilizing NOAA's National Centers for Environmental Information (http://www.ncdc.noaa.gov/). All events are county wide (Barnstable County), unless otherwise noted.

[11] 2018 State Hazard Mitigation and Climate Adaptation Plan, Commonwealth of Massachusetts
[12] 2018 State Hazard Mitigation and Climate Adaptation Plan, Commonwealth of Massachusetts.

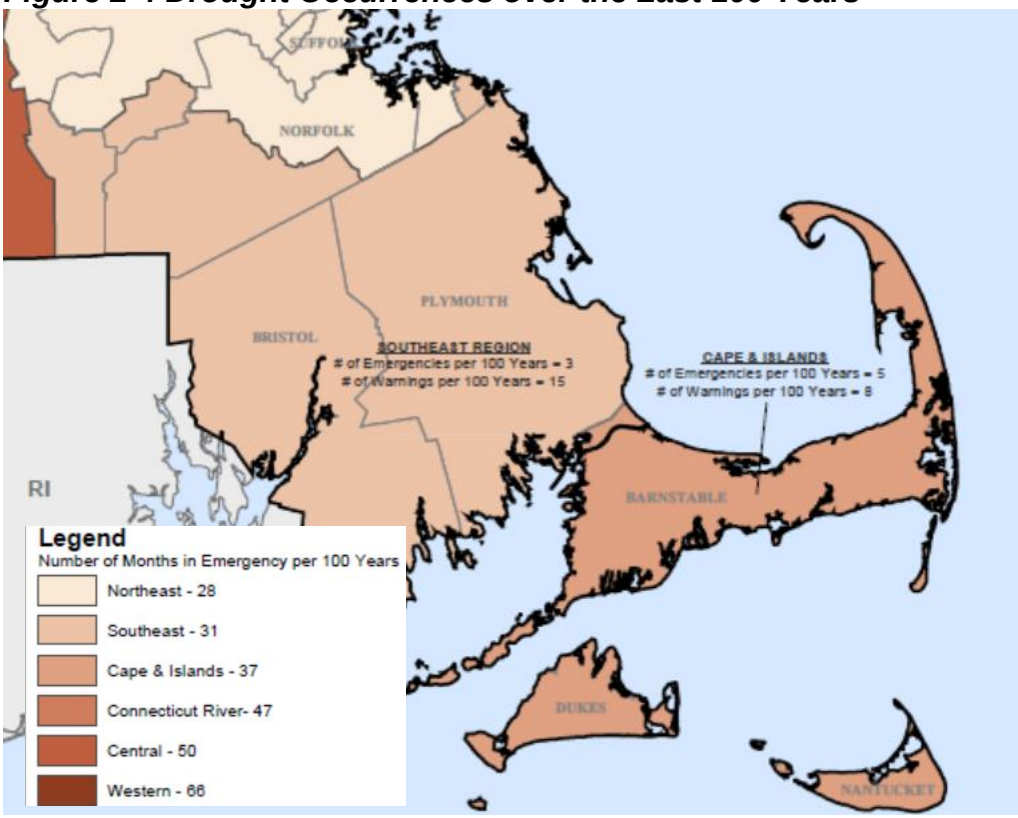
Table 2-18 Significant Drought-Related Events, Barnstable County

Hazard Type	Date	Level/Description	Damages
Drought			
	4/24/2012	Severe drought (4/24/12 to 5/15/ 2012)	
	5/1/2012	Severe drought (4/24/12 to 5/15/ 2012)	
	8/30/2016	Severe drought designated	
	9/1/2016	Severe drought (9/1/16 to 9/30/2016	
	10/1/2016	Severe drought (10/1/16 to 10/31/2016	
	11/1/2016		

Source: NOAA National Centers for Environmental Information, www.ncdc.noaa.gov.
Data is current through December 2019

Figure 2-4 shows that Barnstable County (and Cape and Islands overall) has been in a drought emergency for thirty-seven months over the last 100 years.

Figure 2-4 Drought Occurrences over the Last 100 Years



Source: 2018 State Hazard Mitigation Plan, Commonwealth of Massachusetts.

Based on the high frequency and minor severity of drought events, as reported by the National Centers for Environmental Information and indicated in Table 2-18, the risk of drought is considered moderate/high in Brewster.

Climate Change Impacts on Drought-Related Hazards
Climate change will result in increased average global temperatures, which will likely decrease the number of extreme cold days.

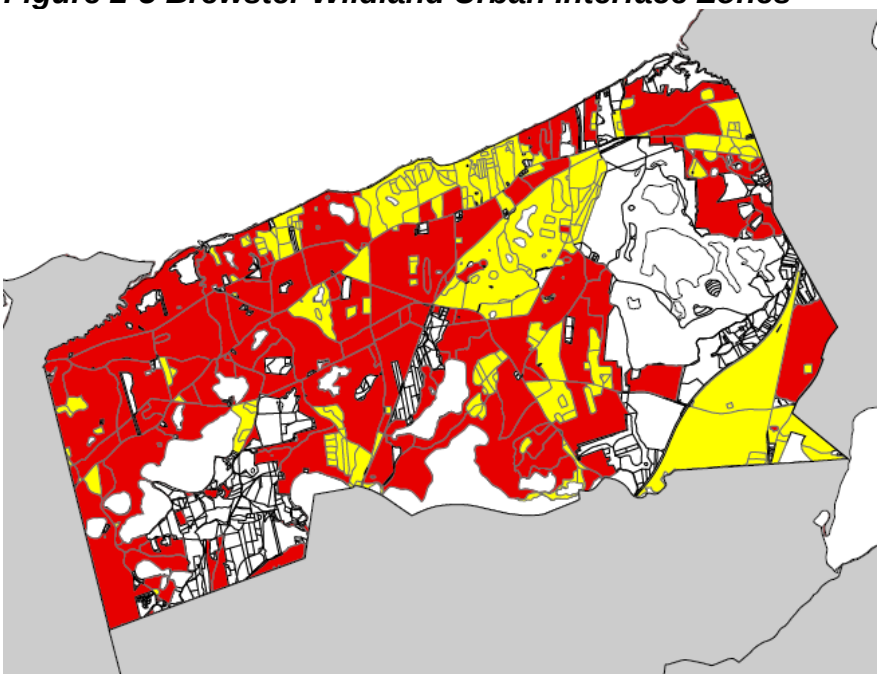
2.3.7 Urban Fire/Wildfire – Related Hazard

Urban fire or conflagration is a large destructive, sometimes uncontrollable, fire that spreads substantial destruction, typically as a result of other hazards, including storms, earthquakes, gas leaks, transportation accidents, hazardous material spills, criminal activity (arson), or terrorism.[13] Alternatively, smaller-scale structural fires often result from everyday events such as cooking, smoking, equipment/appliance malfunctions, etc.

Wildfires are defined as any non-structure fire that occurs in the vegetative wildland, including grass, shrub, leaf litter/debris, and forested tree fuels. Most susceptible to the hazard are pitch pine, scrub oak, and oak forests – the most flammable vegetative fuels. Small wildfires are common throughout the State, especially when drought or near-drought conditions warrant, the potential for spreading wildfires is real. The State's Wildland Urban Interface (WUI) – the area where structures and human development meet and intermingle with undeveloped wildland, creates an environment in which fire can move readily between structural and vegetative fuels, mapped in yellow as shown below (Figure 2-6). The State's WUI includes the Intermix WUI – areas where housing and vegetation intermingle[14], mapped in red as shown in Figure 2–5).

[13] Ibid.
[14] Radeloff, V.C., R.B. Hammer, S.I. Stewart, J.S. Fried, S.S. Holcomb, and J.F. McKeefry. 2005. The Wildland Urban Interface in the United States. Ecological Applications 15:799-805.

Figure 2-5 Brewster Wildland Urban Interface Zones



Source: http://silvis.forest.wisc.edu/data/wui-change/

The impact and vulnerability to wildfire is influenced by a variety of factors, such as land cover conditions, weather and the effectiveness of land management techniques. Suburban neighborhoods located at the WUI are very vulnerable to wildfire. Individual buildings may be more or less vulnerable to damage from wildfire based on factors such as the clear distance around the structure, and the structure's construction materials. A fire in any of these areas would quickly overwhelm local resources and could possibly threaten homes nearby.

Based on the high ranking identified in the Barnstable County Wildfire Preparedness Plan, Barnstable County is considered at high risk to future urban/wildfires.

Climate Change Impacts on Urban Fire/Wildfire
Climate change can alter the weather and fuel factors of wildfires. Hot dry spells can increase the risk of fire due to decreased soil moisture and increased evaporation/evapotranspiration. Climate change can also increase winds that spread fires.

Property at Risk from Urban Fire/Wildfire-Related Hazards

The Town averages approximately 11 wildfires annually and about twelve brush fires annually, none of which have resulted in any significant property damage. Specific areas prone to wildfires include residences within and adjacent to Nickerson State Park, Punkhorn Parklands, Baker's Pond, Ellis Farm, and the various campgrounds located throughout the community.

Probability of Future Occurrence of Urban Fire/Wildfire Hazards

Most urban fires are a result of negligent and/or intentional human behavior (arson, open flames, and cooking) and are preventable. Wildfire season in Massachusetts begins in late March and typically ends in early June, which also corresponds with the driest live fuel moisture periods of the year.

There have been 101 wildfire/brushfires since 2012, for an average of 11 wildfires annually. For this plan, Brewster is considered at high risk for future urban fire/wildfire-related events.

2.3.8 Invasive Species-Related Hazards

For this plan, invasive species (existing and early detection/emergent) for Brewster have been incorporated as a hazard impacting the community. Invasive species are non-native species that can impact the environment, the economy or human health. Typically, they have the potential to cause or contribute to the following:

- Habitat loss/degradation
- Loss of native fish, wildlife, and tree species
- Loss of recreational opportunities and income
- Crop damage/diseases in humans

The list of invasives currently impacting Brewster include:

- Amur Honeysuckle (*Lonicera maackii*)
  Secretes chemical compounds that are harmful to amphibians, and fatally toxic to freshwater insects and crustaceans.
- Asian Bush Honeysuckles (*Lonicera tatarica*)
  Form very dense populations that can outcompete and suppress the growth of native plant species.
- Asiatic Bittersweet (*Celastrus orbiculatus*)
  Fast growing vines can cover, shade and outcompete other vegetation. It can even girdle and kill large trees.
- Autumn-olive (*Elaeagnus umbellate*)
  Form a dense shrub layer which displaces native species and closes open areas.
- Black Locust (*Robinia pseudoacacia*)
  Can dominate and shade native species.
- Border Privet (*Ligustrum obtusifolium*)
  Forms dense thickets that shades native species.
- Burning Bush (*Euonymus alatus*)
  Threatens a variety of habitats including forests, coastal scrublands and prairies where it forms dense thickets, displacing many native woody and herbaceous plant species.
- California Privet (*Ligustrum ovalifolium*)

Fast grower that out-competes native vegetation.

- Chinese Privet (*Ligustrum sinense*)
  Forms an inpenetrable thicket and out-competes native species.
- Common Reed (*Phragmites australis*)
  Rapidly form dense stands of stems which crowd out or shade native vegetation in inland and estuary wetland areas. Turns rich habitats into monocultures devoid of the diversity needed to support a thriving ecosystem.
- Common Barberry (*Berberis vulgaris*)
  Grows into dense stands and out-competes native vegetation.
- Common Mullein (*Verbascum Thapsus*)
  Vigorous grower that can easily overtake a site quickly.
- Cypress Spurge (*Euphorbia cyparissias*)
  Aggressive invader is one of the first plants to emerge in spring displacing native vegetation by shading and out-competing native vegetation for water and nutrients.
- Dwarf Honeysuckle (*Lonicera xylosteum*)
  Fast spreading and displaces native species.
- European Privet (*Ligustrum vulgare*)
  Forms dense thickets and out-competes native vegetation.
- Garlic Mustard (*Alliaria petiolata*)
  Forms dense stands that choke out native plants in the understory by light, water, and nutrient resources.
- Japanese Barberry (*Berberis thunbergii*)
  Displaces many native herbaceous and woody plants. In large infestations, its leaf litter causes changes in the chemistry of the soil, making it more basic.
- Japanese Honeysuckle (Lonicera japonica)
  Fast growing and displaces native species.
- Japanese Knotweed (*Polygonum cuspidatum)*
  Chokes-out native species by way of limiting sunlight infiltration, altering nutrient cycles, or by releasing toxic/inhibiting chemicals. Knotweed can contribute to stream bank erosion and flooding.
- Japanese Rose (*Rosa rugosa*)
  Spreads voraciously and chokes out native species.
- Leafy Spurge (*Euphorbia esula*)
  Overtakes large areas of land and displace native vegetation.
- Morrow's Honeysuckle (*Lonicera morrowii*)
  Out-compete native plants for nutrients, air, sunlight and moisture.
- Multiflora Rose (*Rosa multiflora*)
  Extremely prolific and can form dense thickets, excluding native plant species.
- Northern Catalpa (*Catalpa speciosa*)
  Out-compete native plants for nutrients, air, sunlight and moisture.
- Norway Maple (*Acer platanoides*)

Produce large numbers of seeds that are wind dispersed and invade forests and forest edges. The dense canopy formed by Norway maple inhibits the regeneration of sugar maple and other tree seedlings, reducing forest diversity.

- Porcelain-berry *Ampelopsis brevipedunculata)*
  Invades streambanks, pond margins, forest edges and other disturbed areas. The thick mats formed by this climbing vine can cover and shade out native shrubs and young trees.
- Russian Olive (*Elaeagnus angustifolium*)
  Out-compete native vegetation interfering with natural plant succession.
- Scotch Broom (*Cytisus scoparius*)
  An opportunistic and aggressively prolific plant that often disturns natural areas and forest lands.
- Sycamore Maple (*Acer pseudoplatanus*)
  Capable of producing large numbers of young trees giving rise to dense stands that can crowd out native species.
- Tree of Heaven (*Ailanthus altissima)*
  Produce an overly abundant amount of seeds, reproduction through roots and a chemical that can prevent or kill other plants near it has made it a species that have many states concerned. This invasive tree threatens to overwhelm our natural areas, agricultural fields and roadsides.
- Water Chestnut (*Trapa natans*)
  Colonizes areas of freshwater lakes and ponds and slow-moving streams and rivers where it forms dense mats of floating vegetation, causing problems for boaters and swimmers and negatively impacting aquatic ecosystem functioning.
- Wineberry (*Rubus phoenicolasius*)
  Opportunistic plant that quickly fills in gaps in vegetation, taking advantage of increased sunlight in the tree canopy.

Property at Risk from Invasive Species

Invasive species typically harm native species through predation, habitat degradation and competition for shared resources. Negative consequences can be far-reaching, considering they can spread at astonishing rates and can affect property values, agricultural productivity, public utility operations, native fisheries, tourism, outdoor recreation, and the overall health of an ecosystem. Dependent upon the species, invasives often thrive along roadsides, forested and understory areas, lakes, ponds, rivers, streambanks and pond margins.

Probability of Future Occurrence of Invasive Species

Eradication involves both chemical and mechanical methods, combined with ongoing monitoring. Often, due to limited staffing and diminished municipal budgets, limited controlled stands are typically often realized at best.
Because most invasives are considered more of a nuisance hazard and not directly associated with any primary impacts of other weather-related hazards such as loss of life, limited evacuation, or property damage, Brewster is

considered at low risk with minor expected damages at a small/local level for future spread of invasive species (Table 2-2 Hazard Index).

2.3.9 Communicable (Infectious) Disease – Related Hazard

An infectious disease is an illness due to a specific infectious agent or its toxic products that arises through transmission of that agent or its products from an infected person, animal, or inanimate source to a susceptible host; either directly or indirectly through an intermediate plant or animal host, through a vector, or through contact with the inanimate environment. Diseases such as pertussis, and most recently, COVID-19, are examples of infectious diseases that can pose a threat to a community's population. To gauge the potential impact of disease on the state's human population, it is helpful to classify disease occurrences according to the following:

- **Isolated case of a high-consequence disease:** One or more cases of a particularly serious disease whose further spread is unlikely yet place significant strain on the resources required to isolate and provide treatment.
- **Institutional outbreak:** Two or more cases of similar illness with a common exposure at an institution.
- **Epidemic:** An increase, often sudden, in the number of cases of a disease above what is normally expected in the population.
- **Pandemic:** An epidemic that has spread over several countries or continents affecting many people.

The extent of an infectious disease's impact depends greatly on a number of factors, including:

- The disease's transmissibility, virulence, and pathogenesis,
- Environmental conditions,
- Modes of transmission,
- Individuals' vulnerability factors, such as population densities and/or underlying medical conditions/comorbidities,
- Quality, availability, and equity of healthcare services,
- Immunization history, and
- Availability/accessibility of medical treatment to protect against and treat the disease.

The Brewster Board of Health/Health Department, together with the Barnstable County Department of Health and Environment, is responsible for the protection and promotion of the public's health, control of disease, protection of the environment, and promotion of sanitary living conditions.

Table 2-19 presents data from the Brewster Health Department's top communicable diseases for 2015 - 2020. According to the Health Department,

the top communicable diseases for Brewster in 2020 was COVID-19 with 218 cases, followed by Babesiosis (microscopic parasites that infect red blood cells via tickborne transmission) with six cases.

Table 2-19 Top Infectious Diseases Brewster, MA 2015 – 2020

Condition	Number of Cases					
	2015	2016	2017	2018	2019	2020
Babesiosis	11	14	8	6	5	6
Campylobacteriosis		5	1			4
COVID-19						218
Hepatitis C	9	5		3		4
Human Granulocytic Anaplasmosis	5	7	6		3	1
Influenza	23	10	21	27	15	5[A]
Lyme Disease	30[B]	58	6[C]	4	40[D]	0

Source: Brewster Health Director, July 2, 2021
Notes:
A: 15 suspected cases
B: 7 confirmed/23 probable/59 suspected cases
C: 74 suspected cases
D: suspected cases

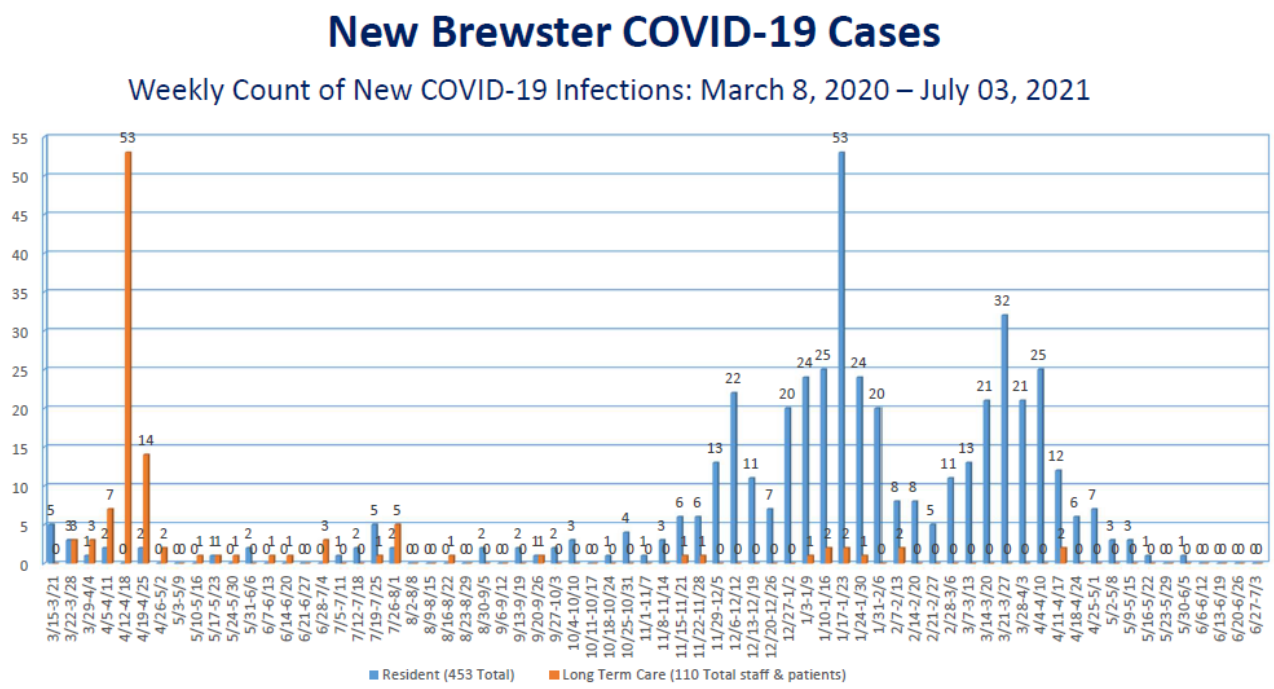
Most recently (January 2020) the Corona Virus pandemic was circulating the world. The first confirmed case of COVID-19 was reported in the Commonwealth of Massachusetts on February 1, 2020 with the number of cases increasing rapidly on March 5, 2020. On March 10, 2020, Governor Baker declared a state of emergency. On March 15, 2020 schools and businesses began to close, with a stay-at-home advisory ordered on March 23, 2020 through April 7, 2020. Phase 1 of the state's reopening plan began on May 18, 2020 with places of worship, essential and manufacturing businesses, and construction sites allowed to reopen with strict limitations. The Commonwealth entered Phase 2 of its reopening plan on June 8, 2020 with childcare, day camps, lodging retail stores, outdoor dining at restaurants and youth sports program allowed to reopen with strict limitations. Step 1 of Phase 3 reopening began July 6, 2020, followed by step 2 of Phase 3 for 'lower risk' communities on October 5, 2020. A second wave began with a large spike in cases in October 2020, requiring the roll back to Phase 3, Step 1 of the reopening plan. As of the end of the first week of February 2021, Massachusetts was averaging over 2,000 confirmed new cases and approximately 50 confirmed deaths per day. Figure 2-7 below illustrates new COVID-19 cases per day (weekly) for the Town of Brewster. As of July 2, 2021, there have been 13,975 confirmed cases and 471 deaths in Barnstable County. As of July 2, 2021, 67% (6,995) of Brewster residents have been fully vaccinated.

Working with the State of Massachusetts, the Brewster Health Department developed and implemented a number of COVID-19 related guidance

documents, standard operating procedures (SOPs), policies and memorandums of understanding/agreements (MOUs/MOAs) for Brewster including:

- Municipal personnel vehicle-use guidance
- Town Hall staffing policy
- Municipal training policies
- Municipal office setting SOPs
- Municipal Pool/Camp policy
- Brewster schools sports travel policy
- Nauset Regional School Nurses/Health Directors COVID Committee to address cluster school cases
- Seasonal, outdoor food/alcohol services policies
- Outer Cape Health Services MOU (testing/vaccinations/homebound vaccinations)
- VNA of Cape Cod MOU
- Region 5b Public Health Agencies MOA

Figure 2-6 Weekly Count New Covid-19 Infections: March 2020 – June 2021, Brewster



Source: [Brewster Health Department.]

Based on the highly likely probability and vulnerability, and extended notice warning time score of communicable (infectious) disease-related events, in addition to the frequency and probability of continued COVID strains, the Town of Brewster is considered at high risk for future communicable (infectious) disease-related hazards.

Population at Risk from Communicable (infectious) Disease-Related Hazards

The entire community is susceptible to the spread of infectious diseases, however, in crowded areas/urban centers where people are in close-proximity and contact with one another, transmission can be exacerbated.

Probability of Future Occurrence of Communicable (infectious) Disease-Related Hazards

As it relates to the current COVID 19 pandemic, until the federal government, and in turn, State of Massachusetts, completes its roll out a reliable vaccination plan for COVID-19, and supplies of vaccines are accelerated, the Town will continue to be at high risk to future occurrences (infected residents, increased hospitalizations and increased number of deaths). Otherwise, the probability of incidents that result from infectious disease occurring in Brewster is difficult to predict, however, with such incidents occurring every year, the probability of an incident over the next year has a significant probability. The probability of an event progressing to the epidemic or pandemic stage within the same time period, is less clear.

2.3.10 Human-Caused (Intentional) Hazards

The term human-caused, or terrorism most often refers to intentional, criminal, malicious acts that originate from human activity. Although there is no single, universally accepted definition of terrorism, the Code of Federal Regulations (CFR) defines terrorism as "the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.[15]

Cyber (Security) Incident

A cybersecurity incident can be characterized as any incident that threatens the confidentiality, integrity, and accessibility of an information system or its' processes, in violation of security policies and practices. Often, cybersecurity incidents require effective response to minimize loss of critical information, but also for continuity of services and security. Although cybersecurity incidents occur frequently, the type of attacks vary significantly and can be classified into three categories:

- **Hacktivists/Petty Criminals**: Constitute most cyber-attacks on the Internet, typically conducted by single individuals or unaffiliated groups using little technical skill and sophistication.
- **Organized Crime/Cyber-terrorists**: Target a specific person or entity for financial gain, intellectual property, or blackmail. These structured attacks tend to be more organized and planned, relying on insider knowledge.

[15] 28 CFR, Section 0.85.

- **Sophisticated Nation States**: Although limited in number, these attackers conduct reconnaissance over long periods of time, with sophisticated preparation and organization.

The risks associated with cybersecurity attacks range from data breaches, personal financial loss, and disruptive actions that carry out social and/or political objectives, including:

A. **Internet of Things (IoT):** Presents unique security challenges (data breaches) due to the number of interconnected devices and systems present, and not created with security in mind.
B. **Cyber theft:** Cyber thieves hacking customer accounts, stealing names, credit and debit card numbers, encrypted PIN data, and card expiration dates (personal financial loss).
C. **Advanced Persistent Threat (APT):** Threat actors gaining unauthorized access to computer systems as a means of carrying out various disruptive actions to achieve political or social objectives.

Based on the high ranking identified in the Massachusetts Hazard Index and Risk Assessment, also confirmed by the Brewster LHMW, the Town of Brewster is considered at high risk to future cyber/cybersecurity incident-related hazards.

Population at Risk from Cybersecurity Incident-Related Hazards

The entire population is significantly reliant on technology for daily life, albeit cell phones, tablets or computers. Public health/access to medical records, power grid failure, government operations, commercial/economic operations, and communications infrastructure are also vulnerable to cyber-attacks. Cyber incidents are not always associated with a defined geographical area therefore, the entire Town is equally susceptible to a cybersecurity incident-related hazard.

Probability of Future Occurrence of Cybersecurity Incident-Related Hazards

Although there have been a number of public safety, local government, medical and education incidents throughout the state, there has only been one recent cyber threat recorded by the Town in 2015 where a municipal department was impacted by ransomware attack. The incident was considered minor, and the IT (Information Technology) Department had the system up and running again by the end of the day. The closest cybersecurity incident for Barnstable County was in December 2018 at Cape Cod Community College. A phishing email distributed a virus in an attachment targeted at the college's financial transactions overwriting URL addresses for the college's bank. Hackers transferred nine fraudulent funds totaling $807,130 from the college.[16]
As hackers become more skilled and sophisticated, there is a likely probability of a cybersecurity incident occurring.

[16] https://www.seculore.com/resources/cyber-attack-archive/massachusetts

Terrorism Incident

The Federal Bureau of Investigation (FBI) defines terrorism as the "the unlawful use of force or violence against persons or property to intimidate, or coerce a government, civilian population, or any segment thereof in the furtherance of political and social objectives."[17] A more recent trend in terrorist threats is the use of weapons of mass destruction (WMD) and improvised explosive devices (IEDs) which require a relatively low level of skill to produce. Vehicle borne improvised explosive devices (VBIED) have also become a trend in terrorist attacks.

The threat an IED poses begins within an adversary's motives and intent to do harm. It becomes a "credible" threat if and when the adversary has the "capability" of doing the intended harm, and if the target has the vulnerability that will facilitate the harmful contact. Specific to IED attacks, 'capability' would include possessing (1) knowledge to build, place, and function an explosive device, and (2) access to materials needed to construct the device (possibly to manufacture the explosive itself). Components consistent with IED threat capabilities include financial support, physical support networks, size of cell with direct operational responsibility, amounts of constituent materials reasonably accessed for the device, gadgeteering skills in construction, technical expertise, and tactical proficiency. If the adversary possesses all the necessary capabilities to carry out the intended threat, they then become limited only by their imagination.

In addition to IEDs and VBIEDs, acts of terrorism also include more commonly available devises such as guns (for mass shootings), edged weapons, vehicles (to use as rams into crowds), and in addition, an emerging trend is the use of drones.[18]

There have been no terrorist attacks recorded in Brewster. Based on the high moderate ranking identified in the Massachusetts Hazard Index and Risk Assessment, also confirmed by the Brewster LHMW, the Town of Brewster is considered at moderate risk to future terrorism hazards.

Population at Risk from Terrorism-Related Hazards

The entire population is equally susceptible to a terrorist attack.

Probability of Future Occurrence of Terrorism-Related Hazards

Although it is often difficult to predict where and when a terrorist attack will be, there remains a likely probability of a terrorist attack occurring.

Civil Unrest/Disturbance Incident

FEMA defines civil disturbance activity as "an activity such as a demonstration, riot, or strike that disrupts a community and requires intervention to maintain

[17] Federal Bureau of Investigation, 2005, Terrorism 2002 – 2005.
[18] Massachusetts Hazard Identification and Risk Assessment.

public safety."[19] Often, civil disturbances arise from spontaneous acts by individuals or a group seeking to gain attention for something they feel in unjust, such as a political grievance, social justice conflict, or response to the demand for goods and services. Citizens have the right to peaceful assembly, and not all assemblies result in violence. The public safety concern is for those assemblages that cause an immediate danger or result in damage or injury to property or person(s) participating or passersby.

As civil disturbances are often spontaneous in nature, it is difficult to predict when and where they may occur. With advancements in technology, such as social media, small gatherings can quickly turn into large, disruptive gatherings.
The severity of a civil disturbance incident varies and depends on the nature of the disturbance as well as the size of the crowd gathered. A low severity disturbance often results when police are dispatched to control traffic. A moderate severity disturbance is considered when businesses are disrupted or the result of property damage, requiring police intervention to restore order. Severe disturbance incidents typically involve some form of rioting, arson, assault, and potential death, warranting aggressive police intervention.

There have been no civil unrest/disturbance incidents recorded in Brewster. Based on the low-ranking score identified in the Massachusetts Hazard Index and Risk Assessment, also confirmed by the Brewster LHMW, the Town of Brewster is considered at low risk to future civil disturbance incident-related hazards.

Population at Risk from Civil Disturbance-Related Hazards

The entire Town is vulnerable to civil disturbance incident-related hazards.

Probability of Future Occurrence of Civil Disturbance Incident-Related Hazards

Though the risk remains, there is the potential of a civil disturbance incident occurring in the near future.

Chemical, Biological, Radiological, Nuclear (CBRN)

CBRN, often referred to as weaponized agents, have the ability to result in mass casualties and mass disruptions to society.[20]

Chemical Incident

A chemical incident is characterized as an unexpected uncontrolled release of a chemical from its containment, and typically occur at fixed-site facilities that manufacture, store, process, or otherwise handle chemical materials. Also, chemical incidents can also occur along major roadways, railways, waterways, and pipelines.

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[19] FEMA, n.d. Glossary: Civil Disturbance.
[20] Massachusetts Hazard Identification and Risk Assessment.

Biological Incident
A biological incident can be characterized by the accidental or intentional release of naturally occurring biological diseases by way of a biological agent, including:

A. **Bacteria:** single-cell organisms that are the causative agents of anthrax, brucellosis, tularemia, plague, as well as other diseases.
B. **Rickettsia:** micro-organisms that resemble bacteria in their form and structure however, differ in that they can reproduce inside animal cells as intracellular parasites (Typhus, Rocky Mountain spotted fever, and Q fever).
C. **Viruses:** intracellular parasites that are about 100 times smaller than bacteria infecting humans, crops, and domestic animals.
D. **Fungi:** can cause severe disease in humans, such as coccidioidomycosis (valley fever) and histoplasmosis.
E. **Toxins:** poisonous substance made by a living system, or a synthetic analogue of a naturally occurring poison (ricin and botulinum toxin).

Biological agents used as weapons fall into three groups: bacteria; viruses; and toxins. Many are difficult to grow and maintain, while many become non-toxic when exposed to environmental factors such as sunlight. On the other hand, others can be very long-lived. Biological agents are deadly in and of themselves, however, the method and accuracy of their delivery determines the overall severity of their damage.

The severity of a biological incident depends on the routes of exposure and means of delivery, including:

A. **Inhalation:** The biological agent is aerosolized in a particle size that could be inhaled by an individual.
B. **Injection:** The introduction of an agent into an individual by penetrating the skin barrier (syringe).
C. **Ingestion:** Swallowing the agent or toxin.
D. **Absorption:** Absorption of an agent by an individual's body, most readily through the mucous membranes.
E. **Person-to-person:** Infecting an individual through a variety of means (including those listed above), with the hope of further community spread.

Radiological/Nuclear Incident
A radiological/nuclear incident can be characterized as the uncontrolled release of radioactive material that can harm people or damage environmental resources. They typically involve nuclear assemblies, research, production, or power reactors and chemical operators. The Nuclear Regulatory Commission (NRC) provides guidance on these facilities and requires the development of response priorities and processes for a radiological event. The potential impacts from a nuclear event rely heavily on the nature of the event, as well as the weather conditions experienced during the time of the event. The NRC has developed an emergency classification system to indicate the risk of a radiological incident to the public, including:

A. **Notification of Unusual Event**: Events are in process or have occurred which indicate potential degradation in the level of safety of the plant (no release of radioactive material requiring offsite response/monitoring).
B. **Alert**: When declared, events are in process or have occurred which involve an actual or potential substantial degradation in the level of safety of the plant (releases of radioactive material are expected to be limited to a small fraction of the Environmental Protection Agency (EPA) Protective Action Guidelines (PAG) exposure levels).
C. **Site Area Emergency**: Involves events in process, or which have occurred that result in actual or likely major failures of plant functions needed for protection of the public (releases of radioactive material not expected to exceed the EPA PAG exposure levels except near the site boundary).
D. **General Emergency**: Events are in process or have occurred which involve actual or imminent substantial core degradation or melting with potential loss of containment integrity (releases can reasonably be expected to exceed the EPA PAG exposure levels offsite).

There have been no recorded chemical, biological, radiological or nuclear incidents in Brewster. Based on the moderate ranking score identified in the Massachusetts Hazard Identification and Risk Assessment, also confirmed by the Brewster LHMW, the Town of Brewster is considered at moderate risk to future CBRN incident-related hazards.

Population at Risk from CBRN Incident-Related Hazards
The entire Town is vulnerable to a CBRN incident-related hazard. Urban areas and areas where people gather are at greater risk.

Probability of Future Occurrence of CBRN Incident-Related Hazards
There is an unlikely probability of a CBRN incident occurring in Brewster.

2.3.11 Technological (Accidental) Hazards

This section incorporates human-related hazards considered to be 'accidental' in nature rather than intentional or acts of terrorism previously discussed.

Infrastructure Failure
Infrastructure failure hazards generally refer to the critical infrastructure/utility facilities or 'lifeline sectors' necessary for the safety, security, and economic well-being of the State and its cities and towns. Infrastructure failure is considered any disruption to critical infrastructure that could have cascading effects that negatively impact a community's security, public health and safety, and economic vitality. The Commonwealth has designated six lifeline sectors whose resources and assets are critical to every aspect of daily lives, in addition to their interdependence on each other and all other sectors (Table 2-20).

Brewster is served by the following public utilities:

- Electricity is supplied by Eversource (NSTAR)
- Natural gas is supplied by National Grid
- Drinking water is supplied by the Brewster Water Department from the Cape Cod Sole Source Aquifer (Monomoy Lens)
- Wastewater is managed by on-site Title 5 subsurface disposal systems, Innovative Alternative systems, or other offsite satellite or centralized treatment processes.
- Telephone/Cell Phone service is provided by AT&T, Sprint, T-Mobile, and Verizon
- Internet/Cable service is provided by Earthlink, Verizon, xfinity, dish and Direct TV (cable)

Table 2-20 Lifeline Sectors Impacted by Infrastructure Failure

Lifeline	Description
Communications	The communications sector includes any services that enable both routine and emergency communications, such as cell towers, phone lines, dispatch systems, radio infrastructure, and satellite communications.
Emergency Services	The emergency services, which include police, fire, emergency management, public works, and emergency medical services life line sectors, provide support to the public during daily response operations. The emergency services sector represents the first line of defense in the prevention and mitigation of risk from hazards such as terrorist attacks, human-caused incidents, and natural disasters. In addition, the emergency services sector has a myriad of specialized capabilities such as hazardous materials response, search and rescue, and tactical teams.
Energy	The energy sector provides power to the community, public and private sectors, government, and first responders. The energy sector is divided into three interrelated segments: electricity, oil, and natural gas.
Information Technology	The information technology sector includes all system networks, hardware, software, information technology systems and services, and the Internet.
Transportation Systems	Transportation systems include roadways (federal, state, and local managed), railway (passenger and freight), airports, and marine ports (passenger and freight). Transportation incidents include a large-scale crash, collision, or incident involving the disruption of an air, land (road), rail, or marine mode of transportation. The Commonwealth is home to major highways, airports, railroads and marine ports.
Water and Wastewater Systems	Water and wastewater/septic systems ensure the provision of clean water and the treatment of all water and wastewater. Safe drinking water is a prerequisite for protecting public health and all human activity and properly treated wastewater is vital for preventing disease and protecting the environment.

Source: Massachusetts Hazard Identification and Risk Assessment.

Communications

The services that rely heavily on communications include emergency response providers and healthcare providers. Disruptions in their ability to communicate effectively can result in delays in emergency response, medical treatment, and potentially loss of life. Disruptions in the general public's communications systems can result in delays regarding the dissemination of emergency information warnings and/or alerts.

Climate Change Impacts on Communications

Natural hazard events can often directly contribute to communications threats primarily through the long-term loss of power. Projected increases in the frequency and severity of natural hazards, particularly wind-related events such as downed power lines, will likely impact the continuity of communications.

Energy

The energy sector is unique in that it enables the functionality of all infrastructure sectors. Power outages, the most common type of failure, can result in negative sequential patterning to the environment and lifestyle: it can cause an overabundance of carbon monoxide due to the use of generators, grills and similar items during an outage; spoiling of food; compromised water purification systems resulting in water that may be unsafe to drink; loss of heating/air conditioning, resulting in vulnerability to extreme heat and cold; electric shock resulting from damaged power lines and power surges when electricity is restored.[21]

Climate Change Impacts on Energy

Climate change and projected increases in warmer temperatures is likely to both increase electricity demand for cooling in the summer and decrease electricity, natural gas, heating oil, and wood demand for heating in the winter. SLR projections and increases in the frequency and intensity of intense storm events could disrupt energy production and delivery by damaging electricity infrastructure, fuel delivery infrastructure and equipment, power plants, or storage facilities.

Information Technology

Information technology systems and services include the networks, hardware, software, and the Internet that so many residents, businesses, and agencies/organizations rely on every day. Threats to information technology systems and services require effective responses to minimize loss of critical data and continuity of services and security.

[21] Massachusetts Hazard Identification and Risk Assessment, p. 207.

The Town periodically conducts comprehensive cyber security education and phish testing (sending phishing emails generated by the IT Department rather than a malicious attacker which provides insight into how well phishing training programs are working and which employees are most likely to be susceptible to a phishing email) for municipal employees. The Brewster Police Department and Council on Aging also conduct cyber education awareness training for residents periodically. The Town is currently transitioning to cloud services (Microsoft 365 – a remote cloud computing server rather than an on-site server), migrating municipal permits to the cloud and has redundant backups of servers.

Climate Change Impacts on Information Technology
Natural hazard events can often indirectly contribute to information technology threats through long-term loss of power, or extreme heat. Projected increases in the frequency and severity of natural hazards, particularly wind-related events such as downed power lines, will likely impact the provision for and security of information technology.

Transportation Systems
The quality of the Town's transportation systems (roads and highways) contributes significantly to the response of a disaster. Poor quality systems and structures can hinder access or limit ability to evacuate if necessary. Bridges are also a component of the critical infrastructure.

Climate Change Impacts on Transportation Systems
Natural hazard events can often indirectly contribute to transportation system threats through making roadways impassable. Projected increases in the frequency and severity of natural hazards such as precipitation and flooding, or wind-related events that cause downed trees or power lines will likely impact the provision for and security of transportation systems.

Drinking Water – Brewster Water Department[22]
The Town has five groundwater wells pumping water from the Monomoy Lens. The Monomoy Lens is one of the six groundwater lenses that make up the Cape Cod Sole Source Aquifer. Each of the well sites has large Town owned tracts of land surrounding them for water quality protection. Activity is restricted to passive recreation on Town wellfield acreage.

A Source Water Assessment was completed in Brewster in 2003 by members of the Department of Environmental Protection (DEP), Drinking Water Program (DWP). A Source Water Assessment and Protection (SWAP) Report has been issued and contains an evaluation of the land uses, environmental vulnerabilities and protection measures around the wellfield areas of the Town. The susceptibility of the Town's wells, as determined during the Assessment, is as follows: Wells #1 – 3 High; Well #4 and #6 Moderate. While these assessments

[22] Brewster Water Department, 2019 Annual Water Quality Report, 2019.

are serious, the reason for the determination is the lack of underground or geological formations, such as a clay layer, that would create a hydrological barrier to possible contamination.

In 2020, the Environmental Protection Agency (EPA) and the Horsley Witten Group, Inc. worked with the Town of Brewster to offer free, confidential, cybersecurity assessments and technical assistance to interested water and wastewater utilities. Based on the results of the water utility assessment, a cyber action plan was developed to assist the Town to better prepare for, respond to and recover from a cyberattack. Due to the limited size of the water utility and Town overall, separate incident response plans were developed for each.

Climate Change Impacts on the Drinking Water System
As sea levels rise, so too does the potential for saltwater intrusion in groundwater aquifers. This saltwater intrusion can significantly increase treatment costs or force the closure of the well.

Wastewater/Septic Systems
As previously discussed, wastewater in Brewster is managed by on-site Title 5 subsurface disposal systems, Innovative Alternative systems, or other offsite satellite or centralized treatment processes. Similar challenges exist to those further described in climate change impacts to wastewater/septic systems that follows.

Climate Change Impacts on Wastewater/Septic Systems[23]
Climate change poses several challenges to septic systems. First, rising sea levels associated with climate change cause near-shore groundwater tables to rise and reduce separation distances to the leachfield base, compromising the systems' ability to treat bacteria and pathogens in wastewater. Leachfields rely on unsaturated soil for proper physical and biochemical treatment of wastewater. When sea levels rise, saltwater from the ocean intrudes into groundwater reservoirs. The saltwater then displaces the less dense, lighter freshwater, causing the groundwater to rise into the soil profile above, limiting the amount of unsaturated soil beneath the leachfield.

Second, increased heavy precipitation events associated with climate change add to the problem of a rising groundwater table. Increased water percolating into the soil from above refills, or "recharges" the groundwater table, resulting in an even higher groundwater table. When increased recharge of groundwater tables (caused by increased precipitation) is combined with rising sea-levels, the groundwater levels could rise as much as an additional foot higher than the projected median sea-level rise at some coastal locations during these precipitation periods.

[23] Elena Mihaly, Avoiding Septic Shock: How Climate Change Can Cause Septic System Failure and Whether New England States are Prepared, Ocean and Coastal Law Journal Volume 23/Number 1, January 2018.

Third, the saturation from increased precipitation depletes oxygen in soils, compromising aerobic microbial activity and the resulting treatment of wastewater. In addition, rising temperatures from climate change further compromises healthy aerobic microbial function due to greater oxygen demand that affects biochemical treatment processes in the soil.

Critical infrastructure in each sector is located throughout the community, including communications infrastructure, energy facilities, transportation systems, and water facilities. Predicting the next infrastructure failure and precise location/sector is often difficult and generally dependent on the quality, upkeep, and maintenance of each piece of infrastructure. Brewster periodically experiences small scale infrastructure failures, often as secondary impacts from natural hazards such as power and communication outages. There have been no recorded disruptions to critical infrastructure that had cascading effects that negatively impacted the community's security, public health and safety, and economic vitality. Brewster is considered at moderate risk of future infrastructure failure incidents.

Population at Risk from Infrastructure Failure-Related Hazards
The entire Town is equally susceptible to an infrastructure failure incident.

Probability of Future Occurrence of Infrastructure Failure-Related Hazards
Although the State of Massachusetts has not experienced recent, prolonged catastrophic infrastructure failures, a significant failure could result in severe disruptions to public life and overall emergency response efforts. There is the potential probability of an infrastructure failure in Brewster within the next five years.

2.4 Vulnerability

Vulnerability indicates what is likely to be damaged by the identified hazards and how severe that damage could be. After identifying types and areas of risk, a vulnerability analysis can help to determine the gaps in the community. This section examines the vulnerability of the built environment, such as structures, utilities, roads, and bridges, as well as social and environmental vulnerability. A vulnerability analysis also estimates the number of people exposed to hazards, including elderly populations and concentrated populations. This also includes such things as whether the shelter capacity is sufficient for the affected population, and whether businesses are likely to face temporary closure due to natural disasters. Historical damages are often good indicators for current exposure and potential damage.

A vulnerability chart was developed based on the identification and profile of the natural hazards that have occurred throughout Brewster over time, as presented earlier in Section 2.3. Below, Table 2-21 Vulnerability Matrix 2021 describes the expected frequency of occurrence, and the potential severity of the damage resulting from each individual hazard evaluated for this update. Coordination with

the State Plan was also a consideration in the development of the updated Vulnerability Matrix.

Table 2-21 Vulnerability Matrix 2021

Hazard	Frequency	Severity
Flood-Related Hazards	High	Serious/Extensive
Winter-Related Hazards	High	Serious
Wind-Related Hazards	High	Serious/Extensive
Geologic-Related Hazards	Very Low/Low	Minor/Serious
Extreme Heat	High	Minor
Drought	High	Minor
Urban Fire/Wildfire	N/A	N/A
Invasive Species	Low	Minor

2.4.1 Development Trends

Since 2016, Brewster's vulnerability to natural disasters has not significantly changed. New developments are compliant with the updated State building codes and stormwater standards, and in turn, these more restrictive codes help facilitate decreases in a structures' overall vulnerability.

Land Use Changes

Brewster experienced a decrease in population and increase in total housing units over the past decade. Between 2010 – 2020, there was a 4.9% decrease in population and a 22% increase in housing stock.[24]

Residential/Mixed Use Development Trends

Development interest and activity continues in Brewster today. Below is a list of major development projects (approved, under construction, or completed since the 2016 draft plan), outside the Special Flood Hazard Area (SFHA):

Residential:

- Brewster Woods (affordable)
  - 30 rental units/Open Space
  - Completed
- Habitat for Humanity (affordable, Paul Hush Way)
  - 14 homes
  - Completed
- Serenity Brewster (age-restricted, 55+)
  - 132 units

[24] https://data.census.gov/cedsci/all?q=Brewster%20town,%20Barnstable%20County,%20Massachusetts%20Housing

    - Opening 2022

Commercial:

- Solar Array (2016)
    - 8,565 SF
    - Completed
- Cumberland Farms (2016)
    - 4,980 SF
    - Completed
- Brewster Fire Department (2016)
    - 23,472 SF
- Commercial Building (2016)
    - 2,400 SF
    - Completed
- Ocean Edge Resort (2017)
    - 6,960 SF Commercial
    - 2,269 SF Mixed Use
    - Completed
- Arts Empowering Life (2017)
    - 17,170 SF
- Commercial Building (2018)
    - 3,200 SF
    - Completed
- Cape Cod Grow Lab (2018)
    - 9,900 SF
- Ocean Edge Custom Homes (2019)
    - 4,200 SF
- Next Grid, Inc. (2019)
    - 35,483 SF (Solar Array)
- Latham Center, Inc. (2019)
    - 3,588 SF Administration Building
    - 10,956 SF Educational/Gym Space
    - 4,038 SF Meeting House/Office Building
- Distributed Solar Development, Inc./Town of Brewster (2020)
    - 36,692 SF (Solar Canopy)
    - Completed
- Next Grid, Inc. (2020)
    - 365,468 SF (Solar Array)

Commercial Development Trends

Other than the new Fire Station and Latham Center (residential care/treatment/education facility), commercial development has been relatively limited in Brewster over the past five.

2.4.2 Economic Vulnerability

NFIP-Insured Property Damage

As seen in Table 2-22, FEMA estimated that the value of property insured by the NFIP in Brewster is $38,345,300 as of April 1, 2020 (MA State NFIP Coordinator/Deputy Hazard Mitigation Officer). Through April 1, 2020, twenty-one total losses were reported with a total of $84,471.07 in payments. In Brewster, there are no properties that meet FEMA's definition of repetitive flood loss through April 1, 2020: *A repetitive loss property is any property, which NFIP has paid two or more flood claims of $1,000 or more in any given 10-year period since 1978*.

Table 2-22 Summary of National Flood Insurance Program Activity in Brewster, MA

Total Policies	Coverage Value	Policies in A-Zone	Claims Since 1978
119	$38, 345,300	5	21/$84,471.07

Source: FEMA, NFIP, Loss Statistics from January 1, 1978 through April 1, 2020

Impacts of FEMA Flood Zones

HW performed an analysis to estimate the total land and building values within FEMA VE, 100-, and 500-year flood zones. The number and types of residential, commercial, industrial, and municipally owned structures are described earlier in Section 2.3.1 and quantified in Table 2-23 Total Vulnerability FEMA VE Flood Zone Summary, Table 2-24 Total Vulnerability 100-Year Flood Zone, 2-25 Total Vulnerability FEMA 500-Year Flood Zone, also shown on Map 2-3 FEMA Flood Hazard Areas.

Table 2-23 Total Vulnerability FEMA VE Flood Zone Summary

Land Use	No. of Parcels Impacted	Total Value
Charitable	8	$3,349,800
Commercial	1	$1,737,300
Hotel/Motel/Inn	1	$3,285,200
Improved - Selectmen (Town)	1	$1,903,900
Multiple Use Property	2	$4,866,800
Other Land	23	$5,393,000
Outdoor Recreation	3	$8,764,200
Public Service	1	$1,500
Residential	320	$385,284,300
State	8	$23,698,700
Vacant - Developable	6	$5,479,000
Vacant - Undevelopable	12	$141,200
Vacant - Conservation (Town)	10	$5,983,200

Vacant - Selectmen (Town)	14	$13,410,800
Total	**410**	**$463,298,900**

Source: Brewster Tax Assessor CAMA data, Massachusetts Property Tax Use Code.

Table 2-24 Total Vulnerability FEMA 100-Year Flood Zone Summary

Land Use	No. of Parcels Impacted	Total Value
Charitable	57	$9,014,500
Commercial	5	$54,631,500
Electric Generation	1	$2,315,000
Hotel/Motel/Inn	4	$13,954,700
Improved - Selectmen (Town)	4	$11,930,200
Mining/Quarrying	1	$2,440,500
Multiple Use Property	12	$12,509,650
Office	3	$2,109,500
Other Land	38	$6,122,600
Outdoor Recreation	7	$10,472,500
Productive Land	1	$253,540
Residential	1,344	$635,492,800
State	13	$41,988,700
Storage/Warehouse	1	$1,905,700
Utility	1	$1,124,900
Vacant - Developable	37	$12,151,200
Vacant - District	1	$1,733,300
Vacant - Undevelopable	49	$296,100
Vacant - Conservation (Town)	66	$19,920,500
Vacant - Conservation (other Town)	1	$8,200
Vacant - Selectmen (Town)	33	$7,777,000
Vacant - Tax/Title (Town)	1	$17,700
Total	**1,680**	**$848,170,290**

Source: Brewster Tax Assessor CAMA data, Massachusetts Property Tax Use Code.

Table 2-25 Total Vulnerability FEMA 500-Year Flood Zone Summary

Land Use	No. of Parcels Impacted	Total Value
Charitable	29	$1,901,500
Hotel/Motel/Inn	1	$8,155,000
Multiple Use Property	6	$7,451,430
Office	4	$2,684,300
Other Land	11	$646,200
Outdoor Recreation	1	$9,308,900
Productive Land	8	$1,407,370

Religious	1	$568,200
Residential	981	$330,228,400
Vacant - Developable	3	$985,700
Vacant - District	1	$513,300
Vacant - Undevelopable	22	$115,100
Vacant - Conservation (Town)	9	$1,436,900
Vacant - Selectmen (Town)	9	$2,613,800
Vacant - Tax/Title (Town)	1	$125,000
Total	**1,087**	**$368,141,100**

Source: Brewster Tax Assessor CAMA data, Massachusetts Property Tax Use Code.

Impacts of Sea Level Rise

Concerns about the accelerated rate of SLR in Massachusetts and the impacts on coastal areas, HW performed a second analysis to estimate the total assessed values of properties across a range of projected SLR scenarios (evaluated for 1-foot and 3-foot rise only). As discussed earlier, the CCC utilized NOAA's Office of Coastal Management – Digital Coast data to illustrate the potential for future impacts across the range of projected SLR scenarios for Massachusetts. The number and types of residential, commercial, industrial, and municipally owned structures are quantified in Table 2-26 Total Vulnerability Sea Level Rise 1-Foot Scenario and Table 2-27 Total Vulnerability Sea Level Rise 3-Foot Scenario below, also shown on Map 2-2 Sea Level Rise Scenarios (Appendix A).

Table 2-26 Total Vulnerability Sea Level Rise 1-Foot Scenario

Land Use	No. of Parcels Impacted	Total Value
Charitable	10	$2,592,300
Commercial	1	$1,737,300
Hotel/Motel/Inn	1	$3,285,200
Improved - Selectmen (Town)	1	$1,903,900
Multiple Use Property	2	$4,866,800
Other Land	20	$5,367,600
Outdoor Recreation	3	$8,764,200
Public Service	1	$1,500
Residential	281	$315,551,400
State	2	$1,299,300
Vacant - Developable	4	$5,164,500
Vacant - Undevelopable	6	$20,900
Vacant - Conservation (Town)	16	$6,911,100
Vacant - Selectmen (Town)	13	$11,475,000
Total	**361**	**$368,941,000**

Source: Brewster Tax Assessor CAMA data, Massachusetts Property Tax Use Code.

Table 2-27 Total Vulnerability Sea Level Rise 3-Foot Scenario

Land Use	No. of Parcels Impacted	Total Value
Charitable	12	$2,627,600
Commercial	1	$1,737,300
Hotel/Motel/Inn	1	$3,285,200
Improved - Selectmen (Town)	1	$1,903,900
Multiple Use Property	3	$6,382,600
Other Land	20	$5,367,600
Outdoor Recreation	3	$8,764,200
Public Service	1	$1,500
Residential	318	$360,948,500
State	8	$22,729,600
Vacant - Developable	6	$5,479,000
Vacant - Conservation (Town)	17	$7,211,200
Vacant - Selectmen (Town)	16	$13,474,700
Total	**407**	**$439,912,900**

Source: Brewster Tax Assessor CAMA data, Massachusetts Property Tax Use Code.

Impacts of Hurricane Surge Inundation Areas

HW performed a third analysis to estimate the total land and building assessed values of properties located within the worst-case hurricane surge areas for categories 1 through 4 hurricanes developed by the National Hurricane Center using the SLOSH Model. The number and types of parcels/structures are quantified in Table 2-28 Total Vulnerability Hurricane Category 1, Table 2-29 Total Vulnerability Hurricane Category 2, Table 2-30 Total Vulnerability Hurricane Category 3, Table 2-31 Total Vulnerability Hurricane Category 4 below, and also shown on Map 2-7 Storm Surge Scenarios.

Table 2-28 Total Vulnerability Hurricane Category 1

Land Use	No. of Parcels Impacted	Total Value
Charitable	7	$513,400
Commercial	1	$1,737,300
Hotel/Motel/Inn	1	$3,285,200
Improved - Selectmen (Town)	1	$1,903,900
Multiple Use Property	2	$4,866,800
Other Land	18	$5,322,900
Outdoor Recreation	3	$8,764,200
Public Service	1	$1,500
Residential	273	$301,115,000
State	2	$1,299,300
Vacant - Developable	3	$4,321,400

Vacant - Undevelopable	5	$17,600
Vacant - Conservation (Town)	10	$6,133,900
Vacant - Selectmen (Town)	10	$8,764,500
Total	**337**	**$348,046,900**

Source: Brewster Tax Assessor CAMA data, Massachusetts Property Tax Use Code

Table 2-29 Total Vulnerability Hurricane Category 2

Land Use	No. of Parcels Impacted	Total Value
Charitable	11	$2,642,300
Commercial	1	$1,737,300
Hotel/Motel/Inn	1	$3,285,200
Improved - Selectmen (Town)	1	$1,903,900
Multiple Use Property	2	$4,357,420
Other Land	20	$5,367,600
Outdoor Recreation	3	$8,764,200
Residential	308	$358,700,680
State	8	$22,729,600
Vacant - Developable	4	$5,164,500
Vacant - Undevelopable	8	$23,500
Vacant - Conservation (Town)	16	$6,911,100
Vacant - Selectmen (Town)	16	$13,474,700
Total	**399**	**$435,062,000**

Source: Brewster Tax Assessor CAMA data, Massachusetts Property Tax Use Code

Table 2-30 Total Vulnerability Hurricane Category 3

Land Use	No. of Parcels Impacted	Total Value
Charitable	31	$3,351,400
Commercial	3	$3,331,700
Hotel/Motel/Inn	1	$3,285,200
Improved - Selectmen (Town)	1	$1,903,900
Multiple Use Property	7	$8,698,250
Other Land	24	$5,937,200
Outdoor Recreation	1	$8,764,200
Public Service	1	$1,500
Residential	373	$424,287,800
State	8	$22,729,600
Vacant - Developable	10	$6,575,100
Vacant - Undevelopable	24	$180,500
Vacant - Conservation (Town)	21	$8,154,100
Vacant - Selectmen (Town)	16	$13,607,900

Total	**521**	**$510,808,350**

Source: Brewster Tax Assessor CAMA data, Massachusetts Property Tax Use Code

Table 2-31 Total Vulnerability Hurricane Category 4

Land Use	No. of Parcels Impacted	Total Value
Charitable	36	$4,344,300
Commercial	3	$3,331,700
Hotel/Motel/Inn	4	$6,241,800
Improved - Selectmen (Town)	1	$1,903,900
Mining/Quarrying	1	$2,440,500
Multiple Use Property	10	$10,422,850
Other Land	22	$5,864,100
Outdoor Recreation	3	$8,764,200
Public Service	1	$1,500
Religious	1	$568,200
Residential	484	$506,664,700
State	11	$24,724,900
Storage/Warehouse	1	$1,905,700
Utility	1	$1,124,900
Vacant - Agricultural/Horticultural	2	$1,000
Vacant - Developable	14	$9,045,700
Vacant - Undevelopable	39	$244,100
Vacant - Conservation (Town)	16	$8,348,800
Vacant - Conservation (other Town)	1	$8,200
Vacant - Selectmen (Town)	14	$12,583,400
Vacant - Tax/Title (Town)	2	$16,200
Total	**667**	**$608,550,650**

Source: Brewster Tax Assessor CAMA data, Massachusetts Property Tax Use Code

Impacts of Business Interruption

Notwithstanding the obvious costs of commercial property damage, the impacts of potential business interruption from a natural disaster in Brewster cannot be under-estimated. Business closures result in a reduction of revenues to proprietors and a loss of wages to employees. Also, State and local tax revenues can be significantly reduced. In addition to the costs of commercial property damage, the impacts from potential business interruption following a disaster in Brewster could have long-lasting effects on the local economy, quality of life, and sense of place that has been maintained and revered for generations.

2.4.3 Social Vulnerability

A critical step in assessing risk and vulnerability of Brewster to natural hazards is to identify the links between the potential destructive impacts to the built and natural environments and that relationship to the social structure. The social assets/potential losses continue to be key components of the community and include the closure of institutions, loss of vital services (communication and transportation systems), and disruption in the movement of goods and services, and emotional strain from financial and physical losses.

The vulnerability of a community obviously includes the potential for direct damage to residential, commercial and industrial property, as well as, schools, government and critical facilities. However, it also includes the potential for disruption of communication and transportation following disasters. Any disruption to the infrastructure, such as a loss of electric power or break in gas lines, can interrupt businesses and cause stress to affected families. This is especially the case where residents are forced to evacuate their homes and become subject to shortages of basic supplies.

Public Infrastructure and Emergency Life Lines

As previously discussed in Section 2.3.11, infrastructure failure is considered any disruption to critical infrastructure that could have cascading effects that negatively impact a community's security, public health and safety, and economic vitality. Although the Town has been proactive in ensuring resilience in its infrastructure, the potential still exists. The development of mitigation actions has been considered over the next five years (Table 2-32).

Table 2-32 Lifeline Sectors Impacted by Infrastructure Failure

Lifeline	Description
Communications	The communications sector is an integral component of the underlying operations of all businesses, public safety organizations, and government. Communications (e.g., phone, cable, internet infrastructure can also be affected through loss of power to system components or direct physical damage to system components caused by natural disaster or intentional acts.
Emergency Services	Disruption of emergency services could inhibit response, which could have cascading impacts to include serious injury or death to those who do not receive emergency services in a timely manner or at all.
Energy	This lifeline sector is uniquely critical because it provides and enables the functionality of all infrastructure sectors. For example, the energy sector supplies fuels to the transportation industry, electricity to households and businesses, and other sources of energy that are integral to growth and production across the nation.

Lifeline	Description
	Power outages, the most common type of failure, can result in negative sequential patterning to the environment and lifestyle: it can cause an overabundance of carbon monoxide due to the use of generators, grills, and similar items during an outage; spoiling of food; compromised water purification systems resulting in water that may be unsafe to drink; loss of heating/air conditioning, resulting in vulnerability to extreme heat and cold; electric shock resulting from damaged power lines and power surges when electricity is restored. Power outages can be particularly dangerous for critical facilities, such as hospitals. Many vaccines must e refrigerated, and a power outage could severely deplete the supply of certain vaccines in the affected area. Depending on the scale of the of the power outage, power may not be restored for some time. If a power outage occurs during extreme cold, water heaters, plumbing systems, and heating and cooling systems may be susceptible to damage due to freezing.
Information Technology	The information technology sector is central to security, economy, and public health and safety as businesses, governments, academia, and private citizens in the Commonwealth of Massachusetts are increasingly dependent upon technological functions for communications and operations.
Transportation Systems	Transportation incidents become critical when they negatively impact or affect critical infrastructure dependent on transportation systems for operations. These can include: transportation and energy systems, defense installations, banking and financial assets, water supplies, chemical plants, food and agricultural resources, police and fire departments, hospitals and public health systems, and government offices.
Water and Wastewater Systems	Water distribution can be affected in three ways: the amount of water available; the quality of the water; and the viability of the physical components of the distribution systems. Contamination of the water supply can occur naturally, as a result of human error, or intentionally. Occasionally, the release of agricultural run-off, manure or other farming byproducts can contaminate water. Disruption to the distribution system can occur because of loss of power to pumping and treatment stations.

Source: Massachusetts Hazard Identification and Risk Assessment.

Evacuation/Population at Risk

The use of mass care facilities during an emergency is dependent on a variety of circumstances. These include warning time, public awareness of the hazard, the level of encouragement from public officials and the availability of shelters. The Town's existing shelter capacity in Red Cross certified shelters is 1,225 persons,

plus the capacity of the Cape Cod Regional Technical High School in Harwich with capacity for approximately 1,000 persons. All shelter facilities have generators. In the event of a major catastrophic event, during tourist season, with people unable to leave Cape Cod, turning back and seeking shelter in the closest town, the total number of persons needing shelter could be extremely high.

Of the Town's estimated 2018 population of 9,806, it is anticipated that an average of approximately 981 (10%) will evacuate and 8,825 will remain in place. Of the evacuating 981, it is estimated that one-third (or 327) will seek some sort of short-term shelter, and one-half (163) will require long-term sheltering – on any given day outside of tourist season. In the event of a major catastrophic event, during tourist season, with people unable to leave Cape Cod, turning back and seeking shelter in the closest town, the total number of persons needing shelter could be significantly higher (population nearly doubles during peak tourist season). That being said, if it is anticipated 10% of the population will evacuate (of an estimated 20,000 people) with approximately 2,000 people looking to evacuate. Of the evacuating 2,000, it is estimated that one-third (or 667) will seek some sort of short-term shelter, and one-half (or 334 will require long-term sheltering. Based on the existing shelter capacity in Brewster (Table 2-33), as well as additional capacity at the Cape Cod Regional Technical High School in Harwich (overflow shelter), there appears to be sufficient capacity for both residents and tourists.

Shelter use is not easily predicted because each emergency situation has different variables such as the length of the warning period, official encouragement of the evacuation, public awareness of the location and availability of shelter, and the severity of the approaching hazard. Shelter use may be higher in the winter, such as an ice or snowstorm, since homes would be without heat should there be power outages.

Table 2-33 Brewster/Regional Public Shelter Facilities

Facility Name	Capacity	Generator
Eddy Elementary School	400	Yes
Stony Brook Elementary School	400	Yes
Captain's Golf Course	150	Yes
Cape Cod Sea Camps	100	Yes
Our Lady of the Cape Catholic Church	75	Yes
Church of Jesus Christ of Latter-Day Saints	100	Yes
Total	**1,225**	

Source: Town of Brewster LHMW

Cultural Resources

Brewster's cultural resources include historic structures, museums, archival collections, and archaeological sites. These resources are significant not only to

the Brewster's history, but also to its economic vitality as a tourist destination. The Town has the Brewster Old King's Highway Historic District listed on the National Register of Historic Places, and several, and the Factory Village Historic District on the State Register of Historic Places. There are also a number of archaeologically sensitive areas. Brewster has a number of mansions, called "Sea Captain's Houses," as well as many other historic homes and structures. Totaling over 200, these are a highly visible component of the historic, rural character of the Town. Brewster also has private, non-profit and Town-owned historical buildings, organizations and museums with valuable archival collections.

Both historic structures and archival collections are subject to loss due to fire, flood, or other natural disasters. Archaeological resources may be uncovered during heavy winds or coastal erosion due to severe storms. Appropriate initial treatment and prompt response measures can help prevent total loss of these resources in the event of a natural disaster or fire.

2.4.4 Environmental Vulnerability

Hurricanes, earthquakes, nor'easters, floods or any weather-related hazard event, in addition to invasive species, will have particular impacts on the natural and built environment. Differences in storm size, speed of movement, wind speeds, and landfall location relative to vulnerable resources makes for high variability in impacts and related costs associated with weather-related events. For invasive species, the location and breadth of the growth/stands will cause the same variability in impacts, however, mostly indirect in nature.

When the natural environment is impacted there are both direct and indirect costs. Impacts of severe weather events to the natural environment include both direct (loss of habitat and salinization of land/ groundwater) and indirect costs (widespread inland damage to the built environment, threats to ecosystems/ species, and contamination of potable water supply).

2.5 FEMA Disaster Grant Assistance

FEMA has provided the Town of Brewster with approximately $215,067.40 in grant assistance for the following recent disasters:

- 2019 Tornado
  Disaster Number: Unknown…Barnstable County did not qualify, however, State legislatures provided supplemental funding.
  $17,710.00

  Main Items for Funding Provided for:
  - Personnel overtime/equipment (Fire/Police/DPW)

- March 2018 Severe Storm
  Disaster Number: DR-4372

$11,225.68

Main Items for Funding Provided for:
- Personnel overtime/equipment (Fire/Police/DPW)
- Materials expenses (salt/sand)

- January 2015 Snowstorm (Juno)
  Disaster Number: DR-4214
  $88,583.71

  Main Items for Funding Provided for:
  - Personnel overtime/equipment (Fire/Police/DPW)
  - Materials expenses (salt/sand)
  - Contractors snow removal and building/system repair costs

- February 2013 Snowstorm (NEMO)
  Disaster Number: DR-4110
  $46,135.59

  Main Items for Funding Provided for:
  - Personnel overtime/equipment (Fire/Police/DPW)
  - Materials expenses (salt/sand)
  - Contractors snow removal and building/system repair costs
- Superstorm Sandy (2012)
  Disaster Number: DR-4097
  $29,191.35

  Main Items for Funding Provided for:
  - Personnel overtime/equipment (Fire/Police/DPW)

- August 2011 Tropical Storm Irene
  Disaster Number: 4028
  $22,221.07

  Main Items for Funding Provided for:
  - Personnel overtime/equipment (Fire/Police/DPW)
  - Contractors building/system repair costs

Section 3 Capability Assessment

3.1 Introduction

The Capabilities Assessment section has been restructured to better document local, state, and federal department, agency and program capabilities in terms of pre- and post-disaster activities. It has been organized into three main sections: Planning and Regulatory capabilities, Administrative and Technical capabilities, and Financial capabilities to better define the programs, policies, and funding opportunities each department or agency is implementing to reduce risk and work towards implementing hazard mitigation programs targeted at increased resiliency.

The Town of Brewster implements several hazard mitigation policies and procedures, current state laws, executive orders, and regulations to promote the safety of its residents and minimize risk to community assets. This section presents a brief description of each of the primary mitigation programs currently in place.

3.2 Planning and Regulatory Capabilities

Town of Brewster Vision Plan 2018

The Brewster Vision Plan expresses the community's preferences for how it intends to evolve socially, physically and economically by guiding town decisions and serving as a framework for other future plans, such as a comprehensive plan. Eight building blocks were developed, those of which are applicable to hazard mitigation planning are referenced below:

Coastal Management

Goal: In the context of coastal change, preserve and protect Brewster's coastal resources and expand public access.

Purpose 1: Protect coastal resources in ways that preserve coastal ecosystems and habitats and the character of the town and coastal neighborhoods.

1. Develop a town-wide Coastal Resource Management Plan based on science and best practices, with a focus on soft solutions, protecting habitat and managing stormwater.
2. Consider best practices for minimally sensitive infrastructure such as boardwalks, parking setback from sensitive areas and the use of permeable materials for parking areas.
3. Implement the Brewster Coastal Adaptation Strategy for the Town's public beaches and landings, including engaging citizens before coming up with specific plans.

Purpose 3: Adapt to climate change projections and advance adaptation and resiliency techniques that are financially and environmentally sustainable.

a. Identify techniques such as living shorelines, nourishment from dredged material, and land acquisition for retreat locations to adapt to coastal change.
b. Provide outreach and education (signs, field trips, publications) to build awareness of citizens and decision makers about the nature of coastal change.

Mapping Storm Tide Pathways in Cape Cod Bay, Massachusetts 2021

In 2019, the Center for Coastal Studies identified 12 pathways in Brewster that are 12 inches above the water level recorded by the USGS Sesuit Harbor tide gauge (16.4 ft MLLW) which would likely flood approximately 49 acres of land and represent new areas of flooding that town staff may not be aware of but might want to consider for future planning.

Open Space and Recreation Plan 2021

The Open Space and Recreation Plan is another planning document intended to advise the Board of Selectmen on open space preservation and acquisition efforts, act as a resource for other agencies with open space concerns, as well as other municipal officials, Boards and Commissions.

Brewster possesses valuable natural areas which provide an opportunity for open space preservation and acquisition. Areas which should be targeted for acquisition include agricultural lands, wetlands, land in drinking water supply watersheds, river and stream corridors, and areas of groundwater recharge. The following goals and objectives applicable to hazard mitigation planning are referenced from the Open Space and Recreation Plan 2021:

Goal 1: Protect the Town's drinking water supply to meet the needs of residents and visitors today and in the future.

Objective 1-B: *Protect existing public supply wells from land-based sources of contamination.*

Goal 3: Preserve and enhance habitat diversity and protect marine and fresh surface water resources to maintain their important ecological functions and values to the community.

Objective 3-A: *Protect marine and freshwater resources from pollution and degradation.*

Objective 3-C: *Acquire, preserve and enhance natural areas to mitigate natural hazards and increase Brewster's resilience to climate change impacts, including projected sea level rise.*

Objective 3-D: *Increase public awareness of the importance of natural resource protection, conservation management, and the impacts of climate change and*

natural disasters to promote environmental stewardship.

Goal 4: Provide a variety of recreation and open space opportunities to promote healthy and active lifestyles for Brewster residents, ensuring equitable access for all users and abilities.

Objective 4-G: *Plan for future pandemics that impact access to open space and recreational resources.*

Integrated Water Resources Management Plan 2013

A series of regulatory and non-regulatory recommendations identified as part of the Phase II analysis, including:

General Recommendation

- Continue to protect open space in sensitive watersheds and in Zone IIs to the Town's public supply wells.

Water Supply

- Strengthen the Water Conservation Bylaw (Chapter 112, Article 1 of the Brewster Town Code.
- Strengthen the Zoning Bylaw provision for drinking water quality protection by mandating the Natural Resource Protection Design (NRPD) in its District of Critical Planning Concern (DCPC), rather than 'encouraging' it.

Stormwater

- Implement a Stormwater Management Bylaw.
- Encourage Low Impact Development (LID) through Zoning Bylaws and Subdivision Rules and Regulations.

Subdivision Rules and Regulations (Chapter 290, Article IV Design and Construction Standards

The Town's Subdivision rules and Regulations (amended 5/27/2009) include requirements that address Drainage and Protection of Natural Features that also address hazard mitigation in the Town.

Section 290-19 Drainage

- The construction of a drainage system, including methods of construction and quality of materials used, shall be in conformity with the definitive plan, and the details shall conform to the details of the Massachusetts Highway Department specifications and standards and typical roadway construction details unless specifically excepted by the Board.
- There shall be a drainage basin every 300 feet on continuous grades.
- The quantity of stormwater carried by drains normally shall be determined by the Rational Formula Method, unless an engineer shows evidence that

another approach is more appropriate in a specific case. However, in no event shall the protection provided be for a lower design storm than specified below. The design storm shall be 25 years in normal cases involving developments, 10 years for industrial subdivisions and 100 years for bridge openings.

- The engineer shall provide a plan for stormwater runoff based on the method outlined above, which shall be attached to the road profiles. Additionally, a topographic plan showing the areas of drainage contribution both on and abutting the development shall be furnished.

Section 290-24 Protection of Natural Features

Due regard shall be shown for all natural features, such as large trees, watercourses, scenic vistas, historic properties and similar community assets, which, if preserved, will add attractiveness and value to the subdivision.

- Topsoil. Topsoil removed during construction shall be redistributed so as to provide at least four inches of cover to all areas of the subdivision and shall be stabilized by seeding and planting. At no time shall topsoil be removed from the site or tract without written permission from the Board.
- Trees. To the fullest extent possible, existing trees shall be preserved by the developer. Special consideration shall be given in the layout of lots and the position of dwellings on the lots to ensure that existing trees shall be preserved, during the process of grading lots and roads. Where there is a question as to the desirability of removing a group of trees in order to allow for use of the land for a lot or lots, and these trees which serve to add interest and variety to the proposed subdivision, the Board may, after proper investigation, withhold approval of such lot or lots.
- Floodplains. Proposed subdivisions shall comply with the state floodplain regulations and any acts in amendment thereof in addition thereto or in substitution therefor. Written notice to the Brewster Conservation Commission will be given by the developer if any portion of the proposed subdivision involves wetlands.
- Removal, filling or dredging of certain areas on coastal waters. Proposed subdivisions shall comply with the Wetlands Protection Act, and any acts in amendment or in addition thereto or in substitution therefor. Filling of any lands within a proposed subdivision should be brought to the attention of the Board at the time of the preliminary plan.

Flooding, Chapter 100 Brewster Zoning Code

Whereas certain areas of the Town of Brewster are subject to periodic flooding causing serious damage to properties within these areas; and whereas relief is available in the form of federally subsidized flood insurance as authorized by the National Flood Insurance Act of 1968; and whereas it is the intent of the Town to require the recognition and evaluation of flood hazards in all official actions relating to land use in the floodplain areas having special flood hazards; and whereas the Town of Brewster has legal authority to adopt land use and control

measures to reduce flood losses pursuant to the Constitution and General Laws of the commonwealth; now, therefore, the Town of Brewster hereby votes that:

A. It will enact and maintain in force for those areas having flood hazards adequate land use and control measures with enforcement provisions consistent with the criteria set forth in § 1910 of the National Flood Insurance Program Regulations.
B. The Conservation Commission or Selectmen or Planning Board is hereby authorized and directed to:
    1. Assist the Flood Insurance Administrator in delineating flood hazard areas on available local maps of sufficient scale to locate building sites for future Town Meeting consideration.
    2. Provide such information as the administrator may request concerning present uses and occupancy of the floodplain.
    3. Cooperate with federal, local and state agencies and private firms which undertake to study, survey, map and identify flood hazard areas and cooperate with neighboring communities with respect to management of adjoining flood hazard areas in order to prevent aggravation of existing hazards.
    4. Submit on the anniversary date of the community's initial eligibility an annual report to the administrator on the progress made during the past year within the community in the development of floodplain management measures.
    5. Take any other action reasonable and proper to carry out program objectives of minimizing or eliminating flood damage.

Floodplain District (Zoning Code, Article II Establishment of Districts, Section 179-7)

The Floodplain District is established as an overlay district. All uses otherwise permitted in the underlying district are allowed, provided that they meet the following additional requirements, as well as those of the Massachusetts State Building Code dealing with construction in floodplains and coastal high hazards.

Statement of purpose. The purposes of the Floodplain District are to:

- Regulate development in areas subject to coastal storm flowage, particularly high hazard velocity zones. in order to minimize threats to public safety, potential loss of life, personal injury, destruction of property, and environmental damage inevitably resulting from storms, flooding, erosion and relative sea level rise.
- Enable safe access to and from coastal homes and buildings for homeowners and emergency response personnel, such as police, fire and rescue departments or other emergency response officials.
- Reduce or prevent public health emergencies resulting from surface and ground water contamination from inundation of or damage to sewage disposal systems and storage areas for typical household hazardous substances.
- Minimize monetary loss and public health threats resulting from storm damage to public facilities (water and gas mains, electric, telephone lines,

streets, bridges, etc.). Avoid the loss of utility services which, if damaged by flooding, would disrupt or shut down the utility network and impact regions of the community beyond the site of flooding.

- Eliminate costs associated with the response to and cleanup of flooding conditions.
- Reduce damage to public and private property resulting from flooding waters.

Floodplain District boundaries and base flood elevation and floodway data.

- The Floodplain District is herein established as an overlay district. The District includes all special flood hazard areas within the Town of Brewster designated as Zone A, AE, or VE on the Barnstable County Flood Insurance Rate Map (FIRM) issued by the Federal Emergency Management Agency (FEMA) for the administration of the National Flood Insurance Program. The map panels of the Barnstable County FIRM that are wholly or partially within the Town of Brewster are panel numbers 25001C0394J, 25001C0413J, 25001C0414J, 25001C0416J, 25001C0417J, 25001C0418J, 25001C0419J, 25001C0438J, 25001C0582J, 25001C0584J, 25001C0601J, 25001C0602J, 25001C0603J, 25001C0606J, 25001C0607J and 25001C0626J dated July 16, 2014. The exact boundaries of the District may be defined by the one-hundred-year base flood elevations shown on the FIRM and further defined by the Barnstable County Flood Insurance Study (FIS) report dated July 16, 2014. The FIRM and FIS report are incorporated herein by reference and are on file with the Town Clerk, Planning Board, Building Commissioner and Conservation Commission.
- Floodway data. In Zone A and AE along watercourses that have not had a regulatory floodway designated, the best available federal, state, local or other floodway data shall be used to prohibit encroachments in floodways which would result in any increase in flood levels within the community during the occurrence of the base flood discharge.
- Base flood elevation data. Base flood elevation data is required for subdivision proposals or other developments greater than 50 lots or five acres; whichever is the lesser, within unnumbered A zones.
    a. Within Zone A, where the base flood elevation is not provided on the FIRM, the applicant shall cause a qualified professional to provide any existing base flood elevation data, which data shall he reviewed by the Building Commissioner/Zoning Agent for its reasonable utilization toward meeting the elevation or floodproofing requirements as appropriate, of the State Building Code.
    b. The Wetlands Protection Act may require applicants to determine base flood elevation information by engineering calculations using whichever specified methodology is most accepted by the Brewster Conservation Commission.

f. Notification of watercourse alteration. In a riverine situation, the property owner and/or applicant shall notify the following of any alteration or relocation of a watercourse:

- Adjacent communities.
- NFIP State Coordinator
  Department of Conservation and Recreation
  251 Causeway Street, Suite 600-700
  Boston, MA 02114-2104
- NFIP Program Specialist
  FEMA Region I
  99 High Street, 6th Floor
  Boston, MA 02110

E. Use regulations.

1. All provisions of the Code of' the Town of Brewster, Chapter 179, shall remain applicable within the Floodplain District; provided, however, where the Floodplain District Bylaw imposes additional or conflicting regulations, the more stringent local regulations shall prevail. All development in the Floodplain District, including structural and nonstructural activities, whether permitted by right or by special permit, most be in compliance with (Chapter 131, Section 40, of the Massachusetts General Laws and with the following:
   a. Section of the Massachusetts State Building Code which addresses floodplain and coastal high hazard areas (currently 780 CMR).
   b. Wetlands Protection Regulations, Department of Environmental Protection (DEP) (currently 310 CMR 10.00).
   c. Inland Wetlands Restriction, IMP (currently 310 CMR 13.00).
   d. Coastal Wetlands Restriction, DEP (currently 310 CMR 12.00).
   e. Minimum Requirements for the Subsurface Disposal of Sanitary Sewage, DEP (currently 310 CMR 15, Tile 5).
   f. Brewster Wetlands Protection Bylaw (currently Chapter 172, Brewster Town Code).
   g. Brewster Wetlands Conservancy District (currently Chapter 179, Article II, § 179-6, Brewster Town Code).
2. Any departure from the provisions and requirements of the above-referenced state or local regulations may only be granted in accordance with the required variance procedures of these state or local regulations.

F. Recommended uses. The following uses, which present low flood damage potential and are unlikely to cause obstructions to flood flows, are encouraged, provided they are permitted in the underlying district

and do not require structures, fill, or the storage of either materials or equipment.

1. Agricultural uses such as farming, grazing, truck farming, horticulture, etc.
2. Forestry and nursery uses.
3. Outdoor recreational uses, including play areas, nature study, boating, fishing and hunting where otherwise legally permitted.
4. Conservation of water, plants and wildlife.
5. Wildlife management areas, foot, bicycle, and/or horse paths and bridges provided such uses do not affect the natural flow pattern of floodwaters or of any watercourse.
6. Temporary nonresidential structures used in connection with fishing, hunting, bird watching, growing, harvesting, storage, or sale of crops raised on the premises.
7. Buildings and uses lawfully existing prior to the adoption of these provisions.

G. Use limitations.

1. Man-made alteration of sand dunes within Zone VE that increase potential flood damage is prohibited.
2. All new construction within Zone VE is required to be located landward of the reach of mean high tide.
3. All subdivision proposals shall be reviewed to assure that:
    a. Such proposals minimize flood damage;
    b. All public utilities and facilities are located and constructed to minimize or eliminate flood damage; and
    c. Adequate drainage is provided to reduce exposure to flood hazards.

H. Administration.

1. There shall be established a routing procedure which will circulate or transmit one copy of the development plan to the Conservation Commission, Planning Board, Board of Health, Town Engineer and Building Commissioner for comments which will be considered by the appropriate permitting board prior to issuing applicable permits.
2. The Building Inspector shall require the applicant to cause a qualified professional to provide records of elevation and floodproofing levels for new construction or substantial improvement within the flood district.

- Severability. If any provision of this section should he disapproved by the Attorney General or invalidated by a court of competent jurisdiction, the remainder of the section shall not be affected thereby. The invalidity of any section or sections or parts of any section or sections of this § 179-7 shall not affect the validity of the remainder of the Town of Brewster's Zoning Bylaw.

Wetlands Protection, Chapter 172 Brewster Zoning Code

The current Brewster Wetland Protection Regulations governs any activity proposed or undertaken which will constitute filling, dredging or altering any areas. These include marshes, wet meadows, bogs, swamps, vernal pools, coastal banks, land under salt ponds, and fish runs. The regulations also apply to any land within 100 feet of any of these areas.

The purpose of this chapter is to protect the wetlands, related water resources and adjoining land areas in the Town by prior review and control of activities deemed by the Conservation Commission to have or be likely to have an effect or cumulative effect upon wetland values, including but not limited to the following: public water supply, private water supply, groundwater and groundwater quality, water quality in the numerous ponds of the Town, flood control, erosion and sedimentation control, storm damage prevention, prevention of water pollution, fisheries, shellfish, wildlife and wildlife habitat, aesthetics and historic values (collectively, the "interests protected by this chapter"). This chapter is further intended to provide a means for review and correction of activities performed by any person in violation of any provision contained herein.

This chapter is adopted under the Home Rule Amendment of the Massachusetts Constitution and the Home Rule statutes, independent of the Wetlands Protection Act, MGL c. 131, § 40, and regulations thereunder.

Wetlands Conservancy District (Zoning Code, Article II Establishment of Districts, Section 179-6)

- Purpose. Wetlands Conservancy Districts are intended to preserve and maintain the groundwater table on which the inhabitants of this or other municipalities depend for water supply; to protect the purity of coastal and inland waters for the propagation of fish and shellfish and for recreational purposes; to protect the public health and safety; to protect persons and property from the hazards of flood and tidal waters which may result from unsuitable development in swamps, ponds, bogs or marshes along watercourses or in areas subject to floods or extreme high tides; and to conserve the natural character of the environment, wildlife and open space for the education and general welfare of the public.

- Locations and Boundaries
  I. Wetlands Conservancy Districts shall include all bordering vegetated wetlands, freshwater banks, land subject to flooding, land under a freshwater body, land under the ocean, coastal beaches, barrier beaches, rocky intertidal shores, land under salt ponds, fish runs, coastal dunes, coastal banks, salt marshes and land containing shellfish which are subject to the jurisdiction of the Wetlands Protection Act, MGL c. 131, § 40, as amended.
  II. Wetlands Conservancy Districts shall also include the following soil types and soil associations, the location and boundaries of which are shown by Overlay Map Sheets 11, 16, 17, 18 and 22 encompassing

the Town of Brewster and found in the “Soil Survey of Barnstable County, Massachusetts” issued March 1993 by the United States Department of Agriculture, Soil Conservation Service, which survey is hereby made part of this chapter: Amostown (AmA); Beaches (Bh); Belgrade Silt Loam (BlB); Berryland (BmA); Boxford (BoA) (BoB); Deerfield (DeA); Dune Land (Dn); Freetown (Fm, Ft); Freetown and Swansea (Fs); Hooksan (HoC, HoD, HxC); Ipswich, Pawcatuck and Matunuck (ImA); Maybid (MaA, MbA); Pipestone (PeA); Scitico (ScA); Brewster (SdA); and Walpole (WvA). Soil descriptions as well as their land uses and limitations are found in this survey. Any parcels of land under this section too small to show on the aforementioned map sheets but containing soil types and associations described in the above survey shall be subject to this chapter. Disturbed areas may be accorded Wetlands Conservancy District status if an on-site investigation determines that the filled area covers a Conservancy District soil or soil association.

- Prohibited Uses. The following uses are prohibited within the Wetlands Conservancy Districts as defined in this chapter:
  A. Residential or commercial structures.
  B. Dumping of filling with refuse, trash, rubbish or debris.
  C. Any sewage disposal systems, storage areas, tanks for chemicals or petroleum products, or other potential sources of substantial pollution.

- Permitted uses. Except as provided in Subsection E below, buildings, structures and premises in Wetlands Conservancy Districts may be used only for the following purposes, so long as no dredging or filling is involved.
  A. Fishing and shellfishing, including the raising and cultivation of fish and shellfish.
  B. Forestry, grazing and farming, nurseries, truck gardening and harvesting of crops, including but not limited to such crops as cranberries, marsh hay, seaweed, berries and shrub fruits and trees, and work incidental thereto.
  C. Conservation of soil, water, plants and wildlife.
  D. Outdoor activities, including hiking, swimming, boating, nature study, fishing, trapping and hunting.
  E. Drainage works which are part of the local flood and mosquito control conducted by an authorized public agent.
  F. Such other agricultural, horticultural, floricultural, religious and educational uses as are exempted from prohibition by MGL c. 40A, § 3.
  G. Uses accessory to residential or other primary uses, such as flower or vegetable gardens, lawns, pastures or forestry areas.
  H. The building and use of footbridges, constructed or fabricated trails and walks, stairways, docks and landings.

I. Notwithstanding the prohibition against any land filling or dumping of any soil, peat, sod, gravel, rocks or other mineral substances in Subsection E(4) below, land filling or dumping of any gravel, rocks, sand or other mineral substance is permitted for property owners for the sole purpose of repairing or re-nourishing of bay front beaches after storm damages.

- Uses permitted by a special permit. The Board of Appeals may issue a special permit for the following uses and structures in accordance with the provisions of § 179-5 of this chapter. Before issuing a special permit under this section, the Board of Appeals shall consider whether or not the proposed use will be detrimental to the environmental quality of both the subject and contiguous lands. The Board of Appeals may, as an alternative to a denial of a special permit under this section, impose such conditions as it deems necessary to contribute to the protection and preservation of subject land in accordance with the purposes of this chapter. Before issuing a special permit under this section, the Board of Appeals shall forward a copy of the application for the special permit to the Conservation Commission, and the Conservation Commission shall, within 35 days of receipt of a copy of such application, make recommendations to the Board of Appeals concerning the application for a special permit. The Board of Appeals shall not grant any special permit under this section until the report of the Conservation Commission has been received and considered, or until 35 days from delivery of the application copy for the special permit to the Conservation Commission has elapsed without the receipt or the report from the Conservation Commission. Any report of the Conservation Commission to the Board of Appeals under this section shall be an advisory report only. The following uses shall be permitted by a special permit only:
- Nonresidential buildings or structures to be used only in conjunction with fishing, shellfishing, the growing and harvesting and storage of crops raised on the premises and boathouses.
- Dams, changes in watercourses or other drainage works, only as part of an overall drainage plan constructed or authorized by a public agency as stated in Subsection D above.
- Appropriate municipal uses, such as waterworks, pumping stations and parks.
- Any landfilling or dumping of any soil, loam, peat, sand, gravel, rocks or other mineral substances
- Any draining, damming, dredging, altering or relocating any watercourse or the removal from Wetlands Conservancy Districts of loam, peat, sod, gravel, rocks or other mineral substances.
- Certain accessory uses related to scientific research or development, as and to the extent mandated in MGL c. 40A, § 9.

- Emergency action. Any special permit required by § 179-6 of this chapter shall not apply to emergency projects necessary for the protection of health and safety of the citizens of Brewster. "Emergency projects" shall mean any project certified to be an emergency by the Commissioner of the Department of Natural Resources (Department of Environmental Protection) and the Conservation Commission, if this chapter and MGL c. 131, § 40, are both applicable, or by the Conservation Commission alone, if only this chapter is applicable. In no case shall any filling, dredging or altering commence prior to any emergency certification, or extend beyond the time necessary to abate the emergency. Emergency action may be performed by:
- An administrative agency of the commonwealth or Town.
- A property owner, if emergency approval has or will be granted under the provisions of this Subsection F above and the Building Commissioner deems the action necessary to protect or prevent further damage to an approved and permitted building or structure. Corrective action is to be limited to protection only, and not to complete replacement.

Massachusetts State Building Code

The Town of Brewster enforces the Massachusetts State Building Code which includes many detailed regulations regarding wind loads, earthquake resistant design, flood-proofing and snow loads.

- Wind-Related Hazards
  - The Town enforces the Massachusetts State Building Code where provisions are adequate to mitigate against most wind damage. The code's provisions are the most cost-effective mitigation measure against tornadoes given the extremely low probability of occurrence.
  - The Town is in need of a bucket truck to assist in the trimming/removal of trees as needed.
- Geologic-Related Hazards
  - The State Building Code contains a section on designing for earthquake loads (780 CMR 1612.0) which states that the purpose of these provisions is "to minimize the hazard to life to occupants of all buildings and non-building structures, to increase the expected performance of higher occupancy structures as compared to ordinary structures, and to improve the capability of essential facilities to function during and after an earthquake." This section goes on to state that due to the complexity of seismic design, the criteria presented are the minimum considered to be "prudent and economically justified" for the protection of life safety. The code also states that absolute safety and prevention of damage, even in an earthquake event with a reasonable

probability of occurrence, cannot be achieved economically for most buildings.

Section 1612.2.5 sets up seismic hazard exposure groups and assigns all buildings to one of these groups according to Table 1612.5. Group II includes buildings which have a substantial public hazard due to occupancy or use and Group III are those buildings having essential facilities which are required for post-earthquake recovery, including fire, rescue and police stations, emergency rooms, power-generating facilities, and communication facilities.

Massachusetts Homeowners Handbook to Prepare for Coastal Hazards

This handbook was developed to help residents prepare for natural hazards in order to reduce risks to family and property, as a cooperative project with MEMA, FEMA MA CZM, MA DCR, MIT Sea Grant and Woods Hole Sea Grant. This handbook provides basic information on coastal storms, flooding and other hazards, how to protect residents and family members (recommendations for emergency supplies, evacuation kits, evacuation planning and procedures, and other important emergency information), how to protect property from wind and water hazards, general insurance information and resources to assist in recovery should storm damage occur, and an overview of climate change in Massachusetts and how it can exacerbate impacts from coastal hazards.

Town of Brewster Coastal Adaptation Strategy 2016

The Town of Brewster's Coastal Adaptation Strategy is a framework for future decision-making about Brewster's public coastal areas and will assist the Town in meeting the diverse access needs of the community and adapting to coastal change, sea level rise, storm surge and shoreline erosion. In developing this strategy, Brewster's shoreline conditions were evaluated and mapped under changing climate scenarios taking into account erosion and accretion along the coast, as well as SLR and storm surge impacts. Based on this evaluation, the Brewster Coastal Adaptation Group chose the following timeframes and future scenarios for the mapping and analyses of SLR and storm surge impacts on Brewster's coast:

- Time horizons of 20 years and a one-foot rise in sea level, 40 years and approximate two-foot rise in sea level, and 60 years and approximate four-foot rise in sea level.
- Storm surge levels of two, four, and eight feet.

A number of adaptation strategies were developed in the context of established guiding principles, those of which are applicable to hazard mitigation planning, referenced below:

New Access Locations in Adapting to the Future

The Town should continue to evaluate possible new access points to the shoreline through collaboration with existing property owners. Properties may include state and town-owned land and private properties. The Town

could evaluate how existing satellite parking facilities could be used or expanded, or if new satellite parking areas and pathways to the shore could be created without impacting sensitive resources.

The Coastal Committee can collaborate with the Town's Open Space Committee and others to identify and plan for the acquisition of parcels that may provide for future access. The proximity of the parcels to sensitive wetland areas and the potential impacts from climate change should be included in this planning process to select sites that will create viable access over the long term.

Access for Emergency Vehicles and Shellfishing
The guiding principles recommend that access should be provided for all users of the shoreline. Access for emergency vehicles, beach maintenance and shellfishing should be maintained over time. Emergency response is limited by access of the relevant emergency vehicles, including rescue boats and such access should be maintained at as many landings as feasible.

Beach Management and Restoration
The Town should periodically evaluate the beach management process to evaluate how well it is working and to incorporate any lessons learned over time. This can be coordinated between the Coastal Committee and the Conservation Commission.

Ongoing beach management is consistent with the guiding principles as it promotes safe access to the shore through repairs to the town landings after storm events. Therefore, the Town should continue its ongoing work to restore areas at the town landings impacted by storm events. This can include beach nourishment and dune restoration to replace sand lost during a storm: the planting of beach grass and the use of dune fencing to stabilize dunes; and the repair or replacement of pathways, stairs, or ramps used to access the beach.

Wetland Resource Adaptation
Promoting wetland retreat as sea level rises helps to preserve the valuable habitat and storm damage prevention function of coastal wetlands and is therefore consistent with the guiding principles. The Town should identify opportunities to promote and support wetland retreat to preserve coastal wetlands, including salt marshes to the extent feasible. Strategies to consider include:

1. Mapping of low-lying areas where wetland retreat is possible.
2. Land acquisition and preservation in areas directly adjacent to existing wetlands to allow for wetland retreat as sea level rises.
3. Incorporation of wetland retreat assessments into plans for the development or redevelopment of properties adjacent to existing wetlands.

4. Development of regulatory guidelines to require that wetland retreat adaptation be incorporated into future development plans.
5. Removal of restrictions to tidal flow into upstream marshes to promote the inland migration of coastal wetlands.
6. Removal of pavement and fill in wetland areas, and/or design and implementation of improved stormwater management where feasible to reduce impacts to existing wetlands.

Ongoing Analysis of Climate Impacts
Continuing research and analysis is needed to manage access to Brewster's shoreline into the future in a manner consistent with the guiding principles, which may include additional monitoring. Further analysis and monitoring of the migration of sediment along the coast is needed to understand how the offshore flats will respond to a rising sea level and whether or not they will remain above water at low tide. The scientific understanding of wetland retreat and salt marsh migration under increasing sea levels will mature over time and any new information should be incorporated into the Town's plans for managing wetland retreat. Future data on the rate of sea level rise can also be used to manage and prioritize future adaptation projects. The Town should also consider the potential contributions to climate change of adaptation options when evaluating different approaches.

The Management Plan could evaluate the implementation of a coastal overlay district to control future development in areas impacted by climate change and manage the rebuilding of existing development in these areas.

Ongoing Adaptive Management
The Coastal Resource Management Plan should be developed with the recognition that climate impacts and the associated adaptation techniques will evolve over time. The Plan should incorporate flexible adaptive management techniques to review and amend recommendations for future actions as new information is gathered from projects from within the Town, and from lessons learned from other communities.

Town of Brewster Coastal Resource Management Plan, Phase I Report

The Brewster Coastal Resource Management Plan Phase I Report is intended to provide vision and policy direction for the future management of Brewster's coastal resources, while meeting diverse community access needs and adapting to coastal change. The Plan builds on the Brewster Vision Plan (2018) and Coastal Adaptation Strategy establishing a framework for coordinating ongoing and future planning efforts and capital projects. The plan identifies five key management issues and provides core strategies and actions for addressing these management issues.

Increase the resilience of public beaches and landings

Provide ongoing monitoring of the coastal system on a regional basis

Recommendation 1: Periodically assess coastal resources conditions for comparison with baseline conditions.

Strategy 1A: Monitor and assess physical processes to support short-term management decisions and long-term planning.

- Every five years (next in 2021) update projections of sea level rise and storm surge and the modeled impacts of these forces on public beaches and landings, infrastructure and coastal resources.
- Update tidal benchmarks; track and record highest annual high tide as proxy for effects of sea level rise.
- Evaluate the potential benefit, cost and candidate locations for installing one or more tide gauge (s) and a wave buoy to provide localized data on trends in tidal dynamics.
- Evaluate the potential benefit, cost and candidate location for installing a wave height buoy.
- Evaluate the potential usefulness of establishing a volunteer-based program to monitor changes in beach profiles.

Strategy 1B: Use best available tools to understand the potential impact of storm surge on public and private property, sensitive infrastructure and natural resources, and to develop strategies and plans to avoid, minimize or mitigate adverse impacts, including tools made available through the Cape Cod Commission's Resilient Cape Cod project, MVP program, and the storm tides pathways assessment project being undertaken by the Barnstable County Extension Service and Center for Coastal Studies.

Recommendation 2: Assess coastal resources on a regional scale.

Strategy 2A: The 2015 Century Scale Sediment Budget should be updated in tandem with the sea level rise (next in 2021) to assess trends in sediment movement within the littoral cell that encompasses Brewster's shoreline. This effort should be evaluated and potentially undertaken in cooperation with Dennis, Orleans and Eastham. The assessment should include recommendations for monitoring protocols

and potential management actions necessary to increase resiliency of Brewster's shoreline and ensure that tidal flats keep pace with sea level rise.

Strategy 2B. Participate with the Barnstable County Extension and Center for Coastal Studies in developing a Storm Tide Pathway for Brewster. The Storm Tide Pathways project will encompass the entire Cape Cod Bay shoreline, and may provide a basis for additional coordinated efforts among towns sharing the same littoral cell.

Strategy 2C: Consider development of a regional framework for coastal resilience.

- Develop a management plan for the Inner Cape Cod Bay Area of Critical Environmental Concern (ACEC), in concert with the other towns sharing the ACEC. Such a plan could encompass studies of sea level rise and sediment budget, regional sediment management, and other ACEC resource issues.
- Consider establishing a regional coastal resilience planning group among towns in the same littoral cell (Dennis , Orleans, Eastham) to identify/study issues of shared concern cost effectively. Regional coordination could increase funding opportunities. This could be in concert with the existing Barnstable County Coastal Resources Committee, or the Cape Cod Commission's Resilient Cape Cod, Cape Cod Bay Work Group.

<u>Proactively address flooding of Brewster's beaches and landings</u>

Recommendation 3: Adopt long-term coastal management resiliency strategies.

Strategy 3A: Evaluate resilient shoreline management practices (those that mimic natural coastal processes) and identify where on Brewster's shoreline they might be applied.

- Preserve coastal landforms and vegetation that provide buffers to erosion caused by storm surge. Salt marsh and fronting coastal dunes have been shown to be effective in mitigation erosion along Brewster's Cape Cod Bay shoreline.
- Beach and dune nourishment practices for public and private beaches: Mant's, Paine's Point of Rocks.

- Dune protection (vegetation, fencing) and reconstruction: Mant's, Breakwater Beach, Point of Rocks.
- Create a living shoreline demonstration project: oyster reef at Mant's Landing.
- Managed retreat similar to the relocation of the Paine's Creek parking lot: locations to be determined.

Strategy 3B: Evaluate changes to the existing groin field, including potential removal/attrition of groins or other structures on the shoreline that impede coastal processes or hasten erosion. Evaluate whether existing groins could impede sediment transport necessary to sustain the tidal flats under different sea level rise scenarios.

Strategy 3C: Enhance stormwater management to minimize or eliminate erosion caused by overland run-off.

- Implement the stormwater management improvements identified in Brewster's Integrated Water Resource Management Plan and the work being undertaken on MS4 General Permit compliance.
- Prioritize stormwater improvements in any locations where infrastructure could reduce or eliminate erosion caused by run-off.
- Provide funding for ongoing maintenance of existing or proposed improvements, possibly through the creation of a stormwater utility.
- Design and adopt a stormwater management bylaw to enhance stormwater management on public and private property; and ensure that issues related to coastal erosion, use of green infrastructure and use of best management practices are incorporated.

Strategy 3D: Evaluate policy and regulatory changes to promote coastal resiliency.

- Evaluate the potential for implementing a flood plain bylaw to, among other things, "restrict or prohibit development and uses on Land Subject to Coastal Storm Flowage (i.e., 100-year coastal floodplain) and its buffer zones in order to minimize potential loss of life, destruction of property, and environmental damage inevitably resulting from inappropriate development on land known to be subject to storms, flooding, erosion, relative sea rise and other coastal zone hazards," (Cape Cod

Commission model bylaw). The Cape Cod Commission model bylaw and efforts implemented in other towns should be evaluated to determine policies applicable to Brewster.

- Develop permitting guidance for erosion control activities on private properties, and work with the Conservation Commission to apply the guidance in the review of Notices of Intent and issuance of Orders of Condition.

Strategy 3E: Ensure consistency with other planning efforts.

- Incorporate the potential for coastal resource impacts in the MVP plan.
- Complete a FEMA eligible multi-hazard mitigation plan.
- Ensure that MVP and multi-hazard planning is informed by the CRMP, and that measures promoted in these plans are considered in future phases of the CRMP.

<u>Maintain and manage public access points to increase resilience</u>

Recommendation 4: Promote management and maintenance

Strategy 4A: Create a coastal resiliency toolkit consisting of best practices for sustainable design, management and maintenance of town-owned landings and beaches. The toolkit should make use of the work being undertaken through the Cape Cod Commission's Resilient Cape Cod project, and other proven techniques, including:

- Managed retreat of parking areas and structures.
- Use of articulated mats to provide stability under ramps and parking areas.
- Use of beach grass planting, beach nourishment, and dune nourishment/rebuilding/stabilization, among other initiatives.

Strategy 4B: Develop a sustainable funding source, possibly through an environmental bond bill offset by short term rental tax revenues, potential increase in deeds tax revenues, town beach sticker revenues or other sources for resilient maintenance and management actions that balance needs for access, public safety, natural resource sustainability, and coastal resiliency; and that meet local and state permitting requirements. These measures include: repair

stairs/ramps/walkways (including measures needed for improved handicapped accessibility). A proactive, resilient maintenance program may lower long-term costs by reducing the potential need for emergency repairs.

Strategy 4C: Conduct technical alternatives assessments for resilient capital projects needed to address erosion pressure and preserve access at highly threatened town-owned access points. Mant's Landing and Paine's Creek are currently experiencing significant erosion and should be prioritized for evaluation and possible resilient capital projects.

Preserve ecosystem services provided by healthy wetlands

Preserve natural sediment transport processes in balance with erosion management

Recommendation 1: Evaluate policy and regulatory changes to protect wetland resources

Strategy 1A: Work with the Conservation Commission to evaluate the Town's wetlands protection bylaw and regulations to determine if any changes would provide enhanced protection of coastal wetlands and natural coastal processes. Areas of exploration could include, but not limited to:

- Potential to incorporate the sediment budget into the local wetlands bylaw and regulations to regulate protection of upland development differently in eroding areas.
- For all new or renewed Orders of Condition for erosion management, require analysis of cumulative system-wide impacts, and require adherence to best practices for shoreline erosion management structures.
- Adopt permitting guidelines based on Woods Hole Oceanographic Institution Sea Grant publication *Spectrum of Erosion Control Methods*. The recent publication of *Guidelines for Erosion Management in Pleasant Bay* provides a guide.
- Require maintenance and nourishment of erosion management structures.
- Incorporate monitoring requirements for erosion control measures to provide information to evaluate their functions and impacts.

Strategy 1B: Review the Town's policy for allowing access through town landings to perform shoreline stabilization work on private property. Ensure that applicants carry adequate insurance coverage in case of damage to resources caused by heavy equipment or fuel spills.

Strategy 1C: Work with the Planning Board to revise, update or extend the Flood Plain Overlay District and Wetlands Conservancy bylaws, based on an evaluation of the bylaw's effectiveness in meeting its original purpose, and based on a survey of similar measures employed in other communities as recommended by the Cape Cod Commission.

Recommendation 2: Increase public awareness of the importance of healthy coastal wetlands and natural coastal processes, and the need to protect these resource areas

Strategy 2A: Education materials should be aimed at shoreline property owners, among others, to discuss the importance of natural sediment transport processes, and best practices for vegetation management, erosion management, and buffer protection, etc. This effort should be coordinated with the development of permitting guidance.

<u>Maintain the elevation of salt marshes and tidal flats</u>

Recommendation 3: Promote opportunities for salt marsh migration.

Strategy 3A: Use the state of the art wetland modeling to assess patterns of salt marsh retreat in Brewster. Model results could then be used to develop salt marsh management plans to counteract loss of marsh due to subsidence or inundation. Management actions could include:

- Channel improvements to restore or enhance hydrology.
- Evaluate the potential for a pilot project for thin layer deposition of material on any subsided areas of salt marsh plane, in coordination with MassDEP permitting guidance.
- Work with the Town's Open Space Committee, Community Preservation Committee and the Brewster Conservation Trust to identify key parcels for acquisition/conservation restriction and to develop a funding strategy for acquisition/protection of these properties; and develop a framework for tracking and pursuing parcel opportunities.

- Identify and remove any remaining undersized culverts that may restrict tidal flow and causing degradation of coastal wetlands. An example is the Crosby salt marsh restoration project.

Strategy 3B: Develop/update and implement resource management plans to protect large areas of salt marsh. Land Use and Management Plans for Quivett Creek/Paine's Creek Marsh and Namskaket Marsh should be developed in coordination with Brewster Conservation Trust, MA DCR, and adjacent towns.

Preserve peak-season access to public beaches and landings

<u>Augment peak seasonal parking demand/capacity at beaches and landings</u>

Recommendation 2: Maintain or enhance peak season access to public beaches and landings

Strategy 2A: Where existing parking facilities face erosion danger, assess opportunities for managed relocation or retreat (e.g., Paine's Creek, Breakwater Beach) or other measures such as use of articulated mats to protect existing parking spaces.

Protect infrastructure, visual access and sense of place threatened by changing conditions

<u>Minimize and mitigate impacts of development in coastal areas; protect vulnerable low roads, groundwater and underground infrastructure.</u>

Recommendation 1: Protect vulnerable low-lying infrastructure.

Strategy 1A: Elevate low-lying road segments and/or retrofit stormwater management systems to mitigate flooding during storm surge conditions. The following segments were identified in the CAS and being of special concern:

- Route 6A at Dennis town line and east of the Cape Cod Museum of Natural History near Paine's Creek.
- Lower Road at Bloomer Path intersection.
- Breakwater Road various locations.
- Crosby Lane.

Strategy 1B: Work with the Board of Health to evaluate whether the required separation to groundwater is sufficient, and whether changes in regulation are needed to prevent groundwater intrusion into wells and onsite wastewater treatment systems.

Recommendation 2: Complete the proposed MVP plan and develop a full-scale multi-hazard mitigation plan.

Strategy 2A: FEMA-approved hazard mitigation plan is needed to access some forms of emergency assistance from FEMA.

Strategy 2B: As part of the hazard mitigation plan, develop an inventory of underground infrastructure (water mains, underground utilities) that may be threatened by increasing groundwater elevation due to sea level rise. Develop a plan to prioritize improvements to protect infrastructure identified as subject to threat.

Recommendation 3: Work with the Planning Board and other stakeholders to evaluate changes to local zoning and regulations to preserve scale, character and resource protection.

Strategy 3A: Consider establishing a Coastal Resource District of Critical Planning Concern as a planning process for considering multiple overlapping planning objectives and tools.

Strategy 3B: Develop and implement a stormwater management bylaw/low impact development zoning bylaw as part of compliance with the MS4 General Permit.

Strategy 3C: Evaluate the potential benefits of establishing a Coastal Conservancy zoning district with enhanced protections for coastal resources and building scale.

Strategy 3D: Evaluate zoning restrictions governing the size, height and lot coverage of newly constructed or reconstructed residential dwellings in the coastal resource planning area.

Strategy 3E: Evaluate the potential benefit of revisions to the Flood Plain Overlay District and Wetlands Conservancy District bylaws to further limit development in velocity zones. Any proposed changes should be based on a thorough assessment of the effectiveness of the current bylaws, and the approaches and experience of other communities with similar circumstances.

3.3 Administrative and Technical Capabilities

Brewster Local Emergency Planning Committee (LEPC)

The LEPC's mission is to bring together town elected and appointed officials, community and industries for enhancing hazardous materials, natural disaster, and terrorism preparedness. This includes providing input into the town Comprehensive Emergency Management Plan.

Cape Cod Medical Reserve Corps (MRC)

The MRC is made up of locally based, medical and non-medical volunteers who want to donate their time and expertise to promote healthy living throughout the year, and to prepare for and respond to emergencies, often supplementing existing local emergency and public health resources. The mission of the MRC

is, ‘to engage volunteers to strengthen public health, emergency response, and community resiliency.’ MRC members are identified, screened, trained, and prepared prior to their participation in any activity.

Brewster-Orleans-Chatham-Harwich (BOCH) Community Emergency Response Team (CERT)

The BOCH CERT Team (a volunteer program) was established in 2019, includes sixteen residents from Brewster and educates and trains citizens to be better prepared to respond to emergency situations in the community. When emergencies happen, CERT members can be deployed at the direction of David Miller of Chatham, a retired fire captain to provide critical support to first responders, provide immediate assistance to victims, and organize spontaneous volunteers at a disaster site. CERT members can also help with non-emergency projects that help improve the safety of the community.

Comprehensive Emergency Management Plan[25]

The Town of Brewster Comprehensive Emergency Management Plan (CEMP) provides a framework for a community-wide emergency management system to ensure a coordinated response to emergencies and coordinated support of certain pre-planned events. The CEMP addresses the roles and responsibilities of all community departments, agencies, government organizations, volunteers and community partners that may be involved in response operations, and identifies how regional, state, private sector, and other resources may be activated to address disasters and emergencies in the community.

The CEMP is intended to accomplish the following goals:

1. Assign responsibilities to agencies, organizations and individuals for carrying out specific actions during an emergency or event;
2. Detail the methods and procedures to be used by designated personnel to assess emergencies and take appropriate actions to save lives and reduce injuries, prevent or minimize damage to public and private property, and protect the environment;
3. Provide a process by which emergency response personnel and local government staff can efficiently and effectively prevent, mitigate, prepare for, respond to, and recover from emergencies and disasters;
4. Identify the responsibilities of local agencies and partnering stakeholder and organizations during emergencies or events; and
5. Identify lines of authority and coordination for the management of an emergency or event.

[25] Town of Brewster Comprehensive Emergency Management Plan (Draft), May 2021.

Emergency Operations Center
The Town maintains a primary and alternate (in the event that the primary location is rendered or deemed unusable) Emergency Operations Center (EOC) which serve as the central point for coordination of the community's emergency management and response activities, maintaining situational awareness about the emergency situation, and facilitating requests for deployment of resources.

Primary EOC:	Brewster Fire and Rescue Headquarters 1671 Main Street Brewster, MA 02631
Alternate EOC:	Brewster Police Department 631 Harwich Road Brewster, MA 02631

Mutual Aid System
The Town of Brewster is part of a mutual aid system (the provision of services from one jurisdiction to another) for additional resources from many fronts. Mutual aid agreements currently include:

- Statewide Mutual Aid Chapter 40 Section 4J of the Massachusetts General Law
- Brewster Fire/Rescue Department: Barnstable County Fire Chief's Association
- Brewster Police Department: Cape and Island Law Enforcement
- Brewster Board of Health: Barnstable County Health Department
- Brewster Water Department: Intrastate Water/Wastewater Agency Response Network

Communications
Communications between community agencies occur through the use of several types of communications equipment including radios, cellular and landline phones, email, and text messaging. In addition, the Commonwealth uses WebEOC and the Health and Homeland Alert Network (HHAN) for external notifications and to provide situational awareness. Public communications range from the Emergency Alert System to the community's website and social media.

The Town of Brewster uses the RAVE Messaging alerting system as the primary tool for dissemination of Emergency information. The alerting system is a voluntary system that an individual can sign up for on the Town's Website. A local communications network is provided by Town of Brewster Local TV Channel 18, and Lower Cape TV that is used to scroll emergency messages. The Town of Brewster uses many of today's social media outlets through Town of Brewster Website and Facebook Page, Brewster Police Website and Facebook Page, Brewster Fire and Rescue Website and Facebook Page as well to provide immediate information to the public.

Staging Area
A staging area is a location where resources needed to support emergency response operations are aggregated and readied for deployment. A staging area, which could be co-located with an ICP, should be located close enough to the incident to allow a timely deployment of assets to the area of the incident, but far enough away to be out of the immediate impact zone. There may be more than one staging area supporting an incident. The designated staging areas for the Town of Brewster are the Eddy Elementary School at 2298 Main Street, the Town Hall at 2198 Main Street, and Brewster Fire and Rescue Headquarters 1671 Main Street.

Points of Distribution
Points of Distribution (PODs) are centralized locations where the public can obtain critical commodities following a disaster or emergency. PODs can accommodate vehicle traffic (drive-through), pedestrian traffic (walk-through) and/or mass transit traffic (bus or rail). Typical critical commodities provided to impacted populations through PODs can include but are not limited to, shelf-stable food, bottled water, ice, tarps and/or blankets. The Points of Distribution (PODs) for the Town of Brewster would be Town Hall at 2198 Main Street and Brewster Council on Aging at 1673 Main Street, and the Our Lady of the Cape at 468 Stony Brook Rd.

Evacuation Routes
The Town Manager or designee has the authority to issue evacuation orders or recommendations. The Governor also has the authority to make evacuation recommendations, and issue evacuation orders under a Gubernatorial Declaration of Emergency.

In the event that an evacuation is recommended or mandated, the population designated for evacuation will leave the affected area using their own private vehicles or be transported from Evacuation Assembly Points with transportation assets coordinated/obtained by Brewster. Depending upon the hazard and other circumstances, shelters for evacuees may be located within or outside of the Community. Evacuees are expected to follow the direction and guidance of trained emergency workers, traffic coordinators, and other assigned emergency officials.

Evacuation routes should be pre-identified by the Town Manager or designee in coordination with other community officials. Evacuation routes for this community are State Highway Route 6 west to the Sagamore or Bourne Bridge and State Route 6A (Main Street) west to the Sagamore or Bourne Bridge.

Evacuation Assembly Points
Evacuation Assembly Points are the location (s) within the community that serve as assembly points for evacuees who do not have their own transportation. Brewster would not utilize traditional evacuation assembly points, rather, Brewster first responders, Town employees, Brewster/Orleans/Chatham/Harwich

(BOCH) CERT team members would pick up individuals who are without transportation at their residences.

Evacuation Transportation Hub
In situations when residents may need to be evacuated outside of the community, Brewster will activate one or more Evacuation Transportation Hubs (T-Hubs) where large numbers of evacuees transported from EAPs throughout the community assemble and wait for transportation to either a state-operated Regional Transportation Center (RRC) or a designated shelter outside of a community. T-Hubs are locally-operated, have adequate indoor facilities to stage evacuees, and adequate outdoor areas for vehicle staging and evacuee embarkation. The Commonwealth is responsible for providing buses or other vehicles to transport evacuees from local T-Hubs to RRCs or shelters. The Evacuation Transportation Hubs (T-Hubs) for the Town of Brewster would be Town Hall at 2198 Main Street, Council-on-Aging 1673 Main Street, and the Eddy School 2298 Main Street.

Municipal Website
The Town's Fire Department maintains a municipal webpage hosted on the Town's website that includes a variety of local, state and regional emergency program information for residents, business owners and tourists, including:

- Alarm Age Facts (http://brewsterfire.com/safety-facts/alarm-age-fact-sheet)
- Can We Find You? (http://brewsterfire.com/safety-facts/can-we-find-you)
- Carbon Monoxide Risks at Home (http://brewsterfire.com/safety-facts/carbon-monoxide-risks-at-home)
- Open Burning Safety Tips (http://brewsterfire.com/safety-facts/open-burning-safety-tips)
- Open Burning Rules and Regulations (http://brewsterfire.com/fire-prevention/open-burning-rules-and-regulations)
- Outside Fires (http://brewsterfire.com/fire-prevention/outside-fires)
- Smoke and Carbon Monoxide Inspections (http://brewsterfire.com/fire-prevention/smoke-detector-and-carbon-monoxide-detector-inspections)
- Smoke Detector Fact Sheet (http://brewsterfire.com/safety-facts/smoke-detector-fact-sheet)
- Christmas Tree Fires (http://brewsterfire.com/safety-facts/christmas-tree-fires)
- Halloween Fire Safety (http://brewsterfire.com/safety-facts/halloween-fire-safety)
- Fire and Safety Checklist (http://records.brewster-ma.gov/weblink/0/doc/75261/Page1.aspx)
- Opening Burning Regulations(http://records.brewster-ma.gov/weblink/0/doc/75259/Page1.aspx)
- Ready.gov information for Massachusetts (https://www.mass.gov/)
- Cold Weather Precautions (https://brewster-ma.gov/376-news-a-announcements/1794-brewster-office-of-emergency-management-cold-weather-precautions)

The Town's Health Department maintains a municipal webpage hosted on the Town's website that includes a variety of local, state and regional health related information for residents, business owners and tourists, including:

- Cape Cod Medical Reserve Corps (https://www.ccmedicalreservecorps.org/)
- Household Hazardous Waste Collection (https://www.brewster-ma.gov/files/2020hhw.pdf)
- Barnstable County Community Septic Management Loan Program (https://www.barnstablecountysepticloan.org/)
- CDC Vital Signs (https://www.cdc.gov/vitalsigns/)
- Coronavirus Information at Barnstable Health Dept. (https://www.barnstablecountyhealth.org/)

The Brewster Health Department conducts quarterly call down drills annually as required by the Comprehensive Emergency Management Plan. The Health Department (in collaboration with the LEPC) also conducts annual tabletop exercises, which in 2021 involved the Barnstable County Health Agents Coalition (HAC) and Mass Maritime Academy with a 'mass vaccination during a pandemic' theme.

MOUs/MOAs for Brewster with adjacent communities and regional agencies include:

- Barnstable County Health Agents Coalition
- Public Health Services Intermunicipal Agreement (May 2006)
- Statewide MA Mutual Aid Program (April 2011)
- Annual Hazardous Waste Collection Events with Cape Cod Cooperative Extension

The Town's Water Dept. participates in the Massachusetts Intrastate Water/Wastewater Agency Response Network (WARN) which supports and promotes statewide emergency planning, preparedness, disaster response, and mutual assistance among water and wastewater utilities during emergencies.

Brewster Municipal Vulnerability Preparedness (MVP) Working Group

Under Executive Order 569, as the Commonwealth advances an integrated climate change strategy, Brewster (and many other Massachusetts cities and towns) is working at the local and regional level on resiliency planning and climate preparedness efforts. In 2019, through a grant from the Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA), Brewster completed a Town-wide vulnerability assessment and developed an action-oriented resiliency plan following a Community Resilience Building Workshop in March 2019. The Town became an MVP-Designated community in 2019.

The Workshop's central objectives included:

- Define top local natural and climate-related hazards of concern
- Identify existing and future strengths and vulnerabilities

- Develop prioritized actions for the community
- Identify immediate opportunities to collaboratively advance actions to increase resilience

The MVP Workshop ended with consensus on the following top eight action items the Town should pursue towards increased resiliency:

1. Review and update Town bylaws and regulations to mitigate projected climate change impacts.
2. Develop and initiate projects to increase resilience to projected climate change impacts (e.g., intense rain, storm surge, sea level rise) for critical infrastructure including but not limited to:
   A. Route 6A from the intersection with Paines Creek Road west across causeway dividing the marsh
   B. Stormwater drainage throughout Town
   C. Potentially vulnerable utility infrastructure
3. Identify and initiate projects to provide backup power at the Town Hall, Water Department and drinking water wells to provide critical infrastructure resilience to power outages.
4. Conduct a stormwater infrastructure inventory and assessment to prioritize and initiate improvements (e.g., increased catch basin maintenance, culvert replacement) based on projected climate change impacts.
5. Develop a Preparedness Campaign for the general public (i.e., residents and seasonal guests) and the private sector that includes guidance and checklists, as well as recommendations to increase community resilience to the impacts of climate change (e.g., extreme weather, health impacts).
6. Develop a Local Multi-Hazard Mitigation Plan that includes considerations for projected climate change impacts.
7. Review and update the Brewster Community Emergency Management Plan to include considerations for projected climate change impacts.
8. Conduct a vulnerability assessment, develop plans and initiate improvements at critical public beach access points in the community (e.g., town landings) to increase resilience to projected climate change impacts.

Coordination with Neighboring Municipalities

The Town of Brewster coordinates with the Towns of Dennis, Orleans, Harwich and Chatham periodically across municipal issues. The Town will continue to coordinate with these adjacent communities on natural hazard mitigation planning, specifically any shared resource plans and evacuation plans.

Municipal Administration and Staff

The Brewster Select Board, Planning Board, Local Hazard Mitigation Committee, municipal officials and staff all work well together to develop, implement and update policies and plans to promote the safety of its residents and minimize risk to the community.

Information Technology (IT) Department
In emergency situations the Town's IT Department is responsible for ensuring all Town IT and communication elements such as phones, internet, websites, and social media accounts are properly functioning and available. In the event that local resources are exhausted assistance may be requested from mutual aid partners or MEMA. The IT department is responsible for assisting with EOC operations. During a large-scale incident they may be asked to perform additional activities depending on the incident. If the Emergency Management Director activates the EOC the IT Department will place a representative in the EOC to help coordinate activities.

Cape Cod Atlas of Tidally Restricted Salt Marshes
As part of this study, a number of salt marsh system sites were identified as either culverts not properly sized to accommodate natural tidal flow, or sites where such infrastructure is broken, collapsed, or otherwise unable to function properly. As such, the Town pursued funding for infrastructure resizing and/or repair/replacement to eliminate the potential for causing flooding, including:

Site DE-2/BR-1: Dennis/Brewster - Sea Street Restriction of Quivett Creek (Town Owned): Sea Street is located just west of Quivett Creek on the Dennis/Brewster town line. Two culverts were located under Sea Street and connected the Creek to Quivett Marsh. After a significant study by a team including the National Marine Fisheries Service (NMFS), the Massachusetts Wetlands Restoration Program, and local officials from Dennis and Brewster, this site was targeted for remediation, with the installation of an 8-foot culvert. This was completed in 2006.

Site BR-4: Brewster - Paines Creek Road Restriction of Channel into Freeman's Pond (remediation started, Town Owned): Located at the mouth of Stony Brook on Cape Cod Bay, a tidal creek flows through a 2-foot metal pipe into Freeman's Pond. Natural stream conditions and free flow are not evident. Freeman's Pond is Brewster's only salt pond. Conditions are severely degraded and the system is gradually converting to a freshwater ecosystem. This channel supports an anadromous fish run (Brown Trout) and the Town would like to restore the natural saltwater ecosystems. Design and permitting of a replacement culvert is underway with assistance of grants through NRCS and NOAA, with installation of a larger culvert expected in fall of 2011. The culvert was replaced in 2013.

Site BR-5: Brewster - Route 6A Restriction of Stony Brook (See BR-6, Town Owned): Stony Brook crosses under Route 6A just east of the Cape Cod Museum of Natural History and west of the intersection of Lower Road with Route 6A. There is significant scouring and bank erosion. In addition there is a large sandbar in the upstream channel. Stony Brook is an active and successful anadromous fish pathway for both Alewives and Brown Trout. This is one of two historic culverts under Route 6A; the second culvert (BR-6) was replaced in late 2010. This culvert was evaluated, but modeling shows the best result is from

leaving this culvert in its current condition and focusing on increased flow at BR-6.

Site BR-6: Brewster - Route 6A Restriction of a Channel off of Stony Brook (Town Owned): Immediately west of the intersection of Lower Road and Route 6A, Stony Brook crosses under Route 6A. This was a major restoration effort completed in the fall of 2010, replacing the approximately three-foot culvert with an 18-foot wide box culvert. This restored over 20 acres of salt marsh and improved fish passage for alewife and herring in Stony Brook. The grant was received through NOAA.

Site BR-7/OR-1: Brewster - Cape Cod Rail Trail Restriction of Namskaket Creek (Town Owned): The Cape Cod Rail Trail crosses Namskaket Creek at the Brewster-Orleans Town line, causing a major tidal restriction. The undersized pipe and degradation of the site had effectively cut off tidal flow from the upstream marsh area. The culvert was replaced in 2008 and additional work is ongoing.

Joint Project for Culvert Replacement to Freeman's Pond: The Natural Resources Conservation Service (NRCS), DEM, Orleans and Brewster local officials, the state Wetlands Restoration Program, and MA Coastal Zone Management completed replacement of this culvert in late 2011. Routine maintenance remains ongoing.

Cyber Incident Response Plan for the Town of Brewster, February 22, 2021[26]
This Plan outlines the procedures that the Town of Brewster uses to detect and respond to unauthorized access or disclosure of private information from systems utilized, housed, maintained or serviced by Brewster. More specifically, this plan defines the roles and responsibilities of various staff with respect to the preparation, detection and analysis, containment, eradication and discovery and any post-incident activity.

3.4 Financial Capabilities

Federal/State Grant Opportunities
The Town, across all municipal departments, considers and pursues all applicable federal, state and local grant opportunities to assist in implementing hazard mitigation programs, such as FEMA, Housing and Urban Development (HUD CDBG Program, United States Department of Agriculture – Natural Resources Conservation Service (NRCS), U.S. Economic Development Administration (EDA), Massachusetts Department of Energy Resources Green Communities Division (GCD), and the Massachusetts EOEEA MVP Program.

[26] Cyber Incident Response Plan for the Town of Brewster.

FEMA Hazard Mitigation Assistance (HMA) Program (HMGP, BRIC, and FMA) – the Town of Brewster has received approximately $215,067.40 in grant assistance from FEMA for various projects (see Section 2.5 for additional details).

USDA NRCS – provides Conservation Technical Assistance, Financial Assistance, and Conservation Innovation Grant programs.

HUD CDBG Program – a flexible program that provides communities with resources to address a wide range of unique community development needs, particularly the Disaster Recovery Assistance Program which provides grants to help cities, counties, and States recover from Presidentially-declared disasters, especially in low-income areas, subject to availability of supplemental appropriations.

MA Department of Energy Resources GCD – offer grants to designated 'Green Communities' to implement energy conservation measures that help them cut energy use and costs. The Green Communities program helps municipalities take action to protect the environment and reduce greenhouse gas emissions. The Town of Brewster received the 'Green Community' designation in March 2020 and was awarded $150,270 towards implementing projects.

MA EOEEA MVP – provides assistance to communities working at the local and regional level on resiliency planning and climate preparedness efforts. The Town became an MVP-Designated community in 2019.

3.5 National Flood Insurance Program

Brewster implements and enforces the state building code and fully participates in the NFIP. Brewster understands that participation in the NFIP is an essential step in mitigation flood damage and is working to consistently enforce NFIP compliant policies in order to continue its participation in this program.

Table 3-1 Actions for Continued Compliance with NFIP below lists those actions that the Town has done and will continue to do and those actions that will be done within the next five years for continued compliance with the NFIP.

Table 3-1 Actions for Continued Compliance with NFIP

Actions (Listed in order of priority)	Done/Ongoing	To be Done
Join the NFIP.	X	
Participate in NFIP training by State and/or FEMA.	X	
Establish mutual aid agreements with neighboring communities to address administering the NFIP following a major storm event.		X
Address NFIP monitoring and compliance	X	

Revise/adopt subdivision regulations and erosion control regulations to improve floodplain management in the community.	X	
Participate in the CRS.	X	
Prepare, distribute, or make available NFIP, insurance and building code explanatory pamphlets or booklets.	X	
Identify and become knowledgeable on non-compliant structures in the community.	X	
Identify and become knowledgeable of submit to rate structures.		X
Identify cause of submit to rate structure and analyze how to prevent non-compliant structures in the future.		X
Inspect foundations at time of completion before framing to determine if lowest floor is at or above BFE.	X	
Require use of elevation certificates.	X	
Report any changes in the Special Flood hazard Area to FEMA within 180 days of change.	X	
Identify and keep track of LOMA/LOMR in the community.	X	
Gain familiarity with community's Flood Insurance Rate Maps.	X	
Address repetitive loss structures.	X	

Source: Brewster LHMW.

3.6 Community Rating System

NFIP's CRS Program is a voluntary program that recognizes and encourages a community's efforts that exceed the NFIP minimum requirements for floodplain management. The CRS program emphasizes three goals:

- the reduction of flood losses
- facilitating accurate insurance rating
- promoting the awareness of flood insurance

By participating in the CRS Program, communities can earn a 5-45% discount for flood insurance premiums based upon the activities that reduce the risk of flooding within the community.

The Town of Brewster does participate in the NFIP's CRS Program. The class rating is 9 which provides a 5% discount to flood insurance policy holders.

3.7 Existing Protection Matrix

A summary of the main identified existing and future protection measures presented above are summarized on Table 3-2. These measures constitute the baseline protection that was further evaluated by the Brewster LHMW to determine gaps in Brewster's protection from natural disasters. Goal statements and specific actions were then developed to mitigate the identified gaps in the existing protection. These identified protection measures facilitate the Town of Brewster to implement various hazard mitigation programs, ultimately making the community more resilient.

Table 3-2 Existing Protection Matrix Brewster, MA

Existing Protection	Description	Area Covered	Effectiveness and/or Enforcement	Improvements or Changes Needed
Planning and Regulatory				
Town of Brewster Vision Plan 2018				
	Includes building blocks to facilitate the community's preferences for how it intends to evolve socially, physically, and economically by guiding town decisions and serving as a framework for future plans.	Town-wide	Effectiveness: Very Good Enforcement: Planning Dept./Planning Board	Continue to Utilize
Mapping Storm Tide Pathways in Cape Cod Bay, MA 2021				
	Includes 12 pathways in Brewster that are 12 inches above the Sesuit Harbor tide gauge that represent new areas of flooding (up to 49 acres) town staff may want to consider for future planning.	Town-wide	Effectiveness: Very Good Enforcement: Natural Resources Dept./Planning Dept.	Begin to Utilize
Open Space and Recreation Plan 2021				
	Includes goals and objectives relative to the Town's natural resources, particularly impacts from climate change to strengthen resilience and adaptability.	Town-wide	Effectiveness: Very Good Enforcement: Parks & Rec./Conservation Comm.	Continue to Utilize
Integrated Water Resources management Plan 2013				
	Includes a series of regulatory and non-regulatory recommendations to address water supply and stormwater,	Town-wide	Effectiveness: Very Good Enforcement: Planning Dept./Planning Board	Continue to Utilize
Flooding, Chapter 100 Brewster Zoning Code				
	Includes land use control measures to reduce flood losses.	Special Flood Hazard Areas	Effectiveness: Good Enforcement: Planning Dept./Planning Board	Continue to Utilize
Floodplain District				
	Includes requirements to regulate development, access, minimize loss/costs/damages in areas subject to coastal storm flowage (VE Zones) to minimize threats to public safety, potential loss of life, personal injury, destruction of property, and environmental damage.	Floodplain District	Effectiveness: Very Good Enforcement: Planning Dept./Planning Board	Continue to Utilize
Subdivision Rules and Regulations				
	Includes requirements that address drainage and protection of natural resources that also address hazard mitigation.	Town-wide	Effectiveness: Very Good Enforcement: Planning Dept./Planning Board	Continue to Monitor

Table 3-2 Existing Protection Matrix Brewster, MA

Existing Protection	Description	Area Covered	Effectiveness and/or Enforcement	Improvements or Changes Needed
Planning and Regulatory				
Wetlands Protection, Chapter 172				
	Includes requirements to protect and preserve the shores, rivers, ponds, wetlands, and other water bodies and related resources by controlling activities that can have significant impacts on wetlands functions and values.	Town-wide	Effectiveness: Very Good Enforcement: Conservation Commission	Continue to Utilize
Wetlands Conservancy District				
	Includes requirements to: preserve and maintain the groundwater table for water supply; to protect the purity of coastal and inland waters for the propagation of fish, shellfish, and for recreational purposes; to protect public health and safety; to protect persons and property from flood hazards along water bodies; and to preserve the natural character of the environment, wildlife, and open space.	Town-wide	Effectiveness: Very Good Enforcement: Conservation Commission	Continue to Utilize
Massachusetts State Building Code				
	The Massachusetts State Building Code contains many detailed regulations regarding wind loads, earthquake resistant design, flood-proofing and snow loads.	Town-wide	Effectiveness: Most effective for new construction Enforcement: Planning Board/Building Official	Continue to Utilize
Massachusetts Homeowners Handbook to Prepare for Coastal Hazards				
	Includes basic information on coastal storms, flooding, and other hazards with recommendations for emergency supplies, evacuation kits/planning/procedures, and other important emergency information.	Coastal Areas	Effectiveness: Good Enforcement: Building Official	Continue to Utilize
Town of Brewster Coastal Adaptation Strategy 2016				
	Provides a framework for future decision-making about Brewster's public coastal areas to assist the Town in meeting future needs and adapting to coastal changes, sea level rise, storm surge and shoreline erosion.	Town-wide	Effectiveness: Very Good Enforcement: Planning and Dept./Planning Board	Continue to Utilize

Table 3-2 Existing Protection Matrix Brewster, MA

Existing Protection	Description	Area Covered	Effectiveness and/or Enforcement	Improvements or Changes Needed
Planning and Regulatory				
Town of Brewster Coastal Resource Management Plan, Phase 1 Report				
	Includes vision and policy direction for the future management of Brewster's coastal resources and adapting to coastal changes	Coastal Areas	Effectiveness: Very Good Enforcement: Planning and Dept./Planning Board	Continue to Utilize
Administrative and Technical				
Brewster Local Emergency Planning Committee				
	Brings together elected and appointed officials, community members, and industries for enhancing hazardous materials, natural disaster and terrorism preparedness	Town-wide	Effectiveness: Good Enforcement: Emergency Management Director	Continue to Utilize
Cape Cod Medical Reserve Corps				
	Strengthens communities by establishing a system for medical and public health volunteers to offer assistance and expertise to existing providers.	Town-wide	Effectiveness: Good Enforcement: Board of Health	Continue to Utilize
Comprehensive Emergency Management Plan				
	Provides a framework for a community-wide emergency management system to ensure a coordinated response to emergencies and coordinated support of certain pre-planned events.	Town-wide	Effectiveness: Very Good Enforcement: Emergency Management Director	Continue to Utilize
Municipal Website				
	A municipal webpage hosted on the Town's website that includes a variety of local, state and regional emergency program information for residents, business owners and tourists.	Town-wide	Effectiveness: Very Good Enforcement: IT/Various other Depts.	Continue to Utilize
Brewster MVP Working Group				
	The Town has become an MVP-Certified community, and as such is eligible to seek implementation grants through the Commonwealth for any hazard mitigation actions identified as a result of the MVP process. A forum for resiliency planning and climate preparedness efforts.	Town-wide	Effectiveness: Good Enforcement: Planning Dept.	Continue to Utilize

Table 3-2 Existing Protection Matrix Brewster, MA

Existing Protection	Description	Area Covered	Effectiveness and/or Enforcement	Improvements or Changes Needed
Administrative and Technical				
Municipal Administration and Staff				
	Municipal officials, staff, Boards and Commissions all work together to develop, implement and update policies and plans to promote the safety of residents and minimize risk to the community.	Town-wide	Effectiveness: Very Good Enforcement: Town Manager, Board of Selectmen, Municipal Department Chairs	Maintain
Coordination with Neighboring Municipalities				
	Coordination to identify applicable efficiencies (resource-sharing and Mutual Aid agreements).	Regional context	Effectiveness: Very Good Enforcement: Emergency Management Director/DPW	Maintain
Cape Cod Atlas of Tidally Restricted Salt Marshes				
	Includes infrastructure needs to accommodate natural tidal flows/functionality.	Dennis/Brewster: Sea St. Restriction of Quivett Creek/Paine's Creek Road Restriction of Channel into Freeman's Pond/Route 6A Restriction of Stony Brook/Route 6A Restriction of a Channel off Stony Brook/ Cape Cod Rail Trail Restriction of Namskaket Creek	Effectiveness: Very Good Enforcement: Planning/Natural Resources Depts./Conservation Commission	Maintain
Cyber Incident Response Plan for the Town of Brewster				
	Outlines procedures to detect and respond to unauthorized access or disclosure of private information from systems utilized, housed, maintained or serviced by the Town of Brewster.	Town-wide	Effectiveness: Very Good Enforcement: Town Administrator	Continue to utilize

Table 3-2 Existing Protection Matrix Brewster, MA

Existing Protection	Description	Area Covered	Effectiveness and/or Enforcement	Improvements or Changes Needed
Financial				
Federal/State Grant Opportunities				
	FEMA HMA Program https://www.fema.gov/grants/mitigation	Town-wide		Continue to utilize
	HUD CDBG Disaster Recovery Assistance: https://www.hud.gov/hudprograms/disaster-recovery	Low-income areas.		Continue to utilize
	USDA, Natural Resources Conservation Service (NRCS) Conservation Technical Assistance: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/technical/cta Financial Assistance: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/ Conservation Innovation Grant Programs:	Town-wide		Continue to utilize
	MA MVP Program https://www.mass.gov/municipal-vulnerability-preparedness-mvp-program	Statewide		Continue to utilize
	MA Coastal Resilience Grant Program https://www.mass.gov/service-details/coastal-resilience-grant-program	Statewide		Continue to utilize
	MA Water Quality Grants https://www.mass.gov/info-details/water-resources-grants-financial-assistance	Statewide		Continue to utilize
	GrantWatch https://www.grantwatch.com/	Statewide		Continue to utilize
	US EDA https://www.eda.gov/funding-opportunities/	Statewide		Continue to utilize
	MA Department of Energy GCD https://www.mass.gov/orgs/green-communities-division	Statewide		Continue to utilize

Section 4 Mitigation Strategy

4.1 Introduction

Removing and precluding development from hazardous areas is the best method of mitigation. However, this cannot be the sole focus of hazard mitigation in Brewster. The Town's character and functionality require a level of intimacy with the areas of greatest risk: flood-related, winter-related and wind-related hazard events.

4.2 Mitigation Activities

In completing the risk and vulnerability analyses, the LHMW considered projects and actions that would reduce Brewster's vulnerability to the identified hazards. The 2021 Risk Assessment Matrix (Table 2-1) is the basis for the mitigation actions presented in Section 4.3.

4.3 Mitigation Action Plan

The LHMW considered the goals of this plan and re-prioritized the matrix and the associated actions based on historical damage, safety of the population, property protection and consistency with town-wide goals and objectives. Although not based on similar methodologies for prioritization, the new 'Priority Score' for each mitigation action (2021 Plan), is followed by the 2016 draft Plan prioritization (*High, Medium/Moderate, Low Priority*) where applicable, to reflect any changes in the prioritization of actions for this 2021 Plan by the LHMW. Issues and objectives were aligned to public health risks, evacuation and mass care considerations, disruption of essential services and potential economic losses to the town.

The LHMW determined that the identified objectives could be met by considering actions aligned to the following Mitigation Categories:

- Public Education and Awareness
- Property Protection
- Natural Resource Protection
- Structural Projects
- Emergency Services
- Planning and Prevention

The LHMW has worked to set goals and objectives that are bounded by a time frame and are compatible and consistent with state hazard mitigation goals. Upon submittal of this plan to MEMA, the State Hazard Mitigation Committee (SHMC) is expected to review and approve these goals and objectives to ensure consistency with the statewide goals and objectives. The time frames used for this strategy are as follows:

- Short Term = 0 to 6 Months
- Medium Term = 6 to 18 Months
- Long Term = 18 Months to 5 Years

The following actions use the Risk Assessment Matrix (Table 2-1) to identify areas at risk, offer mitigation strategies and consider benefits. Each action offers a discussion of the project and if applicable, includes the options considered. Multiple actions associated with a vulnerable area reflect town priorities and are simply prioritized high, medium or low. If known, the actions include cost estimates and assign responsible parties to lead the efforts to complete the action. The cost ranges used for this strategy are as follows:

- Staff Time – municipal personnel time
- Minimal – less than $5,000
- Moderate – more than $5,000, but less than $25,000
- Significant – over $25,000

Other relevant departments/agencies that can offer support to the project are also listed. Finally, possible finance options are offered. Once the 2021 plan receives FEMA's 'Approved Pending Adoption', the mitigation strategy will be put into motion.

Evaluation/Selection of Mitigation Actions

After reviewing the Town's identified risks and vulnerabilities to natural hazards, the input/feedback from the public workshop and recommendations from the Town, and the local Capability Assessment, the LHMW selected mitigation actions to incorporate into the 2021 plan.

Prioritization of Actions

Due to budgetary constraints and other limitations, it is often impossible to implement all mitigation actions. The LHMW needed to select the most cost-effective actions for implementation first to use resources efficiently and develop a realistic approach toward mitigation risks. The DMA 2000 supports this principle of cost-effectiveness by requiring action plans to follow a prioritization process that emphasizes benefits over costs. DMA 2000 states:

> *"The mitigation strategy section shall include an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs."*

Part 1: Review Benefits and Costs
As part of the planning process, the LHMW utilized Review Tools 1, 2, and 3 associated with each action identified.

Part 2 Prioritize Actions – Qualitative Method, Relative Score
The LHMW utilized Method B: Prioritization using the Social, Technical, Administrative, political, Legal, Economic and Environmental (STAPLEE) criterion Relative Scores, suggested in FEMA's Hazard Mitigation Planning How-to-Guide Series (Table 4-1).

Table 4-1 STAPLEE Review and Selection Criteria

Category	Criteria
Social	Is the proposed action socially acceptable to the community?
	Are there equity issues involved that would mean that one segment of the community is treated unfairly?
	Will the action cause social disruption?
Technical	Will the proposed action work?
	Will it create more problems than it solves?
	Does it solve a problem or only a symptom?
	Is it the most useful action considering other community goals?
Administrative	Can the community implement the action?
	Is there someone to coordinate and lead the effort?
	Is there enough funding, staff, and technical support available?
	Are there ongoing administrative requirements that need to be met?
Political	Is the action politically acceptable?
	Is there public support both to implement and to maintain the project?
Legal	Is the community authorized to implement the proposed action? Is there a clear legal basis or precedent for this activity?
	Are there legal side effects? Could the activity be construed as a taking?

	Is the proposed action allowed by a comprehensive plan, or must a comprehensive plan be amended to allow the proposed action?
	Will the community be liable for action or lack of action?
	Will the activity be challenged?
Environmental	How will the action affect the environment?
	Will the action need environmental regulatory approvals?
	Will it meet local and state regulatory requirements?
	Are endangered or threatened species likely to be affected?
Economic	What are the costs and benefits of this action?
	Do the benefits exceed the costs?
	Are initial, maintenance, and administrative costs considered?
	Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit, and private)?
	How will this action affect the fiscal capability of the community?
	What burden will this action place on the tax base of the local economy?
	What are the budget and revenue effects of this activity?
	Does the action contribute to other community goals, such as capital improvements or economic development?
	What benefits will the action provide?

Part 3 Documentation of the Process

Each of the mitigation actions were scored against each of the STAPLEE criteria outlined above with a numerical score. These numbers were then totaled and developed into an overall priority score. The ranking of the Priority Score is a guideline for when the Town should begin acting on the identified strategies, or actions (Table 4-2).

The STAPLEE Method includes a cost-benefit review as part of the Mitigation Actions prioritization process. A more detailed cost-benefit analysis will be done, at the time of application, for those proposed Mitigation Actions that the Town applies for funding under the BRIC and Hazard Mitigation Grant Programs.

Table 4-2 STAPLEE Analysis

2021 Action Number	Title	Cost/ Benefit	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Total	Prioritization
PUBLIC EDUCATION AND AWARENESS											
2021 - 1	Adapt to climate change projections and advance adaptation and resiliency techniques that are financially and environmentally sustainable (adopt Coastal Resilience Bylaw).	Cost	1	2	2	1	0	1	1	7	**20**
		Benefit	2	2	2	1	2	2	2	13	
2021 - 2	Implement Brewster Coastal Resource Management Plan, Phase 1 Report/Storm Tide Pathways Study (A) Increase public awareness of the importance of healthy coastal wetlands and natural coastal processes, and the need to protect these resources (B) Use best available tools to understand the potential impact of storm surge on public and private property, sensitive infrastructure and natural resources and to develop strategies and plans to avoid, minimize or mitigate adverse impacts.	Cost	1	1	2	2	2	2	2	12	**26**
		Benefit	2	2	2	2	2	2	2	14	
2021 - 3	Increase the public's awareness of hazard vulnerabilities (A) Develop a preparedness campaign for the general public and the private sector that includes guidance and checklists, as well as recommendations to increase community	Cost	2	2	2	2	2	2	0	12	**26**

	resilience to the impacts of climate change (B) Annually host a public hazards display for the residents of Brewster in combination with the 'Brewster in Bloom' festival or other appropriate event (C) Distribute tourist evacuation and shelter information.	Benefit	2	2	2	2	2	2	2	14	
NATURAL RESOURCE PROTECTION											
2021 - 4	Implement Brewster Open Space and Recreation Plan: protect the Town's drinking water supply to meet the needs of residents and visitors today and in the future.	Cost	2	2	2	2	2	2	0	12	**26**
		Benefit	2	2	2	2	2	2	2	14	
2021 - 5	Update Zoning Bylaws and Subdivision Rules/Regulations to protect public supply wells.	Cost	2	2	1	1	2	2	2	12	**26**
		Benefit	2	2	2	2	2	2	2	14	
2021 - 6	Implement the Brewster Coastal Adaptation Strategy (A) Identify and acquire new access points to the shoreline (B) Periodically evaluate the beach management process to evaluate how well it is working and to incorporate lessons learned over time (C) Identify opportunities to promote and support wetland retreat to preserve coastal wetlands, including salt marshes to the extent feasible (D) Continuing research and analysis is needed to manage access to Brewster's shoreline into the future which may include additional monitoring.	Cost	2	1	-1	2	2	2	1	9	**22**
		Benefit	2	2	2	2	2	2	1	13	

2021 - 7	Implement Brewster Coastal Resource Management Plan (A) Periodically assess coastal resources conditions for comparison with baseline conditions. Monitor and assess physical processes to support short-term management decisions and long-term planning (B) Periodically assess coastal resources on a regional scale (C) Adopt long-term coastal management resilient strategies (D) Promote management and maintenance of public access points to increase resilience (E) Preserve natural sediment transport processes in balance with erosion. Evaluate policy and regulatory changes to protect wetland resources (F) Maintain the elevation of salt marshes and tidal flats by promoting opportunities for salt marsh migration.	Cost	2	1	-1	2	1	1	2	8	**22**
		Benefit	2	2	2	2	2	2	2	14	
STRUCTURAL PROJECTS											
2021 - 8	Implement the Brewster Coastal Resource Management Plans (A) Minimize and mitigate impacts of development on coastal areas: protect vulnerable low roads, groundwater and underground infrastructure	Cost	2	2	1	1	2	1	2	11	**25**

	(B) Develop and initiate projects to increase resilience to projected climate change impacts for critical infrastructure (C) Conduct a stormwater infrastructure inventory and assessment to prioritize and initiate improvements based on projected climate change impacts.	Benefit	2	2	2	2	2	2	2	14	
2021 - 9	Complete remediation work necessary on two large marsh systems: Site BR-2 Brewster Cranberry Bog Berm Restriction of channel off Quivett Creek; and Site BR-3 Brewster Cranberry Bog Berm Restriction of Channel off Quivett Creek.	Cost	2	2	1	0	-1	2	2	8	**18**
		Benefit	2	2	2	0	0	2	2	10	
EMERGENCY SERVICES											
2021 - 10	Maintain access for emergency vehicles and maintenance.	Cost	2	2	2	1	2	1	0	10	**22**
		Benefit	2	2	2	2	2	1	1	12	
2021 - 11	Conduct a Needs Assessment of privately-owned facilities that have regional importance (medical/daycare centers).	Cost	2	2	2	1	0	2	0	9	**21**
		Benefit	2	2	2	2	2	2	0	12	
2021 - 12	Incorporate the inspection and management of hazardous trees/limbs into the Town's routine monitoring process.	Cost	2	2	2	1	2	2	0	11	**23**
		Benefit	2	2	2	1	2	2	1	12	
2021 - 13	Mitigate impacts of blowing/drifting snow.	Cost	2	2	2	1	0	2	1	10	**22**
		Benefit	2	2	2	1	2	2	1	12	
2021 - 14	Develop a program to train emergency responders and residents in	Cost	2	2	2	0	0	-1	0	7	**17**

	management of domestic animals, horse, sheep, goats, dogs, cats, birds, as well as wild animals, during emergencies such as floods, fires, winds, etc.	Benefit	2	2	2	1	2	1	0	10	
2021 - 15	Coordinate with Nickerson State Park, Towns of Orleans, Harwich and Dennis on fuel reduction programs and response.	Cost	1	2	1	1	1	2	1	9	**21**
		Benefit	2	2	2	1	2	2	1	12	
2021 - 16	Strengthen/enhance the Brewster Health Department's capacity and capabilities (A) Conduct a full-scale exercise to test Brewster's Medical Emergency Distribution System (MEDS) (B) Create a public health nurse position within the Health Dept. © Create a public health communications coordinator position within the Health Department.	Cost	1	0	1	1	2	1	0	6	**18**
		Benefit	2	2	2	2	2	2	0	12	
PLANNING AND PREVENTION											
2021 - 17	Provide a variety of recreation and open space opportunities to promote healthy and active lifestyles for Brewster's residents, ensuring equitable access for all users and abilities.	Cost	2	2	-1	2	2	1	20	8	**21**
		Benefit	2	2	2	2	2	2	1	13	
2021 - 18	Minimize and mitigate impacts of development in coastal areas: Work with the Planning Board and other stakeholders to evaluate changes to local zoning and regulations to preserve scale, character, and resource protection.	Cost	1	1	1	1	2	2	1	9	**21**
		Benefit	2	2	2	1	2	1	2	12	
2021 - 19		Cost	1	1	-1	0	2	1	2	6	**16**

	Review of ditch systems and old bogs for preventative maintenance to increase flood capacity.	Benefit	1	2	1	1	2	1	2	10	

PUBLIC EDUCATION AND AWARENESS

Action #1

…Town of Brewster Vision Plan 2018

Adapt to climate change projections and advance adaptation and resiliency techniques that are financially and environmentally sustainable.

- Identify techniques such as living shorelines, nourishment from dredged material, and land acquisition for retreat locations to adapt to coastal changes.
- Provide outreach and education (signs, field trips, publications) to build awareness of citizens and decision makers about the nature of coastal changes.

  - Action Type: Planning, Pre-Disaster
  - Priority Score: 20
  - Lead: Conservation Commission/Natural Resources Dept.
  - Supporting: Natural Resources Commission
  - Time Frame: Long Term
  - Financing Options: Municipal Budget
  - Cost Estimate: Municipal Personnel Time
  - Benefit: Protection of property, life and infrastructure/Increased awareness of vulnerabilities
  - Vulnerable Area: Municipally-owned Infrastructure/Coastal Wetlands/Private Property

Action #2

…Town of Brewster Coastal Resource Management Plan, Phase 1 Report/Storm Tide Pathways Study

Implement Brewster Coastal Resource Management Plan, Phase 1 Report/Storm Tide Pathways Study:

D. Increase public awareness of the importance of healthy coastal wetlands and natural coastal processes, and the need to protect these resource.

Education materials should be aimed at shoreline property owners, among others, to discuss the importance of natural sediment transport processes, and best practices for vegetation management, erosion management, and buffer protection, etc. This effort should be coordinated with the development of permitting guidance.

E. Use best available tools to understand the potential impact of storm surge on public and private property, sensitive infrastructure and natural resources, and to develop strategies and plans to avoid,

minimize or mitigate adverse impacts, including tools made available through the Cape Cod Commission's Resilient Cape Cod project, MVP program, and the storm tides pathways assessment project being undertaken by the Barnstable County Extension Service and Center for Coastal Studies.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 26
- Lead: Natural Resources Dept.
- Supporting: Natural Resources Advisory Group
- Time Frame: Medium Term
- Financing Options: Municipal Budget
- Cost Estimate: Municipal Personnel Time
- Benefit: Protection of property, life, infrastructure and natural resources/Increased awareness of vulnerabilities
- Vulnerable Area: Repetitive Loss Properties/Floodplains/Municipally-owned Infrastructure/Emergency Response and Public Health/Private Property

Action #3
…MVP/2016 Draft Plan/HW
Increased the public's awareness of hazard vulnerabilities:

F. Develop a Preparedness Campaign for the general public (i.e., residents and seasonal guests) and the private sector that includes guidance and checklists, as well as recommendations to increase community resilience to the impacts of climate change (e.g., extreme weather, health impacts).

G. Annually host a public hazards display for the residents of Brewster in combination with the 'Brewster in Bloom' festival or another appropriate community event. Ensure that such a display will also be hosted during the summer months, when part-time residents are in Town.

H. Distribute Tourist Evacuation and Shelter Information
Out of state tourists may not be familiar with local authorities, evacuation routes, locations of designated shelters, or know what to expect if police-enforced evacuation becomes necessary. Distribute information on town evacuation routes and emergency shelters to hotels, Bed and Breakfasts, real estate agencies dealing with seasonal rentals, and other facilities and events hosting tourists.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 26
- Lead: Fire Dept./Emergency Management/Police Dept.

- Supporting: Planning Dept./Natural Resources Dept./Natural Resources Advisory Commission
- Time Frame: Short Term
- Financing Options: Municipal Budget
- Cost Estimate: Municipal Personnel Time/MVP Action Grants
- Benefit: Protection of property, life and infrastructure/Increased awareness of vulnerabilities/Accelerated evacuation
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Public and Private Property/Social Distress

NATURAL RESOURCE PROTECTION

Action #4
…Open Space and Recreation Plan 2021
Implement Brewster Open Space and Recreation Plan:

F. Protect the Town's drinking water supply to meet the needs of residents and visitors today and in the future.

Protect existing public supply wells from land-based sources of contamination.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 26
- Lead: Water Dept./Community Preservation Committee
- Supporting: Natural Resources Dept./Recreation Dept./Open Space Committee
- Time Frame: Long Term
- Financing Options: Municipal Budget/FEMA and MEMA Grants/Community Preservation Act Fund
- Cost Estimate: Significant
- Benefit: Protection of drinking water supply/Protection of natural resources
- Vulnerable Area: Municipally-owned Infrastructure/Natural Resources

Action #5
…Integrated Water Resources Management Plan 2013
Update Zoning Bylaws and Subdivision Rules/Regulations to protect public supply wells.

- Strengthen the Water Conservation Bylaw (Chapter 112, Article 1 of the Brewster Town Code).
- Strengthen the Zoning Bylaw provision for drinking water quality protection by mandating the Natural Resource Protection Design (NRPD) in its District of Critical Planning Concern (DCPC), rather than 'encouraging it'.
- Implement a Stormwater Management Bylaw.
- Encourage Low Impact Development (LID).

- Action Type: Mitigation, Pre-Disaster

- Priority Score: 26
- Lead: Planning Board
- Supporting: Planning Dept./Water Dept.
- Time Frame: Medium Term
- Financing Options: Municipal Budget
- Cost Estimate: Municipal Personnel Time
- Benefit: Protection of life/infrastructure, increased awareness of vulnerabilities
- Vulnerable Area: Public Health, Safety and Welfare/Social Distress/Natural Resources

Action #6

…Town of Brewster Coastal Adaptation Strategy 2016

Implement Brewster Coastal Adaptation Strategy

E. Identify and acquire new access points to the shoreline.

- The Town should evaluate possible new access points to the shoreline through collaboration with existing property owners, including state and town-owned land and private properties. The Town should also evaluate how existing satellite parking facilities could be used or expanded, or if new satellite parking areas and pathways to the shore could be created without impacting sensitive resources.
- Identify and plan for the acquisition of parcels that may provide for future access. The proximity of the parcels to sensitive wetland areas and the potential impacts from climate change should be included in the planning process to select sites that will create viable access over the long term.

F. Periodically evaluate the beach management process to evaluate how well it is working and to incorporate lessons learned over time.

- Ongoing beach management promotes safe access to the shore through repairs to the town landings after storm events. Therefore, the Town should continue its ongoing work to restore areas at the town landings impacted by storm events. This can include beach nourishment and dune restoration to replace sand lost during a storm: the planting of beach grass and the use of dune fencing to stabilize dunes; and the repair or replacement of pathways, stairs, or ramps used to access the beach.

G. Promoting wetland retreat as sea level rises helps to preserve the valuable habitat and storm damage prevention function of coastal wetlands. The Town should identify opportunities to promote and support wetland retreat to preserve coastal wetlands, including salt marshes to the extent feasible. Strategies to consider include:

- Mapping of low-lying areas where wetland retreat is possible.
- Land acquisition and preservation in areas directly adjacent to existing wetlands to allow for wetland retreat as sea level rises.
- Incorporation of wetland retreat assessments into plans for the development or redevelopment of properties adjacent to existing wetlands.

- Development of regulatory guidelines to require that wetland retreat adaptation be incorporated into future development plans.
- Removal of restrictions to tidal flow into upstream marshes to promote the inland migration of coastal wetlands.
- Removal of pavement and fill in wetland areas, and/or design and implementation of improved stormwater management where feasible to reduce impacts to existing wetlands.

H. Continuing research and analysis is needed to manage access to Brewster's shoreline into the future which may include additional monitoring. Further analysis and monitoring of the migration of sediment along the coast is needed to understand how the offshore flats will respond to a rising sea level and whether or not they will remain above water at low tide.

The scientific understanding of wetland retreat and salt marsh migration under increasing sea levels will mature over time and any new information should be incorporated into the Town's plans for managing wetland retreat. Future data on the rate of sea level rise can also be used to manage and prioritize future adaptation projects. The Town should also consider the potential contributions to climate change of adaptation options when evaluating different approaches.

The Management Plan could evaluate the implementation of a coastal overlay district to control future development in areas impacted by climate change and manage the rebuilding of existing development in these areas.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 22
- Lead: Natural Resources Dept./Natural Resources Advisory Commission
- Supporting: Brewster Open Space Committee/Community Preservation Committee
- Time Frame: Long Term
- Financing Options: MEMA/FEMA grants/Community Preservation Act Funds
- Cost Estimate: Significant
- Benefit: Protection of cultural and natural resources
- Vulnerable Area: Public and Private Property/Cultural Resources/Natural Resources/Emergency Response/Public Health, Safety and Welfare/Municipally-owned Infrastructure/Floodplains

Action #7

…Town of Brewster Coastal Resource Management Plan, Phase 1 Report

Implement Brewster Coastal Resource Management Plan, Phase 1 Report

A. Periodically assess coastal resources conditions for comparison with baseline conditions. Monitor and assess physical processes to support short-term management decisions and long-term planning.

- Every five years (next in 2021) update projections of sea level rise and storm surge and the modeled impacts of these forces on public beaches and landings, infrastructure and coastal resources.
- Update tidal benchmarks; track and record highest annual high tide as proxy for effects of sea level rise.
- Evaluate the potential benefit, cost and candidate locations for installing one or more tide gauge (s) and a wave buoy to provide localized data on trends in tidal dynamics.
- Evaluate the potential benefit, cost and candidate location for installing a wave height buoy.
- Evaluate the potential usefulness of establishing a volunteer-based program to monitor changes in beach profiles.

B. Periodically assess coastal resources on a regional scale.

- The 2015 Century Scale Sediment Budget should be updated in tandem with the sea level rise (next in 2021) to assess trends in sediment movement within the littoral cell that encompasses Brewster's shoreline. This effort should be evaluated and potentially undertaken in cooperation with Dennis, Orleans and Eastham. The assessment should include recommendations for monitoring protocols and potential management actions necessary to increase resiliency of Brewster's shoreline and ensure that tidal flats keep pace with sea level rise.
- Participate with the Barnstable County Extension and Center for Coastal Studies in developing a Storm Tide Pathway for Brewster. The Storm Tide Pathways project will encompass the entire Cape Cod Bay shoreline and may provide a basis for additional coordinated efforts among towns sharing the same littoral cell.
- Consider development of a regional framework for coastal resilience.
    - Develop a management plan for the Inner Cape Cod Bay Area of Critical Environmental Concern (ACEC), in concert with the other towns sharing the ACEC. Such a plan could encompass studies of sea level rise and sediment budget, regional sediment management, and other ACEC resource issues.
    - Consider establishing a regional coastal resilience planning group among towns in the same littoral cell (Dennis , Orleans, Eastham) to identify/study issues of shared concern cost effectively. Regional coordination could increase funding opportunities. This could be in concert with the existing Barnstable County Coastal Resources Committee, or the Cape Cod Commission's Resilient Cape Cod, Cape Cod Bay Work Group.

C. Adopt long-term coastal management resiliency strategies.

- Evaluate resilient shoreline management practices (those that mimic natural coastal processes) and identify where on Brewster's shoreline they might be applied.
    - Preserve coastal landforms and vegetation that provide buffers to erosion caused by storm surge. Salt marsh and fronting coastal dunes have been shown to be effective in mitigation erosion along Brewster's Cape Cod Bay shoreline.
    - Beach and dune nourishment practices for public and private beaches: Mant's, Paine's Point of Rocks.
    - Dune protection (vegetation, fencing) and reconstruction: Mant's, Breakwater Beach, Point of Rocks.
    - Create a living shoreline demonstration project: oyster reef at Mant's Landing.
    - Managed retreat similar to the relocation of the Paine's Creek parking lot: locations to be determined.
- Evaluate changes to the existing groin field, including potential removal/attrition of groins or other structures on the shoreline that impede coastal processes or hasten erosion. Evaluate whether existing groins could impede sediment transport necessary to sustain the tidal flats under different sea level rise scenarios.
- Enhance stormwater management to minimize or eliminate erosion caused by overland run-off.
    - Implement the stormwater management improvements identified in Brewster's Integrated Water Resource Management Plan and the work being undertaken on MS4 General Permit compliance.
    - Prioritize stormwater improvements in any locations where infrastructure could reduce or eliminate erosion caused by run-off.
    - Provide funding for ongoing maintenance of existing or proposed improvements, possibly through the creation of a stormwater utility.
    - Design and adopt a stormwater management bylaw to enhance stormwater management on public and private property; and ensure that issues related to coastal erosion, use of green infrastructure and use of best management practices are incorporated.
- Evaluate policy and regulatory changes to promote coastal resiliency.
    - Evaluate the potential for implementing a flood plain bylaw to, among other things, "restrict or prohibit development and uses on Land Subject to Coastal Storm Flowage (i.e., 100-year coastal floodplain) and its buffer zones in order to minimize potential loss of life, destruction of property, and environmental damage inevitably resulting from inappropriate development on land known to be subject to storms, flooding, erosion, relative sea rise and other coastal zone hazards," (Cape Cod Commission model bylaw). The Cape Cod Commission model bylaw and efforts implemented in other towns should be evaluated to determine policies applicable to Brewster.
    - Develop permitting guidance for erosion control activities on private properties, and work with the Conservation Commission to apply the

guidance in the review of Notices of Intent and issuance of Orders of Condition.

- Ensure consistency with other planning efforts.

D. Promote management and maintenance of public access points to increase resilience.

- Create a coastal resiliency toolkit consisting of best practices for sustainable design, management and maintenance of town-owned landings and beaches. The toolkit should make use of the work being undertaken through the Cape Cod Commission's Resilient Cape Cod project, and other proven techniques, including:
  - Managed retreat of parking areas and structures.
  - Use of articulated mats to provide stability under ramps and parking areas.
  - Use of beach grass planting, beach nourishment, and dune nourishment/rebuilding/stabilization, among other initiatives.
- Develop a sustainable funding source, possibly through an environmental bond bill offset by short term rental tax revenues, potential increase in deeds tax revenues, town beach sticker revenues or other sources for resilient maintenance and management actions that balance needs for access, public safety, natural resource sustainability, and coastal resiliency; and that meet local and state permitting requirements. These measures include: repair stairs/ramps/walkways (including measures needed for improved handicapped accessibility). A proactive, resilient maintenance program may lower long-term costs by reducing the potential need for emergency repairs.
- Conduct technical alternatives assessments for resilient capital projects needed to address erosion pressure and preserve access at highly threatened town-owned access points. Mant's Landing and Paine's Creek are currently experiencing significant erosion and should be prioritized for evaluation and possible resilient capital projects.

E. Preserve natural sediment transport processes in balance with erosion. Evaluate policy and regulatory changes to protect wetland resources.

- Work with the Conservation Commission to evaluate the Town's wetlands protection bylaw and regulations to determine if any changes would provide enhanced protection of coastal wetlands and natural coastal processes. Areas of exploration could include, but not limited to:
  - Potential to incorporate the sediment budget into the local wetlands bylaw and regulations to regulate protection of upland development differently in eroding areas.
  - For all new or renewed Orders of Condition for erosion management, require analysis of cumulative system-wide impacts, and require adherence to best practices for shoreline erosion management structures.

    - Adopt permitting guidelines based on Woods Hole Oceanographic Institution Sea Grant publication *Spectrum of Erosion Control Methods*. The recent publication of *Guidelines for Erosion Management in Pleasant Bay* provides a guide.
    - Require maintenance and nourishment of erosion management structures.
    - Incorporate monitoring requirements for erosion control measures to provide information to evaluate their functions and impacts.
- Review the Town's policy for allowing access through town landings to perform shoreline stabilization work on private property. Ensure that applicants carry adequate insurance coverage in case of damage to resources caused by heavy equipment or fuel spills.
- Work with the Planning Board to revise, update or extend the Flood Plain Overlay District and Wetlands Conservancy bylaws, based on an evaluation of the bylaw's effectiveness in meeting its original purpose, and based on a survey of similar measures employed in other communities as recommended by the Cape Cod Commission.

F. Maintain the elevation of salt marshes and tidal flats by promoting opportunities for salt marsh migration.

- Use the state-of-the-art wetland modeling to assess patterns of salt marsh retreat in Brewster. Model results could then be used to develop salt marsh management plans to counteract loss of marsh due to subsidence or inundation. Management actions could include:
    - Channel improvements to restore or enhance hydrology.
    - Evaluate the potential for a pilot project for thin layer deposition of material on any subsided areas of salt marsh plane, in coordination with MassDEP permitting guidance.
    - Work with the Town's Open Space Committee, Community Preservation Committee and the Brewster Conservation Trust to identify key parcels for acquisition/conservation restriction and to develop a funding strategy for acquisition/protection of these properties; and develop a framework for tracking and pursuing parcel opportunities.
    - Identify and remove any remaining undersized culverts that may restrict tidal flow and causing degradation of coastal wetlands. An example is the Crosby salt marsh restoration project.
- Develop/update and implement resource management plans to protect large areas of salt marsh. Land Use and Management Plans for Quivett Creek/Paine's Creek Marsh and Namskaket Marsh should be developed in coordination with Brewster Conservation Trust, MA DCR, and adjacent towns.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 22
- Lead: Natural Resources Advisory Committee

- Supporting: Natural Resource Dept./Towns of Dennis, Orleans and Eastham
- Time Frame: Long Term
- Financing Options: Municipal Budget/MEMA and FEMA Grants
- Cost Estimate: Significant
- Benefit: Protection of Natural Resources, floodplains and infrastructure/Public and Private Property
- Vulnerable Area: Repetitive Loss Properties/Floodplains/Public and Private Property/Cultural Resources/Natural Resources/Municipally-owned Infrastructure

STRUCTURAL PROJECTS

Action #8

…Town of Brewster Coastal Resource Management Plan, Phase 1 Report/MVP

Implement Brewster Coastal Resource Management Plan, Phase 1 Report

A. Minimize and mitigate impacts of development in coastal areas: protect vulnerable low roads, groundwater and underground infrastructure.

- Elevate low-lying road segments and/or retrofit stormwater management systems to mitigate flooding during storm surge conditions. The following segments were identified in the CAS and being of special concern:
  - Route 6A at Dennis town line and east of the Cape Cod Museum of Natural History near Paine's Creek.
  - Lower Road at Bloomer Path intersection.
  - Breakwater Road various locations.
  - Crosby Lane.
- Work with the Board of Health to evaluate whether the required separation to groundwater is sufficient, and whether changes in regulation are needed to prevent groundwater intrusion into wells and onsite wastewater treatment systems.

B. Develop and initiate projects to increase resilience to projected climate change impacts (e.g., intense rain, storm surge, sea level rise) for critical infrastructure including but not limited to:

- Route 6A from the intersection of Paine's Creek Road west across causeway dividing the marsh.
- Stormwater drainage throughout town.
- Potentially vulnerable utility infrastructure.

C. Conduct a stormwater infrastructure inventory and assessment to prioritize and initiate improvements (e.g., increased catch basin maintenance, culvert replacement) based on projected climate change impacts.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 25
- Lead: DPW/Utility Providers
- Supporting: Board of Health/Natural Resources Advisory Committee/Planning Dept.
- Time Frame: Long Term
- Financing Options: MEMA and FEMA Grants/MVP Action Grants
- Cost Estimate: Significant
- Benefit: Protection of Public and Private Property/Improved Public Health, Safety and Welfare/Protection of Infrastructure
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/ Public and Private Property/Municipally-owned Infrastructure

Action #9
…Cape Cod Atlas of Tidally Restricted Salt Marshes/2016 Draft Plan
Complete remediation work necessary on two large marsh systems:

- **Site BR-2: Brewster - Cranberry Bog Berm Restriction of Channel off Quivett Creek (Privately Owned):** Inactive cranberry bogs dot this marsh. Berms built to support the past cranberry farming are still in place, severing the tidal flow. A six-inch pipe forms the only connection from the bogs to the marsh, allowing in only a fraction of the tidal flow to pass upstream. The scour, bank erosion and vegetation die-off are each evident and are among the worst observed.

- **Site BR-3: Brewster - Cranberry Bog Berm Restriction of Channel off Quivett Creek** (**Privately Owned):** This site also involves another pipe designed to allow water under an old cranberry bog berm. This pipe prevents any waters from naturally flushing the upstream affected area. The upstream effected area is dominated by *Phragmites.*

  - Action Type: Mitigation, Pre-Disaster
  - Priority Score: 18
  - Lead: Brewster Conservation Commission
  - Supporting: Natural Resources Dept./DPW
  - Time Frame: Medium Term
  - Financing Options: MEMA/FEMA Grants
  - Cost Estimate: Significant
  - Benefit: Protection of Natural Resources/Floodplains
  - Vulnerable Area: Floodplains/Natural Resources

EMERGENCY SERVICES

Action #10
…Town of Brewster Coastal Adaptation Strategy 2016
Maintain access for emergency vehicles and maintenance.

- Emergency response is limited by access of the relevant emergency vehicles, including rescue boats and such access should be maintained at as many landings as possible.

    - Action Type: Mitigation, Pre-Disaster
    - Priority Score: 22
    - Lead: Fire/Emergency Management
    - Supporting: Natural Resources Advisory Committee
    - Time Frame: Short Term
    - Financing Options: MEMA/FEMA Grants
    - Cost Estimate: Significant
    - Benefit: Improved Emergency Response/Public Health, Safety and Welfare
    - Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Natural Resources

Action #11
…2016 Draft HMP
Conduct a Needs Assessment of privately-owned facilities that have regional importance (medical centers/day care centers).

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 21
- Lead: Fire/Emergency Management
- Supporting: Town Manager/Select Board
- Time Frame: Medium Term
- Financing Options: Municipal Budget
- Cost Estimate: Municipal Personnel Time
- Benefit: Improved Public Health, Safety and Welfare/Reduced Social Distress
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Social Distress

Action #12
…2016 Draft HMP
Incorporate the inspection and management of hazardous trees/limbs into the Town's routine monitoring process.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 23
- Lead: DPW
- Supporting: Police/Fire
- Time Frame: Medium Term
- Financing Options: Municipal Budget, MEMA/FEMA Grants
- Cost Estimate: Municipal Personnel Time

- Benefit: Improved Public Health, Safety and Welfare/Emergency Response
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Public and Private Property

Action #13
…2016 Draft HMP
Mitigate impacts of blowing/drifting snow.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 22
- Lead: DPW
- Supporting: Police/Fire
- Time Frame: Medium Term
- Financing Options: Municipal Budget, MEMA/FEMA Grants
- Cost Estimate: Municipal Personnel Time
- Benefit: Improved Public Health, Safety and Welfare/Emergency Response
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Public and Private Property

Action #14
…2016 Draft HMP
Develop a program to train emergency responders and residents in management of domestic animals, horses, sheep, goats, dogs, cats, birds, as well as wild animals, during emergencies such as floods, fires, winds, etc.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 17
- Lead: Health Agent/Animal Control
- Supporting: Natural Resources Dept./Conservation Commission
- Time Frame: Medium Term
- Financing Options: Municipal Budget, MEMA/FEMA Grants
- Cost Estimate: Municipal Personnel Time
- Benefit: Improved Public Health, Safety and Welfare/Emergency Response
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare

Action #15
…2016 Draft HMP
Coordination with Nickerson State Park, Towns of Orleans (Baker's Pond), Harwich/Harwich Water Dept. (Punkhorn Parklands), and Dennis/Dennis Water Dept. (Punkhorn Parklands and Ellis Farm) on fuel reduction programs and response.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 21
- Lead: Fire
- Supporting: Towns of Orleans/Dennis
- Time Frame: Medium Term
- Financing Options: Municipal Budget
- Cost Estimate: Municipal Personnel Time
- Benefit: Improved Public Health, Safety and Welfare/Reduced Vulnerability to Fire/Reduced Cleanup Costs/Protection of Natural Resources
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Public and Private Property/Fire Management and Response

Action #16

…Brewster Health Department

Strengthen/Enhance the Brewster Health Dept.'s capacity and capabilities

A. ***Conduct a full-scale exercise to test Brewster's Medical Emergency Distribution System (MEDS).***
   Test the Town's MEDS system's ability to rapidly dispense medical countermeasures to the general public at points of distributions and to predefined populations in hospitals and nursing homes within the Town of Brewster.

B. ***Create a public health nurse position within the Health Department.***
   Create an in-house public health nurse position for communicable disease investigation, resident immunizations, as a liaison to school populations and families, research changing needs of the community/develop new programs accordingly, develop/implement wellness programs, research and seek grant opportunities, create new cooperative relationships and programs to integrate diverse demographic groups in the community (i.e., Council on Aging and Youth Recreation).

C. ***Create a public health communications coordinator position within the Health Department.***
   Create an in-house public health communications coordinator position for the development of appropriate messaging for public health programs, emergency announcements, social media posts, informational literature, promotional programs to highlight the role of the Health Department and Board of Health in the community to garner additional support for programs and positions.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 18
- Lead: Brewster Health Department

- Supporting: Emergency Management Agency/Select Board
- Time Frame: Long Term
- Financing Options: Municipal Budget
- Cost Estimate: Significant
- Benefit: Improved Emergency Response/Public Health, Safety and Welfare
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Social Distress

PLANNING AND PREVENTION

Action #17

…Open Space and Recreation Plan 2021

Provide a variety of recreation and open space opportunities to promote healthy and active lifestyles for Brewster residents, ensuring equitable access for all users and abilities.

- Plan for future pandemics that impact access to open space and recreational resources.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 21
- Lead: Open Space Committee/Recreation Commission
- Supporting: Community Preservation Committee
- Time Frame: Long Term
- Financing Options: MEMA/FEMA Grants/Community Preservation Act Funds
- Cost Estimate: Moderate
- Benefit: Improved Public Health, Safety and Welfare
- Vulnerable Area: Public Health, Safety and Welfare/Social Distress

Action #18

…Town of Brewster Coastal Resource Management Plan, Phase 1 Report

Minimize and mitigate impacts of development in coastal areas: Work with the Planning Board and other stakeholders to evaluate changes to local zoning and regulations to preserve scale, character, and resource protection (adopt Coastal Resilience Bylaw).

- Consider establishing a Coastal Resource District of Critical Planning Concern as a planning process for considering multiple overlapping planning objectives and tools.
- Develop and implement a stormwater management bylaw/low impact development zoning bylaw as part of compliance with the MS4 General Permit.
- Evaluate the potential benefits of establishing a Coastal Conservancy zoning district with enhanced protections for coastal resources and building scale.

- Evaluate zoning restrictions governing the size, height and lot coverage of newly constructed or reconstructed residential dwellings in the coastal resource planning area.
- Evaluate the potential benefit of revisions to the Flood Plain Overlay District and Wetlands Conservancy District bylaws to further limit development in velocity zones. Any proposed changes should be based on a thorough assessment of the effectiveness of the current bylaws, and the approaches and experience of other communities with similar circumstances.

  - Action Type: Mitigation, Pre-Disaster
  - Priority Score: 21
  - Lead: Planning Board
  - Supporting: Planning Dept./Natural Resources Dept./Natural Resources Advisory Commission
  - Time Frame: Medium Term
  - Financing Options: Municipal Budget, MEMA/FEMA Grants
  - Cost Estimate: Moderate
  - Benefit: Protection of life/infrastructure, increased awareness of vulnerabilities
  - Vulnerable Area: Public Health, Safety and Welfare/Social Distress/Natural Resources

Action #19
…2016 Draft HMP
Review of ditch systems and old bogs for preventative maintenance to increase flood capacity.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 16
- Lead: DPW
- Supporting: Conservation Commission
- Time Frame: Medium Term
- Financing Options: Municipal Budget, MEMA/FEMA Grants
- Cost Estimate: Municipal Personnel Time
- Benefit: Increased Flood Capacity
- Vulnerable Area: Public and Private Property/Public Health, Safety and Welfare/Natural Resources

Section 5 Plan Implementation and Maintenance

5.1 Implementation, Evaluation, and Revision of Plan

Implementation
The LHMW realized that assigning a time frame to each recommended mitigation action is important so that activities can be coordinated with other important governmental functions, such as committee meetings and budget hearings. Assigned time frames also provide input to a project plan used for tracking the progress of all activities. Once the 2021 plan receives FEMA's 'Approved Pending Adoption', the mitigation strategy will be put into motion and the Board of Selectmen will adopt the Plan (within one year of FEMA's approval). It is recognized that progress on plan implementation may vary dependent upon available funding and capacity of staff to complete assigned tasks.

Evaluation
The Town Administrator will bring the LHMW together annually to review the status of the mitigation actions. Within two months of this meeting, a status report will be given to the Planning Board and Select Board. Progress will be reviewed annually at advertised public hearings held by the Brewster Planning Board. It is advantageous the annual review be conducted prior to the Town's annual budget process so any locally funded projects can be considered in the budget process.

Revision
As per 44 CFR S 201.6(d)(3), the Plan will be reviewed and revised to reflect progress in local mitigation efforts and changes in priorities and resubmitted for approval within 5 years in order to continue to be eligible for mitigation project grant funding. In order to ensure that the plan remains current, the LHMW, which consists of representatives from the Planning Department, EMA, Public Works, Zoning and Code Enforcement, Water/Sewer Department, Fire Department, and Police Department, Board of Health, and Conservation Commission will meet annually. The Plan will also be evaluated and updated after a disaster, or as funding opportunities arise for the actions and projects identified in the plan. Any updates will be reviewed and submitted to MEMA upon local approval to ensure that the state hazard mitigation strategy remains current.

The Town of Brewster Hazard Mitigation Plan will be incorporated into the Town's Comprehensive Emergency Management Plan (CEMP) and Comprehensive Master Plan when updated and for consistency.

5.2 Continued Public Involvement

The Town of Brewster will continue public involvement in the plan maintenance process by:

- The approved/adopted plan will be posted on the Town's web site;

- The annual meeting of the LHMW to review the implementation of the plan will be posted/advertised as a public meeting as per Town guidelines; and
- The LHMW will include the public in the preparation of the five-year update using the same public participation process as in the development of this update.

References

Federal/National Resources

Avoiding Septic Shock: How Climate Change Can Cause Septic System Failure and Whether New England States are Prepared, Elena Mihaly/Ocean and Coastal Law Journal Volume 23/Number 1. January 2018

Climate Change 2007: The Physical Science Basis, Summary for Policymakers. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007

Code of Federal Regulations (28 CFR), Section 0.85

FEMA Glossary: Civil Disturbance

Local Mitigation Planning Handbook. FEMA, March 2013

Local Mitigation Plan Review Guide. FEMA, October 1, 2011

Saffir Simpson Hurricane Wind Scale. NOAA, https://www.nhc.noaa.gov/aboutsshws.php

Severe Events Database. NOAA National Centers for Environmental Information, www.ncdc.noaa.gov

Terrorism 2002 – 2005, Federal Bureau of Investigation. 2005

The Wildland Urban Interface in the United States. Radeloff, V.C., R.B. Hammer, S.I. Stewart, J.S. Holcomb, and J.F. McKeefry, Ecological Applications 15:799 – 805, 2005

U.S. Drought Monitor 2017. https://droughtmonitor.unl.edu/

Wind Zones in the United States. www.nist.gov

State Resources

Fujita Scale. NOAA, https://www.spc.noaa.gov/efscale/

Heat Index. NOAA National Weather Service, https://www.weather.gov/phi/heatcond

https://www.seculore.com/resources/cyber-attack-archive/massachusetts

Massachusetts Coastal Erosion Commission Final Report, 2015

Massachusetts Hazard Identification and Risk Assessment Commonwealth of Massachusetts. 2019

Massachusetts Homeowners Handbook to Prepare for Coastal Hazards, MEMA/MA CZM/FEMA/MA DCR/MIT Sea Grant/Woods Hole Sea Grant

Massachusetts Ocean Resource Information System. Massachusetts Office of Coastal Zone Management, http://maps.massgis.state.ma.us/map_ol/moris.php

Modified Mercalli Intensity Scale. USGS https://www.usgs.gov/natural-hazards/earthquake-hazards/education

Municipal Vulnerability Preparedness Program. Executive Office of Energy and Environmental Affairs, www.resilientma.org

Ninth Edition of the Massachusetts State Building Code 780. June 8, 2018

Richter Magnitude Scale. USGS, https://earthquake.usgs.gov/learn/glossary/?term=Richter%20scale

2018 State Hazard Mitigation and Climate Adaptation Plan, Commonwealth of Massachusetts. Massachusetts Emergency Management Agency

Local/Regional Resources

Barnstable County Wildfire Preparedness Plan https://www.barnstablecounty.org/barnstable-county/emergency-preparedness/

Brewster Emergency Management Director's Annual Report. 2019

Brewster Emergency Preparedness Handbook, Town of Brewster

Brewster Municipal Vulnerability Preparedness Workshop: Summary of Findings, Horsley Witten Group, Inc. March 28, 2019

Cape Cod Atlas of Tidally Restricted Salt Marshes, Cape Cod Commission. December 2001

Cyber Incident Response Plan for the Town of Brewster, February 22, 2021

Integrated Water Resources Management Plan, Town of Brewster. 2013

Lower Mill Pond Dam Phase I Inspection/Evaluation Report, Tighe & Bond, September 29, 2010

Lower Mill Pond Dam Operation and Maintenance Manual, Tighe & Bond. August 2013

Mapping Storm Tide Pathways in Cape Cod Bay, Massachusetts, Center for Coastal Studies. June 2021

Massachusetts Hurricane Evacuation Study – Brewster

Open Space and Recreation Plan, Town of Brewster. 2021

Town of Brewster Coastal Adaptation Strategy, Horsley Witten Group, Inc. September 2016

Town of Brewster Coastal Resource Management Plan, Phase I Report, Brewster Coastal Committee/Ridlay & Associates. 2019

Town of Brewster Vision Plan 2018, Brewster Vision Advisory Group

2019 Annual Water Quality Report, Brewster Water Department. 2019

Brewster Subdivision Rules and Regulations, Chapter 290, Article IV: Design and Construction Standards, Town of Brewster

Town of Brewster Zoning Code, Flooding, Chapter 100/Floodplain District, Article II Establishment of Districts, Section 179-7/Wetlands Protection Bylaw, Chapter 172/Wetlands Conservancy District, Article II Establishment of Districts, Section 179-6. May 14, 1979

Town of Brewster, MA Comprehensive Emergency Operations Plan

Town of Brewster Tax Assessor CAMA Data.
Massachusetts Property Tax Code, 2020

Appendix A – Maps

Map 2-1: Shoreline Change Brewster

This map is produced by the GIS Department of the Cape Cod Commission, a division of Barnstable County, 2021.
The information depicted on these maps is for planning purposes only. It is notadequate for legal boundary definition, regulatory interpretation, or parcel level analysis. It should not substitute for actual on-site survey, or supersede deed research.

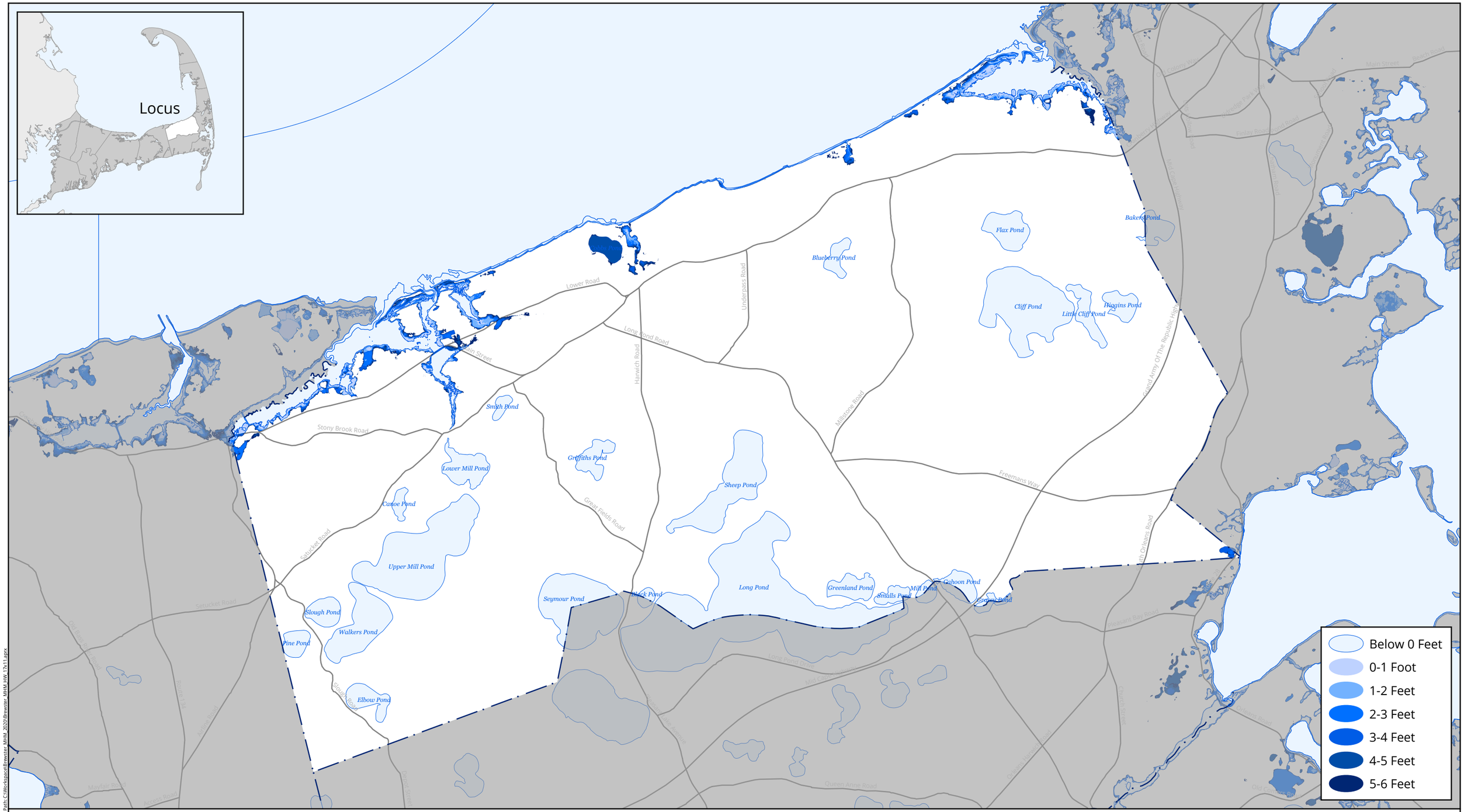
User: gprahm Date: 6/8/2021

High Water Shorelines: MORIS/CZM from NOAA and USGS maps 2009.

Service Layer Credits: World_Imagery: Maxar

0 0.05 0.1 0.2 0.3 Miles

CAPE COD COMMISSION



Map 2-2: Sea Level Rise

Brewster

Sources:
Sea Level Rise: Mean Higher High Water elevations in feet, MassGIS LIDAR data processed by CCC, 2013.
Base map features: MassGIS and Cape Cod Commission.
This map is produced by the GIS Department of the Cape Cod Commission, a division of Barnstable County, 2021.

The information depicted on these maps is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel level analysis. It should not substitute for actual on-site survey, or supersede deed research.

User: gprahm Date: 6/8/2021

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CAPE COD COMMISSION

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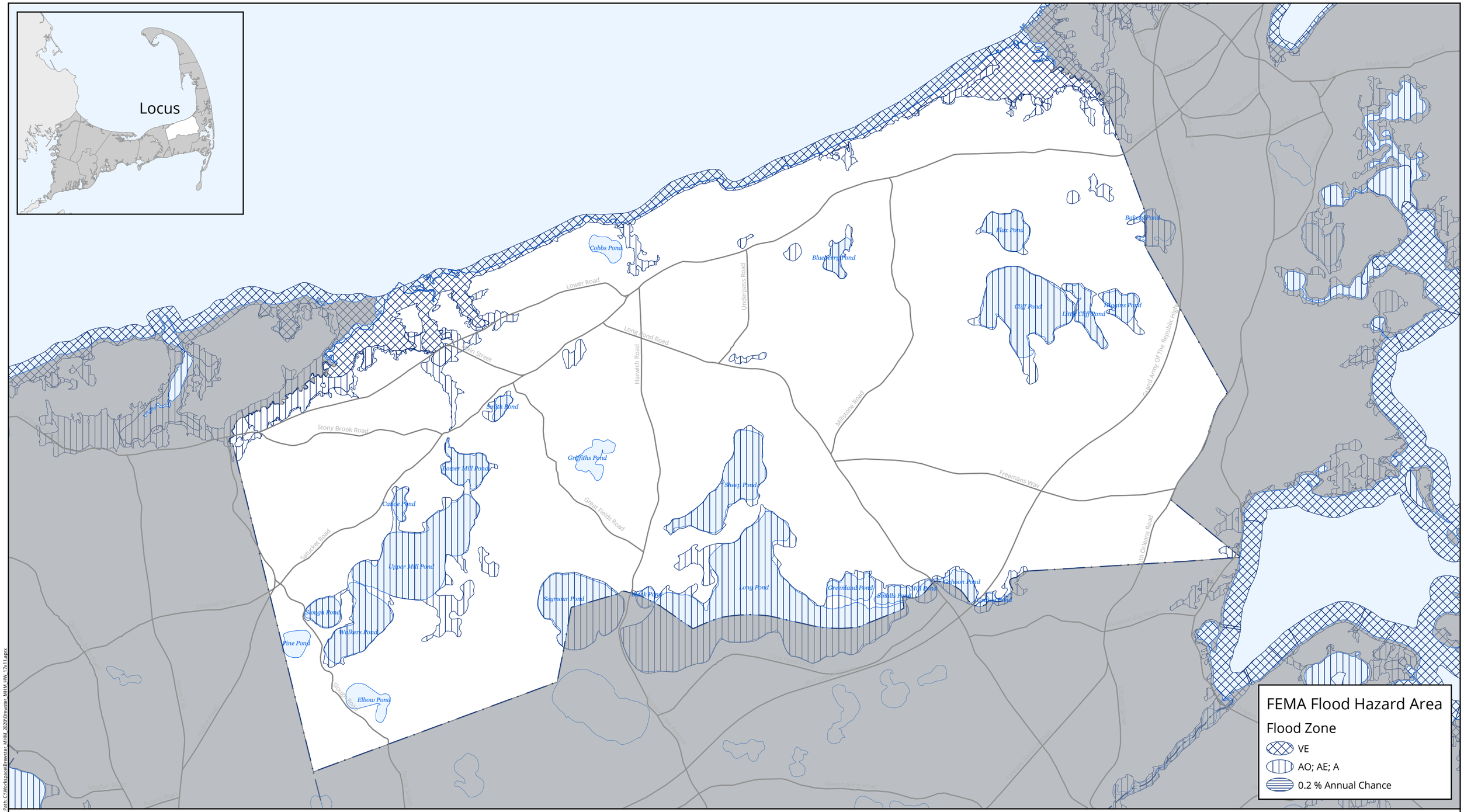

Map 2-3: Flooding (FEMA FIRM)

Brewster

Sources:
Flood Hazard Area: FEMA, 2019.
Base map features: MassGIS and Cape Cod Commission.
This map is produced by the GIS Department of the Cape Cod Commission, a division of Barnstable County, 2021.

The information depicted on these maps is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel level analysis. It should not substitute for actual on-site survey, or supersede deed research.

User: gprahm Date: 6/8/2021

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CAPE COD COMMISSION

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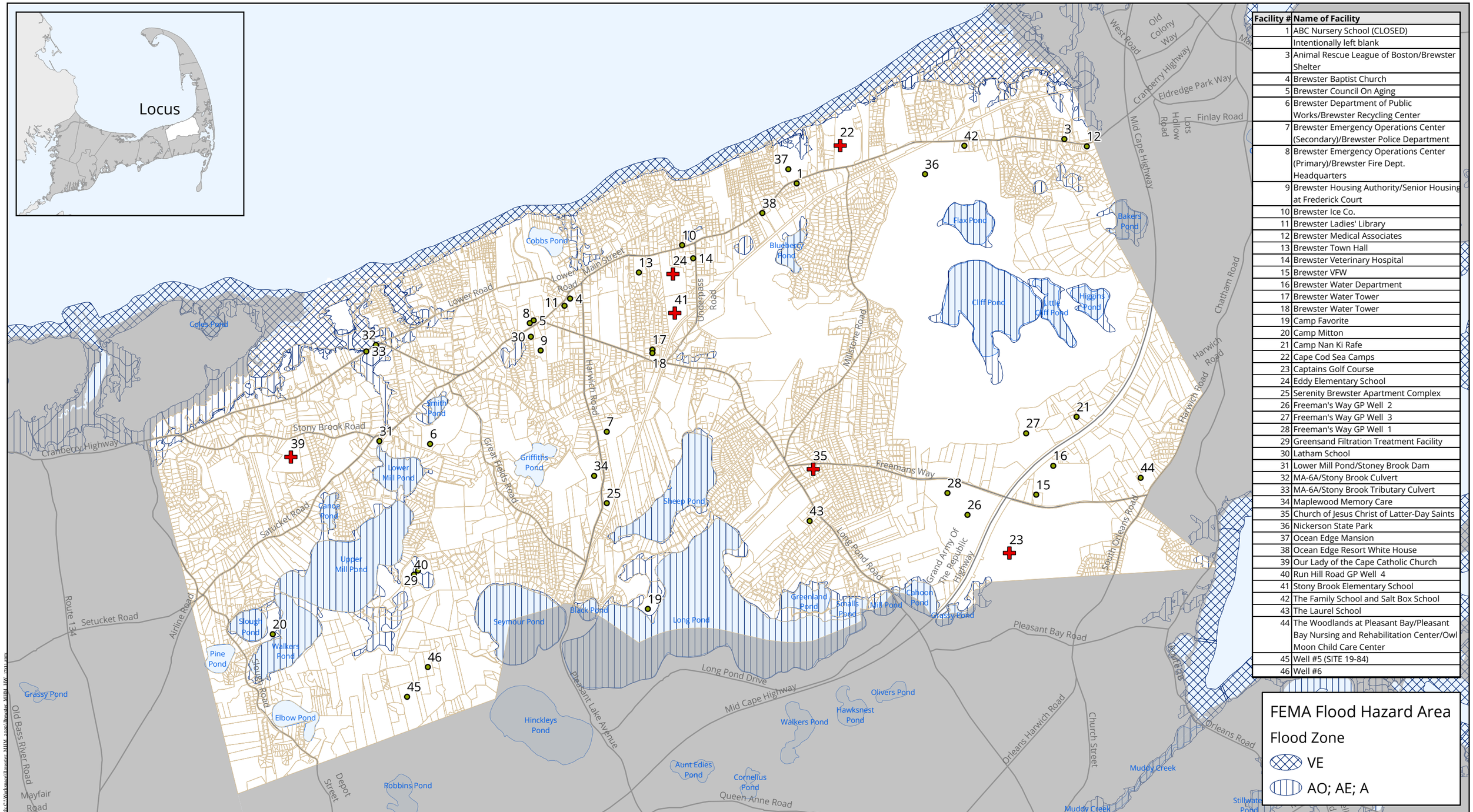


Facility #	Name of Facility
1	ABC Nursery School (CLOSED)
	Intentionally left blank
3	Animal Rescue League of Boston/Brewster Shelter
4	Brewster Baptist Church
5	Brewster Council On Aging
6	Brewster Department of Public Works/Brewster Recycling Center
7	Brewster Emergency Operations Center (Secondary)/Brewster Police Department
8	Brewster Emergency Operations Center (Primary)/Brewster Fire Dept. Headquarters
9	Brewster Housing Authority/Senior Housing at Frederick Court
10	Brewster Ice Co.
11	Brewster Ladies' Library
12	Brewster Medical Associates
13	Brewster Town Hall
14	Brewster Veterinary Hospital
15	Brewster VFW
16	Brewster Water Department
17	Brewster Water Tower
18	Brewster Water Tower
19	Camp Favorite
20	Camp Mitton
21	Camp Nan Ki Rafe
22	Cape Cod Sea Camps
23	Captains Golf Course
24	Eddy Elementary School
25	Serenity Brewster Apartment Complex
26	Freeman's Way GP Well 2
27	Freeman's Way GP Well 3
28	Freeman's Way GP Well 1
29	Greensand Filtration Treatment Facility
30	Latham School
31	Lower Mill Pond/Stoney Brook Dam
32	MA-6A/Stony Brook Culvert
33	MA-6A/Stony Brook Tributary Culvert
34	Maplewood Memory Care
35	Church of Jesus Christ of Latter-Day Saints
36	Nickerson State Park
37	Ocean Edge Mansion
38	Ocean Edge Resort White House
39	Our Lady of the Cape Catholic Church
40	Run Hill Road GP Well 4
41	Stony Brook Elementary School
42	The Family School and Salt Box School
43	The Laurel School
44	The Woodlands at Pleasant Bay/Pleasant Bay Nursing and Rehabilitation Center/Owl Moon Child Care Center
45	Well #5 (SITE 19-84)
46	Well #6

Map 2-4: Critical Facilities and Flood Hazard Areas

Brewster

Sources:
Flood Hazard Area: FEMA, 2019.
Base map features: MassGIS and Cape Cod Commission.
This map is produced by the GIS Department of the Cape Cod Commission, a division of Barnstable County, 2021.

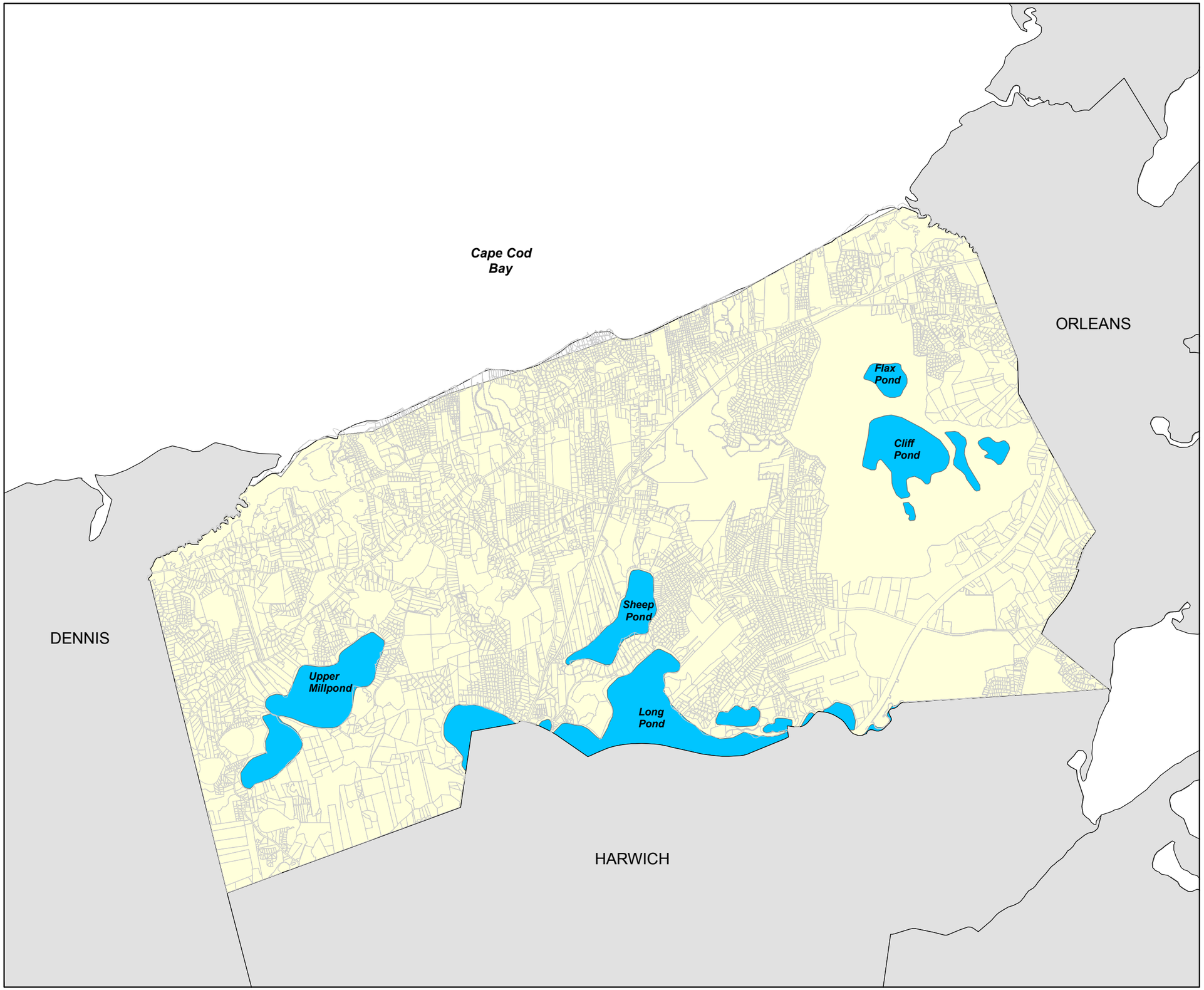
The information depicted on these maps is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel level analysis. It should not substitute for actual on-site survey, or supersede deed research.

User: gprahm Date: 9/23/2021

- Critical Facility
- Shelter/Mass Care Facility
- Parcel, 2019

0.2 0 0.2 0.4 0.6 0.8 1
Miles

CAPE COD COMMISSION



Brewster, MA

0 0.5 1 2 Miles

N

Legend

Average Annual Snowfall

24.1 to 36.0 Inches

Map 2-5
Average Annual Snowfall
Brewster, MA

June 16, ,2021 CSP
Source: MassGIS/FEMA

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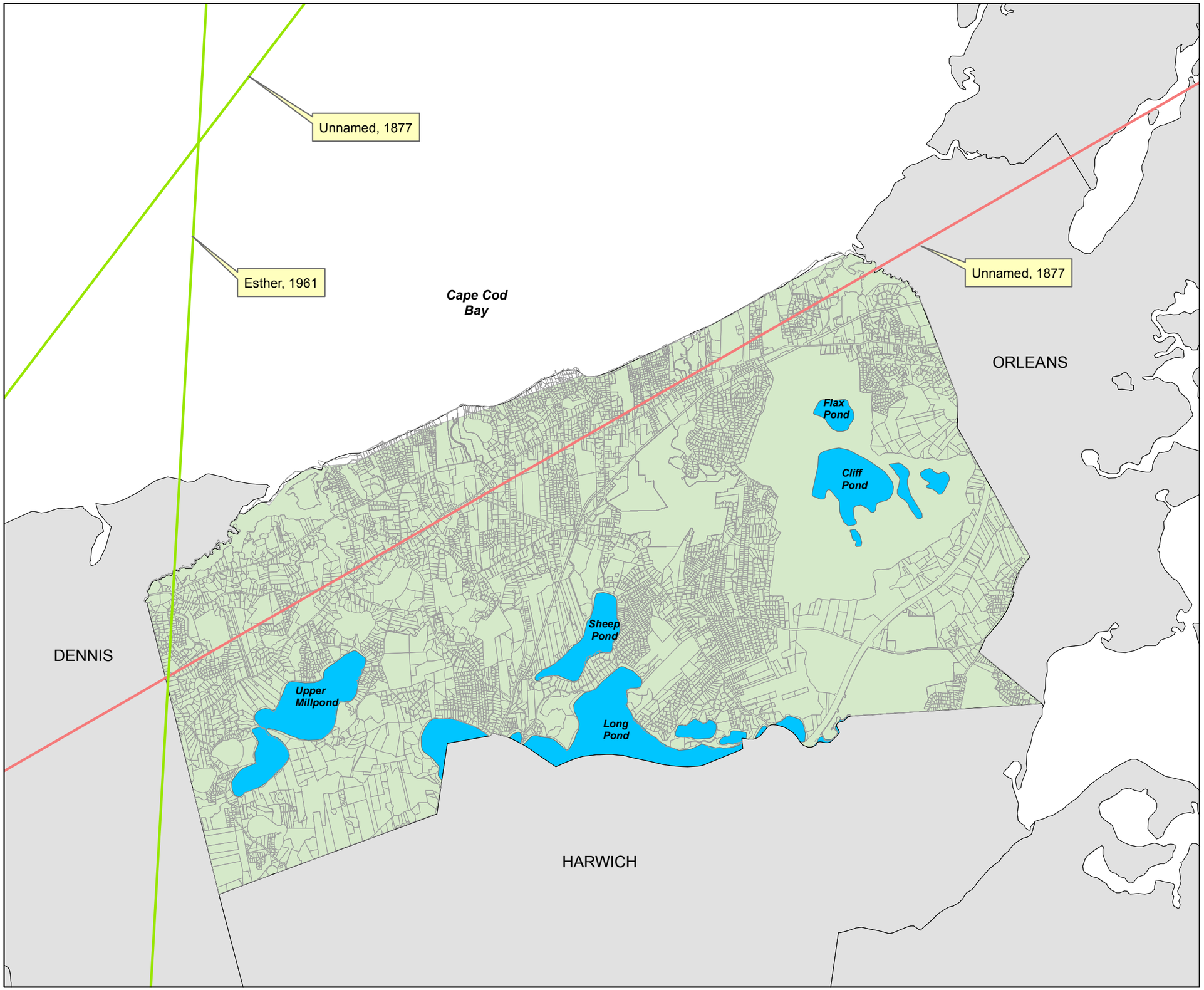

Brewster, MA

0 0.5 1 2 Miles

N

Legend

Hurricane Tracks Category

- Tropical Storm
- Extratropical Storm

Wind Zone

- Zone II (160 mph)

Map 2-6
Hurricanes
Brewster, MA

June 16, ,2021 CSP
Source: MassGIS/FEMA

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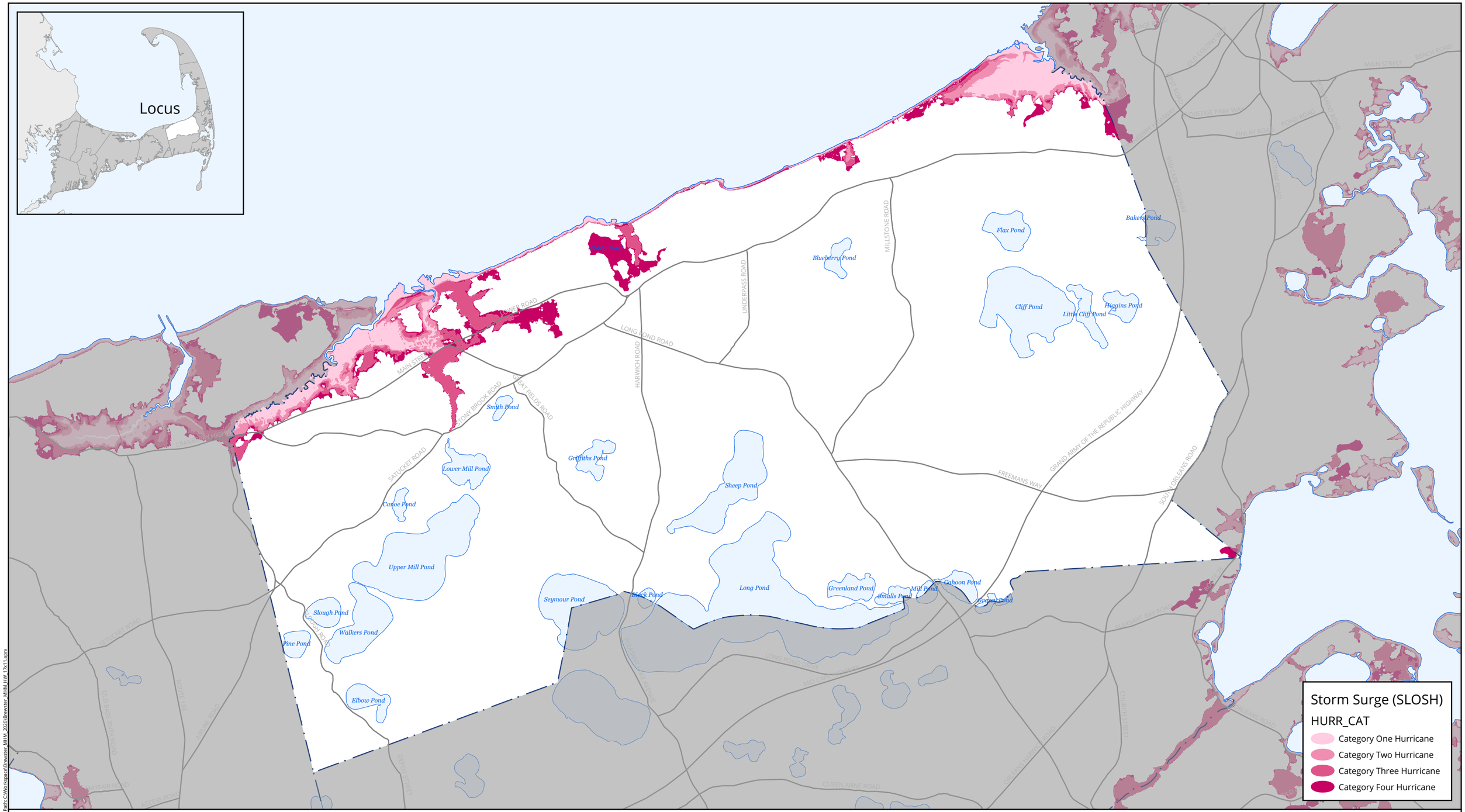


Map 2-7: Storm Surge (SLOSH)

Brewster

Sources:
Storm Surge (SLOSH): Army Corps of Engineers, 2013.
Base map features: MassGIS and Cape Cod Commission.
This map is produced by the GIS Department of the Cape Cod Commission, a division of Barnstable County, 2021.

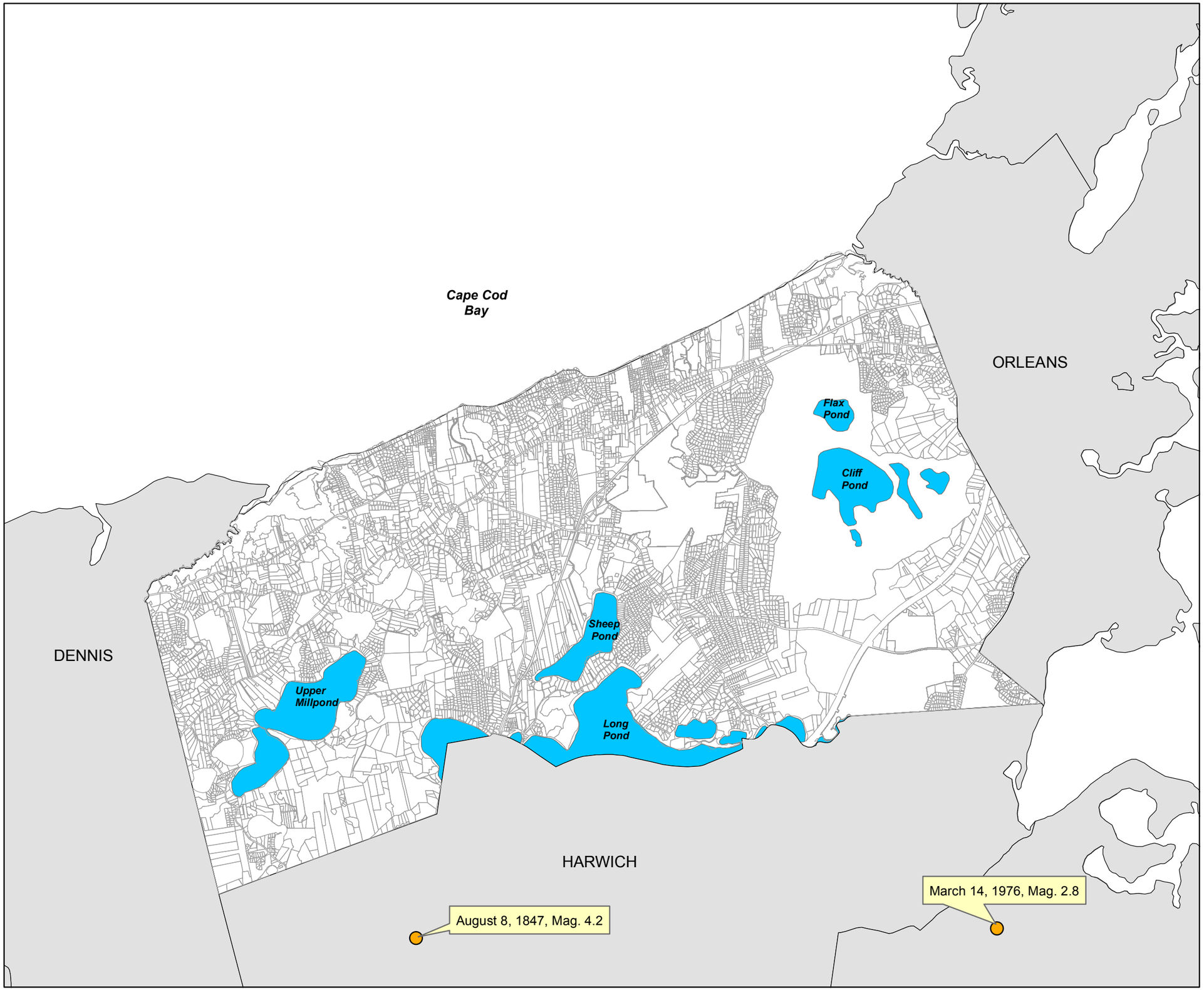
The information depicted on these maps is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel level analysis. It should not substitute for actual on-site survey, or supersede deed research.

User: gprahm Date: 6/8/2021

0.2 0 0.2 0.4 0.6 0.8 1
Miles

CAPE COD COMMISSION

Document Path: C:\Workspace\Brewster_MHM_2020\Brewster_MHM_HW_17x11.aprx



Brewster, MA

0 0.5 1 2 Miles

N

Legend

Earthquake Points

Map 2-8
Earthquakes
Brewster, MA

June 16, ,2021 CSP
Source: MassGIS/FEMA

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Appendix B – Public Information and Outreach

Project Webpage

Local Hazard Mitigation Workgroup Meeting #1: March 12, 2020

Local Hazard Mitigation Workgroup Meeting #2: July 15, 2020

Public Workshop #1: January 30, 2021

Local Hazard Mitigation Workgroup Meeting #3: July 16, 2021

Local Hazard Mitigation Committee Workgroup Meeting #4: September 27, 2021

Public Workshop #2: November 30, 2021

On-Line Survey

Project Webpage

FEMA defines hazard mitigation as:

A series of actions and policies designed to reduce and/or eliminate the impacts of naturally occurring disasters on people and property.

About the Brewster Hazard Mitigation Plan

A hazard mitigation plan should be considered a living document that must grow and adapt, keeping pace with a community's growth and change. The Disaster Mitigation Act of 2000 (DMA) places high priority on the continuation of the planning process after the initial submittal, requiring communities to seek and receive re-approval from FEMA in order to remain eligible for assistance. The evaluation, revision and update process is also a means to create an increased institutional awareness and involvement in hazard mitigation as part of daily activities.

The approach for this plan is premised on four primary methods, all geared towards meeting the requirements of the DMA 2000 Public Law 106-390, October 10, 2000:

- Planning Process—Outreach and Stakeholder Coordination
- Risk Assessment—Identifying Hazards and Estimating Losses
- Mitigation Strategy— Identifying Mitigation Actions and Implementation Strategies
- Plan Maintenance—Implementation, Evaluation and Revision/Update

Stay tuned for more information on how to get involved!

Contacts

Craig Pereira—Project Manager
Horsley Witten Group, Inc.
55 Dorrance St. Suite 200
Providence, RI 02903
cpereira@horsleywitten.com
Phone: (401)272-1717

Local Hazard Mitigation Workgroup Meeting #1: March 12, 2020

Brewster Hazard Mitigation Plan

Local Hazard Mitigation Workgroup Meeting #1

Brewster Town Hall Room C
2198 Main Street
Brewster, MA
March 12, 2020 1:00 PM – 3:00 PM

Agenda

1. Introductions

2. Project Coordination
    a. Scope
    b. Revised Schedule (modified thru Task 4)
    c. Proposed Layout
    d. Public Outreach
        i. Project Webpage
        ii. Interdepartmental memo/email: Project kickoff
    e. Data Collection
        i. HW FTP access/instructions
        ii. January 2016 Draft Plan in native format…received
        iii. Parcel data set with recent CAMA export
        iv. Coordination with CCC for Mapping/Data sets
            1. Location Map
            2. Flood Hazard Areas Map (need to overlay with parcels)…received from MVP project
            3. Earthquakes/Landslides Map
            4. Hurricanes/Tornadoes Map
            5. Average Annual Snowfall Map
            6. Critical Facilities…received from MVP project…current?
            7. Traffic Control Points/Evacuation Map
            8. Others (will need data for Economic Vulnerability Analyses)
                a. Sea Level Rise…received from MVP project, only 3-foot rise (1, 5, 7-foot?)
                b. Hurricane Surge Inundation…received from MVP project

c. Shoreline Change Map

3. January 2016 Mitigation Actions (still relevant?)

4. Agenda/Logistics for Public Workshop #1
    a. Date/Time/Venue
    b. Agenda
        i. Overview
        ii. Why Hazard Mitigation Planning
            1. Mitigation Process
            2. Mitigation Goals
            3. Mitigation Actions
        iii. January 2016 Mitigation Actions
        iv. Questions/Comments
    c. Online Survey kickoff

Horsley Witten Group

Memorandum of Meeting

To: Brewster Local Hazard Mitigation Workgroup (LHMW)

From: Craig Pereira

Date: March 13, 2020

Re: Brewster Hazard Mitigation Plan (HMP) Development

In attendance:

Don Labonte – Resident/CERT
Donna Kalinick – Assistant Town Administrator
Patrick Ellis – DPW Superintendent
Paul Anderson – Water Department Superintendent
Chris Miller – Natural Resources Director
Victor Staley – Building Commissioner
Heath Eldredge – Police Chief
Ryan Bennett – Town Planner

Consultant Team
Craig Pereira, Project Manager - Horsley Witten Group, Inc. (HW)
Will Keefer, Senior Planner - HW

1. Scope of Work/Project Overview.
    a. Craig Pereira provided an overview of the project highlighting the Scope of Work/Tasks.
        i. Workgroup member asked if epidemics would also be covered. Craig Pereira commented that the Town's RFP and HW's proposal did not request/propose man-made and technological hazards. Craig stated that he will coordinate with Ryan Bennett on this.
2. Proposed Plan Layout.
    a. Craig Pereira reviewed provided a proposed layout for the HMP, based on his coordination with MEMA on other HMP projects.
3. Project Webpage.
    a. Craig Pereira provided draft content for the Project Webpage to be hosted on the Town's website.
        i. Several Workgroup members stated that the Town's website in currently transitioning to a new format. Ryan Bennett stated that HW has hosted websites in the past for other projects and could this happen for the HMP. Craig commented that this is not in the Scope and would be better if hosted on the Town website and serve as a repository of public meeting flyers/notices, meeting materials and draft sections of the plan for public comment. Craig will provide all the content, the Town just needs to post it.
4. Data Collection.

a. Craig will conduct a review of the Town's website and obtain what is available. Any other data (plans/reports/studies) not publicly available should be posted to HW's FTP site, access and instructions provided below in follow up section.
b. Craig requested a copy of the Town's GIS parcel data set (shapefile) with a recent CAMA export to include assessed building/land/total value.
c. Mapping. The Town has coordinated with the Cape Cod Commission to provide the required mapping for the hazard mitigation plan. Maps that will be needed as per FEMA requirements include:
    i. Location Map
    ii. Flood Hazard Area Map…received from MVP project, need to overlay onto parcels shapefile for Vulnerability Analyses (infrastructure and economic).
    iii. Earthquakes/Landslides Map
    iv. Hurricanes/Tornadoes Map
    v. Average Annual Snowfall Map
    vi. Critical Facilities…received from MVP project, need to check for currency?
    vii. Traffic Control Points/Evacuation Map

    Other maps needed by Craig to conduct climate change impacts/vulnerability analyses include:
    i. Sea Level Rise…received from MVP project, only 3-foot rise scenario included (1, 5, 7-foot)…discuss whether to expand.
    ii. Hurricane Surge Inundation…received from MVP project
    iii. Shoreline Change Maps

5. Draft Mitigation Strategy.
    a. Craig reviewed the draft mitigation actions included in the mitigation strategy to see what remains relevant, given the plan was only a draft and never submitted/approved by FEMA.
    b. Craig also reviewed the top priorities identified through the MVP project, stating that these mitigation actions will also be folded into the 2020 Mitigation Strategy.
6. Online Survey.
    a. Craig presented the draft online survey to the Workgroup, to be kicked off at the first Public Workshop.

Follow Up Items:

- Ryan Bennett
    - Coordinate with Craig on consideration of man-made/technological hazards.
    - Coordinate with Brewster IT to dedicate a project webpage to HMP.
    - Coordinate with Craig for transfer of GIS Parcel data set.

- All LHMW Members
    - Review the proposed plan layout and provided feedback/requested revisions by April 9, 2020.
    - Any plans/studies/reports not publicly available post to HW's FTP site:
        - Go to http:www.horsleywitten.com
        - On the lower right-hand side of the webpage, click on 'Click here to send us your large files'
        - Enter your email address
        - Enter recipient at HW (Craig Pereira)

- Password is StormWater (case sensitive)
- Browse the files you would like to send
- Click on 'Send this File'

- Review the draft 2016 Mitigation Strategy. For each action, identify:
  - Provide additional descriptive text to action statement
  - Impacts by which hazards
  - Types of impacts (i.e. disruption to lifeline/social/economic/environmental)
  - Cause (i.e. undersized culvert, elevation of roadway)
  - Multiple incidents at one site
  - Completed/Not completed
  - Month/Year if completed
  - Responsible party
  - Funding mechanism/grant amount
- Review the proposed online survey and provide feedback/requested revisions by April 9, 2020.

PROJECT SCHEDULE

HAZARD MITIGATION PLAN DEVELOPMENT	
Task 1: Convene and Coordinate with the LHMC, Conduct Outreach, Document Planning Process	**March 2, 2020 – April 30, 2020**
Meeting #1 – Local Hazard Mitigation Committee - Project Webpage (Municipal Website) - Data Collection ***Coordination with Town Departments/Personnel*** ***Public Workshop #1***	March 12, 2020 Week of April 6, 2020 Week of April 27, 2020
Task 2: Risk Assessment	**May 4, 2020 - May 29, 2020**
- Hazard Identification - Hazard Event Profiles	
Task 3: GIS Mapping	**May 18, 2020 – June 12, 2020**
- Coordination with Cape Cod Commission	
Task 4: Hazard Vulnerability Assessment	**June 15, 2020 – July 10, 2020**
- Risk Assessment/Loss Estimation **Meeting #2 – Local Hazard Mitigation Committee**	 Week of June 15, 2020
Task 5: Develop Goals and Objectives	**June 22, 2020 - July 17, 2020**
- Mitigation Recommendations - Review Goals and Objectives	
Task 6: Analyze Existing/Research New Strategies	**July 20, 2020 - August 14, 2020**
- Plans, Policies and Problems Examination - Identification of Resources	
Task 7: Develop Comprehensive Range of Actions and Projects	**August 17, 2020 - September 11, 2020**
Meeting #3 – Local Hazard Mitigation Committee - Refine Goals and Objectives - Cost Benefit Review/Prioritization	Week of August 17, 2020
Task 8: Update Plan Maintenance/Implementation	**August 31, 2020 – September 11, 2020**
- Mitigation Action Plan	
Task 9: Review, Revision, Approval and Adoption of Plan	**August 31, 2020 - September 11, 2020**
Meeting #4 - Local Hazard Mitigation Committee **Public Comment Period** ***Public Workshop #2/Public Hearing***	Week of September 14, 2020 October 5, 2020 – October 30, 2020 Week of September 28, 2020
Final Deliverable to MEMA	**Friday, November 5, 2020**

Brewster Hazard Mitigation Plan (proposed layout)

Section 1: Introduction

Overview

- Hazard mitigation planning in general

What Hazard Mitigation Can do for Brewster

- Benefits of hazard mitigation planning

Brewster Goals

- TBD…consolidated to be over-arching

Planning Process

- Overview of approach/process of the project
    - Local Hazard Mitigation Committee Meetings
    - Public Workshops
    - Municipal Interviews
    - Survey

Environmental Setting

- Geographic location
- History
- Government Structure

History of Disaster Declarations

- Federal Emergency and Major Disaster Declarations for the County

Recent Disaster Declarations

- Recent (2011 – forward) Federal Emergency and Major Disaster Declarations for the County

Section 2: Risk Assessment

Introduction

- Which hazards merit special attention
- What actions might be taken to reduce the impact(s) of those hazards
- What resources are likely to be needed

Hazard Identification

- Required to evaluate all hazards identified in the State Plan…anticipated list:
    - Riverine/Flash Flooding
    - Heavy Rain/Inland and Urban Flooding
    - Climate Change
    - Sea Level Rise
    - Dam Failure
    - Coastal Erosion/Shoreline Change
    - Coastal Flooding
    - Blizzards/Heavy Snow/Winter Weather/Nor'easters
    - Ice Storms
    - Extreme Cold
    - Hurricanes
    - Tornadoes/High Winds
    - Lightning/Thunderstorms

    - Hail
    - Earthquakes/Landslides
    - Drought
    - Extreme Heat
    - Urban Fire/Wildfires
    - Invasive Species
- Likely not to be addressed:
    - Avalanche
    - Expansive Soils
    - Land Subsidence
    - Volcanoes
    - Tsunamis

Hazard Profiles

- Review of NOAA's National Climatic Data Center (http://www.ncdc.noaa.gov/) 'Storm Events' database and develop tables based on hazard type, date, level/description and damages to develop a Hazard Index.
    - Flood Related
    - Winter Related
    - Wind Related
    - Geologic Related
    - Drought Related
    - Urban Fire/Wildfire Related
    - Invasive Species Related

- Evaluate the location/history/probability of future occurrence of hazards

  Criteria for Frequency Categorization:

  Very low frequency: events that occur less frequently than once in 1,000 years (less than 0.1% per year).

  Low frequency: events that occur from once in 100 years to once in 1,000 years (0.1% to 1% per year).

  Medium frequency: events that occur from once in 10 years to once in 100 years (1% to 10% per year).

  High frequency: events that occur more frequently than once in 10 years (greater than 10% per year).

  Criteria for Severity Categorization (based on past hazard events):

  Minor: Limited and scattered property damage; no damage to public infrastructure; contained geographic area; essential services not interrupted; no injuries or fatalities.

  Serious: Scattered major property damage; some minor infrastructure damage; wider geographic area; essential services are briefly interrupted; some injuries/fatalities.

  Extensive: Consistent major property damage; major damage to public infrastructure; essential services are interrupted for several hours to several days; many injuries and fatalities.

Catastrophic: Property and public infrastructure destroyed; essential services stopped; thousands of injuries and fatalities.

- Mapping will also be developed
    - Critical Facilities
    - FEMA Flood Zones
    - Snowfall, Hurricane paths, storm surge, etc.

Vulnerability

- Evaluates vulnerability of built environment, social and environment.

<u>Development Trends</u>

- Changes over time, future development plans (residential/commercial/industrial)

<u>Economic Vulnerability</u>

- Impacts of FEMA flood zones (Economic by land use type, land/building values)

<u>Social Vulnerability</u>

- Impacts to built/natural environment and that relationship to the social structure of the community
- Infrastructure/Emergency lifelines
- Evacuation/Populations at risk

<u>Environmental Vulnerability</u>

FEMA Disaster Grant Assistance

- Has the Town received any financial assistance from MEMA/FEMA?

Section 3: Capability Assessment

Introduction

- Documents local, state and federal department, agency and program capabilities in terms of pre and post-disaster activities

Planning/Regulatory Capabilities

- Planning documents
- Regulations/Bylaws
- Building Code

Administrative Capabilities

- Emergency Management Plan
    - Emergency Operations Center/Shelter
- Municipal Website
- Coordination with Neighboring Communities
- Municipal Structure/Staff

Financial Capabilities

- Federal/State Grant Opportunities

National Flood Insurance Program

- NFIP/Compliance with NFIP

Existing Protection Matrix

- Summary of all above

Section 4: Mitigation Strategy

Introduction

Mitigation Activities

- Requires an action for every vulnerability identified in the plan

Mitigation Action Plan

- Categories
    - Public Education and Awareness
    - Property Protection
    - Natural Resource Protection
    - Structural Projects
    - Emergency Services
    - Planning and Prevention

- Time Frame
    - Short Term = 0 to 6 Months
    - Medium Term = 6 to 18 Months
    - Long Term = 18 Months to 5 Years

- Cost Estimate
    - Staff Time – municipal personnel time
    - Minimal – less than $5,000
    - Moderate – more than $5,000, but less than $25,000
    - Significant – over $25,000

- Prioritization of Actions (abbreviated Benefit/Cost Analysis)
  STAPLEE Criteria

    - **S**ocial: Is the action compatible with present and future local community needs and values?
    - **T**echnical: Is the action feasible with available local resources (or as supplement by outside resources as necessary)?
    - **A**dministrative: Does the community have the administrative capacity to implement the action?
    - **P**olitical: Is there strong public support to implement and maintain the action?
    - **L**egal: Does the community have the legal authority to implement the action?
    - **E**conomic: Is the action cost-effective?
    - **E**nvironmental: Does the action impact environmental resources, and is the impact positive, negative, or neutral?

- Action Description
    - Action Type:
    - Priority Score:
    - Lead:
    - Supporting:
    - Time Frame:
    - Financing Options:

    - Cost Estimate:
    - Benefit:
    - Vulnerable Area:

Section 5: Plan Implementation/Maintenance

Implementation/Evaluation/Revision

- Implementation
    - Following municipal adoption

- Evaluation
    - Annually

- Revision
    - Every 5 years/after a major event

Continued Public Involvement

- Posted on Town's website
- Annual Town Meeting

FEMA defines hazard mitigation as:

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About the Brewster Hazard Mitigation Plan

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cpereira@horsleywitten.com
Phone: (401)272-1717

2016 Proposed Mitigation Actions

- Updated following the LHMW Meeting #1

Action Item #1 **Remove…established**	**Create a standing Multi-hazard Mitigation Committee**
Hazard designed to mitigate:	All
Objective intended to help achieve:	2, 5
General background of item:	Bring together representatives of public safety, public works, conservation, health and others to share information on areas concerning pre-disaster mitigation and keep an open dialogue on areas of concern and potential mitigation between departments and with adjoining towns.
Responsibility for implementation assigned to:	Planning Department, Board of Selectmen
Potential funding source:	Operating budget
Priority/ time frame for implementation (or target completion date if possible):	Moderate/2011

Action Item #2 **Status ? _____**	**Join the NFIP's Community Rating System (CRS)**
Hazard designed to mitigate:	Flood
Objective intended to help achieve:	1, 3, 9
General background of item:	Acquiring certification in CRS requires completion of a detailed application and certification process.
Responsibility for implementation assigned to:	Planning Department, Building Department
Potential funding source:	Operating budget
Priority/ time frame for implementation (or target completion date if possible):	High/2011

Action Item #3 **Keep? Capability Assessment if ongoing. Currently working with CCC**	**Increase protection of the floodplain by amending the current Floodplain District By-law.**
Hazard designed to mitigate:	Flood
Objective intended to help achieve:	1
General background of item:	Develop and adopt amendments to the floodplain by-law in the Brewster Zoning By-law.
Responsibility for implementation assigned to:	Planning Department, Planning Board
Potential funding source:	Operating budget

Priority/ time frame for implementation (or target completion date if possible):	High/May 2011

Action Item #4 **Ongoing…Town establishing an enhanced permit software program**	**Use the Town's evolving Geographic Information System (GIS) to maintain current building and parcel data for the purpose of conducting more detailed hazard risk assessments and for tracking permitting/ land use.**
Hazard designed to mitigate:	All
Objective intended to help achieve:	1, 2, 9, 13
General background of item:	A GIS system coordinated between several Town departments will allow for the ability to collect, collect, manage, analyze and display spatially referenced data to further hazard mitigation goals.
Responsibility for implementation assigned to:	Planning Department, IT Director, Water Department, Assessing Department, Conservation Department
Potential funding source:	Operating budget, capital budget, grants
Priority/ time frame for implementation (or target completion date if possible):	High/Ongoing

Action Item #5 **Remove…will be completed through HMP process**	**Conduct a thorough investigation of the Town's most at-risk locations identified in the Vulnerability Analysis and evaluate potential mitigation techniques for protecting each location to the maximum extent possible.**
Hazard designed to mitigate:	All
Objective intended to help achieve:	2, 8, 11, 13, 15
General background of item:	An inventory of the Town's critical facilities should be created and maintained by the Town and include information on the risk to each location and possible mitigation measures. Non-town-owned at-risk locations should also be inventoried.
Responsibility for implementation assigned to:	Public Works, Fire and Police, Conservation, Building Department
Potential funding source:	Town Meeting, Grants
Priority/ time frame for implementation (or target completion date if possible):	High/2011

Action Item #6 **Remove…will be completed through HMP process**	**Develop a list of mitigation projects, including but not limited to: snow fencing in areas prone to blowing and drifting snow, and regarding and improved drainage in areas prone to flooding.**
Hazard designed to mitigate:	All
Objective intended to help achieve:	3, 8, 16
General background of item:	The Town should develop a list of potential projects that is periodically updated so that a project can easily be paired with grant funding as it becomes available.
Responsibility for implementation assigned to:	Fire and Police, Public Works, Town Planner
Potential funding source:	Operating Budget
Priority/ time frame for implementation (or target completion date if possible):	High/2011

Action Item # 7 **Status ? _____**	**Conduct a Needs Assessment of privately owned facilities that have regional importance (for example, medical centers and day care centers)**
Hazard designed to mitigate:	All
Objective intended to help achieve:	8
General background of item:	• Use the critical facilities inventory to identify potential mitigation projects for each hazard type. • Once completed, work with private sector to identify and seek resources to mitigate any identified hazards at these critical regional facilities.
Responsibility:	Fire and Police, Town Manager, BOH
Potential funding source:	Private, County staff support, grant funding
Priority/ time frame for implementation (or target completion date if possible):	High/2011

Action Item # 8 **Remove…will be completed through HMP process**	**Conduct a Needs Assessment of mitigation activities that should be undertaken to prepare and protect Brewster's cultural resources from the damaging effects of natural hazards.**
Hazard designed to mitigate:	All
Objective intended to help achieve:	3

General background of item:	• First step is to determine what existing protections are already in place for these resources. If assessment identifies a lack of mitigation for cultural resources, specific action items should be developed and included herein in the future. • Actions may include: training for proper storage of cultural artifacts; formation of a Cultural Incident Response Task Force (based on the American Institute for Conservation's model); firefighter training about proper response; purchase of certain equipment to respond to an event in a sensitive building.
Responsibility:	HDC, Historical Society
Potential funding source:	Grant funding
Priority/ time frame for implementation (or target completion date if possible):	High/2011-12

Action Item #9 **Remove…will be completed through HMP process**	**Quantify potential losses by estimating such losses at varying degrees of storm surge, wind and stormwater hazard severity, as well as specific impacts on critical facilities.**
Hazard designed to mitigate:	Wind, Flood
Objective intended to help achieve:	8, 11
General background of item:	Due to the limits of the Town's GIS systems, this analysis could not be conducted for this plan. As GIS capabilities increase, the ability to develop a building footprint data layer will assist in the estimation of potential losses at varying degrees of storm surge, wind and stormwater hazard severity will be possible.
Responsibility for implementation assigned to:	Town Planner
Potential funding source:	Operating Budget/Grants
Priority/ time frame for implementation (or target completion date if possible):	Moderate/2012

Action Item #10 **Keep…relevant**	**Develop a map indicating hazard sensitive parcels acquired by Brewster**
Hazard designed to mitigate:	All
Objective intended to help achieve:	1

General background of item:	A graphical depiction of past land acquisitions that further hazard mitigation principles has not been created. Most likely this would be a fire hazard map.
Responsibility:	Director of Natural Resources, Planning Board
Potential funding source:	Operating Budgets, Grants
Priority/ time frame for implementation (or target completion date if possible):	High/Ongoing

Action Item #11 **Keep…relevant**	**Incorporate the inspection and management of hazardous trees/limbs into the Town's routine monitoring process.**
Hazard designed to mitigate:	Wind, Snow & Ice
Objective intended to help achieve:	3, 8, 15, 16
General background of item:	Brewster's ability to recognize and prevent hazardous tree conditions (through inspection, pruning or removal) is the best defense against problems and damage caused by tree failure (such as property damages, power outages and fires). Specifically, trees located on Town properties which pose immediate threats to property, utility lines and other crucial facilities should be addressed.
Responsibility for implementation assigned to:	Public Works, Police and Fire
Potential funding source:	Operating Budget, Grants
Priority/ time frame for implementation (or target completion date if possible):	High/Ongoing

Action Item #12 **Remove…will be completed through HMP process**	**Monitor the Town's emergency services to identify needs in terms of personnel, equipment and/or required resources.**
Hazard designed to mitigate:	All
Objective intended to help achieve:	4
General background of item:	Identified needs or shortfalls should be documented and result in specific recommendations to the Board of Selectmen.
Responsibility for implementation assigned to:	Police and Fire, Health Department
Potential funding source:	Operating Budget
Priority/ time frame for implementation (or target completion date if possible):	High/Ongoing

Action Item #13 **Keep…relevant**	**Review of Ditch Systems and old bogs for preventative maintenance - to increase flood capacity**
Hazard designed to mitigate:	Flood
Objective intended to help achieve:	1, 3, 8, 16
General background of item:	Review of Considine and Stony Brook Ditch System research done by SEA? Status of culverts, ditches? Clear vegetation in old bogs to allow for increased flood capacity. Find old maps? Mosquito Control Maps?
Responsibility:	Public Works, Conservation Commission
Potential funding source:	Grants, Operating Budget
Priority/ time frame for implementation (or target completion date if possible):	High/2011

Action Item #14 **Remove…will be completed through HMP process**	**Mitigate impacts of blowing/drifting snow.**
Hazard designed to mitigate:	Wind, Snow and Ice
Objective intended to help achieve:	1, 7
General background of item:	Blowing and drifting snow has caused areas of Brewster to be cut off from emergency services, and require heavy equipment to remove snow.
Responsibility for implementation assigned to:	Police and Fire, Public Works
Potential funding source:	Operating Budget, grant funding
Priority/ time frame for implementation (or target completion date if possible):	High/2011

Action Item #15 **Capability Assessment? Town has a 604B grant for improvements**	**Infrastructure - Route 6A at Drummer Boy Park - Drainage study and re-design to eliminate flooding.**
Hazard designed to mitigate:	Flooding
Objective intended to help achieve:	1, 8, 16
General background of item:	This area tends to flood in heavy rain and is a main east-west road through Brewster.
Responsibility:	Massachusetts Highway Department
Potential funding source:	TIP, grant funding

Priority/ time frame for implementation (or target completion date if possible):	Medium/2012

Action Item #16 **Completed…remove**	**Infrastructure - Underpass Road - drainage study and redesign to eliminate roadway flooding.**
Hazard designed to mitigate:	Flooding
Objective intended to help achieve:	3, 10
General background of item:	During prolonged downpours, Underpass Road can flood to the point where it is impassable by passenger vehicles.
Responsibility:	Public Works
Potential funding source:	TIP, grant funding
Priority/ time frame for implementation (or target completion date if possible):	Medium/2012

Action Item #17 **Ongoing…Capability Assessment**	**Continue to participate in marsh restoration projects to remediate tidally restrictive infrastructure which affects the retention time of floodwaters or impound stormwater.**
Hazard designed to mitigate:	Flood, Fire, Erosion, Sea Level Rise
Objective intended to help achieve:	1, 5
General background of item:	• Several tidally influenced water bodies and marshes in Brewster are often physically restricted in their ability to exchange water freely during tidal cycles. Reducing or removing these restrictions provides hazard mitigation benefits including increased flood storage capacity and reduced wildfire fuel potential from invasive species growth (i.e., Phragmites) resulting from limited flushing. • Seven sites have been identified by the *Cape Cod Atlas of Tidally Restricted Salt Marshes, 2001.* Saltmarshes and ponds may also be shared by two or more towns (Marshes - Quivett (Dennis border), Paines Creek, Namskakett (Orleans border). • Recent projects: Route 6A culvert replaced at Stony Brook Road – 2010; Paines Creek culvert to Freemans Pond to be replaced – 2011 **7 listed tidal restricted areas: Sea Street/ Quivett Creek, Cranberry Bog channel off*

	Quivett Creek (Clarke1), Cranberry Bog channel off Quivett (Clarke2), Paine's Creek Road/Freeman's Pond, Route 6A/Stony Brook, Channel off Stony Brook, Cape Cod Rail Trail/Namskaket Creek.
Responsibility:	Director of Natural Resources, Alewife Committee, Conservation Administrator, adjoining towns
Potential funding source:	Grants
Priority/ time frame for implementation (or target completion date if possible):	Medium/Ongoing

Action Item #18 **Ongoing…Capability Assessment (DART Team)**	**Develop and distribute (or obtain from County/State/Feds) education material concerning care of animals during natural hazard emergencies.**
Hazard designed to mitigate:	All
Objective intended to help achieve:	5, 9
General background of item:	• Obtain education materials for distribution at local vets offices, Animal Rescue League of Boston (ARL), Town Clerk's office (and also given out with annual dog licenses), Board of Health (and given out with annual barn permits), pet store, feed stores, local animal groups, schools • Humane Society (HSUS) has a complete training program relative to care and treatment of animals during natural hazard emergencies
Responsibility:	BOH, Town Clerk, ARL, HSUS, County agencies
Potential funding source:	Grant funding, public service donations from private sector
Priority/ time frame for implementation (or target completion date if possible):	High/2011

Action Item #19 **Keep…relevant**	**Develop a program to train emergency responders and residents in management of domestic animals, horses, sheep, goats, dogs, cats, birds, as well as wild animals, during emergencies such as flood, fires, winds, etc..**

Hazard designed to mitigate:	All
Objective intended to help achieve:	4, 5, 13
General background of item:	The Cape Cod Cooperative Extension (4-H), Humane Society, The Brewster Animal Rescue League and the MSPCA, Wildcare, Carapace and other such organizations have training capabilities, as well as videos and educational material. Residents (owners) as well as responders need to be trained in dealing with animals in such emergencies.
Responsibility:	Health Agent, Director of Natural Resources, Conservation Administrator, Animal Control Officer
Potential funding source:	Operating Budget, grants
Priority/ time frame for implementation (or target completion date if possible):	High/Ongoing

Action Item #20 **Keep…relevant**	**Conduct an educational workshop for coastal and riverfront landowners and contractors on hazard mitigation.**
Hazard designed to mitigate:	Flood, Wind, Erosion, Sea Level Rise
Objective intended to help achieve:	1, 9, 12, 13, 14
General background of item:	Development pressure continues as dwellings are razed and reconstructed in hazard prone areas. The workshop would be an opportunity to educate the public and the building community.
Responsibility for implementation assigned to:	Town Planner, Building Department, Conservation Commission
Potential funding source:	Operating Budget/Grant
Priority/ time frame for implementation (or target completion date if possible):	High/2011

Action Item #21 **Status? _____**	**Supply educational materials on preparedness/mitigation for property owners, for display and distribution at Town Hall, Brewster Ladies' Library, Council on Aging**
Hazard designed to mitigate:	All
Objective intended to help achieve:	5, 9, 12, 13, 14
General background of item:	Some information currently exists, but needs to be updated and available in more locations.
Responsibility for implementation assigned to:	Conservation, Health, Police and Fire, Library
Potential funding source:	Operating budget

Priority/ time frame for implementation (or target completion date if possible):	High/2011

Action Item #22 **Keep…relevant**	**Annually host a public hazards display for the residents of Brewster, in combination with the "Brewster in Bloom" festival or another appropriate community event. Ensure that such a display will also be hosted during the summer months, when part-time residents are in Town**.
Hazard designed to mitigate:	All
Objective intended to help achieve:	3, 9, 12, 13, 14
General background of item:	A hazard display for Town residents and part-time residents should be added to established community event(s) drawing large crowds. The display(s) should be geared toward educating people on the hazards which threaten Brewster and the mitigation and preparedness measures available to protect them. Educational displays/ handouts should be provided such as Flood Insurance Rate Maps, storm surge inundation maps, FEMA publications, hurricane tracking charts, safety tips, animal/pet protection and preparedness measures, etc.
Responsibility:	Planning Board/Building Commissioner, Public Works, Fire and Police
Potential funding source:	Operating Budget, Grants
Priority/ time frame for implementation (or target completion date if possible):	Moderate/2012

Action Item # 23 **Status? _____**	**Incorporate natural hazard mitigation and best-planning practices into Brewster's planning work.**
Hazard designed to mitigate:	All
Objective intended to help achieve:	1, 14
General background of item:	• Adopt Minimum Performance Standards Relevant for hazard mitigation • Incorporate it into all planning initiative and projects • Encourage development bylaws that are intended to keep new development out of high hazard areas • Create a hazard-based District of Critical Planning Concern

Responsibility:	Planning Board, Building Department, Board of Health, Board of Selectmen, Public Works
Potential funding source:	None
Priority/ time frame for implementation (or target completion date if possible):	High/Ongoing

Action Item #24 **Status? _____**	**Participate in Cape Cod Cooperative Extension's Wildfire Assessment and Preparedness Program**.
Hazard designed to mitigate:	Fire
Objective intended to help achieve:	3, 5, 8, 9
General background of item:	The Town owned parcels of conservation and recreation lands with proximity to residentially developed areas are potential sources of wildfires in areas. ♦ Review and refine the designated wildfire risk areas shown on the Wildfire Hazard (Map 4) and work towards appropriate wildland/urban interface (WUI) boundary designations. ♦ Work with County for coordination with Regional Community Wildfire Protection Plan (RCWPP), utilizing appropriate wildland/urban interface fire hazard assessment methodology. ♦ Work with Cape Cod Cooperative Extension to obtain necessary information and measures/steps that homeowners can take to reduce structural ignitability in at-risk areas. ♦ Use County assistance in analysis of fuel-reduction needs along evacuation routes and To provide mitigation recommendations of high-risk areas, and provide matching grant funds for mitigation of evacuation route hazards. ♦ Work with Cape Cod Cooperative Extension Natural Resources Section - Forester/ Community Wildfire Protection Coordinator, for assistance with wildland/open space assessments/management plans, for help to implement risk mitigation recommendations and preparedness plans.

	♦ Conservation Commission needs to become more involved in Wildfire Protection Program
Responsibility:	Fire Department, Director of Natural Resources, Conservation Commission, Planning, Cape Cod Cooperative Extension Service
Potential funding source:	County budget, grant funding
Priority/ time frame for implementation (or target completion date if possible):	High/Ongoing

Action Item #25 **Status?** _____	**Establish a Memorandum of Agreement/ Understanding with the Town of Harwich, and other adjacent towns, regarding the coordinated opening of storm shelters and to ensure adequate shelter capacity for the area.**
Hazard designed to mitigate:	All
Objective intended to help achieve:	4, 5
General background of item:	Shelter space has been adequate in the past but there is risk of overburdening the shelters in the future due to the regional nature of their use.
Responsibility for implementation assigned to:	Emergency Management
Potential funding source:	None needed
Priority/ time frame for implementation (or target completion date if possible):	High/ 2011

Action Item #26 **Status?** _____	**Coordination with Nickerson State Park (NSP), Towns of Orleans (Baker's Pond), Harwich and Harwich Water Department (Punkhorn Parklands) and Dennis and Dennis Water Department (Punkhorn Parklands and Ellis Farm) on fuel reduction programs and response.**
Hazard designed to mitigate:	Fire
Objective intended to help achieve:	3, 5, 8
General background of item:	The Nickerson State Park encompasses over 1,000 acres within Brewster. Town is responsible for NSP. Orleans, Harwich and Dennis - Mutual Aid Agreement in place - required county-wide by law.

	Fire breaks at Town lines.
Responsibility:	Fire Department
Potential funding source:	Operating Budget
Priority/ time frame for implementation (or target completion date if possible):	High/Ongoing

Action Item #27 **Completed…remove**	**Provide remote access for Channel 18 (Brewster television station).**
Hazard designed to mitigate:	Wind, Snow and Ice
Objective intended to help achieve:	9, 12
General background of item:	During a storm event, it allows the Station Manager to update public service announcements and emergency instructions without having to be at the station (which is not accessible in a blizzard, for example).
Responsibility for implementation assigned to:	Station Manager, Cable Provider
Potential funding source:	Operating Budget/Grants
Priority/ time frame for implementation (or target completion date if possible):	High/2011

Action Item #28 **Remove…will be completed through HMP process**	**Identify and seek public funding and private sector funding for residents, businesses, and the Town of Brewster that will allow the implementation of sound hazard mitigation measures.**
Hazard designed to mitigate:	All
Objective intended to help achieve:	2, 5, 7, 16
General background of item:	Work with Cape Cod Commission to identify and seek planning funds and ensure coordination with existing and FEMA-certified plans in region.
Responsibility:	Various departments, Asst. Town Manager
Potential funding source:	MEMAs Hazard Mitigation Grant Program funds FEMA Pre-Disaster Mitigation program annual funds.
Priority/ time frame for implementation (or target completion date if possible	Medium/ongoing activity

The Town of Brewster is currently developing a Natural Hazards Mitigation Plan. This plan is important because it helps the Town plan and receive funding for projects that reduce the risk of injury or damage to property from future natural hazard events such as flooding and hurricanes. We need your help as we gather information for the plan. The information you provide in this survey will help us coordinate activities and identify projects. The survey should take less than 10 minutes to complete and responses will remain anonymous. The Brewster Local Hazard Mitigation Committee thanks you for taking the time to participate in this information-gathering process.

1. Which of the following hazard events have you or has anyone in your household and/or business experienced in the past 20 years within the Town of Brewster? (Check all that apply)

Flood-Related Hazards (Riverine/Flash Flooding, Inland/Urban Flooding, Storm Surge, Coastal Erosion)
Winter-Related Hazards (Blizzards, Heavy Snow)
Wind-Related Hazards (Tornadoes, High Winds, Lightning/Thunderstorms, Hail)
Geologic-Related Hazards (Earthquakes)
Fire-Related Hazard (Urban/Wildfire)
Hurricane-Related Hazard
Temperature-Related Hazard (Extreme Heat, Drought, Extreme Cold)

2. In your opinion, how prepared is your household and/or business to deal with a natural hazard event?

Not at all
Somewhat
Adequately
Well
Very Well
Not Sure

3. Which of the following have provided you with useful information to help you prepare for a hazard event? (Check all that apply)

Attended meetings about disaster preparedness
Personal experience with one or more natural hazards/disasters
Local news/social media
Civic organizations

4. How concerned are you about the following hazards in the Town of Brewster? (Check one response for each hazard)

	Not Concerned	Concerned	Very Concerned
Flood-Related Hazards			
Winter-Related Hazards			
Wind-Related Hazards			
Geologic-Related Hazards			
Fire-Related Hazard			
Hurricane-Related Hazard			
Temperature-Related Hazard			
Climate Change Projections			

5. Which of the following steps has your household and/or business taken to prepare for a hazard event? (Check all that apply)

Made a fire escape plan
Designated a meeting place
Identified utility shut-offs

Stored sand bags
Prepared a disaster supply kit
Installed smoke detectors on each level of the house
Stored food/water/batteries
Prepared a medical supply kit
Purchased natural hazard insurance
Purchased/Learned how to program a NOAA Weather Radio

6. In your opinion, which of the following methods do you think are most effective for providing hazard and disaster information? (Check all that apply)

Radio ads
Internet
Social Media/Cell phone apps.
Fire/Rescue Department
Academic Institutions
Public Library
Telephone Book
Informational Brochures
Public Meetings/Workshops
Auto-Dial Information (Code Ready or similar)
Community Information/Training Sessions

7. Is your property located in or near a FEMA designated floodplain?

Yes
No
Not Sure

8. Do you have flood insurance?

Yes
No
Not Sure

9. Do you have any special access or functional needs within your household and/or business that would require early warning or specialized response during disasters?

Yes
No

10. Are you interested in making your home, business or neighborhood more resistant to hazards?

Yes
No
Not Sure

11. Would you be willing to spend your own money on your current home and/or business to help protect it from impacts of potential future natural disasters within the community? Examples could include: Elevating a flood-prone home; Elevating utilities in flood-prone basements; Strengthening your roof, siding, doors, or windows to withstand high winds; Removing trees/low branches.

Yes
No
Not Sure

12. In your opinion, what types of projects do you believe local, county, state or federal government agencies could be doing to reduce the damage and disruption of natural disasters in Brewster? (Select your top three choices)

Retrofit/Strengthen essential public facilities such as police, fire/emergency, schools
Retrofit public infrastructure, such as elevating roadways and improving drainage systems
Work to improve utilities resiliency (electric, communications, water/wastewater facilities)
Install/improve protective structures (floodwalls)
Replace inadequate/vulnerable bridges
Strengthen codes/ordinances to require higher hazard risk management standards and/or provide greater control over development in high hazard areas
Buy out flood prone properties and maintain as open space
Inform property owners of ways they can reduce the damage caused by natural events
Provide better information about hazard risks and high hazard areas
Assist vulnerable property owners with securing funding to make their properties more resilient

13. In your opinion, has the Town done enough to prepare for the projected future impacts of climate change?

Yes
No
Not Sure

14. Additional comments?

Town of Brewster, MA

Local Hazard Mitigation Committee Meeting #1

Town Hall Room C
2198 Main Street Brewster, MA

March 12, 2020 1:00 PM - 3:00 PM

Name	Email Address
Don Labonte	Resident/CERT
Donna Kalinick	Assistant Town Administrator
Patrick Ellis	DPW Superintendent
Paul Anderson	Water Department Superintendent
Chris Miller	Natural Resources Director
Victor Staley	Building Commissioner
Heath Eldredge	Police Chief
Ryan Bennett	Town Planner
Craig Pereira	Project Manager - HWG
Will Keefer	Planner - HWG

Local Hazard Mitigation Workgroup Meeting #2: July 15, 2020

Brewster Hazard Mitigation Plan

Local Hazard Mitigation Workgroup Meeting #2

Zoom (Virtual) Meeting
July 15, 2020 2:00 PM – 3:00 PM

Agenda

1. Project Update
    a. Municipal Interviews…outstanding
    b. Community Survey…confirmation/post to project webpage
    c. Proposed Plan layout…confirmation
    d. Project Schedule…updated
    e. Project Webpage…Planning Dept. webpage
    f. 2016 Mitigation Actions…still relevant?
    g. Human-Caused/Technological hazards?
    h. Grant Extension…coordinate with MEMA

2. Mapping
    a. Coordination with CCC
        i. Primary POC?
        ii. SOW?
    b. Maps to be developed
        i. Location Map
        ii. Flood Hazard Areas Map (HW completed for MVP)
        iii. Earthquakes/Landslides Map
        iv. Hurricanes/Tornadoes Map
        v. Average Annual Snowfall Map
        vi. Critical Facilities (HW completed for MVP)
            1. Confirmation of data set?
        vii. Traffic Control Points/Evacuation Map
        viii. Others (will need to complete for Economic Vulnerability Analyses)
            1. Sea Level Rise…HW completed for MVP project, only 3-foot rise (1, 5, 7-foot?)
            2. Hurricane Surge Inundation (HW completed for MVP)
            3. Shoreline Change Map
    c. Parcel shapefile received…need CAMA export with unique identifier for merge

d. NFIP Data…Ryan to follow up with Garrett Fish

3. Hazard Index
    a. Dams data
        i. Lower Mill Pond Dam
    b. Wildfire/Urban Fire
        i. Chief to run export of brushfires
    c. Tidal Restrictions
        i. Site BR-4 Paine's Creek Road Reconstruction of Channel into Freeman's Pond…proposed completion 2011…completed?
    d. Invasive species
        i. Current list impacting Brewster
        ii. Agency/Organization coordination?
    e. Development trends
        i. Residential and commercial development proposals, last 5 – 10 years?
            1. Name/Location/No. of units/Status

4. FEMA Disaster grant assistance
    a. Date/Disaster No./Total amount/Purpose

5. ECEMP…need copy to incorporate into Capability Assessment

6. Agenda/Logistics for Public Workshop #1
    a. Date/Time/Venue (early September)
    b. Agenda
        i. Overview
        ii. Why Hazard Mitigation Planning
            1. Mitigation Process
            2. Mitigation Goals
            3. Mitigation Actions
        iii. January 2016 Mitigation Actions/MVP Priority Actions
        iv. Questions/Comments
    c. Online Survey kickoff

Horsley Witten Group

Memorandum of Meeting

To: Brewster Local Hazard Mitigation Workgroup (LHMW)

From: Craig Pereira

Date: July 15, 2020

Re: Brewster Hazard Mitigation Plan (HMP) Development

In attendance:

Donna Kalinick – Assistant Town Administrator
Patrick Ellis – DPW Superintendent
Paul Anderson – Water Department Superintendent
Chris Miller – Natural Resources Director
Victor Staley – Building Commissioner
Heath Eldredge – Police Chief
Amy von Hone – Health Director
Robert Moran – Fire Chief
Pat Hughes – Coastal Committee
Ryan Bennett – Town Planner

Consultant Team
Craig Pereira, Project Manager - Horsley Witten Group, Inc. (HW)

1. Project Update
    a. Municipal Interviews. Craig asked that all LHMW members complete the Municipal Interview questions (attached).
    b. Community Survey. Craig asked that all LHMW members review the survey and provide comment (attached).
    c. Proposed Plan Layout. Craig asked that all LHMW members review and provide comment (attached).
    d. Project Schedule. Craig updated the schedule (attached) due to delays from the pandemic. As of now, the goal is still to make the December 2020 deliverable to MEMA.
    e. Project webpage is up and running on Planning Department's page.
    f. 2016 Draft Mitigation Actions. Craig reviewed the status of the outstanding actions…these will be a focus for the Public Workshop.
    g. Human-Caused/Technological Hazards. Craig asked if the LHMW was still interested in expanding the Plan update to include human-caused and technological hazards. Craig stated that the RFP and HW's proposal/contract is for a 'Natural Hazards Mitigation Plan', however, this could be expanded to include human-caused and technological hazards without a contract amendment. Craig requested the LHMW work with him to accomplish this, particularly around developing the Hazard Index (frequency/severity/geographic range). Historical data maybe limited, so utilizing the state's Index as a starting point may be feasible, then tailoring it to be

more Brewster-specific. Craig will initiate this effort with Ryan as a starting point. LHMW members commented the Town is working with HW on a water cyber security project and has completed SOPs for 'Active Shooter' incidents. Craig to coordinate with HW and Kathy Lambert.

h. Grant Extension. Craig will continue to reach out to MEMA…coordination has been challenging with MEMA personnel activated due to the pandemic.

2. Mapping
    a. Cape Cod Commission coordination. The Town has coordinated with the Cape Cod Commission to provide the required mapping for the hazard mitigation plan.
        i. Maps that will be needed as per FEMA requirements include:
            1. Location Map
            2. Flood Hazard Area Map…HW developed as part of the MVP project, need to overlay onto parcels shapefile for Vulnerability Analyses (infrastructure and economic).
            3. Earthquakes/Landslides Map
            4. Hurricanes/Tornadoes Map
            5. Average Annual Snowfall Map
            6. Critical Facilities…HW developed as part of the MVP project, need to confirm with LHMW. Craig to provide to LHMW (attached).
            7. Traffic Control Points/Evacuation Map
        ii. Primary point of contact at CCC…Ann Reynolds/Gary Promm? Ryan to follow up.
        iii. Scope of Work with CCC? Ryan to follow up.
        iv. Other maps needed by Craig to conduct climate change impacts/vulnerability analyses include:
            1. Sea Level Rise…HW developed as part of the MVP project, only 3-foot rise scenario included…expand to include 1, 5, 7-foot? LHMW stated a Town project also looked at +2, +4, +8- and +10-foot rise. Craig to review.
            2. Hurricane Surge Inundation…HW developed as part of the MVP project.
            3. Shoreline Change Maps
    b. Parcel Shapefile. The Parcel shapefile received from the Town works, although the data included (attribute table is limited). Craig will request a new CAMA data export form the Assessor and merge with the Parcel shapefile.
3. NFIP data coordination. Ryan has made the initial request for severe repetitive flood loss data, however, has not received anything to date. Ryan to follow up with Garrett Fish.
4. Hazard Index.
    a. Dams information. Lower Mill Pond Dam is the only dam in Town. Chris Miller to provide updated information/inspection report.
    b. Wildfire/Urban Fire. Chief Moran provided data on wildfire (Barnstable County Wildfire Preparedness Plan) and has also forwarded an export of brushfires from their database.
    c. Tidal Restrictions projects. Craig asked if Site BR-4 Paine's Creek Reconstruction of Channel into Freeman's Pond was completed. LHMW stated yes, it is completed…Craig to move to Capability Section of the Plan. Chris Miller to provide date/year completed.

i. Another project inter-related includes: A joint project for culvert replacement to Freeman's Pond is underway by the Natural Resources Conservation Service (NRCS), DEM, Orleans and Brewster local officials, the state Wetlands Restoration Program, and MA Coastal Zone Management. A feasibility study, and cost estimates for materials and services have been completed. A grant is expected to cover the engineering and the majority of the construction costs. The project was expected to be completed in late 2011. Chris Miller to provide status update.

d. Invasive Species. Craig requested a current list (common and scientific name) of species currently impacting Brewster, as well as any work completed/ongoing with various local/regional/state agencies/organizations. LHMW stated this varies, perhaps a statewide list could be provided, then LHMW check off ones impacting Brewster. Craig to provide list to LHMW.

e. Development trends. Craig asked for a list of residential and commercial projects over the past 5 – 10 years that were either approved and built, or in the que for construction to understand whether projects are avoiding hazard areas. Ryan with work with the Building Department on this (Name/Location/No. of units or SF/Status).

5. FEMA Disaster Grant Assistance. Craig asked for a list of grant received by the Town over the past 5 – 10 years (Date/Disaster No./Total amount of funds/Purpose). Chief Moran will provide this.

6. Agenda/Logistics for Public Workshop #1. Craig and Ryan spoke several weeks ago with a target date of early September for the first Public Workshop. In-person meetings continue to be on-hold through August…there is a Town meeting scheduled for September 15, 2020 which may be the first in-person meeting for the Town. Craig commented that this kickoff meeting is predominantly informational…providing a baseline of information to move forward with, and a short Q & A session at the end, so a virtual meeting could be utilized. Ryan asked that there be more discussion on potential alternatives with Craig. Craig commented that pushing the Public Workshop beyond September would negatively impact the updated schedule.

Follow Up Items:

- Ryan Bennett
  - Coordinate with Cape Cod Commission to determine Primary point of contact and scope of work for mapping.
  - Coordinate confirmation on Critical Facilities list.
  - Continue to reach out to Garrett Fish regarding NFIP coordination/severe repetitive flood loss properties.
  - Coordinate with Building Department for list of residential and commercial development projects last 5 – 10 years…name/type/location/no. of units or SF/status.
  - Coordinate with Craig on initiating the human-caused and technological hazards incorporation…coordinate with Kathy Lambert.
  - Coordinate with Craig on logistics for Public Workshop #1.

- Chris Miller
  - Provide information/last inspection report for Lower Mill Pond Dam to Craig.
  - Provide status on addition Tidal Restriction project listed above, and date/year Site BR-4 was completed.
  - Provide list of invasive species impacting Brewster, from state list provided by Craig.

- Chief Moran

- Provide list of FEMA Disaster Grant Assistance the Town has received last 10 years…date/disaster no./amount/purpose.

- All LHMW Members
  - Complete the municipal interview and return to Craig by July 29, 2020.
  - Review the Community Survey and provide feedback/requested revisions by July 29, 2020.
  - Review the proposed plan layout and provide feedback/requested revisions by July 29, 2020.
  - Any plans/studies/reports not publicly available post to HW's FTP site:
    - Go to http:www.horsleywitten.com
    - On the lower right-hand side of the webpage, click on 'Click here to send us your large files'
    - Enter your email address
    - Enter recipient at HW (Craig Pereira)
    - Password is StormWater (case sensitive)
    - Browse the files you would like to send
    - Click on 'Send this File'

PROJECT SCHEDULE

HAZARD MITIGATION PLAN DEVELOPMENT	
Task 1: Convene and Coordinate with the LHMC, Conduct Outreach, Document Planning Process	**March 2, 2020 – September 11, 2020**
Meeting #1 – Local Hazard Mitigation Workgroup - Project Webpage (Municipal Website) - Data Collection ***Coordination with Town Departments/Personnel*** ***Public Workshop #1***	March 12, 2020 Week of April 6, 2020 Week of September 7, 2020
Task 2: Risk Assessment	**May 4, 2020 – July 31, 2020**
- Hazard Identification - Hazard Event Profiles	
Task 3: GIS Mapping	**May 18, 2020 – August 28, 2020**
- Coordination with Cape Cod Commission	
Task 4: Hazard Vulnerability Assessment	**August 31, 2020 – September 25, 2020**
- Risk Assessment/Loss Estimation **Meeting #2 – Local Hazard Mitigation Workgroup**	 July 15, 2020
Task 5: Develop Goals and Objectives	**September 28, 2020 – October 23, 2020**
- Mitigation Recommendations - Review Goals and Objectives	
Task 6: Analyze Existing/Research New Strategies	**September 28, 2020 – October 23, 2020**
- Plans, Policies and Problems Examination - Identification of Resources	
Task 7: Develop Comprehensive Range of Actions and Projects	**September 28, 2020 – October 23, 2020**
Meeting #3 – Local Hazard Mitigation Workgroup - Refine Goals and Objectives - Cost Benefit Review/Prioritization	Week of October 19, 2020
Task 8: Update Plan Maintenance/Implementation	**October 26, 2020 – October 30, 2020**
- Mitigation Action Plan	
Task 9: Review, Revision, Approval and Adoption of Plan	**October 26, 2020 – November 27, 2020**
Meeting #4 - Local Hazard Mitigation Workgroup **Public Comment Period** ***Public Workshop #2/Public Hearing***	Week of November 2, 2020 November 9, 2020 – November 27, 30, 2020 Week of November 23, 2020
Final Deliverable to MEMA	**Friday, December 1, 2020**

Brewster Hazard Mitigation Plan (proposed layout)

Section 1: Introduction

Overview

- Hazard mitigation planning in general

What Hazard Mitigation Can do for Brewster

- Benefits of hazard mitigation planning

Brewster Goals

- TBD…consolidated to be over-arching

Planning Process

- Overview of approach/process of the project
    - Local Hazard Mitigation Committee Meetings
    - Public Workshops
    - Municipal Interviews
    - Survey

Environmental Setting

- Geographic location
- History
- Government Structure

History of Disaster Declarations

- Federal Emergency and Major Disaster Declarations for the County

Recent Disaster Declarations

- Recent (2011 – forward) Federal Emergency and Major Disaster Declarations for the County

Section 2: Risk Assessment

Introduction

- Which hazards merit special attention
- What actions might be taken to reduce the impact(s) of those hazards
- What resources are likely to be needed

Hazard Identification

- Required to evaluate all hazards identified in the State Plan…anticipated list:
    - Riverine/Flash Flooding
    - Heavy Rain/Inland and Urban Flooding
    - Climate Change
    - Sea Level Rise
    - Dam Failure
    - Coastal Erosion/Shoreline Change
    - Coastal Flooding
    - Blizzards/Heavy Snow/Winter Weather/Nor'easters
    - Ice Storms
    - Extreme Cold
    - Hurricanes
    - Tornadoes/High Winds
    - Lightning/Thunderstorms

    - Hail
    - Earthquakes/Landslides
    - Drought
    - Extreme Heat
    - Urban Fire/Wildfires
    - Invasive Species
- Likely not to be addressed:
    - Avalanche
    - Expansive Soils
    - Land Subsidence
    - Volcanoes
    - Tsunamis

Hazard Profiles

- Review of NOAA's National Climatic Data Center (http://www.ncdc.noaa.gov/) 'Storm Events' database and develop tables based on hazard type, date, level/description and damages to develop a Hazard Index.
    - Flood Related
    - Winter Related
    - Wind Related
    - Geologic Related
    - Drought Related
    - Urban Fire/Wildfire Related
    - Invasive Species Related

- Evaluate the location/history/probability of future occurrence of hazards

  Criteria for Frequency Categorization:

  Very low frequency: events that occur less frequently than once in 1,000 years (less than 0.1% per year).

  Low frequency: events that occur from once in 100 years to once in 1,000 years (0.1% to 1% per year).

  Medium frequency: events that occur from once in 10 years to once in 100 years (1% to 10% per year).

  High frequency: events that occur more frequently than once in 10 years (greater than 10% per year).

  Criteria for Severity Categorization (based on past hazard events):

  Minor: Limited and scattered property damage; no damage to public infrastructure; contained geographic area; essential services not interrupted; no injuries or fatalities.

  Serious: Scattered major property damage; some minor infrastructure damage; wider geographic area; essential services are briefly interrupted; some injuries/fatalities.

  Extensive: Consistent major property damage; major damage to public infrastructure; essential services are interrupted for several hours to several days; many injuries and fatalities.

Catastrophic: Property and public infrastructure destroyed; essential services stopped; thousands of injuries and fatalities.

- Mapping will also be developed
    - Critical Facilities
    - FEMA Flood Zones
    - Snowfall, Hurricane paths, storm surge, etc.

Vulnerability

- Evaluates vulnerability of built environment, social and environment.

<u>Development Trends</u>

- Changes over time, future development plans (residential/commercial/industrial)

<u>Economic Vulnerability</u>

- Impacts of FEMA flood zones (Economic by land use type, land/building values)

<u>Social Vulnerability</u>

- Impacts to built/natural environment and that relationship to the social structure of the community
- Infrastructure/Emergency lifelines
- Evacuation/Populations at risk

<u>Environmental Vulnerability</u>

FEMA Disaster Grant Assistance

- Has the Town received any financial assistance from MEMA/FEMA?

Section 3: Capability Assessment

Introduction

- Documents local, state and federal department, agency and program capabilities in terms of pre and post-disaster activities

Planning/Regulatory Capabilities

- Planning documents
- Regulations/Bylaws
- Building Code

Administrative Capabilities

- Emergency Management Plan
    - Emergency Operations Center/Shelter
- Municipal Website
- Coordination with Neighboring Communities
- Municipal Structure/Staff

Financial Capabilities

- Federal/State Grant Opportunities

National Flood Insurance Program

- NFIP/Compliance with NFIP

Existing Protection Matrix

- Summary of all above

Section 4: Mitigation Strategy

Introduction

Mitigation Activities

- Requires an action for every vulnerability identified in the plan

Mitigation Action Plan

- Categories
    - Public Education and Awareness
    - Property Protection
    - Natural Resource Protection
    - Structural Projects
    - Emergency Services
    - Planning and Prevention

- Time Frame
    - Short Term = 0 to 6 Months
    - Medium Term = 6 to 18 Months
    - Long Term = 18 Months to 5 Years

- Cost Estimate
    - Staff Time – municipal personnel time
    - Minimal – less than $5,000
    - Moderate – more than $5,000, but less than $25,000
    - Significant – over $25,000

- Prioritization of Actions (abbreviated Benefit/Cost Analysis)
  STAPLEE Criteria

    - **S**ocial: Is the action compatible with present and future local community needs and values?
    - **T**echnical: Is the action feasible with available local resources (or as supplement by outside resources as necessary)?
    - **A**dministrative: Does the community have the administrative capacity to implement the action?
    - **P**olitical: Is there strong public support to implement and maintain the action?
    - **L**egal: Does the community have the legal authority to implement the action?
    - **E**conomic: Is the action cost-effective?
    - **E**nvironmental: Does the action impact environmental resources, and is the impact positive, negative, or neutral?

- Action Description
    - Action Type:
    - Priority Score:
    - Lead:
    - Supporting:
    - Time Frame:
    - Financing Options:

    - Cost Estimate:
    - Benefit:
    - Vulnerable Area:

Section 5: Plan Implementation/Maintenance

Implementation/Evaluation/Revision

- Implementation
    - Following municipal adoption

- Evaluation
    - Annually

- Revision
    - Every 5 years/after a major event

Continued Public Involvement

- Posted on Town's website
- Annual Town Meeting

The Town of Brewster is currently developing a Natural Hazards Mitigation Plan. This plan is important because it helps the Town plan and receive funding for projects that reduce the risk of injury or damage to property from future natural hazard events such as flooding and hurricanes. This Hazard Mitigation Plan will build on some of the work already completed by the Town including the *Brewster Coastal Adaptation Strategy* (September 2016), *Town of Brewster Vision Plan* (2018), the *Town of Brewster Coastal Resource Management Plan* (2019), and the *Municipal Vulnerability Preparedness Plan* (2019).

We need your help as we gather information for the plan. The information you provide in this survey will help us coordinate activities and identify projects. The survey should take less than 10 minutes to complete and responses will remain anonymous. The Brewster Local Hazard Mitigation Workgroup thanks you for taking the time to participate in this information-gathering process.

1. Which of the following hazard events have you or has anyone in your household and/or business experienced in the past 20 years within the Town of Brewster? (Check all that apply)

Flood-Related Hazards (Riverine/Flash Flooding, Inland/Urban Flooding, Storm Surge, Coastal Erosion)
Winter-Related Hazards (Blizzards, Heavy Snow)
Wind-Related Hazards (Tornadoes, High Winds, Lightning/Thunderstorms, Hail)
Geologic-Related Hazards (Earthquakes)
Fire-Related Hazard (Urban/Wildfire)
Hurricane-Related Hazard
Temperature-Related Hazard (Extreme Heat, Drought, Extreme Cold)
Invasive Species-Related Hazard

2. Which of the following have provided you with useful information to help you prepare for a hazard event? (Check all that apply)

Attended meetings about disaster preparedness
Personal experience with one or more natural hazards/disasters
Local news/social media
Civic organizations

3. Which of the following steps has your household and/or business taken to prepare for a hazard event? (Check all that apply)

Made a fire escape plan
Designated a meeting place
Identified utility shut-offs
Stored sand bags
Prepared a disaster supply kit
Installed smoke detectors on each level of the house
Stored food/water/batteries
Prepared a medical supply kit
Purchased natural hazard insurance
Purchased/Learned how to program a NOAA Weather Radio

4. In your opinion, how prepared is your household and/or business to deal with a natural hazard event?

Not at all
Somewhat
Adequately
Well
Very Well
Not Sure

5. Is your property located in or near a FEMA designated floodplain?

Yes
No
Not Sure

6. Do you have flood insurance?

Yes
No
Not Sure

7. How concerned are you about the following hazards in the Town of Brewster? (Check one response for each hazard)

	Not Concerned	Concerned	Very Concerned
Flood-Related Hazards			
Winter-Related Hazards			
Wind-Related Hazards			
Geologic-Related Hazards			
Fire-Related Hazard			
Hurricane-Related Hazard			
Temperature-Related Hazard			
Climate Change Projections			

8. In your opinion, which of the following methods do you think are most effective for providing hazard and disaster information? (Check all that apply)

Radio ads
Internet
Social Media/Cell phone apps.
Fire/Rescue Department
Academic Institutions
Public Library
Telephone Book
Informational Brochures
Public Meetings/Workshops
Auto-Dial Information (Code Ready or similar)
Community Information/Training Sessions

9. Do you have any special access or functional needs within your household and/or business that would require early warning or specialized response during disasters?

Yes
No

10. Are you interested in making your home, business or neighborhood more resistant to hazards?

Yes
No
Not Sure

11. Would you be willing to spend your own money on your current home and/or business to help protect it from impacts of potential future natural disasters within the community? Examples could include: Elevating a flood-prone home; Elevating utilities in flood-prone basements; Strengthening your roof, siding, doors, or windows to withstand high winds; Removing trees/low branches.

Yes
No
Not Sure

12. In your opinion, what types of projects do you believe local, county, state or federal government agencies could be doing to reduce the damage and disruption of natural disasters in Brewster? (Select your top three choices)

Retrofit/Strengthen essential public facilities such as police, fire/emergency, schools
Retrofit public infrastructure, such as elevating roadways and improving drainage systems
Work to improve utilities resiliency (electric, communications, water/wastewater facilities)
Install/improve protective structures (floodwalls)
Replace inadequate/vulnerable bridges
Strengthen codes/ordinances to require higher hazard risk management standards and/or provide greater control over development in high hazard areas
Buy out flood prone properties and maintain as open space
Inform property owners of ways they can reduce the damage caused by natural events
Provide better information about hazard risks and high hazard areas
Assist vulnerable property owners with securing funding to make their properties more resilient

13. In your opinion, has the Town done enough to prepare for the projected future impacts of climate change?

Yes
No
Not Sure

14. Additional comments?

2016 Proposed Mitigation Actions

- Updated following the LHMW Meeting #1

Action Item #1 **Remove…established**	**Create a standing Multi-hazard Mitigation Committee**
Hazard designed to mitigate:	All
Objective intended to help achieve:	2, 5
General background of item:	Bring together representatives of public safety, public works, conservation, health and others to share information on areas concerning pre-disaster mitigation and keep an open dialogue on areas of concern and potential mitigation between departments and with adjoining towns.
Responsibility for implementation assigned to:	Planning Department, Board of Selectmen
Potential funding source:	Operating budget
Priority/ time frame for implementation (or target completion date if possible):	Moderate/2011

Action Item #2 **Status ? 2018**	**Join the NFIP's Community Rating System (CRS)**
Hazard designed to mitigate:	Flood
Objective intended to help achieve:	1, 3, 9
General background of item:	Acquiring certification in CRS requires completion of a detailed application and certification process.
Responsibility for implementation assigned to:	Planning Department, Building Department
Potential funding source:	Operating budget
Priority/ time frame for implementation (or target completion date if possible):	High/2011

Action Item #3 **Keep? Capability Assessment if ongoing. Currently working with CCC**	**Increase protection of the floodplain by amending the current Floodplain District By-law.**
Hazard designed to mitigate:	Flood
Objective intended to help achieve:	1
General background of item:	Develop and adopt amendments to the floodplain by-law in the Brewster Zoning By-law.
Responsibility for implementation assigned to:	Planning Department, Planning Board
Potential funding source:	Operating budget

Priority/ time frame for implementation (or target completion date if possible):	High/May 2011

Action Item #4 **Ongoing…Town establishing an enhanced permit software program**	**Use the Town's evolving Geographic Information System (GIS) to maintain current building and parcel data for the purpose of conducting more detailed hazard risk assessments and for tracking permitting/ land use.**
Hazard designed to mitigate:	All
Objective intended to help achieve:	1, 2, 9, 13
General background of item:	A GIS system coordinated between several Town departments will allow for the ability to collect, collect, manage, analyze and display spatially referenced data to further hazard mitigation goals.
Responsibility for implementation assigned to:	Planning Department, IT Director, Water Department, Assessing Department, Conservation Department
Potential funding source:	Operating budget, capital budget, grants
Priority/ time frame for implementation (or target completion date if possible):	High/Ongoing

Action Item #5 **Remove…will be completed through HMP process**	**Conduct a thorough investigation of the Town's most at-risk locations identified in the Vulnerability Analysis and evaluate potential mitigation techniques for protecting each location to the maximum extent possible.**
Hazard designed to mitigate:	All
Objective intended to help achieve:	2, 8, 11, 13, 15
General background of item:	An inventory of the Town's critical facilities should be created and maintained by the Town and include information on the risk to each location and possible mitigation measures. Non-town-owned at-risk locations should also be inventoried.
Responsibility for implementation assigned to:	Public Works, Fire and Police, Conservation, Building Department
Potential funding source:	Town Meeting, Grants
Priority/ time frame for implementation (or target completion date if possible):	High/2011

Action Item #6 **Remove…will be completed through HMP process**	**Develop a list of mitigation projects, including but not limited to: snow fencing in areas prone to blowing and drifting snow, and regarding and improved drainage in areas prone to flooding.**
Hazard designed to mitigate:	All
Objective intended to help achieve:	3, 8, 16
General background of item:	The Town should develop a list of potential projects that is periodically updated so that a project can easily be paired with grant funding as it becomes available.
Responsibility for implementation assigned to:	Fire and Police, Public Works, Town Planner
Potential funding source:	Operating Budget
Priority/ time frame for implementation (or target completion date if possible):	High/2011

Action Item # 7 **Status ? _keep_____**	**Conduct a Needs Assessment of privately owned facilities that have regional importance (for example, medical centers and day care centers)**
Hazard designed to mitigate:	All
Objective intended to help achieve:	8
General background of item:	• Use the critical facilities inventory to identify potential mitigation projects for each hazard type. • Once completed, work with private sector to identify and seek resources to mitigate any identified hazards at these critical regional facilities.
Responsibility:	Fire and Police, Town Manager, BOH
Potential funding source:	Private, County staff support, grant funding
Priority/ time frame for implementation (or target completion date if possible):	High/2011

Action Item # 8 **Remove…will be completed through HMP process**	**Conduct a Needs Assessment of mitigation activities that should be undertaken to prepare and protect Brewster's cultural resources from the damaging effects of natural hazards.**
Hazard designed to mitigate:	All
Objective intended to help achieve:	3

General background of item:	• First step is to determine what existing protections are already in place for these resources. If assessment identifies a lack of mitigation for cultural resources, specific action items should be developed and included herein in the future. • Actions may include: training for proper storage of cultural artifacts; formation of a Cultural Incident Response Task Force (based on the American Institute for Conservation's model); firefighter training about proper response; purchase of certain equipment to respond to an event in a sensitive building.
Responsibility:	HDC, Historical Society
Potential funding source:	Grant funding
Priority/ time frame for implementation (or target completion date if possible):	High/2011-12

Action Item #9 **Remove…will be completed through HMP process**	**Quantify potential losses by estimating such losses at varying degrees of storm surge, wind and stormwater hazard severity, as well as specific impacts on critical facilities.**
Hazard designed to mitigate:	Wind, Flood
Objective intended to help achieve:	8, 11
General background of item:	Due to the limits of the Town's GIS systems, this analysis could not be conducted for this plan. As GIS capabilities increase, the ability to develop a building footprint data layer will assist in the estimation of potential losses at varying degrees of storm surge, wind and stormwater hazard severity will be possible.
Responsibility for implementation assigned to:	Town Planner
Potential funding source:	Operating Budget/Grants
Priority/ time frame for implementation (or target completion date if possible):	Moderate/2012

Action Item #10 **Keep…relevant**	**Develop a map indicating hazard sensitive parcels acquired by Brewster**
Hazard designed to mitigate:	All
Objective intended to help achieve:	1

General background of item:	A graphical depiction of past land acquisitions that further hazard mitigation principles has not been created. Most likely this would be a fire hazard map.
Responsibility:	Director of Natural Resources, Planning Board
Potential funding source:	Operating Budgets, Grants
Priority/ time frame for implementation (or target completion date if possible):	High/Ongoing

Action Item #11 **Keep…relevant**	**Incorporate the inspection and management of hazardous trees/limbs into the Town's routine monitoring process.**
Hazard designed to mitigate:	Wind, Snow & Ice
Objective intended to help achieve:	3, 8, 15, 16
General background of item:	Brewster's ability to recognize and prevent hazardous tree conditions (through inspection, pruning or removal) is the best defense against problems and damage caused by tree failure (such as property damages, power outages and fires). Specifically, trees located on Town properties which pose immediate threats to property, utility lines and other crucial facilities should be addressed.
Responsibility for implementation assigned to:	Public Works, Police and Fire
Potential funding source:	Operating Budget, Grants
Priority/ time frame for implementation (or target completion date if possible):	High/Ongoing

Action Item #12 **Remove…will be completed through HMP process**	**Monitor the Town's emergency services to identify needs in terms of personnel, equipment and/or required resources.**
Hazard designed to mitigate:	All
Objective intended to help achieve:	4
General background of item:	Identified needs or shortfalls should be documented and result in specific recommendations to the Board of Selectmen.
Responsibility for implementation assigned to:	Police and Fire, Health Department
Potential funding source:	Operating Budget
Priority/ time frame for implementation (or target completion date if possible):	High/Ongoing

Action Item #13 **Keep…relevant**	**Review of Ditch Systems and old bogs for preventative maintenance - to increase flood capacity**
Hazard designed to mitigate:	Flood
Objective intended to help achieve:	1, 3, 8, 16
General background of item:	Review of Considine and Stony Brook Ditch System research done by SEA? Status of culverts, ditches? Clear vegetation in old bogs to allow for increased flood capacity. Find old maps? Mosquito Control Maps?
Responsibility:	Public Works, Conservation Commission
Potential funding source:	Grants, Operating Budget
Priority/ time frame for implementation (or target completion date if possible):	High/2011

Action Item #14 **Remove…will be completed through HMP process**	**Mitigate impacts of blowing/drifting snow.**
Hazard designed to mitigate:	Wind, Snow and Ice
Objective intended to help achieve:	1, 7
General background of item:	Blowing and drifting snow has caused areas of Brewster to be cut off from emergency services, and require heavy equipment to remove snow.
Responsibility for implementation assigned to:	Police and Fire, Public Works
Potential funding source:	Operating Budget, grant funding
Priority/ time frame for implementation (or target completion date if possible):	High/2011

Action Item #15 **Capability Assessment? Town has a 604B grant for improvements**	**Infrastructure - Route 6A at Drummer Boy Park - Drainage study and re-design to eliminate flooding.**
Hazard designed to mitigate:	Flooding
Objective intended to help achieve:	1, 8, 16
General background of item:	This area tends to flood in heavy rain and is a main east-west road through Brewster.
Responsibility:	Massachusetts Highway Department
Potential funding source:	TIP, grant funding

Priority/ time frame for implementation (or target completion date if possible):	Medium/2012

Action Item #16 **Completed…remove**	**Infrastructure - Underpass Road - drainage study and redesign to eliminate roadway flooding.**
Hazard designed to mitigate:	Flooding
Objective intended to help achieve:	3, 10
General background of item:	During prolonged downpours, Underpass Road can flood to the point where it is impassable by passenger vehicles.
Responsibility:	Public Works
Potential funding source:	TIP, grant funding
Priority/ time frame for implementation (or target completion date if possible):	Medium/2012

Action Item #17 **Ongoing…Capability Assessment**	**Continue to participate in marsh restoration projects to remediate tidally restrictive infrastructure which affects the retention time of floodwaters or impound stormwater.**
Hazard designed to mitigate:	Flood, Fire, Erosion, Sea Level Rise
Objective intended to help achieve:	1, 5
General background of item:	• Several tidally influenced water bodies and marshes in Brewster are often physically restricted in their ability to exchange water freely during tidal cycles. Reducing or removing these restrictions provides hazard mitigation benefits including increased flood storage capacity and reduced wildfire fuel potential from invasive species growth (i.e., Phragmites) resulting from limited flushing. • Seven sites have been identified by the *Cape Cod Atlas of Tidally Restricted Salt Marshes, 2001.* Saltmarshes and ponds may also be shared by two or more towns (Marshes - Quivett (Dennis border), Paines Creek, Namskakett (Orleans border). • Recent projects: Route 6A culvert replaced at Stony Brook Road – 2010; Paines Creek culvert to Freemans Pond to be replaced – 2011 **7 listed tidal restricted areas: Sea Street/ Quivett Creek, Cranberry Bog channel off*

	Quivett Creek (Clarke1), Cranberry Bog channel off Quivett (Clarke2), Paine's Creek Road/Freeman's Pond, Route 6A/Stony Brook, Channel off Stony Brook, Cape Cod Rail Trail/Namskaket Creek.
Responsibility:	Director of Natural Resources, Alewife Committee, Conservation Administrator, adjoining towns
Potential funding source:	Grants
Priority/ time frame for implementation (or target completion date if possible):	Medium/Ongoing

Action Item #18 **Ongoing…Capability Assessment (DART Team)**	**Develop and distribute (or obtain from County/State/Feds) education material concerning care of animals during natural hazard emergencies.**
Hazard designed to mitigate:	All
Objective intended to help achieve:	5, 9
General background of item:	• Obtain education materials for distribution at local vets offices, Animal Rescue League of Boston (ARL), Town Clerk's office (and also given out with annual dog licenses), Board of Health (and given out with annual barn permits), pet store, feed stores, local animal groups, schools • Humane Society (HSUS) has a complete training program relative to care and treatment of animals during natural hazard emergencies
Responsibility:	BOH, Town Clerk, ARL, HSUS, County agencies
Potential funding source:	Grant funding, public service donations from private sector
Priority/ time frame for implementation (or target completion date if possible):	High/2011

Action Item #19 **Keep…relevant**	**Develop a program to train emergency responders and residents in management of domestic animals, horses, sheep, goats, dogs, cats, birds, as well as wild animals, during emergencies such as flood, fires, winds, etc..**

Hazard designed to mitigate:	All
Objective intended to help achieve:	4, 5, 13
General background of item:	The Cape Cod Cooperative Extension (4-H), Humane Society, The Brewster Animal Rescue League and the MSPCA, Wildcare, Carapace and other such organizations have training capabilities, as well as videos and educational material. Residents (owners) as well as responders need to be trained in dealing with animals in such emergencies.
Responsibility:	Health Agent, Director of Natural Resources, Conservation Administrator, Animal Control Officer
Potential funding source:	Operating Budget, grants
Priority/ time frame for implementation (or target completion date if possible):	High/Ongoing

Action Item #20 **Keep…relevant**	**Conduct an educational workshop for coastal and riverfront landowners and contractors on hazard mitigation.**
Hazard designed to mitigate:	Flood, Wind, Erosion, Sea Level Rise
Objective intended to help achieve:	1, 9, 12, 13, 14
General background of item:	Development pressure continues as dwellings are razed and reconstructed in hazard prone areas. The workshop would be an opportunity to educate the public and the building community.
Responsibility for implementation assigned to:	Town Planner, Building Department, Conservation Commission
Potential funding source:	Operating Budget/Grant
Priority/ time frame for implementation (or target completion date if possible):	High/2011

Action Item #21 **Status?** **____available_____**	**Supply educational materials on preparedness/mitigation for property owners, for display and distribution at Town Hall, Brewster Ladies' Library, Council on Aging**
Hazard designed to mitigate:	All
Objective intended to help achieve:	5, 9, 12, 13, 14
General background of item:	Some information currently exists, but needs to be updated and available in more locations.
Responsibility for implementation assigned to:	Conservation, Health, Police and Fire, Library
Potential funding source:	Operating budget

Priority/ time frame for implementation (or target completion date if possible):	High/2011

Action Item #22 **Keep…relevant**	**Annually host a public hazards display for the residents of Brewster, in combination with the "Brewster in Bloom" festival or another appropriate community event. Ensure that such a display will also be hosted during the summer months, when part-time residents are in Town**.
Hazard designed to mitigate:	All
Objective intended to help achieve:	3, 9, 12, 13, 14
General background of item:	A hazard display for Town residents and part-time residents should be added to established community event(s) drawing large crowds. The display(s) should be geared toward educating people on the hazards which threaten Brewster and the mitigation and preparedness measures available to protect them. Educational displays/ handouts should be provided such as Flood Insurance Rate Maps, storm surge inundation maps, FEMA publications, hurricane tracking charts, safety tips, animal/pet protection and preparedness measures, etc.
Responsibility:	Planning Board/Building Commissioner, Public Works, Fire and Police
Potential funding source:	Operating Budget, Grants
Priority/ time frame for implementation (or target completion date if possible):	Moderate/2012

Action Item # 23 **Status? _____keep, part of HMP development_____**	**Incorporate natural hazard mitigation and best-planning practices into Brewster's planning work.**
Hazard designed to mitigate:	All
Objective intended to help achieve:	1, 14
General background of item:	• Adopt Minimum Performance Standards Relevant for hazard mitigation • Incorporate it into all planning initiative and projects • Encourage development bylaws that are intended to keep new development out of high hazard areas • Create a hazard-based District of Critical Planning Concern

Responsibility:	Planning Board, Building Department, Board of Health, Board of Selectmen, Public Works
Potential funding source:	None
Priority/ time frame for implementation (or target completion date if possible):	High/Ongoing

Action Item #24 **Status? _participate, not as robust, limited opportunities**	**Participate in Cape Cod Cooperative Extension's Wildfire Assessment and Preparedness Program.**
Hazard designed to mitigate:	Fire
Objective intended to help achieve:	3, 5, 8, 9
General background of item:	The Town owned parcels of conservation and recreation lands with proximity to residentially developed areas are potential sources of wildfires in areas. ♦ Review and refine the designated wildfire risk areas shown on the Wildfire Hazard (Map 4) and work towards appropriate wildland/urban interface (WUI) boundary designations. ♦ Work with County for coordination with Regional Community Wildfire Protection Plan (RCWPP), utilizing appropriate wildland/urban interface fire hazard assessment methodology. ♦ Work with Cape Cod Cooperative Extension to obtain necessary information and measures/steps that homeowners can take to reduce structural ignitability in at-risk areas. ♦ Use County assistance in analysis of fuel-reduction needs along evacuation routes and To provide mitigation recommendations of high-risk areas, and provide matching grant funds for mitigation of evacuation route hazards. ♦ Work with Cape Cod Cooperative Extension Natural Resources Section - Forester/ Community Wildfire Protection Coordinator, for assistance with wildland/open space assessments/management plans, for help to implement risk mitigation recommendations and preparedness plans.

	♦ Conservation Commission needs to become more involved in Wildfire Protection Program
Responsibility:	Fire Department, Director of Natural Resources, Conservation Commission, Planning, Cape Cod Cooperative Extension Service
Potential funding source:	County budget, grant funding
Priority/ time frame for implementation (or target completion date if possible):	High/Ongoing

Action Item #25 **Status?** **_____ongoing_____**	**Establish a Memorandum of Agreement/ Understanding with the Town of Harwich, and other adjacent towns, regarding the coordinated opening of storm shelters and to ensure adequate shelter capacity for the area.**
Hazard designed to mitigate:	All
Objective intended to help achieve:	4, 5
General background of item:	Shelter space has been adequate in the past but there is risk of overburdening the shelters in the future due to the regional nature of their use.
Responsibility for implementation assigned to:	Emergency Management
Potential funding source:	None needed
Priority/ time frame for implementation (or target completion date if possible):	High/ 2011

Action Item #26 **Status? _____nothing formalized, but coordination ongoing_____**	**Coordination with Nickerson State Park (NSP), Towns of Orleans (Baker's Pond), Harwich and Harwich Water Department (Punkhorn Parklands) and Dennis and Dennis Water Department (Punkhorn Parklands and Ellis Farm) on fuel reduction programs and response.**
Hazard designed to mitigate:	Fire
Objective intended to help achieve:	3, 5, 8
General background of item:	The Nickerson State Park encompasses over 1,000 acres within Brewster. Town is responsible for NSP. Orleans, Harwich and Dennis - Mutual Aid Agreement in place - required county-wide by law.

	Fire breaks at Town lines.
Responsibility:	Fire Department
Potential funding source:	Operating Budget
Priority/ time frame for implementation (or target completion date if possible):	High/Ongoing

Action Item #27 **Completed…remove**	**Provide remote access for Channel 18 (Brewster television station).**
Hazard designed to mitigate:	Wind, Snow and Ice
Objective intended to help achieve:	9, 12
General background of item:	During a storm event, it allows the Station Manager to update public service announcements and emergency instructions without having to be at the station (which is not accessible in a blizzard, for example).
Responsibility for implementation assigned to:	Station Manager, Cable Provider
Potential funding source:	Operating Budget/Grants
Priority/ time frame for implementation (or target completion date if possible):	High/2011

Action Item #28 **Remove…will be completed through HMP process**	**Identify and seek public funding and private sector funding for residents, businesses, and the Town of Brewster that will allow the implementation of sound hazard mitigation measures.**
Hazard designed to mitigate:	All
Objective intended to help achieve:	2, 5, 7, 16
General background of item:	Work with Cape Cod Commission to identify and seek planning funds and ensure coordination with existing and FEMA-certified plans in region.
Responsibility:	Various departments, Asst. Town Manager
Potential funding source:	MEMAs Hazard Mitigation Grant Program funds FEMA Pre-Disaster Mitigation program annual funds.
Priority/ time frame for implementation (or target completion date if possible	Medium/ongoing activity

Town of Brewster, MA

Local Hazard Mitigation Committee Meeting #2

Join Zoom Meeting
Join Zoom Meeting
https://us02web.zoom.us/j/88664723031?pwd=NkNTbWkvenUvMzlTSmNiYVo5cTJodz09

Meeting ID: 886 6472 3031
Password: 192740

July 15, 2020 2:00 PM - 3:00 PM

Name	Email Address
Chris Miller	
Heath Eldridge	
Patrick Ellis	
Paul Anderson	
Victor Staley	
Ryan Bennett	
Donna Kalinick	
Craig Pereira	

Public Workshop #1: January 30, 2021

Town of Brewster
Multi-Hazard Mitigation Plan

Virtual Public Workshop

Saturday, January 30, 2021
10:00 AM—12:00 PM

To join the webinar:
https://us02web.zoom.us/j/88616260444?pwd=cy9ZUDJiOEx0OGhZU3U3NDYxSWdtdz09
Passcode: 892988
Or iPhone one-tap :
US: +19294362866,,88616260444#,,,,*892988# or
+13017158592,,88616260444#,,,,*892988#
Or Telephone:
Dial (for higher quality, dial a number based on your current location):
US: +1 929 436 2866 or +1 301 715 8592 or +1 312 626 6799 or +1 669 900 6833 or
+1 253 215 8782 or +1 346 248 7799
Webinar ID: 886 1626 0444
Passcode: 892988
International numbers available: https://us02web.zoom.us/u/kbNENfN2AQ

About the Multi-Hazard Mitigation Plan

The Town of Brewster is currently developing a Multi-Hazard Mitigation Plan. This plan is important because it helps the Town plan and receive funding for projects that reduce the risk of injury or damage to property from future natural, communicable, human-caused or technological hazard events such as flooding, hurricanes or cyber security. This Multi-Hazard Mitigation Plan update will build on some of the work already completed by the Town including the Brewster Coastal Adaptation Strategy (September 2016), Town of Brewster Vision Plan (2018), the Town of Brewster Coastal Resource Management Plan (2019), and the Municipal Vulnerability Preparedness Plan (2019).

For more information please visit:
https://www.brewster-ma.gov/departments-mainmenu-26/planning-department-mainmenu-104/2908-brewster-hazard-mitigation-plan

Contact

Craig Pereira—Project Manager
Horsley Witten Group, Inc.
55 Dorrance St. Suite 200
Providence, RI 02903
cpereira@horsleywitten.com
Phone: (401) 272-1717

Town of Brewster, MA
Multi-Hazard Mitigation Plan
Public Workshop

Craig Pereira, CFM
Project Manager – Horsley Witten Group

Date: January 30, 2021 10:00 AM – 12:00 PM
Virtual

1

Virtual Platform

zoom

Horsley Witten Group

2

A Request of Participants

- **In the Chat area to Ryan Bennett:**
  - Your Full Name
  - Are you a resident, business owner, municipal employee?
  - Expectations you have for the workshop

Horsley Witten Group

3

Welcome…

WELCOME!

Horsley Witten Group

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Town of Brewster, MA
Local Hazard Mitigation Committee

- Paul Anderson, Water Department Superintendent
- Ryan Bennett, Town Planner
- Heath Eldredge, Police Chief
- Patrick Ellis, DPW Superintendent
- Pat Hughes, Coastal Committee
- Don Labonte, Resident/CERT
- Peter Lombardi, Town Administrator
- Donna Kalinick, Assistant Town Administrator
- Chris Miller, Natural Resources Director
- Robert Moran, Fire Chief
- Victor Staley, Building Commissioner
- Amy von Hone, Health Department Director

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Why Hazard Mitigation Planning?

Disaster Mitigation Act of 2000, Interim Final Rule, 44 CFR Parts 201 and 206 states, "All communities must have an approved Multiple Hazards Mitigation Plan in order to qualify for future federal disaster mitigation grants".

Reduction or elimination of long-term risk to life, property, and the environment.

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Mitigation Process

- **Assess Risks**
- Establish Goals
- Identify Projects/Actions
- Update/Maintain Plan

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7

Assess Risks… Risk and Vulnerability Assessment

Natural Hazard:

"Any event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, and agricultural loss, damage to the environment, interruption of business, or other types of harm and/or loss".

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Assess Risks… Natural Hazards

Flood-related hazards
- Riverine/Flash Flooding
- Inland/Urban Flooding
- Heavy Rain
- Climate Change
- Dam Failure
- Coastal Flooding
- Sea Level Rise
- Storm Surge
- Coastal Erosion/Shoreline Change

Winter-related hazards
- Blizzards/Heavy Snow
- Nor' easters
- Extreme Cold

Geologic-related hazards
- Earthquakes
- Landslides

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Assess Risks… Natural Hazards

Wind-related hazards
- Hurricanes
- Tornadoes
- High Winds
- Lightning/Thunderstorms
- Hail
- Tropical Storms

Urban/Wildfire-related hazards
- Urban Fire/Wildfire

Drought-related hazards
- Drought
- Extreme Heat

Invasive Species-related hazards
- Invasive Species

Communicable-related hazards
- Infectious Disease

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Assess Risks… Human-Caused/Technological Hazards

Human-Caused Hazards
- Cyber Incident
- Terrorism
- Civil Unrest
- Chemical/Biological/Radiological/Nuclear

Technological Hazards
- Infrastructure Failure
- Hazardous Materials Accident/Spill
- Major Aircraft Crash
- Catastrophic Dam Failure

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Assess Risks… Natural Hazard Profiles

Flood-related hazards
- Riverine/Flash Flooding: Moderate
- Inland/Urban Flooding: Moderate
- Heavy Rain: Moderate
- Climate Change: Moderate
- Dam Failure: Moderate
- Coastal Flooding: High
- Sea Level Rise: Moderate
- Storm Surge: Moderate
- Coastal Erosion/Shoreline Change: High

Winter-related hazards
- Blizzards/Heavy Snow: Moderate
- Nor' easters: Moderate
- Extreme Cold: Low

Geologic-related hazards
- Earthquakes: Low
- Landslides: Low

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Assess Risks…
Natural Hazard Profiles

Wind-related hazards
- Hurricanes: High
- Tornadoes: Low
- High Winds: High
- Lightning/Thunderstorms: Moderate
- Hail: Moderate
- Tropical Storms: High

Urban/Wildfire-related hazards
- Urban Fire/Wildfire: High

Drought-related hazards
- Drought: Moderate
- Extreme Heat: Moderate

Invasive Species-related hazards
- Invasive Species: Low

Communicable-related hazards
- Infectious Disease: High

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Assess Risks…
Human-Caused/Technological Hazard Profiles

Human-Caused Hazards
- Cyber Incident: High
- Terrorism: Moderate
- Civil Unrest: Low
- Chemical/Biological/ Radiological/Nuclear: Moderate

Technological Hazards
- Infrastructure Failure: Moderate
- Hazardous Materials Accident/Spill: Moderate
- Major Aircraft Crash: Low
- Catastrophic Dam Failure: Moderate

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Assess Risks…
Risk and Vulnerability Assessment - Assets

- **Economic Assets**
  - Businesses/employers
  - Tourist destinations
- **Social Assets**
  - Vulnerable populations
  - Cultural locations

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Assess Risks…
Risk and Vulnerability Assessment - Assets

- **Natural Resources**
  - Lifeline and utility systems
  - Wetlands
  - Conservation and recreation lands
- **Essential Buildings and Critical Facilities**
  - Government buildings
  - Hazardous facilities
  - Roadways
  - GIS Mapping

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Mitigation Process

- Assess Risks
- **Establish Goals**
- Identify Projects/Actions
- Update/Maintain Plan

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Establish Goals…Community Goals (2016)

- To reduce the potential for loss of life, property, critical facilities, infrastructure, environmental resources and landforms, and cultural resources from natural disasters.
- To educate residents and policy makers about natural hazard risk and vulnerability, so as to encourage hazard mitigation planning as part of the municipal planning process.
- To implement cost effective and feasible mitigation projects, funded whenever possible with grant programs.
- To coordinate Brewster hazard mitigation planning with neighboring towns in the Mid and Lower Cape Cod Region and Barnstable County.
- To reduce potential financial losses incurred by municipal, residential and commercial establishments due to disasters.
- To ensure that mitigation measures are context sensitive to natural features, historic resources and community character.

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Mitigation Process

- Assess Risks
- Establish Goals
- **Identify Projects/Actions**
- Update/Maintain Plan

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Mitigation Measures…Categories

- Planning and Prevention
- Property Protection
- Natural Resource Protection
- Structural Projects
- Emergency Services, and
- Public Education and Awareness

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Identify Projects/Actions… Identification of Mitigation Actions

Mitigation actions to be developed based on review of the Town's identified risks, vulnerabilities to natural hazards, and capabilities.

Each action incorporates a brief description of the intended action, who the responsible parties are, a proposed time frame for completion and potential funding sources.

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Identify Projects/Actions… Capability Assessment

Pre- and Post-Disaster Activities…

- Planning and Regulatory
  - Existing Plans, Studies and Reports
  - Zoning Code/Subdivision Rules and Regulations
- Administrative and Technical
  - Partnerships (CERT)
  - Municipal Administration and staff
- Financial
  - Federal/State grant opportunities

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Identify Projects/Actions… Capability Assessment

Town of Brewster Vision Plan 2018

Expresses the community's preference for how it intends to evolve socially, physically and economically by guiding town decisions, with eight building blocks identified.

- Coastal Management – in the context of coastal change, preserve and protect Brewster's coastal resources and expand public access.
  - Protect coastal resources in ways that preserve coastal ecosystems and habitats and the character of the town and coastal neighborhoods.
  - Adapt to climate change projections and advance adaptation and resiliency techniques that are financially and environmentally sustainable.

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Identify Projects/Actions… Capability Assessment

Open Space and Recreation Plan 2021

Advises the Board of Selectmen on open space preservation and acquisition efforts, acts as a resource for other agencies such as municipal departments, Boards and Commissions with open space concerns:

- Goal 1: Protect the Town's drinking water supply to meet the needs of residents and visitors today and in the future.
- Preserve and enhance habitat diversity and protected marine and freshwater resources to maintain their important ecological functions and values to the community.

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Identify Projects/Actions... Capability Assessment

Town of Brewster Coastal Adaptation Strategy 2016

A framework for future decision-making about Brewster's public coastal areas through established guiding principles:

- New access locations in adapting to the future
- Access for emergency vehicles and shell fishing
- Beach management and restoration
- Wetland resource adaptation
- Ongoing analysis of climate impacts
- Ongoing adaptive management

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Identify Projects/Actions... Capability Assessment

Town of Brewster Coastal Resource Management Plan, Phase 1 Report

Intended to provide vision and policy direction for the future management of Brewster's coastal resources while meeting diverse community access needs and adapting to coastal change.

- Increase the resilience of public beaches and landings.
  - Periodically assess coastal resources conditions for comparison with baseline conditions.
  - Assess coastal resources on a regional scale.
  - Adopt long-term coastal management resiliency strategies.
  - Promote management and maintenance.

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Identify Projects/Actions... Capability Assessment

Town of Brewster Coastal Resource Management Plan, Phase 1 Report

- Preserve ecosystem services provided by healthy wetlands.
  - Evaluate policy and regulatory changes to protect wetland resources.
  - Increase public awareness of the importance of healthy coastal wetlands and natural coastal processes, and the need to protect these resource areas.
  - Promote opportunities for salt marsh migration.
- Preserve peak-season access to public beaches and landings.
  - Maintain or enhance peak-season access to public beaches and landings.

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Identify Projects/Actions... Capability Assessment

Town of Brewster Coastal Resource Management Plan, Phase 1 Report

- Protect infrastructure, visual access and sense of place threatened by changing conditions.
  - Protect vulnerable low-lying infrastructure.
  - Complete the proposed MVP plan and develop a full-scale multi-hazard mitigation plan.
  - Work with the Planning Board and other stakeholders to evaluate changes to local zoning and regulations to preserve scale, character and resource protection.

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Identify Projects/Actions... Capability Assessment

Brewster Municipal Vulnerability Preparedness Working Group

- Review and update Town bylaws and regulations to mitigate projected climate change impacts.
- Develop and initiate projects to increase resilience to projected climate change impacts (i.e., intense rain, storm surge, sea level rise) for critical infrastructure.
- Identify and initiate projects to provide backup power at the Town Hall, Water Department and drinking water wells to provide critical infrastructure resilience to power outages.
- Conduct a stormwater infrastructure inventory and assessment to prioritize and initiate improvements (e.g., increased catch basin maintenance, culvert replacement) based on projected climate change impacts.

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Identify Projects/Actions... Capability Assessment

Brewster Municipal Vulnerability Preparedness Working Group

- Develop a Preparedness Campaign for the general public (i.e., residents and seasonal guests) and the private sector that includes guidance and checklists, as well as recommendations to increase community resilience to the impacts of climate change.
- Develop a local Multi-Hazard Mitigation Plan that includes considerations for projected climate change impacts.
- Review and update the Brewster Community Emergency Management Plan to include considerations for projected climate change impacts.
- Conduct a vulnerability assessment, develop plans and initiate improvements at critical public beach access points in the community to increase resilience to projected climate change impacts.

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Identify Projects/Actions… Capability Assessment

Cape Cod Atlas of Tidally Restricted Salt Marshes

Salt marsh systems requiring infrastructure resizing and/or repair/replacement to eliminate potential for causing flooding.

- **Site BR-2: Brewster - Cranberry Bog Berm Restriction of Channel off Quivett Creek (Privately Owned):** Inactive cranberry bogs dot this marsh. Berms built to support the past cranberry farming are still in place, severing the tidal flow. A six-inch pipe forms the only connection from the bogs to the marsh, allowing in only a fraction of the tidal flow to pass upstream.
- **Site BR-3: Brewster - Cranberry Bog Berm Restriction of Channel off Quivett Creek (Privately Owned):** This site also involves another pipe designed to allow under an old cranberry bog berm. This pipe prevents any waters from naturally flushing the upstream affected area.

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Identify Projects/Actions… Prioritization of Actions…STAPLEE Method

- **Social**…is the action socially acceptable?
- **Technical**…is the action technically feasible and provide appropriate level of protection?
- **Administrative**…does the Town have the capability to complete the action?
- **Political**…will the Town support or oppose the project?
- **Legal**…does the Town have the legal authority to complete the action?
- **Economic**…is the action cost-effective?
- **Environmental**…will the action affect the natural environment?

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Identify Projects/Actions… Implementation

- Plan Adoption/Incorporation into Existing Plans

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Mitigation Process

- Assess Risks
- Establish Goals
- Identify Projects/Actions
- **Update/Maintain Plan**

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2016 Draft Plan

Action #1
Create a standing Multi-Hazard Mitigation Committee.
Remove…completed

Action #2
Join the NFIP's Community Rating System.
Ongoing…move to Capability Assessment (2018)

Action #3
Increase protection of the floodplain by amending the current Floodplain District Bylaw.
Ongoing…move to Capability Assessment

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2016 Draft Plan

Action #4
Use the Town's evolving Geographic Information System (GIS) to maintain current building and parcel data for the purpose of conducting more detailed hazard risk assessments and for tracking permitting/land use.
Ongoing…move to Capability Assessment (Town is establishing an enhanced permit software program)

Action #5
Conduct a thorough investigation of the Town's most at-risk locations identified in the Vulnerability Analysis and evaluate potential mitigation techniques for protecting each location to the maximum extent possible.
Ongoing…part of this plan's development

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2016 Draft Plan

Action #6
Develop a list of mitigation projects, including but not limited to: snow fencing in areas prone to blowing and drifting snow, and regarding and improved drainage in areas prone to flooding.
Ongoing…part of this plan's development

Action #7
Conduct a Needs Assessment of privately-owned facilities that have regional importance (medical centers/day care centers).
Carry forward to 2021 Plan

Action #8
Conduct a Needs Assessment of mitigation activities that should be undertaken to prepare and protect Brewster's cultural resources from the damaging effects of natural hazards.
Ongoing…part of this plan's development

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2016 Draft Plan

Action #9
Quantify potential losses by estimating such losses at varying degrees of storm surge, wind and stormwater hazard severity, as well as specific impacts on critical facilities.
Ongoing…part of this plan's development

Action #10
Develop a map indicating hazard sensitive parcels acquired by Brewster.
Carry forward to 2021 Plan

Action #11
Incorporate the inspection and management of hazardous trees/limbs into the Town's routine monitoring process.
Carry forward to 2021 Plan

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2016 Draft Plan

Action #12
Monitor the Town's emergency services to identify needs in terms of personnel, equipment and/or required resources.
Ongoing…part of this plan's development

Action #13
Review of Ditch Systems and old bogs for preventative maintenance - to increase flood capacity.
Carry forward to 2021 Plan

Action #14
Mitigate impacts of blowing/drifting snow.
Carry forward to 2021 Plan

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2016 Draft Plan

Action #15
Infrastructure – Route 6A at Drummer Boy Park: Drainage study and re-design to eliminate flooding.
Ongoing…move to Capability Assessment (Town has a 604B grant for improvements)

Action #16
Infrastructure – Underpass Road: Drainage study and re-design to eliminate roadway flooding.
Completed…remove

Action #17
Continue to participate in marsh restoration projects to remediate tidally-restrictive infrastructure which affects the retention time of floodwaters or impound stormwater.
Carry forward to 2021 Plan

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2016 Draft Plan

Action #18
Develop/distribute education material concerning care of animals during hazard emergencies.
Ongoing…move to Capability Assessment (DART Team)

Action #19
Develop a program to train emergency responders and residents in management of domestic animals, horses, sheep, goats, dogs, cats, birds, as well as wild animals, during emergencies such as flood, fires, winds, etc.
Carry forward to 2021 Plan

Action #20
Conduct an educational workshop for coastal and riverfront landowners and contractors on hazard mitigation.
Carry forward to 2021 Plan

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2016 Draft Plan

Action #21
Supply educational materials on preparedness/mitigation for property owners, for display and distribution at Town Hall, Brewster Ladies' Library, Council on Aging.
Ongoing…move to Capability Assessment (DART Team)

Action #22
Annually host a public hazards display for the residents of Brewster, in combination with the "Brewster in Bloom" festival or another appropriate community event. Ensure that such a display will also be hosted during the summer months, when part-time residents are in Town.
Carry forward to 2021 Plan

Action #23
Incorporate natural hazard mitigation and best-planning practices into Brewster's planning work.
Ongoing…part of this plan's development

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2016 Draft Plan

Action #24
Participate in Cape Cod Cooperative Extension's Wildfire Assessment and Preparedness Program.
Ongoing…move to Capability Assessment

Action #25
Establish an MOU/MOA with the Town of Harwich, and other adjacent towns, regarding the coordinated opening of storm shelters and to ensure adequate shelter capacity for the area.
Ongoing…move to Capability Assessment

Action #26
Coordination with Nickerson State Park, Towns of Orleans (Baker's Pond, Harwich/Harwich Water Department (Punkhorn Parklands), and Dennis/Dennis Water Department (Punkhorn Parklands and Ellis Farm) on fuel reduction programs and response.
Carry forward to 2021 Plan

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2016 Draft Plan

Action #27
Provide remote access for Channel 18.
Remove…completed

Action #28
Identify and seek public/private sector funding for residents, businesses and the Town that will allow the implementation of sound hazard mitigation measures.
Ongoing…part of this plan's development

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Online Public Survey

https://www.surveymonkey.com/r/BrewsterHazardMitigationPlan

Horsley Witten Group

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Project Schedule

Draft Update available for comment: **Summer/Fall 2021**

Draft Update to MEMA: **Early Fall 2021**

Horsley Witten Group

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Contact Us…

Questions/Comments:

Ryan Bennett
Town Planner
Town of Brewster

rbennett@brewster-ma.gov
Phone: (508) 896-3701

Craig Pereira—Project Manager
Senior Planner
Horsley Witten Group, Inc.

55 Dorrance Street, Suite 200
Providence, RI 02903
cpereira@horsleywitten.com
Phone: (401) 263-6048

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Town of Brewster, MA

Virtual Public Workshop #1

To join the webinar:
https://us02web.zoom.us/j/88616260444?pwd=cy9ZUDJiOEx0OGhZU3U3NDYxSWdtdz09
Passcode: 892988
Or iPhone one-tap :
US: +19294362866, *892988#
Or Telephone:
Dial (for higher quality, dial a number based on your current location):
US: +1 929 436 2866 Webinar ID: 886 1626 0444
Passcode: 892988

January 31, 2021 10:00 AM - 12:00 PM

Name	Email Address
Ryan Bennett	
Craig Pereira	
Donna Kalinick	
Chris Miller	
Pat Hughes	
Suzanne Bryan	

Horsley Witten Group
Sustainable Environmental Solutions
www.horsleywitten.com

Local Hazard Mitigation Workgroup Meeting #3: July 16, 2021

Brewster Hazard Mitigation Plan

Local Hazard Mitigation Workgroup Meeting #3

Zoom (Virtual) Meeting
July 16, 2021 1:00 PM – 2:30 PM

Join Zoom Meeting
https://us02web.zoom.us/j/88296659243?pwd=bU9ubnVSZnFlcFNxUHhGOG1YbG5RUT09
Meeting ID: 882 9665 9243
Passcode: 646044
One tap mobile
+1-929-436-2866, *646044# US (New York)

Agenda

1. Outstanding Data Needs
    a. Tidal Restrictions
    b. Municipal Interviews
    c. Online Community Survey
    d. Development Trends
    e. Evacuation/Traffic Control Points
    f. Cyber-related Mitigation Actions for Consideration
    g. Participants List Workshop #1

2. Mapping
    a. Coordination with CCC
    b. Horsley Witten

3. Actions for Continued Compliance with NFIP

4. Mitigation Actions for Consideration

Horsley Witten Group

Memorandum of Meeting

To: Brewster Local Hazard Mitigation Workgroup (LHMW)

From: Craig Pereira

Date: July 16, 2021

Re: Brewster Hazard Mitigation Plan (HMP) Development

In attendance:

Peter Lombardi – Town Administrator
Donna Kalinick – Assistant Town Administrator
Griffin Ryder – DPW Superintendent
Paul Anderson – Water Department Superintendent
Chris Miller – Natural Resources Director
Victor Staley – Building Commissioner
Heath Eldredge – Police Chief
Amy von Hone – Health Director
Pat Hughes – Coastal Committee
Ryan Bennett – Town Planner

Consultant Team
Craig Pereira, Project Manager - Horsley Witten Group, Inc. (HW)

1. Outstanding Data Needs:
    - Tidal Restriction Projects.
      Craig Pereira requested clarification on the joint project for culvert replacement to Freeman's Pond with the Natural Resources Conservation Service/DEM/Orleans and Brewster local officials and the state Wetlands Restoration Program, and MA CZM.
        - Chris Miller stated the project as completed in late 2011 and now includes routine maintenance.
    - Municipal Interviews.
      Craig Pereira stated there are a number of members who have not completed/returned the interview template, including Robert Moran, Chris Miller, Paul Anderson, Don Labonte, and Griffin Ryder.
        - These LHMW members are asked to complete/return the interview template to Craig (attached).
    - Community Survey.
      Craig commented that the survey will need to be closed and summarized for inclusion in the draft plan, shortly. To date, there have been 62 responses received.
        - Peter Lombardi offered to put the link on the front page/News section of the Town's webpage to push it out for a few more weeks in hopes of additional responses.
    - Development Trends.

Craig requested a breakdown of major residential and commercial development trends over the past 7 years to evaluate if the Town is encouraging development outside of the special flood hazard area. Data should include:

- Major Residential/Commercial Development:
  - Name
  - Address
  - Number of units/total SF of commercial space
  - Status: completed…pending approval…under construction
- Pat Hughes asked if it would be possible to correlate development trends with Orders of Condition requested by the Conservation Commission, indicating there have been 4 – 5 properties built in hazard areas. This request is outside of the needs for the HMP.
- Ryan Bennett and Victor Staley will work together to develop summary of major development trends for the past 7 years, provide an annual summary of building permits, and a copy of the 2019 CRS report to Craig.

- Evacuation/Traffic Control Points.
  Craig requested sanctioned GIS data or both…this data is outside/different than that for hurricane inundation zones at the state level. Craig indicated the availability of this data fluctuates where some communities don't have sanctioned routes/TCP, and that both are event-specific and fluid.
  - Heath Eldredge stated the Town's approach is event-specific and fluid, based on the extent/location/type of event.
- Cyber-related Actions for Consideration.
  Craig stated that no cyber-related actions were submitted for consideration.
  - Craig will reach back to Kathy Lambert to see if there any actions to be included for consideration.
  - Peter stated the Town does have a Cyber Plan in place. He will review and forward to Craig.
- Public Workshop Attendance List.
  Craig requested a copy of the attendance list from the January 2021 Public Workshop.
  - Ryan will provide this list to Craig.

2. Mapping
   - Cape Cod Commission Coordination.
     Craig stated that the Town has coordinated with the Cape Cod Commission to provide some of the required mapping for the hazard mitigation plan and HW completed the remaining maps.
     i. Maps developed by the CCC include:
        1. 2-1 Shoreline Change
        2. 2-2 Sea Level Rise Scenarios (although the mapping shows a range of scenarios up to 6 feet, the Vulnerability Analysis included in the plan looked at a rise of 1-foot and 3-feet only, as agreed upon by the LHMW).
           - Pat commented that the Town's adaptation study included recommendations and should be referenced in the plan. Craig stated that all previous plans, studies and reports have been summarized and included as part of Section 3 –

Capability Assessment, and that all actions/strategies/recommendations have been assembled into the Mitigation Actions for Consideration document.

3. 2-3 FEMA Flood Hazard Areas (used by HW to complete the Vulnerability Analysis – Economic impacts)
4. 2-4 Critical Facilities
    - Chris Miller commented that #25 is no longer Epoch…it is now Serenity Brewster Apartment Complex. Craig will coordinate with the CCC to revise the data set.
5. 2-7 Storm Surge Scenarios (used by HW to complete the Vulnerability Analysis -Economic impacts)
6. 2-5 Average Annual Snowfall
7. 2-6 Tornadoes/Hurricanes
8. 2-8 Earthquakes/Landslides
    - All LHMW members to review maps and provide comments to Craig.

3. Actions for Continued Compliance with NFIP.
   Craig presented the table to the group for completion. Half way through, Ryan requested a copy of the table and indicated she will complete it with Victor and return to Craig.
4. Mitigation Actions for Consideration.
   Craig briefly reviewed the Mitigation Actions for Consideration document with the LHMW, including:
   - Categories for actions
   - Where the actions came from (identified in red, bold font)
   - Time Frame description
   - Cost Estimate description
   - Notations where Craig thought actions could be combined.
     - Ryan requested a first look at the document before it goes out to the larger group.
     - Once Ryan has reviewed, Craig will forward it to the LHMW for review and comment.
       - Craig requested that all LHMW members review each action and the bulleted list that follows to ensure the appropriate responsible parties, time frames, cost estimates, etc. are accurate.

5. General Comments.
   - Craig offered to have a coordination call with Griffin Ryder to catch him up on the HMP process/evolution to date.
   - Ryan suggested the fourth and final LHMW meeting be held in person, perhaps in September.
   - Pat asked if the Natural Resources Committee should be weighing in on the mitigation actions for consideration. Ryan commented it would be difficult to bring in so many folks to weigh in, and Craig stated that Pat's role to the LHMW is to represent the interests of this committee.
   - Chris Miller commented that the Town is participating in a Storm Tide Pathways mapping project through Barnstable County. A final report is due out soon.
     i. Chris will provide a copy of the recorded presentation to Craig.

    ii. Craig will coordinate with Shannon Hulst on the availability of the final report.
    iii. Craig stated that Ryan already requested the project be referenced in the plan.
- Several members indicated there are additional MOUs/MOAs for municipal services that should be included.
    i. Paul Anderson will provide the water/wastewater Agency Response Network (WARN) agreement.

Time Frame:

- Short Term = 0 to 6 Months
- Medium Term = 6 to 18 Months
- Long Term = 18 Months to 5 Years

Cost Estimate:

- Staff Time – municipal personnel time
- Minimal – less than $5,000
- Moderate – more than $5,000, but less than $25,000
- Significant – over $25,000

PUBLIC EDUCATION AND AWARENESS

Action #1

…Town of Brewster Vision Plan 2018

Adapt to climate change projections and advance adaptation and resiliency techniques that are financially and environmentally sustainable (adopt Model Coastal Resilience Bylaw).

- Identify techniques such as living shorelines, nourishment from dredged material, and land acquisition for retreat locations to adapt to coastal changes.
- Provide outreach and education (signs, field trips, publications) to build awareness of citizens and decision makers about the nature of coastal changes.

    - Action Type: Planning, Pre-Disaster
    - Priority Score:
    - Lead: Conservation Commission/Natural Resources Dept.
    - Supporting: Coastal Advisory Group
    - Time Frame: Long Term
    - Financing Options: Municipal Budget
    - Cost Estimate: Municipal Personnel Time
    - Benefit: Protection of property, life and infrastructure/Increased awareness of vulnerabilities
    - Vulnerable Area: Municipally-owned Infrastructure/Coastal Wetlands/Private Property

Action #2

…Town of Brewster Coastal Resource Management Plan, Phase 1 Report/Storm Tide Pathways Study

Implement Brewster Coastal Resource Management Plan, Phase 1 Report/Storm Tide Pathways Study:

A. Increase public awareness of the importance of healthy coastal wetlands and natural coastal processes, and the need to protect these resource. Education materials should be aimed at shoreline property owners, among others, to discuss the importance of natural sediment transport processes, and best practices for vegetation management, erosion management, and buffer

protection, etc. This effort should be coordinated with the development of permitting guidance.

B. ***Use best available tools to understand the potential impact of storm surge on public and private property, sensitive infrastructure and natural resources, and to develop strategies and plans to avoid, minimize or mitigate adverse impacts, including tools made available through the Cape Cod Commission's Resilient Cape Cod project, MVP program, and the storm tides pathways assessment project being undertaken by the Barnstable County Extension Service and Center for Coastal Studies.***

- Action Type: Mitigation, Pre-Disaster
- Priority Score:
- Lead: Natural Resources Dept.
- Supporting: Natural Resources Advisory Group
- Time Frame: Medium Term
- Financing Options: Municipal Budget
- Cost Estimate: Municipal Personnel Time
- Benefit: Protection of property, life, infrastructure and natural resources/Increased awareness of vulnerabilities
- Vulnerable Area: Repetitive Loss Properties/Floodplains/Municipally-owned Infrastructure/Emergency Response and Public Health/Private Property

Action #3
…MVP/2016 Draft Plan/HW
Increased the public's awareness of hazard vulnerabilities:

A. ***Develop a Preparedness Campaign for the general public (i.e., residents and seasonal guests) and the private sector that includes guidance and checklists, as well as recommendations to increase community resilience to the impacts of climate change (e.g., extreme weather, health impacts).***

B. ***Annually host a public hazards display for the residents of Brewster in combination with the 'Brewster in Bloom' festival or another appropriate community event. Ensure that such a display will also be hosted during the summer months, when part-time residents are in Town.***

C. ***Distribute Tourist Evacuation and Shelter Information***
Out of state tourists may not be familiar with local authorities, evacuation routes, locations of designated shelters, or know what to expect if police-enforced evacuation becomes necessary. Distribute information on town evacuation routes and emergency shelters to hotels, Bed and Breakfasts, real estate agencies dealing with seasonal rentals, and other facilities and events hosting tourists.

- Action Type: Mitigation, Pre-Disaster
- Priority Score:

- Lead: Fire Dept./Emergency Management/Police Dept.
- Supporting: Planning Dept.
- Time Frame: Short Term
- Financing Options: Municipal Budget
- Cost Estimate: Municipal Personnel Time/MVP Action Grants
- Benefit: Protection of property, life and infrastructure/Increased awareness of vulnerabilities/Accelerated evacuation
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Public and Private Property/Social Distress

NATURAL RESOURCE PROTECTION

Action #4
…Open Space and Recreation Plan 2021
Implement Brewster Open Space and Recreation Plan:

A. Protect the Town's drinking water supply to meet the needs of residents and visitors today and in the future.
Protect existing public supply wells from land-based sources of contamination.

- Action Type: Mitigation, Pre-Disaster
- Priority Score:
- Lead: Water Dept./Community Preservation Committee
- Supporting: Natural Resources Dept./Recreation Dept./Open Space Committee
- Time Frame: Long Term
- Financing Options: Municipal Budget/FEMA and MEMA Grants/Community Preservation Act Fund
- Cost Estimate: Significant
- Benefit: Protection of drinking water supply/Protection of natural resources
- Vulnerable Area: Municipally-owned Infrastructure/Natural Resources

Action #5
…Integrated Water Resources Management Plan 2013
Update Zoning Bylaws and Subdivision Rules/Regulations to protect public supply wells.

- Strengthen the Water Conservation Bylaw (Chapter 112, Article 1 of the Brewster Town Code).
- Strengthen the Zoning Bylaw provision for drinking water quality protection by mandating the Natural Resource Protection Design (NRPD) in its District of Critical Planning Concern (DCPC), rather than 'encouraging it'.
- Implement a Stormwater Management Bylaw.
- Encourage Low Impact Development (LID).

- Action Type: Mitigation, Pre-Disaster
- Priority Score:

- Lead: Planning Board
- Supporting: Planning Dept./Water Dept.
- Time Frame: Medium Term
- Financing Options: Municipal Budget
- Cost Estimate: Municipal Personnel Time
- Benefit: Protection of life/infrastructure, increased awareness of vulnerabilities
- Vulnerable Area: Public Health, Safety and Welfare/Social Distress/Natural Resources

Action #6

…Town of Brewster Coastal Adaptation Strategy 2016

Implement Brewster Coastal Adaptation Strategy

A. Identify and acquire new access points to the shoreline.

- The Town should evaluate possible new access points to the shoreline through collaboration with existing property owners, including state and town-owned land and private properties. The Town should also evaluate how existing satellite parking facilities could be used or expanded, or if new satellite parking areas and pathways to the shore could be created without impacting sensitive resources.
- Identify and plan for the acquisition of parcels that may provide for future access. The proximity of the parcels to sensitive wetland areas and the potential impacts from climate change should be included in the planning process to select sites that will create viable access over the long term.

B. Periodically evaluate the beach management process to evaluate how well it is working and to incorporate lessons learned over time.

- Ongoing beach management promotes safe access to the shore through repairs to the town landings after storm events. Therefore, the Town should continue its ongoing work to restore areas at the town landings impacted by storm events. This can include beach nourishment and dune restoration to replace sand lost during a storm: the planting of beach grass and the use of dune fencing to stabilize dunes; and the repair or replacement of pathways, stairs, or ramps used to access the beach.

C. Promoting wetland retreat as sea level rises helps to preserve the valuable habitat and storm damage prevention function of coastal wetlands. The Town should identify opportunities to promote and support wetland retreat to preserve coastal wetlands, including salt marshes to the extent feasible. Strategies to consider include:

- Mapping of low-lying areas where wetland retreat is possible.
- Land acquisition and preservation in areas directly adjacent to existing wetlands to allow for wetland retreat as sea level rises.
- Incorporation of wetland retreat assessments into plans for the development or redevelopment of properties adjacent to existing wetlands.
- Development of regulatory guidelines to require that wetland retreat adaptation be incorporated into future development plans.

- Removal of restrictions to tidal flow into upstream marshes to promote the inland migration of coastal wetlands.
- Removal of pavement and fill in wetland areas, and/or design and implementation of improved stormwater management where feasible to reduce impacts to existing wetlands.

D. Continuing research and analysis is needed to manage access to Brewster's shoreline into the future which may include additional monitoring. Further analysis and monitoring of the migration of sediment along the coast is needed to understand how the offshore flats will respond to a rising sea level and whether or not they will remain above water at low tide.

The scientific understanding of wetland retreat and salt marsh migration under increasing sea levels will mature over time and any new information should be incorporated into the Town's plans for managing wetland retreat. Future data on the rate of sea level rise can also be used to manage and prioritize future adaptation projects. The Town should also consider the potential contributions to climate change of adaptation options when evaluating different approaches.

The Management Plan could evaluate the implementation of a coastal overlay district to control future development in areas impacted by climate change and manage the rebuilding of existing development in these areas.

- Action Type: Mitigation, Pre-Disaster
- Priority Score:
- Lead: Natural Resources Dept./Natural Resources Advisory Committee
- Supporting: Brewster Open Space Committee/Community Preservation Committee
- Time Frame: Long Term
- Financing Options: MEMA/FEMA grants/Community Preservation Act Funds
- Cost Estimate: Significant
- Benefit: Protection of cultural and natural resources
- Vulnerable Area: Public and Private Property/Cultural Resources/Natural Resources/Emergency Response/Public Health, Safety and Welfare/Municipally-owned Infrastructure/Floodplains

Action #7

…Town of Brewster Coastal Resource Management Plan, Phase 1 Report

Implement Brewster Coastal Resource Management Plan, Phase 1 Report

A. Periodically assess coastal resources conditions for comparison with baseline conditions. Monitor and assess physical processes to support short-term management decisions and long-term planning.

- Every five years (next in 2021) update projections of sea level rise and storm surge and the modeled impacts of these forces on public beaches and landings, infrastructure and coastal resources.

- Update tidal benchmarks; track and record highest annual high tide as proxy for effects of sea level rise.
- Evaluate the potential benefit, cost and candidate locations for installing one or more tide gauge (s) and a wave buoy to provide localized data on trends in tidal dynamics.
- Evaluate the potential benefit, cost and candidate location for installing a wave height buoy.
- Evaluate the potential usefulness of establishing a volunteer-based program to monitor changes in beach profiles.

B. Periodically assess coastal resources on a regional scale.

- The 2015 Century Scale Sediment Budget should be updated in tandem with the sea level rise (next in 2021) to assess trends in sediment movement within the littoral cell that encompasses Brewster's shoreline. This effort should be evaluated and potentially undertaken in cooperation with Dennis, Orleans and Eastham. The assessment should include recommendations for monitoring protocols and potential management actions necessary to increase resiliency of Brewster's shoreline and ensure that tidal flats keep pace with sea level rise.
- Participate with the Barnstable County Extension and Center for Coastal Studies in developing a Storm Tide Pathway for Brewster. The Storm Tide Pathways project will encompass the entire Cape Cod Bay shoreline and may provide a basis for additional coordinated efforts among towns sharing the same littoral cell.
- Consider development of a regional framework for coastal resilience.
    - Develop a management plan for the Inner Cape Cod Bay Area of Critical Environmental Concern (ACEC), in concert with the other towns sharing the ACEC. Such a plan could encompass studies of sea level rise and sediment budget, regional sediment management, and other ACEC resource issues.
    - Consider establishing a regional coastal resilience planning group among towns in the same littoral cell (Dennis , Orleans, Eastham) to identify/study issues of shared concern cost effectively. Regional coordination could increase funding opportunities. This could be in concert with the existing Barnstable County Coastal Resources Committee, or the Cape Cod Commission's Resilient Cape Cod, Cape Cod Bay Work Group.

C. Adopt long-term coastal management resiliency strategies.

- Evaluate resilient shoreline management practices (those that mimic natural coastal processes) and identify where on Brewster's shoreline they might be applied.
    - Preserve coastal landforms and vegetation that provide buffers to erosion caused by storm surge. Salt marsh and fronting coastal dunes have been shown to be effective in mitigation erosion along Brewster's Cape Cod Bay shoreline.
    - Beach and dune nourishment practices for public and private beaches: Mant's, Paine's Point of Rocks.

    - Dune protection (vegetation, fencing) and reconstruction: Mant's, Breakwater Beach, Point of Rocks.
    - Create a living shoreline demonstration project: oyster reef at Mant's Landing.
    - Managed retreat similar to the relocation of the Paine's Creek parking lot: locations to be determined.
- Evaluate changes to the existing groin field, including potential removal/attrition of groins or other structures on the shoreline that impede coastal processes or hasten erosion. Evaluate whether existing groins could impede sediment transport necessary to sustain the tidal flats under different sea level rise scenarios.
- Enhance stormwater management to minimize or eliminate erosion caused by overland run-off.
    - Implement the stormwater management improvements identified in Brewster's Integrated Water Resource Management Plan and the work being undertaken on MS4 General Permit compliance.
    - Prioritize stormwater improvements in any locations where infrastructure could reduce or eliminate erosion caused by run-off.
    - Provide funding for ongoing maintenance of existing or proposed improvements, possibly through the creation of a stormwater utility.
    - Design and adopt a stormwater management bylaw to enhance stormwater management on public and private property; and ensure that issues related to coastal erosion, use of green infrastructure and use of best management practices are incorporated.
- Evaluate policy and regulatory changes to promote coastal resiliency.
    - Evaluate the potential for implementing a flood plain bylaw to, among other things, "restrict or prohibit development and uses on Land Subject to Coastal Storm Flowage (i.e., 100-year coastal floodplain) and its buffer zones in order to minimize potential loss of life, destruction of property, and environmental damage inevitably resulting from inappropriate development on land known to be subject to storms, flooding, erosion, relative sea rise and other coastal zone hazards," (Cape Cod Commission model bylaw). The Cape Cod Commission model bylaw and efforts implemented in other towns should be evaluated to determine policies applicable to Brewster.
    - Develop permitting guidance for erosion control activities on private properties, and work with the Conservation Commission to apply the guidance in the review of Notices of Intent and issuance of Orders of Condition.
- Ensure consistency with other planning efforts.

D. Promote management and maintenance of public access points to increase resilience.

- Create a coastal resiliency toolkit consisting of best practices for sustainable design, management and maintenance of town-owned landings and beaches. The toolkit should make use of the work being undertaken through the Cape

Cod Commission's Resilient Cape Cod project, and other proven techniques, including:
  - Managed retreat of parking areas and structures.
  - Use of articulated mats to provide stability under ramps and parking areas.
  - Use of beach grass planting, beach nourishment, and dune nourishment/rebuilding/stabilization, among other initiatives.
- Develop a sustainable funding source, possibly through an environmental bond bill offset by short term rental tax revenues, potential increase in deeds tax revenues, town beach sticker revenues or other sources for resilient maintenance and management actions that balance needs for access, public safety, natural resource sustainability, and coastal resiliency; and that meet local and state permitting requirements. These measures include: repair stairs/ramps/walkways (including measures needed for improved handicapped accessibility). A proactive, resilient maintenance program may lower long-term costs by reducing the potential need for emergency repairs.
- Conduct technical alternatives assessments for resilient capital projects needed to address erosion pressure and preserve access at highly threatened town-owned access points. Mant's Landing and Paine's Creek are currently experiencing significant erosion and should be prioritized for evaluation and possible resilient capital projects.

E. Preserve natural sediment transport processes in balance with erosion. Evaluate policy and regulatory changes to protect wetland resources.

- Work with the Conservation Commission to evaluate the Town's wetlands protection bylaw and regulations to determine if any changes would provide enhanced protection of coastal wetlands and natural coastal processes. Areas of exploration could include, but not limited to:
  - Potential to incorporate the sediment budget into the local wetlands bylaw and regulations to regulate protection of upland development differently in eroding areas.
  - For all new or renewed Orders of Condition for erosion management, require analysis of cumulative system-wide impacts, and require adherence to best practices for shoreline erosion management structures.
  - Adopt permitting guidelines based on Woods Hole Oceanographic Institution Sea Grant publication *Spectrum of Erosion Control Methods*. The recent publication of *Guidelines for Erosion Management in Pleasant Bay* provides a guide.
  - Require maintenance and nourishment of erosion management structures.
  - Incorporate monitoring requirements for erosion control measures to provide information to evaluate their functions and impacts.
- Review the Town's policy for allowing access through town landings to perform shoreline stabilization work on private property. Ensure that applicants carry adequate insurance coverage in case of damage to resources caused by heavy equipment or fuel spills.
- Work with the Planning Board to revise, update or extend the Flood Plain Overlay District and Wetlands Conservancy bylaws, based on an evaluation of

the bylaw's effectiveness in meeting its original purpose, and based on a survey of similar measures employed in other communities as recommended by the Cape Cod Commission.

F. Maintain the elevation of salt marshes and tidal flats by promoting opportunities for salt marsh migration.

- Use the state-of-the-art wetland modeling to assess patterns of salt marsh retreat in Brewster. Model results could then be used to develop salt marsh management plans to counteract loss of marsh due to subsidence or inundation. Management actions could include:
  - Channel improvements to restore or enhance hydrology.
  - Evaluate the potential for a pilot project for thin layer deposition of material on any subsided areas of salt marsh plane, in coordination with MassDEP permitting guidance.
  - Work with the Town's Open Space Committee, Community Preservation Committee and the Brewster Conservation Trust to identify key parcels for acquisition/conservation restriction and to develop a funding strategy for acquisition/protection of these properties; and develop a framework for tracking and pursuing parcel opportunities.
  - Identify and remove any remaining undersized culverts that may restrict tidal flow and causing degradation of coastal wetlands. An example is the Crosby salt marsh restoration project.
- Develop/update and implement resource management plans to protect large areas of salt marsh. Land Use and Management Plans for Quivett Creek/Paine's Creek Marsh and Namskaket Marsh should be developed in coordination with Brewster Conservation Trust, MA DCR, and adjacent towns.

- Action Type: Mitigation, Pre-Disaster
- Priority Score:
- Lead: Natural Resources Advisory Committee
- Supporting: Natural Resource Dept./Towns of Dennis, Orleans and Eastham
- Time Frame: Long Term
- Financing Options: Municipal Budget/MEMA and FEMA Grants
- Cost Estimate: Significant
- Benefit: Protection of Natural Resources, floodplains and infrastructure/Public and Private Property
- Vulnerable Area: Repetitive Loss Properties/Floodplains/Public and Private Property/Cultural Resources/Natural Resources/Municipally-owned Infrastructure

STRUCTURAL PROJECTS

Action #8

…Town of Brewster Coastal Resource Management Plan, Phase 1 Report/MVP

Implement Brewster Coastal Resource Management Plan, Phase 1 Report

A. Minimize and mitigate impacts of development in coastal areas: protect vulnerable low roads, groundwater and underground infrastructure.

- Elevate low-lying road segments and/or retrofit stormwater management systems to mitigate flooding during storm surge conditions. The following segments were identified in the CAS and being of special concern:
  - Route 6A at Dennis town line and east of the Cape Cod Museum of Natural History near Paine's Creek.
  - Lower Road at Bloomer Path intersection.
  - Breakwater Road various locations.
  - Crosby Lane.
- Work with the Board of Health to evaluate whether the required separation to groundwater is sufficient, and whether changes in regulation are needed to prevent groundwater intrusion into wells and onsite wastewater treatment systems.

B. Develop and initiate projects to increase resilience to projected climate change impacts (e.g., intense rain, storm surge, sea level rise) for critical infrastructure including but not limited to:

- Route 6A from the intersection of Paine's Creek Road west across causeway dividing the marsh.
- Stormwater drainage throughout town.
- Potentially vulnerable utility infrastructure.

C. Conduct a stormwater infrastructure inventory and assessment to prioritize and initiate improvements (e.g., increased catch basin maintenance, culvert replacement) based on projected climate change impacts.

- Action Type: Mitigation, Pre-Disaster
- Priority Score:
- Lead: DPW/Utility Providers
- Supporting: Board of Health/Natural Resources Advisory Committee/Planning Dept.
- Time Frame: Long Term
- Financing Options: MEMA and FEMA Grants/MVP Action Grants
- Cost Estimate: Significant
- Benefit: Protection of Public and Private Property/Improved Public Health, Safety and Welfare/Protection of Infrastructure
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/ Public and Private Property/Municipally-owned Infrastructure

Action #9

…Cape Cod Atlas of Tidally Restricted Salt Marshes/2016 Draft Plan

Complete remediation work necessary on two large marsh systems:

- **Site BR-2: Brewster - Cranberry Bog Berm Restriction of Channel off Quivett Creek (Privately Owned):** Inactive cranberry bogs dot this marsh.

Berms built to support the past cranberry farming are still in place, severing the tidal flow. A six-inch pipe forms the only connection from the bogs to the marsh, allowing in only a fraction of the tidal flow to pass upstream. The scour, bank erosion and vegetation die-off are each evident and are among the worst observed.

- **Site BR-3: Brewster - Cranberry Bog Berm Restriction of Channel off Quivett Creek** (**Privately Owned):** This site also involves another pipe designed to allow water under an old cranberry bog berm. This pipe prevents any waters from naturally flushing the upstream affected area. The upstream effected area is dominated by *Phragmites.*

  - Action Type: Mitigation, Pre-Disaster
  - Priority Score:
  - Lead: Brewster Conservation Commission
  - Supporting: Natural Resources Dept./DPW
  - Time Frame: Medium Term
  - Financing Options: MEMA/FEMA Grants
  - Cost Estimate: Significant
  - Benefit: Protection of Natural Resources/Floodplains
  - Vulnerable Area: Floodplains/Natural Resources

EMERGENCY SERVICES

Action #10
…Town of Brewster Coastal Adaptation Strategy 2016
Maintain access for emergency vehicles and maintenance.

- Emergency response is limited by access of the relevant emergency vehicles, including rescue boats and such access should be maintained at as many landings as possible.

  - Action Type: Mitigation, Pre-Disaster
  - Priority Score:
  - Lead: Fire/Emergency Management
  - Supporting: Natural Resources Advisory Committee
  - Time Frame: Short Term
  - Financing Options: MEMA/FEMA Grants
  - Cost Estimate: Significant
  - Benefit: Improved Emergency Response/Public Health, Safety and Welfare
  - Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Natural Resources

Action #11
…2016 Draft HMP

Conduct a Needs Assessment of privately-owned facilities that have regional importance (medical centers/day care centers).

- Action Type: Mitigation, Pre-Disaster
- Priority Score:
- Lead: Fire/Emergency Management
- Supporting: Town Manager/Select Board
- Time Frame: Medium Term
- Financing Options: Municipal Budget
- Cost Estimate: Municipal Personnel Time
- Benefit: Improved Public Health, Safety and Welfare/Reduced Social Distress
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Social Distress

Action #12
…2016 Draft HMP
Incorporate the inspection and management of hazardous trees/limbs into the Town's routine monitoring process.

- Action Type: Mitigation, Pre-Disaster
- Priority Score:
- Lead: DPW
- Supporting: Police/Fire
- Time Frame: Medium Term
- Financing Options: Municipal Budget, MEMA/FEMA Grants
- Cost Estimate: Municipal Personnel Time
- Benefit: Improved Public Health, Safety and Welfare/Emergency Response
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Public and Private Property

Action #13
…2016 Draft HMP
Mitigate impacts of blowing/drifting snow.

- Action Type: Mitigation, Pre-Disaster
- Priority Score:
- Lead: DPW
- Supporting: Police/Fire
- Time Frame: Medium Term
- Financing Options: Municipal Budget, MEMA/FEMA Grants
- Cost Estimate: Municipal Personnel Time
- Benefit: Improved Public Health, Safety and Welfare/Emergency Response
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Public and Private Property

Action #14
…2016 Draft HMP
Develop a program to train emergency responders and residents in management of domestic animals, horses, sheep, goats, dogs, cats, birds, as well as wild animals, during emergencies such as floods, fires, winds, etc.

- Action Type: Mitigation, Pre-Disaster
- Priority Score:
- Lead: Health Agent/Animal Control
- Supporting: Natural Resources Dept./Conservation Commission
- Time Frame: Medium Term
- Financing Options: Municipal Budget, MEMA/FEMA Grants
- Cost Estimate: Municipal Personnel Time
- Benefit: Improved Public Health, Safety and Welfare/Emergency Response
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare

Action #15
…2016 Draft HMP
Coordination with Nickerson State Park, Towns of Orleans (Baker's Pond, Harwich/Harwich Water Dept. (Punkhorn Parklands), and Dennis/Dennis Water Dept. (Punkhorn Parklands and Ellis Farm) on fuel reduction programs and response.

- Action Type: Mitigation, Pre-Disaster
- Priority Score:
- Lead: Fire
- Supporting: Towns of Orleans/Dennis
- Time Frame: Medium Term
- Financing Options: Municipal Budget
- Cost Estimate: Municipal Personnel Time
- Benefit: Improved Public Health, Safety and Welfare/Reduced Vulnerability to Fire/Reduced Cleanup Costs/Protection of Natural Resources
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Public and Private Property/Fire Management and Response

Action #16
…Brewster Health Department
Strengthen/Enhance the Brewster Health Dept.'s capacity and capabilities

A. ***Conduct a full-scale exercise to test Brewster's Medical Emergency Distribution System (MEDS).***
   Test the Town's MEDS system's ability to rapidly dispense medical countermeasures to the general public at points of distributions and to predefined populations in hospitals and nursing homes within the Town of Brewster.

B. ***Create a public health nurse position within the Health Department.***

Create an in-house public health nurse position for communicable disease investigation, resident immunizations, as a liaison to school populations and families, research changing needs of the community/develop new programs accordingly, develop/implement wellness programs, research and seek grant opportunities, create new cooperative relationships and programs to integrate diverse demographic groups in the community (i.e., Council on Aging and Youth Recreation).

C. ***Create a public health communications coordinator position within the Health Department.***
Create an in-house public health communications coordinator position for the development of appropriate messaging for public health programs, emergency announcements, social media posts, informational literature, promotional programs to highlight the role of the Health Department and Board of Health in the community to garner additional support for programs and positions.

- Action Type: Mitigation, Pre-Disaster
- Priority Score:
- Lead: Brewster Health Department
- Supporting: Emergency Management Agency/Select Board
- Time Frame: Long Term
- Financing Options: Municipal Budget
- Cost Estimate: Significant
- Benefit: Improved Emergency Response/Public Health, Safety and Welfare
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Social Distress

PLANNING AND PREVENTION

Action #17
…Open Space and Recreation Plan 2021
Provide a variety of recreation and open space opportunities to promote healthy and active lifestyles for Brewster residents, ensuring equitable access for all users and abilities.

- Plan for future pandemics that impact access to open space and recreational resources.

- Action Type: Mitigation, Pre-Disaster
- Priority Score:
- Lead: Open Space Committee/Recreation Commission
- Supporting: Community Preservation Committee
- Time Frame: Long Term
- Financing Options: MEMA/FEMA Grants/Community Preservation Act Funds
- Cost Estimate: Moderate

- Benefit: Improved Public Health, Safety and Welfare
- Vulnerable Area: Public Health, Safety and Welfare/Social Distress

Action #18

…Town of Brewster Coastal Resource Management Plan, Phase 1 Report

Minimize and mitigate impacts of development in coastal areas: Work with the Planning Board and other stakeholders to evaluate changes to local zoning and regulations to preserve scale, character, and resource protection.

- Consider establishing a Coastal Resource District of Critical Planning Concern as a planning process for considering multiple overlapping planning objectives and tools.
- Develop and implement a stormwater management bylaw/low impact development zoning bylaw as part of compliance with the MS4 General Permit.
- Evaluate the potential benefits of establishing a Coastal Conservancy zoning district with enhanced protections for coastal resources and building scale.
- Evaluate zoning restrictions governing the size, height and lot coverage of newly constructed or reconstructed residential dwellings in the coastal resource planning area.
- Evaluate the potential benefit of revisions to the Flood Plain Overlay District and Wetlands Conservancy District bylaws to further limit development in velocity zones. Any proposed changes should be based on a thorough assessment of the effectiveness of the current bylaws, and the approaches and experience of other communities with similar circumstances.

- Action Type: Mitigation, Pre-Disaster
- Priority Score:
- Lead: Planning Board
- Supporting: Planning Dept./Natural Resource Dept.
- Time Frame: Medium Term
- Financing Options: Municipal Budget
- Cost Estimate: Municipal Personnel Time
- Benefit: Protection of life/infrastructure, increased awareness of vulnerabilities
- Vulnerable Area: Public Health, Safety and Welfare/Social Distress/Natural Resources

Action #19

…MVP

Identify and initiate projects to provide backup power at the Town Hall, Water Department and drinking water wells to provide critical infrastructure resilience to power outages.

- Action Type: Mitigation, Pre-Disaster
- Priority Score:
- Lead: Fire/Emergency Management/Utility Providers
- Supporting: Water Dept.

- Time Frame: Medium Term
- Financing Options: MEMA/FEMA Grants/MVP Action Grants
- Cost Estimate: Moderate
- Benefit: Improved Emergency Response/Public Health, Safety and Welfare
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Natural Resources

Action #20
…2016 Draft HMP
Develop a map indicating hazard sensitive parcels acquired by Brewster.

- Action Type: Mitigation, Pre-Disaster
- Priority Score:
- Lead: Natural Resources Dept.
- Supporting: GIS/IT Dept.
- Time Frame: Medium Term
- Financing Options: Municipal Budget, MEMA/FEMA Grants
- Cost Estimate: Municipal Personnel Time
- Benefit: Reduced Vulnerability to Hazards/Proactive Planning Approach
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Floodplains/Public and Private Property

Action #21
…2016 Draft HMP
Review of ditch systems and old bogs for preventative maintenance to increase flood capacity.

- Action Type: Mitigation, Pre-Disaster
- Priority Score:
- Lead: DPW
- Supporting: Conservation Commission
- Time Frame: Medium Term
- Financing Options: Municipal Budget, MEMA/FEMA Grants
- Cost Estimate: Municipal Personnel Time
- Benefit: Increased Flood Capacity
- Vulnerable Area: Public and Private Property/Public Health, Safety and Welfare/Natural Resources

Part 2: Prioritize Actions – Quantitative Method
Method C – Simple Score

Criterion:	Cost	Benefit
Social: Is the action compatible with present and future local community needs and values? - Is the proposed action socially acceptable to the community? - Are there equity issues involved that would mean that one segment of a community is treated unfairly? - Will the action cause social disruption?		
Technical: Is the action feasible with available local resources (or as supplement by outside resources as necessary)? - Will the proposed action work? - Will it create more problems than it solves? - Does it solve a problem or a symptom? - Is it the most useful action in light of other community goals?		
Administrative: Does the community have the administrative capacity to implement the action? - Can the community implement the action? - Is there someone to coordinate and lead the effort? - Is there sufficient funding, staff, and technical support available? - Are there ongoing administrative requirements that need to be met?		
Political: Is there strong public support to implement and maintain the action? - Is the action politically acceptable? - Is there public support both to implement and to maintain the project?		
Legal: Does the community have the legal authority to implement the action? - Are there legal side effects (taking)? - Is the action allowed via Comprehensive Plan, or does it need to be amended? - Will the community be liable for the action? - Will the activity be challenged?		
Economic: Is the action cost-effective? - What are the costs and benefit of the action? - Do the benefits exceed the costs? - Are initial, maintenance, and administrative costs taken into account? - Has funding been secured for the proposed action? - What burden will this action place on the tax base of local economy? - Does the action contribute to other community goals?		
Environmental: Does the action impact environmental resources, and is the impact positive, negative, or neutral? - Will the action need environmental regulatory approvals? - Will it meet local and state regulatory requirements?		
Sub-total		
Priority/Total Score		

Ranking Descriptions:
Very Beneficial: 2
Favorable: 1
Not Applicable: 0
Not Favorable: -1

Town of Brewster, MA

Local Hazard Mitigation Committee Meeting #3

Join Zoom Meeting
https://us02web.zoom.us/j/88296659243?pwd=bU9ubnVSZnFlcFNxUHhGOG1YbG5RUT09
Meeting ID: 882 9665 9243
Passcode: 646044
One tap mobile
+1-929-436-2866, *646044# US (New York)

July 16, 2021 1:00 PM - 2:30 PM

Name	Email Address
Peter Lombardi	Town Administrator
Donna Kalinick	Assistant Town Administrator
Griffin Ryder	DPW Superintendent
Paul Anderson	Water Department Superintendent
Chris Miller	Natural Resources Director
Victor Staley	Building Commissioner
Heath Eldredge	Police Chief
Amy Von Hone	Health Director
Pat Hughes	Coastal Committee
Ryan Bennett	Town Planner
Craig Pereira	Project Manager - HWG

Local Hazard Mitigation Workgroup Meeting #4: September 27, 2021

Brewster Hazard Mitigation Plan

Local Hazard Mitigation Workgroup Meeting #4

September 27, 2021 11:00 AM – 12:30 PM

2198 Main Street
Brewster, MA
Meeting Room B

Agenda

1. Mitigation Actions Prioritization
2. Outstanding Data Needs
3. Next Steps

Horsley Witten Group

Memorandum of Meeting

To: Brewster Local Hazard Mitigation Workgroup (LHMW)

From: Craig Pereira

Date: September 27, 2021

Re: Brewster Hazard Mitigation Plan (HMP) Development – Meeting #4

In attendance:

Peter Lombardi – Town Administrator
Donna Kalinick – Assistant Town Administrator
Griffin Ryder – DPW Superintendent
Paul Anderson – Water Department Superintendent
Chris Miller – Natural Resources Director
Davis Walters – Building Commissioner
Heath Eldredge – Police Chief
Amy von Hone – Health Director
Kathy Lambert – IT Director
Robert Moran – Fire Chief
Conor Kenny – Town Planner

Consultant Team
Craig Pereira, Project Manager - Horsley Witten Group, Inc. (HW)

1. Outstanding Data Needs:
    - Residential development trends…

      Craig requested a breakdown of major residential development trends over the past 6 years (2016) to evaluate if the Town is encouraging development outside of the special flood hazard area. Data should include:
        - Major Residential Development:
            - Name
            - Address
            - Number of units/total SF of commercial space (if mixed use)
            - Status: completed…pending approval…under construction
2. Mitigation Actions Prioritization:

   Craig briefly reviewed the Mitigation Actions for Consideration document with the LHMW, including:
   - Categories for actions
   - Where the actions came from (identified in red, bold font)
   - Time Frame description
   - Cost Estimate description

   Craig also reviewed the STAPLEE Prioritization Score Sheet with the workgroup. The Final Mitigation Actions and table of STAPLEE prioritization are attached.

3. Next Steps:
    - Craig will provide the LHMW a summary table of the STAPLEE prioritization and final mitigation actions for review and comment.
        i. All LHMW members to review and provide feedback on the STAPLEE scoring by October 5, 2021.
    - Craig will finish the draft plan (absent any content regarding public comments) to the LHMW for their review and comment prior to the start of the public comment period. LHMW members will have two weeks to review and provide feedback.
    - Select Board does not have to review the draft plan prior to start of the public comment period.
    - Craig will work with Conor Kenny to finalize the public comment period (anticipated for the month of November) and set the date for the final Public Workshop (within the public comment period). It was determined a Public Hearing with the Select Board (public invited to comment) can serve as the final Public Workshop (to be held virtually via Zoom).
        i. Conor to check Select Board's schedule and agenda to select the appropriate date/time.
    - Once the dates of the public comment period have been set:
        i. Craig will provide the draft plan to Conor for posting on the project webpage.
            1. Conor to post the draft plan on the project webpage.
        ii. Conor to send out an interdepartmental email, as well as an email to Brewster Boards and Commissions announcing the availability of the draft and dates of the public comment period (directing folks to the plan on the project webpage). All comments should be directed to Craig Pereira at cpereira@horsleywitten.com. Conor to copy Craig on these emails to be included in the Appendices of the plan (required).
        iii. Craig will send a notice of availability of the draft plan to adjacent communities (Orleans, Harwich and Dennis) and save a copy for the Appendices (required).
    - Once the date/time of the Public Hearing with the Select Board has been determined:
        i. Craig will develop a flyer announcing the meeting and provide to Conor.
            1. Conor to post flyer on the project webpage and distribute throughout Town Hall and other networks.
    - Following the completion of the public comment period and Public Hearing:
        i. Craig to update the draft plan with any required revisions.
        ii. Craig to provide Conor with a draft Resolution that is required to accompany the draft plan to MEMA (unsigned).
            1. Conor to review draft Resolution and request any revisions necessary.
        iii. Conor to send any substantive changes on the draft plan to the Select Board.
        iv. Craig to complete the Plan Review Tool (required) to accompany the draft plan submission to MEMA (Jeff Zukowski).
        v. Craig will submit the plan and Plan Review Tool to MEMA for review and approval (typically a 45-day review period). If no comments returned, plan will get forwarded up to FEMA for review and approval (typically a 45 – 60-day review period). Once FEMA returns the plan 'Approved Pending Adoption', the Town will have one year to formally adopt the plan through

the signed Resolution. Signed Resolution needs to be inserted into final plan PDF and forwarded to MEMA for their records.

Time Frame:

- Short Term = 0 to 6 Months
- Medium Term = 6 to 18 Months
- Long Term = 18 Months to 5 Years

Cost Estimate:

- Staff Time – municipal personnel time
- Minimal – less than $5,000
- Moderate – more than $5,000, but less than $25,000
- Significant – over $25,000

PUBLIC EDUCATION AND AWARENESS

Action #1

…Town of Brewster Vision Plan 2018

Adapt to climate change projections and advance adaptation and resiliency techniques that are financially and environmentally sustainable.

- Identify techniques such as living shorelines, nourishment from dredged material, and land acquisition for retreat locations to adapt to coastal changes.
- Provide outreach and education (signs, field trips, publications) to build awareness of citizens and decision makers about the nature of coastal changes.

  - Action Type: Planning, Pre-Disaster
  - Priority Score: 20
  - Lead: Conservation Commission/Natural Resources Dept.
  - Supporting: Natural Resources Commission
  - Time Frame: Long Term
  - Financing Options: Municipal Budget
  - Cost Estimate: Municipal Personnel Time
  - Benefit: Protection of property, life and infrastructure/Increased awareness of vulnerabilities
  - Vulnerable Area: Municipally-owned Infrastructure/Coastal Wetlands/Private Property

Action #2

…Town of Brewster Coastal Resource Management Plan, Phase 1 Report/Storm Tide Pathways Study

Implement Brewster Coastal Resource Management Plan, Phase 1 Report/Storm Tide Pathways Study:

A. Increase public awareness of the importance of healthy coastal wetlands and natural coastal processes, and the need to protect these resource. Education materials should be aimed at shoreline property owners, among others, to discuss the importance of natural sediment transport processes, and best practices for vegetation management, erosion management, and buffer protection, etc. This effort should be coordinated with the development of permitting guidance.

B. ***Use best available tools to understand the potential impact of storm surge on public and private property, sensitive infrastructure and natural resources, and to develop strategies and plans to avoid, minimize or mitigate adverse impacts, including tools made available through the Cape Cod Commission's Resilient Cape Cod project, MVP program, and the storm tides pathways assessment project being undertaken by the Barnstable County Extension Service and Center for Coastal Studies.***

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 26
- Lead: Natural Resources Dept.
- Supporting: Natural Resources Advisory Group
- Time Frame: Medium Term
- Financing Options: Municipal Budget
- Cost Estimate: Municipal Personnel Time
- Benefit: Protection of property, life, infrastructure and natural resources/Increased awareness of vulnerabilities
- Vulnerable Area: Repetitive Loss Properties/Floodplains/Municipally-owned Infrastructure/Emergency Response and Public Health/Private Property

Action #3
…MVP/2016 Draft Plan/HW
Increased the public's awareness of hazard vulnerabilities:

A. ***Develop a Preparedness Campaign for the general public (i.e., residents and seasonal guests) and the private sector that includes guidance and checklists, as well as recommendations to increase community resilience to the impacts of climate change (e.g., extreme weather, health impacts).***

B. ***Annually host a public hazards display for the residents of Brewster in combination with the 'Brewster in Bloom' festival or another appropriate community event. Ensure that such a display will also be hosted during the summer months, when part-time residents are in Town.***

C. ***Distribute Tourist Evacuation and Shelter Information***
Out of state tourists may not be familiar with local authorities, evacuation routes, locations of designated shelters, or know what to expect if police-enforced evacuation becomes necessary. Distribute information on town evacuation routes and emergency shelters to hotels, Bed and Breakfasts, real estate agencies dealing with seasonal rentals, and other facilities and events hosting tourists.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 26
- Lead: Fire Dept./Emergency Management/Police Dept.
- Supporting: Planning Dept.

- Time Frame: Short Term
- Financing Options: Municipal Budget
- Cost Estimate: Municipal Personnel Time/MVP Action Grants
- Benefit: Protection of property, life and infrastructure/Increased awareness of vulnerabilities/Accelerated evacuation
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Public and Private Property/Social Distress

NATURAL RESOURCE PROTECTION

Action #4
…Open Space and Recreation Plan 2021
Implement Brewster Open Space and Recreation Plan:

A. ***Protect the Town's drinking water supply to meet the needs of residents and visitors today and in the future.***
   Protect existing public supply wells from land-based sources of contamination.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 26
- Lead: Water Dept./Community Preservation Committee
- Supporting: Natural Resources Dept./Recreation Dept./Open Space Committee
- Time Frame: Long Term
- Financing Options: Municipal Budget/FEMA and MEMA Grants/Community Preservation Act Fund
- Cost Estimate: Significant
- Benefit: Protection of drinking water supply/Protection of natural resources
- Vulnerable Area: Municipally-owned Infrastructure/Natural Resources

Action #5
…Integrated Water Resources Management Plan 2013
Update Zoning Bylaws and Subdivision Rules/Regulations to protect public supply wells.

- Strengthen the Water Conservation Bylaw (Chapter 112, Article 1 of the Brewster Town Code).
- Strengthen the Zoning Bylaw provision for drinking water quality protection by mandating the Natural Resource Protection Design (NRPD) in its District of Critical Planning Concern (DCPC), rather than 'encouraging it'.
- Implement a Stormwater Management Bylaw.
- Encourage Low Impact Development (LID).

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 26
- Lead: Planning Board
- Supporting: Planning Dept./Water Dept.

- Time Frame: Medium Term
- Financing Options: Municipal Budget
- Cost Estimate: Municipal Personnel Time
- Benefit: Protection of life/infrastructure, increased awareness of vulnerabilities
- Vulnerable Area: Public Health, Safety and Welfare/Social Distress/Natural Resources

Action #6

…Town of Brewster Coastal Adaptation Strategy 2016

Implement Brewster Coastal Adaptation Strategy

A. Identify and acquire new access points to the shoreline.

- The Town should evaluate possible new access points to the shoreline through collaboration with existing property owners, including state and town-owned land and private properties. The Town should also evaluate how existing satellite parking facilities could be used or expanded, or if new satellite parking areas and pathways to the shore could be created without impacting sensitive resources.
- Identify and plan for the acquisition of parcels that may provide for future access. The proximity of the parcels to sensitive wetland areas and the potential impacts from climate change should be included in the planning process to select sites that will create viable access over the long term.

B. Periodically evaluate the beach management process to evaluate how well it is working and to incorporate lessons learned over time.

- Ongoing beach management promotes safe access to the shore through repairs to the town landings after storm events. Therefore, the Town should continue its ongoing work to restore areas at the town landings impacted by storm events. This can include beach nourishment and dune restoration to replace sand lost during a storm: the planting of beach grass and the use of dune fencing to stabilize dunes; and the repair or replacement of pathways, stairs, or ramps used to access the beach.

C. Promoting wetland retreat as sea level rises helps to preserve the valuable habitat and storm damage prevention function of coastal wetlands. The Town should identify opportunities to promote and support wetland retreat to preserve coastal wetlands, including salt marshes to the extent feasible. Strategies to consider include:

- Mapping of low-lying areas where wetland retreat is possible.
- Land acquisition and preservation in areas directly adjacent to existing wetlands to allow for wetland retreat as sea level rises.
- Incorporation of wetland retreat assessments into plans for the development or redevelopment of properties adjacent to existing wetlands.
- Development of regulatory guidelines to require that wetland retreat adaptation be incorporated into future development plans.
- Removal of restrictions to tidal flow into upstream marshes to promote the inland migration of coastal wetlands.

- Removal of pavement and fill in wetland areas, and/or design and implementation of improved stormwater management where feasible to reduce impacts to existing wetlands.

D. Continuing research and analysis is needed to manage access to Brewster's shoreline into the future which may include additional monitoring. Further analysis and monitoring of the migration of sediment along the coast is needed to understand how the offshore flats will respond to a rising sea level and whether or not they will remain above water at low tide.

The scientific understanding of wetland retreat and salt marsh migration under increasing sea levels will mature over time and any new information should be incorporated into the Town's plans for managing wetland retreat. Future data on the rate of sea level rise can also be used to manage and prioritize future adaptation projects. The Town should also consider the potential contributions to climate change of adaptation options when evaluating different approaches.

The Management Plan could evaluate the implementation of a coastal overlay district to control future development in areas impacted by climate change and manage the rebuilding of existing development in these areas.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 22
- Lead: Natural Resources Dept./Natural Resources Advisory Committee
- Supporting: Brewster Open Space Committee/Community Preservation Committee
- Time Frame: Long Term
- Financing Options: MEMA/FEMA grants/Community Preservation Act Funds
- Cost Estimate: Significant
- Benefit: Protection of cultural and natural resources
- Vulnerable Area: Public and Private Property/Cultural Resources/Natural Resources/Emergency Response/Public Health, Safety and Welfare/Municipally-owned Infrastructure/Floodplains

Action #7

…Town of Brewster Coastal Resource Management Plan, Phase 1 Report

Implement Brewster Coastal Resource Management Plan, Phase 1 Report

A. Periodically assess coastal resources conditions for comparison with baseline conditions. Monitor and assess physical processes to support short-term management decisions and long-term planning.

- Every five years (next in 2021) update projections of sea level rise and storm surge and the modeled impacts of these forces on public beaches and landings, infrastructure and coastal resources.
- Update tidal benchmarks; track and record highest annual high tide as proxy for effects of sea level rise.

- Evaluate the potential benefit, cost and candidate locations for installing one or more tide gauge (s) and a wave buoy to provide localized data on trends in tidal dynamics.
- Evaluate the potential benefit, cost and candidate location for installing a wave height buoy.
- Evaluate the potential usefulness of establishing a volunteer-based program to monitor changes in beach profiles.

B. Periodically assess coastal resources on a regional scale.

- The 2015 Century Scale Sediment Budget should be updated in tandem with the sea level rise (next in 2021) to assess trends in sediment movement within the littoral cell that encompasses Brewster's shoreline. This effort should be evaluated and potentially undertaken in cooperation with Dennis, Orleans and Eastham. The assessment should include recommendations for monitoring protocols and potential management actions necessary to increase resiliency of Brewster's shoreline and ensure that tidal flats keep pace with sea level rise.
- Participate with the Barnstable County Extension and Center for Coastal Studies in developing a Storm Tide Pathway for Brewster. The Storm Tide Pathways project will encompass the entire Cape Cod Bay shoreline and may provide a basis for additional coordinated efforts among towns sharing the same littoral cell.
- Consider development of a regional framework for coastal resilience.
    - Develop a management plan for the Inner Cape Cod Bay Area of Critical Environmental Concern (ACEC), in concert with the other towns sharing the ACEC. Such a plan could encompass studies of sea level rise and sediment budget, regional sediment management, and other ACEC resource issues.
    - Consider establishing a regional coastal resilience planning group among towns in the same littoral cell (Dennis , Orleans, Eastham) to identify/study issues of shared concern cost effectively. Regional coordination could increase funding opportunities. This could be in concert with the existing Barnstable County Coastal Resources Committee, or the Cape Cod Commission's Resilient Cape Cod, Cape Cod Bay Work Group.

C. Adopt long-term coastal management resiliency strategies.

- Evaluate resilient shoreline management practices (those that mimic natural coastal processes) and identify where on Brewster's shoreline they might be applied.
    - Preserve coastal landforms and vegetation that provide buffers to erosion caused by storm surge. Salt marsh and fronting coastal dunes have been shown to be effective in mitigation erosion along Brewster's Cape Cod Bay shoreline.
    - Beach and dune nourishment practices for public and private beaches: Mant's, Paine's Point of Rocks.
    - Dune protection (vegetation, fencing) and reconstruction: Mant's, Breakwater Beach, Point of Rocks.

    - Create a living shoreline demonstration project: oyster reef at Mant's Landing.
    - Managed retreat similar to the relocation of the Paine's Creek parking lot: locations to be determined.
- Evaluate changes to the existing groin field, including potential removal/attrition of groins or other structures on the shoreline that impede coastal processes or hasten erosion. Evaluate whether existing groins could impede sediment transport necessary to sustain the tidal flats under different sea level rise scenarios.
- Enhance stormwater management to minimize or eliminate erosion caused by overland run-off.
    - Implement the stormwater management improvements identified in Brewster's Integrated Water Resource Management Plan and the work being undertaken on MS4 General Permit compliance.
    - Prioritize stormwater improvements in any locations where infrastructure could reduce or eliminate erosion caused by run-off.
    - Provide funding for ongoing maintenance of existing or proposed improvements, possibly through the creation of a stormwater utility.
    - Design and adopt a stormwater management bylaw to enhance stormwater management on public and private property; and ensure that issues related to coastal erosion, use of green infrastructure and use of best management practices are incorporated.
- Evaluate policy and regulatory changes to promote coastal resiliency.
    - Evaluate the potential for implementing a flood plain bylaw to, among other things, "restrict or prohibit development and uses on Land Subject to Coastal Storm Flowage (i.e., 100-year coastal floodplain) and its buffer zones in order to minimize potential loss of life, destruction of property, and environmental damage inevitably resulting from inappropriate development on land known to be subject to storms, flooding, erosion, relative sea rise and other coastal zone hazards," (Cape Cod Commission model bylaw). The Cape Cod Commission model bylaw and efforts implemented in other towns should be evaluated to determine policies applicable to Brewster.
    - Develop permitting guidance for erosion control activities on private properties, and work with the Conservation Commission to apply the guidance in the review of Notices of Intent and issuance of Orders of Condition.
- Ensure consistency with other planning efforts.

D. Promote management and maintenance of public access points to increase resilience.

- Create a coastal resiliency toolkit consisting of best practices for sustainable design, management and maintenance of town-owned landings and beaches. The toolkit should make use of the work being undertaken through the Cape Cod Commission's Resilient Cape Cod project, and other proven techniques, including:
    - Managed retreat of parking areas and structures.

    - Use of articulated mats to provide stability under ramps and parking areas.
    - Use of beach grass planting, beach nourishment, and dune nourishment/rebuilding/stabilization, among other initiatives.
- Develop a sustainable funding source, possibly through an environmental bond bill offset by short term rental tax revenues, potential increase in deeds tax revenues, town beach sticker revenues or other sources for resilient maintenance and management actions that balance needs for access, public safety, natural resource sustainability, and coastal resiliency; and that meet local and state permitting requirements. These measures include: repair stairs/ramps/walkways (including measures needed for improved handicapped accessibility). A proactive, resilient maintenance program may lower long-term costs by reducing the potential need for emergency repairs.
- Conduct technical alternatives assessments for resilient capital projects needed to address erosion pressure and preserve access at highly threatened town-owned access points. Mant's Landing and Paine's Creek are currently experiencing significant erosion and should be prioritized for evaluation and possible resilient capital projects.

E. Preserve natural sediment transport processes in balance with erosion. Evaluate policy and regulatory changes to protect wetland resources.

- Work with the Conservation Commission to evaluate the Town's wetlands protection bylaw and regulations to determine if any changes would provide enhanced protection of coastal wetlands and natural coastal processes. Areas of exploration could include, but not limited to:
    - Potential to incorporate the sediment budget into the local wetlands bylaw and regulations to regulate protection of upland development differently in eroding areas.
    - For all new or renewed Orders of Condition for erosion management, require analysis of cumulative system-wide impacts, and require adherence to best practices for shoreline erosion management structures.
    - Adopt permitting guidelines based on Woods Hole Oceanographic Institution Sea Grant publication *Spectrum of Erosion Control Methods*. The recent publication of *Guidelines for Erosion Management in Pleasant Bay* provides a guide.
    - Require maintenance and nourishment of erosion management structures.
    - Incorporate monitoring requirements for erosion control measures to provide information to evaluate their functions and impacts.
- Review the Town's policy for allowing access through town landings to perform shoreline stabilization work on private property. Ensure that applicants carry adequate insurance coverage in case of damage to resources caused by heavy equipment or fuel spills.
- Work with the Planning Board to revise, update or extend the Flood Plain Overlay District and Wetlands Conservancy bylaws, based on an evaluation of the bylaw's effectiveness in meeting its original purpose, and based on a survey of similar measures employed in other communities as recommended by the Cape Cod Commission.

F. Maintain the elevation of salt marshes and tidal flats by promoting opportunities for salt marsh migration.

- Use the state-of-the-art wetland modeling to assess patterns of salt marsh retreat in Brewster. Model results could then be used to develop salt marsh management plans to counteract loss of marsh due to subsidence or inundation. Management actions could include:
  - Channel improvements to restore or enhance hydrology.
  - Evaluate the potential for a pilot project for thin layer deposition of material on any subsided areas of salt marsh plane, in coordination with MassDEP permitting guidance.
  - Work with the Town's Open Space Committee, Community Preservation Committee and the Brewster Conservation Trust to identify key parcels for acquisition/conservation restriction and to develop a funding strategy for acquisition/protection of these properties; and develop a framework for tracking and pursuing parcel opportunities.
  - Identify and remove any remaining undersized culverts that may restrict tidal flow and causing degradation of coastal wetlands. An example is the Crosby salt marsh restoration project.
- Develop/update and implement resource management plans to protect large areas of salt marsh. Land Use and Management Plans for Quivett Creek/Paine's Creek Marsh and Namskaket Marsh should be developed in coordination with Brewster Conservation Trust, MA DCR, and adjacent towns.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 22
- Lead: Natural Resources Advisory Committee
- Supporting: Natural Resource Dept./Towns of Dennis, Orleans and Eastham
- Time Frame: Long Term
- Financing Options: Municipal Budget/MEMA and FEMA Grants
- Cost Estimate: Significant
- Benefit: Protection of Natural Resources, floodplains and infrastructure/Public and Private Property
- Vulnerable Area: Repetitive Loss Properties/Floodplains/Public and Private Property/Cultural Resources/Natural Resources/Municipally-owned Infrastructure

STRUCTURAL PROJECTS

Action #8

…Town of Brewster Coastal Resource Management Plan, Phase 1 Report/MVP

Implement Brewster Coastal Resource Management Plan, Phase 1 Report

A. Minimize and mitigate impacts of development in coastal areas: protect vulnerable low roads, groundwater and underground infrastructure.

- Elevate low-lying road segments and/or retrofit stormwater management systems to mitigate flooding during storm surge conditions. The following segments were identified in the CAS and being of special concern:
  - Route 6A at Dennis town line and east of the Cape Cod Museum of Natural History near Paine's Creek.
  - Lower Road at Bloomer Path intersection.
  - Breakwater Road various locations.
  - Crosby Lane.
- Work with the Board of Health to evaluate whether the required separation to groundwater is sufficient, and whether changes in regulation are needed to prevent groundwater intrusion into wells and onsite wastewater treatment systems.

B. Develop and initiate projects to increase resilience to projected climate change impacts (e.g., intense rain, storm surge, sea level rise) for critical infrastructure including but not limited to:

- Route 6A from the intersection of Paine's Creek Road west across causeway dividing the marsh.
- Stormwater drainage throughout town.
- Potentially vulnerable utility infrastructure.

C. Conduct a stormwater infrastructure inventory and assessment to prioritize and initiate improvements (e.g., increased catch basin maintenance, culvert replacement) based on projected climate change impacts.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 25
- Lead: DPW/Utility Providers
- Supporting: Board of Health/Natural Resources Advisory Committee/Planning Dept.
- Time Frame: Long Term
- Financing Options: MEMA and FEMA Grants/MVP Action Grants
- Cost Estimate: Significant
- Benefit: Protection of Public and Private Property/Improved Public Health, Safety and Welfare/Protection of Infrastructure
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/ Public and Private Property/Municipally-owned Infrastructure

Action #9

…Cape Cod Atlas of Tidally Restricted Salt Marshes/2016 Draft Plan

Complete remediation work necessary on two large marsh systems:

- **Site BR-2: Brewster - Cranberry Bog Berm Restriction of Channel off Quivett Creek (Privately Owned):** Inactive cranberry bogs dot this marsh. Berms built to support the past cranberry farming are still in place, severing the tidal flow. A six-inch pipe forms the only connection from the bogs to the marsh,

allowing in only a fraction of the tidal flow to pass upstream. The scour, bank erosion and vegetation die-off are each evident and are among the worst observed.

- **Site BR-3: Brewster - Cranberry Bog Berm Restriction of Channel off Quivett Creek** (**Privately Owned):** This site also involves another pipe designed to allow water under an old cranberry bog berm. This pipe prevents any waters from naturally flushing the upstream affected area. The upstream effected area is dominated by *Phragmites.*

  - Action Type: Mitigation, Pre-Disaster
  - Priority Score: 18
  - Lead: Brewster Conservation Commission
  - Supporting: Natural Resources Dept./DPW
  - Time Frame: Medium Term
  - Financing Options: MEMA/FEMA Grants
  - Cost Estimate: Significant
  - Benefit: Protection of Natural Resources/Floodplains
  - Vulnerable Area: Floodplains/Natural Resources

EMERGENCY SERVICES

Action #10
…Town of Brewster Coastal Adaptation Strategy 2016
Maintain access for emergency vehicles and maintenance.

- Emergency response is limited by access of the relevant emergency vehicles, including rescue boats and such access should be maintained at as many landings as possible.

  - Action Type: Mitigation, Pre-Disaster
  - Priority Score: 22
  - Lead: Fire/Emergency Management
  - Supporting: Natural Resources Advisory Committee
  - Time Frame: Short Term
  - Financing Options: MEMA/FEMA Grants
  - Cost Estimate: Significant
  - Benefit: Improved Emergency Response/Public Health, Safety and Welfare
  - Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Natural Resources

Action #11
…2016 Draft HMP
Conduct a Needs Assessment of privately-owned facilities that have regional importance (medical centers/day care centers).

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 21
- Lead: Fire/Emergency Management
- Supporting: Town Manager/Select Board
- Time Frame: Medium Term
- Financing Options: Municipal Budget
- Cost Estimate: Municipal Personnel Time
- Benefit: Improved Public Health, Safety and Welfare/Reduced Social Distress
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Social Distress

Action #12
…2016 Draft HMP
Incorporate the inspection and management of hazardous trees/limbs into the Town's routine monitoring process.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 23
- Lead: DPW
- Supporting: Police/Fire
- Time Frame: Medium Term
- Financing Options: Municipal Budget, MEMA/FEMA Grants
- Cost Estimate: Municipal Personnel Time
- Benefit: Improved Public Health, Safety and Welfare/Emergency Response
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Public and Private Property

Action #13
…2016 Draft HMP
Mitigate impacts of blowing/drifting snow.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 22
- Lead: DPW
- Supporting: Police/Fire
- Time Frame: Medium Term
- Financing Options: Municipal Budget, MEMA/FEMA Grants
- Cost Estimate: Municipal Personnel Time
- Benefit: Improved Public Health, Safety and Welfare/Emergency Response
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Public and Private Property

Action #14
…2016 Draft HMP

Develop a program to train emergency responders and residents in management of domestic animals, horses, sheep, goats, dogs, cats, birds, as well as wild animals, during emergencies such as floods, fires, winds, etc.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 17
- Lead: Health Agent/Animal Control
- Supporting: Natural Resources Dept./Conservation Commission
- Time Frame: Medium Term
- Financing Options: Municipal Budget, MEMA/FEMA Grants
- Cost Estimate: Municipal Personnel Time
- Benefit: Improved Public Health, Safety and Welfare/Emergency Response
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare

Action #15
…2016 Draft HMP
Coordination with Nickerson State Park, Towns of Orleans (Baker's Pond, Harwich/Harwich Water Dept. (Punkhorn Parklands), and Dennis/Dennis Water Dept. (Punkhorn Parklands and Ellis Farm) on fuel reduction programs and response.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 21
- Lead: Fire
- Supporting: Towns of Orleans/Dennis
- Time Frame: Medium Term
- Financing Options: Municipal Budget
- Cost Estimate: Municipal Personnel Time
- Benefit: Improved Public Health, Safety and Welfare/Reduced Vulnerability to Fire/Reduced Cleanup Costs/Protection of Natural Resources
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Public and Private Property/Fire Management and Response

Action #16
…Brewster Health Department
Strengthen/Enhance the Brewster Health Dept.'s capacity and capabilities

A. ***Conduct a full-scale exercise to test Brewster's Medical Emergency Distribution System (MEDS).***
   Test the Town's MEDS system's ability to rapidly dispense medical countermeasures to the general public at points of distributions and to predefined populations in hospitals and nursing homes within the Town of Brewster.

B. ***Create a public health nurse position within the Health Department.***
   Create an in-house public health nurse position for communicable disease investigation, resident immunizations, as a liaison to school populations and

families, research changing needs of the community/develop new programs accordingly, develop/implement wellness programs, research and seek grant opportunities, create new cooperative relationships and programs to integrate diverse demographic groups in the community (i.e., Council on Aging and Youth Recreation).

C. ***Create a public health communications coordinator position within the Health Department.***
Create an in-house public health communications coordinator position for the development of appropriate messaging for public health programs, emergency announcements, social media posts, informational literature, promotional programs to highlight the role of the Health Department and Board of Health in the community to garner additional support for programs and positions.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 18
- Lead: Brewster Health Department
- Supporting: Emergency Management Agency/Select Board
- Time Frame: Long Term
- Financing Options: Municipal Budget
- Cost Estimate: Significant
- Benefit: Improved Emergency Response/Public Health, Safety and Welfare
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Social Distress

PLANNING AND PREVENTION

Action #17
…Open Space and Recreation Plan 2021
Provide a variety of recreation and open space opportunities to promote healthy and active lifestyles for Brewster residents, ensuring equitable access for all users and abilities.

- Plan for future pandemics that impact access to open space and recreational resources.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 21
- Lead: Open Space Committee/Recreation Commission
- Supporting: Community Preservation Committee
- Time Frame: Long Term
- Financing Options: MEMA/FEMA Grants/Community Preservation Act Funds
- Cost Estimate: Moderate
- Benefit: Improved Public Health, Safety and Welfare
- Vulnerable Area: Public Health, Safety and Welfare/Social Distress

Action #18

…Town of Brewster Coastal Resource Management Plan, Phase 1 Report

Minimize and mitigate impacts of development in coastal areas: Work with the Planning Board and other stakeholders to evaluate changes to local zoning and regulations to preserve scale, character, and resource protection (adopt Coastal Resilience Bylaw).

- Consider establishing a Coastal Resource District of Critical Planning Concern as a planning process for considering multiple overlapping planning objectives and tools.
- Develop and implement a stormwater management bylaw/low impact development zoning bylaw as part of compliance with the MS4 General Permit.
- Evaluate the potential benefits of establishing a Coastal Conservancy zoning district with enhanced protections for coastal resources and building scale.
- Evaluate zoning restrictions governing the size, height and lot coverage of newly constructed or reconstructed residential dwellings in the coastal resource planning area.
- Evaluate the potential benefit of revisions to the Flood Plain Overlay District and Wetlands Conservancy District bylaws to further limit development in velocity zones. Any proposed changes should be based on a thorough assessment of the effectiveness of the current bylaws, and the approaches and experience of other communities with similar circumstances.

  - Action Type: Mitigation, Pre-Disaster
  - Priority Score: 21
  - Lead: Planning Board
  - Supporting: Planning Dept./Natural Resource Dept.
  - Time Frame: Medium Term
  - Financing Options: Municipal Budget, MEMA/FEMA Grants
  - Cost Estimate: Moderate
  - Benefit: Protection of life/infrastructure, increased awareness of vulnerabilities
  - Vulnerable Area: Public Health, Safety and Welfare/Social Distress/Natural Resources

Action #19……..Delete, already happened/happening

…MVP

Identify and initiate projects to provide backup power at the Town Hall, Water Department and drinking water wells to provide critical infrastructure resilience to power outages.

  - Action Type: Mitigation, Pre-Disaster
  - Priority Score:
  - Lead: Fire/Emergency Management/Utility Providers
  - Supporting: Water Dept.
  - Time Frame: Medium Term

- Financing Options: MEMA/FEMA Grants/MVP Action Grants
- Cost Estimate: Moderate
- Benefit: Improved Emergency Response/Public Health, Safety and Welfare
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Natural Resources

Action #20
…2016 Draft HMP
Develop a map indicating hazard sensitive parcels acquired by Brewster…delete, already happening

- Action Type: Mitigation, Pre-Disaster
- Priority Score:
- Lead: Natural Resources Dept.
- Supporting: GIS/IT Dept.
- Time Frame: Medium Term
- Financing Options: Municipal Budget, MEMA/FEMA Grants
- Cost Estimate: Municipal Personnel Time
- Benefit: Reduced Vulnerability to Hazards/Proactive Planning Approach
- Vulnerable Area: Emergency Response/Public Health, Safety and Welfare/Floodplains/Public and Private Property

Action #21
…2016 Draft HMP
Review of ditch systems and old bogs for preventative maintenance to increase flood capacity.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 16
- Lead: DPW
- Supporting: Conservation Commission
- Time Frame: Medium Term
- Financing Options: Municipal Budget, MEMA/FEMA Grants
- Cost Estimate: Municipal Personnel Time
- Benefit: Increased Flood Capacity
- Vulnerable Area: Public and Private Property/Public Health, Safety and Welfare/Natural Resources

Town of Brewster, MA

Local Hazard Mitigation Committee Meeting #4

Town of Brewster Offices
2198 Main Street
Meeting Room B

September 27, 2021 11:30 AM - 12:30 PM

Name	Email Address
Chris Miller	
Paul Anderson	
Heath Eldredge	
Griffin Ryder	
Davis Walters	
Conor Kenny	
Amy von Hone	
Kathy Lambert	
Robert Moran	
Peter Lombardi	
Craig Pereira	
Donna Kalinick	

Public Workshop #2: November 30, 2021

Town of Brewster
Multi-Hazard Mitigation Plan

Virtual Public Workshop

Tuesday, November 30, 2021
6:00 PM—8:00 PM

Please click the link below to join the webinar:
https://us02web.zoom.us/j/81177153357?pwd=YTFBQnBNRHJTWWFGV3c3WmNuT1BMUT09
Passcode: 086700

US: +1 301 715 8592 or +1 312 626 6799
Webinar ID: 811 7715 3357
Passcode: 086700

Come hear about the process to date and the mitigation actions developed as part of the plan.

About the Multi-Hazard Mitigation Plan

The Town of Brewster has developed a draft Multi-Hazard Mitigation Plan. This plan is important because it helps the Town plan and receive funding for projects that reduce the risk of injury or damage to property from future natural, communicable, human-caused or technological hazard events such as flooding, hurricanes or cyber security. This Multi-Hazard Mitigation Plan builds on previous work already completed by the Town including the Brewster Coastal Adaptation Strategy (September 2016), Town of Brewster Vision Plan (2018), the Town of Brewster Coastal Resource Management Plan (2019), and the Municipal Vulnerability Preparedness Plan (2019).

For more information please visit:
https://www.brewster-ma.gov/departments-mainmenu-26/planning-department-mainmenu-104/2908-brewster-hazard-mitigation-plan

Contact

Craig Pereira—Project Manager
Horsley Witten Group, Inc.
55 Dorrance St. Suite 200
Providence, RI 02903
cpereira@horsleywitten.com
Phone: (401) 272-1717

Town of Brewster, MA
Multi-Hazard Mitigation Plan
Public Workshop #2

Craig Pereira, CFM
Project Manager – Horsley Witten Group

November 30, 2021 6:00 PM – 8:00 PM
Virtual

1

Virtual Platform

zoom

2

A Request of Participants

- **In the Chat area to Conor Kenny:**
  - Your Full Name
  - Are you a resident, business owner, municipal employee?

3

Welcome…

WELCOME!

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Town of Brewster, MA
Local Hazard Mitigation Committee

- Paul Anderson, Water Department Superintendent
- Conor Kenny, Project Manager (Ryan Bennett, former Town Planner)
- Heath Eldredge, Police Chief
- Griffin Ryder, DPW Superintendent
- Pat Hughes, Coastal Committee
- Don Labonte, Resident/CERT
- Peter Lombardi, Town Administrator
- Donna Kalinick, Assistant Town Administrator
- Chris Miller, Natural Resources Director
- Robert Moran, Fire Chief
- Davis Walters, Building Commissioner
- Amy von Hone, Health Department Director

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Why Hazard Mitigation Planning?

Disaster Mitigation Act of 2000, Interim Final Rule, 44 CFR Parts 201 and 206 states, "All communities must have an approved Multiple Hazards Mitigation Plan in order to qualify for future federal disaster mitigation grants".

Reduction or elimination of long-term risk to life, property, and the environment.

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Mission Statement

The purpose of the Brewster Multi-Hazard Mitigation Plan is to reduce future damages to life, property, infrastructure, and natural, cultural, and economic resources from natural, human-caused and technological hazards and to decrease the number of hazard areas and impediments to rescue/evacuation and clean-up that currently exist in the Town.

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Mitigation Process

- Assess Risks
- Establish Goals
- Identify Projects/Actions
- Update/Maintain Plan

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Assess Risks… Natural Hazards

Flood-related hazards
- Riverine/Flash Flooding
- Inland/Urban Flooding/Heavy Rain
- Dam Failure
- Coastal Flooding
- Sea Level Rise
- Storm Surge
- Coastal Erosion/Shoreline Change

Winter-related hazards
- Blizzards/Heavy Snow
- Nor' easters
- Extreme Cold

Geologic-related hazards
- Earthquakes
- Landslides

Climate Change…As one of the most pressing issues with both direct and indirect impacts on the range of natural hazards the town is vulnerable to, it has been included as a 'climate change impacts on' section to each natural hazard profiled.

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Assess Risks… Natural Hazards

Wind-related hazards
- Hurricanes
- Tornadoes
- High Winds
- Lightning/Thunderstorms
- Hail
- Tropical Storms

Urban/Wildfire-related hazards
- Urban Fire/Wildfire

Drought-related hazards
- Drought
- Extreme Heat

Invasive Species-related hazards
- Invasive Species

Communicable-related hazards
- Infectious Disease

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Risk Assessment Hazard Index Natural Hazards

Natural Hazard	Frequency (i.e. Very Low, Low, Medium, High)	Location (i.e. small/local, medium/regional, large/multiple communities)	Severity (i.e. minor, serious, extensive, catastrophic)	Hazard Index (i.e. ranked by combining frequency and severity; 10 - high, 1 - low)
Flood-Related Hazards				
- Riverine/Flash Flooding	High	Medium/Regional	Serious	6
- Inland/Urban Flooding/Heavy Rain	High	Medium/Regional	Serious	6
- Climate Change	Medium	Large/Multiple	Serious	6
- Dam Failures	N/A	N/A	N/A	5
- Coastal Flooding	High	Medium/Regional	Extensive	7
- Sea Level Rise	High	Large/Multiple	Serious	6
- Storm Surge	High	Medium/Regional	Serious	6
- Coastal Erosion/Shoreline Change	High	Medium/Regional	Extensive	7
Winter-Related Hazards				
- Blizzards/Snow/Nor' easter	High	Large/Multiple	Serious	6
- Extreme Cold	Low	Small/Local	Minor	2
Wind-Related Hazards				
- Hurricanes	High	Large/Multiple	Extensive	8
- Tornadoes[2]/High Winds	High	Medium/Regional	Extensive	7
- Lightning/Thunderstorms	High	Small/Local	Serious	6
- Hail	High	Small/Local	Serious	6
- Tropical Storm	High	Large/Multiple	Serious	7
Geologic Related Hazards				
- Earthquakes	Very Low	Small/Local	Serious	3
- Landslides	Very Low	Small/Local	Minor	2
Drought				
- Drought	High	Medium/Regional	Minor	5
- Extreme Heat	High	Small/Local	Minor	5
Urban Fire/Wildfire				
- Urban Fire/Wildfire[3]	N/A	N/A	N/A	7
Invasive Species				
- Multiple	Low	Small/Local	Minor	3

1: Hazard Index ranking taken from Massachusetts Hazard Index and Risk Assessment (Feb. 2018).
2: Tornadoes not a major issue for Brewster.
3: Hazard Index ranking taken from Barnstable County Wildfire Preparedness Plan.

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Assess Risks… Human-Caused/Technological Hazards

Human-Caused Hazards
- Cyber Incident
- Terrorism
- Civil Unrest
- Chemical/Biological/Radiological/Nuclear

Technological Hazards
- Infrastructure Failure
- Hazardous Materials Accident/Spill
- Major Aircraft Crash
- Catastrophic Dam Failure

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Risk Assessment Hazard Index
Human-caused and Technological Hazards

Hazard	Likelihood	Range	Consequence Analysis					Hazard Index
			Population	Government	Built Environment	Natural Resources/ Environment	Economy	
Natural Hazards								
Infectious Disease[1]	Highly Likely	Medium	Significant	Significant	Negligible	Negligible	Significant	High
Human-Caused Hazards[2]								
Cyber Incident	Likely	Medium	Negligible	Limited	Significant	Limited	Limited	High
Terrorism	Likely	Medium	Significant	Negligible	Negligible	Limited	Negligible	Moderate
Civil Unrest	Potential	Small	Negligible	Negligible	Limited	Negligible	Limited	Low
Chemical, Biological, Radiological, Nuclear	Unlikely	Small	Significant	Limited	Limited	Limited	Limited	Moderate
Technological Hazards[2]								
Infrastructure Failure	Potential	Small	Limited	Negligible	Limited	Negligible	Limited	Moderate
Hazardous Materials Accident/Spill	Likely	Small	Significant	Negligible	Negligible	Limited	Negligible	Moderate
Major Aircraft Crash	Unlikely	Small	Significant	Negligible	Negligible	Negligible	Negligible	Low
Catastrophic Dam Failure	Unlikely	Small	Negligible	Negligible	Negligible	Limited	Negligible	Moderate

1: Hazard index ranking determined by LHMW.
2: Hazard ranking taken from Massachusetts Hazard Index and Risk Assessment (Feb. 2019).

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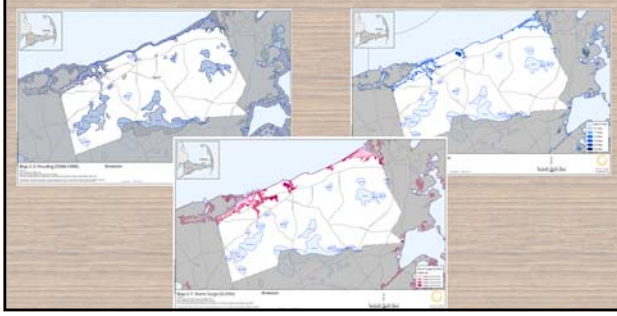
Economic Vulnerability Analyses
Various Scenarios



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Social Vulnerability

- Public Infrastructure and Emergency Lifelines
  - Communications
  - Emergency Services
  - Energy
  - Information Technology
  - Transportation Systems
  - Water/Wastewater Systems
- Evacuation/Population at Risk

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Environmental Vulnerability

- Direct Impacts
  - Loss of Habitat
  - Salinization of land and groundwater
- Indirect Impacts
  - Inland damage to the built environment
  - Threats to ecosystems and species
  - Contamination of potable water supply

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Capability Assessment

- Planning and Regulatory
  - Storm Tide Pathways project
  - Open Space and Recreation Plan
  - Coastal Adaptation Study
- Administrative and Technical
  - Local Emergency Planning Committee
  - ECEMP
  - Municipal Website
- Financial
  - FEMA HMGP/BRIC/FMA
  - EOEEA MVP Initiative

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Goals

1. To reduce the potential loss of life, property, critical facilities, infrastructure, environmental resources and landforms and cultural resources from natural disasters.
2. To educate residents and policy makers about natural hazard risk and vulnerability, so as to encourage hazard mitigation planning as part of the municipal planning process.
3. To implement cost effective and feasible mitigation projects, funded whenever possible with grant programs.
4. To coordinate Brewster hazard mitigation planning with neighboring towns in the mid and lower Cape Cod Region and Barnstable County.
5. To reduce potential financial losses incurred by municipal, residential and commercial establishments due to disasters.
6. To ensure that mitigation measures are context-sensitive to natural features, historic resources and community character.

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Mitigation Strategy

Mitigation actions identified from:

- Carry Over from 2016 draft plan
- MVP Report
- LHMW Coordination
- Various Plans, Studies and Reports
- HWG/Consultant

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Mitigation Measures…Categories

- **Social**…is the action socially acceptable?
- **Technical**…is the action technically feasible and provide appropriate level of protection?
- **Administrative**…does the Town have the capability to complete the action?
- **Political**…will the Town support or oppose the project?
- **Legal**…does the Town have the legal authority to complete the action?
- **Economic**…is the action cost-effective?
- **Environmental**…will the action affect the natural environment?

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Mitigation Measures…Categories

- Planning and Prevention
- Property Protection
- Natural Resource Protection
- Structural Projects
- Emergency Services, and
- Public Education and Awareness

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Mitigation Actions

Time Frames

- Short Term: 0 – < 6 months
- Medium Term: > 6 – < 18 months
- Long Term: 18 months – 5 years

Cost Ranges

- Staff Time: Municipal personnel time
- Minimal: < $5,000
- Moderate: > $5,000 but < $25,000
- Significant: > $25,000

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2021 Mitigation Strategy

PUBLIC EDUCATION AND AWARENESS

Action #1 Town of Brewster Vision Plan 2018

Adapt to climate change projections and advance adaptation and resiliency techniques that are financially and environmentally sustainable.

Action #2 Brewster Coastal Resource Management Plan/Storm Tide Pathways Study

Implement Brewster Coastal Resource Management Plan/Storm Tide Pathways Study.

- Increase public awareness of the importance of healthy coastal wetlands and natural coastal processes, and the need to protect these resources.
- Use best available tools to understand the potential impact of storm surge on public and private property, sensitive infrastructure and natural resources, and to develop strategies and plans to avoid, minimize or mitigate adverse impacts, including tools made available through the Cape Cod Commission's Resilient Cape Cod project, MVP program, and the Storm Tide Pathways Assessment project.

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2021 Mitigation Strategy

PUBLIC EDUCATION AND AWARENESS

Action #3 MVP/2016 Draft HMP/HW

Increase the public's awareness of hazard vulnerabilities:

- Develop a preparedness campaign for the general public (i.e., residents and seasonal guests) and the private sector that includes guidance and checklists, as well as recommendations to increase community resilience to the impacts of climate change.
- Annually host a public hazards display for the residents of Brewster in combination with the 'Brewster in Bloom' festival or another appropriate community event. Ensure that such a display will also be hosted during the summer months, when part-time residents are in Town.
- Distribute tourist evacuation and shelter information.

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2021 Mitigation Strategy

NATURAL RESOURCE PROTECTION

Action #4 Open Space and Recreation Plan

Implement Brewster Open Space and Recreation Plan:

- Protect the Town's drinking water supply to meet the needs of residents and visitors today and in the future.

Action #5 Integrated Water Resources Management Plan 2013

Update Zoning Bylaws and Subdivision Rules/Regulations to protect public supply wells.

- Strengthen the Water Conservation Bylaw.
- Strengthen the Zoning Bylaw provision for drinking water quality protection by mandating the Natural Resource Protection Design in its District of Critical Planning Concern, rather than 'encouraging it'.
- Implement a Stormwater Management Bylaw.
- Encourage Low Impact Development.

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2021 Mitigation Strategy

NATURAL RESOURCE PROTECTION

Action #6 Brewster Coastal Adaptation Plan

Implement Brewster Coastal adaptation Strategy:

- Identify and acquire new access points to the shoreline.
- Periodically evaluate the beach management process to evaluate how well it is working and to incorporate lessons learned over time.
- Identify opportunities to promote and support wetland retreat to preserve coastal wetlands, including salt marshes to the extent feasible.
- Analyze and monitor the migration of sediment along the coast to understand how the offshore flats will respond to a rising sea level and whether or not they will remain above water at low tide.

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2021 Mitigation Strategy

NATURAL RESOURCE PROTECTION

Action #7 Coastal Resource Management Plan

Implement Brewster Coastal Resource Management Plan:

- Periodically assess coastal resources conditions for comparison with baseline conditions. Monitor and assess physical processes to support short-term management decisions and long-term planning.
- Periodically assess coastal resources on a regional scale.
- Adopt long-term coastal management resiliency strategies.
- Promote management and maintenance of public access points to increase resilience.
- Preserve natural sediment transport processes in balance with erosion. Evaluate policy and regulatory changes to protect wetland resources.
- Maintain the elevation of salt marshes and tidal flats by promoting opportunities for salt marsh migration.

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2021 Mitigation Strategy

STRUCTURAL PROJECTS

Action #8 Coastal Resource Management Plan/MVP

Implement Brewster Coastal Resource Management Plan:

- Minimize and mitigate impacts of development in coastal areas: protect vulnerable low roads, groundwater and underground infrastructure.
- Elevate low-lying road segments and/or retrofit stormwater management systems to mitigate flooding during storm surge conditions:
  - Route 6A at Dennis town line and east of Cape Cod Museum of Natural History
  - Lower Road at Bloomer Path intersection.
  - Breakwater Road various locations.
  - Crosby Lane

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2021 Mitigation Strategy

STRUCTURAL PROJECTS

Action #8 (continued) Coastal Resource Management Plan/MVP

Implement Brewster Coastal Resource Management Plan:

- Develop and initiate projects to increase resilience to projected climate change impacts (e.g. intense rain, storm surge, sea level rise) for critical infrastructure including, but not limited to:
  - Route 6A from the intersection of Paine's Creek Road west across causeway dividing the marsh.
  - Stormwater drainage throughout town.
  - Potentially vulnerable utility infrastructure.
- Conduct a stormwater infrastructure inventory and assessment to prioritize and initiate improvements (e.g. increased catch basin maintenance, culvert replacement) based on projected climate change impacts.

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2021 Mitigation Strategy

STRUCTURAL PROJECTS

Action #9 Cape Cod Atlas of Tidally Restricted Salt Marshes/2016 Draft HMP

Complete remediation work necessary on two marsh systems:

- Site BR-2: Brewster Cranberry Bog Berm Restriction of Channel off Quivett Creek (privately owned).
- Site BR-3: Brewster Cranberry Bog Berm Restriction of Channel off Quivett Creek (privately owned).

EMERGENCY SERVICES

Action #10 Coastal Adaptation Strategy 2016

Maintain access for emergency vehicles and maintenance.

Action #11 2016 Draft HMP

Conduct a Needs Assessment of privately-owned facilities that have regional importance (medical centers/day care centers).

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2021 Mitigation Strategy

EMERGENCY SERVICES

Action #12 2016 Draft HMP

Incorporate the inspection and management of hazardous trees/limbs into the Town's routine monitoring process.

Action #13 2016 Draft HMP

Mitigate impacts of blowing/drifting snow.

Action #14 2016 Draft HMP

Develop a program to train emergency responders and residents in management of domestic animals, horses, sheep, goats, dogs, cats, birds, as well as wild animals during emergencies such as floods, fires, winds, etc.

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2021 Mitigation Strategy

EMERGENCY SERVICES

Action #15 2016 Draft HMP

Coordinate with Nickerson State Park, Towns of Orleans (Baker's Pond), Harwich/Harwich Water Dept. (Punkhorn Parklands), and Dennis/Dennis Water Dept. (Punkhorn Parklands and Ellis Farm) on fuel reduction programs and response.

Action #16 Brewster Health Department

Strengthen/Enhance the Brewster Health Dept.'s capacity and capabilities:

- Conduct a full-scale exercise to test Brewster's Medical Emergency Distribution System (MEDS).
- Create a public health nurse position within the Health Department.
- Create a public health communications coordinator position within the Health Department.

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2021 Mitigation Strategy

PLANNING AND PREVENTION

Action #17 Open Space and Recreation Plan

Provide a variety of recreation and open space opportunities to promote healthy and active lifestyles for Brewster residents, ensuring equitable access for all users and abilities.

Action #18 Coastal Resource Management Plan

Minimize and mitigate impacts of development in coastal areas: Work with Planning Board and other stakeholders to evaluate changes to local zoning and regulations to preserve scale, character, and resource protection (adopt Coastal Resilience Bylaw).

Action #19 2016 Draft HMP

Review of ditch systems and old bogs for preventative maintenance to increase flood capacity.

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Project Schedule

Public Comment Period open through December 3, 2021

Draft Plan to MEMA: anticipated by January 1, 2021

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Contact Us…

Questions/Comments:

Conor Kenny
Project Manager
Town of Brewster

ckenny@brewster-ma.gov
Phone: (508) 896-3701 Ext. 1129

Craig Pereira—Project Manager
Senior Planner
Horsley Witten Group, Inc.

55 Dorrance Street, Suite 200
Providence, RI 02903
cpereira@horsleywitten.com
Phone: (401) 263-6048

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Town of Brewster, MA

Virtual HMP Public Workshop #2

Please click the link below to join the webinar:
https://us02web.zoom.us/j/81177153357?pwd=YTFBQnBNRHJTWWFGV3c3WmNuT1BMUT09
Passcode: 086700

US: +1 301 715 8592 or +1 312 626 6799
Webinar ID: 811 7715 3357
Passcode: 086700

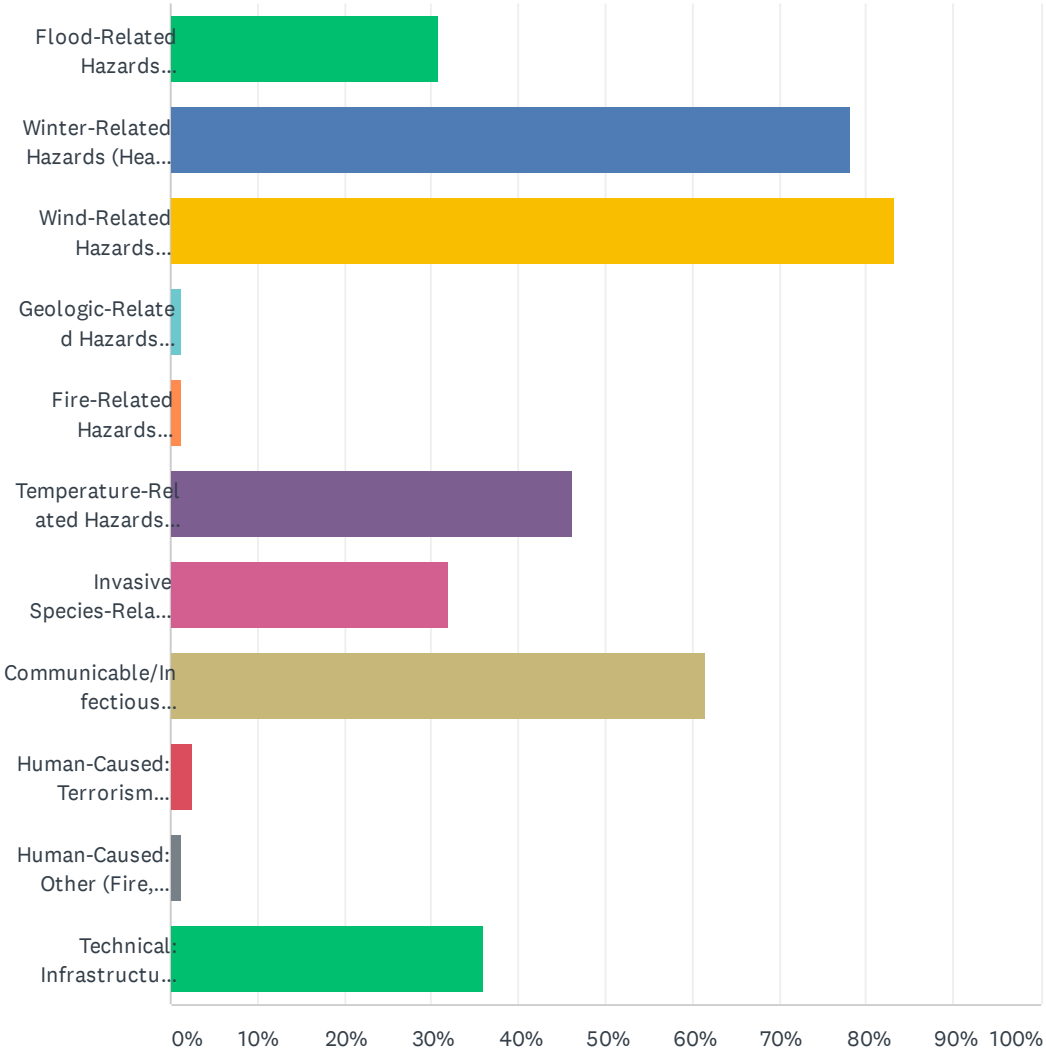
November 30, 2021 6:00 PM - 8:00 PM

Name	Email Address
Dave Whitney	
Craig Pereira	
Donna Kalinick	
Kimberley Pearson	
Bruce Semple	
Suzanne Bryan	
Conor Kenny	
Peter Lombardi	
Griffin Ryder	
Ned Chatelain	
Kari Hoffmann	
Cindy Bingham	

On-Line Survey

Q1 Which of the following hazard events have you or has anyone in your household and/or business experienced in the past 20 years within the Town of Brewster? (Check all that apply)

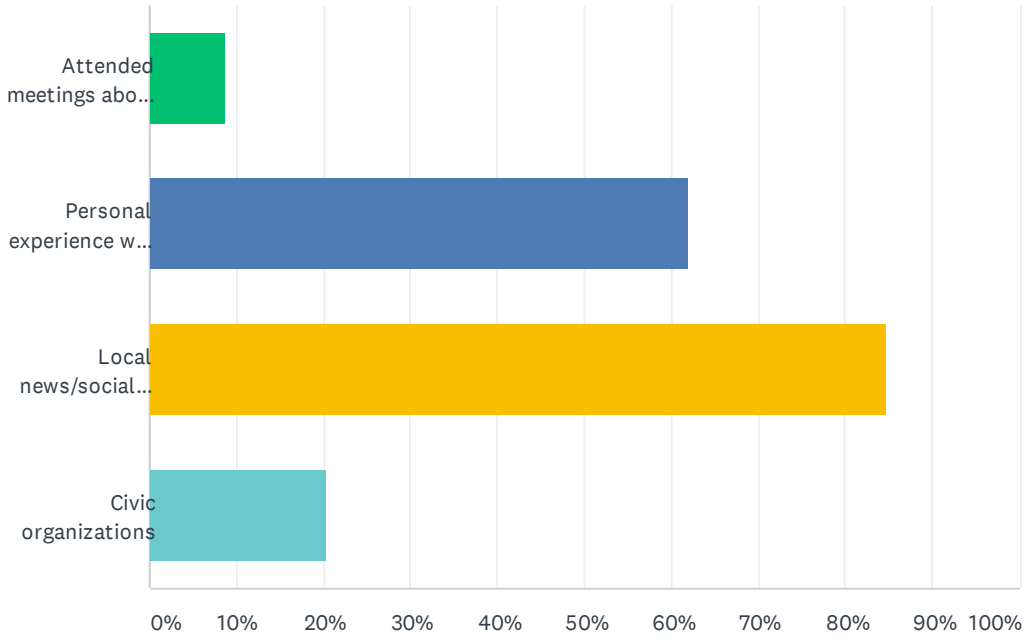
Answered: 78 Skipped: 2



ANSWER CHOICES	RESPONSES	
Flood-Related Hazards (Riverine/Flash Flooding, Inland/Urban Flooding, Coastal Flooding/Storm Surge, Coastal Erosion, Climate Change/Sea Level Rise)	30.77%	24
Winter-Related Hazards (Heavy Snow, Blizzards)	78.21%	61
Wind-Related Hazards (Hurricanes, Tornadoes, High Winds, Lightning/Thunderstorms, Hail)	83.33%	65
Geologic-Related Hazards (Earthquakes)	1.28%	1
Fire-Related Hazards (Wildfire/Urban Fire)	1.28%	1
Temperature-Related Hazards (Extreme Heat/Cold, Drought)	46.15%	36
Invasive Species-Related Hazards	32.05%	25
Communicable/Infectious Disease (Epidemic, Pandemic)	61.54%	48
Human-Caused: Terrorism (Biological, Chemical/Hazardous Materials Release, Cyber, Explosive, Radiological/Nuclear, Civil Disobedience/Unrest)	2.56%	2
Human-Caused: Other (Fire, Mass Casualty Incident, Dam Inundation, Special/VIP Events)	1.28%	1
Technical: Infrastructure/Utility Failure (Communications, Emergency Services, Energy, Information Technology, Transportation Systems, Water/Wastewater Systems)	35.90%	28
Total Respondents: 78		

Q2 Which of the following have provided you with useful information to help you prepare for a hazard event? (Check all that apply)

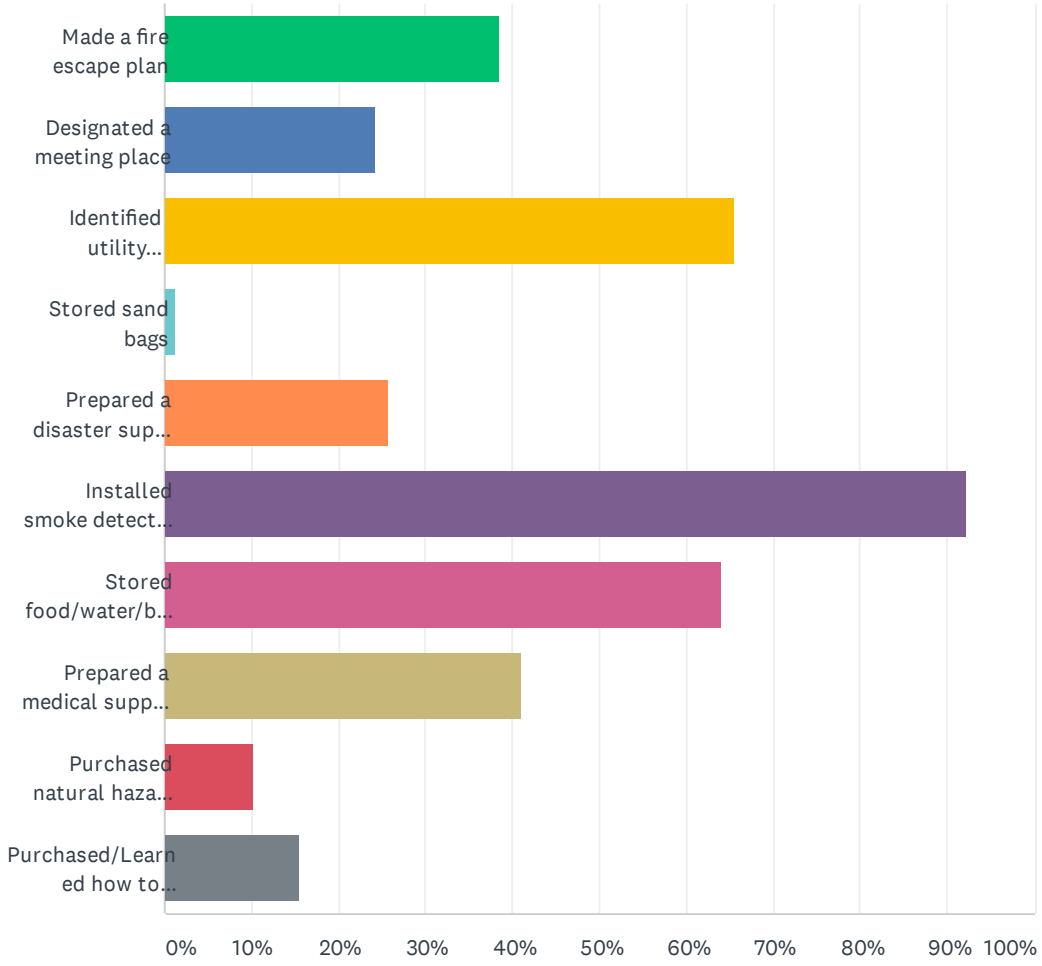
Answered: 79 Skipped: 1



ANSWER CHOICES	RESPONSES	
Attended meetings about disaster preparedness	8.86%	7
Personal experience with one or more multi-hazards/disasters	62.03%	49
Local news/social media	84.81%	67
Civic organizations	20.25%	16
Total Respondents: 79		

Q3 Which of the following steps has your household and/or business taken to prepare for a natural, communicable, human-caused, or technological hazard event? (Check all that apply)

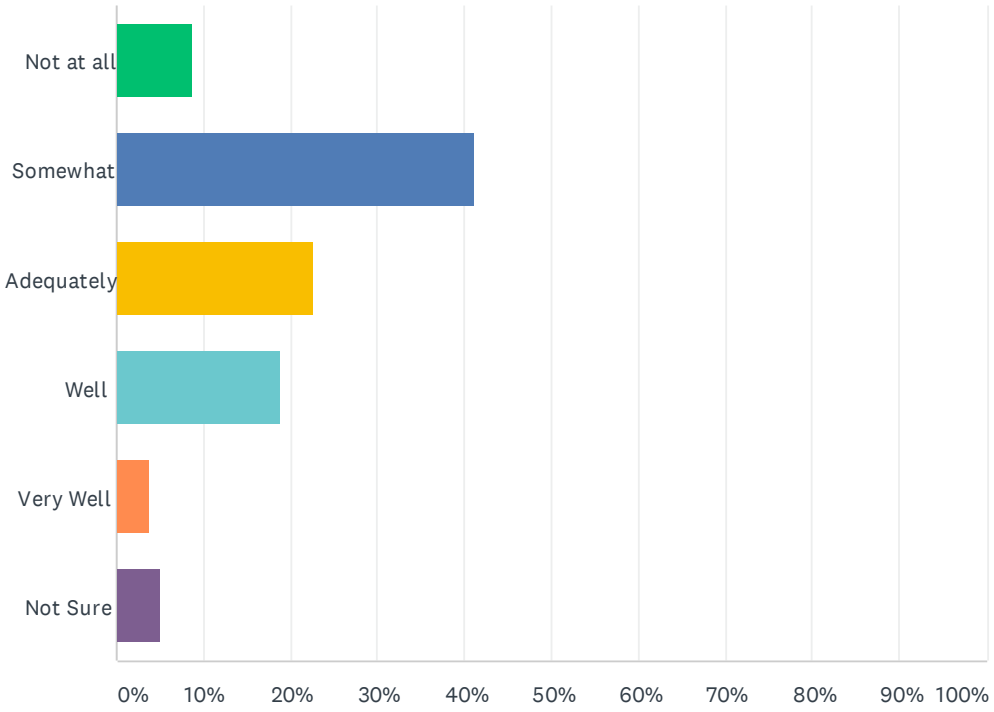
Answered: 78 Skipped: 2



ANSWER CHOICES	RESPONSES	
Made a fire escape plan	38.46%	30
Designated a meeting place	24.36%	19
Identified utility shut-offs	65.38%	51
Stored sand bags	1.28%	1
Prepared a disaster supply kit	25.64%	20
Installed smoke detectors on each level of the house	92.31%	72
Stored food/water/batteries	64.10%	50
Prepared a medical supply kit	41.03%	32
Purchased natural hazard insurance	10.26%	8
Purchased/Learned how to program a NOAA Weather Radio	15.38%	12
Total Respondents: 78		

Q4 In your opinion, how prepared is your household and/or business to deal with a natural, communicable, human-caused, or technological hazard event?

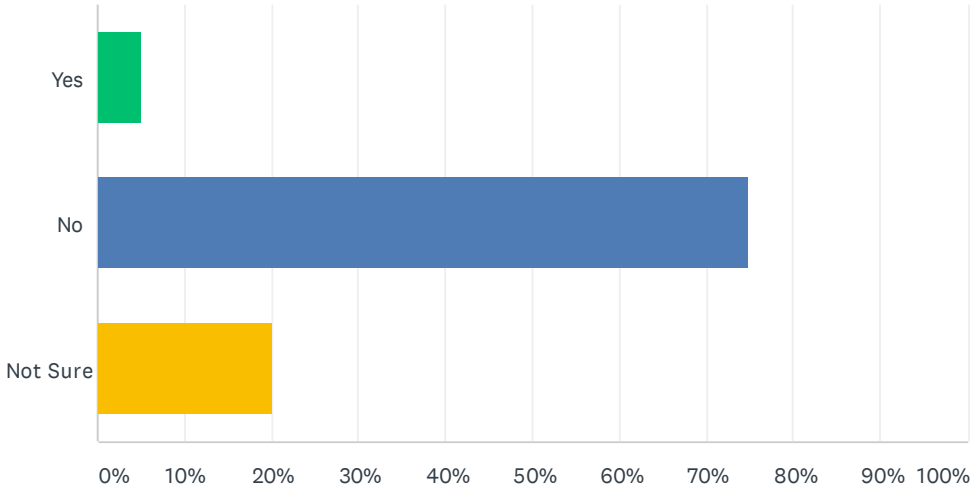
Answered: 80 Skipped: 0



ANSWER CHOICES	RESPONSES	
Not at all	8.75%	7
Somewhat	41.25%	33
Adequately	22.50%	18
Well	18.75%	15
Very Well	3.75%	3
Not Sure	5.00%	4
TOTAL		80

Q5 Is your property located in or near a FEMA designated floodplain?

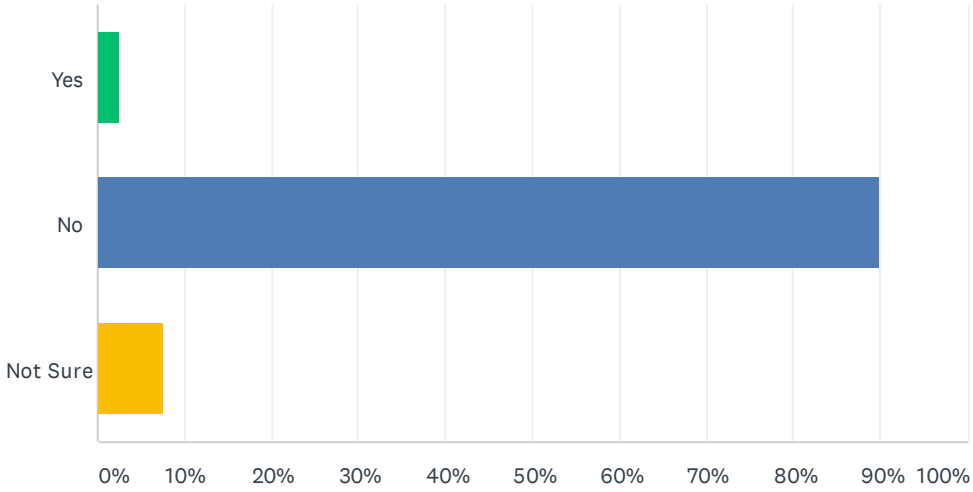
Answered: 80 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	5.00%	4
No	75.00%	60
Not Sure	20.00%	16
TOTAL		80

Q6 Do you have flood insurance?

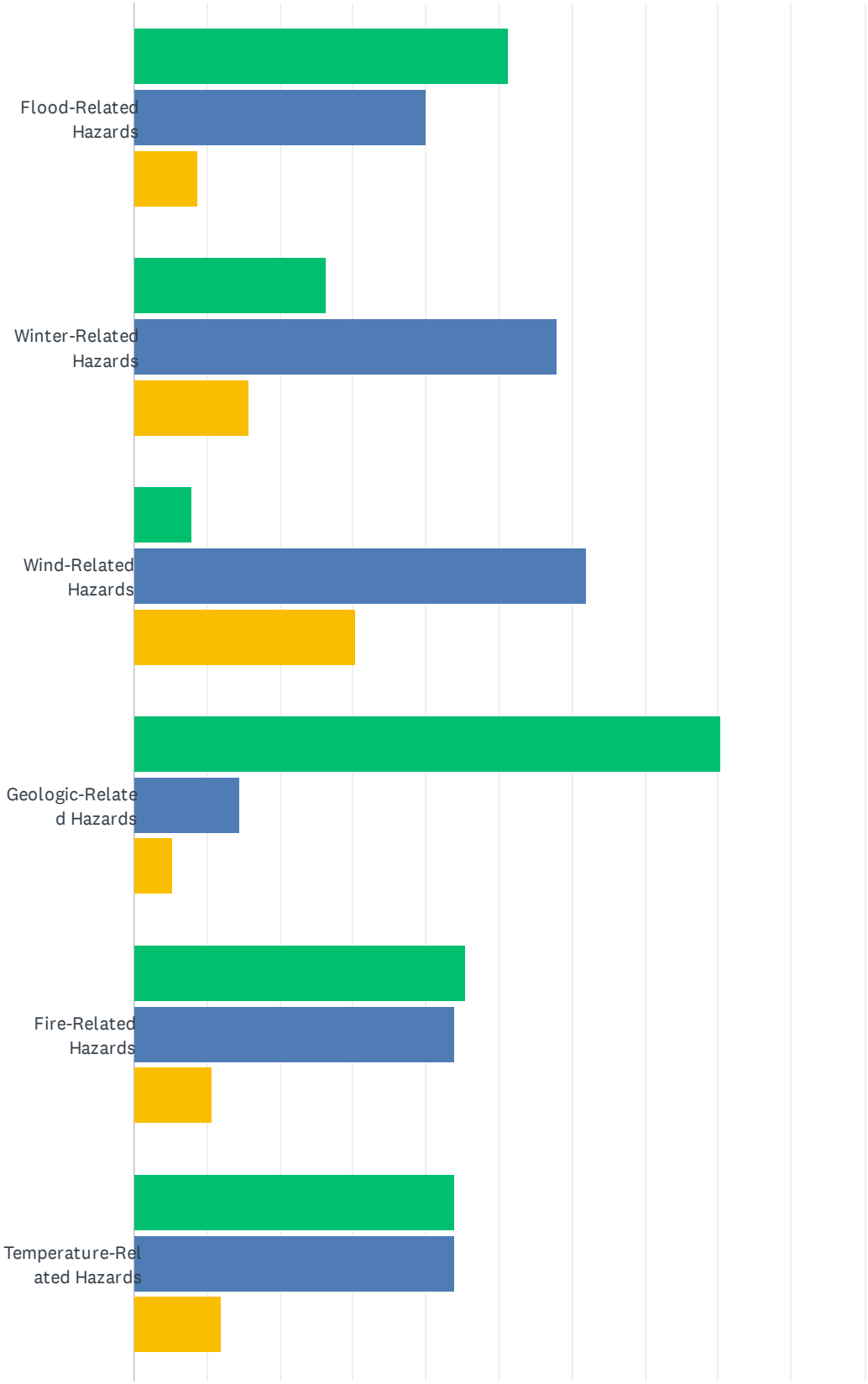
Answered: 79 Skipped: 1

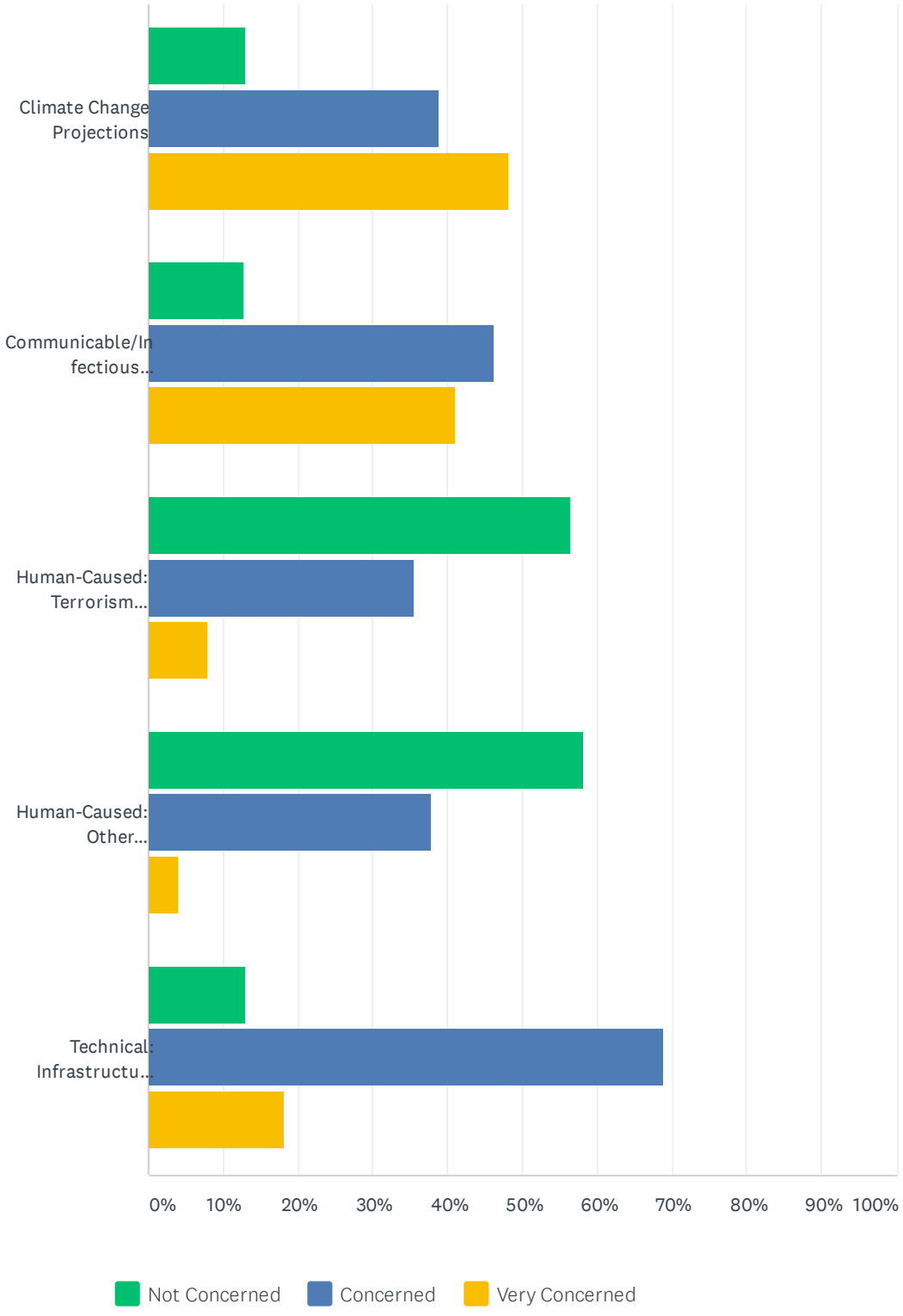


ANSWER CHOICES	RESPONSES	
Yes	2.53%	2
No	89.87%	71
Not Sure	7.59%	6
TOTAL		79

Q7 How concerned are you about the following hazards in the Town of Brewster? (Check one response for each hazard)

Answered: 80 Skipped: 0

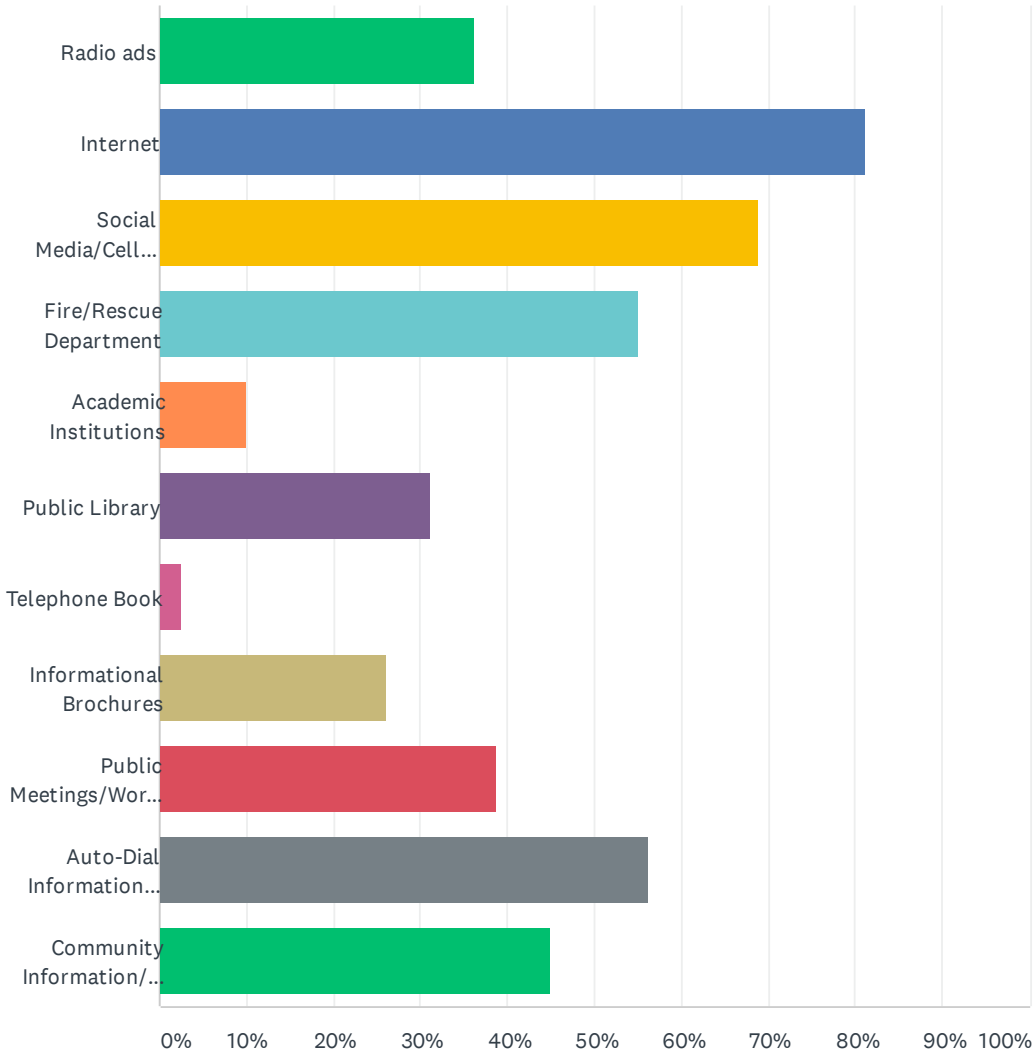



Climate Change Projections
Communicable/Infectious...
Human-Caused: Terrorism...
Human-Caused: Other...
Technical: Infrastructu...
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Not Concerned
Concerned
Very Concerned

	NOT CONCERNED	CONCERNED	VERY CONCERNED	TOTAL
Flood-Related Hazards	51.25% 41	40.00% 32	8.75% 7	80
Winter-Related Hazards	26.32% 20	57.89% 44	15.79% 12	76
Wind-Related Hazards	7.89% 6	61.84% 47	30.26% 23	76
Geologic-Related Hazards	80.26% 61	14.47% 11	5.26% 4	76
Fire-Related Hazards	45.33% 34	44.00% 33	10.67% 8	75
Temperature-Related Hazards	44.00% 33	44.00% 33	12.00% 9	75
Climate Change Projections	12.99% 10	38.96% 30	48.05% 37	77
Communicable/Infectious Disease	12.82% 10	46.15% 36	41.03% 32	78
Human-Caused: Terrorism (Intentional)	56.58% 43	35.53% 27	7.89% 6	76
Human-Caused: Other (Accidental)	58.11% 43	37.84% 28	4.05% 3	74
Technical: Infrastructure/Utility Failure	12.99% 10	68.83% 53	18.18% 14	77

Q8 In your opinion, which of the following methods do you think are most effective for providing hazard and disaster information? (Check all that apply)

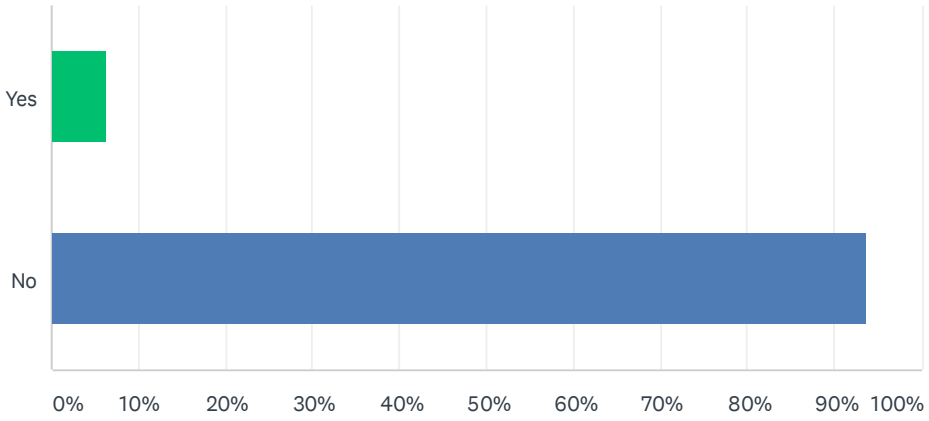
Answered: 80 Skipped: 0



ANSWER CHOICES	RESPONSES	
Radio ads	36.25%	29
Internet	81.25%	65
Social Media/Cell phone apps.	68.75%	55
Fire/Rescue Department	55.00%	44
Academic Institutions	10.00%	8
Public Library	31.25%	25
Telephone Book	2.50%	2
Informational Brochures	26.25%	21
Public Meetings/Workshops	38.75%	31
Auto-Dial Information (Code Ready)	56.25%	45
Community Information/Training Sessions	45.00%	36
Total Respondents: 80		

Q9 Do you have any special access or functional needs within your household and/or business that would require early warning or specialized response during hazardous events or disasters?

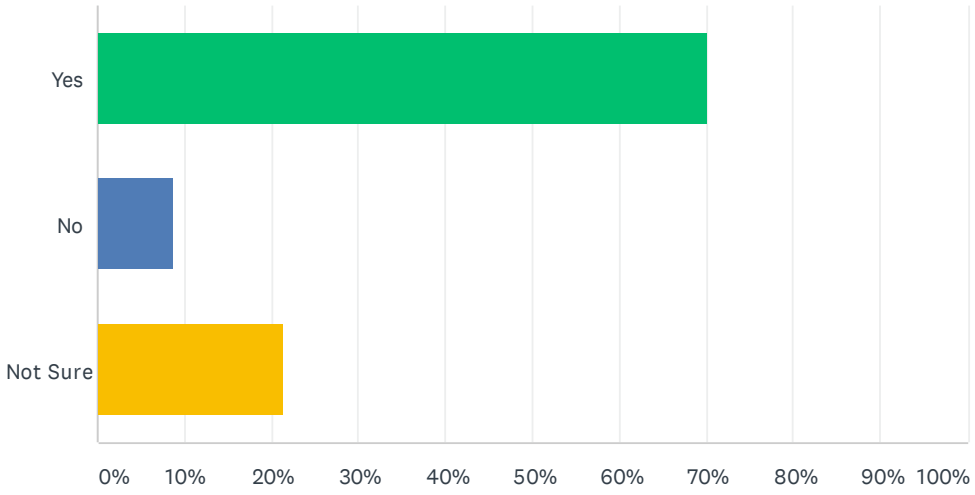
Answered: 80 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	6.25%	5
No	93.75%	75
TOTAL		80

Q10 Are you interested in making your home, business or neighborhood more resistant to hazards?

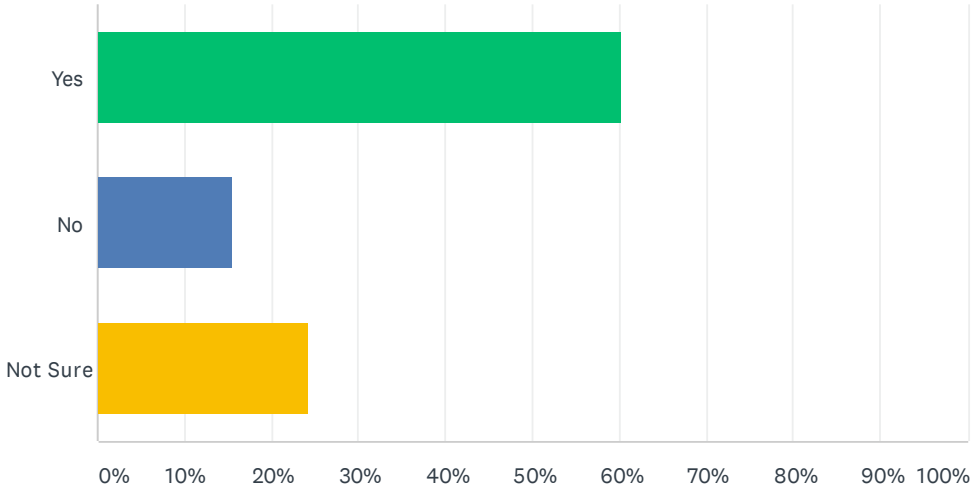
Answered: 80 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	70.00%	56
No	8.75%	7
Not Sure	21.25%	17
TOTAL		80

Q11 Would you be willing to spend your own money on your current home and/or business to help protect it from impacts of potential future hazards and/or disasters within the community? Examples could include: Elevating a flood-prone home; Elevating utilities in flood-prone basements; Strengthening your roof, siding, doors, or windows to withstand high winds; Removing trees/low branches.

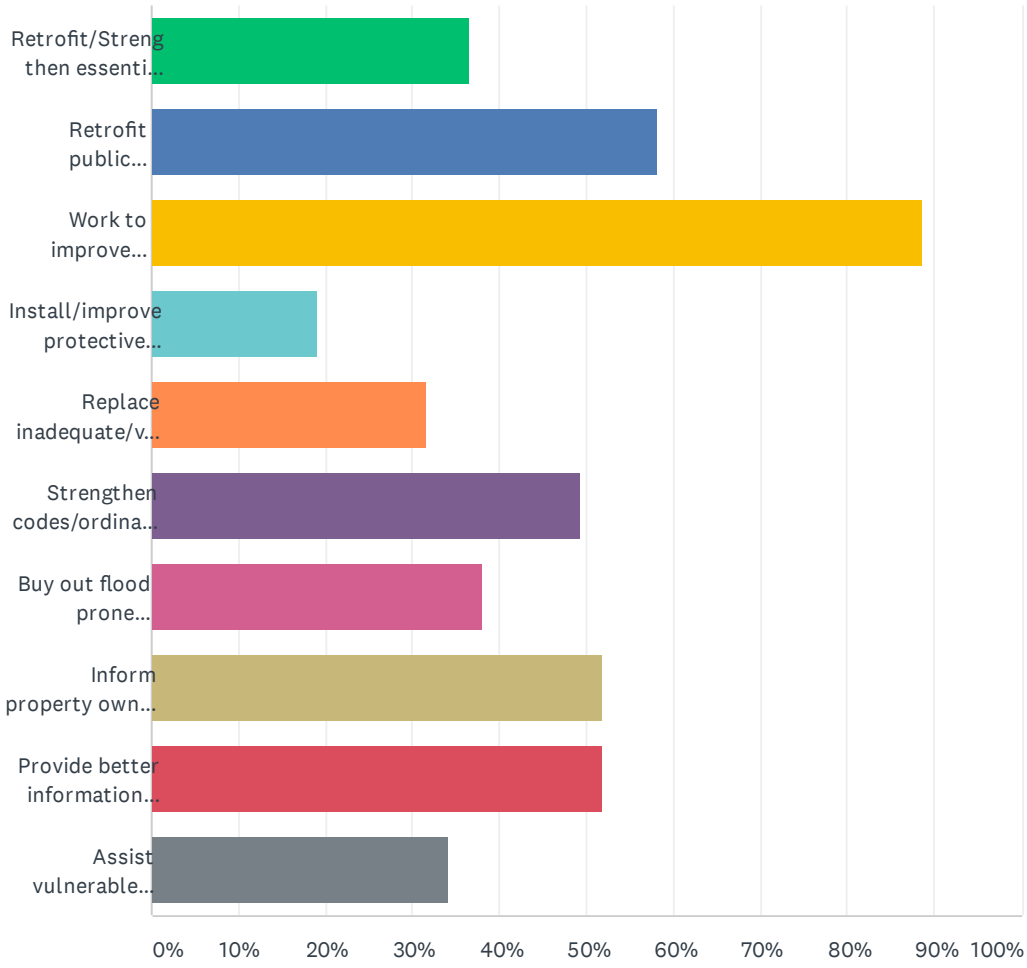
Answered: 78 Skipped: 2



ANSWER CHOICES	RESPONSES	
Yes	60.26%	47
No	15.38%	12
Not Sure	24.36%	19
TOTAL		78

Q12 What types of projects do you believe local, county, state or federal government agencies could be doing to reduce the damage and disruption of natural disasters in Brewster? (Select your top three choices)

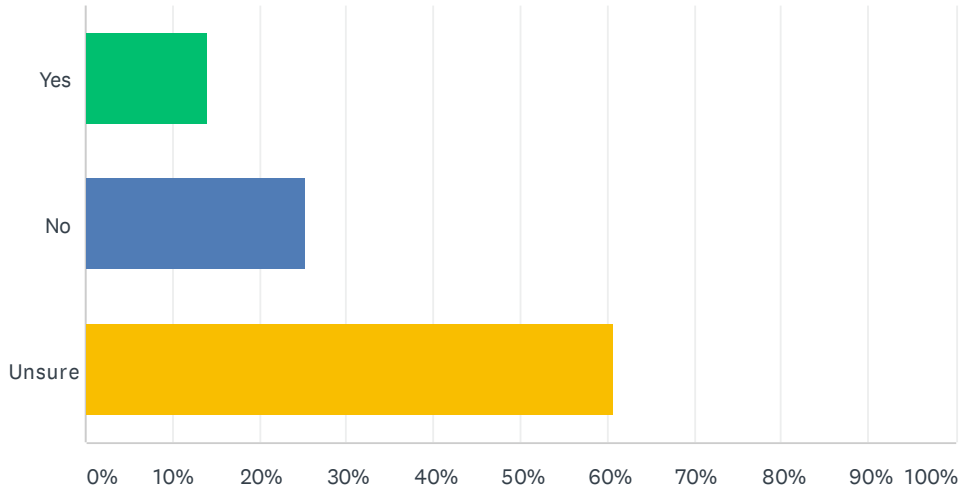
Answered: 79 Skipped: 1



ANSWER CHOICES	RESPONSES	
Retrofit/Strengthen essential public facilities such as police, fire/emergency, schools,	36.71%	29
Retrofit public infrastructure, such as elevating roadways and improving drainage systems	58.23%	46
Work to improve utilities resiliency (electric, communications, water/wastewater facilities)	88.61%	70
Install/improve protective structures (floodwalls/sea walls)	18.99%	15
Replace inadequate/vulnerable bridges and causeways	31.65%	25
Strengthen codes/ordinances to require higher hazard risk management standards and/or provide greater control over development in high hazard areas	49.37%	39
Buy out flood prone properties and maintain as open space	37.97%	30
Inform property owners of ways they can reduce the damage caused by natural events	51.90%	41
Provide better information about hazard risks and high hazard areas	51.90%	41
Assist vulnerable property owners with securing funding to make their properties more resilient	34.18%	27
Total Respondents: 79		

Q13 In your opinion, has the Town done enough to prepare for the projected impacts of climate change?

Answered: 79 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	13.92%	11
No	25.32%	20
Unsure	60.76%	48
TOTAL		79

Q14 Additional comments?

Answered: 16 Skipped: 64

#	RESPONSES	DATE
1	Use common sense and don't waste $	7/22/2021 6:44 PM
2	I chose 'buy out flood prone properties' for what the government could do, but want to clarify that I do NOT mean by eminent domain, or otherwise forcing people to move/sell their property. I mean continuing to offer to buy out such properties once people want to sell. Also, I've heard of programs in other coastal communities where towns will buy out such properties (voluntarily), but then temporarily rent out the dwellings on the property, on the understanding that when they become uninhabitable (i.e. washed away) they will not be replaced and then the property is just maintained as public land. Also, if codes are strengthened, this absolutely has to be coupled with a way to help lower income homeowners meet more expensive code requirements when they want to make changes to their homes. Otherwise you're just encouraging unpermitted work that could be dangerous even absent natural disasters.	7/22/2021 10:13 AM
3	The biggest problem that I am having is paying my real estate tax bill. I moved to Brewster over twenty years ago and my tax bill has tripled during that time. I was hoping that I would be able to retire here. However I am unsure if I am going to be able to afford to stay here.	10/11/2020 11:53 AM
4	Brewster needs better cell service especially if we come to rely upon it for emergency information.	10/10/2020 10:57 AM
5	A better approval process prior to construction. We are currently sueing our neighbor for stormwater damage despite our pleas to him and the town prior to construction.	10/7/2020 3:33 PM
6	Open space is critical to mitigating many of the impacts of climate change. Additionally restoration and management of conservation lands to reduce fire risk and mitigate invasive species impacts is important. The brush from these activities could be burned as biomass or pyrolisized to create biochar with waste heat used to power and heat town buildings. It would reduce CO2 emissions by locking up carbon from invasive plants, as well as reduce the load from fossil fuels to heat homes, or help fill the gap of solar and wind. The biochar could them be used for management and restoration efforts or sold to community members.	10/1/2020 4:25 PM
7	I's answer # 13 by saying the Town has made efforts, however we need to implement some of the plans and do more to manage and re-direct development. Thanks	9/27/2020 1:47 PM
8	The idea that Climate Change will lead to intense natural disaster is a hoax. Town and County should do more to require cutting of dead/leaning trees as well as trees that can damage power lines if toppled by wind or ice/snow load.	9/24/2020 12:54 PM
9	Financial Assistance to homeowners should be based on financial need. I am against new construction of any kind- including affordable housing- on land not previously used. Too much development, runoff, loss of trees, and open space, all weaken natural protections. Houston serves as a proven example of what can happen when humans remove natural sea barriers, and increase runoff from homes. We need dunes, trees and shrubs to hold the soil and sand for as long as humanly possible. investment in preserving water quality, protecting water supplies, I see as being most urgent.	9/23/2020 9:04 AM
10	Controlling development, restricting the construction of giant houses, restricting use of impermeable landscape materials, not allowing outdoor burning which is hazardous and pollutes neighborhood air, providing more pedestrian friendly walkways, reducing car traffic on Main St.	9/23/2020 7:54 AM
11	Flooding at the causeway on 6A at the history museum during storm events has occurred. This section of the road should be prioritized to address either a bridge, or higher roadway, for evacuation and safety reasons.	9/23/2020 7:30 AM
12	Thank you.	9/23/2020 7:05 AM
13	Generators in senior housing buildings.	9/23/2020 6:16 AM

14	Our biggest vulnerabilities seem to be climate change related - coastal/wind damage and forest fires. We should proactively assess risk, and engage in mitigation strategies. First we should commit to becoming fossil fuel neutral. We should develop buyback programs for residences on/near coastline to offer non-coastal sq ft values for those that need to retreat, so we can retire thos homes and handle the erosion more naturally. We should ban expansion in vulnerable areas. We should make sure we are doing what we can to mitigate the greatest fire risks, such as clearing invasives/underbrush and creating more fire breaks if/where necessary. We also need to be more vigilant to stop amateur firework/pyrotechnic use and educate people about the fire risks.	9/22/2020 2:59 PM
15	Our major vulnerabilites are sea level rise and, secondly, fire. We should protect marshes and restrict development in vulnerable areas. We should warn about trees near buildings and about outdoor fires.	9/22/2020 2:50 PM
16	Continue Brewster's tradition of protecting open space. This will help with Hazard Mitigation and resiliency. Using ecosystem-based adaption as a strategy, we can use nature to help people cope with the expected impacts of climate change.	9/22/2020 12:19 PM

Appendix C – Correspondences

Availability of Draft Plan – Municipal Posting

Availability of Draft Plan – Adjacent Communities

Availability of Draft Plan – Municipal Departments

Public Comments

of Brewster, Massachusetts

https://www.brewster-ma.gov

risk of injury or damage to property from future natural, communicable, human-caused or technological hazard events such as flooding, hurricanes or cyber security. This Multi-Hazard Mitigation Plan builds on previous work already completed by the Town including the Brewster Coastal Adaptation Strategy (September 2016), Town of Brewster Vision Plan (2018), the Town of Brewster Coastal Resource Management Plan (2019), and the Municipal Vulnerability Preparedness Plan (2019).

Hazard Mitigation Plan Virtual Public Workshop 11/30/21

Come hear about the process to date and the mitigation actions developed as part of the plan. Tuesday, November 30, 2021, 6:00 PM—8:00 PM

Please click here to join the webinar: https://us02web.zoom.us/j/81177153357?pwd=YTFBQnBNRHJTWWFGV3c3WmNuT1BMUT09
Passcode: 086700
US: +1 301 715 8592 or +1 312 626 6799
Webinar ID: 811 7715 3357
Passcode: 086700

Public Comment Period 11/8/21 - 12/3/21

The public comment period will occur from Monday, November 8, 2021 to Friday, December 3, 2021. All comments should be directed to Craig Pereira at cpereira@horsleywitten.com.

From:	Craig Pereira
To:	Dan Fortier
Cc:	Conor Kenny
Subject:	Notice of Availability
Date:	Tuesday, November 9, 2021 4:58:00 PM
Attachments:	image001.png

Good Morning Mr. Fortier,

The Town of Brewster has developed a draft Hazard Mitigation Plan over the past year. As such, we are required by FEMA to provide adjacent communities the opportunity to review and comment on the draft plan. The Brewster Hazard Mitigation Plan is now available for public comment at: https://www.brewster-ma.gov/files/drafthazardmitigationplan.pdf

The public comment period runs through December 3, 2021. All comments should be directed to me.

Regards,
Craig

Craig Pereira, CFM | **Senior Planner**
Horsley Witten Group
55 Dorrance Street | Suite 200
Providence, RI 02903
Office: 401-272-1717
Direct: 774-413-2900 x 308

From:	Craig Pereira
To:	jidman@town.harwich.ma.us
Cc:	Conor Kenny
Subject:	Notice of Availability
Date:	Tuesday, November 9, 2021 4:57:00 PM
Attachments:	image001.png

Good Morning Mr. Idman,

The Town of Brewster has developed a draft Hazard Mitigation Plan over the past year. As such, we are required by FEMA to provide adjacent communities the opportunity to review and comment on the draft plan. The Brewster Hazard Mitigation Plan is now available for public comment at: https://www.brewster-ma.gov/files/drafthazardmitigationplan.pdf

The public comment period runs through December 3, 2021. All comments should be directed to me.

Regards,
Craig

Craig Pereira, CFM | **Senior Planner**
Horsley Witten Group
55 Dorrance Street | Suite 200
Providence, RI 02903
Office: 401-272-1717
Direct: 774-413-2900 x 308

From:	Craig Pereira
To:	gmeservey@town.orleans.ma.us
Cc:	Conor Kenny
Subject:	Notice of Availability - Brewster draft Hazard Mitigation Plan 2021
Date:	Tuesday, November 9, 2021 4:56:00 PM
Attachments:	image001.png

Good Morning Mr. Meservey,

The Town of Brewster has developed a draft Hazard Mitigation Plan over the past year. As such, we are required by FEMA to provide adjacent communities the opportunity to review and comment on the draft plan. The Brewster Hazard Mitigation Plan is now available for public comment at: https://www.brewster-ma.gov/files/drafthazardmitigationplan.pdf

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Regards,
Craig

Craig Pereira, CFM | **Senior Planner**
Horsley Witten Group
55 Dorrance Street | Suite 200
Providence, RI 02903
Office: 401-272-1717
Direct: 774-413-2900 x 308

From:	Conor Kenny
To:	Craig Pereira
Subject:	FW: Hazard Mitigation Plan Virtual Public Workshop 11/30/21
Date:	Monday, November 8, 2021 1:41:15 PM
Attachments:	Draft Brewster Multi-Hazard Mitigation Plan.pdf Multi-Hazard Mitigation Plan Virtual Public Workshop Flyer.pdf

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The email was sent to the below recipients:

Dept Heads <DeptHeads@brewster-ma.gov>; 'anevins@verizon.net'; 'Golf Commission' <golfcommission@brewster-ma.gov>; 'consiglioal@nausetschools.org'; 'bjburgo19@gmail.com'; 'beyestone@eastham-ma.gov'; 'wyschirmacher@gmail.com'; 'bharrison2@comcast.net'; 'Crosby1888@aol.com'; 'easleyc@nausetschools.org'; 'capeduo@comcast.net'; 'cynthia.baran@comcast.net'; Cynthia Bingham <cbingham@brewster-ma.gov>; 'dtelman@comcast.net'; 'Denise Rego' <drego@brewster-ma.gov>; 'diana@lambs.net'; 'derickson@capecod.net'; 'efswin@c4.net'; Elizabeth Taylor <etaylor@brewster-ma.gov>; 'faythe.ellis@outlook.com'; Frank Bridges <fbridges@brewster-ma.gov>; 'gc1@alabe.com'; 'George Boyd' <gboyd@nyc.rr.com>; 'hminis1@gmail.com'; Honey Pivirotto <hpivirotto@brewster-ma.gov>; 'jveara@thedavenportcompanies.com'; 'tawktame@hotmail.com'; 'jft4@comcast.net'; 'jpernice@brewsterladieslibrary.org'; 'Joseph Sullivan' <jp.sullivan3@gmail.com>; 'director@Brewsterhousing.org'; 'kimberley.crocker.pearson@gmail.com'; 'kyle@brewster-capecod.com'; 'iceman@c4.net'; 'brewster.recycling@gmail.com'; '842tobin@comcast.net'; 'paulwallace@outerbarco.com'; 'penelopeholeman@gmail.com'; Pete Dahl <pdahl@brewster-ma.gov>; 'peter@americanfalconinc.com'; Roland Bassett <rbassett@brewster-ma.gov>; 'sean@seanparker.us'; 'sltennstedt@gmail.com'; 'sbrown@town.orleans.ma.us'; 'Suzanne Bryan' <sbryan@brewster-ma.gov>; 'timhackert@gmail.com'; Tom Rogers <tr94163@gmail.com>

From: Conor Kenny
Sent: Friday, November 5, 2021 9:51 AM
Cc: 'Craig Pereira' <cpereira@horsleywitten.com>
Subject: Hazard Mitigation Plan Virtual Public Workshop 11/30/21

Good morning,

The Town of Brewster has developed a draft Multi-Hazard Mitigation Plan (see attached). This plan is important because it helps the
Town plan and receive funding for projects that reduce the risk of injury or damage to property from future natural,
communicable, human-caused or technological hazard events such as flooding, hurricanes or cyber security. This Multi-
Hazard Mitigation Plan builds on previous work already completed by the Town including the Brewster Coastal
Adaptation Strategy (September 2016), Town of Brewster Vision Plan (2018), the Town of Brewster Coastal Resource
Management Plan (2019), and the Municipal Vulnerability Preparedness Plan (2019).

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Please click here to join the webinar: https://us02web.zoom.us/j/81177153357?pwd=YTFBQnBNRHJTWWFGV3c3WmNuT1BMUT09
Passcode: 086700
US: +1 301 715 8592 or +1 312 626 6799
Webinar ID: 811 7715 3357
Passcode: 086700

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Conor Kenny
Project Manager
Town of Brewster
508-896-3701 x 1129