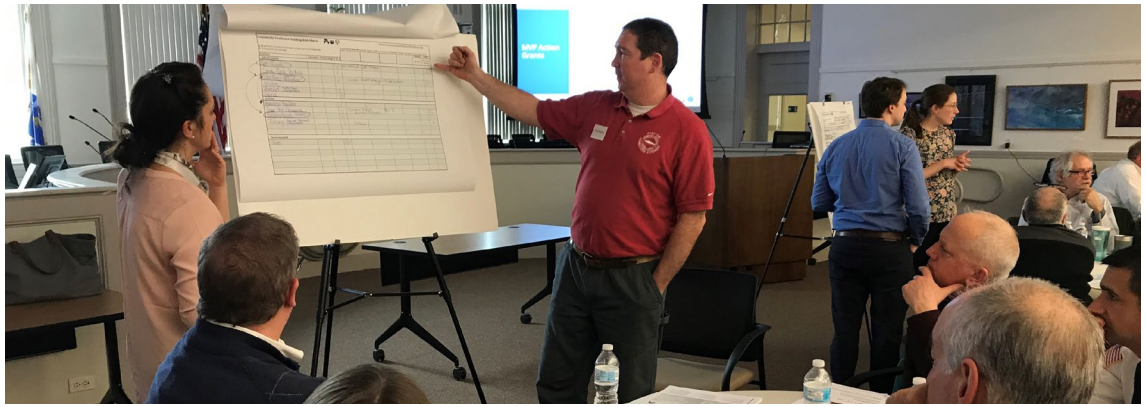
Barnstable Community Resilience Building Workshop Summary of Findings

MUNICIPAL VULNERABILITY PREPAREDNESS PROGRAM

CAPE COD COMMISSION

CAPE COD COOPERATIVE EXTENSION



ACKNOWLEDGEMENTS

Special thanks to the Town of Barnstable for their willingness to embrace this process and provide the facilities and refreshments for the workshop, and to the participants for their invaluable input about the community.

This project was made possible through funding by the Municipal Vulnerability Preparedness Program from the Massachusetts Executive Office of Energy and Environmental Affairs.

Table of Contents

Introduction and Overview

The need for municipalities, regional planning organizations, states, and federal agencies to plan for increased resilience and adaption to extreme weather events and climate changes is evident, particularly in coastal communities. Cape Cod has already begun to experience the effects of changing climate conditions and associated natural hazards, including sea level rise and extreme weather events. The strong nor'easters of 2018 unleashed a new sense of urgency to act. Massachusetts Governor Baker's Executive Order 569 aims to provide communities with technical support, climate change data, and planning tools to identify natural hazards and develop strategies to improve resilience. This resulted in the Massachusetts Municipal Vulnerability Preparedness (MVP) program, which provides communities with funding to identify vulnerabilities and develop plans to specifically increase resilience to climate change.

The Town of Barnstable has the potential to be impacted by a wide range of natural hazards, and each one presents certain risks to life and property. With 170 miles of shoreline and natural resource areas, Barnstable's most notable risks are increased flooding due to rising sea levels, more intense coastal storms, and more extreme precipitation events. Together with flooding, Barnstable's future will likely include more frequent heat waves and droughts, as well as changes to coastal resource areas, with significant implications for the seasonal economy. These risks threaten Barnstable's population, building, infrastructure, landscapes, and ecosystem health.

The Town of Barnstable acts as a regional economic, jobs, transportation and service center for Cape Cod. Its southern coast is home to a major regional hospital and the primary passenger and freight ferry terminal providing service to Nantucket. These facilities, along with essential water, sewer, and transportation infrastructure, dozens of local critical facilities and millions of dollars of residential real estate and economic assets are located in the vulnerable coastal zone.

Tourism is one of the primary sources of economic development in Barnstable. A longer summer season and warmer winters may extend Barnstable's tourist season, which could have a positive economic impact. However, the potential negative impacts of climate change on Barnstable's beaches, marshes, and other natural and recreational assets may outweigh any benefits of an extended tourist season. In addition, tourist infrastructure in flood-prone areas, such as along the coast, is vulnerable to sea level rise and coastal storms. Further, many of Barnstable's most valuable homes and properties are in areas that are at risk from coastal flooding and sea level rise, and impacts to these properties could detrimentally affect the town's economy and tax base.

The Town is committed to taking a comprehensive approach to its planning efforts. With a $35,500 grant from the Massachusetts Executive Office of Energy and Environmental Affairs MVP Program, the Town of Barnstable contracted with staff from the Cape Cod Commission and Woods Hole Sea Grant & Cape Cod Cooperative Extension (the "project team"), certified MVP providers, to conduct the Community Resilience Building workshop.

With the Town Planning and Development Director as the lead, the Town established a Core Team of town staff to help prepare for and conduct the workshop. In addition to the Town Planning and Development Director, the Core Team included representatives from the Conservation Program, Marine and Environmental Affairs Department, and Department of Public Works. For a complete list of Barnstable Core Team members, See Project Team Members on pg. 13. The project team held a kickoff meeting with the Core Team in November to review the project scope, prepare for the workshop, and discuss ways to engage stakeholders to participate. This early meeting with the Core Team helped to identify a broad range of interests and an opportunity to brainstorm potential groups and individuals to invite to the workshop.

The group discussed ways to engage participants, including flyers (see Appendix), a webpage (https://townofbarnstable.us/Departments/planninganddevelopment/projects/MVP-Climate-Resilience-Event.asp), and email invitations to town boards and others. This meeting was also used to discuss background materials needed for the workshop.

The Core Team met with the project team again in December 2018 to discuss resource mapping, format, and timeframe for the workshop. At this meeting, the project team reviewed a draft storymap (produced by the Cape Cod Commission) with the Core Team that could be used to help educate stakeholders about the purpose of the MVP planning effort, provide resource maps and data on climate change, and to help identify critical facilities in the community. The group discussed needed content and ways to present that content, including defining resiliency, defining the planning horizon, identifying hazards on the tabletop maps, and collecting photos for the presentation

and storymap. The project team agreed to work on the presentation, agenda for the workshop, storymap refinements and get those drafts to the Core Team for feedback.

Several weeks before the workshop the Town sought community members/stakeholder participation through invitations to local board and committee members. The Town Planning and Development Director also created a web page on the Town website with information about the workshop, including a public invitation to participate and a brief survey for those who registered. The event was widely publicized through a variety of channels, including a press release, coverage in the Town's weekly newsletter, social media posts, announcements to the Town Council, and a segment on the local cable access daily news program. The website provided a link to the storymap to help prepare and inform community members about coastal hazards prior to the workshop. The Core Team and project team met a third time a few days before the workshop to finalize the agenda, confirm staffing and presenters, and discuss the addition to the agenda of an overview of potential project types and funding sources.

The goal of the workshop was to identify existing and identify future infrastructural, societal, and environmental vulnerabilities resulting from natural hazards and changing climate conditions and to collect, develop, and prioritize municipal and community response actions. Building on existing efforts, the Town sought to reiterate, augment, and prioritize opportunities for the community to reduce risks and build resilience. The Workshop's central objectives were to:

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

The workshop was conducted in accordance with CRB guidance[1] and held on March 29, 2019 in one eight-hour session. In addition to the Core Team and project team members, approximately 26 stakeholder/community members participated in the workshops, including Town department staff, Town board and committee members, public safety officials, residents, local civic groups, and local business owners. Workshop participants were assigned to small diversified teams for the duration of the workshop.

This report provides a summary of the concerns, ideas, and priorities shared by these participants during Barnstable's CRB workshop. The summary of findings described in this report, including those that concern the evolving nature of risk assessment and associated action, are compiled from comments, discussion, and brainstorming from workshop participants and Core Team members.

1 CRB guidance: www.communityresiliencebuilding.org

Hazards, Concerns, and Strengths

TOP HAZARDS AND VULNERABLE AREAS

During the morning session of the workshop, participants learned about and discussed eight locally relevant climate hazards:

- Coastal erosion
- Flooding
- High winds
- Hurricanes
- Nor'easters
- Sea level rise
- Severe winter weather
- Thunderstorms

Greg Berman, Coastal Processes Specialist with the Woods Hole Sea Grant & Cape Cod Cooperative Extension, gave a PowerPoint presentation on top vulnerabilities/ hazards identified by the State, regional vulnerabilities/hazards, and climate change projections in Massachusetts with data from the Climate Change Clearing House for the Commonwealth (www.resilientma.org). (See Appendix).

The morning session of the workshop focused on identifying top hazards, vulnerabilities, and strengths. The afternoon session of the workshop focused on identifying and prioritizing actions. Workshop participants were directed to sit at any one of five tables (A, B, C, D, or E) and were joined by a project team member, acting as facilitator, and a Core Team member (or project team member) acting as scribe. Basemaps with critical town information such as infrastructure, floodplains, public water supply areas, and conservation land were placed at each table (see Appendix). Each table worked on its own risk matrix through facilitated "small team" exercises and later worked together as a large team with all stakeholders to consolidate information (See Appendix for completed risk matrices). The combination of the Risk Matrix and the basemap provided decision-support and risk visualization to enable stakeholders to identify the community's strengths and

vulnerabilities and prioritize actions to reinforce strengths or mitigate vulnerabilities. The process resulted in informed input, shared experiences, and dialogue among stakeholders.

Using the basemaps and storymap resources as a guide, each small team engaged in a facilitated discussion to identify what it considered to be the top four hazards that pose the greatest current and future threats to Barnstable. To help each group determine the priority hazards, facilitators asked participants to consider where, how often, and in what ways hazards have impacted the community; what hazards are impacting the community currently; what effects will these hazards have in the future; what is exposed to hazards and climate threats; what have been the impacts to municipal operations and budgets, planning and mitigation efforts; and other concerns/considerations related to impacts.

Small teams discussed whether top hazards should be identified as those with the most impact, such as a hurricane, one that occurs more frequently such as flooding or high winds, hazards that the town was least prepared for or would impact the town's budget and/or impact the most people. Stakeholders also felt that there was significant overlap among the top hazards, such as high winds and hurricanes, or nor'easters and winter weather. Stakeholder discussion was focused primarily on current hazards; while sea level rise was identified as a top priority hazard by 2 of the 5 small teams, there was less consensus about this being a top hazard for the community.

TOP HAZARDS

Based on the results of the small team exercise, workshop participants identified the following as the top/priority hazards:

- Flooding
- High winds
- Winter or extreme weather
- Coastal erosion
- Sea level rise
- Wildfire
- Climate change and ocean acidification

Flooding was identified as the hazard having the greatest direct impact on the Town of Barnstable both currently and in the recent past, particularly the impact of flooding on regional and local roadways. The groups identified Routes 6A and 28, Ocean Street, Squaw Island, Main Street Cotuit, Bridge Street, and Duck Pond as being particularly vulnerable. The group also noted the large number of homes and businesses located within the floodplain, as well as harbors (Hyannis and Millway) vulnerable to storm-related and sea level rise flooding.

High winds and severe storms such as nor'easters and winter storms were also identified as a major concern for the community as these events result in power outages, downed tree limbs, and place a strain on public safety resources and personnel.

Coastal erosion was another priority hazard as it impacts bayside beaches, parking lots that serve these beaches, and numerous private properties. Maintaining access to local beaches presents natural resource concerns and is an economic priority for the community.

One of the small teams identified wildfire risk as a threat in areas of town where there are large woodlands with tinder build-up, and proximate to densely populated areas. Another group identified climate change generally, and ocean acidification and rising temperatures more specifically, as threats to the town's economic well-being and health.

AREAS OF CONCERN

Following the discussion of hazards, each small team identified infrastructural, societal, and environmental community vulnerabilities and strengths, including town and private assets. Areas of concern identified during the workshop were grouped into the following categories.

TRANSPORTATION

Many low-lying roads that presently flood during storm events or even during king tides; bridges and culverts that are undersized; access to the Hyannis Transportation Center may be affected by flooding; ferry terminals may be affected by sea level rise.

EMERGENCY SERVICES

The regional hospital, emergency responders, and fire station(s) may be affected by flooding.

OTHER INFRASTRUCTURE

Above-ground electrical and other utilities, including communication, are vulnerable to damage/outage from storms/high winds; sewer pump stations and the sewage treatment plant could be vulnerable during power outages; stormwater systems may be inadequate.

PUBLIC AMENITIES/FACILITIES

Marinas (access and fuel tanks), boatyards, yacht clubs, and beach facilities (bathhouses, parking lots, etc.) that are vulnerable.

ECOSYSTEMS

Barrier beaches that provide protection to mainland structures, beaches that provide recreation and access to the water; salt marsh health and ability to provide important services such as flood storage and filtration; water quality of both salt and fresh water, including ponds and drinking water; long term viability of endangered species; farms; trees as carbon fixers, temperature regulators, and role in improving air quality.

SOCIAL

Homes and septic systems, some private wells located within the floodplain; vulnerable populations, including seniors, homeless, and environmental justice communities vulnerable to multiple threats; farming, including shellfish.

CURRENT CONCERNS AND CHALLENGES PRESENTED BY HAZARDS AND CLIMATE CHANGE

The Town of Barnstable has shoreline on both Cape Cod Bay and Nantucket Sound, each with its own set of challenges. The Nantucket Sound shoreline is highly vulnerable to tropical storms, which are relatively low frequency but can be highly destructive. Additionally, sections of this shoreline (for example, Long Beach and Short Beach) are susceptible to permanent inundation by even 3 feet of sea level rise. The Cape Cod Bay shoreline experiences a much larger tide range, with potentially less infrastructure in the way of rising sea levels, however the relatively frequent winter storms are eroding coastal landforms across this area. Coastal bank erosion has permanently removed sections of upland property; at the same time, this erosion has provided the material for dune and beach recovery.

Flooding of the Cape Cod Bay shoreline occurred during the winter storms of 2018. The winter storm of January 4th and 5th, 2018 is the new record-breaking water level (Boston Tide Gauge), having exceeded the previous record (Winter storm of 1978) by 2 inches. The tide gauge record shows about 4.5 inches of sea level rise during the time between these two storms, meaning that the only reason 2018 was a record-breaking event was due to climate change. Another anomaly was the series of winter storms in early March 2018. The storm surge was 1-2 feet for over a week, which weakened many coastal resource areas and resulted in significant erosion. There are concerns that both long-duration and high water-level storms will be the "new normal".

The primary climate and natural hazards identified by the participants included winter storms and flooding. Nor'easters have impacted Barnstable for many years, but storm frequency and intensity in recent years have increased. In addition to Nor'easters, several participants noted concern about hurricanes, which can have different impacts than a Nor'easter. Participants identified areas where flooding impacts local roadways, and expressed concern about anticipated flooding along Route 6A, a significant east/west route. Participants also expressed concern about impacts from downed utility lines, communication lines and downed trees and limbs across roadways, hampering access/egress and communication during storm events. Erosion was also a concern, though there were fewer specific examples of erosion impacts than there were of flooding and winter storm damage. Looking forward, participants also recognized the threat of sea level rise and ocean acidification as something the community will need to contend with.

SPECIFIC CATEGORIES OF CONCERNS AND CHALLENGES

LOW-LYING INFRASTRUCTURE (TRANSPORTATION)

There are many low-lying roads in town (many noted on the maps, see Appendix), including portions of Route 6A, Route 149, Route 28, Squaw Island Road, Ocean Street, Main Street Cotuit, Short Beach Road, and Bridge Street. Undersized culverts and bridges associated with these roads and at other locations (Keveney Lane, Millway, Eel River, Bumps River – see maps, Appendix) are also vulnerabilities. The group noted that the railroad tracks in West Barnstable are vulnerable to flooding. While not located in the town of Barnstable, the Cape Cod Canal bridges were identified as significant vulnerabilities, limiting egress during a significant hazard event.

IMPACTS TO HUMAN HEALTH

Many infrastructure elements that support human health and wellbeing were identified as potential vulnerabilities during hazard events. There was concern about failure of sewer pump stations and impacts to the waste water treatment facility due to power failure. Septic systems and stormwater systems could be vulnerable to flooding, either fresh or salt, and then could fail, contributing to the nitrogen loading challenges in the bays and estuaries that the town already faces. There was also concern that with sea level rise there could be salt water intrusion into drinking water supplies.

ISOLATION, EMERGENCY ACCESS, AND PEOPLE IN HARM'S WAY

All of the small discussion groups identified several populations under threat from coastal hazards. The groups under threat include many neighborhoods that either currently experience flooding, or are likely to in the future. Millway and Hyannis Harbors, and homes along Short Beach Road were areas identified as very vulnerable to flooding. Groups were concerned that the homeless population is generally more vulnerable during hazard events, but additionally that they tend to migrate toward lower-lying land and may have greater exposure to flood hazards. There was also concern about environmental justice communities where language or other barriers may contribute to greater exposure to hazards.

As with all Cape Cod communities, Barnstable has a significant senior population (including over 600 residents over the age of 90). Many of these seniors may have difficulty moving around during intense weather and may be confined to a home with limited food, water, medical supplies, and heating and cooling during significant weather events. Oyster Harbors was identified as an area where many residents are older and may need assistance.

Seasonal residents and visitors were also identified as vulnerable during severe and unexpected events. Part-time residents or visitors are unlikely to receive the same communications as year-round residents and are less likely to be prepared or understand how to best respond to a disaster.

Related to all of the vulnerable populations was concern that the region's shelters are likely under-sized and would be

overwhelmed during a significant flooding or power outage event. The move from local to regional shelters was identified as a concern for residents. Participants also expressed concern that first responders would be placed in harm's way during serious hazard events.

THREATS TO THE ENVIRONMENT

Barnstable is bounded on the north and south by coastal resource areas that can provide significant storm damage prevention, but are also vulnerable to the effects of severe weather, erosion, and sea level rise. Concerns were identified about the health of salt marshes and their ability to migrate landward with sea level rise, as well as ocean acidification and impacts on the shellfish industry. Rising ocean temperatures may have an adverse impact on existing fisheries, and the commercial and recreational fishing industries. Participants were also concerned about impacts to town beaches and barrier beaches, including Kalmus, Dead Neck Island, and Sandy Neck. Impacts to endangered species associated with a changing climate were also a concern. Wildfire risk, elevated due to decades of fire suppression and buildup of fuel loads in Barnstable's woodlands, was a concern both for the environment and the human neighborhoods nearby. Specific areas of concern were identified both on the north and south sides of town.

TELECOMMUNICATIONS/ UTILITIES

Barnstable is primarily reliant on above ground utilities, which can become incapacitated during and following storm events. Without power, residents may lose access to heat, food may spoil, and without telecommunications, it can be difficult to know if a household is okay or in need of help. The inability to communicate with social networks reduces social resiliency. Recent storms have highlighted the fragility of both the power supply and delivery infrastructure, as well as telecommunications.

CURRENT STRENGTHS AND ASSETS

Workshop participants were aware of the community's strengths and how they relate to its vulnerabilities. It was a clear priority that these strengths be reinforced and expanded to increase preparedness and resiliency in the community.

EMERGENCY SERVICES

- The Town of Barnstable is fortunate to host the regional hospital for the mid- and outer- Cape, Cape Cod Hospital. The hospital, and associated medical services, is an incredible asset to the community. At the same time, the hospital is located adjacent to the floodplain and Hyannis Harbor, and access routes are vulnerable to flooding and snow accumulation.
- Emergency responders were identified as a strength of the community, and two airports (Barnstable Municipal Airport and Cape Cod Airfield in Marstons Mills) in town provide the infrastructure for moving goods and people into and out of the community.

- The town maintains a shelter at the Barnstable Intermediate School that functions as a regional shelter during emergencies.
- The Town operates a CodeRED system that is an alert system that enables town officials to send out notifications of emergencies to all users who have signed up for the service. This is an effective means of communication, but is limited by the fact that only those who have signed up will get the notifications.

COMMUNITY

Groups identified the town staff as an asset of the community, including services provided by the senior center. A strong building code and zoning laws help address the threats. Town committees were identified as a strength of the town and town government. Participants also identified environmental, faith based, and civic groups as important components of the community fabric that help with education, communication, and project support.

NATURAL ASSETS

The natural environment, including town beaches, waterways, and woodland conservation areas are a significant draw to residents and visitors in Barnstable and all provide buffering from storm events. Participants noted that the town's marshes are community strengths, as they help absorb floodwaters and potentially sea level rise. Fishing and shellfishing, as well as water-based recreation and tourism, are also community assets, though it was noted that these are potentially vulnerable to impacts from climate change and severe storms. Farms in Barnstable were also identified as a potentially important asset.

Recommendations and Next Steps

TOP RECOMMENDATIONS TO IMPROVE RESILIENCE

In small groups, workshop participants developed recommended actions based on identified vulnerabilities. In the afternoon portion of the workshop, participants returned to their assigned small teams to complete the following:

1. Generate potential actions to reduce vulnerabilities and reinforce the strengths identified during the morning session;

2. Consider whether the actions address more than one top hazard, are intermediate steps, or strengthen existing initiatives;

3. Prioritize actions and differentiate them as short-term, long-term, and ongoing; and

4. Identify their top five recommendations to improve resilience to the top hazards in Barnstable.

The top recommendations reported out of the five small groups included the following:

- Make changes to zoning bylaws and regulations, including to reduce vulnerability of structures in the floodplain, grandfathered pre-1978 structures along the coast, and incentives for economic recovery.
- Conduct a feasibility assessment for the vulnerable neighborhood of Millway/Barnstable Harbor, including an alternatives analysis for adaptation and retreat.
- Conduct coastal resource planning for barrier beaches, beaches, and salt marshes (key locations).
- Plan for adequate size and number of shelters, and serving vulnerable populations.
- Protect wastewater infrastructure, including the Freezer Road plant and septic systems threatened by flooding.
- Achieve consensus on Sandy Neck coastal resiliency analysis and pursue action.

- Develop and implement community-based education programs with an emphasis on positive solutions, targeting multiple demographics and seasons.
- Land acquisition program to accommodate retreating salt marshes, saltwater facilities, beaches, etc.
- Improve resiliency of roads to coastal and urban flooding.
- Support and fund implementation of wastewater plan.
- Develop a green transportation plan including bike safety, transit and walkability.
- Prioritize and design high priority culvert replacements town-wide.
- Implement improvements to the town-wide water system, including expansion of the existing system, interconnections with neighboring towns, and open space acquisition for new wells.
- Develop policies for lowering emissions.
- Improve the stormwater system, including drainage maintenance, culverts, and pollution.
- Conduct a study to examine retreat or engineered solution to flooding in Hyannis Harbor and hospital area.
- Conduct coastal resiliency alternatives analysis for south side beaches.

These recommended actions were then presented to the large group and voted on through a dot exercise to identify the most important recommendations to benefit the community. The following actions represent the top recommendations of the assembled participants, organized by priority.

1. CHANGES TO ZONING BYLAWS AND REGULATIONS

Several of the small groups identified the need to change zoning and other regulations to address vulnerabilities within hazard areas. This action, which included several sub-actions, received the highest number of votes. The sub-actions include identify new or different regulations for Land Subject to Coastal Storm Flowage (i.e. the floodplain), address current allowances for reconstruction of pre-1978 structures (stop the practice of grandfathering structures in hazard areas), create incentives for floodproofing of structures, updating the building code, and streamlining permitting to facilitate economic recovery after a storm event. The town's zoning code and other regulations have not been comprehensively evaluated for resiliency.

2. ACHIEVE CONSENSUS ON SANDY NECK COASTAL RESILIENCY ANALYSIS AND ACTION PLAN

Two groups identified this action as one of their top 5, and it received the second most votes in the dot exercise. Planning has already been done and multiple meetings have occurred to address erosion of the Sandy Neck parking lot, but consensus on what option to pursue has not been reached. Assistance in guiding the community to consensus is needed. Action to address erosion and protect municipal assets is needed.

3. DEVELOP AND IMPLEMENT A COMMUNITY-BASED EDUCATION PROGRAM

Three of the five small groups identified the need for improved public understanding about the hazards facing the community. Part of the emphasis identified in this action includes creating positive messaging, presenting viable solutions, and targeting multiple populations, including those with language barriers and seasonal residents. Outreach efforts and participation in programs to raise aware and improve resilience, such as FEMA's Community Rating System, should be pursued.

4. DEVELOP A FEASIBILITY STUDY OF REMEDIES FOR THE MILLWAY/BARNSTABLE HARBOR NEIGHBORHOOD

Two groups had identified a priority action seeking solutions to the flooding within this neighborhood, and the larger group agreed that this should be a priority for the town moving forward. Details include identifying alternatives for flood adaptation and/or retreat, and to use the feasibility study as a test case to utilize with other neighborhoods vulnerable to flooding.

5. LAND ACQUISITION AS A TOOL TO ACCOMMODATE RETREAT

The group agreed that buying strategic properties to allow for the retreat of existing coastal resource areas such as salt marshes, beaches, and salt water facilities would be a valuable investment by the town. Protecting land and improving town assets with nature-based resiliency solutions was seen as a priority strategy for building long-term resilience.

CONCLUSION AND NEXT STEPS

The Town of Barnstable will continue the MVP certification process by presenting and distributing this report to the public at a formal public information and listening session scheduled for June 11, 2019. This session will provide an opportunity for any member of the interested public to learn about the MVP process and provide feedback about the MVP workshop and recommended highest priority actions resulting from the workshop.

Priorities identified during the March 29, 2019 workshop will be integrated into existing local planning efforts. The Town will consider pursuing grant funding to implement the priority actions as appropriate to continue to improve the Town's resilience to climate change.

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CRB WORKSHOP PARTICIPANTS

- Walter Watson, Planning Board Member
- Tom Lee, Conservation Commission
- Farley Lewis, Land Acquisition and Preservation Committee
- Peter Burke, Hyannis Fire Department
- Candace Rufleth
- David Anthony, Town of Barnstable
- John Boyle, Infrastructure and Energy Committee
- Frank Ward
- Sean Duffey, Mass CZM
- Theresa Santos, Town of Barnstable
- Peter Rufleth
- Gregory Egan, Business Owner
- Bill Monroe, Sandy Neck Board
- Peter Doyle, Infrastructure and Energy Committee
- Darcy Karle, Conservation Administrator
- Shawn McCoy, CapeBuilt Development
- Kris Clark, Land Acquisition and Preservation Committee
- April Wobst, Association to Preserve Cape Cod
- Avery Revere, Friends of Barnstable Harbor
- Bruce Epperly
- Gordon Starr, Infrastructure and Energy Committee
- Katherine Garofoli
- Lillie Peterson-Wirtanen, Barnstable Land Trust
- Lynne Poyant
- Roger Parsons
- Rick Pfautz
- Patricia Farinha

Observers:

- Sara Sperber, Waquoit Bay National Estuarine Research Reserve
- Tonna-Marie Surgeon Rogers, Waquoit Bay National Estuarine Research Reserve

CRB WORKSHOP PROJECT TEAM

PROJECT COORDINATOR

- Elizabeth Jenkins, Director, Planning and Development

CORE TEAM MEMBERS

- Elizabeth Jenkins, Director, Planning and Development
- Liz Hartsgrove, Assistant Director, Planning and Development
- Dan Horn, Director of Marine and Environmental Affairs/Harbormaster
- Nina Coleman, Director of Natural Resources/Sandy Neck Park Manager
- Darcy Karle, Conservation Administrator
- Dale Saad, Senior Project Manager – Special Projects, Department of Public Works
- Paul Graves, Senior Project Manager, Department of Public Works

MVP PROVIDER – CAPE COD COMMISSION

- Sharon Rooney, Chief Planner
- Heather McElroy, Natural Resources Manager
- Erin Perry, Deputy Director
- Chloe Schaefer, Community Design Planner
- Martha Hevenor, Planner II
- Anne Reynolds, GIS Director

MVP PROVIDER – WOODS HOLE SEA GRANT/CAPE COD COOPERATIVE EXTENSION

- Greg Berman, Coastal Processes Specialist
- Shannon Jarbeau, Floodplain Specialist & CRS Coordinator

Appendix

Friday, March 29, 2019
9:00 a.m. to 4:30 p.m.
Barnstable Town Hall, 367 Main Street, Hyannis
Lunch & Refreshments Provided

The Town of Barnstable is hosting a community planning event to explore how we are impacted by natural hazards and to develop a comprehensive strategy to reduce potential risks, improve our ability to recover quickly after major hazard events, and improve our overall resilience.

Through the Municipal Vulnerability Preparedness process, the participants will explore current and future vulnerabilities to our infrastructure, community, and environment resulting from natural hazards and changing climate conditions and develop and prioritize municipal and community response actions.

Learn More at townofbarnstable.us/PlanningAndDevelopment

During the MVP workshop, participants will work with local and regional leaders to:

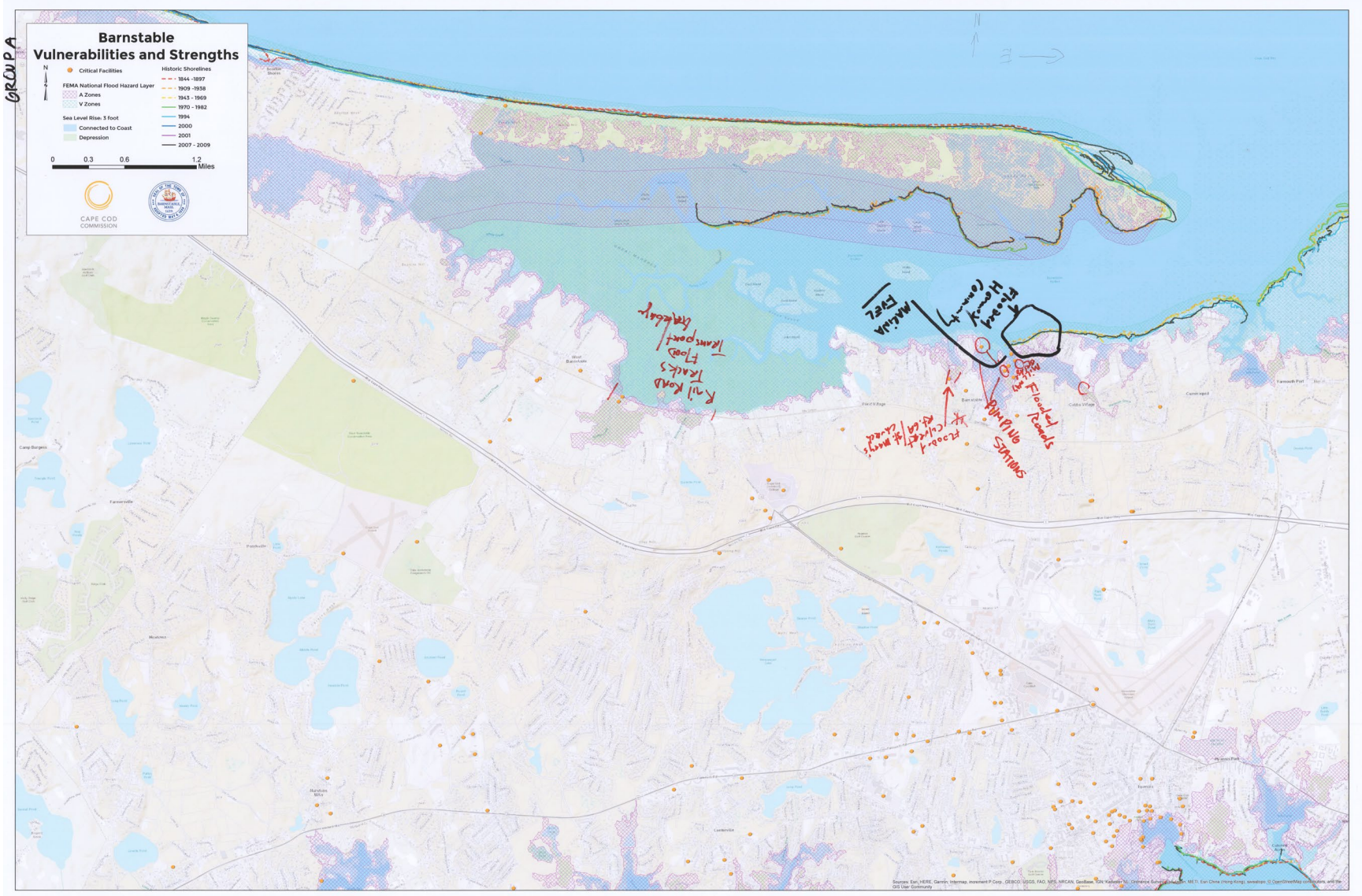
- Characterize the hazards facing the community
- Identify community vulnerabilities and hazards
- Identify and prioritize potential community actions
- Determine overall priority actions for the community

This workshop is a product of the Town of Barnstable's participation in the Commonwealth's Municipal Vulnerability Preparedness (MVP) program. This program provides support for towns in Massachusetts to plan for and implement projects that mitigate the impacts of climate change and natural hazards. Communities that complete the MVP program become certified as an "MVP community" and are eligible for State grant funding and other opportunities.

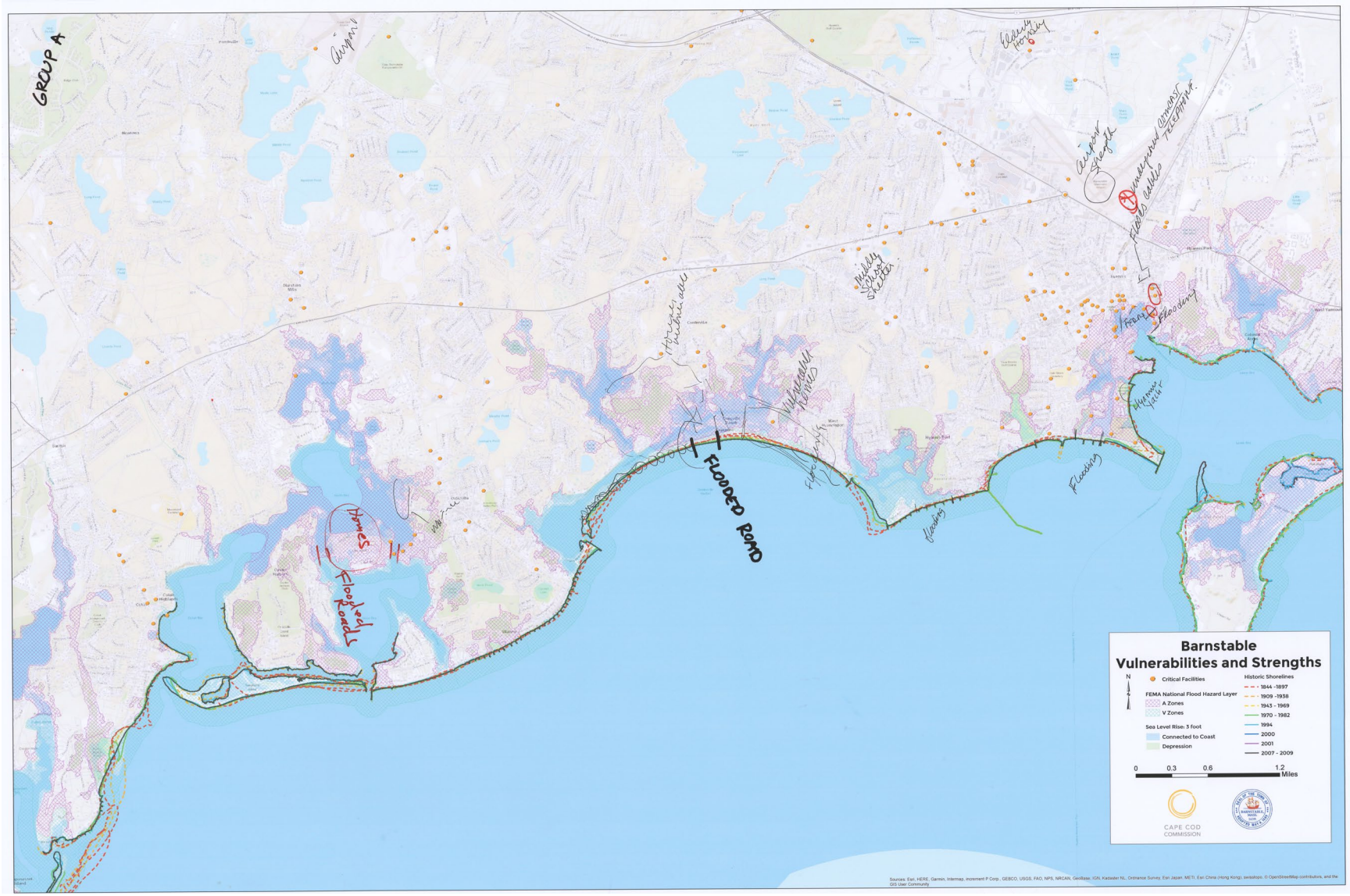
Interested participants should register on the Planning & Development Department's MVP Project Website or by calling 508-862-4678. There you can also access the Cape Cod Commission's StoryMap for the event and learn about other local climate resilience efforts and resources.

CAPE COD COMMISSION

WORKSHOP FLYER



GROUP A BASEMAP (NORTH)



GROUP A BASEMAP (SOUTH)

GROUP A

Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.org

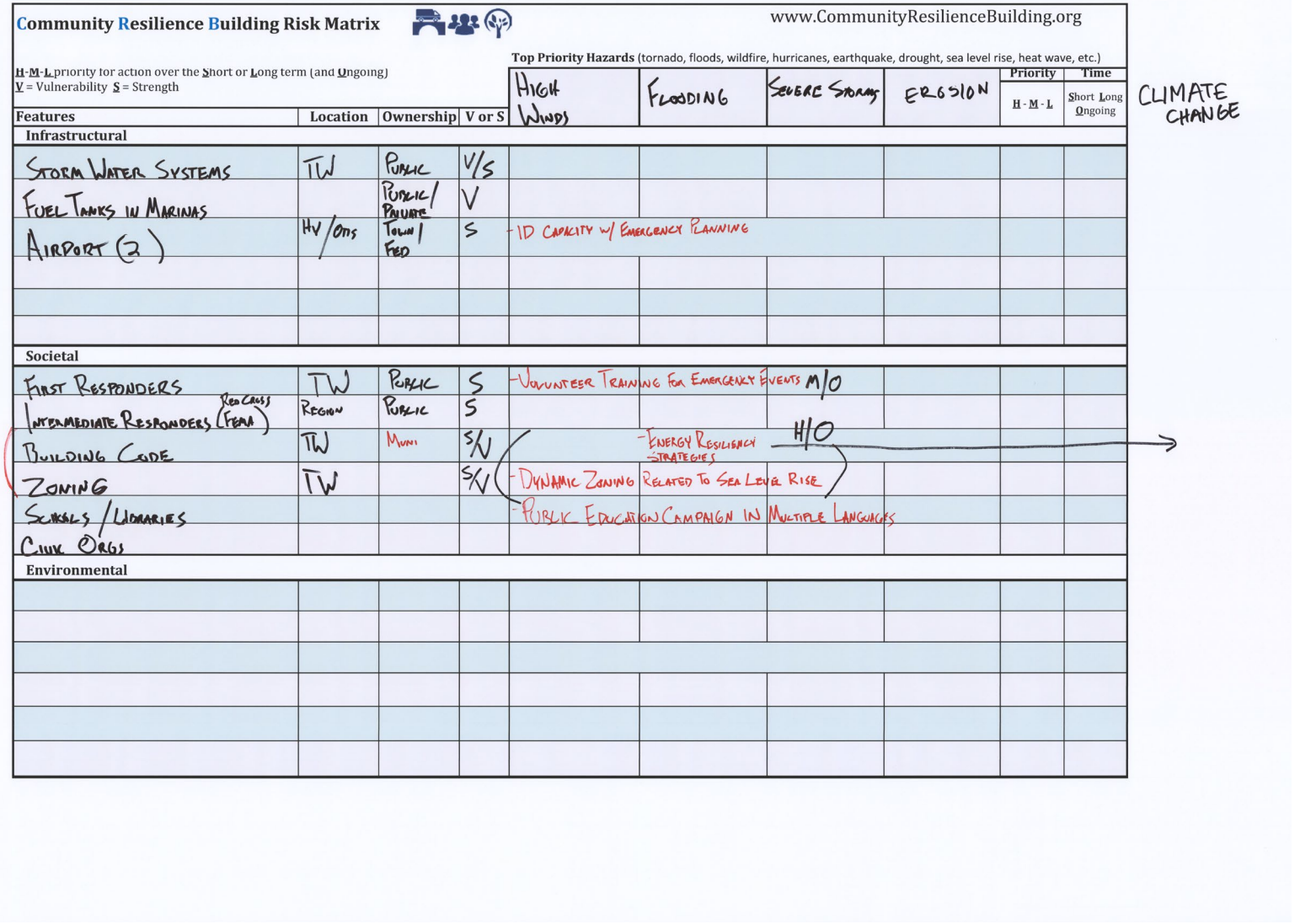
H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength

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

CLIMATE CHANGE
OCEAN ACIDIFICATION

Features	Location	Ownership	V or S	HIGH WINDS	FLOODING	SEVERE STORMS/ WINTER WEATHER	COASTAL EROSION	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
TELEPHONE POLES/POWER LINES	TW	PRIVATE?	V	TRIM TREES H/O	ID OUTAGE AREAS H/O + BACKUP STRATEGIES				
COMMUNICATIONS/UTILITIES	TW	PRIVATE?	V						
ROADS - LONG BEACH/SHORT BEACH - OYSTER HARBORS - MILL WAY/COMMERCE WAY - OCEAN ST - HYANNIS - ROUTE 6A	COASTAL	STATE + LOCAL	V		- STUDY TO ID MAINTENANCE + CONSTRUCTION NEEDS FOR DRAINAGE + CULVERTS H/L - LOWER CO_2 EMISSIONS H/L - ID VULNERABLE ROADS H/L				
PUMPING STATIONS → SEWER	NORTH SIDE	TOWN	V		- FLOOD PROOFING H/L - GREEN STRATEGIES				
CANAL BRIDGES		ACE	V		- PLANNING FOR SHELTER IN-PLACE + EVACUATION, INCLUDE BRIDGES IN LOCAL PLANNING H/O				
HOSPITAL	HY	CCH	V/S						
Societal									
HOMES/COMMUNITIES - AIRPORT - OSTER NORTH - MIDDLE SCHOOL	CENTERVILLE - BAYSIDE PT	PRIVATE	V		- BUILDING REGULATIONS IN FLOOD PLAIN STRENGTHENED H/L				
SHELTERS TRANSPORT - RTA		MULTI	V/S	- PUBLIC AWARENESS M/L - ID NEW LOCATIONS FOR LOCAL SHELTERS					
SENIOR POPULATION	TW	PRIVATE/ INSTITUTIONAL	V	- IMPROVE PREPAREDNESS + AWARENESS					
MARINAS/ACCESS TO COAST/T. BLUE ECONOMY	TW		V		- ID PRIORITY LAND ACQUISITION H/O				
TOURISM	COASTAL		V	- EMERGENCY EDUCATION FOR TOURISTS M/L					
SHELLFISHING INDUSTRY	COASTAL		V		- POLICIES FOR LOWERING EMISSIONS H/O - PLANNING TO REDUCE CLOSURES M/L				
Environmental									
FRESH WATER SOURCES TW	PUBLIC/ PRIVATE →	PUBLIC	V		- SUPPORT 208 PLAN - INVESTIGATE BACKUP STRATEGIES FOR PUMPING L/O				
SALT MARSHES	COASTAL		V/S		- ID STRATEGIES TO EXPAND SALT MARSHES / LAND ACQUISITION / WETLAND BUFFER AREAS H/O				
NITROGEN LOADING SEWER/SEPTIC STORMWATER	TW		V						
BEACHES			V/S		- ENCOURAGE BEACH GRASS PLANTING, SNOW FENCE M/S - DEVELOP RETREAT STRATEGIES - PERVIOUS PAVING H/O				
VEGETATION (TREES, BEACH GRASS)			V/S						

GROUP A RISK MATRIX 1



Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.org

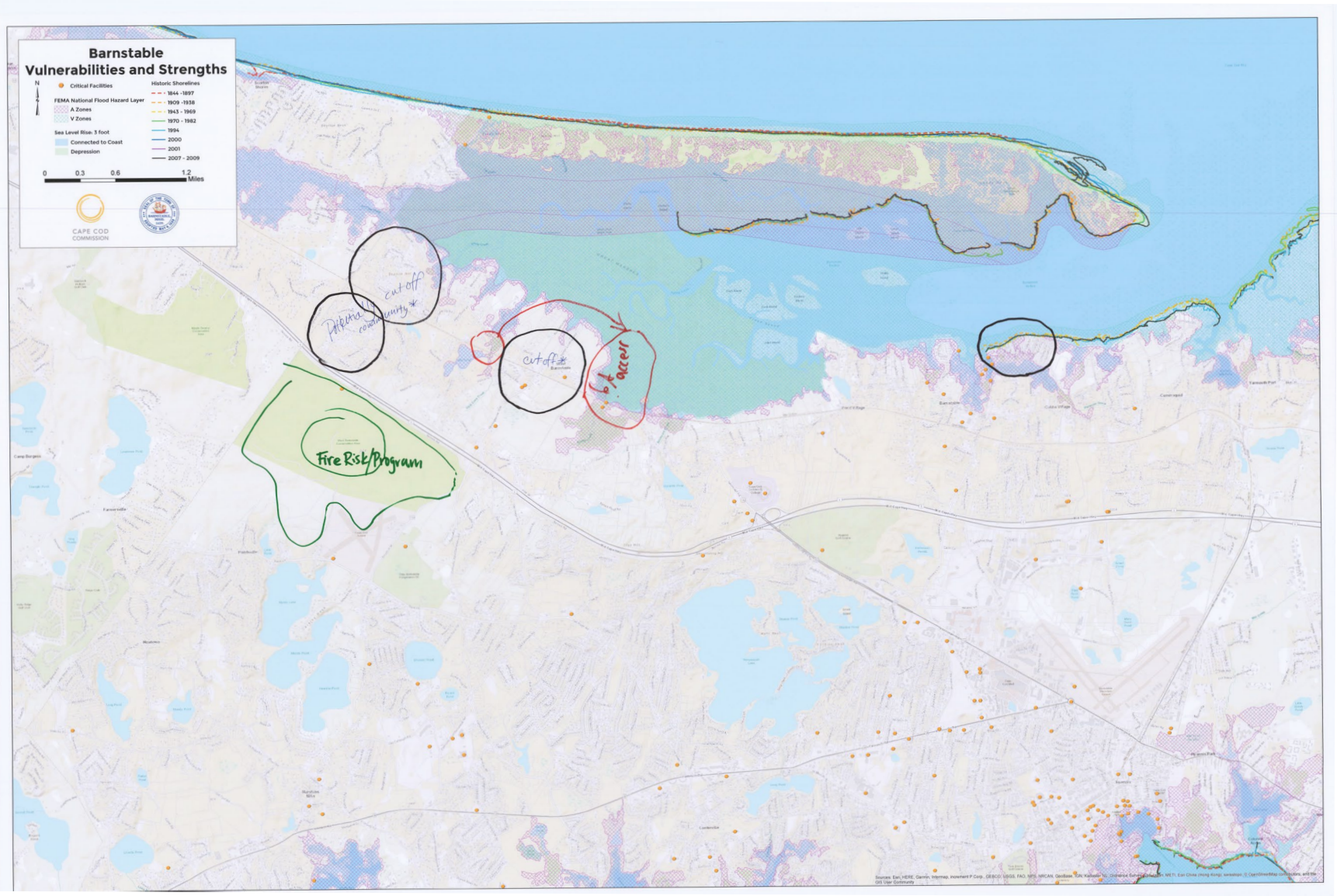
H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength

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

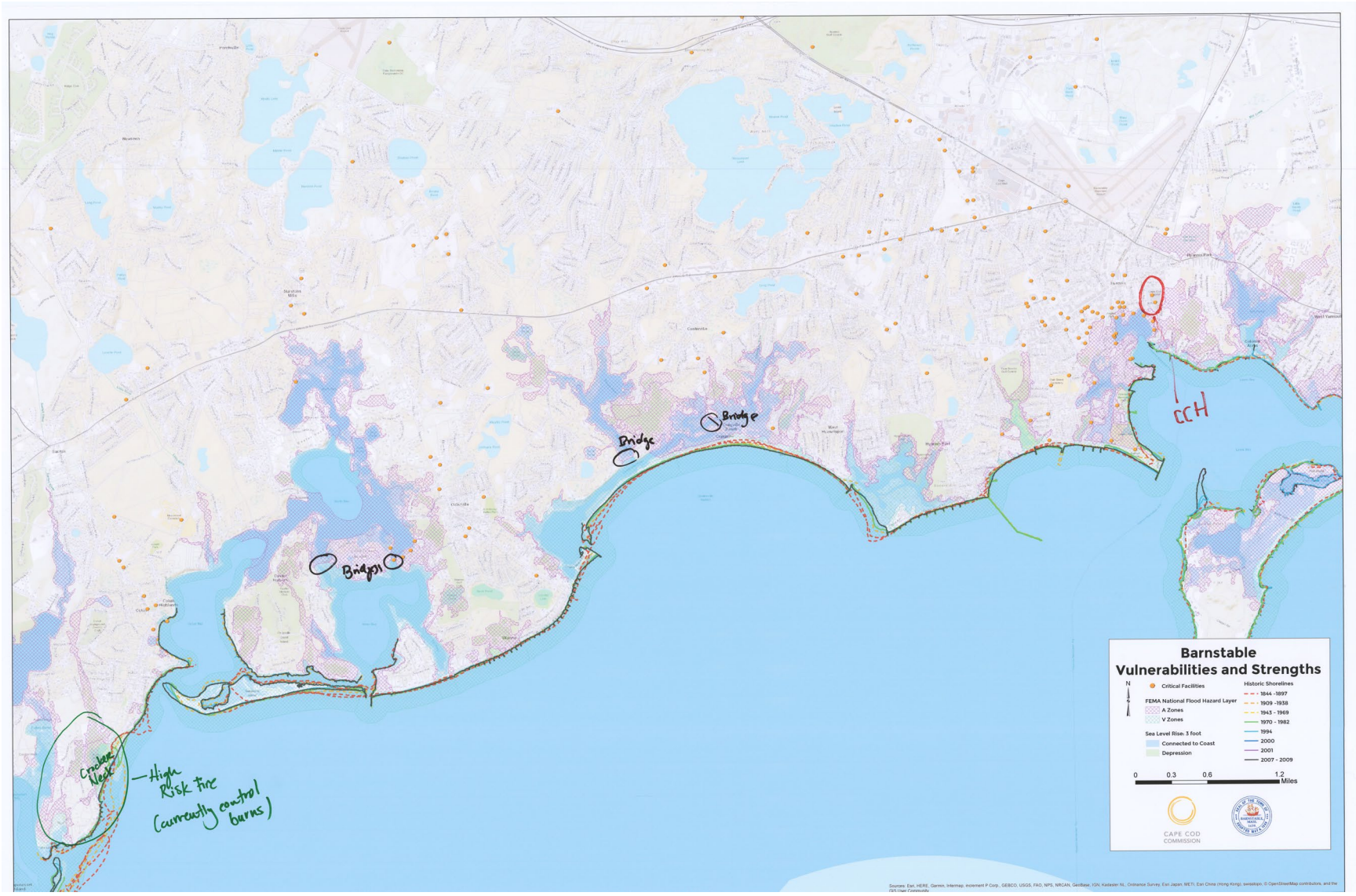
CLIMATE CHANGE

Features	Location	Ownership	V or S	High Winds	Flooding	Severe Storms	Erosion	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
Storm Water Systems	TW	Public	V/S						
Fuel Tanks in Marinas		Public/ Private	V						
Airport (2)	HV/Ots	Town/ Fed	S	-ID Capacity w/ Emergency Planning					
Societal									
First Responders	TW	Public	S	-Volunteer Training for Emergency Events M/O					
Intermediate Responders (Red Cross FEMA)	Region	Public	S						
Building Code	TW	Muni	S/V		-Energy Resiliency Strategies	H/O			
Zoning	TW		S/V	-Dynamic Zoning	Related to Sea Level Rise				
Schools/Libraries				-Public Education Campaign in Multiple Languages					
Civic Orgs									
Environmental									

GROUP A RISK MATRIX 2



GROUP B BASEMAP (NORTH)



GROUP B BASEMAP (SOUTH)

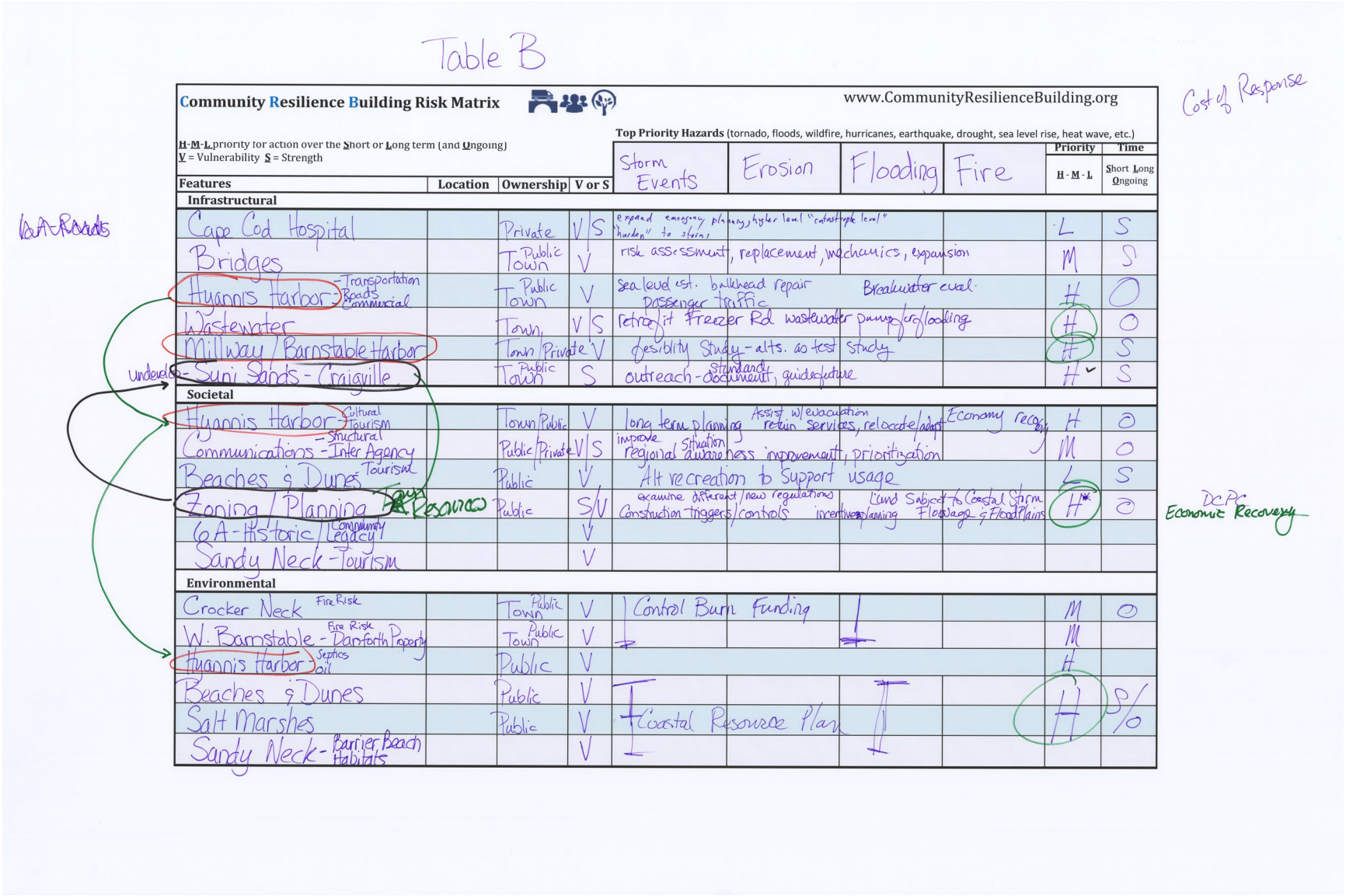


Table B

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V = Vulnerability S = Strength

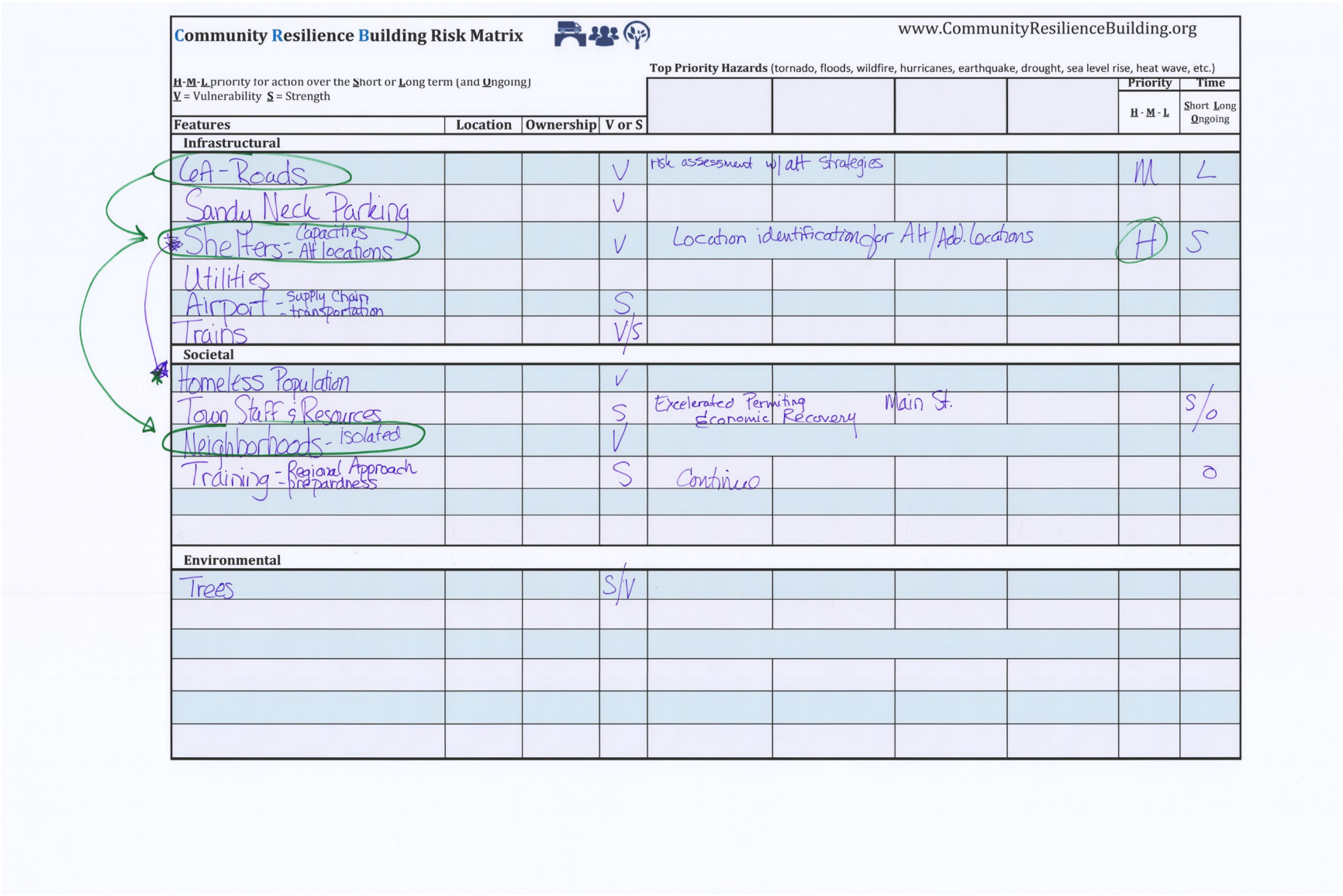
Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Storm Events	Erosion	Flooding	Fire	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
Cape Cod Hospital		Private	V/S	expand emergency planning, higher level "catastrophic level" "harden" to storms				L	S
Bridges		Public Town	V	risk assessment, replacement, mechanics, expansion				M	S
Hyannis Harbor - Transportation Roads Commercial		Public Town	V	sea level est. bulkhead repair passenger traffic		Breakwater eval.		H	O
Wastewater		Town	V/S	retrofit Freezer Rd wastewater pump/erg/flooding				H	O
Millway / Barnstable Harbor		Town Private	V	desibity Study - alts. as test study				H	S
Sun. Sands - Craigville		Public Town	S	outreach - standard documentation, guide future				H	S
Societal									
Hyannis Harbor - Cultural Tourism - Structural		Town Public	V	long term planning		Assist w/evacuation retain services, relocate/adapt	Economy recov.	H	O
Communications - Inter Agency		Public/Private	V/S	improve regional situation awareness improvement, prioritization				M	O
Beaches & Dunes - Tourism		Public	V	Alt recreation to Support usage				L	S
Zoning / Planning		Public	S/V	examine different/new regulations Construction triggers/controls		incentive planning Land Subject to Coastal Storm Flowage & Flood Plains		H	O
GA - Historic / Legacy / Community			V						
Sandy Neck - Tourism			V						
Environmental									
Crocker Neck - Fire Risk		Public Town	V	Control Burn Funding				M	O
W. Barnstable - Fire Risk - Danforth Property		Public Town	V					M	
Hyannis Harbor - Septics oil		Public	V					H	
Beaches & Dunes		Public	V					H	S/O
Salt Marshes		Public	V	Coastal Resource Plan				H	S/O
Sandy Neck - Barrier Beach Habitats			V						

Cost of Response

DCPC Economic Recovery

GROUP B RISK MATRIX 1



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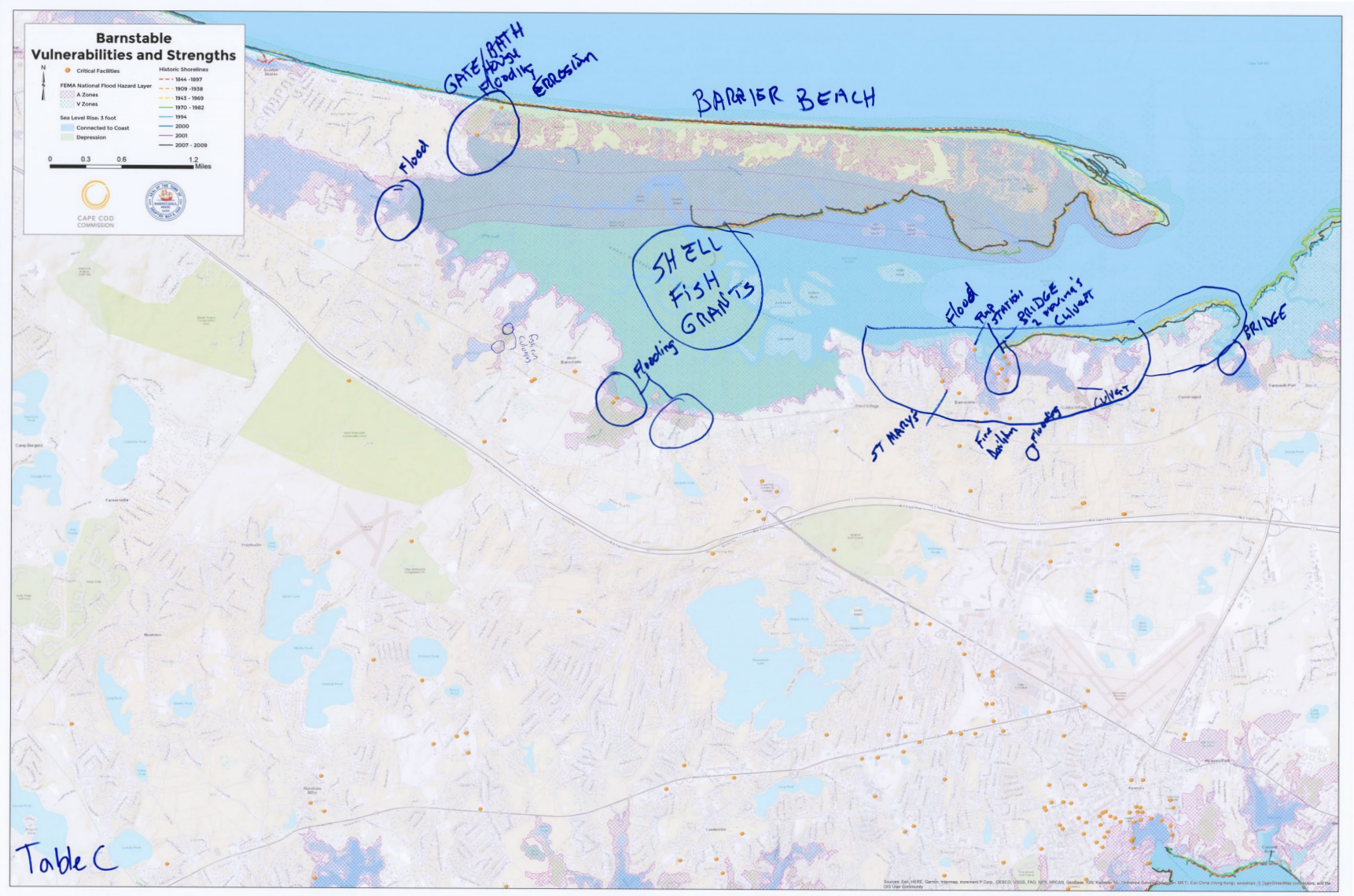
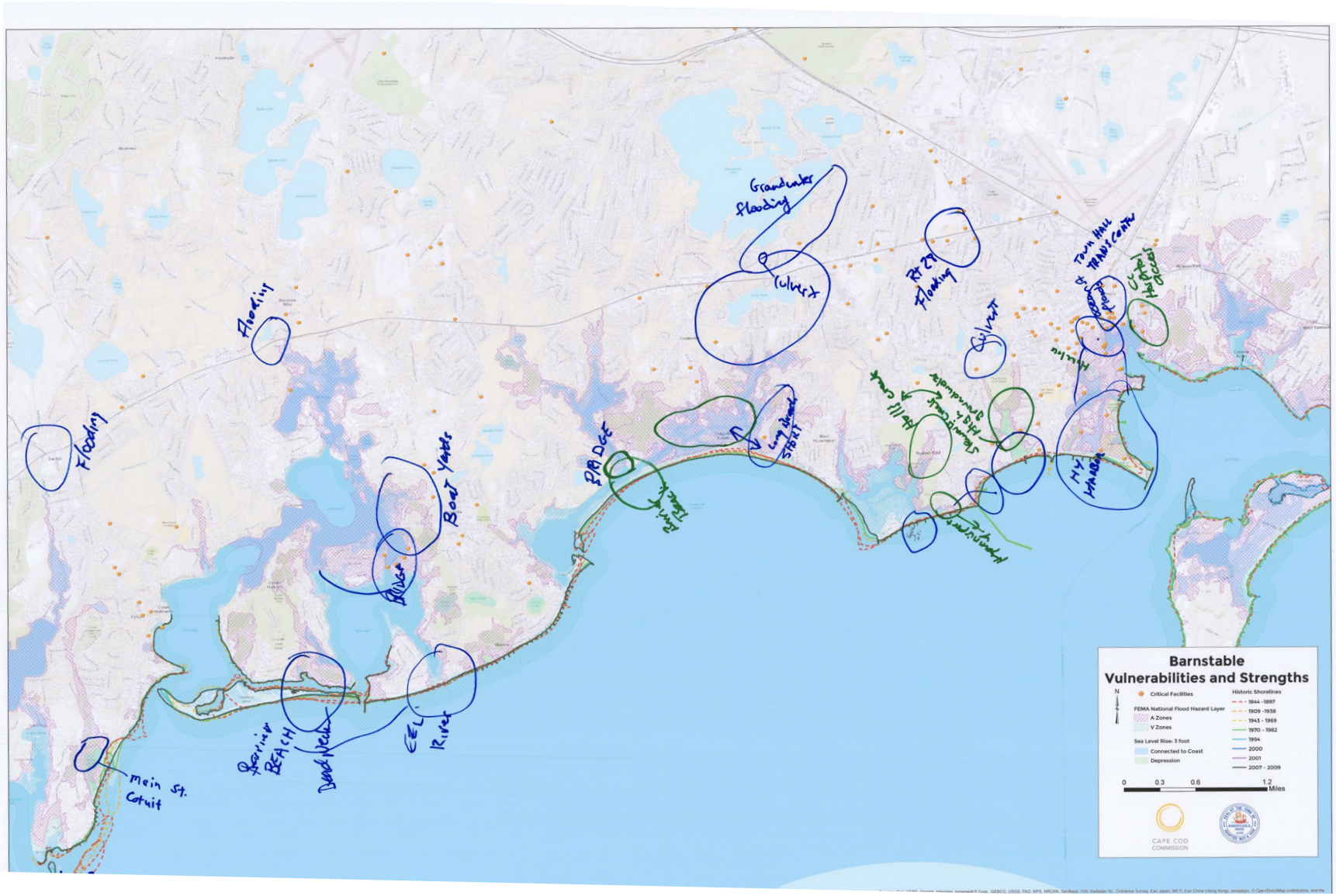
Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S					Priority H-M-L	Time Short Long Ongoing
Infrastructural									
CeA - Roads			V	risk assessment w/ alt strategies				M	L
Sandy Neck Parking			V						
Shelters - Capacities Alt locations			V	Location identification for Alt/Add. locations				H	S
Utilities									
Airport - supply chain - transportation			S						
Trains			V/S						
Societal									
Homeless Population			V						
Town Staff & Resources			S	Excelerated Permiting & Economic Recovery	Main St.				S/O
Neighborhoods - isolated			V						
Training - Regional Approach Preparedness			S	Continue					O
Environmental									
Trees			S/V						

GROUP B RISK MATRIX 2



GROUP C BASEMAP (NORTH)



GROUP C BASEMAP (SOUTH)

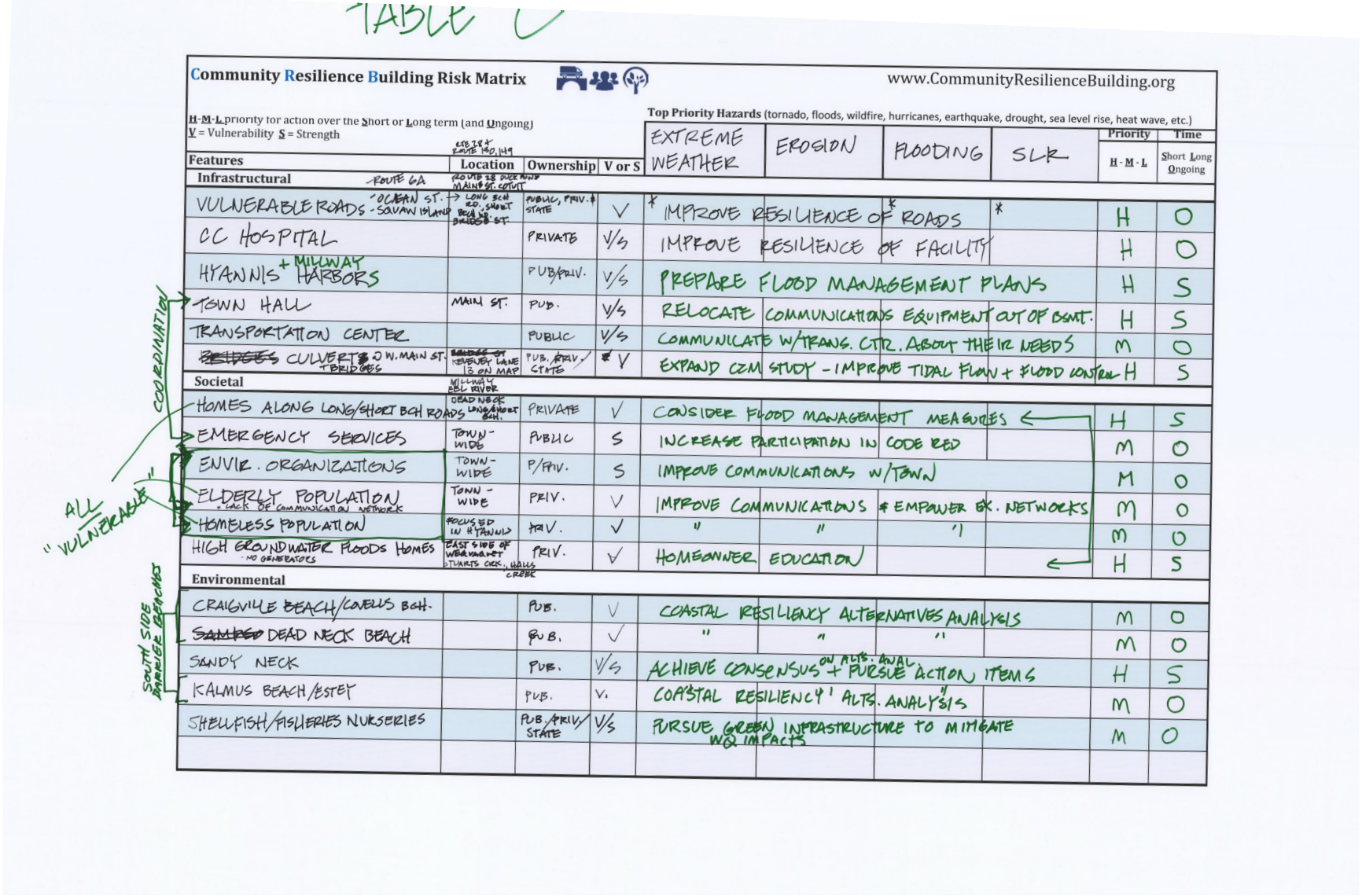


TABLE C

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

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

Features	Location	Ownership	V or S	EXTREME WEATHER	EROSION	FLOODING	SLR	Priority H-M-L	Time Short Long Ongoing
Infrastructural	ROUTE 6A / ROUTE 132 & ROUTE 130, 149 / ROUTE 28 DOWN MAIN ST. COUNT								
VULNERABLE ROADS - 'OCEAN ST. → SAQUAN ISLAND	LONG BCH RD., SHORT BCH RD & BRIDGE ST.	PUBLIC, PRIV. & STATE	V	* IMPROVE RESILIENCE OF ROADS			*	H	O
CC HOSPITAL		PRIVATE	V/S	IMPROVE RESILIENCE OF FACILITY				H	O
HYANNIS + MILLWAY HARBORS		PUB/PRIV.	V/S	PREPARE FLOOD MANAGEMENT PLANS				H	S
TOWN HALL	MAIN ST.	PUB.	V/S	RELOCATE COMMUNICATIONS EQUIPMENT OUT OF BSMT.				H	S
TRANSPORTATION CENTER		PUBLIC	V/S	COMMUNICATE W/TRANS. CTR. ABOUT THEIR NEEDS				M	O
~~BRIDGES~~ CULVERTS @ W. MAIN ST. + BRIDGES	~~BRIDGES~~ CULVERTS REVIEW LANE IS ON MAP	PUB./PRIV./ STATE	* V	EXPAND CZM STUDY - IMPROVE TIDAL FLOW + FLOOD CONTROL				H	S
Societal	MILLWAY & BBL RIVER								
HOMES ALONG LONG/SHORT BCH ROADS	DEAD NECK LONG & SHORT BCH.	PRIVATE	V	CONSIDER FLOOD MANAGEMENT MEASURES ←				H	S
EMERGENCY SERVICES	TOWN-WIDE	PUBLIC	S	INCREASE PARTICIPATION IN CODE RED				M	O
ENVIR. ORGANIZATIONS	TOWN-WIDE	P/PRIV.	S	IMPROVE COMMUNICATIONS W/TOWN				M	O
ELDERLY POPULATION * LACK OF COMMUNICATION NETWORK	TOWN-WIDE	PRIV.	V	IMPROVE COMMUNICATIONS & EMPOWER EX. NETWORKS				M	O
HOMELESS POPULATION	FOCUSED IN HYANNIS	PRIV.	V	"	"	"		M	O
HIGH GROUNDWATER FLOODS HOMES - NO GENERATORS	EAST SIDE OF WEAVER MKT STUARTS CKK., HALLS CREEK	PRIV.	V	HOMEOWNER EDUCATION			←	H	S
Environmental									
CRAIGVILLE BEACH/COVELLS BCH.		PUB.	V	COASTAL RESILIENCY ALTERNATIVES ANALYSIS				M	O
~~SANDY~~ DEAD NECK BEACH		PUB.	V	"	"	"		M	O
SANDY NECK		PUB.	V/S	ACHIEVE CONSENSUS ON ALTS. ANAL. + PURSUE ACTION ITEMS				H	S
KALMUS BEACH/ESTEY		PUB.	V	COASTAL RESILIENCY ALTS. ANALYSIS "				M	O
SHELLFISH/FISHERIES NURSERIES		PUB./PRIV./ STATE	V/S	PURSUE GREEN INFRASTRUCTURE TO MITIGATE W/Q IMPACTS				M	O

COORDINATION

ALL " VULNERABLE

SOUTH SIDE MARINAS/BEACHES

GROUP C RISK MATRIX 1

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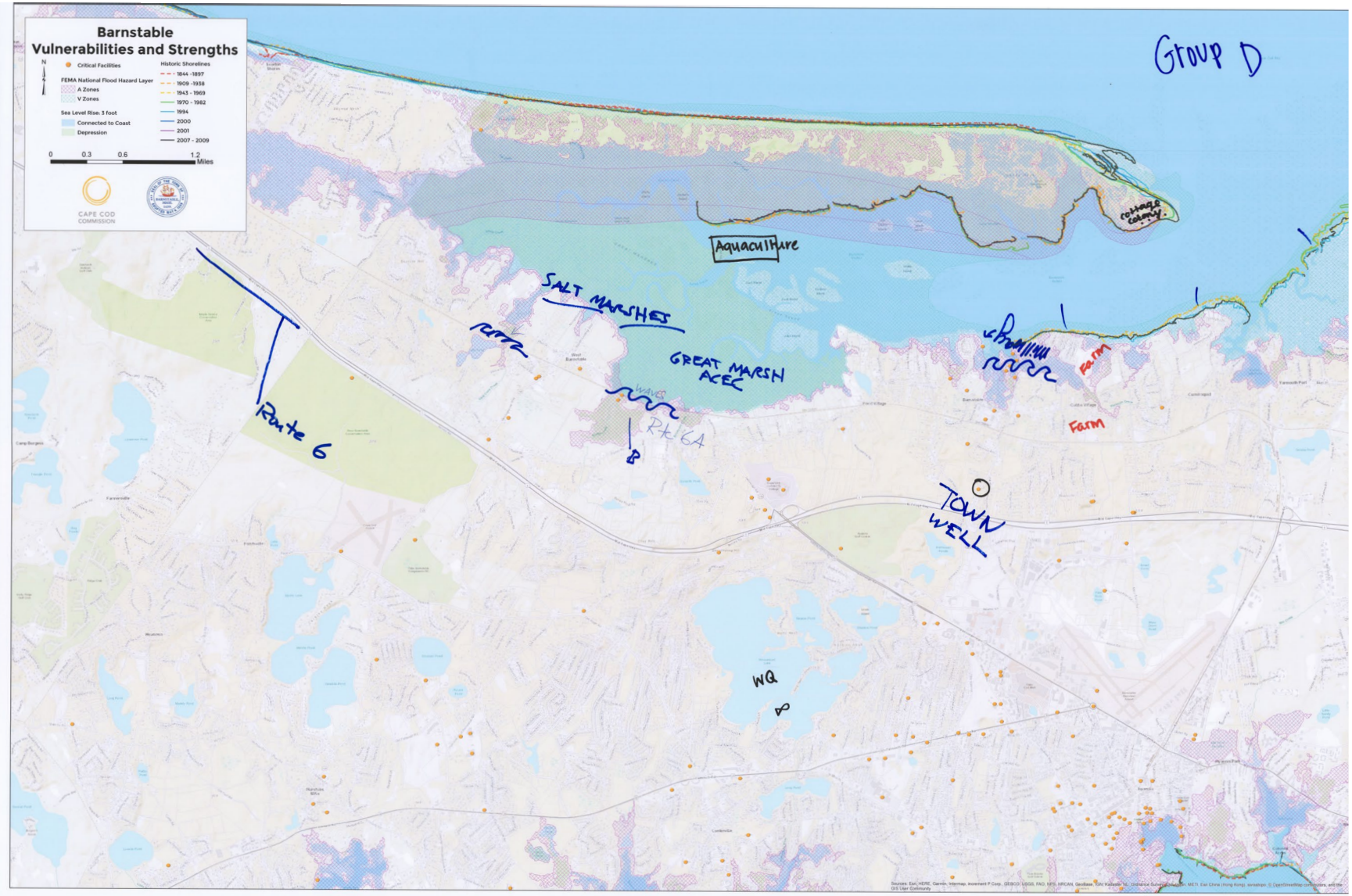
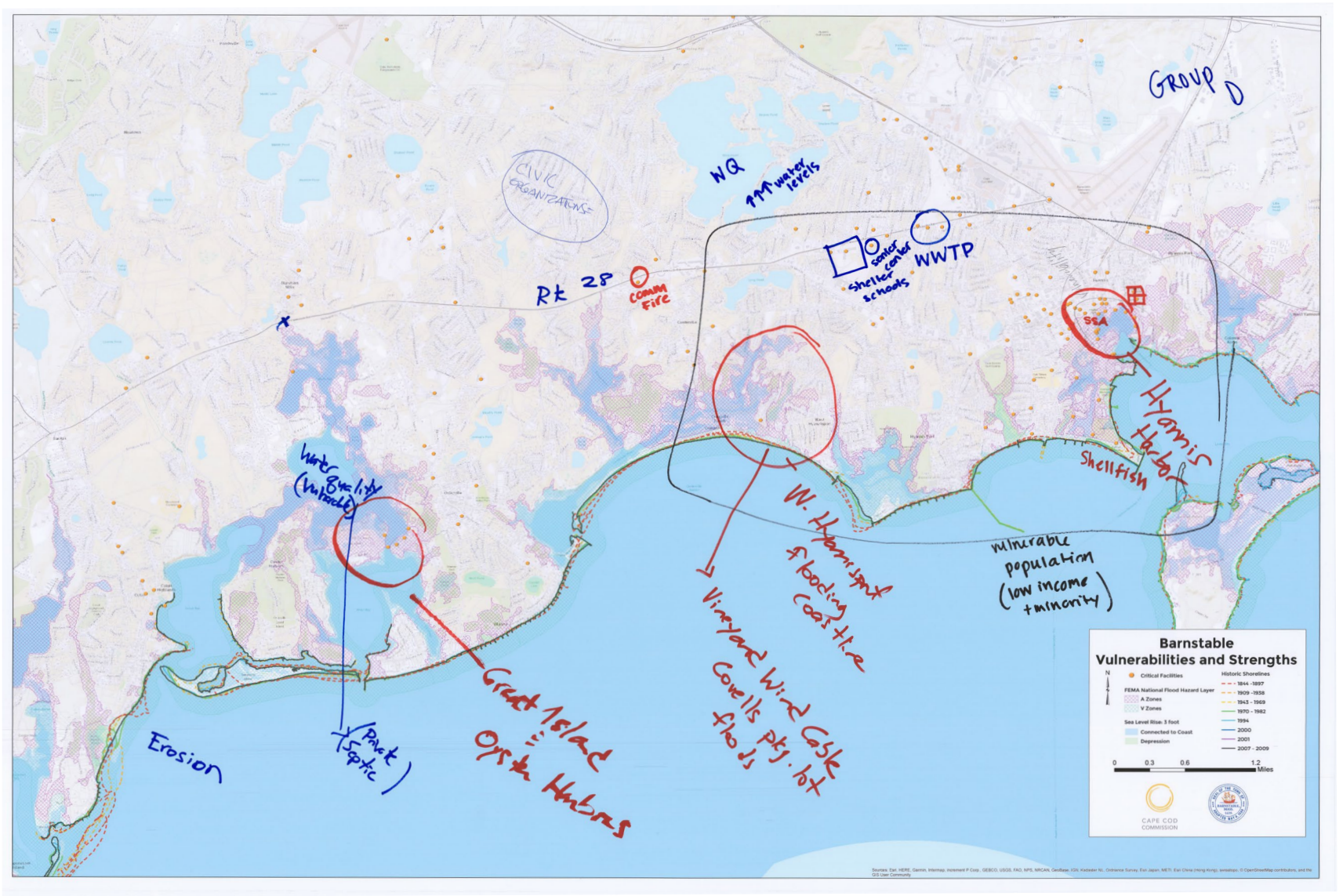
Features	Location	Ownership	V or S	EXTREME WEATHER	EROSION	FLOODING	SLR	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
BOATYARDS	OSTERVILLE - OYSTER HARBORS - CROSBY	PRIVATE	V	COMMUNICATE	W/BOATYARDS	ABOUT HAZ WASTE MGMT.		M	O
HYANNIS YACHT CLUB	HYANNISPORT	PRIV.	V						
SANDY NECK BATHOUSE		PUBLIC	V	SEE	OTHER	PAGE		H	S
FIRE STATION	BARN. VILL.	PUB.	V/S	Assess	RESILIENCY	OF	FIRE STATION	H	S
LOCAL ROADS FLOODING "HIGH GW FLOOD/STORMWATER"	TOWN WIDE	PUB.	V	DEVELOP	STORMWATER	MGMT.	PLAN	H	S
Societal									
Environmental									

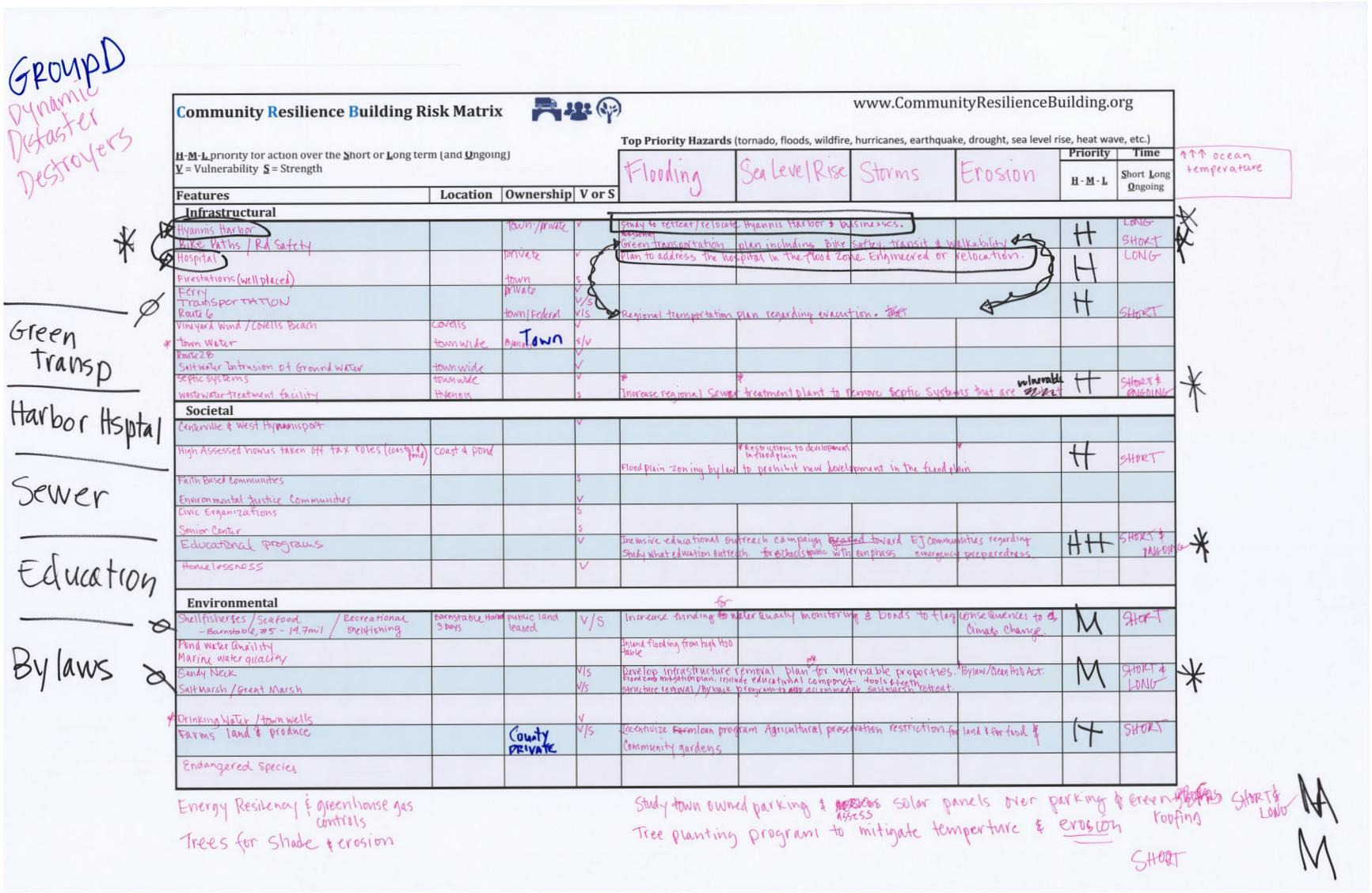
GROUP C RISK MATRIX 2



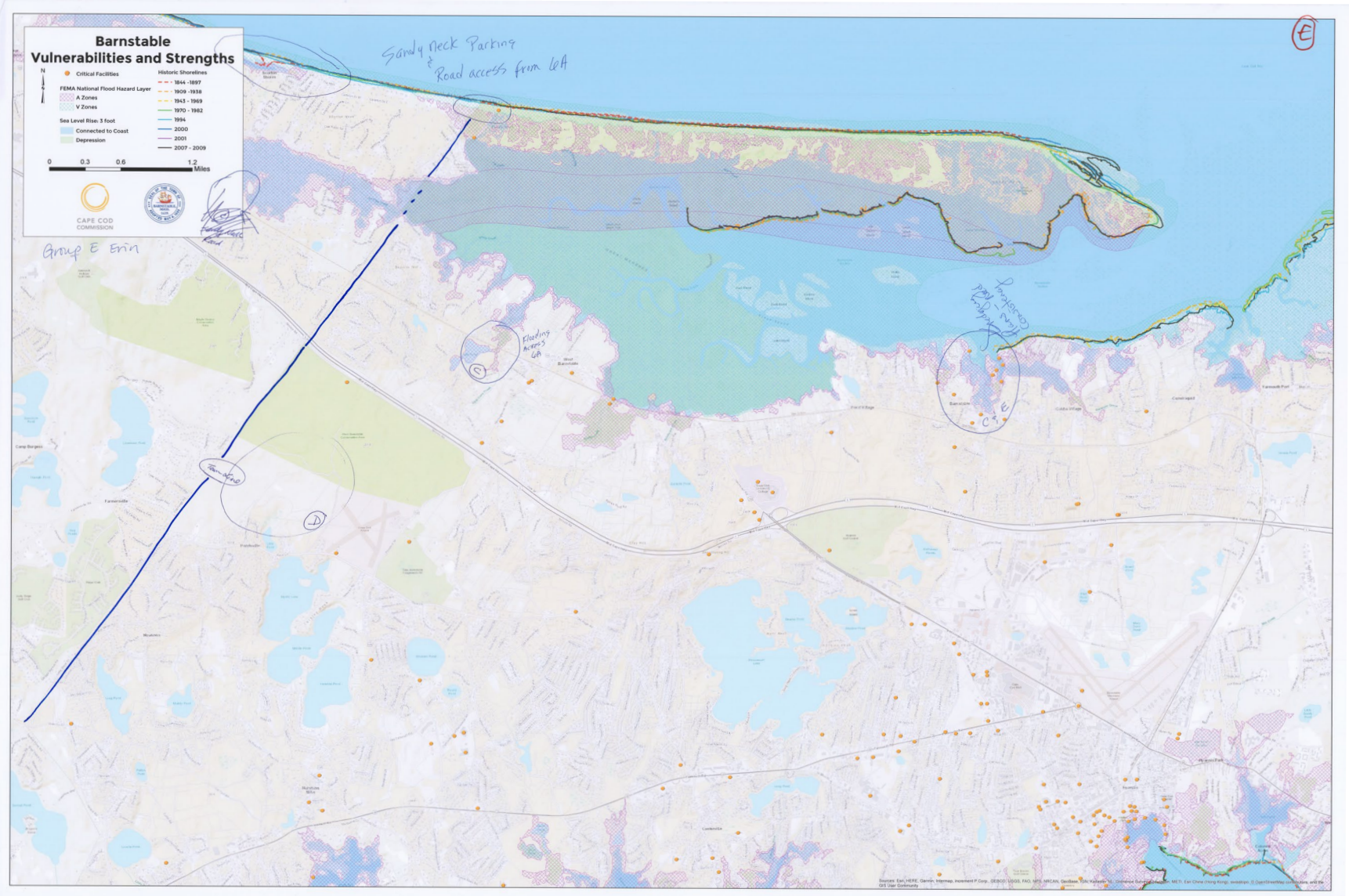
GROUP D BASEMAP (NORTH)



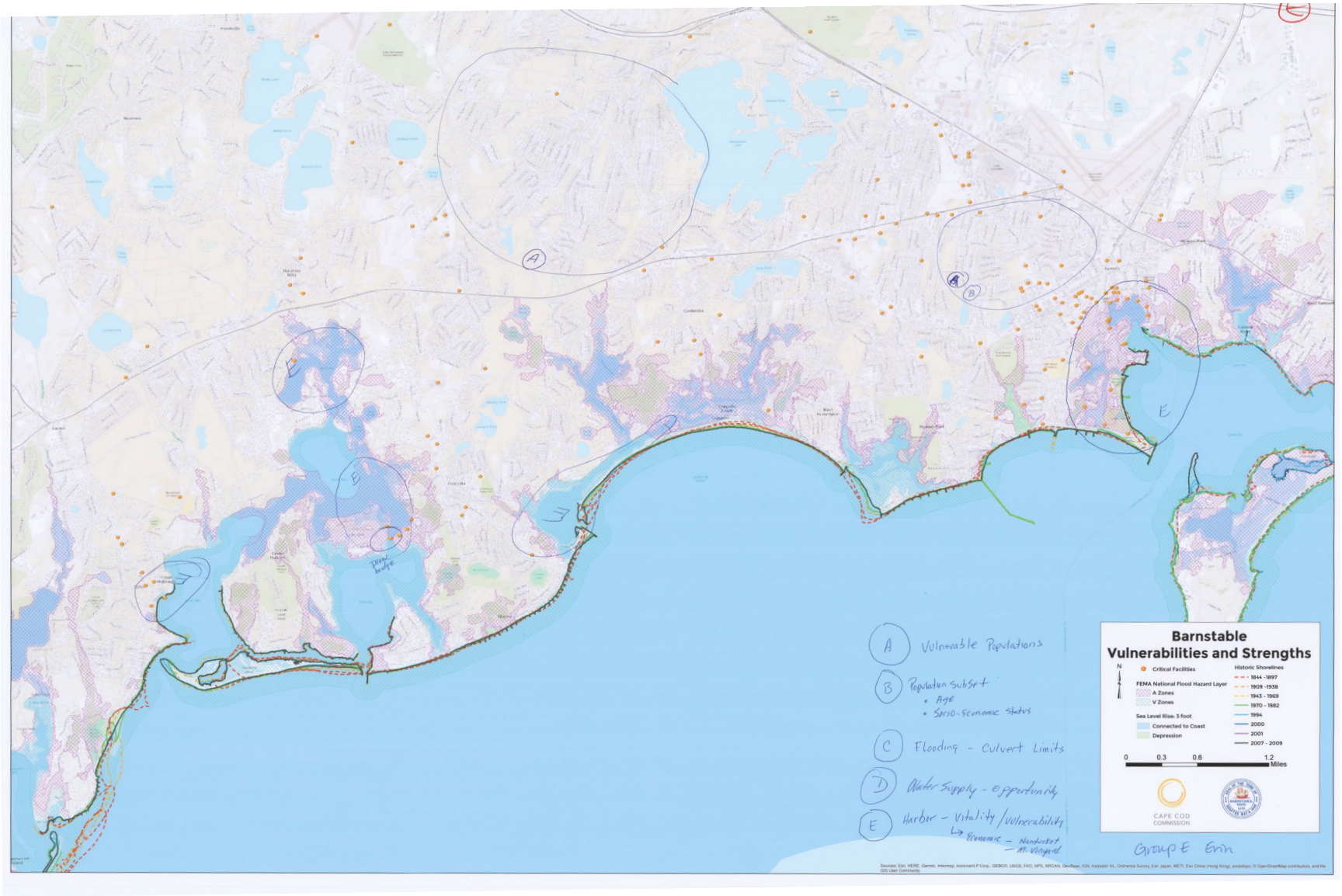
GROUP D BASEMAP (SOUTH)



GROUP D RISK MATRIX 1



GROUP E BASEMAP (NORTH)



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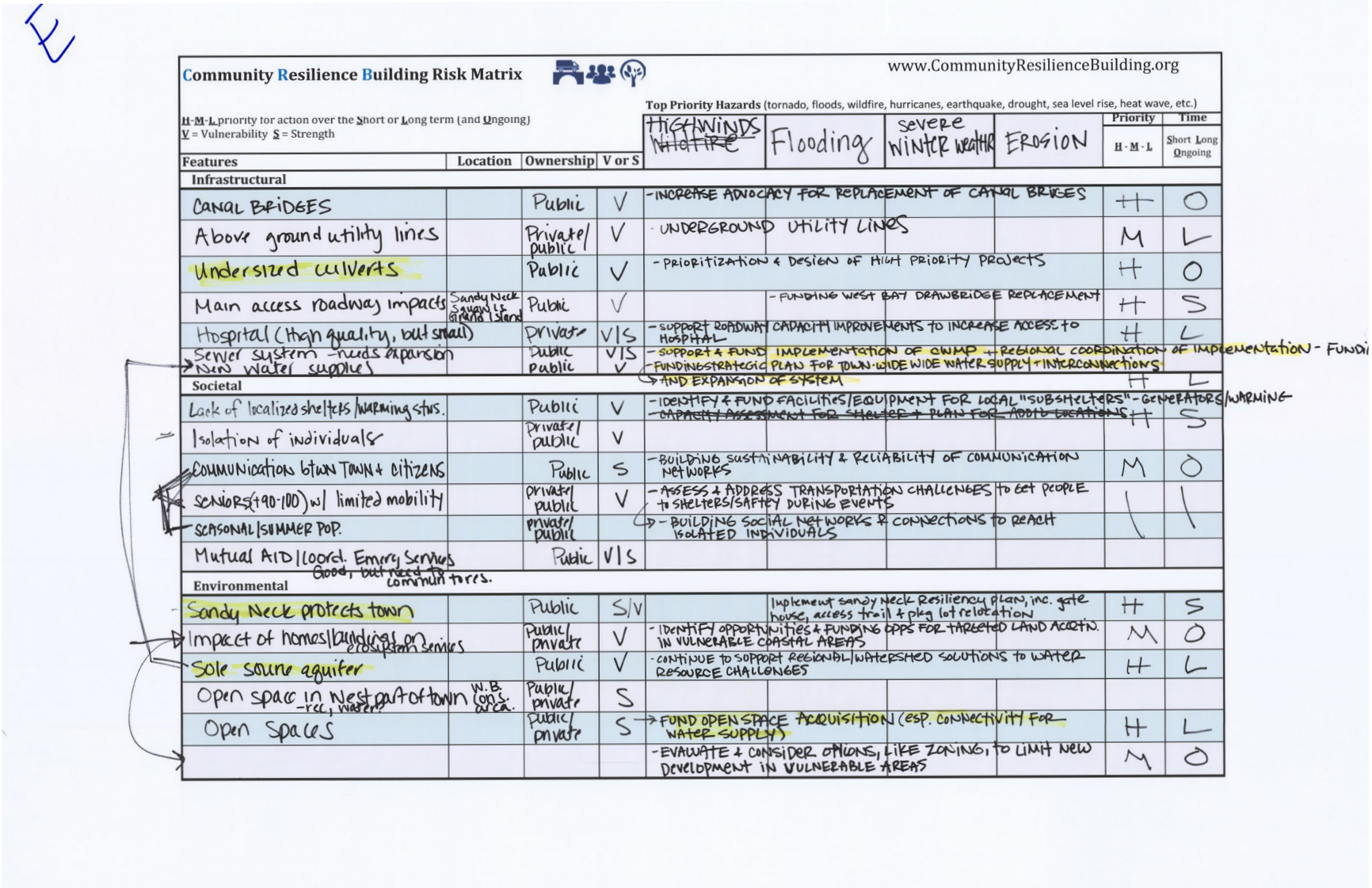

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Features	Location	Ownership	V or S	HIGH WINDS WILDFIRE	Flooding	severe WINTER WEATHR	EROSION	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
CANAL BRIDGES		Public	V	-INCREASE ADVOCACY FOR REPLACEMENT OF CANAL BRIGES				H	O
Above ground utility lines		Private/ public	V	- UNDERGROUND UTILITY LINES				M	L
Undersized culverts		Public	V	- PRIORITIZATION & DESIGN OF HIGH PRIORITY PROJECTS				H	O
Main access roadway impacts	Sandy Neck Sawyer Lt Strong Island	Public	V		- FUNDING WEST BAY DRAWBRIDGE REPLACEMENT			H	S
Hospital (high quality, but small)		Private	V/S	- SUPPORT ROADWAY CAPACITY IMPROVEMENTS TO INCREASE ACCESS TO HOSPITAL				H	L
Sewer system -needs expansion		Public	V/S	- SUPPORT & FUND IMPLEMENTATION OF CWMP → REGIONAL COORDINATION OF IMPLEMENTATION - FUNDI					
New water supplies		Public	V	- FUNDING STRATEGIC PLAN FOR TOWN-WIDE WIDE WATER SUPPLY + INTERCONNECTIONS → AND EXPANSION OF SYSTEM				H	L
Societal									
Lack of localized shelters/warming stns.		Public	V	- IDENTIFY & FUND FACILITIES/EQUIPMENT FOR LOCAL "SUBSHELTERS" - GENERATORS/WARMING - ~~CAPACITY ASSESSMENT FOR SHELTER + PLAN FOR ADDTL LOCATIONS~~				H	S
Isolation of individuals		Private/ public	V						
COMMUNICATION b/w TOWN & CITIZENS		Public	S	- BUILDING SUSTAINABILITY & RELIABILITY OF COMMUNICATION NETWORKS				M	O
SENIORS (+90-100) w/ limited mobility		private/ public	V	- ASSESS & ADDRESS TRANSPORTATION CHALLENGES to get PEOPLE to SHELTERS/SAFTEY DURING EVENTS					
SEASONAL/SUMMER POP.		private/ public		→ - BUILDING SOCIAL NETWORKS & CONNECTIONS TO REACH ISOLATED INDIVIDUALS					
Mutual AID/coord. Emerg Services		Public	V/S	Good, but need to communicate.					
Environmental									
Sandy Neck protects town		Public	S/V		Implement sandy neck Resiliency plan, inc. gate house, access trail & pkg lot relocation			H	S
Impact of homes/buildings on ecosystem services		Public/ private	V	- IDENTIFY OPPORTUNITIES & FUNDING OPPS FOR TARGETED LAND ACQTN. IN VULNERABLE COASTAL AREAS				M	O
Sole source aquifer		Public	V	- CONTINUE TO SUPPORT REGIONAL/WATERSHED SOLUTIONS TO WATER RESOURCE CHALLENGES				H	L
Open space in West part of town -rec, water?	W.B. cons. area.	Public/ private	S						
Open Spaces		Public/ private	S	→ FUND OPEN SPACE ACQUISITION (esp. CONNECTIVITY FOR WATER SUPPLY)				H	L
				- EVALUATE & CONSIDER OPTIONS, LIKE ZONING, TO LIMIT NEW DEVELOPMENT IN VULNERABLE AREAS				M	O

GROUP E RISK MATRIX 1

E

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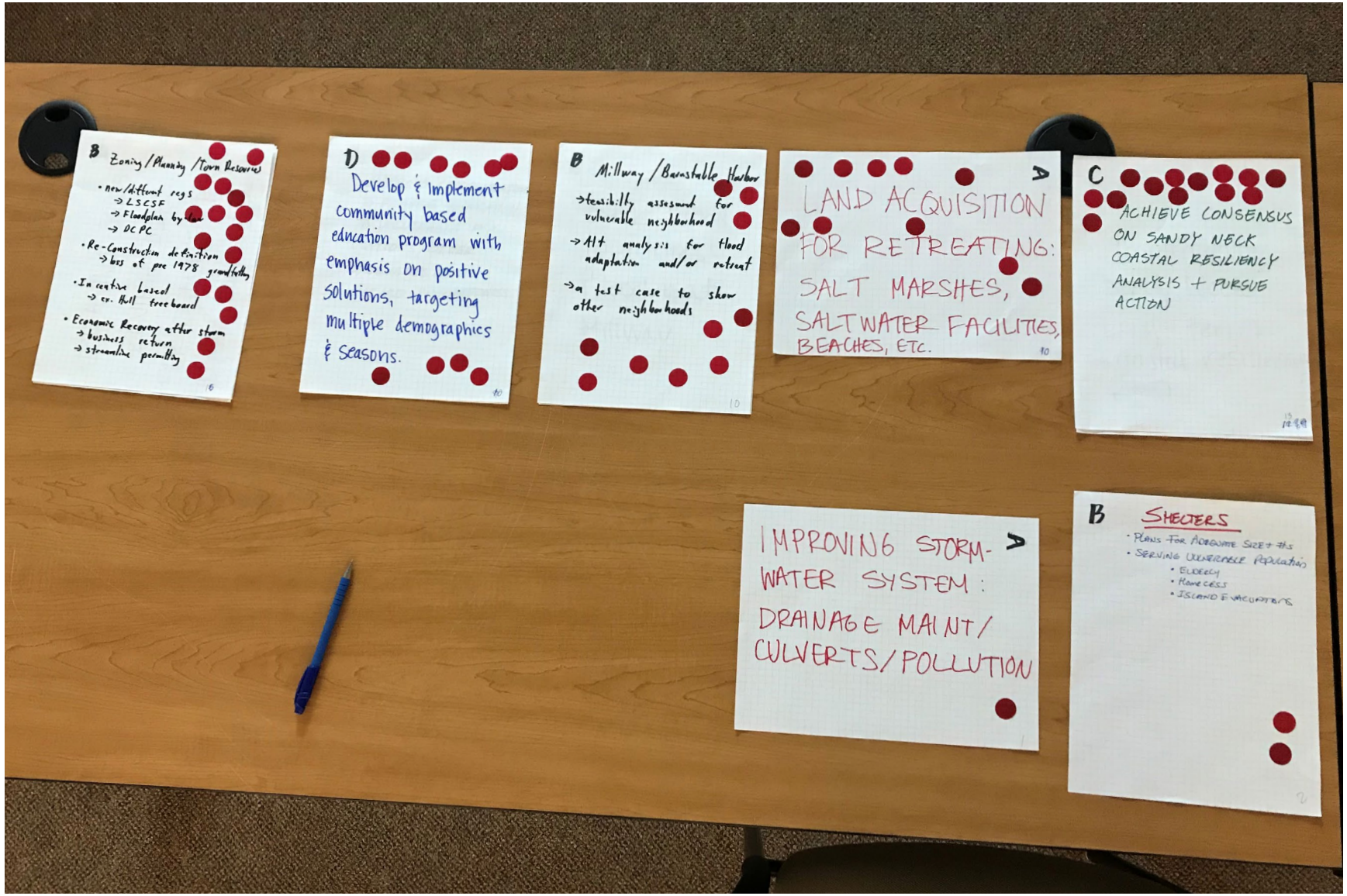
Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	High Winds	Flood	Winter Weather	Erosion	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
Marstons Mills Airfield – rec emerg.		Public	S						
Municipal airport – econ. emerg.		public	S						
Harbor + associated infra – econ. Benefit		public/ private	S/V	? INCREASE RELIABILITY OF WATER TRANSPORT – CONDUCT FLOODING & RESILIENCY STUDY OF HARBORS				L L	L L
Millway/Commerce Rd Flooding		Public	V		# for Roadway + culvert, etc impacts			H	S
Societal									
Strong Town committees		Public	S						
Environmental									

GROUP E RISK MATRIX 2



DOT EXERCISE RESULTS

Municipal Vulnerability Preparedness Workshop

TOWN OF BARNSTABLE

March 29, 2019

Today's Agenda

Morning

- **9:00 Registration, coffee, tea...**
- **9:15 Workshop Overview and Introductions** – Elizabeth Jenkins
- **9:30 MVP Program Background** – Heather McElroy
- **9:45 Science, Climate Projections, Resources** – Greg Berman
- **10:15 Break**
- **10:20 Small Team Exercise**
  - **Team Orientation**
  - **Discuss and Identify Priority Hazards**
  - **Identify Vulnerable Features and Strengths**
  - **Prepare for Report-out**
- **12:00 Teams Report on Hazards, Vulnerabilities, Strengths**
- **12:30 Lunch!**

Today's Agenda

Afternoon

- **1:00 Review afternoon workshop goals** – Shannon Hulst Jarbeau
- **1:10 Small Team Exercise** – Heather McElroy
  - **Discuss and Identify Actions**
  - **Identify Priority and Urgency of Actions**
  - **Prepare for Report Out**
- **2:45 Break**
- **3:00 Small Teams Report on Top Actions**
- **3:30 Dot Exercise**
- **3:45 Summary Discussion – Compile Top Actions**
- **4:15 Wrap Up and Next Steps**
- **4:30 Adjourn**

Project Team

MVP PROVIDER | CAPE COD COMMISSION

- Sharon Rooney - *Chief Planner*
- Heather McElroy - *Natural Resources Manager*
- Erin Perry – *Deputy Director*
- Chloe Schaefer - *Community Design Planner*
- Martha Hevenor - *Planner II*
- Anne Reynolds - *GIS Director*

MVP PROVIDER | COOPERATIVE EXTENSION

- Greg Berman - *Coastal Processes Specialist, Woods Hole Sea Grant/ Cape Cod Cooperative Extension*
- Shannon Hulst Jarbeau - *Floodplain Specialist & CRS Coordinator, Woods Hole Sea Grant/Cape Cod Cooperative Extension*

TOWN PROJECT MANAGER

- Elizabeth Jenkins – *Director of Planning and Development*

WORKSHOP PRESENTATION

MVP Program Background

EXECUTIVE ORDER 569: AN INTEGRATED CLIMATE CHANGE STRATEGY FOR THE COMMONWEALTH 9.16.16

- Reducing greenhouse gas emissions to combat climate change
- Preparing for the impacts of climate change
  - State Adaptation Plan
  - Agency Vulnerability Assessments
  - Municipal Support
  - Climate Coordinators

4

ENVIRONMENTAL BOND BILL, 3.15.18

- $1.4 billion bond bill with focus on climate change resiliency
- $300 million for climate change adaptation
- Codifies EO 569

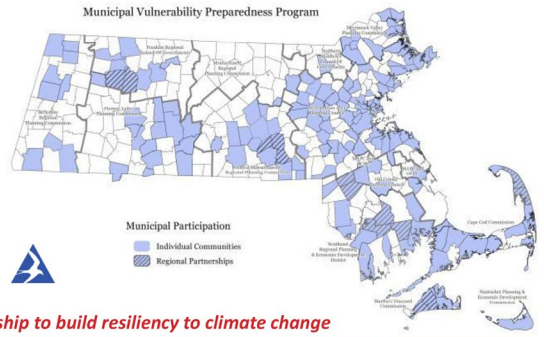
5

- www.resilientma.com
- **Integrated Plan:** First in the nation Climate Adaptation and Hazard Mitigation plan
- **Mainstreaming climate change**: Incorporating climate change into current planning, budgeting, and policy frameworks

WORKSHOP PRESENTATION

Municipal Vulnerability Preparedness (MVP)

2017-2019



State and local partnership to build resiliency to climate change

1. Engage Community
2. Identify CC impacts and hazards
3. Complete assessment of vulnerabilities & strengths
4. Develop and prioritize actions
5. Take Action

7

MVP 2018

- 82 new planning grants, now 43% of the Commonwealth
- 39 Action Grant projects
- $7.2 million dollars committed
- ~~Have budgeted~~ $10 million approved for action grants next year in Governor Baker's Capital Plan

29

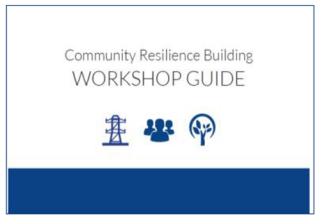
MVP Action Grant

- **Who's eligible?**
  - Municipalities with MVP designation
  - Municipalities completing 2017 MVP process who have completed workshop(s) and have identified prioritized actions
- Funding: $10,000 - $400,000 per project
- Match: At least 25% of total project cost required

25

MVP Principles

- **Community-led process** that employs local knowledge and requires local buy-in and support
- **Accessible**
- **Utilizes partnerships** and leverages existing efforts
- **Mainstreams** climate change
- **See communities** as local innovators
- **Frames** coordinated statewide efforts.



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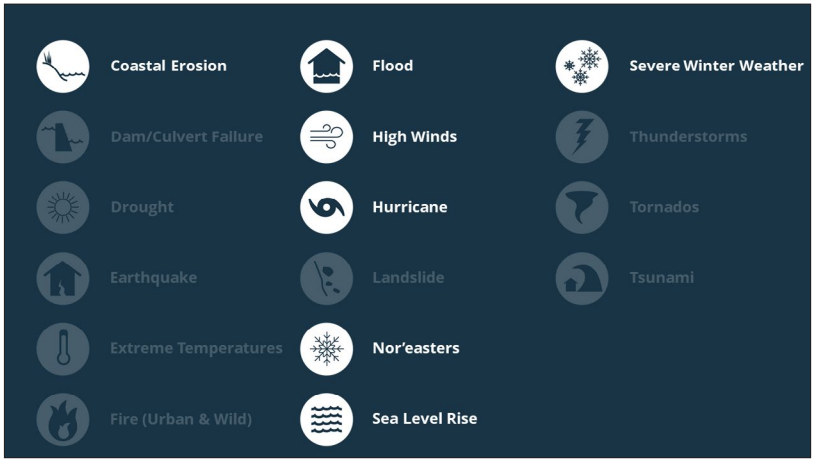
WORKSHOP PRESENTATION



WORKSHOP PRESENTATION

Examples of Vulnerability/ Hazards

From State Hazard Mitigation Plan

Changes in Precipitation
- Inland Flooding
- Drought
- Landslide

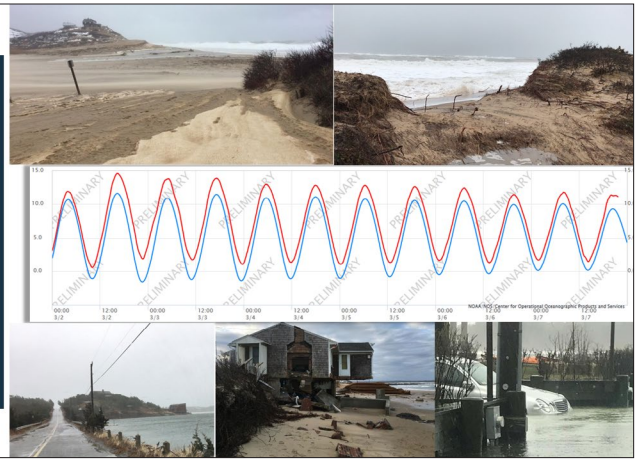
Sea Level Rise
- Coastal Flooding
- Coastal Erosion
- Tsunami

Rising Temperatures
- Average/Extreme Temperature
- Wildfires
- Invasive Species

Extreme Weather
- Hurricanes/Tropical Storms
- Severe Winter Storm / Nor'easter
- Tornadoes

Earthquake

HAZARD Storms



HAZARD Storms: Erosion & Flooding

HAZARD Sea Level Rise

Nor'Easter (January 2018)

Hurricane Sandy (10/29-30/2012)
Predicted High WL = 10.3 MLLW
Actual High WL = 12.8 MLLW
Max Surge: 4.5'
High Tide Surge: 2.5'

Nor'easter Nemo (2/8-2/9/2013)
Predicted High WL = 10.0 MLLW
Actual High WL = 13.0 MLLW
Max Surge: 3.9'
High Tide Surge: 3.0'

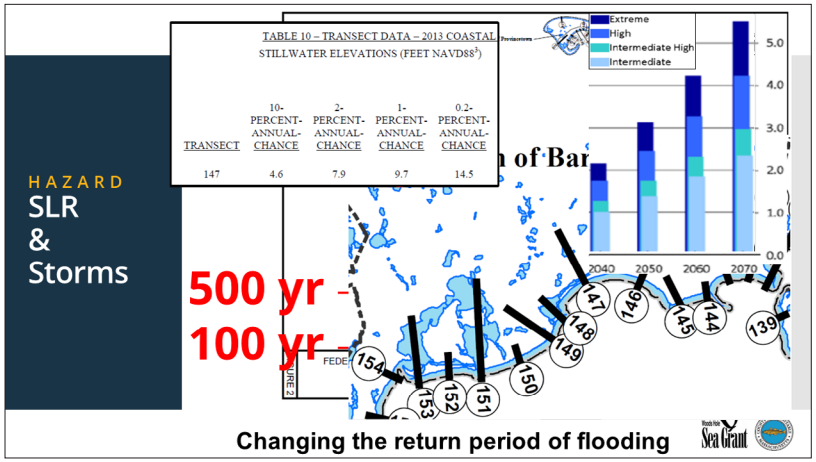
Nor'easter Grayson (1/4-5/2018)
Predicted High WL = 12.1 MLLW
Actual WL = 15.2 MLLW
Max Surge: 3.1'
High Tide Surge: 3.1'

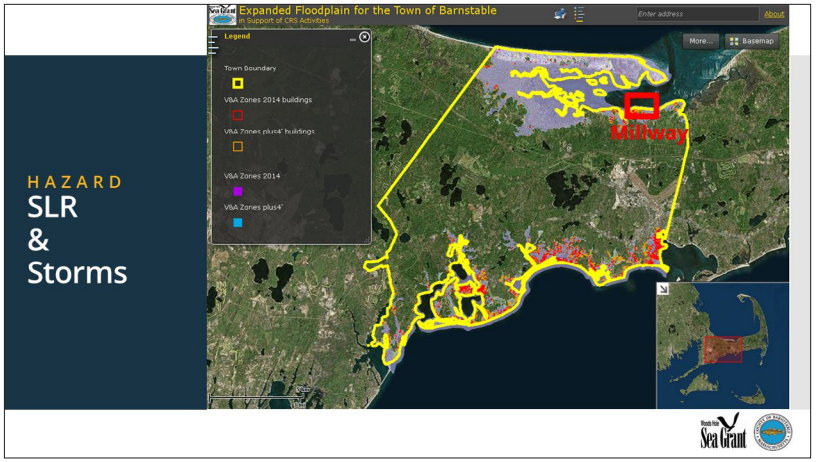
SL has risen ~4.5" in the 40 years since 1978....so SLR is the reason the record was broken!!!

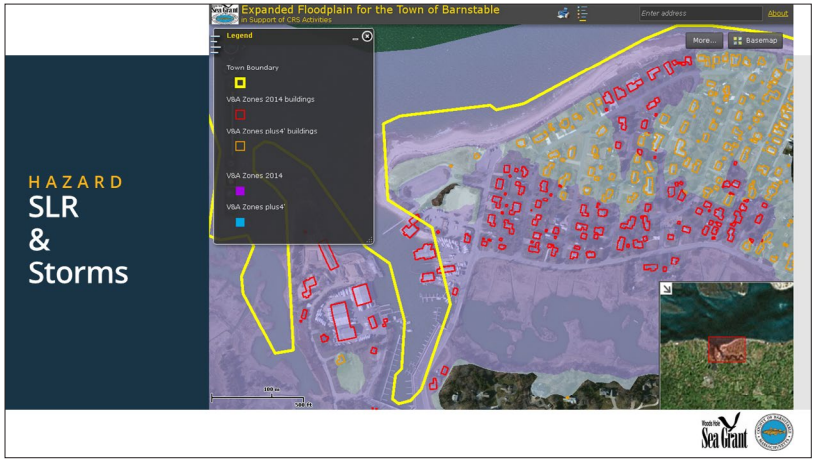
In Boston, a storm tide of 15.16' was recorded which beat the record set by the Blizzard of 1978 (15.0')

~2"

WORKSHOP PRESENTATION



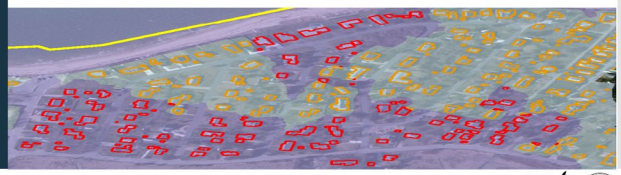




WORKSHOP PRESENTATION

HAZARD
SLR & Storms

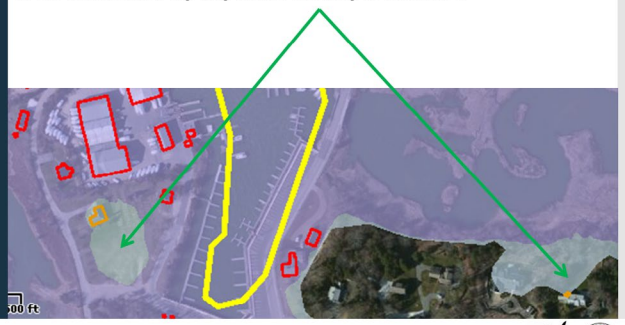
	# houses	#houses (+4')	Diff	Acres	Acres (+4')	Diff
Cape Cod Bay	324	648	2x	7,101	7,562	461
Nantucket Sound	1,880	3,138	1.7x	5,060	6,059	999
Total for Barnstable	2,204	3,786	1.7x (>1,500)	12,162	13,622	1,460



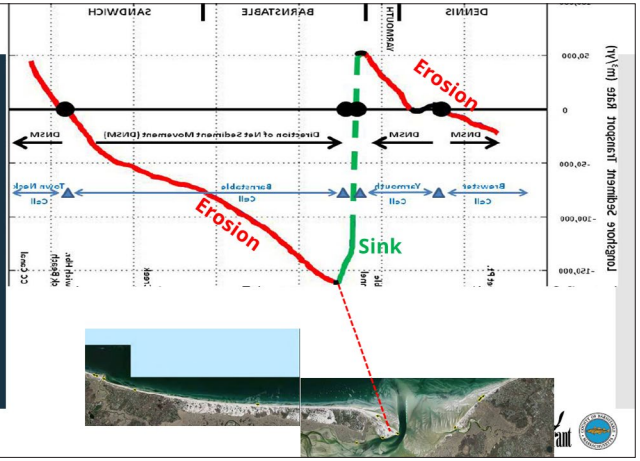
HAZARD
SLR & Storms

A well built house can last > 100 years...
...consider the existing and potential floodplain!

Areas that are now dry may not be that way in the future.

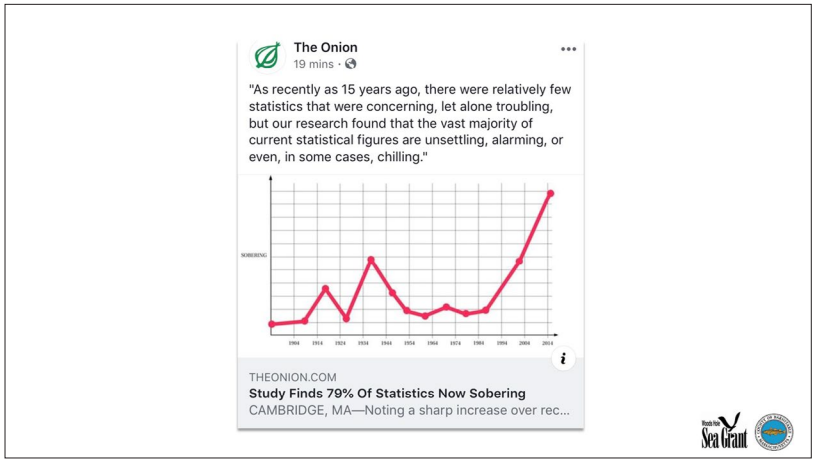


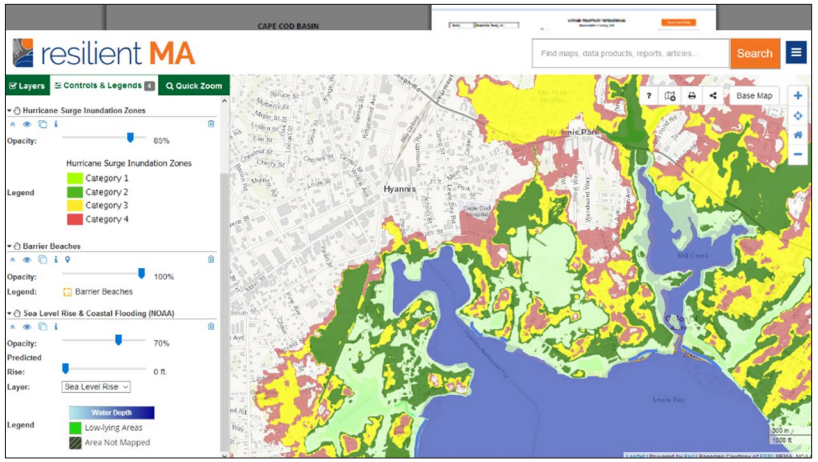
HAZARD
Erosion

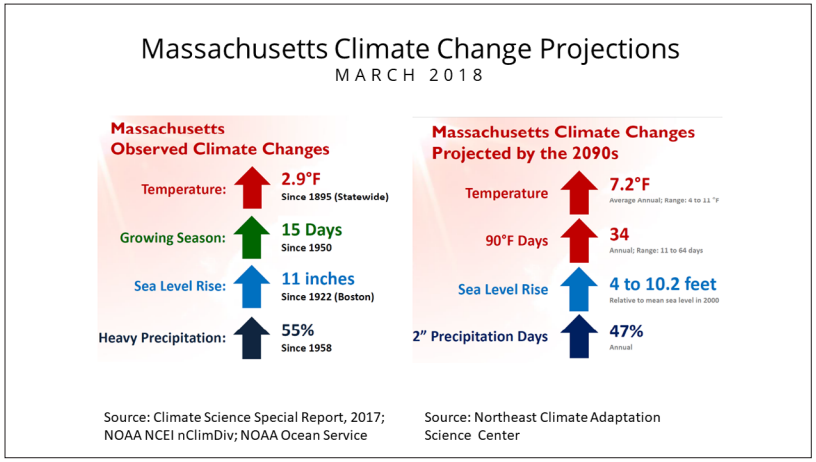


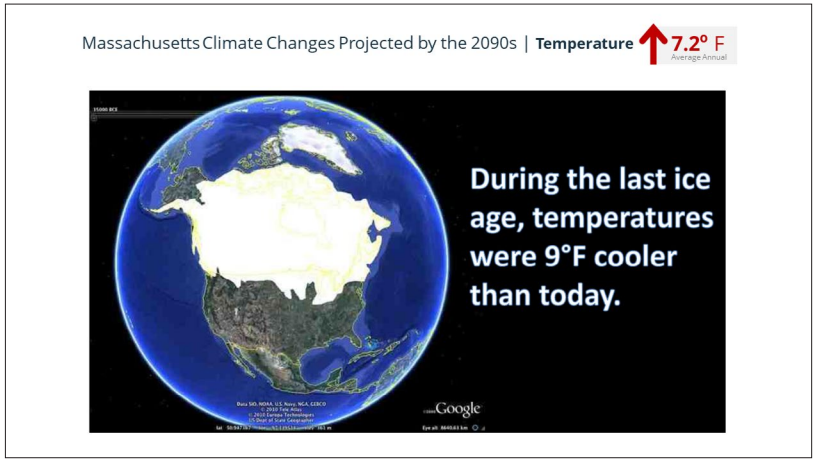
Overview of Data and Maps

WORKSHOP PRESENTATION



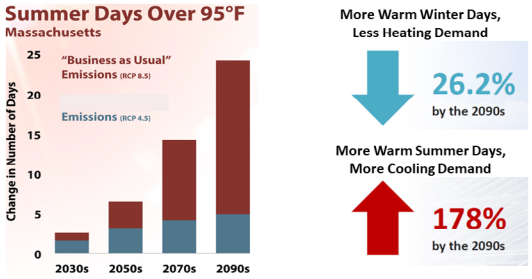






WORKSHOP PRESENTATION

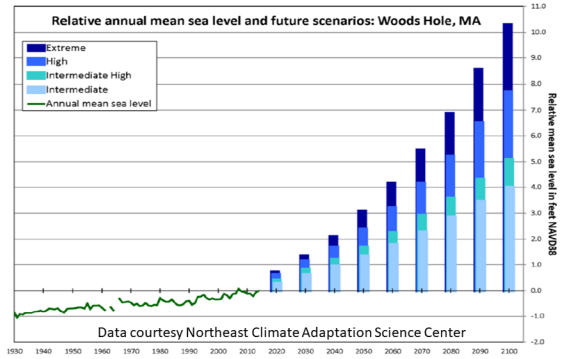
Massachusetts Climate Changes Projected by the 2090s | **Temperature** ↑ 7.2° F Average Annual ↑ 34 Annual



Data courtesy A. Karmalkar, Northeast Climate Adaptation Science Center. Figure by D. Brown

Source: Northeast Climate Adaptation Science Center, ResilientMA.org, accessed 2018.

Massachusetts Climate Changes Projected by the 2090s | **SLR** ↑ 4 to 10.2 feet Relative to mean sea level in 2000



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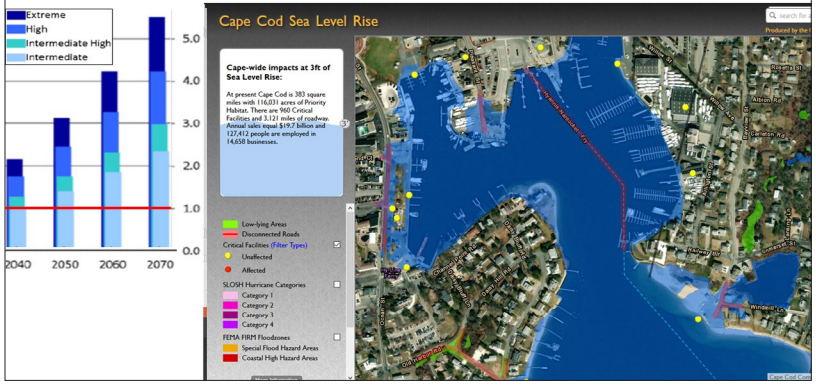

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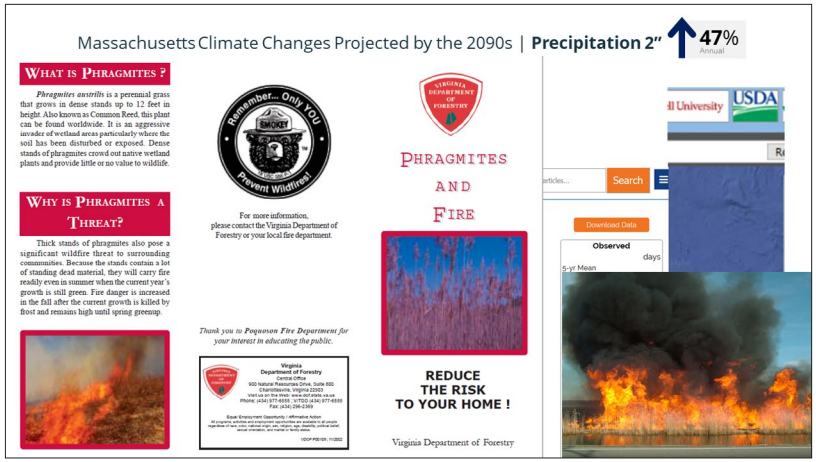
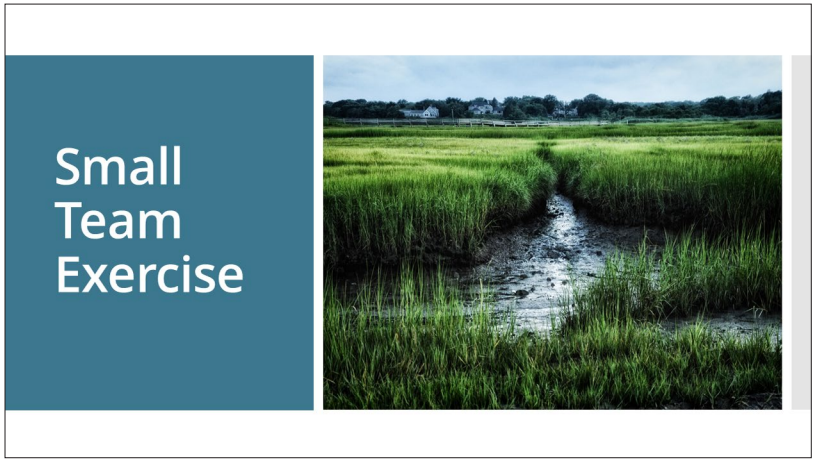
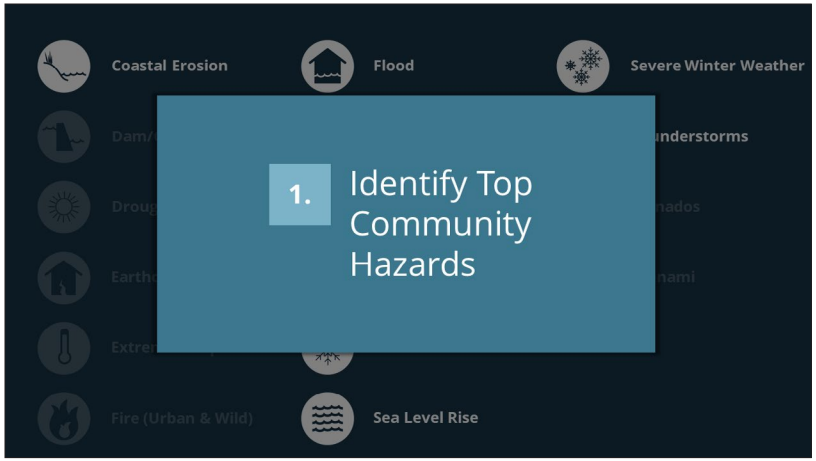
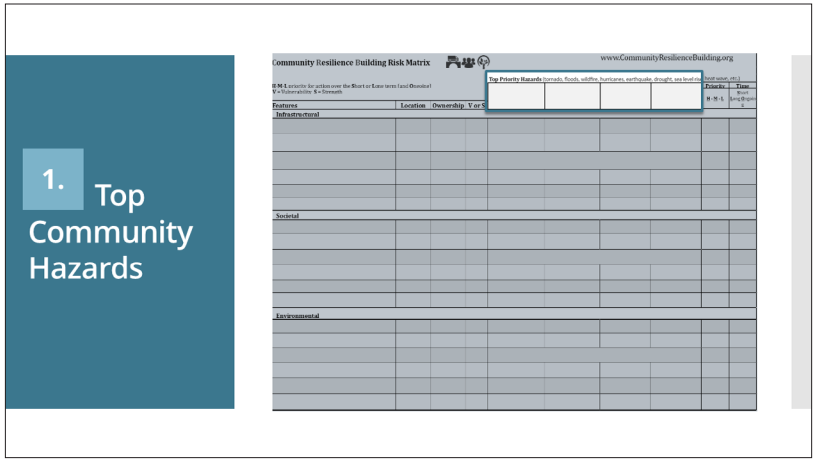
WORKSHOP PRESENTATION

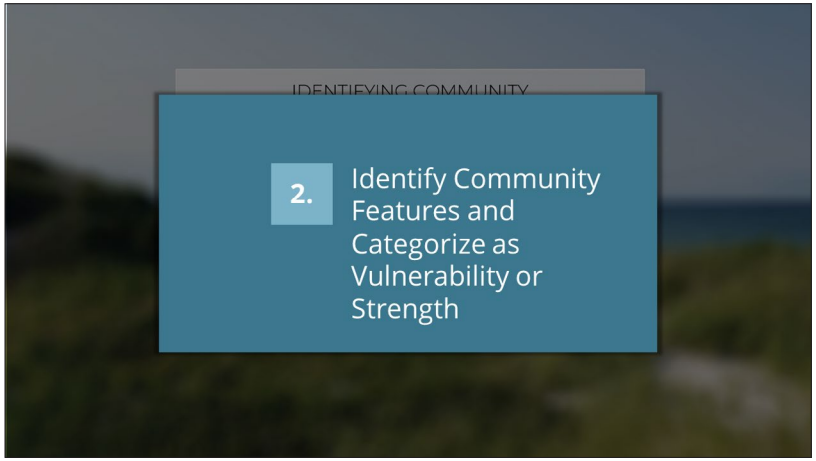


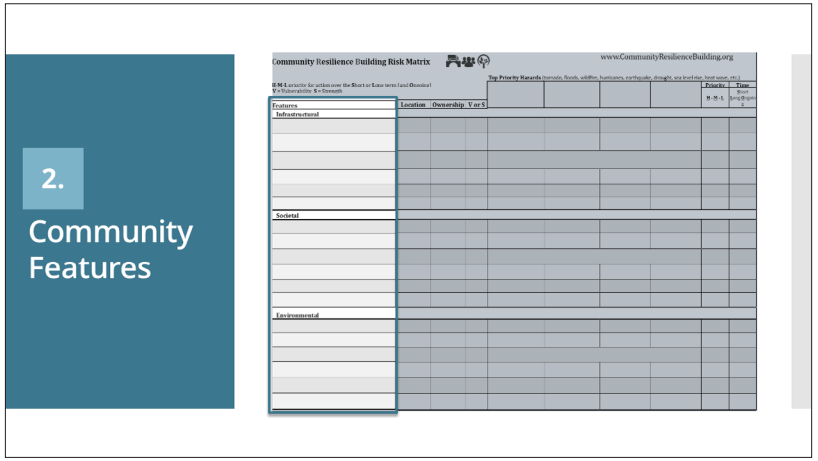


WORKSHOP PRESENTATION

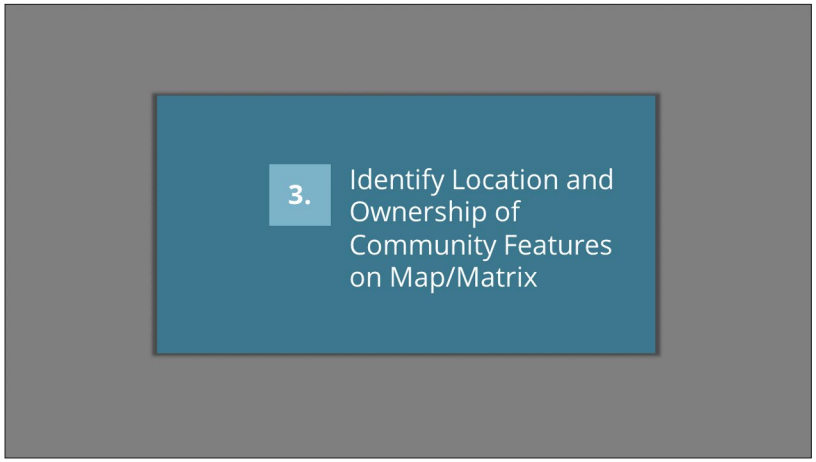


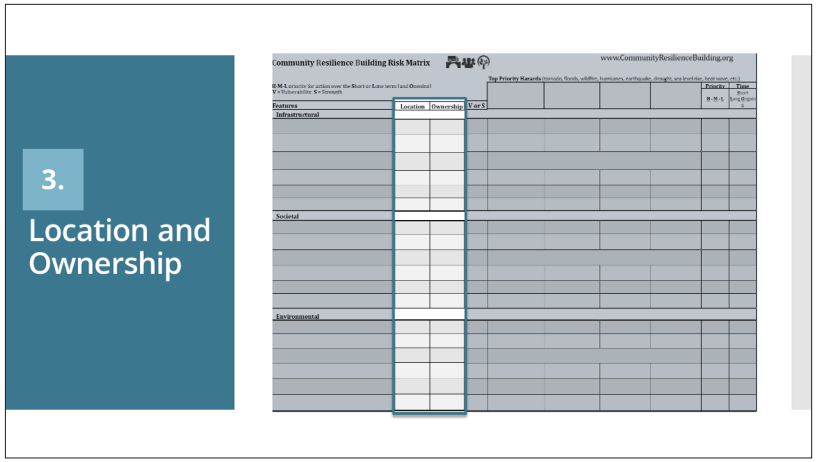






WORKSHOP PRESENTATION





WORKSHOP PRESENTATION

Small Teams Report Out

Summary Discussion

Lunch!

Today's Agenda

Afternoon

- **1:00 Review afternoon workshop goals –** Shannon Hulst Jarbeau
- **1:15 Small Team Exercise** – Heather McElroy
  - **Discuss and Identify Actions**
  - **Identify Priority and Urgency of Actions**
  - **Prepare for Report Out**
- **2:45 Break**
- **3:00 Small Teams Report on Top Actions**
- **3:30 Dot Exercise**
- **3:45 Summary Discussion – Compile Top Actions**
- **4:15 Wrap Up and Next Steps**
- **4:30 Adjourn**

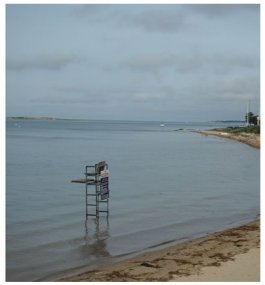
WORKSHOP PRESENTATION

What's Next for MVP?

Shannon Hulst Jarbeau, Floodplain Specialist
Woods Hole Sea Grant & Cape Cod Cooperative Extension

Sources of Available Grants

- Municipal Vulnerability Preparedness (MVP) Program
- Coastal Zone Management (CZM) Program's Coastal Resilience Grant Program
- FEMA's Hazard Mitigation Grant Program
- Others



MVP Action Grants

- Detailed Vulnerability and Risks Assessment Further Planning
- Community outreach and education
- Local Bylaws, Ordinances, Plans, and Other Management Measures
- Redesigns and Retrofits
- Energy Resilience Strategies
- Chemical Safety and Climate Vulnerabilities
- Nature-Based Flood Protection, Drought Prevention, Water Quality, and Water Infiltration Techniques
- Nature-Based Infrastructure and Technology Solutions to Reduce Vulnerability to Extreme Heat and Poor Air Quality
- Nature-Based Solutions to Reduce Vulnerability to Climate Change Impacts
- Acquisition of land to achieve a resiliency objective
- Ecological Restoration and Habitat Management to Increase Resiliency

Proposals should address stages

- Planning, feasibility assessment, and siting
- Design
- Permitting
- Construction, installation, and monitoring

MVP Action Grant Details

- One-year timeframe
- $25,000 - $2,000,000 for single towns
- Up to $5,000,000 for regional projects
- Must be used to advance priority adaptation actions identified in MVP reports
- 25% match

CZM's Coastal Resilience Grant Program

- Vulnerability and Risk Assessment
- Public Education and Communication
- Local Bylaws, Adaptation Plans, and Other Management Measures
- Redesigns and Retrofits
- Natural Storm-Damage Protection Techniques

MVP vs CZM

MVP

- All climate-related issues
- Currently open
- $25K - $2 million
- 25% match
- If it fits CZM, apply to both programs

CZM

- Coastal only
- Not open yet
- Up to $500,000
- 25% match
- If it fits MVP, apply to both programs

Small Team Exercise

Small Team Exercise

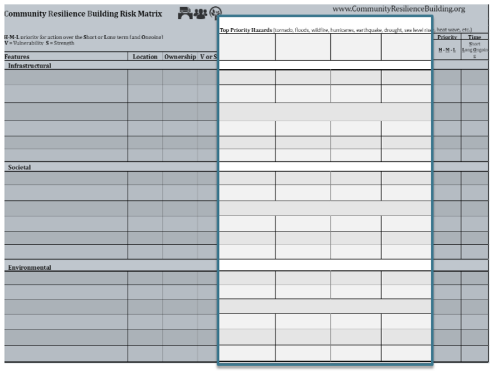
OVERVIEW

- Identify Small Team Spokesperson
- Clarifying questions

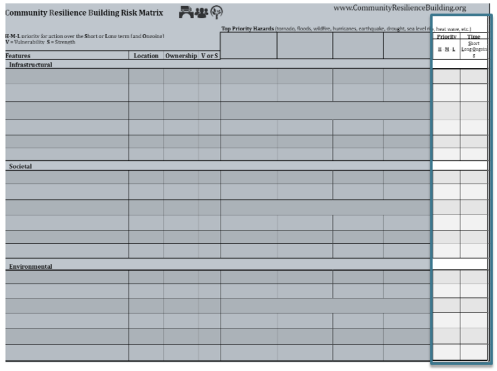
EXERCISE

1. Identify Actions to Reduce Vulnerability or Reinforce Strengths
2. Assign Priority and Urgency of Each Action
   - Infrastructure
   - Societal
   - Environmental
3. Identify Top 5 Priority Actions

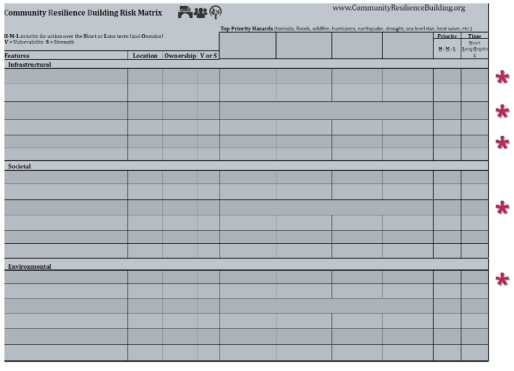
1. Identify Actions



2. Assign Priority and Urgency



3. Identify Top Priority Actions



WORKSHOP PRESENTATION

Small Team Exercise

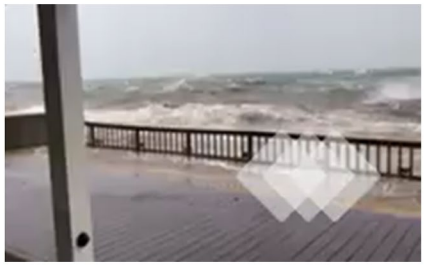
OVERVIEW

- Identify Small Team Spokesperson
- Clarifying questions

EXERCISE

1. Identify Actions to Reduce Vulnerability or Reinforce Strengths
2. Assign Priority and Urgency of Each Action
   - Infrastructure
   - Societal
   - Environmental
3. Identify Top 5 Priority Actions

Break



Small Teams Report Out on Top Priority Actions

Selecting Priorities: Dot Exercise

Summary Discussion – Compile Top Actions

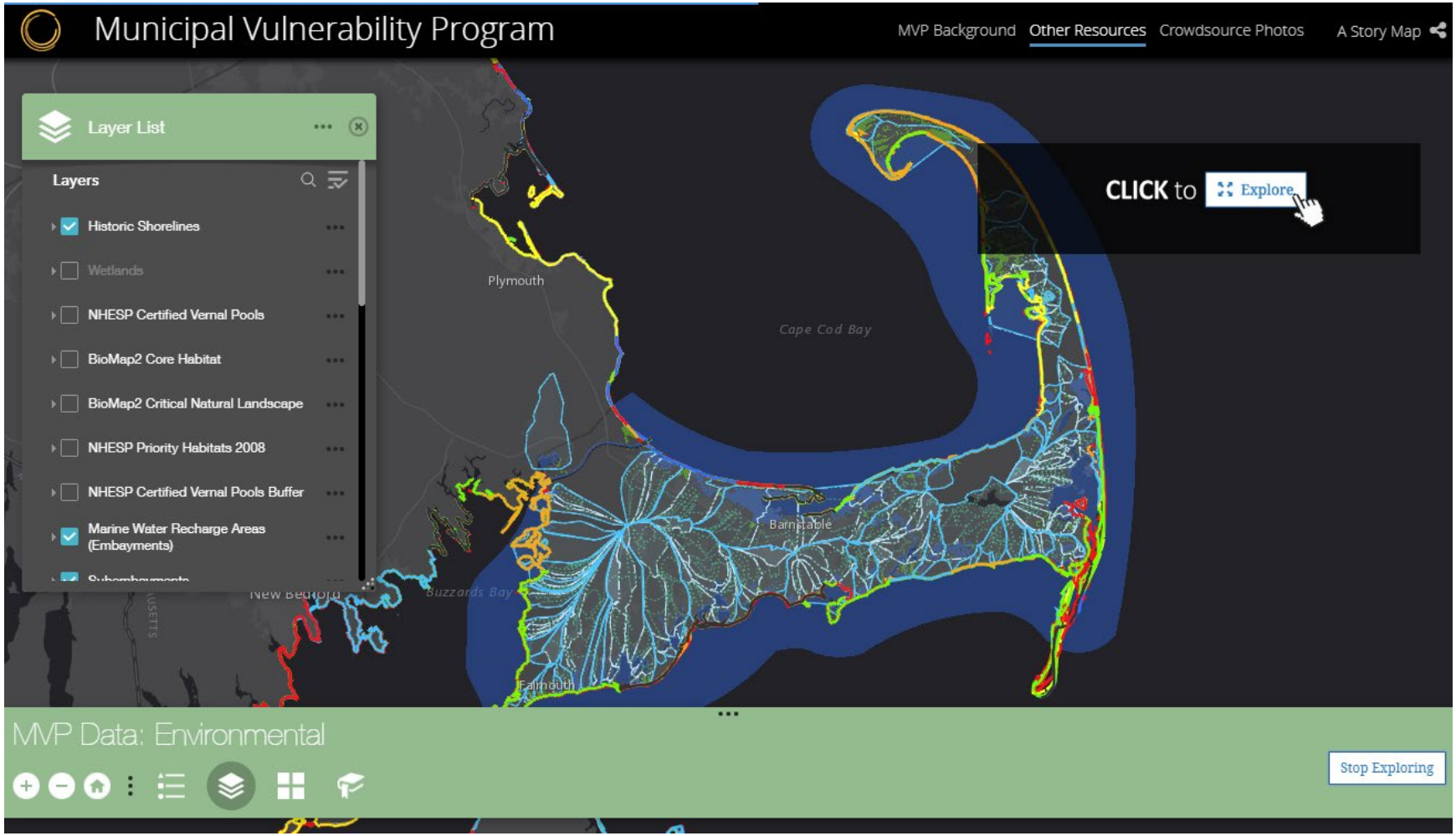
Wrap-up and Next Steps

Municipal Vulnerability Preparedness Workshop

TOWN OF BARNSTABLE

March 29, 2019

WORKSHOP PRESENTATION



MVP STORYMAP (available at https://arcg.is/1CX4K9)

Municipal Vulnerability Preparedness Information & Listening Session

TOWN OF BARNSTABLE

June 11, 2019

Agenda

MVP Overview

Summary of Findings from MVP Workshop

Questions

Feedback and Suggestions

Project Team

MVP PROVIDER | CAPE COD COMMISSION

- Sharon Rooney - *Chief Planner*
- Heather McElroy - *Natural Resources Manager*
- Erin Perry – *Deputy Director*
- Chloe Schaefer - *Community Design Planner*
- Martha Hevenor - *Planner II*
- Anne Reynolds - *GIS Director*

MVP PROVIDER | COOPERATIVE EXTENSION

- Greg Berman - *Coastal Processes Specialist, Woods Hole Sea Grant/ Cape Cod Cooperative Extension*
- Shannon Hulst Jarbeau - *Floodplain Specialist & CRS Coordinator, Woods Hole Sea Grant/Cape Cod Cooperative Extension*

Project Team

TOWN PROJECT MANAGER

Elizabeth Jenkins, *Director of Planning and Development*

MVP CORE TEAM | TOWN OF BARNSTABLE

- Liz Hartsgrove, *Assistant Director, Planning and Development*
- Dan Horn, *Director of Marine and Environmental Affairs/Harbormaster*
- Nina Coleman, *Director of Natural Resources/Sandy Neck Park Manager*
- Darcy Karle, *Conservation Administrator*
- Dale Saad, *Sr Project Manager – Special Projects, DPW*
- Paul Graves, *Senior Project Manager, Department of Public Works*

LISTENING SESSION PRESENTATION

MVP Program

EXECUTIVE ORDER 569: AN INTEGRATED CLIMATE CHANGE STRATEGY FOR THE COMMONWEALTH 9.16.16

- Reducing greenhouse gas emissions to combat climate change
- Preparing for the impacts of climate change
  - State Adaptation Plan
  - Agency Vulnerability Assessments
  - Municipal Support
  - Climate Coordinators

4

ENVIRONMENTAL BOND BILL, 3.15.18

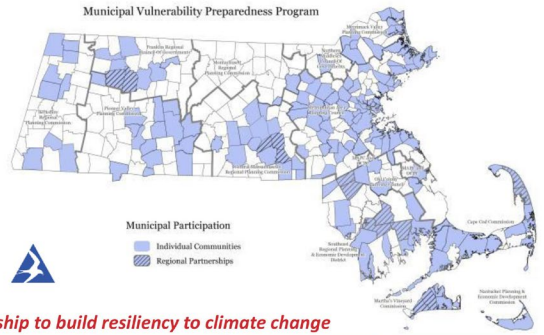
- $1.4 billion bond bill with focus on climate change resiliency
- $300 million for climate change adaptation
- Codifies EO 569

5

- www.resilientma.com
- **Integrated Plan:** First in the nation Climate Adaptation and Hazard Mitigation plan
- **Mainstreaming climate change**: Incorporating climate change into current planning, budgeting, and policy frameworks

Municipal Vulnerability Preparedness (MVP)

2017-2019



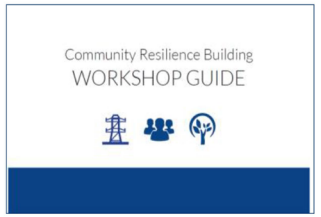
State and local partnership to build resiliency to climate change

1. Engage Community
2. Identify CC impacts and hazards
3. Complete assessment of vulnerabilities & strengths
4. Develop and prioritize actions
5. Take Action

7

MVP Principles

- **Community-led process** that employs local knowledge and requires local buy-in and support
- **Accessible**
- **Utilizes partnerships** and leverages existing efforts
- **Mainstreams** climate change
- **See communities** as local innovators
- **Frames** coordinated statewide efforts.



8

Overview of the Process

- PREPARE FOR THE WORKSHOP
- CHARACTERIZE HAZARDS
- IDENTIFY COMMUNITY VULNERABILITIES AND STRENGTHS
- IDENTIFY AND PRIORITIZE COMMUNITY ACTIONS
- DETERMINE OVERALL PRIORITY ACTIONS
- PUT IT ALL TOGETHER – FINAL REPORT
- MOVE FORWARD

MVP Action Grant

- **Who's eligible?**
  - Municipalities with MVP designation
  - Municipalities completing 2017 MVP process who have completed workshop(s) and have identified prioritized actions
- Funding: $10,000 - $400,000 per project
- Match: At least 25% of total project cost required

25

LISTENING SESSION PRESENTATION

MVP Action Grants

- Detailed Vulnerability and Risks Assessment Further Planning
- Community outreach and education
- Local Bylaws, Ordinances, Plans, and Other Management Measures
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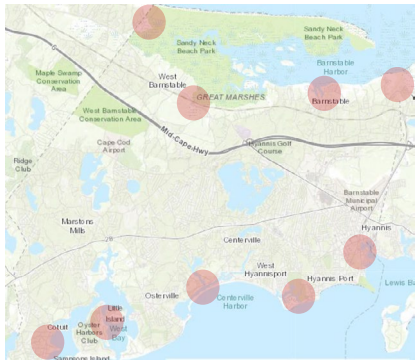
- Acquisition of land to achieve a resiliency objective
- Ecological Restoration and Habitat Management to Increase Resiliency

MVP Workshop Findings

- Coastal Erosion
- Dam/Culvert Failure
- Drought
- Earthquake
- Extreme Temperatures
- Fire (Urban & Wild)
- Flood
- High Winds
- Hurricane
- Landslide
- Nor'easters
- Sea Level Rise
- Severe Winter Weather
- Thunderstorms
- Tornados
- Tsunami
- Climate Change & Ocean Acidification

Challenges: Low-Lying Infrastructure



LISTENING SESSION PRESENTATION

Challenges: Impacts to Human Health

- Failure of wastewater infrastructure (pump stations, septic systems)
- Salt water intrusion into drinking water supply

Challenges: Isolation, Emergency Access, People in Harm's Way

- Areas at very high risk of flooding
- Vulnerable populations
- First responders
- Emergency Shelters

Challenges: Threats to Environment

- Salt marshes and migration
- Ocean acidification/Rising water temps – fish & shellfish
- Town and barrier beaches
- Native & threatened species
- Fire risk

Challenges: Telecom & Utilities

- Above-ground Utilities
- Communication

LISTENING SESSION PRESENTATION

Strengths: Emergency Services

- Regional Hospital
- Emergency responders & infrastructure
- Regional shelter
- Town CodeRED alert system

Strengths: Community

- Town staff & services
- Town Boards & Committees
- Environmental, faith-based groups, civic groups

Strengths: Natural Assets

- Coastal Assets: Beaches, salt-marshes
- Blue (water-based) economy
- Conservation Areas, farms and open spaces

Priority Actions

Group Recommend-ations

- Make changes to zoning bylaws and regulations, including to reduce vulnerability of structures in the floodplain, grandfathered pre-1978 structures along the coast, and incentives for economic recovery.
- Conduct a feasibility assessment for the vulnerable neighborhood of Millway/Barnstable Harbor, including an alternatives analysis for adaptation and retreat.
- Conduct coastal resource planning for barrier beaches, beaches, and salt marshes (key locations).
- Plan for adequate size and number of shelters, and serving vulnerable populations.
- Protect wastewater infrastructure, including the Freezer Road plant and septic systems threatened by flooding.
- Achieve consensus on Sandy Neck coastal resiliency analysis and pursue action.
- Develop and implement community-based education programs with an emphasis on positive solutions, targeting multiple demographics and seasons.
- Land acquisition program to accommodate retreating salt marshes, saltwater facilities, beaches, etc.
- Improve resiliency of roads to coastal and urban flooding.
- Support and fund implementation of wastewater plan.
- Develop a green transportation plan including bike safety, transit and walkability.
- Prioritize and design high priority culvert replacements town-wide.
- Implement improvements to the town-wide water system, including expansion of the existing system, interconnections with neighboring towns, and open space acquisition for new wells.
- Develop policies for lowering emissions.
- Improve the stormwater system, including drainage maintenance, culverts, and pollution.
- Conduct a study to examine retreat or engineered solution to flooding in Hyannis Harbor and hospital area.
- Conduct coastal resiliency alternatives analysis for south side beaches.

Priority Actions

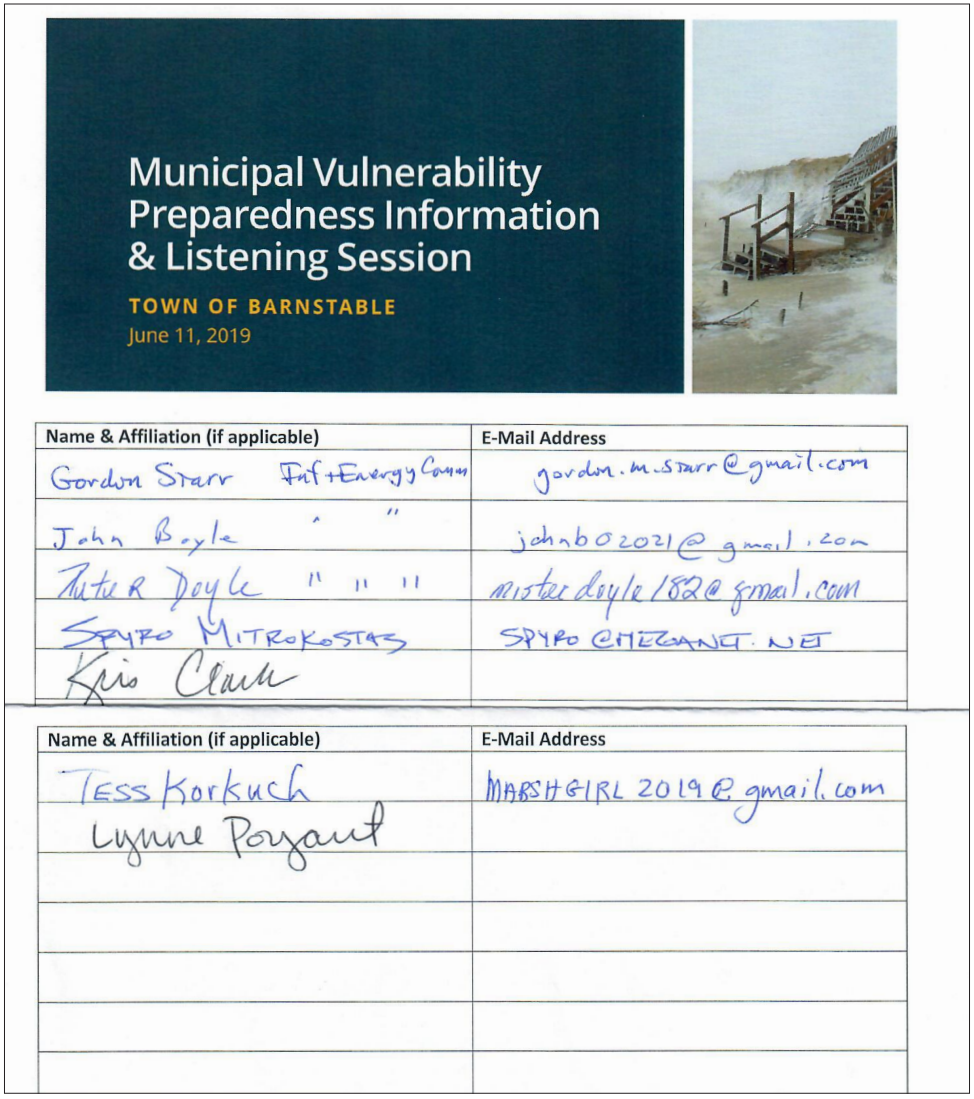
1. **Changes to zoning ordinances and regulations.**
2. **Achieve consensus on Sandy Neck coastal resiliency analysis and action plan.**
3. **Develop and implement a community-based education program.**
4. **Develop a feasibility study of remedies for the Millway/Barnstable Harbor neighborhood.**
5. **Land Acquisition as a tool to accommodate retreat.**

Municipal Vulnerability Preparedness Information & Listening Session

TOWN OF BARNSTABLE

June 11, 2019

LISTENING SESSION PRESENTATION



Municipal Vulnerability Preparedness Information & Listening Session

TOWN OF BARNSTABLE

June 11, 2019

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Peter R Doyle " " "	misterdoyle182@gmail.com
SPYRO MITROKOSTAS	SPYRO@MEGANET.NET
Kris Clark	

Name & Affiliation (if applicable)	E-Mail Address
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Lynne Poyant	

LISTENING SESSION SIGN-IN SHEET

BARNSTABLE COMMUNITY RESILIENCE BUILDING WORKSHOP
SUMMARY OF FINDINGS

PREPARED BY THE CAPE COD COMMISSION & CAPE COD COOPERATIVE EXTENSION

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