Town of Sandwich

Community Resilience Building Workshop Summary of Findings

June 2018

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Town of Sandwich
Community Resilience Building Workshop
Summary of Findings

Overview:

The need for municipalities, regional planning organizations, states and federal agencies to increase resilience and adapt to extreme weather events and mounting natural hazards is strikingly evident amongst the communities of coastal Massachusetts. Recent events such as successive March 2018 nor'easters have reinforced this urgency and compelled leading communities like the Town of Sandwich to proactively plan and mitigate potential risks through a community driven process. Ultimately, these efforts will reduce the vulnerability of Sandwich's citizens, infrastructure and ecosystems, and serve as a model for communities across Cape Cod, Massachusetts and the Nation.

In the winter of 2017-18, with funding from the Executive Office of Energy and Environmental Affairs Massachusetts Municipal Vulnerability Preparedness Program, David DeCanto from the Sandwich Department of Natural Resources contacted the Woods Hole Group to implement the Community Resilience Building process. A municipal-based core team was established to organize and implement an 8-hour Community Resilience Building Workshop on April 28, 2018. The goal of this effort was to engage community stakeholders to facilitate the education, planning and, ultimately, implementation of priority adaptation actions. The list of workshop invitees and workshop content was guided by input from an interdisciplinary working group comprised of Town staff, and consultants from Woods Hole Group. 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.

Sixteen (16) participants from town departments/committees/boards, community organizations, local business owners, and neighborhood associations were in attendance for the workshop, which employed a community-driven workshop process following the Community Resilience Building (CRB) framework (www.CommunityResilienceBuilding.com). The CRB's Risk Matrix format, large-scale maps of the Town of Sandwich (Appendix A & B), and various datasets on natural hazards (Appendix C & D) were integrated into the workshop process to provide both decision support and risk visualization for workshop participants. The workshop included a combination of large group presentations and small group discussions. The large group presentation outlined the workshop process/goals, presented relevant hazard and community data, shared example actions, and provided an update on local planning efforts and non-profit initiatives. Participants also had an opportunity to work together in small groups consisting of 5-7 people with different roles, responsibilities and expertise to foster an exchange of ideas and perspectives. Spokespersons from the small groups then reported their findings back to the larger group. This workshop process, rich with information, and experiences and dialogues from the participants produced the findings detailed in this summary report. This report provides an overview of the top hazards, current concerns and challenges, current strengths and vulnerabilities, and recommends actions to improve the Town of Sandwich's resilience to natural and climate-related hazards today and in the future.

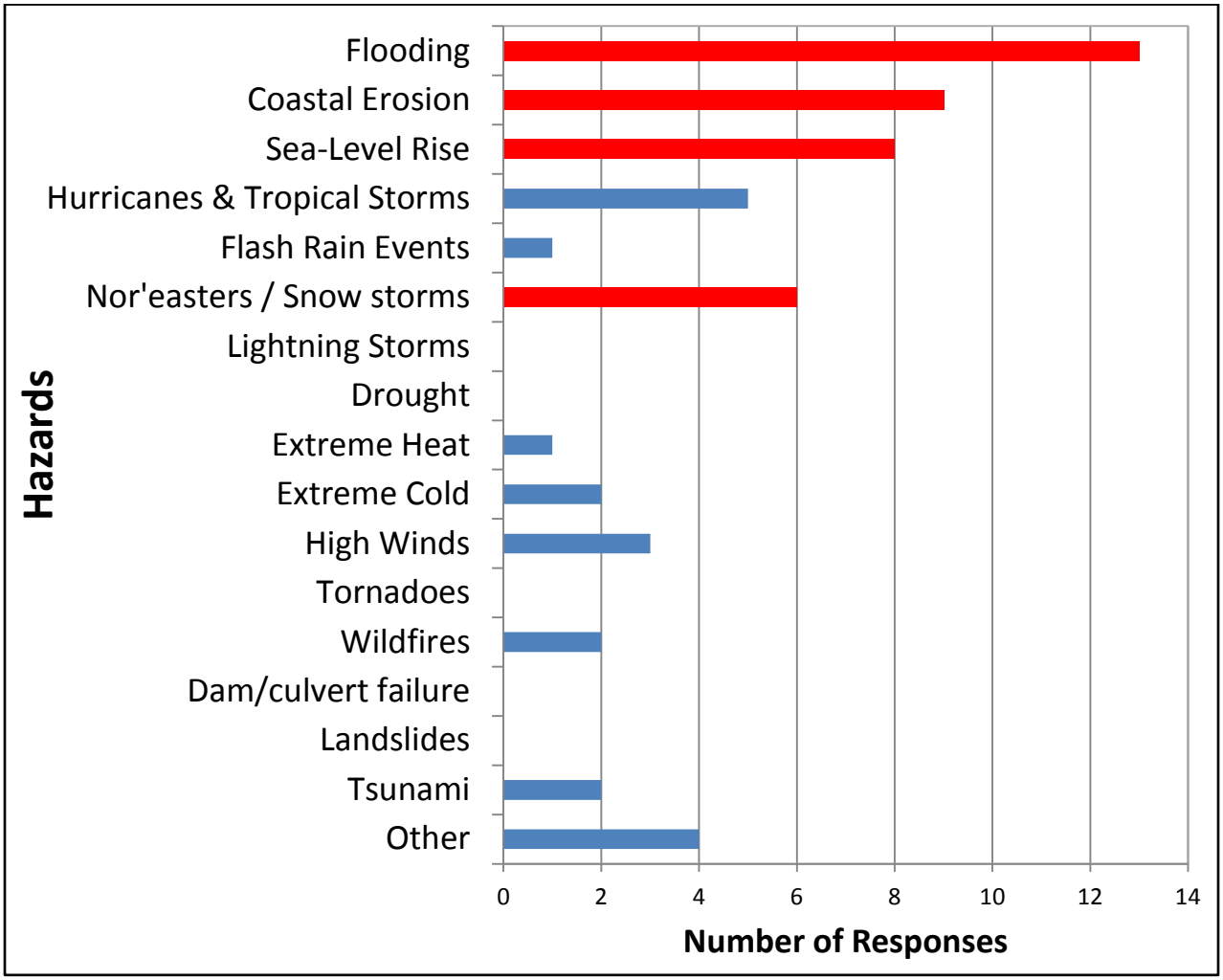
Workshop participants and other interested stakeholders are encouraged to provide comments, corrections and updates on the summary of findings described in this report. The Town of Sandwich's ongoing community resilience will benefit from the participation of all those concerned.

Top Hazards and Vulnerable Areas

Prior to the Community Resilience Building Workshop in April 2018, invited workshop participants were asked to identify the top natural hazards for the Town of Sandwich as part of a pre-workshop online survey. Coastal flooding and erosion from intense storms and coastal storm surge were identified as the hazards of greatest concern. Sea-Level Rise due to climate change was also identified by the town as one of the top concerns. Finally, additional hazards, such as snow, ice, and high winds resulting in downed trees, blocked roads and power outages associated with nor'easters and major snow storms were also highlighted as major concerns by the survey respondents.

Top Hazards

1. Flooding
2. Coastal Erosion
3. Sea-Level Rise
4. Nor'easters/Snow Storms



Areas of Concern

Neighborhoods: Historic Sandwich Village, East Sandwich, Spring Hill District, Town Neck area neighborhood.

Populations: Concentrations of elderly residences (nursing homes and residents living at home), seasonal visitors and tourists, students who attend Riverview School.

Ecosystems: Beaches (Town Neck beach, Spring Hill beach, Scusset beach, E. Sandwich beach), Tidal creeks and marsh ecosystems (Mill Creek, Scorton Creek), ponds (Snake Pond, Weekes Pond), shellfish propagation, Old Sandwich Harbor area

Transportation: Roads blocked by flooding (Route 6A), regional bridges (Sagamore bridge)

Infrastructure: Major state road (Route 6A), septic systems, Canal power plant, storm water drains and culverts, bridges (Scorton Creek bridge, Mill Creek bridge), Cape Cod Canal and jetties

Facilities: Fire Station, Schools (Sandwich High School and Riverview School)

Current Concerns and Challenges Presented by Hazards

The Town of Sandwich has many concerns and faces multiple challenges related to the impacts of natural hazards. In recent years, Sandwich has experienced a series of highly disruptive and damaging weather events, including three successive nor'easters in March 2018, as well as significant rainfall events, such as the >2 inches of rain that fell on a single day in July 2017. The impacts from recent nor'easters included significant coastal flooding, inundating some neighborhoods for days, high winds resulting in approximately 98% of the town without power and many downed trees blocking roads, and coastal erosion resulting from heavy surf and storm surge. The frequency of these storms in March 2018 exacerbated the impacts, as the Town was still recovering from the last storm when the next one arrived. The magnitude and severity of the impacts of these storms produced a heightened level of awareness in Town and provided additional motivation to comprehensively improve resilience and reduce local vulnerabilities to natural hazards.

This series of extreme weather events highlighted that impacts from hazards are felt differently across the Town from the low-lying coastal areas to the forested uplands to the more developed downtown area. The northern part of Sandwich (anywhere north of Route 6A in particular) borders Cape Cod Bay and is exposed to damage from coastal flooding and storm surge. The forested inland areas (anywhere south of Route 6A in particular) experience the effects of tree damage from wind, snow and ice, as well as hazards from inland flooding along roads due to poor drainage. The combination of these issues presents a challenge to emergency preparedness and response, and requires comprehensive yet tailored actions for establishing mitigation priorities for different areas of Town.

The workshop participants were generally in agreement that the Town of Sandwich is experiencing more intense and frequent storms which has greatly exacerbated local coastal erosion issues, among other impacts. The impacts, particularly during the series of March 2018 nor'easters, affected the daily activities of every resident. Coastal areas are experiencing greater impact from major storms and increases in average tidal ranges are resulting in routine flooding events in certain low lying places during lunar high tides. Specifically, there was a general consensus that a long-range plan needed to be developed for the town beaches in the face of ongoing coastal erosion and sea-level rise.

Specific Categories of Concerns and Challenges

Beach and Coastal Erosion

All small working groups identified ongoing erosion along Sandwich's coastline as a point of concern. Town beaches of particular concern included Town Neck Beach, Spring Hill Beach, East Sandwich Beach, and Scusset Beach. Sandwich's coastline is not only inherent to the character of the Town, but these beaches also provide valuable tourism and recreational benefits, vital habitat for threatened and endangered species, such as piping plovers, and provide the first line of defense against coastal storms, flooding, wave action and storm surge. However, Sandwich is unique in that the Cape Cod Canal, with terminal jetties, divides the town and is one of the main contributing factors to the town's vulnerability to coastal erosion. The jetty on the north side of the canal and adjacent to Scusset Beach traps sand that would otherwise be transported along shore. The beaches (Town Neck, Spring Hill, E. Sandwich) adjacent to the jetty on the south side of the canal are then starved of sediment that normally would have been transported there increasing the risk to coastal erosion. The town is currently in the midst of the beach nourishment permitting process and seeking an offshore borrow site at Scusset Beach, but the workshop participants noted that finding a way to expedite the often long and highly regulated permitting process is important.

Vulnerability of Town Road Network

Another concern expressed by participants was the vulnerability of the Town's coastal road network given the increasing hazards presented by flooding, sea-level rise and coastal erosion. Coastal roads, including Route 6A, Jones Lane, and Town Neck road are regularly inundated during storm events, preventing travel as well as emergency management services from reaching impacted areas.

Another concern to town residents was the vulnerability of the Town's more inland roads given the precipitation and freezing temperatures associated with Nor'easters and snowstorms. There are several roads, including Chipman Road, Gully Lane and parts of Route 6A, where water flows down the adjacent hillsides and freezes over the roadways creating a hazard for drivers.

Historic Sandwich Village District and Downtown Fire station

Sandwich residents expressed concern about the vulnerability of the Historic Sandwich Village District given that it is located within the 100-year flood plain and is susceptible to inland and coastal flooding. The historic village contains municipal and culturally important buildings including Town Hall, the Public Library, the Dexter Grist Mill and the Sandwich Glass Museum. This is a concern because not only does Town Hall house important documents but the other buildings provide historical and economic importance to the area. These facilities are in jeopardy from several flooding scenarios as explored during the CRB workshop. Another hot topic of conversation among workshop participants was the location of the downtown fire station as it is also located in the 100-year flood plain and agreed that the town should consider the relocation of the fire station to a more inland area.

Town-Wide Utility Services (Water and Electrical)

Another large concern for the town is not having a town-wide sewer system and waste water treatment facility. Most residents rely on septic tanks to treat their waste water. Many homes that have septic tanks are located along the coast and are at risk of failing because of the coastal erosion and flooding hazards the town experiences. Septic systems may become exposed and experience salt damage when inundated by flood waters and physical damage by coastal erosion. The exposure and damage of septic systems can cause further complications such as salt water intrusion and leaching of septic materials which can affect the health of nearshore water bodies and marsh ecosystems.

The power distribution system was cited as one of the important infrastructure features in Town and can impact all residents regardless of where they live. The Town's utility lines were impacted by high winds (>80mph) and heavy snow in the recent March Nor'easter storms. Mature trees and overhanging limbs along roadways are a primary culprit because they can bring down power lines if they are toppled by high winds. Power interruptions due to storms can cause disruption to heating or cooling systems, as well as loss of potable water for homes supplied by electrically pumped wells. Workshop participants identified elderly and less mobile residents at particular risk during electric service outages.

Coastal Flood Damage

Coastal flooding (standing flood waters, storm surge, resulting erosion) presents a major threat to the Town's infrastructure, facilities, neighborhoods, and individual homes and property. Recent flooding events had prompted participants to consider the future impact of coastal flooding events when exacerbated by sea-level rise, and to reevaluate the costs of maintaining and/or rebuilding versus relocating roads, facilities and utilities to less vulnerable areas. Of particular concern is that coastal flooding has and will continue to inundate roads and neighborhoods, isolating certain areas from the rest of Town (particularly areas north of route 6A) and making it difficult for first responders and other services to access those areas during emergencies. Neighborhoods specifically located along Route 6A in East Sandwich were specifically highlighted as an area of concern.

Current Strengths and Assets

As a result of Sandwich's recent experiences with extreme weather, the Town is well acquainted with its existing strengths. Reinforcing and expanding these supportive practices and assets will improve resilience against future storms. Additional planning will help the Town address anticipated increases in storm surge, sea-level rise and precipitation.

- Sandwich's residents have proven a key asset during recent natural hazards. On a neighborhood level, residents face common challenges and have demonstrated desire to help one another recover quickly.
- Volunteerism and supportive social services (e.g., transportation systems, food banks, and shelters) were highlighted as important community assets. These services often provide vital support to elderly or vulnerable populations in Town.
- Responsive and committed Town leadership and staff are an important asset to Sandwich, both in day-to-day operations, as well as during and immediately following a natural hazard or an emergency event.
- Marshes, beaches, coastal banks, and tidal creeks along Sandwich's coasts were recognized as an important buffer, offering the first line of defense against storms through storm surge attenuation and reduction of wave energy. Without these natural resources in place, the Town's coastal and inland infrastructure and homes would suffer greater damage during storm events.
- Key organizations/service providers in Town have proven to be important strengths. The Upper Cape Water Regional Water Supply Cooperative, for example, is a regional group including other towns in the Upper Cape which oversees concerns about the water supply. Sandwich High School can function as an emergency shelter providing residents with vital amenities such as shelter, heat, and electricity during and following a hazard event. The Joint Base Cape Cod, Coastguard, and DPW were also mentioned as important organizations that aid in community recovery during and after hazard events.

Top Recommendations to Improve Resilience

A common thread throughout the Workshop discussions was the recognition that the Town and residents need to be better prepared through longer-term, community-based contingency planning across key areas of concern. This and additional core highlights are addressed below. The following were the top priority actions developed by each working group, and later aggregated by common themes. After each working group presented their top five priority actions, and these actions were grouped by similar themes, the large group voted on all priority actions (5 voting dots per workshop participant). These top priority actions are presented in order of votes received.

1. **Develop a Beach/Harbor Ecosystem Management Plan**

   Given the threat that flooding, sea-level rise, coastal erosion, and Nor'easters pose to Sandwich's coastal areas, and given the impacts already experienced by the Town's beach and dune systems in recent years, workshop participants felt it was critical to develop a Beach/Harbor Ecosystem Management Plan. Much discussion in many groups focused on acknowledging that beaches, dunes, and salt marsh complexes provide natural buffers to all of the top hazards, and that these natural resources protect the adjacent developed areas of Town. However recent storms have intensified impacts on these already stressed assets, providing a window through which to preview future impacts and vulnerabilities. Since the natural coastal processes in Sandwich are interrupted by the Canal jetties and other coastal infrastructure, down-drift beaches and dunes are eroding. Workshop participants stressed the need for a comprehensive approach to managing these important resources that can provide cascading resiliency benefits if maintained in good health. Components of such a plan could include identifying sources of sand for beach nourishment and dune reconstruction, sediment management schemes, and developing actions to maintain/increase salt marsh health.

2. **Develop an Educational Outreach Strategy on Climate Change and Beaches/Dunes for homeowners and businesses**

   Many of Sandwich's beaches and dunes are experiencing significant and ongoing erosion. However, workshop participants noted that not all residents and businesses are aware of what actions can be taken or are already underway to stem these impacts and reduce community vulnerability. Multiple groups suggested developing educational outreach materials (for homeowners, businesses, real-estate agencies, and law firms) to increase community awareness of the importance of Beach/Dune systems and the hazards they are expose to (both present and future), the actions that can reduce vulnerability at a variety of scales, as well as the various regulatory and permitting considerations for implementing adaptation measures.

3. **Seek Expedited Permitting for beach/dune/bank projects**

   As coastal resources and properties face repeated and relentless impacts from extreme weather, some workshop participants noted that beneficial projects to reduce coastal vulnerability can experience significant delays due to permitting. Many expressed a desire to develop a fast-tracked permitting process for beach, dune, and coastal bank projects (especially in the wake of a significant storm event) so that coastal green infrastructure can be rebuilt

quickly after experiencing storm impacts (or ongoing erosion) in order to safeguard against further (and potentially more severe) community impacts due to reduced protective capacity of the resource.

4. **Investigate potential for sewering or alternative wastewater treatment (North of Route 6A especially)**
   One of the concerns voiced by workshop participants centered around wastewater – both the potential impact of septic leachate on wetlands that provide flood protection services (as well as habitat and recreational value), and the potential for sea level rise and saltwater intrusion to reduce the functionality of coastal septic systems. Various suggested actions from the groups on this topic included considering the feasibility of sewering as well as the use of alternative wastewater treatment technologies.

5. **Stabilize Mill Creek Inlet and Dredge to Increase Flood Storage Capacity**
   The flood storage capacity of the Mill Creek and adjacent wetland areas was a primary concern among workshop participants, since these natural assets front the more developed portions of Sandwich around the downtown area. Community members prioritized actions to remove sediments that have accumulated in the inlet in order to increase flood storage capacity, and then stabilize the inlet to prevent future in-filing (thereby maintaining flood storage capacity). A potential co-benefit of such an action would be beneficially re-using the dredged material to renourish eroded portions of Town Neck Beach or Spring Hill Beach.

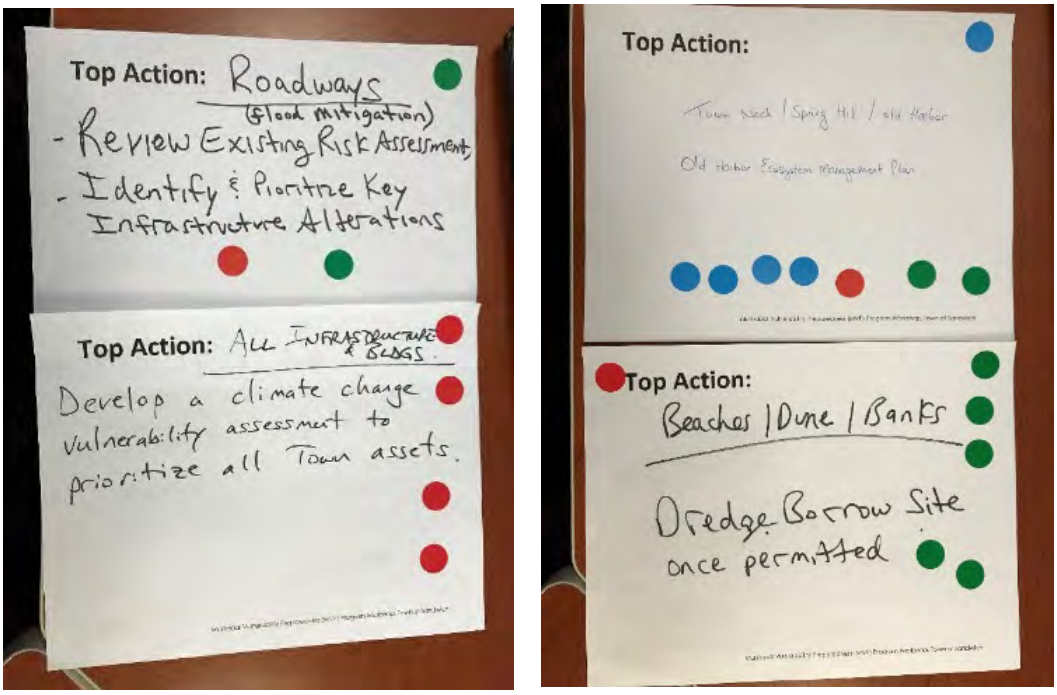
6. **Develop a Stormwater Management Plan and Coordinate with Ecosystem Management Plan**
   Flooding from precipitation events (in addition to coastal storm surge events) impinges access throughout Town (roads and developed areas), and can also impact ecosystem health if not managed properly during and after the event. Deficiencies in stormwater drains, piped infrastructure, and culverts in marsh ecosystems was a concern of Sandwich residents since the town is currently experiencing flooded roadways – both coastal and inland – during storm events which (if occurring in winter) sometimes freeze over and require significant attention from the Department of Public Works. Residents mentioned that drain pipes often get filled in by sediment restricting the drainage of standing water, but that also specific culverts in Town (e.g. River Street, Dewey Avenue, Jones Lane) are either failing or not large enough to support sufficient drainage which could negatively impact the health of the marsh ecosystem. Brady Island Marsh, located in Sandwich Village, is a prime example where insufficient drainage has allowed phragmites to grow and persist. Residents stressed the need to create a stormwater management plan to assess and prioritize repairs/improvements/replacements for drainage infrastructure and culverts, and recommended coordination with the ecosystem management plan to assess and improve the health of the Town's marsh ecosystems.

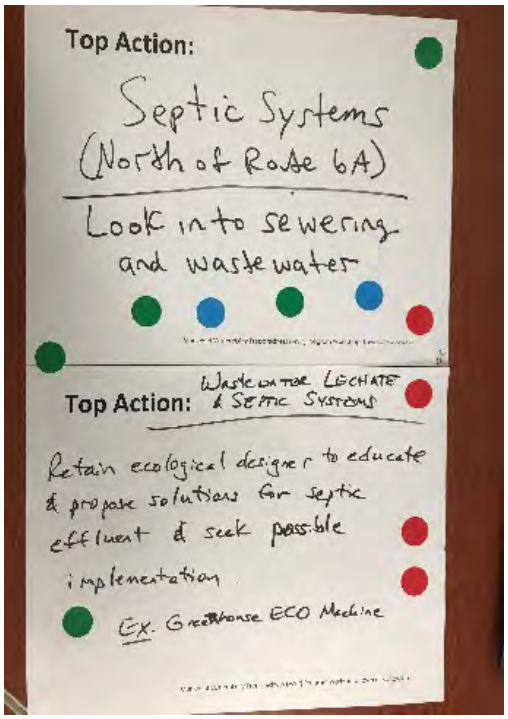
7. **Upgrade Systems at the Town's Emergency Shelter (High School)**
   One of the major strengths participants mentioned about the Town of Sandwich during the workshop was the regional cooperation and response during emergencies and natural hazards.

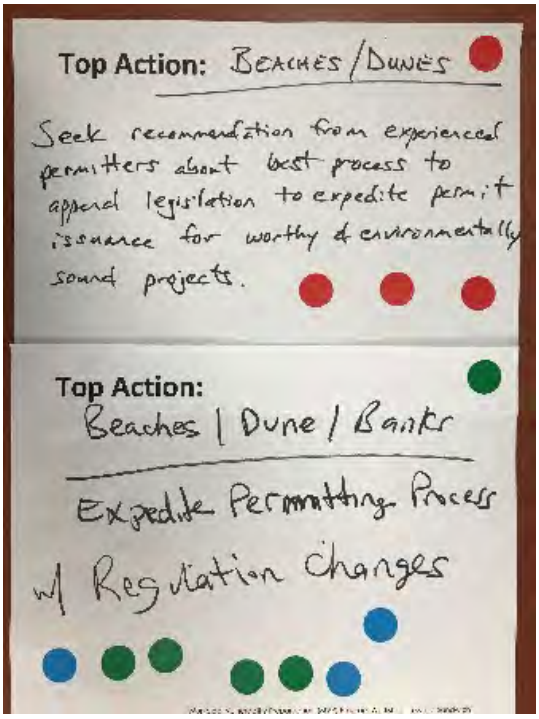
In particular, the Sandwich High School was identified as an important feature for the town, as it is considered a regional shelter for storm response and recovery. Participants decided that the replacement of the generator and performing other needed system updates was integral to ensuring the shelter facility can operate at its full capacity.

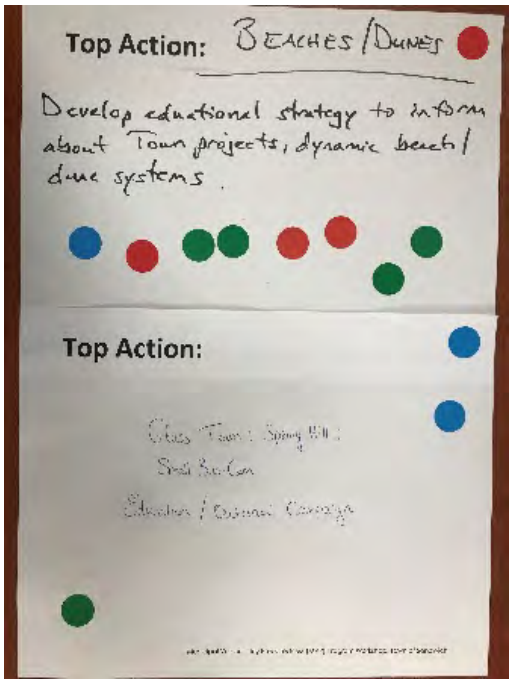
8. **Develop a Detailed Climate Change Vulnerability Assessment to Prioritize Town Assets**

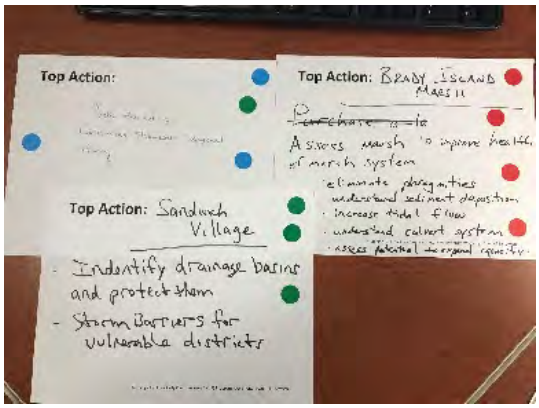
Throughout the workshop, it was evident that residents, business-owners, and Town officials are well aware of the current and future vulnerabilities throughout the Town, especially to sea level rise and storm surge hazards. Participants acknowledged that a more detailed and granular understanding of the degree to which Town assets (e.g. buildings, infrastructure, roads, marshes, beaches, culverts, etc.) will be vulnerable to these top hazards considering climate change was needed in order to adequately plan and allocate resources for adaptation. Like any town, Sandwich has limited resources (e.g. time, logistics, and budget) and cannot realistically complete every project on their "to-do" list. Thus, it is crucial to Sandwich's strategic planning to understand which assets are most vulnerable and have significant consequences of loss/failure, such that actions to reduce vulnerability may be prioritized and phased over time. Therefore, the Town highlighted the need to develop a detailed climate change vulnerability assessment which would prioritize all of the town's assets – both infrastructural and environmental – in terms of their site-specific vulnerability to sea level rise and storm surge and the consequence of loss to the community.

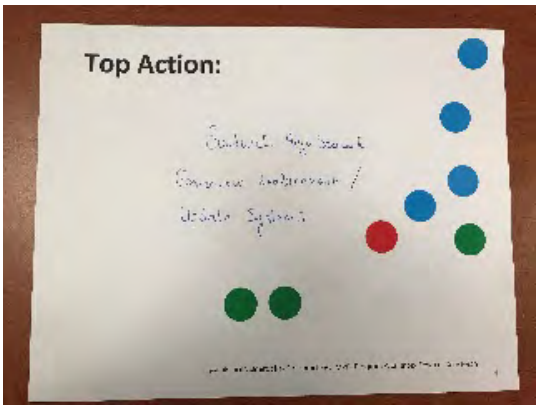


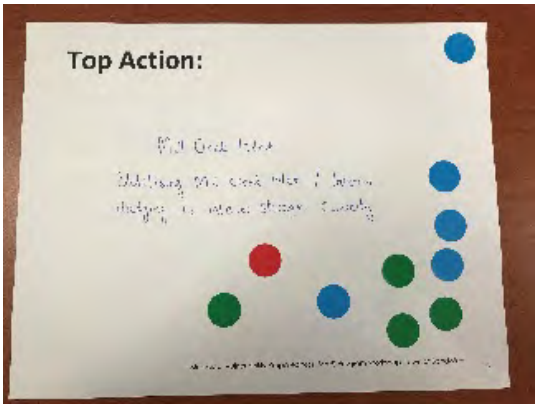

Top Action:
Septic Systems (North of Route 6A)
Look into sewering and wastewater
Top Action: Wastewater LEACHATE & Septic Systems
Retain ecological designer to educate & propose solutions for septic effluent & seek possible implementation
Ex. Greenhouse ECO Machine


Top Action: BEACHES / DUNES
Seek recommendation from experienced permitters about best process to appeal legislation to expedite permit issuance for worthy & environmentally sound projects.
Top Action:
Beaches | Dune | Banks
Expedite Permitting Process
w/ Regulation changes


Top Action: BEACHES / DUNES
Develop educational strategy to inform about Town projects, dynamic beach / dune systems.
Top Action:


Top Action:
Top Action: BRADY ISLAND MARSH
Assess marsh to improve health of marsh system
eliminate phragmites
understand sediment deposition
increase tidal flow
understand culvert system
Top Action: Sandwich Village
- Identify drainage basins and protect them
- Storm barriers for vulnerable districts





In addition to these top priority actions chosen by the working groups, the participants also developed a larger series of recommended actions, which they prioritized into “high”, “medium” and “low” priority actions:

Other High Priority Actions:

- Relocate the downtown fire station to a more inland location outside of the 100-year flood plain.
- Complete the redesign and reconstruction of the boardwalk.
- Maintain a good emergency response to hazard events
    - Train municipal staff in the development of an emergency response team
    - Improve offerings and care available at all shelters.

Moderate Priority Actions:

- Identify vulnerable roads and identify ways to reduce vulnerability which includes building new bridges and elevate roads where appropriate.
- Investigate the status of buildings in the Historic Sandwich Village
    - Review zoning regulations of new buildings
    - Implement storm barriers to protect existing buildings
    - Elevate and/or relocate existing buildings.
- Develop a planning strategy for new coastal home construction or retreat of existing coastal homes
    - Public acquisition of private property
    - Look at zoning regulations for new homes
- Conduct a feasibility study for designing and engineering the Scorton Creek Bridge
    - Would include a study to understand the geology, tidal dynamics, and wetland status of the area

Lower Priority Actions:

- Gain support from State to assess Route 6A in Sandwich and charge them to identify problems and help facilitate solutions
- Detail a plan to place the electrical distribution grid underground

CRB Workshop Participants

Below is a table of workshop participants.

Name	Department/Affiliation
Leanne Drake	Planning Department and Economic Division
Dave DeConto	Town Dept. of Natural Resources
Bud Dunham	Town Manager
Shawn Konary	NRG (Local Business)
Deb Rudolf	State Senate Candidate
Bill Boles	Trustees of Sandwich Beaches
Teri Stanley	Sandwich Chamber of Commerce
Ed MacLean	Sandwich Dumroamin Park (Local Business)
Arlene Wilson	Conservation Commission
Susan Jason	Resident/Engineer
Laura Wing	Trustees of Sandwich Beaches
Joshua Wrigley	Town Dept. of Natural Resources
Dorothy Torrey	Path to Vibrant Health (Local Business)
Sue James	Sandwich Board of Selectmen
Michael Pottey	Oceanfront Property Owner
Catherine Paris	Biologist

Below is a table of additional entities that were invited but were unable to attend.

Department/Affiliation	Department/Affiliation
Police Department	School Department
Joint Base Cape Cod	Harbormaster's Office
Thorton Burgess Society	Dept. of Public Works
Heritage Museums & Gardens	Council on Aging
State Fish Hatchery	Health Department
State Scusset Beach Facility	Inspections Office
South Shore YMCA	Marshland Restaurant Group (Local Business)
US Coast Guard Canal Station	Fire Protection Consultant
Canal Region Chamber	Dan'l Webster Inn (Local Business)
Water Quality Advisory Committee	Fisherman's View (Local Business)
Sandwich Enterprise	Eversource
Girls & Boys Club	Sandwich Conservation Trust
Sandwich Glass Museum	State Shawme-Crowell State Forest
Sandwich Water District	Local Churches

Recommended Citation

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CRB Workshop Project Team

Town of Sandwich:

David DeCanto, Town of Sandwich DNR
Joshua Wrigley, Town of Sandwich DNR
Leanne Drake, Planning & Economic Dev
Douglas Lapp, Administrator
Bud Dunham, Town Manager
Jason Keeve, Police Dept
Bill Carrico, Fire Dept
Paul Tilton, DPW

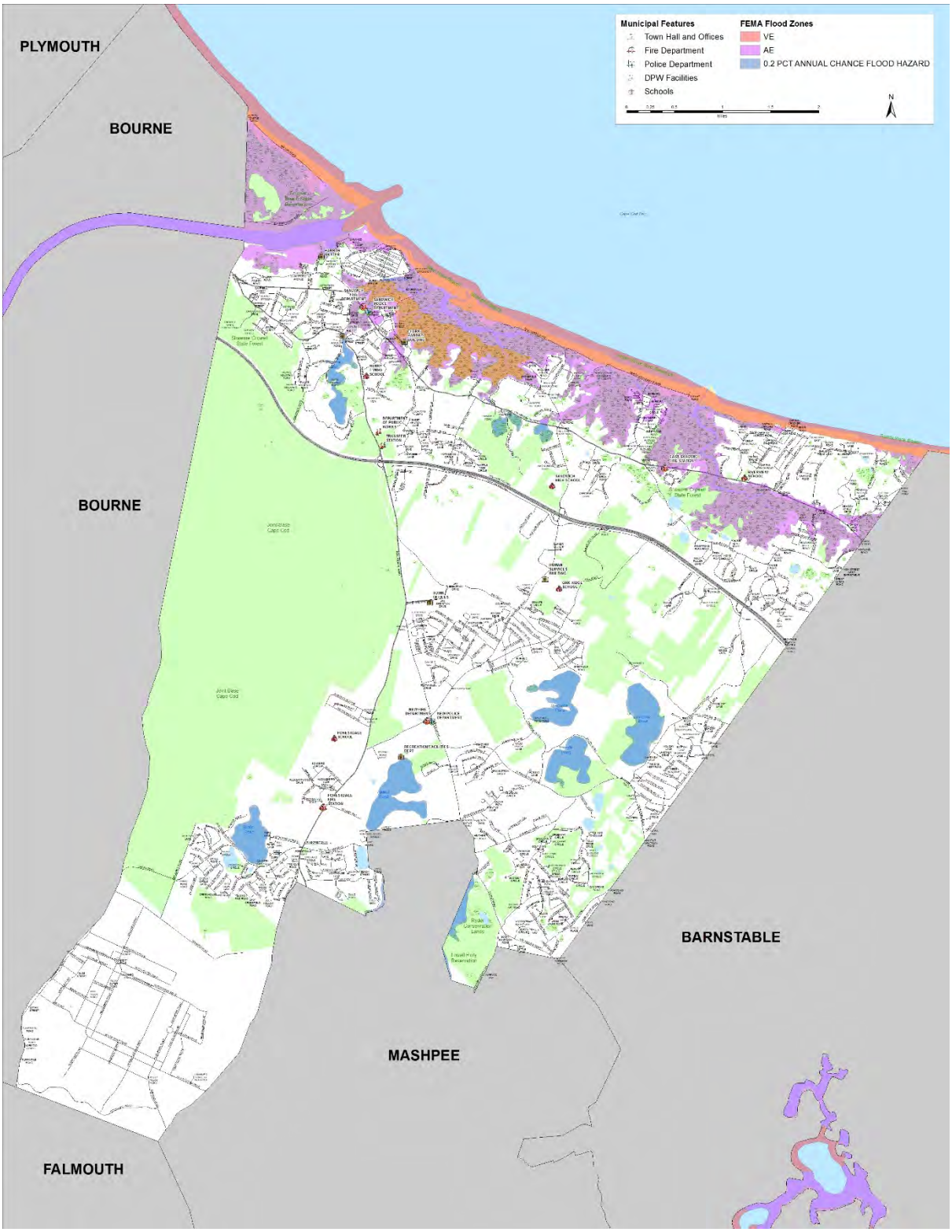
Woods Hole Group:

Joseph Famely (Lead Facilitator)
Brittany Hoffnagle (Small Group Facilitator)
Beth Gurney (Small Group Facilitator)
Adam Finkle (Small Group Facilitator)
Elise Leduc (Project Coordinator)

Acknowledgements

Special thanks to the Town of Sandwich for their willingness to embrace this process and engage a good cross section of workshop participants. Thanks also to the Sandwich Hollows Golf Club for providing the facilities to convene. This project was made possible through funding from the Executive Office of Energy and Environmental Affairs' Municipal Vulnerability Preparedness (MVP) Grant Program.

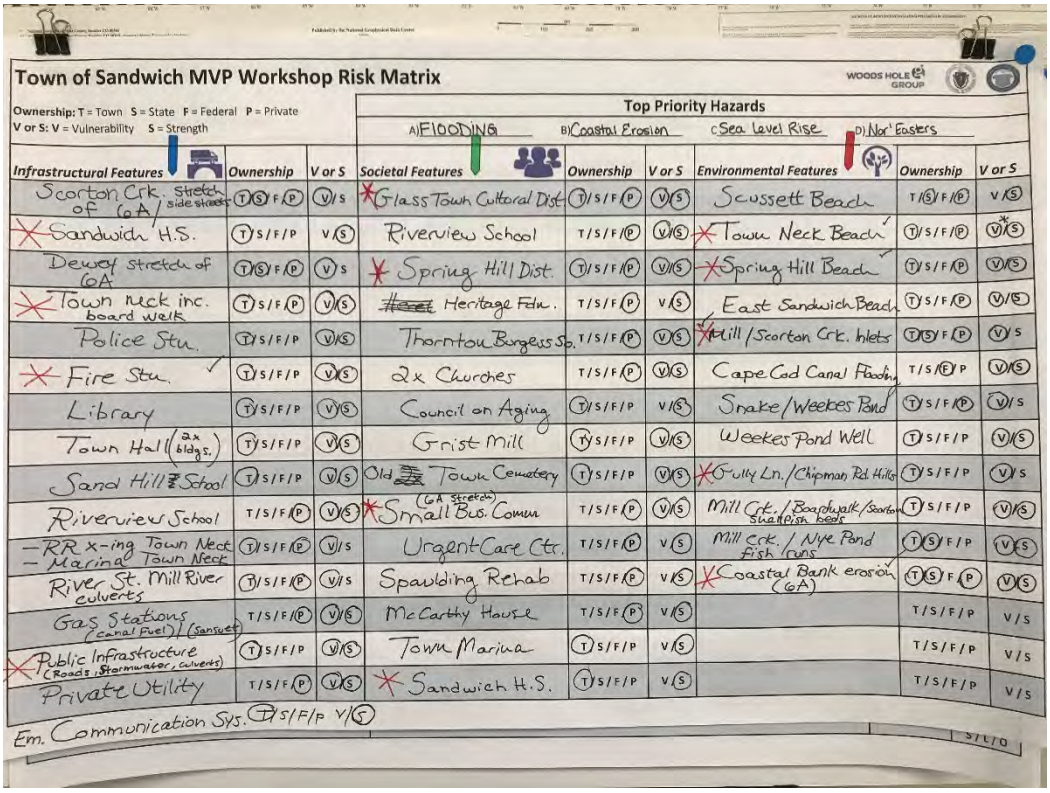
Appendix A: Workshop Base Map



Appendix B: Participatory Mapping and Matrices Results


Municipal Features
Town Hall and Offices
Fire Department
Police Department
DPW Facilities
Schools
FEMA Flood Zones
VE
AE
0.2 PCT ANNUAL CHANCE FLOOD HAZARD
PLYMOUTH
BOURNE
BOURNE
BARNSTABLE
MASHPEE
FALMOUTH
Scarton Creek Bridge


Municipal Features
Town Hall and Offices
Fire Department
Police Department
DPW Facilities
Schools
FEMA Flood Zones
VE
AE
0.2 PCT ANNUAL CHANCE FLOOD HAZARD
PLYMOUTH
BOURNE
BOURNE
BARNSTABLE
MASHPEE
FALMOUTH
*=Marsh Systems
salt H2O incursion
Flooded
Coastal Dunes
UNDERGROUND fuel or above ground
Power outages
Food Bank
NEW FIRE DEPARTMENT
NEW POLICE DEPARTMENT
FORESTDALE SCHOOL
TOWN OFFICES
Joint Base Cape Cod
Scorton Bridge vulnerability
YMCA
wooded area



Town of Sandwich MVP Workshop Risk Matrix

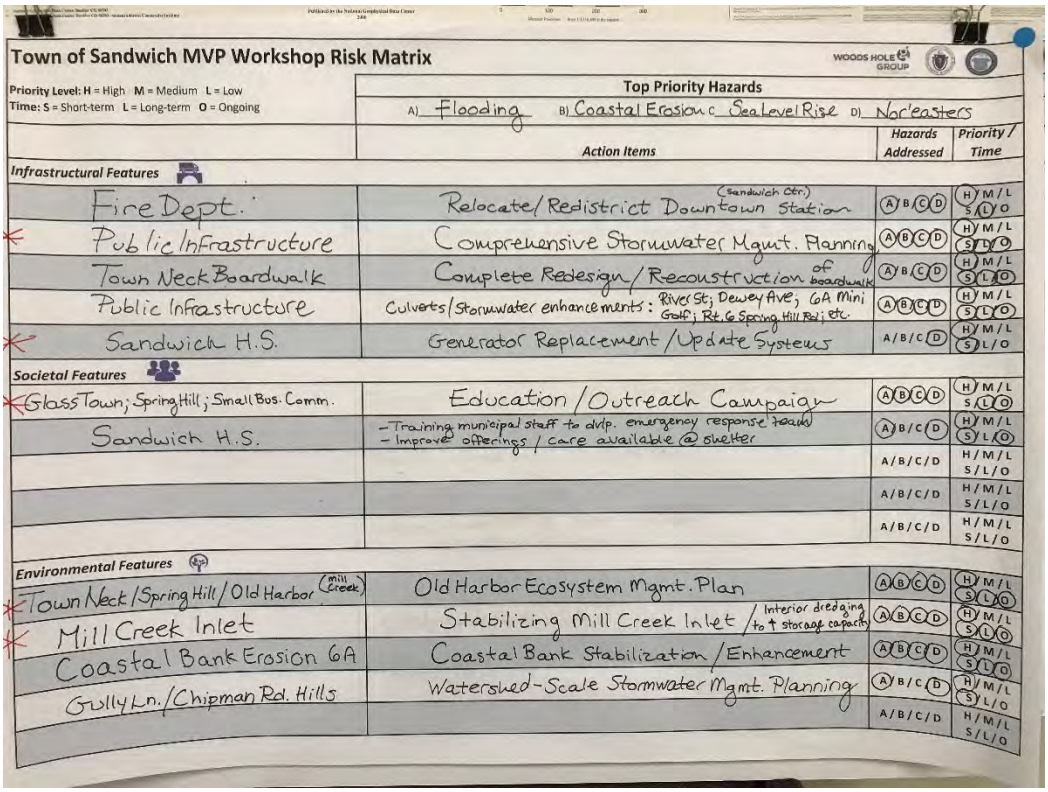
WOODS HOLE GROUP

Ownership: T = Town S = State F = Federal P = Private
V or S: V = Vulnerability S = Strength

Top Priority Hazards

A) FLOODING B) Coastal Erosion C) Sea Level Rise D) Nor'Easters

Infrastructural Features	Ownership	V or S	Societal Features	Ownership	V or S	Environmental Features	Ownership	V or S
Scorton Crk. stretch of 6A / side streets	T/S/F/P	V/S	Glass Town Cultural Dist.	T/S/F/P	V/S	Scussett Beach	T/S/F/P	V/S
Sandwich H.S.	T/S/F/P	V/S	Riverview School	T/S/F/P	V/S	Town Neck Beach ✓	T/S/F/P	V/S
Dewey stretch of 6A	T/S/F/P	V/S	Spring Hill Dist.	T/S/F/P	V/S	Spring Hill Beach ✓	T/S/F/P	V/S
Town Neck inc. board walk	T/S/F/P	V/S	~~Heritage~~ Heritage Fdn.	T/S/F/P	V/S	East Sandwich Beach	T/S/F/P	V/S
Police Stn.	T/S/F/P	V/S	Thornton Burgess Soc.	T/S/F/P	V/S	Mill / Scorton Crk. Inlets	T/S/F/P	V/S
Fire Stn. ✓	T/S/F/P	V/S	2x Churches	T/S/F/P	V/S	Cape Cod Canal Flooding	T/S/F/P	V/S
Library	T/S/F/P	V/S	Council on Aging	T/S/F/P	V/S	Snake / Weekes Pond	T/S/F/P	V/S
Town Hall (2x bldgs.)	T/S/F/P	V/S	Grist Mill	T/S/F/P	V/S	Weekes Pond Well	T/S/F/P	V/S
Sand Hill School	T/S/F/P	V/S	Old Town Cemetery	T/S/F/P	V/S	Gully Ln. / Chipman Rd. Hills	T/S/F/P	V/S
Riverview School	T/S/F/P	V/S	Small Bus. Comm. (6A Stretch)	T/S/F/P	V/S	Mill Crk. / Boardwalk / Scorton Shellfish beds	T/S/F/P	V/S
RR x-ing Town Neck Marina Town Neck	T/S/F/P	V/S	Urgent Care Ctr.	T/S/F/P	V/S	Mill Crk. / Nye Pond fish runs	T/S/F/P	V/S
River St. Mill River culverts	T/S/F/P	V/S	Spaulding Rehab	T/S/F/P	V/S	Coastal Bank erosion (6A)	T/S/F/P	V/S
Gas Stations (Canal Fuel) / (Sansuet)	T/S/F/P	V/S	McCarthy House	T/S/F/P	V/S		T/S/F/P	V/S
Public Infrastructure (Roads, Stormwater, culverts)	T/S/F/P	V/S	Town Marina	T/S/F/P	V/S		T/S/F/P	V/S
Private Utility	T/S/F/P	V/S	Sandwich H.S.	T/S/F/P	V/S		T/S/F/P	V/S
Em. Communication Sys.	T/S/F/P	V/S						



Town of Sandwich MVP Workshop Risk Matrix

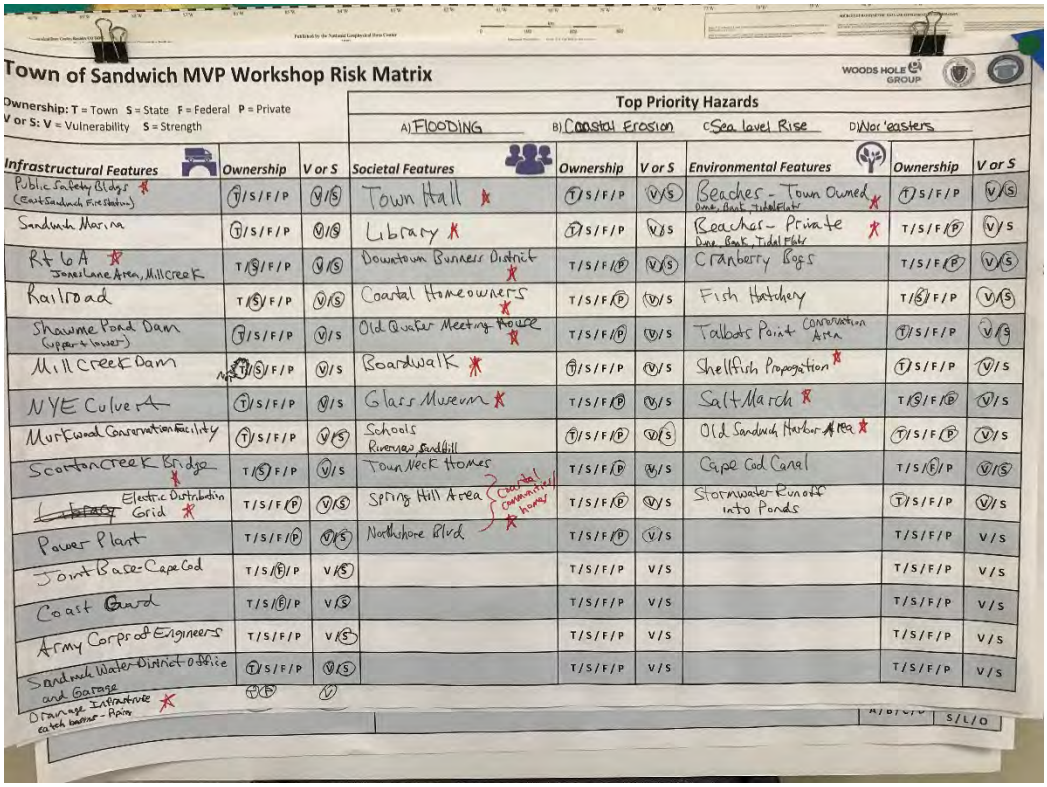
WOODS HOLE GROUP

Priority Level: H = High M = Medium L = Low
Time: S = Short-term L = Long-term O = Ongoing

Top Priority Hazards

A) Flooding B) Coastal Erosion C) Sea Level Rise D) Nor'easters

	Action Items	Hazards Addressed	Priority / Time
Infrastructural Features			
Fire Dept.	Relocate / Redistrict Downtown Station (Sandwich Ctr.)	A/B/C/D	H/M/L S/L/O
Public Infrastructure	Comprehensive Stormwater Mgmt. Planning	A/B/C/D	H/M/L S/L/O
Town Neck Boardwalk	Complete Redesign / Reconstruction of boardwalk	A/B/C/D	H/M/L S/L/O
Public Infrastructure	Culverts / Stormwater enhancements: River St; Dewey Ave; 6A Mini Golf; Rt. 6 Spring Hill Rd; etc.	A/B/C/D	H/M/L S/L/O
Sandwich H.S.	Generator Replacement / Update Systems	A/B/C/D	H/M/L S/L/O
Societal Features			
Glass Town; Spring Hill; Small Bus. Comm.	Education / Outreach Campaign	A/B/C/D	H/M/L S/L/O
Sandwich H.S.	- Training municipal staff to dvlp. emergency response team - Improve offerings / care available @ shelter	A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O
Environmental Features			
Town Neck / Spring Hill / Old Harbor (Mill Creek)	Old Harbor Ecosystem Mgmt. Plan	A/B/C/D	H/M/L S/L/O
Mill Creek Inlet	Stabilizing Mill Creek Inlet / Interior dredging to ↑ storage capacity	A/B/C/D	H/M/L S/L/O
Coastal Bank Erosion 6A	Coastal Bank Stabilization / Enhancement	A/B/C/D	H/M/L S/L/O
Gully Ln. / Chipman Rd. Hills	Watershed-Scale Stormwater Mgmt. Planning	A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O



Town of Sandwich MVP Workshop Risk Matrix

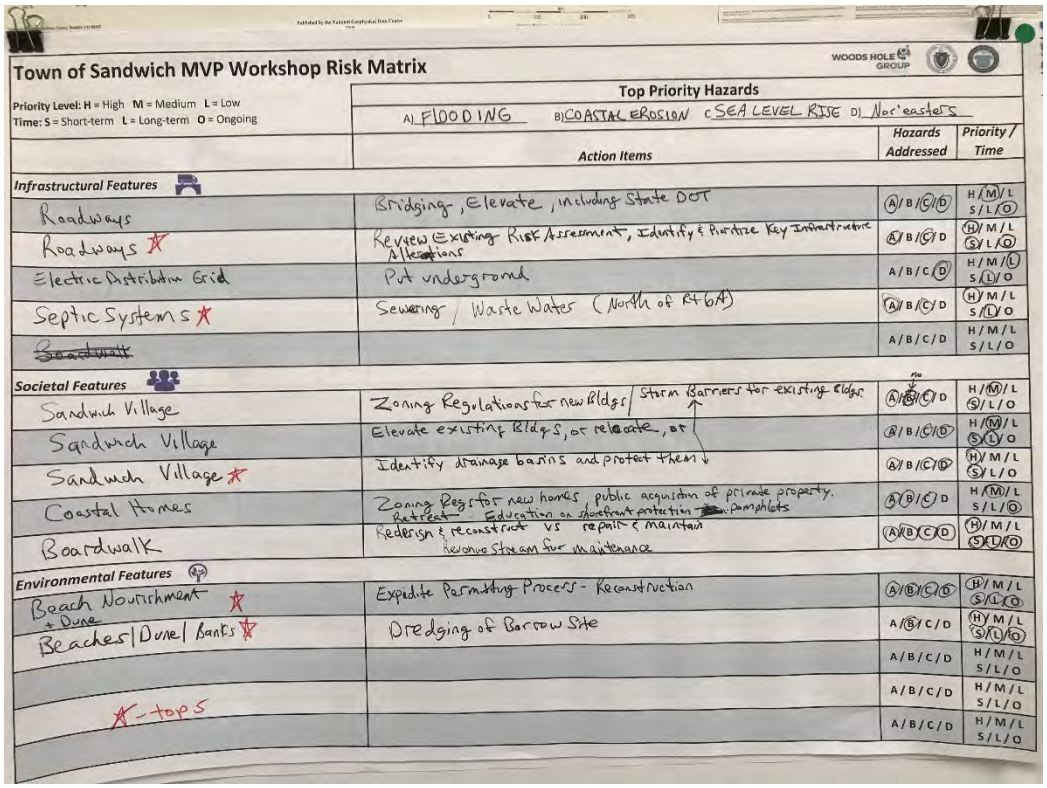
WOODS HOLE GROUP

Ownership: T = Town S = State F = Federal P = Private
V or S: V = Vulnerability S = Strength

Top Priority Hazards

A) FLOODING B) Coastal Erosion C) Sea level Rise D) Nor'easters

Infrastructural Features	Ownership	V or S	Societal Features	Ownership	V or S	Environmental Features	Ownership	V or S
Public Safety Bldgs (East Sandwich Fire Station)	T/S/F/P	V/S	Town Hall	T/S/F/P	V/S	Beaches - Town Owned (Dune, Bank, Tidal Flats)	T/S/F/P	V/S
Sandwich Marina	T/S/F/P	V/S	Library	T/S/F/P	V/S	Beaches - Private (Dune, Bank, Tidal Flats)	T/S/F/P	V/S
Rt 6A (Jones Lane Area, Mill Creek)	T/S/F/P	V/S	Downtown Business District	T/S/F/P	V/S	Cranberry Bogs	T/S/F/P	V/S
Railroad	T/S/F/P	V/S	Coastal Homeowners	T/S/F/P	V/S	Fish Hatchery	T/S/F/P	V/S
Shawme Pond Dam (Upper & Lower)	T/S/F/P	V/S	Old Quaker Meeting House	T/S/F/P	V/S	Talbots Point Conservation Area	T/S/F/P	V/S
Mill Creek Dam	T/S/F/P	V/S	Boardwalk	T/S/F/P	V/S	Shellfish Propagation	T/S/F/P	V/S
NYE Culvert	T/S/F/P	V/S	Glass Museum	T/S/F/P	V/S	Salt Marsh	T/S/F/P	V/S
Mur Wood Conservation Facility	T/S/F/P	V/S	Schools (Riverview, Southside)	T/S/F/P	V/S	Old Sandwich Harbor Area	T/S/F/P	V/S
Scorton Creek Bridge	T/S/F/P	V/S	Town Neck Homes	T/S/F/P	V/S	Cape Cod Canal	T/S/F/P	V/S
~~Library~~ Electric Distribution Grid	T/S/F/P	V/S	Spring Hill Area (Coastal Community Homes)	T/S/F/P	V/S	Stormwater Runoff into Ponds	T/S/F/P	V/S
Power Plant	T/S/F/P	V/S	Northshore Blvd	T/S/F/P	V/S		T/S/F/P	V/S
Joint Base-Cape Cod	T/S/F/P	V/S		T/S/F/P	V/S		T/S/F/P	V/S
Coast Guard	T/S/F/P	V/S		T/S/F/P	V/S		T/S/F/P	V/S
Army Corps of Engineers	T/S/F/P	V/S		T/S/F/P	V/S		T/S/F/P	V/S
Sandwich Water District Office and Garage	T/S/F/P	V/S		T/S/F/P	V/S		T/S/F/P	V/S
Drainage Infrastructure catch basins - Repair	T/F/P	V						



Town of Sandwich MVP Workshop Risk Matrix

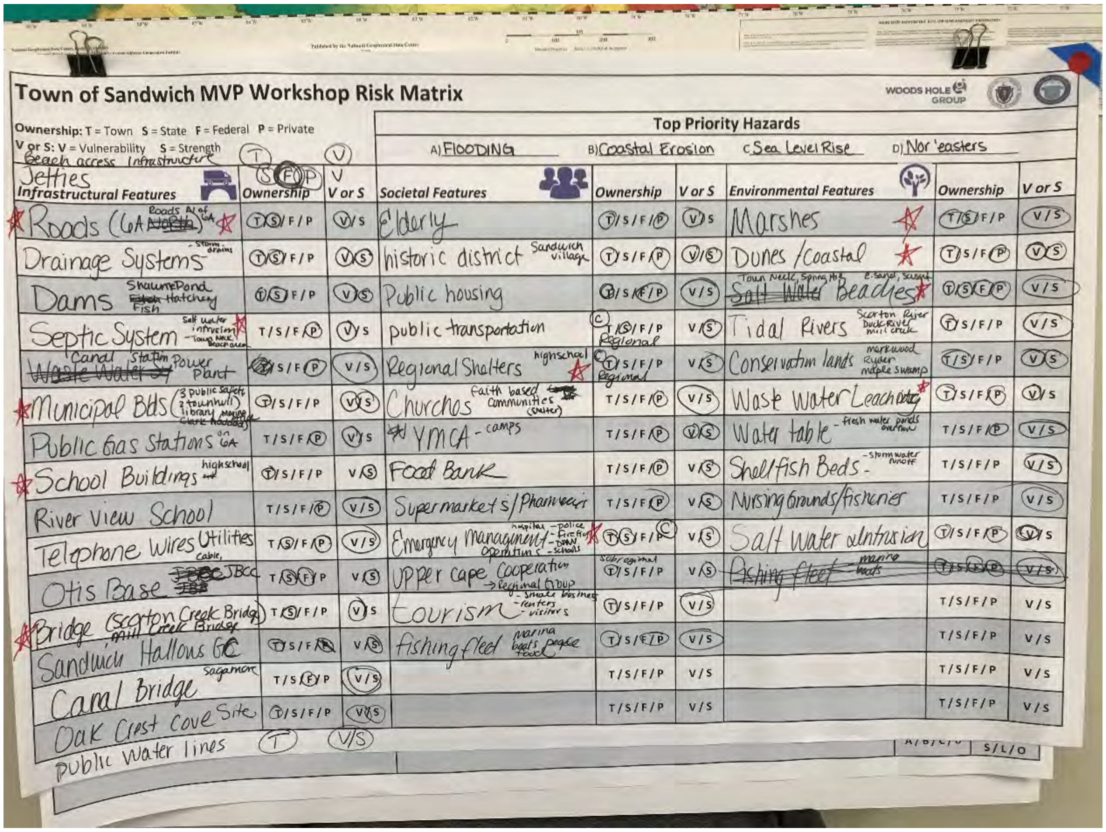
WOODS HOLE GROUP

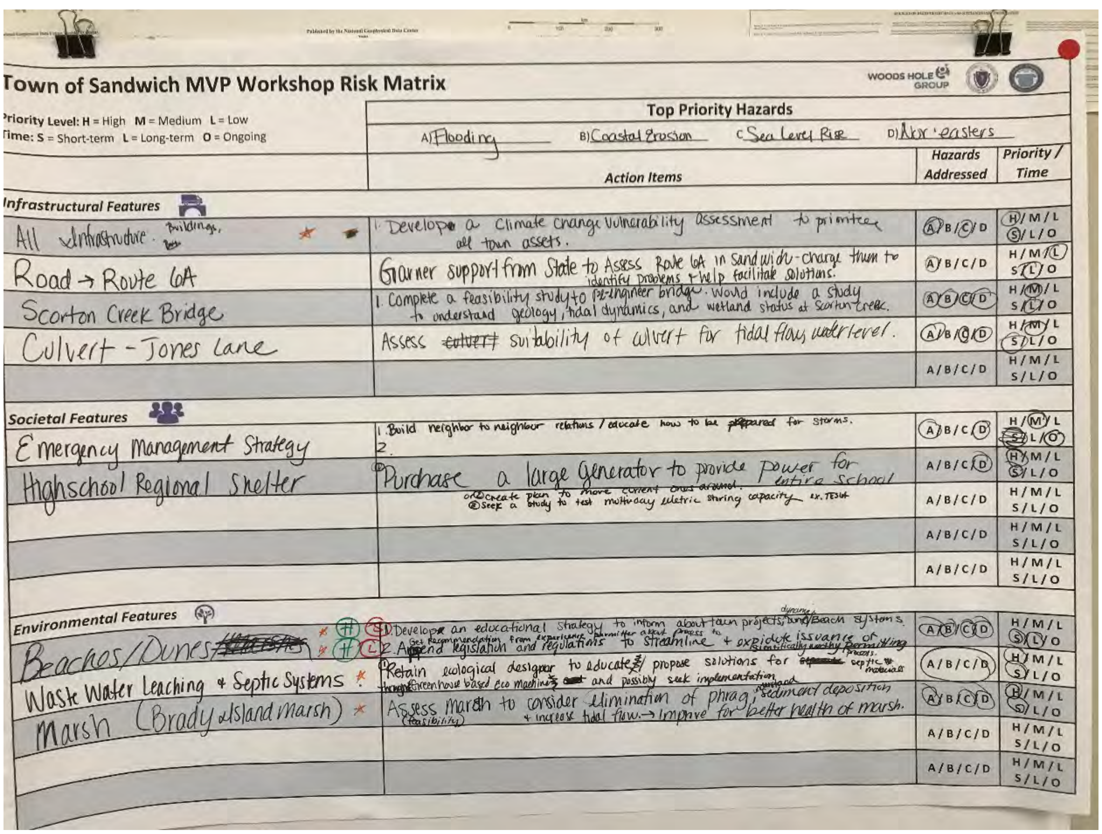
Priority Level: H = High M = Medium L = Low
Time: S = Short-term L = Long-term O = Ongoing

Top Priority Hazards

A) FLOODING B) COASTAL EROSION C) SEA LEVEL RISE D) Nor'easters

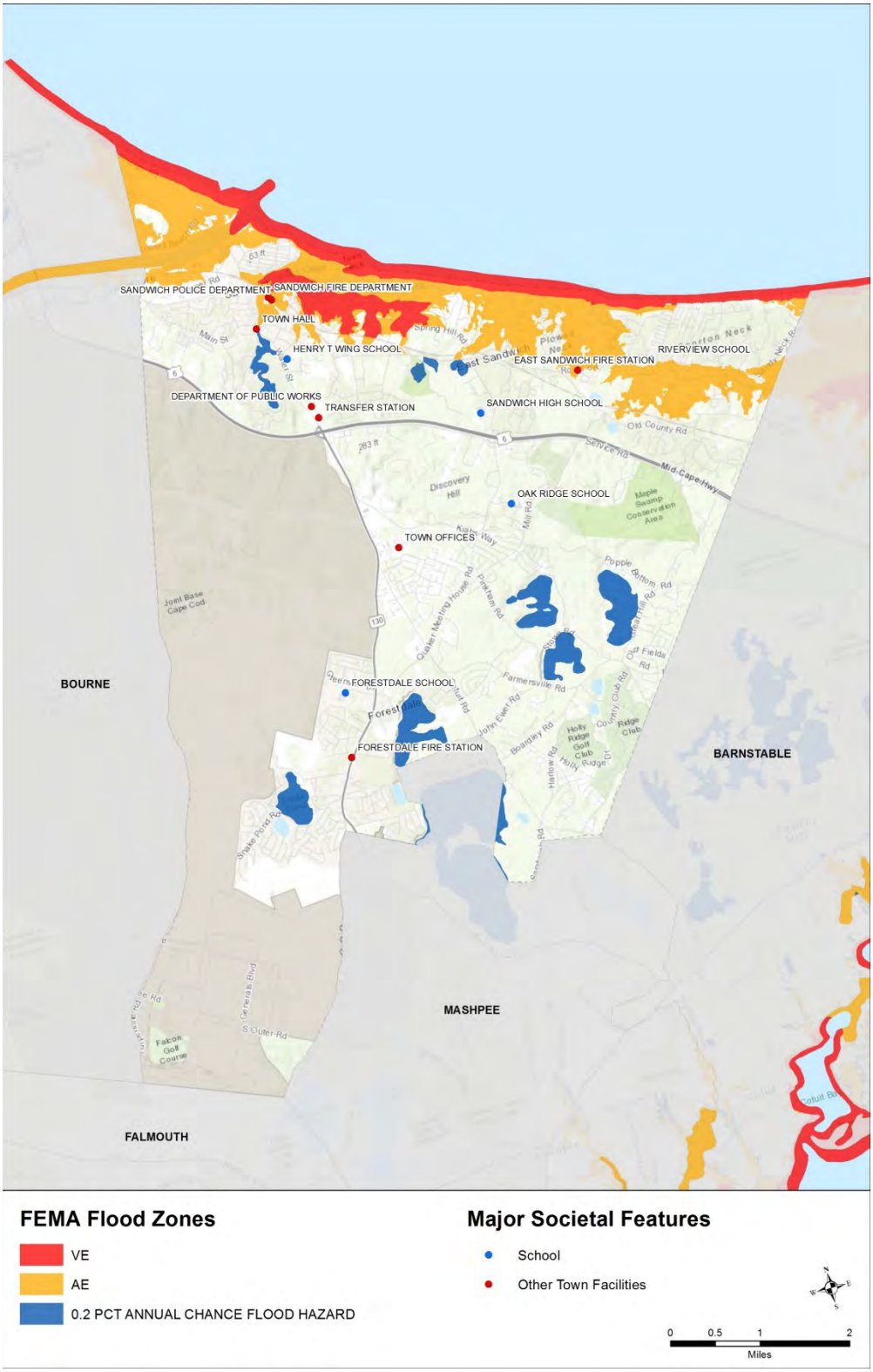
	Action Items	Hazards Addressed	Priority / Time
Infrastructural Features			
Roadways	Bridging, Elevate, including State DOT	A/B/C/D	H/M/L S/L/O
Roadways	Review Existing Risk Assessment, Identify & Prioritize Key Infrastructure Alterations	A/B/C/D	H/M/L S/L/O
Electric Distribution Grid	Put underground	A/B/C/D	H/M/L S/L/O
Septic Systems	Sewering / Waste Waters (North of Rt 6A)	A/B/C/D	H/M/L S/L/O
~~Boardwalk~~		A/B/C/D	H/M/L S/L/O
Societal Features			
Sandwich Village	Zoning Regulations for new Bldgs / Storm Barriers for existing Bldgs	A/B/C/D	H/M/L S/L/O
Sandwich Village	Elevate existing Bldgs, or relocate, or	A/B/C/D	H/M/L S/L/O
Sandwich Village	Identify drainage basins and protect them	A/B/C/D	H/M/L S/L/O
Coastal Homes	Zoning Reg for new homes, public acquisition of private property. Retreat - Education on shoreline protection - pamphlets	A/B/C/D	H/M/L S/L/O
Boardwalk	Redesign & reconstruct vs repair & maintain. Revenue stream for maintenance	A/B/C/D	H/M/L S/L/O
Environmental Features			
Beach Nourishment + Dune	Expedite Permitting Process - Reconstruction	A/B/C/D	H/M/L S/L/O
Beaches/Dune/Banks	Dredging of Borrow Site	A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O
★ - tops		A/B/C/D	H/M/L S/L/O
		A/B/C/D	H/M/L S/L/O

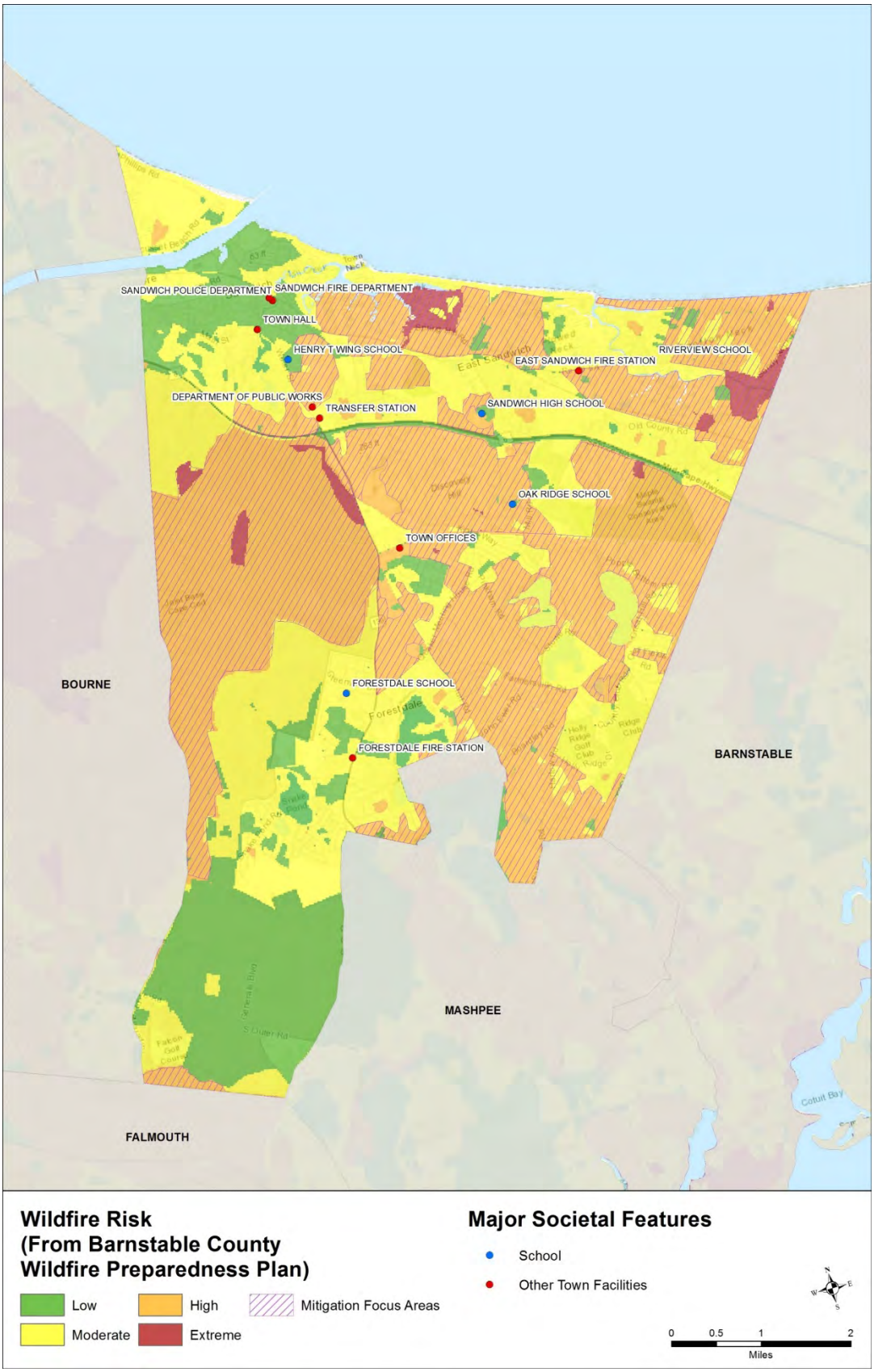

Town of Sandwich MVP Workshop Risk Matrix
Ownership: T = Town S = State F = Federal P = Private
V or S: V = Vulnerability S = Strength
Top Priority Hazards
A) FLOODING B) Coastal Erosion C) Sea Level Rise D) Nor'easters
Infrastructural Features
Ownership
V or S
Societal Features
Environmental Features
Beach access Infrastructure
Jetties
Roads (6A North)
Drainage Systems
Dams
Septic System
Canal Station Power Plant
Municipal Blds
Public Gas Stations
School Buildings
River view School
Telephone Wires Utilities
Otis Base
Bridge (Scorton Creek Bridge)
Sandwich Hollows GC
Canal Bridge
Oak Crest Cove Site
public water lines
Elderly
historic district
Public housing
public transportation
Regional Shelters
Churches
YMCA
Food Bank
Supermarkets/Pharmacies
Emergency Management
Upper Cape Cooperation
tourism
fishing fleet
Marshes
Dunes/Coastal
Salt Water Beaches
Tidal Rivers
Conservation lands
Waste Water Leachate
Water table
Shellfish Beds
Nursing Grounds/fisheries
Salt water intrusion
Fishing fleet


Town of Sandwich MVP Workshop Risk Matrix
Priority Level: H = High M = Medium L = Low
Time: S = Short-term L = Long-term O = Ongoing
Top Priority Hazards
A) Flooding B) Coastal Erosion C) Sea Level Rise D) Nor'easters
Action Items
Hazards Addressed
Priority / Time
Infrastructural Features
All infrastructure, Buildings
Develop a climate change vulnerability assessment to prioritize all town assets.
Road → Route 6A
Garner support from State to Assess Route 6A in Sandwich - charge them to identify problems + help facilitate solutions.
Scorton Creek Bridge
Culvert - Jones Lane
Assess suitability of culvert for tidal flow, water level.
Societal Features
Emergency Management Strategy
Build neighbor to neighbor relations / educate how to be prepared for storms.
Highschool Regional Shelter
Purchase a large generator to provide power for entire school
Environmental Features
Beaches/Dunes
Waste Water Leaching + Septic Systems
Marsh (Brady's Island Marsh)
Assess marsh to consider elimination of phrag, sediment deposition + increase tidal flow → improve for better health of marsh.

Appendix C: Sandwich Risk Maps Used During Workshop

(Given as workshop handouts)

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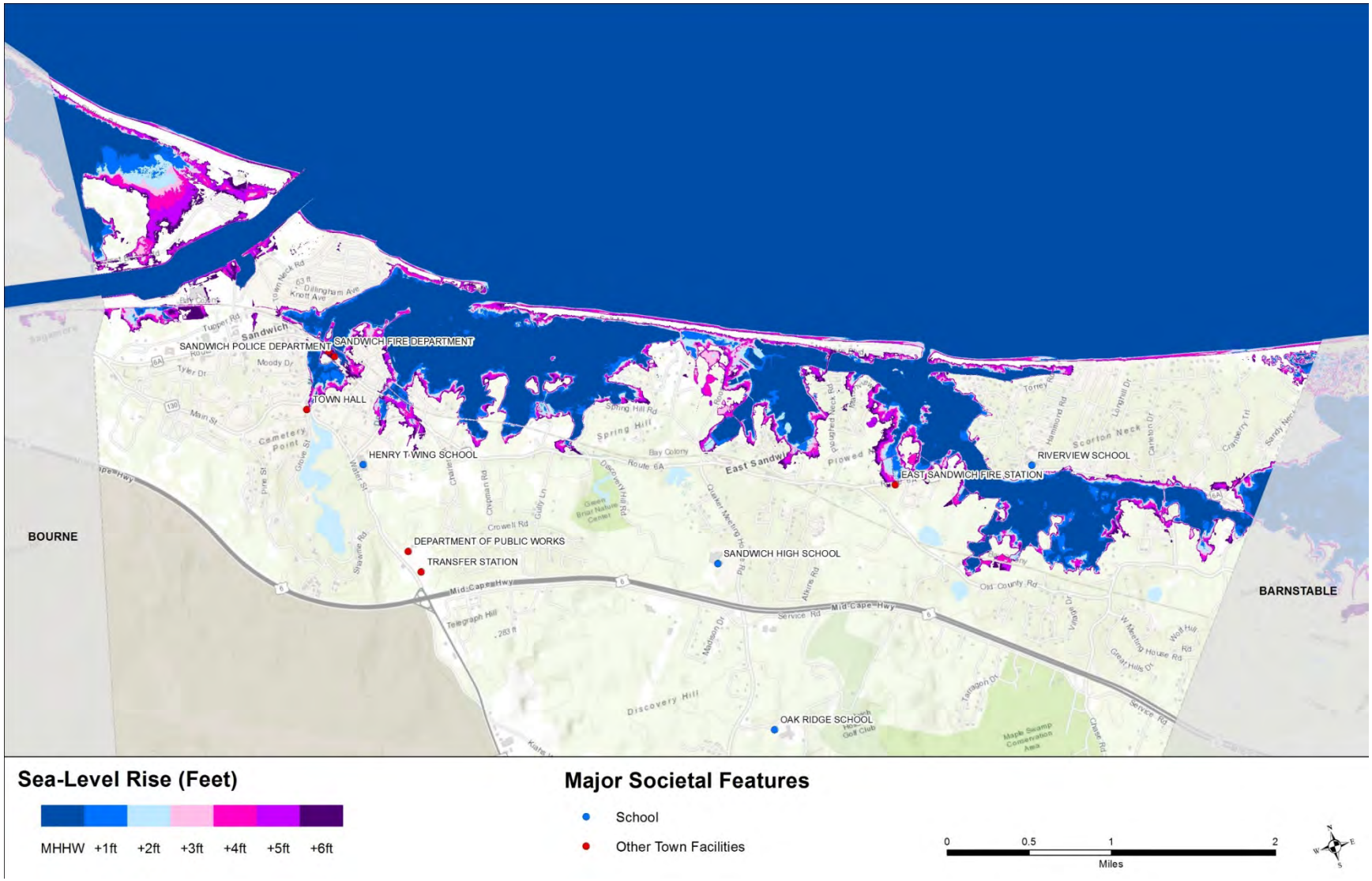
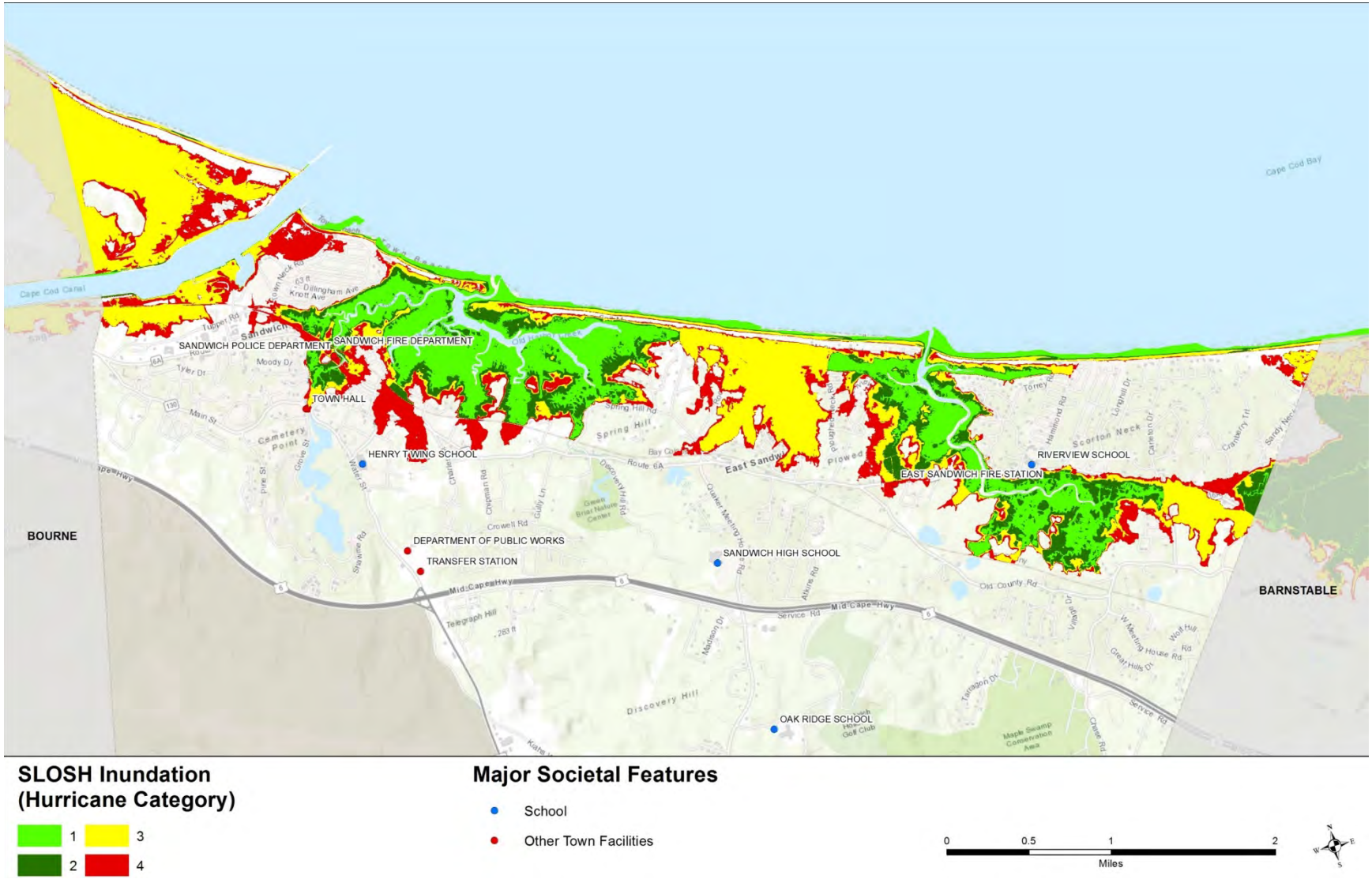
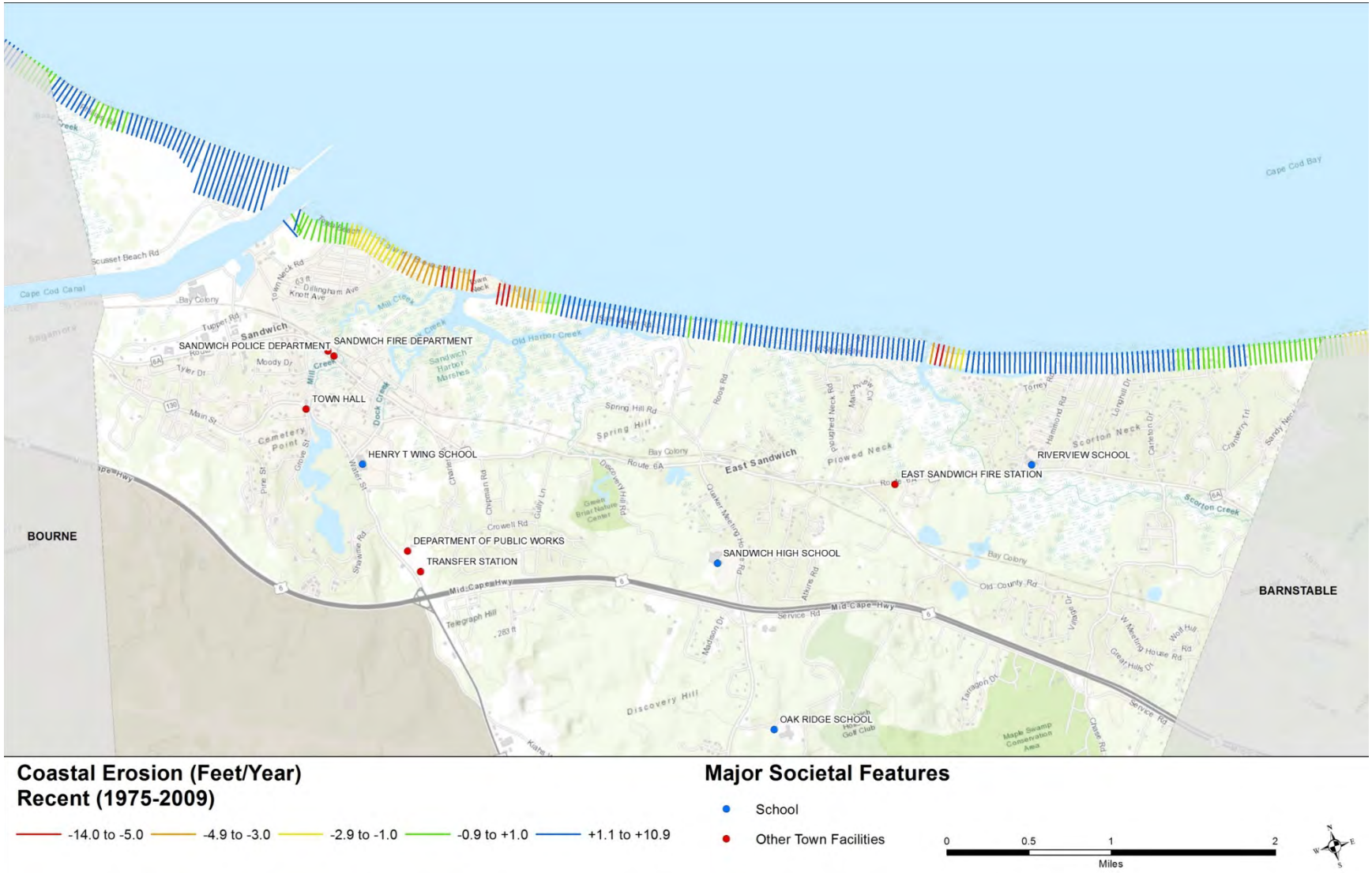
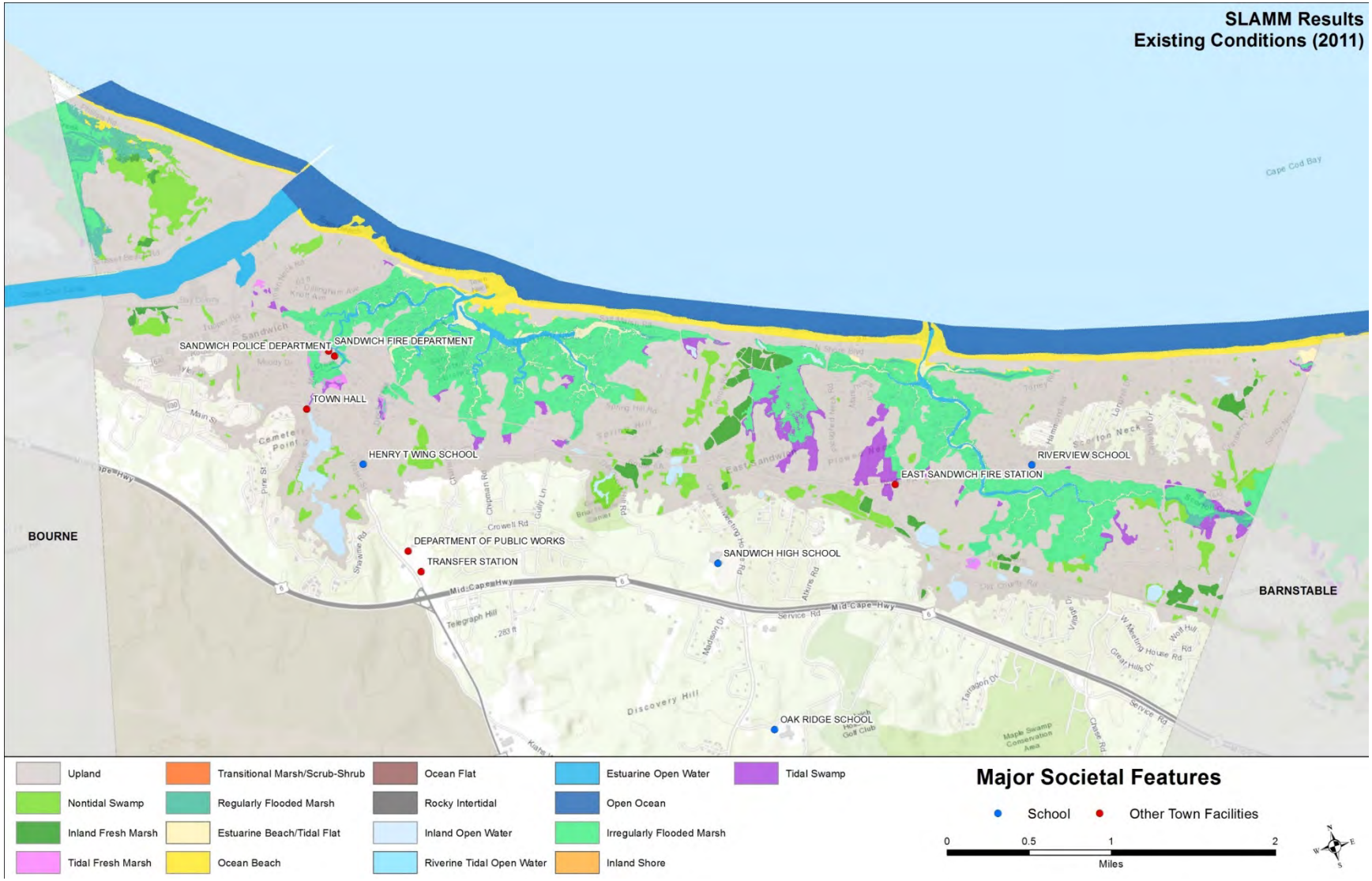
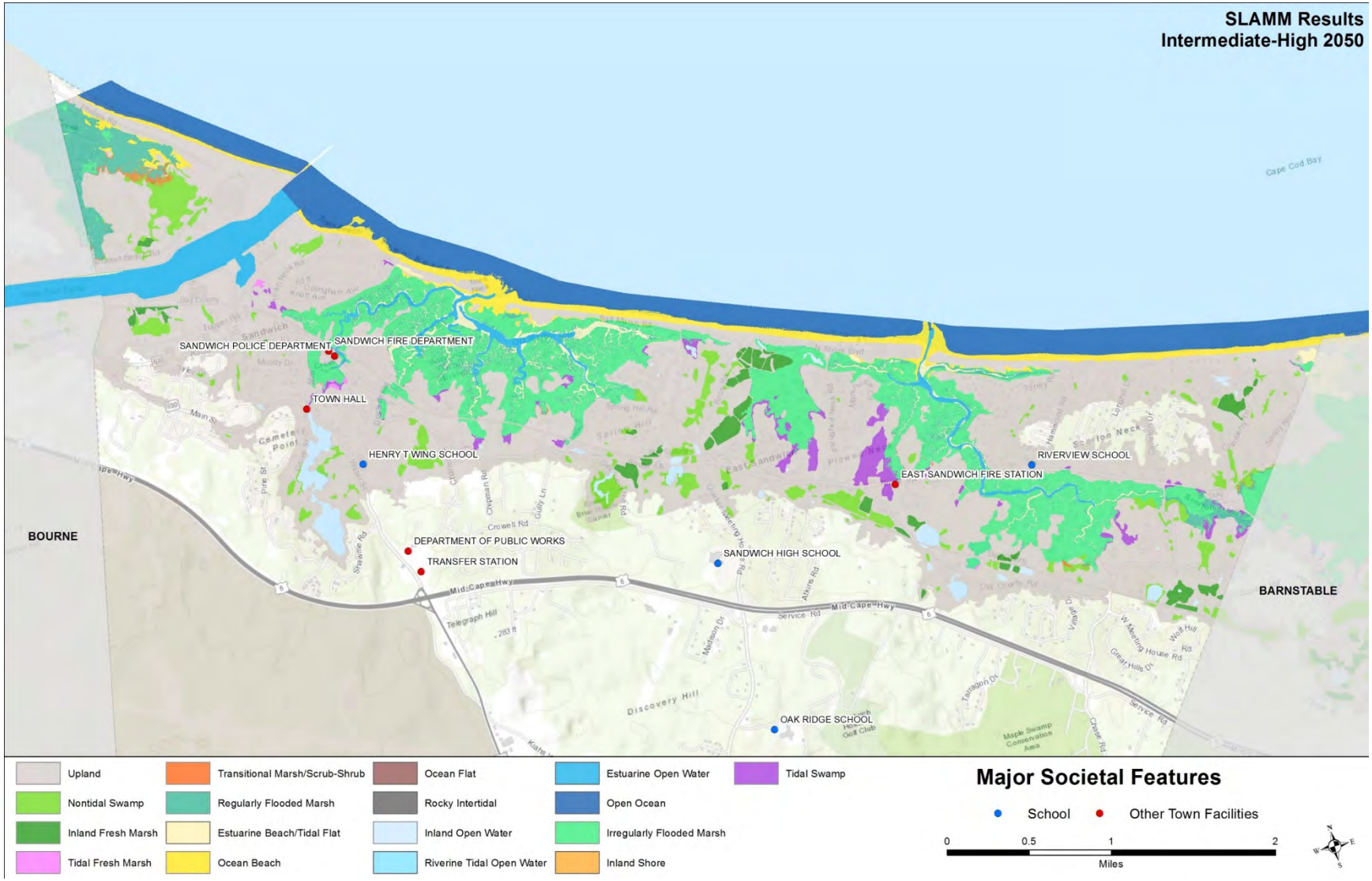
SANDWICH FIRE DEPARTMENT
TOWN HALL
HENRY T. WING SCHOOL
EAST SANDWICH FIRE STATION
RIVERVIEW SCHOOL
DEPARTMENT OF PUBLIC WORKS
TRANSFER STATION
SANDWICH HIGH SCHOOL
OAK RIDGE SCHOOL
TOWN OFFICES
FORESTDALE SCHOOL
FORESTDALE FIRE STATION
BOURNE
BARNSTABLE
MASHPEE
FALMOUTH
Wildfire Risk
(From Barnstable County
Wildfire Preparedness Plan)
Low
High
Mitigation Focus Areas
Moderate
Extreme
Major Societal Features
School
Other Town Facilities
0
0.5
1
2
Miles

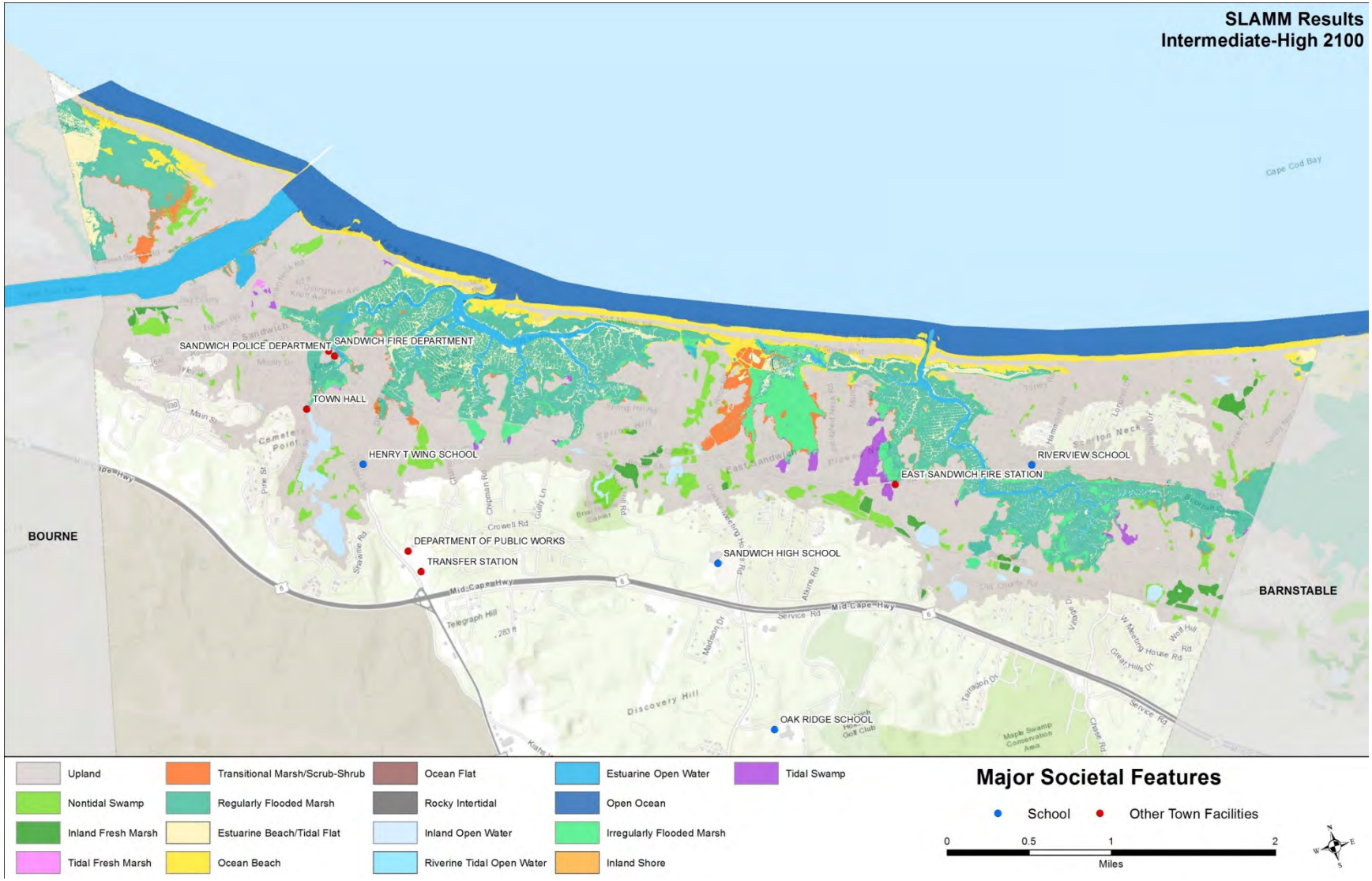

SANDWICH POLICE DEPARTMENT
SANDWICH FIRE DEPARTMENT
TOWN HALL
HENRY T WING SCHOOL
RIVERVIEW SCHOOL
EAST SANDWICH FIRE STATION
DEPARTMENT OF PUBLIC WORKS
TRANSFER STATION
SANDWICH HIGH SCHOOL
OAK RIDGE SCHOOL
BOURNE
BARNSTABLE
Sandwich
East Sandwich
Mid Cape Hwy
Route 6A
Spring Hill
Discovery Hill
Sea-Level Rise (Feet)
MHHW +1ft +2ft +3ft +4ft +5ft +6ft
Major Societal Features
School
Other Town Facilities
0 0.5 1 2
Miles


SANDWICH POLICE DEPARTMENT
SANDWICH FIRE DEPARTMENT
TOWN HALL
HENRY T WING SCHOOL
DEPARTMENT OF PUBLIC WORKS
TRANSFER STATION
SANDWICH HIGH SCHOOL
OAK RIDGE SCHOOL
RIVERVIEW SCHOOL
EAST SANDWICH FIRE STATION
BOURNE
BARNSTABLE
Cape Cod Canal
Cape Cod Bay
Route 6A
Mid Cape Hwy
Service Rd
Spring Hill
Discovery Hill
Telegraph Hill
SLOSH Inundation (Hurricane Category)
1
2
3
4
Major Societal Features
School
Other Town Facilities
0
0.5
1
2
Miles


SANDWICH POLICE DEPARTMENT
SANDWICH FIRE DEPARTMENT
TOWN HALL
HENRY T WING SCHOOL
DEPARTMENT OF PUBLIC WORKS
TRANSFER STATION
SANDWICH HIGH SCHOOL
OAK RIDGE SCHOOL
EAST SANDWICH FIRE STATION
RIVERVIEW SCHOOL
BOURNE
BARNSTABLE
Sandwich
East Sandwich
Cape Cod Canal
Cape Cod Bay
Mid Cape Hwy
Route 6A
Spring Hill
Discovery Hill
Coastal Erosion (Feet/Year)
Recent (1975-2009)
-14.0 to -5.0
-4.9 to -3.0
-2.9 to -1.0
-0.9 to +1.0
+1.1 to +10.9
Major Societal Features
School
Other Town Facilities
0
0.5
1
2
Miles


SLAMM Results
Existing Conditions (2011)
SANDWICH POLICE DEPARTMENT
SANDWICH FIRE DEPARTMENT
TOWN HALL
HENRY T WING SCHOOL
RIVERVIEW SCHOOL
EAST SANDWICH FIRE STATION
DEPARTMENT OF PUBLIC WORKS
TRANSFER STATION
SANDWICH HIGH SCHOOL
OAK RIDGE SCHOOL
BOURNE
BARNSTABLE
Cape Cod Bay
Mid Cape Hwy
Upland
Nontidal Swamp
Inland Fresh Marsh
Tidal Fresh Marsh
Transitional Marsh/Scrub-Shrub
Regularly Flooded Marsh
Estuarine Beach/Tidal Flat
Ocean Beach
Ocean Flat
Rocky Intertidal
Inland Open Water
Riverine Tidal Open Water
Estuarine Open Water
Open Ocean
Irregularly Flooded Marsh
Inland Shore
Tidal Swamp
Major Societal Features
School
Other Town Facilities
0
0.5
1
2
Miles


SLAMM Results
Intermediate-High 2050
SANDWICH POLICE DEPARTMENT
SANDWICH FIRE DEPARTMENT
TOWN HALL
HENRY T WING SCHOOL
DEPARTMENT OF PUBLIC WORKS
TRANSFER STATION
SANDWICH HIGH SCHOOL
OAK RIDGE SCHOOL
RIVERVIEW SCHOOL
EAST SANDWICH FIRE STATION
BOURNE
BARNSTABLE
Cape Cod Bay
Mid-Cape Hwy
Upland
Nontidal Swamp
Inland Fresh Marsh
Tidal Fresh Marsh
Transitional Marsh/Scrub-Shrub
Regularly Flooded Marsh
Estuarine Beach/Tidal Flat
Ocean Beach
Ocean Flat
Rocky Intertidal
Inland Open Water
Riverine Tidal Open Water
Estuarine Open Water
Open Ocean
Irregularly Flooded Marsh
Inland Shore
Tidal Swamp
Major Societal Features
School
Other Town Facilities
0
0.5
1
2
Miles


SLAMM Results
Intermediate-High 2100
SANDWICH POLICE DEPARTMENT
SANDWICH FIRE DEPARTMENT
TOWN HALL
HENRY T WING SCHOOL
DEPARTMENT OF PUBLIC WORKS
TRANSFER STATION
SANDWICH HIGH SCHOOL
OAK RIDGE SCHOOL
RIVERVIEW SCHOOL
EAST SANDWICH FIRE STATION
BOURNE
BARNSTABLE
Cape Cod Bay
Mid Cape Hwy
Upland
Nontidal Swamp
Inland Fresh Marsh
Tidal Fresh Marsh
Transitional Marsh/Scrub-Shrub
Regularly Flooded Marsh
Estuarine Beach/Tidal Flat
Ocean Beach
Ocean Flat
Rocky Intertidal
Inland Open Water
Riverine Tidal Open Water
Estuarine Open Water
Open Ocean
Irregularly Flooded Marsh
Inland Shore
Tidal Swamp
Major Societal Features
School
Other Town Facilities
0
0.5
1
2
Miles

Appendix D: Massachusetts Updated Climate Projections

(Given as workshop handouts)

CAPE COD BASIN

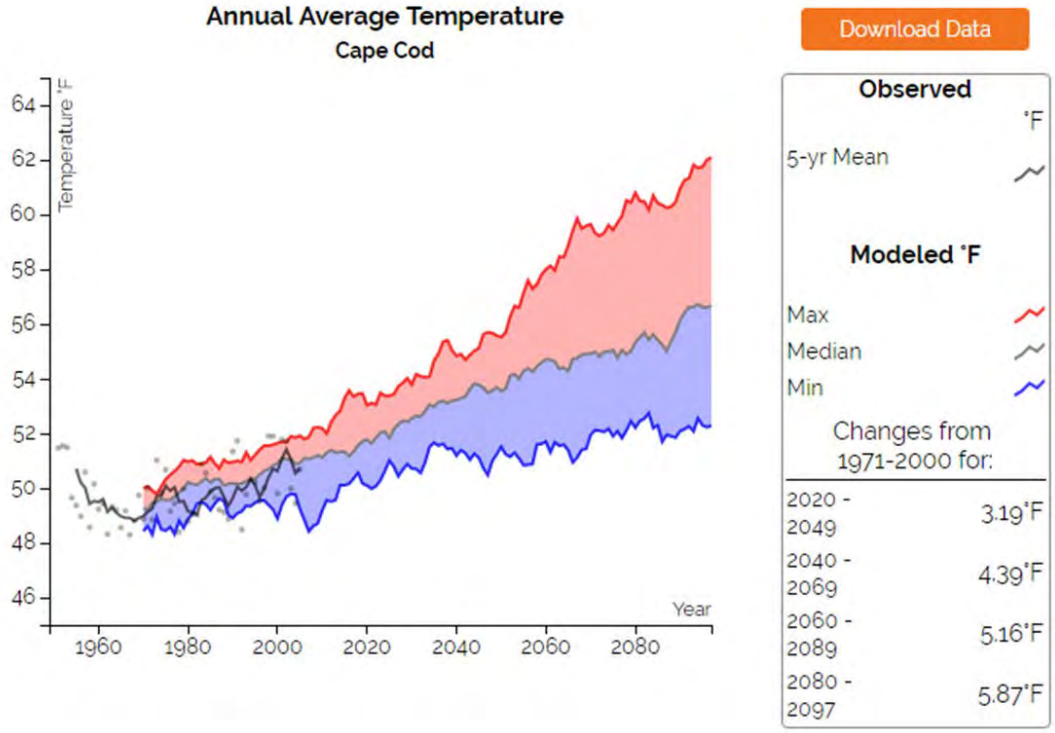
MUNICIPALITIES WITHIN CAPE COD BASIN:

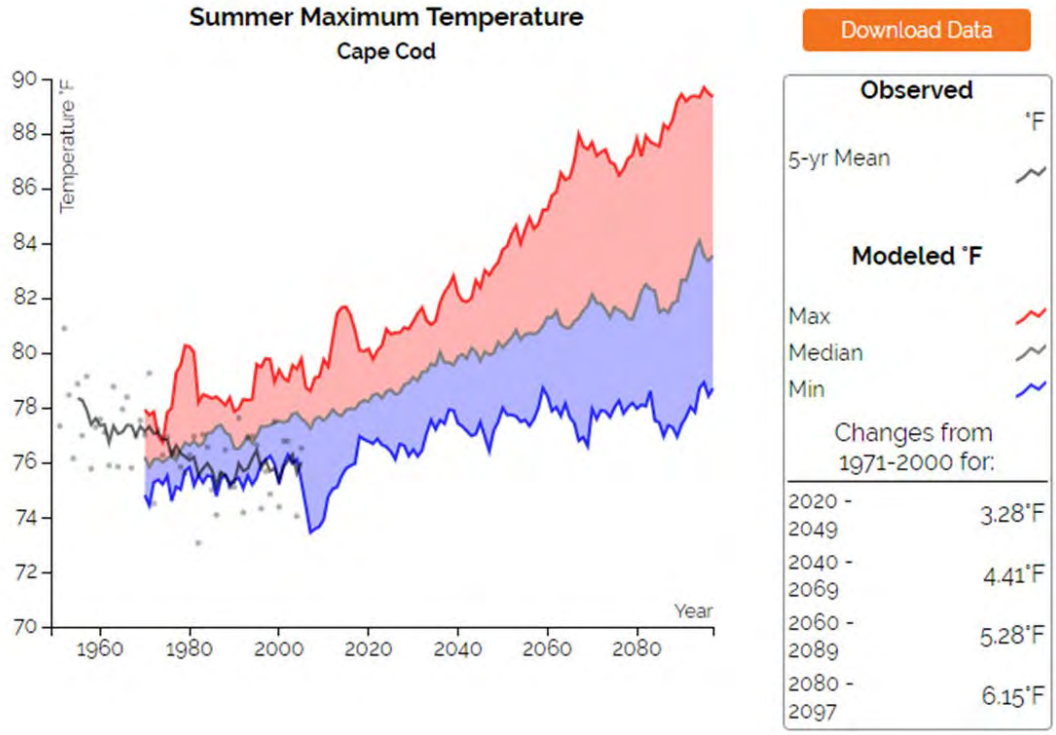
Barnstable, Bourne, Brewster, Chatham, Dennis, Eastham, Falmouth, Harwich, Mashpee, Orleans, Provincetown, Sandwich, Truro, Wellfleet, Yarmouth

CAPE COD BASIN

Cape Cod Basin		Observed Baseline 1971-2000 (°F)	Projected Change in 2030s (°F)	Mid-Century Projected Change in 2050s (°F)	Projected Change in 2070s (°F)	End of Century Projected Change in 2090s (°F)
Average Temperature	Annual	49.92	+1.78 to +3.41	+2.41 to +5.39	+2.74 to +7.78	+3.11 to +9.52
	Winter	31.92	+1.76 to +3.72	+2.50 to +5.70	+3.07 to +7.69	+3.35 to +9.20
	Spring	45.98	+1.73 to +3.23	+2.16 to +5.04	+2.59 to +6.74	+2.94 to +7.69
	Summer	68.15	+1.50 to +3.62	+2.08 to +5.66	+2.45 to +8.58	+3.03 to +10.43
	Fall	53.32	+1.92 to +3.83	+3.03 to +5.86	+2.85 to +8.29	+3.35 to +10.06
Maximum Temperature	Annual	57.74	+1.63 to +3.38	+2.19 to +5.23	+2.43 to +7.73	+2.82 to +9.26
	Winter	39.76	+1.52 to +3.60	+2.10 to +5.27	+2.60 to +7.27	+3.01 to +8.65
	Spring	53.74	+1.44 to +3.11	+1.92 to +4.80	+2.30 to +6.54	+2.62 to +7.55
	Summer	75.95	+1.35 to +3.48	+1.95 to +5.60	+2.29 to +8.47	+2.68 to +10.27
	Fall	61.24	+1.84 to +3.80	+2.81 to +5.83	+2.76 to +8.00	+3.08 to +9.97
Minimum Temperature	Annual	42.09	+1.92 to +3.53	+2.67 to +5.50	+3.06 to +7.84	+3.42 to +9.67
	Winter	24.08	+2.06 to +3.97	+2.90 to +6.16	+3.53 to +8.34	+3.81 to +9.85
	Spring	38.23	+1.74 to +3.47	+2.51 to +5.28	+2.71 to +6.93	+3.19 to +7.83
	Summer	60.35	+1.65 to +3.75	+2.23 to +5.72	+2.61 to +8.66	+3.32 to +10.64
	Fall	45.41	+1.92 to +4.01	+3.14 to +5.88	+2.96 to +8.49	+3.63 to +10.28

- The Cape Cod basin is expected to experience increased average temperatures throughout the 21st century. Maximum and minimum temperatures are also expected to increase throughout the end of the century. These increased temperature trends are expected for annual and seasonal projections.
- Seasonally, maximum summer and fall temperatures are expected to see the highest projected increase throughout the 21st century.
    - Summer mid-century increase of 2 °F to 5.6 °F (3-7% increase); end of century increase of 2.7 °F to 10.3 °F (4-14% increase).
    - Fall mid-century increase of 2.8°F to 5.8°F (5-10% increase); end of century increase by and 2.8 °F to 5.8 °F (5-16% increase).
- Seasonally, minimum winter and fall temperatures are expected to see increases throughout the 21st century.
    - Winter mid-century increase of 2.9 °F to 6.2 °F (12-26% increase); end of century increase by 3.8 °F to 9.9 °F (16-41% increase).
    - Fall mid-century of 3.1 °F to 5.9 °F (7-13% increase); end of century increase of 3.6 °F to 10.3 °F (8-23% increase).

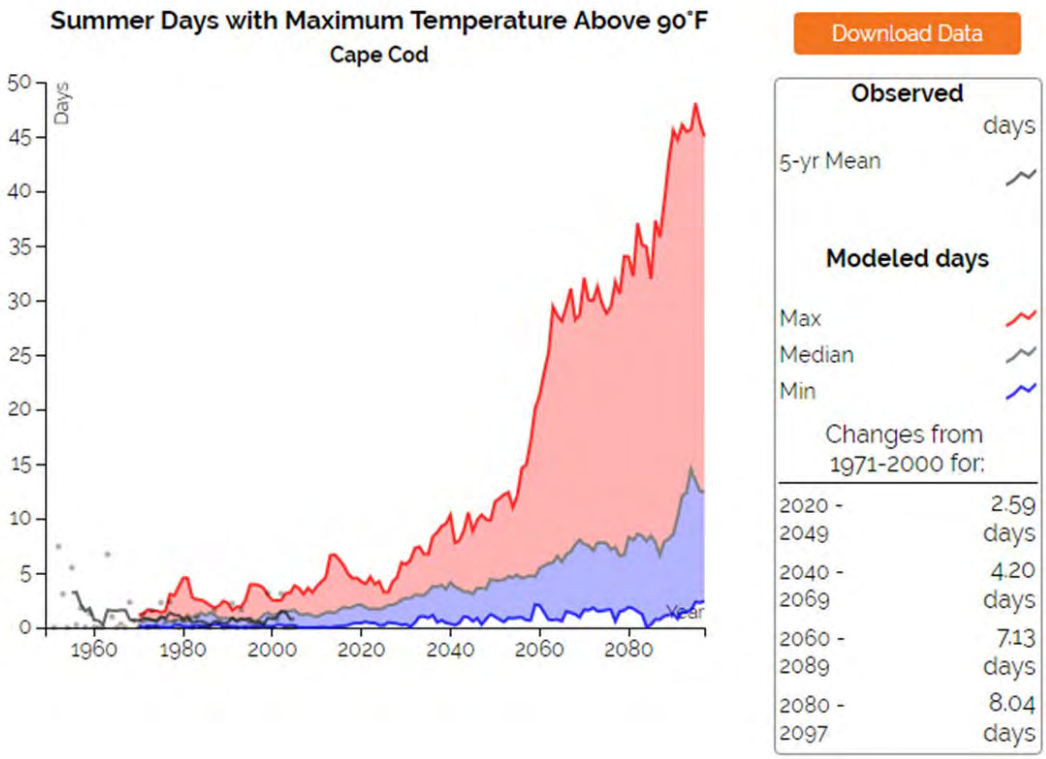

Annual Average Temperature
Cape Cod
Temperature °F
64
62
60
58
56
54
52
50
48
46
Year
1960
1980
2000
2020
2040
2060
2080
Download Data
Observed
°F
5-yr Mean
Modeled °F
Max
Median
Min
Changes from 1971-2000 for:
2020 - 2049 3.19°F
2040 - 2069 4.39°F
2060 - 2089 5.16°F
2080 - 2097 5.87°F

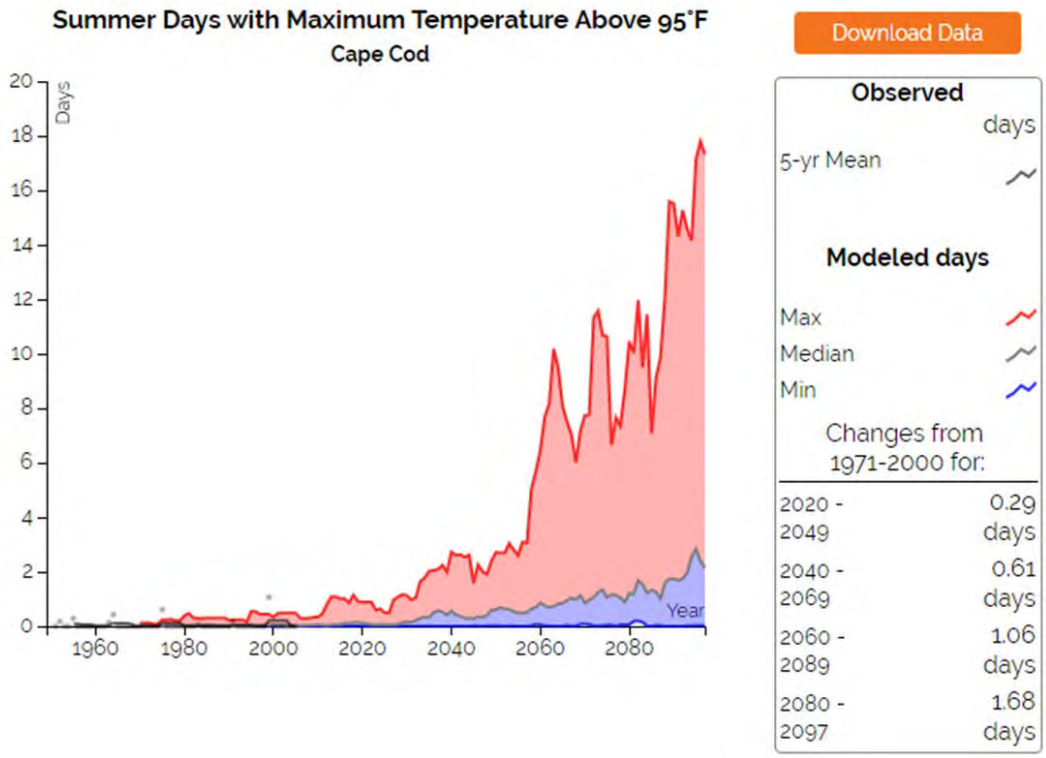

Summer Maximum Temperature
Cape Cod
Temperature °F
90
88
86
84
82
80
78
76
74
72
70
Year
1960
1980
2000
2020
2040
2060
2080
Download Data
Observed
°F
5-yr Mean
Modeled °F
Max
Median
Min
Changes from 1971-2000 for:
2020 - 2049 3.28°F
2040 - 2069 4.41°F
2060 - 2089 5.28°F
2080 - 2097 6.15°F

CAPE COD BASIN

Cape Cod Basin		Observed Baseline 1971-2000 (Days)	Projected Change in 2030s (Days)	Mid-Century Projected Change in 2050s (Days)	Projected Change in 2070s (Days)	End of Century Projected Change in 2090s (Days)
Days with Maximum Temperature Over 90°F	Annual	0.76	+1.17 to +3.89	+1.93 to +9.25	+2.46 to +21.33	+3.23 to +33.89
	Winter	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00
	Spring	0.01	-0.02 to +0.09	-0.02 to +0.13	+0.00 to +0.20	+0.00 to +0.29
	Summer	0.73	+1.06 to +3.58	+1.79 to +8.62	+2.34 to +19.96	+3.04 to +31.61
	Fall	0.01	+0.06 to +0.28	+0.10 to +0.68	+0.13 to +1.26	+0.19 to +2.26
Days with Maximum Temperature Over 95°F	Annual	0.06	+0.08 to +0.63	+0.19 to +1.88	+0.25 to +4.51	+0.26 to +9.49
	Winter	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00
	Spring	0.00	+0.00 to +0.01	-0.00 to +0.02	+0.00 to +0.05	+0.00 to +0.08
	Summer	0.06	+0.07 to +0.61	+0.18 to +1.85	+0.25 to +4.32	+0.26 to +9.11
	Fall	0.00	+0.00 to +0.03	+0.00 to +0.06	+0.00 to +0.17	+0.00 to +0.42
Days with Maximum Temperature Over 100°F	Annual	0.00	+0.00 to +0.07	+0.00 to +0.31	+0.01 to +0.80	+0.03 to +1.71
	Winter	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00
	Spring	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.01
	Summer	0.00	+0.00 to +0.07	+0.00 to +0.31	+0.01 to +0.80	+0.02 to +1.69
	Fall	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.01	+0.00 to +0.04

- Due to projected increases in average and maximum temperatures throughout the end of the century, the Cape Cod basin is also expected to experience an increase in days with daily maximum temperatures over 90 °F, 95 °F, and 100 °F.
    - Annually, the Cape Cod basin is expected to see days with daily maximum temperatures over 90 °F increase by 2 to 9 more days by mid-century, and 3 to 34 more days by the end of the century.
    - Seasonally, summer is expected to see an increase of 2 to 9 more days with daily maximums over 90 °F by mid-century.
    - By end of century, the Cape Cod basin is expected to have 3 to 32 more days.

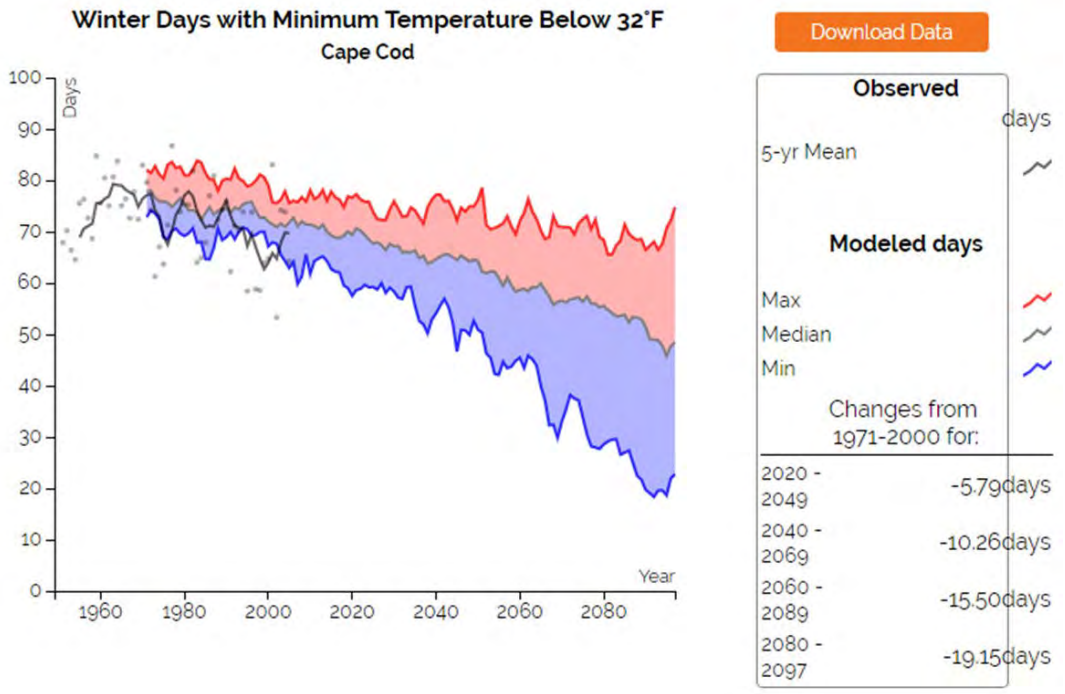

Summer Days with Maximum Temperature Above 90°F
Cape Cod
Days
50
45
40
35
30
25
20
15
10
5
0
1960
1980
2000
2020
2040
2060
2080
Year
Download Data
Observed
days
5-yr Mean
Modeled days
Max
Median
Min
Changes from 1971-2000 for:
2020 - 2049 2.59 days
2040 - 2069 4.20 days
2060 - 2089 7.13 days
2080 - 2097 8.04 days


Summer Days with Maximum Temperature Above 95°F
Cape Cod
Days
20
18
16
14
12
10
8
6
4
2
0
1960
1980
2000
2020
2040
2060
2080
Year
Download Data
Observed
days
5-yr Mean
Modeled days
Max
Median
Min
Changes from 1971-2000 for:
2020 - 2049 0.29 days
2040 - 2069 0.61 days
2060 - 2089 1.06 days
2080 - 2097 1.68 days

CAPE COD BASIN

Cape Cod Basin		Observed Baseline 1971-2000 (Days)	Projected Change in 2030s (Days)	Mid-Century Projected Change in 2050s (Days)	Projected Change in 2070s (Days)	End of Century Projected Change in 2090s (Days)
Days with Minimum Temperature Below 0°F	Annual	0.79	-0.08 to -0.37	-0.09 to -0.39	-0.14 to -0.4	-0.15 to -0.4
	Winter	0.79	-0.08 to -0.37	-0.09 to -0.39	-0.14 to -0.4	-0.15 to -0.4
	Spring	0.00	-0.01 to -0.00	-0.01 to -0.00	-0.01 to -0.00	-0.01 to -0.00
	Summer	0.00	-0.00 to -0.00	-0.00 to -0.00	-0.00 to -0.00	-0.00 to -0.00
	Fall	0.00	-0.00 to -0.00	-0.00 to -0.00	-0.00 to -0.00	-0.00 to -0.00
Days with Minimum Temperature Below 32°F	Annual	104.75	-13.60 to -27.72	-19.29 to -41.91	-23.29 to -54.38	-24.54 to -66.71
	Winter	70.7	-5.68 to -12.20	-7.00 to -20.22	-10.21 to -29.71	-11.46 to -38.36
	Spring	23.8	-5.16 to -11.14	-7.22 to -14.64	-7.87 to -17.32	-9.50 to -18.96
	Summer	0.00	-0.05 to -0.00	-0.04 to -0.00	-0.04 to -0.00	-0.05 to -0.00
	Fall	10.16	-3.40 to -6.37	-4.69 to -8.2	-5.09 to -9.62	-5.34 to -10.71

- Due to projected increases in average and minimum temperatures throughout the end of the century, the Cape Cod basin is expected to experience a decrease in days with daily minimum temperatures below 32 °F and 0 °F.
- Seasonally, winter, spring and fall are expected to see the largest decreases in days with daily minimum temperatures below 32 °F.
    - Winter is expected to have 7 to 20 fewer days by mid-century, and 11 to 38 fewer days by end of century.
    - Spring is expected to have 7 to 15 fewer days by mid-century, and 10 to 19 fewer days by end of century.
    - Fall is expected to have 5 to 8 fewer days by mid-century, and 5 to 11 fewer days by end of century.


Winter Days with Minimum Temperature Below 32°F
Cape Cod
Days
Year
100
90
80
70
60
50
40
30
20
10
0
1960
1980
2000
2020
2040
2060
2080
Download Data
Observed
days
5-yr Mean
Modeled days
Max
Median
Min
Changes from 1971-2000 for:
2020 - 2049 -5.79days
2040 - 2069 -10.26days
2060 - 2089 -15.50days
2080 - 2097 -19.15days

CAPE COD BASIN

Cape Cod Basin		Observed Baseline 1971-2000 (Degree-Days)	Projected Change in 2030s (Degree-Days)	Mid-Century Projected Change in 2050s (Degree-Days)	Projected Change in 2070s (Degree-Days)	End of Century Projected Change in 2090s (Degree-Days)
Heating Degree-Days (Base 65°F)	Annual	5956.64	-475.48 to -913.39	-685.90 to -1374.26	-773.67 to -1828.23	-854.04 to -2171.56
	Winter	2996.33	-164.51 to -347.77	-220.16 to -520.87	-277.06 to -697.53	-304.13 to -831.96
	Spring	1753.89	-152.01 to -285.19	-190.19 to -444.68	-229.91 to -584.74	-267.48 to -649.94
	Summer	94.49	-30.02 to -57.56	-41.95 to -69.89	-44.65 to -80.65	-44.99 to -85.45
	Fall	1105.61	-131.82 to -268.87	-226.73 to -393.30	-215.14 to -547.22	-242.01 to -619.87
Cooling Degree-Days (Base 65°F)	Annual	435.71	+144.74 to +364.43	+224.26 to +601.17	+250.48 to +965.18	+314.49 to +1226.21
	Winter	nan	+0.13 to +1.43	+0.38 to +3.50	+0.92 to +3.19	-0.34 to +3.91
	Spring	7.08	+3.48 to +9.44	+4.94 to +20.08	+5.86 to +34.34	+7.02 to +52.03
	Summer	384.03	+107.28 to +279.41	+148.81 to +457.16	+184.27 to +701.82	+229.32 to +875.35
	Fall	43.77	+30.85 to +80.41	+41.77 to +138.18	+48.96 to +224.33	+71.67 to +296.72
Growing Degree-Days (Base 50°F)	Annual	2421.38	+343.19 to +690.79	+460.30 to +1078.12	+519.05 to +1678.13	+617.96 to +2104.38
	Winter	4.84	+0.24 to +9.74	+0.28 to +15.26	+2.10 to +25.74	+4.23 to +35.89
	Spring	197.63	+50.56 to +105.22	+69.23 to +195.43	+77.64 to +277.13	+77.88 to +342.92
	Summer	1669.64	+137.95 to +332.36	+190.73 to +520.48	+224.93 to +789.31	+278.12 to +958.80
	Fall	546.41	+107.92 to +248.13	+174.67 to +396.65	+168.86 to +571.84	+215.05 to +716.85

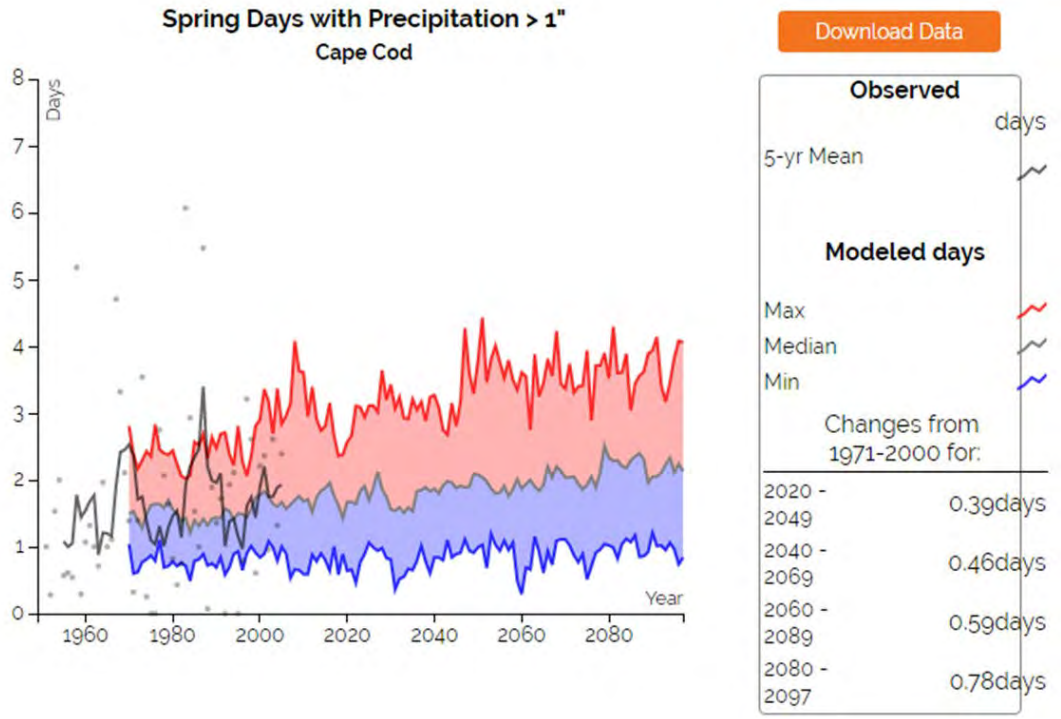
- Due to projected increases in average, maximum, and minimum temperatures throughout the end of the century, the Cape Cod basin is expected to experience a decrease in heating degree-days, and increases in both cooling degree-days and growing degree-days.
- Seasonally, winter historically exhibits the highest number of heating degree-days and is expected to see the largest decrease of any season, but spring and fall are also expected to see significant change.
    - The winter season is expected to see a decrease of 220-521 degree-days by mid-century (a decrease of 7-17%), and a decrease of 304-832 degree-days by the end of century (a decrease of 10-28%).
    - The spring season is expected to decrease in heating degree-days by 11-25% (190-445 degree-days) by mid-century, and by 15-37% (267-650 degree-days) by the end of century.
    - The fall season is expected to decreases in heating degree-days by 21-36% (227-393 degree-days) by mid-century, and by and 22-56% (242-620 degree-days) by the end of century.
- Conversely, due to projected increasing temperatures, summer cooling degree-days are expected to increase by 39-119% (149-457 degree-days) by mid-century, and by 60-228% (229-875 degree-days) by end of century.

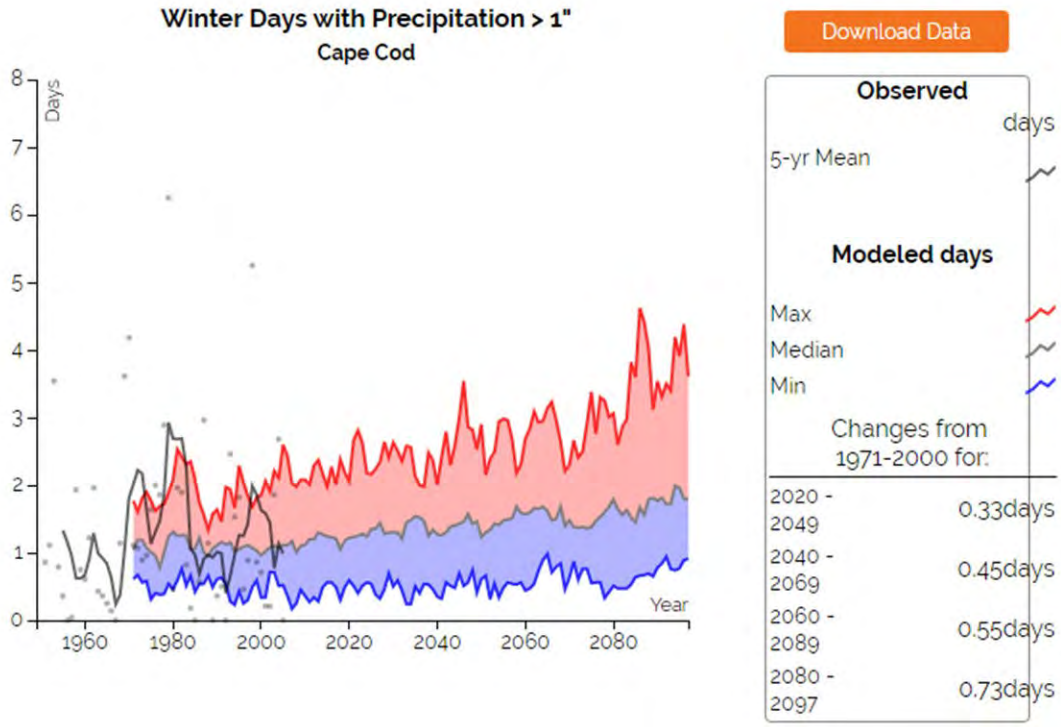
- Seasonally, summer historically exhibits the highest number of growing degree-days and is expected to see the largest decrease of any season, but the shoulder seasons of spring and fall are also expected to see an increase in growing degree-days.
    - The summer season is projected to increase by 11-31% (190.73-520.48 degree-days) by mid-century, and by 17-57% (278-959 degree-days) by end of century.
    - Spring is expected to see an increase by 35-99% (69-195 degree-days) by mid-century and 39-174% (78-343 degree-days) by end of century.
    - Fall is expected to see an increase by 32-73% (175-397 degree-days) by mid-century and 39-131% (215-717 degree-days) by end of century.

CAPE COD BASIN

Cape Cod Basin		Observed Baseline 1971-2000 (Days)	Projected Change in 2030s (Days)	Mid-Century Projected Change in 2050s (Days)	Projected Change in 2070s (Days)	End of Century Projected Change in 2090s (Days)
Days with Precipitation Over 1"	Annual	7.02	+0.16 to +1.76	+0.66 to +2.66	+0.45 to +2.92	+0.55 to +3.41
	Winter	1.45	-0.10 to +0.62	+0.08 to +0.67	+0.02 to +1.04	+0.09 to +1.35
	Spring	1.65	+0.08 to +0.65	+0.08 to +0.90	+0.22 to +1.05	+0.29 to +1.20
	Summer	1.92	-0.18 to +0.55	-0.13 to +0.78	-0.40 to +0.66	-0.46 to +0.58
	Fall	2.01	-0.23 to +0.62	-0.13 to +0.85	-0.31 to +0.94	-0.35 to +1.11
Days with Precipitation Over 2"	Annual	0.75	-0.04 to +0.43	+0.07 to +0.52	+0.08 to +0.71	+0.05 to +0.74
	Winter	0.09	-0.05 to +0.16	-0.02 to +0.15	-0.02 to +0.20	-0.02 to +0.27
	Spring	0.05	-0.03 to +0.13	+0.01 to +0.18	+0.02 to +0.19	-0.01 to +0.25
	Summer	0.33	-0.07 to +0.15	-0.05 to +0.23	-0.05 to +0.20	-0.05 to +0.22
	Fall	0.28	-0.04 to +0.13	-0.01 to +0.20	-0.01 to +0.23	-0.07 to +0.31
Days with Precipitation Over 4"	Annual	0.01	+0.00 to +0.03	+0.00 to +0.03	-0.01 to +0.05	-0.01 to +0.05
	Winter	0.00	+0.00 to +0.00	+0.00 to +0.01	-0.00 to +0.00	+0.00 to +0.00
	Spring	0.00	+0.00 to +0.01	+0.00 to +0.00	+0.00 to +0.01	+0.00 to +0.00
	Summer	0.00	-0.01 to +0.02	-0.01 to +0.02	-0.01 to +0.03	-0.01 to +0.03
	Fall	0.01	-0.00 to +0.02	+0.00 to +0.01	+0.00 to +0.02	+0.00 to +0.03

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


Spring Days with Precipitation > 1"
Cape Cod
Days
Year
0
1
2
3
4
5
6
7
8
1960
1980
2000
2020
2040
2060
2080
Download Data
Observed
days
5-yr Mean
Modeled days
Max
Median
Min
Changes from 1971-2000 for:
2020 - 2049 0.39days
2040 - 2069 0.46days
2060 - 2089 0.59days
2080 - 2097 0.78days


Winter Days with Precipitation > 1"
Cape Cod
Days
Year
0
1
2
3
4
5
6
7
8
1960
1980
2000
2020
2040
2060
2080
Download Data
Observed
days
5-yr Mean
Modeled days
Max
Median
Min
Changes from 1971-2000 for:
2020 - 2049 0.33days
2040 - 2069 0.45days
2060 - 2089 0.55days
2080 - 2097 0.73days

CAPE COD BASIN

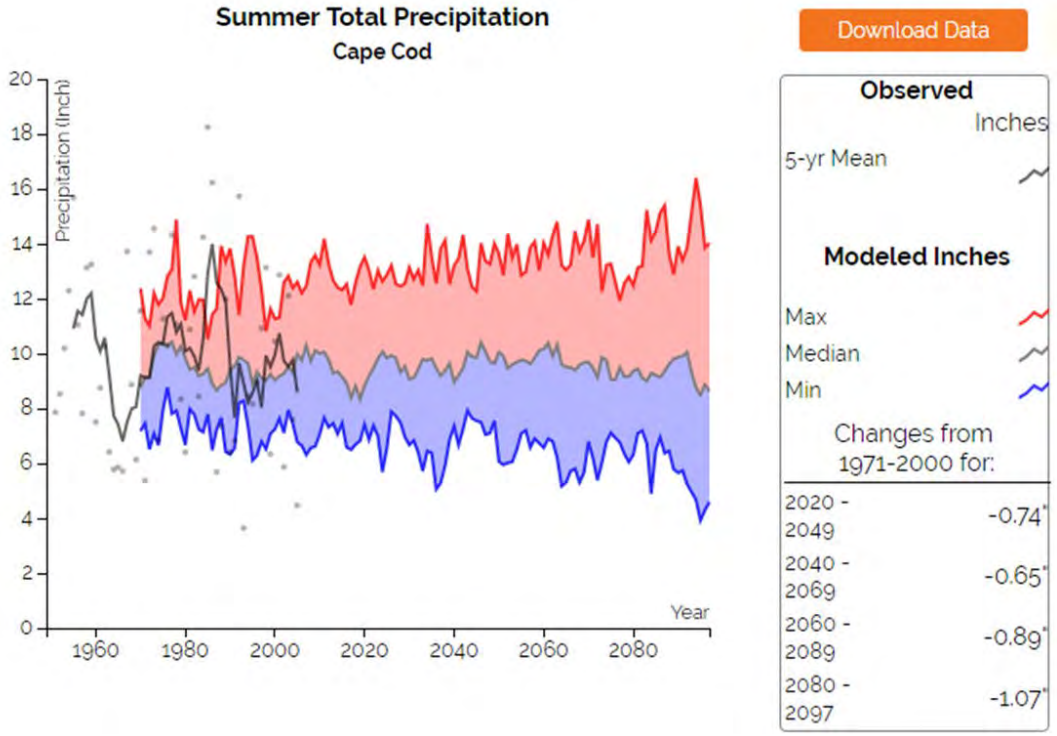
Cape Cod Basin		Observed Baseline 1971-2000 (Inches)	Projected Change in 2030s (Inches)	Mid-Century Projected Change in 2050s (Inches)	Projected Change in 2070s (Inches)	End of Century Projected Change in 2090s (Inches)
Total Precipitation	Annual	44.94	-1.08 to +3.47	-0.38 to +4.54	-0.78 to +5.79	-0.83 to +5.45
	Winter	11.63	-0.40 to +1.24	-0.22 to +1.59	-0.05 to +2.10	-0.04 to +3.13
	Spring	11.51	-0.04 to +1.48	-0.26 to +1.67	-0.21 to +2.08	+0.08 to +2.45
	Summer	10.24	-0.95 to +1.19	-1.05 to +1.73	-1.64 to +2.00	-2.22 to +1.66
	Fall	11.62	-0.96 to +0.90	-0.99 to +1.09	-1.40 to +1.64	-1.52 to +1.26

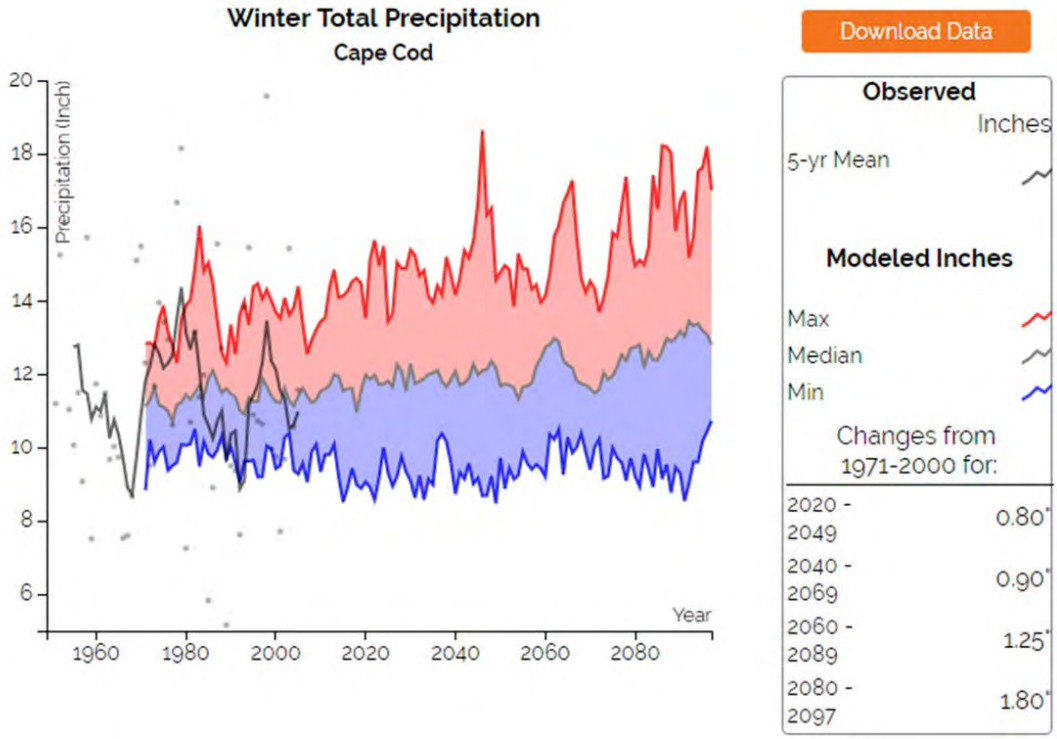
- Similar to projections for number of days receiving precipitation over a specified threshold, seasonal projections for total precipitation are also variable for the Cape Cod basin.
    - The winter season is expected to experience the greatest change with a decrease of 2% to an increase of 14% by mid-century, and an increase of 0-27% by end of century.
    - Projections for the summer and fall seasons are more variable, and could see either a drop or increase in total precipitation throughout the 21st century.
        - The summer season projections for the Cape Cod or basin could see a decrease of 1.1 to an increase of 1.7 inches by mid-century (decrease of 10% to increase of 17%), and a decrease of 2.2 to an increase of 1.7 inches by the end of the century (decrease of 22% to increase of 16%).
        - The fall season projections for the Cape Cod basin could see a decrease of -1 to an increase of 1.1 inches by mid-century (decrease of 9% to increase of 9%), and a decrease of 1.5 to an increase of 1.3 inches by the end of the century (decrease of 13% to increase of 11%).

Cape Cod Basin		Observed Baseline 1971-2000 (Days)	Projected Change in 2030s (Days)	Mid-Century Projected Change in 2050s (Days)	Projected Change in 2070s (Days)	End of Century Projected Change in 2090s (Days)
Consecutive Dry Days	Annual	18.72	-1.06 to +1.99	-0.56 to +2.62	-0.34 to +3.63	-0.26 to +4.65
	Winter	10.19	-0.52 to +1.53	-0.44 to +1.46	-0.31 to +1.83	-0.94 to +1.97
	Spring	11.59	-0.99 to +1.21	-0.86 to +1.50	-1.00 to +1.48	-1.34 to +1.58
	Summer	15.38	-1.00 to +2.02	-0.83 to +2.61	-0.89 to +4.38	-1.03 to +5.26
	Fall	13.05	-0.57 to +2.45	-0.04 to +2.29	+0.17 to +2.82	+0.04 to +3.45

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

The summer season is expected to experience a decrease of 1 day to an increase of 5 days in consecutive dry days by the end of the century.


Summer Total Precipitation
Cape Cod
Precipitation (Inch)
Year
1960
1980
2000
2020
2040
2060
2080
Download Data
Observed
Inches
5-yr Mean
Modeled Inches
Max
Median
Min
Changes from 1971-2000 for:
2020 - 2049 -0.74"
2040 - 2069 -0.65"
2060 - 2089 -0.89"
2080 - 2097 -1.07"


Winter Total Precipitation
Cape Cod
Precipitation (Inch)
Year
1960
1980
2000
2020
2040
2060
2080
Download Data
Observed
Inches
5-yr Mean
Modeled Inches
Max
Median
Min
Changes from 1971-2000 for:
2020 - 2049 0.80"
2040 - 2069 0.90"
2060 - 2089 1.25"
2080 - 2097 1.80"

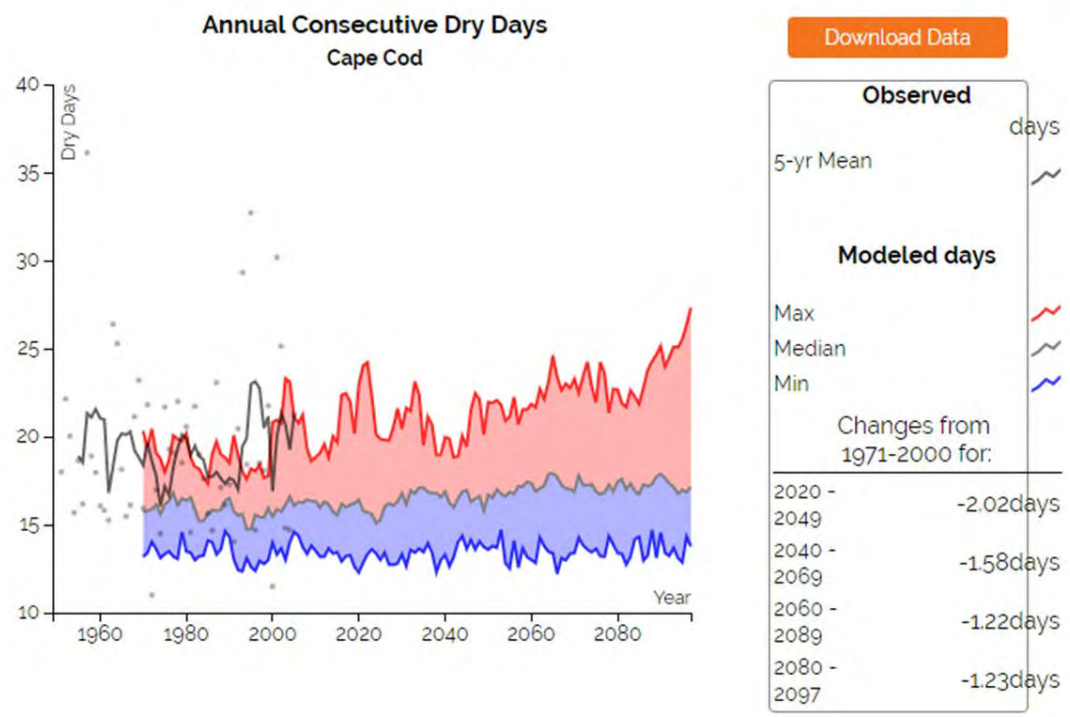
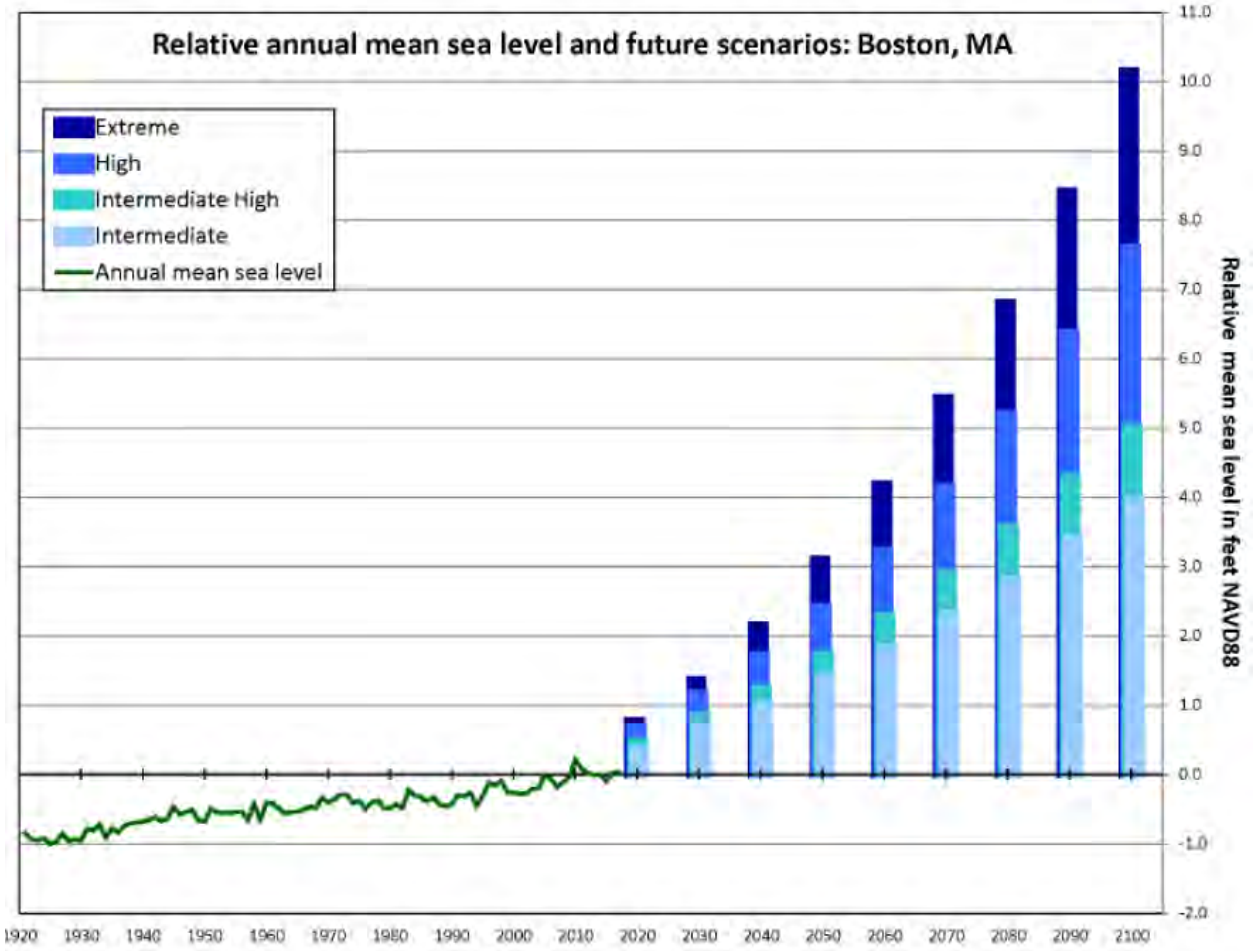
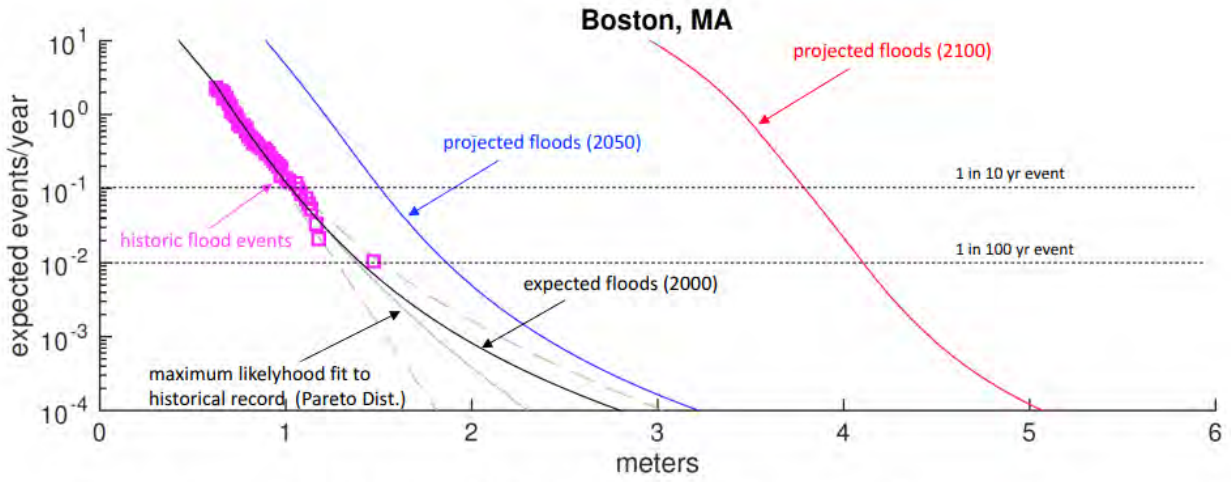

Annual Consecutive Dry Days
Cape Cod
Dry Days
40
35
30
25
20
15
10
1960
1980
2000
2020
2040
2060
2080
Year
Download Data
Observed
days
5-yr Mean
Modeled days
Max
Median
Min
Changes from 1971-2000 for:
2020 - 2049 -2.02days
2040 - 2069 -1.58days
2060 - 2089 -1.22days
2080 - 2097 -1.23days

Table 1/Figure 1. Sea level rise target values for Boston, MA (feet NAVD88) based on four National Climate Assessment global scenarios with associated probabilistic model outputs.

Relative mean sea level (feet NAVD88) for Boston, MA					
Scenario	**Cross-walked probabilistic projections**	**2030**	**2050**	**2070**	**2100**
Intermediate	Unlikely to exceed (83%) under RCP8.5	0.7	1.4	2.3	4.0
	• Extremely unlikely to exceed (95%) under RCP4.5 • Unlikely to exceed (83%) under RCP4.5 • About as likely as not to exceed (50%) under RCP4.5 when accounting for possible ice sheet instabilities				
Intermediate - High	Extremely unlikely to exceed (95%) under RCP8.5	0.8	1.7	2.9	5.0
	• Unlikely to exceed (83%) under RCP4.5 when accounting for possible ice sheet instabilities • About as likely as not to exceed (50%) under RCP8.5 when accounting for possible ice sheet instabilities				
High	Extremely unlikely to exceed (99.5%) under RCP8.5	1.2	2.4	4.2	7.6
	• Unlikely to exceed (83%) under RCP8.5 when accounting for possible ice sheet instabilities • Extremely unlikely to exceed (95%) under RCP4.5 when accounting for possible ice sheet instabilities				
Extreme (Maximum physically plausible)	Exceptionally unlikely to exceed (99.9%) under RCP8.5	1.4	3.1	5.4	10.2
	• Extremely unlikely to exceed (95%) under RCP8.5 when accounting for possible ice sheet instabilities				


Relative annual mean sea level and future scenarios: Boston, MA
Extreme
High
Intermediate High
Intermediate
Annual mean sea level
Relative mean sea level in feet NAVD88
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
2030
2040
2050
2060
2070
2080
2090
2100



Recurrence frequencies were also provided for Nantucket, Woods Hole, and Newport, RI

after Buchanan et al., (2016)

Appendix E: Listening Session Public Comments

Sandwich MVP Listening Session (May 24, 2018) Public Comments

A MVP Listening Session was held on May 24, 2018 at the Sandwich Town Hall (130 Main Street), in conjunction with the Board of Selectmen meeting. In keeping with EEA guidance, one hour was reserved on the Agenda for the MVP Listening Session and was widely advertised by the Town.

The Board of Selectmen Agenda Packet is available at:
http://www.sandwichmass.org/AgendaCenter/ViewFile/Agenda/_05242018-1129

The Agenda Packet included a number of relevant attachments for review:

- MVP Listening Session Guidelines from EEA
- Documentation of Public Outreach for the Listening Session, including postings on the Town's website, Civic Alerts page, Facebook page, and Twitter account. Additionally, direct email invitations were sent to all Workshop invitees (70), and the Town initiated a press release to announce the Listening Session.
- FY17 MVP Planning Grant Application
- Sandwich Community Resilience Building Workshop Summary of Findings (Draft Report)
- FY18 MVP Action Grant Application

Attendance at the MVP Listening Session consisted of the Project Team (Town Manager, Director of Natural Resources, Woods Hole Group), the Board of Selectmen, additional Town staff, local media, and a few residents. There was a lively discussion of community resilience building among the attendees, which is documented in the Board of Selectmen Meeting Minutes and the following notes.

The Board of Selectmen Meeting Minutes are available at:

http://www.sandwichmass.org/AgendaCenter/ViewFile/Minutes/_05242018-1129

The MVP Listening Session commenced with a presentation by Town Manager George Dunham on the MVP workshop proceedings and outcomes. This presentation outlined the background on the MVP Grant, the basics of the Community Resilience Building framework, the top hazards addressed, climate projections considered, identification of strengths and vulnerabilities, and the development and prioritization of actions to build community resilience. Mr. Dunham also provided insight into the Town's experience going through the MVP process. Some general discussion followed, resulting in the general acknowledgement of the significant role that marshes play in absorbing storm impacts and protecting the Town of Sandwich.

Next, the Selectmen and attendees were invited to ask questions and provide feedback via oral or written (notecards and maps) comments. The various questions and comments that were put forward by MVP Listening Session attendees follows:

- Priority actions – Mr. Dunham points out that there was a lot of focus on natural resources - marshes as a buffer. This is a theme that the Detailed Vulnerability Assessment (Action Grant) will address.

- Old Harbormaster's office now inundated at high tide.

- Sandwich is currently very focused on Town Neck Beach…but it's more than the beach that's the problem, as evident in the storm impact this winter…we have to do something else…what will the grant study address?

    - *Detailed SLR and storm surge vulnerability assessment (probabilistic hydrodynamic model) for all Town infrastructure, assets, and natural resources.*

- Question on "Top Priorities" slide: What is the management plan? We have a beach management plan.
    - *Need a holistic management plan to address health and resiliency of beaches, dunes, marshes, harbors, and all coastal ecosystems because they have interdependencies. Need to keep the beach to preserve the rest of Sandwich. Dredging mill creek should help.*

- Can't fish in areas I used to fish in when I was a kid.

- Need to change the building codes to allow expansion of rising waters.

- Laying sand on top of sand doesn't work. Fiber rolls would slow the situation down and provide more protection.

- Ecosystem management plan - needs to be a 3 pronged approach, build back dunes and dredge marsh to allow to absorb storms. Able to build back coastal banks. Any government agency always asks "do you have a plan"? Dave Deconto believes we should develop a plan to have in place.

- MVP Action could be used for retrofitting and flood proofing.

    - *That could be a follow-on after vulnerabilities are assessed and prioritized.*

- What about drainage issues? Replacing culverts, etc.

    - *To be considered in detailed vulnerability assessment during the Action Grant.*

- Issue of using Coast Guard to push sand back up from the creek bed.

- What constitutes an emergency permit? It takes too long to get permits…we are in an emergency right now.

- The Section 111 is important…but it will take a few years. Anything we can do to buffer that for the meantime is worthwhile.

- Can we continually renew permits? Yes, some of them are multiyear permits, including the boardwalk conservation permits. Can we add the other finger of sand to the permits? Might be more difficult to get the finger…would be included in the dredging the creek permit.

- What our goal is: to save our barrier beaches to save our town. We don't want to see overwash of barrier dunes…if those go away, the marshes turn into a bay.

- Need to drain the marsh in Mill Creek to improve drainage.

- Would it be possible to put removable barrier in Mill Creek to stop flooding coming in?

    - *Could investigate culvert w/ operable barrier. Might be a recommendation of detailed vulnerability assessment.*

- Two primary flooding pathways…by fire station and by Dewey Ave.

- It's not just the ocean flooding coming in, but draining water from upland gets backed up by saltwater coming in…important to increase capacity of Mill Creek.

- Second phase of Inner/Old Harbor Study will be occurring this summer.

- Used to be a lot of clams and mussels, but not anymore b/c too much sand in the system.

- Should the Town send a letter to agencies or to EEA regarding permitting?

    - *The Town is working through the appropriate channels.*

Following the MVP Listening Session, a written comment period was opened through June 8, 2018. The Director of Natural Resources received one comment via email on June 5. These comments are provided below:

From: Bill Boles [mailto:xxxxxxxxx@xxxxx.xxx]
Sent: Tuesday, June 5, 2018 5:03 PM
To: Deconto, Dave
Subject: Municipal Vulnerability Preparedness Comment

Dave,

Thanks for the opportunity to provide written comment on the MVP Program.

As I've stated in my verbal remarks at the MVP meetings I feel that the greatest threat to the town at this time is flooding.

We all know that Town Neck Beach, Spring Hill Beach and part of the East Sandwich beaches and dunes have been adversely affected by the extension of the northern Cape Cod Canal jetty in the late 60's. Until recently little mitigation has been done to counteract the erosion caused by the Canal's blocking the littoral drift of sand from the Plymouth cliffs.

Currently we are fighting a battle to preserve our coastal barrier dunes, to prevent over wash and additional cuts or entrances to our marshes. In my opinion MVP planning must center on this battle. We must somehow counteract the years of sand loss and migration caused by the canal and, at the very least, make sure that it doesn't get any worse. All options to do this should be considered as part of our Municipal Vulnerability Preparedness program.

Predicted sea level rise for the rest of this century can only worsen the problem. Our historic town center, many businesses, our coastal properties, many of our roadways and even the rail line running through town are all at risk.

I believe that there are solutions to this problem and I know that the Town of Sandwich and its dedicated employees and public officials are up to the task. But, the first step, must center on formulating a plan of action and then on its implementation.

Bill Boles
Trustees of Sandwich Beaches
http://www.trusteesofsandwichbeaches.org/

Appendix F: Final Risk Matrix

Sandwich MVP				Top Priority Hazards A) Flooding B) Coastal Erosion C) Sea Level Rise D) Nor'easters			
Features	Ownership	V or S	Group	Action Items	Hazards Addressed	Priority H-M-L	Time S-L-O
Infrastructural							
Fire Dept.	T	V/S	Blue	Relocate/Redistrict Downtown Station (Sandwich Ctr.)	A, C, D	H	L
Police Station	T	V/S	Blue				
Em. Communication Sys	T	S	Blue				
Culvert-Jones Lane	T	V	Red	Assess suitability of culvert for tidal flow waterlevel	A,C,D	M	S
NYE culvert	T	V	Green				
River St. Mill River culverts	T,P	V/S	Blue				
All Infrastructure	T,S	V/S	Red	Develop a climate change vulnerability assessment to prioritize all town assets	A,C	H	S
Public Infrastructure	T	V/S	Blue	Culverts/Stormwater enhancements:River St; Dewey Ave; 6A Mini Golf; Rt.6 Spring Hill rd.;etc.	A,B,C,D	H	S,L,O
Public Infrastructure	T	V/S	Blue	Comprehensive Stormwater Mgmt. Planning	A,B,C,D	H	S,L,O
Roads	T,S	V	Red				
Roadways	T,S	V/S	Green	Bridging, Elevate, include State DOT	A,C,D	H	S
Roadways	T,S	V/S	Green	Review existing, risk assessment, identify & priortize key infrastructure alterations	A,C,	H	S,O
RR x-ing Town Neck, Marina Town neck	T,P	V	Blue				
Railroad	S	V/S	Green				
Town Neck Boardwalk	T,P	V/S	Blue	Complete Redesign/Reconstruction of boardwalk	A,C,D	H	S,L,O
School Buildings	T	S	Red				
Sandwich H.S.	T	S	Blue	generator Replacement/Update Systems	D	H	S
Scorton Crk. Stretch side streets	T,S,P	V	Blue				
Scorton Crk. Bridge	S	V	Green				
Scorton Crk. Bridge	S	V	Red	Complete a feasibility study to re-engineer bridge. Would include a study to understand geology, tidal dynamics, and wetland status at Scorton creek	A,B,C,D	M	S
Dewey stretch of 6A	T,S,P	V	Blue				
Rt. 6A	S	V/S	Green				
Route 6A	T,S	V	Red	Garner support from state to asseess Rt. 6A in Sandwich, change them to indentify problems + help facility solutions	A	L	L
Library	T	V/S	Blue				
Public Saftey Buildings	T	V/S	Green				
Municipal Buildings(schools,library,townh	T	v/S	Red				
Town Hall	T	V/S	Blue				
Sand Hill School	T	V/S	Blue				
Riverview School	P	V/S	Red				
Riverview School	P	V/S	Blue				
Public Gas Stations	P	V	Red				
Gas Stations	P	V/S	Blue				
Private Utility	P	V/S	Blue				
SagamorE Bridge	F	V/S	Red				
Canal Station Power Plant	P	V/S	Red				
Power Plant	P	V/S	Green				
Electric Distribution	P	V/S	Green	Put underground	D	L	L
Electric Distribution Grid	P	V/S	Green				
Telephone Wires	S,P	V/S	Red				
Public Water lines	T	V/S	Red				
Sandwich Water District Office	T	V/S	Green				
Drainage Systems	T,S	V/S	Red				
Drainage Infrastucture	T,P	V	Green				
Septic System	P	V	Red				
Septic Distribution	T,P	V	Green	Sewering/ Waste Water (North of Rt. 6A)	A,C	H	L
Sandwich Marina	T	V/S	Green				
Dams	T,S	V/S	Red				
Shawme Pond Dam(upper+lower)	T	V	Green				
Mill Creek Dam	S	V	Green				
Murkwood Conservation Facility	T	V/S	Green				
Joint Base Cape Cod	F	S	Green				
Otis base	S,F	S	Red				
Coast Guard	F	S	Green				
Army Corps of Engineers	F	S	Green				
Sandwich Hallows	T	S	Red				
Oak Crest Cove Site	T	V/S	Red				

Sandwich MVP				Top Priority Hazards A) Flooding B) Coastal Erosion C) Sea Level Rise D) Nor'easters			
Features	**Ownership**	**V or S**	**Group**	**Action Items**	**Hazards Addressed**	**Priority H-M-L**	**Time S-L-O**
Societal							
Glass Town; Spring Hill; Small Bus. Comm.	T,P	V/S	Blue	Education/Outreach campaign	A,B,C,D	H	L,O
Glass Museum	P	S	Green				
Emergency Management Strat	T,S	S	Red	Build neighbor to neighbor relations/educate how to be prepared for storms	A,D	M	O
High School Regional Shelter	T	S	Red	Purchase a large generator ro provide power for entire school. Create plan to move current one around. Seek a study to test multi-day electric storing capacity	D	H	S
Sandwich Highschool	T	S	Blue	Training municpal staff to develop emegency response team, improve offerings/care available @shelter	A,D	H	S,O
Riverview School	P	V/S	Blue				
Schools Riverview, Sand Hill	T,P	V/S	Green				
Heritage Fdu.	P	S	Blue				
Thorton Burgess So.	P	V/S	Blue				
2x Churches	P	V/S	Blue				
Churches	P	v/S	Red				
Elderly	T,P	V	Red				
Council on Aging	T	S	Blue				
Grist Mill	T	V/S	Blue				
Old Quaker Meeting House	P	V	Green				
Old Town Cemetery	T	V/S	Blue				
Small Bus 6A Stretch	P	V/S	Blue				
Urgent Care Ctr.	P	S	Blue				
Spaulding Rehab	P	S	Blue				
McCarthy House	P	S	Blue				
Fishing Fleet	T,F,P	V/S	Red				
Town marina	T	S	Blue				
Sandwich Village	T,P	V	Green	Zoning Regulations for new Bldgs/ Storm barriers for existing bldgs.	A,B,C	M	S
Sandwich Village	T,P	V	Green	Elevate existing Bldgs, or relocate	A,C,D	M	S,L
Sandwich Village	T,P	V	Green	Indentify drainage basins and protect them	A,C,D	H	S
Public Trans.	S	S	Red				
Public Housing	T,F,P	V/S	Red				
Town Neck Homes	P	V	Green				
Coastal Homes	P	V	Green	Zoning Regs for new homes, public acquistion of private property. Retreat. Education on shorefront protection(pamphlets)	A,B,C	M	O
Boardwalk	T	V	Green	Redesign & reconstruct vs repair & maintain. Revenue Stream for maintenance	A,B,C,D	H	S,L,O
Town Hall	T	V/S	Green				
Library	T	V	Green				
Spring Hill Area	P	V	Green				
Northshore Blvd.	P	V	Green				
Historic District	T,P	V/S	Red				
YMCA	P	V/S	Red				
Food Bank	P	S	Red				
Super Market/ Pharmacies	P	S	Red				
Upper Cape Cooperation	T	S	Red				
Tourism	T	V/S	Red				

Sandwich MVP				Top Priority Hazards A) Flooding B) Coastal Erosion C) Sea Level Rise D) Nor'easters			
Features	**Ownership**	**V or S**	**Group**	**Action Items**	**Hazards Addressed**	**Priority H-M-L**	**Time S-L-O**
Environmental							
Town Neck/ Spring Hill/ Old Harbor (mill cr	T,P	V/S	Blue	Old Harbor Ecosystem Mgmt. Plan	A,B,C,D	H	L,O
Town Neck/ Spring Hill Beaches	T,S,F,P	V/S	Red				
Old Sandwich Harbor	T,P	V	Green				
Mill/Scorton Creek Inlet	T,S,P	V	Blue	Stabilizing Mill Creek Inlet/ Interior dredging to maximum storage capacity	A,B,C,D	H	S,L,O
Coastal Bank Erosion 6A	T,S,P	V/S	Blue	Coastal Bank Stabilization/Enhancement	A,B,C,D	H	S,L,O
Gully Ln./ Chipman Rd. Hills	T	V	Blue	Watershed-Scale Stormwater Mgmt. Planning	A,D	H	S
Scussett Beach	S,P	S	Blue				
East Sandwich Beach	T,P	V/S	Blue				
Beach Nourishment	P	S	Green	Expedite permitting process- reconstruction	A,B,C,D	H	S,L,O
Beaches/Dunes/Banks	T,S	S	Green	Dredging of Borrow Site	B	H	S,L,O
Beaches/Dunes	T,S,F	S	Red	Develop an educational strategy to inform about town projects, dune/beach systems. Get recommendation from expirienced permitter about process to append legislation and regulations to streamline + expedite assurance of scientifically worthy premitting process.	A,B,C,D	H	S,L
Beaches-Town Owned(Dunes, Banks, Tidal	T	V/S	Green				
Beaches-Private(Dunes, Banks, Tidal Flats	P	S	Green				
Dunes/Coastal	T,P	V/S	Red				
Cape Cod Canal Flooding	F	V/S	Blue				
Cape Cod Canal	F	V/S	Green				
Snake/Weekes Pond	T,P	V	Blue				
Weekes Pond Well	T	V/S	Blue				
Mill Crk./Boardwalk/ Scorton shellfish bed	T	V/S	Blue				
Shellfish Beds(stormwater runoff)	T	V/S	Red				
Shellfish Propogation	T	V	Green				
Mill Crk./Boardwalk/ Scorton fish runs	T,S	V/S	Blue				
Fish Hatchery	S	V/S	Green				
Cranberry Bogs	P	V/S	Green				
Talbots Point(Conservation Area)	T	V/S	Green				
Conservation Lands	T,S	V/S	Red				
Salt Marshes	S,P	V	Green				
Nursing Grounds/ Fisheries	T	V/S	Red				
Marsh (Brady+ Island Marsh)	T,S	V/S	Red	Assess marsh to consider elimination of phrag, understand sediment deposition(feasibility) + increase tidal flow---> improve better health of marsh	A,C,D	H	S
Stormwater Runoff into Ponds	T	V	Green				
Waste water Leaching + Septic Systems	T,P	V	Red	Retain ecological designer to educate/propose solutions for septic materials through Greenhouse based eco machine and possibly seek implmentation	A,B,C,D	H	S
Tidal Rivers	T	V/S	Red				
Saltwater Intrusion	T,P	V	Red				