



Applying the Science: Mapping and Managing Flood Risk through Floodplain Management

July 15, 2022

Shannon Hulst, CFM
Cape Cod Cooperative Ext/Woods Hole Sea Grant

WHSG Teacher
Workshop

Outline

- Mapping Flood Risk
 - FEMA (regulatory)
 - Sea Level Rise
 - Storm Tide Pathways
- Managing flood risk
 - Protect
 - Adapt
 - Retreat



Engagement Questions

- Who has heard of a floodplain?



Engagement Questions

- Who has heard of a floodplain?
- Who has heard about FEMA maps and flood insurance?





"I couldn't have moved forward without flood insurance."

— MARTY SEVERSON
WISCONSIN FLOOD SURVIVOR

GET FLOOD INSURANCE



FEMA



PROTECT YOUR HOME:
20% OF FLOOD CLAIMS COME FROM PLACES WHERE THE FLOOD RISK IS LOW



Just 1 inch of water can cause **\$25,000** of damage to your home.

GET FLOOD INSURANCE



FEMA



Engagement Questions

- Who has heard of a floodplain?
- Who has heard about FEMA maps and flood insurance?
- Who has experienced a flood?



Engagement Questions

- Who has heard of a floodplain?
- Who has heard about FEMA maps and flood insurance?
- Who has experienced a flood?
- Who looks up tides for beaching or boating?



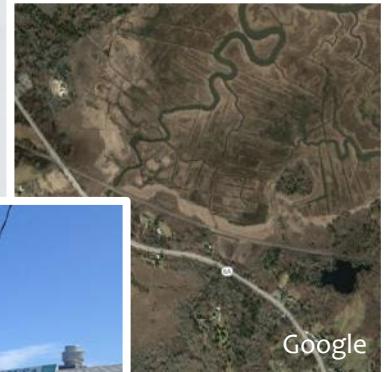
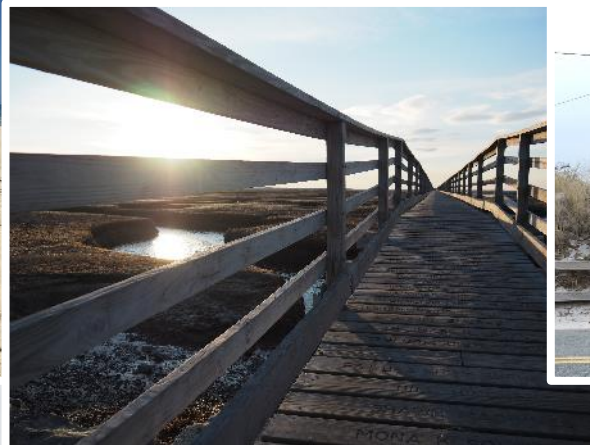


Photo: Ptownie



What is Affected by Flooding?

- Infrastructure
- Local and state assets
- Private property
- Tax base
- Coastal recreation and tourism
- Community character
- Public safety and well-being
- First responder access



Liam Ohman

Mapping Flood Risk



- FEMA Flood Maps
- Sea Level Rise Viewers
- Storm Tide Pathways

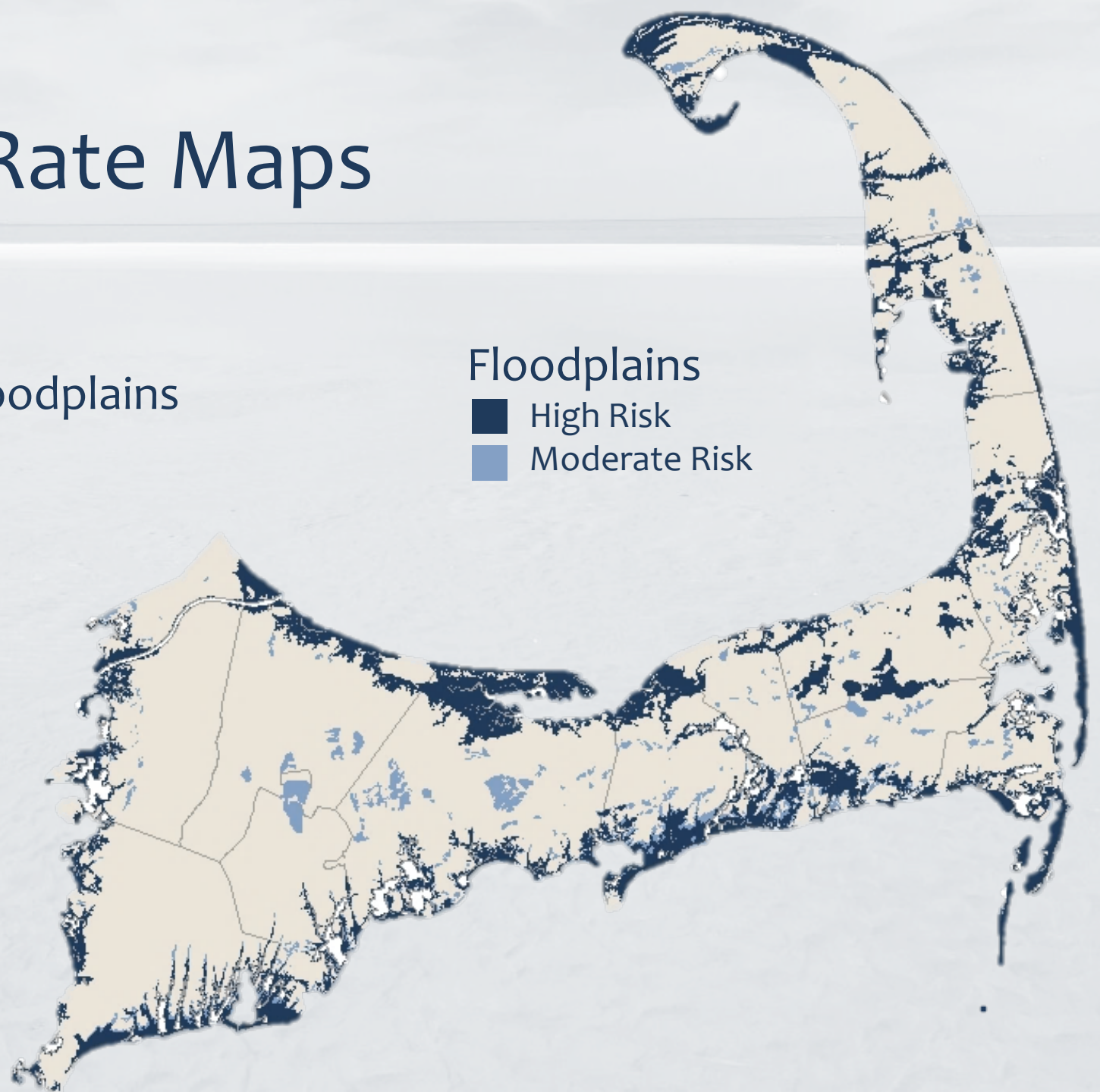
FEMA Flood Maps

Flood Insurance Rate Maps

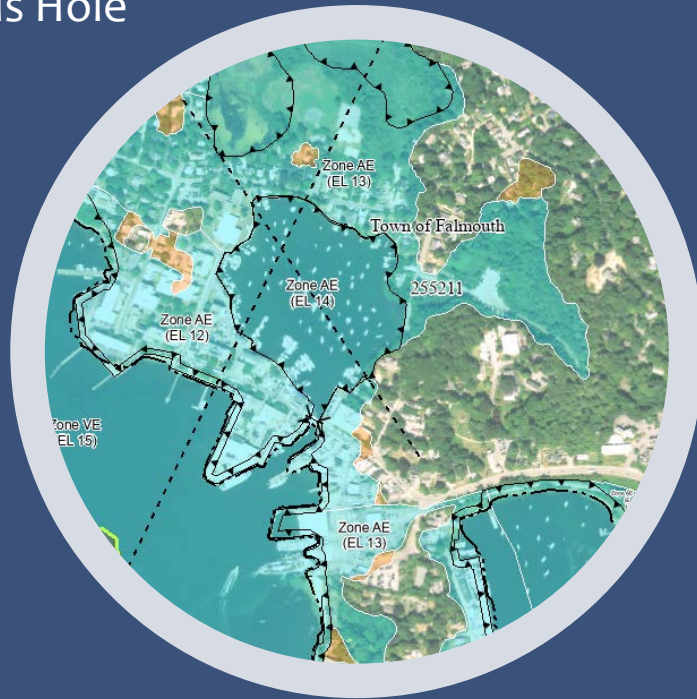
- What they show:
 - High and moderate risk floodplains
 - Regulatory floodplain (1% annual chance storm)
- Used for:
 - Insurance requirements
 - Building code compliance
 - Zoning and Conservation regulations
- Access: msc.fema.gov

Floodplains

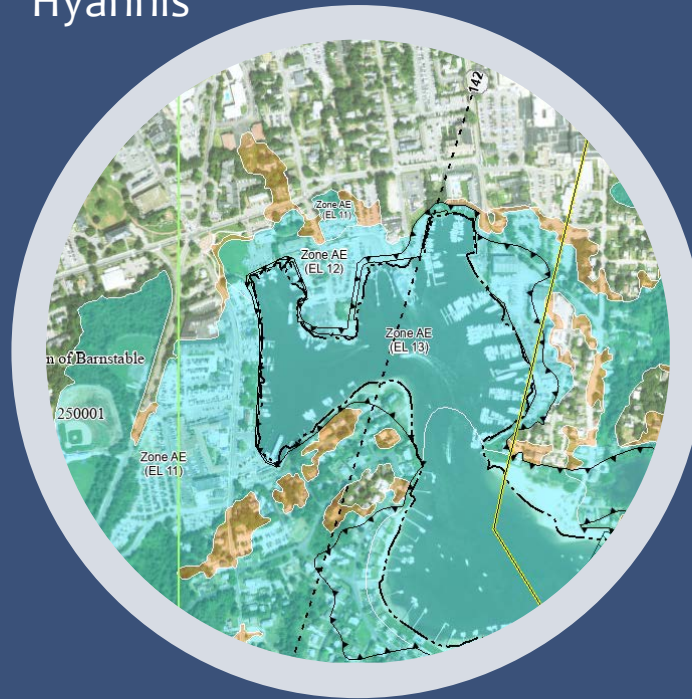
- High Risk
- Moderate Risk



Woods Hole



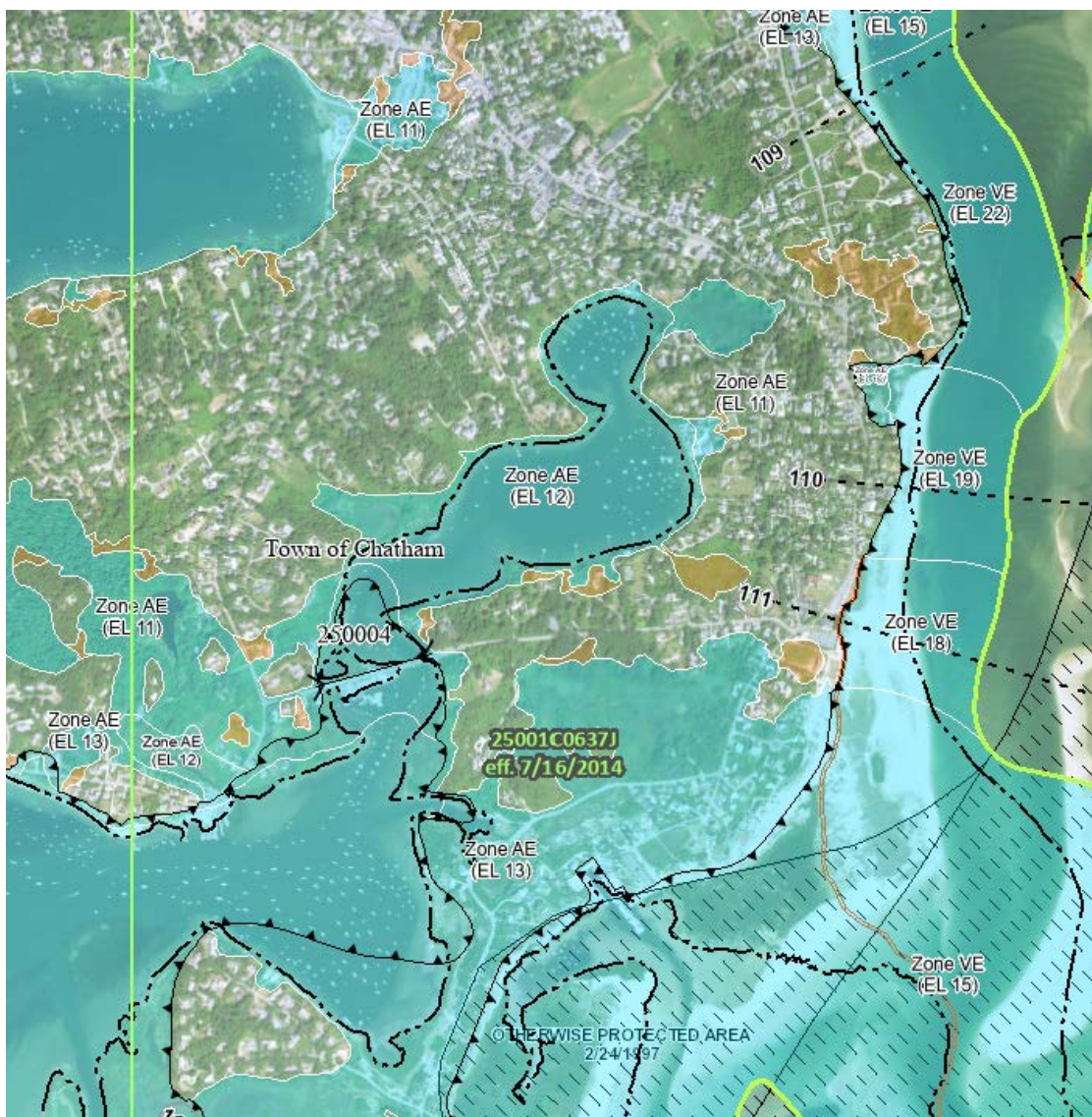
Hyannis











Chatham



FEMA Flood Maps (FIRMs)



Flood Hazard Zones

-  1% Annual Chance Flood Hazard
-  Regulatory Floodway
-  Special Floodway
-  Area of Undetermined Flood Hazard
-  0.2% Annual Chance Flood Hazard
-  Future Conditions 1% Annual Chance Flood Hazard
-  Area with Reduced Risk Due to Levee
-  Area with Risk Due to Levee

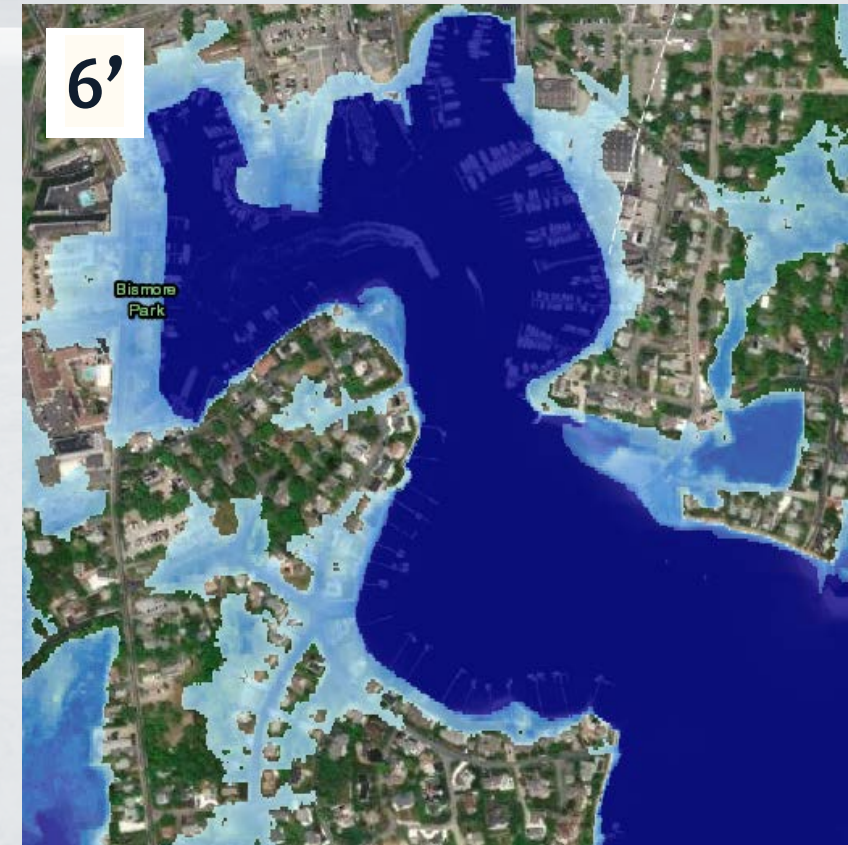
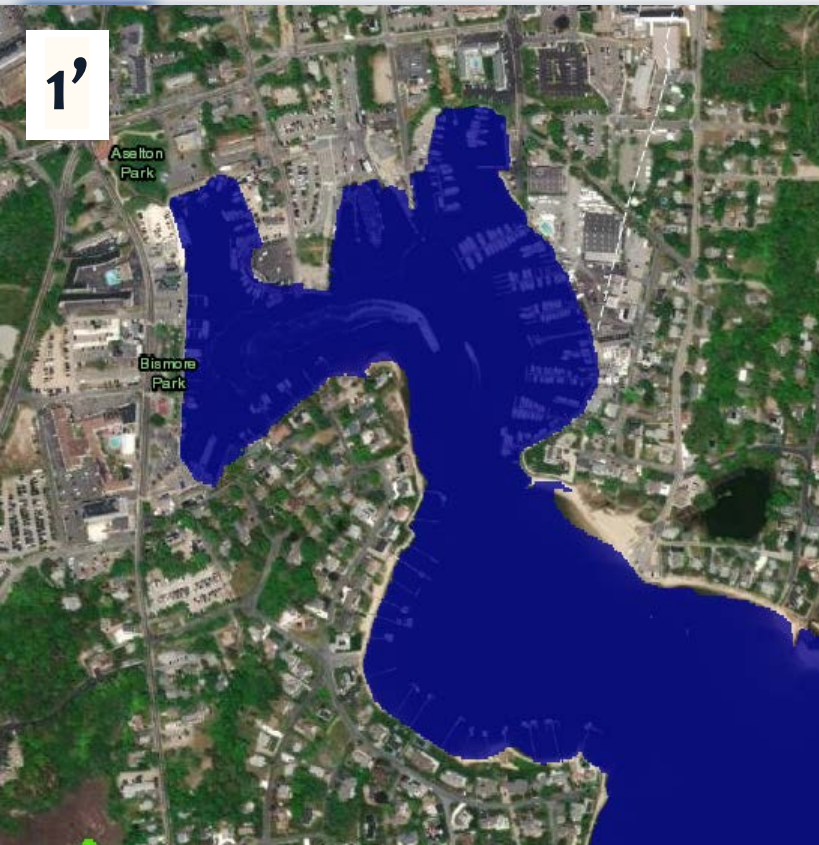
Sea Level Rise Viewers

Sea Level Rise Viewers

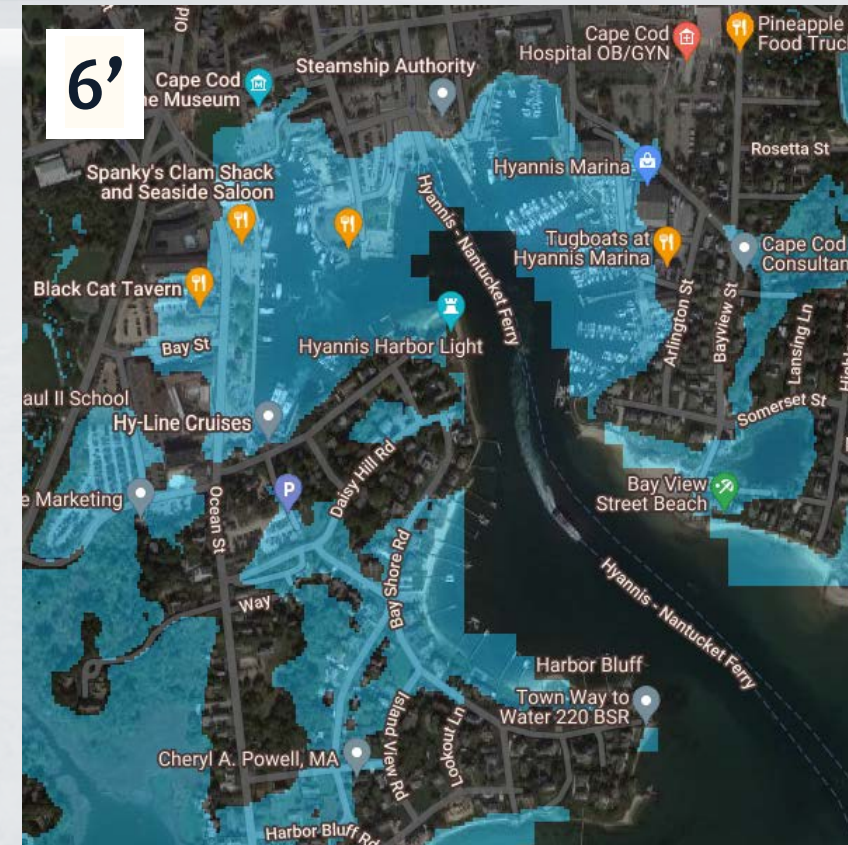
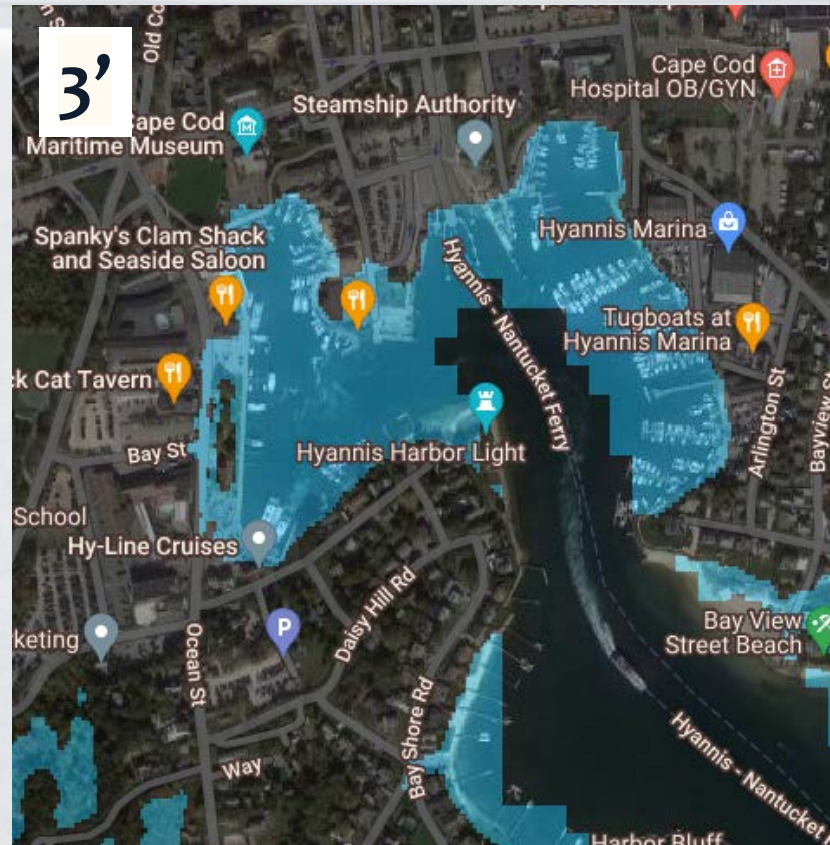
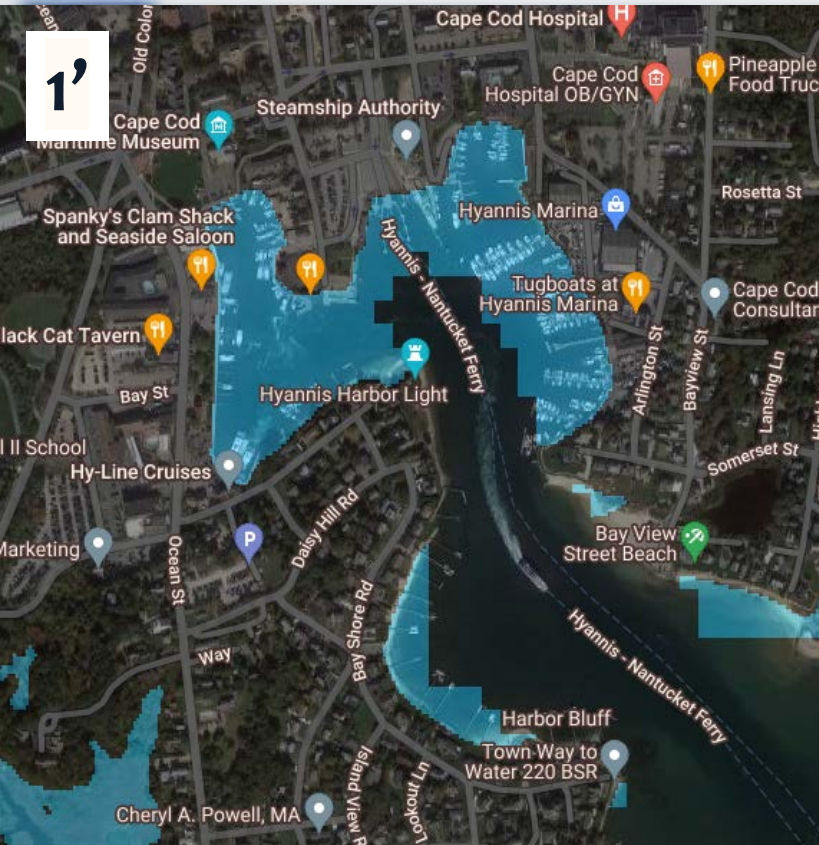
- What they show:
 - Areas that will be inundated under varying sea level rise scenarios
 - Usually show flooding at high tide
- Used for:
 - Planning
 - Some development decisions

NOAA SLR Viewer

coast.noaa.gov/slr/



Climate Central Coastal Risk Screening Tool

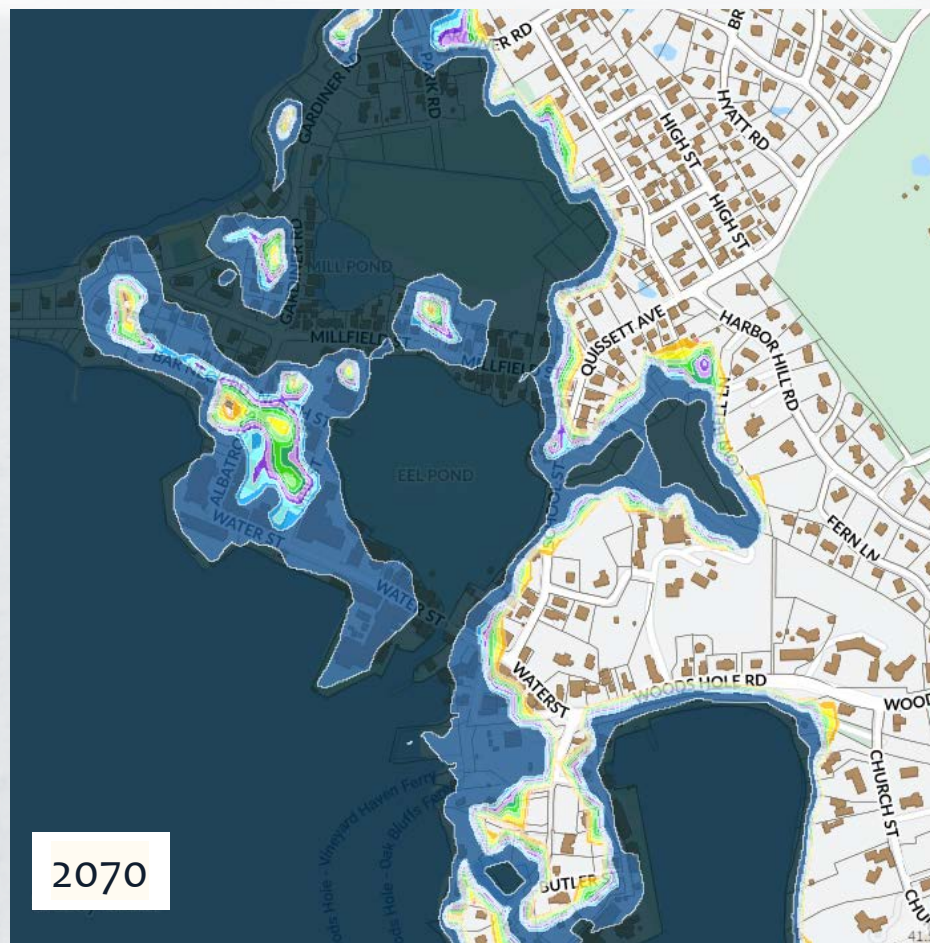
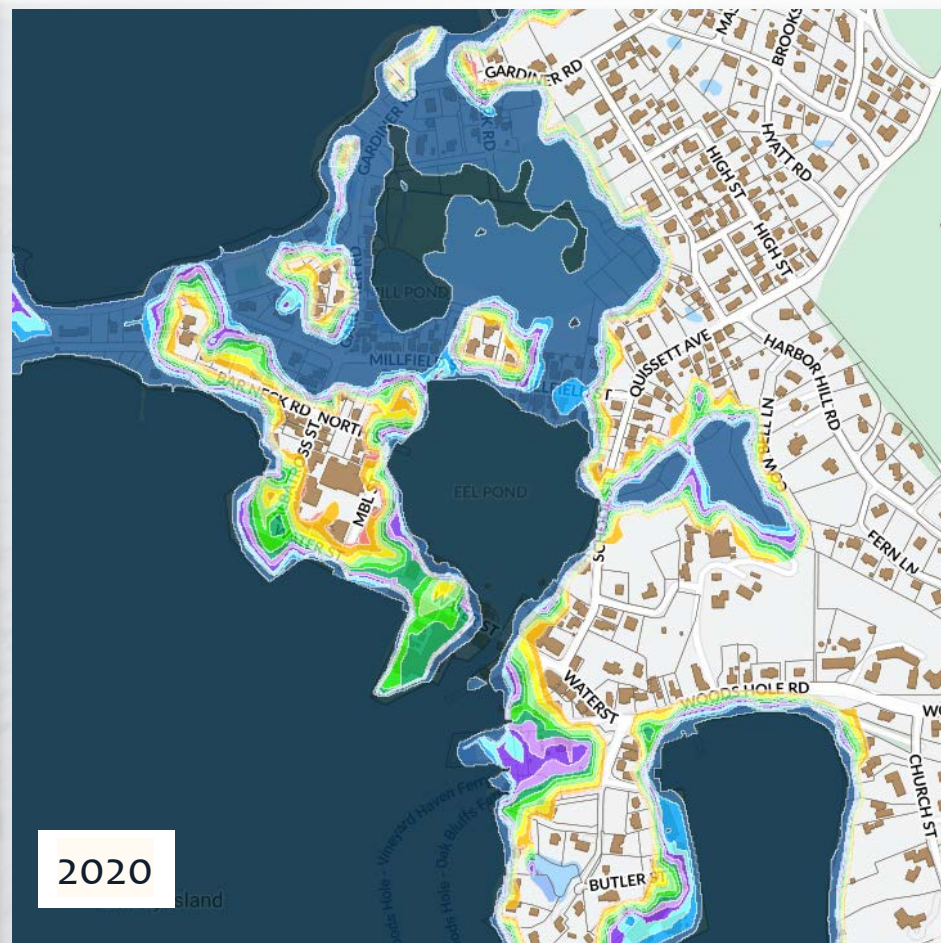


Cape Cod Commission Sea Level Rise Viewer

www.capecodcommission.org/our-work/sea-level-rise



Falmouth: MA Coastal Flood Risk Model



Inundation Depths



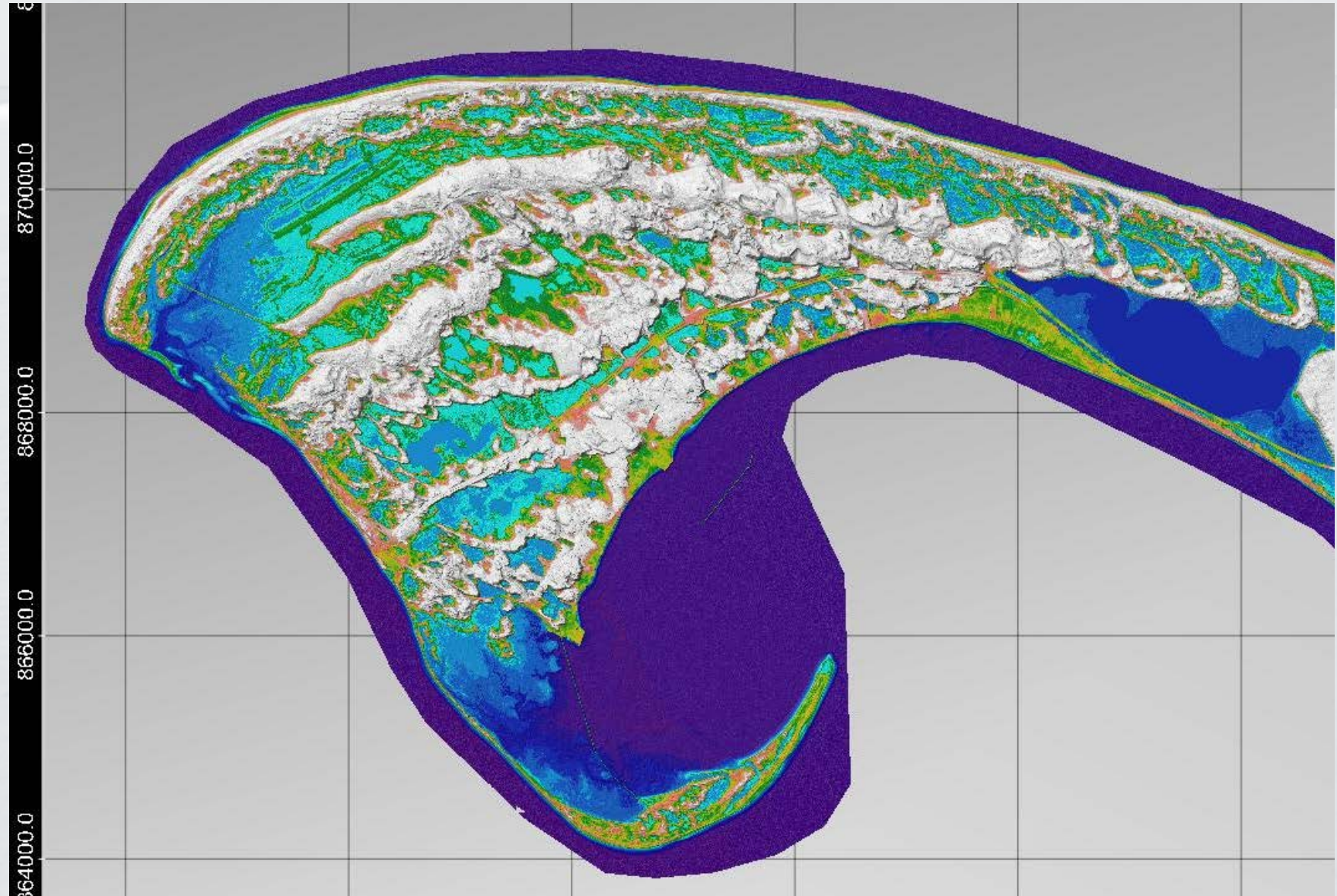
Others

- Resilient Woods Hole
- Low Lying Roads

Storm Tide Pathways

Provincetown, MA

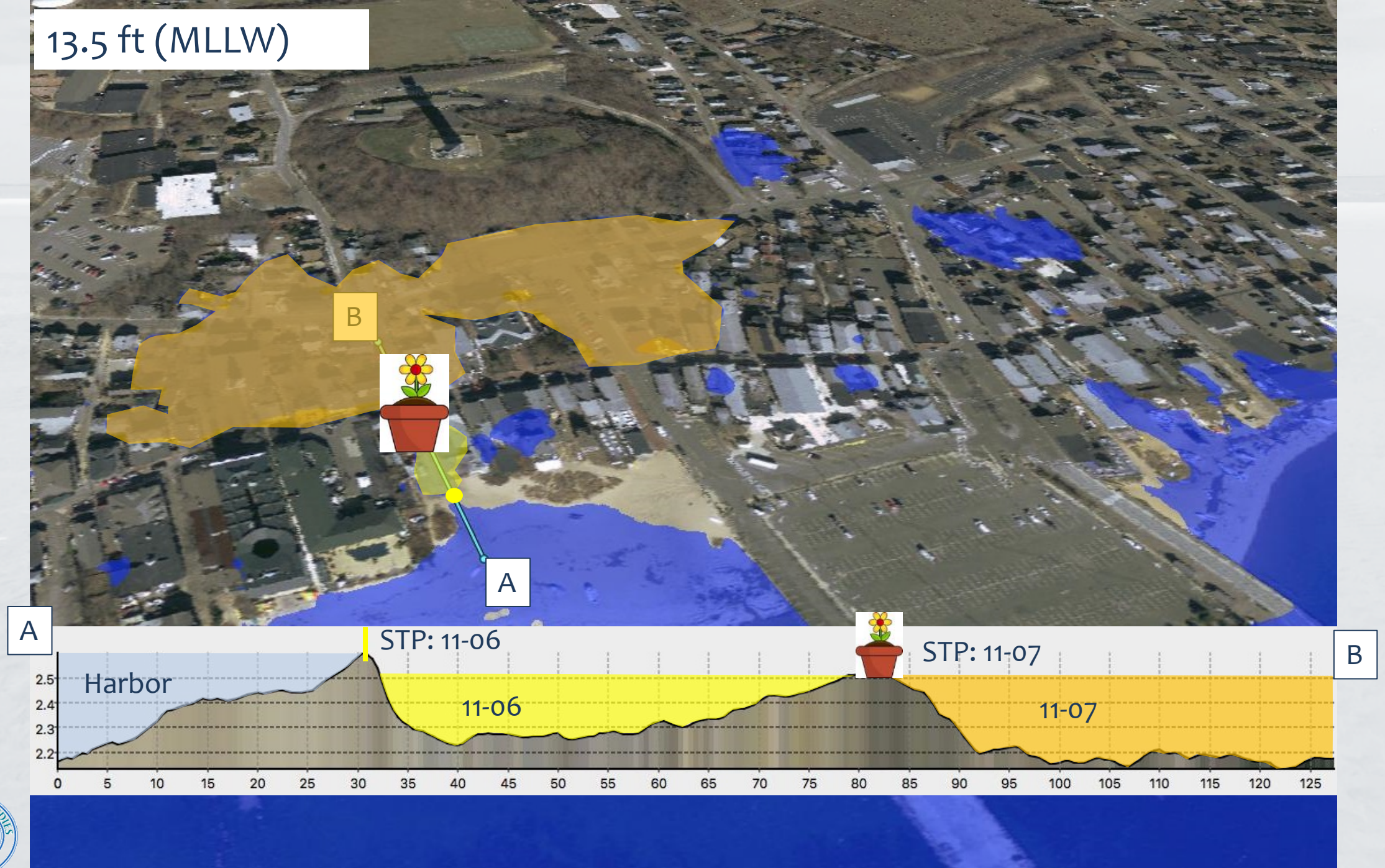
- Use LiDAR to identify plane, low points
- Elevation: Storm of record + 4'
- 6" increments
- Ground-truthed all identified STPs



Provincetown, MA




13.5 ft (MLLW)






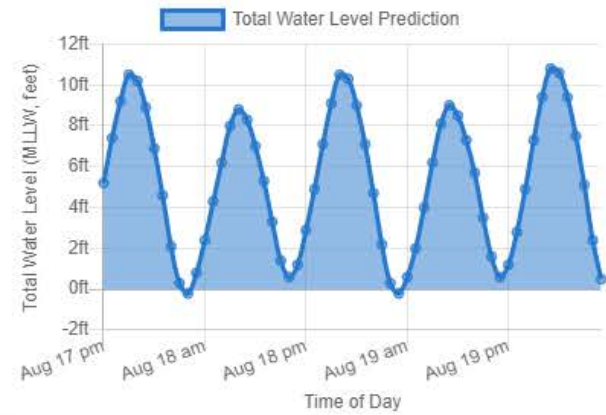
Storm Tide Pathways

Predicted Total Water Level 




Select Town

Choose Tide Gauge: 



Total Water Level Slider 



Settings 



Partners, Sponsors & Supporters Information



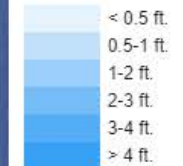
Stormtides.org



5 mi

Map Legend

Water Depth:



NWS Flooding Categories (MLLW ft):

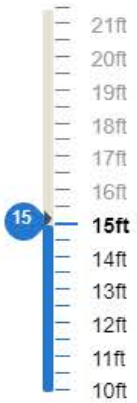


Storm Tide Pathways

Stormtides.org

Predicted Total Water Level

Total Water Level Slider



Settings

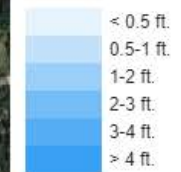
Partners, Sponsors & Supporters Information



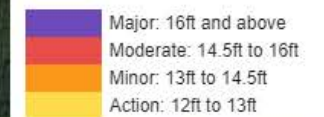
STP ID:	75-167
Plane Elevation:	14.00 - 14.50
MLLW (ft):	14.42
MLLW (m):	4.40
NAVD88 (ft):	8.63
NAVD88 (m):	2.63
Tide Restricted:	0
Storm of record:	2.2882152

Map Legend

Water Depth:



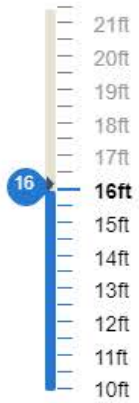
NWS Flooding Categories (MLLW ft):



Storm Tide Pathways

Predicted Total Water Level

Total Water Level Slider



Settings

Partners, Sponsors & Supporters Information



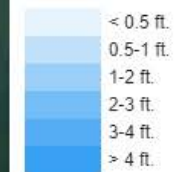
Google



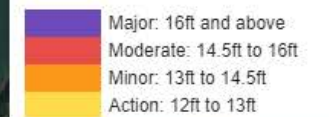
Stormtides.org

Map Legend

Water Depth:



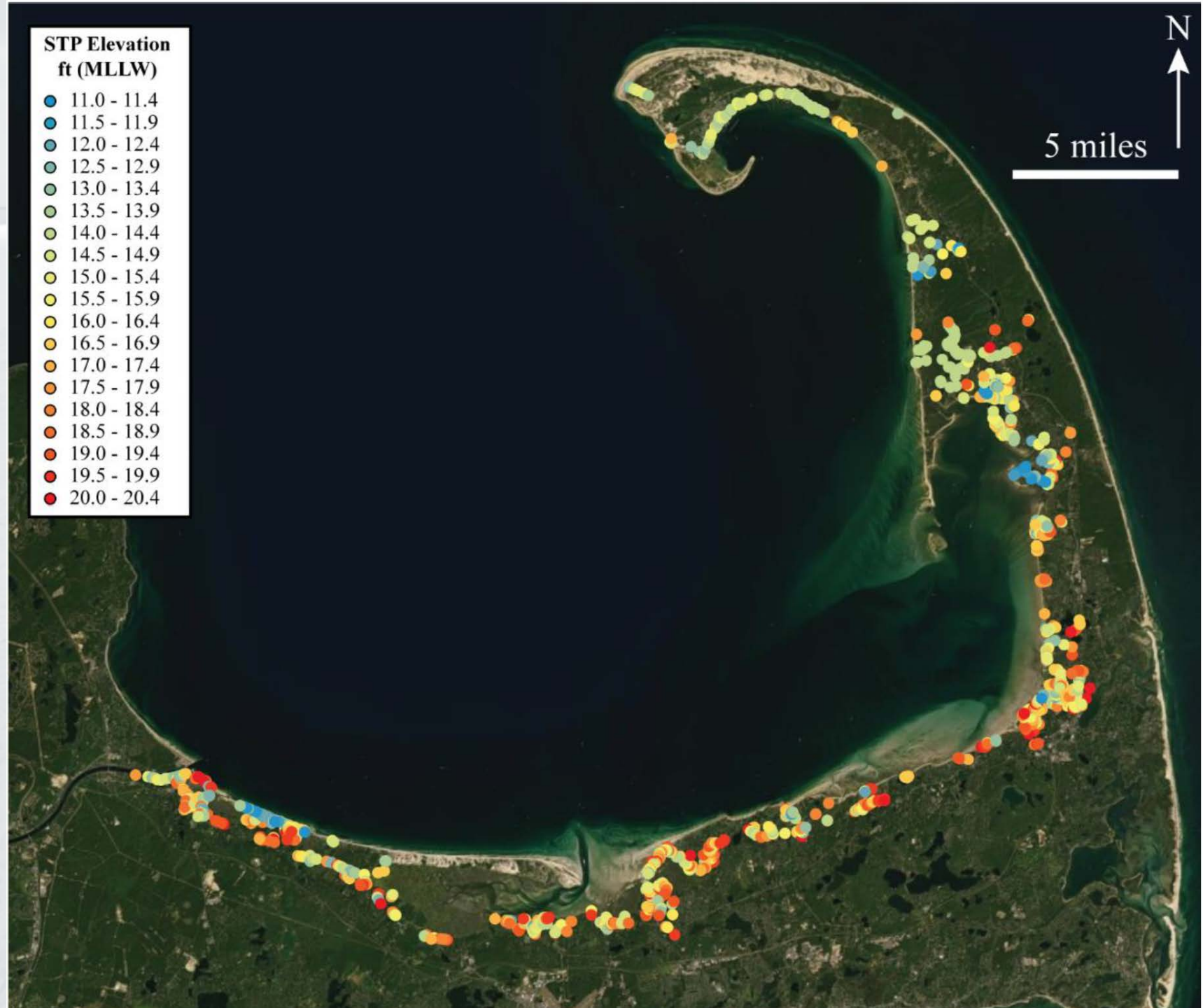
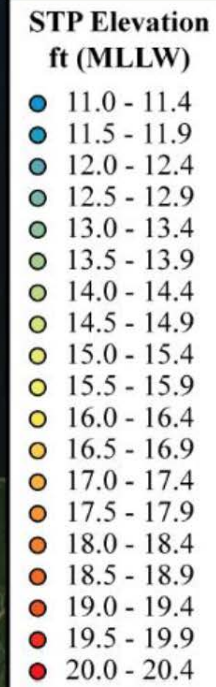
NWS Flooding Categories (MLLW ft):



1000 ft

Cape Cod Bay

- Storm of record + 4'
- 1,500 STPs
- Ground-truthed



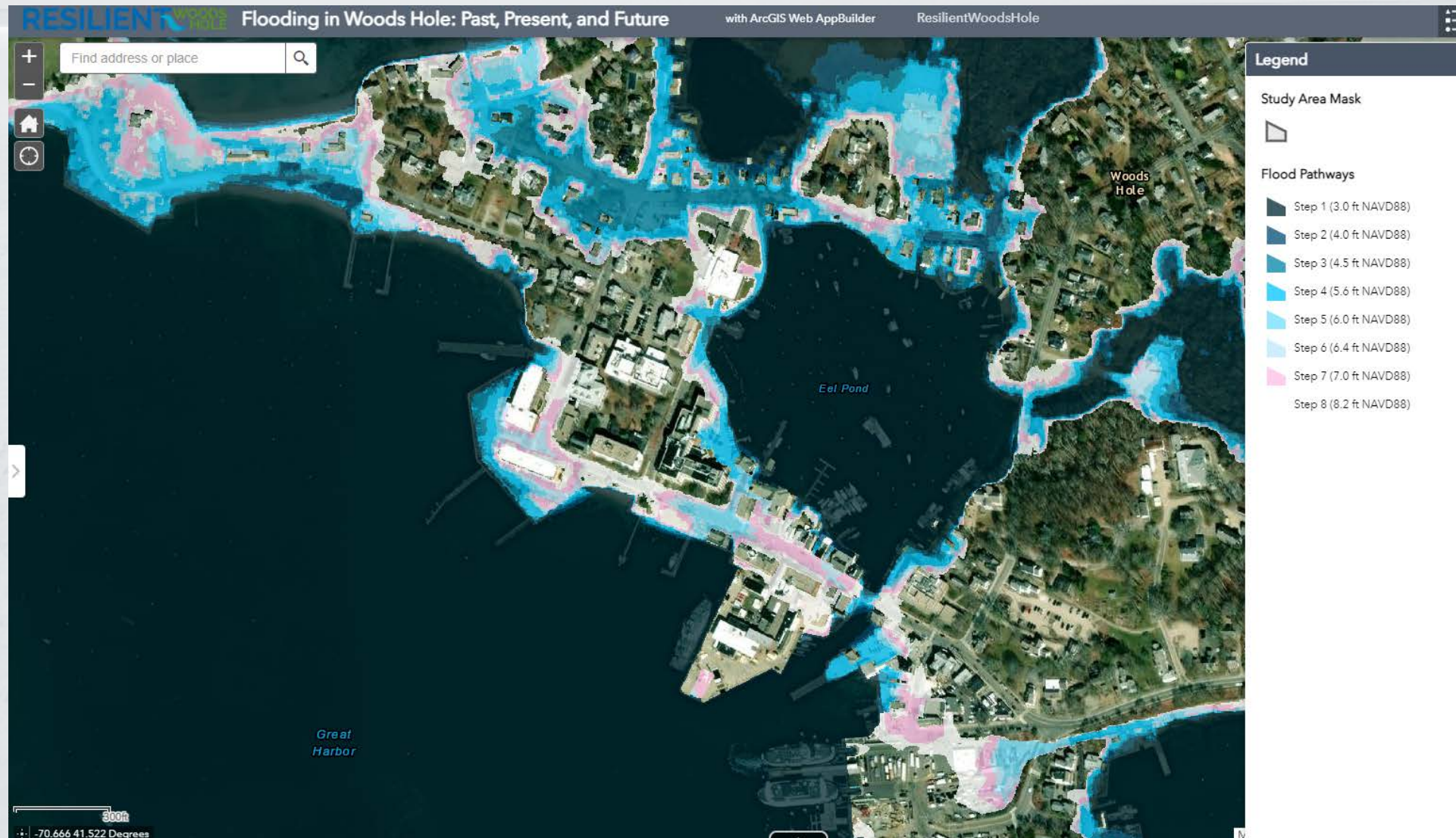
STPs within 1'
of storm of
record



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Falmouth STPs



Managing Flood Risk



Ways to Manage Flood Risk

- Protect
 - Seawalls, groins, breakwaters
 - Living shorelines / natural infrastructure
- Adapt
 - Building regulations
 - Conservation Commission regulations
 - Zoning regulations
 - Hazard Mitigation Planning
 - CZM and MVP grants
- Retreat
 - Buyouts
 - Development prohibitions



Protect: Keep the Water Out

- Hard structures
 - Seawalls
 - Groins
 - Breakwaters
- Natural infrastructure
 - Marshes
 - Dunes
 - Living shorelines
 - Berms?



Adapt: Live with the Water

Regulations

Planning

Projects

Adapt: Regulations

- Building: how to build
- Zoning: where to build
- Conservation Commission / Wetlands Protection Act: where and how to build in environmentally sensitive locations



Adapt: Planning

- Hazard mitigation
- Municipal Vulnerability Preparedness
- Coastal Zone Management
- Examples:
 - Resilient Woods Hole
 - Low-Lying Roads
 - Resilient Cape Cod
 - Coastal Resiliency Bylaws
 - Pleasant Bay Living Shoreline
 - Sediment Study

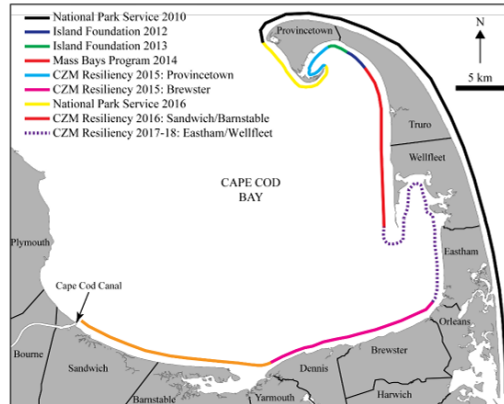


Figure 1. This project, focusing on the Eastham/Wellfleet shoreline (dashed line) completes work to quantify a comprehensive sediment budget for Cape Cod Bay, east of the Cape Cod Canal.





Retreat: Get Away from the Water

- Historic examples
- Buyout Programs
- Political Challenges





Retreat: Sandwich, MA



2015



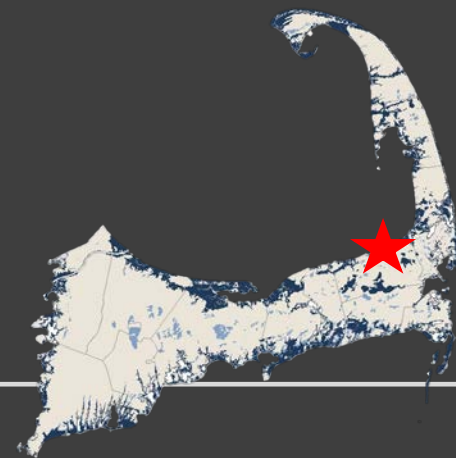
2017



2016



Retreat:
Brewster, MA



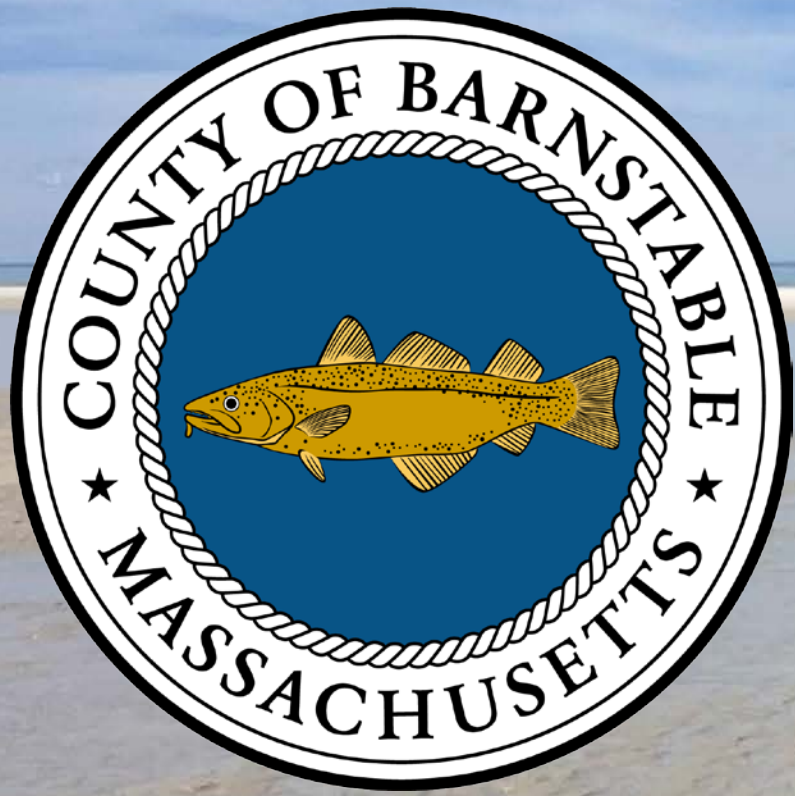
Resources

Links from Today

- [FEMA Flood Maps](#)
- [NOAA Sea Level Rise Viewer](#)
- [Climate Central Sea Level Rise Viewer](#)
- [Cape Cod Commission Sea Level Rise Viewer](#)
- [MA Coastal Flood Risk Model for Falmouth](#)
- [Resilient Woods Hole](#)
- [Low Lying Roads](#)
- [Storm Tide Pathways](#)
- [Falmouth Storm Tide Pathways](#)

Other Resources

- [Woods Hole Sea Grant: Storms, Erosion, and Flooding](#)
- [Woods Hole Sea Grant Information for Property Owners](#)
- [Prep-RI](#)
- [US Army Corps Virtual Reality Flood Visualization](#)
- [Floodsmart.gov Hurricane Season Outreach](#)
- [Charleston County, SC You Tube Series](#)
- [New York Flood Help Page](#)
- [Hampton Roads, VA Flood Page](#)



Woods Hole
Sea Grant

Thank You!

Shannon.Hulst@barnstablecounty.org
(508) 375-6952