

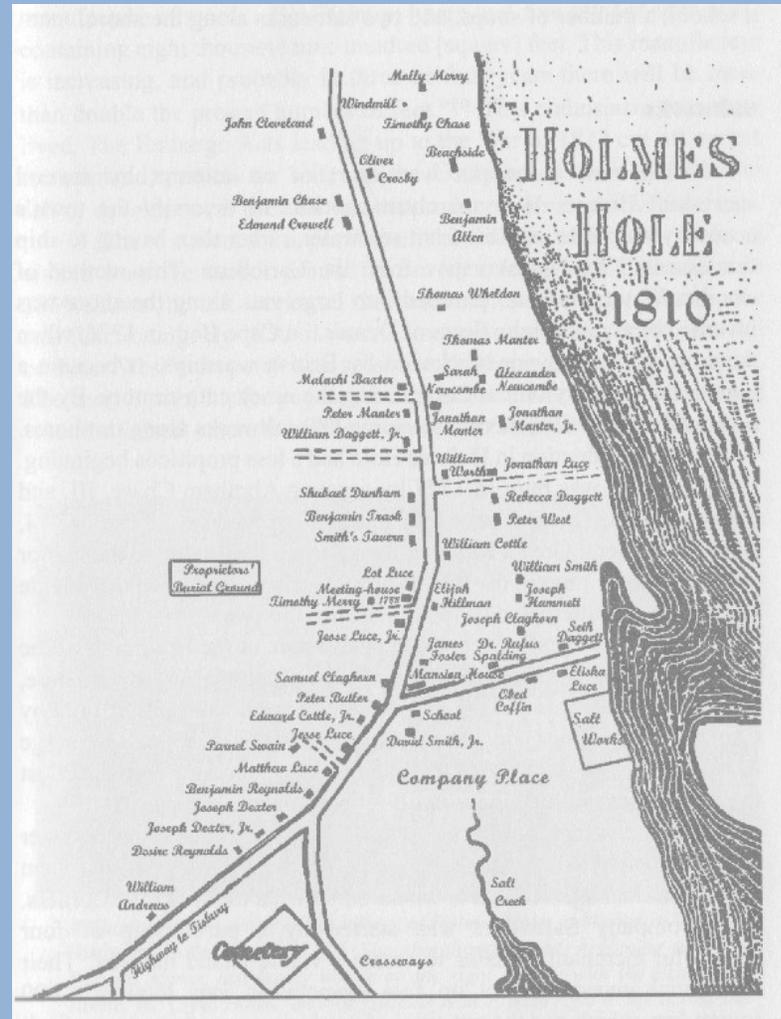
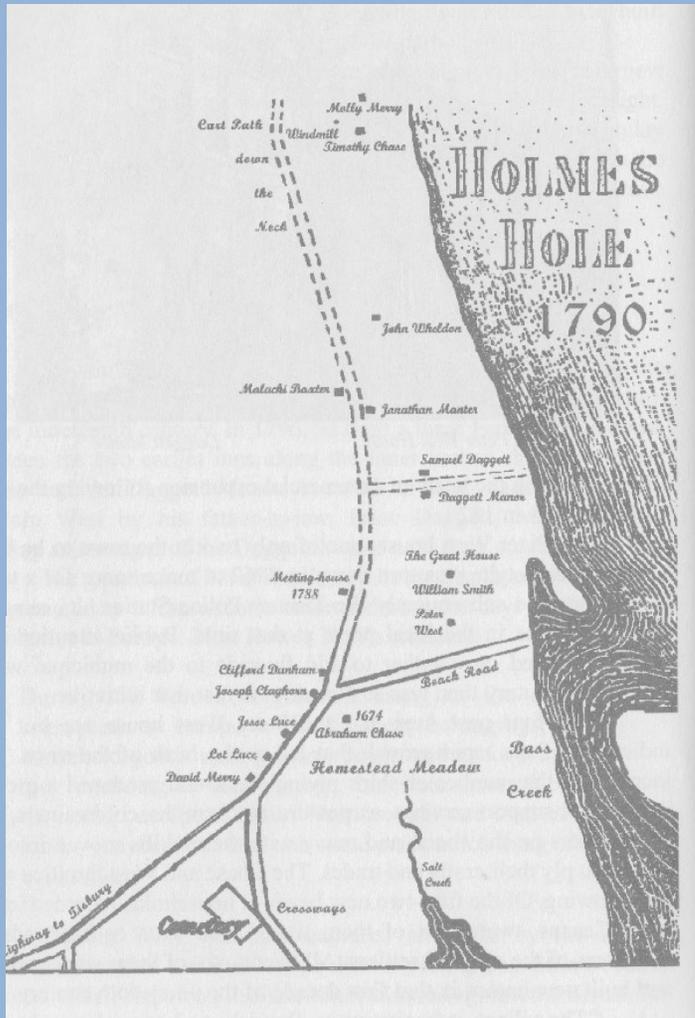
# COASTAL RESILIENCE

TOWN OF TISBURY - MARTHA'S VINEYARD AS A CASE STUDY

NATALIE M. SPINOLA  
SUNY ESF | DEPARTMENT OF LANDSCAPE ARCHITECTURE  
CAPSTONE PROPOSAL PRESENTATION

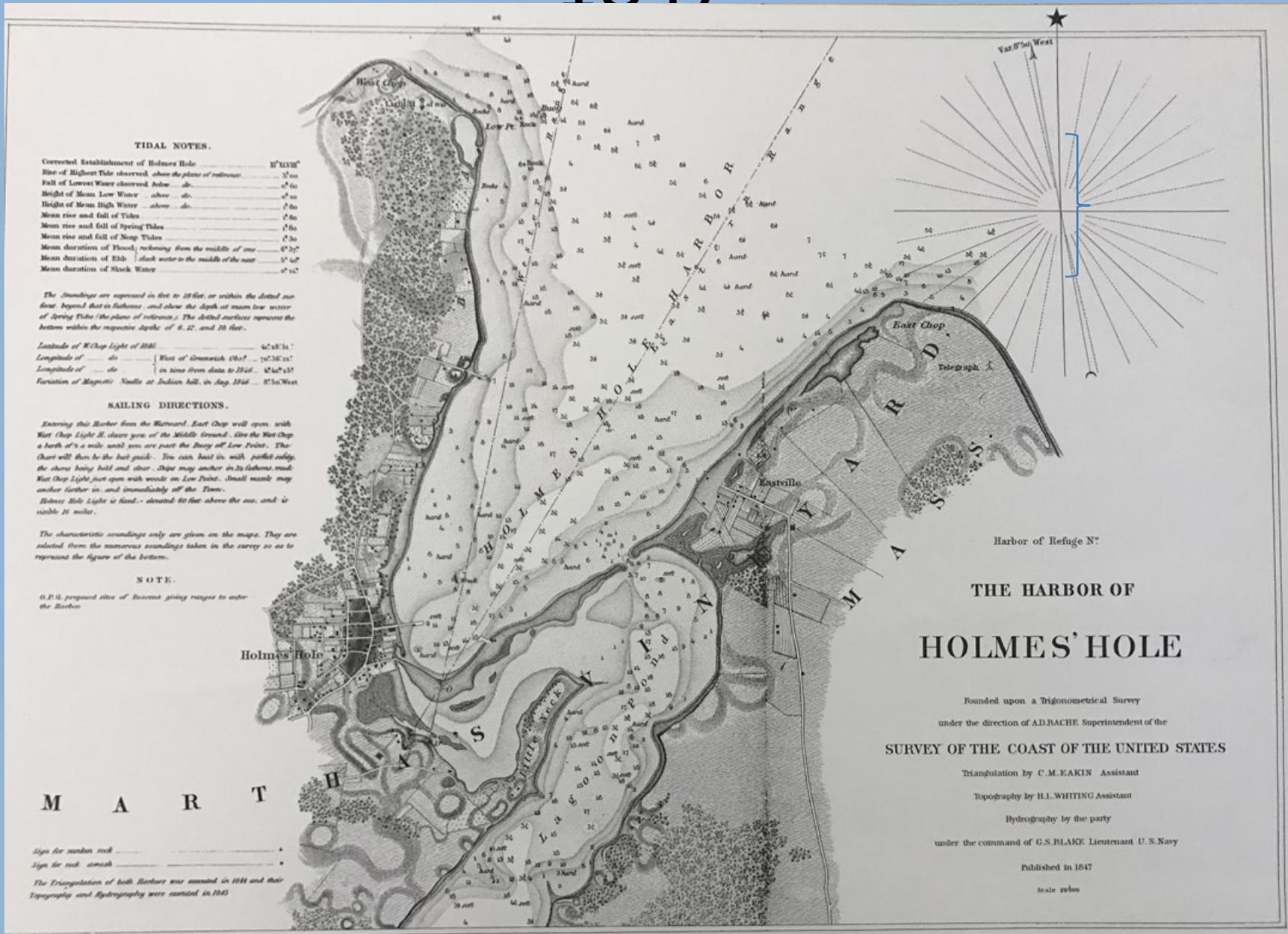
STEERING COMMITTEE  
RICHARD HAWKS | MAREN KING

Maps and Historic Photos from the Martha's Vineyard Museum  
Diagrams, maps and design studies related to Sea Level rise by Natalie Spinola

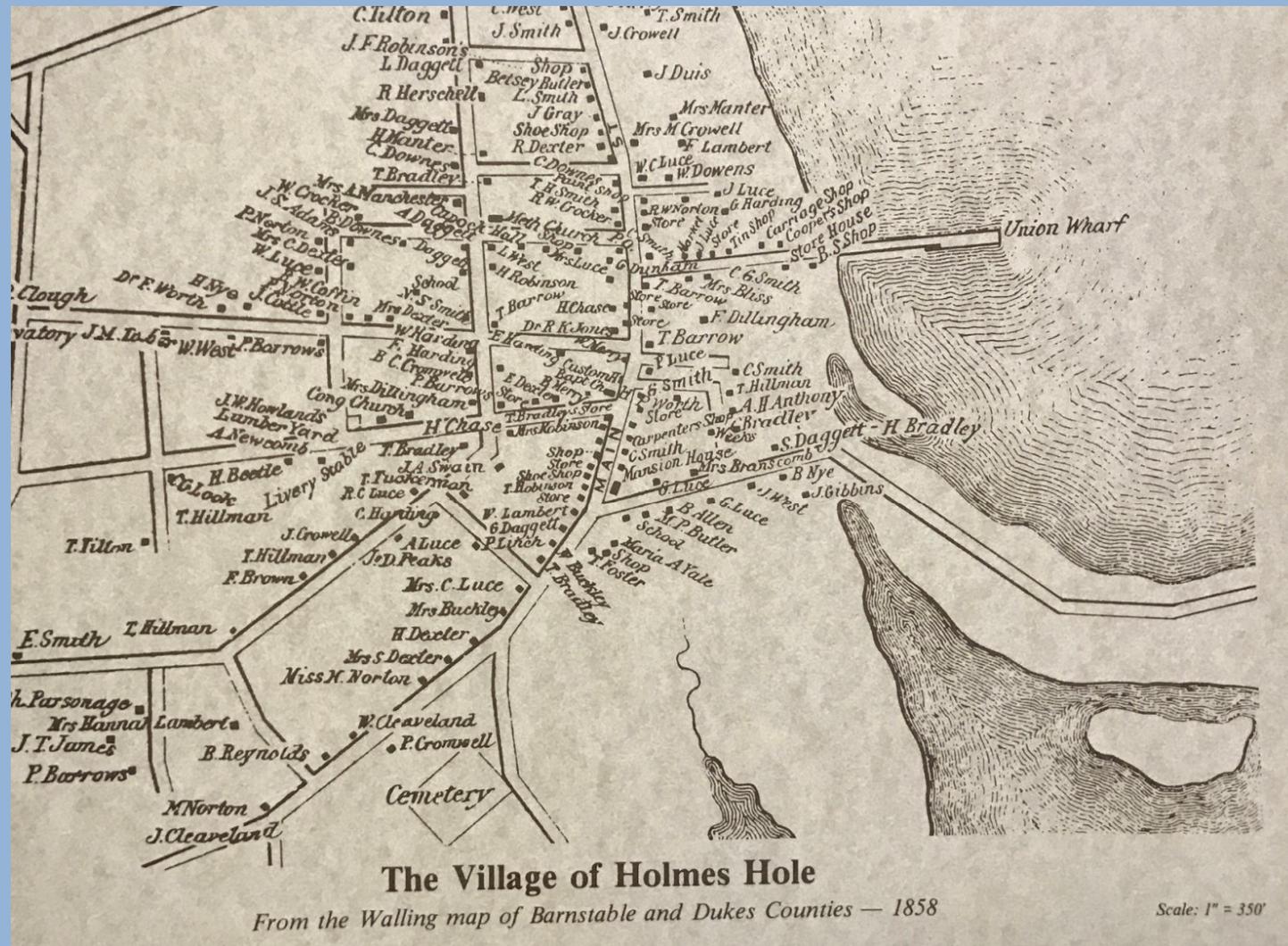


1835 November gale closed the opening

# 1847

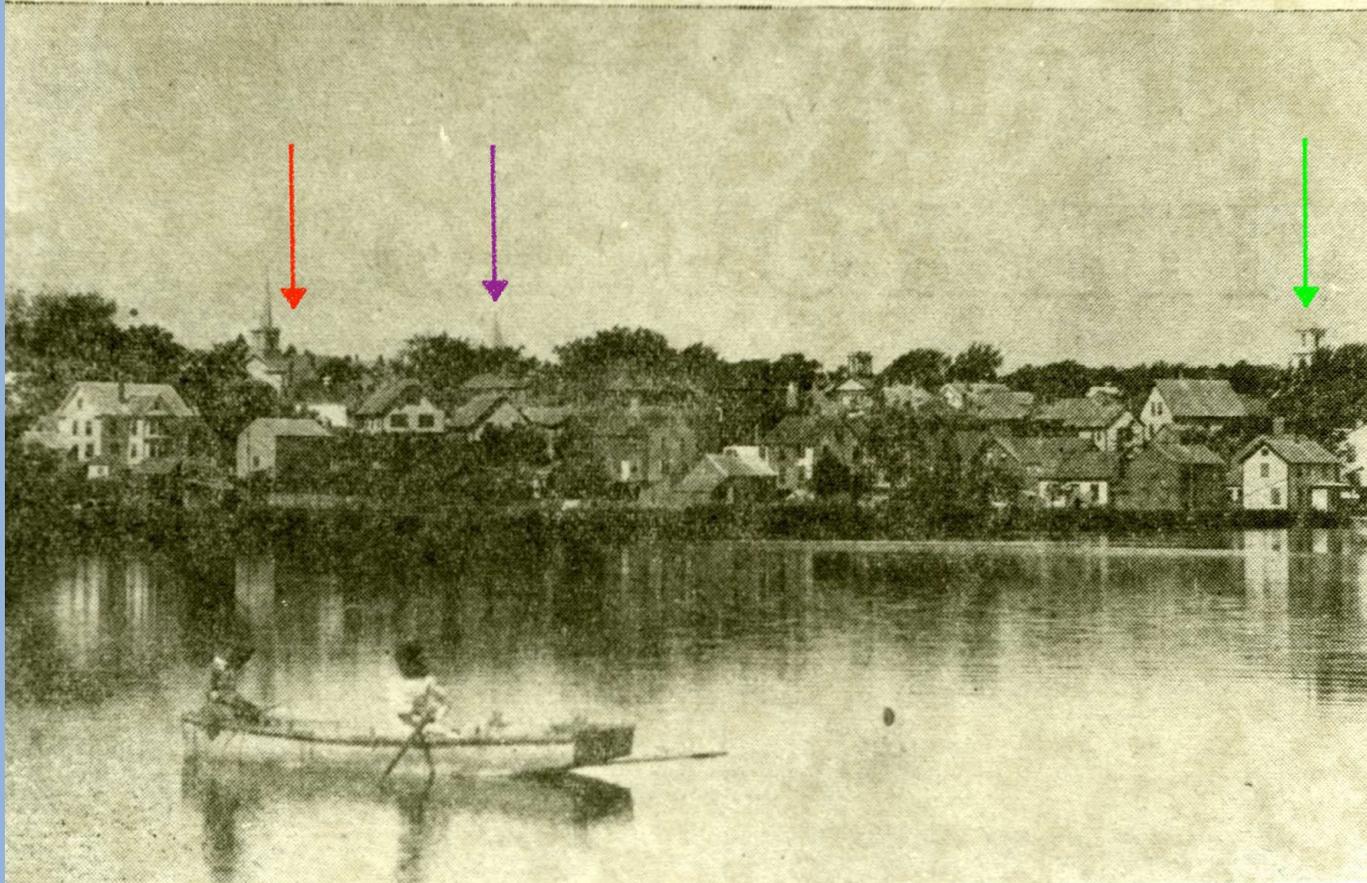


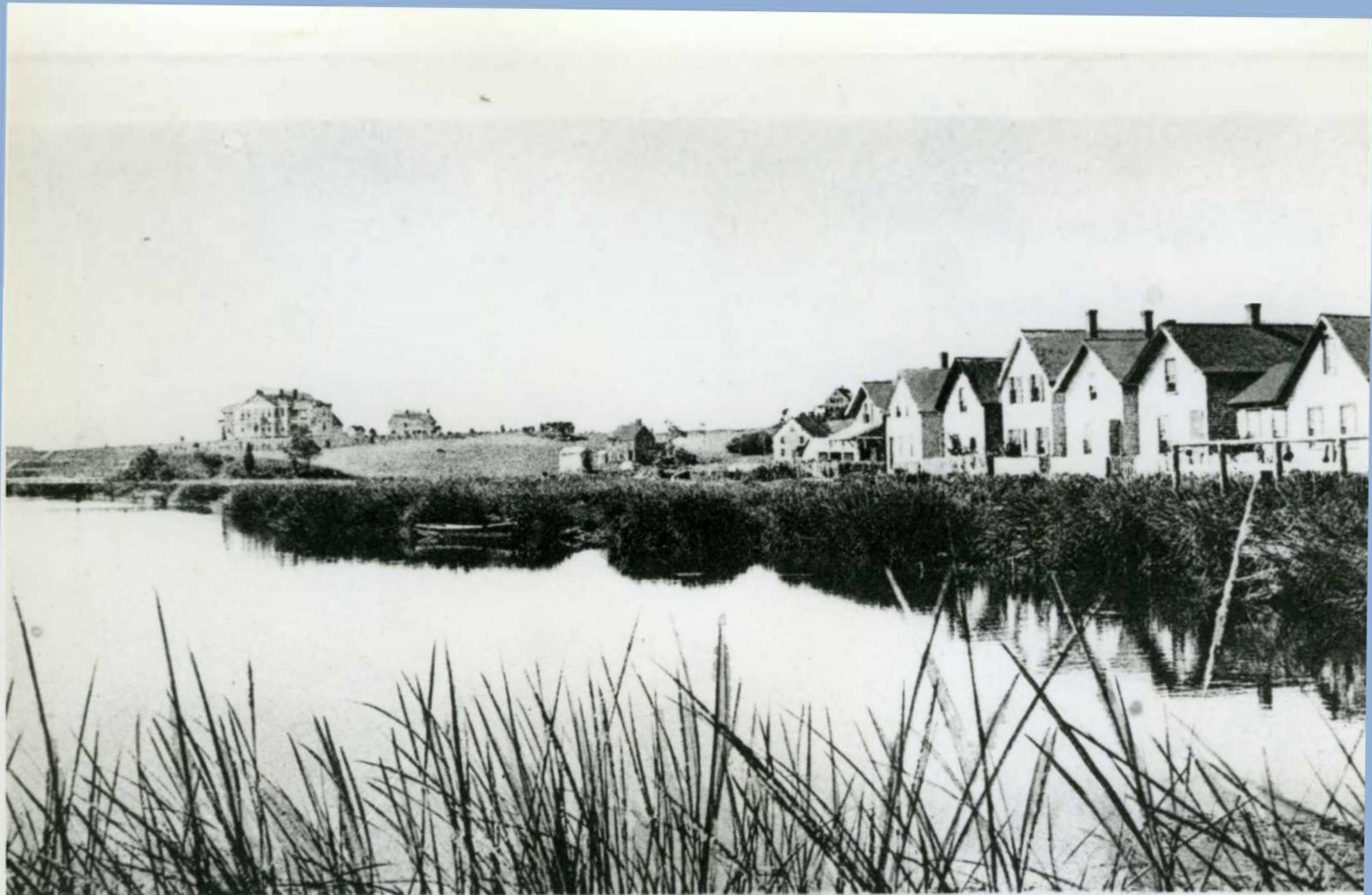
# 1858



1889 -7 Protection of the chops

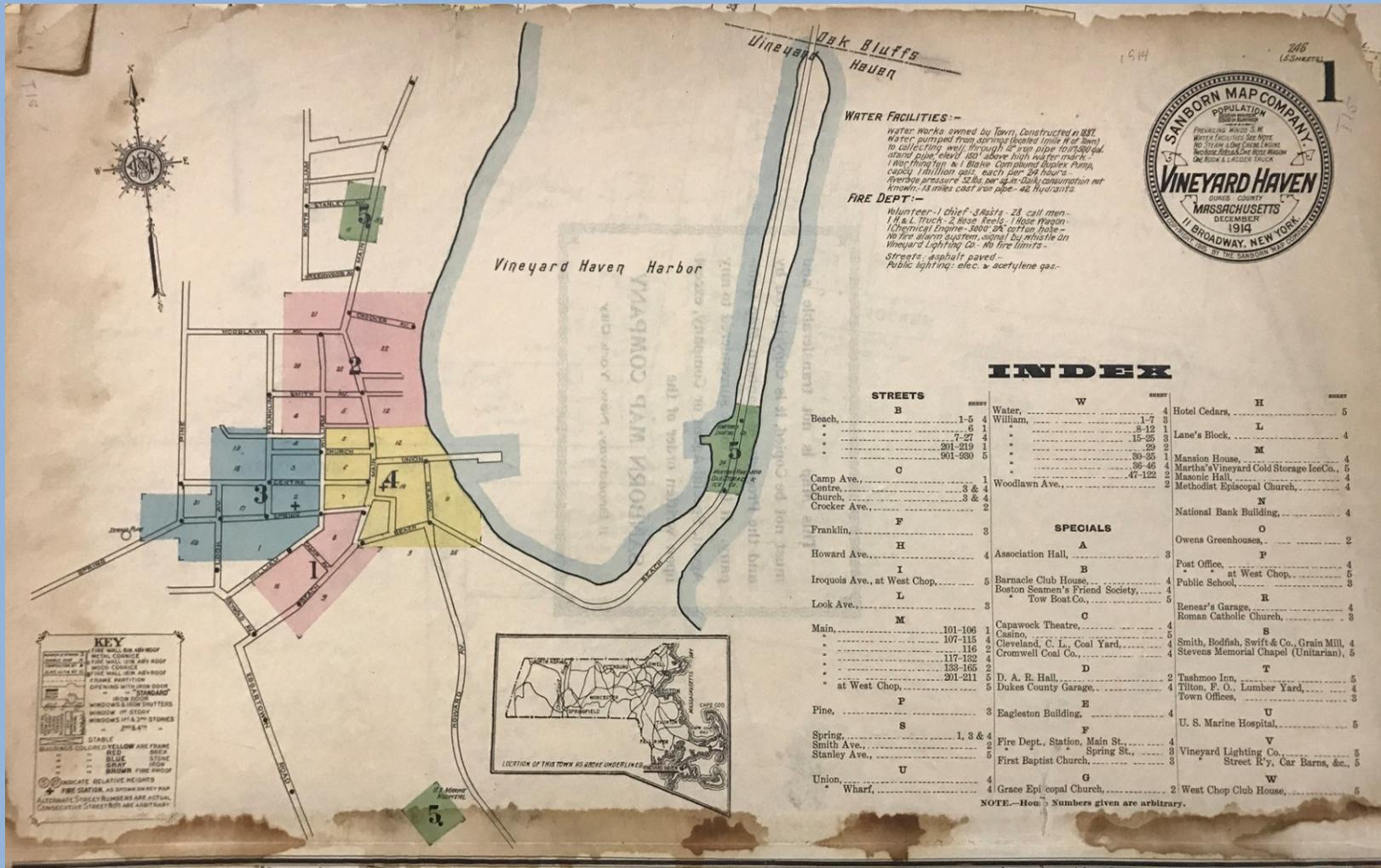
*A ROW ON BASS CREEK, THAT VANISHED BEAUTY SPOT OF VINEYARD HAVEN*





The Lagoon (Marine Hospital in distance) Vineyard Haven, Mass.

# 1914



1905- 15 Construction of the inner harbor break wall

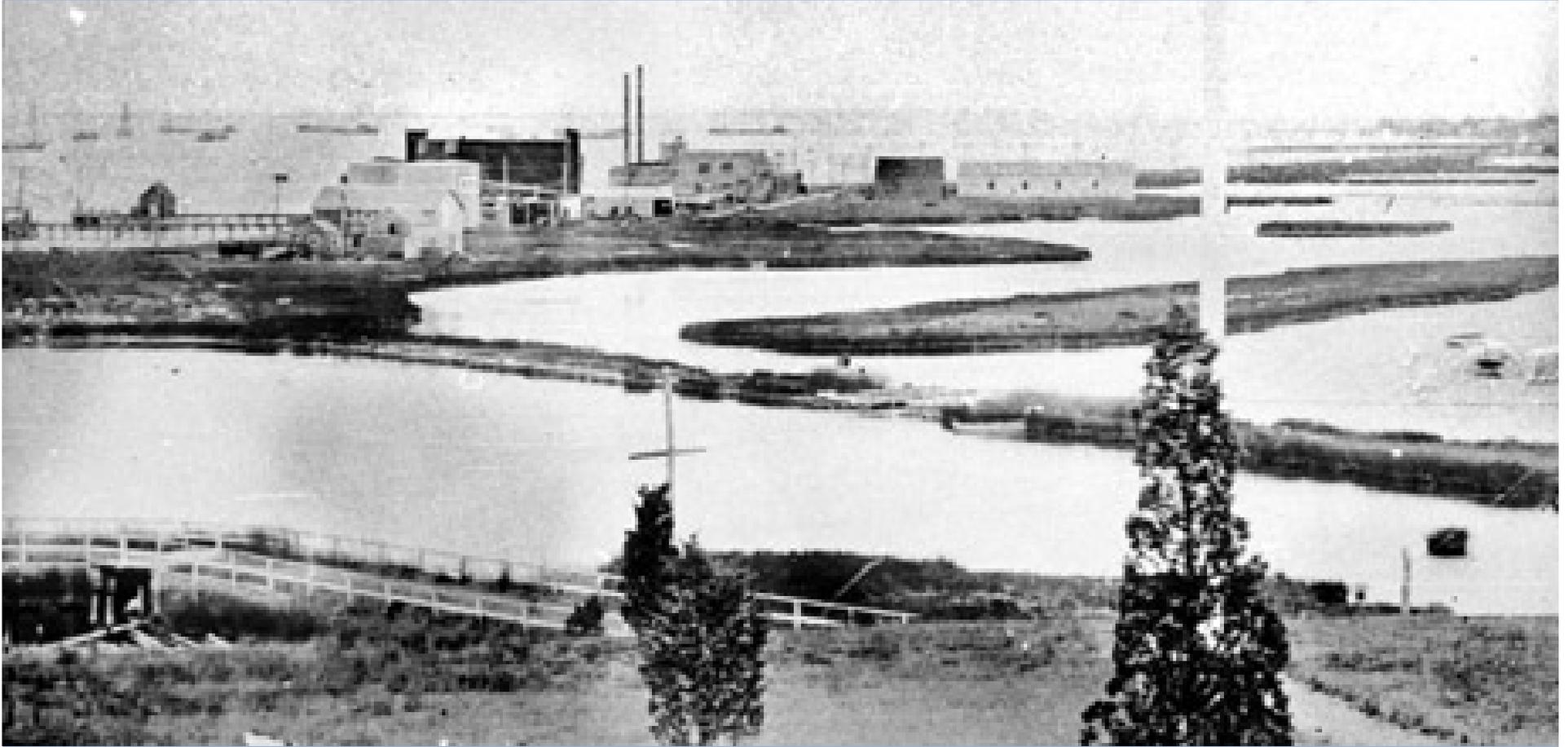
1918



**Harbor view from Hospital,  
Vineyard Haven, Mass.**



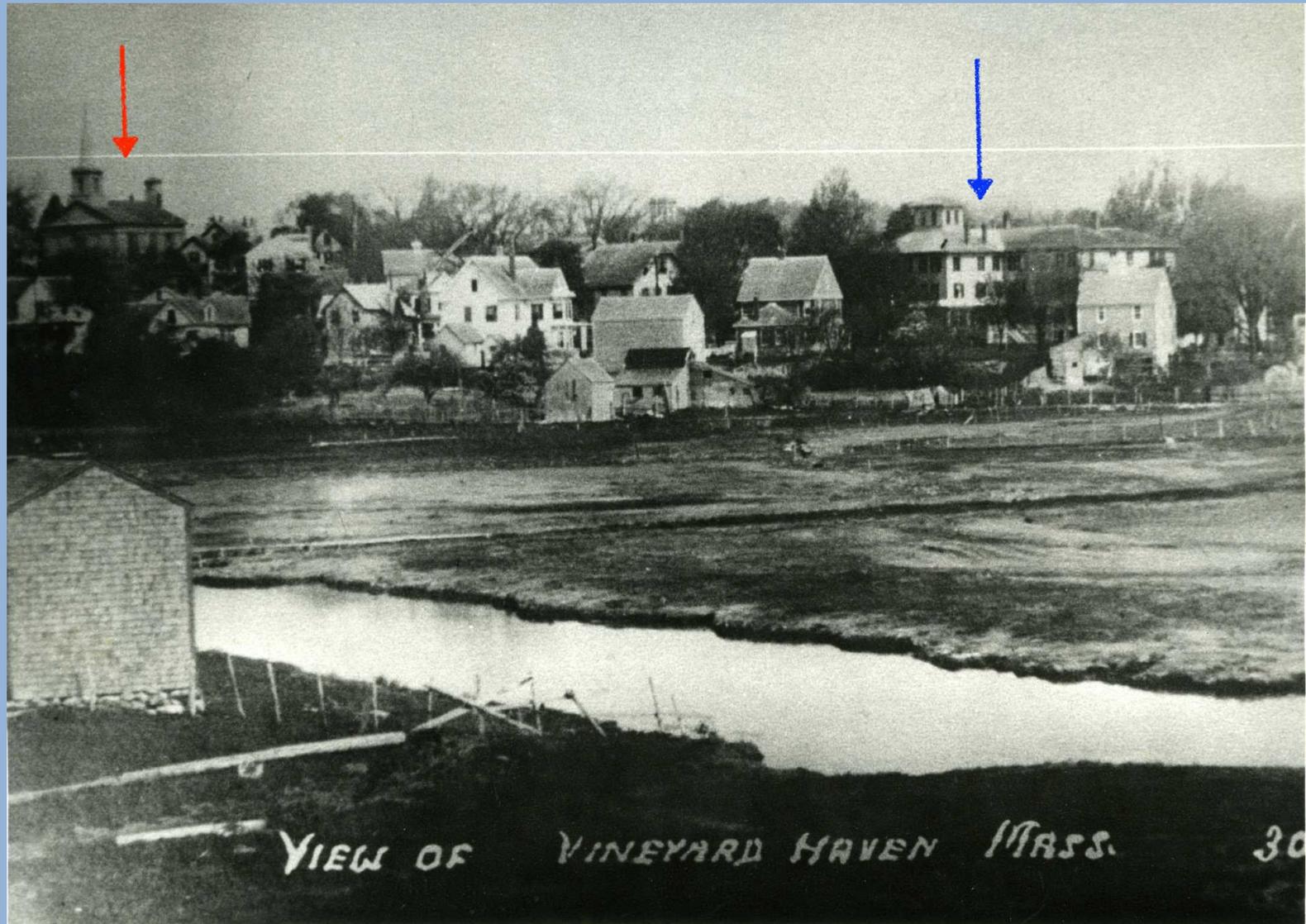
1920



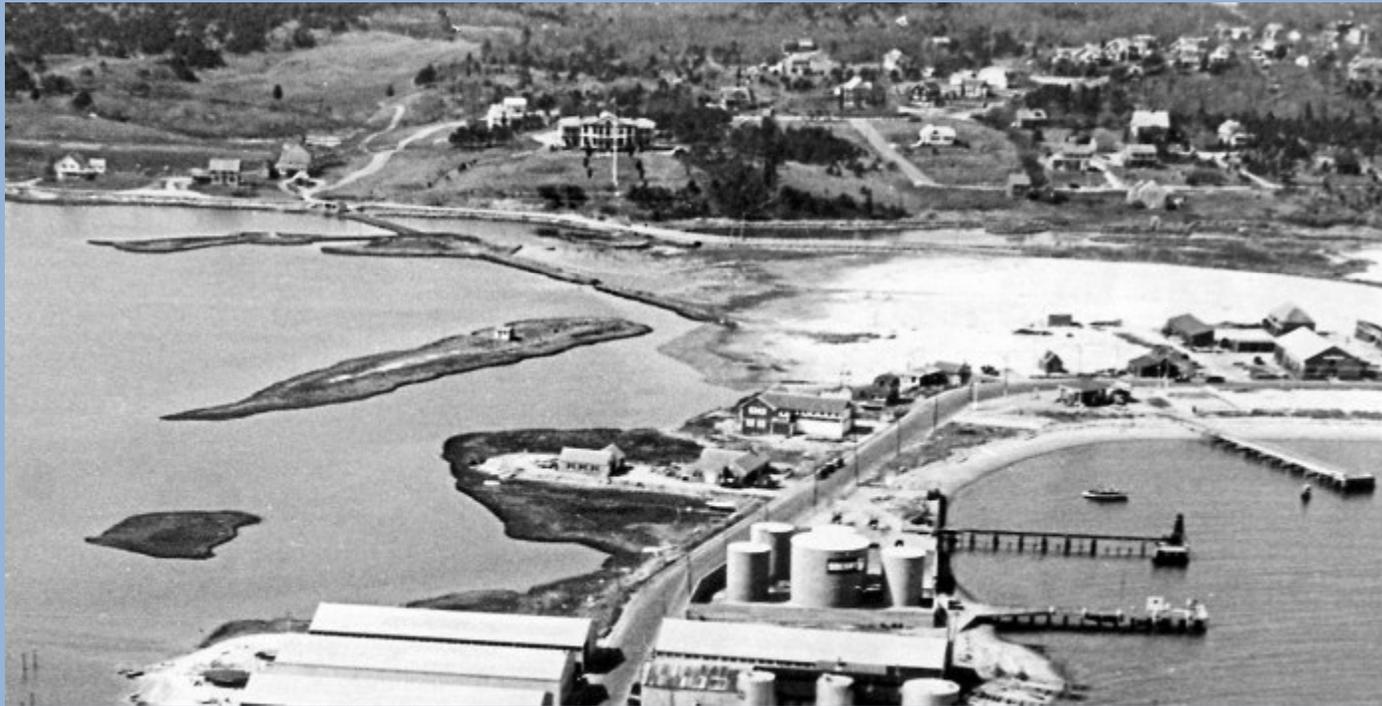
*1933 Construction of the first part of Eastville jetty*

*1934 30 ft drawbridge constructed*

1930



1930

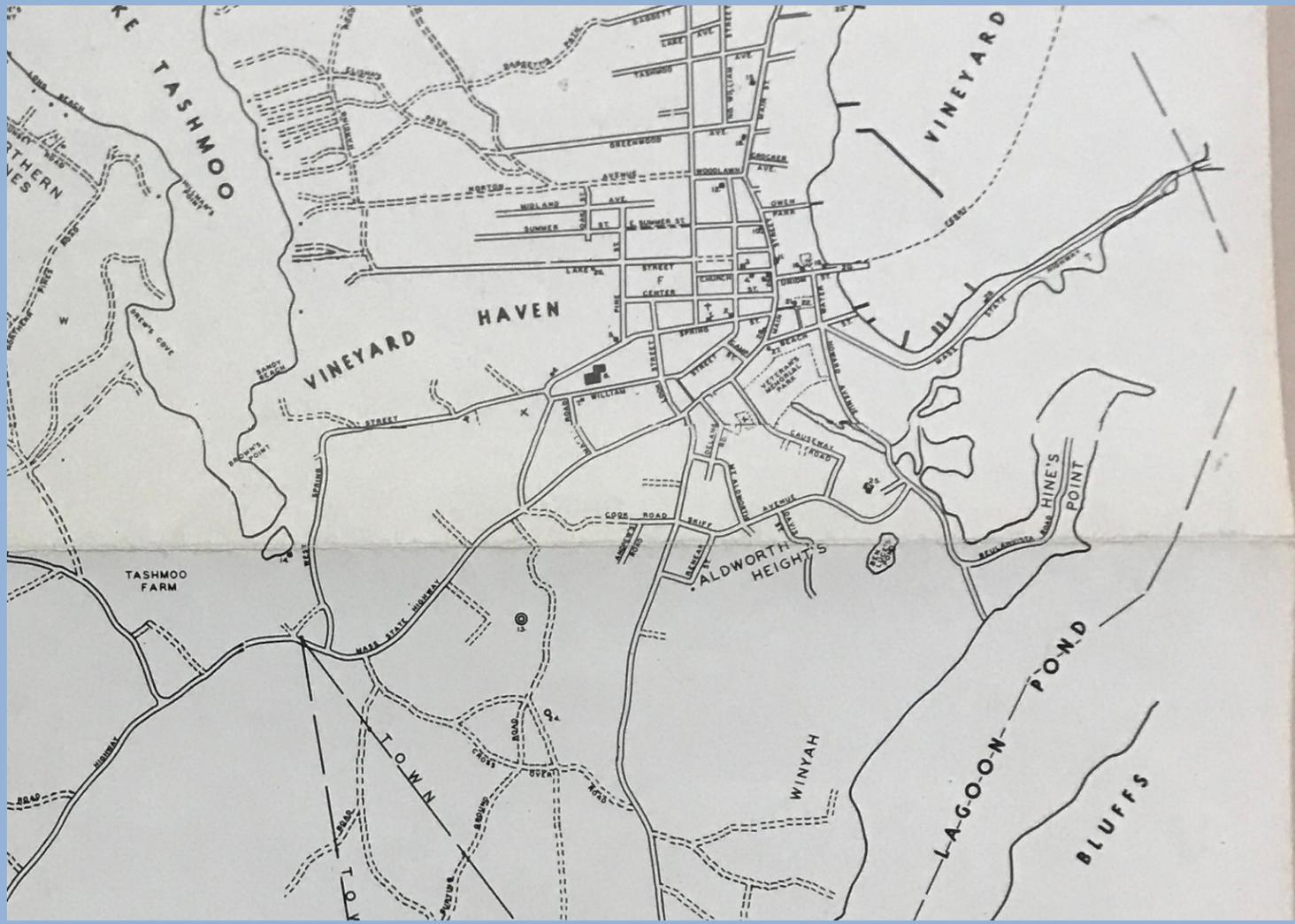


# Beach Rd 1975



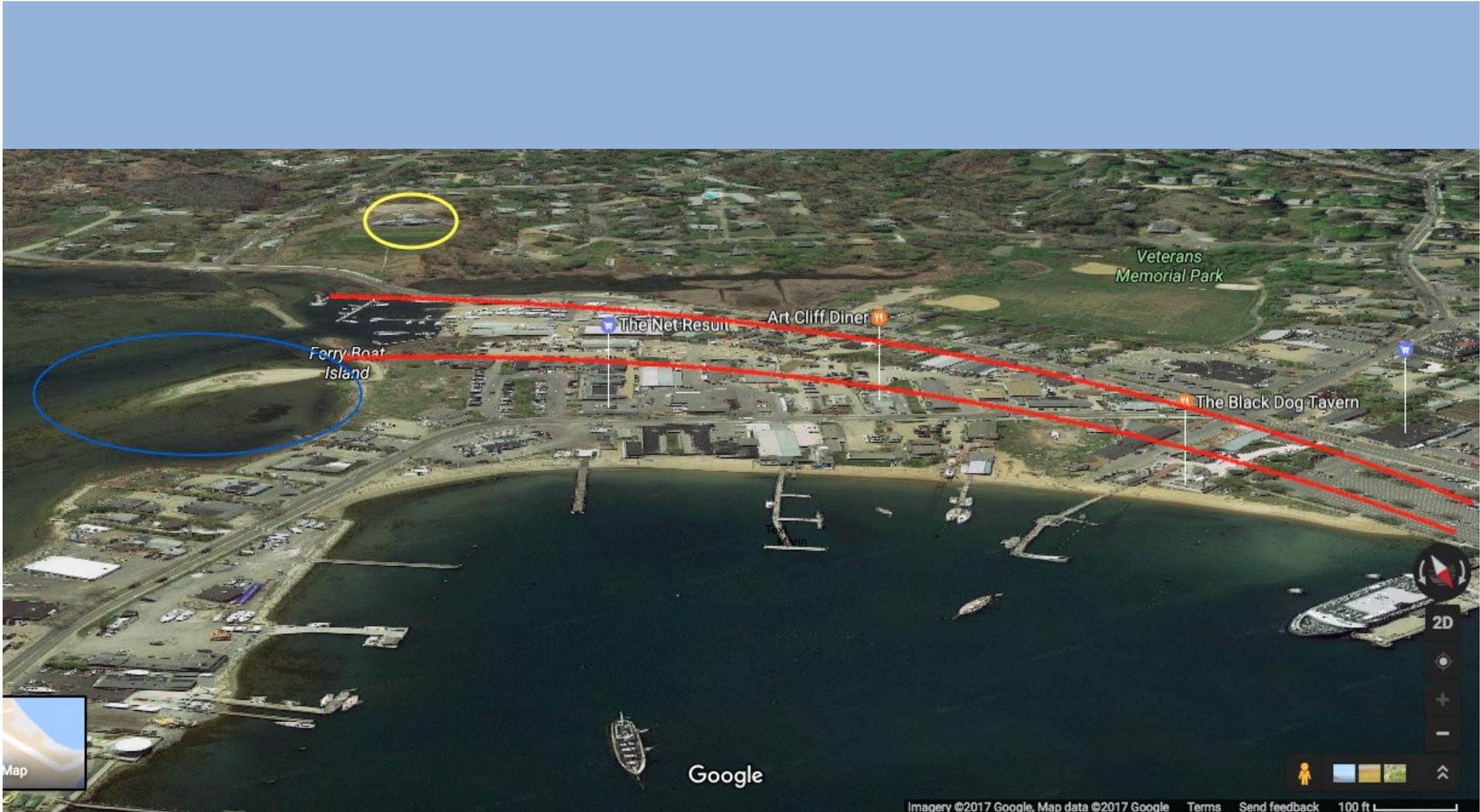
*1973 Extension of Eastville jetty*

# Post world war II





1979



Ferry Boat  
Island

The Net Result

Art Cliff Diner

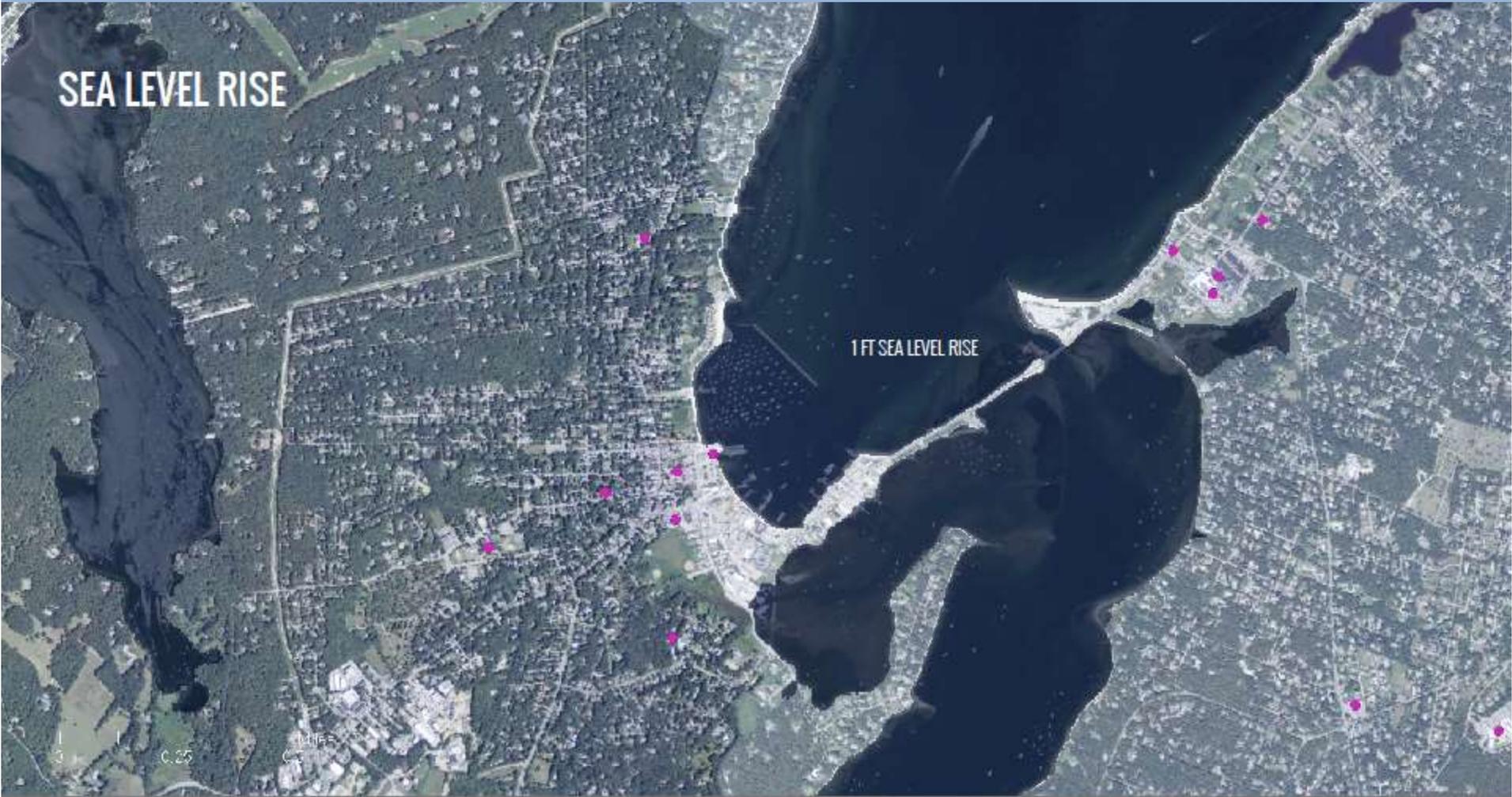
Veterans  
Memorial Park

The Black Dog Tavern

Google

Imagery ©2017 Google, Map data ©2017 Google Terms Send feedback 100 ft

# SEA LEVEL RISE

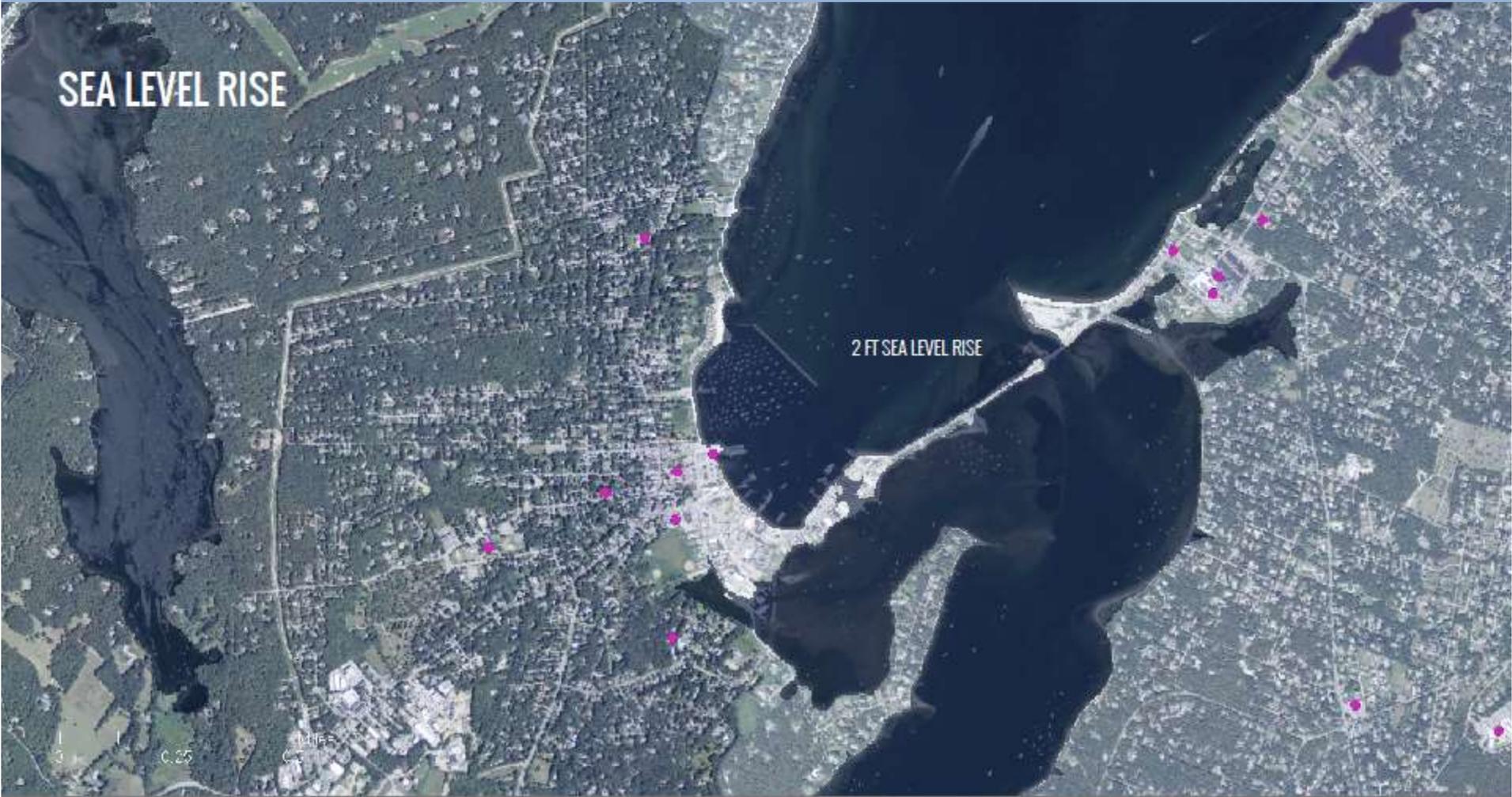


1 FT SEA LEVEL RISE

NATALIE M. SPINOLA  
SUNY ESF 1 DEPARTMENT OF LANDSCAPE ARCHITECTURE  
CAPSTONE PROPOSAL PRESENTATION

STEERING COMMITTEE  
RICHARD HAWKS | HAGEN KING

# SEA LEVEL RISE

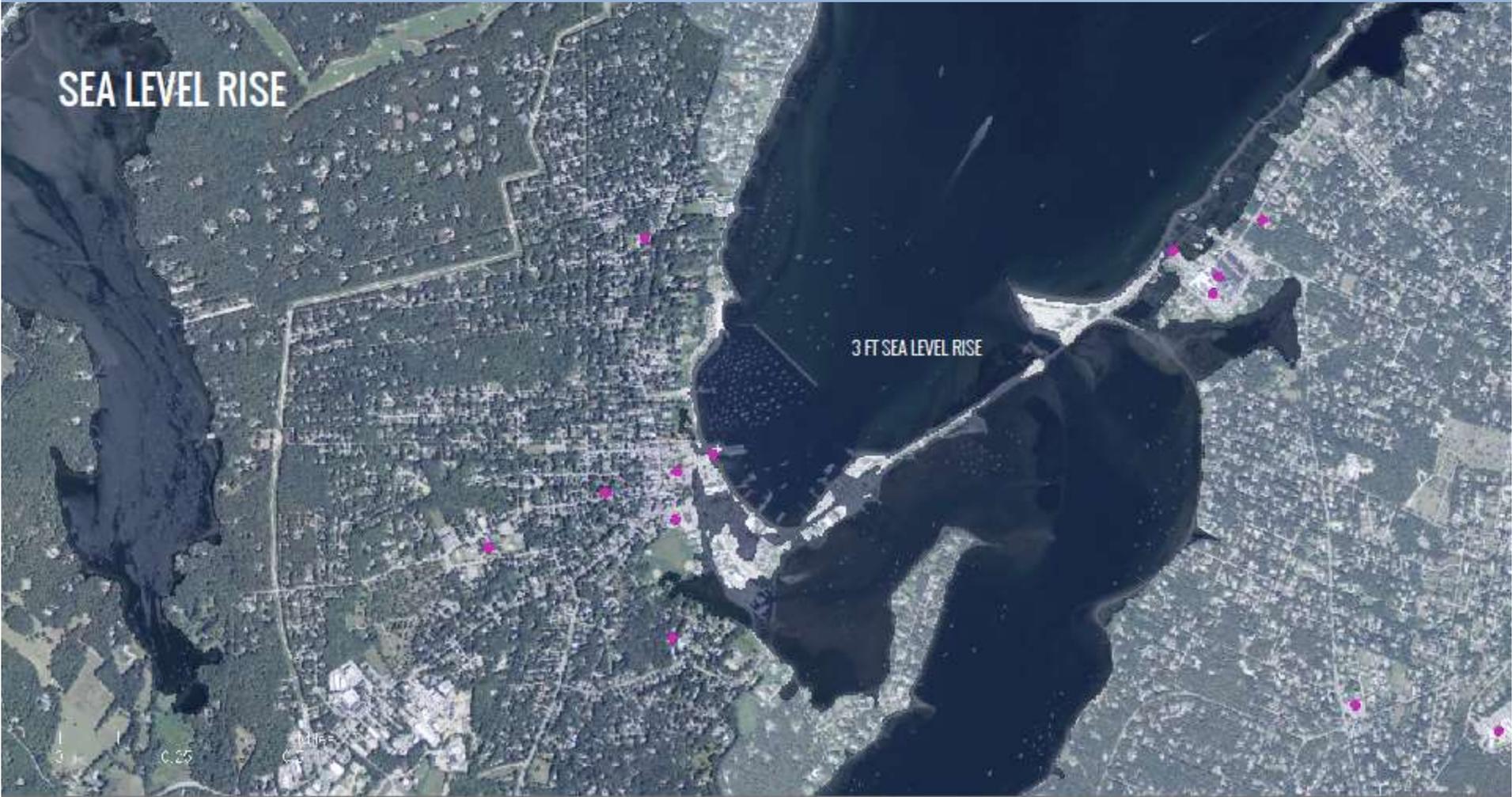


2 FT SEA LEVEL RISE

NATALIE M. SPINOLA  
SUNY ESF 1 DEPARTMENT OF LANDSCAPE ARCHITECTURE  
CAPSTONE PROPOSAL PRESENTATION

STEERING COMMITTEE  
RICHARD HAWKS | HAREN KING

# SEA LEVEL RISE

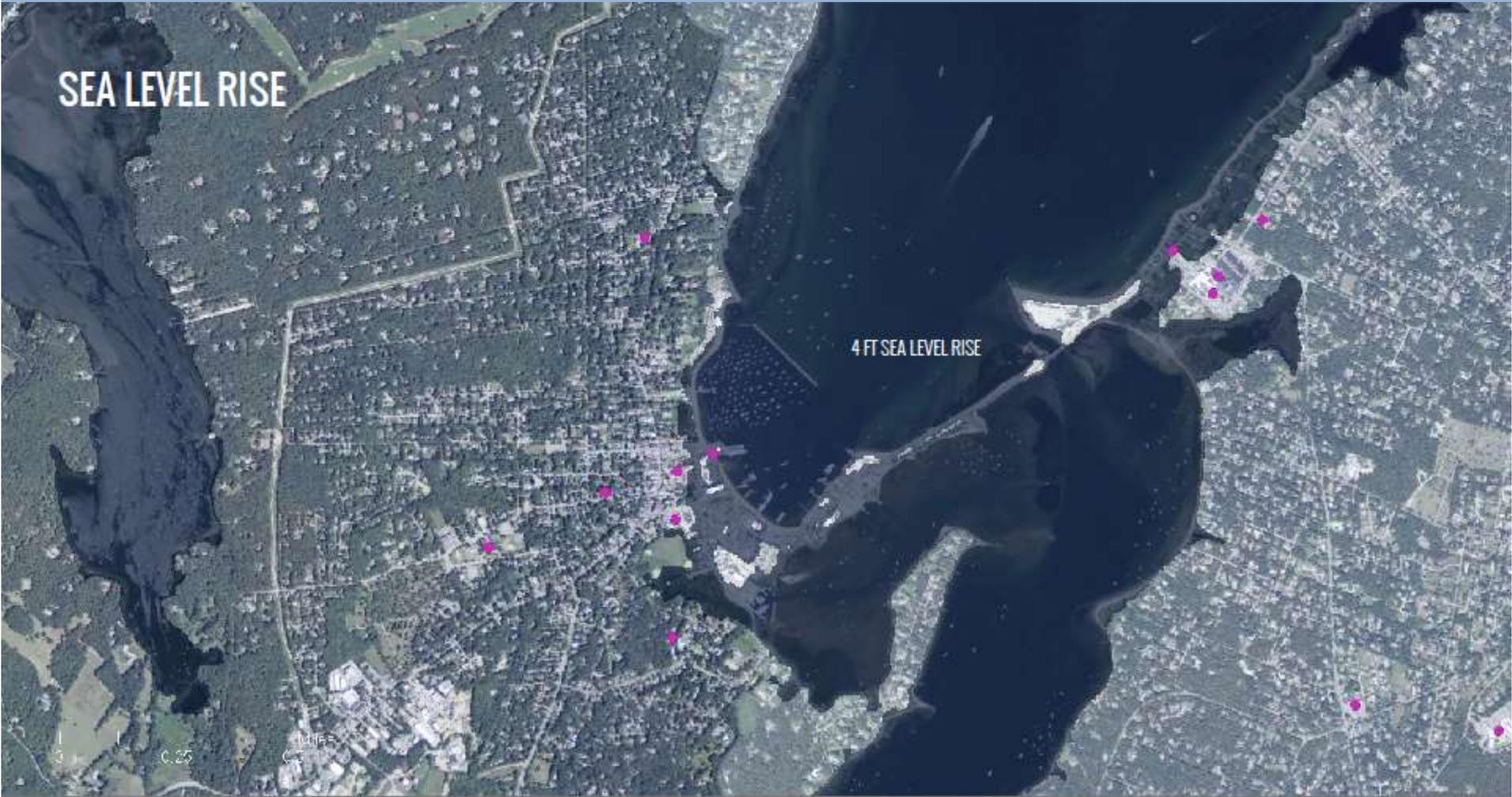


3 FT SEA LEVEL RISE

NATALIE M. SPINOLA  
SUNY ESF 1 DEPARTMENT OF LANDSCAPE ARCHITECTURE  
CAPSTONE PROPOSAL PRESENTATION

STEERING COMMITTEE  
RICHARD HAWKS | HAGEN KING

# SEA LEVEL RISE

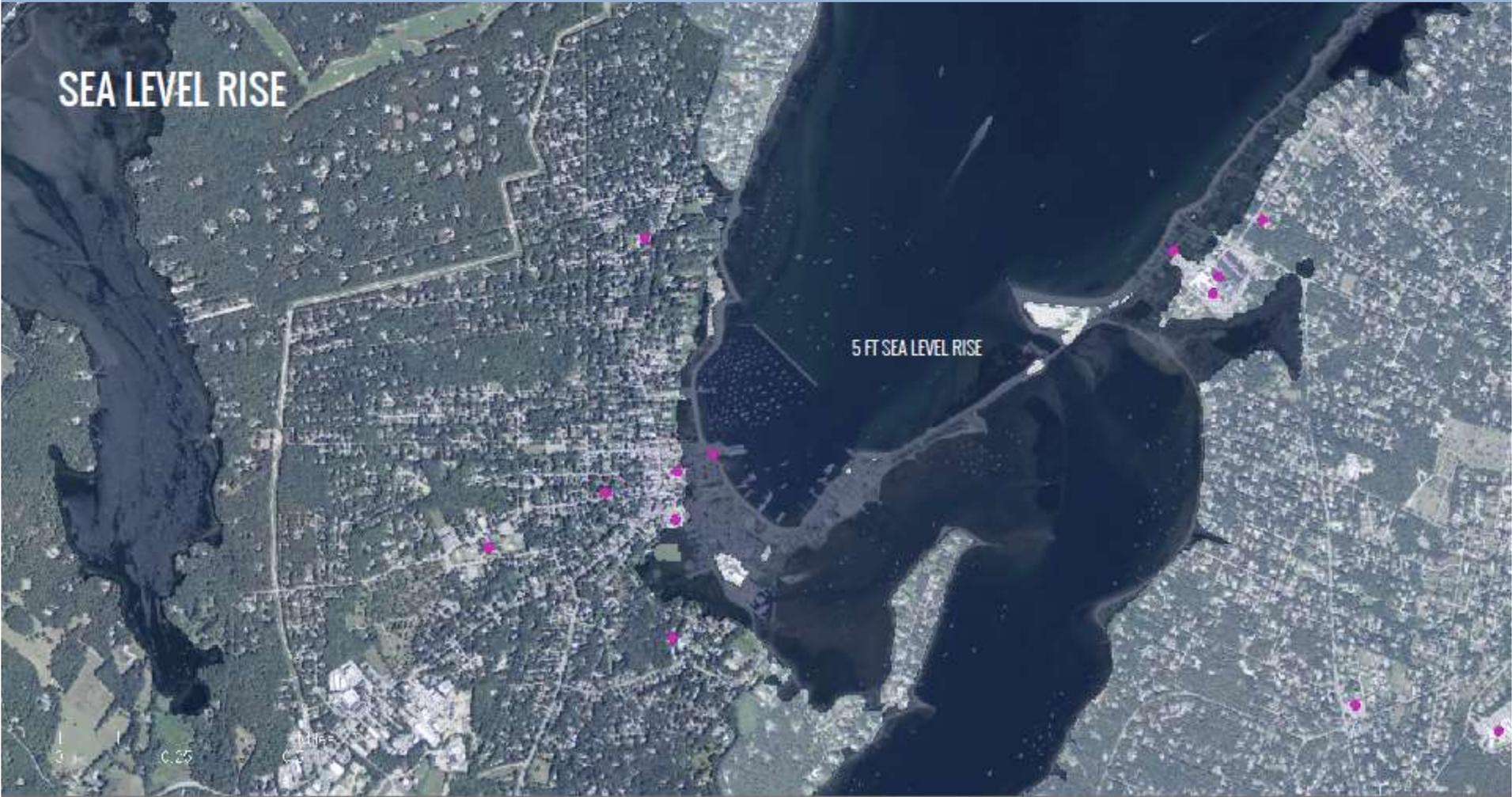


4 FT SEA LEVEL RISE

NATALIE M. SPINOLA  
SUNY ESF 1 DEPARTMENT OF LANDSCAPE ARCHITECTURE  
CAPSTONE PROPOSAL PRESENTATION

STEERING COMMITTEE  
RICHARD HAWKS | HAGEN KING

# SEA LEVEL RISE

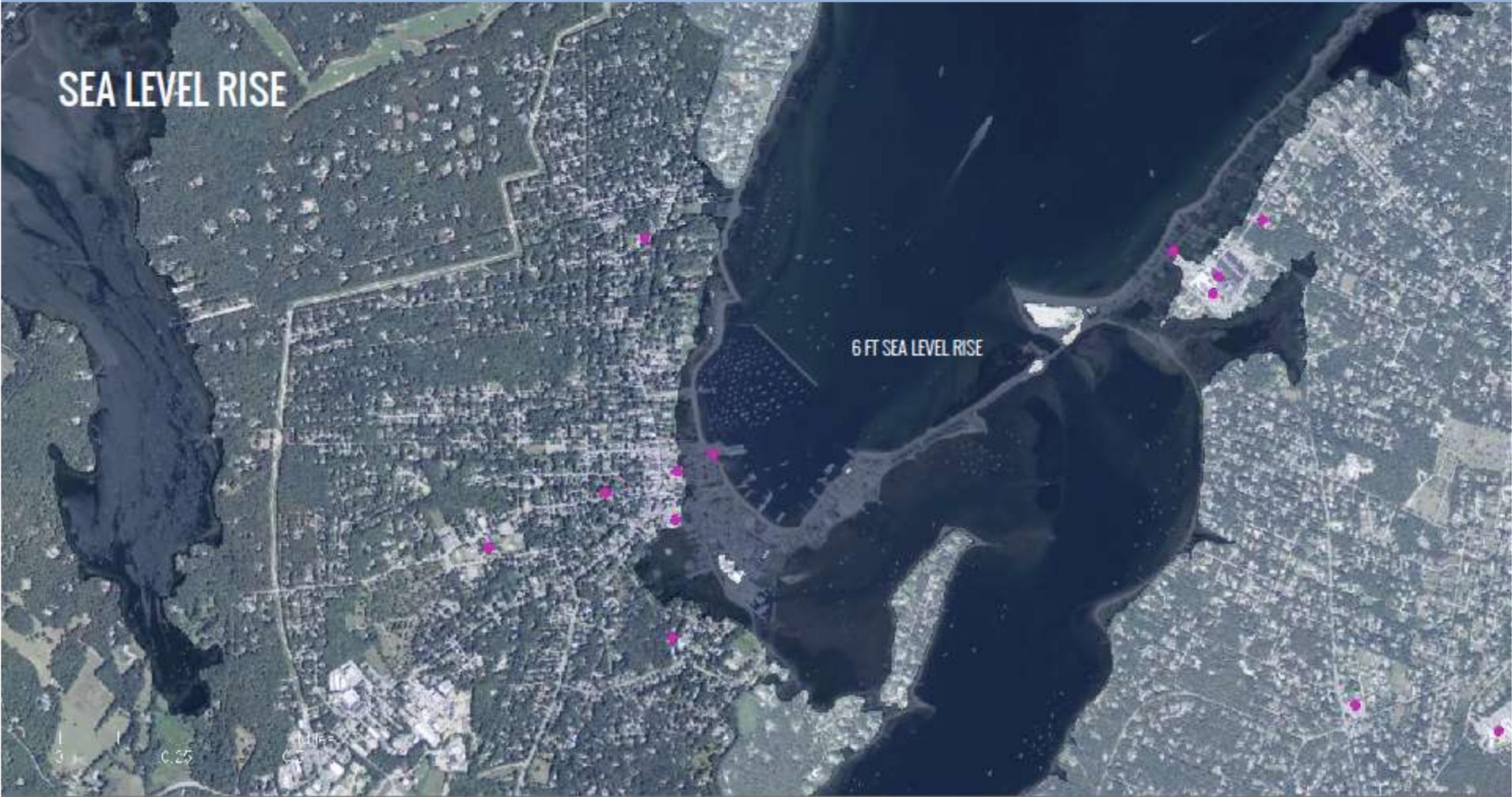


5 FT SEA LEVEL RISE

NATALIE M. SPINOLA  
SUNY ESF 1 DEPARTMENT OF LANDSCAPE ARCHITECTURE  
CAPSTONE PROPOSAL PRESENTATION

STEERING COMMITTEE  
RICHARD HAWKS | HAGEN KING

# SEA LEVEL RISE

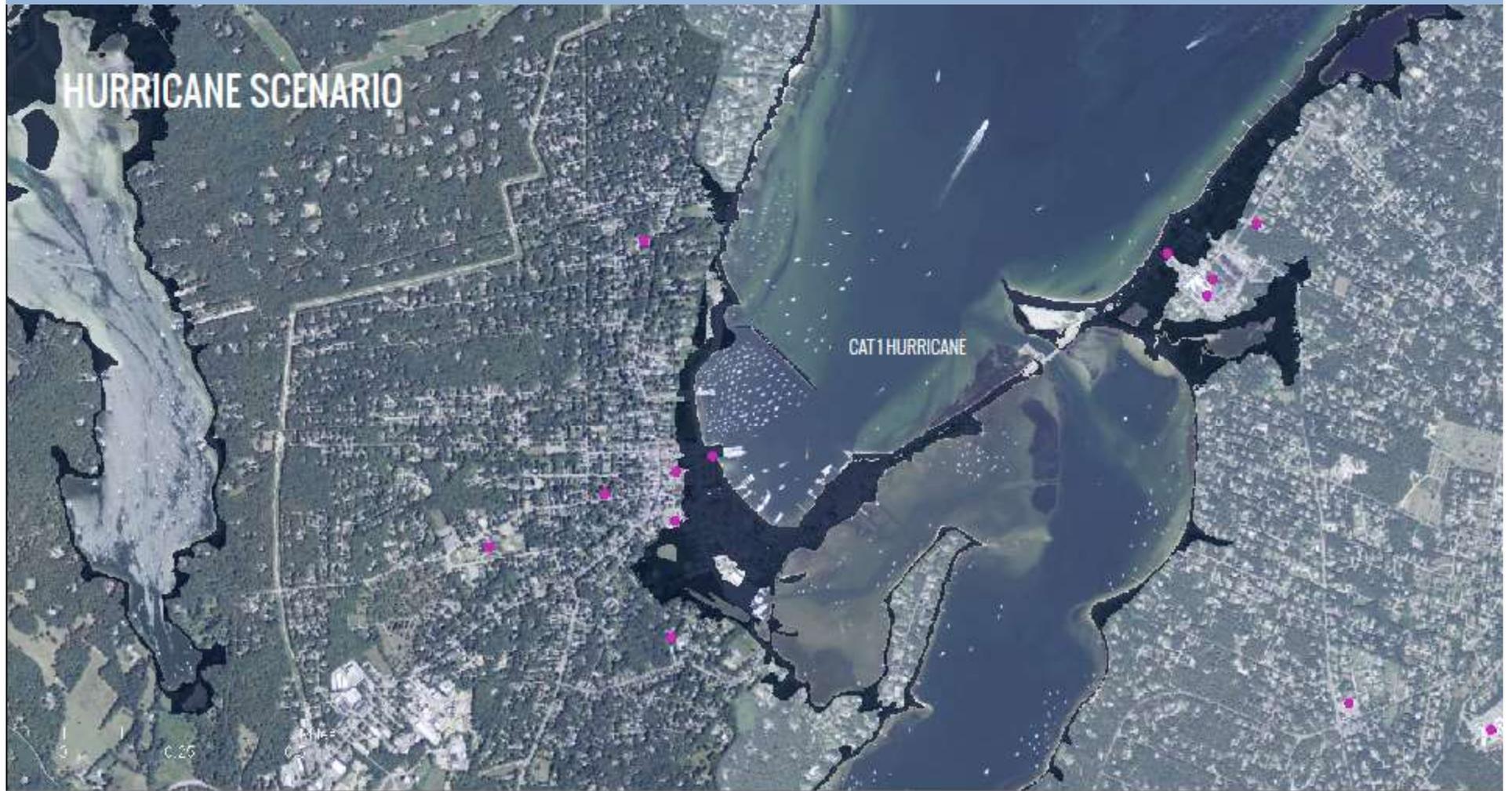


6 FT SEA LEVEL RISE

NATALIE M. SPINOLA  
SUNY ESF 1 DEPARTMENT OF LANDSCAPE ARCHITECTURE  
CAPSTONE PROPOSAL PRESENTATION

STEERING COMMITTEE  
RICHARD HAWKS | HAREN KING

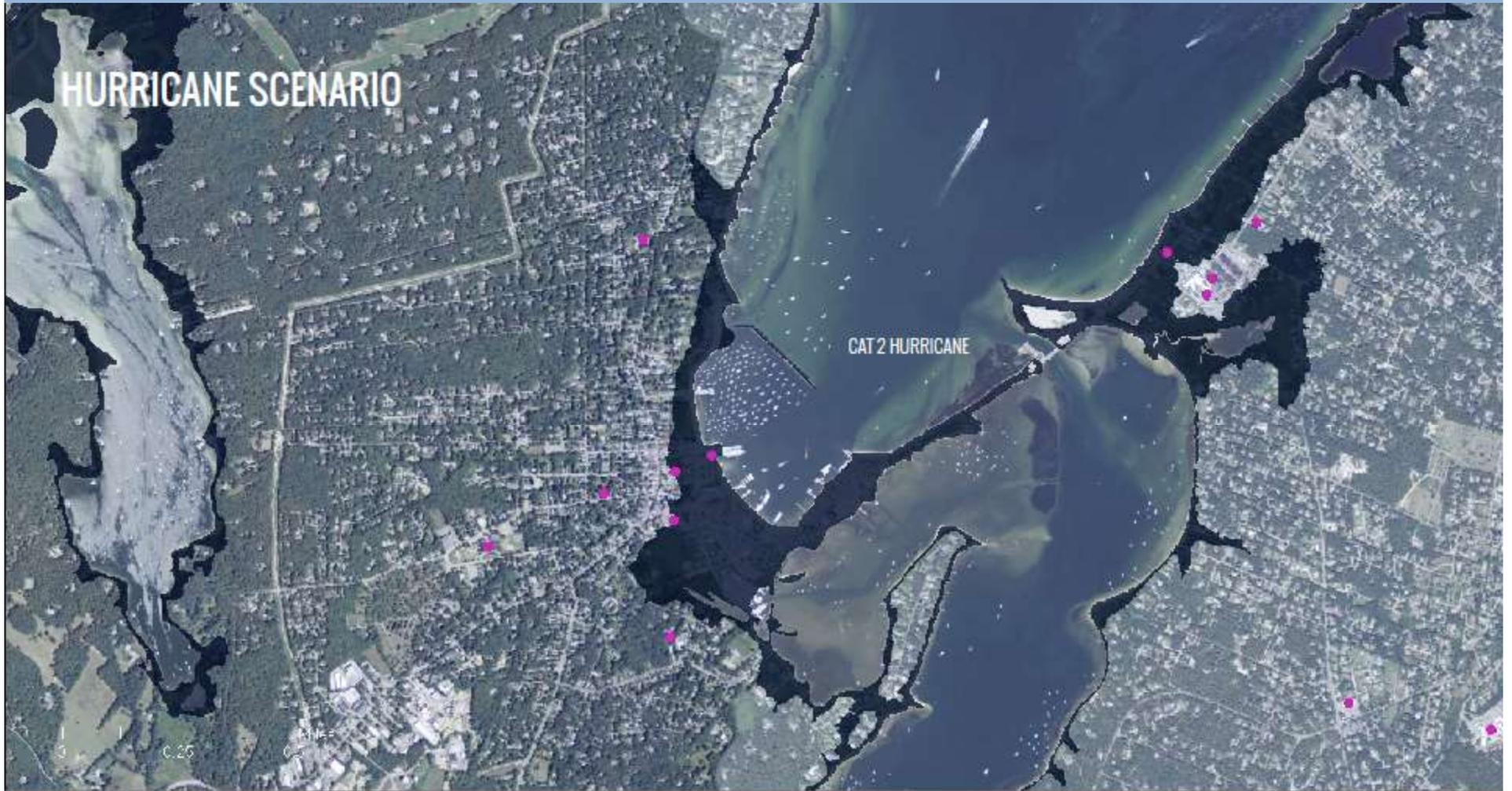
# HURRICANE SCENARIO



NATALIE M. SPINOLA  
SUNY ESF 1 DEPARTMENT OF LANDSCAPE ARCHITECTURE  
CAPSTONE PROPOSAL PRESENTATION

STEERING COMMITTEE  
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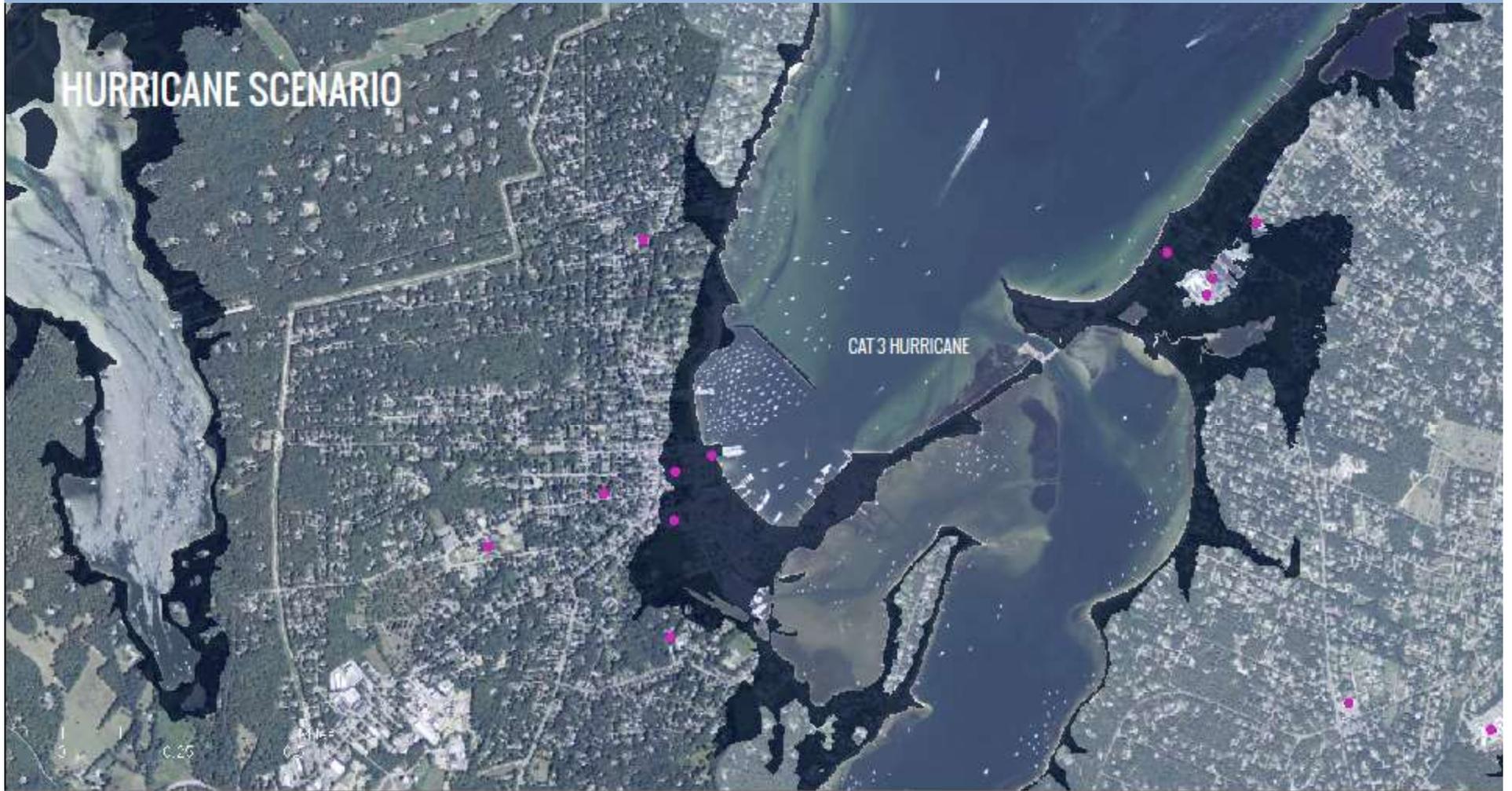
# HURRICANE SCENARIO



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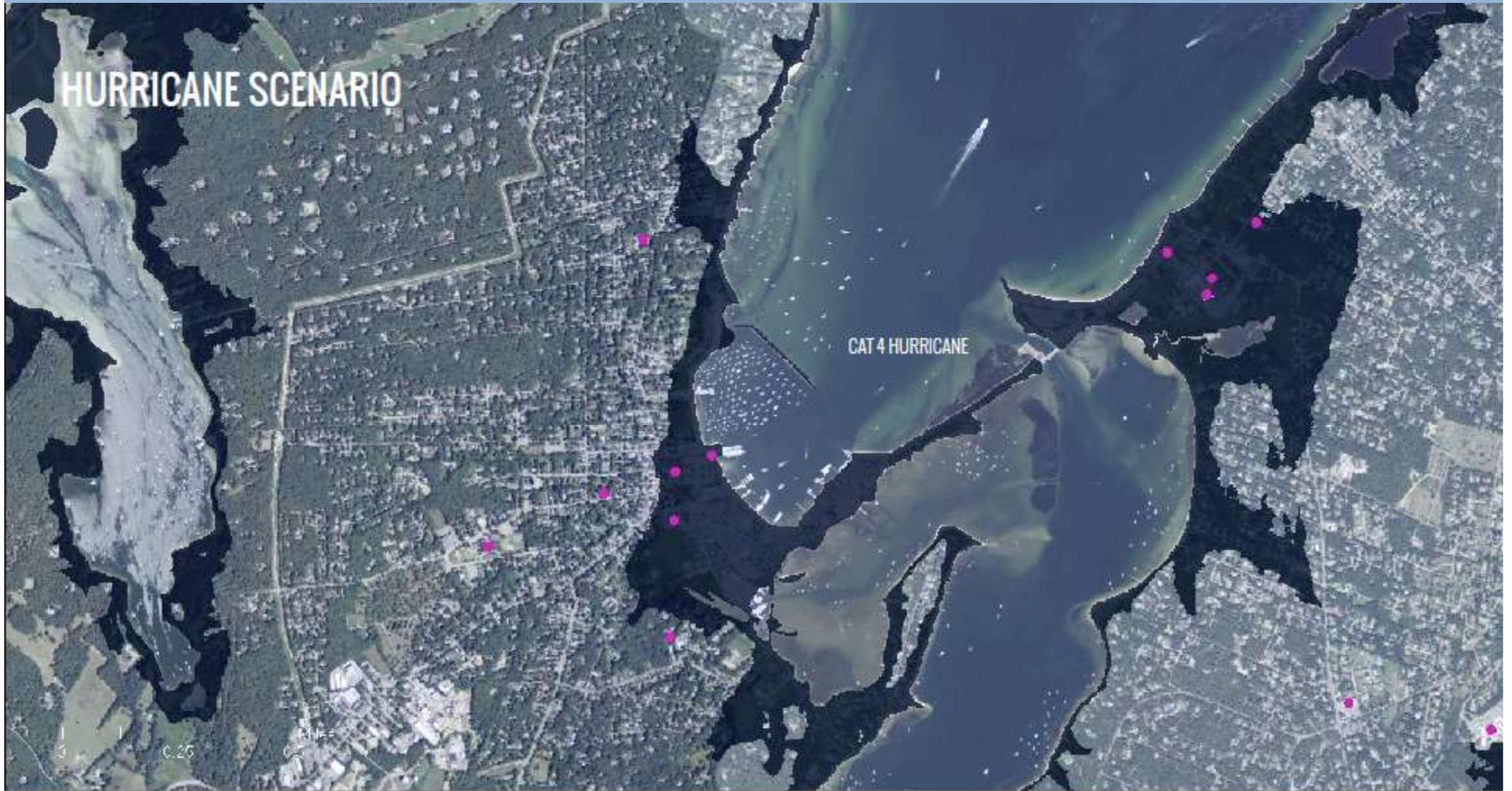
# HURRICANE SCENARIO



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# HURRICANE SCENARIO



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STEERING COMMITTEE  
RICHARD HAWKS | HAREN KING

# DESIGNING A STORM SCENARIO



Data Source: NOAA Office of Coastal Management Sea Level Rise  
MASS GIS - USGS Orthoimagery 2014

+



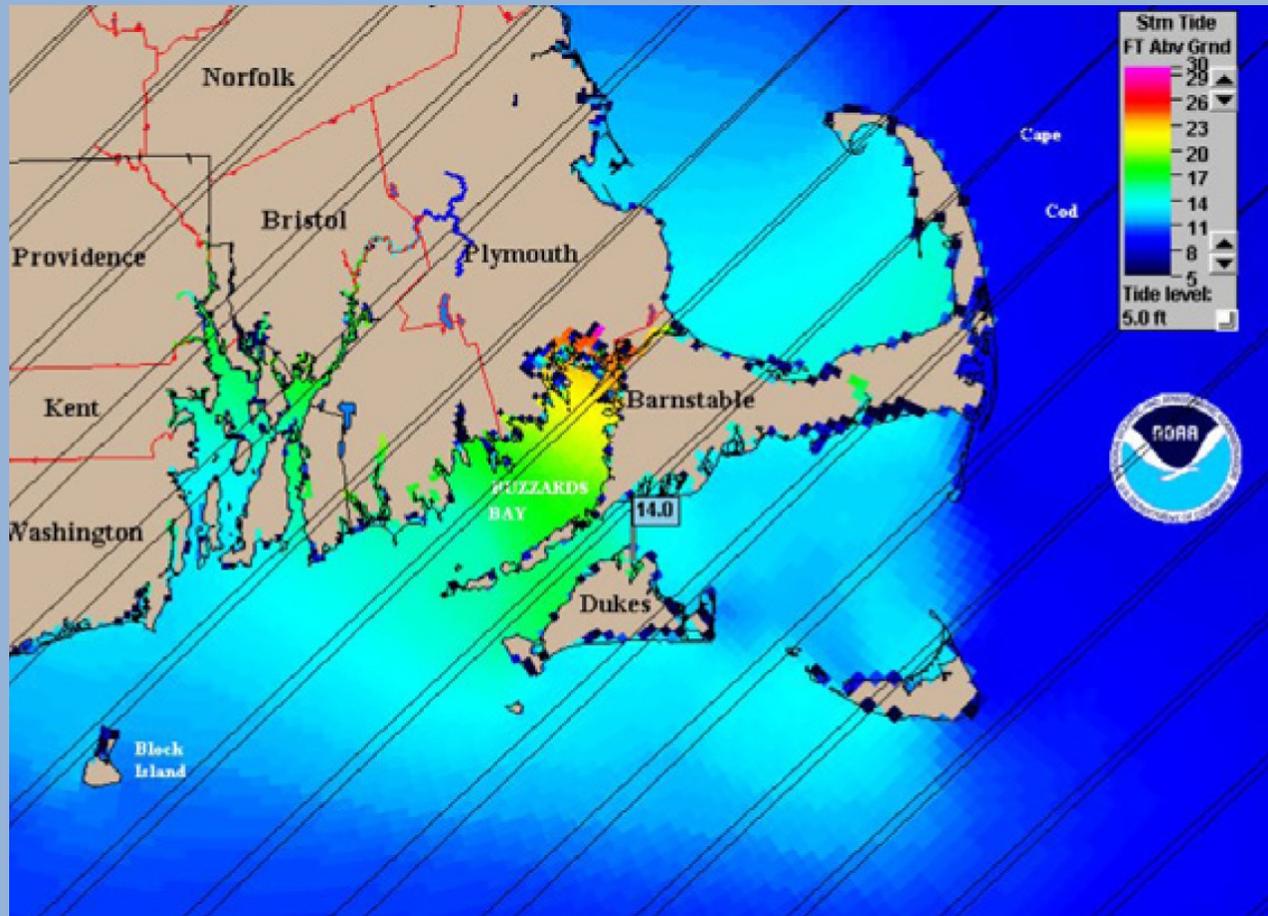
Data Source: NOAA National Hurricane Center Sea, Lake and  
Overland Surges from Hurricanes (SLOSH),  
MASS GIS - USGS Orthoimagery 2014

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# Vulnerability: storm surge prediction



Category 1 - 8.1 ft  
Category 2 - 10.9ft

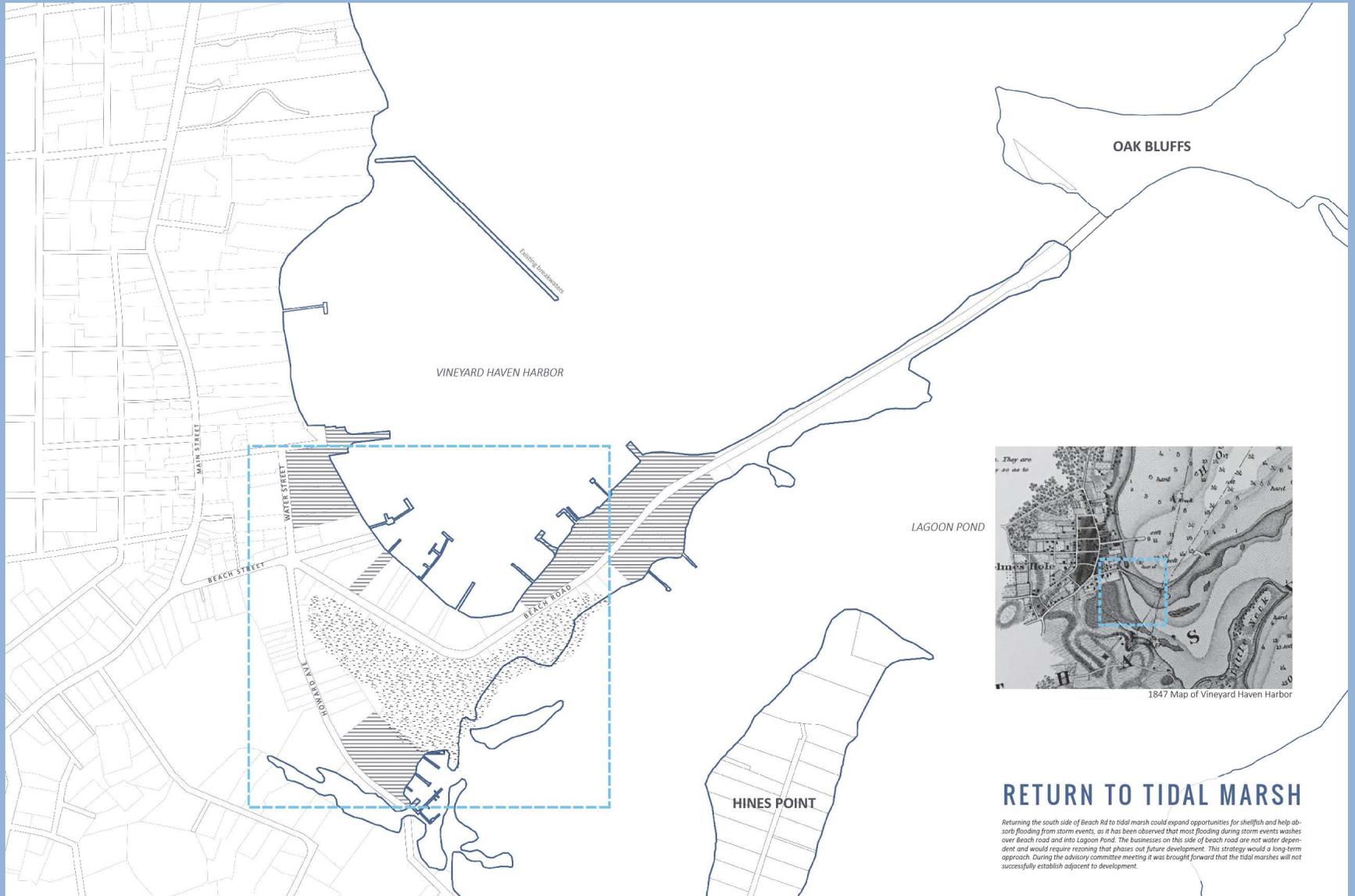
Category 3: Vineyard Haven slosh - 14 ft.



# strategies



# Accommodating: marsh



# Accommodating: lifting buildings



**Image:** *Shipyards at 100 Lagoon Pond Road.* Some properties in the Village of Vineyard Haven have begun to elevate service buildings in the waterfront.

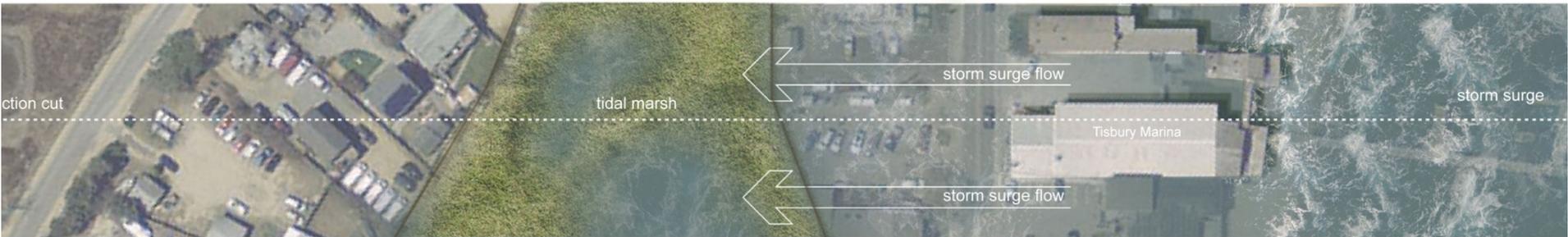




**Context Map: Section cut at Tisbury  
Marina 52 Beach Road**

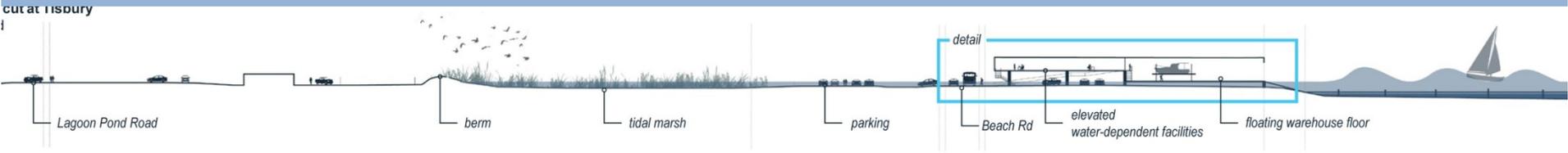


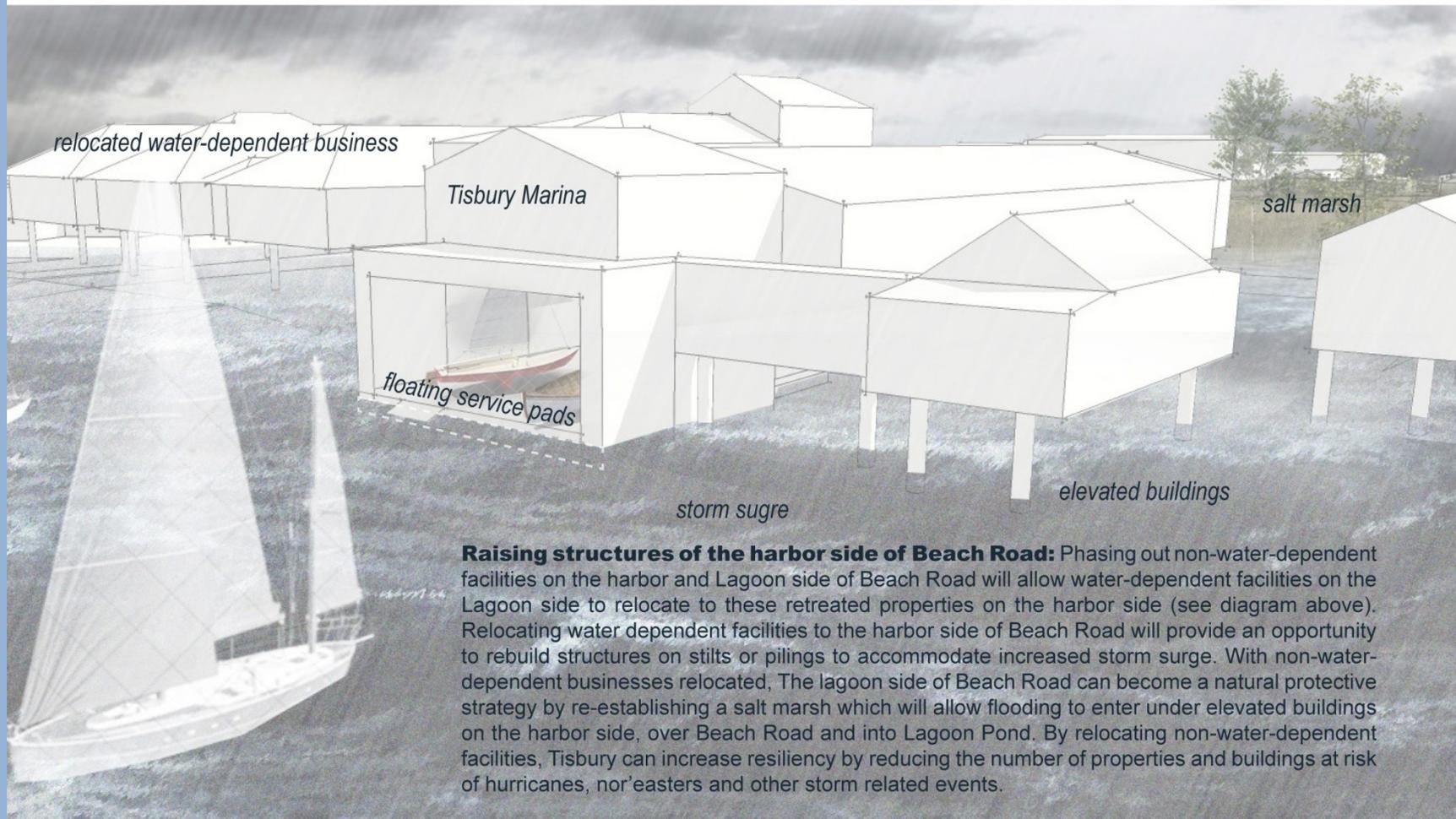
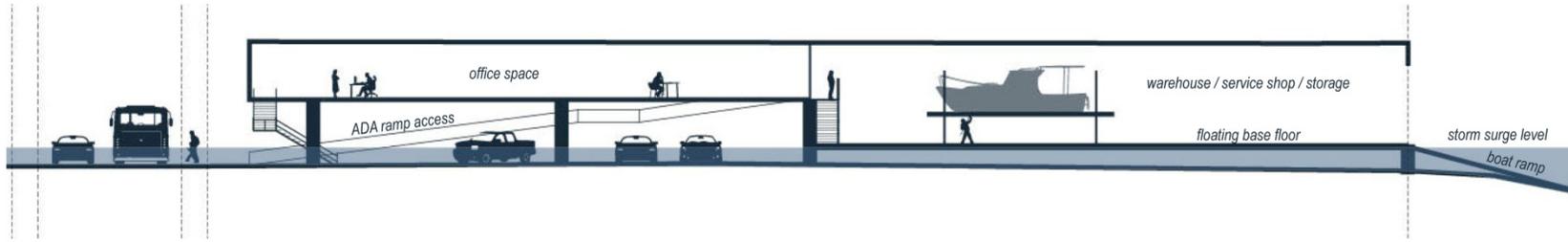
onditions



30-50 ESTABLISHING TIDAL MARSH

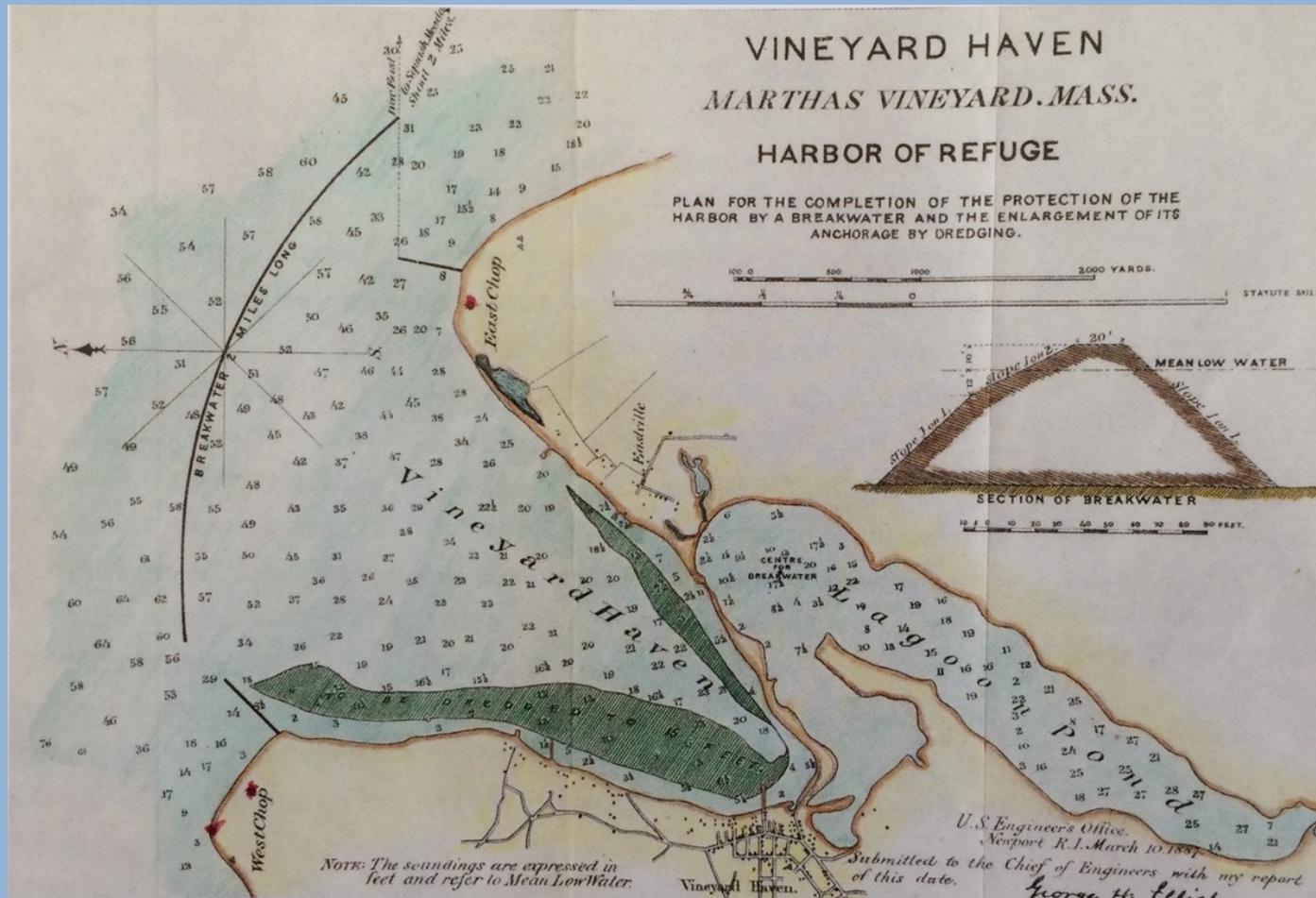
1-10 YEARS RAISING BUILDINGSS



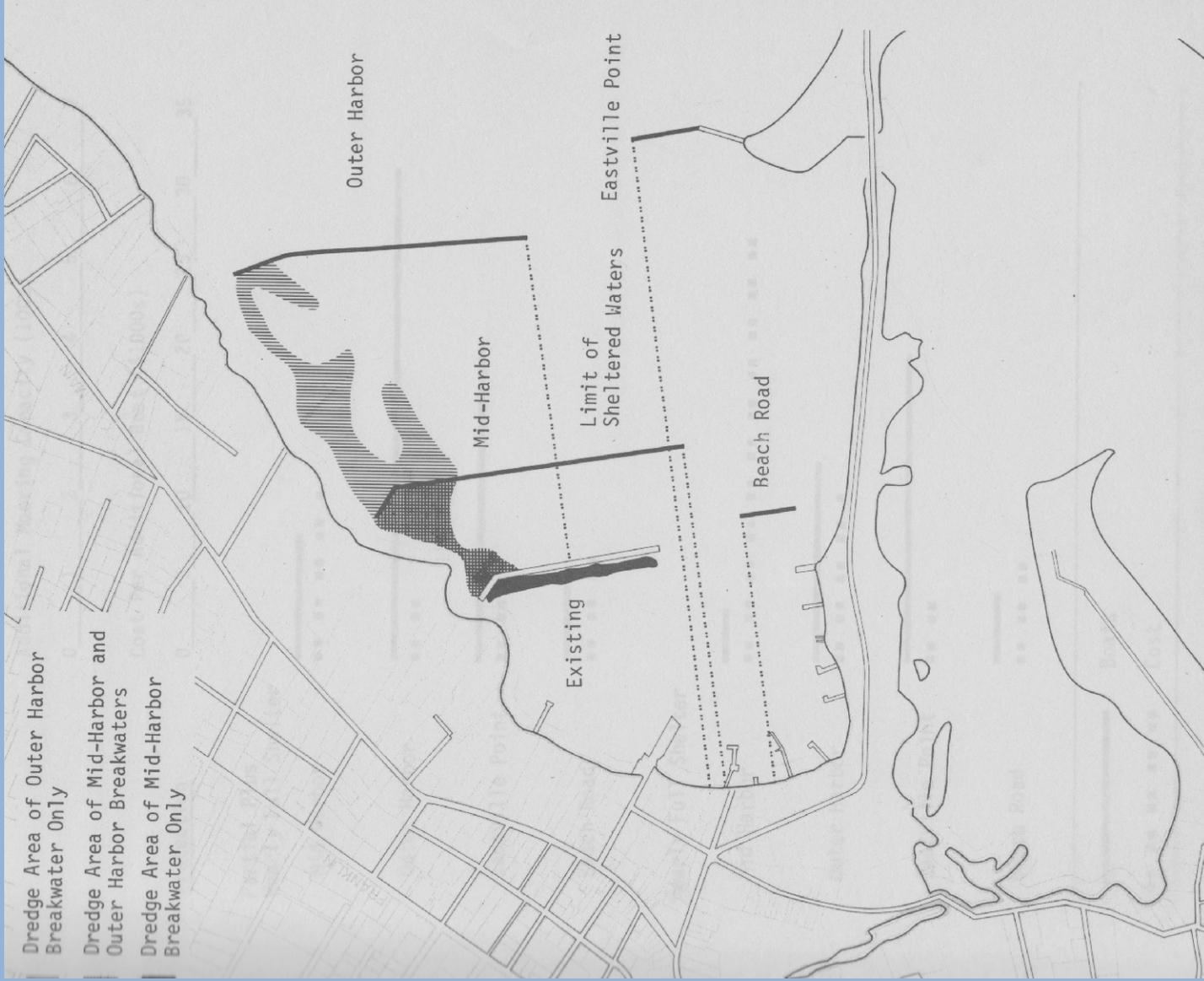


**Raising structures of the harbor side of Beach Road:** Phasing out non-water-dependent facilities on the harbor and Lagoon side of Beach Road will allow water-dependent facilities on the Lagoon side to relocate to these retreated properties on the harbor side (see diagram above). Relocating water dependent facilities to the harbor side of Beach Road will provide an opportunity to rebuild structures on stilts or pilings to accommodate increased storm surge. With non-water-dependent businesses relocated, The lagoon side of Beach Road can become a natural protective strategy by re-establishing a salt marsh which will allow flooding to enter under elevated buildings on the harbor side, over Beach Road and into Lagoon Pond. By relocating non-water-dependent facilities, Tisbury can increase resiliency by reducing the number of properties and buildings at risk of hurricanes, nor'easters and other storm related events.

# Protect: break wall

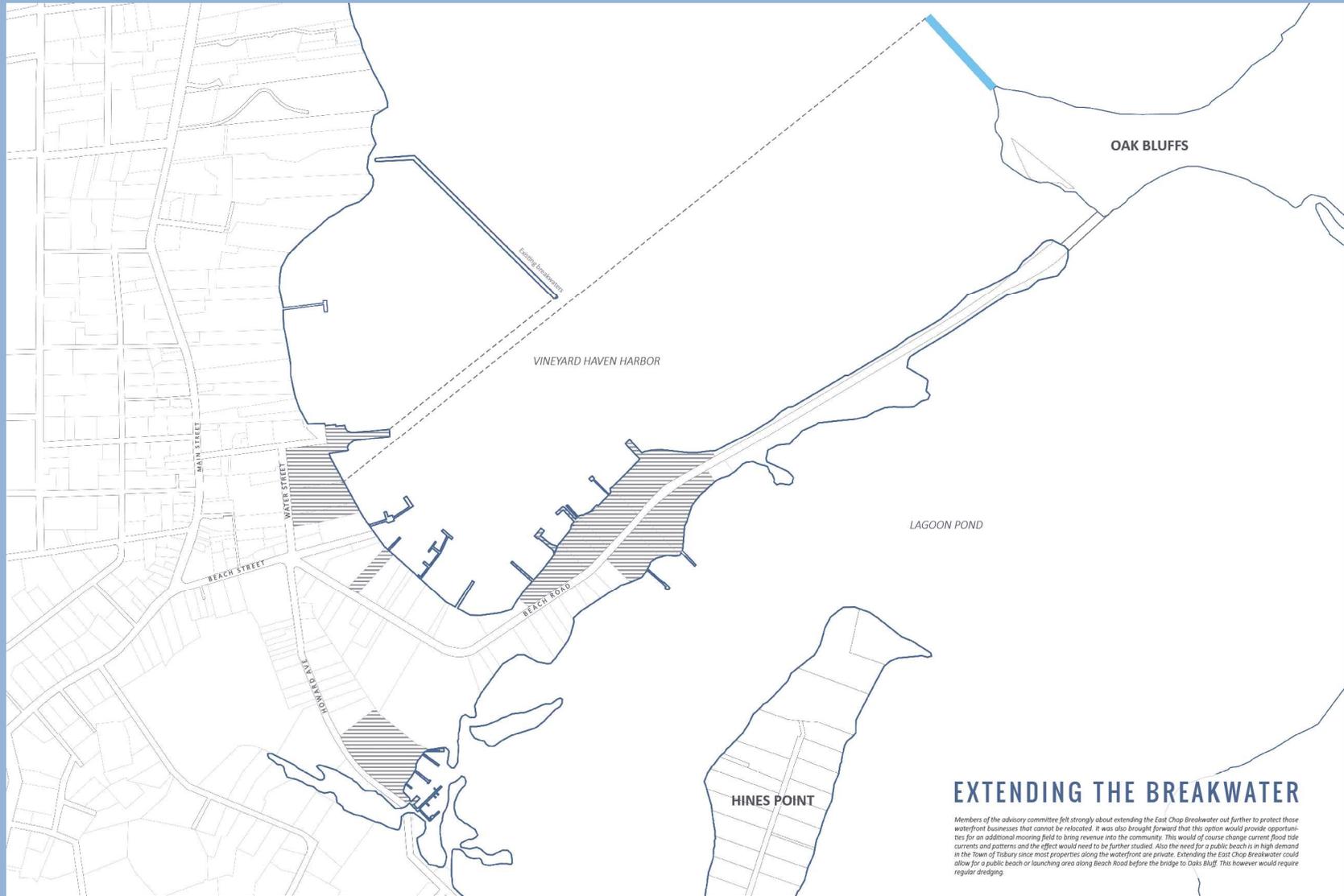


1887



1980

# Extend Eastville Breakwater



## EXTENDING THE BREAKWATER

*Members of the advisory committee felt strongly about extending the East Chop Breakwater out further to protect those waterfront businesses that cannot be relocated. It was also brought forward that this option would provide opportunities for an additional mooring field to bring revenue into the community. This would of course change current flood tide currents and patterns and the effect would need to be further studied. Also the need for a public beach is in high demand in the Town of Tisbury since most properties along the waterfront are private. Extending the East Chop Breakwater could allow for a public beach or launching area along Beach Road before the bridge to Oaks Bluff. This however would require regular dredging.*





## EXTENDING EASTVILLE BEACH BREAKWATER

The current breakwater extends approximately 200 feet offshore. It was brought forward by members of the advisory committee that extending Eastville Beach Breakwater will help dissipate storm surge and protect water dependent business along Beach Road. Further studies would need to be conducted to examine the change in tidal patterns. It may also be necessary to have a number of culverts along the Beach Road corridor that would allow storm surge to move through the barrier beach and into Lagoon Pond. One main concern with this strategy would be its effect on shellfish and eel grass in the area. Other opportunities can be found in this strategy by potentially providing an additional mooring field at the extended breakwater and could allow pedestrian access. This image shows the extension adding approximately 400 feet to the existing breakwater.

# ARMORING BEACH ROAD





**Armoring Beach Road peninsula:** Armoring the stretch of Beach Road creates an opportunity for pedestrian access and provides an amenity for the local community, seasonal visitors, and island travelers. As Tisbury's ferry terminal is the only year round port, this feature could receive a significant amount of use for those traveling by foot. Although this strategy would be addressing sea level rise, it may also have the capacity to protect Beach Road from intense storm surge. This strategy also eliminates phases of adaptation by constructing this pedestrian revetment feature in one phase to proactively address the global sea level prediction. Over time as facilities reach their life span and need to be reconstructed, second stories can be used for loading to allow easier transportation of materials from the docks to the facilities depending on the function and use.



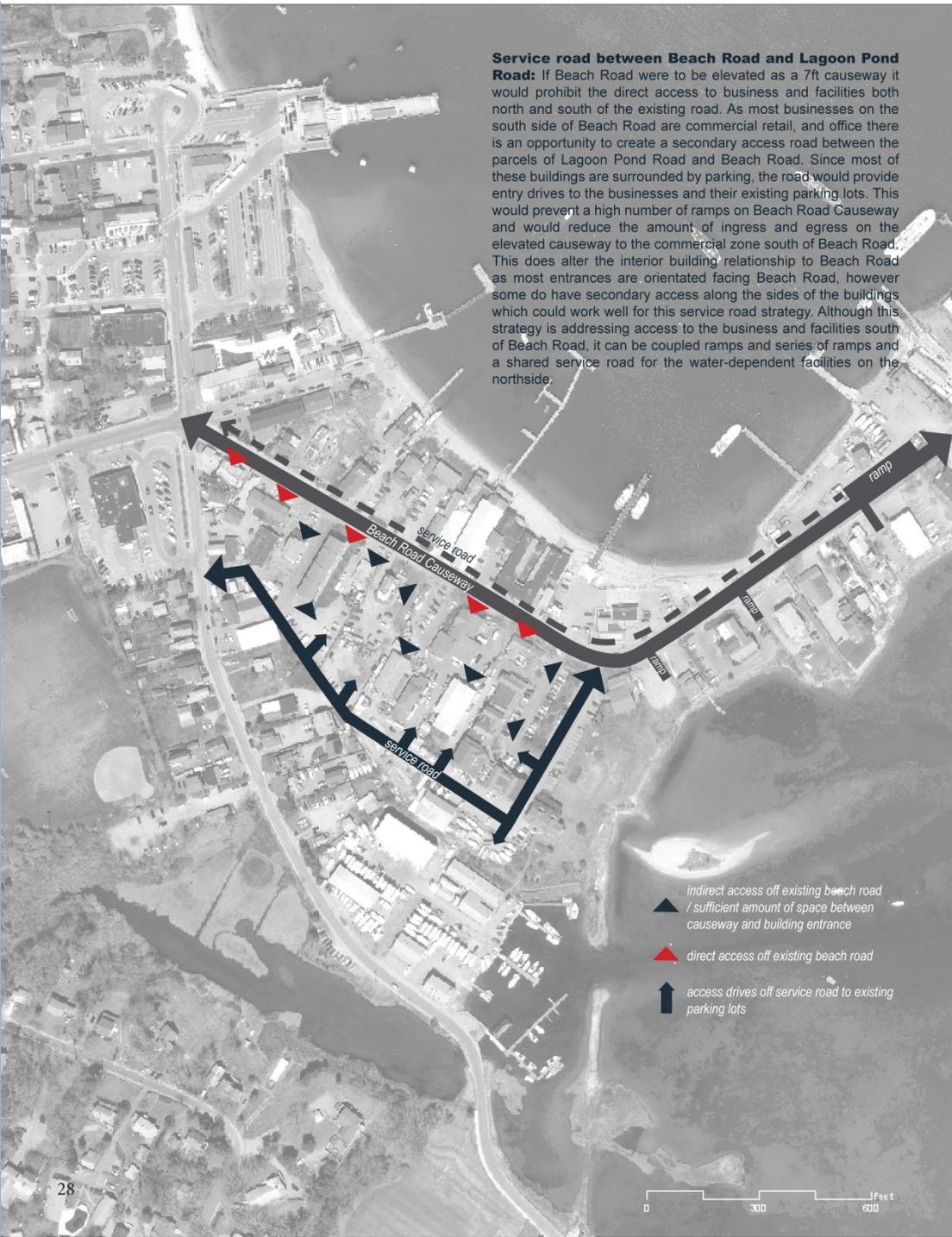
**1-10 years: Construct Beach Road Causeway.** As noted on the previous page, sea level rise will also occur in Lagoon Pond which will cause flooding to the properties south of Beach Road. In addition to raising Beach Road to a causeway, additional protection will need to be added along the shore of Lagoon Pond.



**30-50 years: Fill adjacent land to meet causeway grade.** In this location there is no property to raise on the north side of Beach Road. However there may be an opportunity to have some type of stair access off the causeway to allow public access to the water.

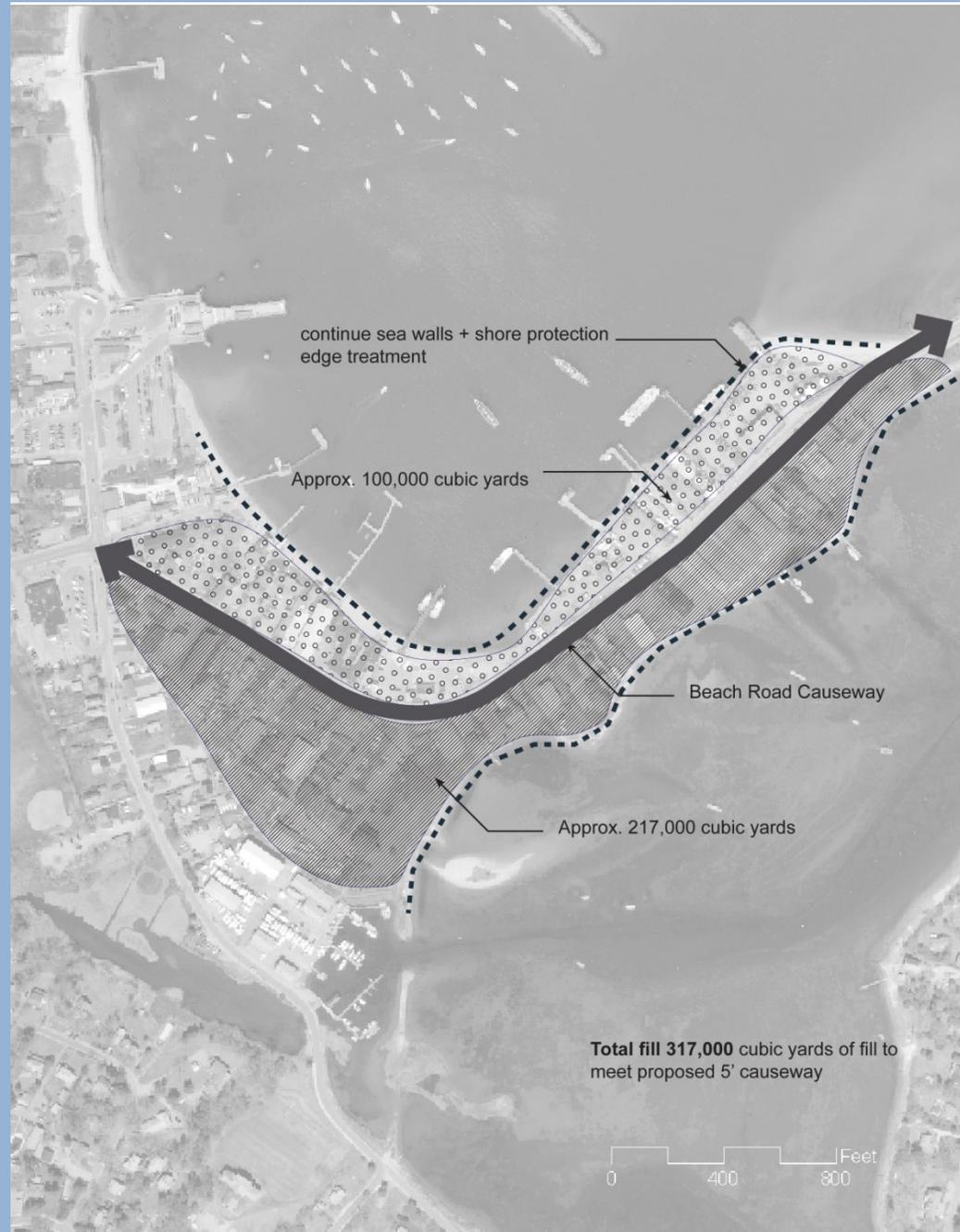
**Service road between Beach Road and Lagoon Pond Road**

**Road:** If Beach Road were to be elevated as a 7ft causeway it would prohibit the direct access to business and facilities both north and south of the existing road. As most businesses on the south side of Beach Road are commercial retail, and office there is an opportunity to create a secondary access road between the parcels of Lagoon Pond Road and Beach Road. Since most of these buildings are surrounded by parking, the road would provide entry drives to the businesses and their existing parking lots. This would prevent a high number of ramps on Beach Road Causeway and would reduce the amount of ingress and egress on the elevated causeway to the commercial zone south of Beach Road. This does alter the interior building relationship to Beach Road as most entrances are orientated facing Beach Road, however some do have secondary access along the sides of the buildings which could work well for this service road strategy. Although this strategy is addressing access to the business and facilities south of Beach Road, it can be coupled ramps and series of ramps and a shared service road for the water-dependent facilities on the northside.

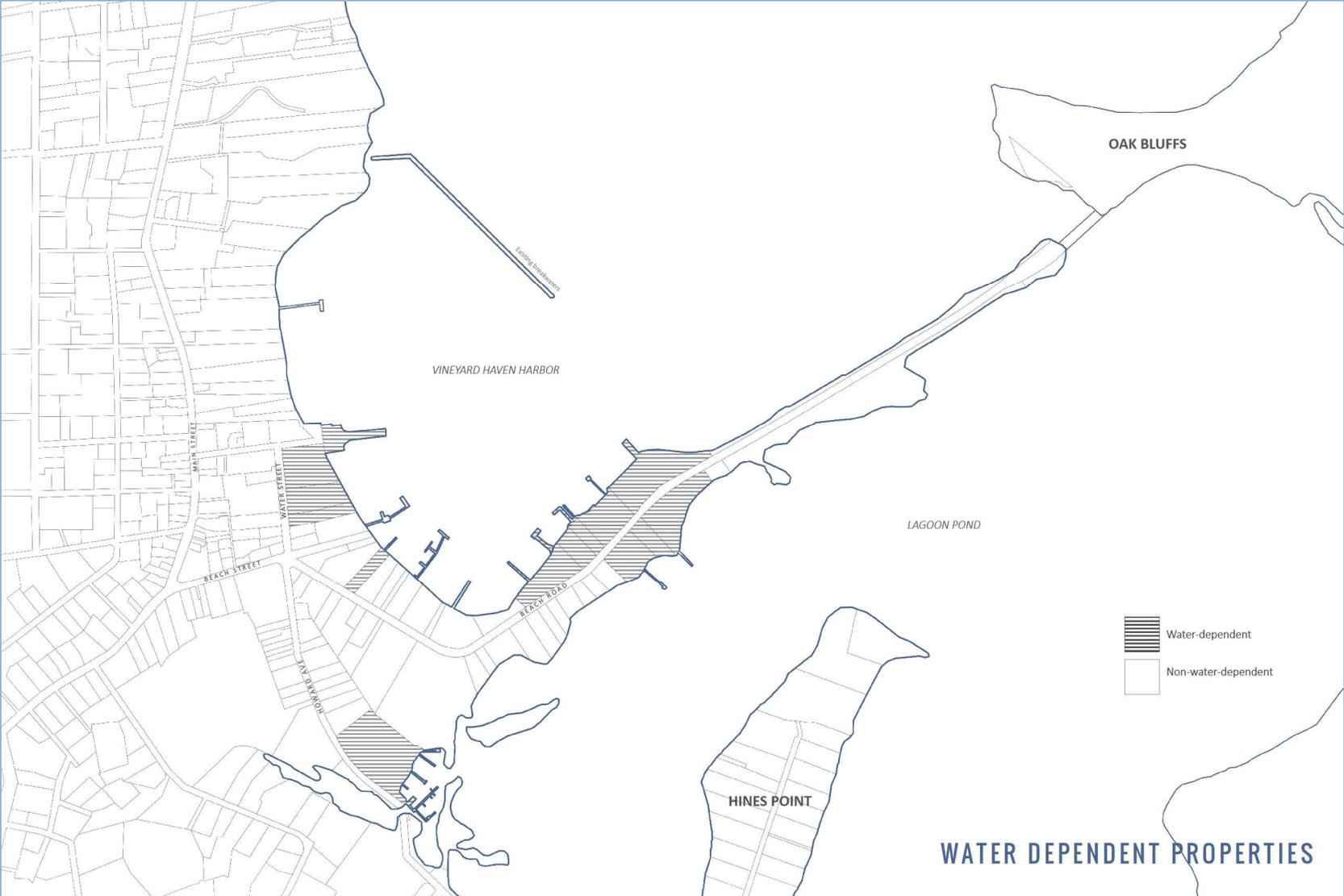


- ▲ indirect access off existing beach road / sufficient amount of space between causeway and building entrance
- ▲ direct access off existing beach road
- ↑ access drives off service road to existing parking lots

# Fill Calculations



# Retreat



# Strategies

	Strategy	Near-Term (1-10 years)*	Mid-range (10-30 years)*	Long-term (30-50 years)*
<b>PROTECT</b>	<b><i>Vineyard Harbor Pedestrian Boardwalk and Revetment</i></b>	Observe local sea level rise (slr) rates	Construct boardwalk feature and with access ramps	Build adjacent buildings with second store loading
	<b><i>Extending Eastville Beach Breakwater</i></b>	Construct Eastville Beach Break water extension	Provide pedestrian access	
<b>ACCOMMODATE</b>	<b><i>Elevate water-dependent business</i></b>	construct buildings on pilings	relocate water-dependent business from the lagoon side of Beach Road to the harbor side	re-establish tidal marsh on lagoon side of Beach Road
	<b><i>Beach Road Causeway</i></b>	Construct Beach Road Causeway  Construct service road between existing Beach Road and Lagoon Pond Road for temporary access to business	Raise adjacent land on the harbor side of Beach Road to meet grade of the causeway	Raise adjacent land on the lagoon side of Beach Road to meet grade of causeway
	<b><i>Culverts under Beach Road</i></b>	Environmental Impact study of impacts to Lagoon Pond and hydrologic engineering studies	Construct x number of culverts along beach road	
<b>RETREAT</b>	<b><i>Phasing out nonwater dependent</i></b>	Map low flood lands  Zoning amendments	Begin to develop conservation easements and land purchase strategies with landbank  Phase out existing non-water-dependent business and facilities	Reestablish former tidal marsh