Rising to the Challenge: Preparing for Sea Level Rise in Southern New England

Groton, Connecticut and North Kingstown, RI

4



AP / NEUROLOG

Santino, shown in this undated photo, sometimes would throw rocks at visitors at the Furuvik zoo in Sweden.

Chimp showed signs of planning ahead

Researchers report observing Santino gathering piles of rocks that he would later hurl at zoo visitors.

THE WASHINGTON POST

It's a little disappointing, but perhaps not surprising, that a newly documented example of planning ahead by our closest non-human relative involves laying up weapons.

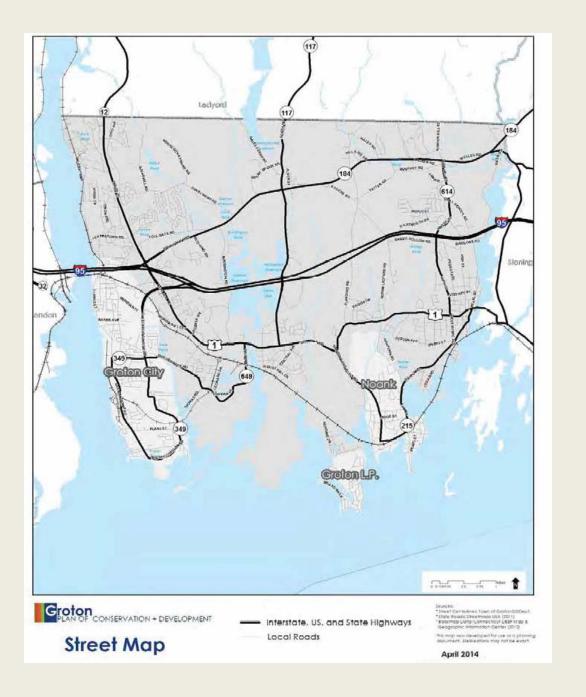
In a scientific paper published yesterday, a primatologist describes an adult male chimpanzee in a Swedish zoo often collects stones before opening time so he can have them ready later on when visitors arrive and he becomes agitated.

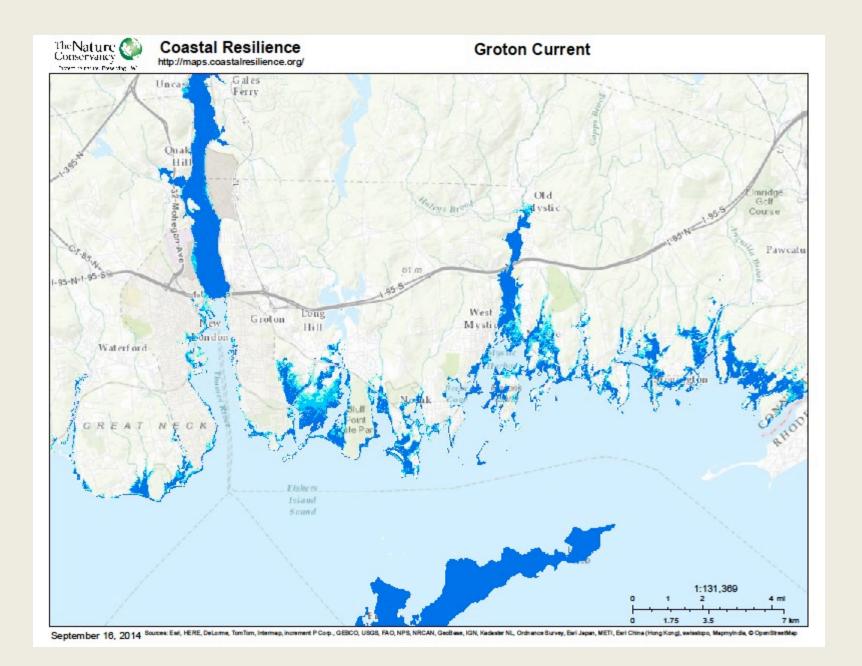
The chimpanzee, named "Santino," was born in a zoo in Munich in 1978 but has lived all but five years of his life at Furuvik Zoo, about 60 miles north of Stockholm.

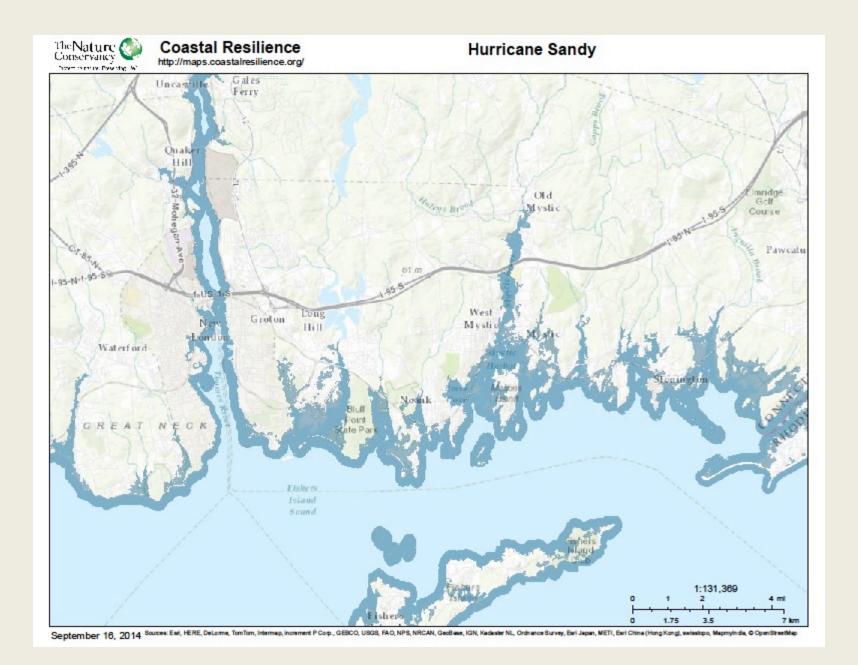
He began throwing stones at age 16 when he became the sole—and therefore dominant—male in a group that included about a half-dozen females.

None of the other chimpanzees, including a male that was in the group briefly, stored or threw stones.

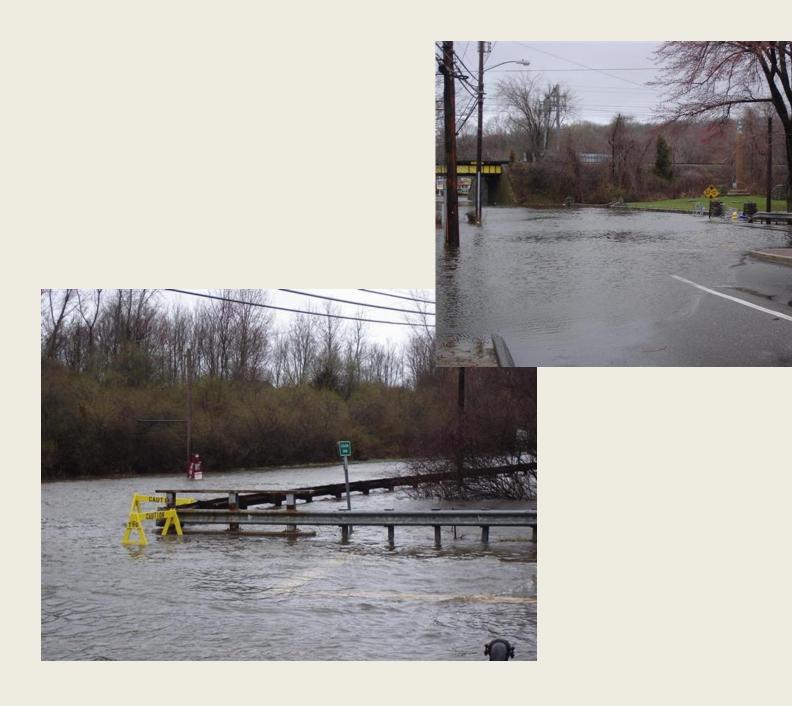
The troop's habitat is an island surrounded by a moat. The stone-throwing is more frequent early in the season when the zoo reopens to after the winter and Santino sees crowds of people across the water for the



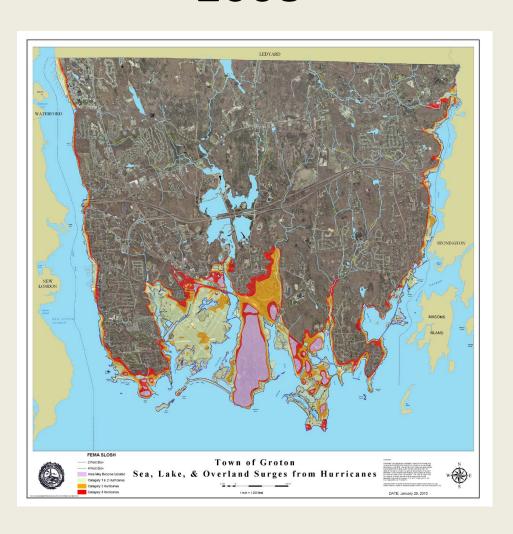








Coastal Hazards Analysis and Management Program 2008



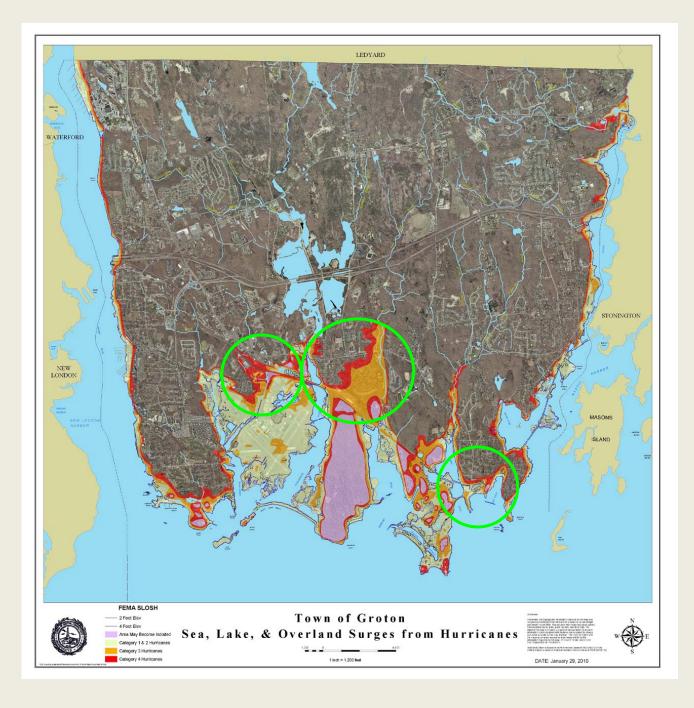
Four Areas of Concern

Transportation

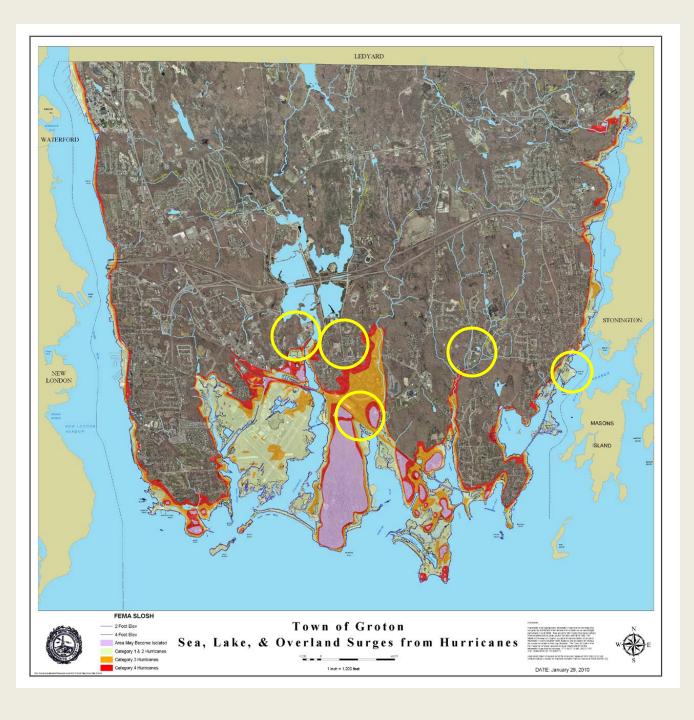
Other Infrastructure

Residential and Commercial Areas

Ecological and Cultural Resources

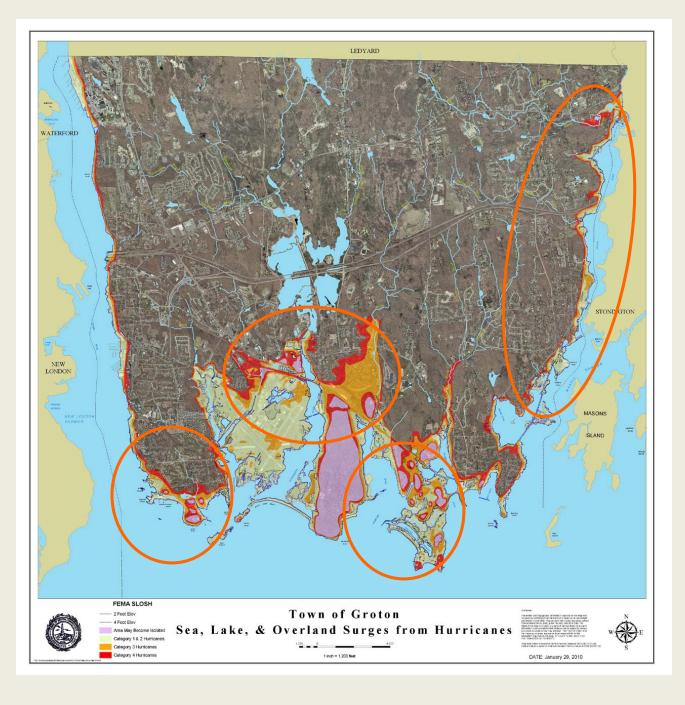


- Poquonnock Road
- Fort Hill Road
- Groton Long Point Road
- Emergency Services
 - Police
 - FireDepartments
 - TownOperations



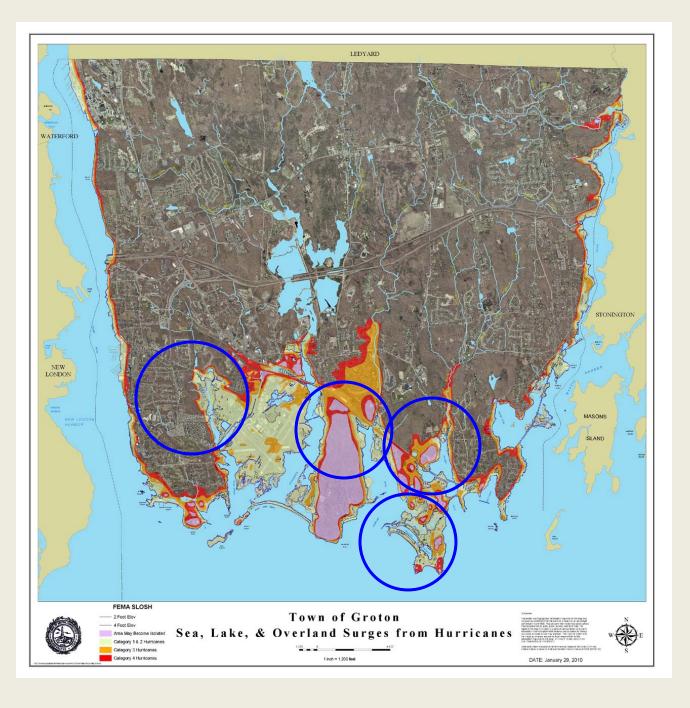
Other Infrastructure

- Reservoir and treatment plant
- Claude Chester Elementary School
- Waste Water Treatment Plant
- Cutler Middle
 School
- Waste Water Pump Stations



Residential & Commercial

- Residential
 - MumfordCove, GrotonLong Point,Noank
 - PoquonnockBridge
 - Eastern Point
 - Mystic River
- Commercial
 - Mystic
 - Fort Hill
 - AirportIndustrial Park



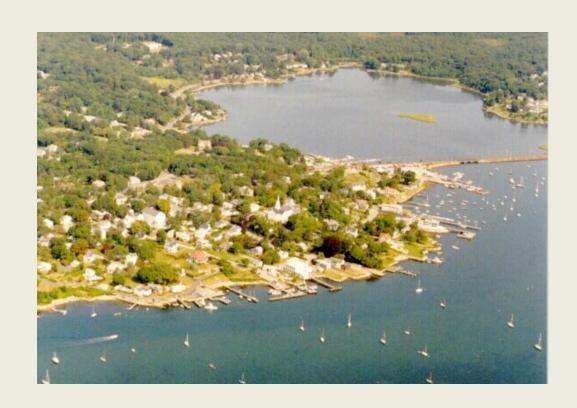
Ecological and Cultural Resources

- Birch PlainCreek BakerCove
- Fort Hill Brook -Mumford Cove
- Eccleston BrookPalmer Cove
- Groton Long
 Point Marshes
- Cemeteries
- Historic Structures

Task Force on Climate Change and Sustainable Community

- Established in 2008 in response to growing concern about the impact of climate change
- Recommendations:
 - Adopt climate change and sustainability as a central organizing planning and development principal for Groton
 - Establish an Office of Climate Change and Sustainability
 - Establish a permanent task force on Climate Change and Sustainable Community
 - Establish a Permanent Energy Conservation and Efficiency Revolving Fund

Preparing for Climate Change in Groton, Connecticut: A Model Process for Communities in the Northeast



2010 Workshops

Workshop 1 – Projected Climate Change

Workshop 2 – Identification of Vulnerabilities

Workshop 3 – Actions to Increase Resilience

Increased shoreline erosion

Increased storm intensity

Sea Level Rise

Tidal marsh migration

Vulnerabilities

- Transportation
- Infrastructure
- Commercial Areas
- Ecological Resources
- Emergency Services

Actions Taken So Far

Energy Action Plan

Energy Efficiency and Conservation Committee

Vulnerability Assessment Data Base

 Capital Improvement Projects evaluated for Sustainability Goals

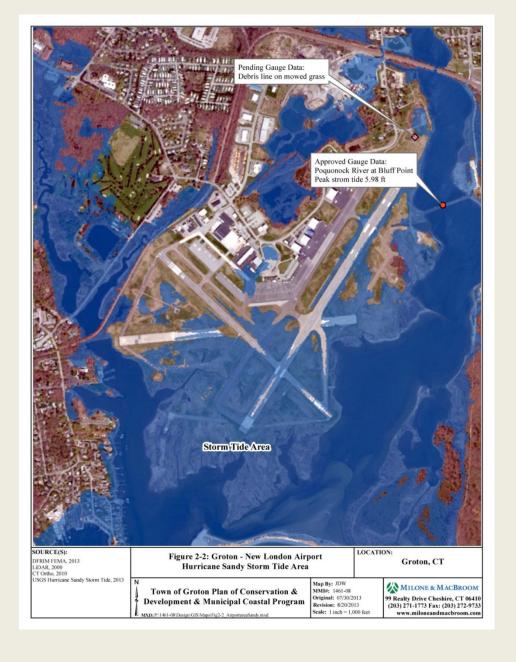
Sustainability Goals

- 1) Reduce overall energy use (make facilities more efficient, meet any established goals, energy retrofits)
- 2) Facilitate transitions to renewable energy (invest in alternatives such as solar, wind, etc.)
- 3) Help reduce GHG emissions and/or reduction of vehicle trips (bikeways, sidewalks, trails, paths)
- 4) Adapt to climate change (alternative location decisions to avoid floodplains, elevate roads, move facilities, protect assets, etc.)
- 5) Retention of landscaping, reduction of impervious surfaces, innovative stormwater management methods, etc.

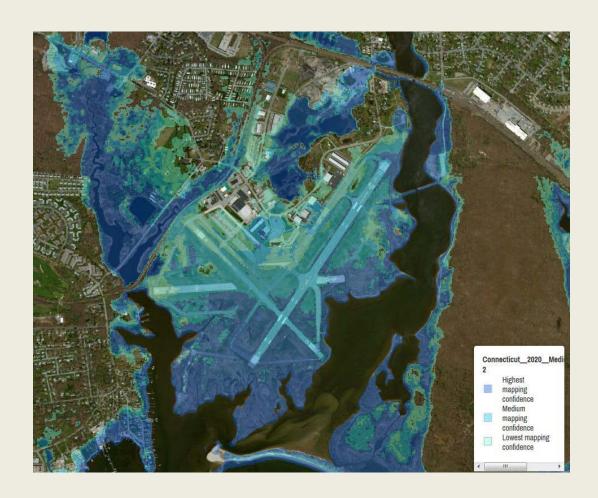
Proposed Actions

- Plan of Conservation and Development Update
 - Reconsider where vulnerable populations are allowed
 - Open space purchases to accommodate sea level rise
- Municipal Coastal Program Update
 - Vulnerable areas studied in depth
 - Increase coastal setbacks
 - make building requirements more stringent in coastal zones and flood zones

Sandy Inundation



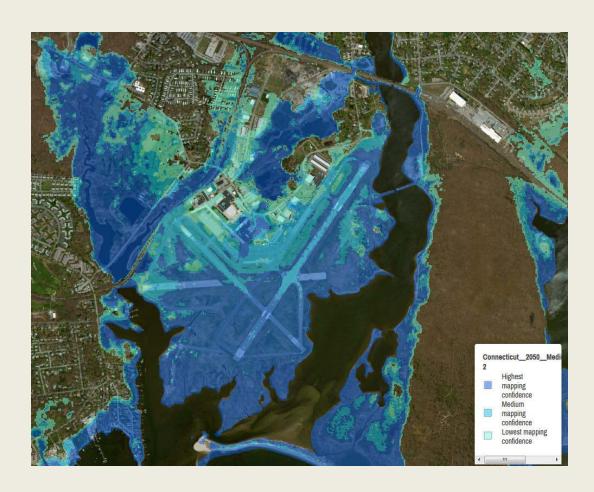
Projected Inundation: 2020 Category 2 Storm



Projected Inundation: 2050 Daily High Tide



Projected Inundation: 2050 Category 2 Storm





Resilience in Southeastern Connecticut







Focus Area: Southeastern Connecticut



Goals for Workshops

- Build a shared understanding of what resilience means for the communities of southeastern Connecticut;
- Identify the key questions and information needed to move the region towards greater resilience;
- Increase clarity and reveal individual and shared challenges between municipalities across the region;
- Surface, catalogue, and help define steps for achieving greater resilience;
- Catalyze creative thinking about the region's future with a particular focus on nature-based solutions to hazard mitigation, economic development, and community well-being.

The Big Question

Within the context of a changing climate, extreme weather, and changing economic conditions, how can we best expand upon the region's strengths, take advantage of opportunities, improve upon weaknesses, and mitigate threats?

Climate Adaptation for Coastal Communities



Jonathan J. Reiner, AICP
Town of North Kingstown

Tides are Rising



Wickford, 9/10/10

T. Crean



Multi-Institutional Working Group

- RI Sea Grant
- RI Statewide Planning Program
- RI Coastal Resources Mgmt Council
- RI Emergency Management Agency
- **URI Environmental Data Center**
- The Nature Conservancy
- State Geologist
- Town of North Kingstown



















Rising waters with tides and storms



Superstorm Sandy – 4'above MHHW



Spring Tide – 2010 – 1.4 MHHW







MHW, Simulation of 1' and 3' SLR

"SuperStorm" Sandy – Wickford Village



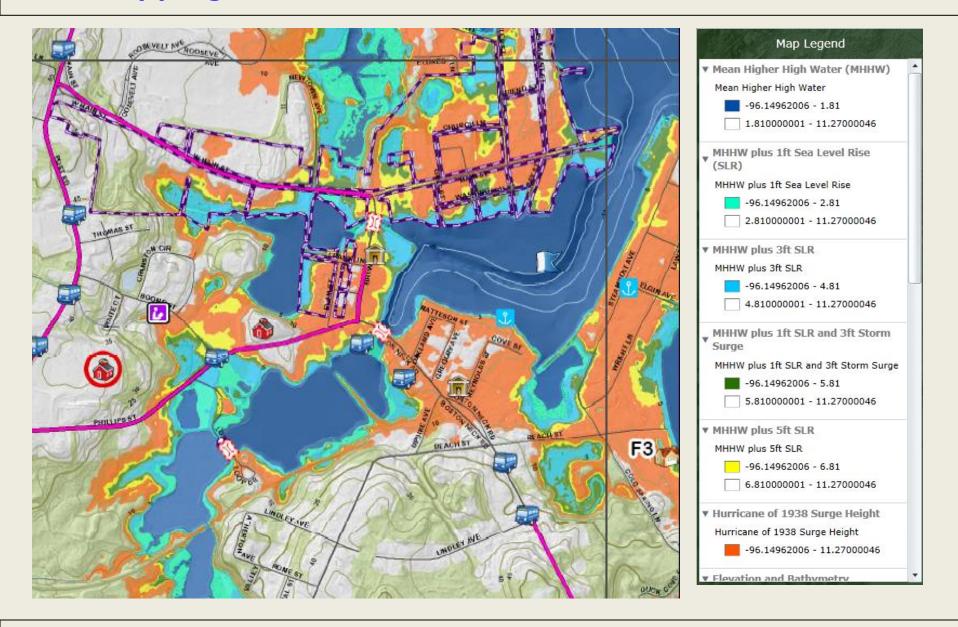




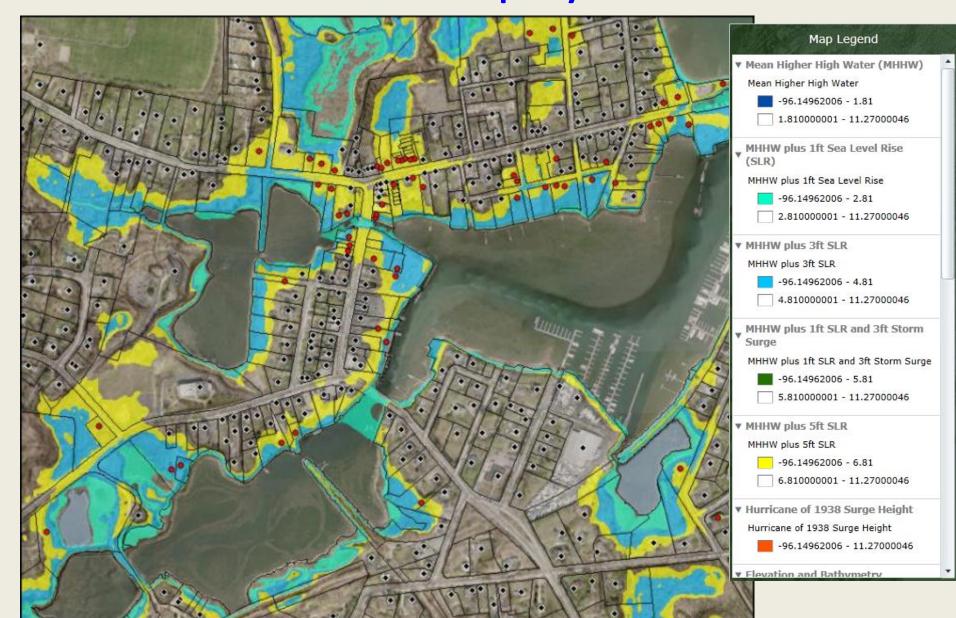




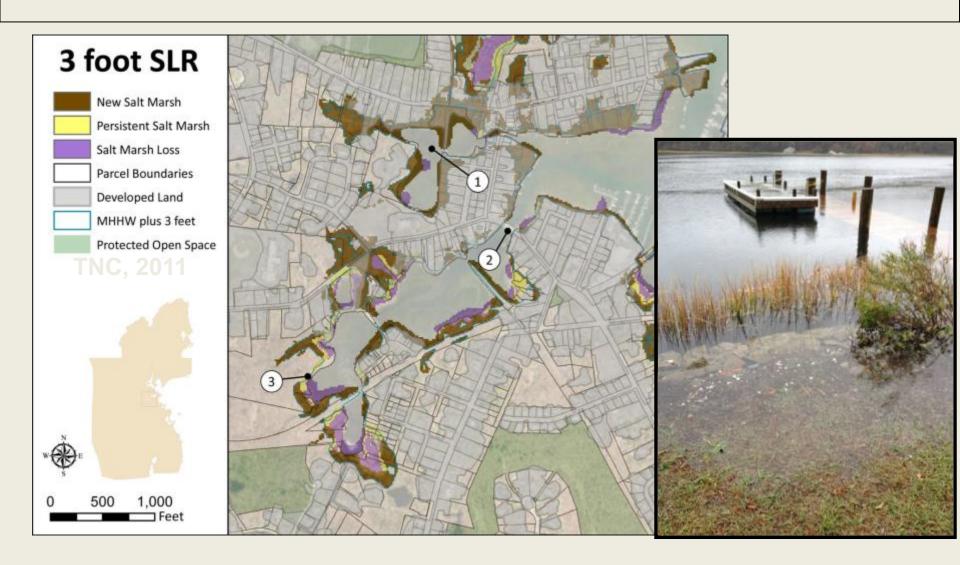
Mapping Sea Level Rise – Wickford – Infrastructure



Mapping Sea Level Rise – Wickford Real Property



Modeling Salt Marsh Migration ...From Pilot to Program to Policy...



http://seagrant.gso.uri.edu/climate/slr_tools.html

- Regulatory zoning ordinance (height increases for floodplain mgt, etc...) and comprehensive plan amendments
- Hazard Mitigation Plan incorporate and implement actions
- Educate Locally distribute information to elected officials and homeowners
- Incorporate into town GIS and IMS more accessible information
- Community Rating System (CRS) impacts achieve lower rating
- Transportation ID roads and infrastructure inundated
- State of RI Transportation Improvement Program (TIP) –incorporate into future application
- Capital Improvement Plan (municipal) –infrastructure improvements (i.e. sewers, dams, roadways, water)
- Building Code work with RIBA and CRMC to modify code in coastal zone
- Open space acquisition ID/prioritize lands for protection, salt marsh creation

Adaptation Planning in North Kingstown, Phase 1

Project objectives:

- Set out baselines and what we hoped to accomplish for scenarios;
- Map out SLR scenarios;
- Get municipal boards and commission to have a basic understanding of issues;
- Prepare municipality for next steps; and
- Introduce and serve as the pilot municipality statewide.

Adaptation Planning in North Kingstown, Phase 2

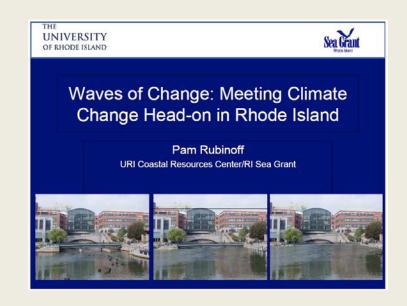
Project objectives:

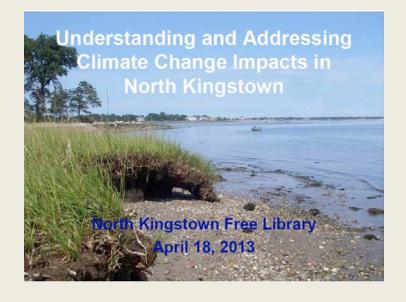
- Develop collaboratively with North Kingstown and the state a comprehensive community plan element to address climate change adaptation as it relates to transportation and land use issues; (COMPLETED)
- Prepare with the town and the state a detailed listing of priority transportation and land use projects that support the climate change adaptation effort and are appropriate for inclusion in the state Transportation Improvement Program and municipal Capital Improvement Program proposals; and
- Prepare a summary of the process as a model for other municipalities to follow.

Public Outreach & Meetings:

April 2013 Public Event drew 85
residents to the Thursday
night lecture. Smaller
numbers of residents
attended the Friday
roundtable discussions and
Saturday morning Open
House.

Many other outreach meetings since





Public Outreach & Meetings:

Follow-up meetings have been completed with:

North Kingstown Chamber of Commerce / Wickford Merchants Association

Quonset Development Corporation

North Kingstown Public Works Director & Town Engineer

RI Department of Transportation

RI Coastal Resources Management Council & Army Corps of Engineers

Wickford Plan Committee

Cedarhurst Condominium Association

Hamilton Harbor Condominium Association (scheduled)

NK Historic District Commission / RI Historic Preservation & Heritage Commission (scheduled)

North Kingstown Planning Commission

Mapping

- 11 Study Areas of North Kingstown have been defined around the vulnerable transportation infrastructure as identified by the mapping exercise.
- Individual properties and buildings that intersect with the different sea level rise scenarios have been identified and summarized in maps and tables that will be included in the draft report.
- Report completed in 2014

Local Process

Comprehensive Plan Element

The Vision for the Town – Major policy document

Zoning Ordinance

The legal standards and requirements for development and redevelopment

Land Development and Subdivision Regulations

The process for implementing and building

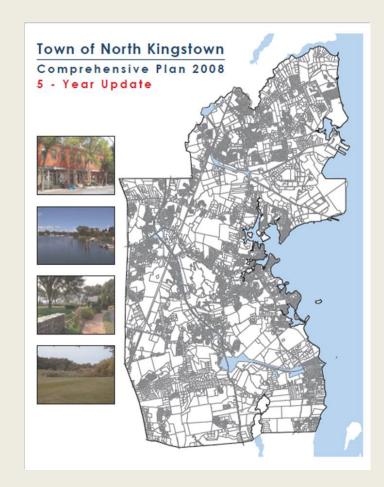
PHASE 2 – Climate Change Adaptation

Objective 1: Transportation / Land Use Comprehensive Plan development

Incorporate Natural Hazards —
"...identification of areas that could be vulnerable to the effects of sea-level rise, flooding, storm damage, drought, or other natural hazards."

Identify goals, policies, and implementation techniques to avoid or minimize impacts to lives, infrastructure, and property

Develop collaboratively with **NK and the state**



PHASE 2 – Climate Change Adaptation

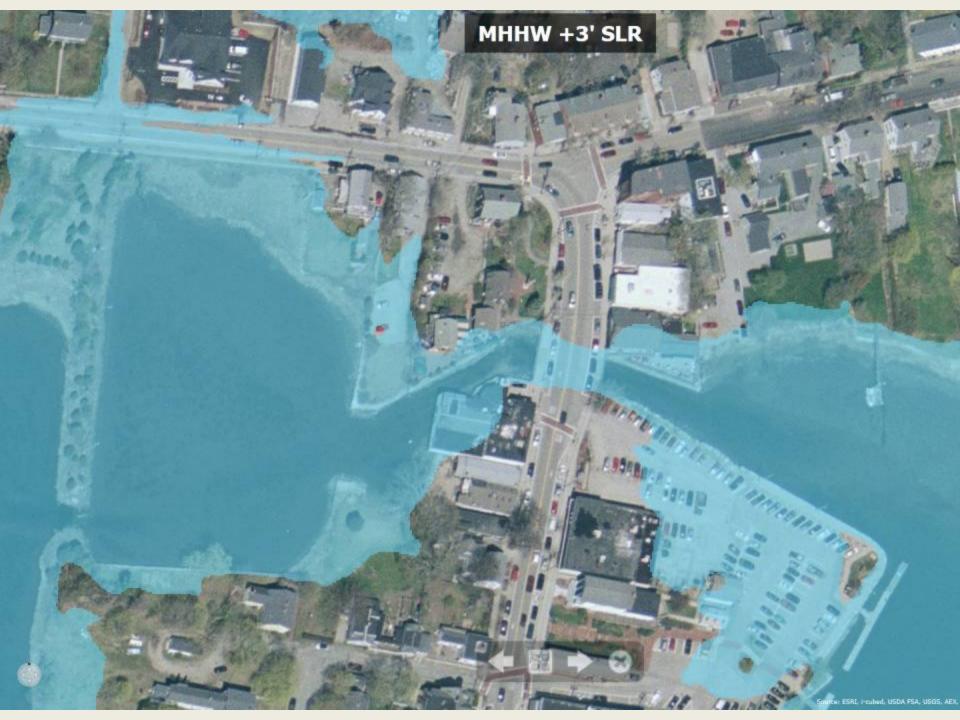
Objective 2: Detailed listing of priority transportation/land use projects that support climate change adaptation

- Prepared with the Town and State
- Appropriate for inclusion into Transportation Improvement Program (TIP) and Capital Improvement Plan (CIP)

NKS	LR Project List				
Project	Vulnerable Asset/Affected Area	Management Actions	Construction Needs	Cost	Project Outcome
1					
2					
3					
4					
5					
6					





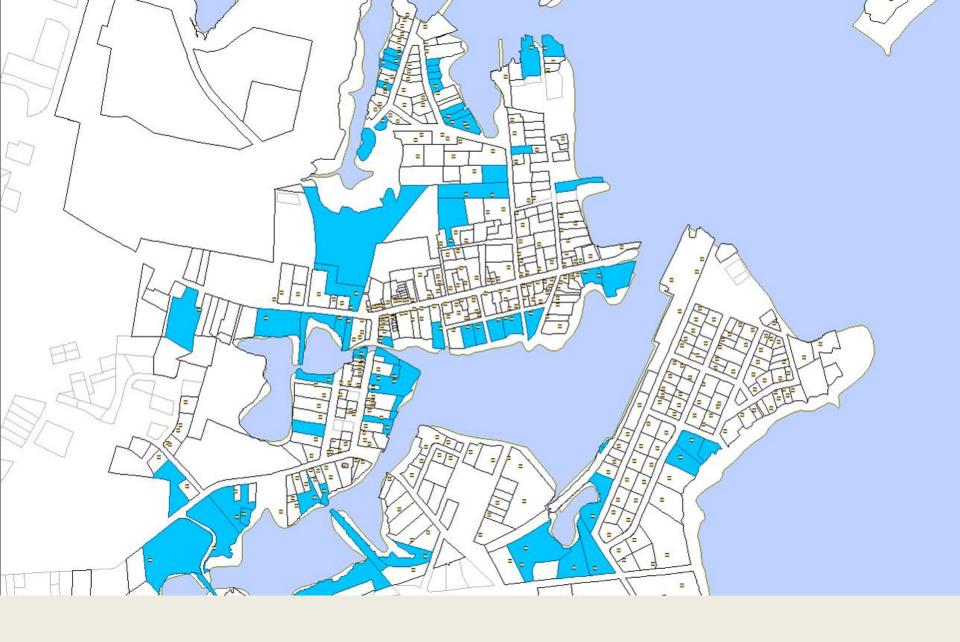








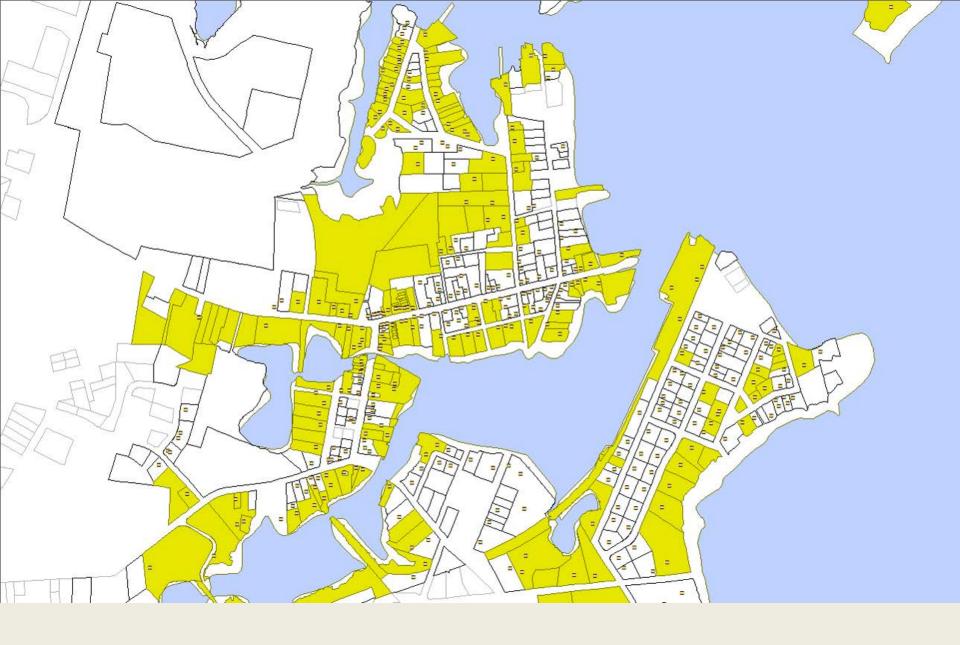
Parcels impacted by 1' of Sea Level Rise



Parcels impacted by 3' of Sea Level Rise



Parcels impacted by 4' of Sea Level Rise Or, 1' sea level rise + 3' storm surge (Sandy)



Parcels impacted by 5' of Sea Level Rise

Study Area #6 - Roads

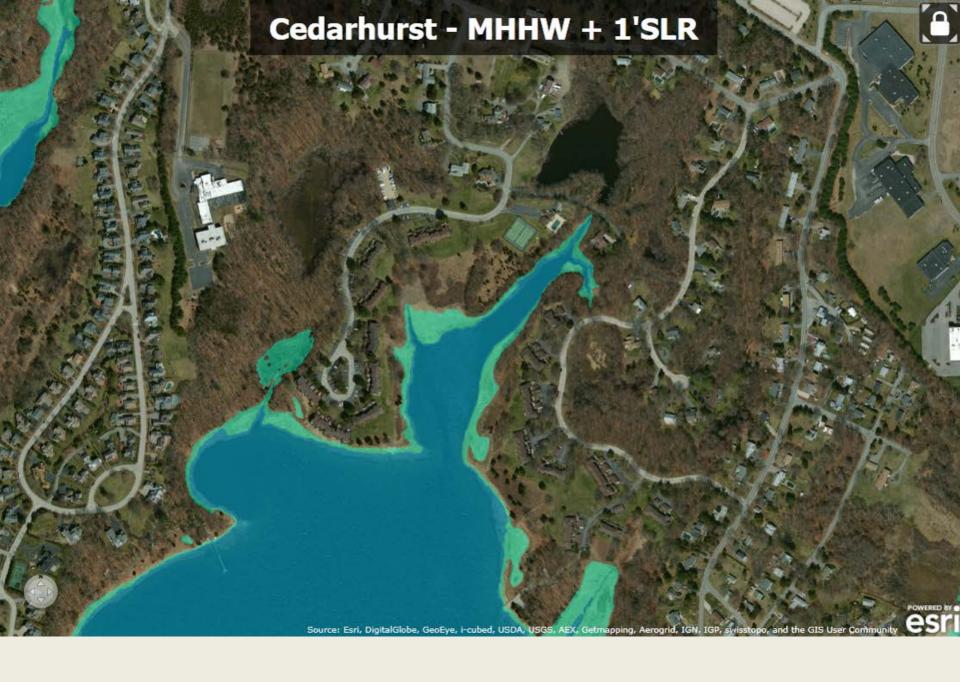


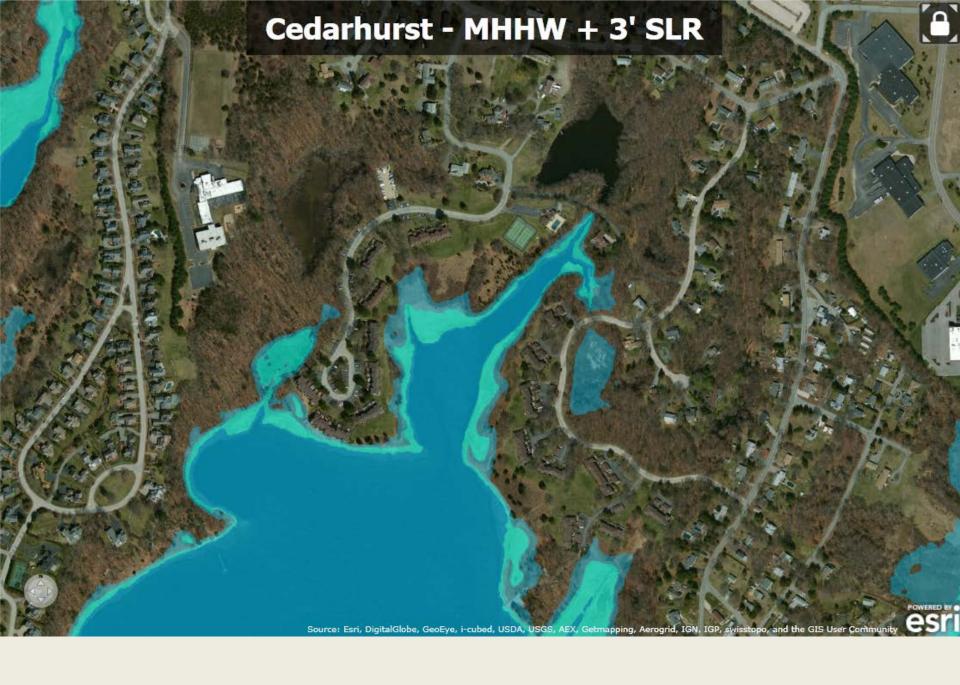
QUESTIONS:

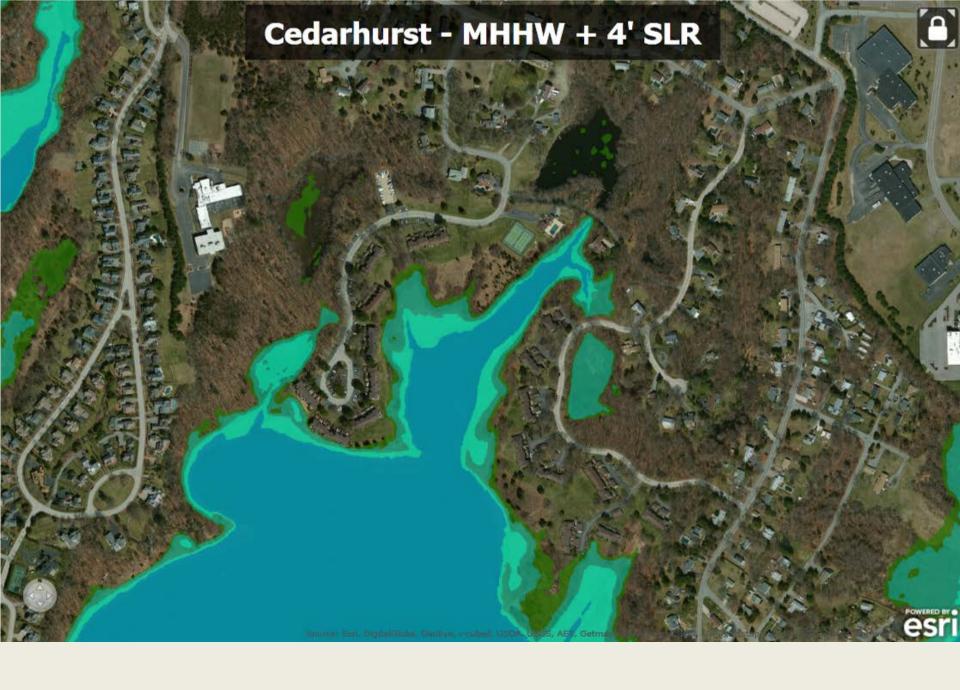
- 1. Current condition of the roads?
- Brown Street Bridge?
- 3. Maintenance schedule?
- 4. Planning horizons?
- 5. Acceptance of risk?
- 6. Storm readiness & response?
- 7. Considerations:
 - No action
 - Rebuild
 - Relocate
 - Abandon

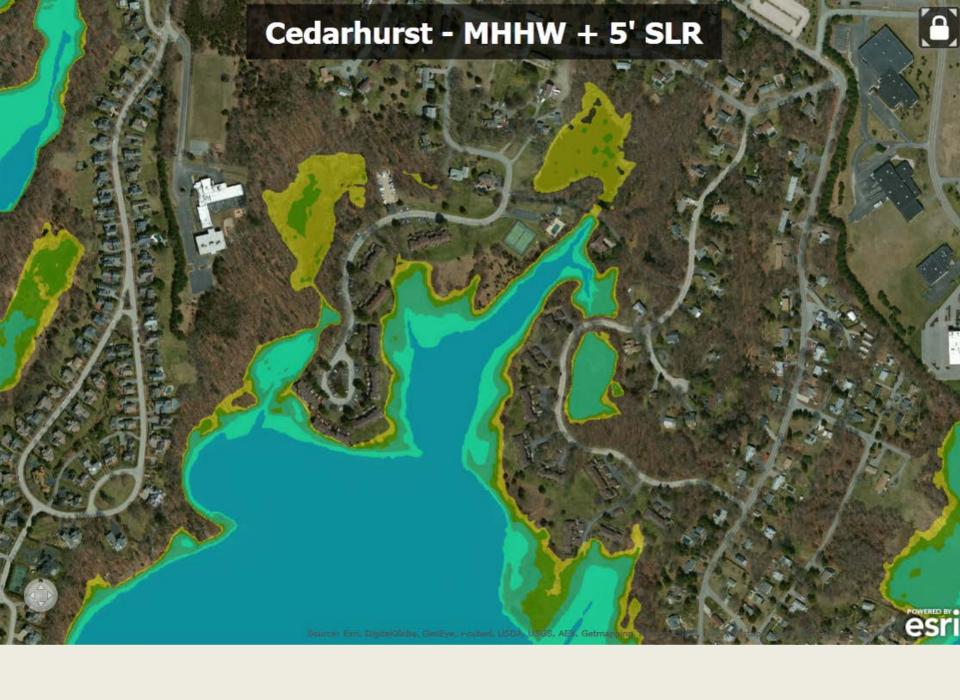
Roads impacted by SLR Scenarios - ALL

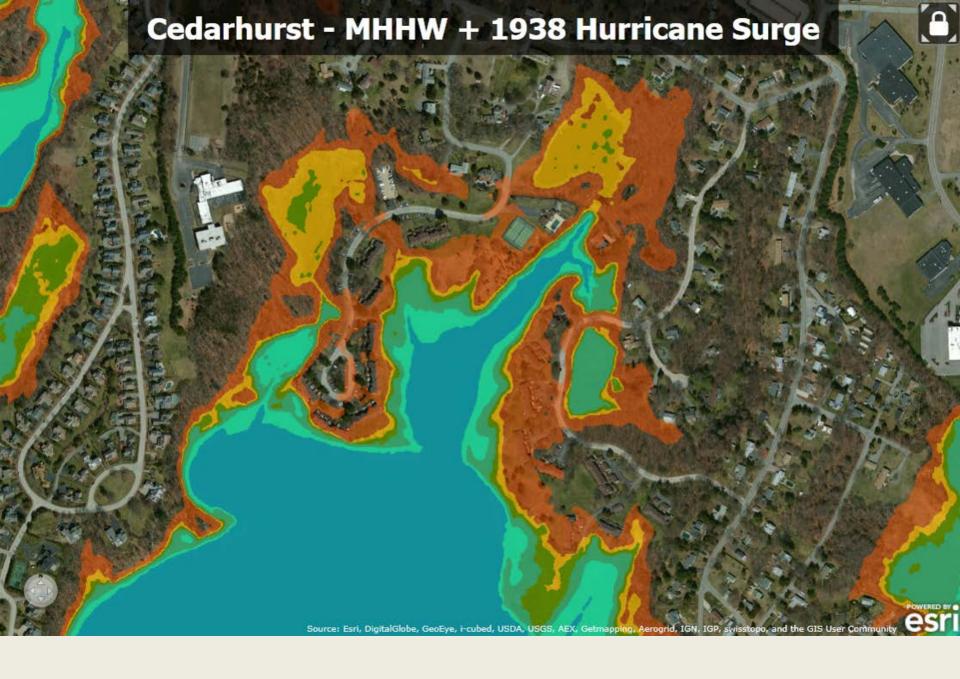


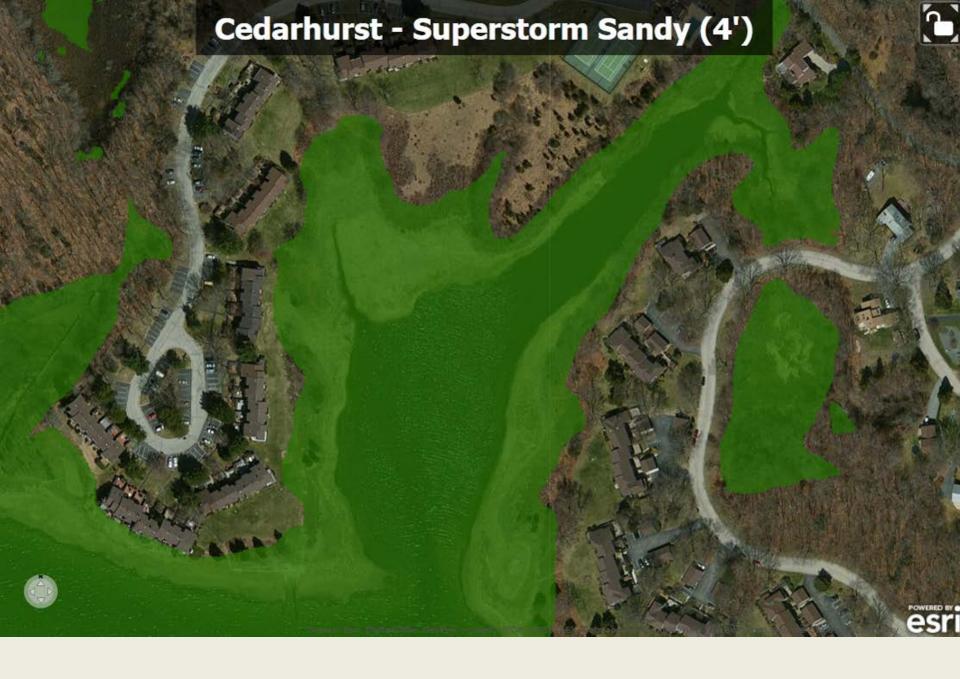












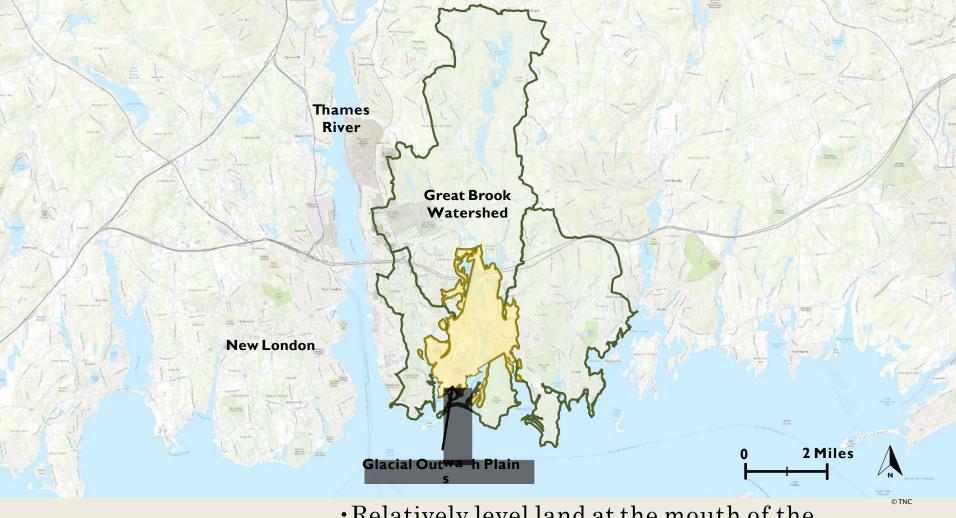






Poquonnock Plains





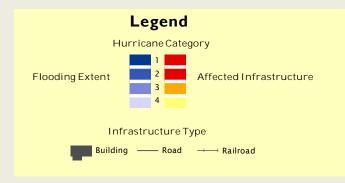
The Poquonnock Plains

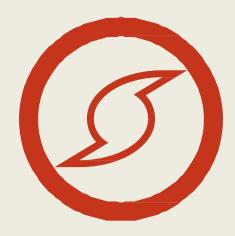
- •Relatively level land at the mouth of the Poquonnock River
- Formed by glacial meltwaters flowing down Great Brook (Groton Reservoir) and depositing sediment into Glacial Lake Connecticut (Long Island Sound).



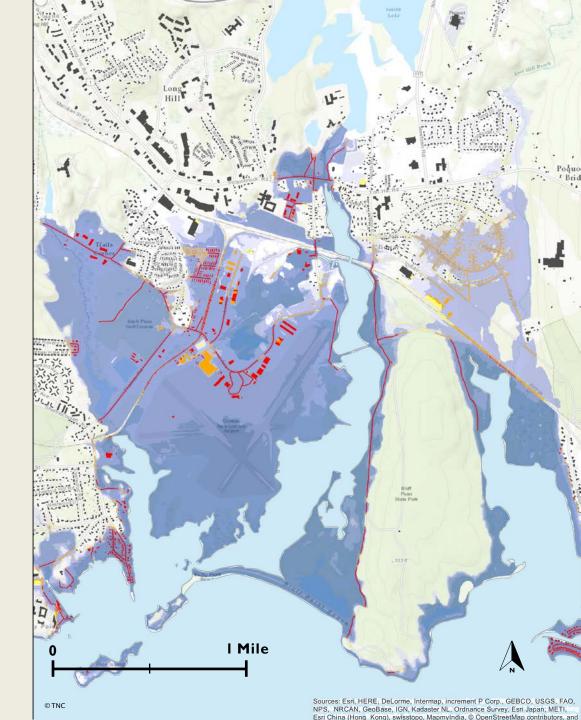


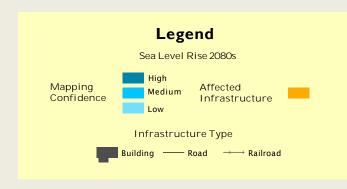
- Pequot and colonial agricultural fields (Top left)
- •20th century: gradual expansion of Groton reservoir system floods much of the previous Great Brook watershed.
- •1904: Shoreline Railroad opens
- •1938: Hurricane decimates summer community cottages on Bluff Point (Top right)





Analysis Hurricane Surge

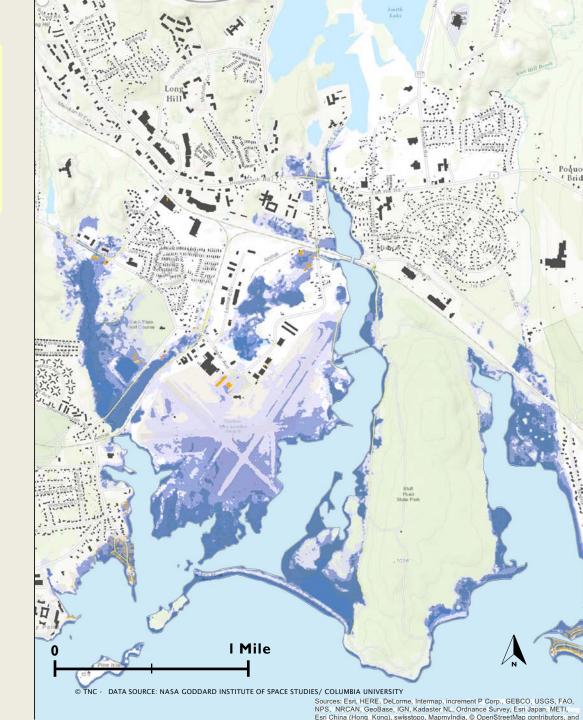


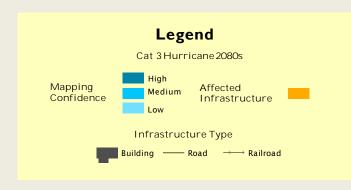




Analysis

Sea Level Rise 2080s*

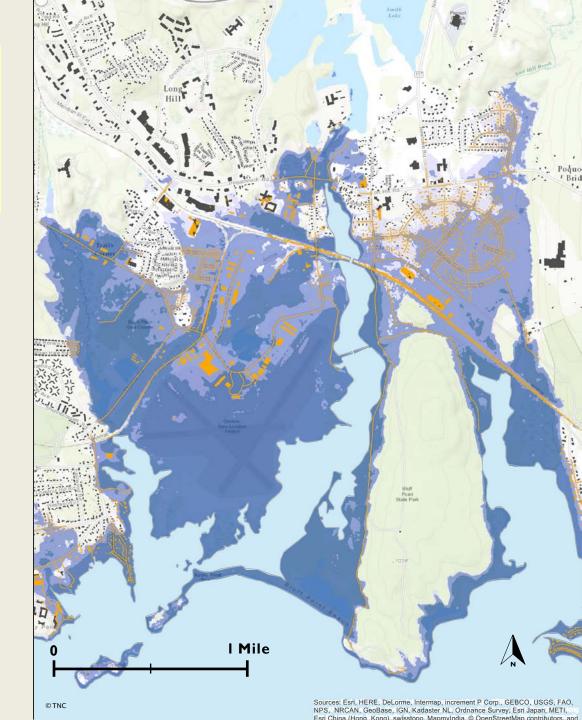




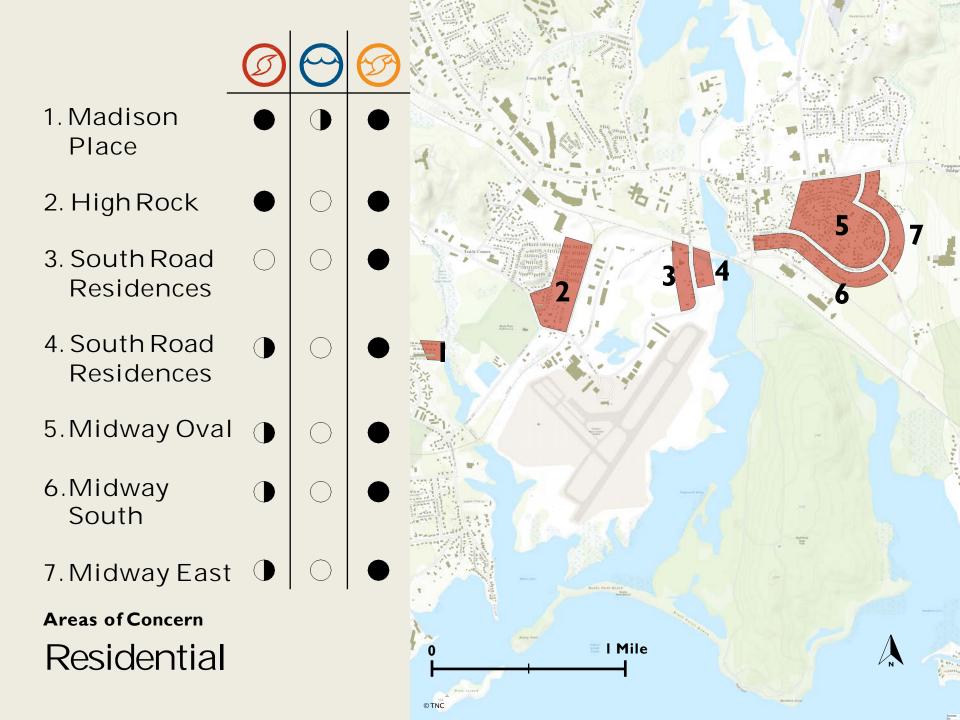


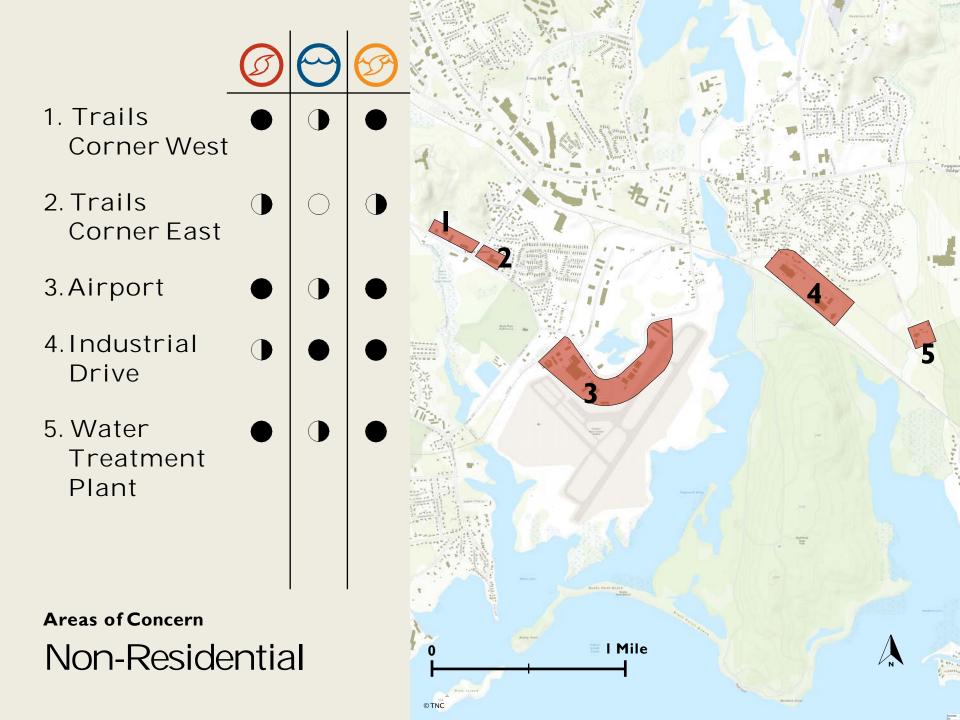
Analysis

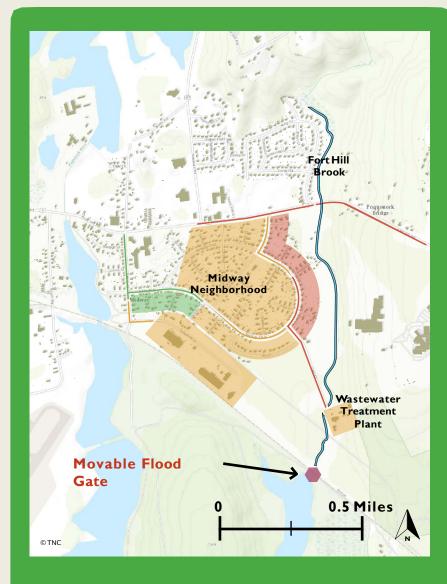
Hurricane Surge 2080s*





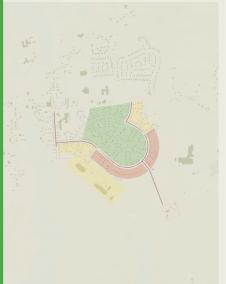


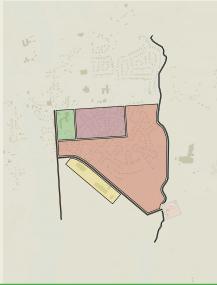




Focus Area I

Flood Gate





Pros

- Protects Midway Neighborhood and Wastewater Treatment Plant from coastal storm surge
- One time investment

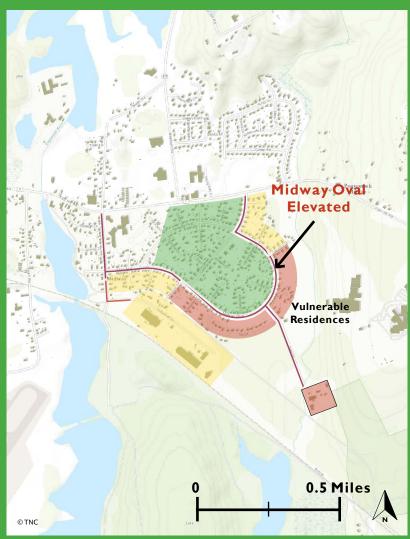
Cons

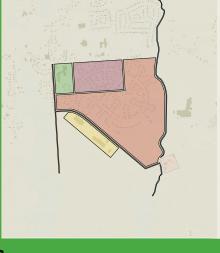
- May exacerbate riverine flooding from Fort Hill Brook
- May be overtopped in Cat 2+ hurricanes
- May prevent saltwater intrusion and prevent Fort Hill floodplain from converting to salt marsh
- Expensive





- Phased approach allows flexibility based on varying sea levels
- No required voluntary buyouts





Cons

- Extensive road raising is expensive and may conflict with homeowner's property
- Homes South and East of Midway Oval still vulnerable to flooding

Focus Area I Midway Barricade



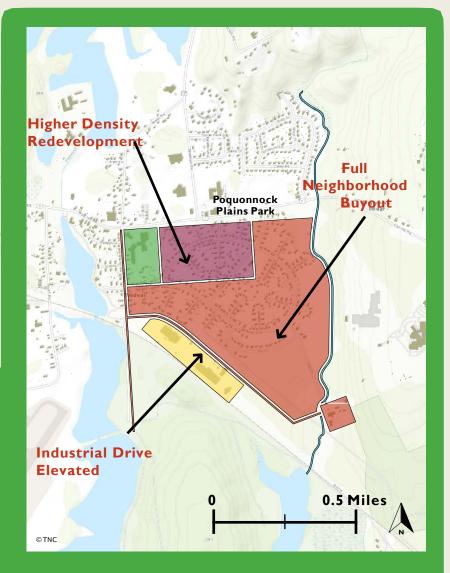




- Moves all residents outside of flood vulnerability area.
- Opportunity to improve Town's affordable housing stock
- Integrates new green space in with existing Poquonnock Plainspark
- Industrial drive elevated to preserve access to waste water treatment plant

Cons

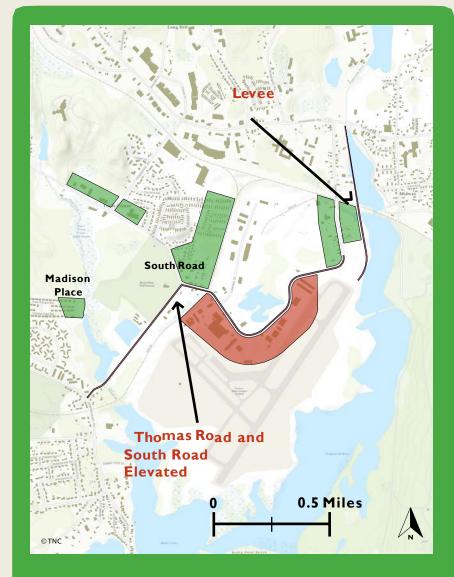
- Extensive relocation of residents may be very expensive and logistically difficult
- If not properly designed, berms could disrupt current and actually increase risk to residents both upstream and downstream from berm.



Focus Area I

Redevelopment







- Provides surge protection to all residential areas around airport
- Maintains two access points to the airport at all times

Cons

- Extensive road raising may be financially infeasible
- If not property designed, berms could disrupt current and actually increase risk to residents both upstream and downstream from berm. This could be a issue at Madison Pl and along South Rd.

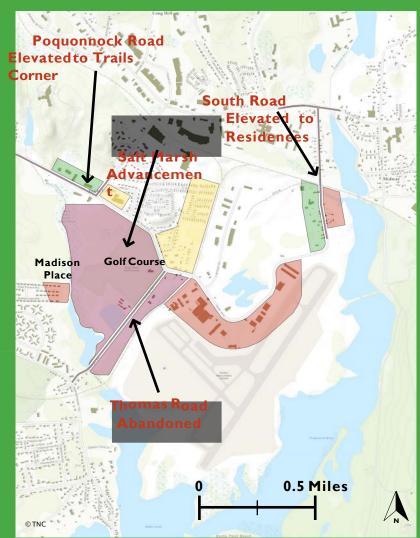
Focus Area 2

South Road Levee





- Cost effective utilization of existing natural infrastructure to reduce risk
- Eliminate
 maintenance costs
 associated with
 Thomas Rd
- Marsh restoration
 may reduce flood
 vulnerability to
 Madison Pl and High
 Rock



Focus Area 2

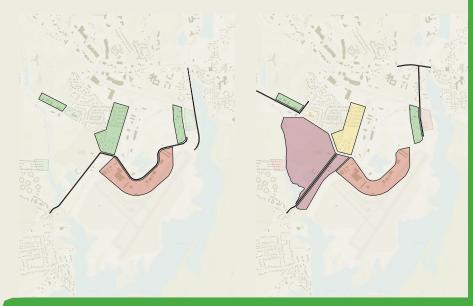
Birch Plain Restoration



Cons

- May not provide fail safe protection of residence near Trails Corner
- Only leaves one access to airport under hurricane conditions
- Marsh restoration in Birch Plain Creek may conflict with golf course use currently.

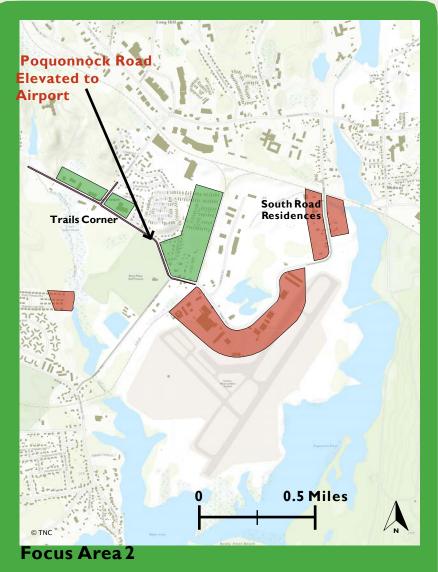




- Protects all residences in Trail Corner area
- Provides reliable access of airport from the City of Groton.

Cons

- Only one access of airport under hurricane conditions
- · Buyout of homes on South Rd likely expensive



Strengthen Poquonnock Road



1. Airport Salt Marsh

- Stabilizes soil for airport runway
- Will likely erode without management

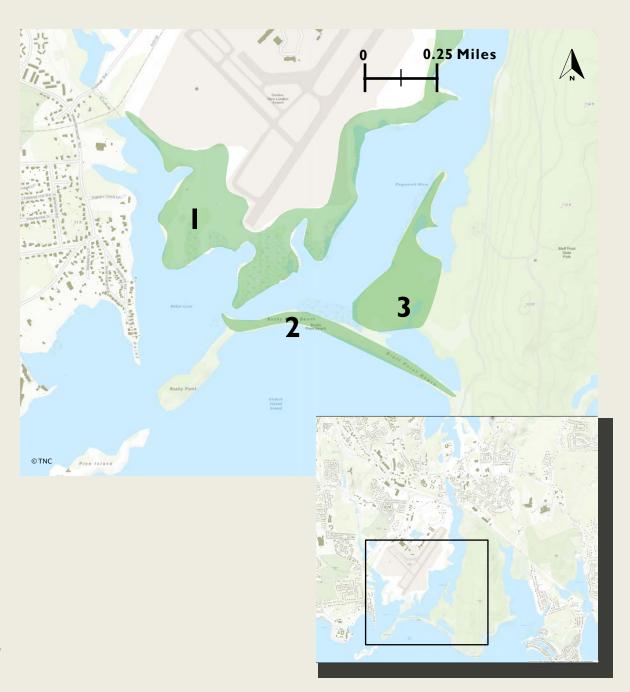
2.Bluff Point Beach

- First line of defense for upriver communities and infrastructure
- Could be over-topped or breached by extreme weather and sea level rise

3. Bluff Point Marsh

- Second line of defense for upriver communities and infrastructure
- Will likely erode without management

Natural Defenses



- •Raising marsh elevation with dredge spoils to keep pace with sea level rise
- •Protect airport runway from erosion and impacts of storm damage further up Poquonnock River

Natural Defenses Salt Marsh Elevation



METTHEA YEPSEN(TNC)



METTHEA YEPSEN(TNC)

- •Prioritize future salt marsh advancement areas around Poqounnock River mouth
- Protect, create and enhance critical advancement areasto reduce stormdamage
- •1,172 acres of undeveloped areas that will receive salt marsh (360 acres on single airport parcel).

Natural Defenses

Salt Marsh Advancment



- •Reduce wave impacts to coastline
- •Trap sediment and slow rates of coastal erosion
- •CT DEEP currently does not permit hard structures in water



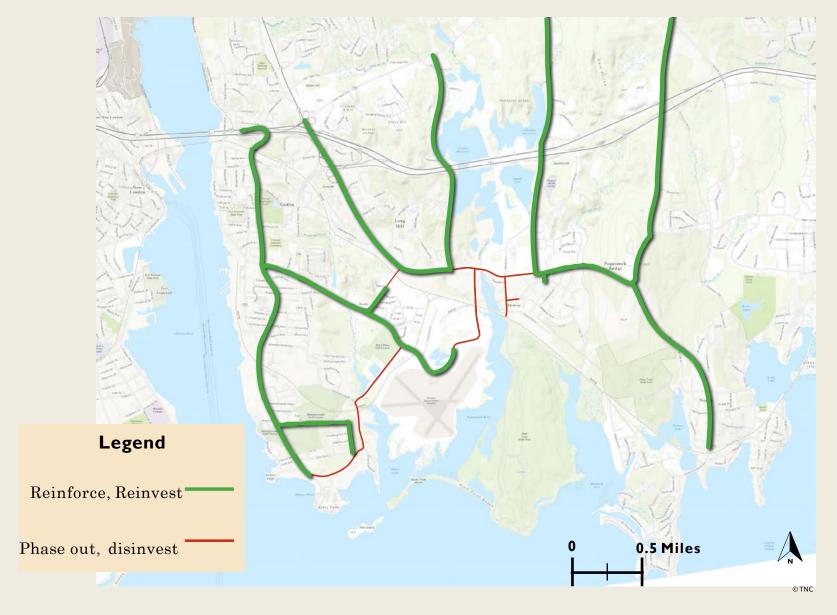
Oyster Restoration



ERIKANORTEMANN (TNC)



AMI VITALE



Resilient Corridors

How does a municipality respond and what will they do?

Planning Commission

Town Council

General public

Change is hard, and reacting to an unknown is very difficult for people

What do we (the municipalities) need????

Locally

 Time to review, understand potentially impacted areas, timelines and come up with local strategies

State

- Clear state policy direction, laws, rules, and guidelines
- Model examples of how others have done this (NK and Groton pilot projects)
- Technical assistance for policy, science and outreach
- Money for/or to complete mapping (maps more available now)

Federal government

- Clear policy direction, laws, rules, and guidelines
- Funding to study and implement

Still working on...

What is the low hanging fruit?

How to accommodate climate change and sea level rise into daily decisions with minimal impact on community character?

Retreat options

The push/pull between environmental protection and Economic Development

Takeaways...

- What are your goals and what are you trying to accomplish?
- Develop short term and long term goals
- Limit development in flood zones and projected SLR areas
- No new subdivisions in flood zones
- No new infrastructure or facilities in flood zones or SLR areas
- Open space and floodplain acquisition (where)...
- Do NOT complete a very expensive study with lofty goals
- Who are your local champion(s)?
- Succession planning

Q & A

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