COASTAL RESILIENCE FOR WASTEWATER SYSTEMS

Presented to:
CAWPCA Fall Workshop
November 14, 2014

Presented by:
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Presentation Agenda

- Federal and State Background
- Coastal Resilience Concepts
- Wastewater System Vulnerabilities
- Adaptation Options for Wastewater Systems
- Who is Planning in Connecticut?
- Who is Planning in Other States?
- Funding Sources

Terminology

- In the climate change field, mitigation = carbon emission reductions and adaptation = making changes to live with new conditions
- In the flood world, mitigation = making changes to reduce flood damage
- When we talk about coastal resilience, we are talking about flood mitigation and climate adaptation
- Flood mitigation includes prevention, property protection, structural projects, natural resources protection, emergency services, and public information

Federal Background

- Executive Order ***Preparing the United States for the Impacts of Climate Change*** – November 2013
- The President's Action Plan (June 2013) includes the statement "Support Climate Resilient Investments"
  - ✓ Federal agencies are working to ensure grants, technical assistance, and other programs support smarter, more resilient investments
  - ✓ Established the President's *State, Local and Tribal Leaders Task Force on Climate Preparedness and Resilience* which is made up of 26 Governors, county executives, mayors and tribal leaders

State Background

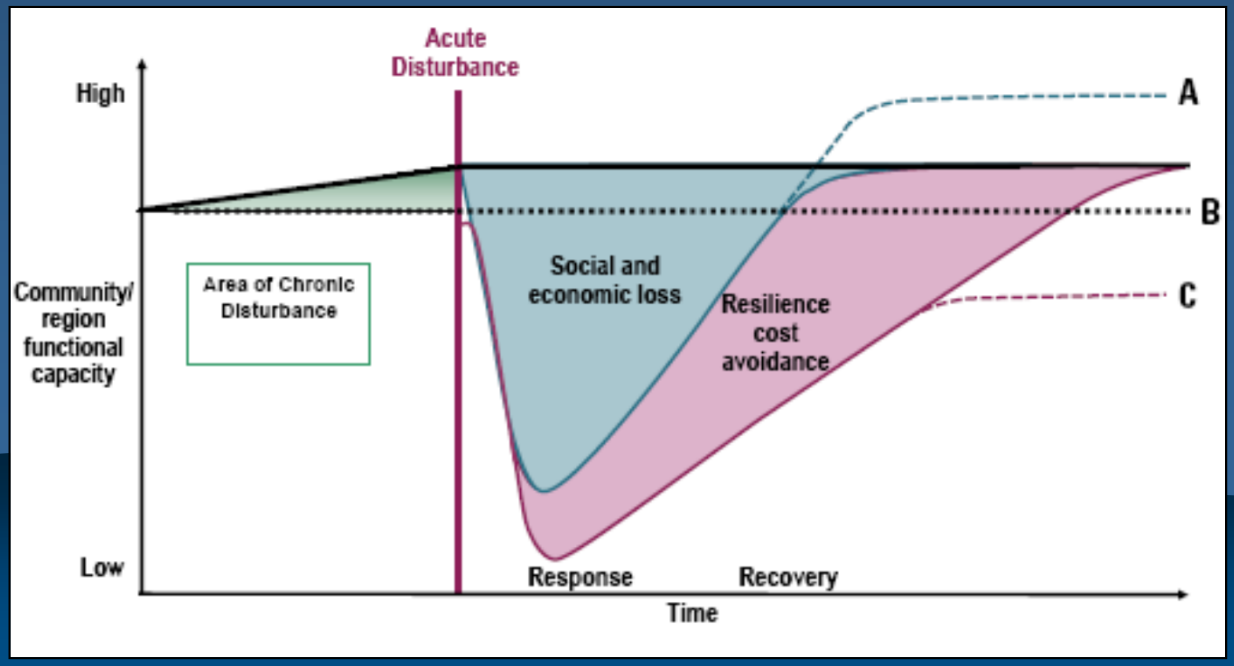
- Public Act 12-101, An Act Concerning the Coastal Management Act and Shoreline Flood and Erosion Control Structures
  - ✓ Sea level rise was incorporated into the Connecticut Coastal Management Act (CMA) relative to the general goals and policies of coastal planning
- Public Act 13-9, An Act Concerning Climate Change and Data Collection
  - ✓ State to establish a center that will conduct research, analysis, design, outreach and education projects to guide the development and implementation of technologies, methods and policies that increase the protection of ecosystems, coastal properties and other lands and attributes of the state that are subject to the effects of rising sea levels and natural hazards

State Background

- The Connecticut Climate Change Preparedness Plan (draft, 2011 with the warning "do not cite or quote")
  - ✓ "Assess the impact of climate change on wastewater treatment facilities, and encourage the development of facility-specific adaptation plans"

Coastal Resilience Concepts

- Resilience or Resiliency is "the ability of any system (infrastructure, government, business, and citizenry) to resist, absorb and recover from or successfully adapt to an adversity"
- Coastal resilience is the ability to resist, absorb, recover from, or adapt to coastal hazards such as sea level rise, increased flooding, and more frequent storm surges



Community and Regional Resilience Initiative (CARRI, 2011) "Resilience Loss Recovery Curve"

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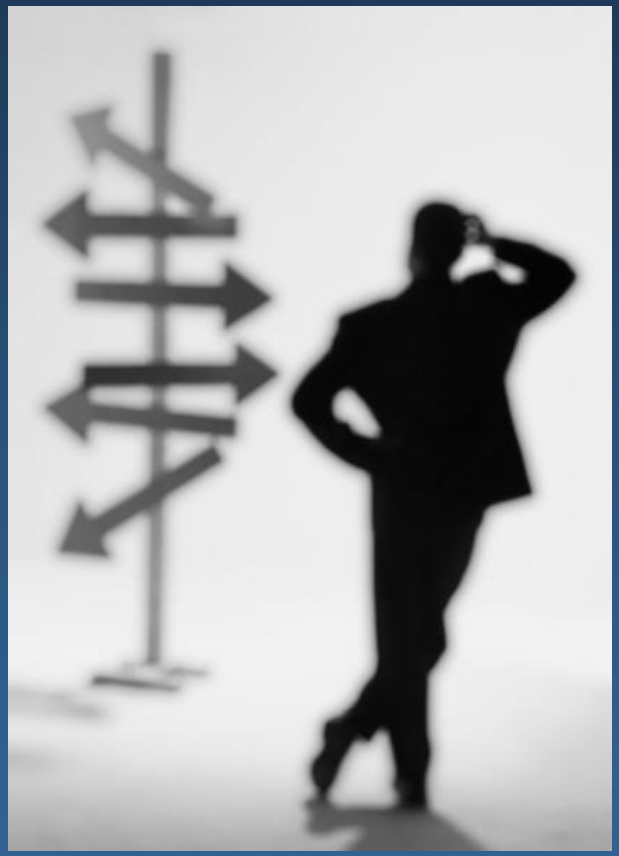
Coastal Resilience Concepts

- We need to define vulnerabilities in order to define risks
- Risk is commonly defined as the product or sum of vulnerability and frequency
- We need to be able to communicate to our residents and business owners with specific examples
- We need to think of appropriate adaptation strategies
- We want to be well-positioned to obtain funds to reduce vulnerabilities and therefore reduce risks

Coastal Resilience Concepts

- Communities are at a crossroads:
  - Vulnerabilities can remain static and risks can increase
  - Vulnerabilities can be reduced to hold risk at bay
  - *If vulnerabilities can be reduced even further*, then risks can be lowered in the face of rising sea level and increased coastal storms, leading to increased resilience



Coastal Resilience Concepts

- What if we don't believe in climate change?
  - That's OK – we still know that sea level is rising
  - And we know that coastal flooding will occur
  - Irene and Sandy were back-to-back storm surge events for Connecticut
  - We might as well be more resilient as we design our new infrastructure

Coastal Resilience Concepts

- We need to understand the following to reduce risks:
  - WHAT is vulnerable?
  - WHERE is it vulnerable?
  - HOW is it vulnerable?
  - WHY is it vulnerable?
  - WHEN will it be vulnerable?
  - WHO will be in charge of initiating adaptation?

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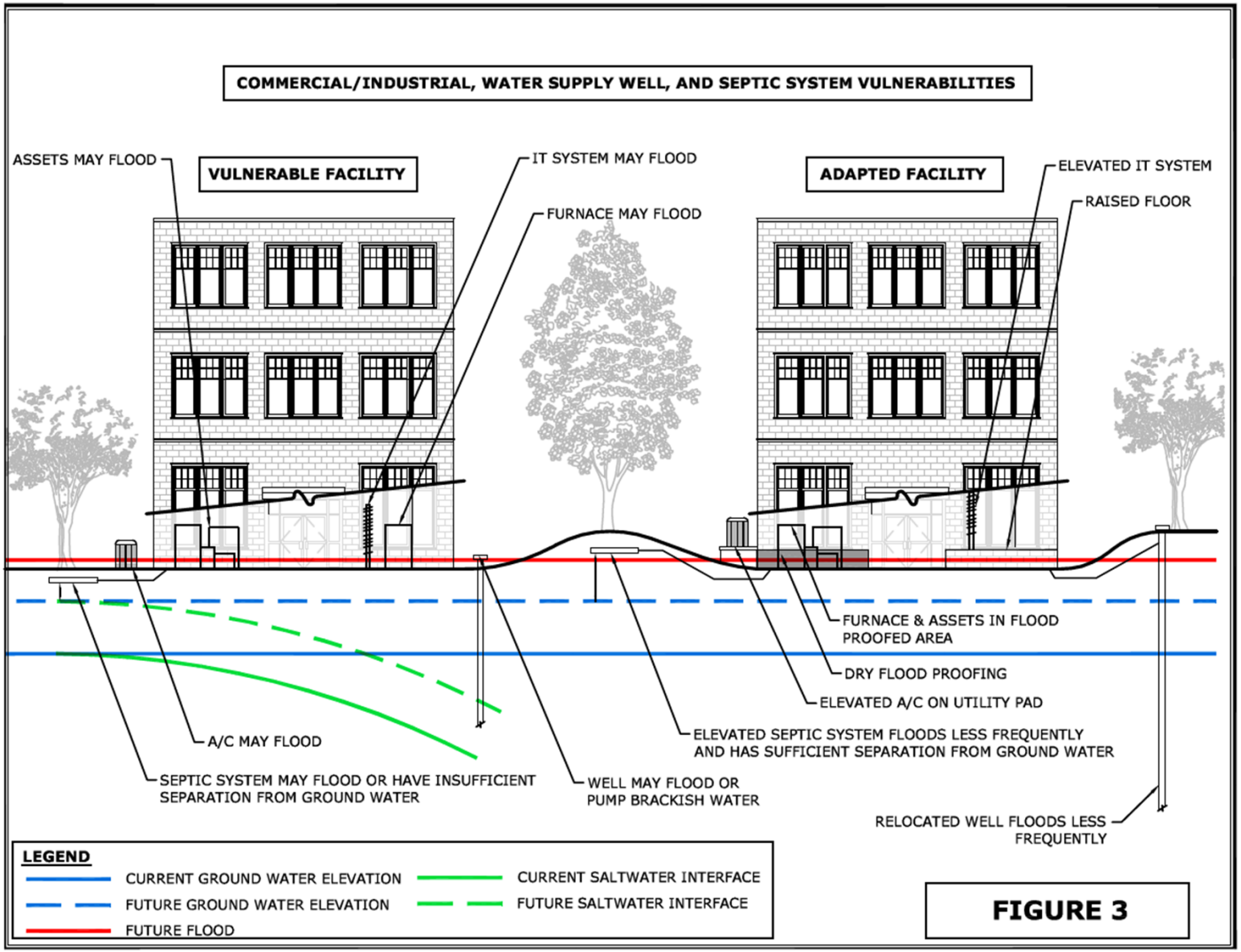
Wastewater System Vulnerabilities

- Individual subsurface disposal systems
  - ✓ Septic tanks
  - ✓ Leachfield
  - ✓ The unsaturated zone below the system
- Community subsurface disposal systems
  - ✓ Same parts as the individual systems, plus…
  - ✓ Electrical components
  - ✓ Pumps
  - ✓ Pretreatment systems

Individual & Community System Vulnerabilities



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Individual & Community System Vulnerabilities

- Where is the septic system? In the tidal wetland?

- Are these septic systems operational?

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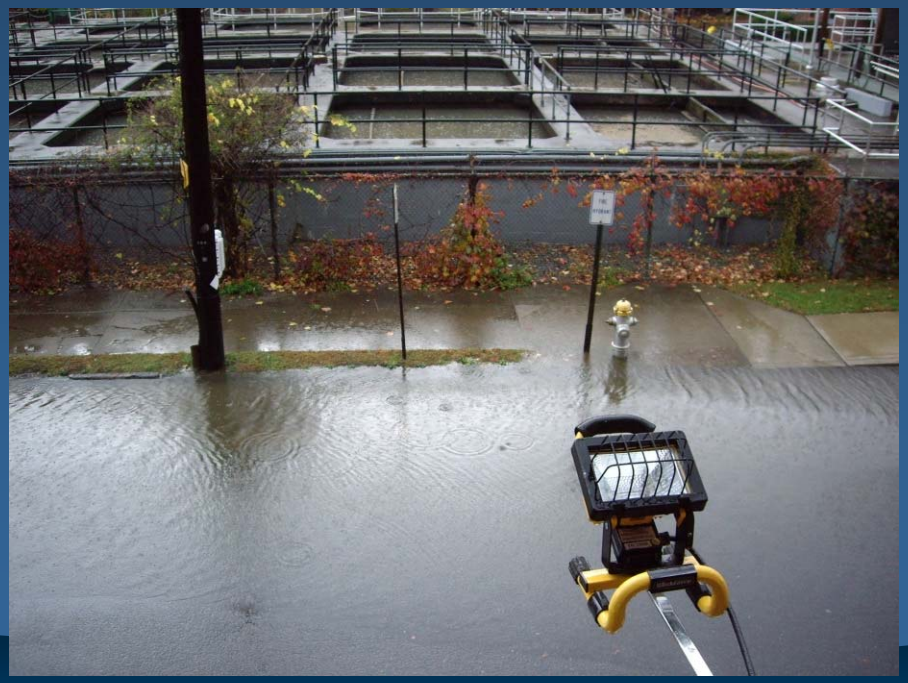
Wastewater System Vulnerabilities

- Sanitary sewer systems and their components
  - ✓ Collection systems
  - ✓ Pumping stations
  - ✓ Treatment facilities and their components (headworks, pumps, tanks, lagoons)
  - ✓ Offices at the treatment facility
  - ✓ Chemical storage tanks and areas
  - ✓ Controls
  - ✓ Outfalls
  - ✓ Electricity for all of the above
  - ✓ Standby power supplies and fuel for all of the above
  - ✓ Access roads
  - ✓ Personnel

Sanitary Sewer System Vulnerabilities

- Kingston's treatment facility and lagoons – adjacent to an area of tidal flooding



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Sanitary Sewer System Vulnerabilities

- Passaic Valley Sewerage Commission facility

Figure 5-15:
Subgrade electric system damaged by floodwater at the Passaic Valley Sewerage Commission wastewater facility (Newark, NJ)

Source: FEMA P-942

Sanitary Sewer System Vulnerabilities

- Yonkers Wastewater Treatment Plant

Figure 5-16:
Air vents (red arrow) along walkway over subgrade utility tunnel adjacent to settling tanks on the left were overtopped by approximately 2 feet of floodwater, flooding the basement areas below at the Yonkers Wastewater Treatment Plant (Yonkers, NY)

Source: FEMA P-942

Options for Adaptation

- Adapting Areas served by Individual Systems
  - ✓ On-site solutions such as elevating or moving the system
  - ✓ Develop community systems for groups of properties where individual systems are no longer viable
  - ✓ Extend sewer system from elsewhere
  - ✓ Vacate or condemn property when none of the above are feasible

Source: Rolling Easements, EPA

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Options for Adaptation

- Adapting Areas served by Community Systems
  - ✓ On-site solutions such as elevating or moving the system
  - ✓ Relocate community system to nearby site at higher elevation or located further inland
  - ✓ Add pre-treatment if groundwatershed decreases in size and dilution can no longer treat the nitrogen
  - ✓ Extend sewer system from elsewhere
  - ✓ Neighborhood-scale retreat when none of the above are feasible

Options for Adaptation

- Adapting Collection Systems and Pumping Stations
  - ✓ Elevate pumping station components
  - ✓ Floodproof pumping station components
    - ✓ Careful – don't forget vents and other pathways for floodwaters
  - ✓ Use submersible pumps where possible
  - ✓ Provide standby power or elevate standby power sources
  - ✓ Set up pumping stations in such a way that they can be repaired more quickly
  - ✓ Harden collection system components and reduce infiltration and inflow pathways
  - ✓ Convert gravity systems to pumped systems as buildings and roads are elevated in adapting neighborhoods
  - ✓ Install backflow prevention where needed
  - ✓ Alternate collection systems

Options for Adaptation

- Adapting WWTPs/WPCFs
  - ✓ Floodproof the buildings and large structures
  - ✓ Elevate components inside buildings
  - ✓ Floodproof components inside buildings
  - ✓ Raise all electrical systems and controls
  - ✓ Use parts that resist corrosion from salt water
  - ✓ Harden the outfall and add structure to prevent sediment from covering it
  - ✓ Backflow prevention where needed
  - ✓ Secure chemical tanks that could float
  - ✓ Flood wall around the facility

Options for Adaptation

- Adapting WWTPs/WPCFs
  - ✓ Harden electrical lines that lead to the facility
  - ✓ Install redundant electrical lines to the facility
  - ✓ Add redundant standby power supplies or establish "quick connection" procedures for portable generators
  - ✓ Create dry land access to and from the facility
  - ✓ Backup important records and files
  - ✓ Move the office to higher levels of the facility
  - ✓ Designate safe spaces for employees riding out the event
  - ✓ Consider developing or improving remote access
  - ✓ Make sure personnel know how to quickly change operations, or…
  - ✓ Relocate the entire treatment facility!

Who is Planning in Connecticut?

- Guilford
- Groton
- Greenwich
- Old Saybrook
- Clinton
- Stonington

Guilford

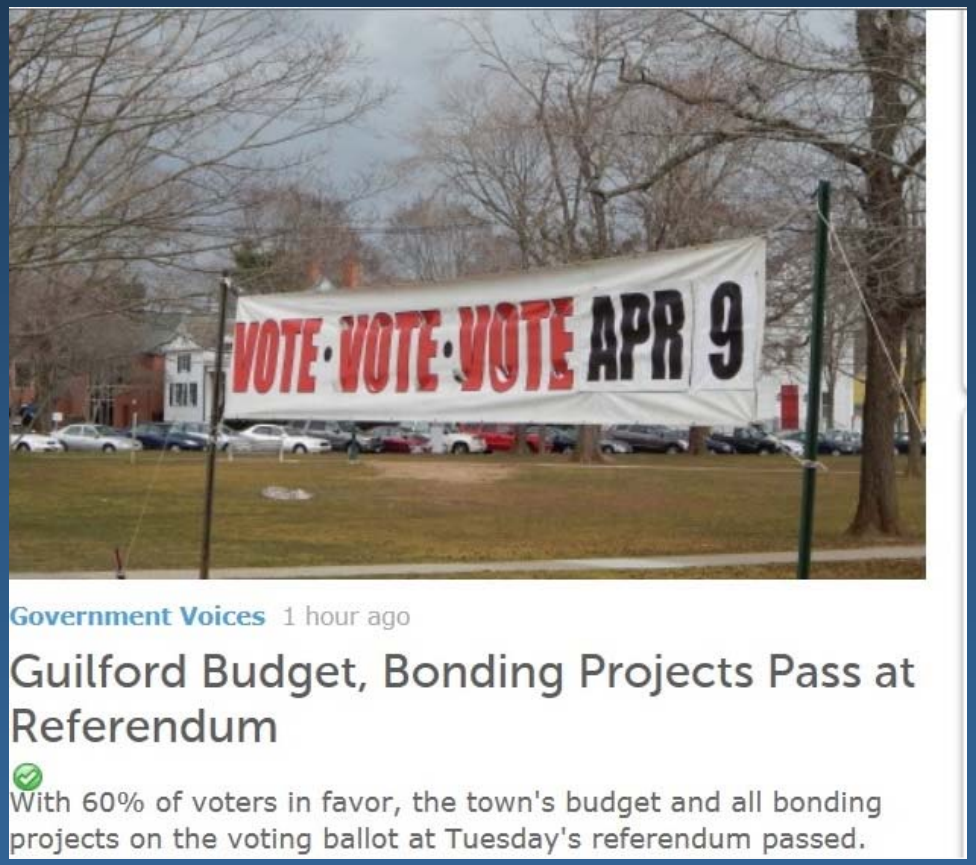
- Guilford is most advanced – it has a Coastal Resilience Plan

Option	Typical Actions
1. Management of coastal real estate and structures	May include phasing with coastal realignment strategies and may occur through zoning overlay districts or zoning amendments; May include strengthening building codes to require freeboard, using V zone standards in A zones, and acquisition of property damaged by coastal hazards.
2. Shoreline protection and management of coastal and near-shore lands	May include hard shoreline protections, living shorelines, land acquisition and land conservation practices for tidal marsh advancement, and tidal wetland buffers for near-shore flood protection.
3. Roadway alterations	May include elevation of roadways, abandonment of some roads, re-analysis of emergency access, and developing alternative egress for some areas.
4. Protection or replacement of water supply wells and septic systems	May include on-site retrofits, development of community systems, extension of sewer and water systems, or vacating properties.

Guilford

- Guilford is starting with roads

However, wastewater planning is already underway…



Guilford Example – Soundview Road

- Scenarios that informed the Soundview Road plan

2020s Daily Inundation

2080s Daily Inundation

Source: TNC (www.coastalresilience.org)

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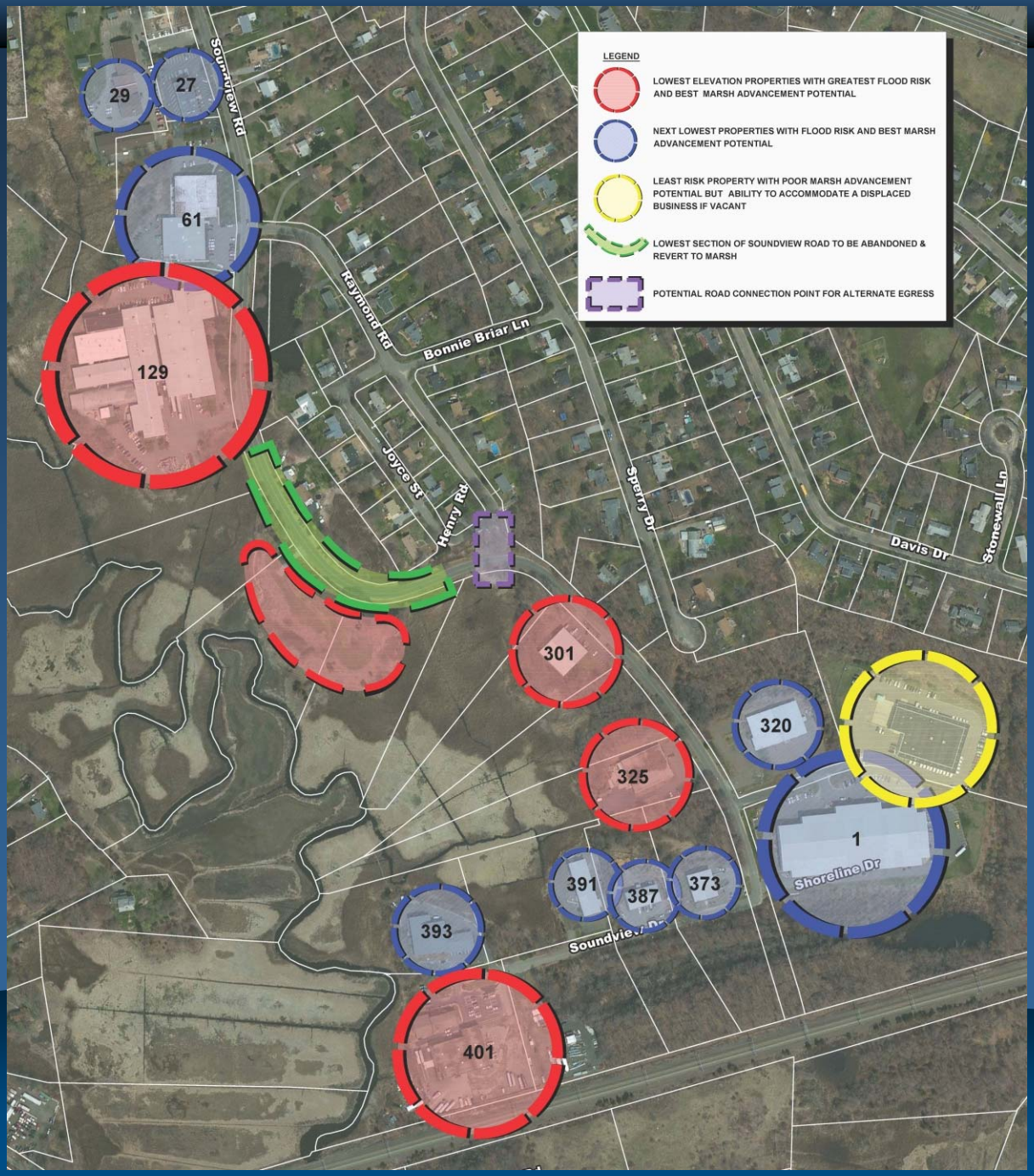
Guilford Example – Soundview Road



- Coastal adaptation will require tradeoffs:
  - New road connection vs. raising Soundview Road's lowest section
  - Floodproofing nonresidential properties vs. local relocation vs. regional relocation
  - Facilitating marsh advancement on private properties vs. on Soundview Road

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Guilford Example – Soundview Road

Coastal adaptation may allow different outcomes:

- Relocated residents from elsewhere may be able to settle here
- Housing would need to be resilient and able to withstand floods and storm surges
- Space for tidal marshes must be available

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Guilford Example – Seaside Avenue

Seaside Avenue/Guilford Marina

- Flooding of structures
- Septic system failures
- Public beach at one end and marina at the other end

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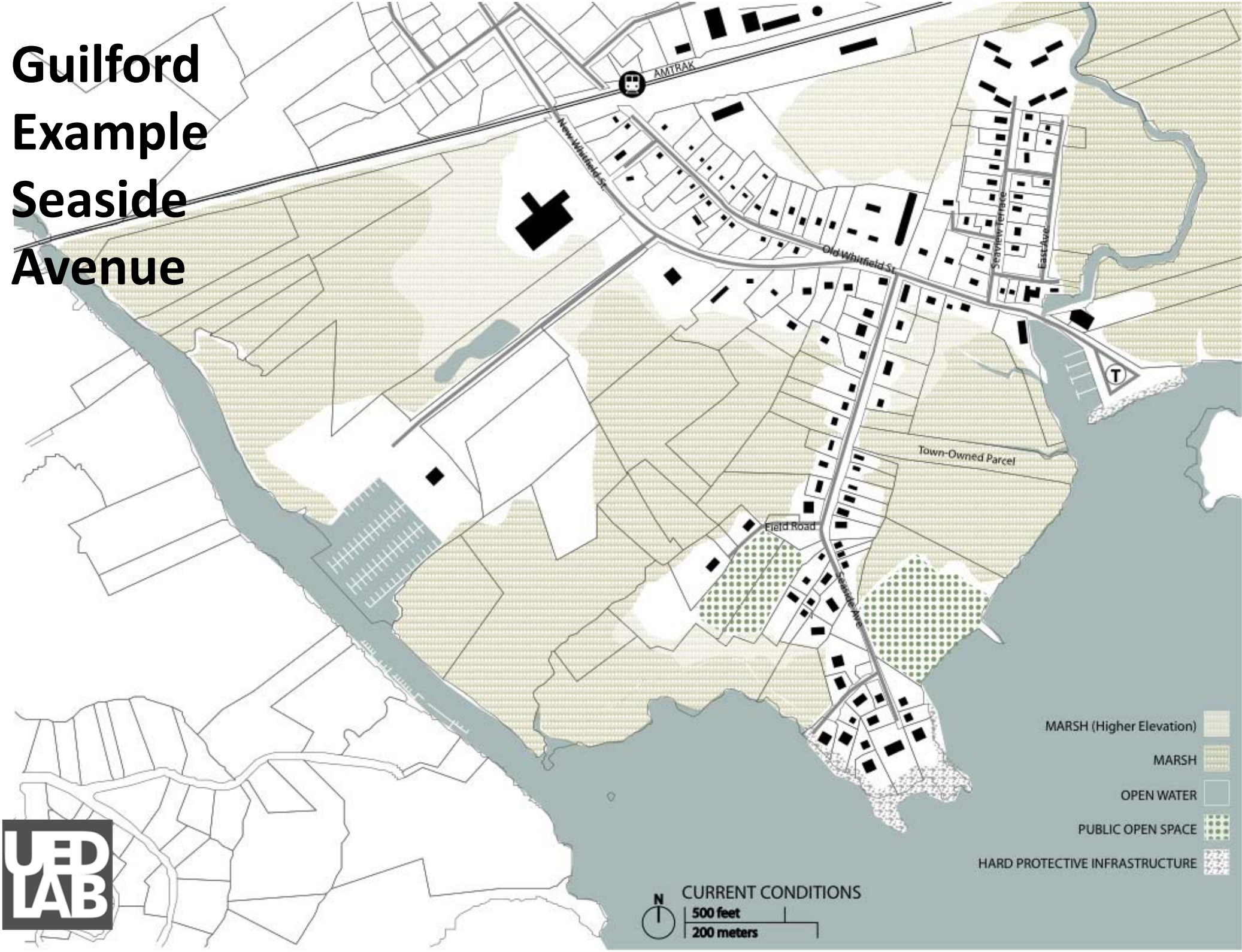
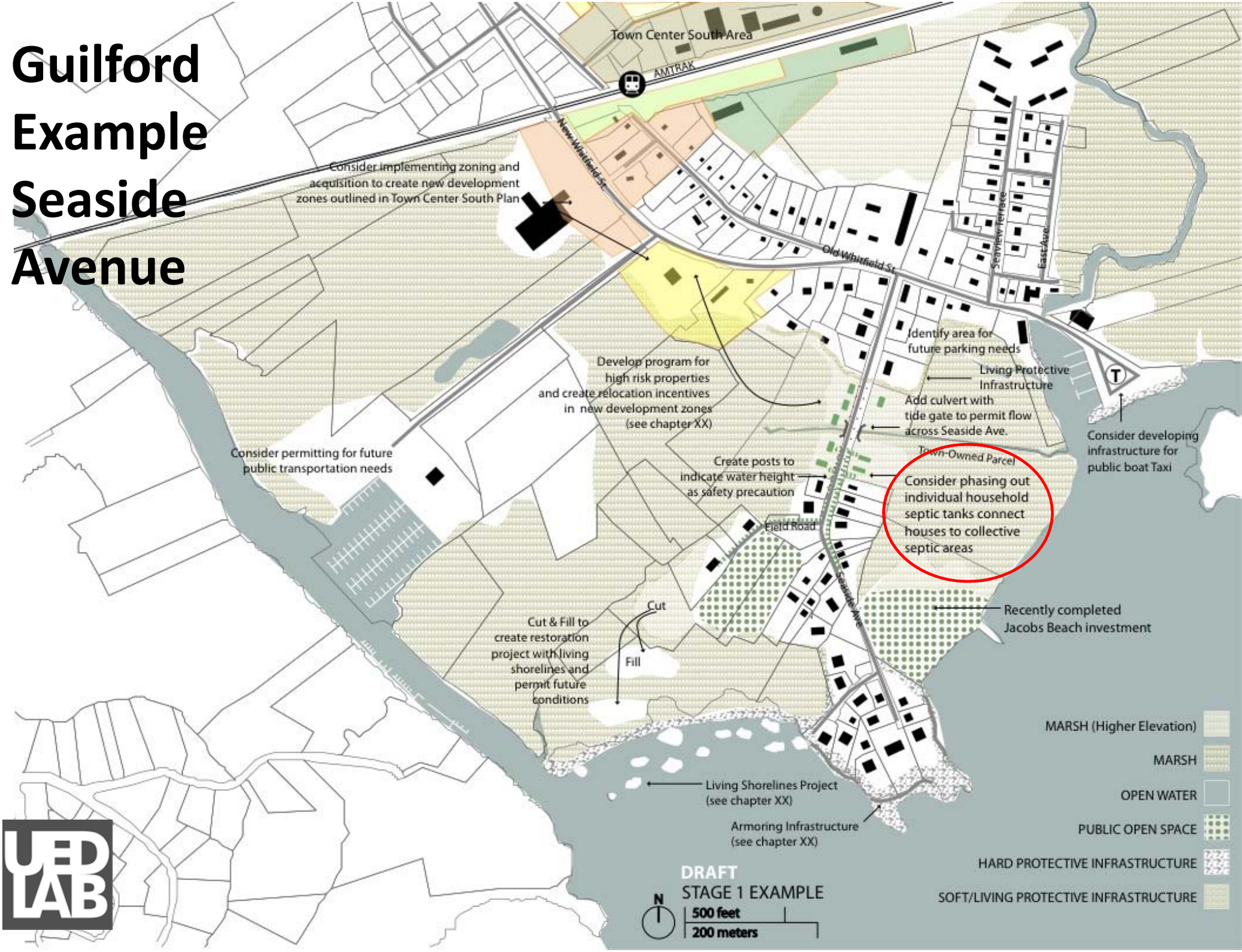
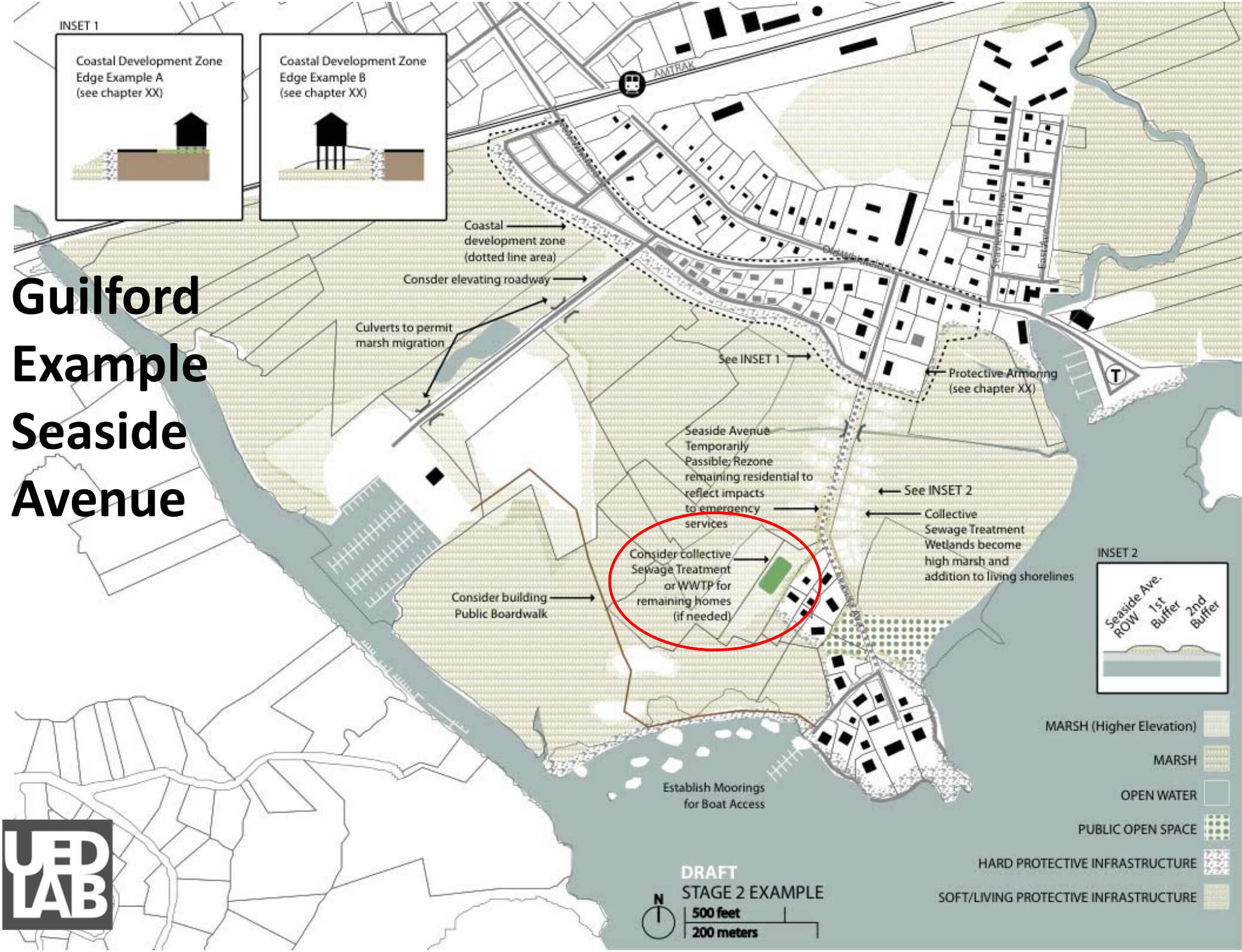
Guilford Example Seaside Avenue



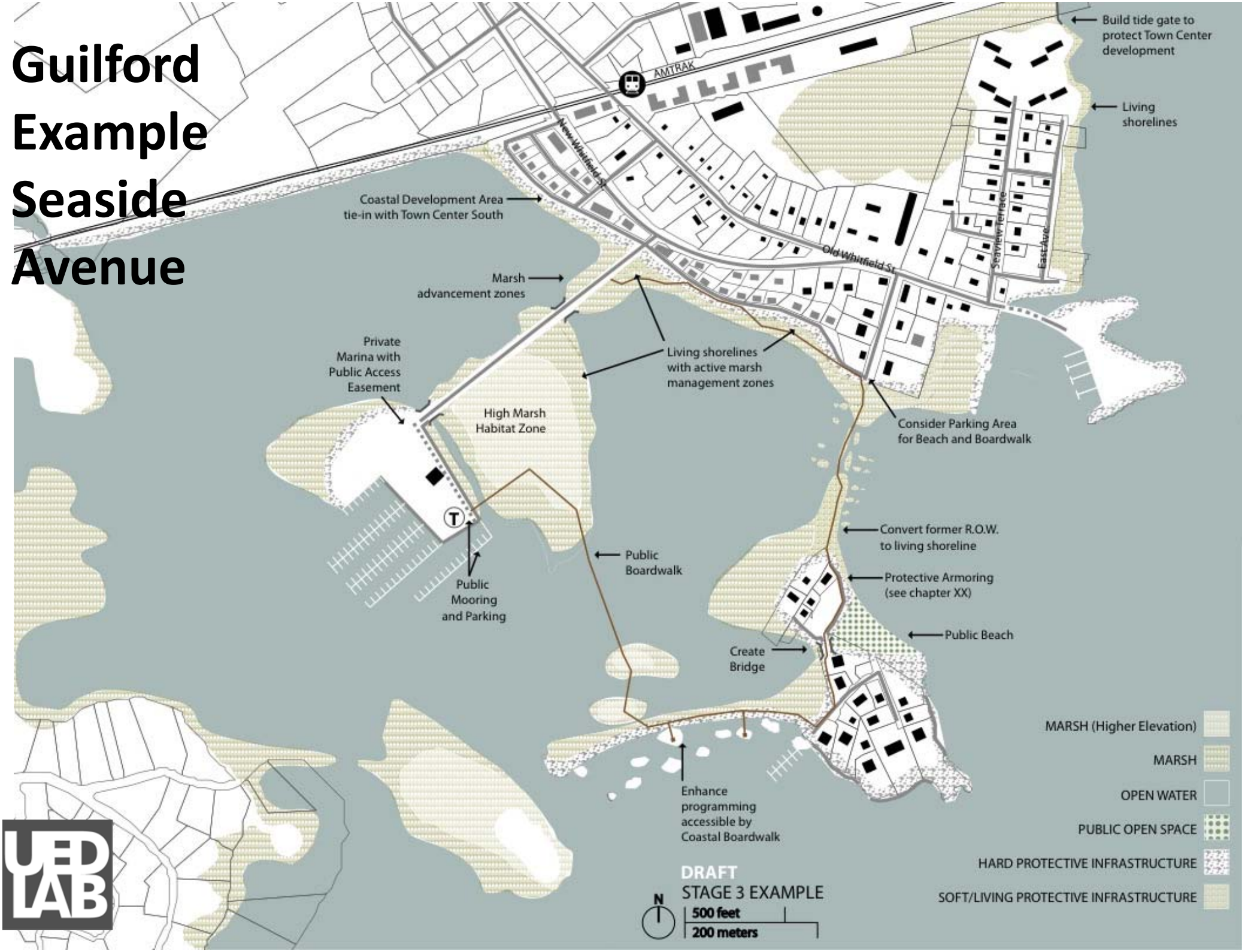
Guilford Example Seaside Avenue



Guilford Example Seaside Avenue



Guilford Example Seaside Avenue



Groton (Town)

- Groton has completed EPA-funded climate change planning (2011), an updated hazard mitigation plan (2012), and the update of its Municipal Coastal Program (draft, 2014)
  - This is the airport area plan

Note the pumping station call-out

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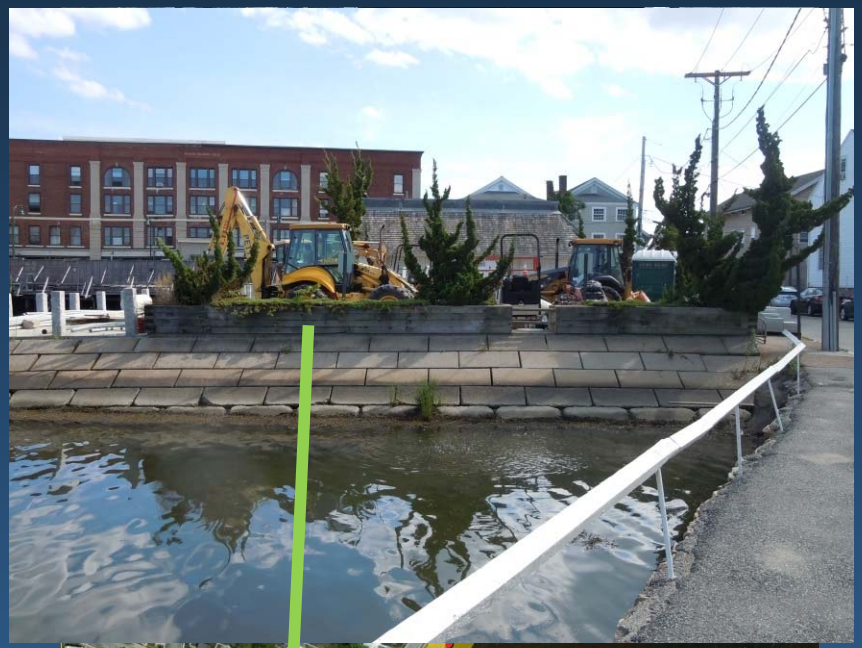
Groton (Town)

This is the Mystic area plan

Note the pumping station call-out



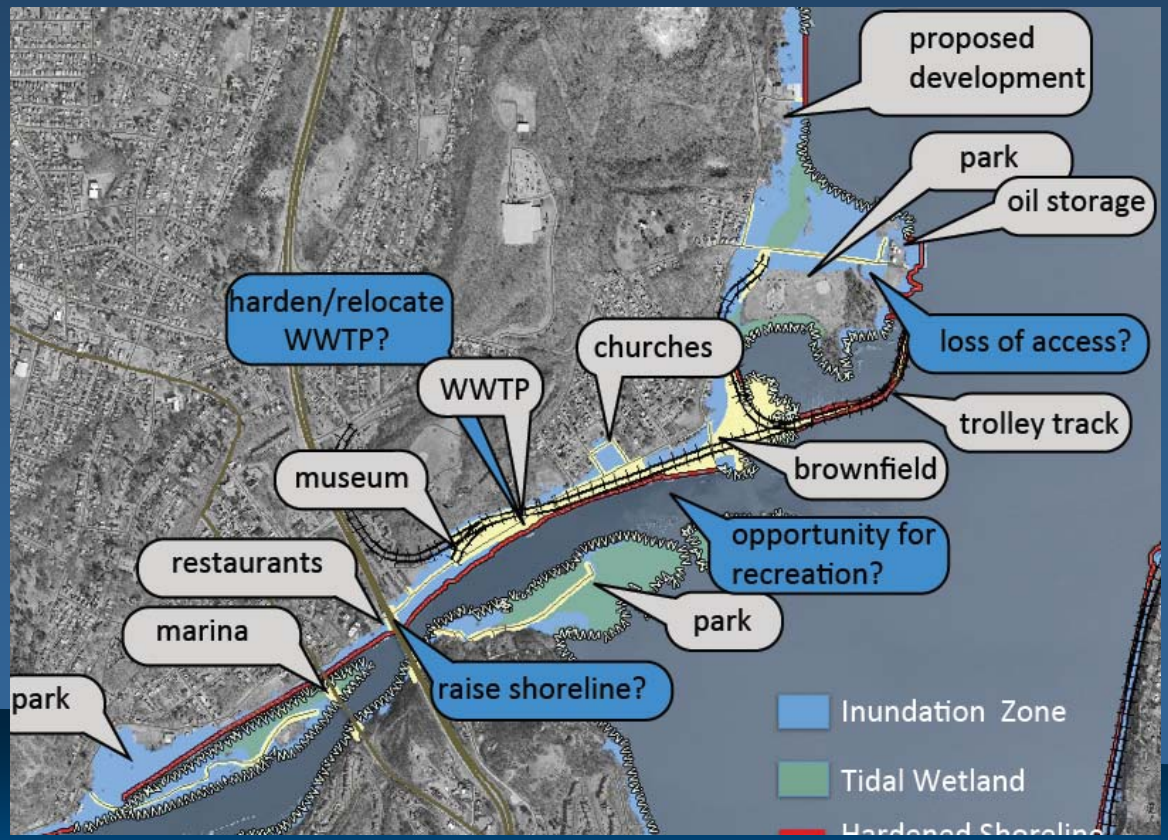
Who Else is Planning in Connecticut?

- Greenwich has evaluated flood risks at individual properties and is working on improving effective notification and evacuation
- Old Saybrook has adopted stronger flood damage prevention codes and has formed a Sea Level Rise/Climate Adaptation Committee (SLR/CAC)
- Stonington has formed a Climate Change Task Force and is thinking about developing a coastal resilience plan
- Clinton has formed a Resiliency Planning Committee and its first meeting is on November 25
- Many other towns have hosted vulnerability workshops with The Nature Conservancy

Perhaps some of you are already involved?

Who is Planning in Other States?

- Kingston, NY
  - ✓ The City's treatment facility is along the tidal Rondout Creek near the Hudson River
  - ✓ This area floods frequently and flooding is projected to increase
  - ✓ The City has a Climate Action Plan (adopted 2012)



Source: City of Kingston

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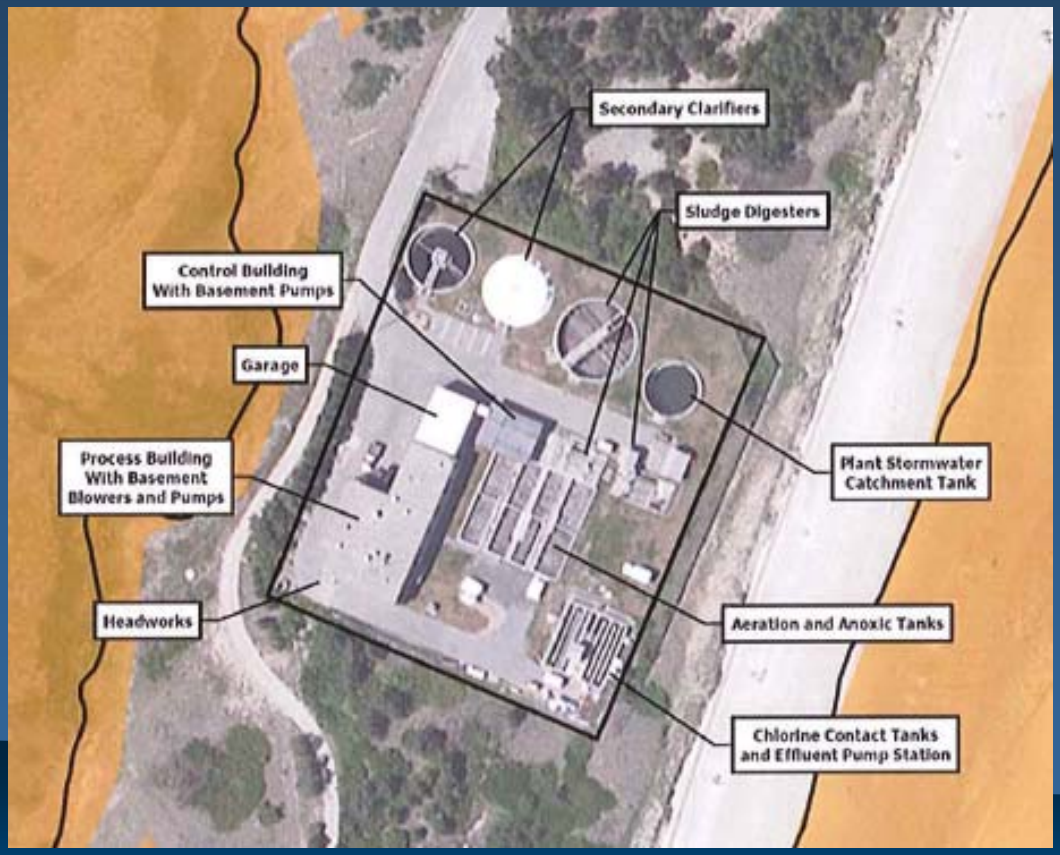
Who is Planning in Other States?

- Ogunquit, ME
  - ✓ Conducted evaluation of the wastewater treatment plant that is located on a barrier island
  - ✓ Determined that relocation of the facility was an option



Source: Town of Ogunquit

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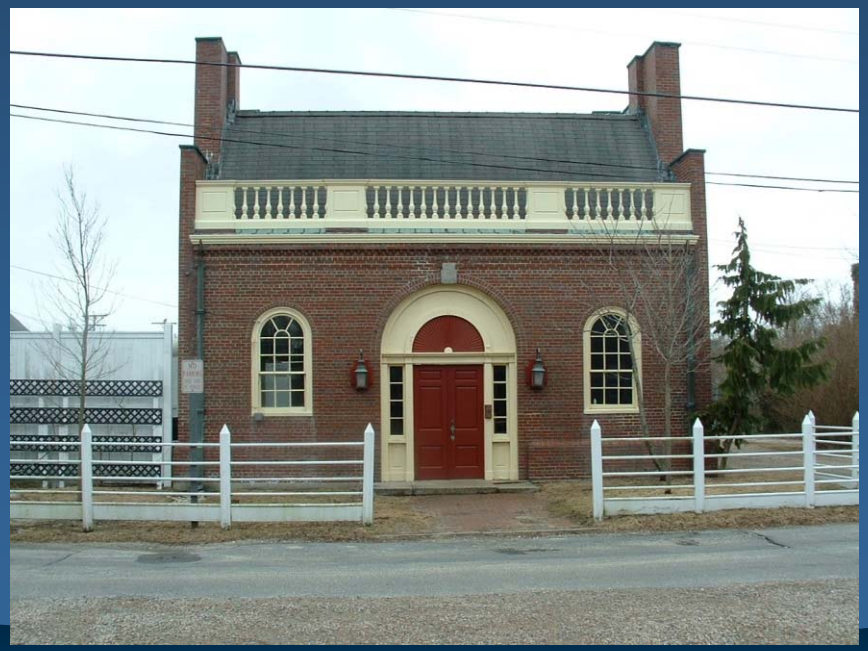
Who is Planning in Other States?

- Nantucket, MA
  - ✓ The Sconset wastewater facility was discussed in the Hazard Mitigation Plan
  - ✓ The effluent beds will need to be relocated when the shoreline has eroded to within a certain distance of the beds
  - ✓ The Sea Street sewer pumping station is regularly flooded and sandbags are used to protect it

Sconset Wastewater Effluent Beds



Sea Street Pumping Station

Who is Planning in Other States?

- Somerset County (MD) Rising Sea Level Guidance
  - ✓ **Adopt a Floodplain Planning Zone overlay; use 2050 projected inundation area as boundary**
  - ✓ Adopt V zone standards in A zones
  - ✓ Require 2 feet of freeboard
  - ✓ Regulate 500-year flood zones as SFHAs (A zones)
  - ✓ **Require site plans to show future areas for mounded or holding tank septic systems during subdivision and planning approvals**
  - ✓ Develop design criteria for elevating roads (bed material, etc.)
  - ✓ Require extra cross drains along roads
  - ✓ Install backflow prevention along drainage systems

Who is Planning in Other States?

- SLR Technical Guidance for Dorchester County (MD)
  - ✓ **<u>Adopt Sea Level Rise Overlay District; use 25-year high scenario as boundary</u>**
  - ✓ Overlay District will prohibit or strictly control some activities (prohibit expansions, restrict renovations)
  - ✓ **<u>Prohibit investment of new infrastructure in SLR Overlay</u>**
  - ✓ Provide for closure of inundated roads and termination of road maintenance when only a few homes are served or where the cost of maintenance exceeds value of homes
  - ✓ Require 2 feet of freeboard
  - ✓ Require wellheads to be elevated above future flood levels
  - ✓ Create Economic Development Department to assist businesses
  - ✓ Identify properties for acquisition/demolition

Who is Planning in Other States?

- City of Lewes (DE) Adaptation Action Plan
  - ✓ Integrate adaptation into Comp Plan
  - ✓ Amend zoning code to require freeboard, create strict floodproofing requirements for critical facilities, prohibit expansions of buildings in flood zones, and create floodplain setbacks
  - ✓ Increase standards in the Floodplain, Drainage, Stormwater, and Erosion/Sediment Control sections of Zoning Code
  - ✓ Provide financial incentives to build above code
  - ✓ **Allocate funds to capital improvements**
  - ✓ Consider stormwater utility
  - ✓ Consider beach nourishment tax district
  - ✓ Create buffers zones for marsh migration

Funding Sources

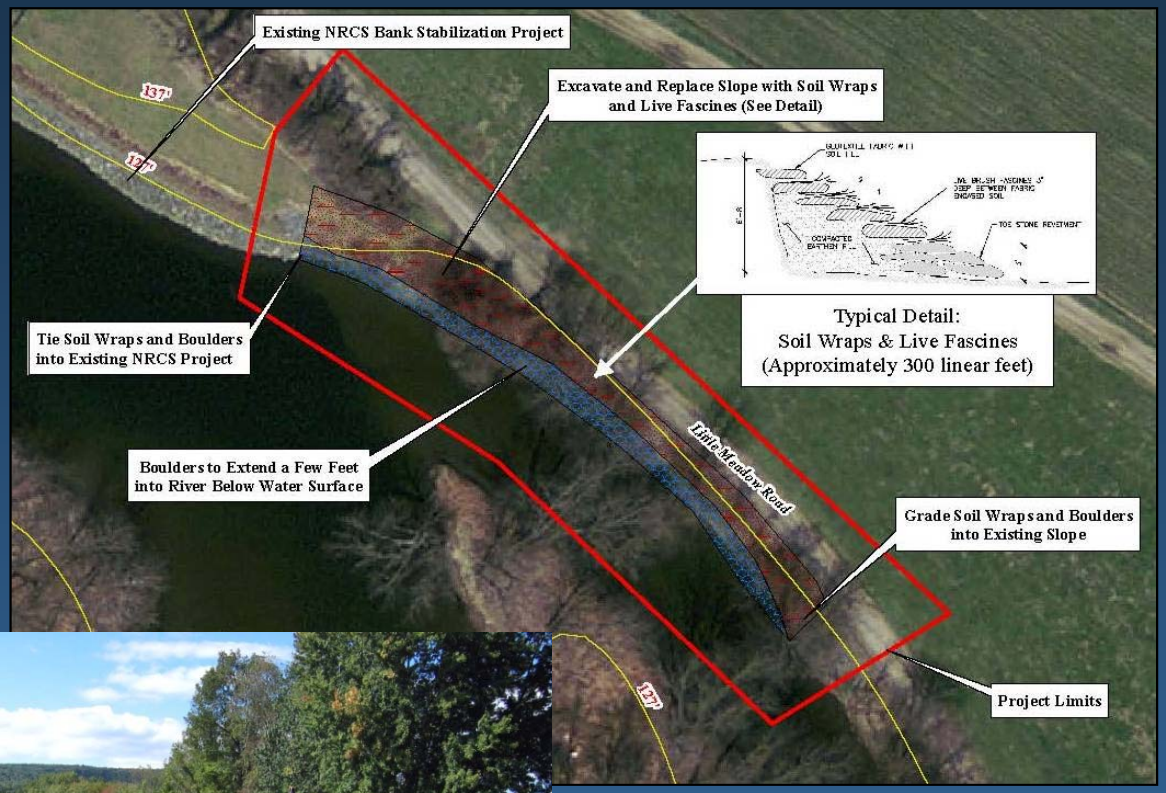
- FEMA post-disaster and pre-disaster mitigation grants
- NOAA planning grants
- Post-Sandy grants and competitions
- EPA/State Clean Water Funds
- Army Corps of Engineers
- Other State of Connecticut

Funding Sources

- FEMA post-disaster mitigation grants – ensure that reconstruction is to a higher standard and more resilient
  - ✓ Challenging to ensure that the "upgrade" occurs while reconstructing after the disaster
- FEMA pre-disaster mitigation grants
  - ✓ Necessary to demonstrate a potential for significant losses if the project is not funded
  - ✓ This will drive up the benefit cost ratio and make the project eligible
  - ✓ Examples in western Massachusetts where loss of sewer system service was used to calculate project benefits

Funding Sources

- Deerfield, MA



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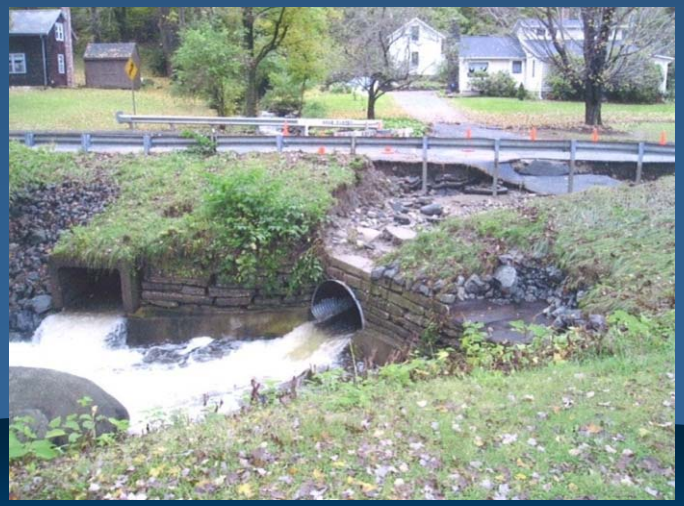
Funding Sources

- Buckland, MA

Gloria
1985

Floyd
1999



October
2005

Irene
2011

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Funding Sources

- NOAA coastal resilience planning grants
  - ✓ Funded Guilford's coastal resilience plan
  - ✓ Funded Greenwich's assessment of building flood risks
  - ✓ Has also funded many plans outside Connecticut
- Post-Sandy grants and competitions
  - ✓ Largely through the FY 2013 Disaster Relief Appropriations Act
  - ✓ CDBG is being used to administer disaster recovery grants in many states including Connecticut
  - ✓ CDBG-DR planning grant of $150,000 awarded to Branford, Madison, and Milford
  - ✓ DOI/NFWF grant of $700,000 awarded to SCRCOG for coastal resilience planning in southern Connecticut
  - ✓ Bridgeport was a HUD/Rebuild by Design competition "loser" but the consolation prize was $1 million for planning and projects

Funding Sources

- EPA/State CWF
  - ✓ Clean Water State Revolving Fund (CWSRF) supports a variety of water quality protection projects, including those that address nonpoint source pollution, watershed protection, and municipal wastewater treatment.
  - ✓ CWSRF was identified by President Obama in the 2013 Climate Action Plan as a key tool for climate change preparedness
  - ✓ Administered by CT DEEP as the Clean Water Fund (CWF) and its parts (Water Pollution Control State account and the Federal Revolving Loan account)

Funding Sources

- Army Corps of Engineers
  - ✓ Currently funding riverbank stabilization at Middletown's public water supply wellfield
  - ✓ Section 205 – Small Flood Damage Reduction Projects
  - ✓ Section 14 – Emergency Streambank and Shoreline Protection
  - ✓ Section 103 – Hurricane and Storm Damage Reduction Projects
  - ✓ Section 206 – Floodplain Management Services
- State of Connecticut
  - ✓ Become a CT Sea Grant research project
- Small Town Economic Assistance Program (STEAP)
  - ✓ If all else fails, apply for a STEAP grant?
  - ✓ Wastewater and sewer projects have been partly funded by STEAP

Questions?