TOWN OF BRANFORD
COASTAL RESILIENCE PLAN

Presentation of Vulnerability/Risk Assessment

Janice Plaziak, P.E., Town of Branford
David Murphy, P.E., CFM, Milone & MacBroom, Inc.
Scott Choquette, CFM, Dewberry

Town of Branford, Connecticut | November 18, 2015

Presentation Agenda

- Coastal Resilience Background
- Project Funding and Planning Steps
- Assessing Vulnerabilities and Risk
- What is Vulnerable and What is at Risk?
- Inundation and Surge Risks by Geography
- Additional Types of Risk in Selected Areas
- Next Steps
- Questions and Discussion

What is Coastal Resilience?

- **Resilience** is "the ability of any system (infrastructure, government, business, and citizenry) to resist, absorb and recover from or successfully adapt to an adversity"
- **Community** Resilience is "the ability of a community to prepare for anticipated hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions." - NIST
- **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.

A home is elevated in Branford
Photo: Shoreline Times

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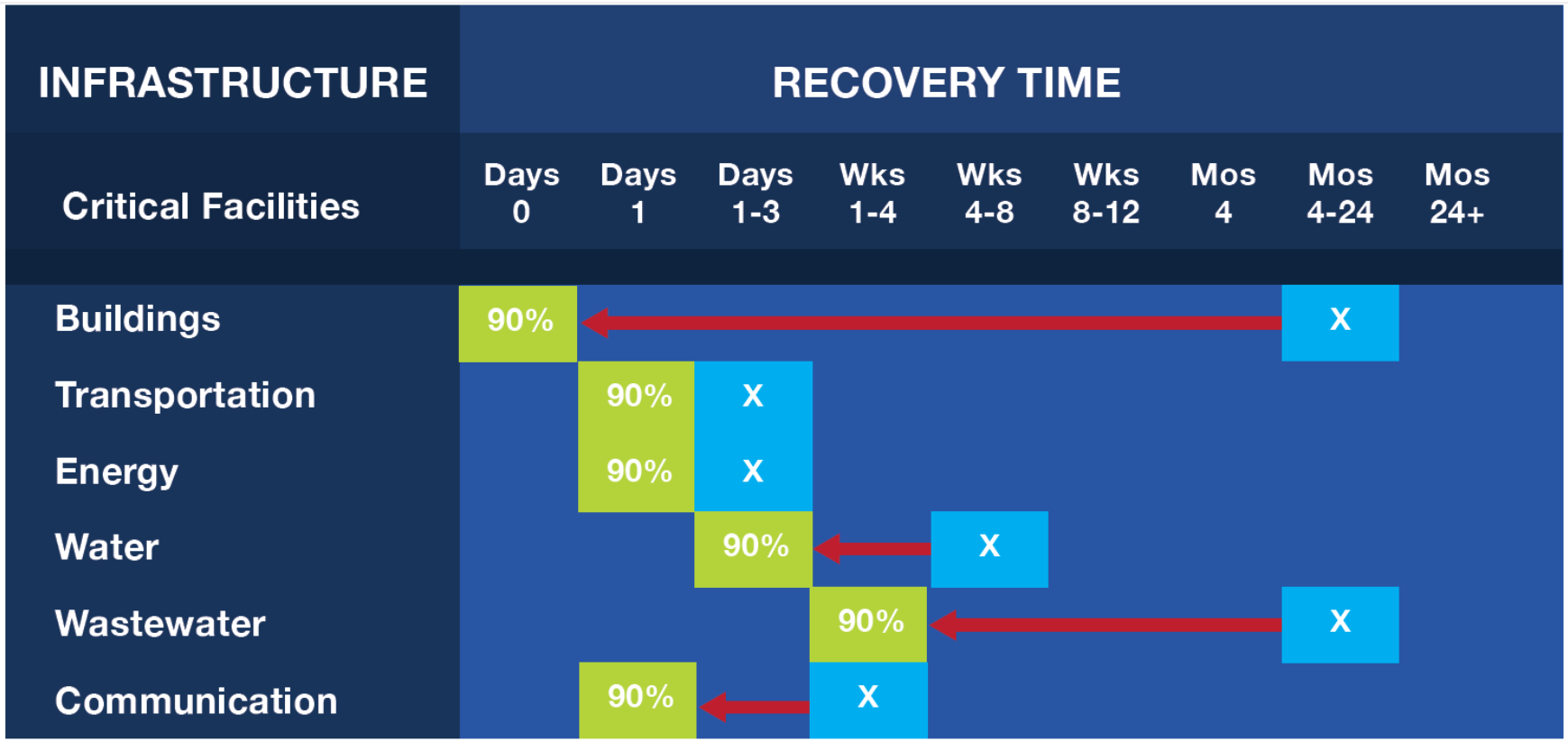
What is Coastal Resilience?



Where we want to be

Where we are now

Closing the gap

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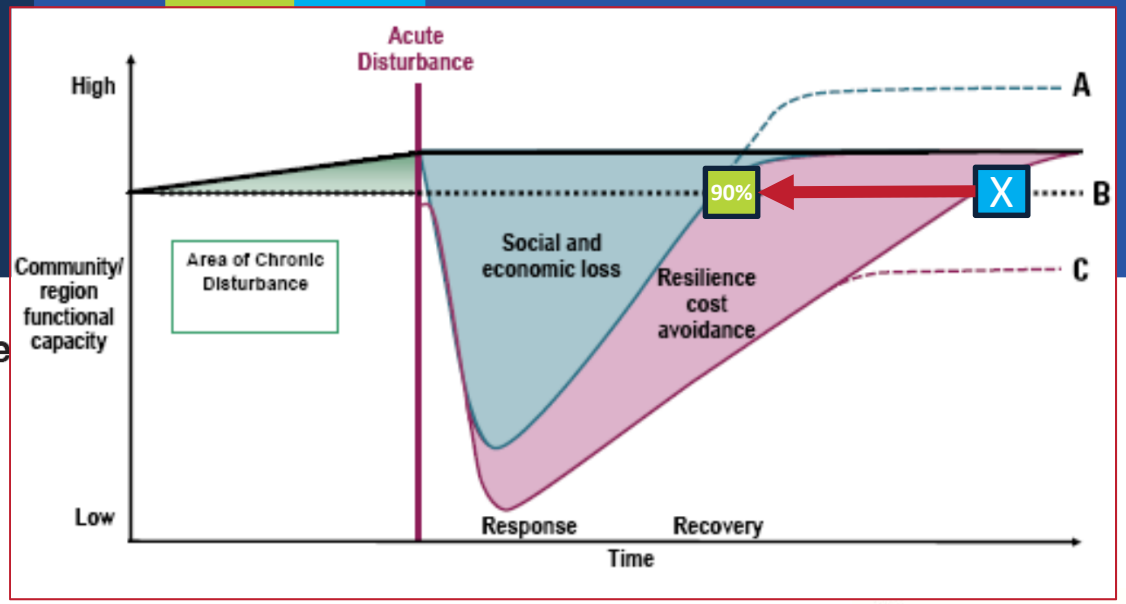
What is Coastal Resilience?

INFRASTRUCTURE	RECOVERY TIME								
Critical Facilities	Days 0	Days 1	Days 1-3	Wks 1-4	Wks 4-8	Wks 8-12	Mos 4	Mos 4-24	Mos 24+
Buildings	90%							X	
Transportation		90%	X						
Energy		90%	X						
Water									
Wastewater									
Communication									



Where we want to be

Where we are now

Closing the gap

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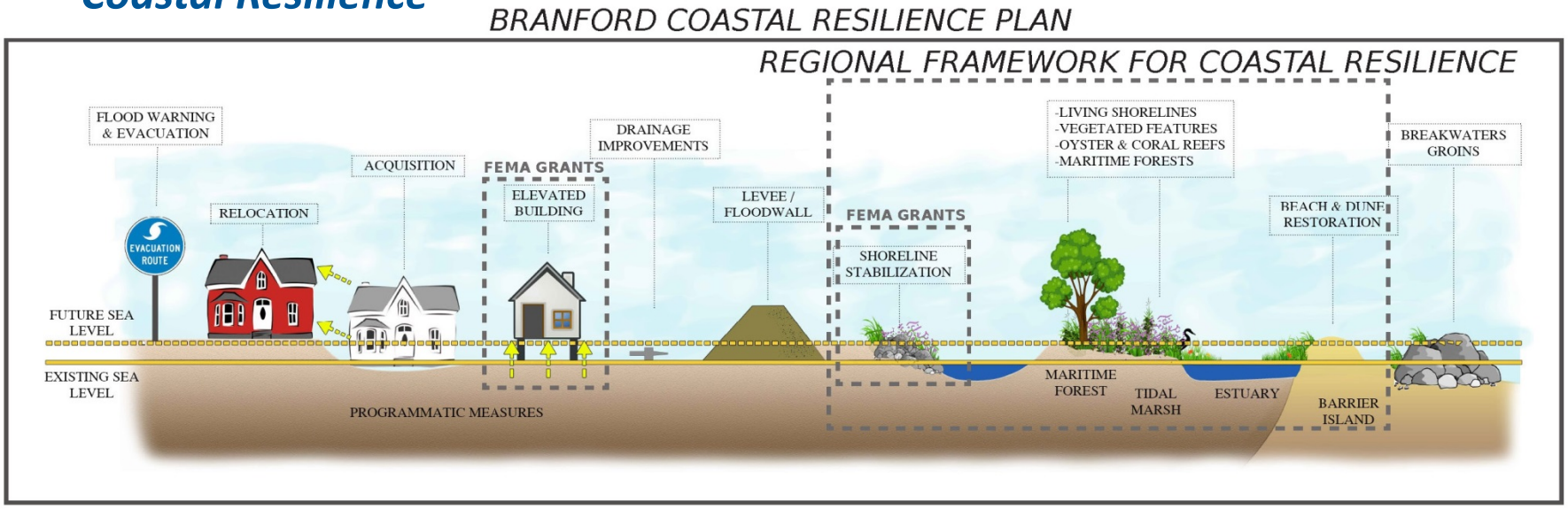
Project Funding

- **CDBG-DR to develop coastal resilience plan**
- **Goal is to "increase social, economic, and ecological resilience of Branford in the face of sea level rise and increases in the frequency and severity of storm surges, coastal flooding, and erosion"**
- **Interface with the *Regional Framework for Coastal Resilience***

COMMUNITY PLANNING & DEVELOPMENT

CDBG Disaster Recovery Eligible Activities



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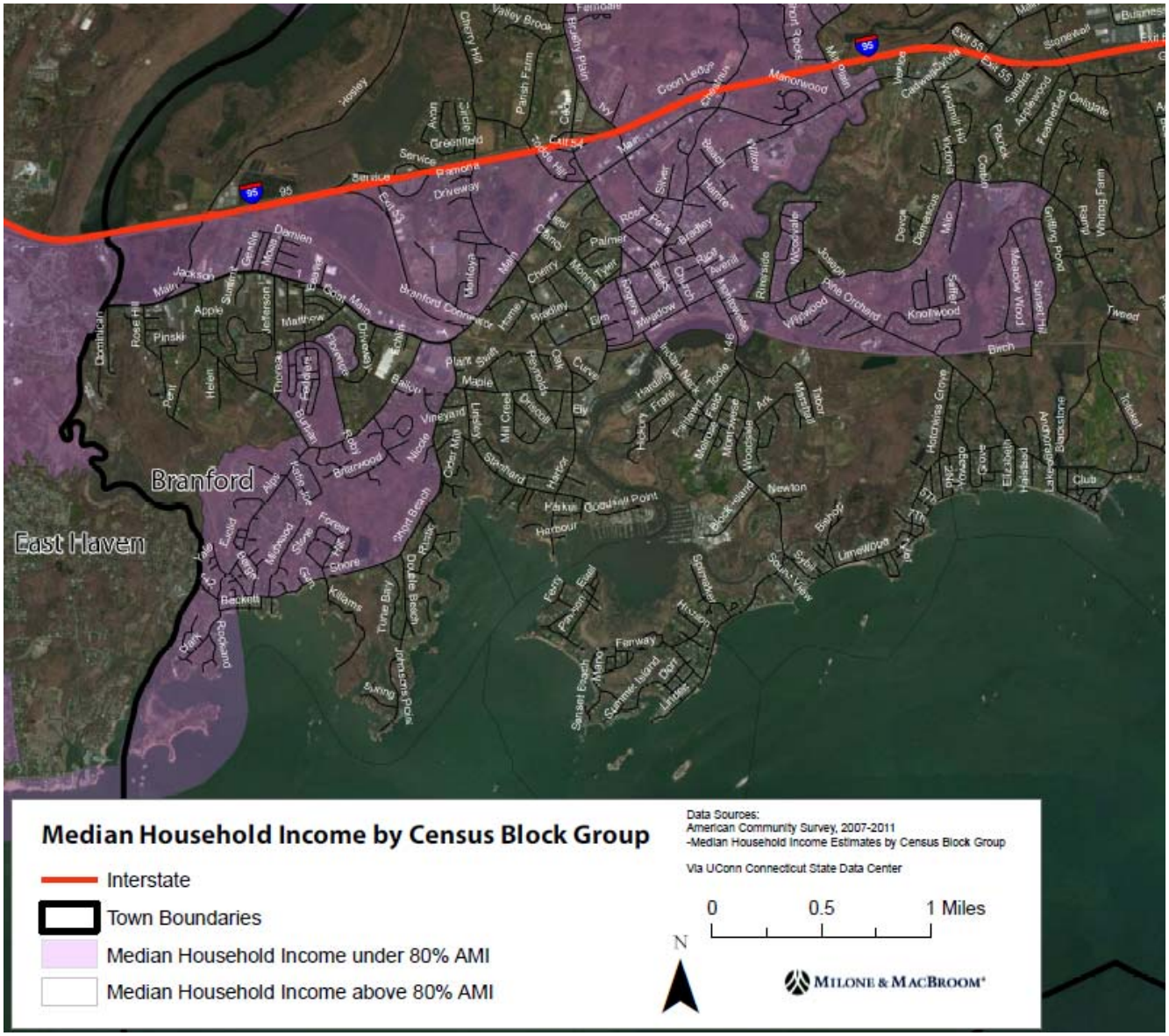
Project Funding



- **Will be important to demonstrate the benefit to populations with unmet needs and low-to-moderate income populations**

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Planning Steps

1. Review of Existing Programs, Plans, and Capabilities
2. Coordinate with "Regional Framework for Coastal Resilience"
3. Data Collection
4. Vulnerability and Risk Assessment
5. Review of Adaptation Options
6. Public Information Meetings, Surveys
7. Selection of Sandy-Impacted Neighborhoods for Planning

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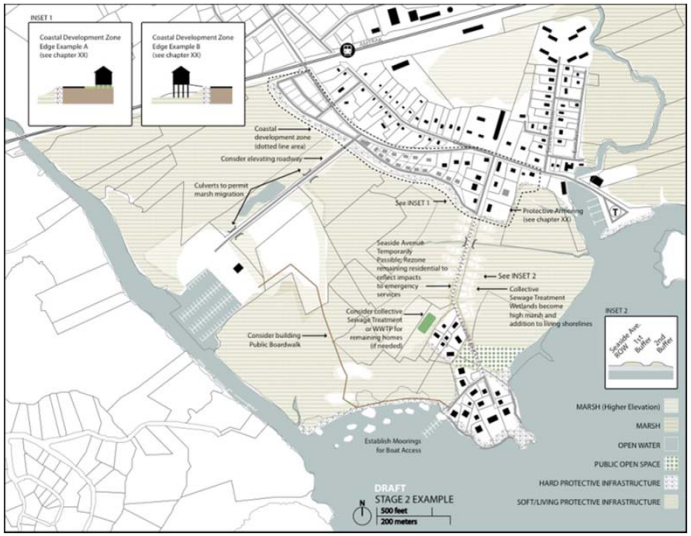
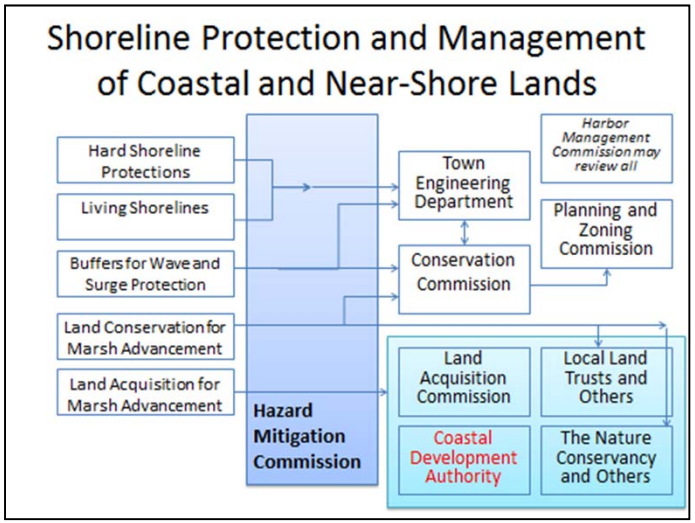
Planning Steps (continued)

8. **Coastal Resilience Plan Document**
   Combinations of coastal hazard mitigation, adaptation, and resilience solutions at the locations that are highlighted in Task 7, as well as strategies and actions for the entire town

9. **Implementation Plan and Process**

10. **Conceptual Designs**
    Adaptation options advanced to concept design in two areas





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Assessing Vulnerabilities and Risk

Risk: commonly defined as Vulnerability x Frequency:

- Low Risk: event with a **low** frequency and **few** people, structures, or infrastructure are vulnerable to the effects of that event.
  - Connecticut Example: Earthquakes

Minor damage in Plainfield, CT, after a small quake in January
Photo: wtnh.com

- High Risk: event with a **high** frequency and **many** people, structures, or infrastructure are vulnerable to the effects of that event.
  - Connecticut Example: Floods

Flooding on Driscoll Road after Sandy
Photo: Branford Eagle

- Moderate Risk: Either **low** frequency coupled with **high** vulnerability or **high** frequency coupled with **low** vulnerability.

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Assessing Vulnerabilities and Risk

- **Branford has conducted the subject risk and vulnerability assessment as a step toward developing a Coastal Resilience Plan**

Vulnerability Assessment

2020
2050
2080

Infrastructure
Natural
Societal

Daily Inundation
Chronic Storms
Major Storms

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Assessing Vulnerabilities and Risk

- **The risk assessment relies on sea level rise projections generated under contract between The Nature Conservancy and Columbia University's Earth Institute/NASA Goddard Institute for Space Studies in 2010-2011**

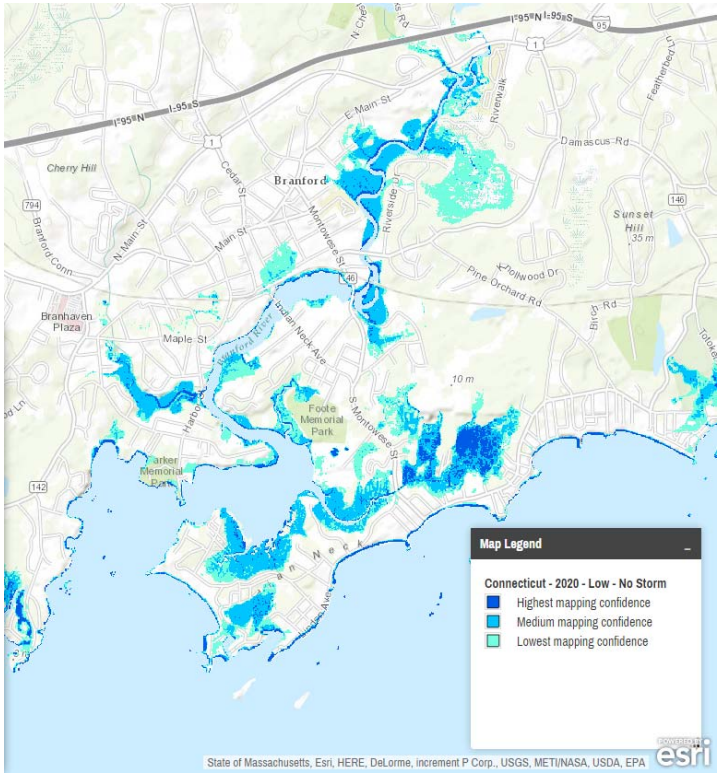
Scenarios	2020	2050	2080
Conservative	3.5 inches	10 inches	18.5 inches
Medium	3.5 inches	10 inches	20 inches
High	9 inches	26 inches	52 inches

Assessing Vulnerabilities and Risk

- **2020s: scenarios mapped by TNC's coastal resilience viewer**

Decade	Condition	Sea Level Rise Estimates*	Elevation (feet, NAVD)
2020s	No Storm	High	3.7
		Medium	3.3
		Conservative	3.3
	Category 2	High	9.8
		Medium	9.4
		Conservative	9.4
	Category 3	High	12.8
		Medium	12.4
		Conservative	12.4

Source: TNC (www.coastalresilience.org)



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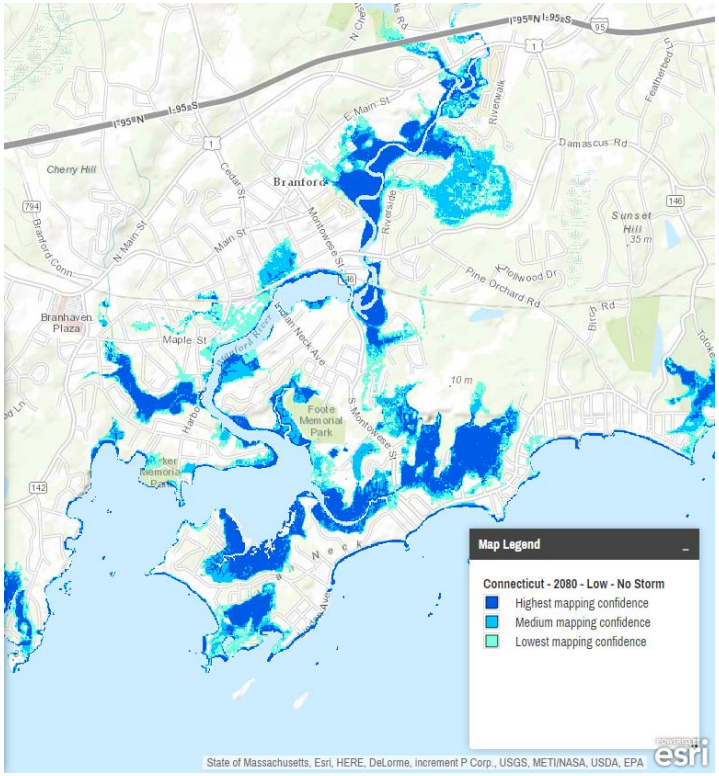
Assessing Vulnerabilities and Risk

- **2080s: scenarios mapped by TNC's coastal resilience viewer**

Decade	Condition	Sea Level Rise Estimates*	Elevation (feet, NAVD)
2080s	No Storm	High	7.3
		Medium	4.7
		Conservative	4.5
	Category 2	High	13.4
		Medium	10.8
		Conservative	10.6
	Category 3	High	16.4
		Medium	13.8
		Conservative	13.6

Source: TNC (www.coastalresilience.org)



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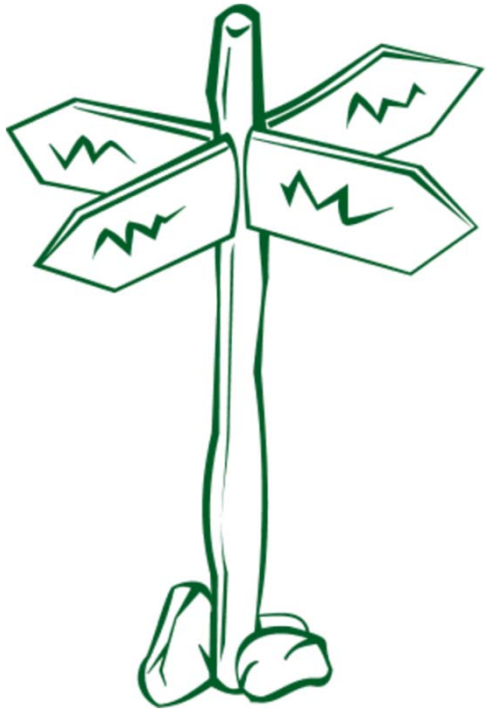
Assessing Vulnerabilities and Risk

Risk: commonly defined as Vulnerability x Frequency

Branford is 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 could be lowered in the face of rising sea level and increased coastal storms, leading to increased resilience.**



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What is Vulnerable and What is at Risk?

- **Socio-Economic**

  Residents, Commerce/Industry, Institutional/Municipal, Tourism, Development

- **Infrastructure**

  Roads, Bridges, Railroads, Stormwater Systems, Tide Gates, Seawalls/bulkheads, Boat Ramps, Public Works

- **Utilities**

  Sanitary Sewer System and WWTP, Public Water Systems, Private Water Supplies, Septic Systems, Electrical Grid, Communications

- **Critical Facilities**

  Fire, Police, Shelters, Evacuation Routes, Healthcare, Senior Living Facilities

- **Natural Systems**

  Tidal wetlands, other coastal landforms

What is Vulnerable and What is at Risk?

- **Socio-Economic**
  - **Residents**
  - **Commerce/Industry**
  - **Institutional/Municipal**
  - **Tourism**
  - **Future Development**

Branford Coast During Irene
Image: Branford Eagle

Meadow Street after Sandy
Image: Branford Eagle

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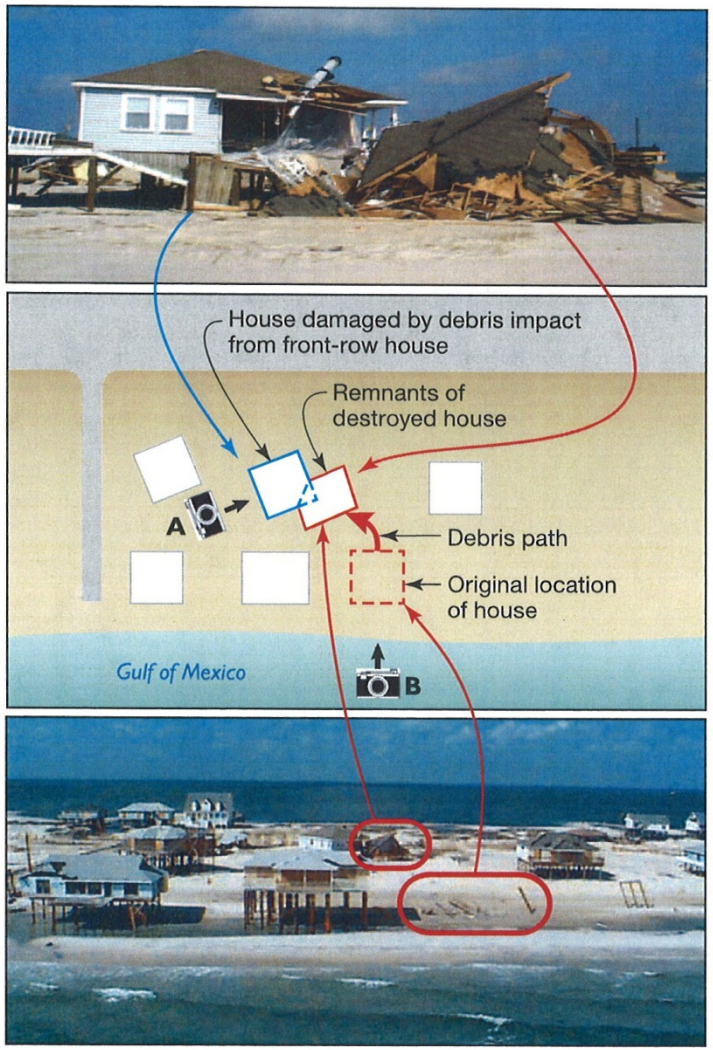
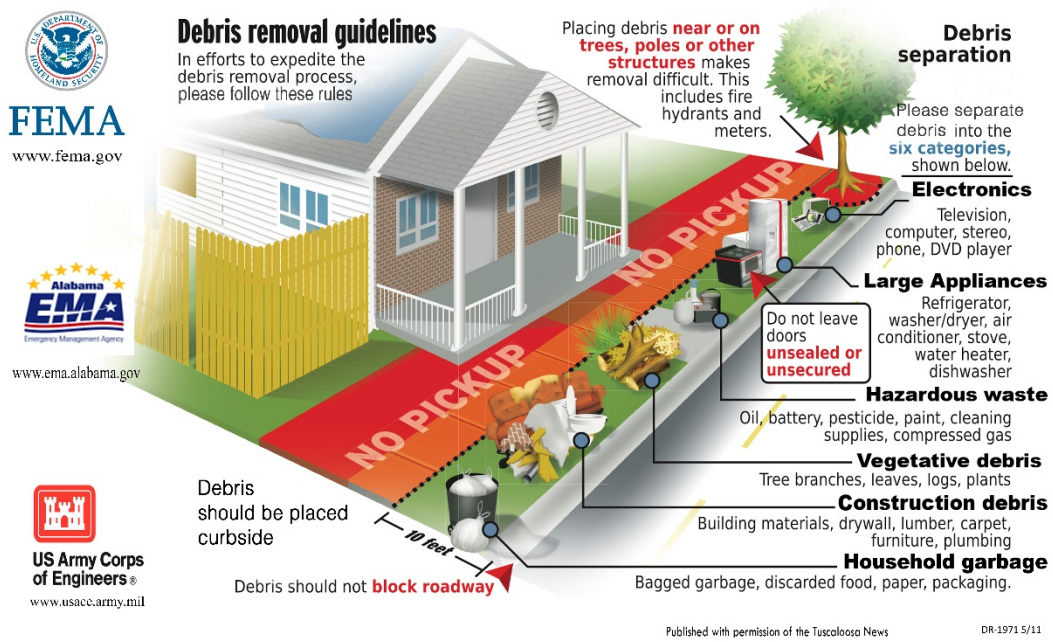
What is Vulnerable and What is at Risk?



- **Economic**
  - **Secondary Damage**
  - **Debris Removal**



Graphics courtesy of FEMA

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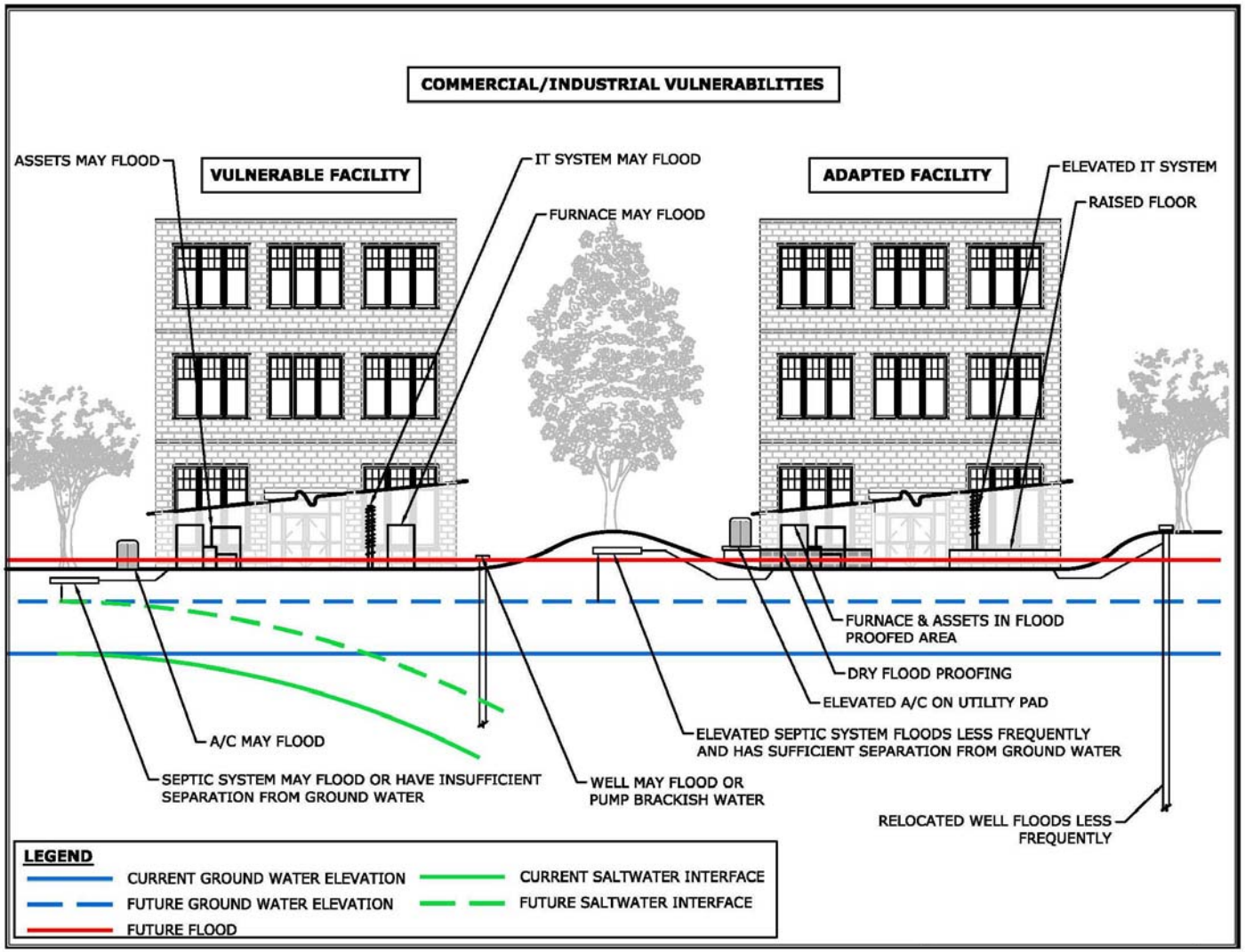
What is Vulnerable and What is at Risk?



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What is Vulnerable and What is at Risk?

- **Infrastructure**
  - **Roads**
  - **Bridges**
  - **Railroads**
  - **Stormwater Systems**
  - **Tide gates**

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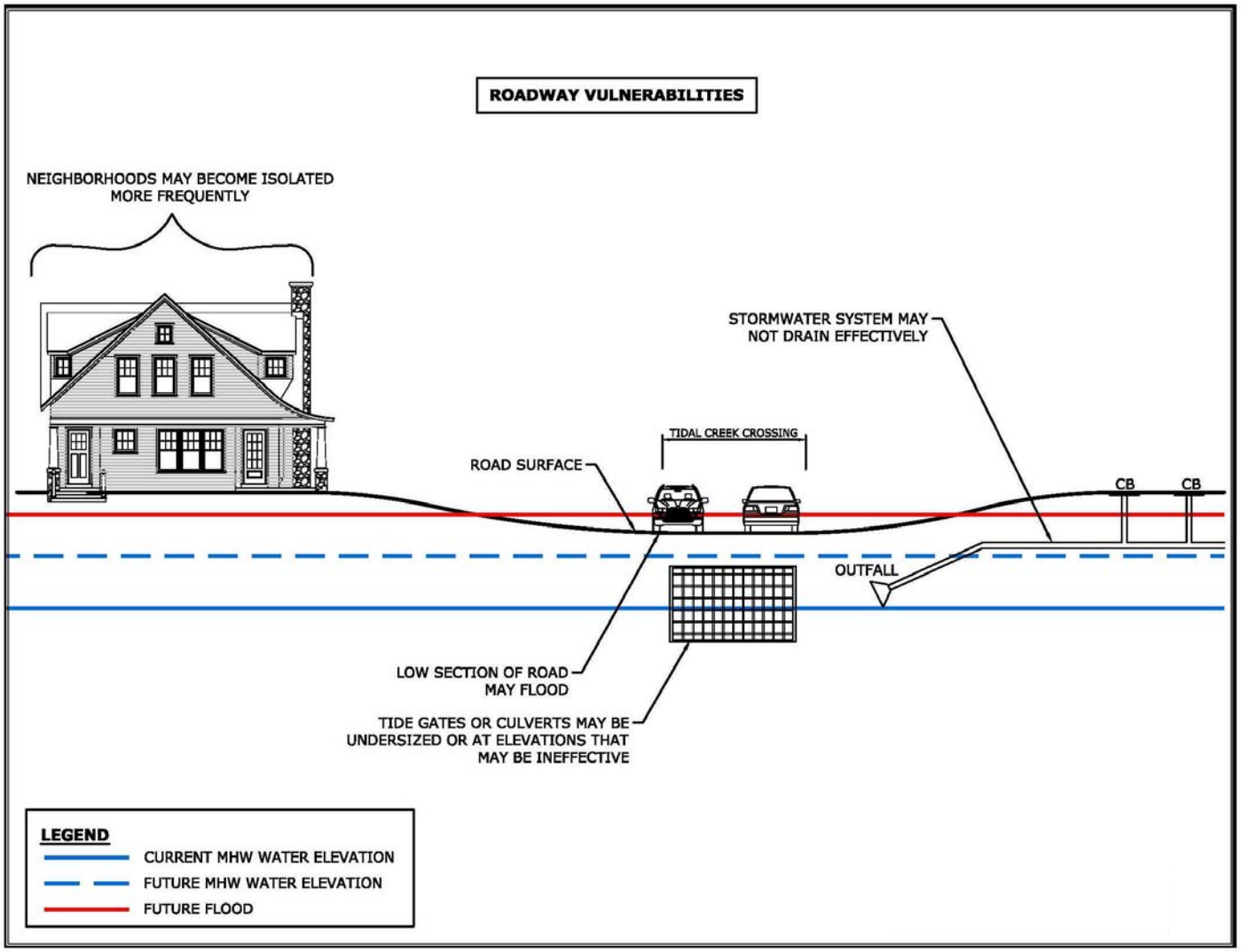
What is Vulnerable and What is at Risk?

- Infrastructu
  - **Roads**
  - Bridges
  - Railroads
  - Stormwat
  - Tide gates
  - Seawalls/
  - Boat Ram
  - Public Wo



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What is Vulnerable and What is at Risk?

- **Infrastructure**
  - **Seawalls/bulkheads**
  - **Marinas**
  - **Boat ramps**
  - **Public Works**

Collapsed seawall below Linden Ave
Image: Pam Johnson/The Sound

Repaired shoreline

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What is Vulnerable and What is at Risk?

- **Utilities**
  - **Public Water Systems**
  - **Private Water Supplies**
  - **Sewer System and WWTP**
  - **Septic Systems**
  - **Electrical Grid**
  - **Telecommunications**

A downed power lines near the CT Hospice
Image: The Branford Eagle

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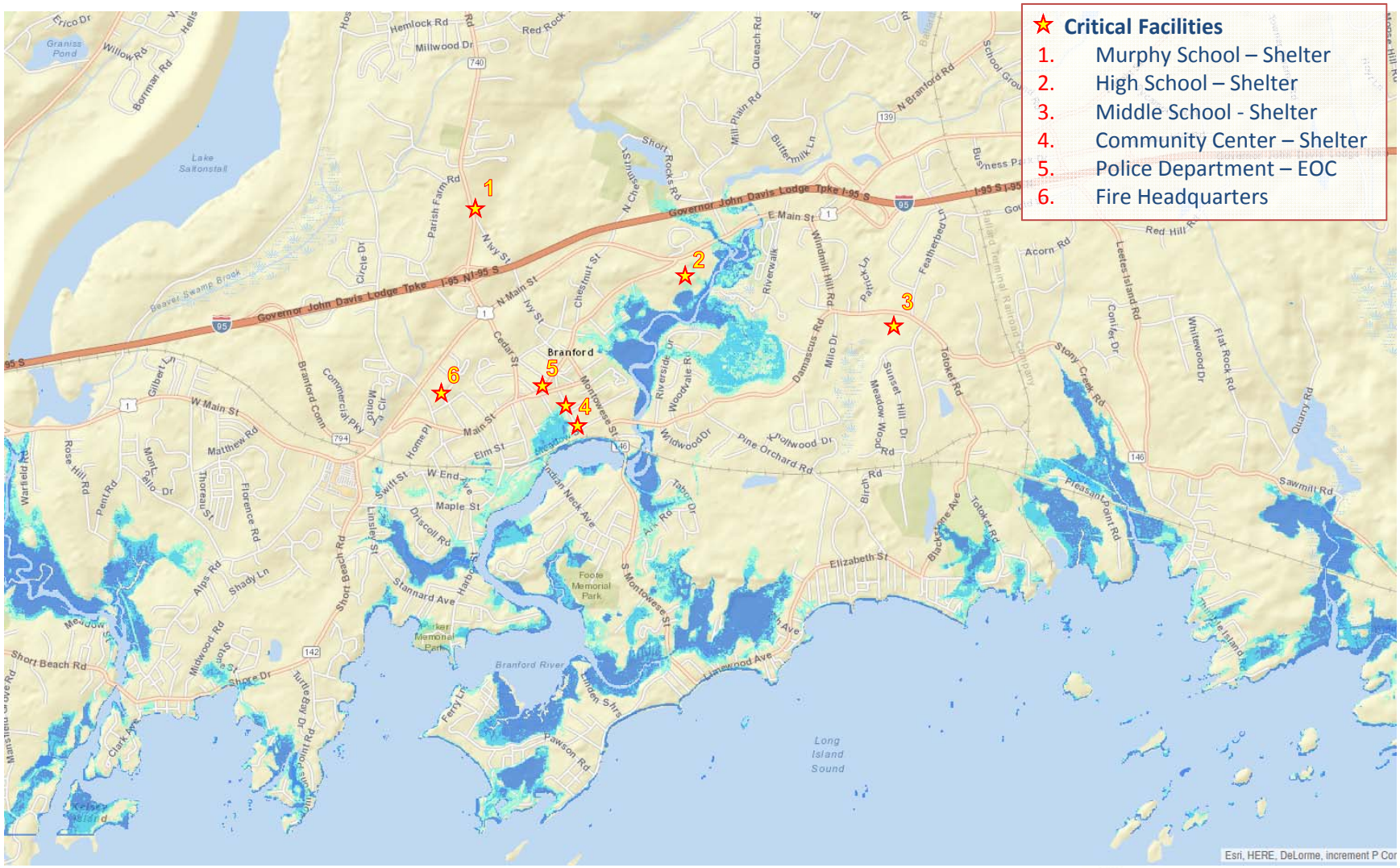
What is Vulnerable and What is at Risk?

- **Critical Facilities**
  - **Fire**
  - **Police**
  - **Shelters**
  - **Evacuation Routes**
  - **Healthcare**
  - **Senior Living Facilities**

What is Vulnerable and What is at Risk?

- **Critical Facilities**



2080 High Tide Projection

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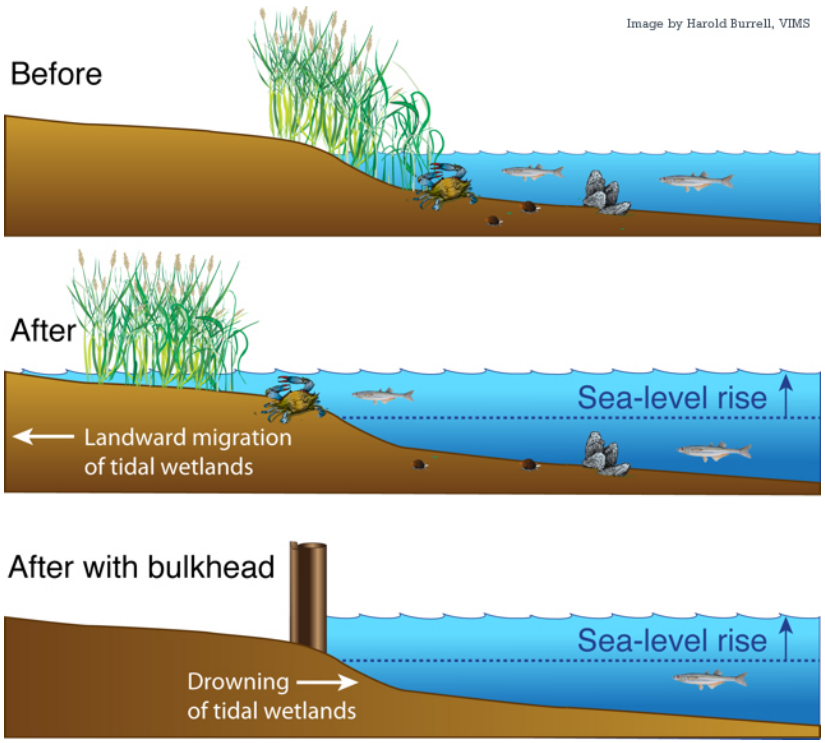
What is Vulnerable and What is at Risk?

- **Natural Systems**
  - **Tidal Wetlands**
  - **Other Coastal Landforms**



Tidal wetlands keep pace with slow rates of sea-level rise by migrating onto newly inundated land area.

If sea level rises faster than the marsh ecosystem can migrate, wetlands will be drowned.

If bulkheads or other structures are constructed to protect assets, wetlands cannot migrate and are drowned.

- Titus, J.G. 1991. Greenhouse Effect and Coastal Wetland Policy, *Environmental Management.* 15(1):39-58

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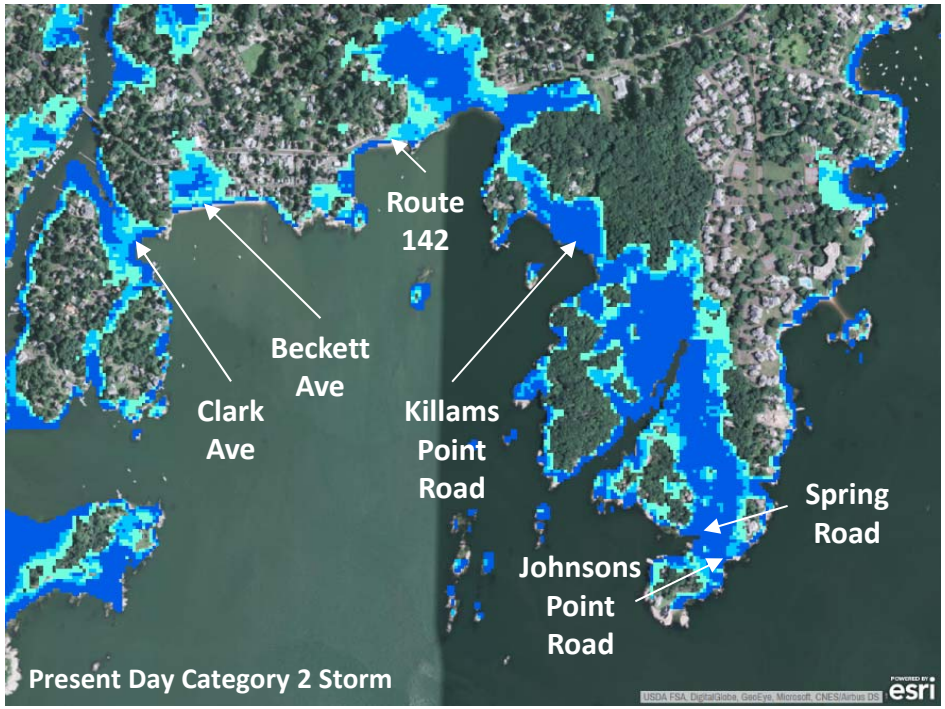
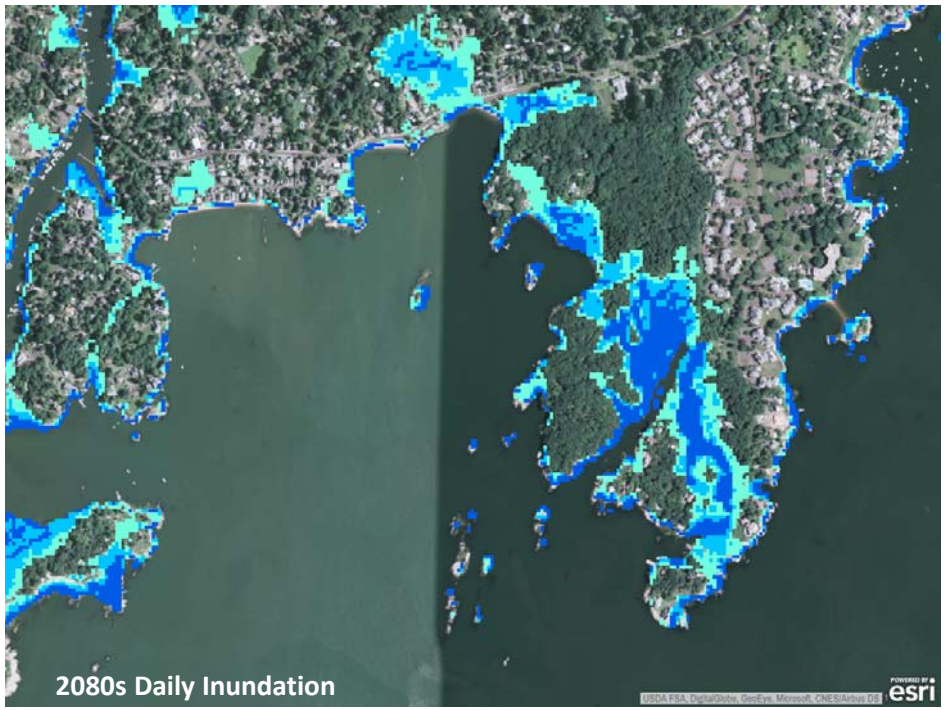
Inundation and Surge Risks by Geography

- **Paynes Point, Short Beach, Johnsons Point**





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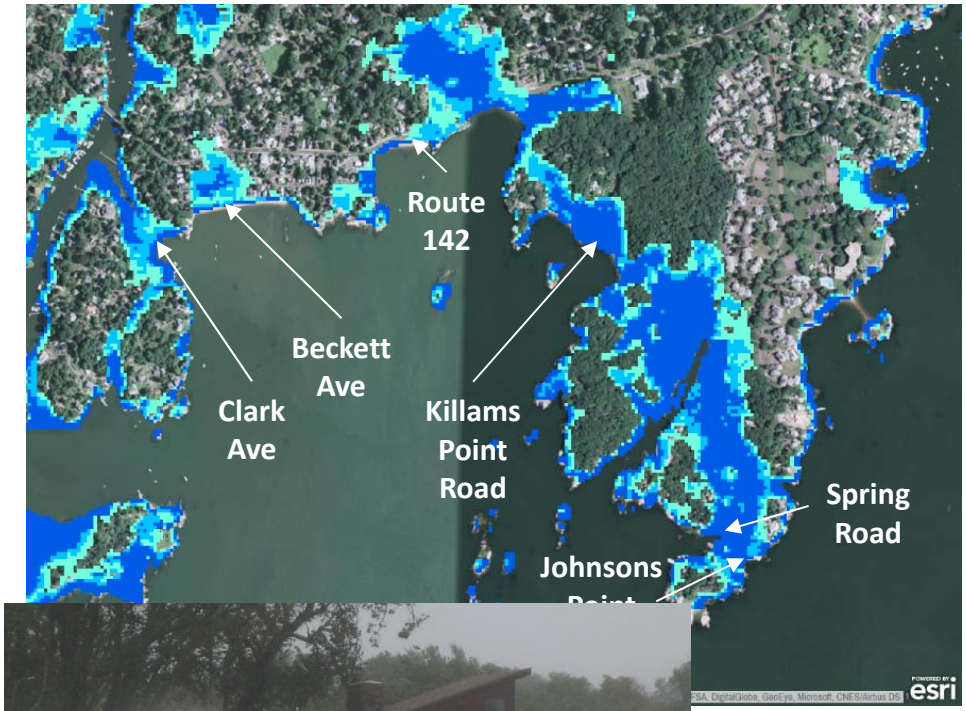
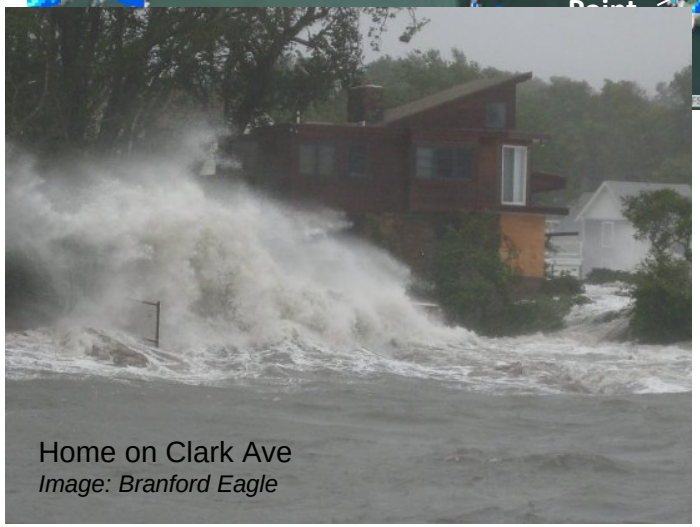
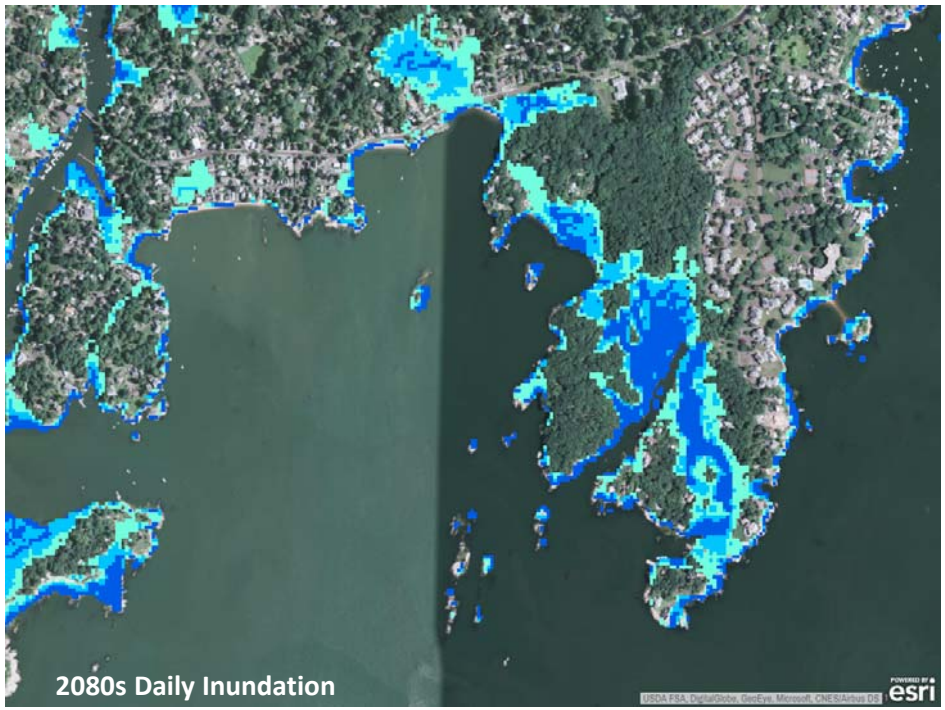
Inundation and Surge Risks by Geography

- **Paynes Point, Short Beach, Johnsons Point**





Home on Clark Ave
Image: Branford Eagle



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Inundation and Surge Risks

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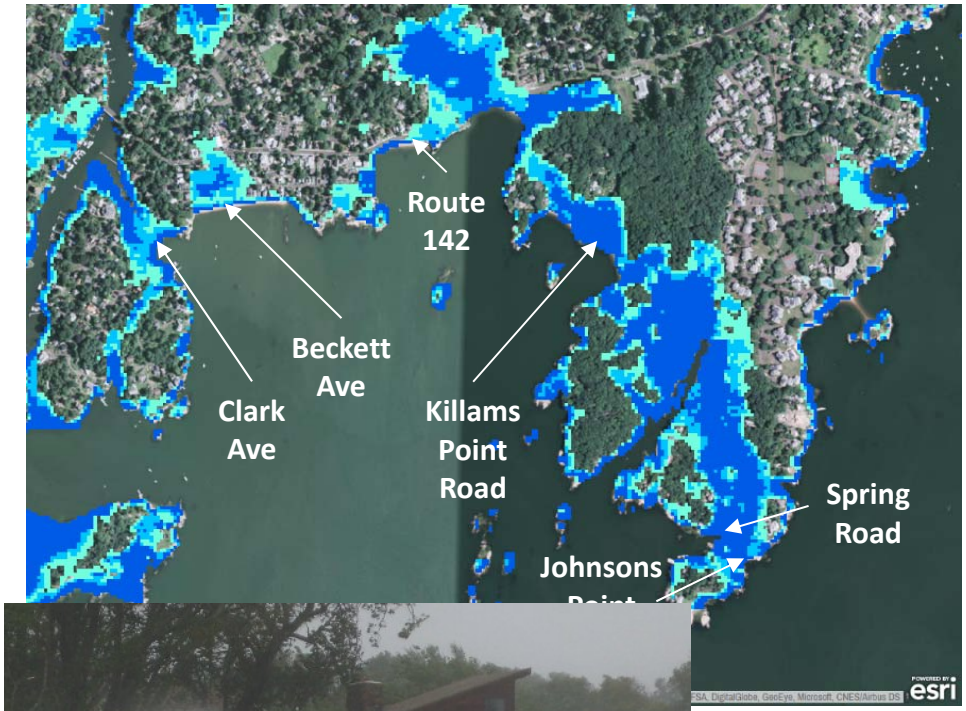
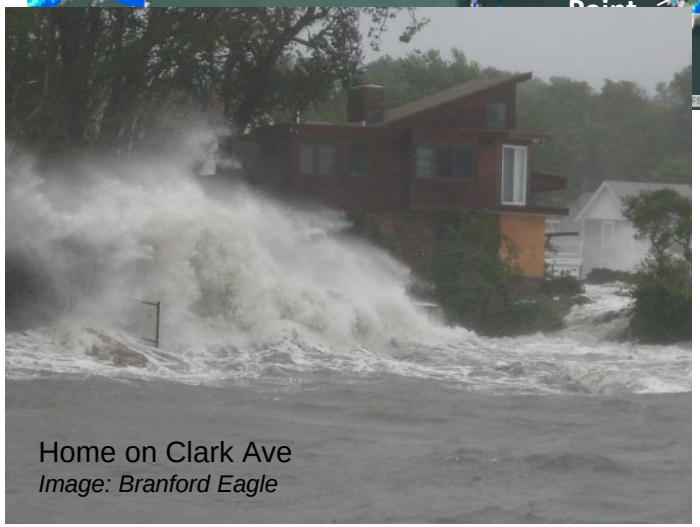
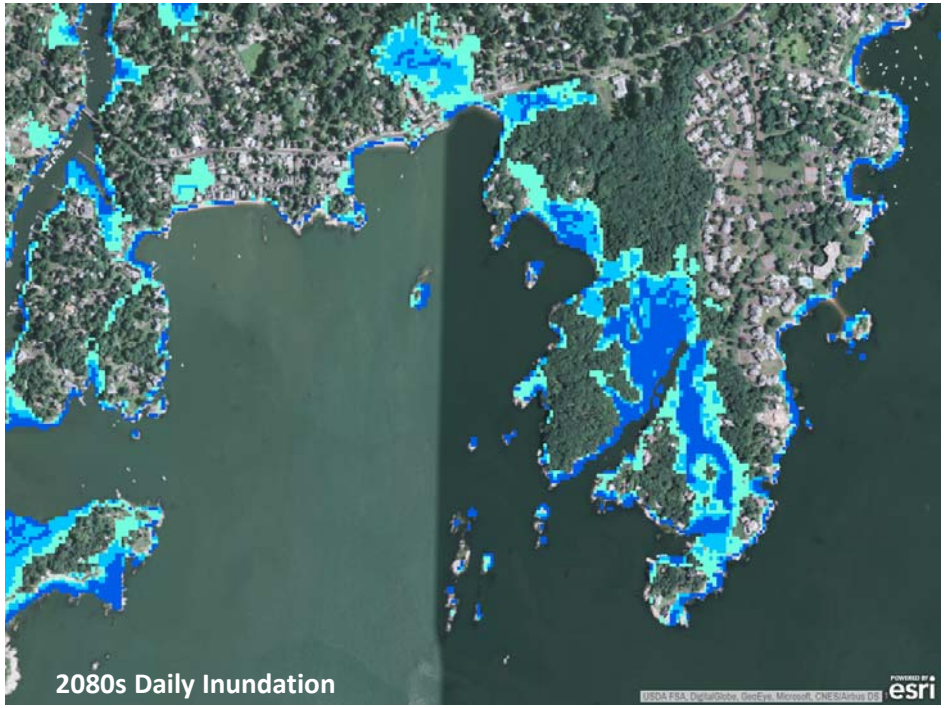


Short Beach
Image: Branford Eagle



Home on Clark Ave
Image: Branford Eagle



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Inundation and Surge Risks

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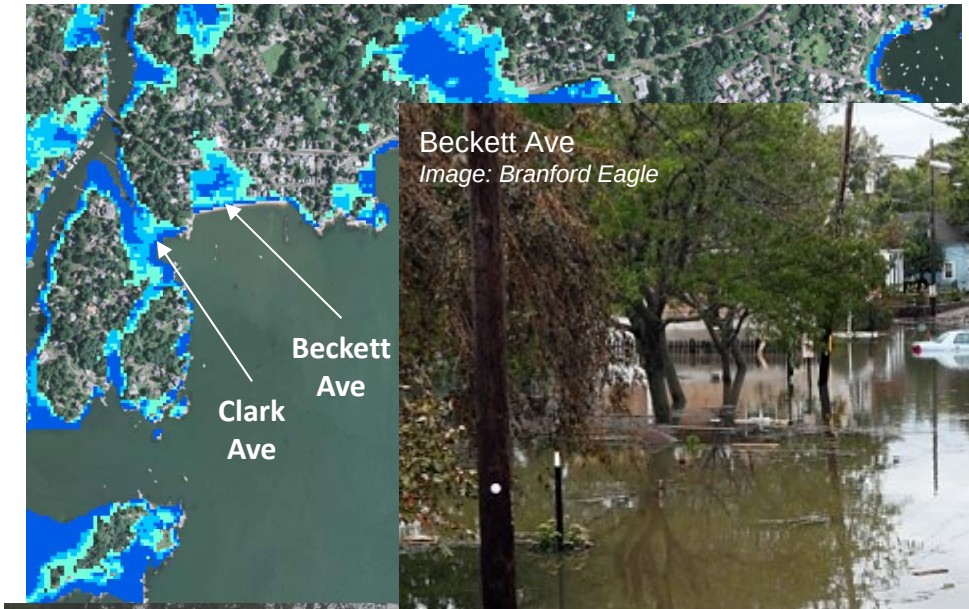
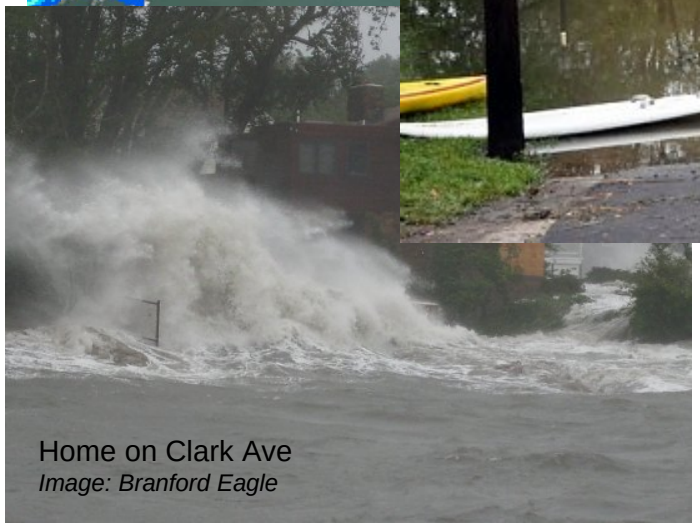
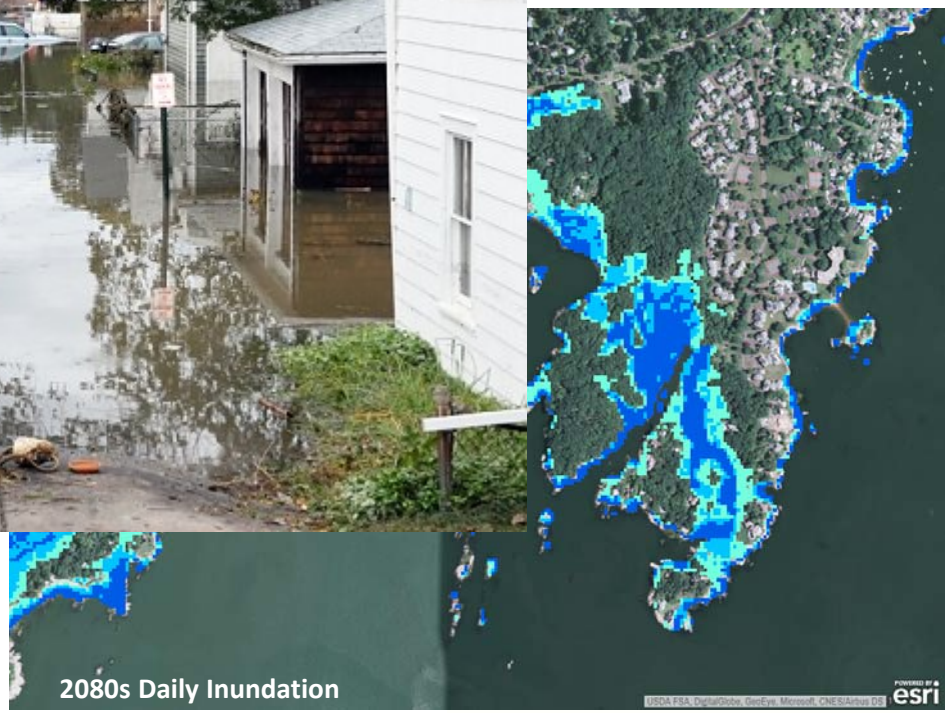


Beckett Ave
Image: Branford Eagle



Home on Clark Ave
Image: Branford Eagle



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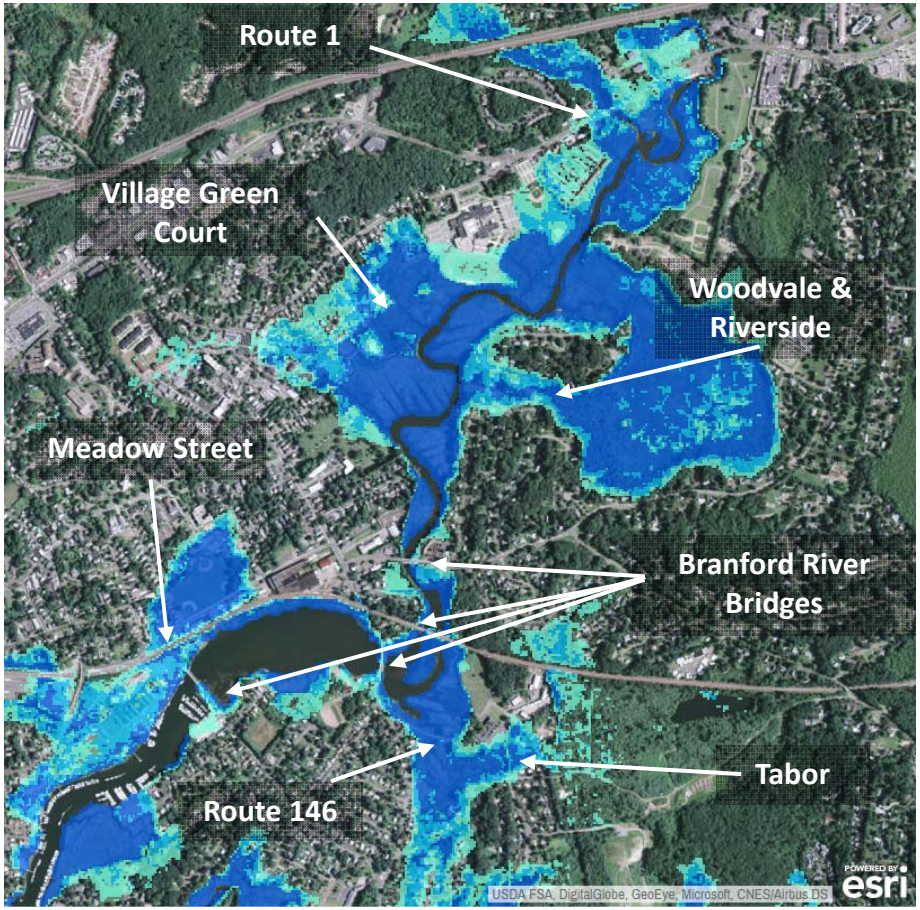
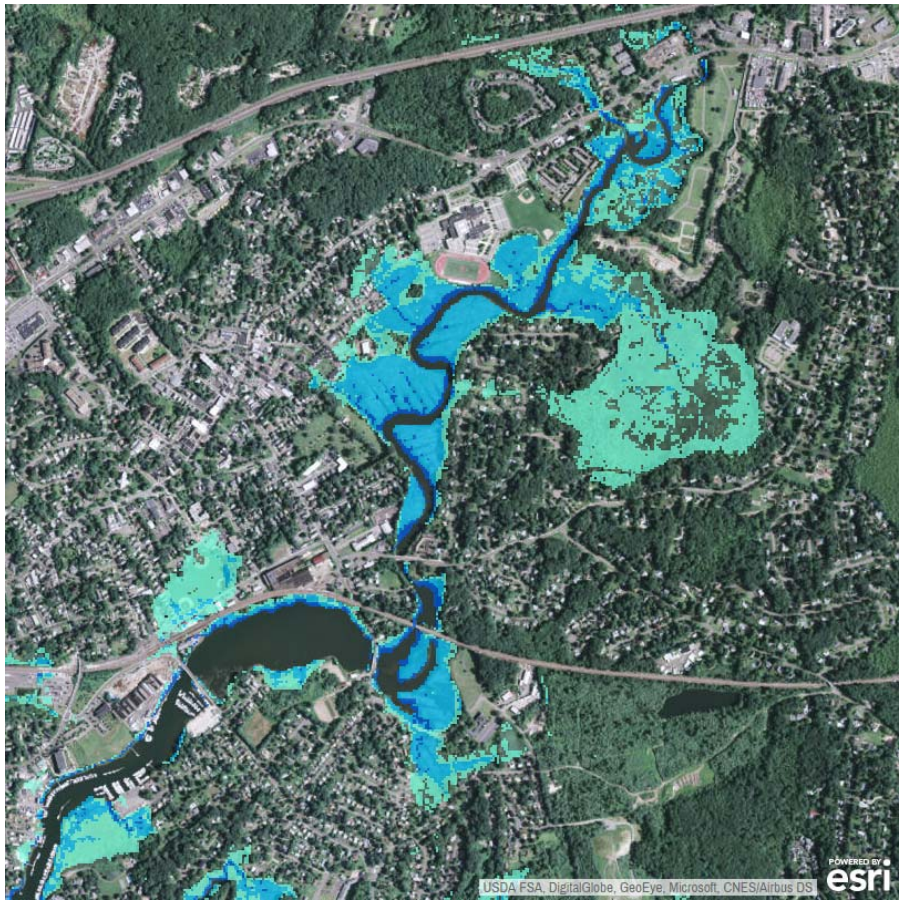
Inundation and Surge Risks by Geography

- **Branford Center**



Present Day Category 2 Storm



2080s Daily Inundation

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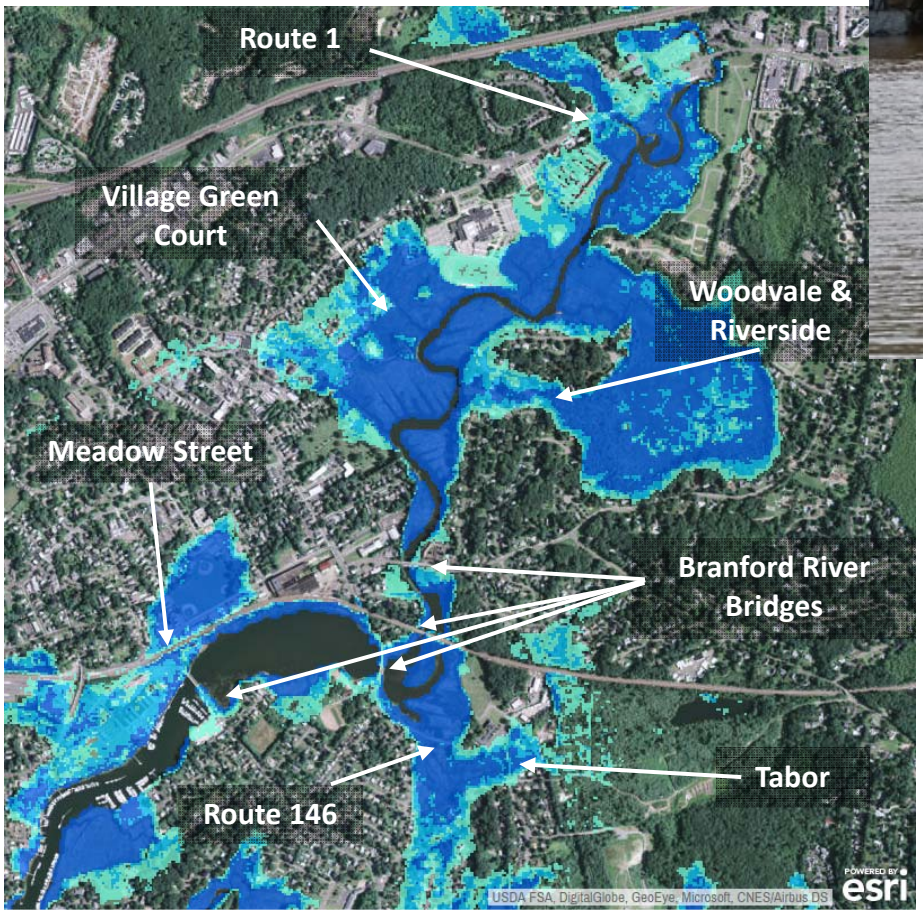
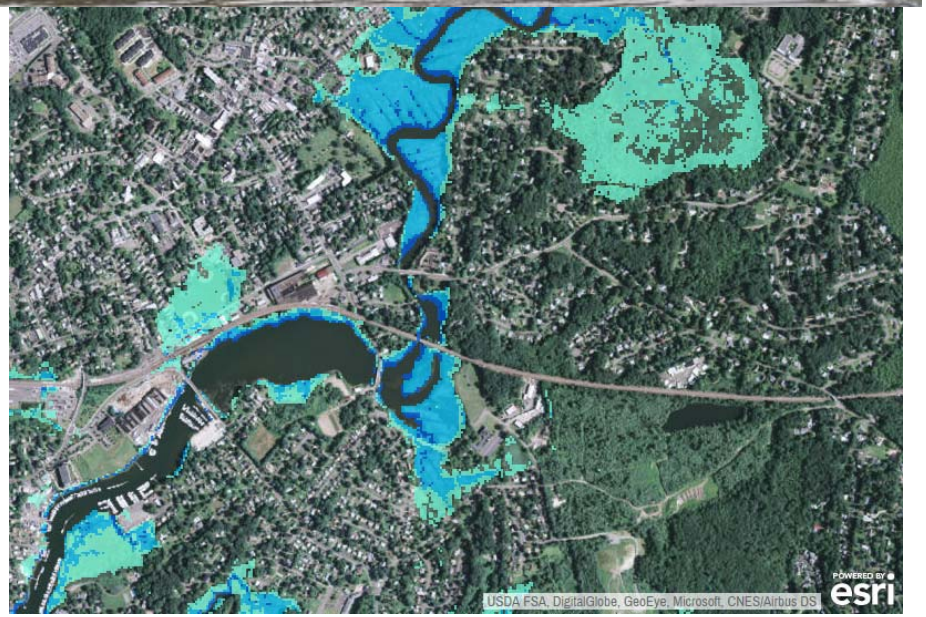
Inundation and Surge

- **Branford Center**



Present Day Category 2 Storm

Meadow Street/Indian Neck Ave
Image: Branford Eagle



2080s Daily Inundation

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Inundation and Surge

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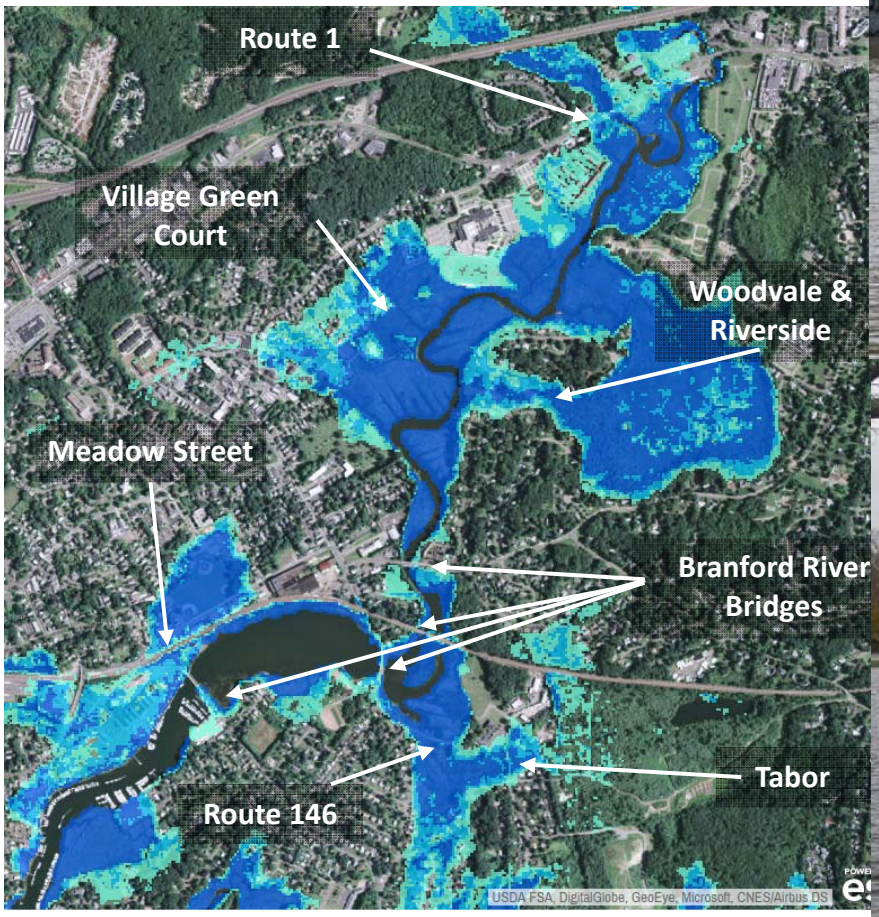

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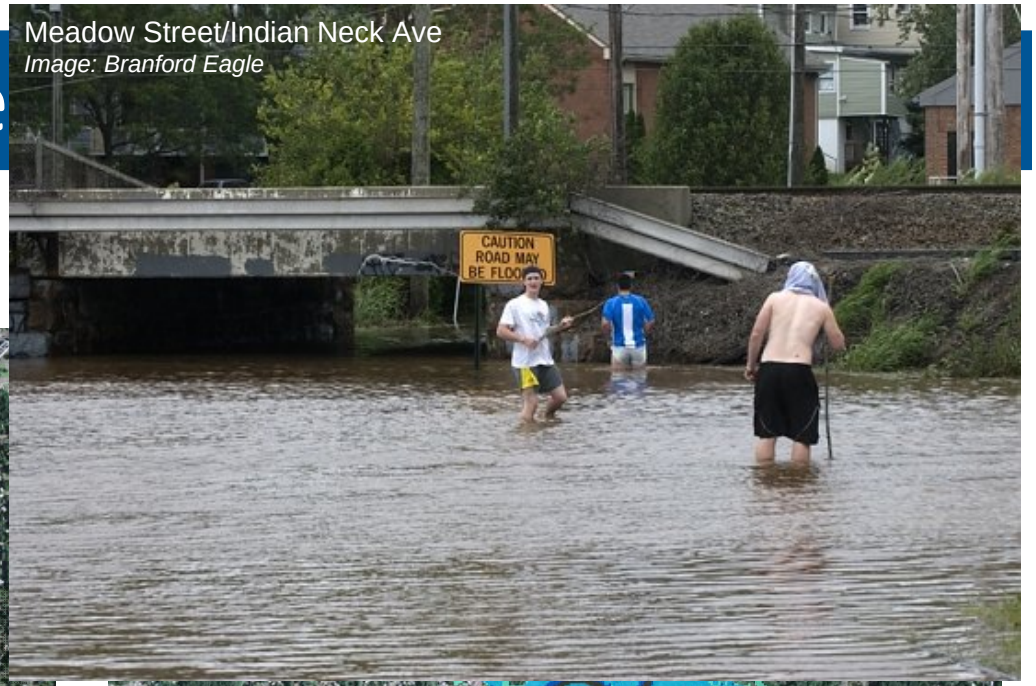

Meadow Street/Indian Neck Ave
Image: Branford Eagle

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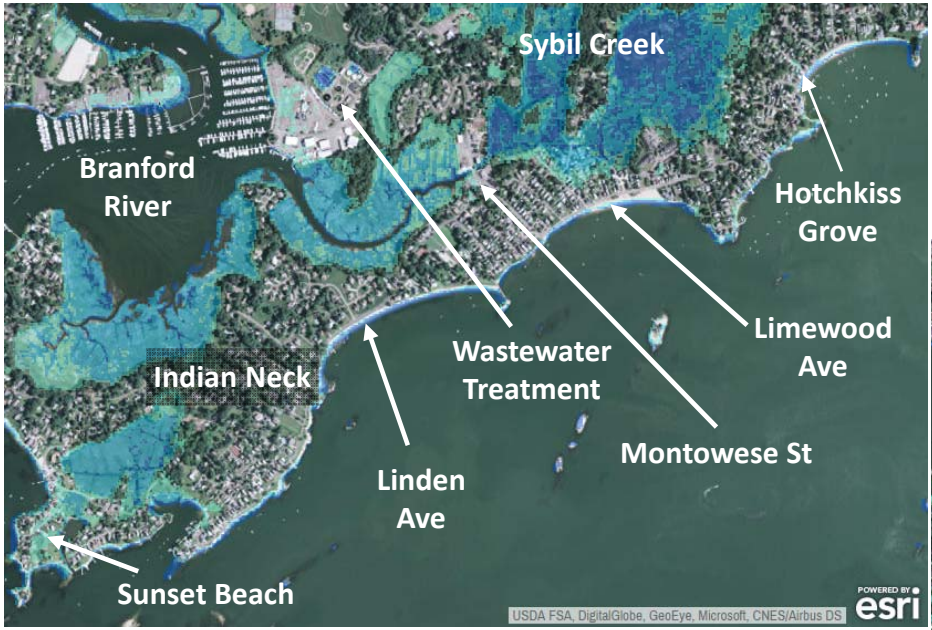
Inundation and Surge Risks by Geography

- **Indian Neck and Sybil Creek**



2020 Daily Inundation

2080s Daily Inundation

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Inundation and Surge Risks by Geography

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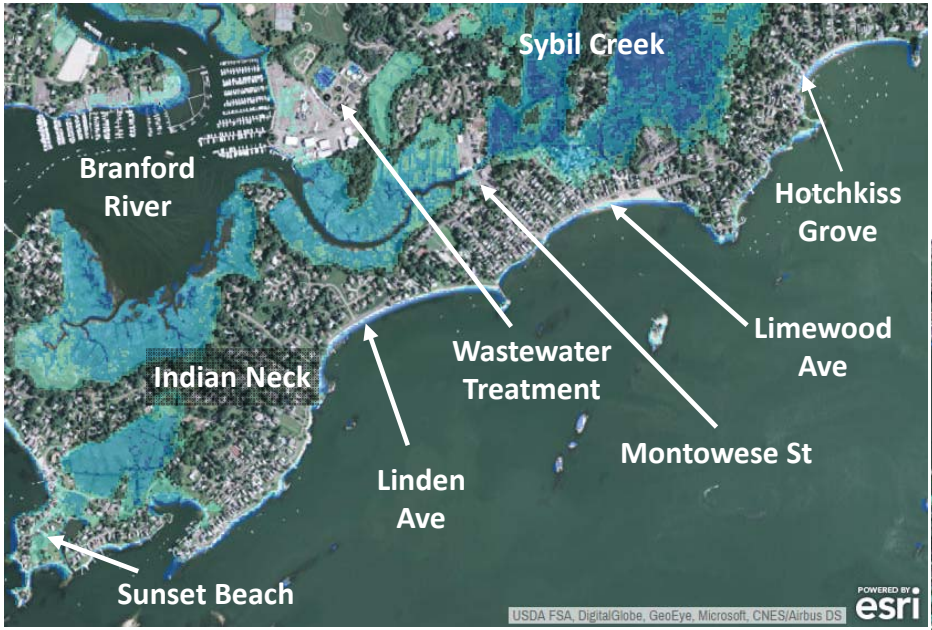

2020 Daily Inundation

Inundation and Surge Risks by Geography

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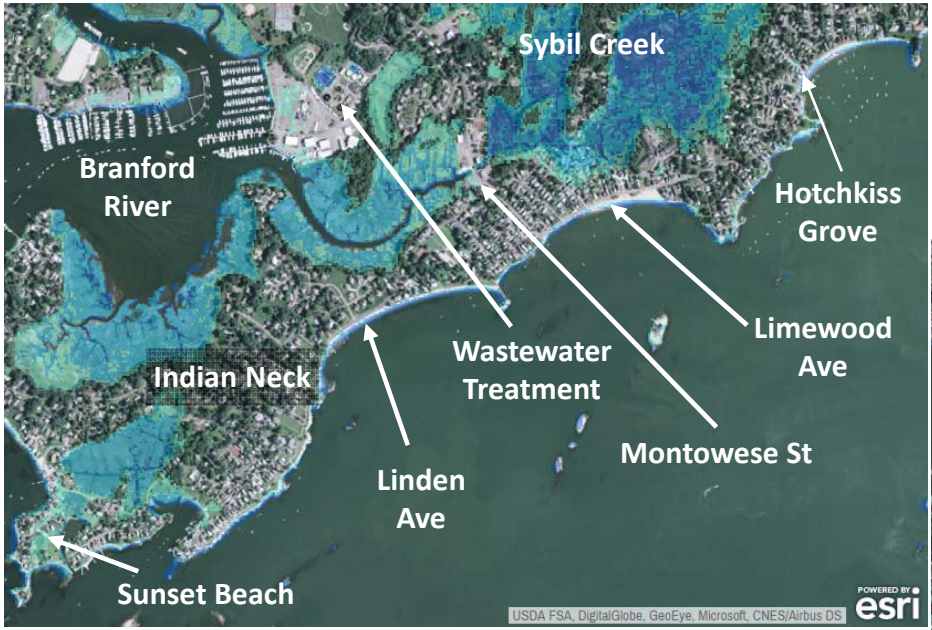
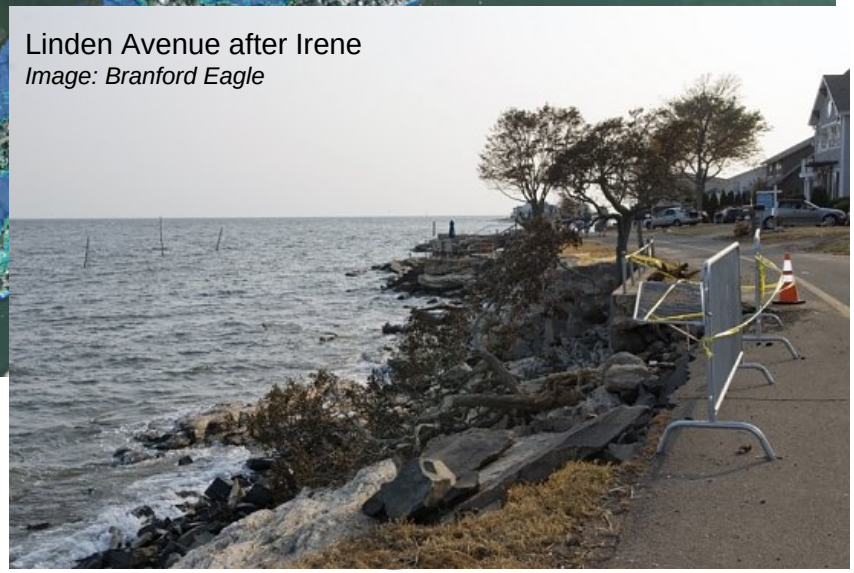


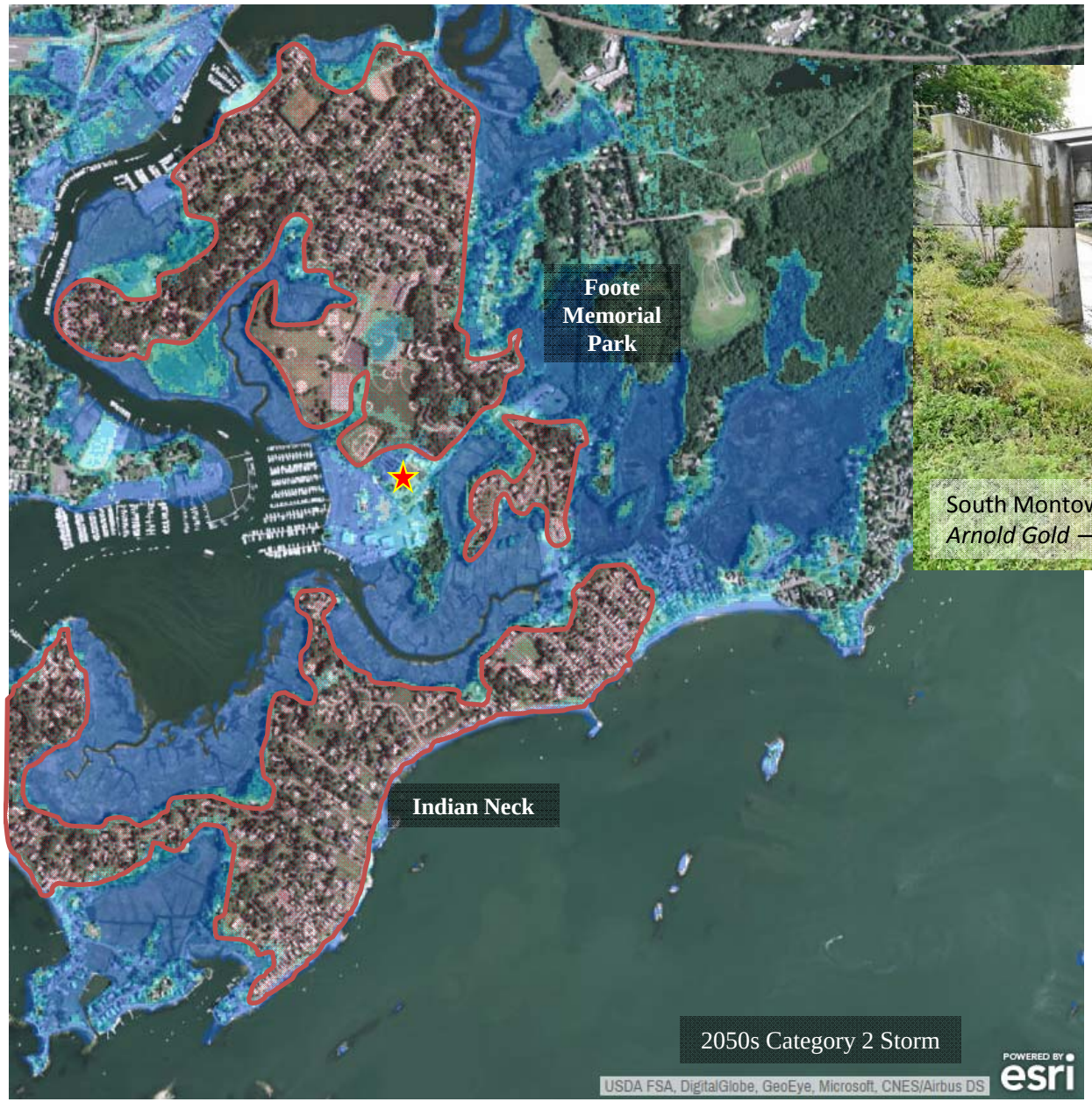
2020 Daily Inundation

Hotchkiss Grove
Image: Branford Eagle



Linden Avenue after Irene
Image: Branford Eagle

Inundation and Surge Risks by Geography



South Montowese Street in Branford, October 2015.
Arnold Gold — New Haven Register

Isolated Areas
Sewage Treatment Plant

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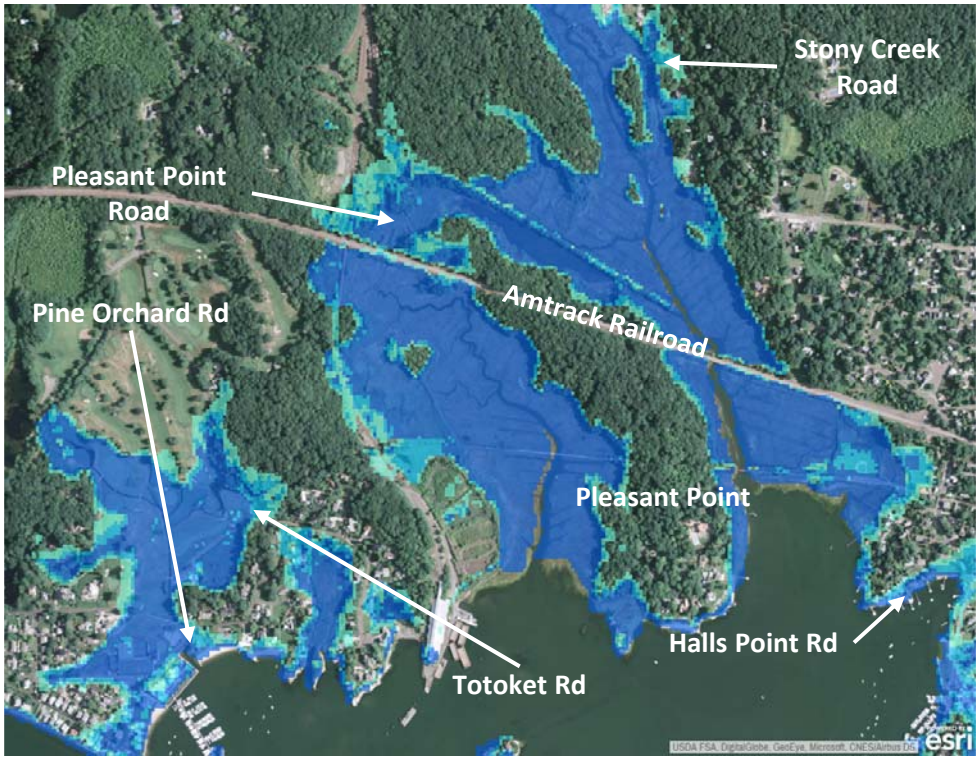
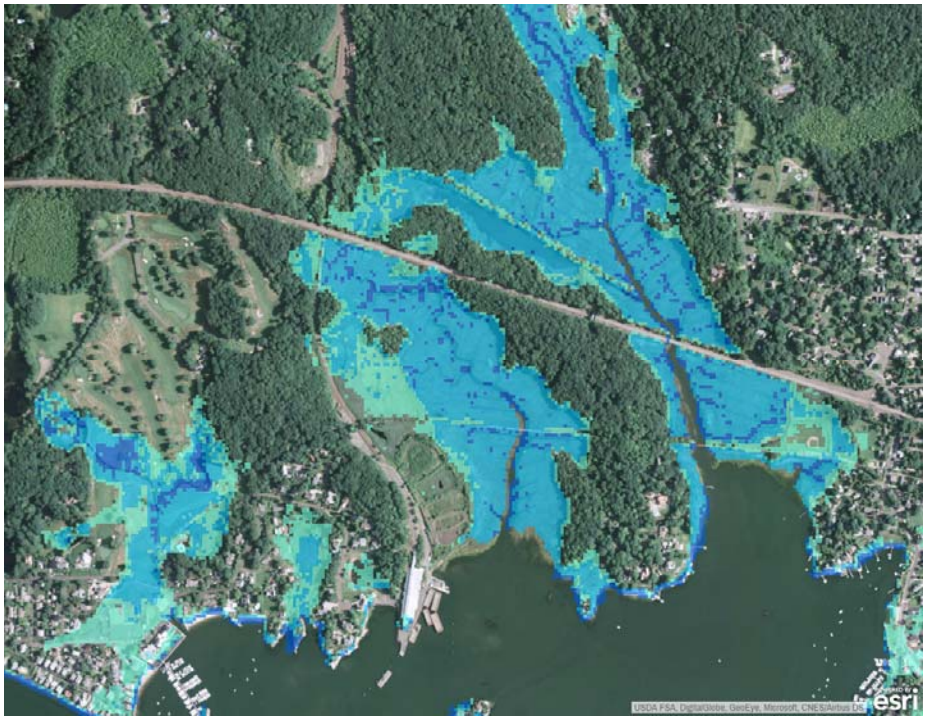
Inundation and Surge Risks by Geography

- **Pine Orchard and Stony Creek**



Present Day Category 2 Storm



2050s Daily Inundation

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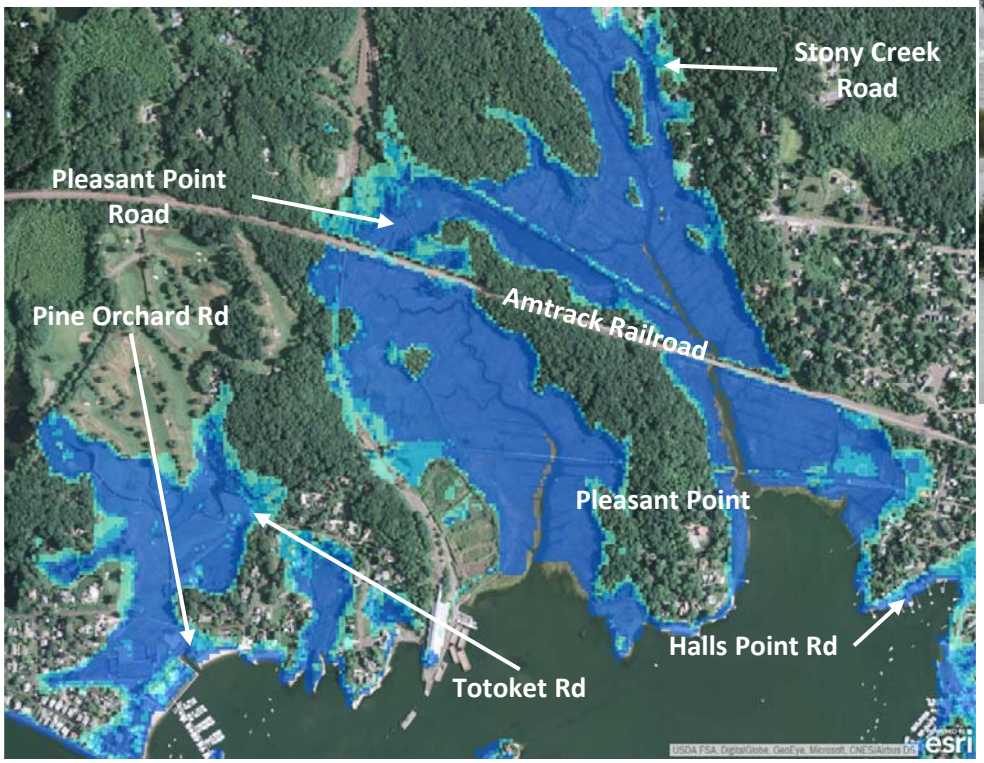
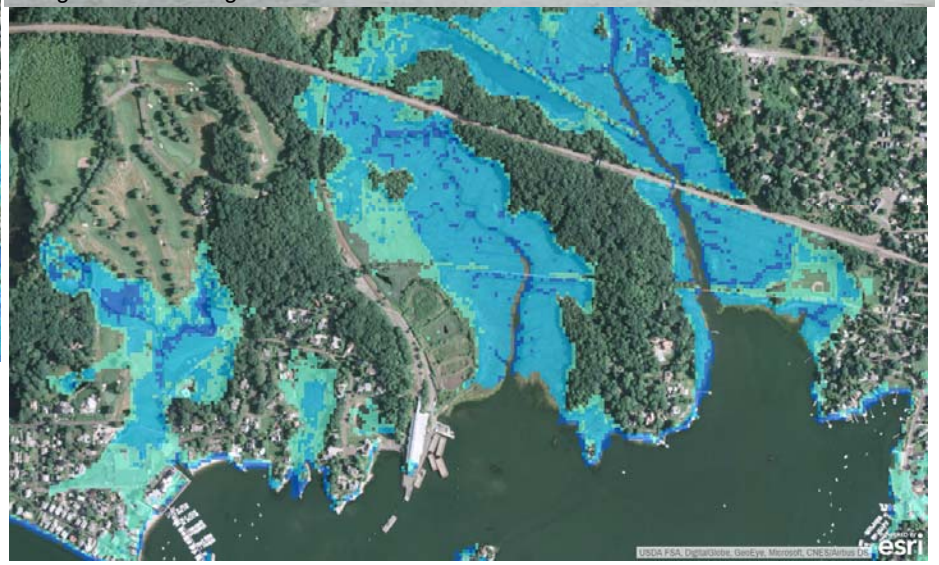
Inundation and Surge Risks by Geography

- **Pine Orchard and Stony Creek**



Pine Orchard Country Club Clubhouse
Image: Branford Eagle



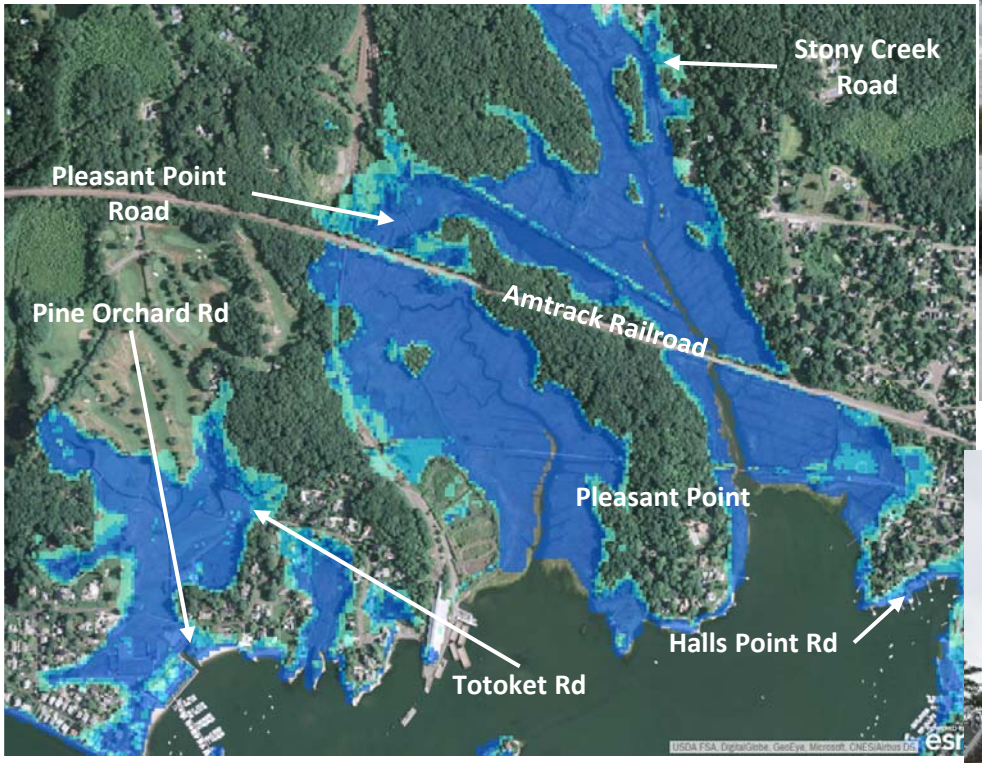
Present Day Category 2 Storm

2050s Daily Inundation

MILONE & MACBROOM

Inundation and Surge Risks by Geography

- **Pine Orchard and Stony Creek**



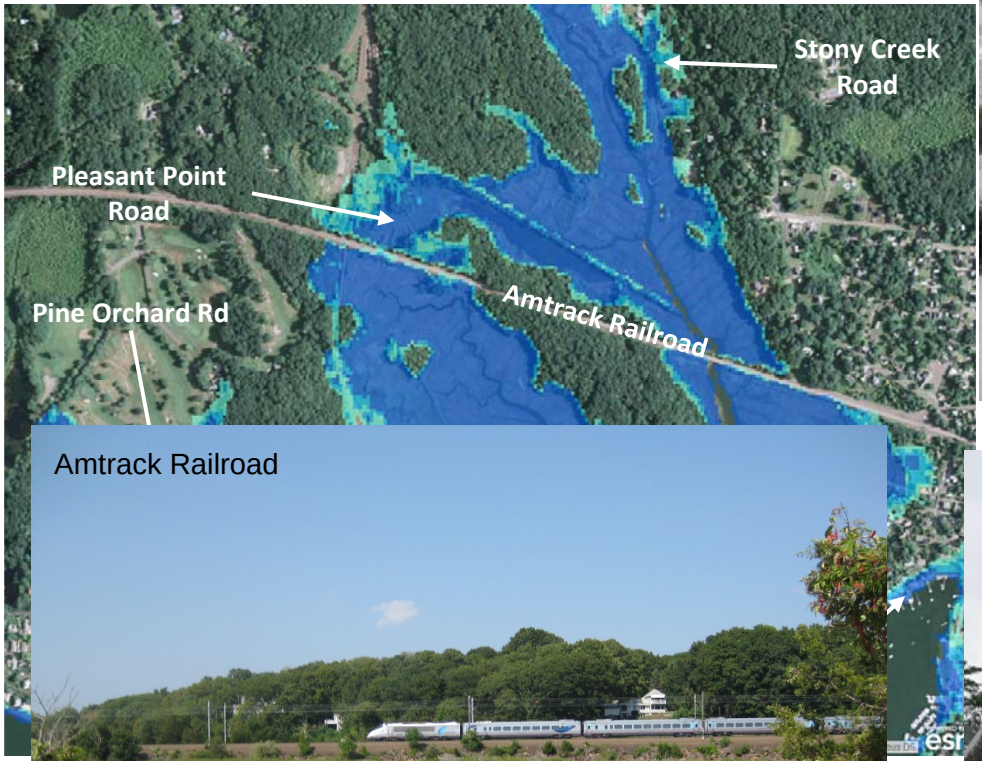
Pine Orchard Country Club Clubhouse
Image: Branford Eagle

Halls Point Road
Image: Branford Eagle

Present Day Category 2 Storm

Inundation and Surge Risks by Geography

- **Pine Orchard and Stony Creek**



Amtrack Railroad

Pine Orchard Country Club Clubhouse
Image: Branford Eagle

Halls Point Road
Image: Branford Eagle

Additional Types of Risk in Selected Areas

- **Many of the Town's pumping stations are coastal**
- **Present and future risks can be assessed using TNC's coastal resilience tool**

Assett		Likelihood of Flooding												
		Present Day			2020s			2050s			2080s			
Type	Name	FEMA	Cat 2	Cat 3	Daily	Cat 2	Cat 3	Daily	Cat 2	Cat 3	Daily	Cat 2	Cat 3	!
Pump Station	Branford Point	AE	Med	High	No	Med	High	No	Med	High	Low	Med	High	
Pump Station	Beckett Ave	No	Med	High	No	Med	High	No	High	High	Low	High	High	
Pump Station	Blocks	AE	Med	High	No	High	High	Low	High	High	Low	High	High	
Pump Station	Bradley Ave	AE	Med	High	Low	Med	High	Low	High	High	Low	High	High	
Pump Station	Burban	?	No	Low	No	No	Med	No	No	Med	No	No	Med	
Pump Station	Clark Ave	AE	Low	Med	No	Med	High	Low	Med	High	Low	High	High	
Pump Station	Farm River	AE	Low	Med	No	Low	High	No	Med	High	No	Med	High	
Pump Station	Damascus	AE	Low	Med	No	Med	High	No	Low	High	No	Med	High	
Pump Station	Dominican	No	Low	Low	No	Low	Low	No	Low	Low	No	Low	Med	
Pump Station	Frank St	AE	Low	High	No	Med	High	No	Med	High	No	Med	High	
Pump Station	Harbor St	AE	High	High	Low	High	High	Med	High	High	Med	High	High	
Pump Station	Johnsons Point	AE	Med	High	No	Med	High	Low	High	High	Low	High	High	
Pump Station	Lanphier Season	VE	Low	High	Low	Med	High	Low	High	High	Med	High	High	
Pump Station	Lanphier Cove	No	No	Low	No	No	Low	No	No	Low	No	No	Med	
Pump Station	Linden Shores	No	No	Low	No	No	Low	No	No	Low	No	No	Med	
Pump Station	Little Bay Lane	AE	Med	High	No	Med	High	No	High	High	Low	High	High	
Pump Station	Maltby	AE	Low	High	No	Med	High	Low	High	High	Low	High	High	
Pump Station	Central	AE	High	High	No	High	High	Low	High	High	Low	High	High	
Pump Station	Pages	AE	High	High	Low	High	High	Med	High	High	Med	High	High	
Pump Station	Pawson Rd	No	No	Low	No	No	Low	No	No	Med	No	No	Med	
Pump Station	Pine Orchard	AE	High	High	Low	High	High	Low	High	High	Med	High	High	
Pump Station	Riverside Dr	AE	Med	High	Low	High	High	Low	High	High	Low	High	High	
Pump Station	River Rd	AE	Low	High	Low	Med	High	Low	Med	High	Low	High	High	
Pump Station	So Montowese	AE	Low	High	No	Low	High	No	Med	High	No	Med	High	
Pump Station	Summer Island	AE	Med	High	No	Med	High	No	Med	High	No	High	High	
Pump Station	Sunrise Cove	No	No	Low	No	No	Med	No	Low	Med	No	Low	Med	
Pump Station	Sybil	AE	Med	High	Low	Med	High	Low	High	High	Med	High	High	
Pump Station	Hotchkiss Grove	AE	High	High	No	High	High	Low	High	High	Low	High	High	
Pump Station	Tidelands	X500	Low	Med	No	Low	High	No	Med	High	No	Med	High	
Pump Station	WWTP (Inter)	AE	No	Med	No	No	Med	No	Low	Med	No	Low	Med	
Pump Station	Greenview	X500	Low	Med	No	Low	Med	No	Med	Med	No	Med	High	

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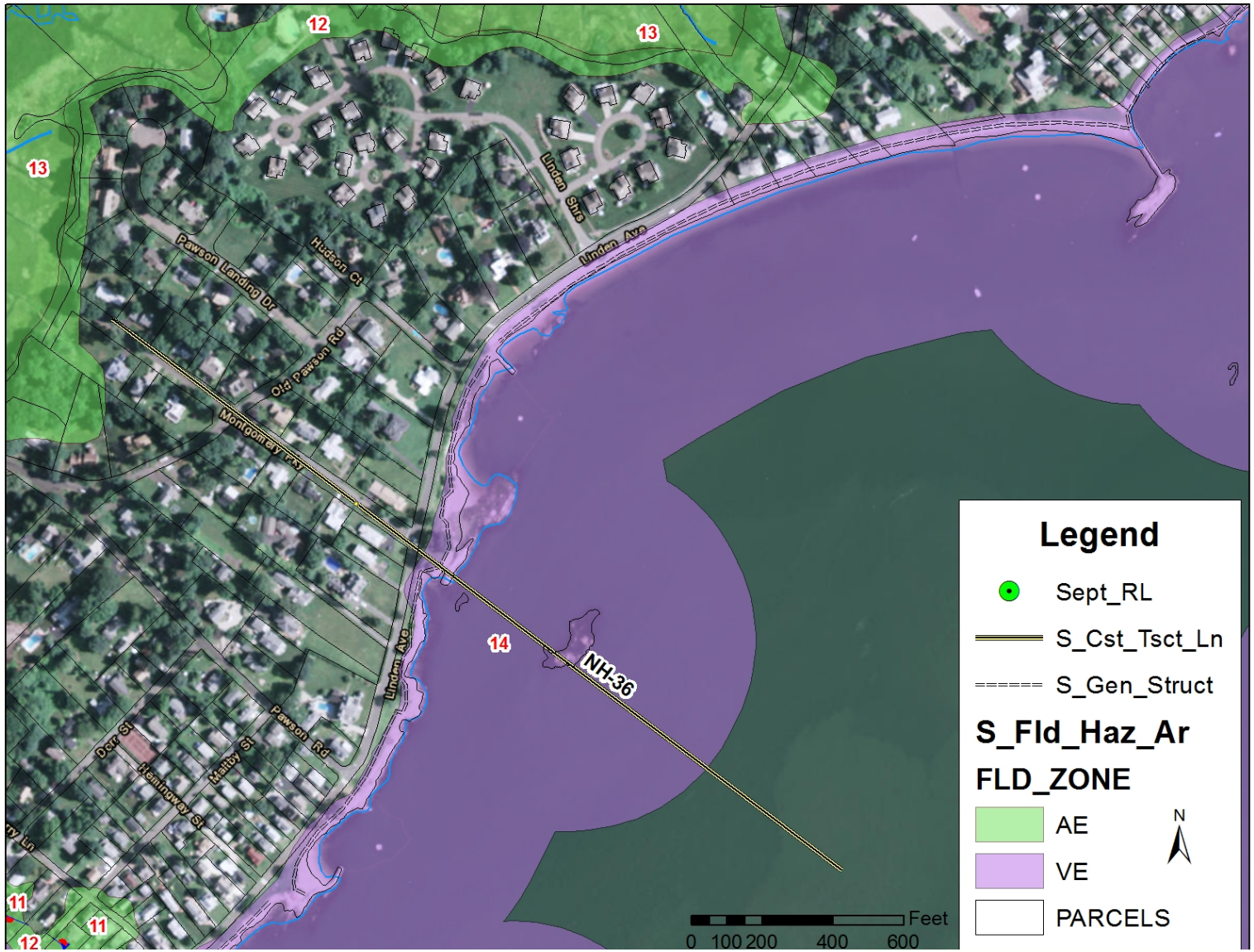
Additional Types of Risk in Selected Areas

- **FEMA Flood Insurance Studies can provide additional information not captured by TNC's coastal resilience tool**
- **August 10, 2015 Coastal Study**
- **Transect NH-36 at Linden Avenue**



Dewberry Milone & MacBroom

Additional Types of Risk in Selected Areas

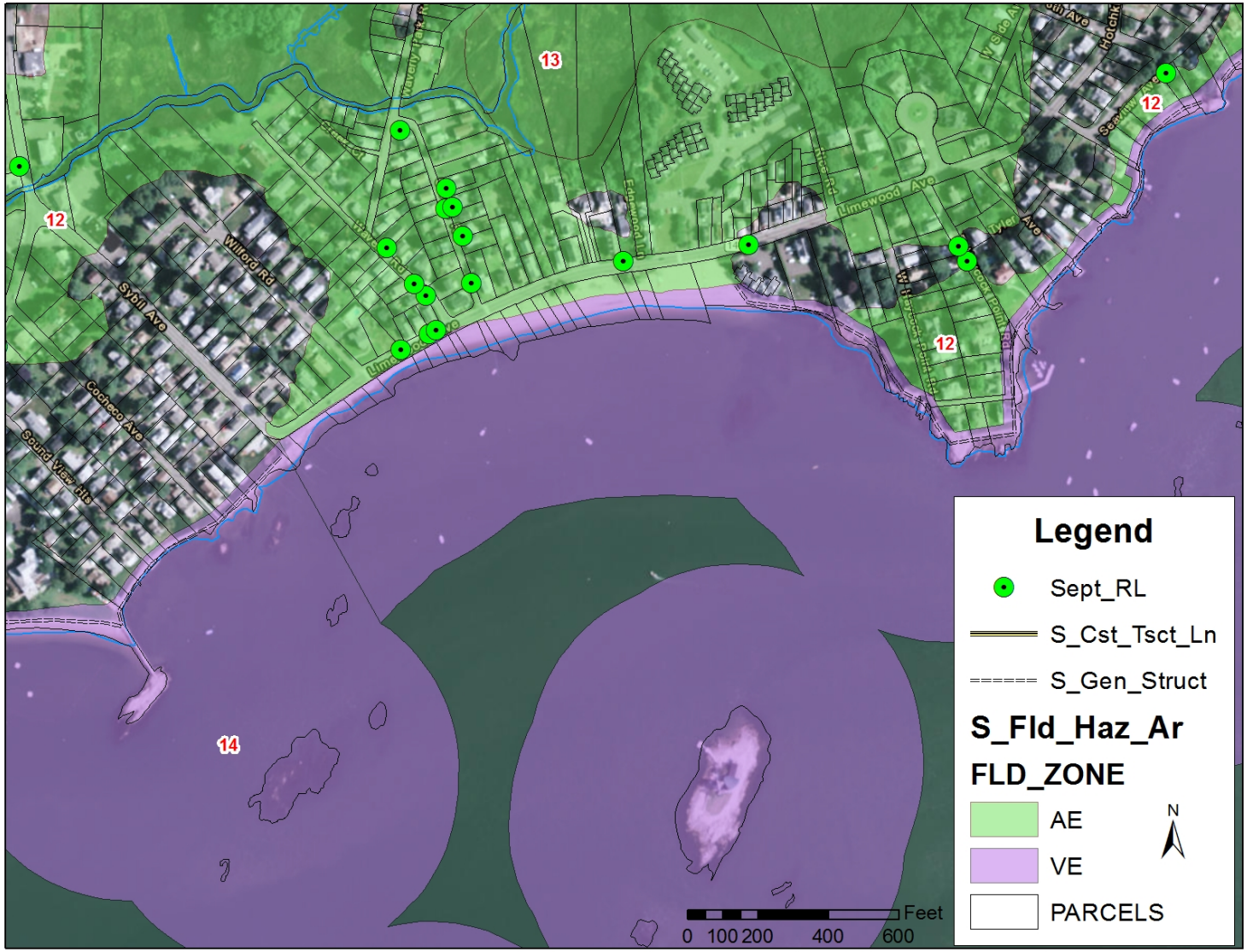
- **August 10, 2015 Coastal Study**
- **Transect NH-36 at Linden Avenue**

North Facing at FEMA Coastal Study Transect NH-36

South Facing at FEMA Coastal Study Transect NH-36

Additional Types of Risk in Selected Areas

- **August 10, 2015 Coastal Study**
- **Limewood Road and Limewood Beach**



Additional Types of Risk in Selected Areas

- **August 10, 2015 Coastal Study**
- **Limewood Road and Limewood Beach**

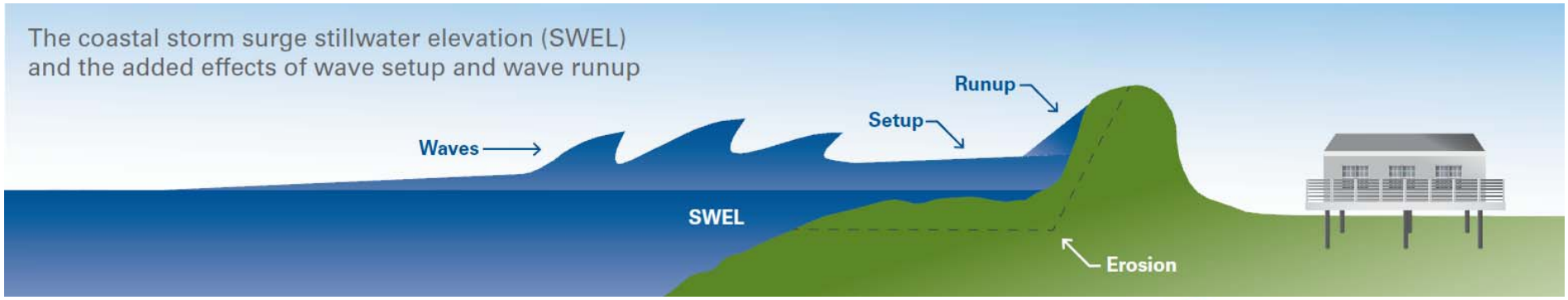
North Facing Toward Haycock Point

Southwest Facing at Limewood and Sybil Avenue

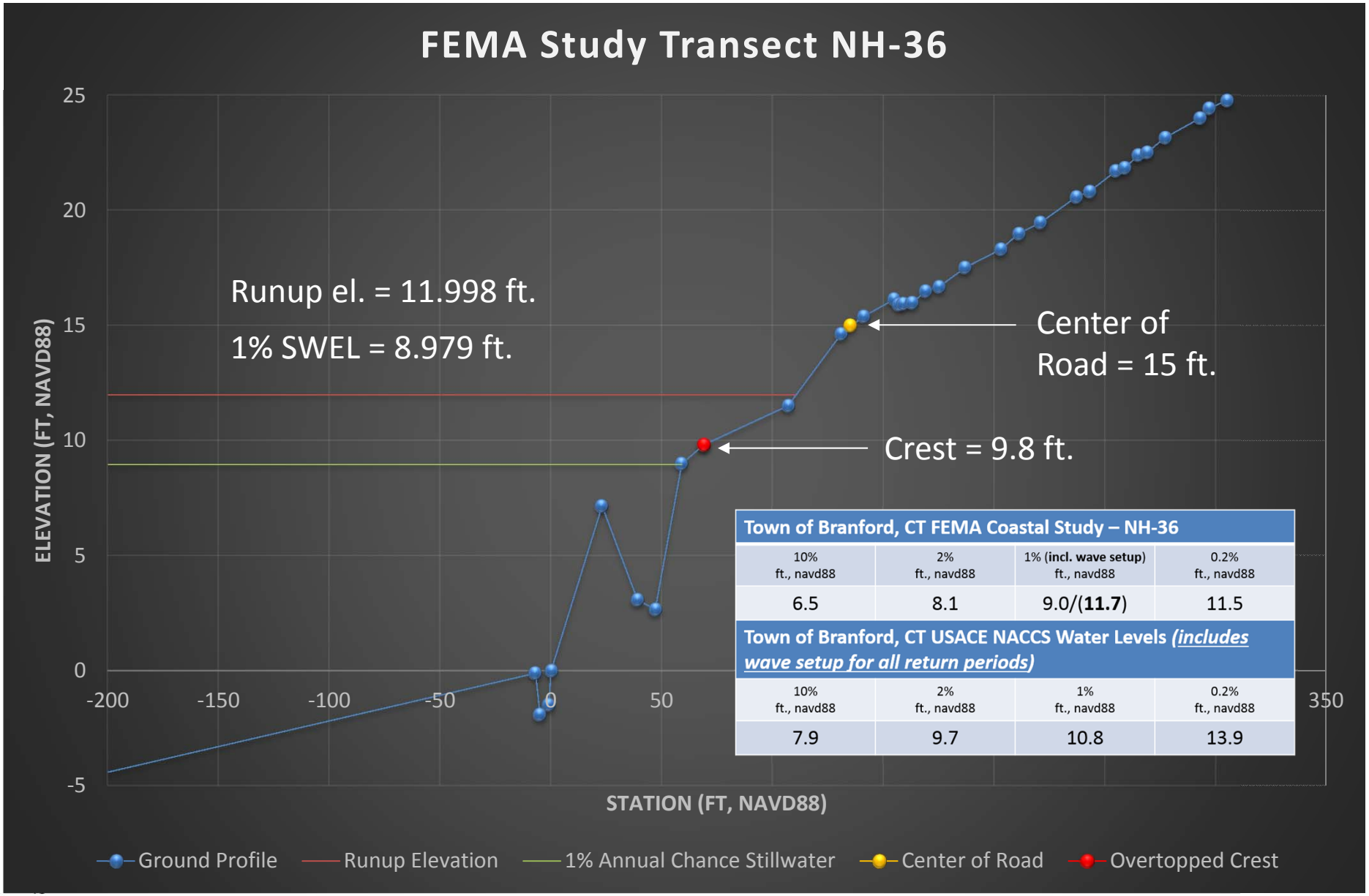
Additional Types of Risk in Selected Areas

Summary of Primary Hazards:
Linden and Limewood Avenues, Town of Branford, CT
FEMA Coastal Study Transect NH-36
(Sandy Beach backed by shore protection structures):

- Wave runup elevations dominate over wave heights (steeply sloped beaches, bluffs, and/or shore-parallel flood protection structures)
- Wave Overtopping – Inland extent of Zone VE mapped to Wave Overtopping Splash Zone
- Overland Wave Inundation (Limewood Avenue only) – Zone VE offshore and Zone AE mapped inland
- Velocity Zone at Shoreline
- 1-Percent-Annual-Chance Stillwater - 9 feet, NAVD88



Additional Types of Risk in Selected Areas



Town of Branford, CT FEMA Coastal Study – NH-36			
10% ft., navd88	2% ft., navd88	1% (**incl. wave setup**) ft., navd88	0.2% ft., navd88
6.5	8.1	9.0/(**11.7**)	11.5

Town of Branford, CT USACE NACCS Water Levels *(includes wave setup for all return periods)*			
10% ft., navd88	2% ft., navd88	1% ft., navd88	0.2% ft., navd88
7.9	9.7	10.8	13.9

Next Steps

- **Incorporate comments from residents and business owners**
- **Develop townwide coastal adaptation and resilience options**
  - **Other towns in Connecticut will be considered**
  - **Other states will be considered**
- **Focus on areas of greatest impact from Tropical Storm Irene and Hurricane Sandy**
- **Development of a Coastal Resilience Plan**
- **Prepare conceptual designs for addressing two specific areas of risk such as neighborhoods or infrastructure**

Questions and Discussion

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