



# City of Clearwater

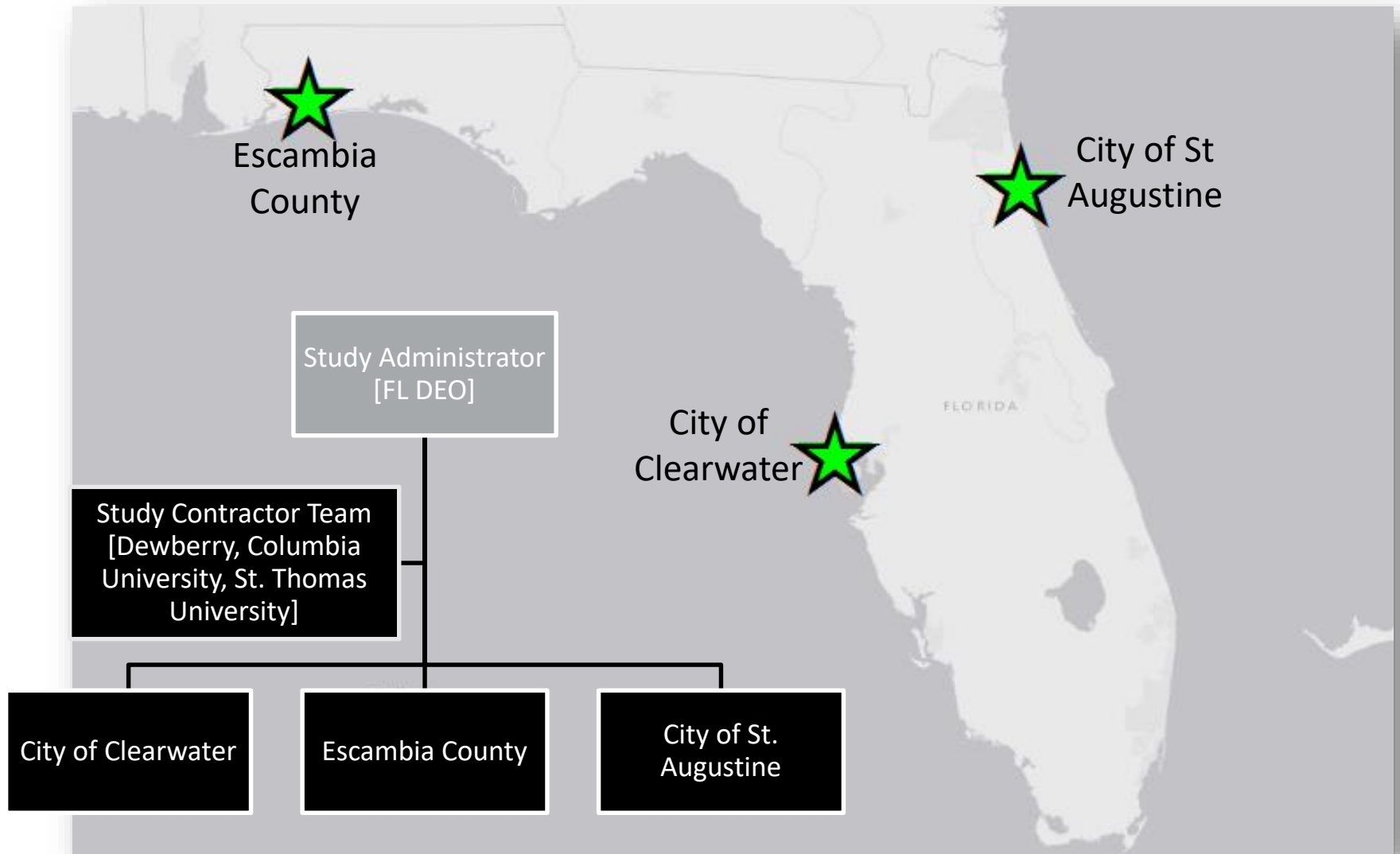
## Sea Level Rise Adaptation – Technical Assistance Pilot Project Vulnerability and Planning Support

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# Project Team Overview

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# Study Tasks Overview

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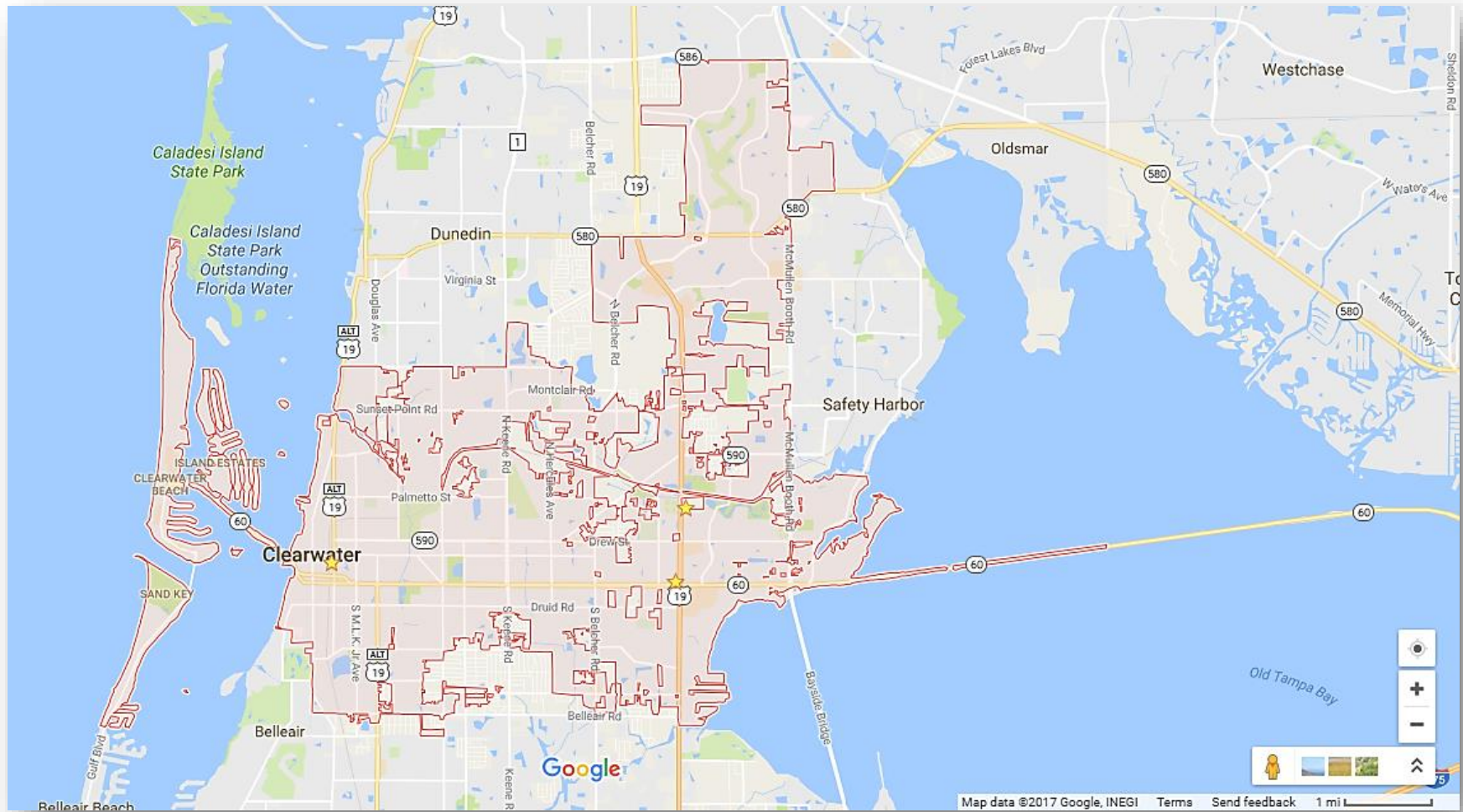
## Task 1. Vulnerability/Risk Assessment

- Future condition scenarios
- Hazard data development
- Overlay of hazard data on natural/built assets
- Summary of impacts (cartographic, tabular, narrative)

## Task 2. Adaptation Planning

- Review of existing programs/policies
- Prioritize Task 1 findings
- Qualitative and/or quantitative evaluation
- Recommendations

# Clearwater City Limits

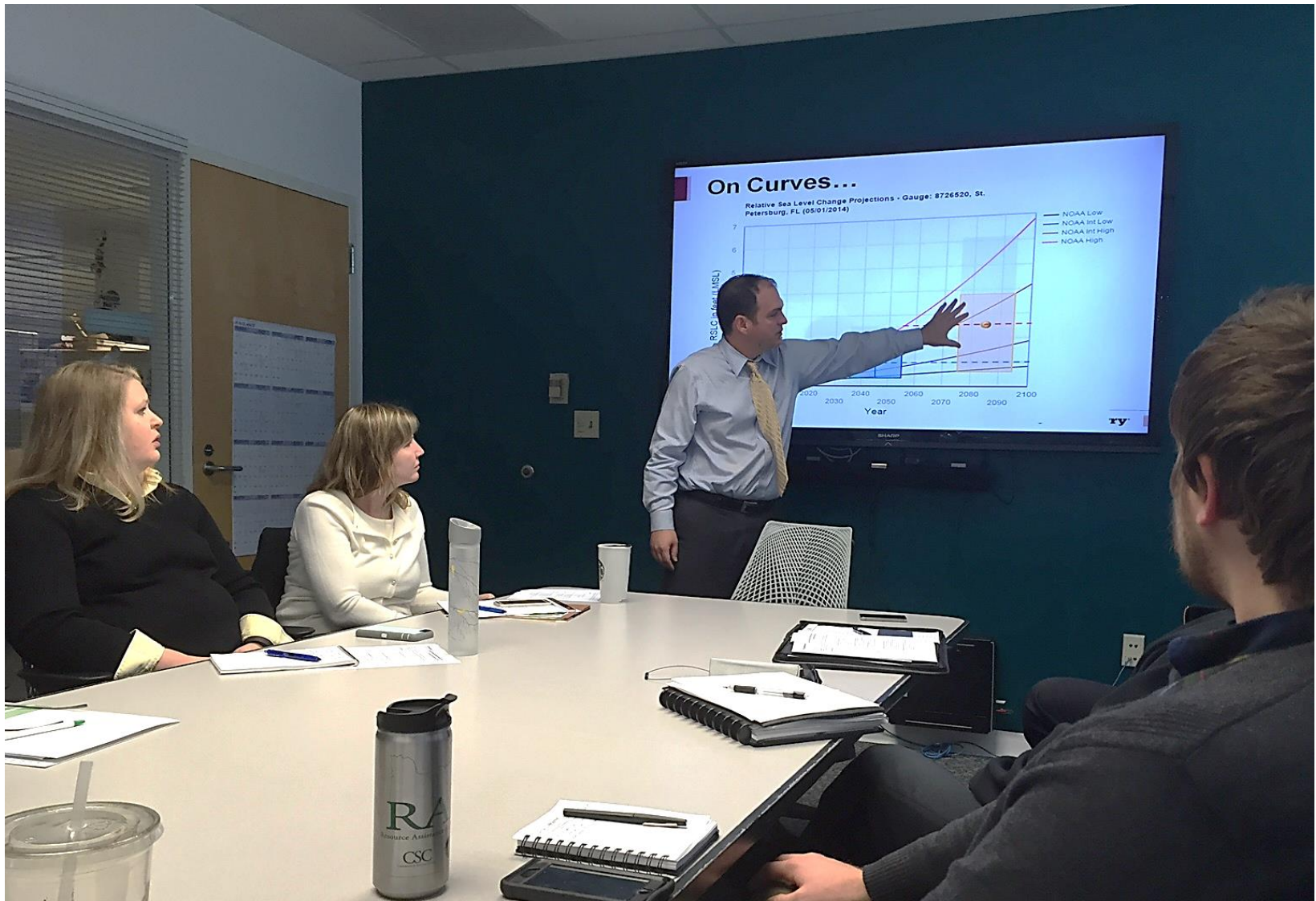


# Vulnerability Assessment

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# SLR Scenarios



# SLR Scenarios

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- From the NOAA Technical Report OAR CPO-1, Global Sea Level Rise Scenarios for the United States National Climate Assessment, Dec 2012.
- Design meeting established a preference for representative short-, moderate- and long-term values with the short-term value providing a “no regrets” planning elevation

Time Horizon	Low	Intermediate-Low	Intermediate High	High	Average Value	Representative Value
Short-term (2040s)	0.41	0.66	1.21	1.85	1.03	1
Moderate-term (2070s)	0.64	1.25	2.61	4.16	2.17	2
Long-term (2090s)	0.80	1.74	3.83	6.22	3.14	3

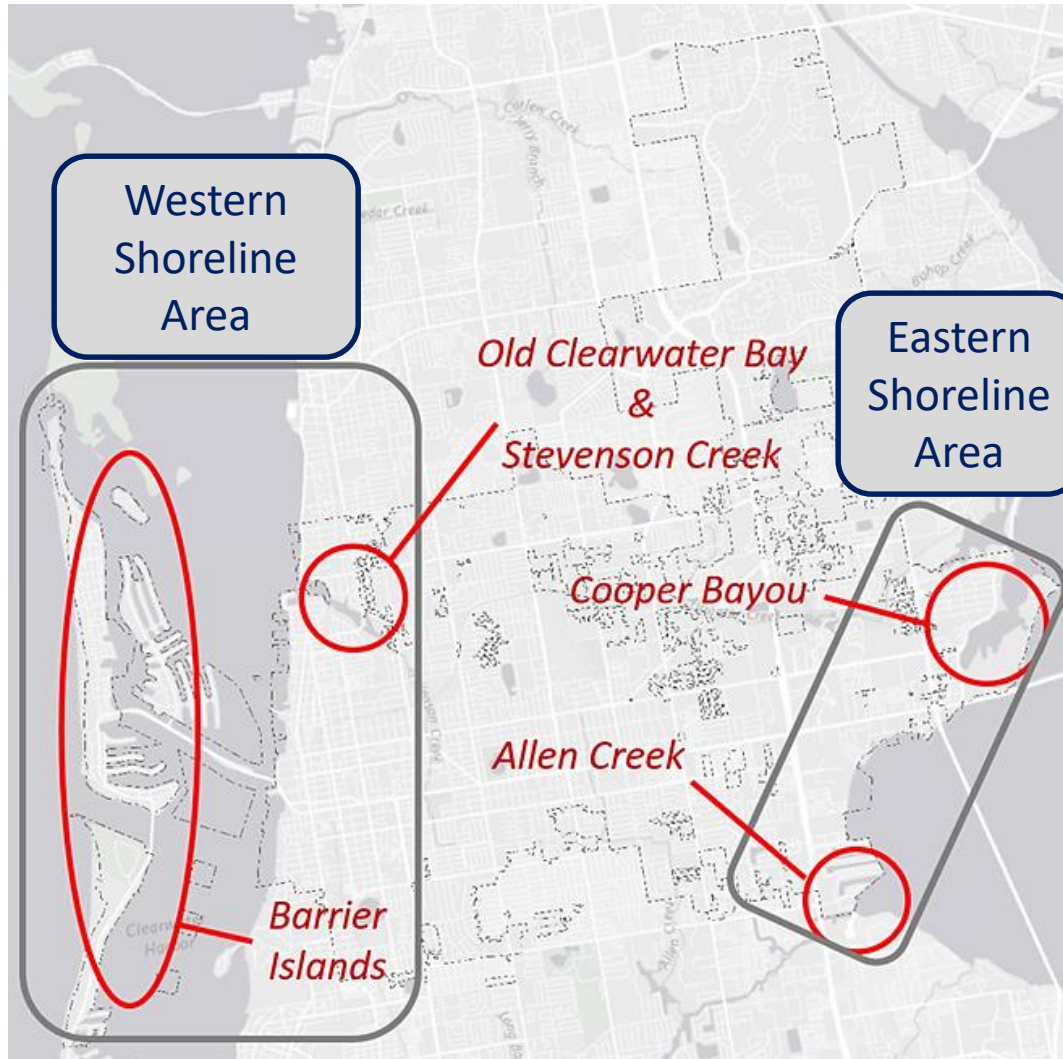
# Source of Flood Elevations

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Coastal Flood Event Type	Description	Frequency/Likelihood	Water Elevation, ft NAVD88	Data Source
<b>Nuisance Flooding</b>	Areas frequently flooded by tides and/or small coastal storms. Results in shallow flooding, which may disrupt or limit use.	~1-2 times monthly	3 ft	Tidal gauge analysis and coordination with the City
<b>100-year Floodplain</b>	Areas subject to flooding by significant coastal storms. Defines the Special Flood Hazard Area as delineated on Federal Emergency Management Agency Flood Insurance Rate Maps. Also known as the “Base Flood”	1% chance per year, ~26% chance in 30 years	~6-10 ft	Preliminary FEMA FIS for Pinellas County
<b>500-year Floodplain</b>	Areas subject to flooding by extreme hurricanes. These areas are at higher elevations and otherwise have minimal flood hazards from coastal events.	0.2% chance per year, ~6% chance in 30 years	~10-14 ft	Preliminary FEMA FIS for Pinellas County



# Sea Level Rise Mapping - Results

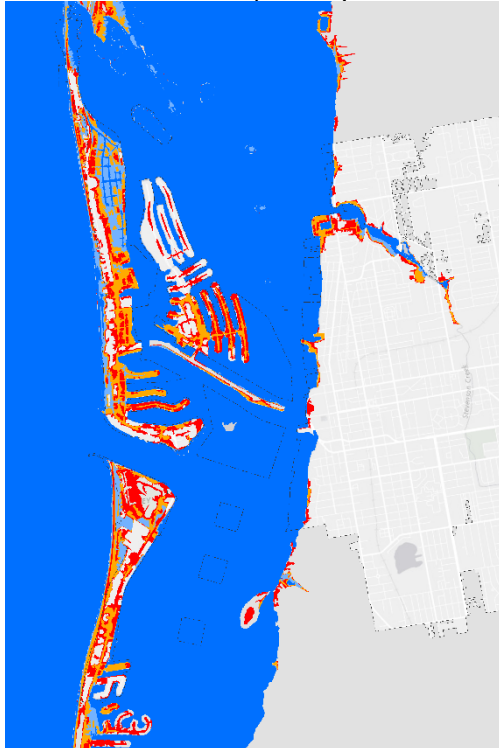


## Clearwater Flooding

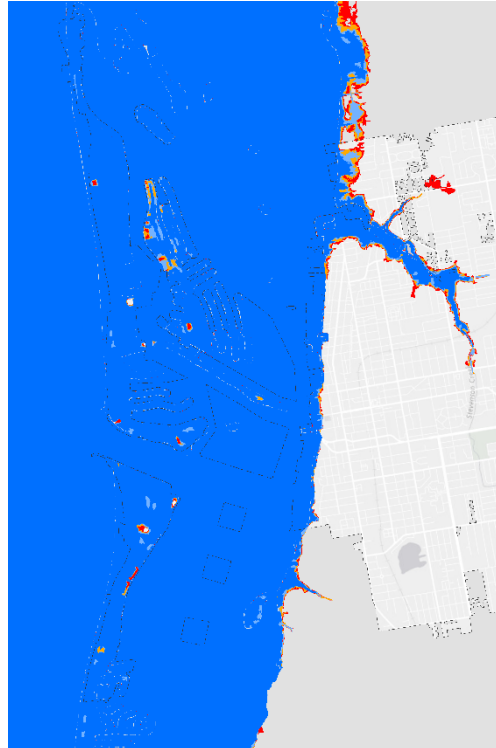
- The main city is fairly insulated from SLR impacts
- Barrier islands face difficulties under all scenarios
- Old Clearwater Bay, Allen Creek and possibly Cooper Bayou are notably impacted

# Sea Level Rise Mapping – Gulf Coast

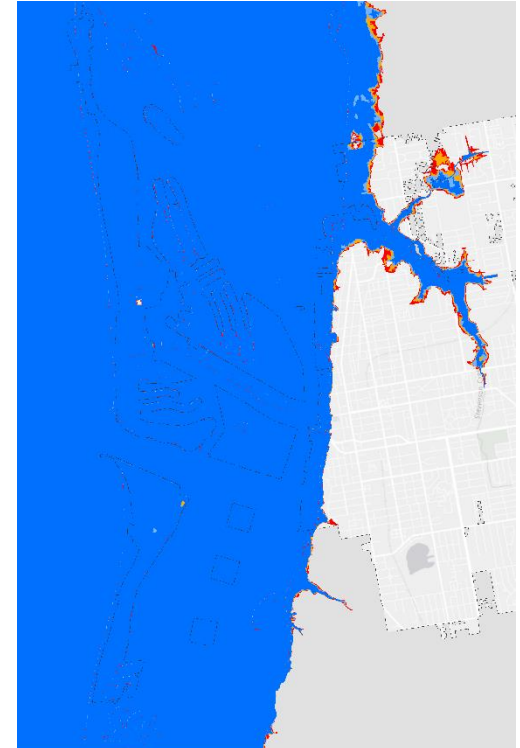
Nuisance (3 ft.)



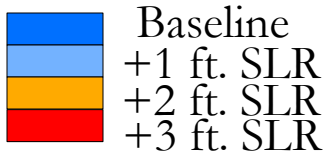
1% Event



0.2% Event

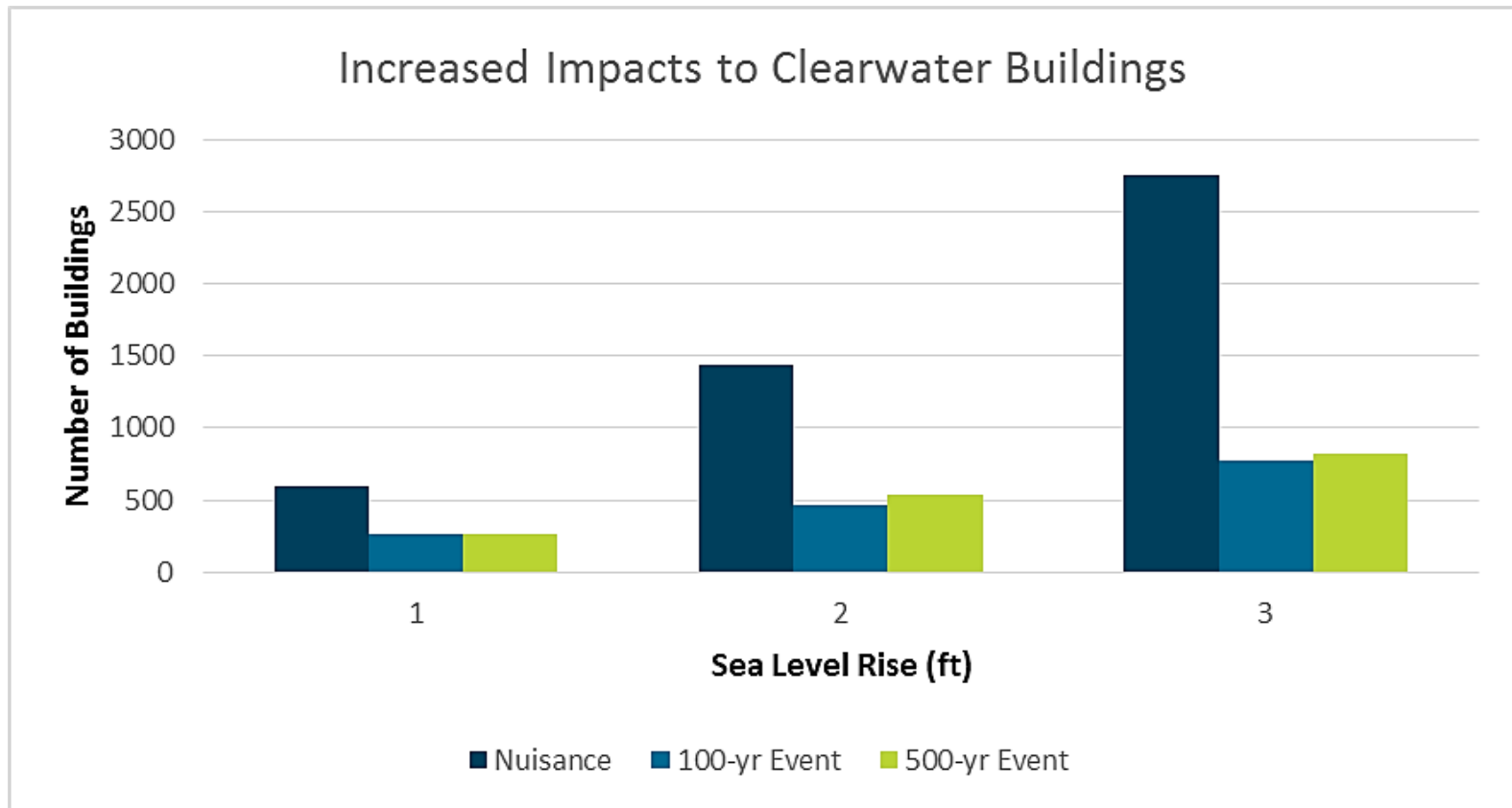


## Legend

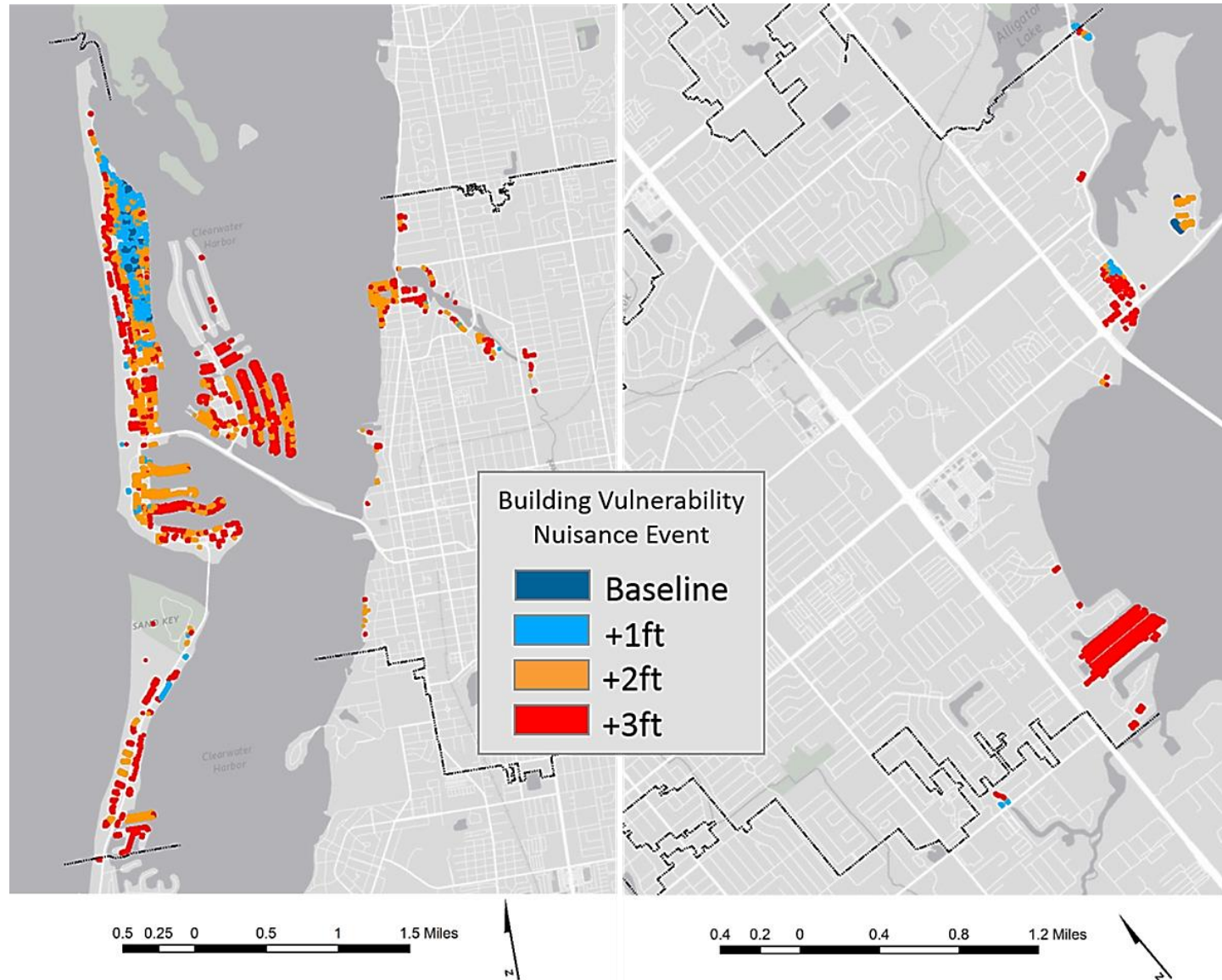


# Impacts to Buildings

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# Impacts to Buildings



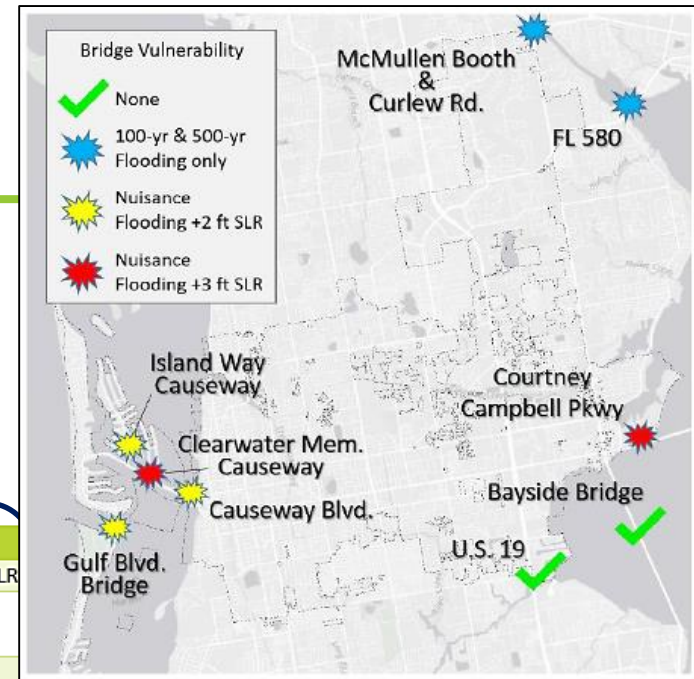


# Impacts to Bridges

Summary of bridge vulnerability to each flood type and SLR combination:

- “O” indicates “Open”;
- “P” indicates “Passable”, meaning bridge or approach to bridge partially obstructed in one lane;
- “NP” indicates bridge is not passable due to inundation or approach inundation under the flood event and SLR scenario combination.

Bridge	Nuisance Flood Event			100-yr Flood Event			500-yr Flood Event		
	1 ft SLR	2 ft SLR	3 ft SLR	1 ft SLR	2 ft SLR	3 ft SLR	1 ft SLR	2 ft SLR	3 ft SLR
US 19	O	O	O	O	O	O	O	O	O
Bayside Bridge	O	O	O	O	O	O	O	O	O
Courtney Campbell Pkwy	O	O	P	NP	NP	NP	NP	NP	NP
FL 580	O	O	O	NP	NP	NP	NP	NP	NP
McMullen Booth Rd	O	O	O	P	NP	NP	NP	NP	NP
Curlew Rd	O	O	O	NP	NP	NP	NP	NP	NP
Causeway Blvd	O	P	NP	NP	NP	NP	NP	NP	NP
Clearwater Memorial Causeway	O	O	P	NP	NP	NP	NP	NP	NP
Island Way Causeway	O	NP	NP	NP	NP	NP	NP	NP	NP
Gulf Blvd Bridge	O	NP	NP	NP	NP	NP	NP	NP	NP



Causeway is impacted in all 100-yr and 500-yr conditions. Intersection at Gulf to Bay Blvd begins to be impacted by nuisance flooding at the 3 ft SLR scenario.

Bridge access clear in all scenarios on the Clearwater side. On the east side it will not be passable to the 100-yr and 500-yr conditions.

For a 100-yr condition, 1 ft of SLR may cause issues south of intersection. Vulnerable, but passable to the 100-yr condition with 1 ft SLR. Not passable to 100-yr events with 2, and 3 ft SLR or any 500-yr conditions.

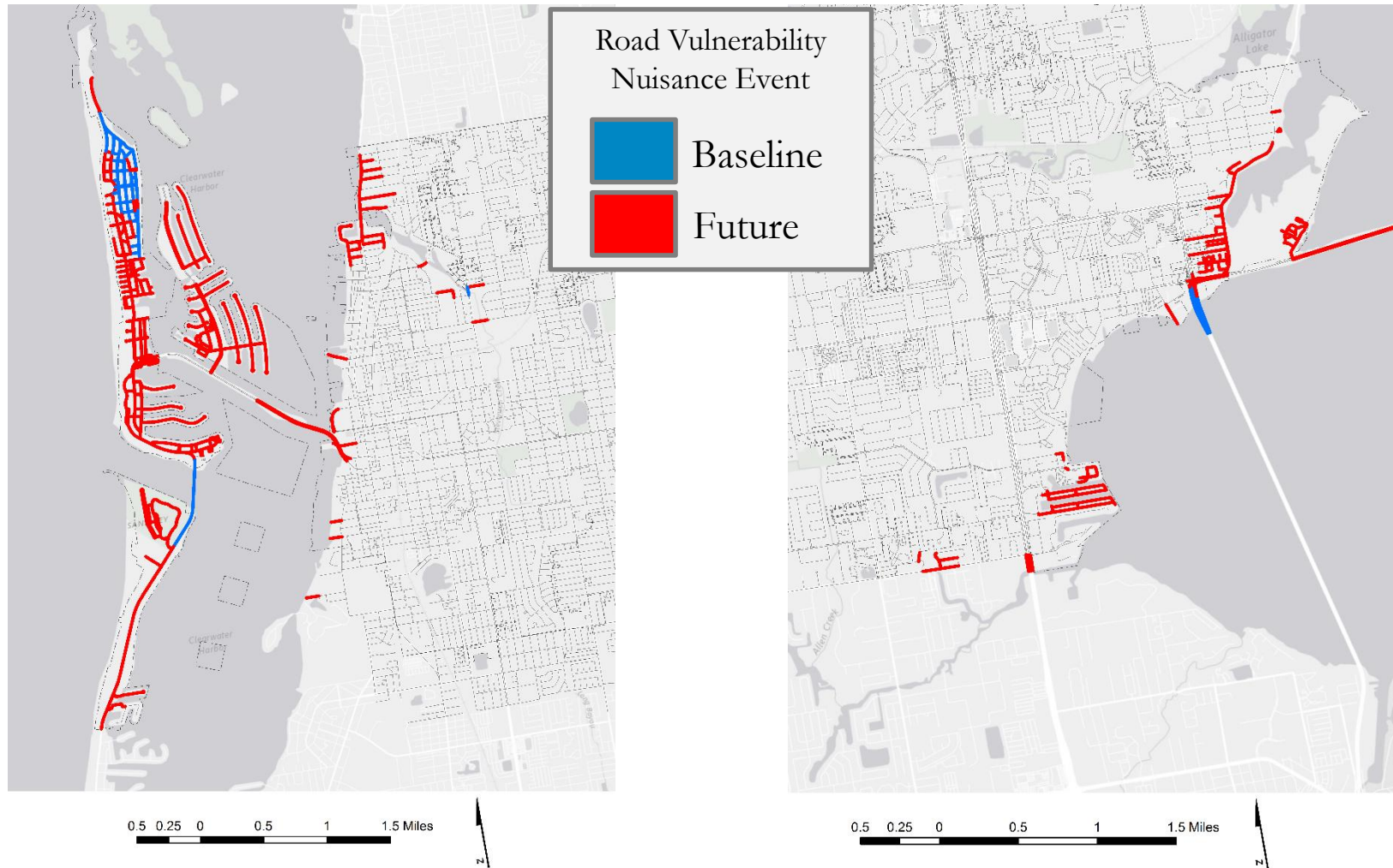
East side of Curlew Rd bridge not passable for all 100-yr and 500-yr scenarios.

Causeway begins to be vulnerable to nuisance flooding at the 2 ft SLR scenario. Inundated by nuisance flooding with the 3 ft scenario.

Causeway begins to be vulnerable to nuisance flooding at the 3 ft SLR scenario. Not passable under any existing or future 100-yr or 500-yr event conditions.

Not passable under nuisance flood events after 2 ft of SLR.  
Bridge passable, but routes on both ends are inundated under nuisance flooding with 2 ft of SLR.

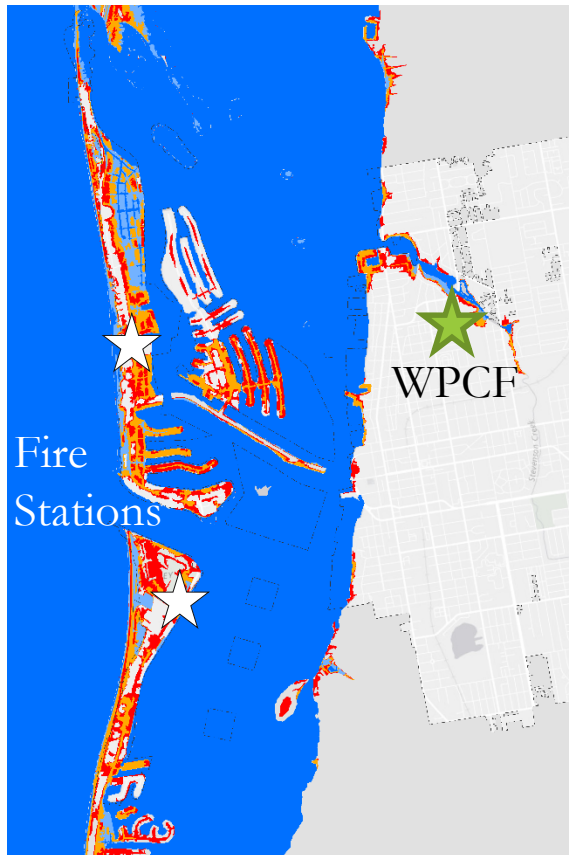
# Vulnerability Assessment - Roads



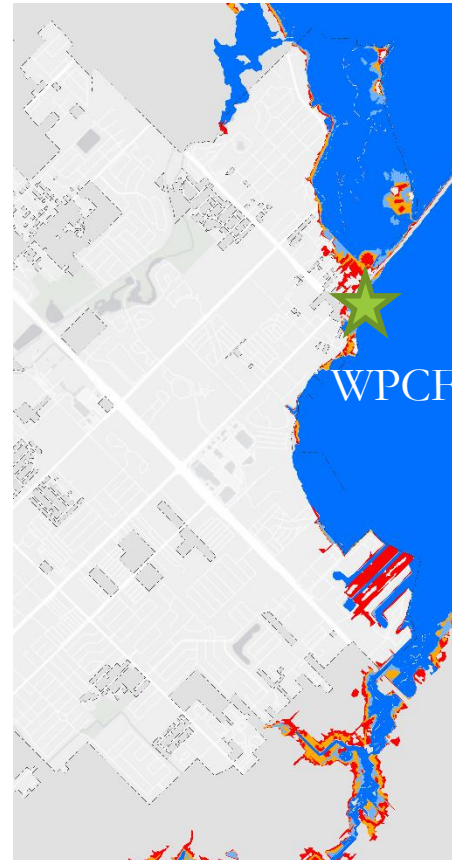


# Vulnerability Assessment – Critical Infrastructure

Nuisance (3 ft.),  
Gulf Coast



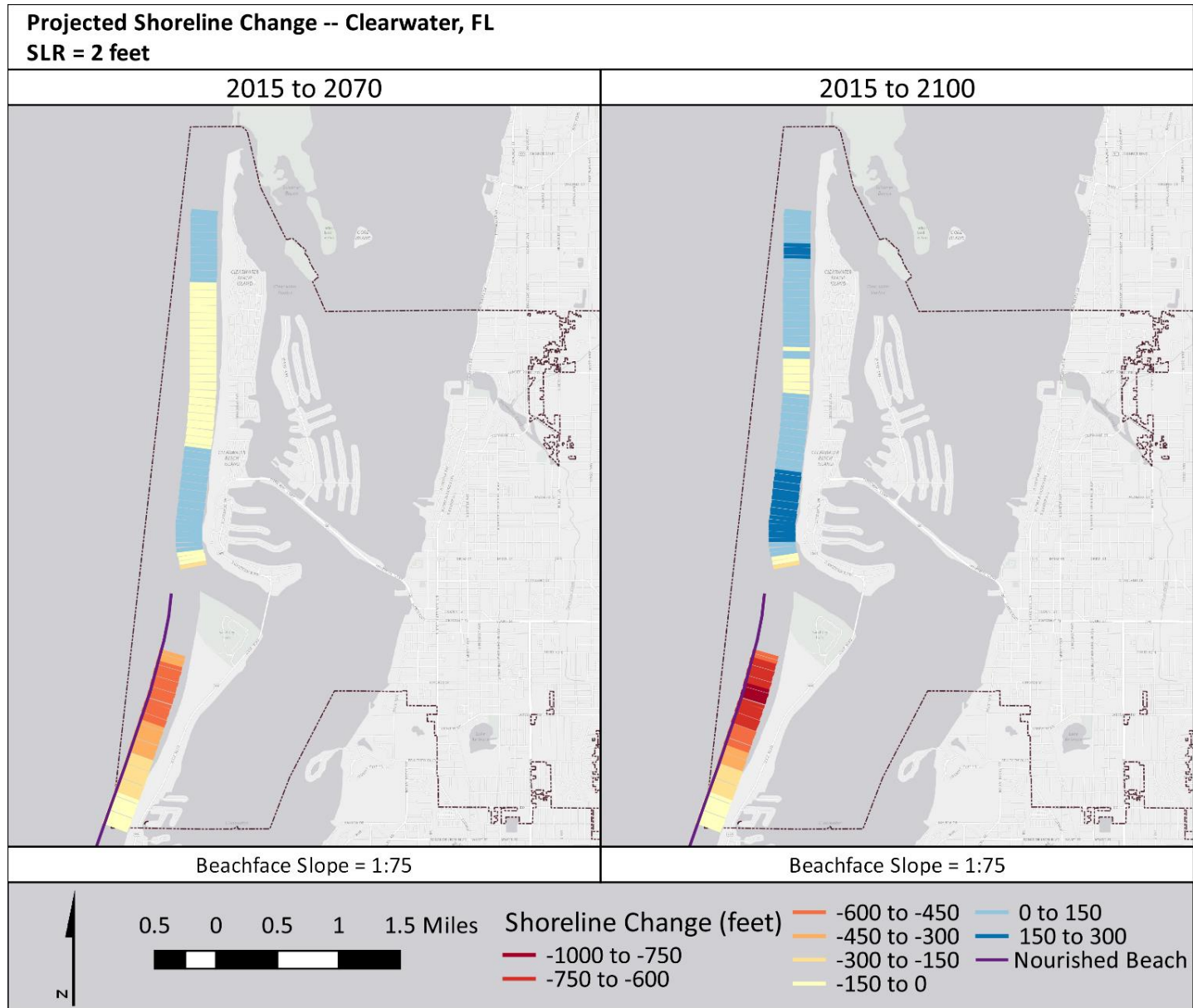
Nuisance (3 ft.),  
Eastern Shore



## Vulnerability Assessment

- Two fire stations on the barrier islands are affected by 1% (100-yr) and 0.2% (100-yr) event as well as nuisance above 2 ft. SLR.
- Two water pollution control facilities are impacted by 1% and 0.2% currently and under future scenarios
- No schools are within floodplains

# Shoreline Response +2 ft.



# Vulnerability Summary

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*Some analysis was more useful than others*

- NOAA scenarios
  - Representative values for short, moderate, and long term
  - Flood extents for nuisance, 1% and 0.2% recurrence interval floods
    - Impacts to buildings, roads, bridges, infrastructure
    - Vulnerability can be evaluated further when additional data (ie lowest floor elevations) are available
- Shoreline and Water Table Response
  - Historical and future shoreline positions
  - Historical and future water table
  - Aquifer vulnerability to SLR

# Task 2. Adaptation Planning



# Task 2. Adaptation Planning

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## Adaptation Workshop

- Purpose:
  - Discuss available planning, policy and regulatory strategies to improve resilience to issue; obtain community input to support further evaluation and prioritization
- Outcomes:
  - Identification of gaps or unfeasible strategies
  - Obtain community input into feasibility rating factors for strategy evaluation/prioritization framework
- Participating Agencies
  - Planning
  - Transportation
  - Stormwater
  - Economic Development
  - Parks
  - Utilities

# Examples of Stakeholder Concerns

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## Political

- Likely resistance from hotel and condo owners, especially on the barrier island, to restrictions on current development
- Optics and messaging challenges owing to climate change skepticism
- Doubts about flood insurance's prudence
- General preference for hard protective measures over alternatives



# Examples of Stakeholder Concerns

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## Regulatory

- State agencies will generally defer to localities' adoption of adaptation-oriented provisions in disaster recovery, development, and re-development planning elements
- Patchwork jurisdiction with Pinellas County (85% is Clearwater; 15% Pinellas) means collaboration is necessary for enforcement, programmatic changes, and sometimes grant requests in stormwater management and water quality contexts
- “Substantial improvement” criteria in flood zones currently provides a loophole for avoiding code compliance

# Adaptation Discussions

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Issue Area	Specific Issues Identified	Potential Responses Discussed
Stormwater Management	7	8
Flood Insurance and Freeboard	5	4
Coastal Management	1	1
Wastewater Management	2	3
Roads and Bridges	2	2
Disaster Recovery	3	3
Justifying Adaptation Measures	2	2

# Adaptation Issue Areas - Stormwater

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Issue Identified	Responsive Strategy Discussed
Nuisance flooding is already straining the capacity of the current system, which is gravity-driven, and is expected to become more frequent and severe	➔ Flood plain restoration (past instance entailed buyout of mobile home park; few obvious places to repeat this solution), installation of catchment ponds and labyrinth weir, use of sports fields as overflow basin; Greater use of green infrastructure (including pervious pavements and retention basins) to reduce inflow volumes
Noncompliance by residents of Pinellas County patches with stormwater-related restrictions	➔ Greater coordination with Pinellas re implementation of MS4 permit
Lack of setbacks in residential areas promotes erosion into system, which in turn requires more maintenance effort	➔ Berms, buffers and other BMPs have reduced erosion

# Adaptation Issue Areas - Stormwater

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Issue Identified	Responsive Strategy Discussed
Trash in grates, traps/impedes flow	➔ Inform public of linkage between litter and flooding
Constant inundation of some pipes supports growth barnacles, which reduce flow unless cleared out (again, higher maintenance effort)	➔ Re-engineer and/or line pipes; budgeting for more maintenance
CSX rail ties (left to fall into adjacent ditches) and vegetation control regime both promote erosion and impede flow	➔ Gather evidence of CSX conduct, approach CSX informally to warn that legal challenge could follow
Consent decree-driven TMDLs for bacteria, nitrogen, require address	➔ Growing flood risk will bring water quality issues closer to stormwater management issues; projects to deal with one should consider implications for the other

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# Adaptation Planning Process

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## Current Status

The National Oceanic and Atmospheric Administration's U.S. Climate Toolkit describes adaptation planning as proceeding in five steps:

- 1) Identify climate-related changes and risks;
- 2) Assess vulnerabilities;
- 3) Investigate possible responses;
- 4) Prioritize responses to achieve near- and longer-term adaptation goals; and
- 5) Execute and evaluate outcomes.

Clearwater completed steps 1 and 2 with Dewberry's help and is currently engaged in step 3. **For Clearwater to complete steps 3 and 4—and eventually 5—it should use the recommendations in the adaptation report** to develop plans for specific projects, which can be assessed and prioritized based on analyses that consider their feasibility, costs, benefits, and cost-effectiveness relative to alternatives.

# Florida Community Resiliency Initiative Pilot Project

## Adaptation Plan *for Clearwater, Florida*

May 2017

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# Technical Assistance Process

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## End of Pilot Project

- Clearwater and St Augustine are currently leveraging vulnerability products to help address SB 1094 “Peril of Flood” requirements
- Final materials are being reviewed and transmitted to stakeholders
- A “lessons learned” document was also provided to capture what worked and didn’t work throughout vulnerability and adaptation processes
- A guidebook will be produced to help communities going through similar activities

# Additional Information

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