Transportation | Planning | Exchange

TRANSPLEX WEB SERIES

Drowning in Scenarios? Decision Making for Sea Level Rise

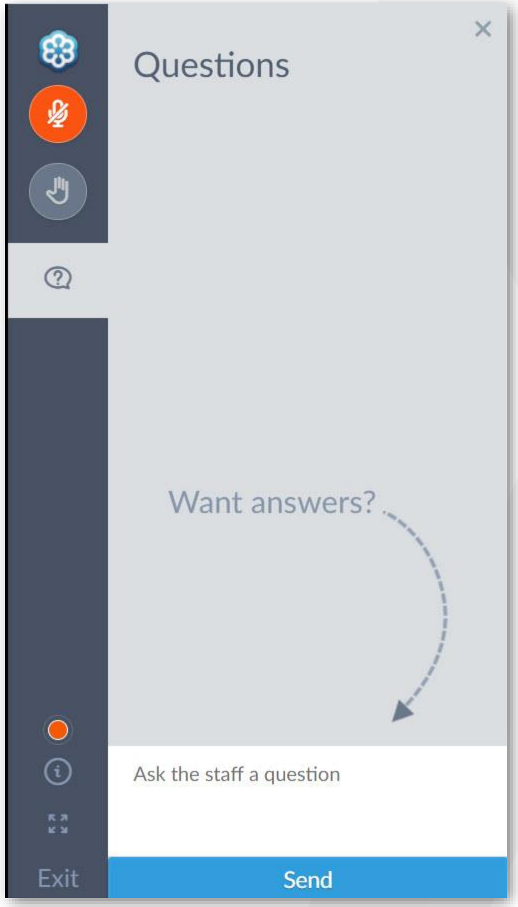
October 16, 2020

FDOT

Office of Policy Planning

ATTENDEE PARTICIPATION PANEL

- Attendees are automatically muted throughout the webinar
- Click the ? to open the panel box and submit a question to the panelists
- Answers to questions will be addressed by the panelists either verbally or in the question box
- Webinars are being recorded and will be available with other materials on the TransPlex website
- Please complete the follow up survey that will be sent via email at the conclusion of this webinar



PROFESSIONAL DEVELOPMENT CREDITS

Offered for Planners and Engineers that attend the live session.

1.5

You must attend the entire session to be eligible for 1.5 hours of credits.

FDOT employees will can download certificates through Learning Curve.

All other attendees will receive certificates via email.

CELEBRATING FLORIDA'S PLANNERS
(2020 PLANNING PROFESSIONAL OF THE YEAR NOMINEES)

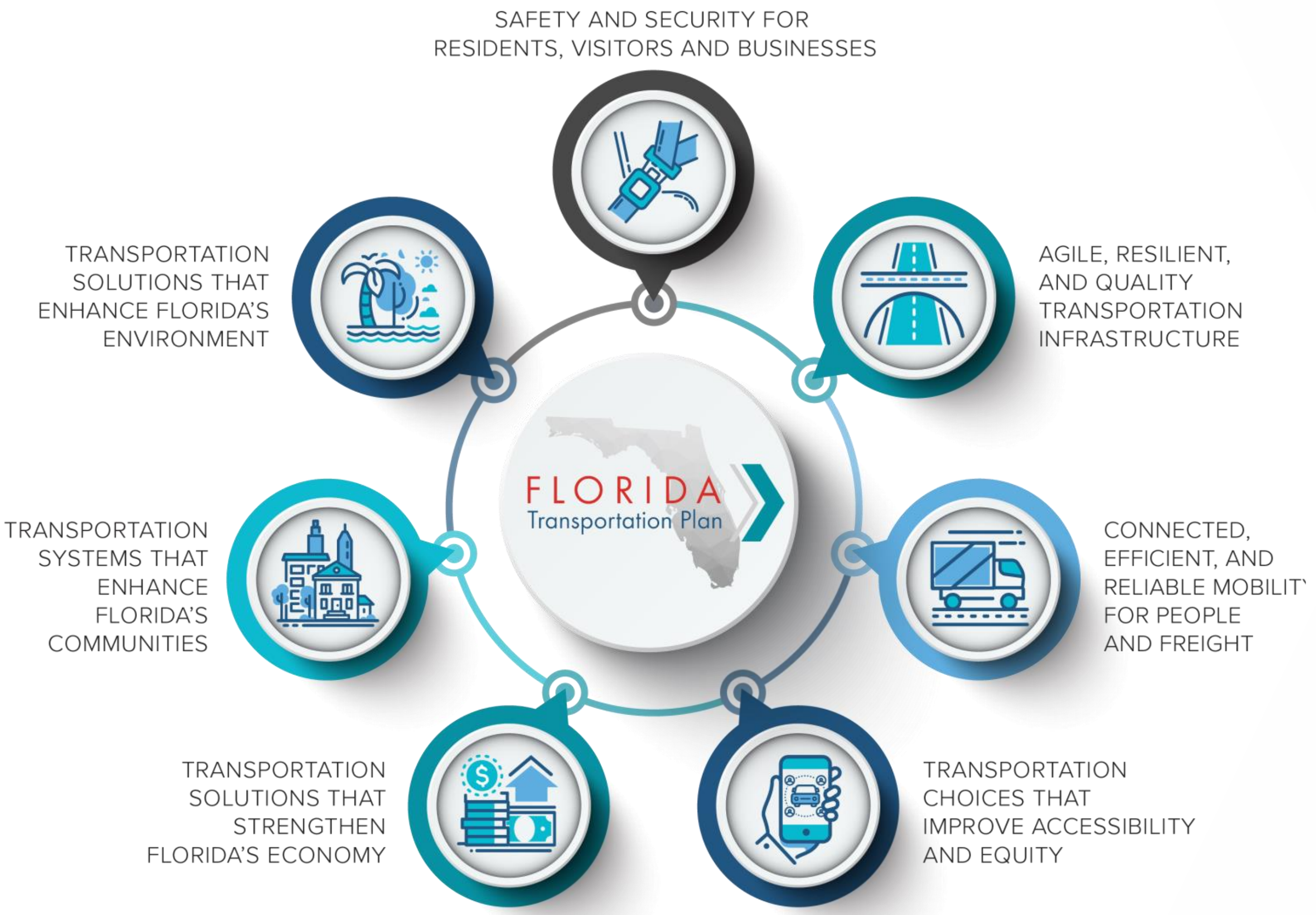
Sarah Kraum

Space Coast Transportation Planning Organization

Thomas Hawkins

1000 Friends of Florida

FLORIDA TRANSPORTATION PLAN GOALS



PRESENTERS

Jennifer Z. Carver, AICP
Florida Department of Transportation

Crystal Goodison
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University of Florida

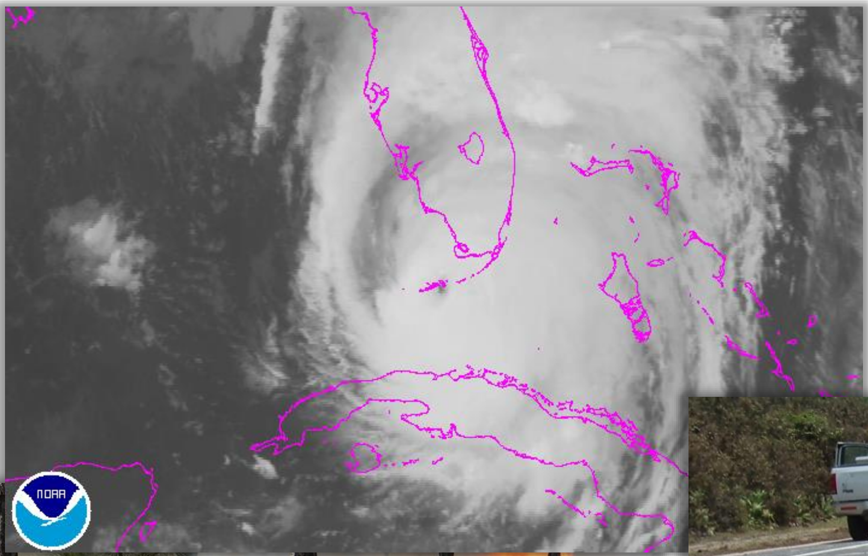
Renee Collini
Northern Gulf of Mexico Sentinel Site Cooperative
Mississippi State University
MS-AL Sea Grant Consortium

INSERT POLL ANSWERS

NATURAL HAZARDS IMPACTING FLORIDA

- Hurricane Storm Events
- Precipitation Events
- Sea Level Rise
- Wildfires
- Drought
- Sinkholes

Irma making landfall in the Florida Keys
Credit: NOAA



A law enforcement vehicle patrols a flooded street in Everglades City, Florida, U.S., September 11, 2017. REUTERS/Bryan Woolston

Credit: Florida Forest Service

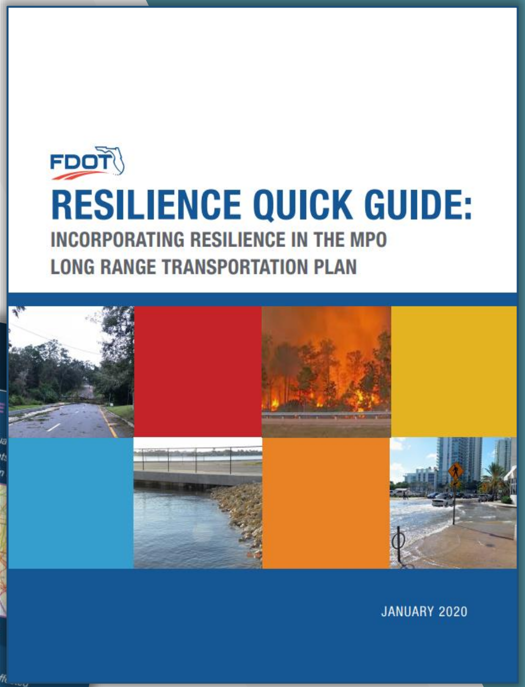
US 98 in Franklin County. FDOT

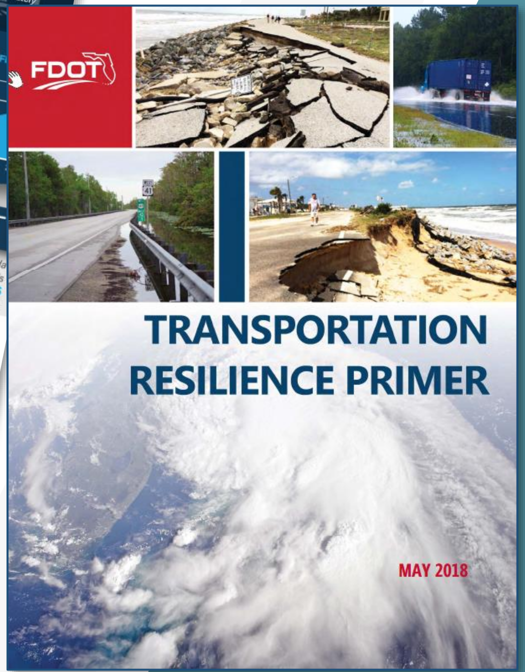
WHY RESILIENCY?

- **Resiliency --** The ability of the transportation system to adapt to changing conditions and prepare for, withstand, and recover from disruptions.
- **Why?** Mitigate risk, make wiser investment decisions, and provide safer, more reliable transportation.
  - Fixing America's Surface Transportation (FAST) Act
  - Florida Transportation Plan (FTP)
  - Transportation Asset Management Plan (TAMP)

FDOT RESILIENCY INITIATIVES

- Statewide Planning & Policy
- Interagency Coordination/Collaboration
- Vulnerability Assessment
- Tools, Guidance, Standards
  - Guidance for MPOs
  - Sea Level Scenario Sketch Planning Tool
  - Case Studies/Adaptation Planning
- Research
- Projects





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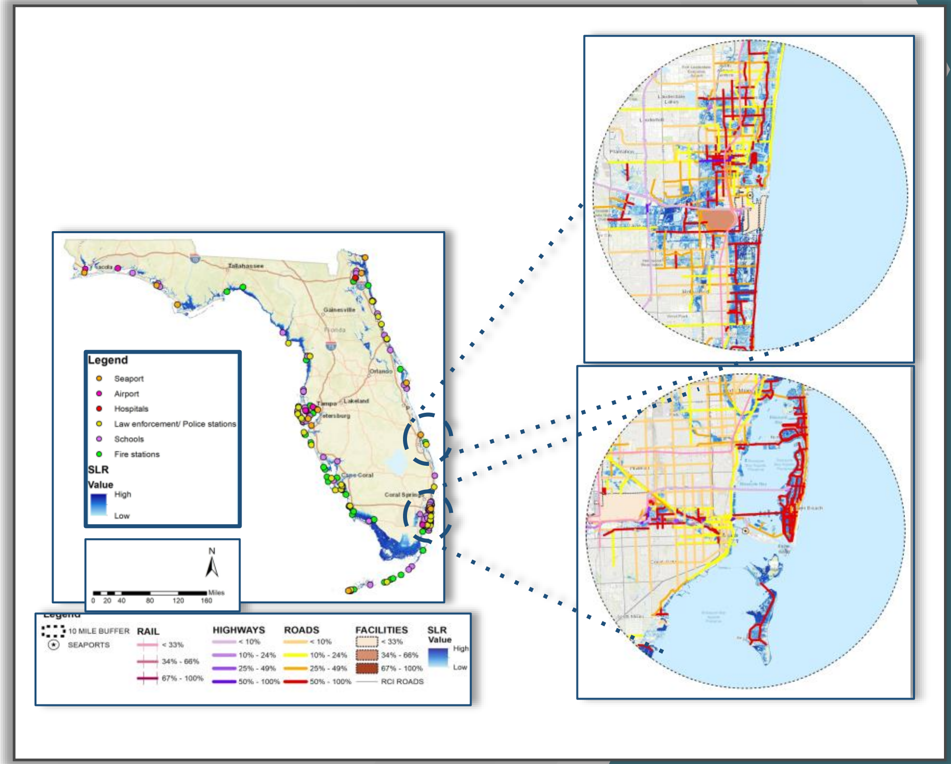
STRATEGIC INTERMODAL SYSTEM (SIS) VULNERABILITY ASSESSMENT

FDOT RESEARCH

- Completed
  - Incorporating Risk in Transportation Planning and Project Implementation
  - Sea Level Rise Risk research led to development of Sea Level Scenario Sketch Planning Tool
- Ongoing
  - Sea Level Scenario Sketch Planning Tool Updates
  - Transportation System Resilience and Vulnerable Populations
  - Resilience Index for Transportation System

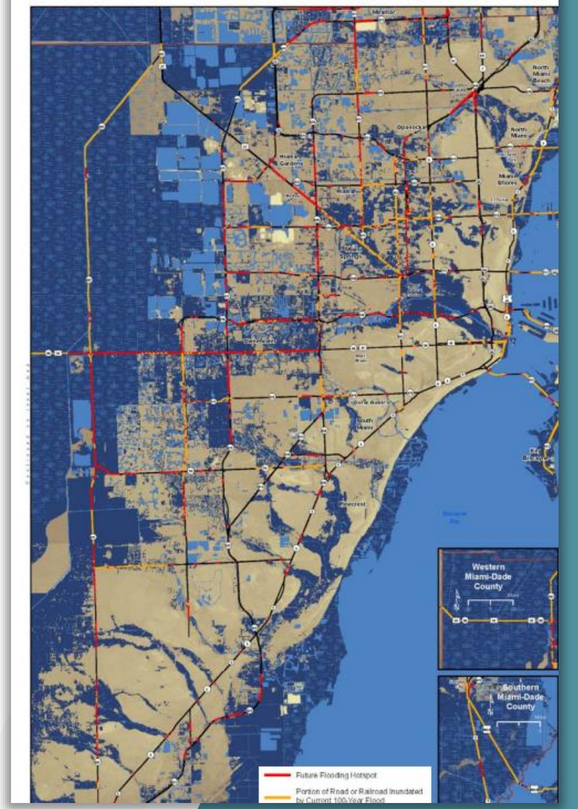
	Risk Event	Likelihood	Consequence	Vulnerability	Overall Risk	Timeframe	Risk Level	Consequence Management
	Threats							
security for residents, visitors, and businesses	Hacking and cybersecurity threats to public and private transportation	4	4	5	80	E	Extreme Risk	Avoid
	New technology causes investment to be prematurely obsolete	4	4	5	80	E	Extreme Risk	Avoid
	Intensification of development in high hazard areas	5	4	4	80	C	Extreme Risk	Avoid
	Aging population causes surge in demand for safe mobility options	5	4	3	60	E	High Risk	Coordinate
	Wildfires disrupt major transportation routes and reduce visibility	4	3	4	48	U	Moderate Risk	Mitigate
	New technology systems perform unsafely or increase liability	3	5	3	45	U	Moderate Risk	Avoid
	Failure to evacuate vulnerable populations due to evacuation routes in high hazard areas	2	5	4	40	U	Moderate Risk	Coordinate
	Arterial flooding disrupts major transportation routes and systems	4	3	3	36	C	Moderate Risk	Mitigate



UPCOMING RESEARCH & STUDIES

- FDOT
  - Incorporation of Climatic and Hydrologic Nonstationarity into FDOT Planning and Design Guidelines & Processes
  - Florida Sea Level Scenario Sketch Tool Extension for Custom Analysis
  - Integrating Resiliency in the Transportation Planning Process: A Baseline Assessment of Florida's MPOs Data Needs
- National Cooperative Highway Research Program (NCHRP)
  - Incorporating resilience in planning & design; business case for resilience; and more

Figure 7: Future flooding "hot spots" in Miami-Dade County.



Drowning in Scenarios? Decision-Making for Sea Level Rise

Renee Collini

Transplex Webinar

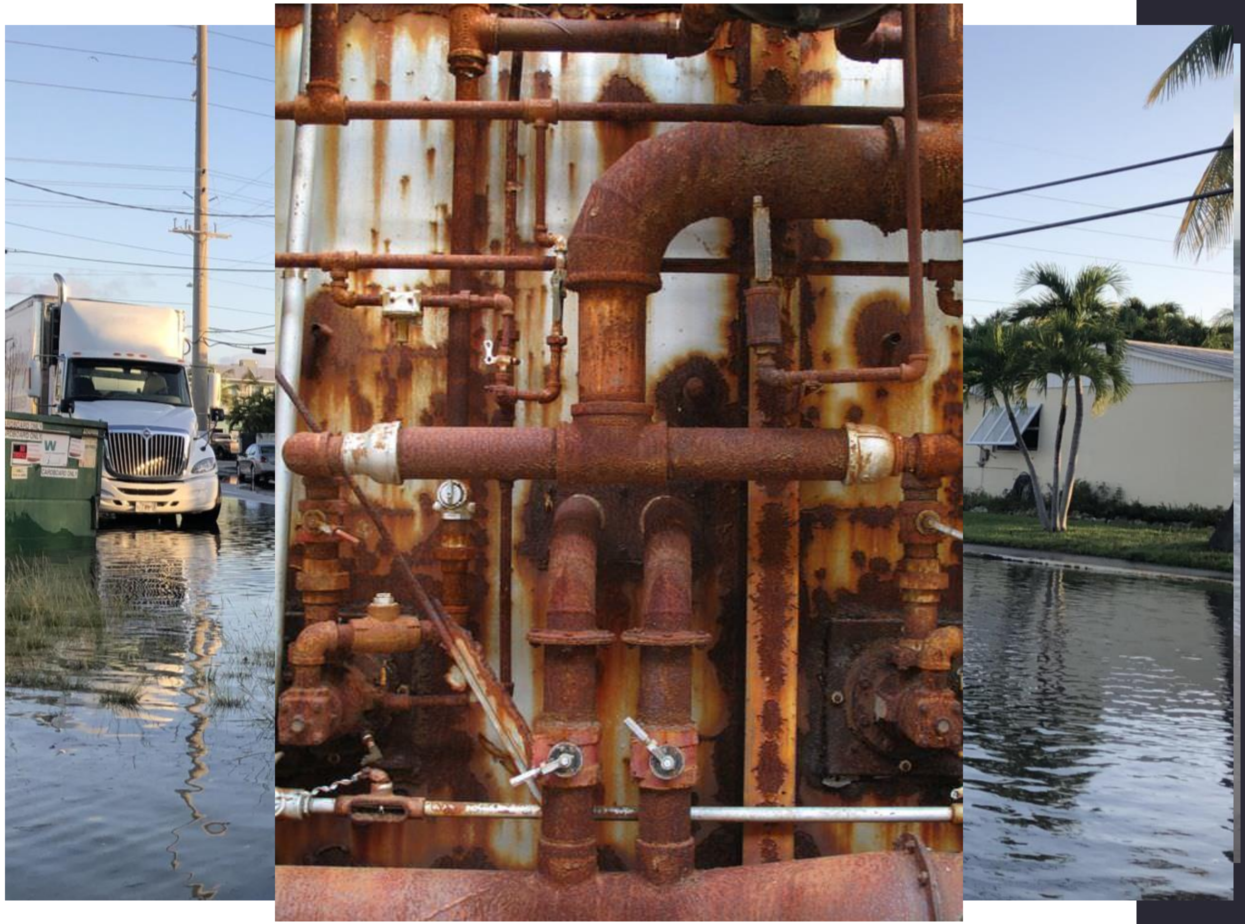
October 16, 2020

Overview

- Basics
- Narrowing Scenarios
- Translating Scenarios into Planning Info
- Case Studies
- Wrap-Up

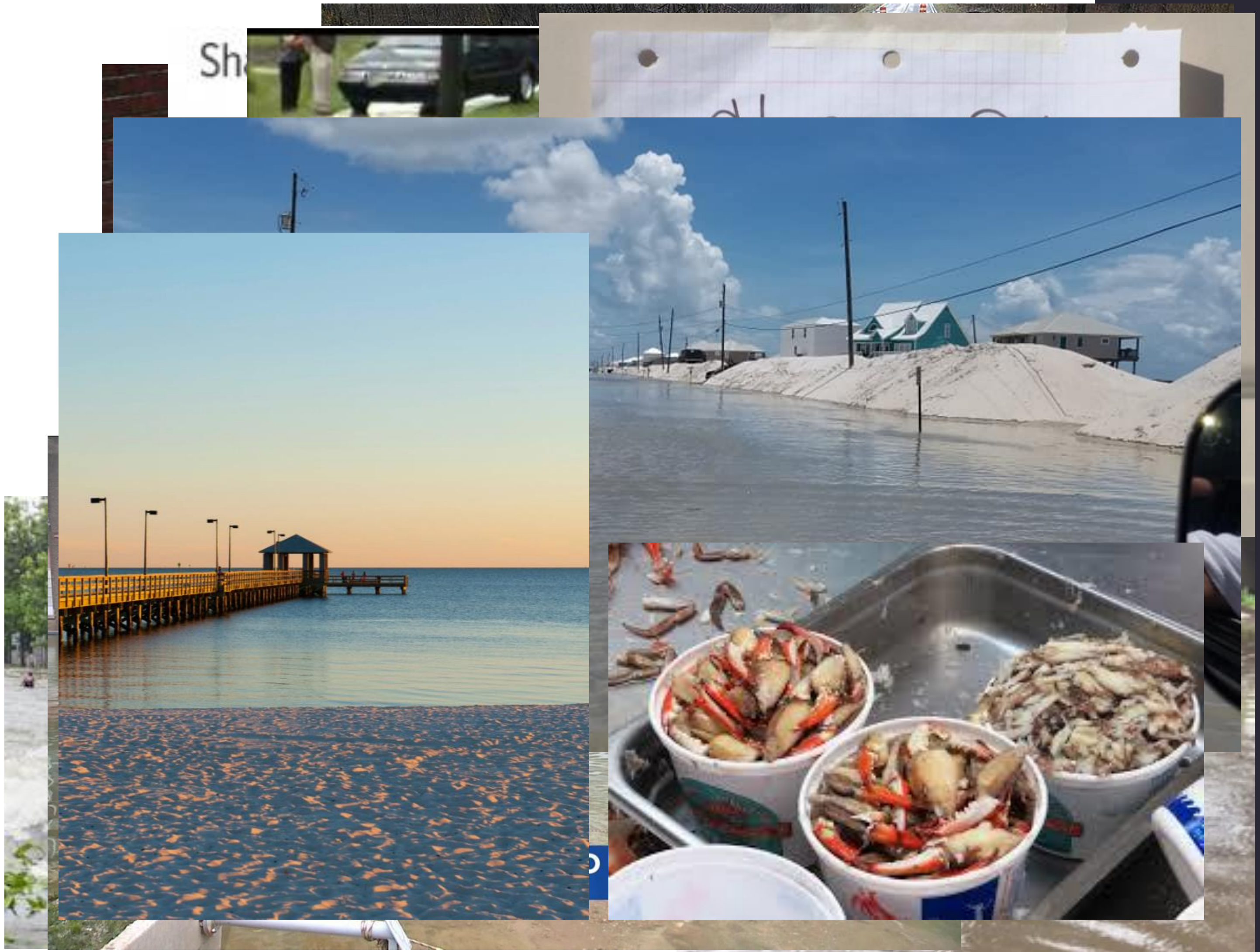
What does sea-level rise look like?

- Reduced storm drainage
- Exacerbated storm surge
- Increased erosion
- High tide flooding
- Saltwater intrusion



What does it mean for people?

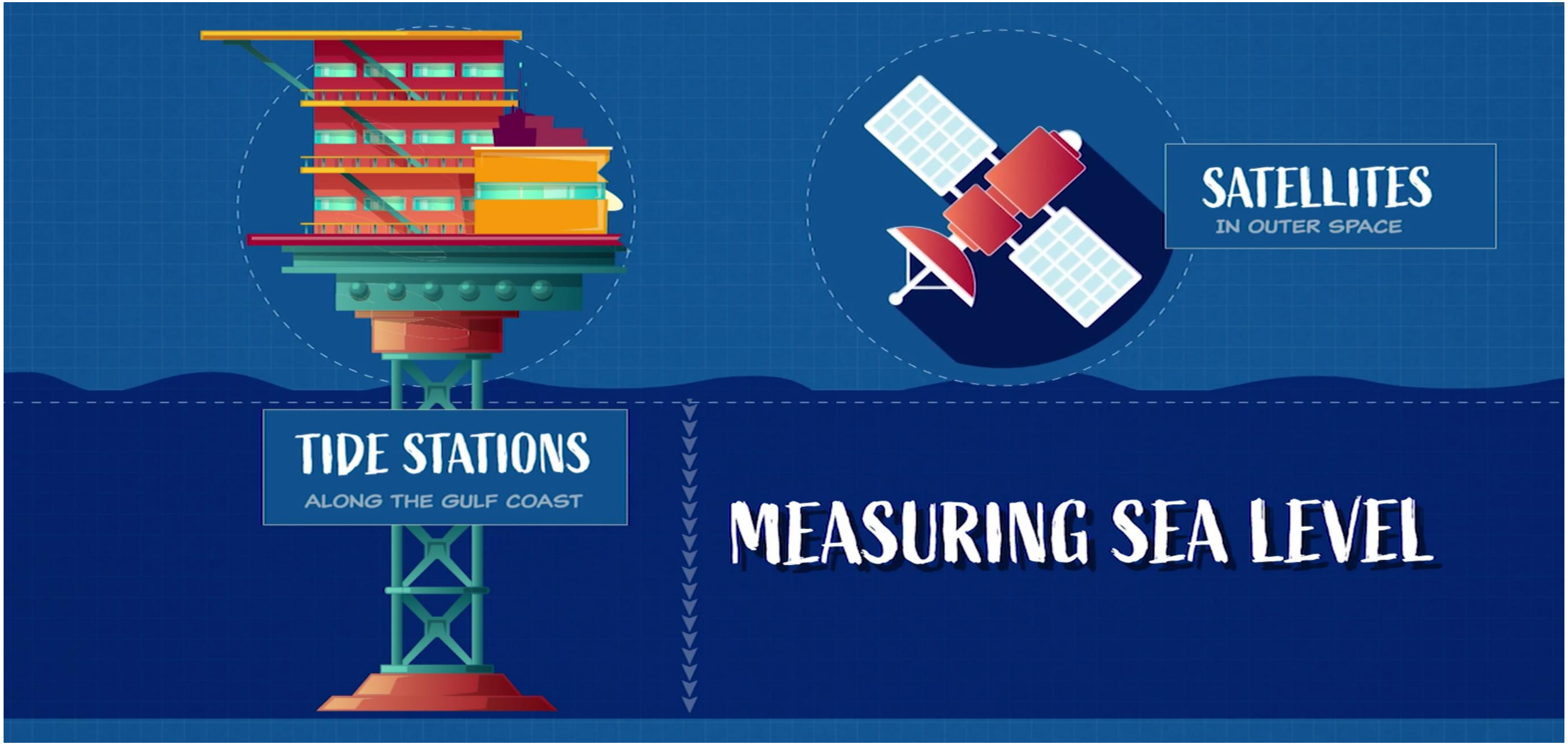
- Health risks
- Safety issues
- Direct damages
  - Individuals & Communities
- Economic disruptions
- Reduction in services
- Cultural impacts



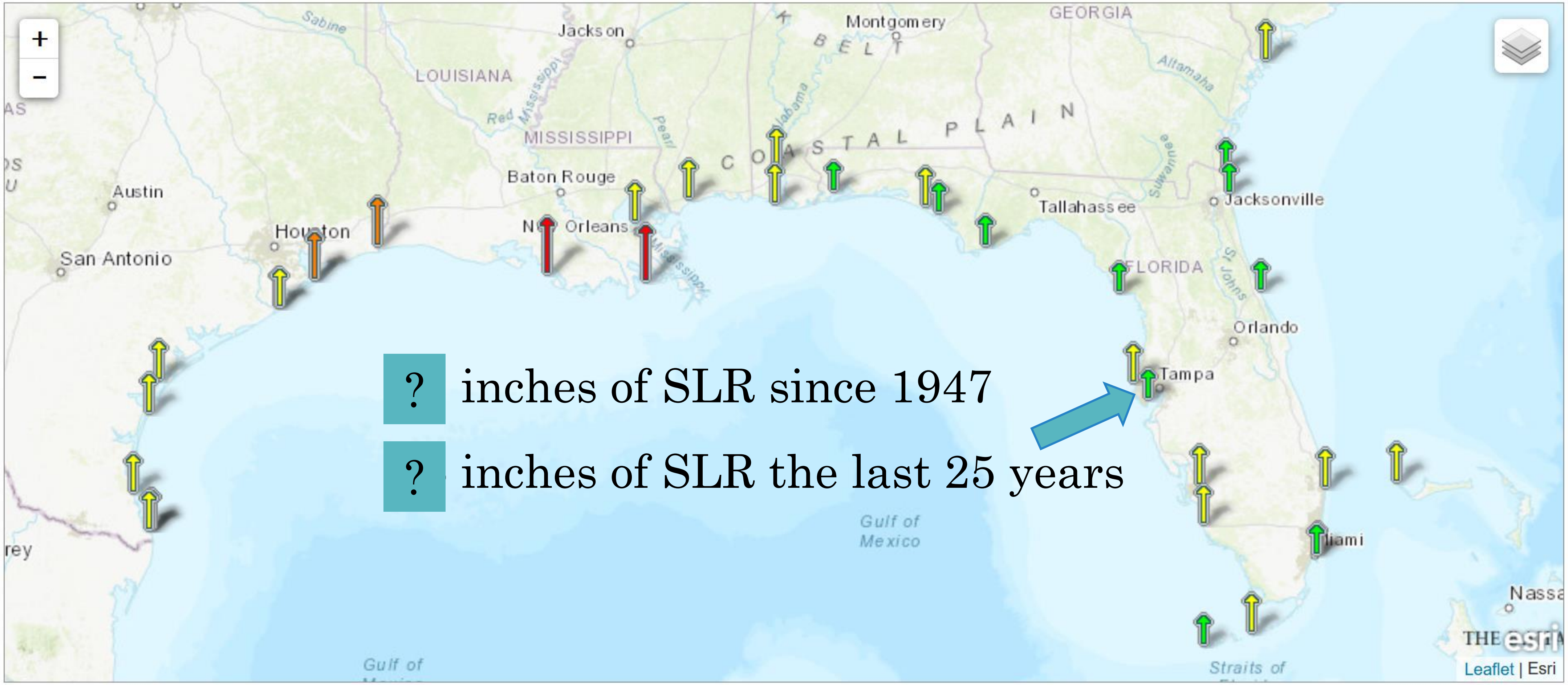
Understanding SLR

What is sea-level?

How do we know?

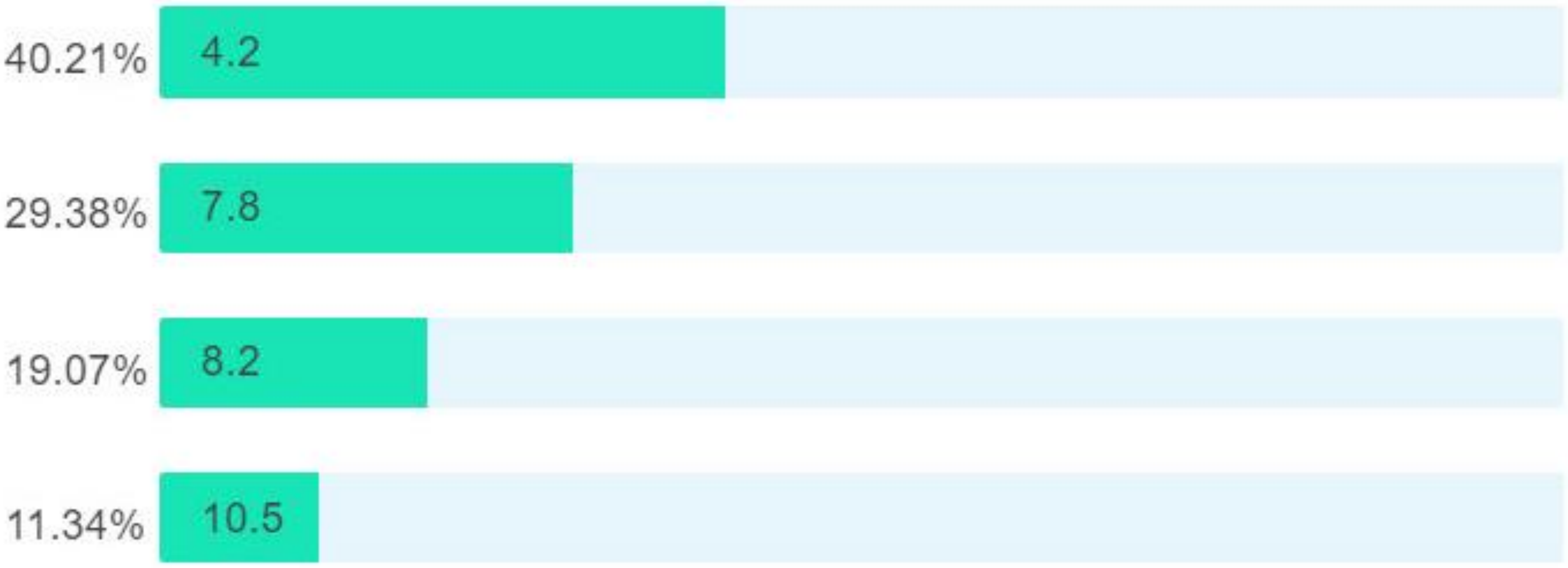


Relative Sea Level Rise



How many inches do you think seas have risen in St. Pete since 1947?

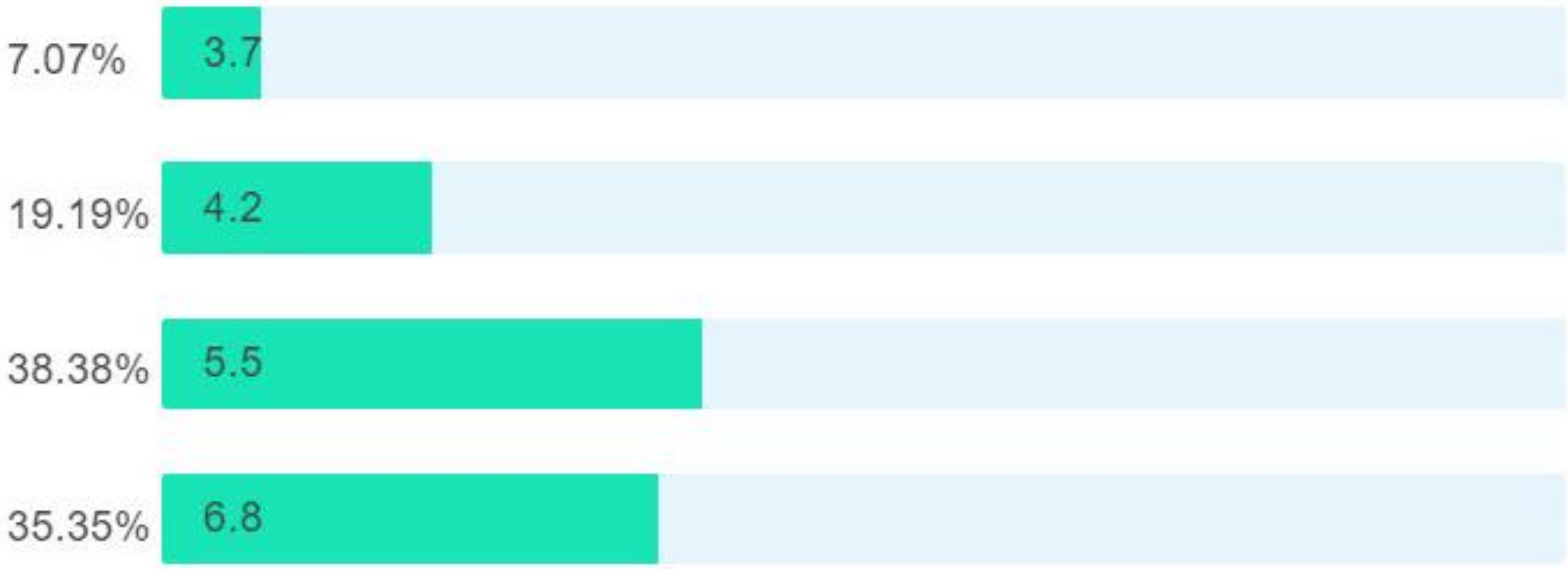
Multiple choice with single answer



Correct Answer: 8.2 inches

How many inches do you think seas have risen in St. Pete since 1995?

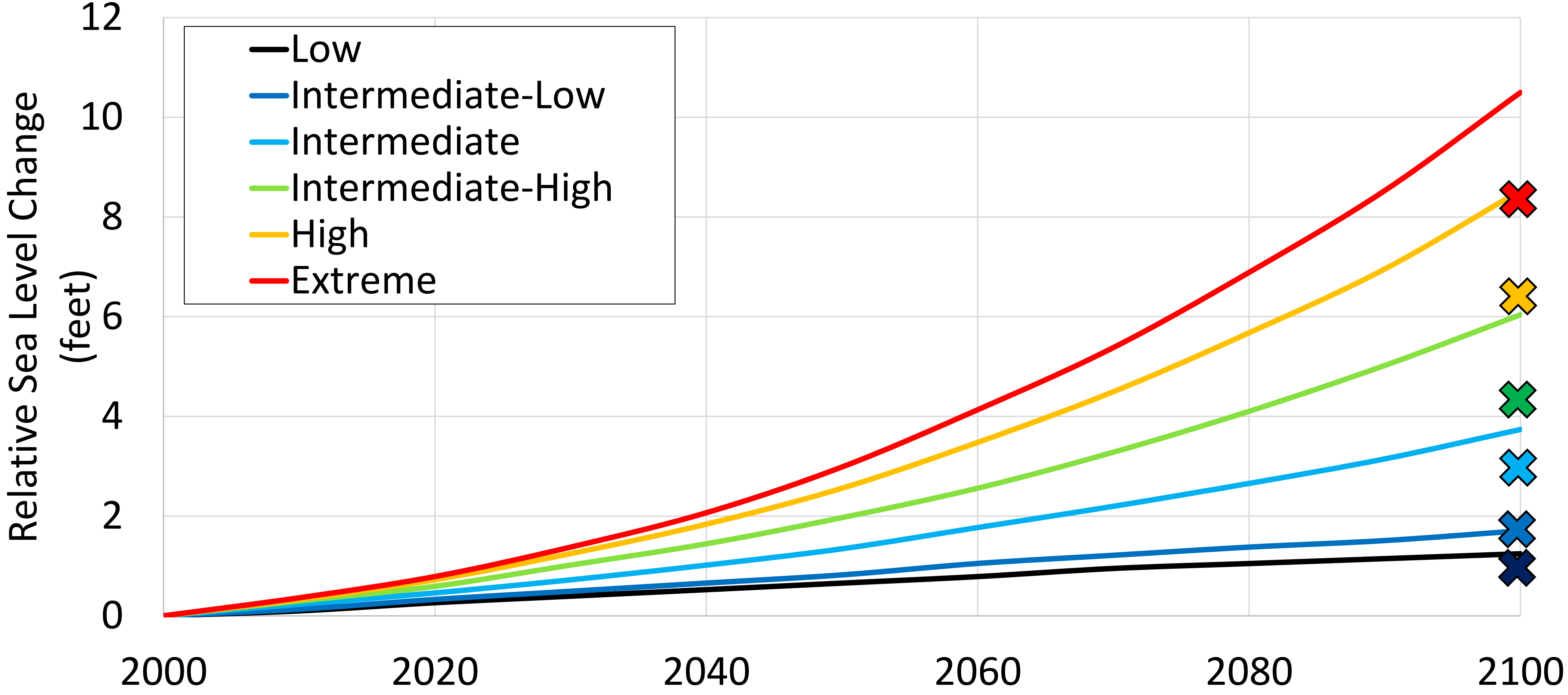
Multiple choice with single answer



Correct Answer: 5.5 inches

Relative Sea-Level Rise Scenarios

SLR Projections for Brevard County, FL



Local SLR Projections

- Sweet et al., 2017
- Printable PDF Resource Suite
- On

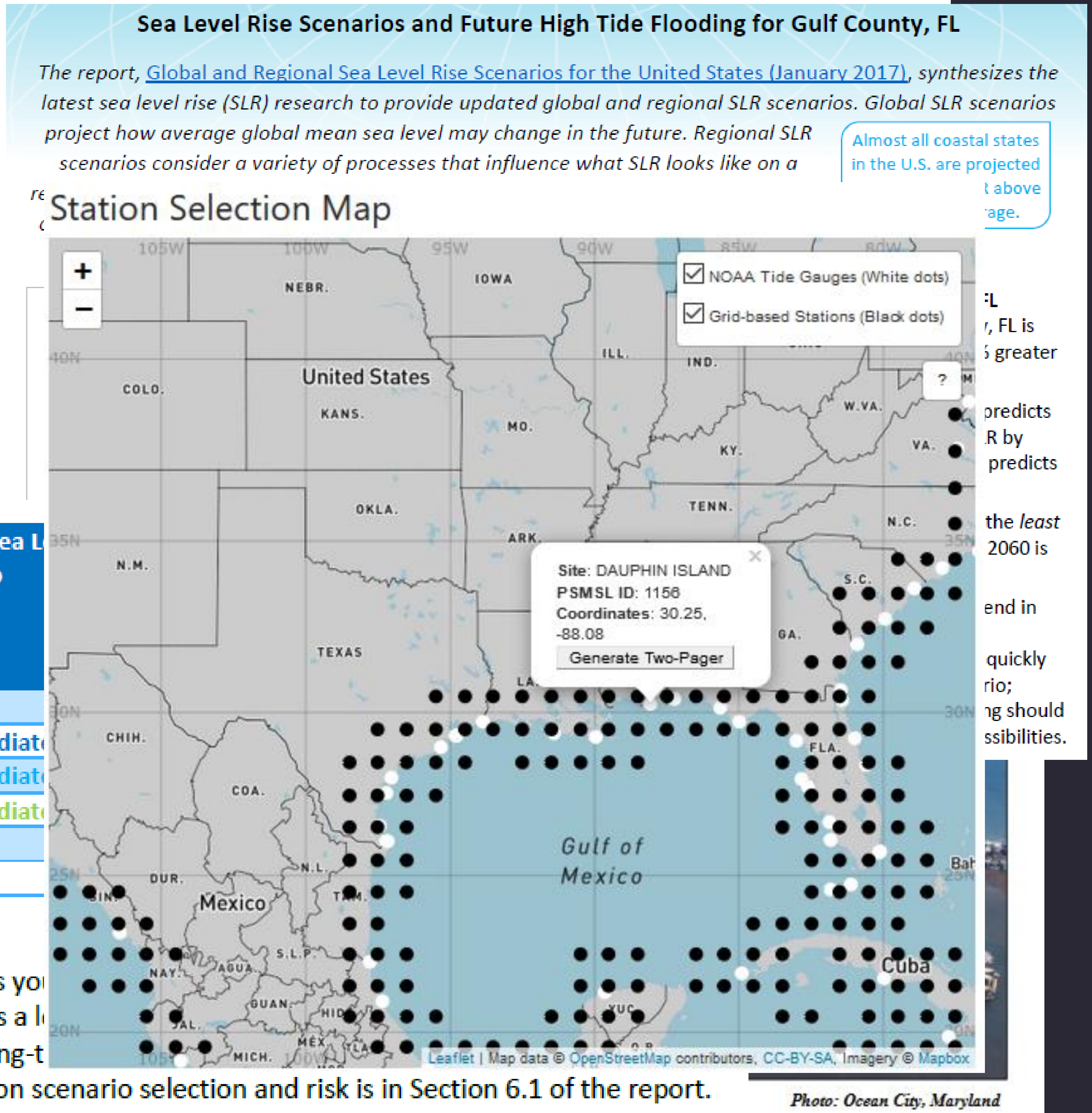
What do the probabilities mean?

The updated scenarios, low through extreme, cover the range of scientifically plausible scenarios. Probabilities help us understand the likelihood of each scenario occurring. For example, under RCP8.5, it is 100% likely that there will be at least 1 foot of SLR by 2100, while there is a low probability that there will be 8.2

upports yo
ario has a l
of occurring, you may want to plan for it when protecting long-t
military base or water treatment facility. More information on scenario selection and risk is in Section 6.1 of the report.

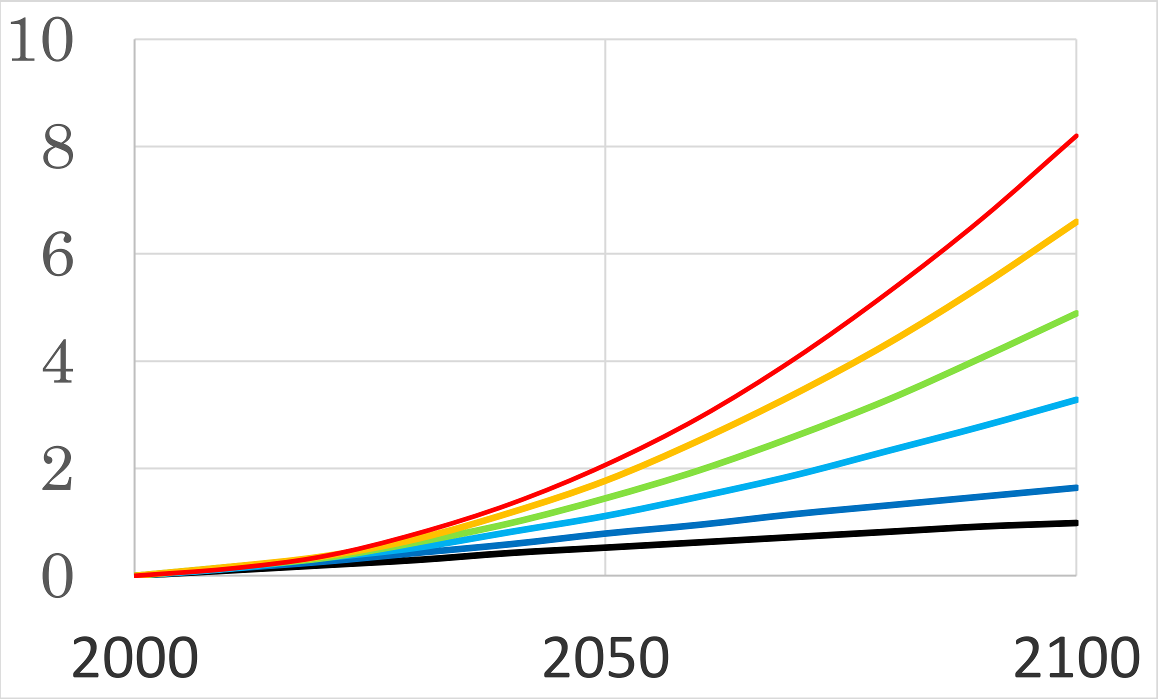
Global Sea L
Scenario
Low
Intermediat
Intermediat
Intermediat
High
Extreme

www.LocalSLR.org



Narrowing SLR Scenarios to a Planning Range

Why such a large range?



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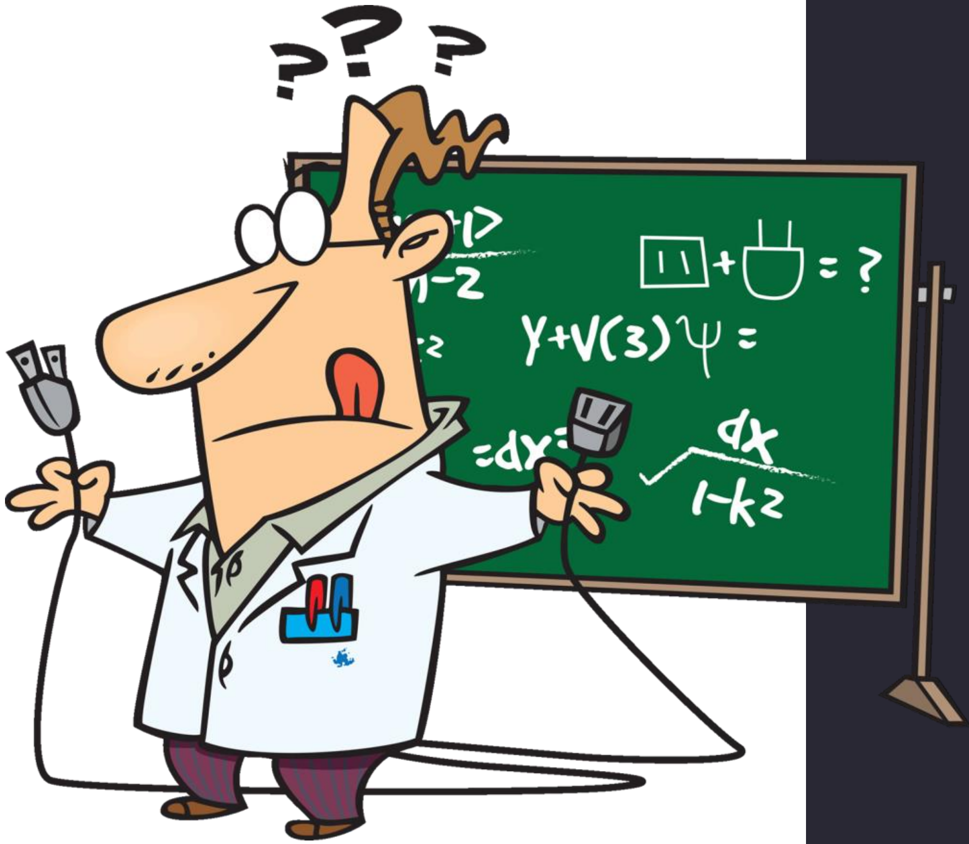


Big companies' climate cl
are 'unambitious', say ana

U.S. NEWS

US companies act on climate despite Trump: Survey

- Companies are still among the most ambitious in setting targets to combat global warming despite President Donald Trump's plans to quit the Paris

n a 2017 "A list" of 159 companies
ing climate change and protecting

Ireland secures 'fair deal' on carbon emissions under EU pact

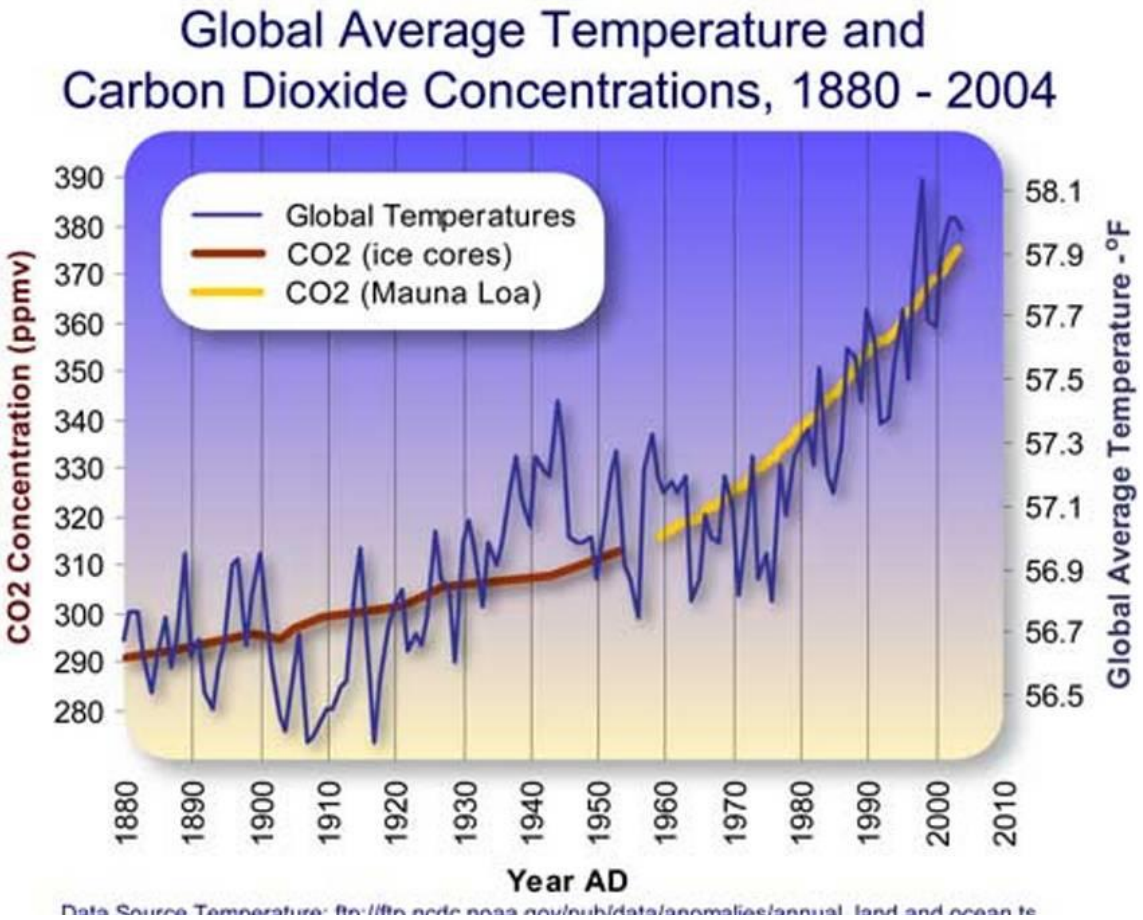
Implementing the Paris Agreement in the Pacific

Over 400 industries reduced CO2 emission by 2% in 2012-15

PTI | Oct 25, 2017, 02.23 PM IST

1 – We do not know how much carbon will be in the atmosphere.

Three major reasons for scenarios

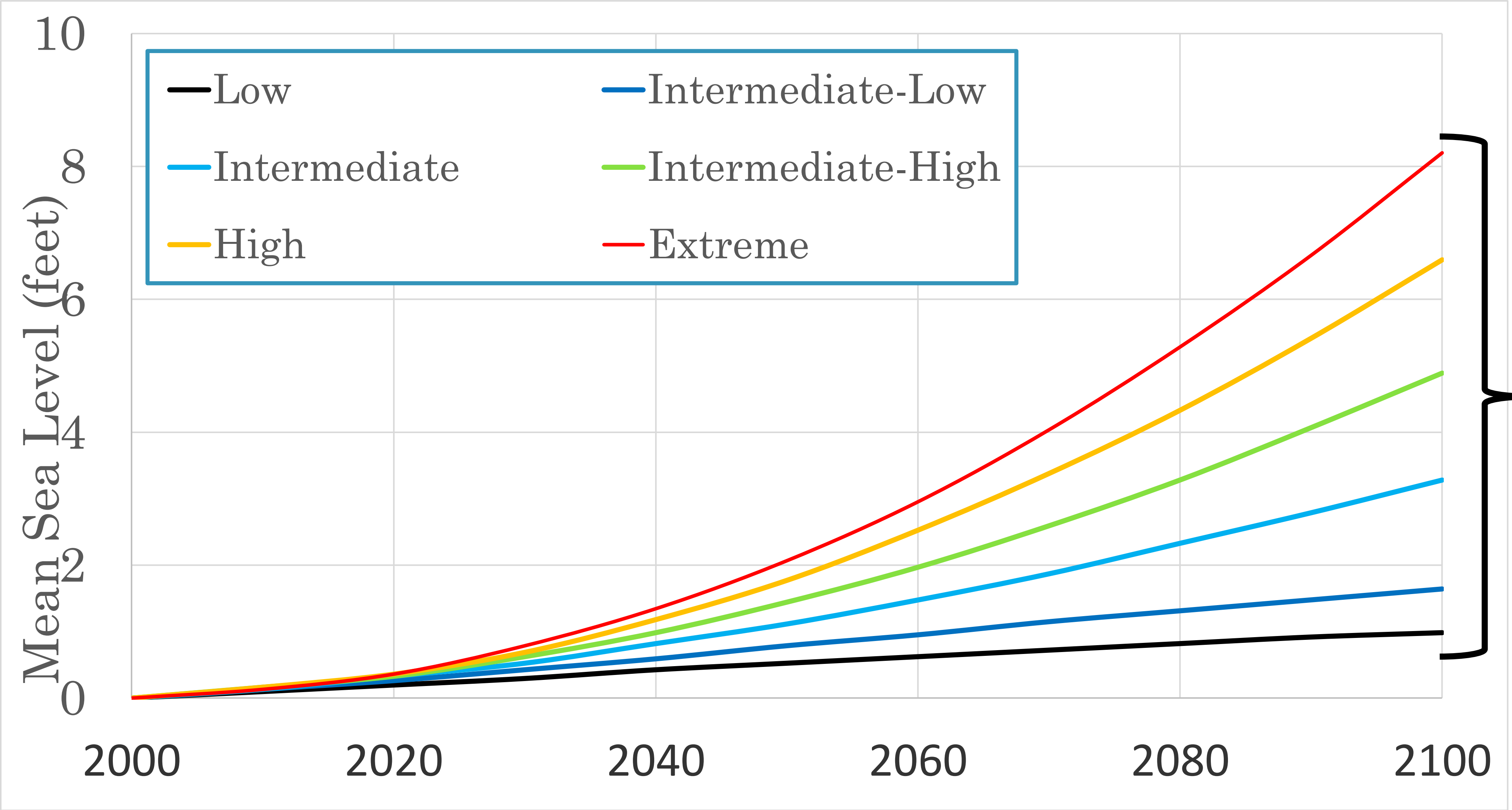


2 – Natural variability

Three major reasons for scenarios

3 – Still studying the ice sheet melt – the science to watch!

Global Scenarios - 2017



Range of scientifically possible scenarios

Likelihood of scenarios

Global Sea Level Rise Scenario	RCP2.6 dramatic reduction of carbon emissions	RCP4.5 modest reduction in carbon emissions	RCP8.5 no change in carbon emissions
Low	94%	98%	100%
Intermediate-low	49%	73%	96%
Intermediate	2%	3%	17%
Intermediate-high	0.4%	0.5%	1.3%
High	0.1%	0.1%	0.3%
Extreme	0.05%	0.05%	0.1%

What is your flood risk tolerance?

High Tolerance for Risk

Minor Impact

Moderate Tolerance for Risk

Moderate Impact

Low Tolerance for Risk

Major Impact

Thinking about your risk tolerance

- Scale dependent
- Location dependent
- Cost/value
- Function
  - Critical service?
  - Number of people impacted
- Length of Time
- Adaptability

Risk Tolerance Examples

- Hospital
  - High Expense
  - Critical function
  - Long-term

Bridge that is critical to ingress/egress

- Buying A Home
  - Moderate Expense
  - Critical function to me
  - Mid-term (30 years)

Main route for commerce and/or commuting

- Shed
  - Minor Expense
  - Not critical
  - Short-term

Repaving or smaller roads with many alternatives

Linking risk tolerance & likelihood

Sea level rise scenario	Likelihood
Low	100%
Intermediate-low	96%
Intermediate	17%
Intermediate-high	1.3%
High	0.3%
Extreme	0.1%

High Tolerance for Risk

Moderate Tolerance for Risk

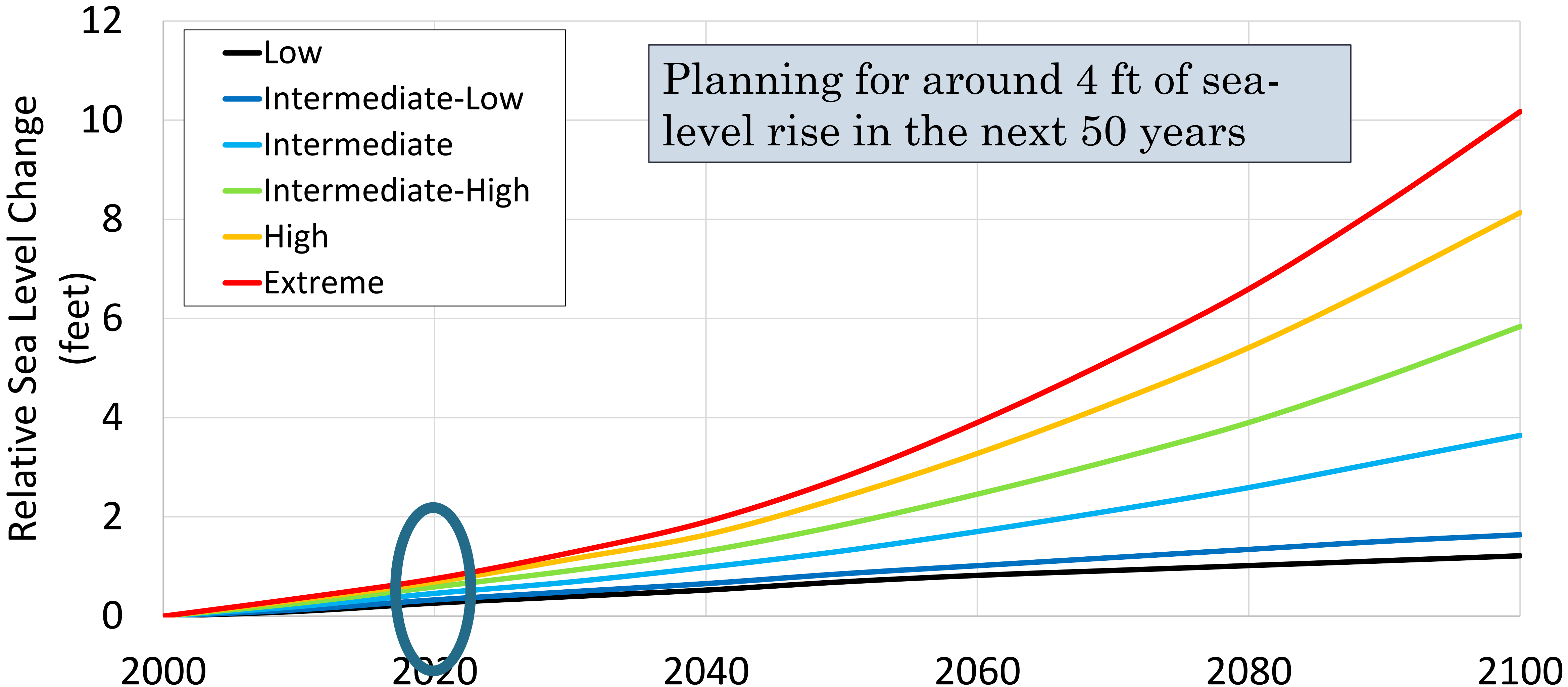
Low Tolerance for Risk

Low chance of happening, but would have a big impact

High chance of happening, but would have a low impact

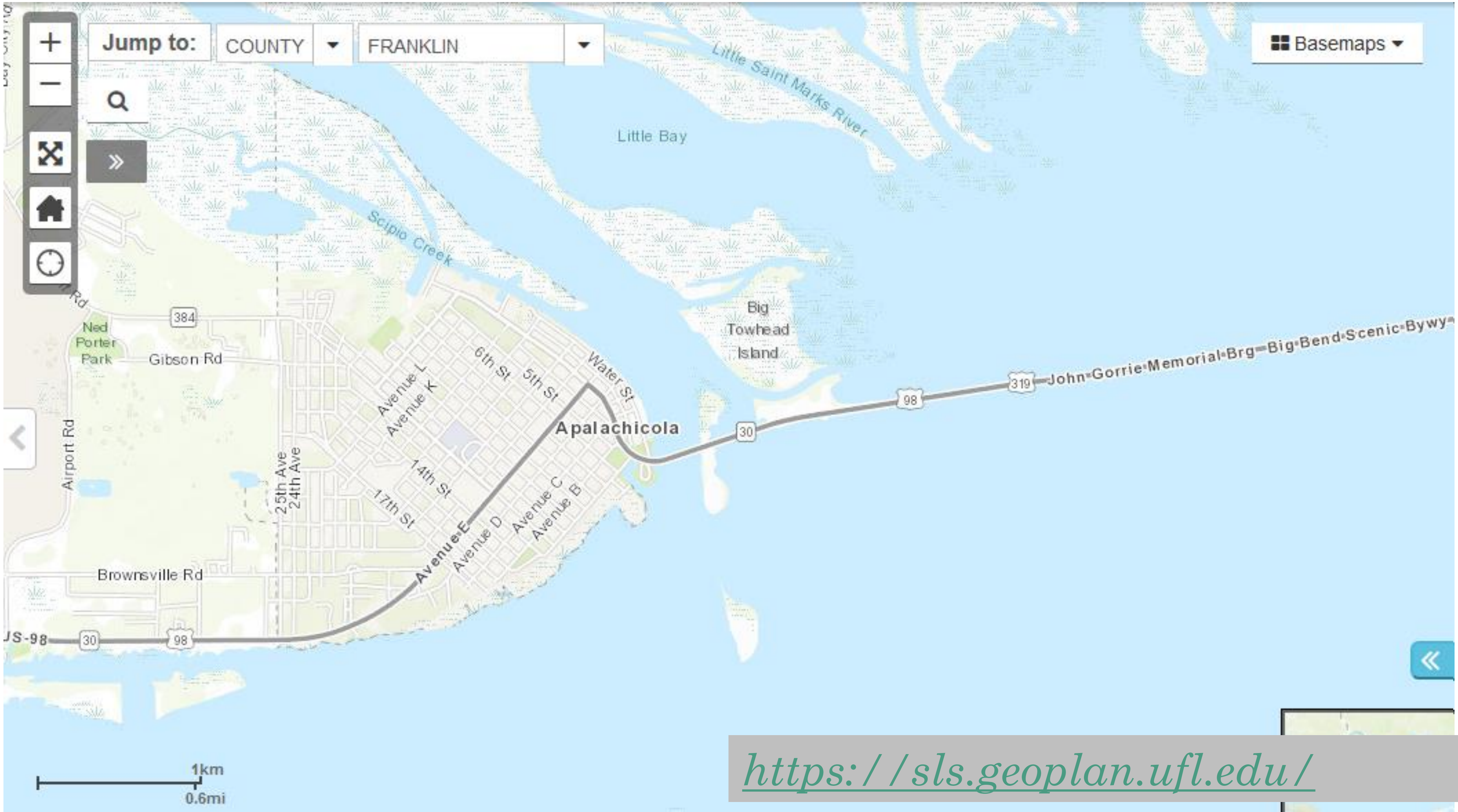
Moderate chance of happening, would have a moderate impact

Hospital in Coastal County



Translating Scenarios into Planning Info

Translate your scenario – new high tide



https://sls.geoplan.ufl.edu/

What does this information help with?

- Low lying areas
- Increased high-tide flooding
- Infrastructure
  - Stormwater outfalls
  - Lift stations
- Transportation
  - Commerce/EMA routes
  - Maintenance
  - Design

Translate your scenario – future storm surge

An EESLR-NGOM Story Map

Coastal Dynamics of Sea Level Rise: Simulated Storm Surge

Stillwater Storm Surge

Download the data

By using state-of-the-art high-resolution astronomic tide, wind-wave, and hurricane storm surge modeling, **return period (percent annual chance) stillwater elevation** maps under four different sea level rise scenarios were developed. These 1% and 0.2% annual chance data (commonly referred to as 100 and 500 year flood plains) were developed to assess the effects of future coastal change on stillwater storm surge under different SLR scenarios.

Inundation depth above ground (m)

6.0+ (m)
4
2
0.1 (m)

Stillwater storm surge inundation depth above ground (in meters) in 2100 for Low (+0.2m or 0.7ft in left panel) and Intermediate-High (+1.2m or 3.9ft in right panel) sea level rise scenarios. Data ranges shown are equivalent to 0.3 to 19.7 feet.

Shown at right are the 1% annual chance probability of storm surge inundation in 2100 for **Low** (+0.2m or 0.7ft in left panel) and **Intermediate-High** (+1.2m or 3.9ft in right panel) SLR scenarios.

Try this:
Slide the bar to see changes in storm surge inundation depth between these two scenarios. Enter 'Pensacola, FL' in the location search box (top right) to see storm surge differences near Pensacola, FL.

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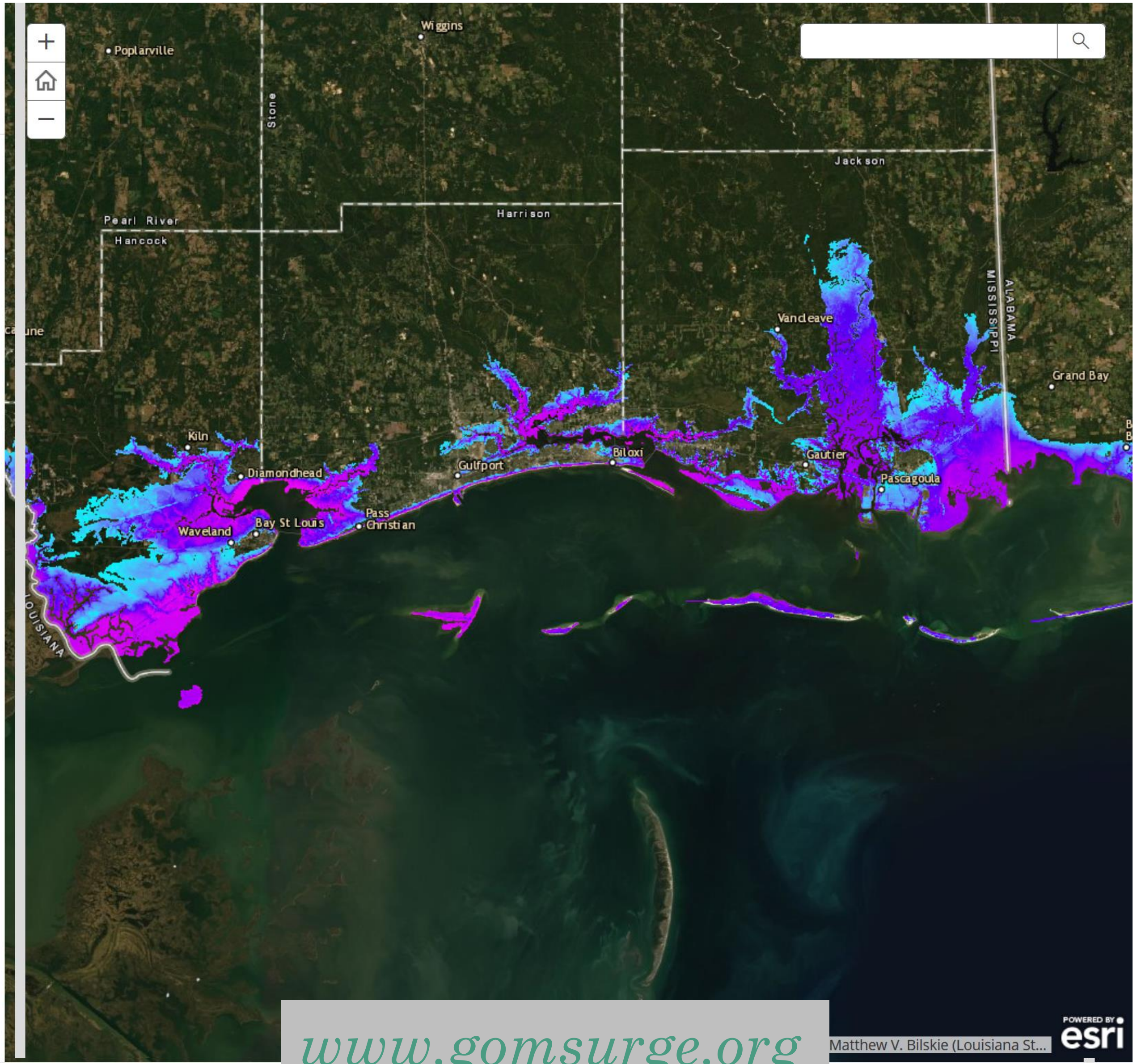
www.msstate.edu/directory/employee/ of future stillwater levels under Low (left) and



www.gomsurge.org

What does this information help with?

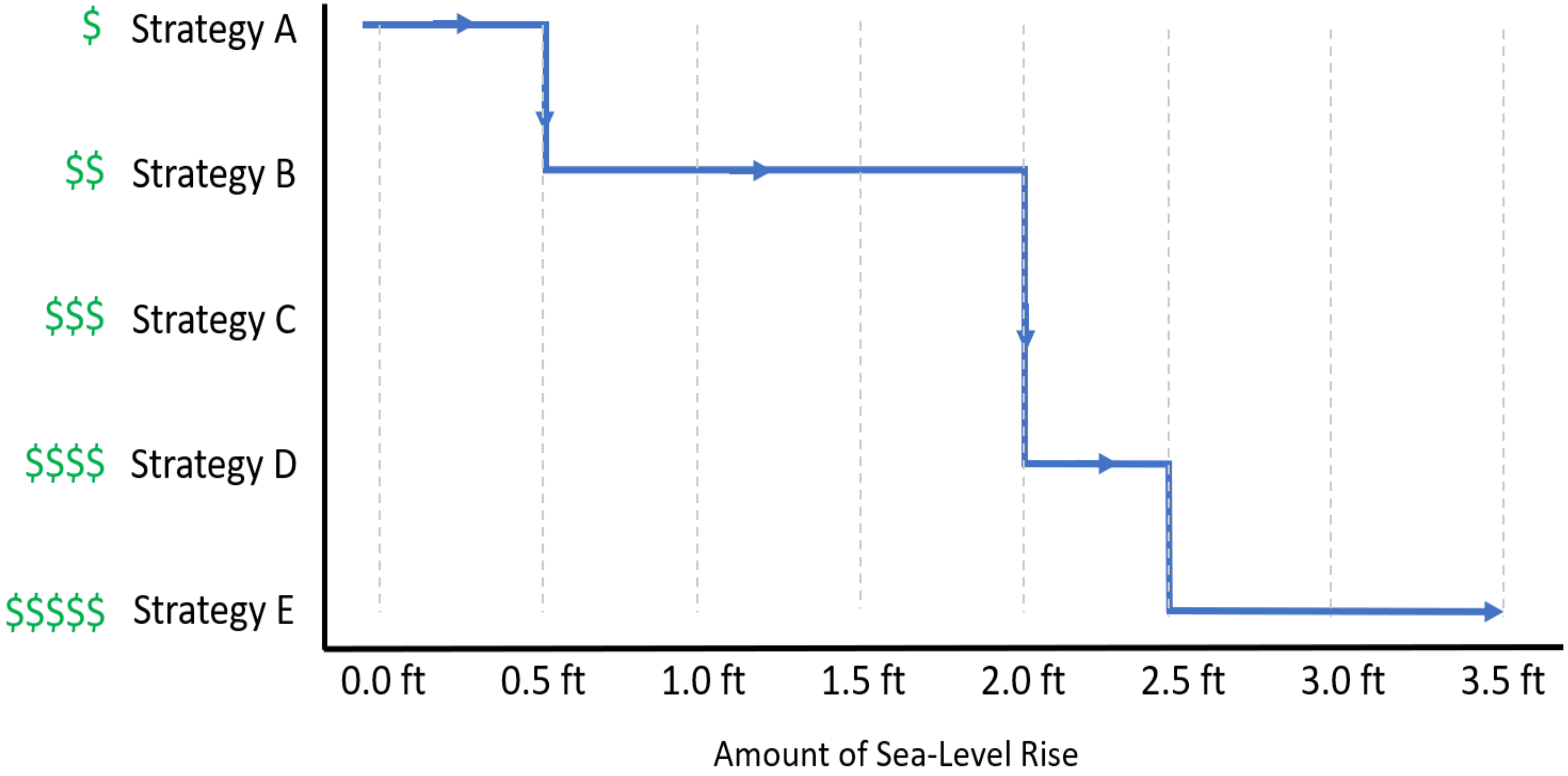
- Changes in 1% and 0.2% annual chance flood area
- Changes in inundation depth
  - Considerations for freeboard
- Infrastructure
  - At risk
  - Future design
- Transportation
  - Evacuation routes

Case Studies – How to integrate information into projects

Case Study: County Utility Authority

- Design and construction of new wastewater reclamation facility
- SLR during two-phases
  - Site selection: high-tide
  - Berm design: 0.2% event over 50 years
- Conducting a cost benefit analysis
- Engagement occurred just after 15% design was completed

Case Study: Dauphin Island, AL



Adapted from Smallegan et al. 2017

Summary

- SLR is already negatively impacting communities
- Resources available to facilitate integration of science into planning
- Adaptation is diverse; today provided foundational tools for a variety of situations
- Leverage the many resources for supporting these efforts
  - Technical expertise – UF Geoplan Center, Sea Grant, NOAA OCM
  - Colleagues w/similar efforts – Gulf of Mexico Climate and Resilience Community of Practice & Gulf of Mexico Alliance Resilience Team

Thank you!!!

r.collini@msstate.edu

DROWNING IN SCENARIOS? DECISION MAKING FOR SEA LEVEL RISE

Crystal Goodison, Associate Director + Associate Scholar
University of Florida GeoPlan Center

Transplex Webinar, October 16, 2020

UNIVERSITY OF FLORIDA GEOPLAN CENTER

The GeoPlan Center is a geospatial research and teaching facility, in the UF School of Landscape Architecture & Planning.

We support land use, transportation, and environmental planning in the State with our geospatial expertise:

- Develop and distribute standardized geospatial data.
- Design, develop, and maintain enterprise mapping systems and decision support tools for visualization, analysis, and facilitation of business processes.
- Helping to turn data into information.
- Training and education.

UF | GEOPLAN CENTER

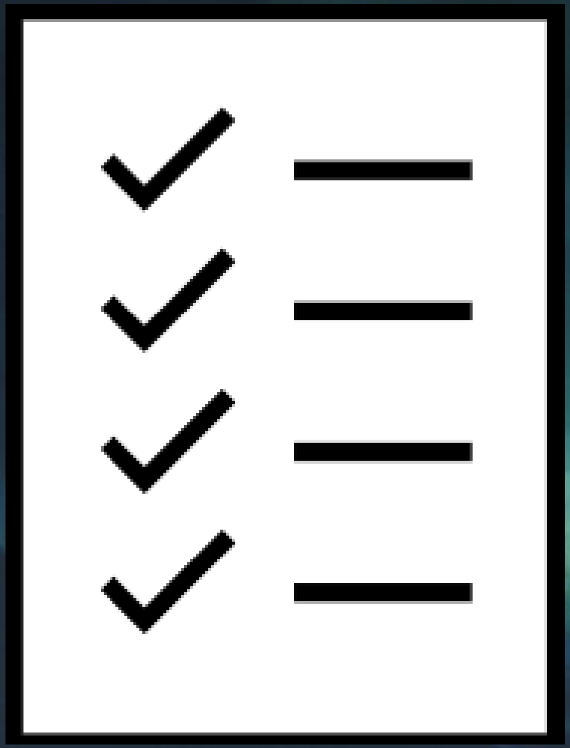
FGDL
FLORIDA GEOGRAPHIC DATA LIBRARY

etdm
Efficient Transportation Decision Making

FLORIDA 2070

SIGNAL FOUR ANALYTICS

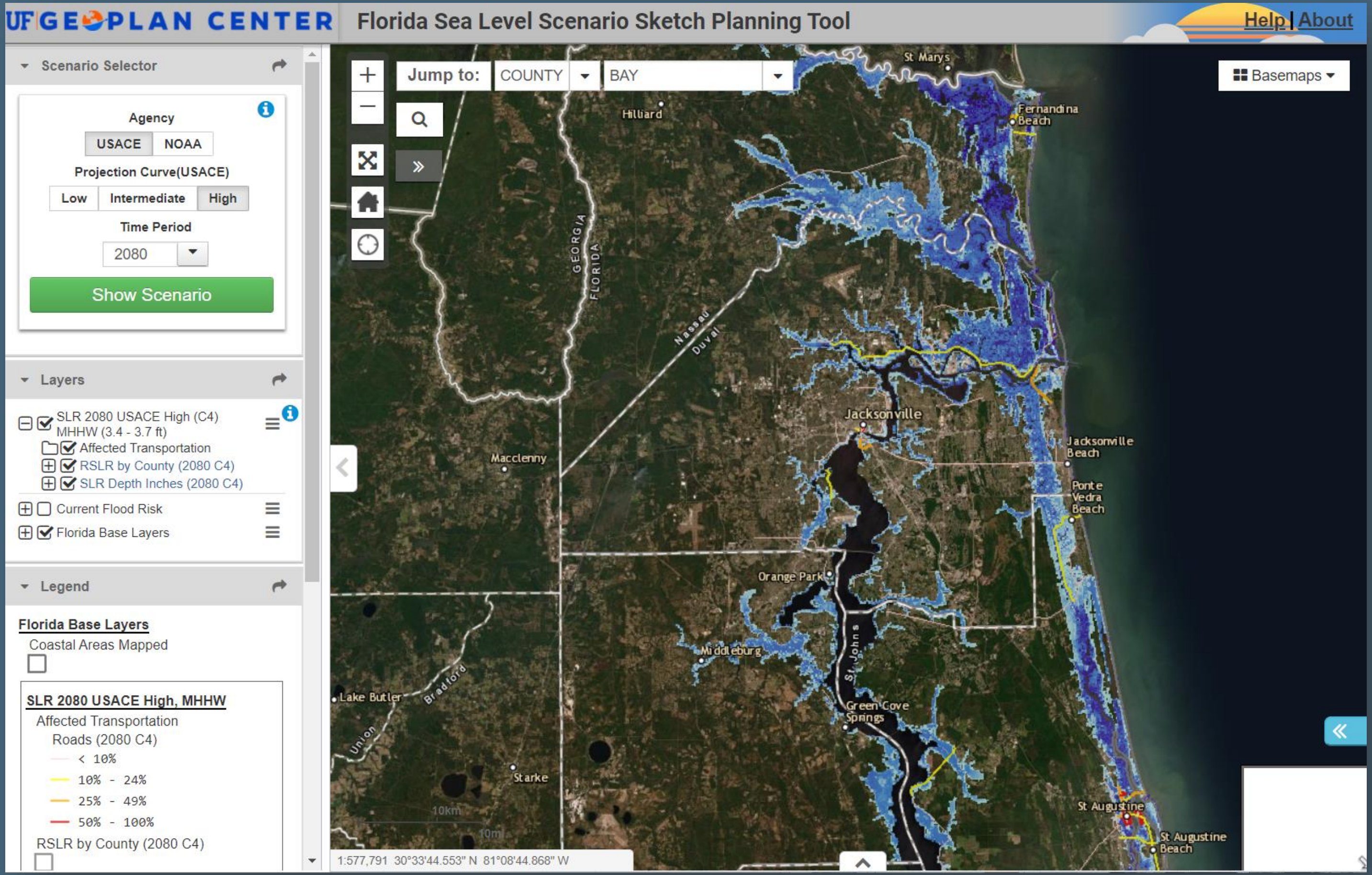
OUTLINE OF PRESENTATION



- Sea Level Scenario Sketch Planning Tool
  - Features & Functionality
  - Updates and new data
- How to Use the Data
- Live Demo/ Using the viewer

SEA LEVEL SCENARIO SKETCH PLANNING TOOL

- Online geospatial mapping tool to assess potential impacts of current and future flooding on the transportation system
- Planning-level analyses shows *where* and *when* sea level rise is projected to occur in Florida under various scenarios and time periods
- Public map viewer & GIS data: sls.geoplan.ufl.edu



FEATURES & FUNCTIONALITY

Areas Mapped

- 35 coastal counties + 2 inland counties

View and Compare Local Sea Level Rise Scenarios

- USACE & NOAA scenarios mapped for local context
- Decades in map viewer: 2040, 2060, 2080, 2100 (2070 coming!)
- Quickly visualize and compare multiple scenarios

Transportation Analyses

- Segment and asset-level analysis of future flooding (SLR) and current flood risk

Download GIS Data

- Download statewide or by county

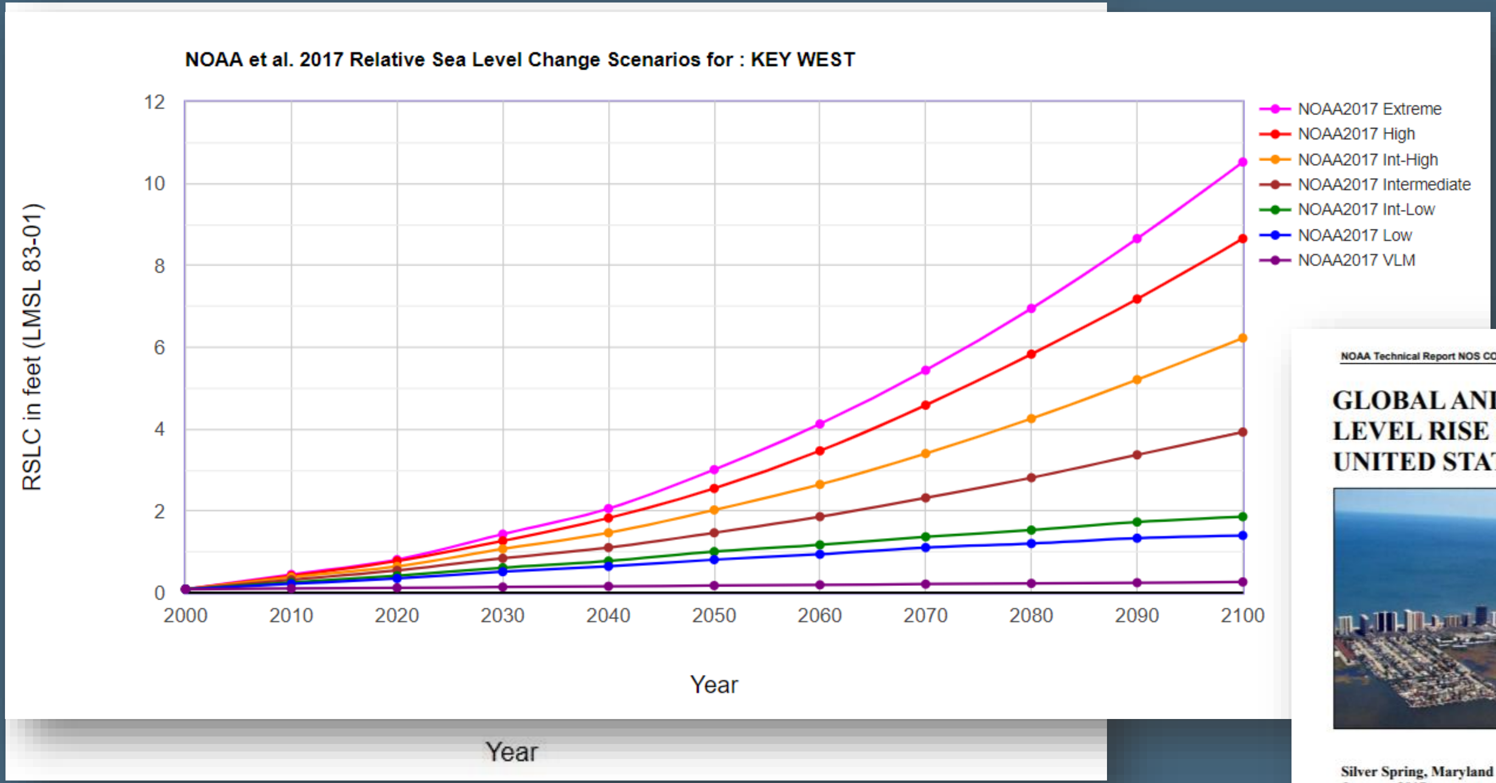
SEA LEVEL RISE SCENARIOS MAPPED

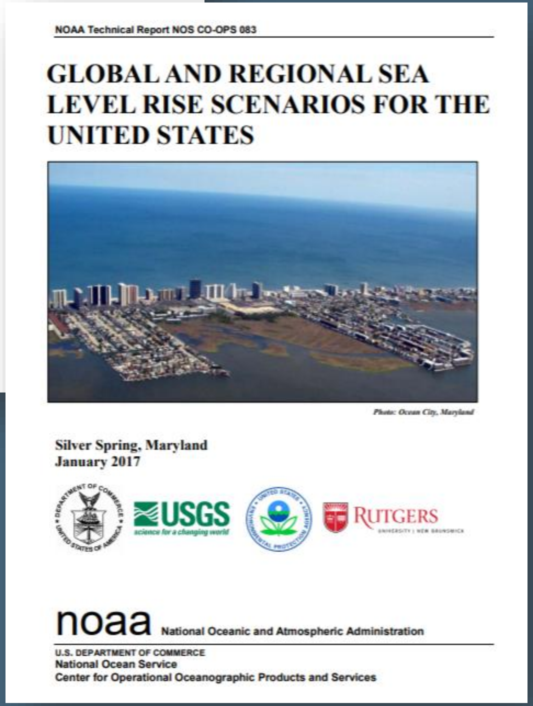
5 total SLR scenarios:

U.S. Army Corps of Engineers (USACE 2013)
- Upper curve ~ 5ft (1.5m) by 2100

National Oceanic & Atmospheric Administration (NOAA 2012):
- Upper curve ~ 6ft (2m) by 2100

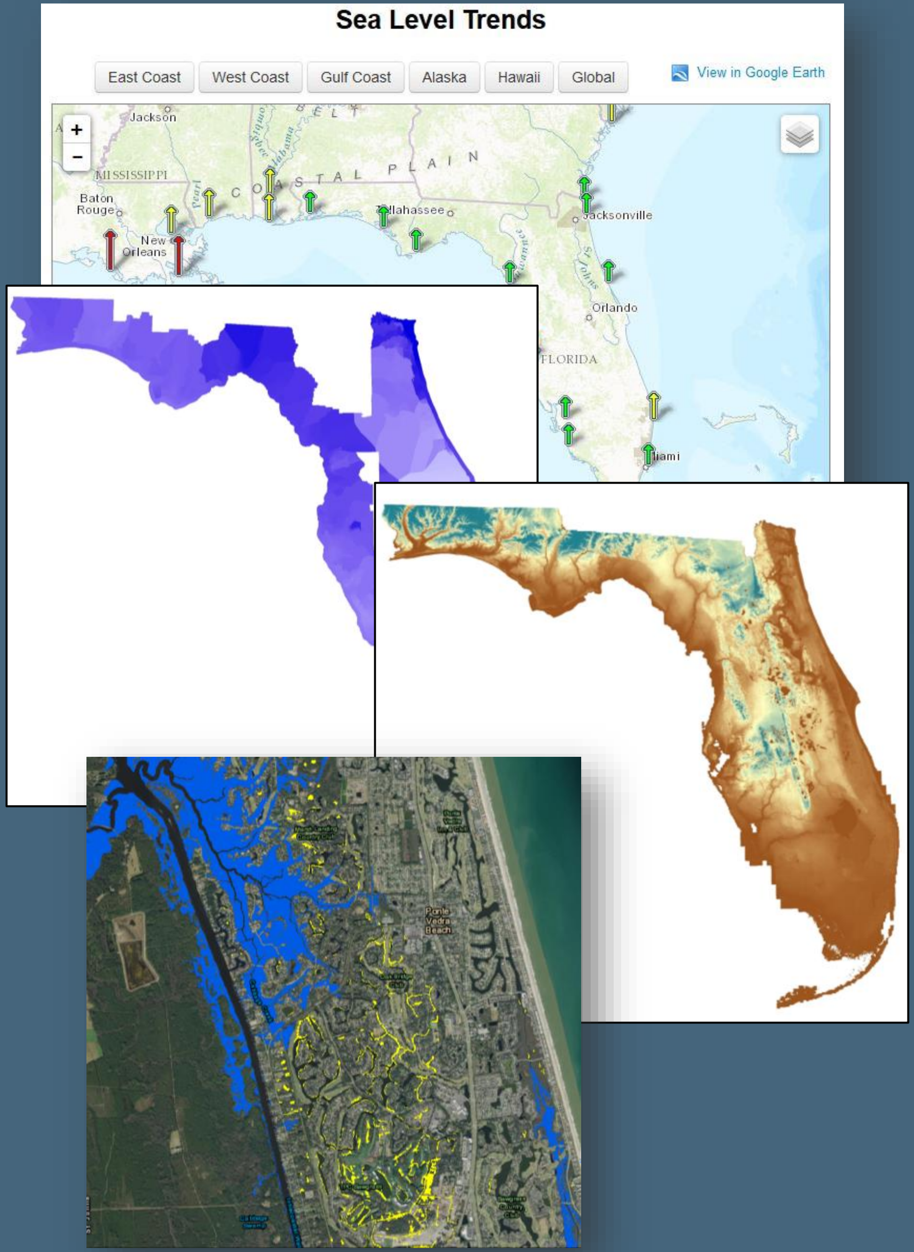
Adding (November):
NOAA 2017
- 6 scenarios
- Upper curve ~ 10ft (3m) by 2100





MAPPING LOCAL SCENARIOS

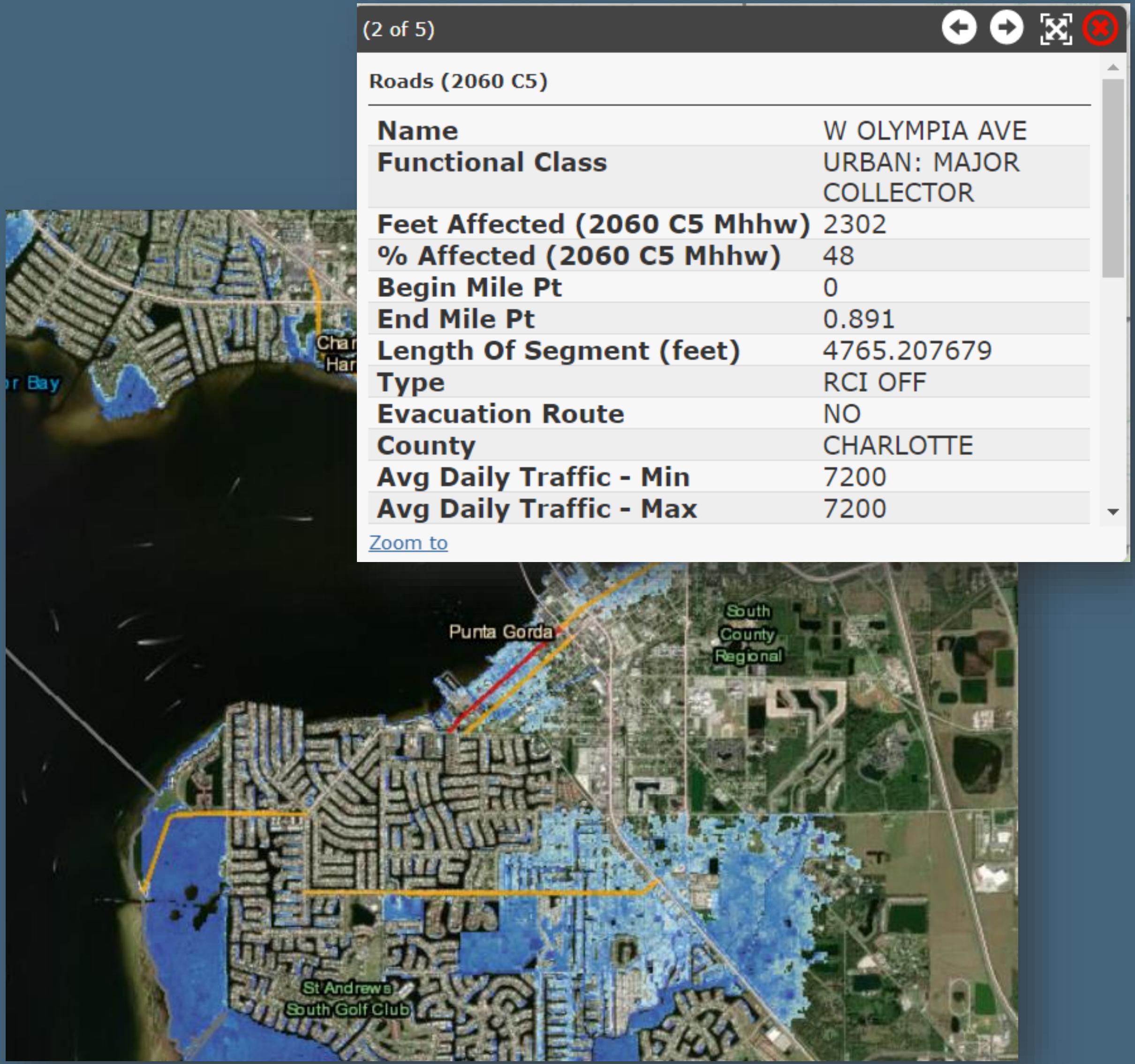
- U.S. Army Corps of Engineers Sea Level Change Curve Calculator - SLR values by tide station.
- Mean Higher High Water (MHHW) tidal datum
- High resolution elevation data
- Modified bathtub inundation models (account for surface hydrologic connectivity)
- Locally and regionally standardized models – align with regional compacts/ collaboratives and unified SLR Projections



SOUTHEAST FLORIDA REGIONAL COMPACT CLIMATE CHANGE

east central florida REGIONAL RESILIENCY ACTION PLAN

TAMPA BAY REGIONAL RESILIENCY COALITION



TRANSPORTATION ANALYSIS

Segment and asset-level analysis of current & future flood risk:

- Future flood risk: from USACE & NOAA SLR scenarios over 7 decades
- Current flood risk: 100-year & 500-year floodplains, storm surge zones

Transportation assets analyzed:

- Roadways (RCI and Tiger)
- Airports, seaports, freight terminals, rails
- SIS designations

SKETCH TOOL UPDATES: WHAT'S NEW?

NOAA 2017 SCENARIOS

UPDATED BASE DATA (LIDAR, TRANSPORTATION)

LOCAL ROADWAYS

TRAINING WEBINAR

Data will be live in mid-November

That’s a lot of data – what do we do with it??

SKETCH TOOL: WHY AND HOW TO USE IT?

Uses (to name a few…):

- High level vulnerability assessments to get big picture of permanently inundated areas
- Evaluate local SLR scenarios over time and determine broad tipping points for impacts
- Start conversation with community about long-term SLR impacts.
- Then narrow down focus to asset level and do high level asset screening: risk-based approach

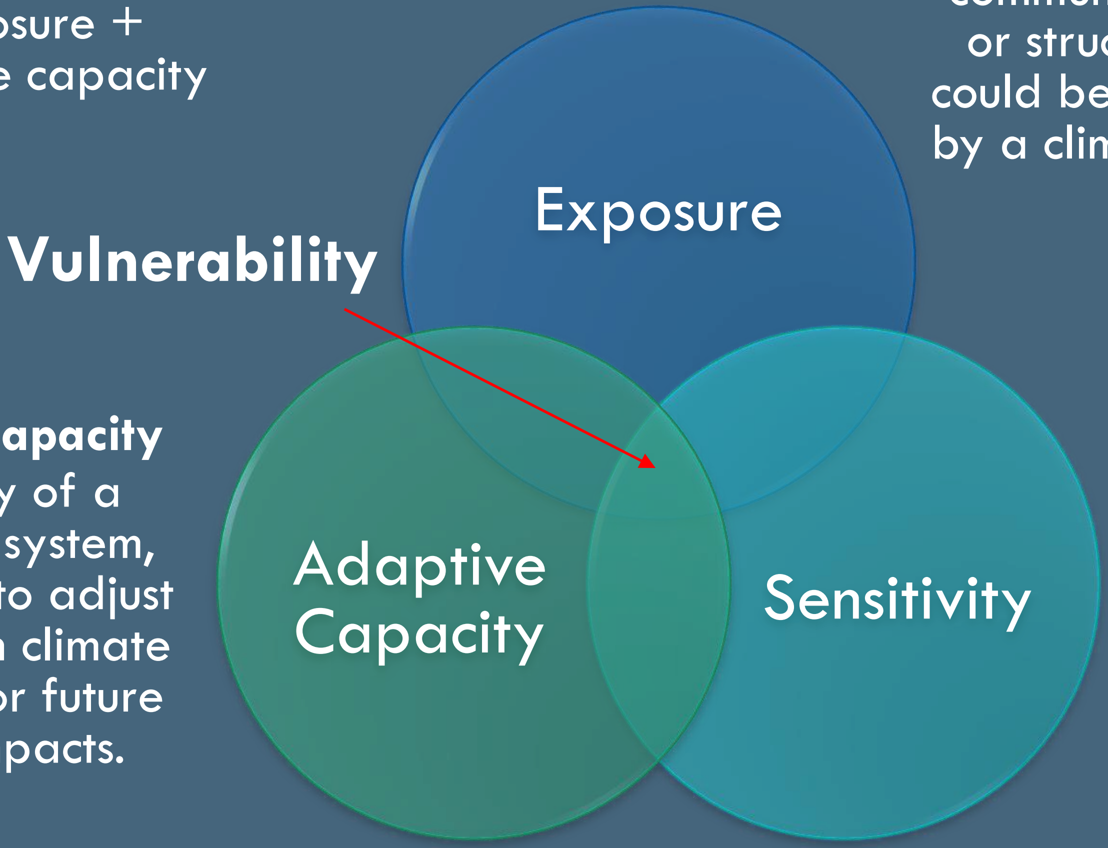
Not Intended for:

- Not intended for engineering design, stormwater or drainage design, property assessment, or permitting.

MEASURING VULNERABILITY

Vulnerability
The propensity or predisposition to be adversely affected.
A function of exposure + sensitivity + adaptive capacity

Exposure
The presence of a community, people, system, or structure in places that could be adversely affected by a climate change stressor

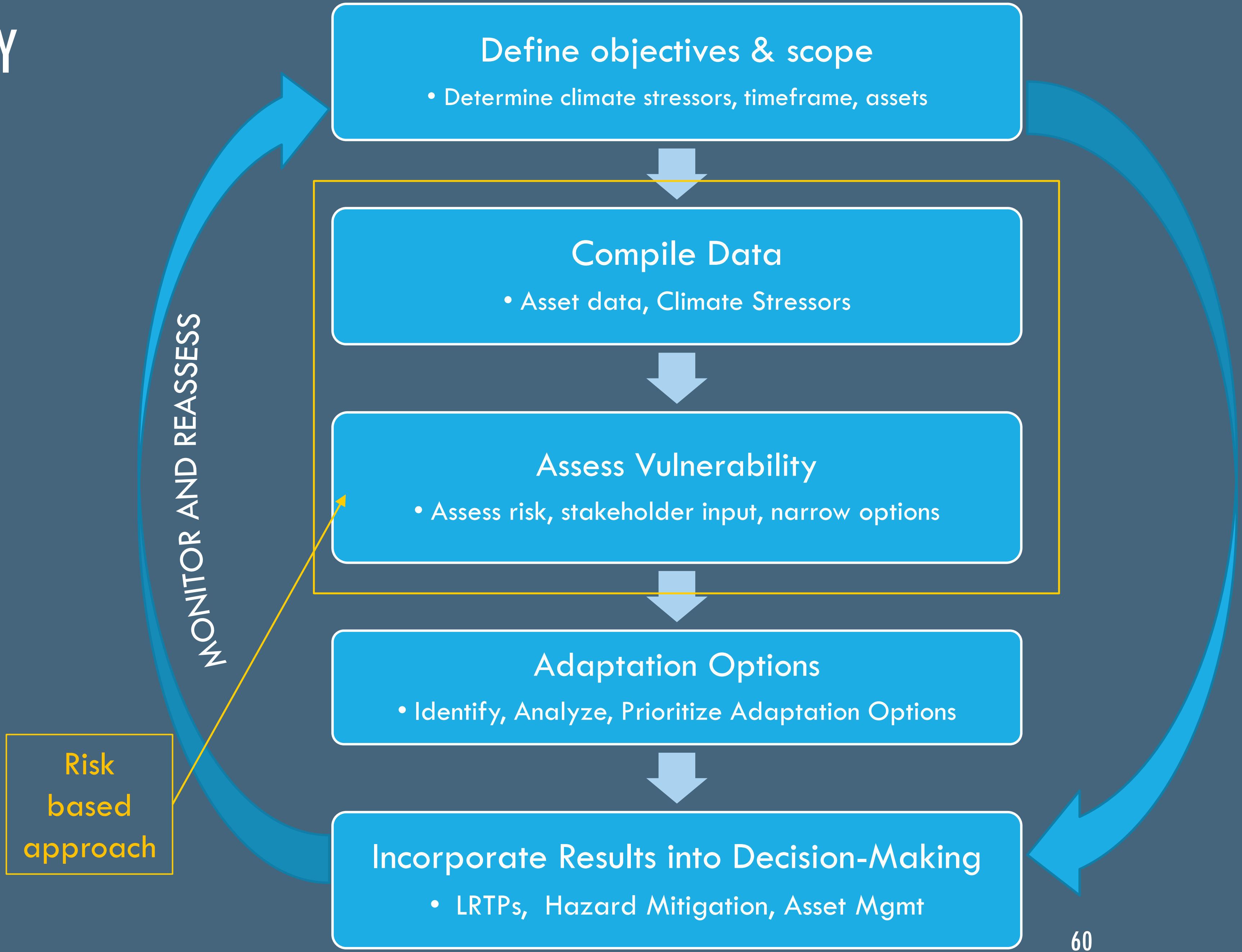


Adaptive Capacity
The ability of a community, system, or structure to adjust or cope with climate variability or future climate impacts.

Sensitivity
The degree to which a community, system, or structure are affected by a climate stressor.

FHWA VULNERABILITY ASSESSMENT & ADAPTATION FRAMEWORK

- SLR is often one part of a larger process
- Other stressors and factors considered in planning process
- Process is cyclical and needs to be revisits as better data, models, and science are developed



VULNERABILITY ASSESSMENTS

Sketch Tool provides ready-to-use, standardized data for coastal areas. This has facilitated VA by numerous municipalities, regional transportation agencies.

2080 NOAA Int High Projection					
Road Name	Segment from	Segment to	Length of Segment (ft)	Feet Affected	% Affecte
N. BEACH CSWY	US-1	Indian River County Line	40852	2337	6%
BINNEY DR	Entire Road	Entire Road	3870	640	17%
S. OCEAN DR	Harbour Isle Dr.	Martin County Line	88333	10754	12%
Total			133056	13731	10%
2100 NOAA Int High Projection					
Road Name	Segment from	Segment to	Length of Segment (ft)	Feet Affected	% Affecte
S. INDIAN RIVER DR	Savannah Rd.	Martin County Line	61421	366	1%
AVE H	N. 7th St.	Coast	2032	838	41%
AVE C	US-1	N. Indian River Dr.	1197	196	16%
N. BEACH CSWY	US-1	Indian River County Line	40852	8336	20%
BINNEY DR	Entire Road	Entire Road	3870	3001	78%
S. OCEAN DR	Harbour Isle Dr.	Martin County Line	88333	61010	69%
SEAWAY DR	US-1	Harbour Isle Dr.	6569	255	4%
Total			204275	74002	36%

SPACE COAST TPO VULNERABILITY ASSESSMENT (2018)

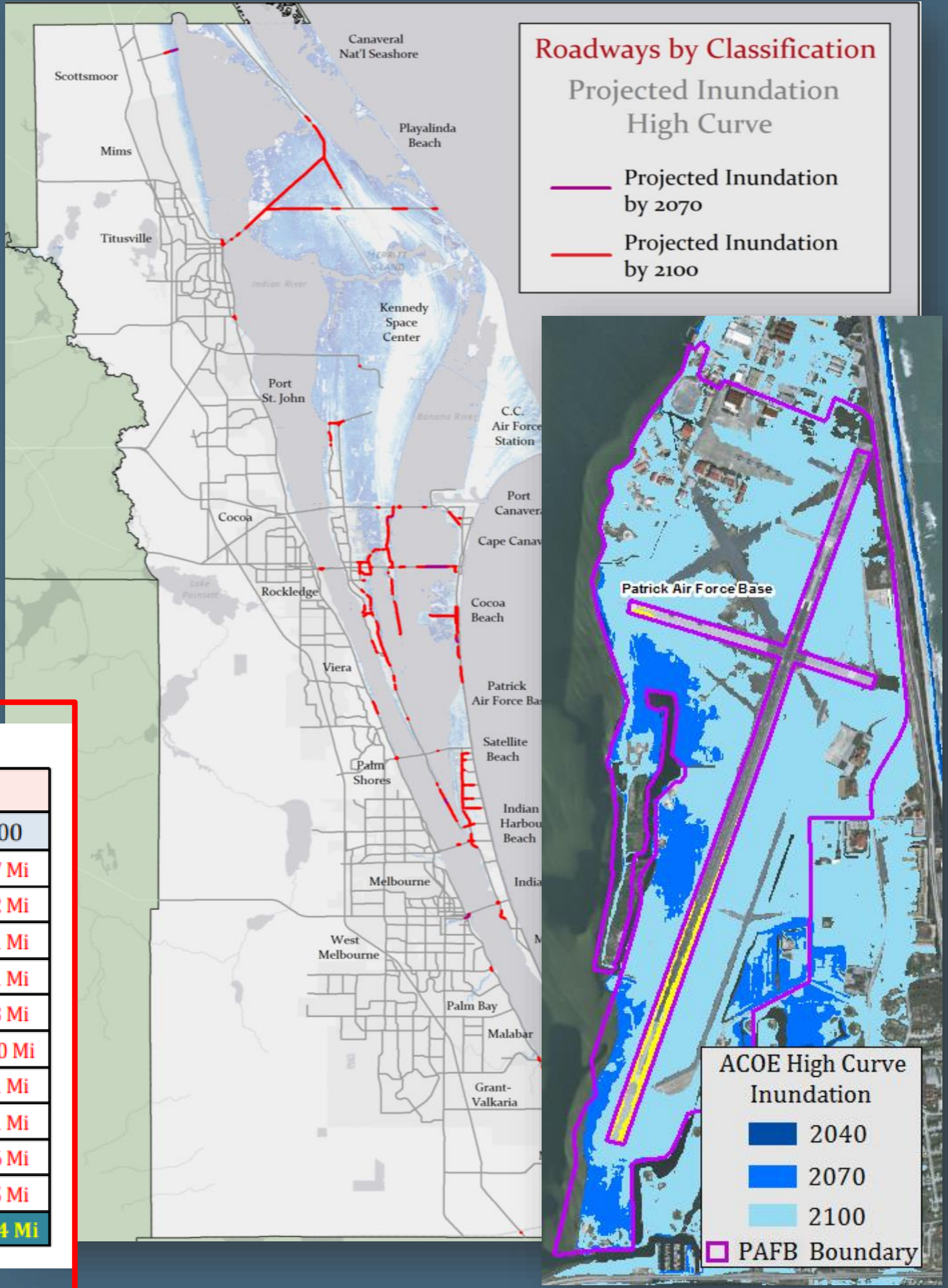
East Central Florida Regional Planning Council

- Time frames: 2040, 2070, 2100
- SLR Scenarios: Low, Intermediate High
- Assets: Evac routes, roads, bus stops, trails, special assets

Allows for assessment of broad tipping points, screening of assets and areas for more study

Table 5: Roadway by Classification Inundation Summary

	Low Curve			Intermediate Curve			High Curve		
Classification	2040	2070	2100	2040	2070	2100	2040	2070	2100
Local - Urban	None	None	None	None	None	None	None	None	0.57 Mi
Local - Rural	None	None	None	None	None	None	None	0.23 Mi	0.62 Mi
Minor Collector - Urban	None	None	None	None	None	None	None	0.11 Mi	8.11 Mi
Major Collector - Urban	None	None	None	None	None	None	None	3.2 Mi	6.71 Mi
Major Collector - Rural	None	None	None	None	None	None	None	None	5.23 Mi
Minor Arterial - Urban	None	None	None	None	None	None	None	<0.1 Mi	11.20 Mi
Principal Arterial - Expressway	None	None	None	None	None	None	None	None	<0.1 Mi
Principal Arterial - Interstate	None	None	None	None	None	None	None	None	<0.1 Mi
Principal Arterial - Urban Other	None	None	None	None	None	None	None	None	8.66 Mi
Principal Arterial - Rural Other	None	None	None	None	None	None	None	None	5.05 Mi
	None	None	None	None	None	None	None	0.68 Mi	46.34 Mi



SPACE COAST TPO TRANSPORTATION RESILIENCY MASTER PLAN

Road map for implementing resiliency

- Develop Education and Engagement Strategy
- Define and Develop Scenarios for shocks and stressors
  - Define shocks and stressors. Identify critical infrastructure & develop methods to prioritize vulnerable corridors
- Master Plan Development
  - Develop Tailored implementation guides for municipalities with short, mid, and long-term strategies

CONSIDERATIONS FOR CHOOSING SCENARIOS FOR ASSET LEVEL ANALYSIS

- **Function:** Level of use and criticality to network
- **Adaptive Capacity:** the degree of redundancy in the system
- **Cost/ Value:** cost of replacement, economic loss, environmental impacts, cultural values, or loss of life
- **Lifespan:** Expected/ estimated service lifespan

DEMO TIME!

CLOSING THOUGHTS

- *Things change* (climate scenarios, data, models) This process is dynamic and need to be replicable.
- *SLR is one (big) piece of puzzle*: Other flood threats will impact systems before permanent SLR. Other climate and non-climate stressors to address.
- *We are learning together*: building tools to match and meet needs
- *Looking to the future*: next version of Sketch Tool
  - 2020-21: State of the Practice & Data Needs for MPO Resiliency
  - 2021 -22: Building Geospatial Framework to Move from Planning to Project Scale

WANT TO LEARN MORE?

Sketch Tool Training Webinar

Thursday, November 19, 2:00-4:00pm

- Interactive virtual training on map viewer and data.
- To receive registration information:
  sls.geoplan.ufl.edu/training

Contact: Crystal Goodison, goody@geoplan.ufl.edu

Website: https://sls.geoplan.ufl.edu

Questions?

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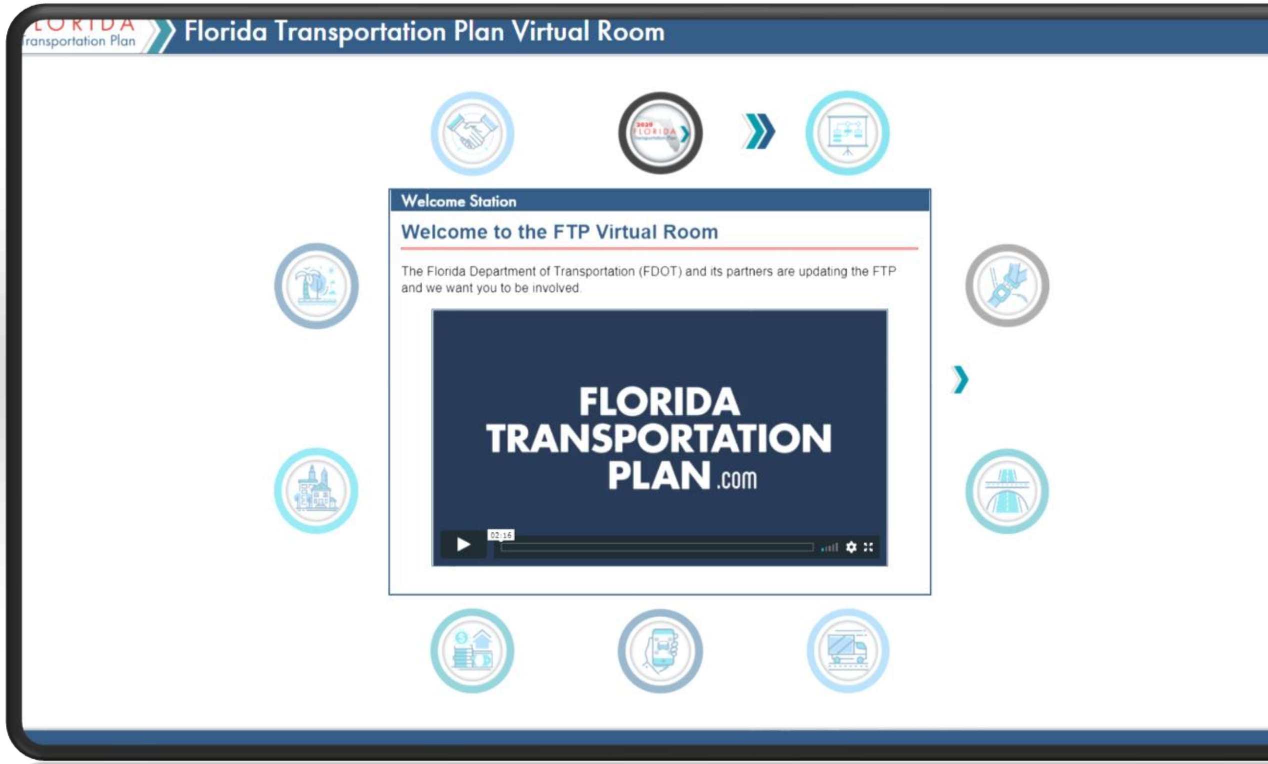
FTP VIRTUAL ROOM

- Walk through the seven goal stations to provide your input on the draft strategies and share your ideas for reaching our goals.
- No specific time, always open!
- Opening October 5

www.floridatransportationplan.com



FDOT Office of Policy Planning | Transportation | Planning | Exchange TRANSPLEX WEB SERIES

THANK YOU FOR ATTENDING

- Up Next: **Discovering the Keys to Access and Opportunity… Friday, October 23 @ 9am**
- Please complete the follow up survey that will be sent via email at the conclusion of this webinar

Please take a moment to visit the FTP Virtual Room and leave your comments www.floridatransportationplan.com