



Oisin Dolley, PE – City Engineer
Jordan Varble, PE – Johnson Engineering

June 12, 2025

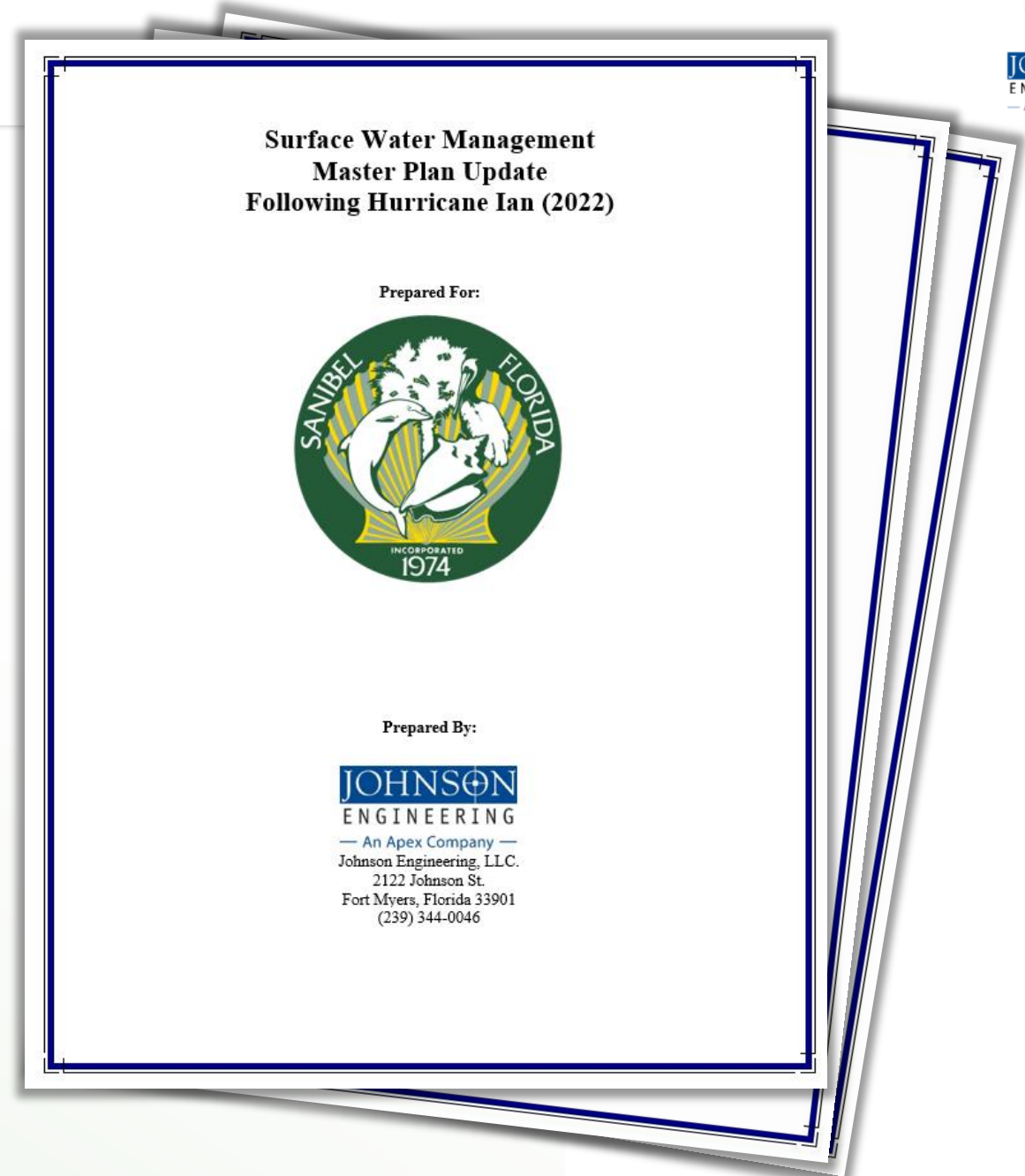
City of Sanibel



**Resilient Recovery: Vegetation,
Hydrology, and Stormwater
Management Post-Hurricane**

Agenda

1. Introduction
2. Damage Repairs Post-Hurricane Ian
3. Flooding and Vulnerability
4. Data Collection
5. Resiliency



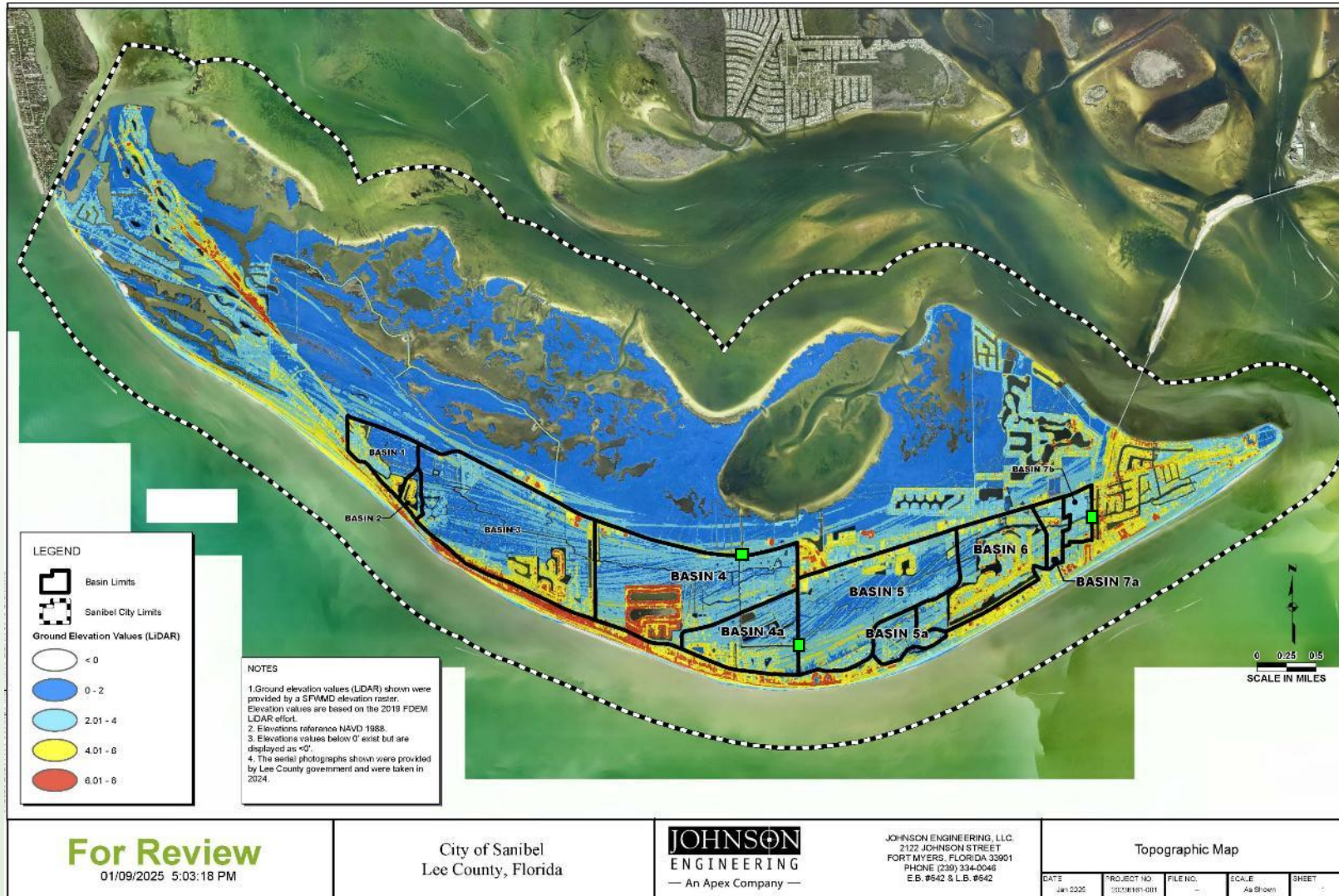
Sanibel Island



1. Introduction – Sanibel Island

- *Sanibel is a low-lying barrier island in Lee County*
- *It is about 12 miles long, with an average elevation of about 4 feet above sea level*
- *The island hosts a valuable interior wetlands ecosystem*
- *Since incorporation in 1974, the city has emphasized environmental preservation and coexistence with nature*

Interior Wetlands and Overland Flow



1. Introduction – Interior Wetlands and Overland Flow

- *The island is essentially a bowl*
- *System fills and overflows, it doesn't drain dry.*
- *Two interior freshwater basins outfall to Pine Island Sound via weirs*
- *Saltwater intrusion occurs when freshwater head decreases*
- *It is necessary to retain as much rainwater as possible to maintain the freshwater wetland ecosystem*

Damages from Hurricane Ian

2. Damage Repairs Post-Hurricane Ian – Introduction

- *Hurricane Ian severely damaged the island's infrastructure.*
- *Culverts, inlets, and swales were buried, leaving the island more vulnerable to riverine flooding.*



PHOTO CREDIT: Steve Helber, the AP, ABC News



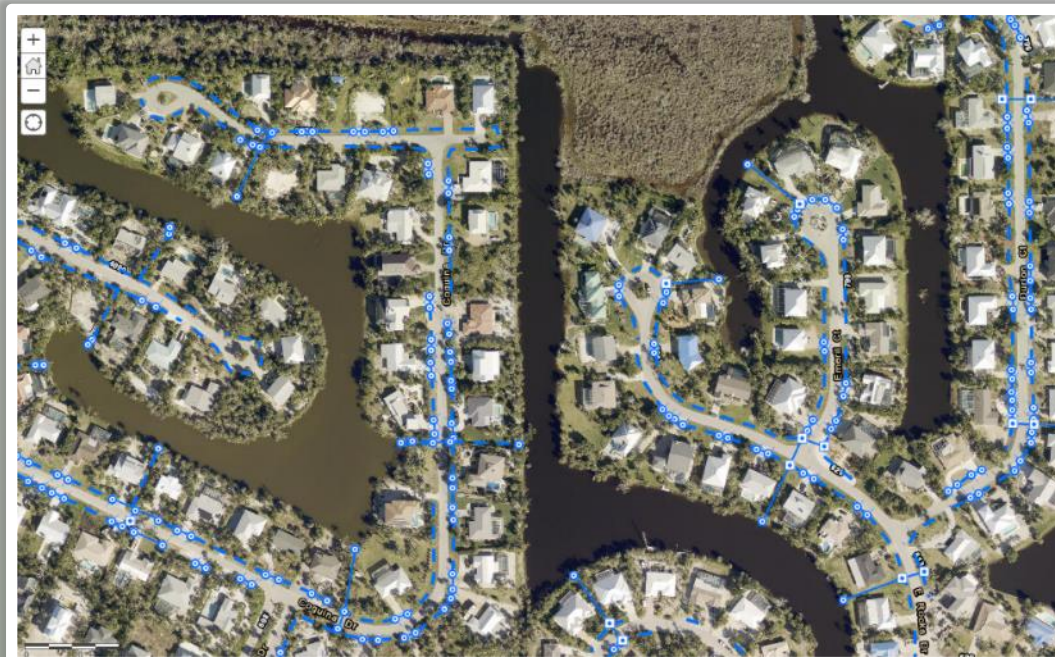
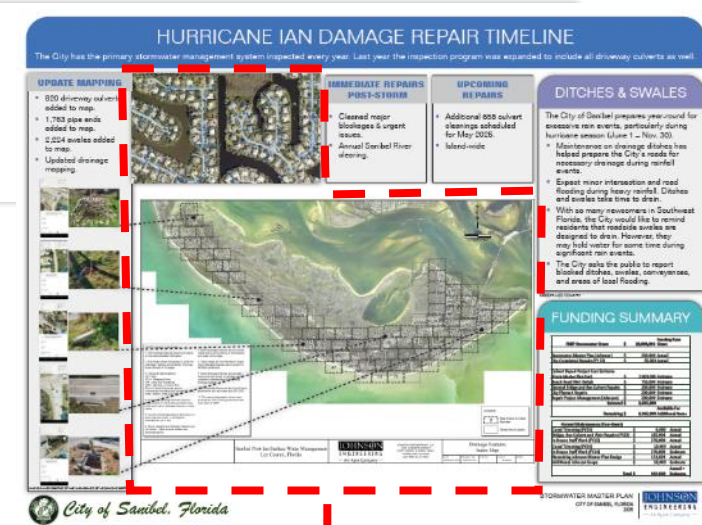
PHOTO CREDIT: Getty Images, ABC News



Response: Mapping, Repairs, and Funding

2. Damage Repairs Post-Hurricane Ian – Mapping, Repairs, and Funding

- Mapping efforts
 - › At least 4,807 culverts, pipe ends, and swales added to map
- Damage repairs
 - › Hundreds of culverts and swales are in the process of being cleaned/dug out
- Funding was provided by a \$10 million FDEP stormwater grant



Flooding 101

3. Flooding and Vulnerability – Riverine


- *Public meeting display boards*
- *Heavy rainfall causes rivers & streams to exceed their capacity.*

FLOODING 101

Sanibel has been heavily impacted by various types of flooding over its history.



FLOODING DUE TO RAINFALL

Occurs when streams and rivers exceed their capacity. Sanibel has two interior watersheds that collect rainfall and outfall via two veins to Pine Island Sound.



STORM SURGE

The sudden rise in seawater level during a tropical storm. FEMA flood maps show the island is wholly inundated by seawater in the 100-year storm event.



FLOOD MITIGATION

Multiple City departments work together on flood mitigation:

- Public Works | Natural Resources | Planning | Building
- The City maintains drainage infrastructure, including natural systems, ditches, culverts, and weirs.
- Multiple flood mitigation projects have been implemented over the City's history.
- Sanibel is currently completing a Coastal Vulnerability Study.
- FEMA elevation standards are enforced on new construction and rebuilds.
- Sanibel is pursuing grant funds and planning Capital Improvement Projects.
- A water level monitoring network has been deployed.

This is a continuous, year-round effort. It is important to know your home elevation and your flood zone elevation.

FAQs

"My house has never flooded before. Why now?"
Many years ago, Sanibel passed the general drainage ordinance that set a minimum of 12 inches of elevation above the ground level for all new construction. This ordinance was designed to protect homes from flooding. However, due to the unique geography of Sanibel, the water table is very high, and the ground is very soft. This means that even if a house is built on a slight rise, it can still be vulnerable to flooding. The water table can rise to the level of the ground surface, and if it rains, the water can seep into the house. This is why it is important to know your home elevation and your flood zone elevation.

"We have tide-gate gates that should protect us from storm surge. Why did we flood?"
Tide-gate gates are designed to prevent seawater from entering the island during a storm surge. However, they are not perfect. They can become clogged with debris, and they can be damaged by the surge itself. Additionally, the surge can be so high that it overflows the gates. This is why it is important to know your home elevation and your flood zone elevation.

"How did Sanibel's unique geography contribute to the flooding?"
Sanibel is a long, narrow island with a very low elevation. The water table is very high, and the ground is very soft. This means that even if a house is built on a slight rise, it can still be vulnerable to flooding. The water table can rise to the level of the ground surface, and if it rains, the water can seep into the house. This is why it is important to know your home elevation and your flood zone elevation.

"Will dredging and vegetation removal increase flood capacity?"
Dredging and vegetation removal can increase the capacity of a waterway to handle a storm surge. However, it is important to do this in a way that does not harm the environment. Sanibel is a natural area, and it is important to preserve its natural resources. This is why it is important to know your home elevation and your flood zone elevation.

City of Sanibel, Florida

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Flooding Due to Rainfall



Flooding 101

3. Flooding and Vulnerability – Storm Surge

- FEMA flood maps: Sanibel is entirely inundated in 100-year storm event

FLOODING 101

Sanibel has been heavily impacted by various types of flooding over its history

FLOODING DUE TO RAINFALL

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FAQs

"My home has never flooded before. Why now?"
 Sanibel is a barrier island, and the ocean is a powerful force. The ocean's rising water level can inundate the island, and the ocean's power can erode the island's infrastructure. The ocean's power can also erode the island's infrastructure, and the ocean's power can also erode the island's infrastructure.

"Why have tide-gate gates that should protect our community from storm surge?"
 The gates are not a solution to the problem of storm surge. The gates are not a solution to the problem of storm surge. The gates are not a solution to the problem of storm surge.

"Will design and construction increase our community's flood capacity?"
 The design and construction of flood mitigation projects can increase the community's flood capacity. The design and construction of flood mitigation projects can increase the community's flood capacity.

Flooding Due to Storm Surge



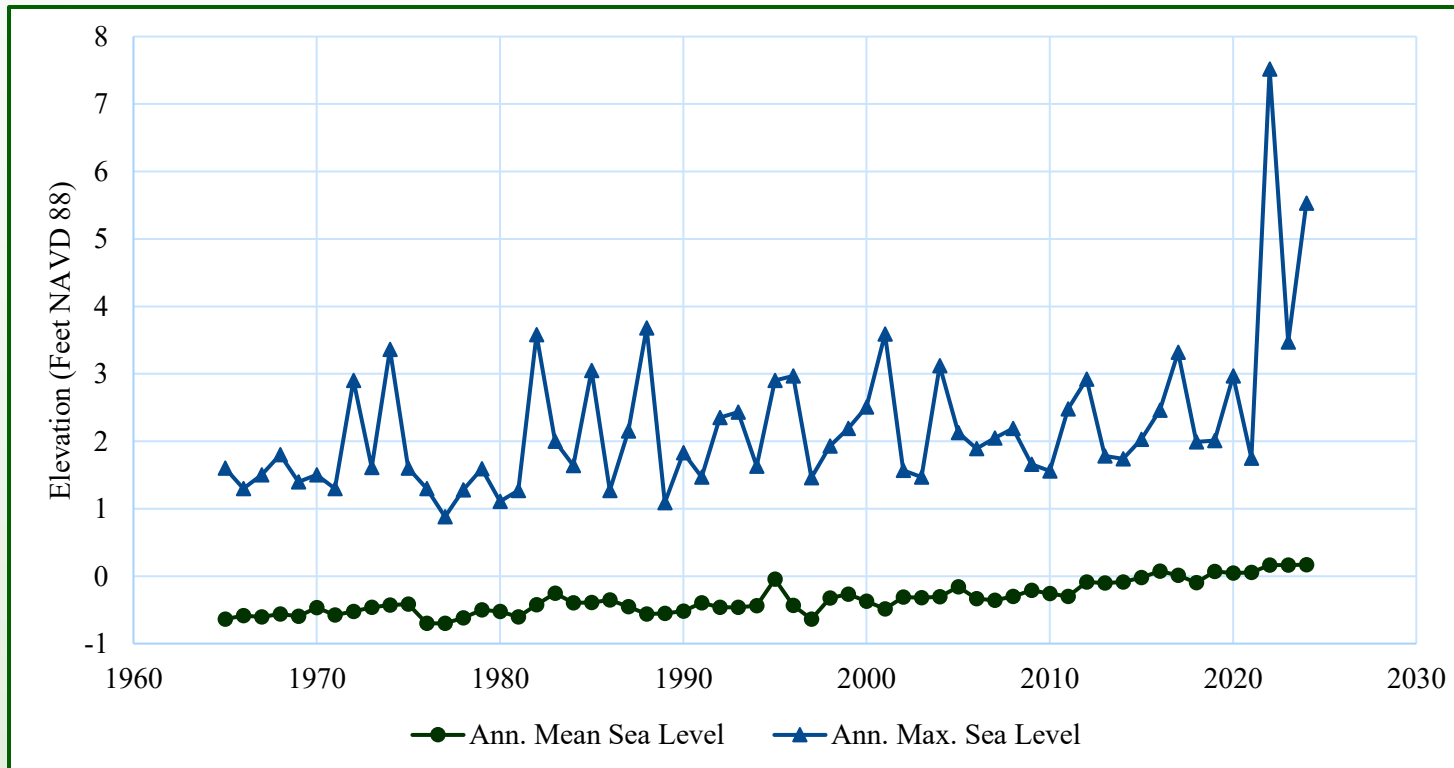
PHOTO CREDIT: ANDREW WEST, THE NEWS-PRESS & NAPLESNEWS.COM

Flooding due to Storm Surge

3. Flooding and Vulnerability – Storm Surge

- *My home has never flooded before. Why now?*
- *5 of top 10 water levels occurred within 3 storm seasons*

NOAA Tide Station – Fort Myers (8725520)



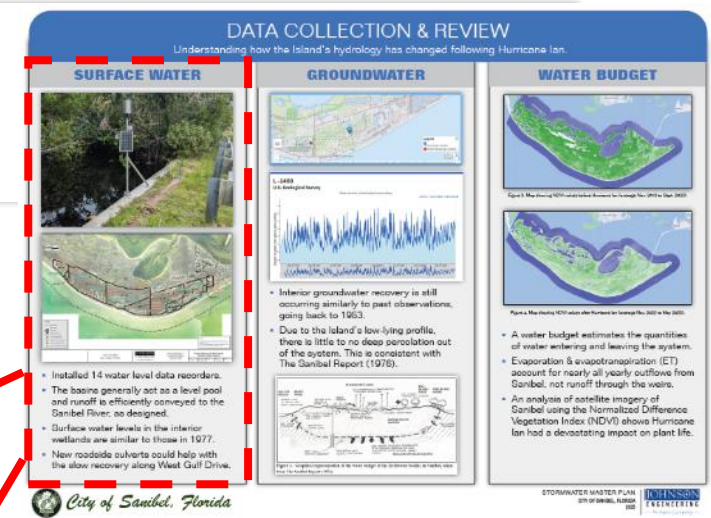
10 Highest Water Levels
1965 to Present

Rank	Peak EL	Date
1	7.52	2022-09-28
2	5.53	2024-10-10
3	5.4	2024-09-27
4	3.68	1988-11-23
5	3.59	2001-09-14
6	3.58	1982-06-18
7	3.53	2024-08-04
8	3.47	2023-08-30
9	3.36	1974-06-25
10	3.32	2017-09-11

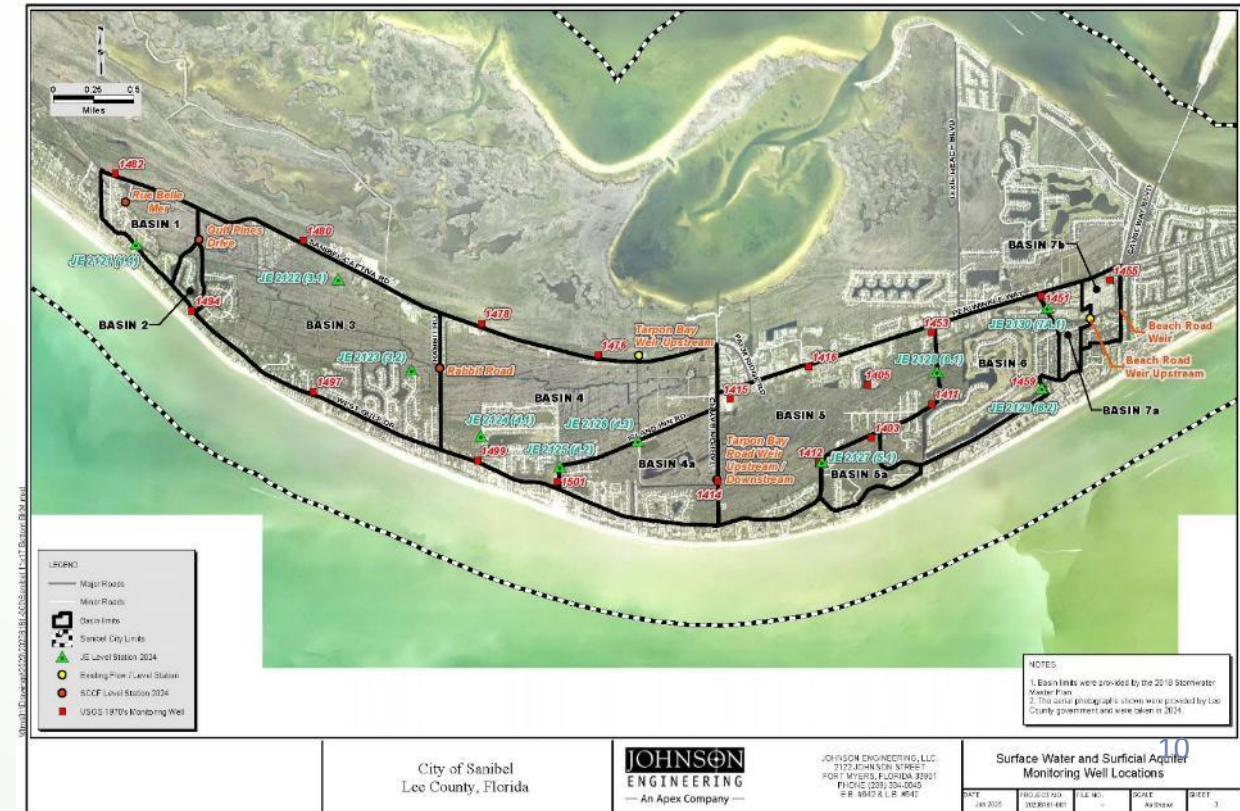
Surface Water Monitoring

4. Data Collection & Review – Surface Water

- *Water Level Monitoring Network*
 - › 14 Water Level Datalogger Installations
- *The basins generally act as a level pool*



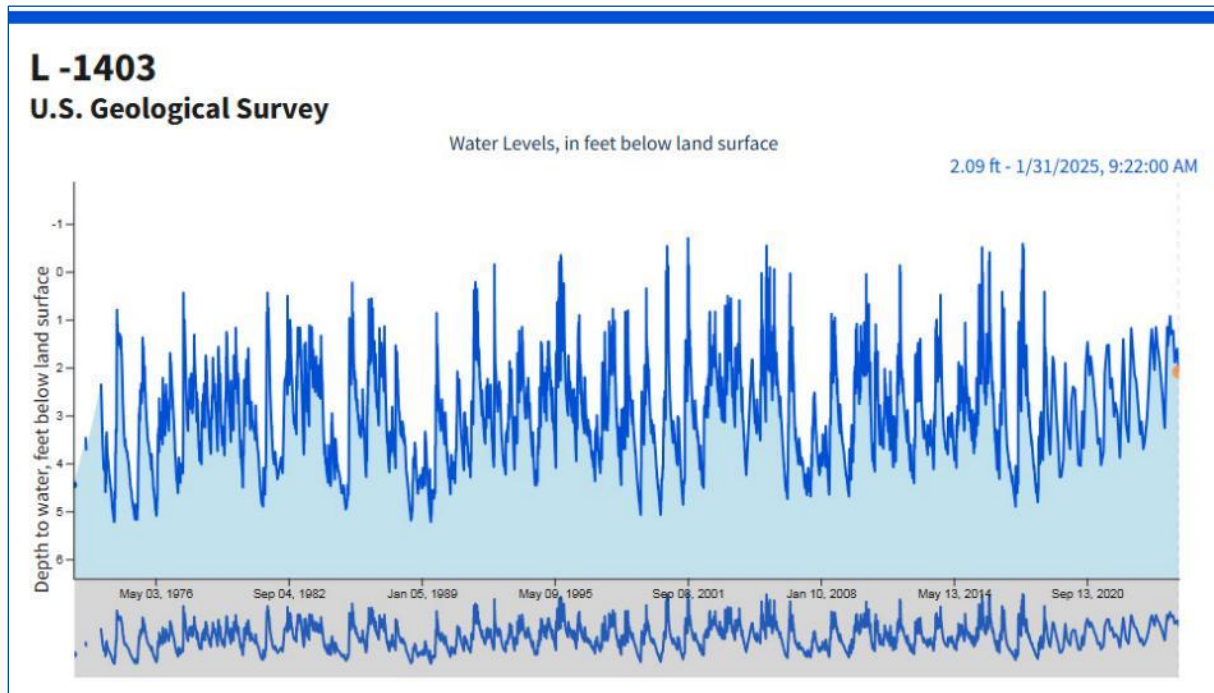
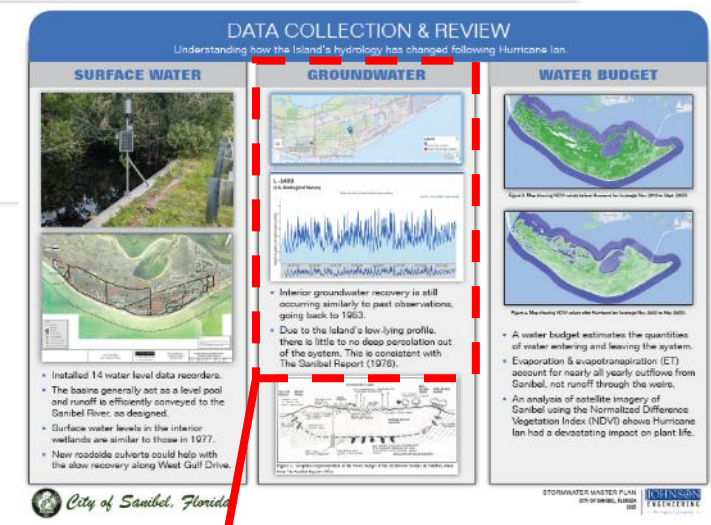
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Groundwater Monitoring

4. Data Collection & Review – Groundwater

- Interior groundwater percolation is still occurring similarly to past observations, going back to 1953.
- Due to the Island's low-lying profile, there is little to no deep percolation out of the system. This is consistent with The Sanibel Report (1976).



Water Budget

4. Data Collection & Review – Water Budget

- *Evaporation & evapotranspiration (ET) account for nearly all yearly outflows from Sanibel, not runoff through the weirs.*

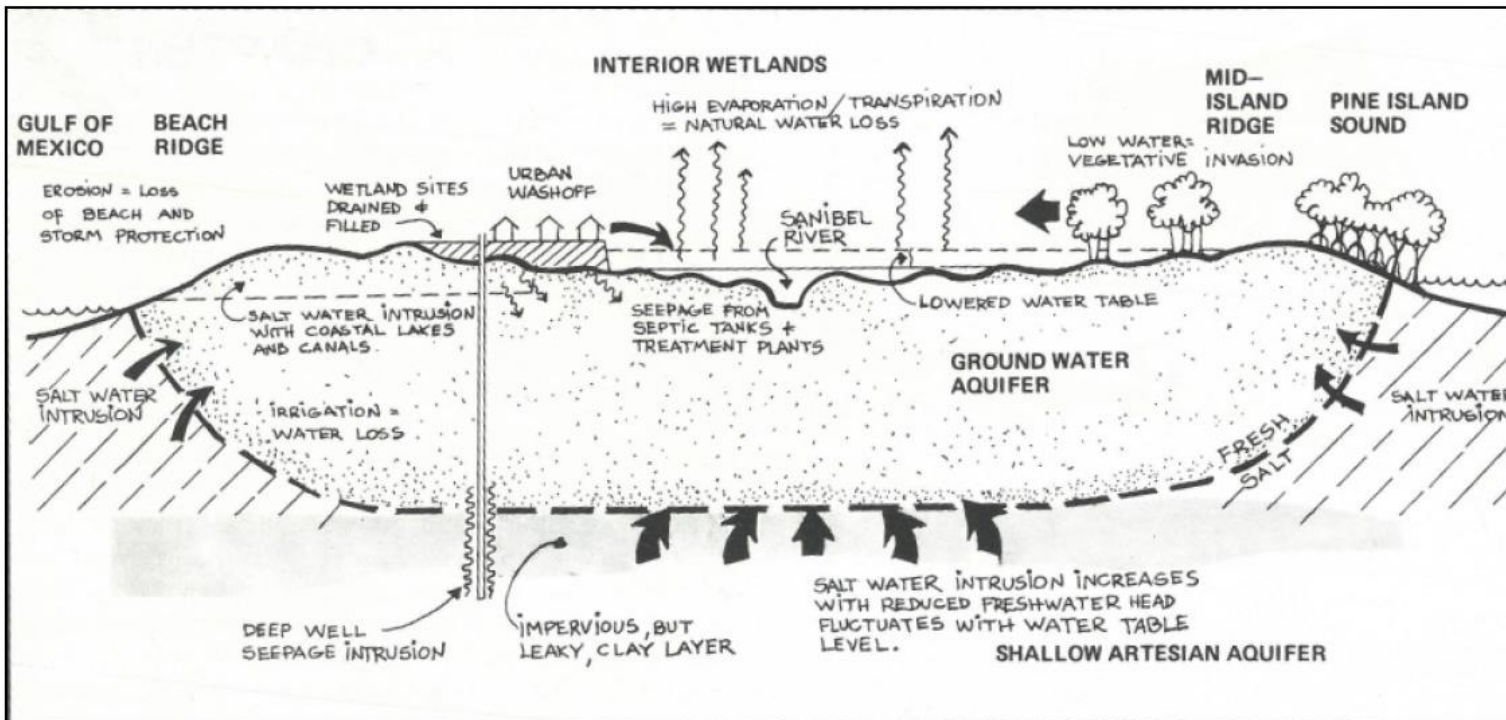
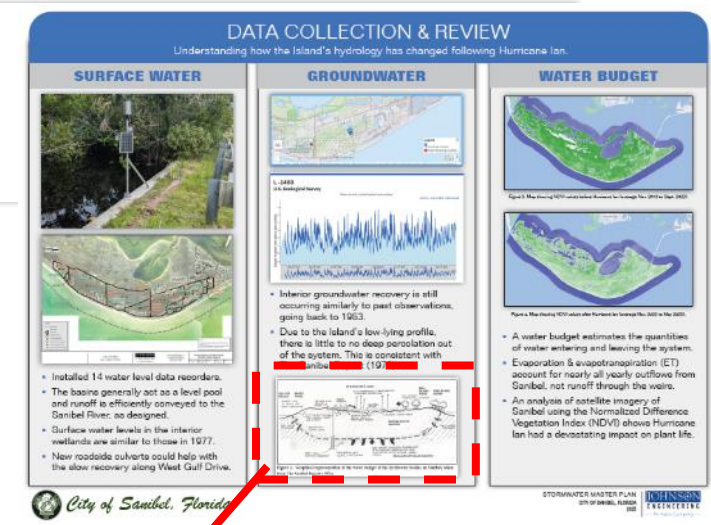
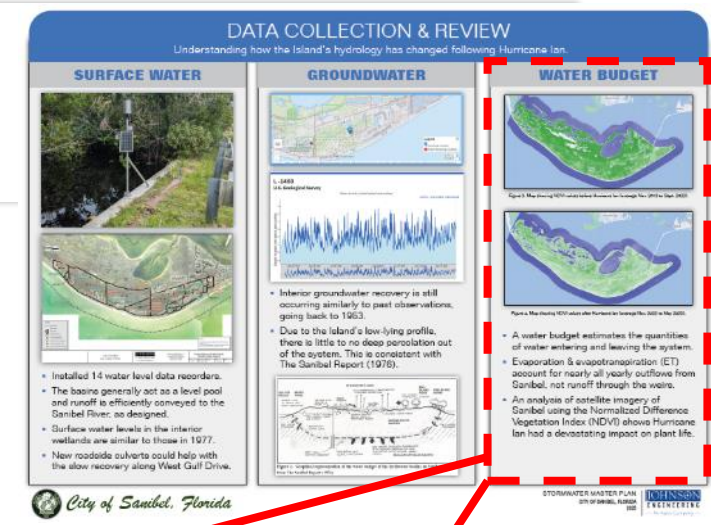


Figure 1. Graphical representation of the water budget of the freshwater basins on Sanibel, taken from The Sanibel Report (1976).

Water Budget and NDVI

4. Data Collection & Review – Water Budget

- *An analysis of satellite imagery of Sanibel using the Normalized Difference Vegetation Index (NDVI) shows Hurricane Ian had a devastating impact on plant life.*
- *As less water is lost to ET, management strategies may change.*

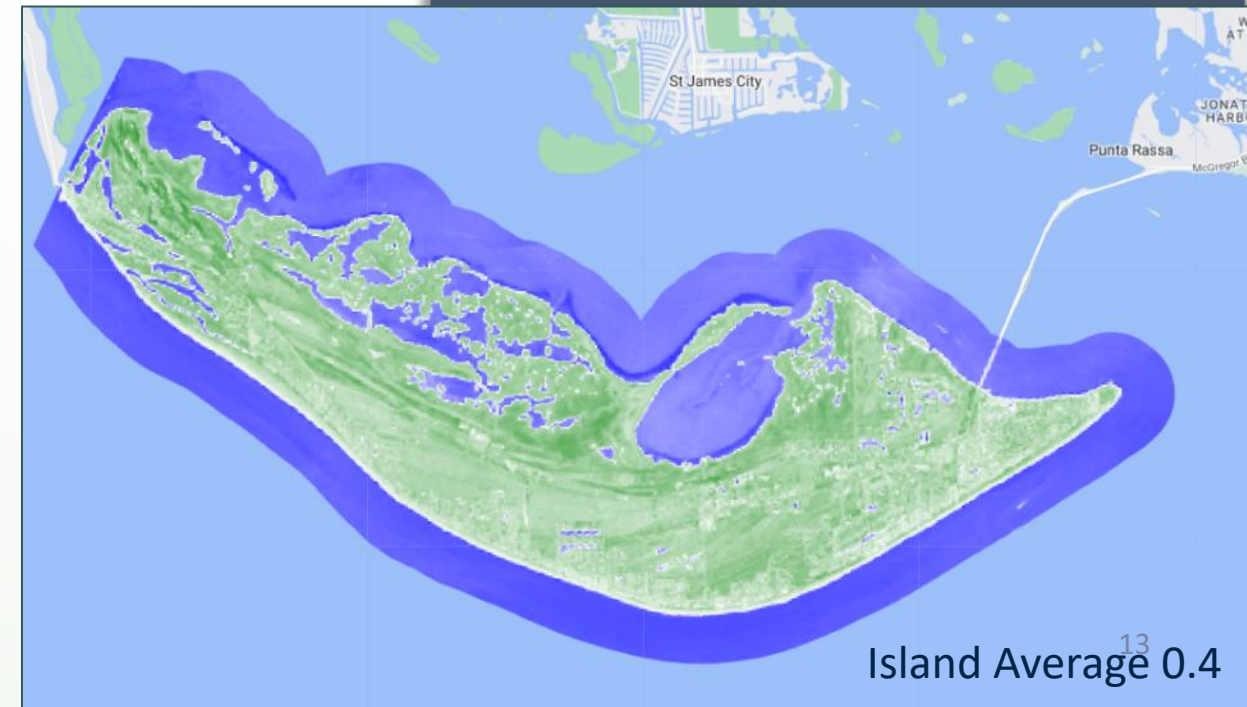


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NDVI BEFORE HURRICANE IAN (2013-22)



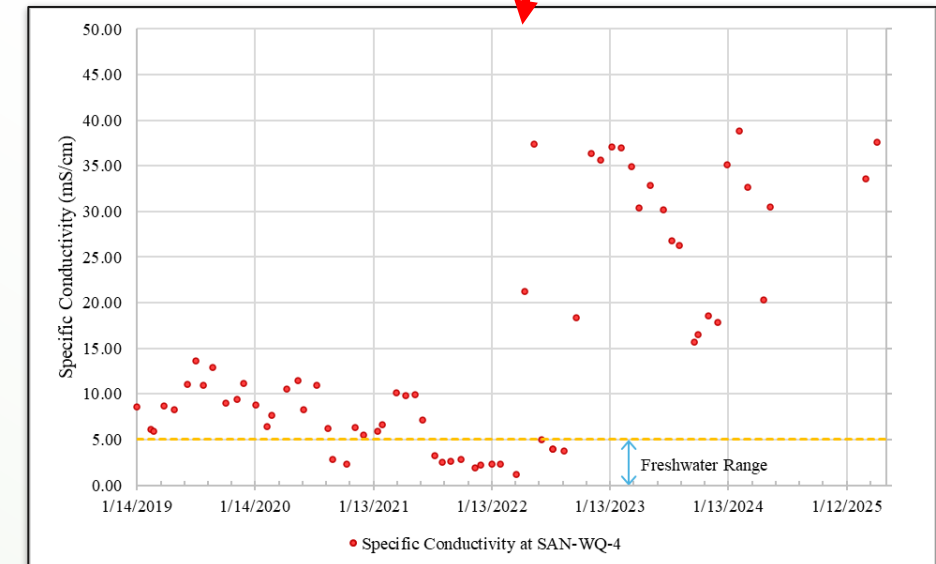
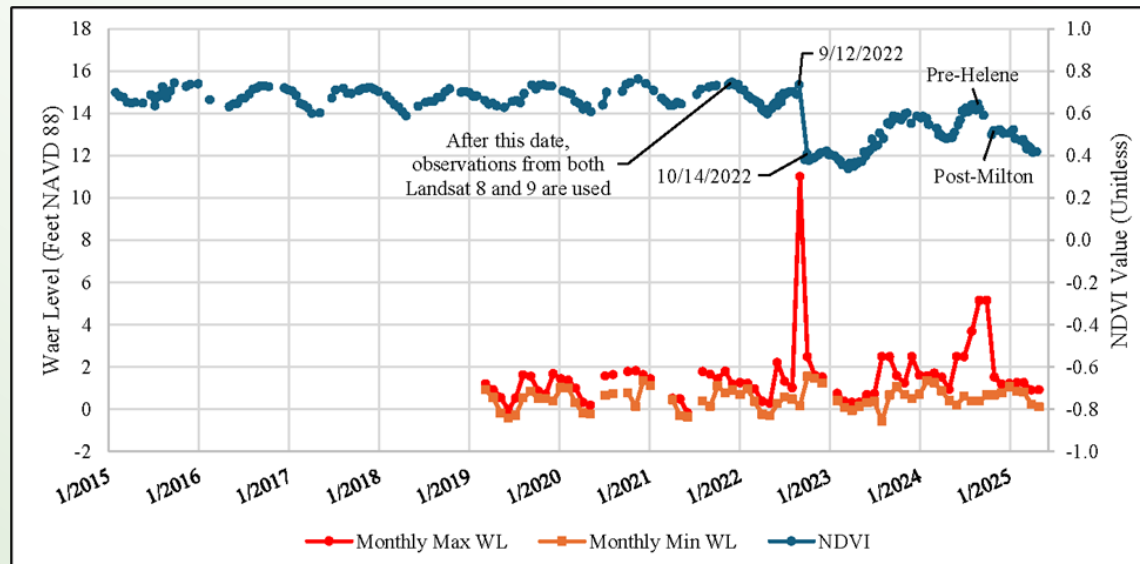
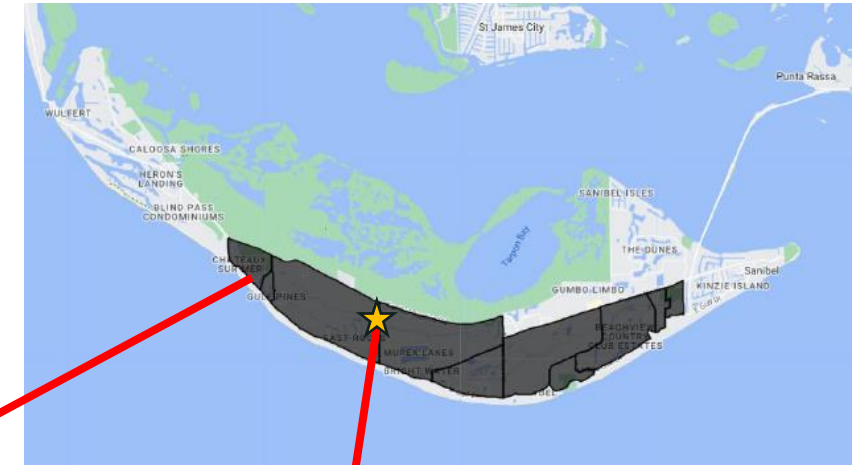
NDVI AFTER HURRICANE IAN (2022-23)



NDVI Method and Findings

4. Data Collection & Review – Method and Findings

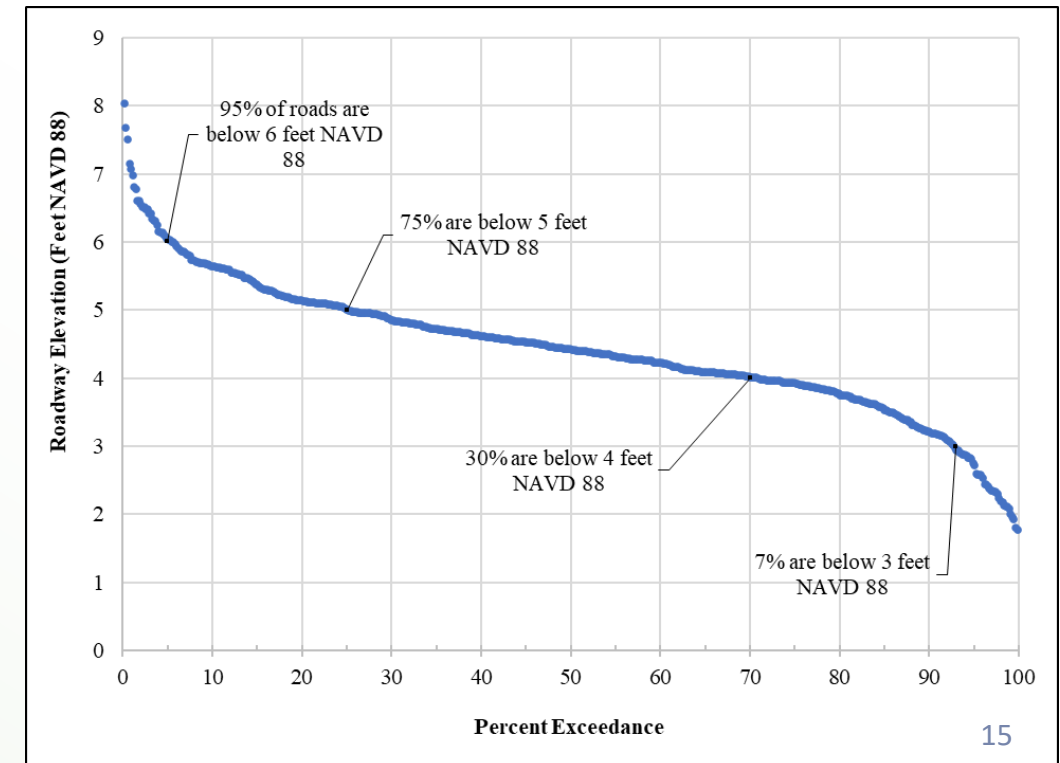
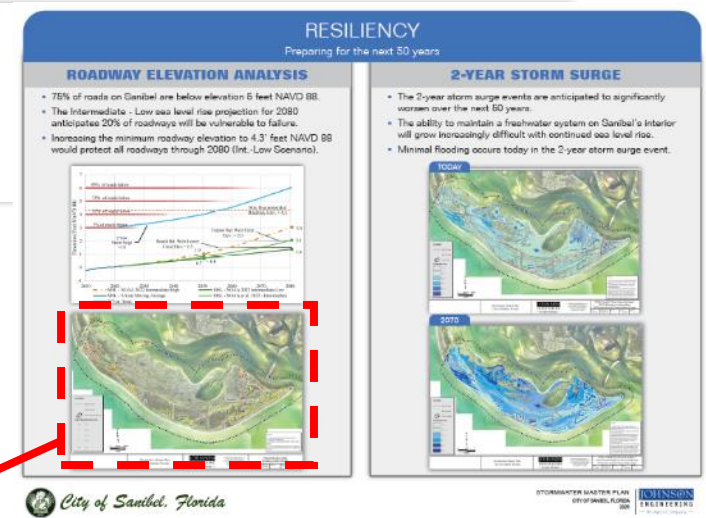
- *Used Landsat 8 and Landsat 9 surface reflectance products to calculate average NDVI for the interior basins over time.*
- *Results:*
 - › *Significant drop in NDVI post-Ian (2022)*
 - › *Progress towards vegetative recovery until 2024 hurricanes*
- *This drop was likely caused by stress due to extreme wind, wave action, and increased salinity.*



Roadway Elevation Analysis

5. Resiliency – Roadway Elevation Analysis

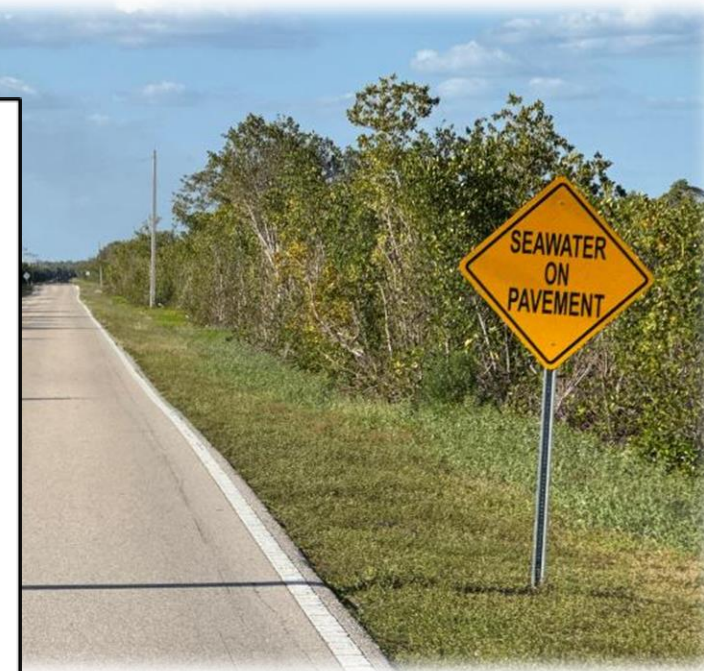
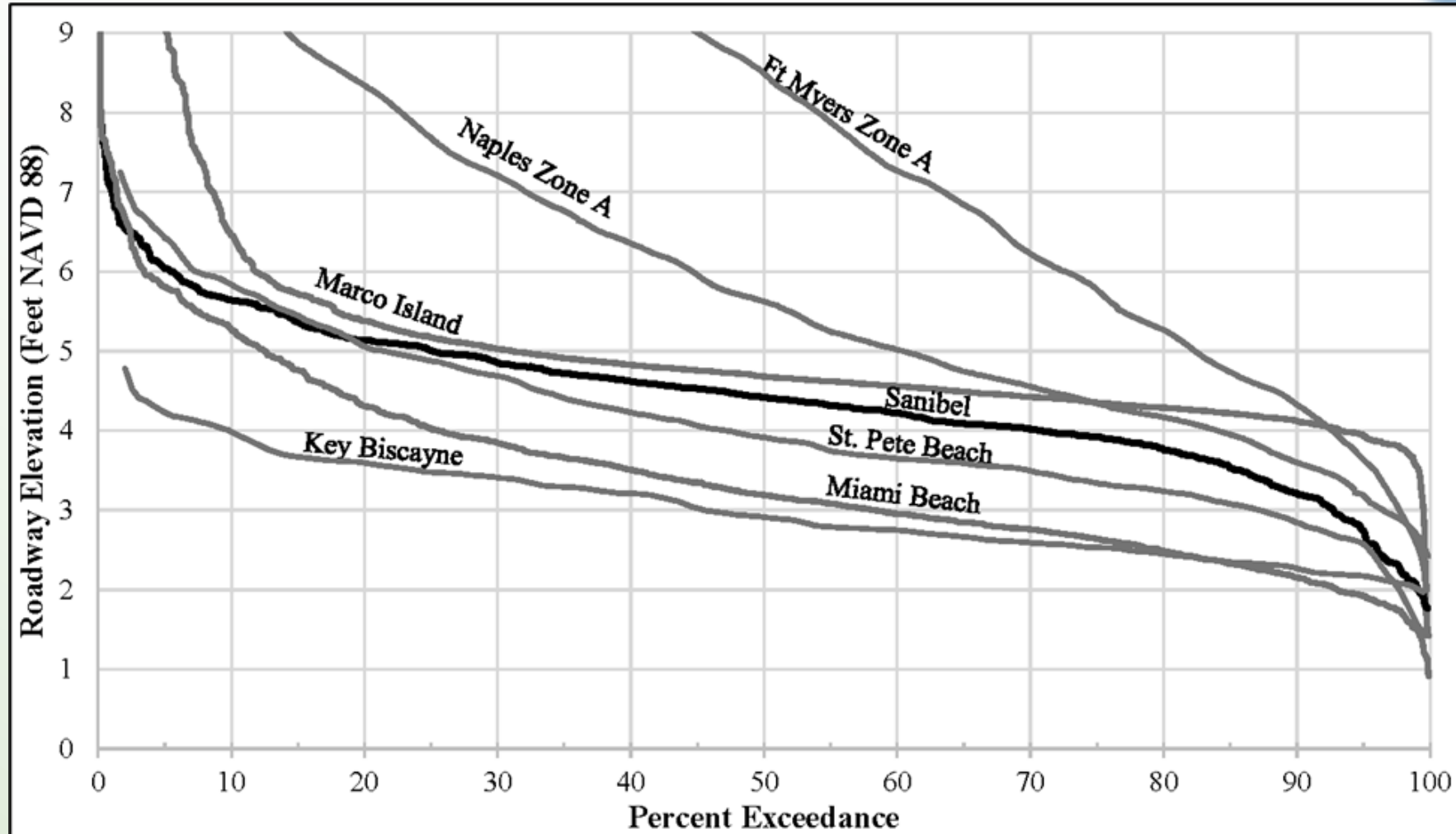
- 75% of roads on Sanibel are below elevation 5 feet NAVD 88.



Roadway Elevation Comparison



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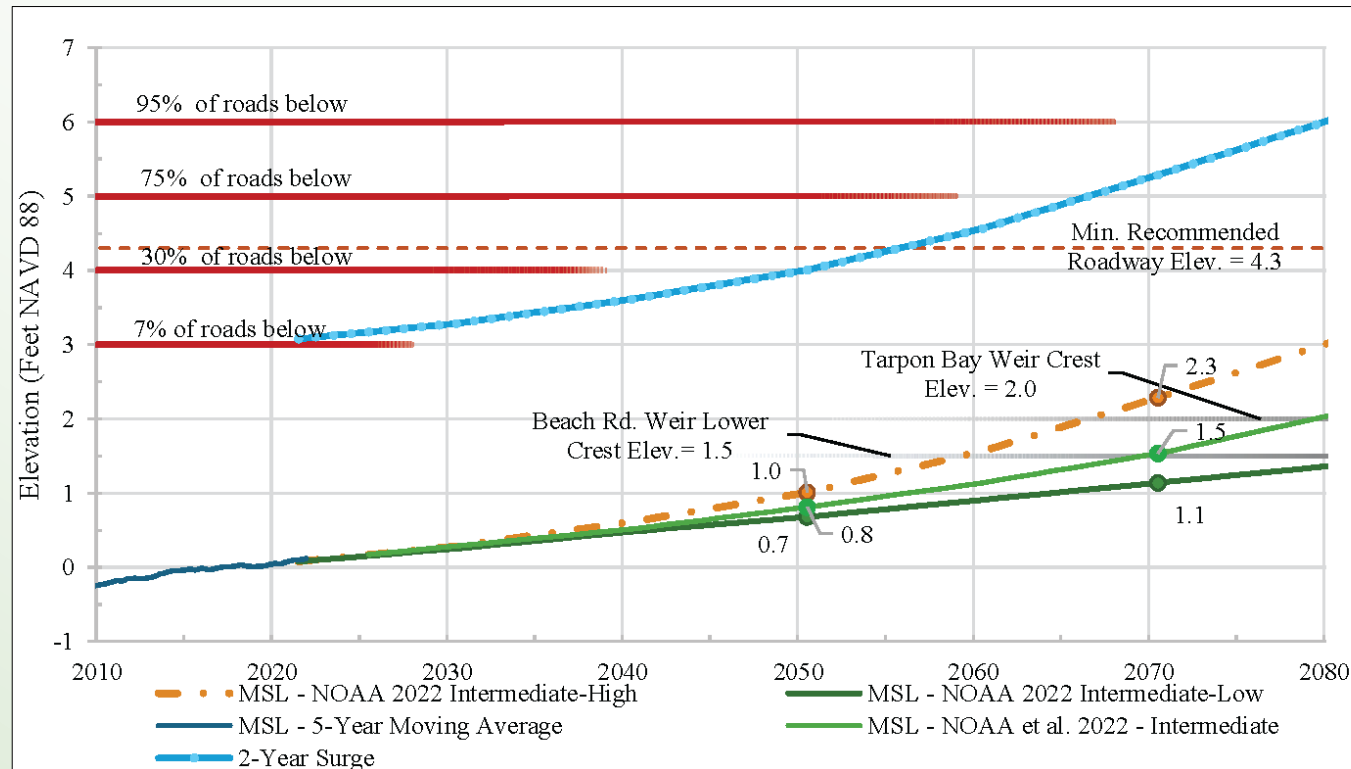
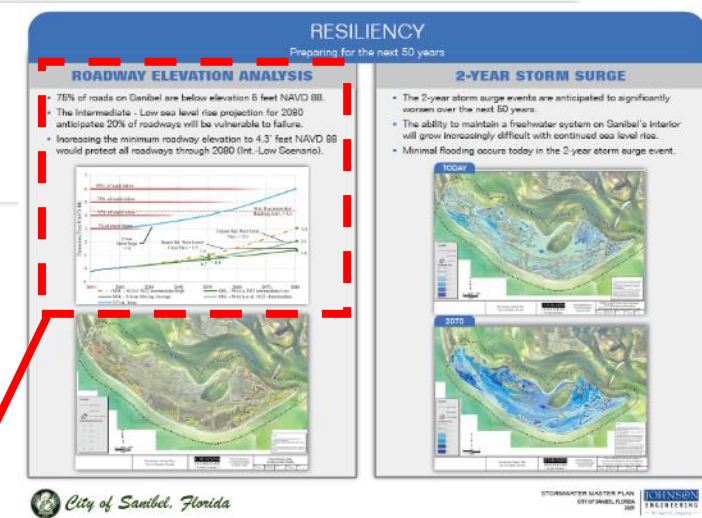


Collier County Road 92
to Marco Island

Roadway Elevation and Sea Level Rise

5. Resiliency – Roadway Elevation and SLR

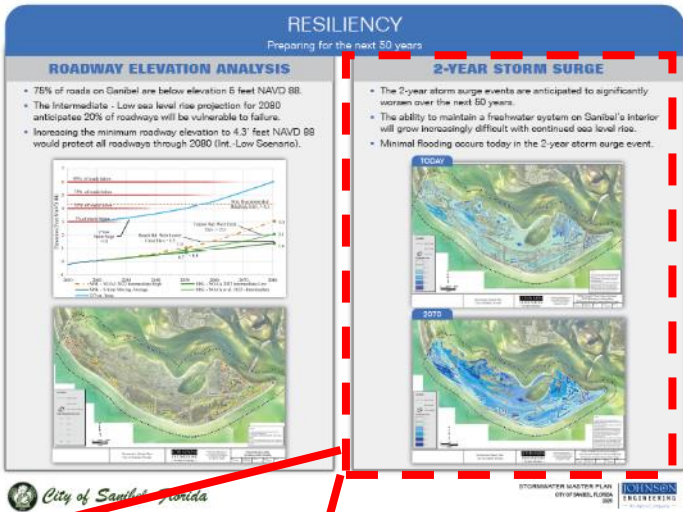
- The Intermediate - Low sea level rise projection for 2080 anticipates 20% of roadways will be vulnerable.*
- Increasing the minimum roadway elevation to 4.3' feet NAVD 88 would protect all roadways through 2080 (Int.-Low Scenario).*



2-Year Storm Surge Event

5. Resiliency – 2-Year Storm Surge

- Minimal flooding today in the 2-year surge event.
- Impacts of storm surge are anticipated to worsen.



2-Year Storm Surge Event

5. Resiliency – Weir Operations and Stormwater Management

- *Maintaining freshwater wetlands becomes increasingly difficult.*
- *Changes to Weir Gate Policy*
- *Pumping During Recovery*



Questions and Comments



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Thank you!

