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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



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**Surface Water Management
Master Plan Update
Following Hurricane Ian (2022)**

Prepared For:



Prepared By:

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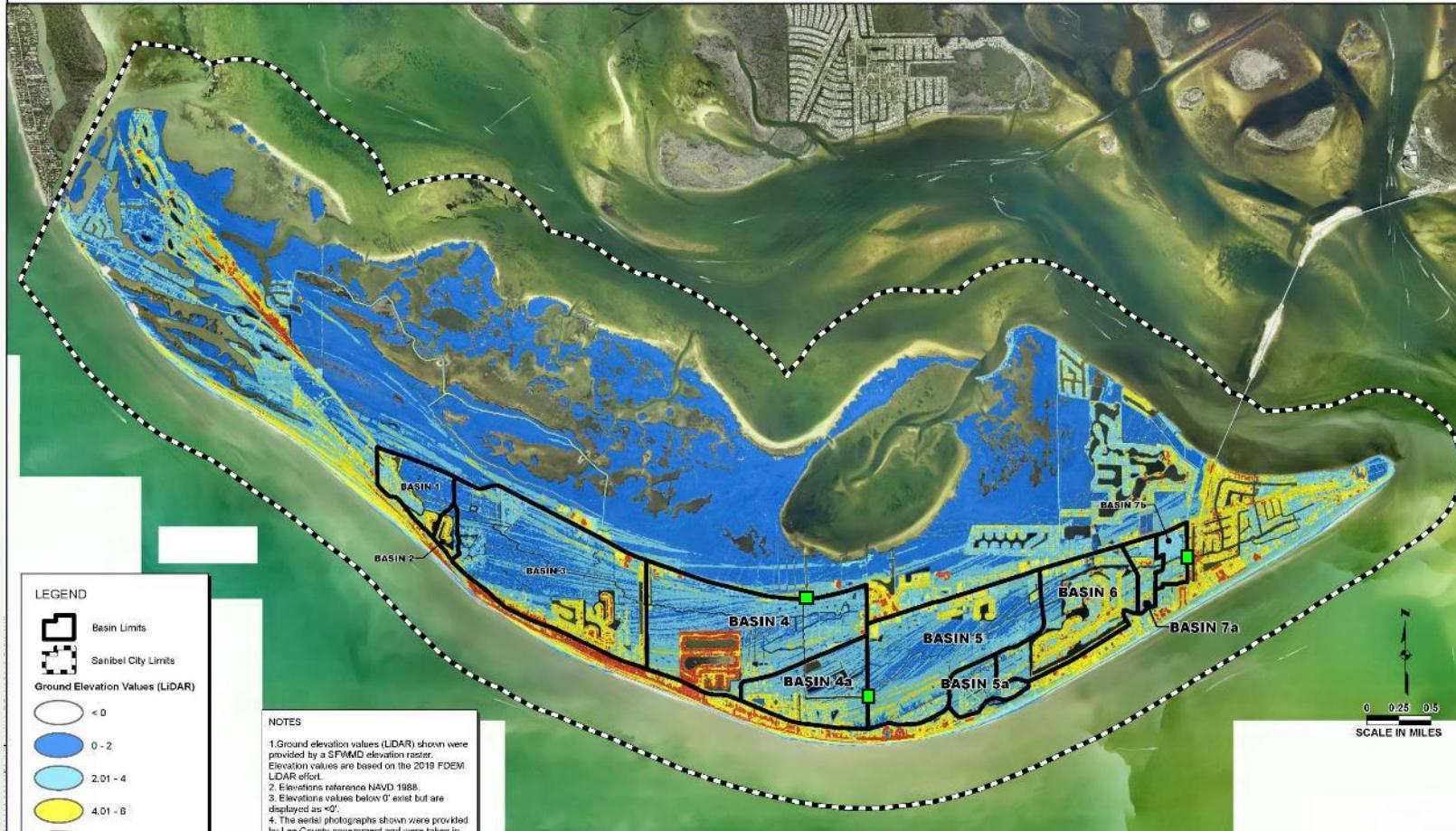
Sanibel Island



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



For Review
01/09/2025 5:03:18 PM

City of Sanibel
Lee County, Florida

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Topographic Map

DATE	PROJECT NO.	FILE NO.	SCALE	HEET
Jan 2025	103206161-081	-	As Shown	-

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

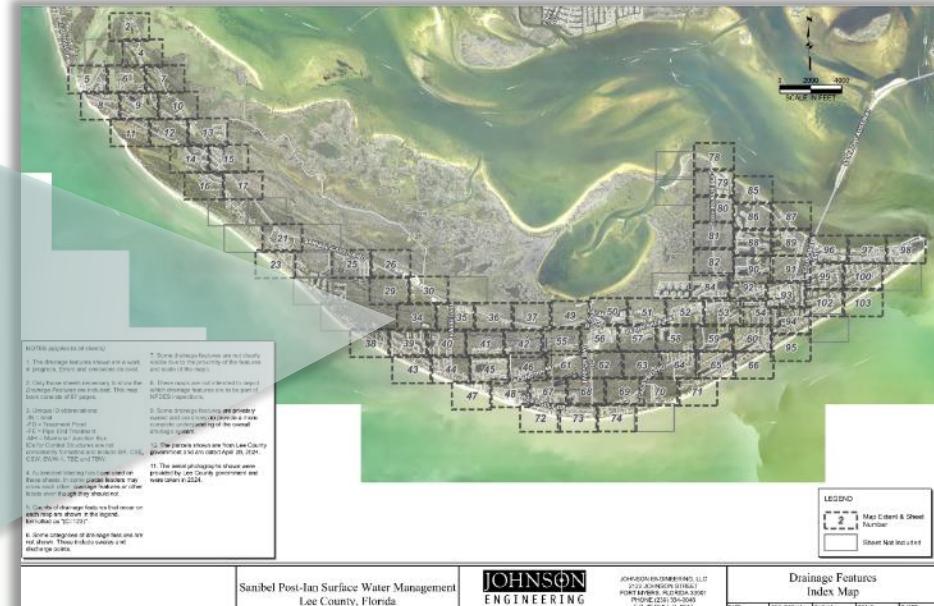
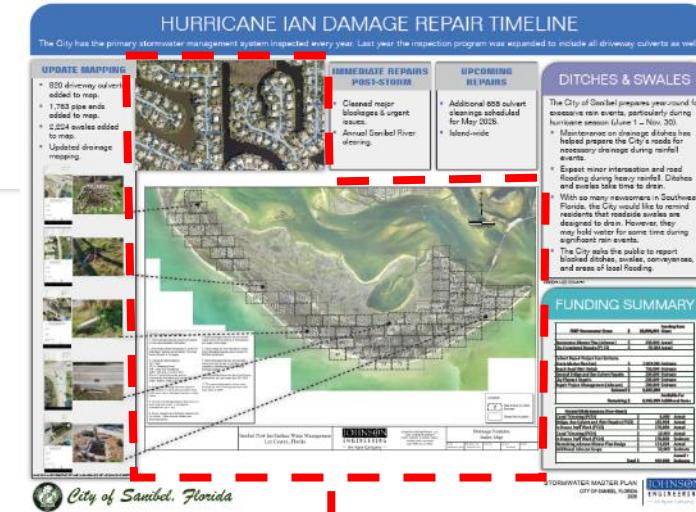
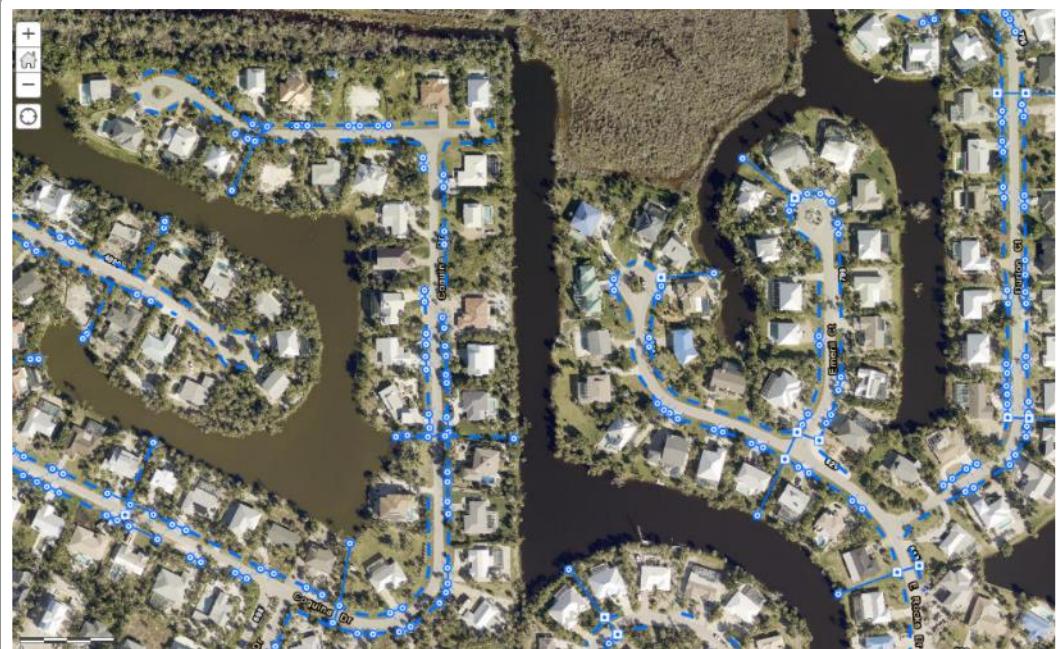
- *Hurricane Ian severely damaged the island's infrastructure.*
- *Culverts, inlets, and swales were buried, leaving the island more vulnerable to riverine flooding.*



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*



Sanibel Post-Ian Surface Water Management
Lee County, Florida

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Drainage Features
Index Map

Flooding 101

3. Flooding and Vulnerability – Riverine

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

Flooding Due to Rainfall



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 waters 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 veins.
• 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 home has never flooded before. Why now?”
Every storm is different. Increases present the greatest challenge for flooding. Sanibel has two interior watersheds that collect rainfall and outfall via two waters to Pine Island Sound. The increase in water volume from a storm can cause flooding in areas that have not flooded in the past. The following are some of the reasons why flooding may occur:

- Origin
- Duration of precipitation
- Distance from the water body
- Location of residence

“We have high/flat ground that should protect our property from storm surge. Why did we flood?”
This is a common misconception that the Sanibel that any one can avoid flooding. The increase in water volume from a storm can cause flooding in areas that have not flooded in the past. The following are some of the reasons why flooding may occur:

- Distance from the water body
- Location of residence

“How did Sanibel’s infrastructure mitigate the flooding?”
Infrastructure is vital in keeping the aquifer free from flooding and inundation. After being identified, flood-prone areas, flood-prone areas are identified and mitigated. The City of Sanibel has invested millions of dollars in flood mitigation projects. These projects have been completed through the City’s efforts to keep the risks from inundation, they are integral to the City’s economy and can only have maximum benefit to the community. The City of Sanibel has invested millions of dollars in flood mitigation projects. These projects have been completed through the City’s efforts to keep the risks from inundation, they are integral to the City’s economy and can only have maximum benefit to the community.

“Will flooding and vegetation increase flood severity?”
In certain areas, the stormwater carrying capacity of a river, creek or canal is exceeded. This is due to a variety of factors such as sedimentation, debris, and debris. The increase in water volume from a storm can cause flooding in areas that have not flooded in the past. The following are some of the reasons why flooding may occur:

- Distance from the water body
- Location of residence

“Is my home likely to flood?”
If you are located in a flood-prone area, you are at a greater risk. The elevation of your home or building is a critical factor. You can find your flood zone by searching for your address on the City of Sanibel’s website.

STORMWATER MASTER PLAN CITY OF SANIBEL, FLORIDA **JOHNSON ENGINEERING**



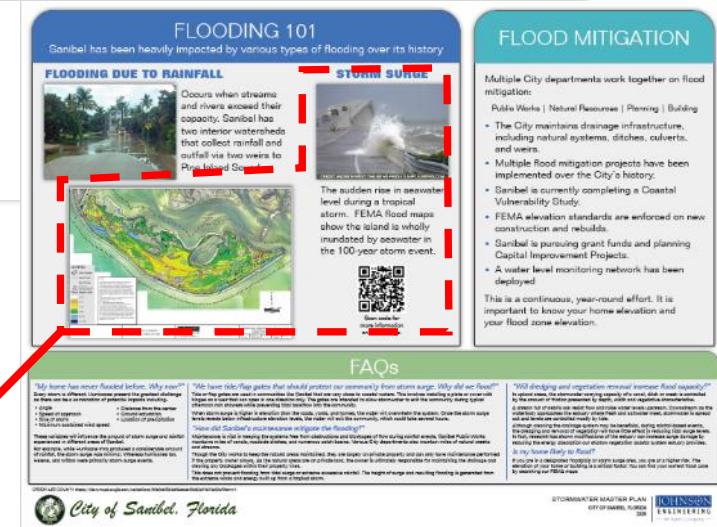
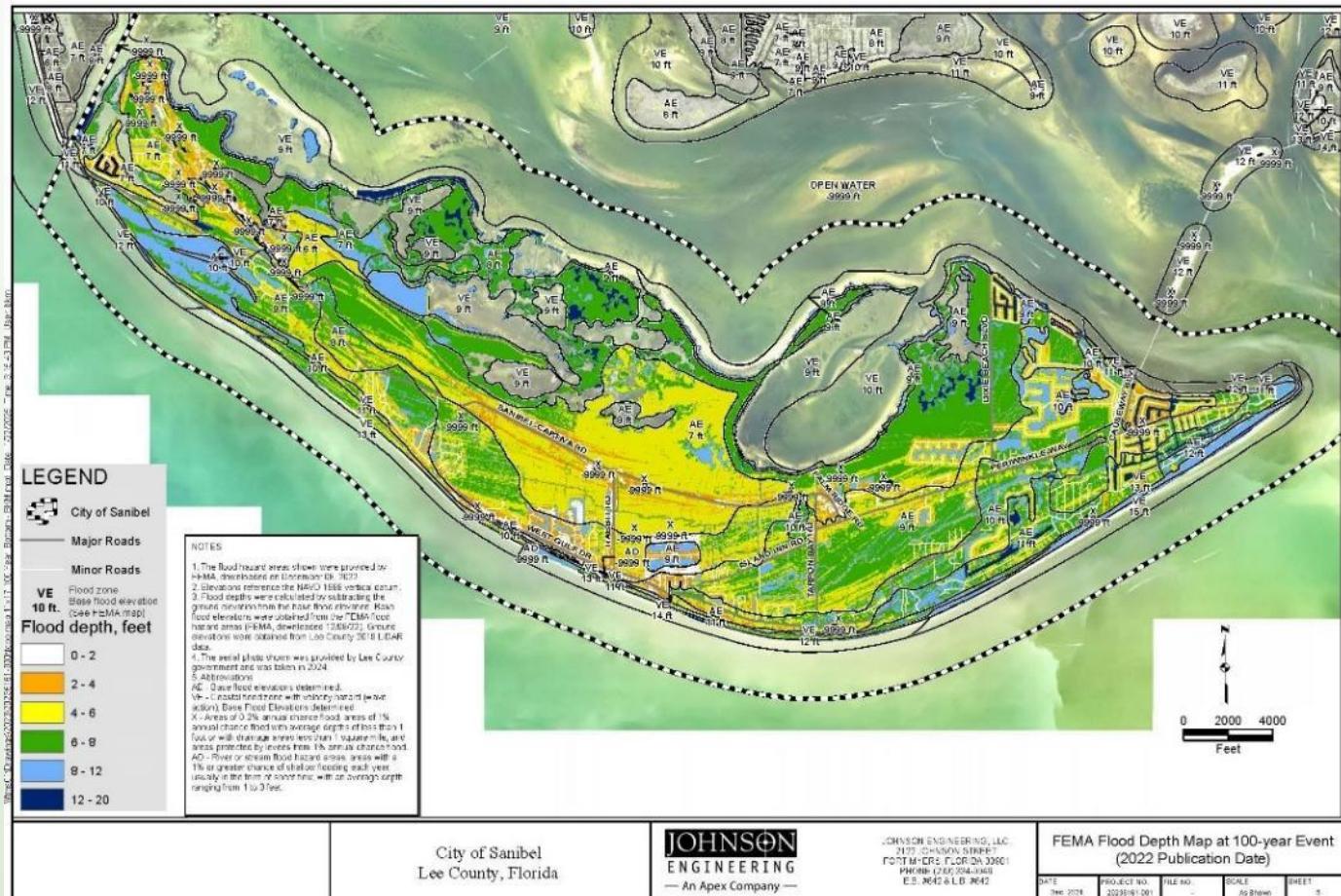
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Flooding 101

3. Flooding and Vulnerability – Storm Surge

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

Flooding Due to Storm Surge

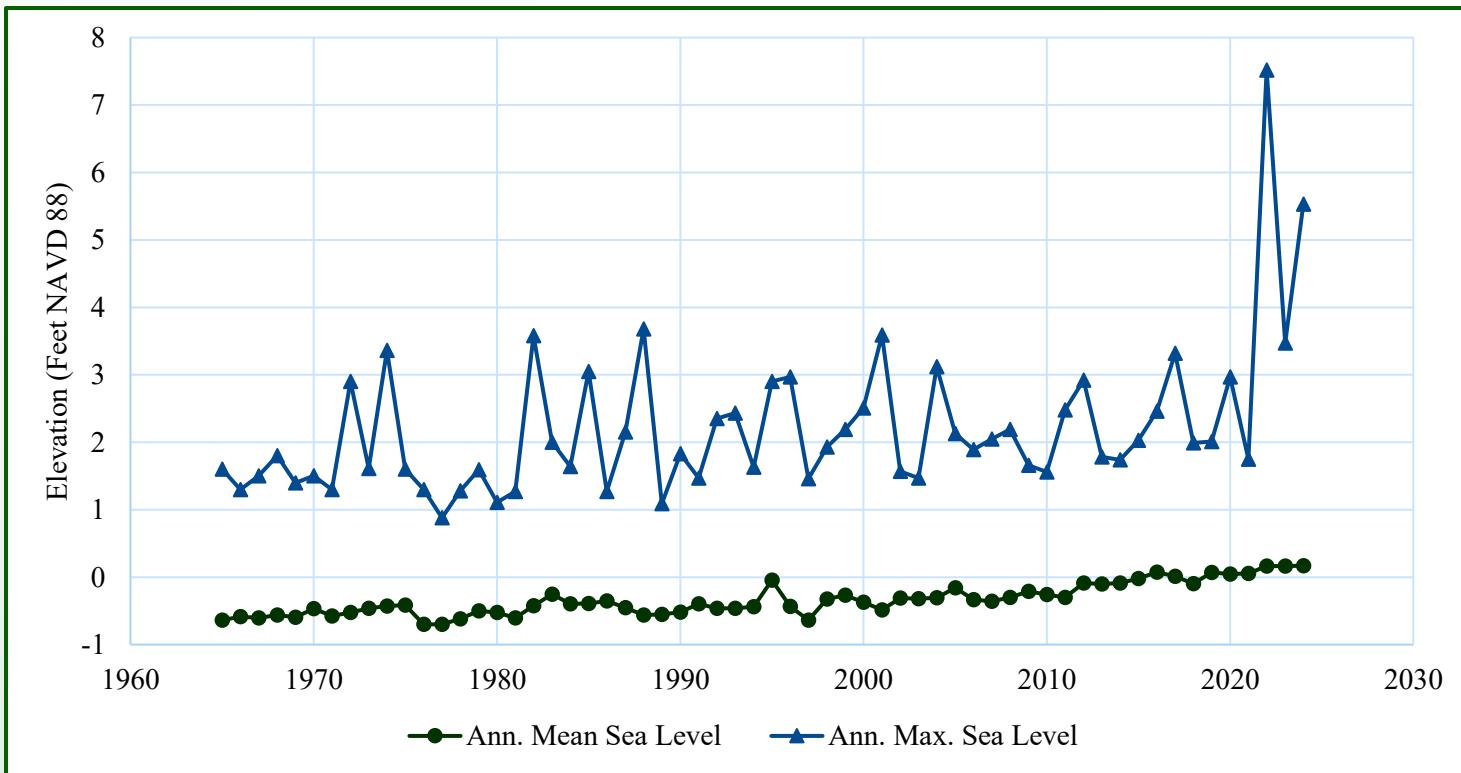


Flooding due to Storm Surge

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)



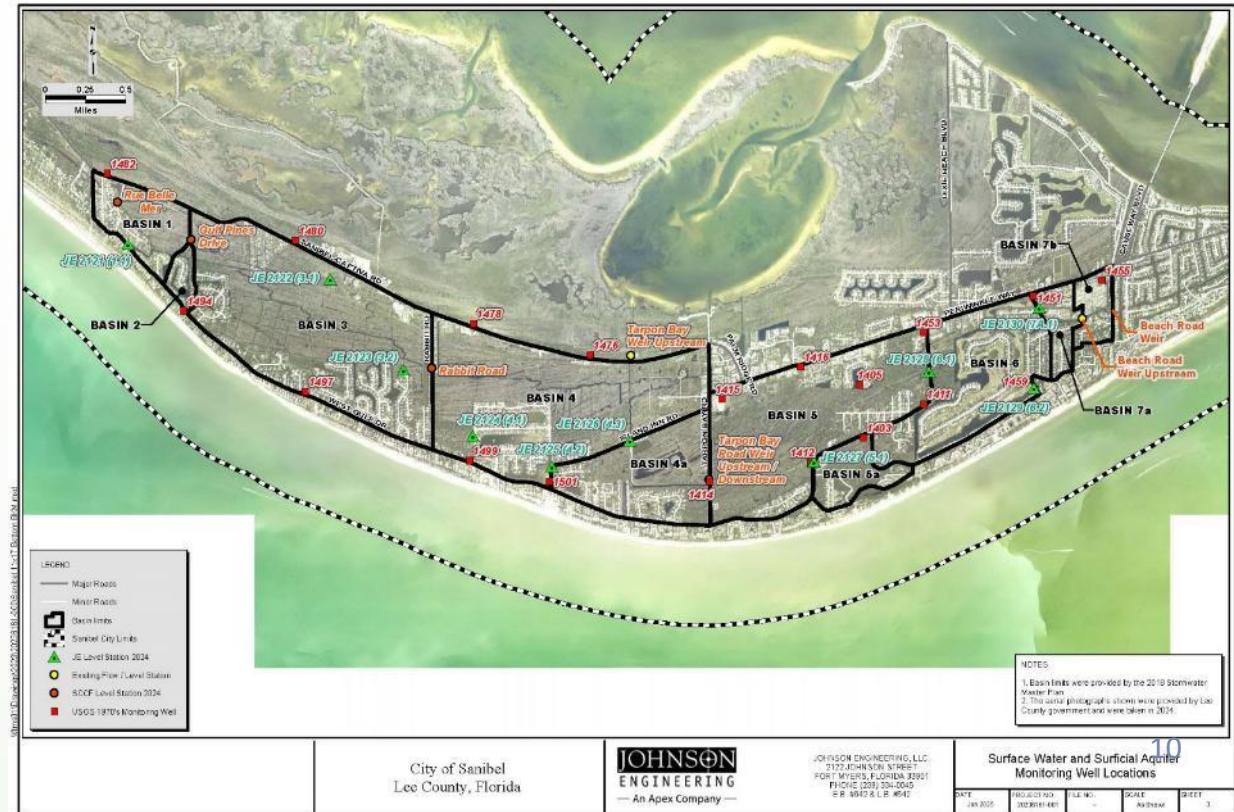
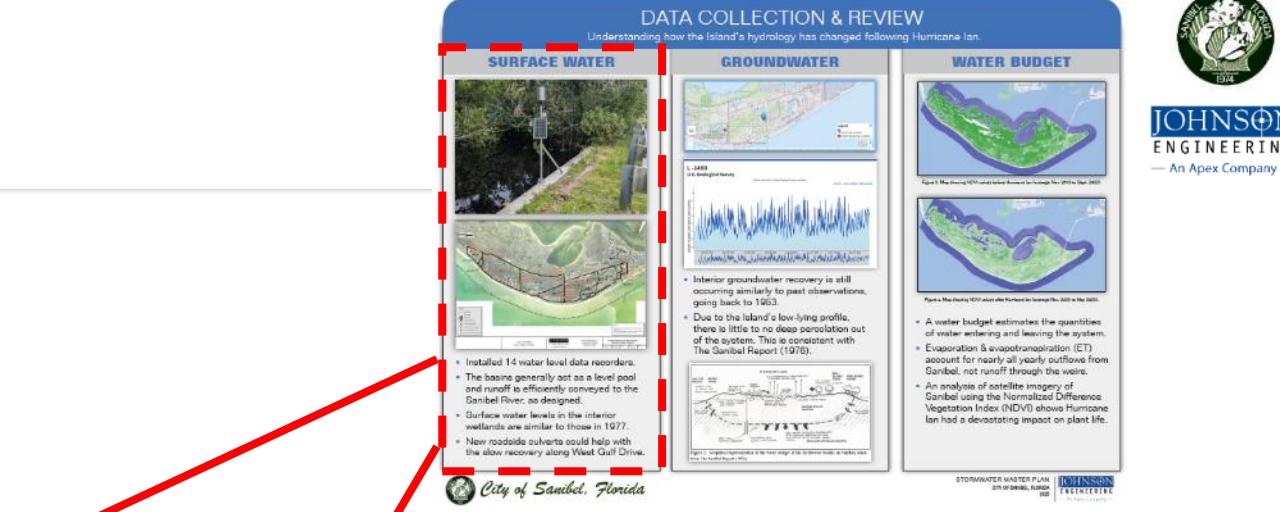
10 Highest Water Levels
1965 to Present

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

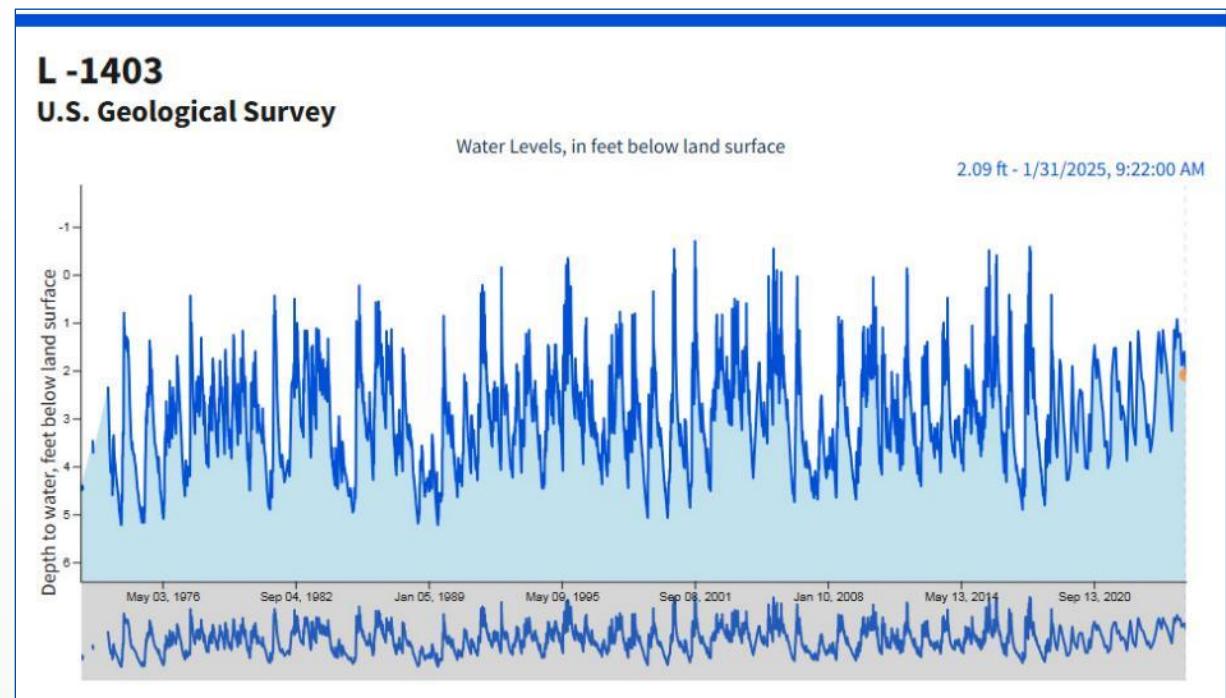
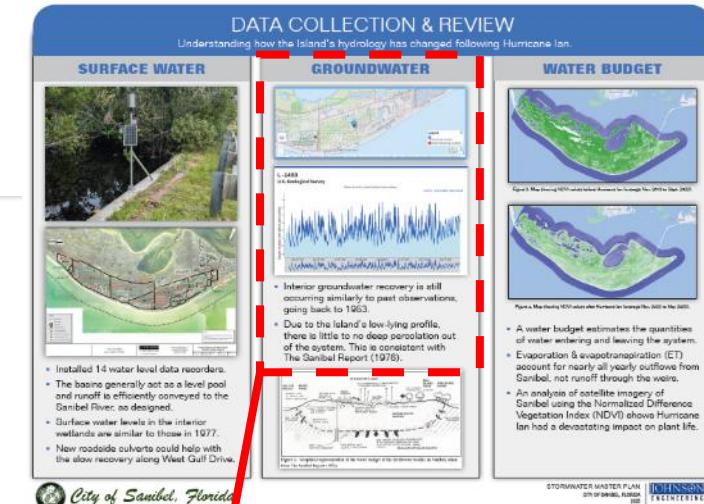
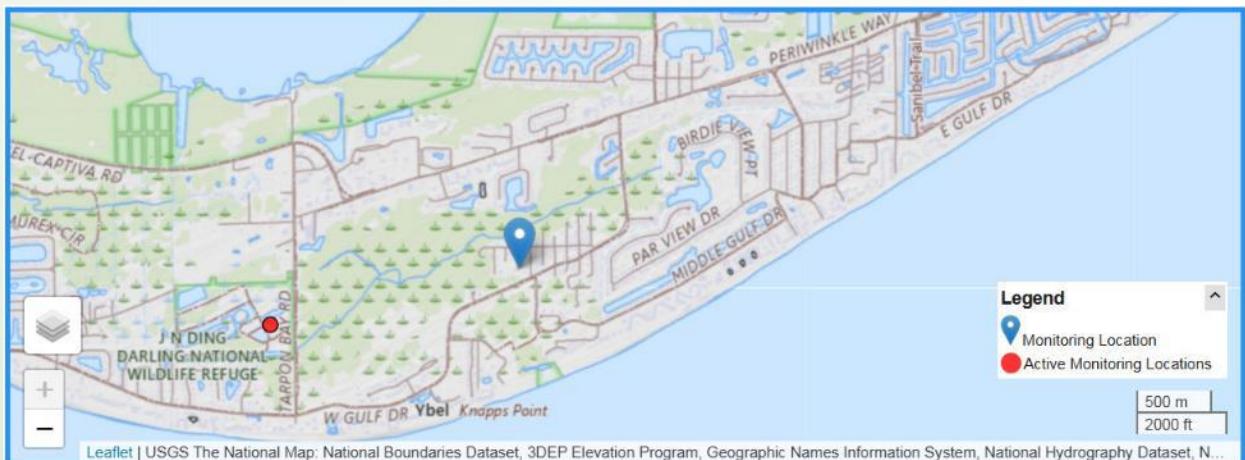
- Water Level Monitoring Network
 - 14 Water Level Datalogger Installations
- The basins generally act as a level pool



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.

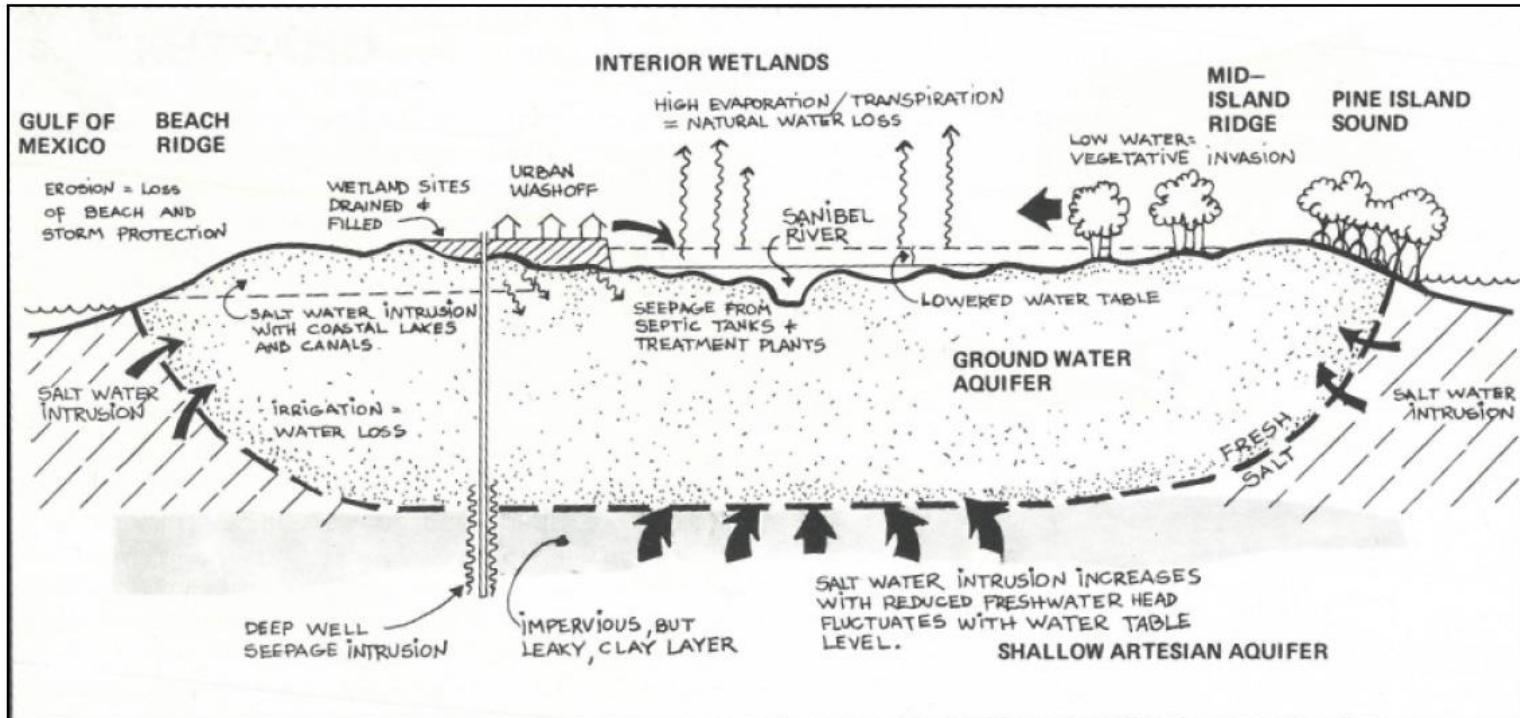
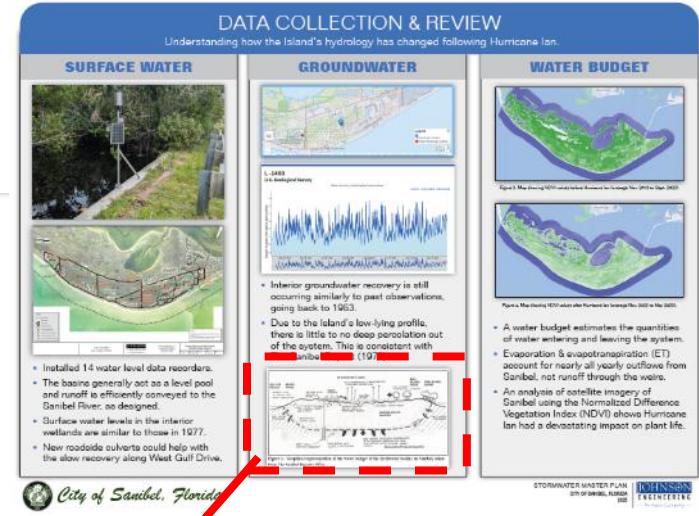
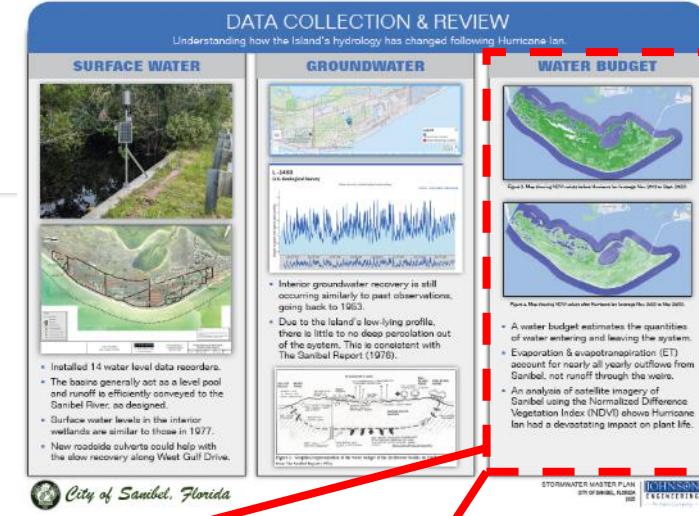


Figure 1. Graphical representation of the water budget of the freshwater basins on Sanibel, taken from The Sanibel Report (1976).

Water Budget and NDVI

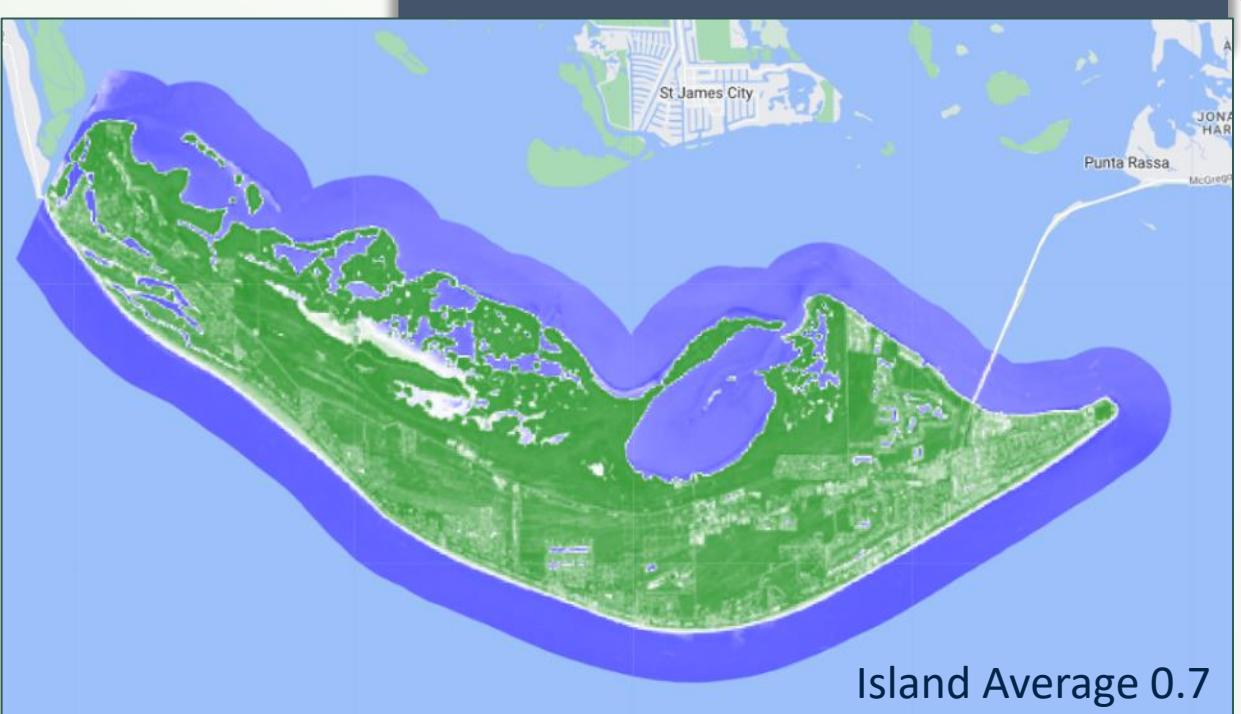
4. Data Collection & Review – Water Budget

- 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.

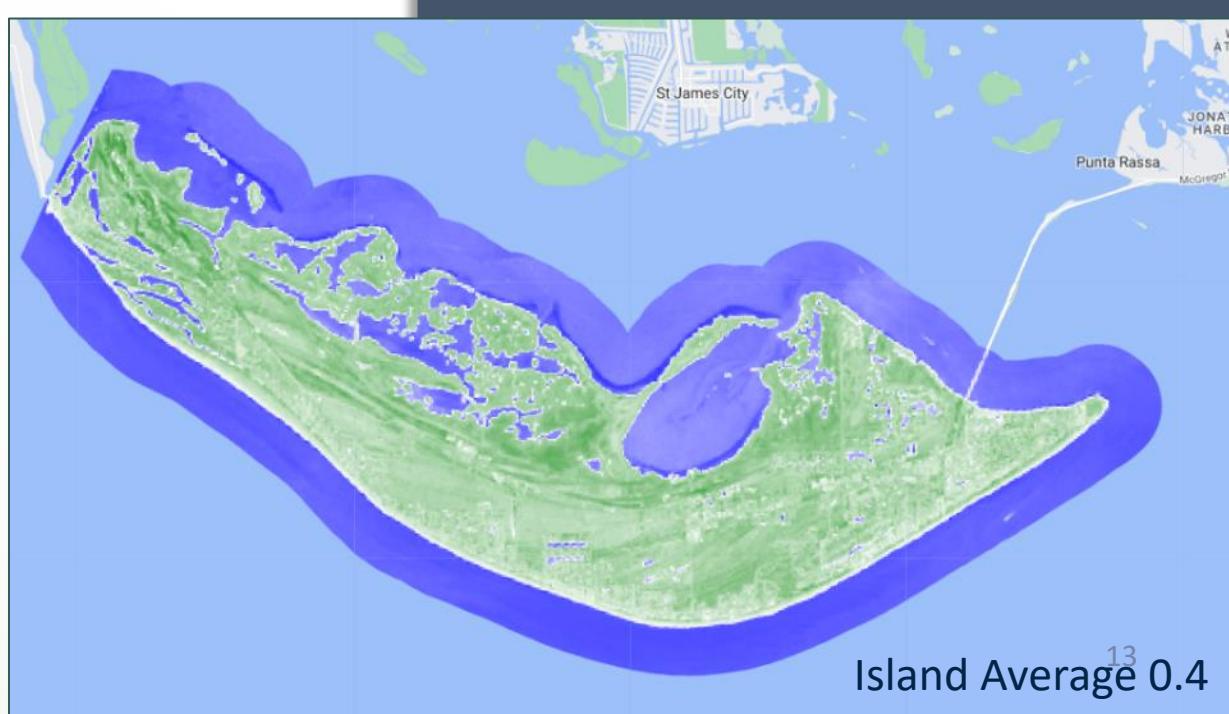


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NDVI BEFORE HURRICANE IAN (2013-22)



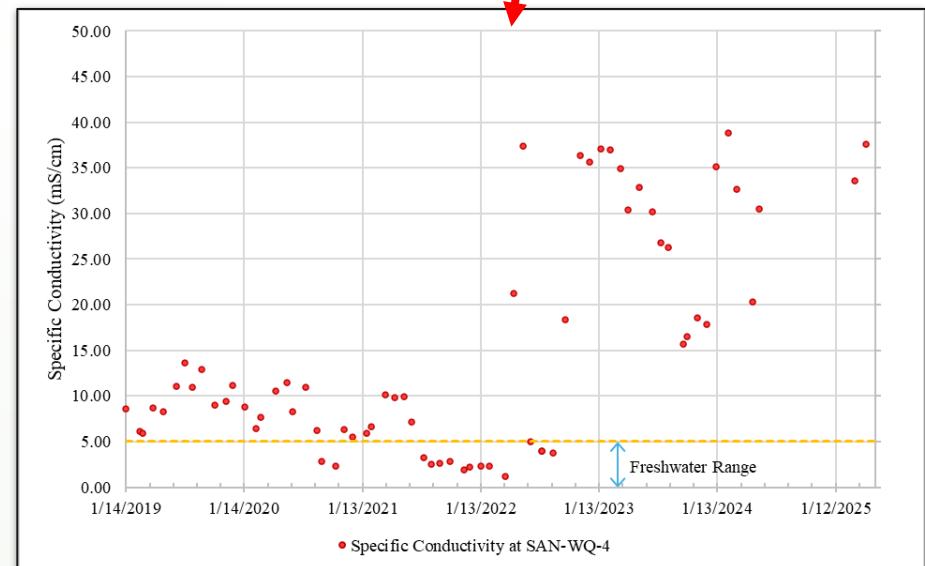
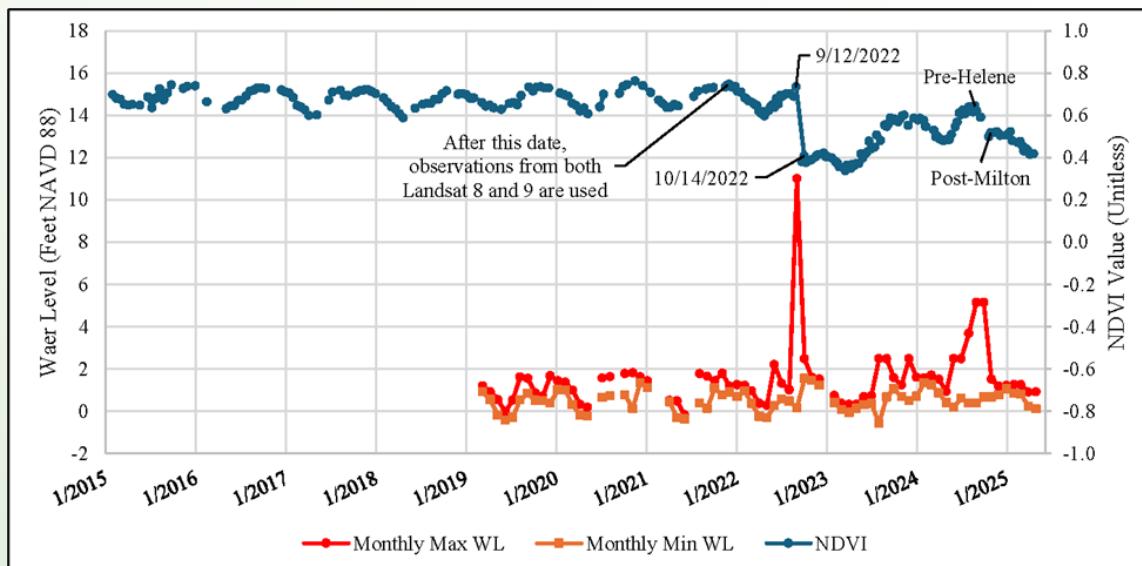
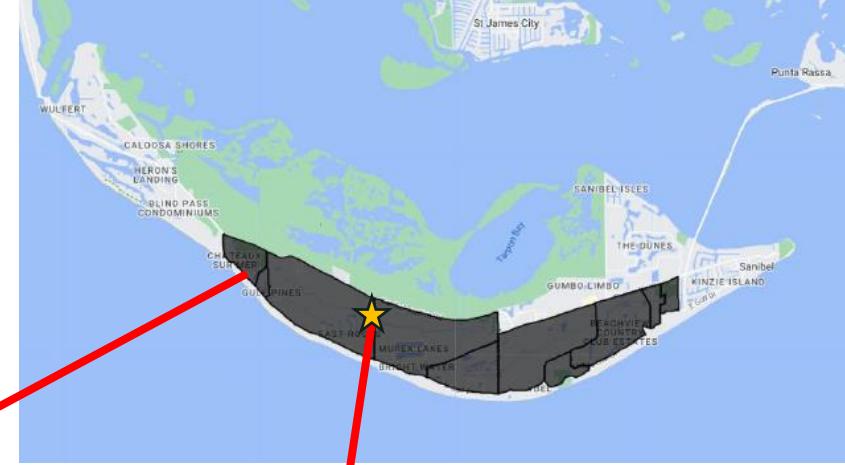
NDVI AFTER HURRICANE IAN (2022-23)



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-Han (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.



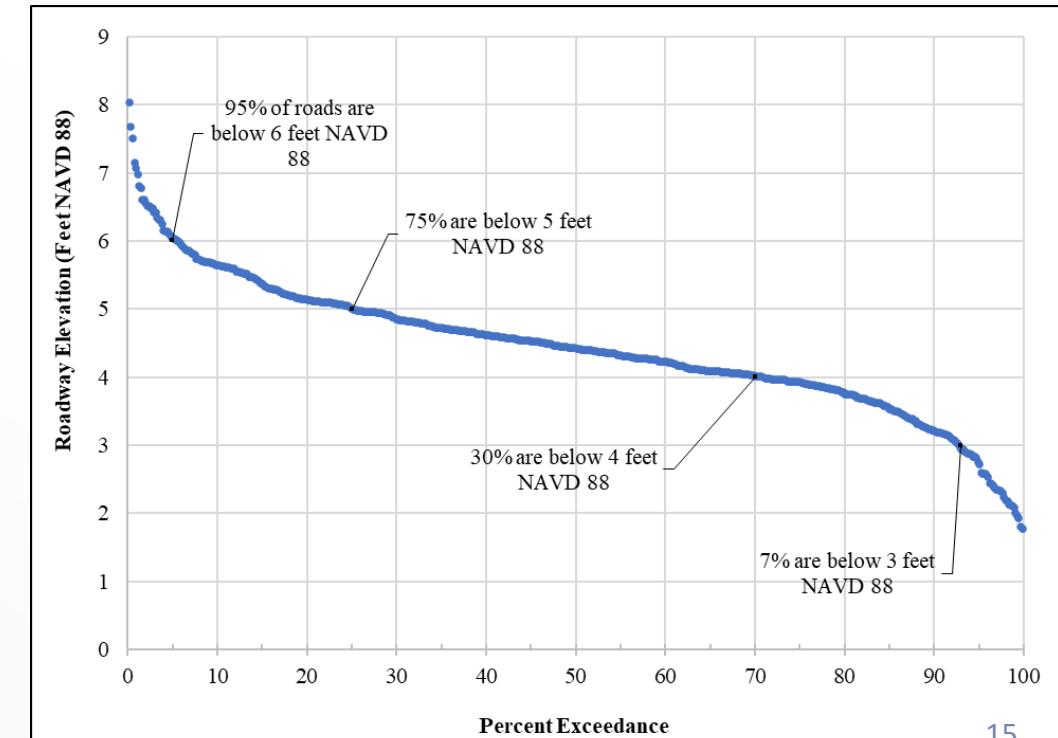
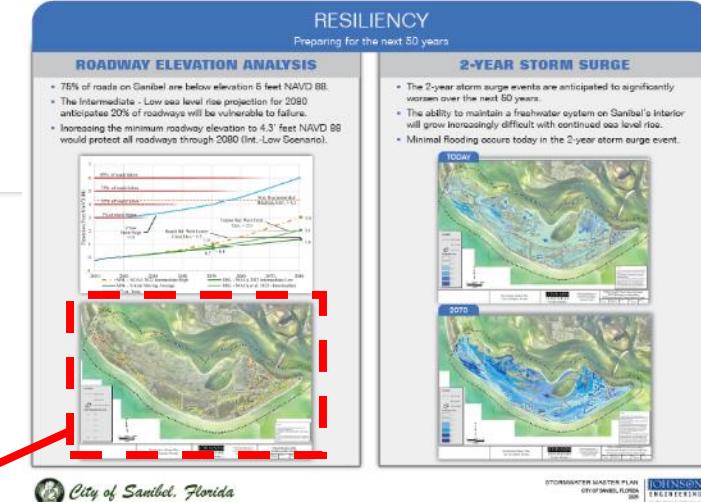
Stormwater Master Plan
City of Sanibel, Florida

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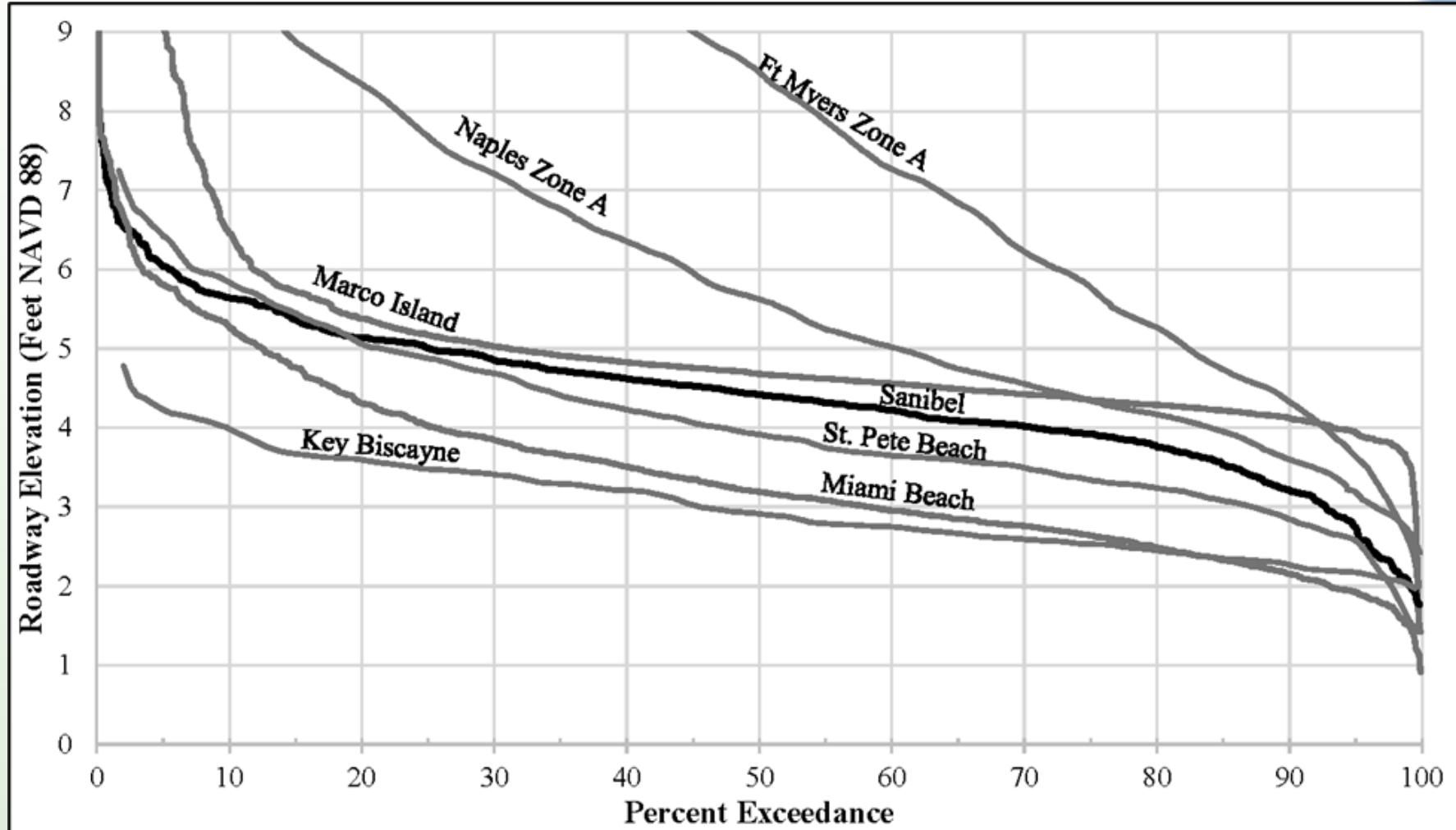
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Road Elevation Map
(Existing Public Roads)

DATE: Jan 2029 PROJECT NO.: 2021081-001 FILE NO.: - SCALE: 1:20,000 SHEET: 4



Roadway Elevation Comparison

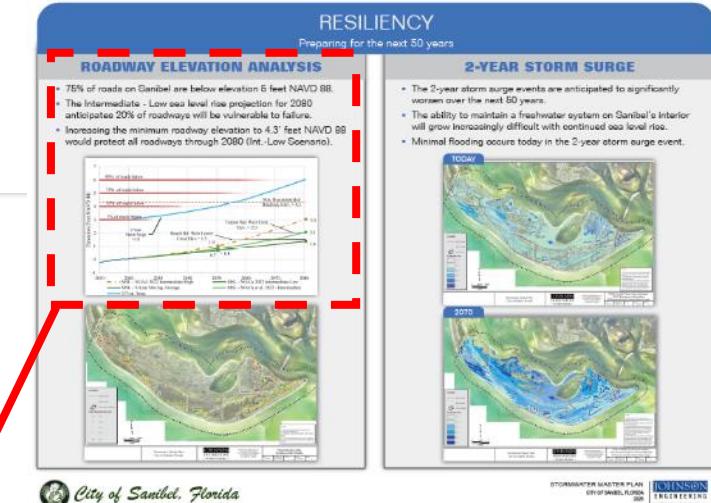
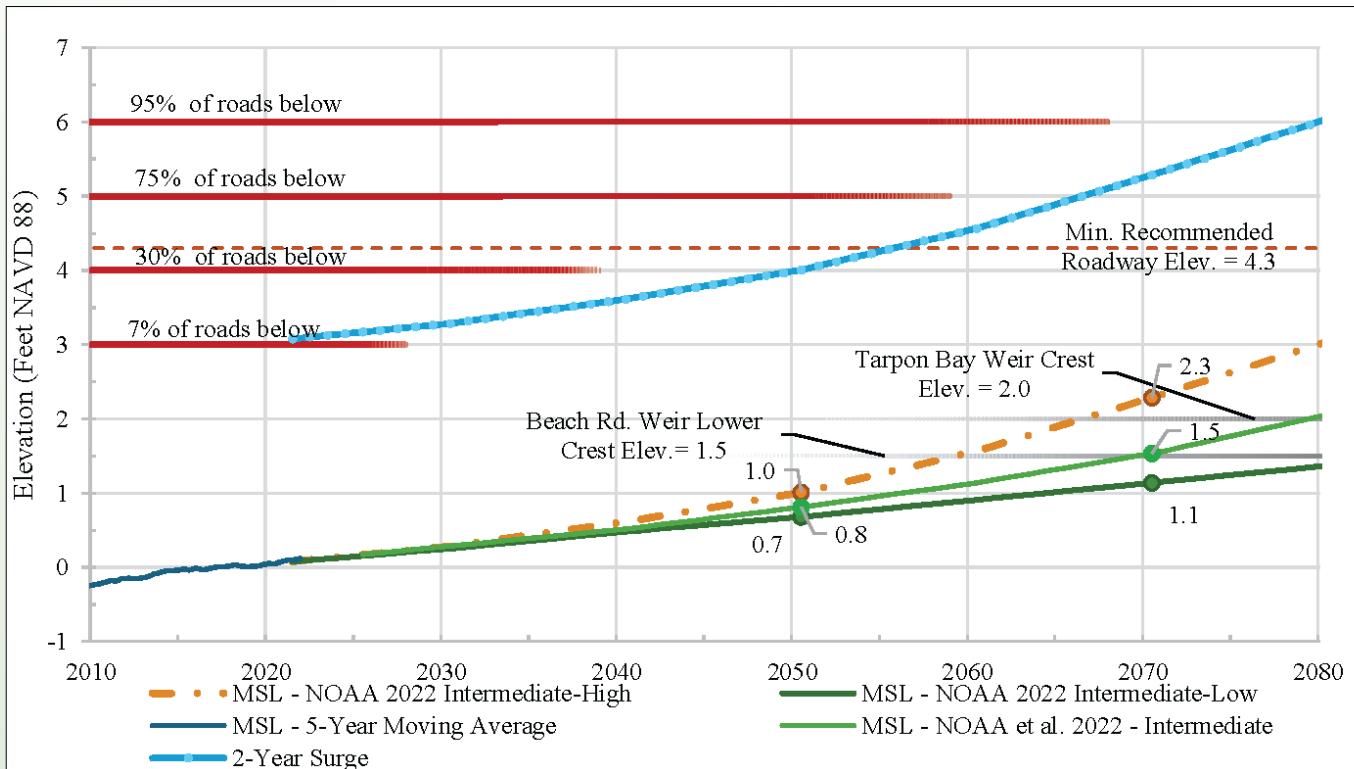


Collier County Road 92
to Marco Island

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).*

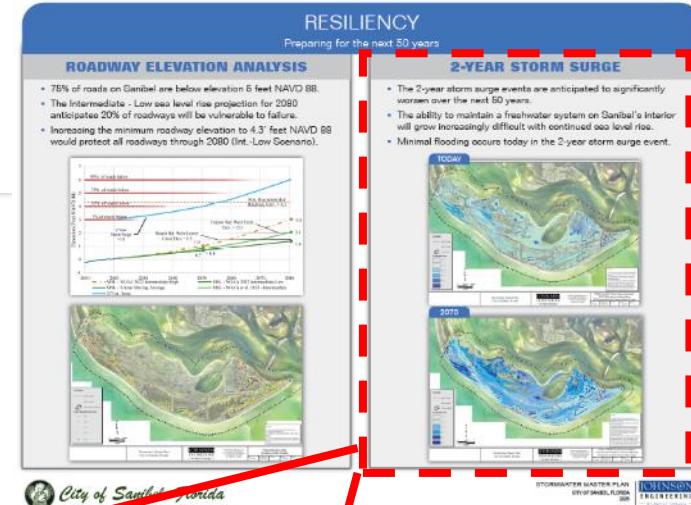


2-Year Storm Surge Event



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

Thank you!

