



**Coastal Structure Management
Considerations
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Beach Preservation Technology
Conference

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INTRODUCTION



Congratulations!

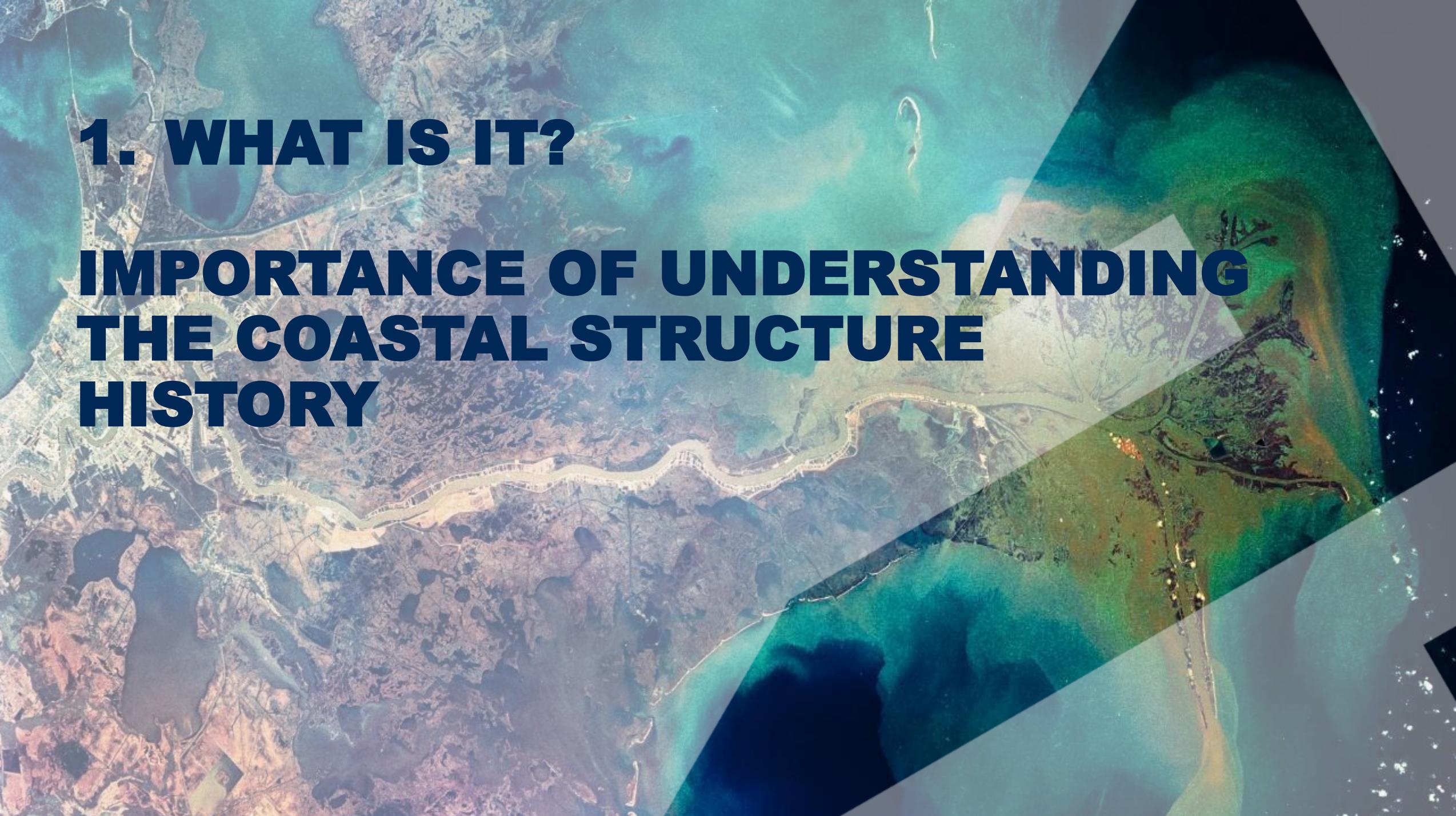
- ▶ 800 Miles of Sandy Beaches
 - ▶ Recreational amenity for 120 M visitors
 - ▶ Storm protection for residents, and public infrastructure
 - ▶ Habitat for sea turtles, shorebirds



TABLE OF CONTENTS

- ▶ History of Structures
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An aerial photograph of a coastal region. A prominent, winding river or canal system flows through a brownish, vegetated landscape. To the right, a large body of water is visible, with a dark, narrow strip of land or a break in the coast. The image is overlaid with a semi-transparent blue and green geometric shape on the right side.

1. WHAT IS IT?

IMPORTANCE OF UNDERSTANDING THE COASTAL STRUCTURE HISTORY

What, Why and When?:

- ▶ Design information.
 - ▶ Plans
 - ▶ Permits
 - ▶ Design reports
- ▶ Construction / Asbuilts
 - ▶ Photographs
 - ▶ Surveys
- ▶ Age

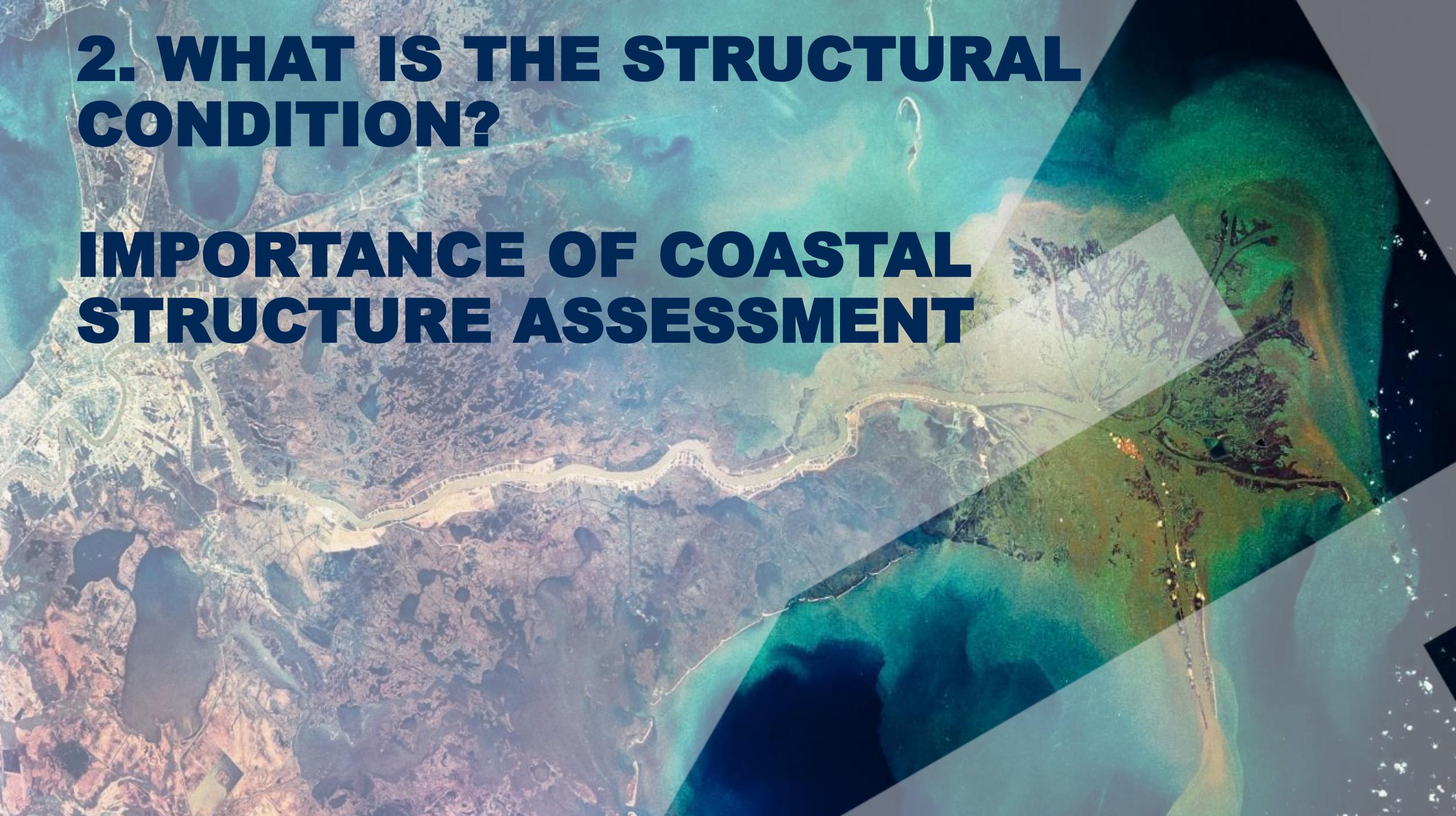
- ▶ Better to understand the present by knowing the past.
- ▶ Better to assess the current condition by knowing the details of what should be present.

- ▶ Do the research before you need it.

SOURCES OF INFORMATION

- ▶ Local government records
- ▶ FDEP's Document Management System: Oculus
- ▶ FDEP's Inlet Management Plans,
- ▶ FDEP's Strategic Beach Management Plan
- ▶ USACE permits
- ▶ USACE Design Document (GRRs, LRRs, etc.)
- ▶ Engineers of Record

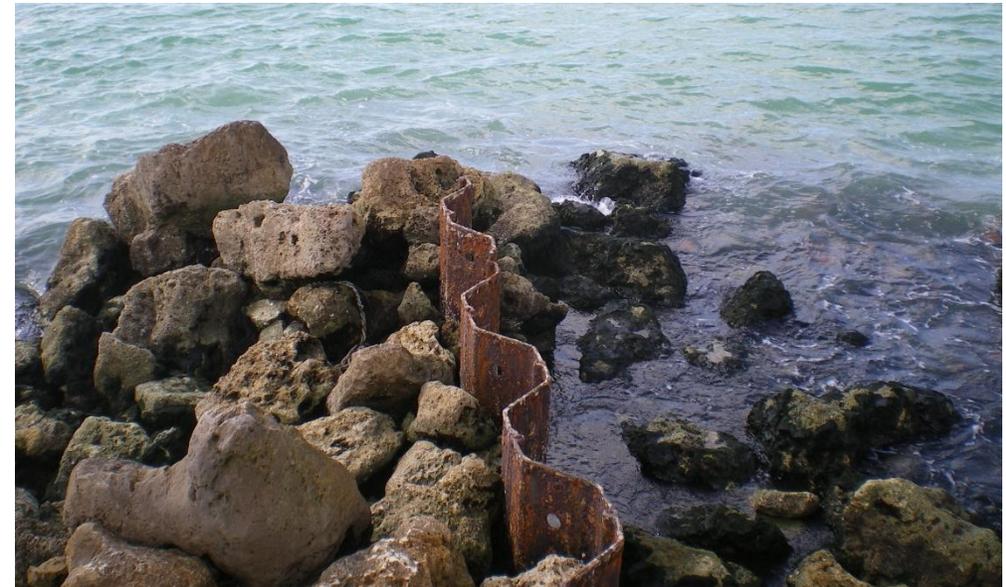
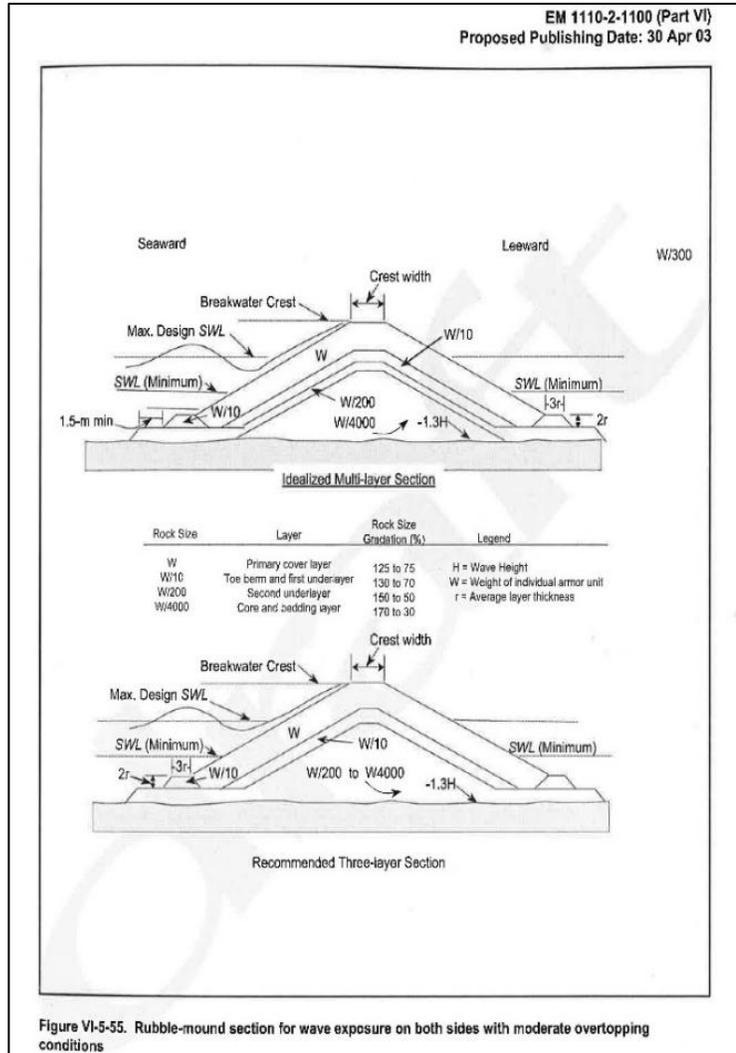


An aerial photograph of a coastal region. A prominent, winding road or path runs horizontally across the middle of the frame. To the left, there are several large, dark, irregularly shaped water bodies, possibly ponds or small lakes. The terrain is a mix of brownish and greenish hues, suggesting a mix of vegetation and possibly some construction or cleared areas. The right side of the image shows a more developed area with some structures and a different terrain texture. The overall image has a slightly desaturated, vintage feel.

2. WHAT IS THE STRUCTURAL CONDITION?

IMPORTANCE OF COASTAL STRUCTURE ASSESSMENT

Expect the Unexpected



EVALUATION STANDARDS

ASCE's Manual of Practice 130 (2nd ed.)

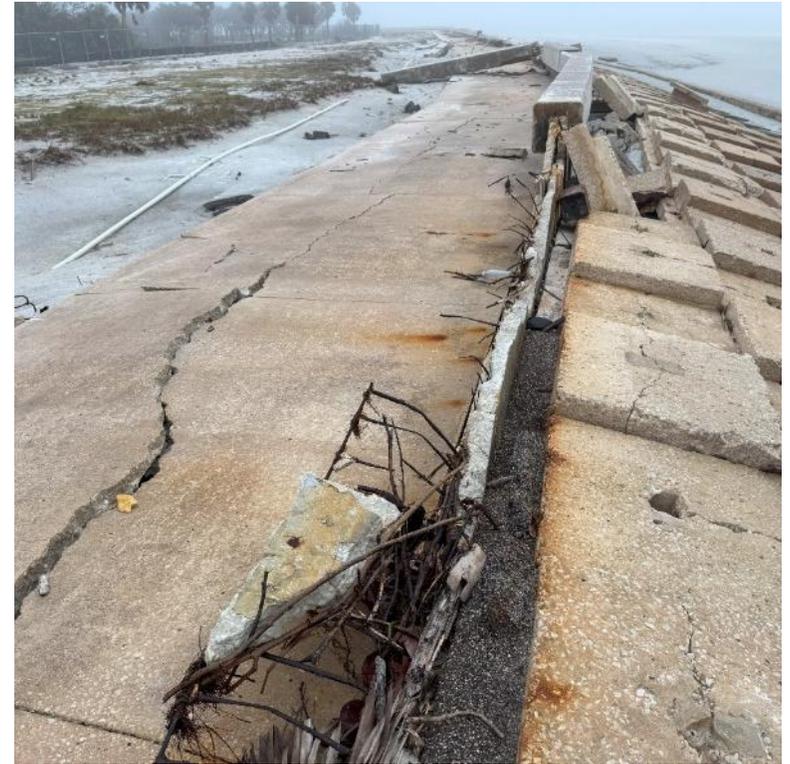
- ▶ Good for objective comparison of structural condition over time, or between structures.
- ▶ Assists in summarizing field data into easy-to-understand messaging to decision makers.
- ▶ While the MOP is not written for rubblemound structures, the principals of
 - ▶ material condition/degradation, and
 - ▶ structural function can be similarly applied.

FREQUENCY OF ASSESSMENT

- ▶ Every 5 to 10 years, Or
- ▶ After hurricane/ major nor'easter impacts



May 2020



Post Hurricanes 2024

An aerial photograph of a large reservoir with a winding dam. The water is a deep blue-green color, and the surrounding land is a mix of brown and green. The dam is a long, narrow structure that follows the curve of the reservoir. The text is overlaid on the top left portion of the image.

3. HOW LONG WILL IT LAST?

LIFECYCLE CONSIDERATIONS

How long should a coastal structure last?

Or perform without loss of function?

2012



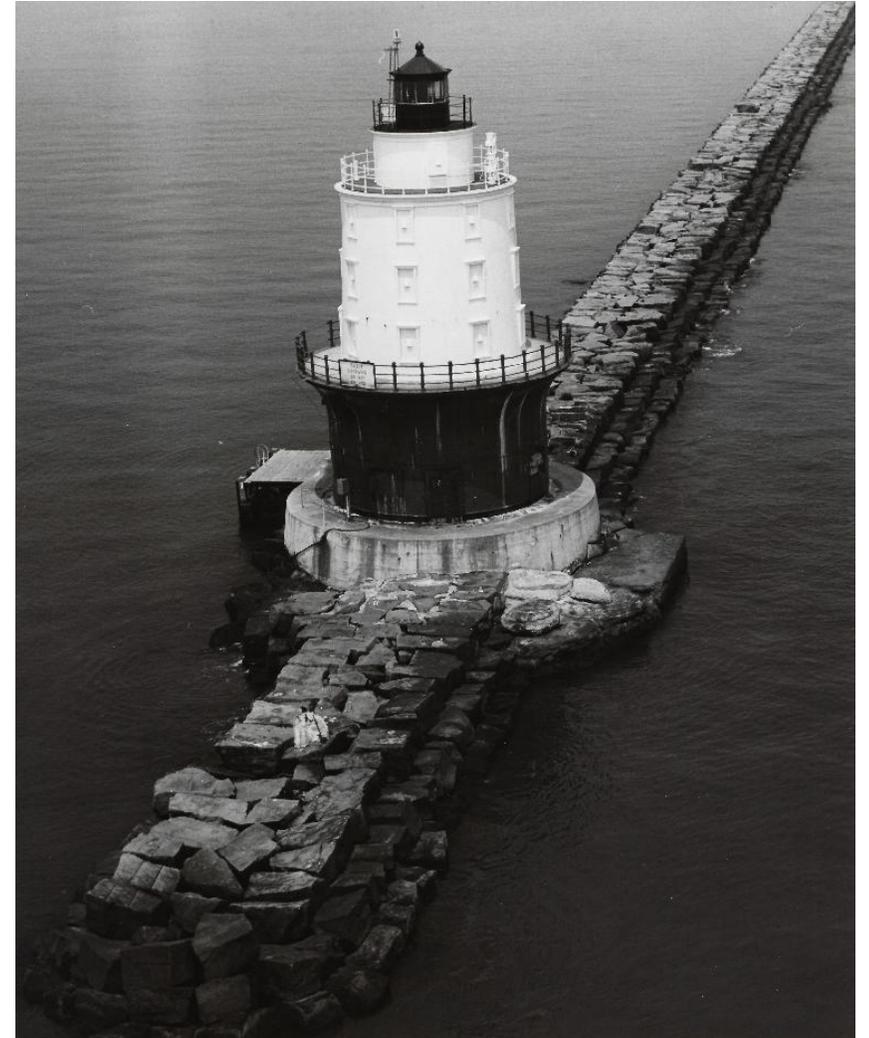
2022



WHAT IS THE STRUCTURAL LIFE OF RUBBLE MOUNDS?

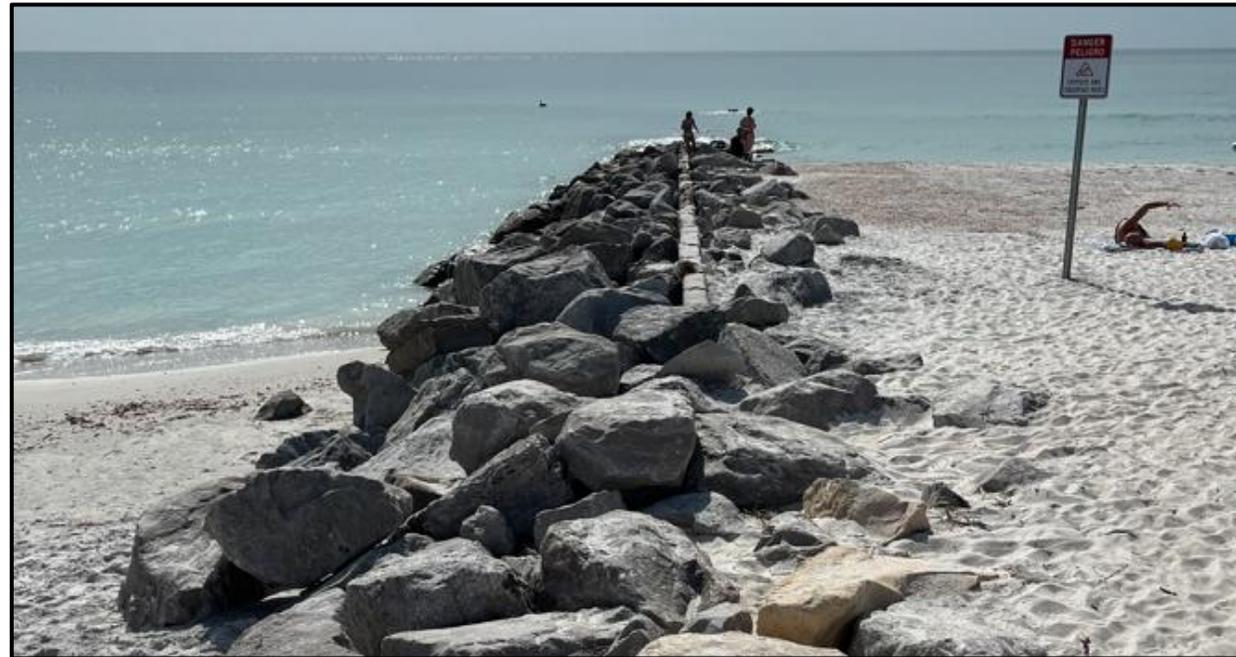
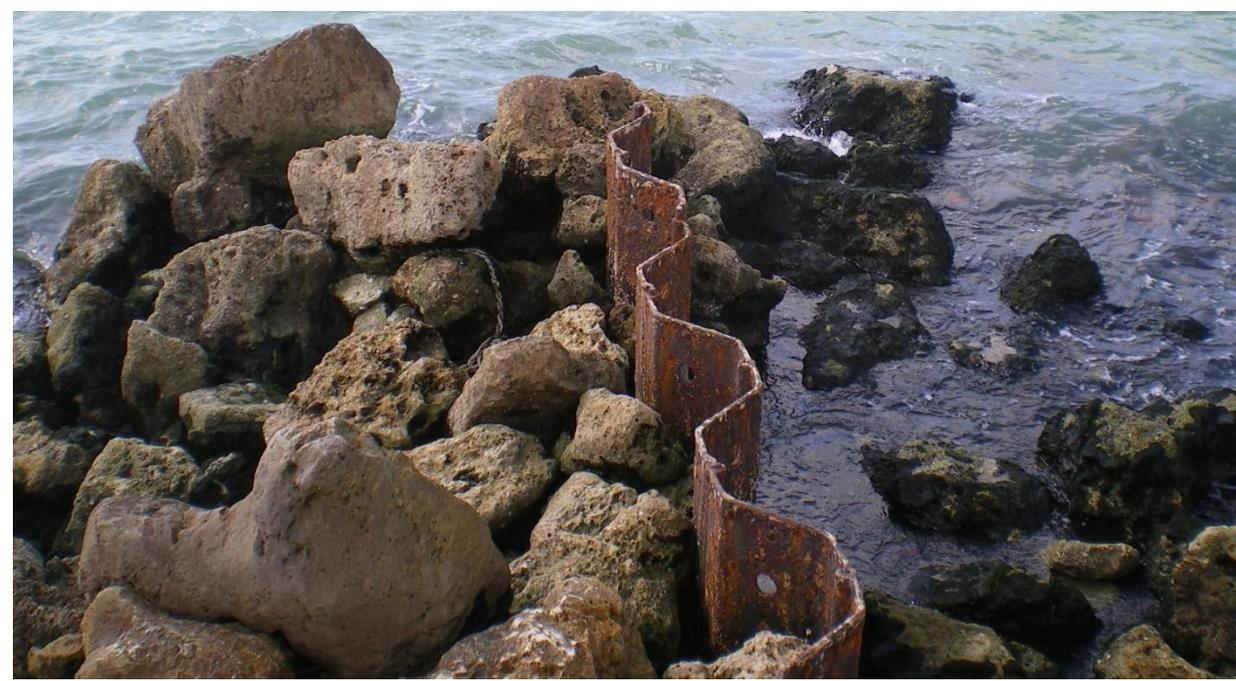
50 years?

- ▶ Usually has a long design life.
- ▶ In many cases, performance degrades slowly over time.
 - ▶ Stone breakage
 - ▶ Stone displacement by waves or scour
 - ▶ Subsidence of the entire structure
 - ▶ Sea level rise reduces freeboard, crest elevation, etc.
- ▶ Design vs Construction Issues



STONE QUALITY ISSUES

- ▶ Florida Limestone “Cap rock” unit weight ~120 pcf
- ▶ Dense Florida limestone ~140-145 pcf.
- ▶ Granite/Dolomite/Metamorphic Limestone- ~165 p.c.f



RELATIVE WATER LEVELS

- ▶ Real challenge for Louisiana structures
 - ▶ Sea Level Rise
 - ▶ Subsidence
 - ▶ Consolidation?



STONE DISPLACEMENT

- ▶ Construction with too small stones
- ▶ Exposure of foundation stones
- ▶ Results in displacement
- ▶ Flat slopes
- ▶ Loss of performance
- ▶ Compromise recreational beach and sea turtle habitat



DESIGN VS CONSTRUCTION

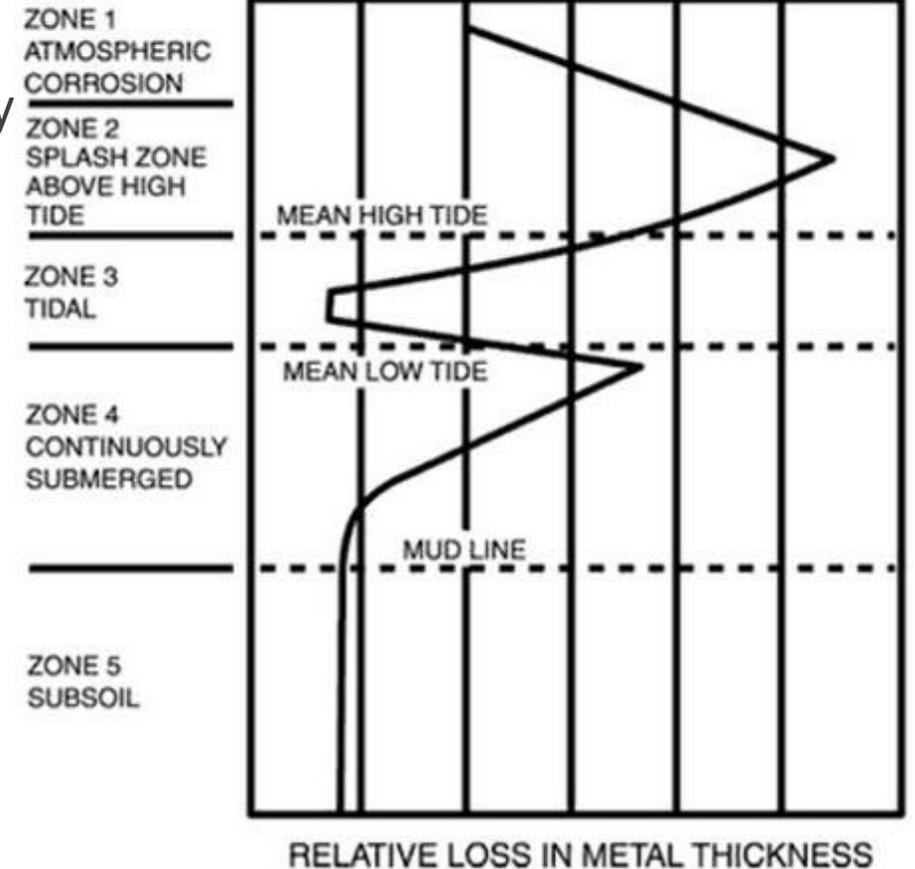
Did the construction follow the plans?

- ▶ Good design: two layers of dense armor stone over a foundation layer, over a geotextile
- ▶ Construction: one (1) layer of armor stone (variable sized), over foundation stone, over a geotextile.



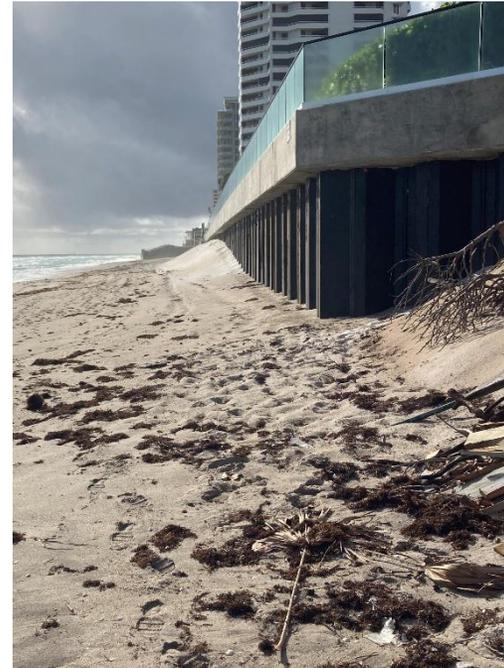
DESIGN LIFE OF STEEL SHEET PILE

- ▶ Unprotected steel in salt water will corrode.
- ▶ Corrosion in the submerged zone “can and does vary greatly being influenced by water velocity, temperature, oxygen concentration, pollution, pH, fouling, salinity, and sometimes scouring” (AISI, 1981).

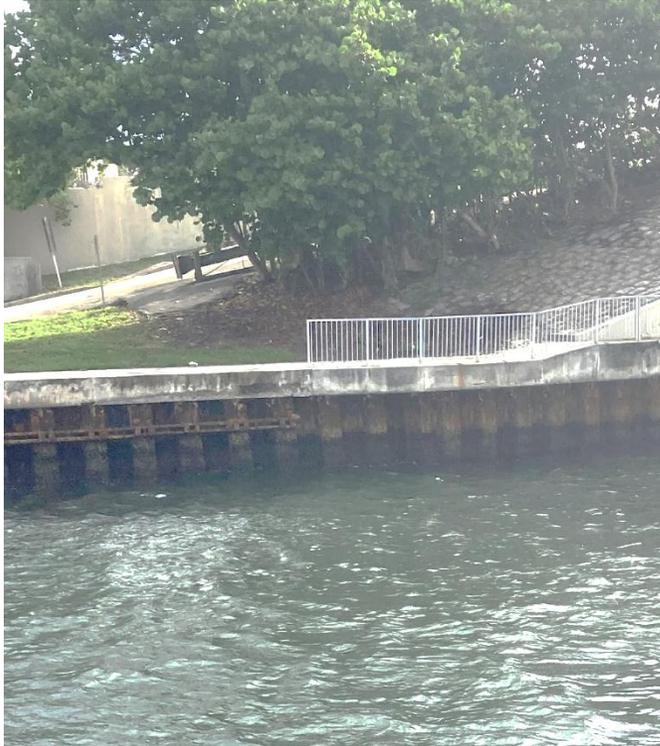


STEEL SHEET PILE LIFE EXTENSIONS

- ▶ Steel can be protected through
 - ▶ Coal tar epoxy
 - ▶ Cathodic protection
 - ▶ Sacrificial thickness
 - ▶ Concrete facia



STEEL SHEET PILE LIFE EXTENSIONS WITH NO GUARANTEES



35-year-old Atlantic inlet SSP with single coat of CTE



STEEL SHEET PILE LIFE EXTENSIONS WITH NO GUARANTEES

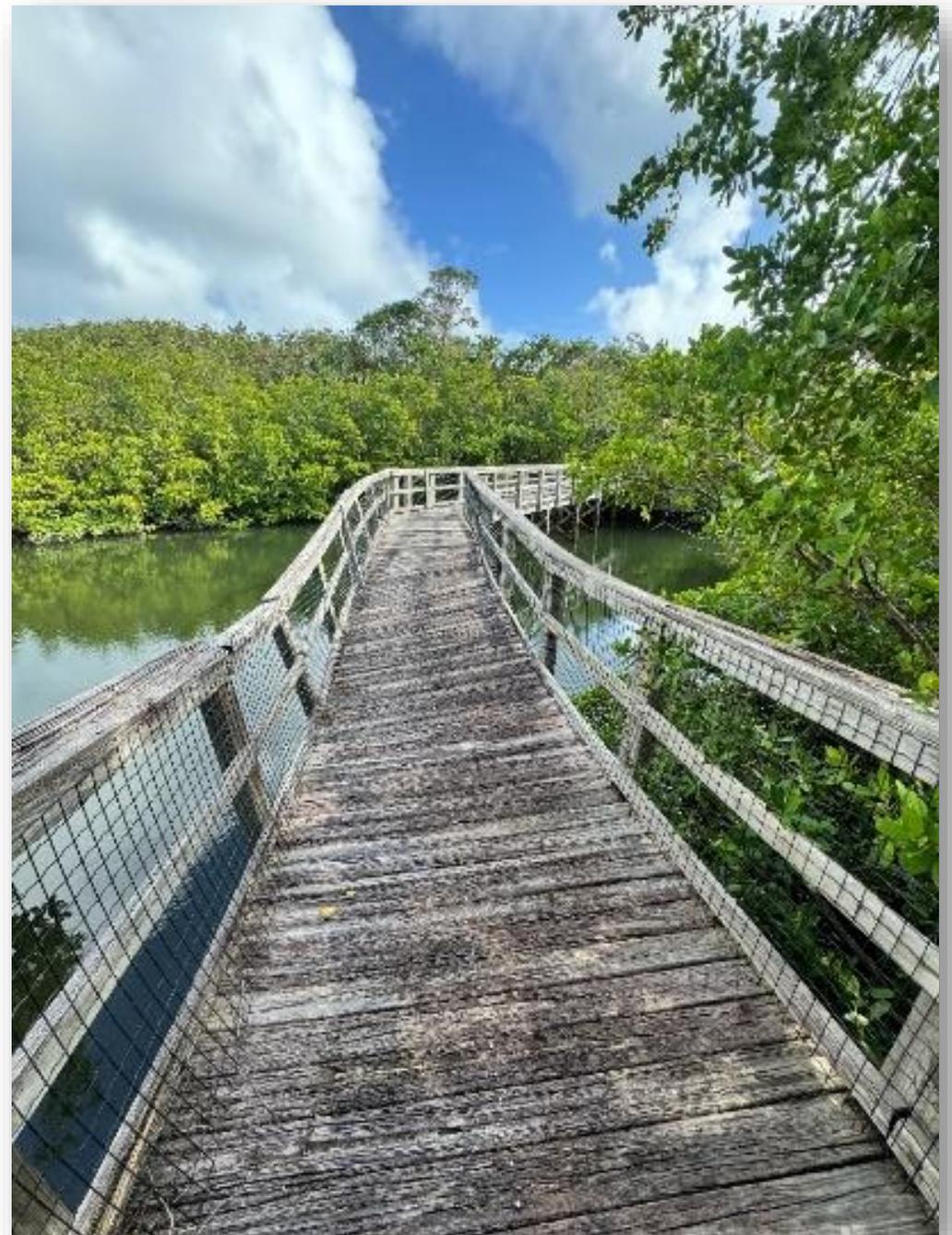


SSP installed circa 1929
1.5-inch-thick concrete facia
installed circa late 1960's.

An aerial photograph of a river delta, likely the Mississippi River delta, showing a large dam structure across the river. The river branches out into a complex network of channels and smaller waterways. The surrounding land is a mix of brown and green, indicating a mix of agricultural and natural land. The water is a deep blue-green color. The text "4. DOES IT NEED TO BE REPAIRED OR REPLACED?" is overlaid in large, bold, blue letters on the left side of the image.

4. DOES IT NEED TO BE REPAIRED OR REPLACED?

SOME DECISIONS ARE EASY



CONFLICTING OPINIONS

- ▶ No original design documents
- ▶ No permit sketches
- ▶ Structure has
 - ▶ Partial structural decay,
 - ▶ Partial loss of function,
 - ▶ Evidence of partial repair
- ▶ Environmental resources nearby

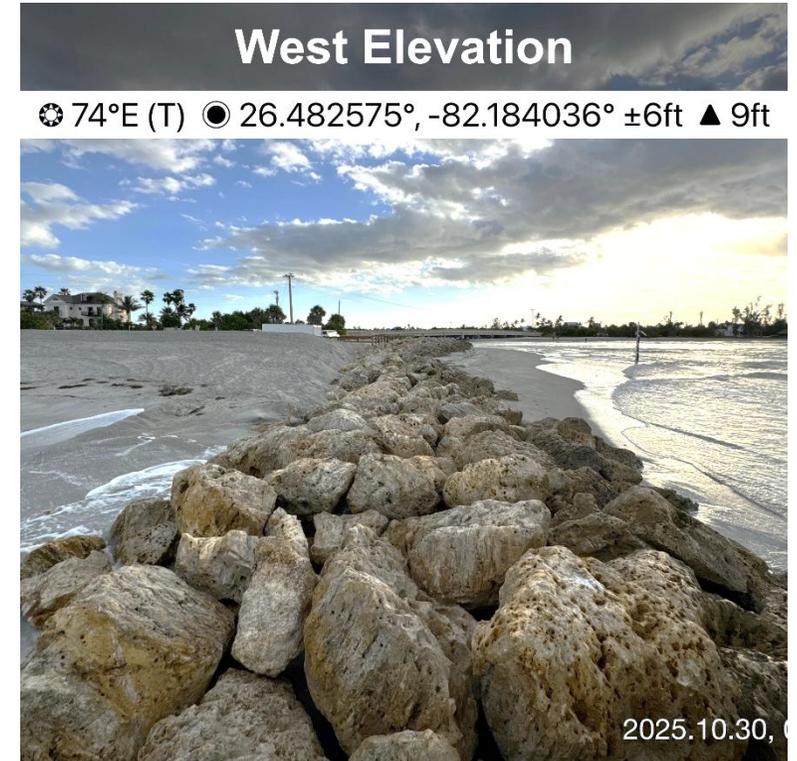


5. WHOSE STRUCTURE IS IT ANYWAY?



WHOSE STRUCTURE IS IT?

- ▶ Florida history suggests these structures were built by:
 - ▶ USACE
 - ▶ Ports
 - ▶ FDOT
 - ▶ County governments
 - ▶ Local governments
 - ▶ Erosion control districts
 - ▶ Inlet districts
 - ▶ Local interests
- ▶ Chapter 161.051, F.S. states that if you build a structure with a permit, all ownership responsibilities lies with the permittee.
- ▶ At the ends of barrier islands, end parcels of land may or may not have had a specific legal description, and a clear owner.



OWNERSHIP EXAMPLE 1

Terminal Groin at Turner Beach Park

- ▶ Lee County Property Appraiser says the blue parcel is County land.
- ▶ Lee County road department built a revetment in 1972 to protect the bridge.
- ▶ In 1988, CEPD repaired the revetment and extended the terminal groin ~100 feet west.



OWNERSHIP EXAMPLE 2

North Jetty at the Murderkill River, DE

- ▶ Concrete Bag Jetty appears to have been built on private land.
- ▶ State eventually obtained easements to build, maintain, repair, the jetty from each owner.



5. TOWARDS STRUCTURE MANAGEMENT

An aerial photograph of a river system. A prominent dam structure is visible in the middle of the river. The river flows through a landscape with a mix of brownish, rocky terrain and green forested areas. The water in the river is a light, milky color. The image is overlaid with a semi-transparent, dark green and blue geometric shape on the right side.

CONCLUSIONS

Coastal Structure Management requires

- ▶ Understanding the original design, if available;
- ▶ Documenting the condition;
- ▶ Understanding the lifecycle of the structure;
- ▶ Determine structural repair needs;
- ▶ Identifying ownership or maintenance responsibilities.



ACKNOWLEDGMENT

- ▶ To our clients who have let me observe, document, repair and or replace their coastal structures.
- ▶ Thank you for your insightful questions.



An aerial photograph of a coastal area. The top half shows a sandy beach with waves breaking onto the shore. The bottom half shows a residential development with several houses, some with swimming pools, and a line of trees separating the houses from the beach.

THANK YOU

Questions?

