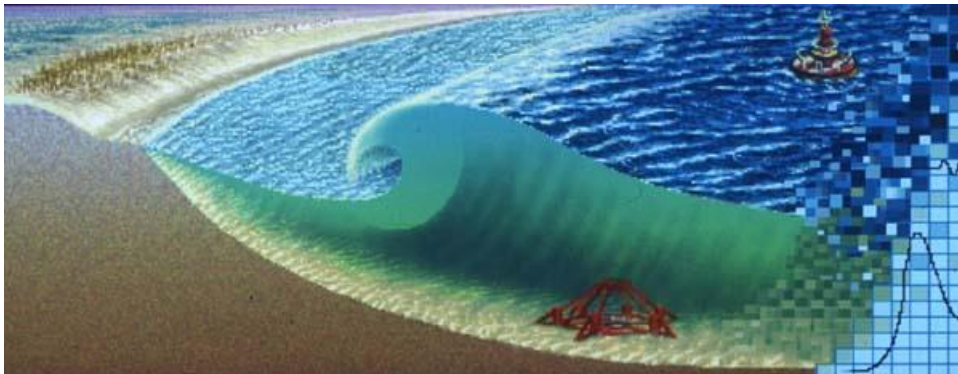


# *USING ORGANIC ENGINEERING PRINCIPLES TO ADDRESS ECOSYSTEM VALUES IN THE BOTTOM LINE*

David D. McGehee, P.E., M.Oc.E., D. CE



*Emerald Ocean Engineering LLC*

*Pensacola Beach, FL*

# Organic Engineering:

Integration of engineered features with natural processes to efficiently and sustainably provide economic, environmental and social benefits.

Nature as the Client, not a Problem

Ecosystems as a Goal, not Collateral Damage

Society (Regulators) as a Partner, not an Obstacle

# FORM ORIENTED

## The Engineer's Shape Goggles

The Project = The Plans

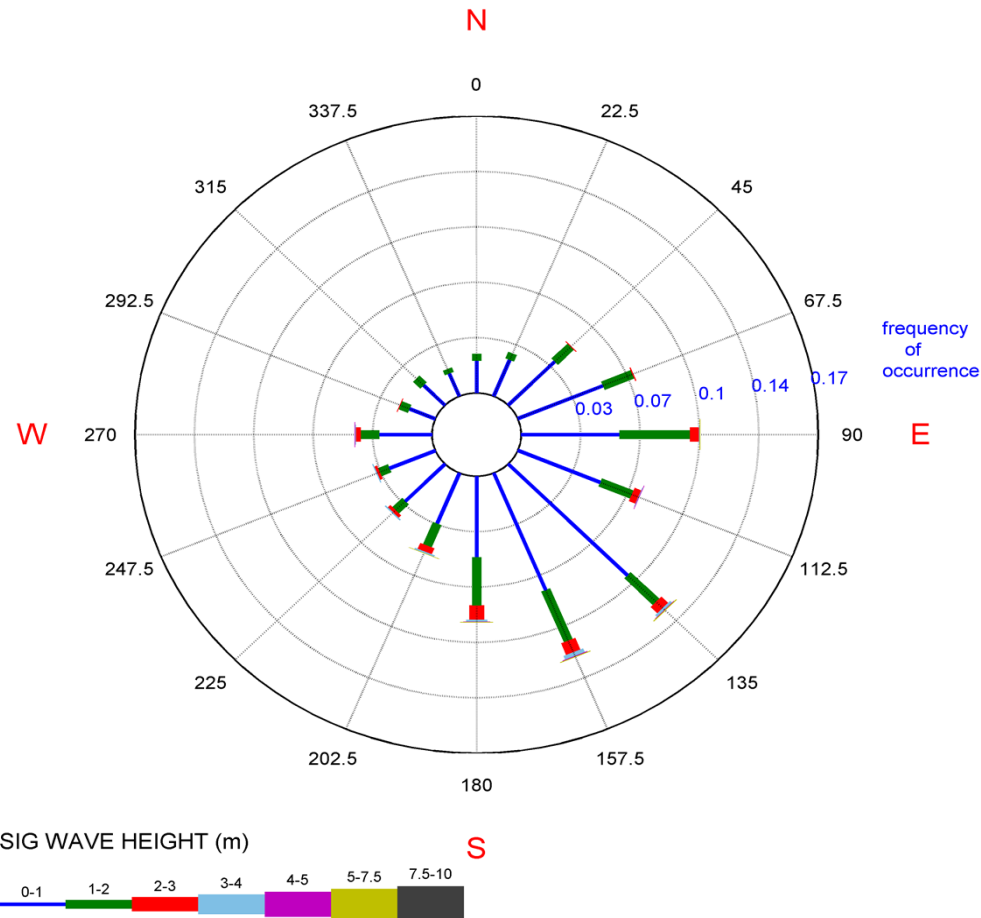
Success = Preserving the Form

# Dynamic Range, or The Hard Structure's Dilemma



Gulf of Mexico WIS Station 73170  
01-Jan-1980 thru 31-Dec-1999  
Long: -87.084° Lat: 30.166° Depth: 25 m  
Total Obs : 58438

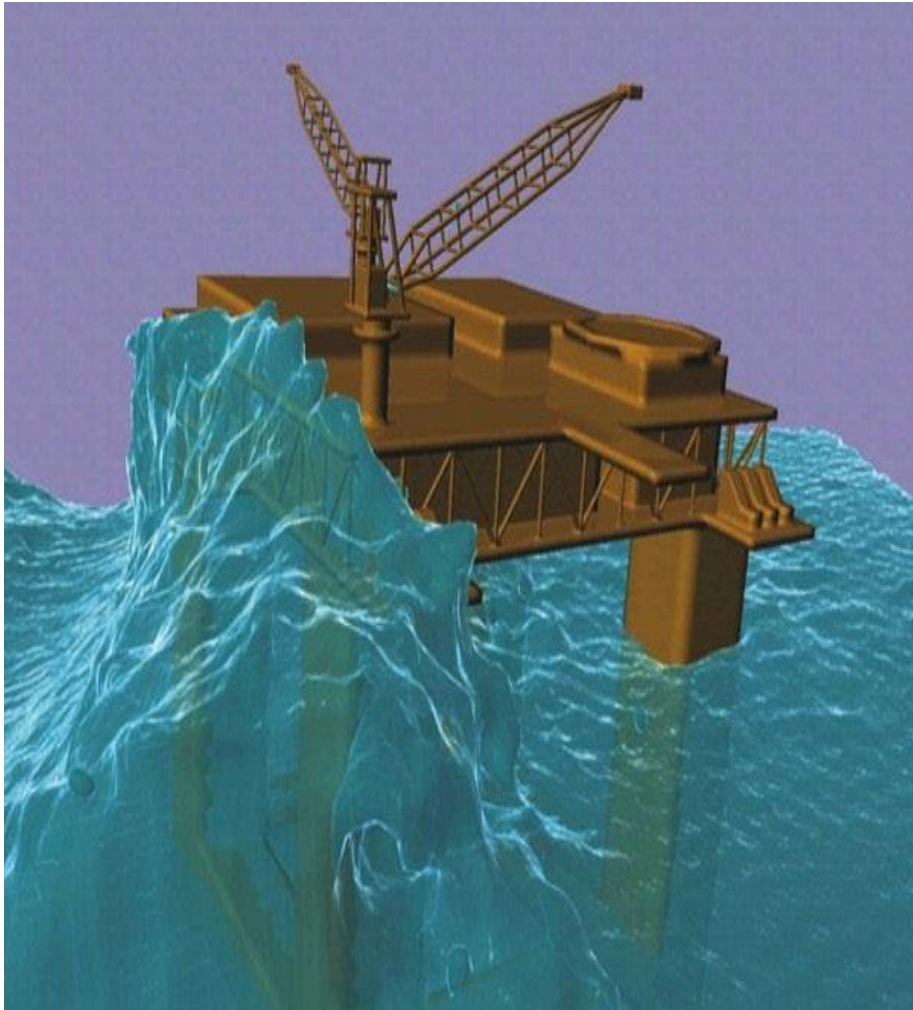
WAVE ROSE



## Dynamic Range of Wave Loads

- $T > 70\%, F_w \leq O (1)$
- $T < 1\%, F_w \leq O (10)$
- $T < .02\%, F_w \sim O (50)$
- $T < .0005\%, F_w \sim O (100+)$

# Design a Form to Endure the Loads



**SUCCESS!**



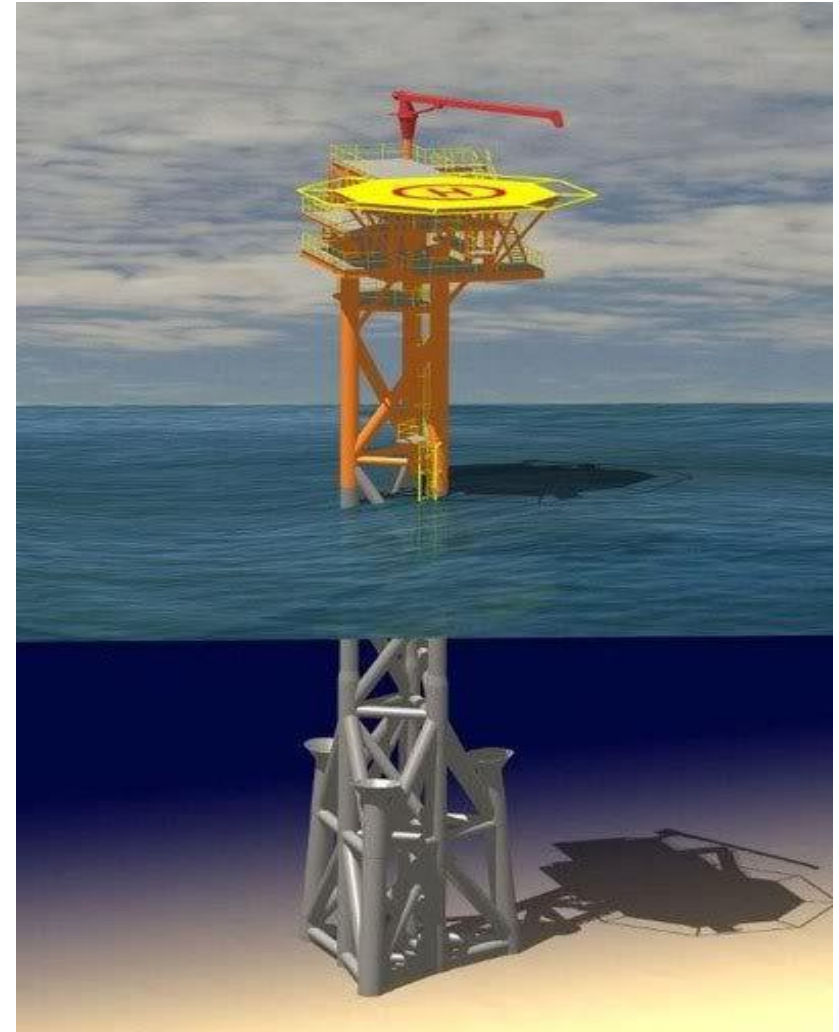
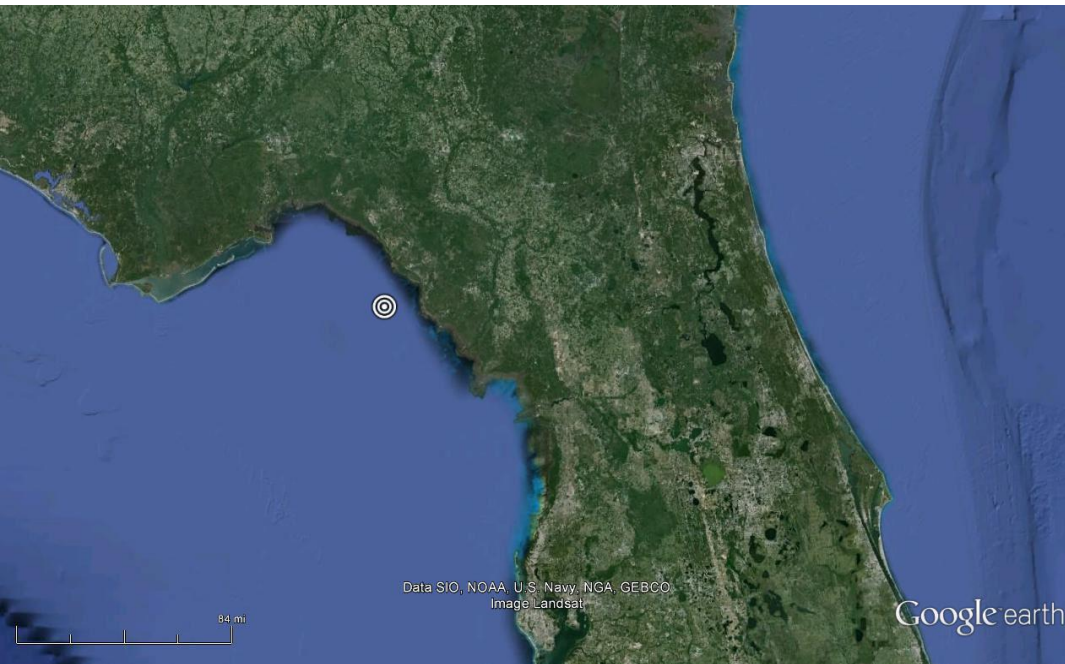
# Form Loss = Failure



# Telemetry Platform

Mission: Measure/Trx Hurricane Waves

Hazards → Hurricanes,  
Vessels



Std. Form → O ~ \$ M

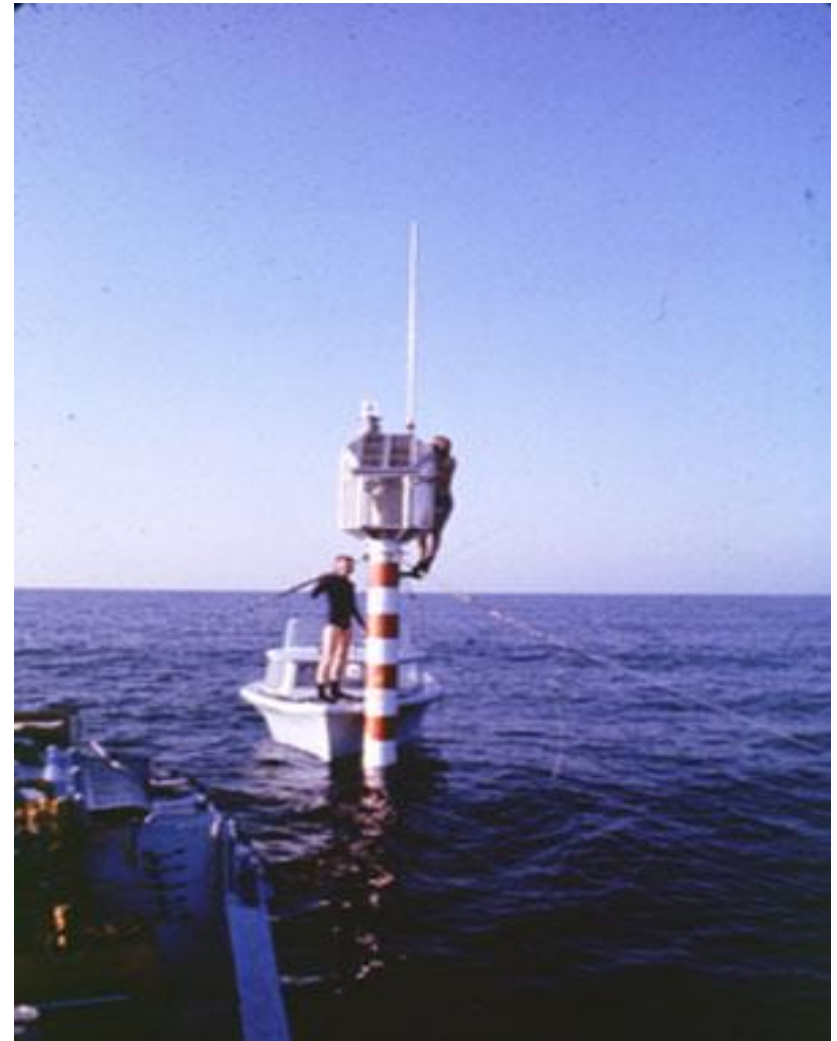
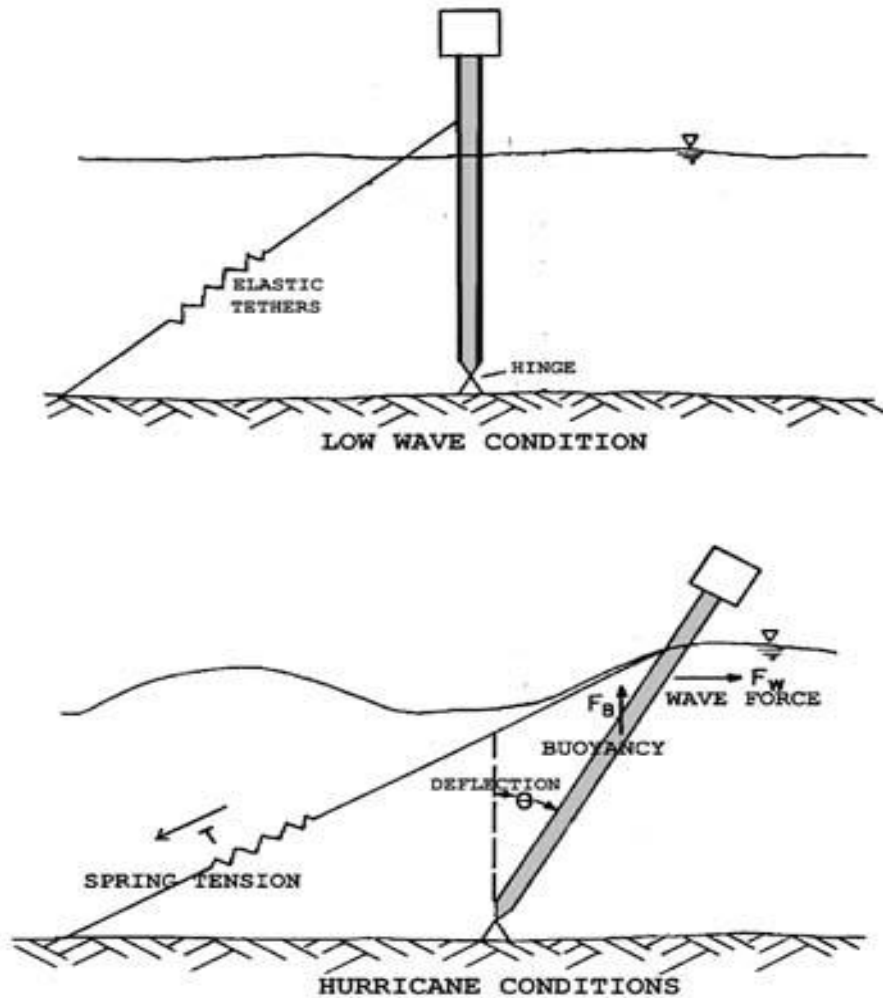
# FUNCTION Oriented

Maintain function over time

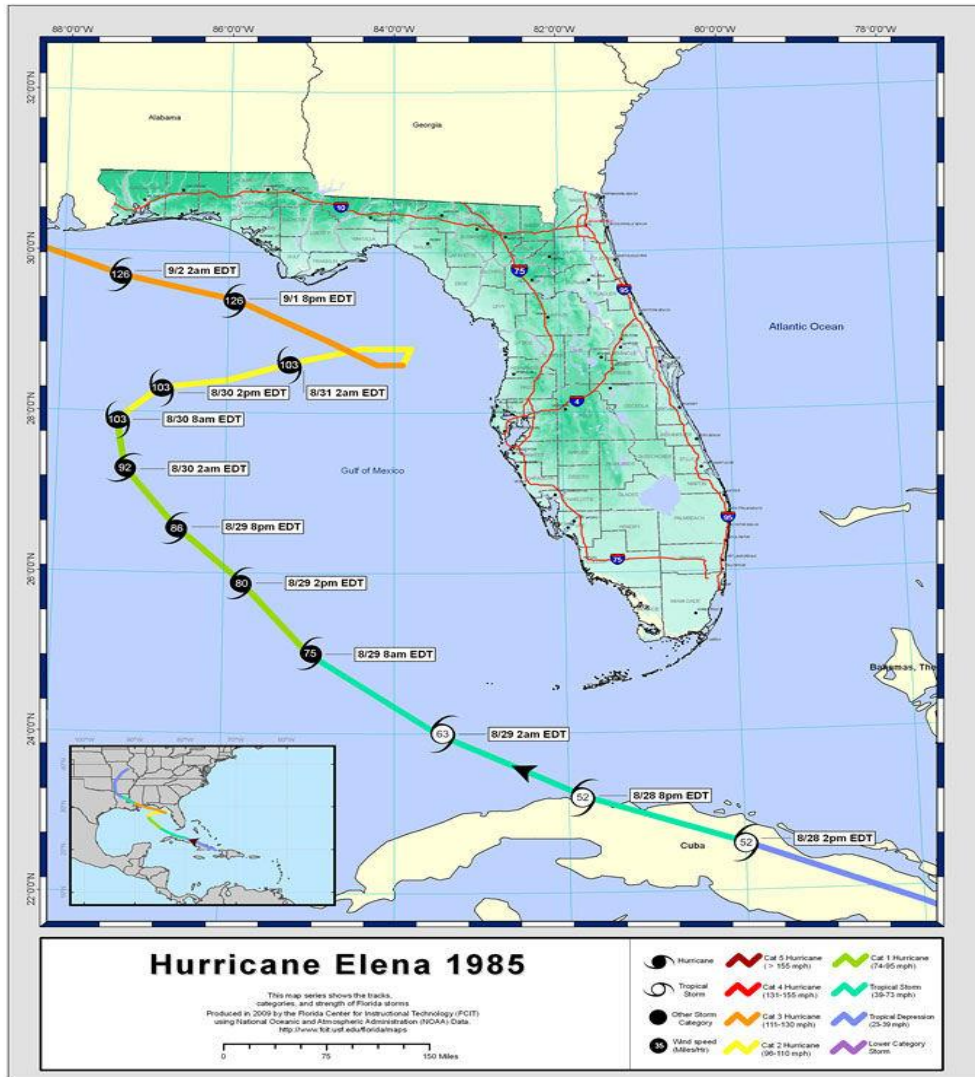
Allow form to respond to environment



# *Resilient* Offshore Platform



# Performance



- 100 + mph winds
- 15 +ft breaking waves
- 0 function @ storm
- 0 damage
- 100 % function immediately after

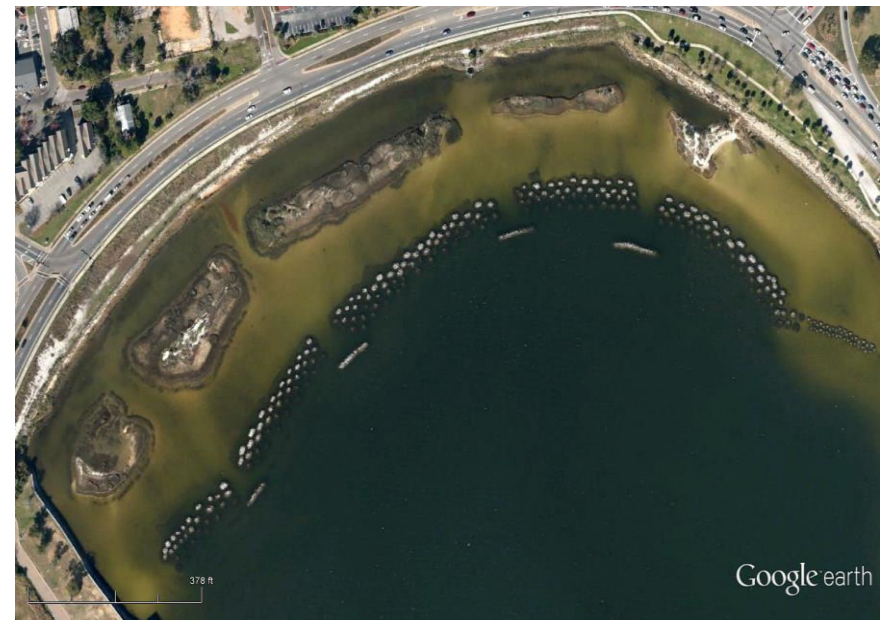
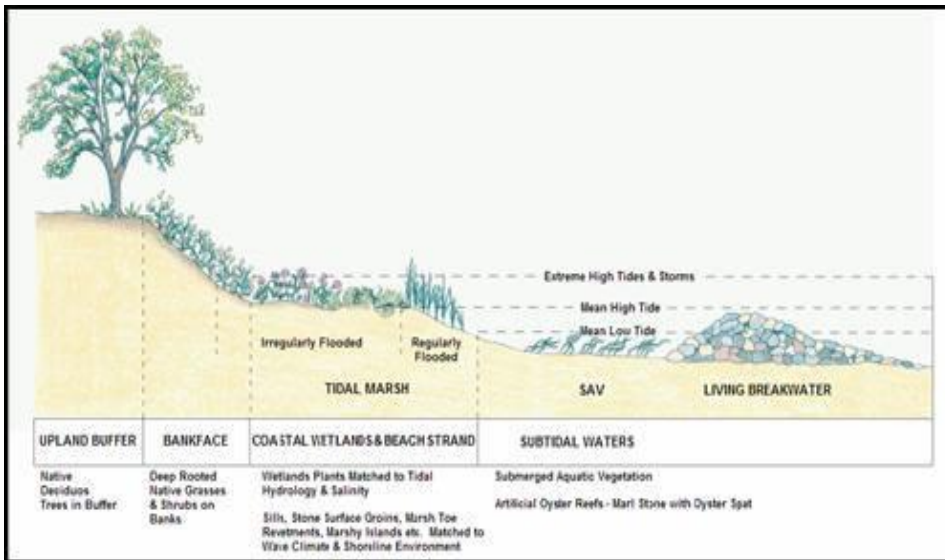
# What is a Living Shoreline?



# What is a Living Shoreline?



# Form Oriented Living Shorelines



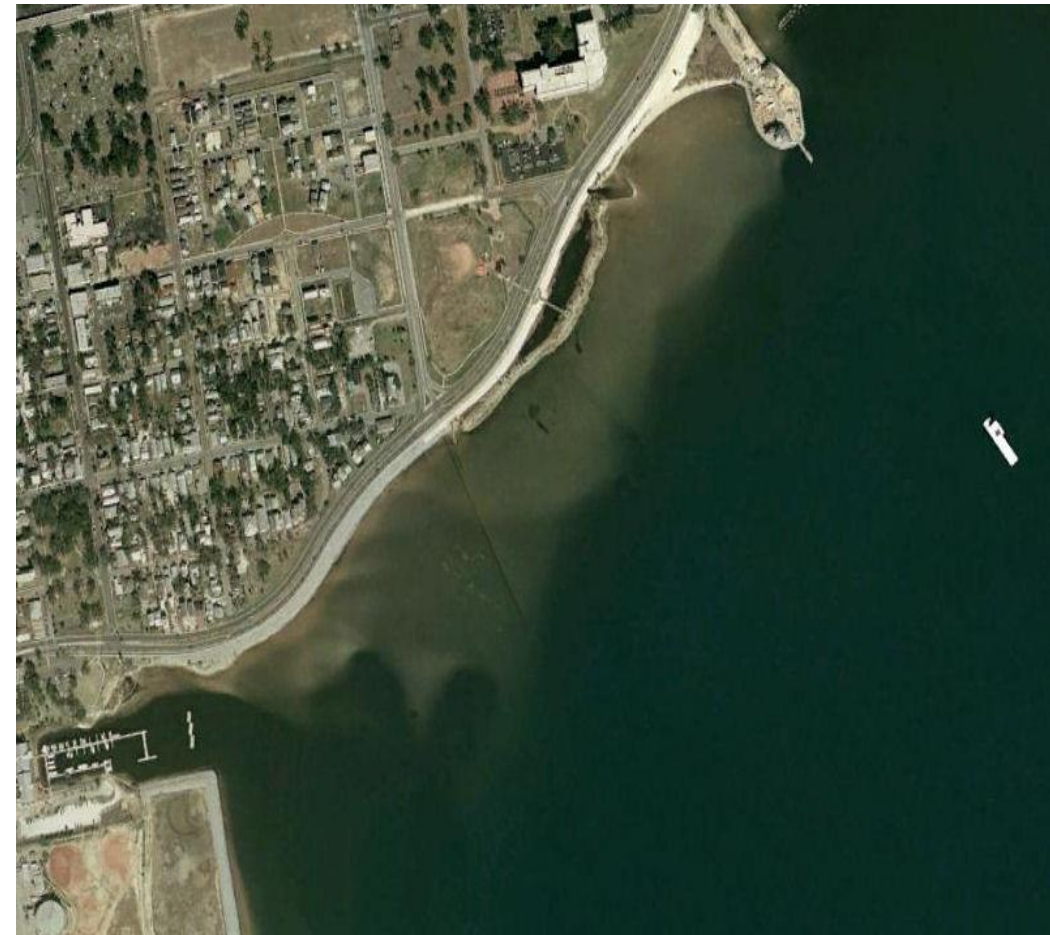
# Living Functional Characteristics

- Resilient: Survives extremes
- Adaptable: Responds to change
- Grows if fed
- Contributes to Ecosystem
- Protects Itself

# Project Greenshores Phase II, Plan (marsh adapts to environment)

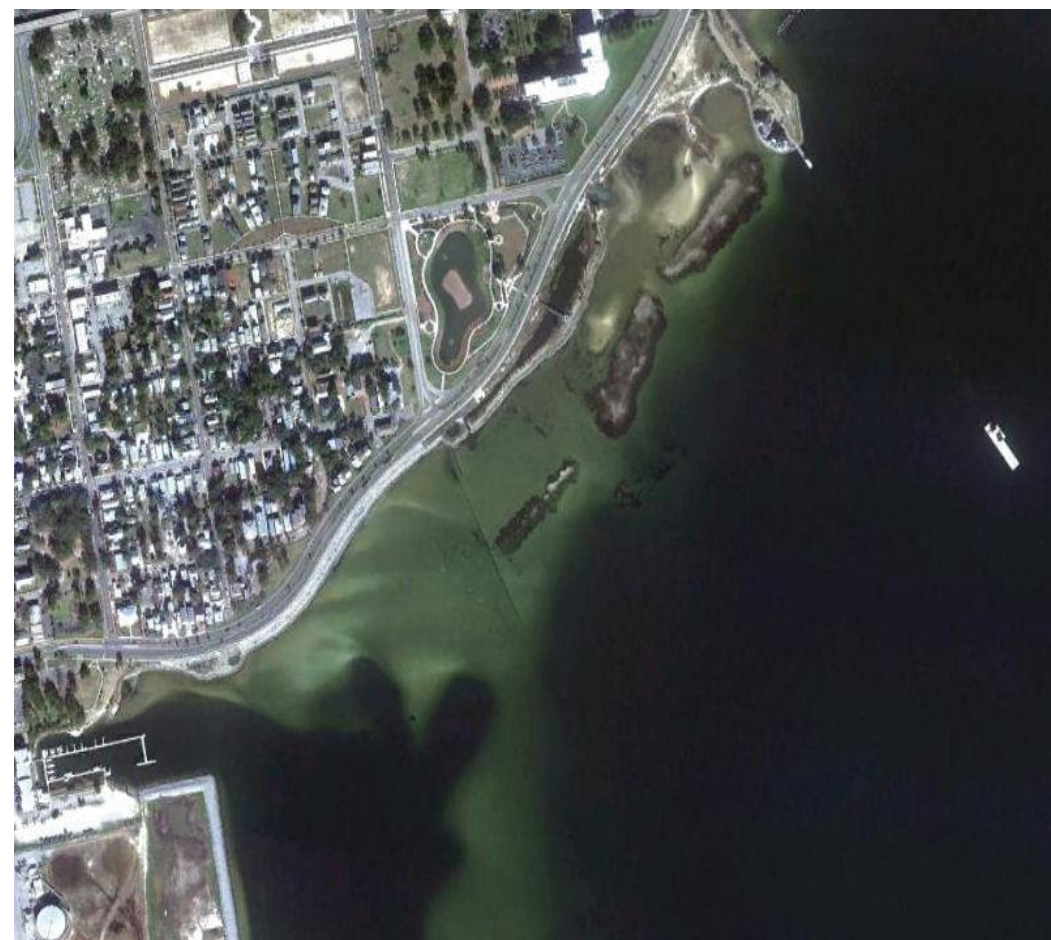
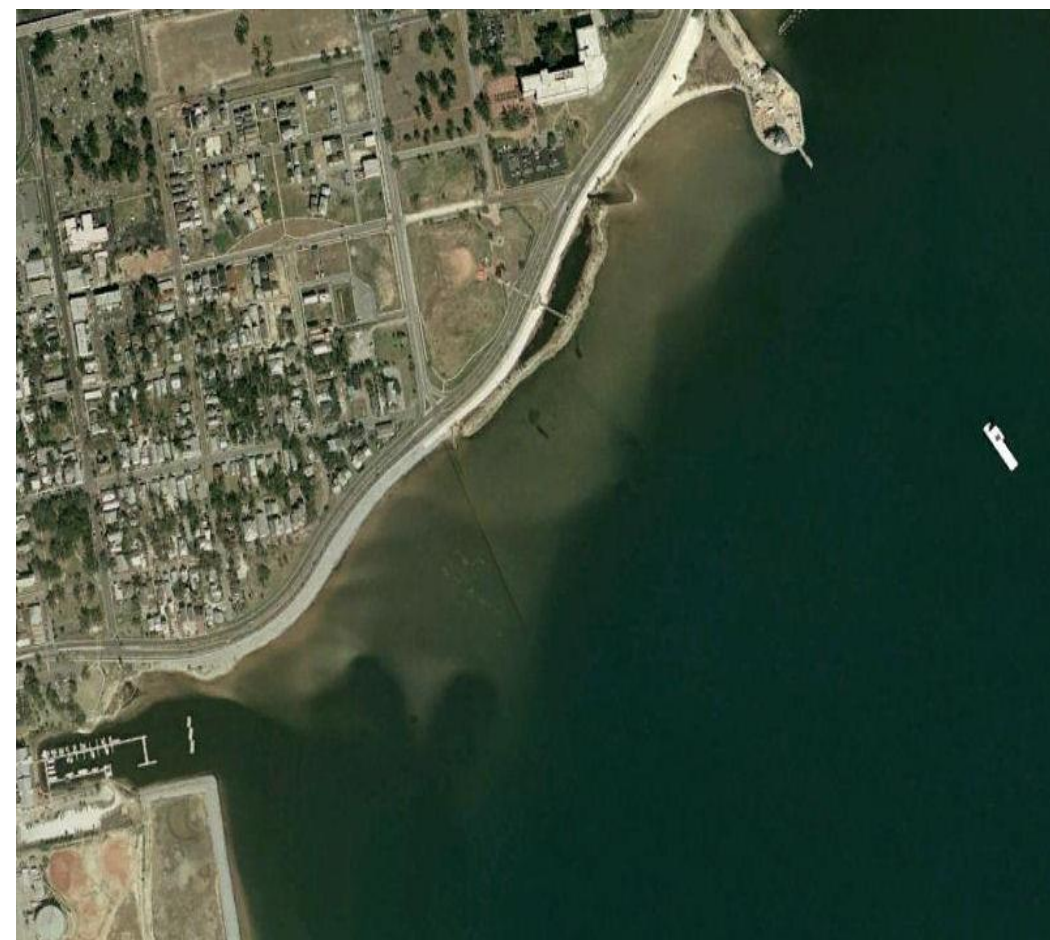


# Greenshores, As Built

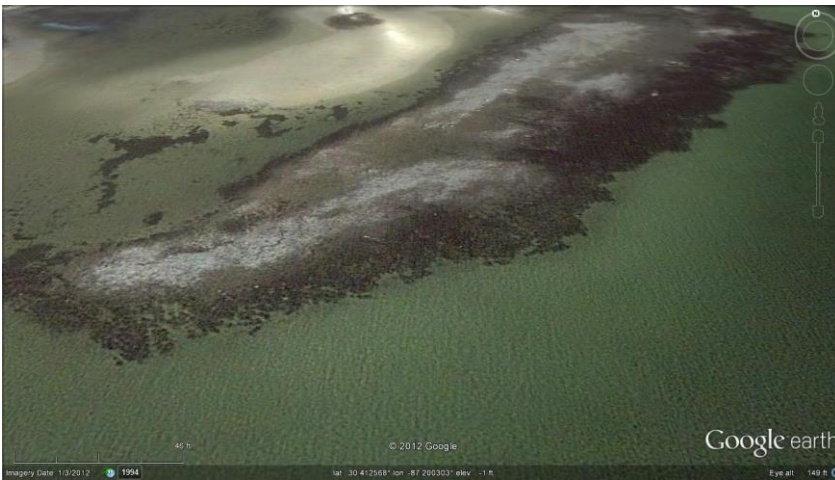




# Greenshores, As Built (adapting to reality)



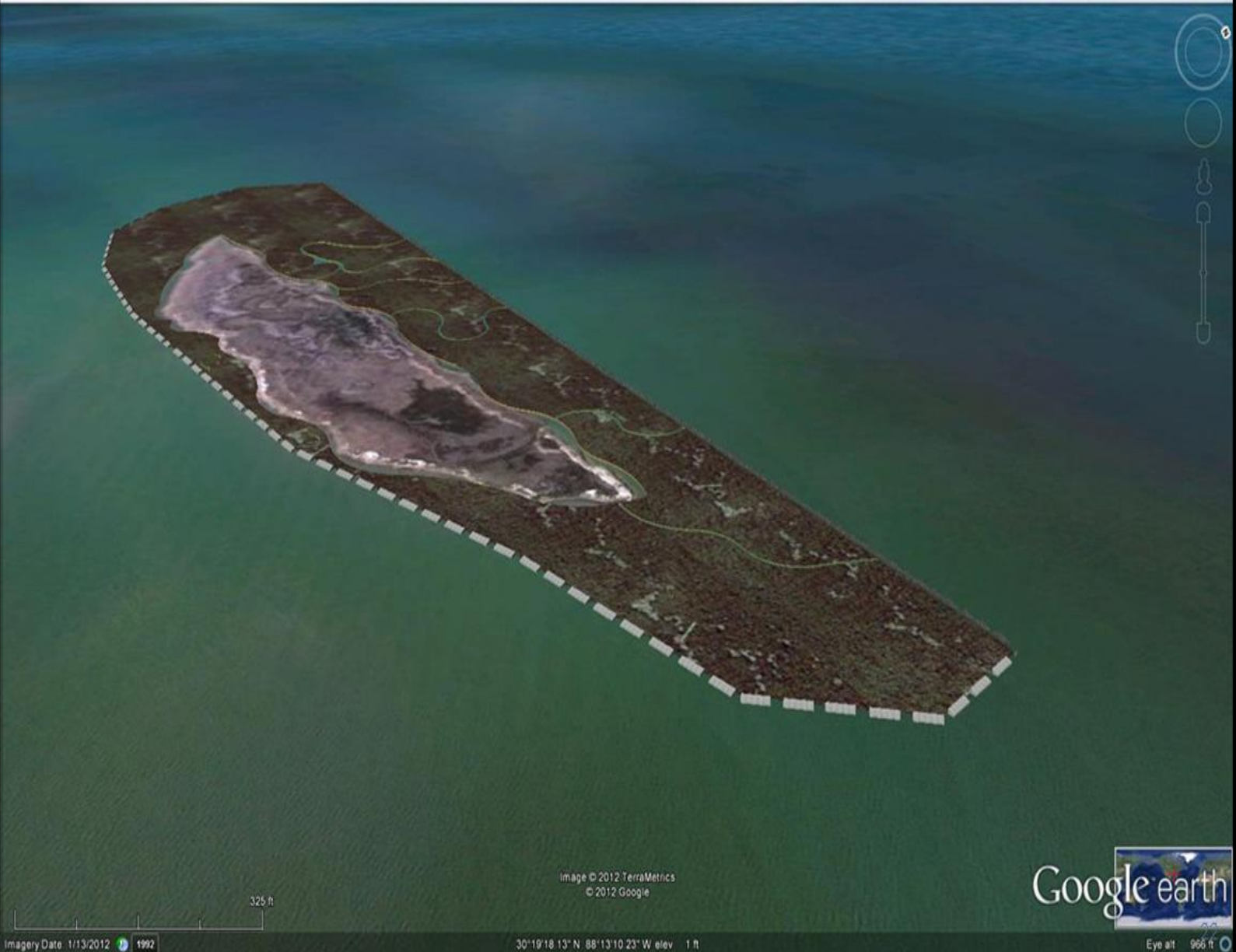
# Greenhores, Being Built



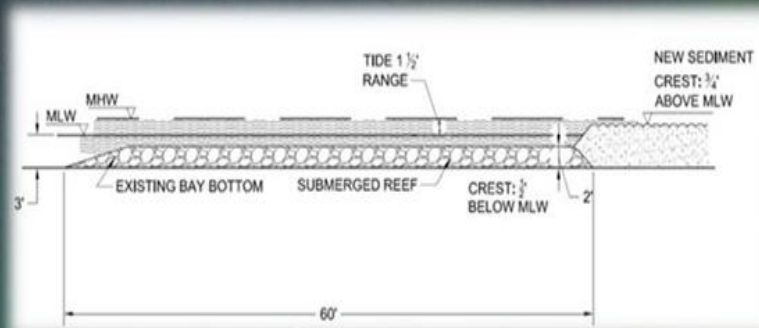
# Living Revetment (it grew some)



# Potential Design Element Alternatives



# Alternate Concept

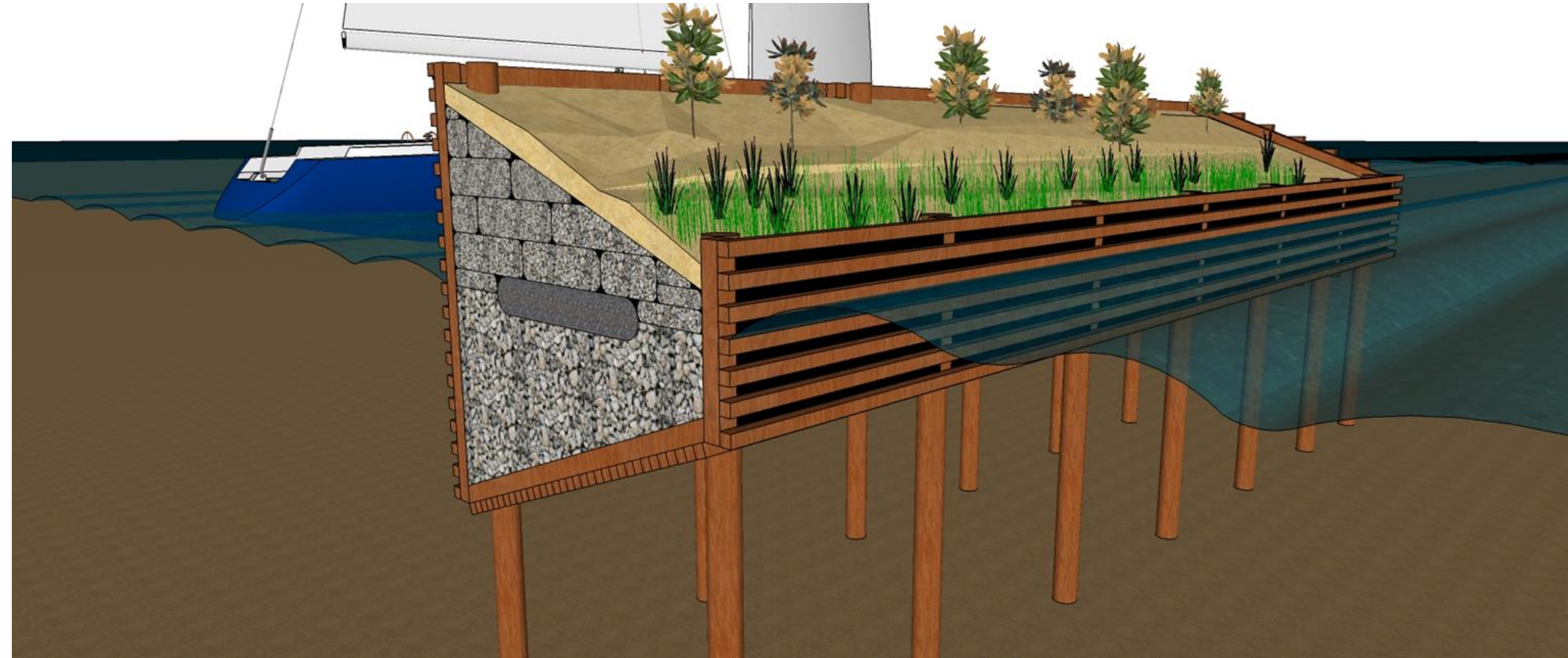


Google earth

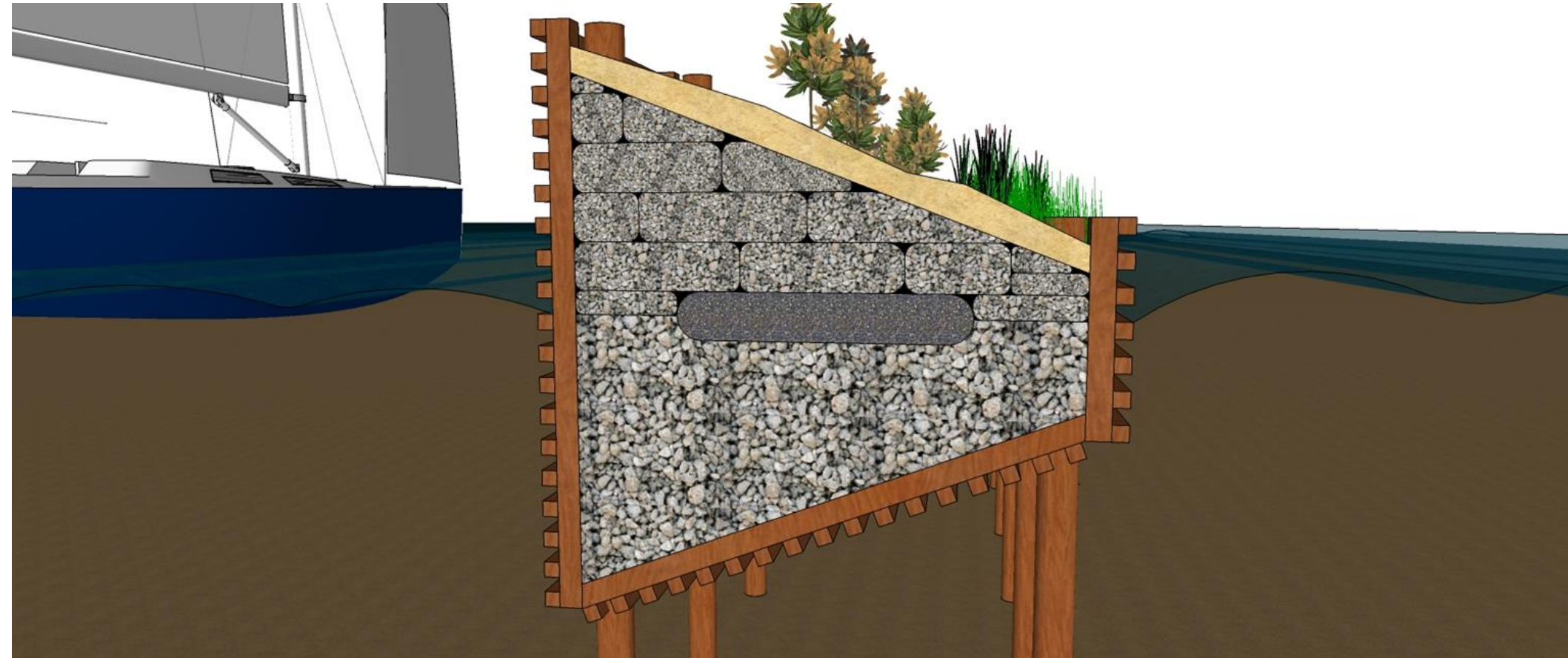
# Living Marina Concept



# Living Breakwater



# Breakwater w/ Kidneys





# Spill Response



# QUESTIONS



wtf????