

COASTAL TX PROTECTION AND RESTORATION FEASIBILITY STUDY

Texas Association of Environmental Professionals
Study Update

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01/16/2020

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Study Name: Coastal Texas Protection & Restoration Feasibility Study

Authorization: Sec. 4091, Water Resources Development Act (WRDA) of 2007
Public Law 110-114

Appropriation: 2014-2019 yr increments thru public law
2020-2021 thru Bipartisan Budget Act of 2018

Budget: \$20.18 Million (\$12.282 Federal: \$7.898 Cost-shared)

Non-Federal Sponsor: Texas General Land Office

Schedule: Recon: 2014-2015
Feasibility Study Start: Oct 2016
Scheduled Completion: May 2021

Multi-Purpose: Coastal Storm Risk Management and Ecosystem Restoration

Scope:

Develop a **comprehensive plan** to determine the feasibility of carrying out projects for flood damage reduction, **hurricane** and **storm damage reduction**, and **ecosystem restoration** in the coastal areas of the State of Texas.

The comprehensive plan shall provide for the **protection, conservation**, and **restoration** of wetlands, barrier islands, shorelines, and related lands and features that **protect critical resources, habitat, and infrastructure** from the impacts of coastal storms, hurricanes, erosion, and subsidence



NATIONAL SIGNIFICANCE



Population Centers

- >\$125B assets at risk, growing to \$200B
- 18 coastal counties
- 6.1 million residents, growing to 9M in 50 yrs
- >24% of the TX population



Critical Infrastructure

- Nationally ranked deep-draft ports
- 450 miles of Gulf Intracoastal Waterway (GIWW)
- 40% of the Nation's petrochemical industry
- 25% of national petroleum-refining capacity
- NASA
- UTMB – Level 4 Viral Laboratory



Coastal Ecosystems

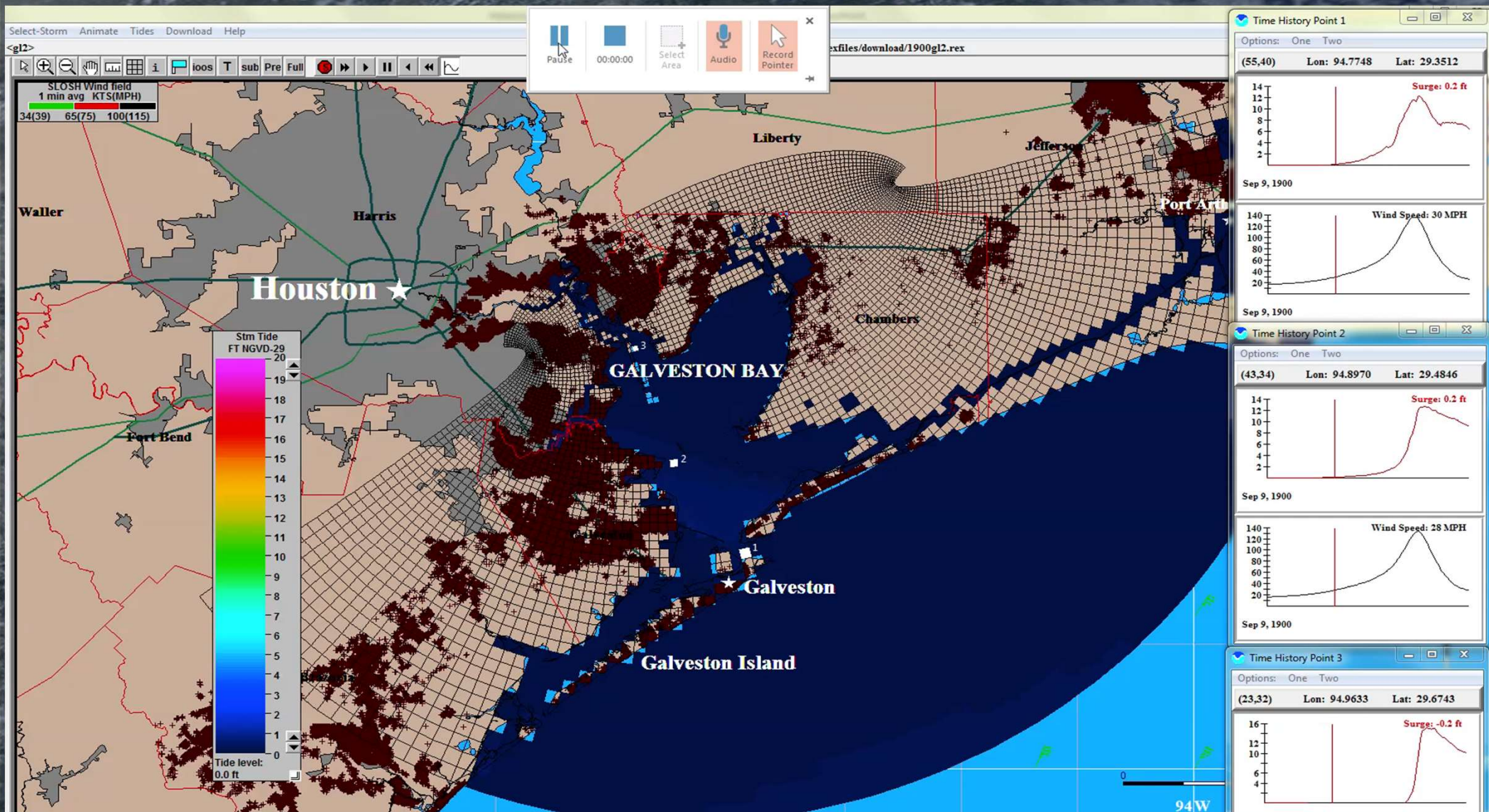
- Wetlands, seagrass beds, oyster reefs, dunes, and beaches
- Critical threatened and endangered species habitat
- Nursery habitat and significant commercial fisheries for oysters, shrimp, and finfish

Critical Natural Features

- 2 National Estuary Program sites
- Central Flyway Migration Corridor
- The Laguna Madre - a rare hypersaline lagoon
- Padre Island National Seashore
- 12 National Wildlife Refuges



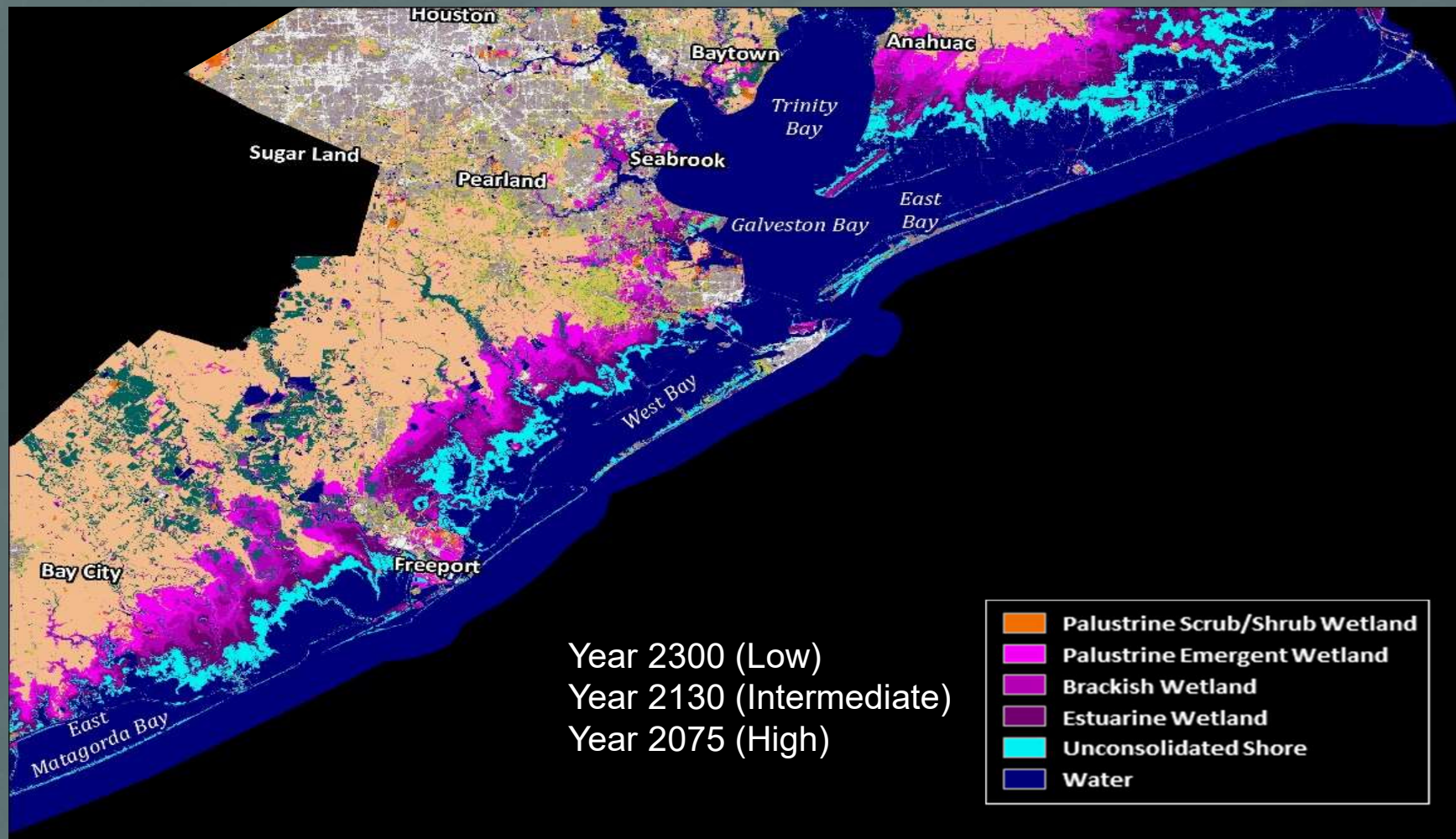
STORM OF 1900



ANTICIPATED RELATIVE SEA LEVEL CHANGES



Upper Texas Coast Break Point in Sea Level Change (about 3.5 feet)



MULTIPLE LINES OF DEFENSE



1st Line: Hardened Perimeter at the Gulf Inlet
Storm Surge Gates

Next Lines: Lateral and Interior Features

Dune Flanks

Ring Barrier

Upper West Bay – Clear Creek, Dickinson & Non-Structural

GIWW Breakwaters

Oyster Reefs

ER Site-specific restoration features (e.g., marsh creation)

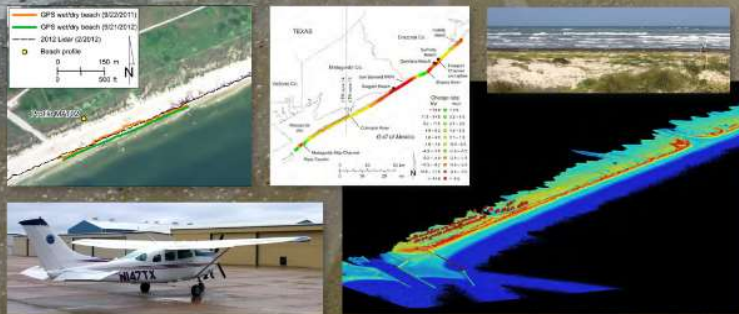




Final Report

Shoreline Movement along the Texas Gulf Coast, 1930's to 2012

Jeffrey G. Paine, Tiffany Caudle, and John Andrews



Bureau of Economic Geology

Scott W. Tinker, Director
Jackson School of Geosciences
The University of Texas at Austin
Austin, Texas 78713-8924

GLO Contract Number 09-074-000
CEPRA Project No. 1563
Work Order No. 777B

Final Report Prepared For
General Land Office under
contract no. 09-074-000.



August 2014

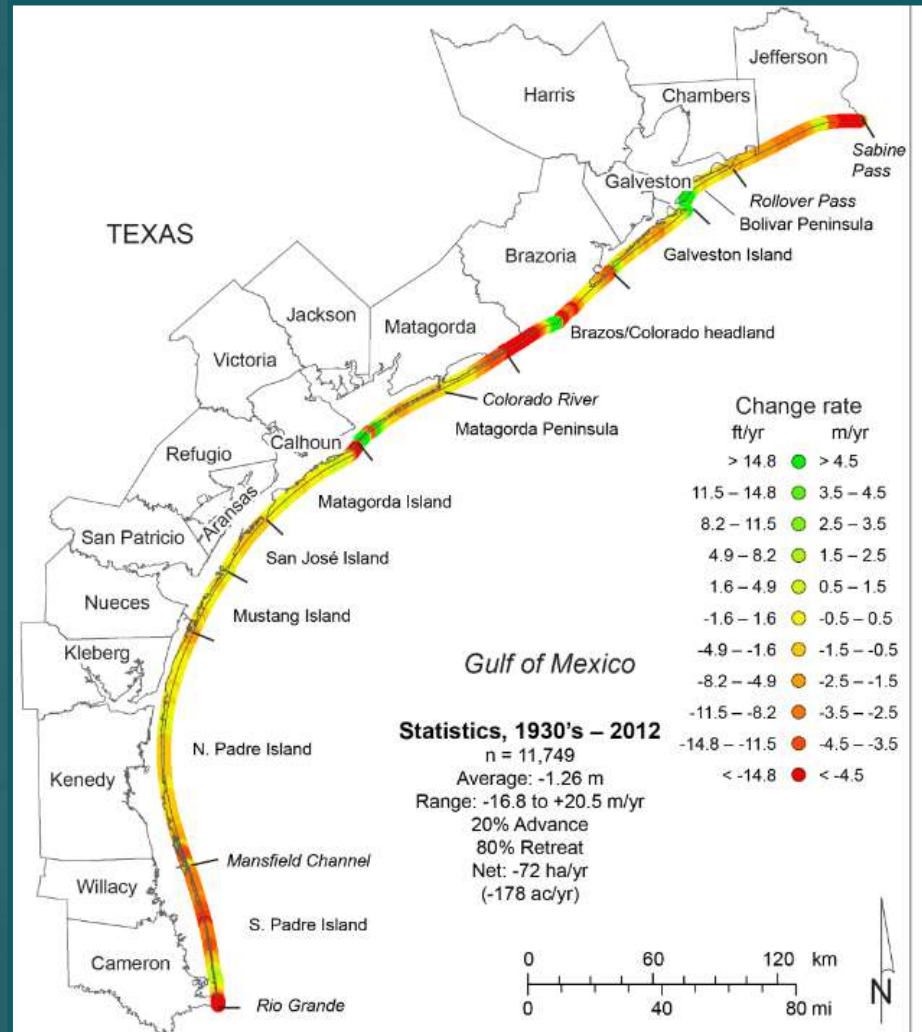


Figure 14. Net rates of long-term change for the Texas Gulf shoreline between Sabine Pass and the Rio Grande calculated from shoreline positions between the 1930's and 2012. Change rates at 11,749 measurement sites are available on the accompanying data CD in GIS-compatible format.



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SITE SELECTION STRATEGY

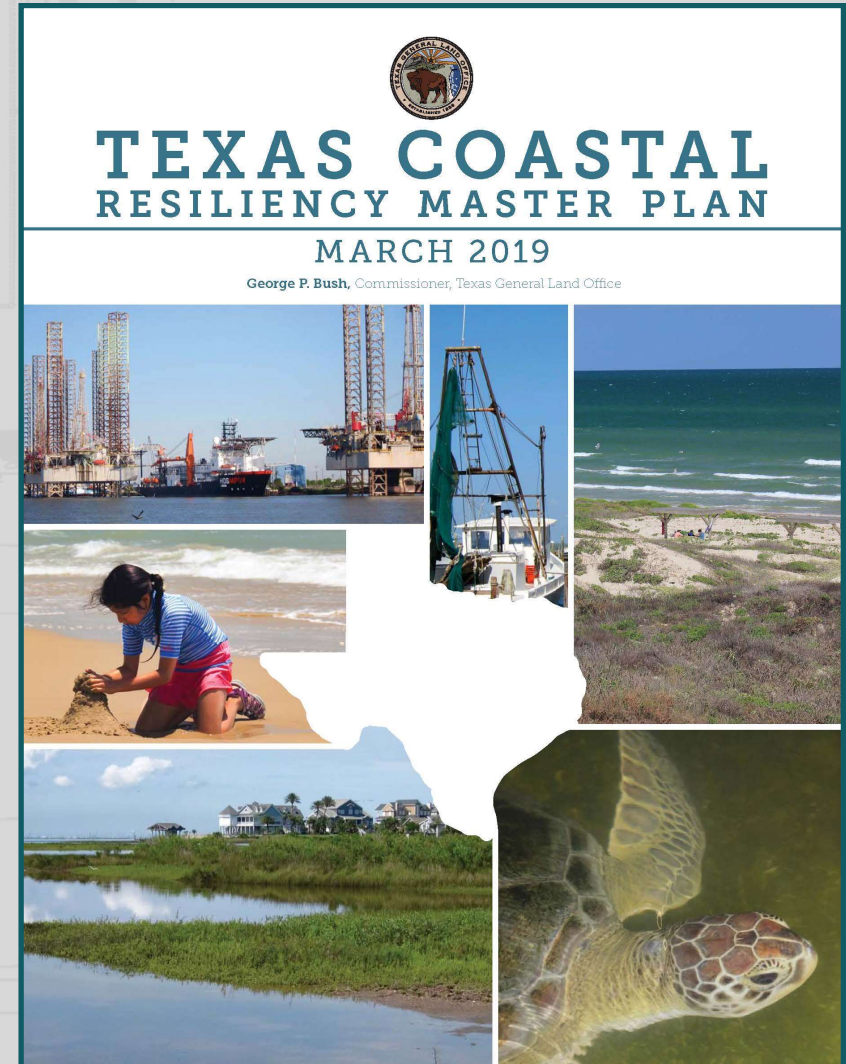


The Goal: Synergize with ongoing initiatives to promote resilience at a systems scale:

- TX GLO's MP
- RESTORE Act Sites
- USFWS NWRs
- NRDA

Our Approach

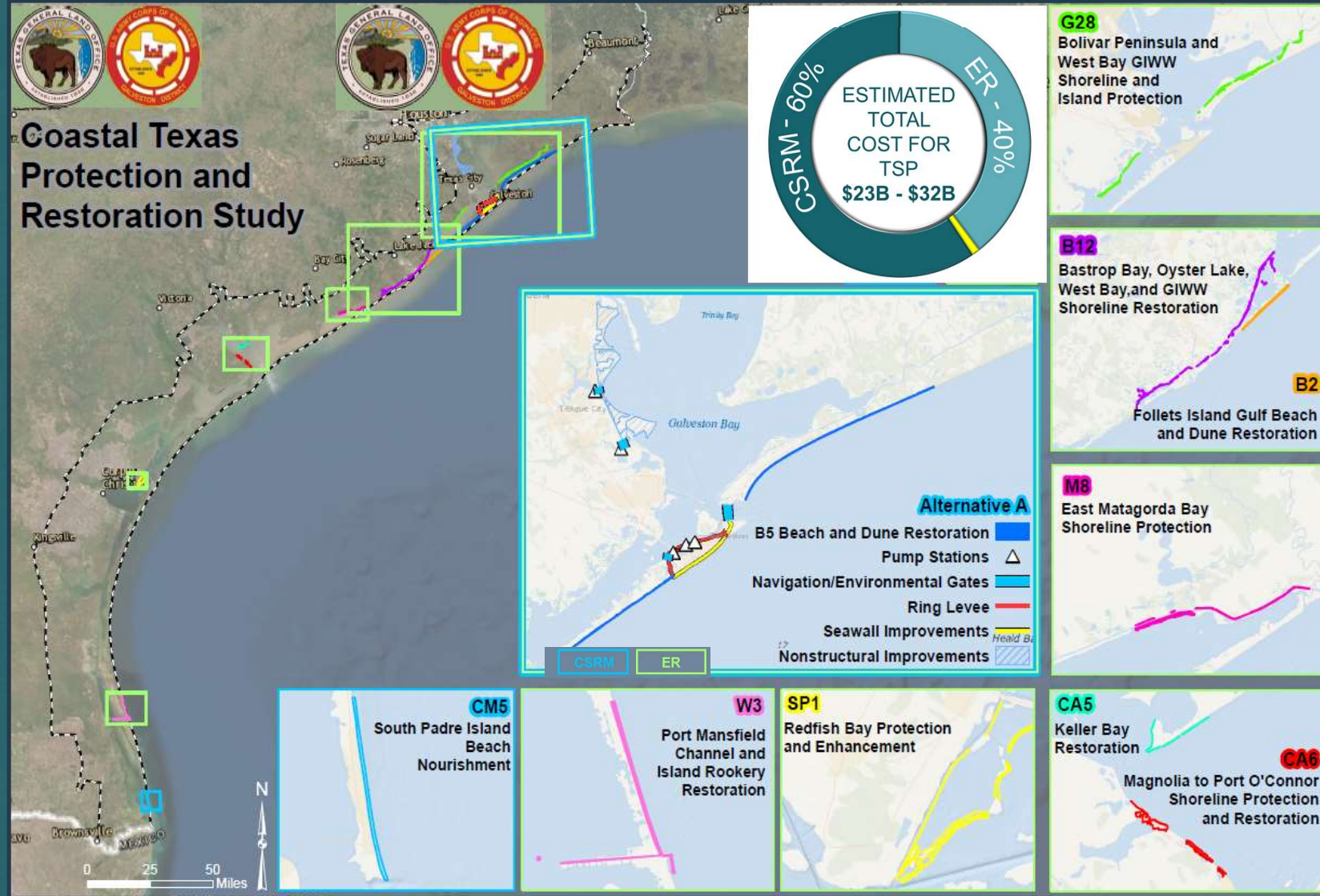
- **Formulated** a list of potential sites
- **Developed** site selection criteria to characterize the sites
- **Used** Subject Matter Experts (SMEs) to screen and select sites based on these criteria
- **Quantified** the benefits using Habitat Evaluation Procedures (HEP) & compared that to the costs (construction/operations/maintenance)
- **Recommended** a combination of sites for inclusion in the comprehensive Tentatively Selected Plan (TSP)



RECOMMENDED PLAN

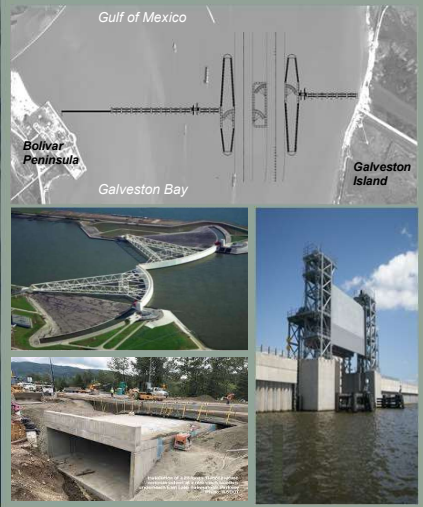


Revised Coastal Resilience Comprehensive Strategy



Coastal Storm Risk Management

- 2 large & 2 small sector gates
- 15 vertical lift gates & 16 monoliths
- 42 mi of Gulf-side dune/beach barrier
- 18 mi of ring barrier
- 4-ft high extension of the seawall
- Gated closures at four locations
- Non-structural measures on the mainland
- 2 mi beach/dunes on South Padre

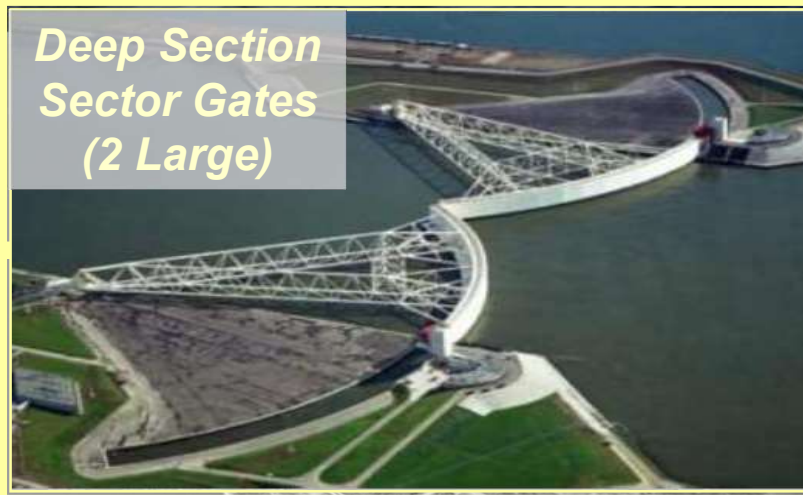
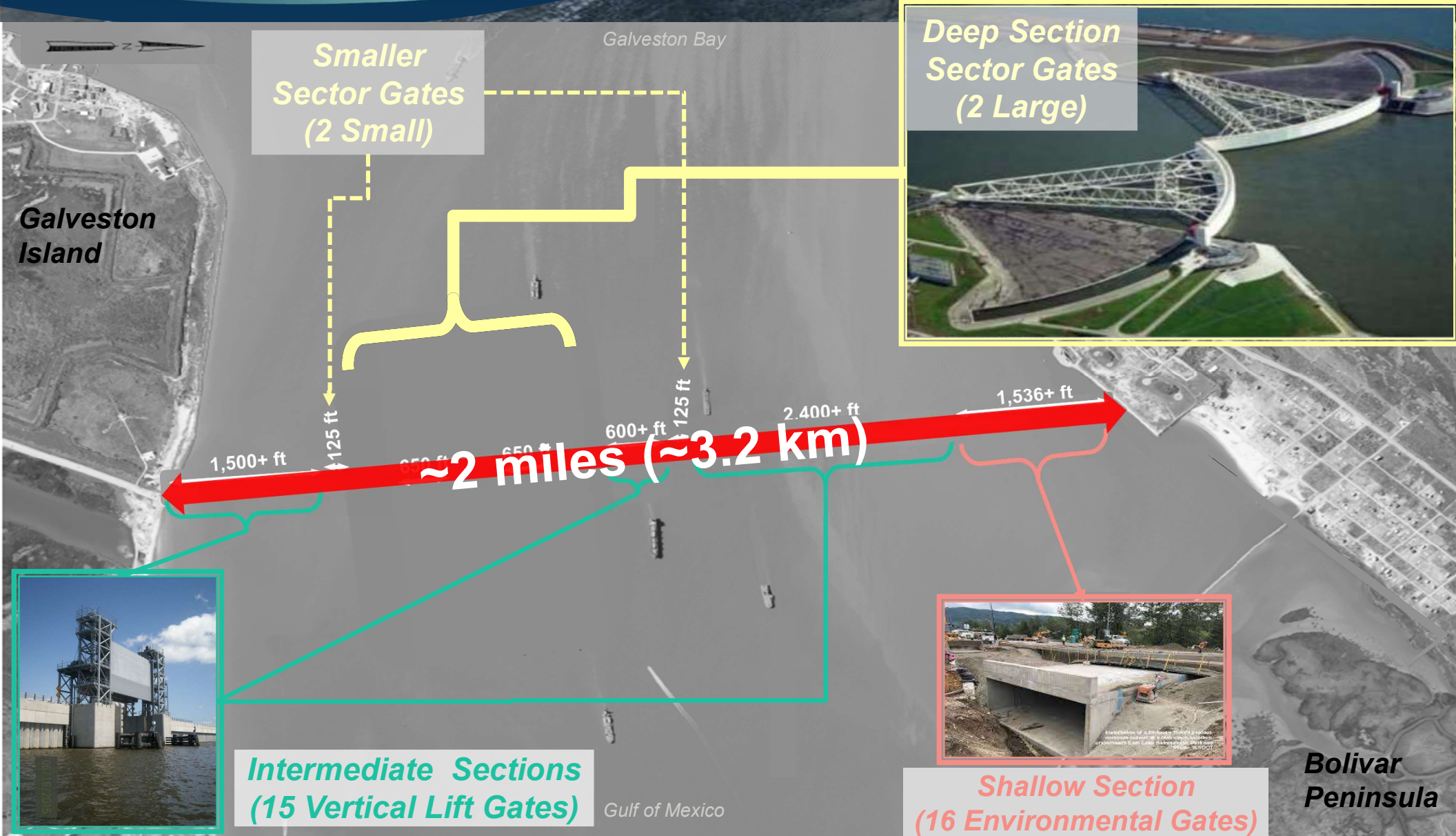


Ecosystem Restoration (6,000+ ac)

- 737 ac of breakwaters
- 838 ac of bird islands
- 1,985 ac of marshes
- 44 ac of oyster reefs
- 2,519 ac of dunes/beaches



STORM SURGE GATES (DESIGN IN PROGRESS)



Bolivar Peninsula

Gulf of Mexico



NATURE-BASED SOLUTIONS: DUNE & BEACHES

<http://CoastalStudy.Texas.gov>

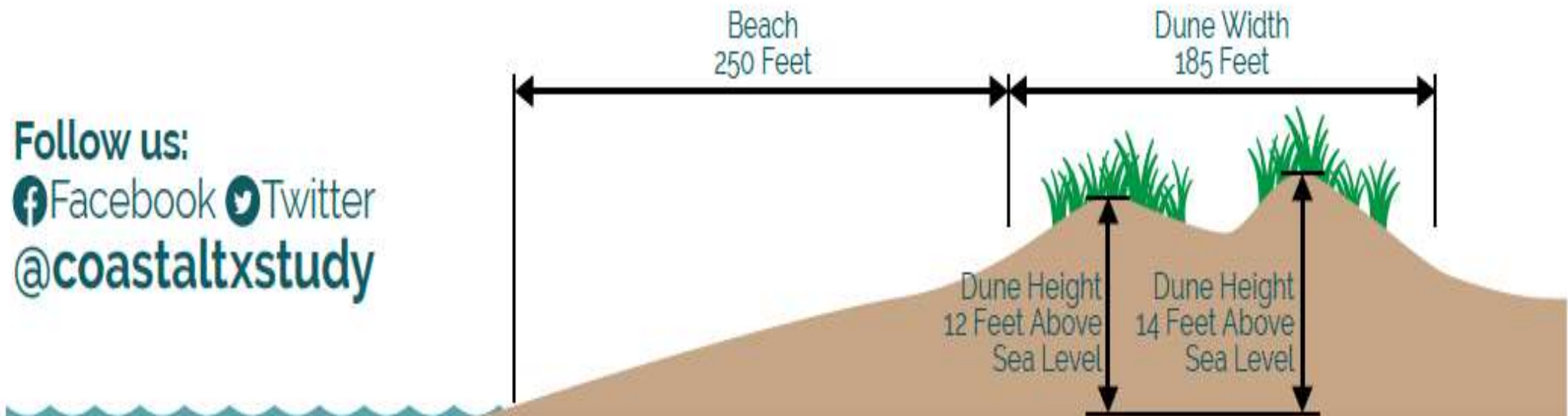
CoastalTXStudy



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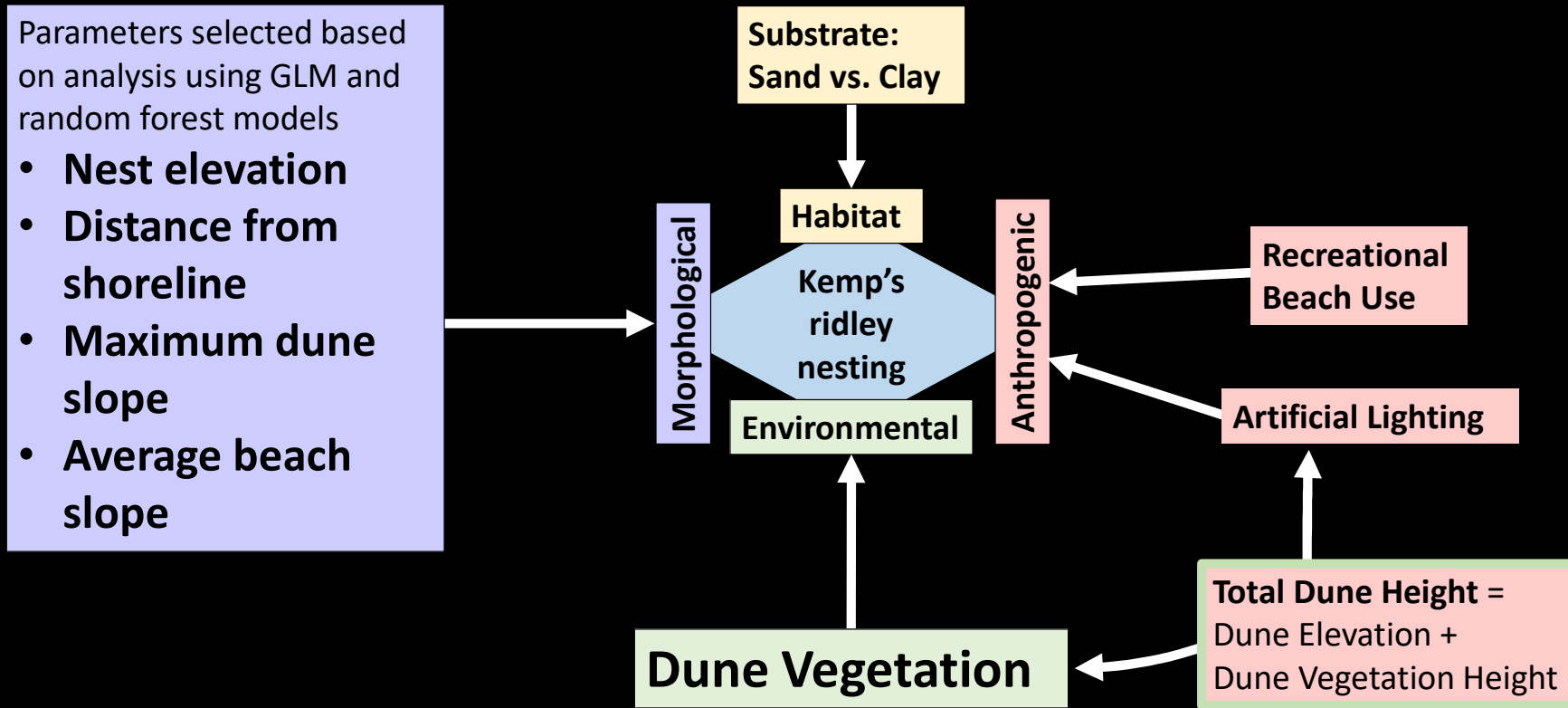


Beach and Dune System Components

(Drawing is representational and for illustrative purposes only. All dimensions are approximate)

More information is available online at: coastalstudy.texas.gov

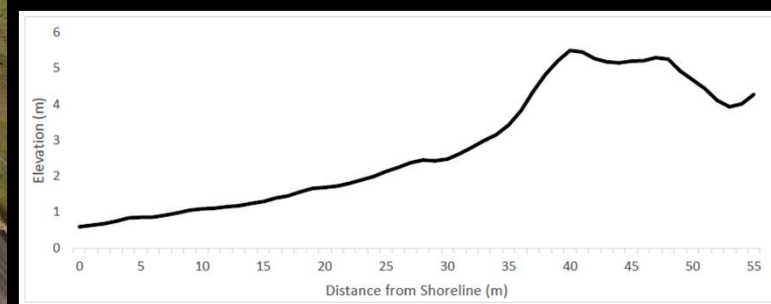
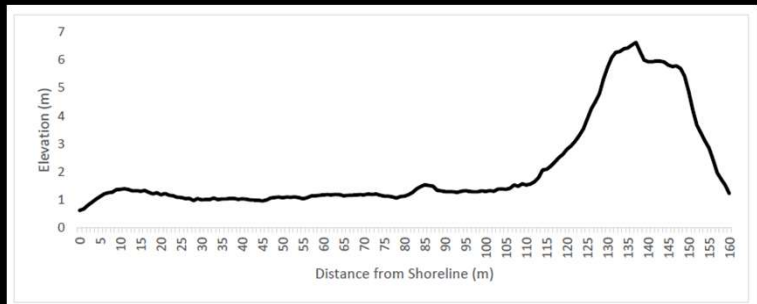
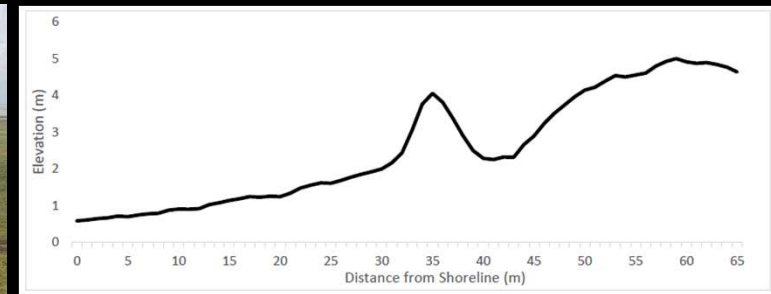
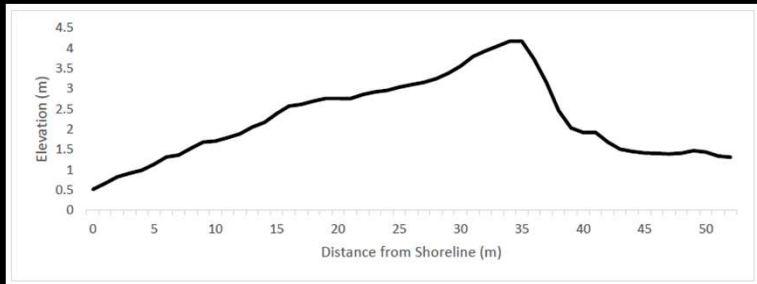
Conceptual Model 11, 2019 using Agency (GLO, NPS, TPWD, and ERDC) Feedback Updated on December



$$HSI = \sqrt[3]{Elevation * \sqrt{Total Dune Height * Substrate} * \sqrt{Max Dune Slope * Average Beach Slope}}$$



- Kemp's Ridley sea turtle chosen as target species for modeling because they are the most frequent sea turtle nester on the Texas Gulf Coast and they are considered sentinel species
- Figures from M.S. Thesis by Michelle F. Culver (2018), Beach Geomorphology and Kemp's Ridley (*Lepidochelys kempii*) Nest Site Selection along Padre Island, TX, USA

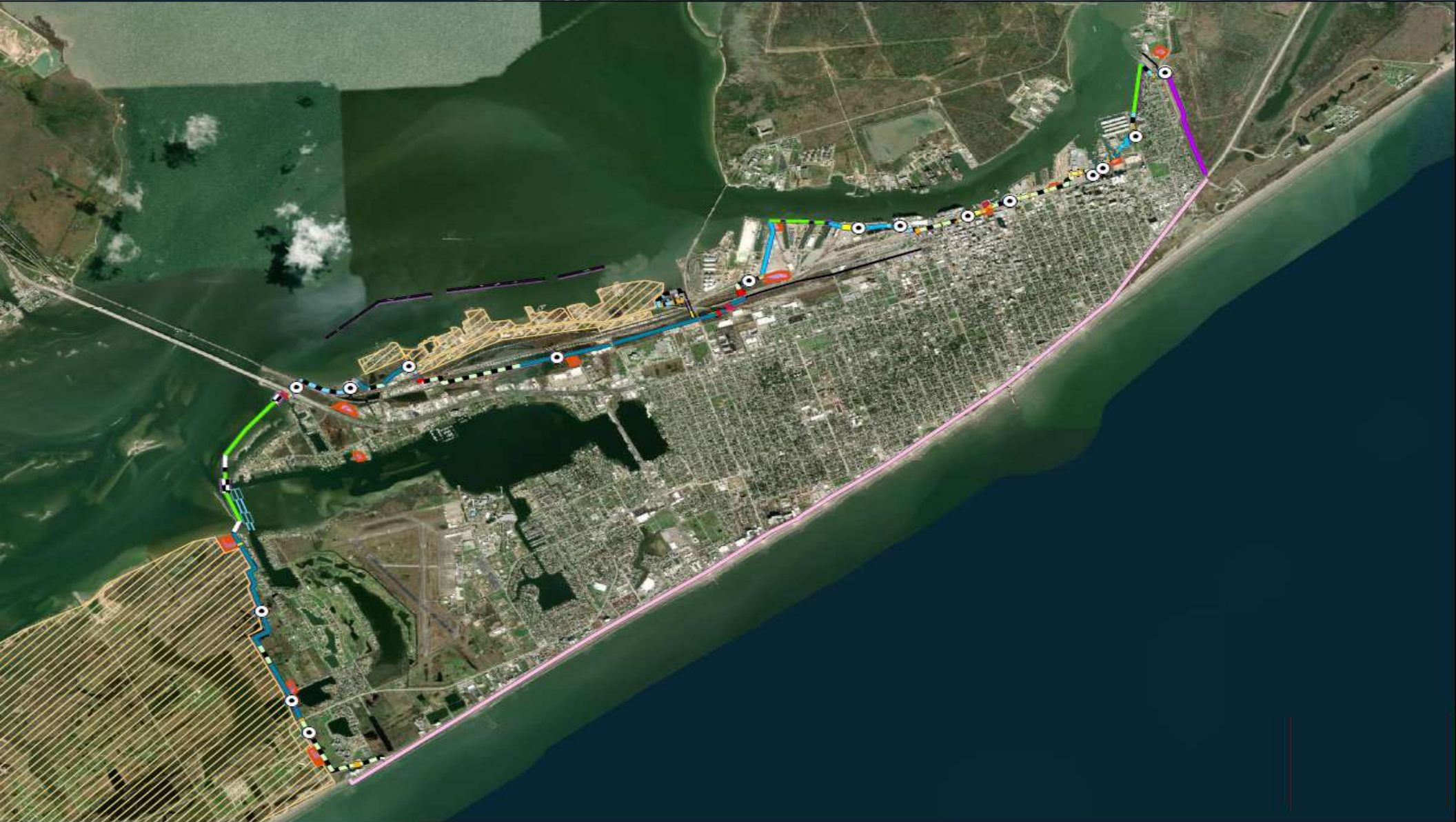




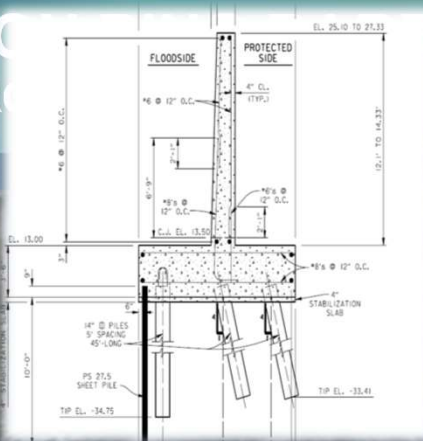
GALVESTON RING BARRIER (DESIGN IN PROGRESS)

<http://CoastalStudy.Texas.gov>

 CoastalTXStudy



Floodwall



Road Closure



Railroad Gate



Combi-Wall



Circulation Gates



Navigation Gate



Vertical Lift Gate



Slide Gate



Flap Gate



Pump Station



ECOSYSTEM RESTORATION (DESIGNS IN PROGRESS)



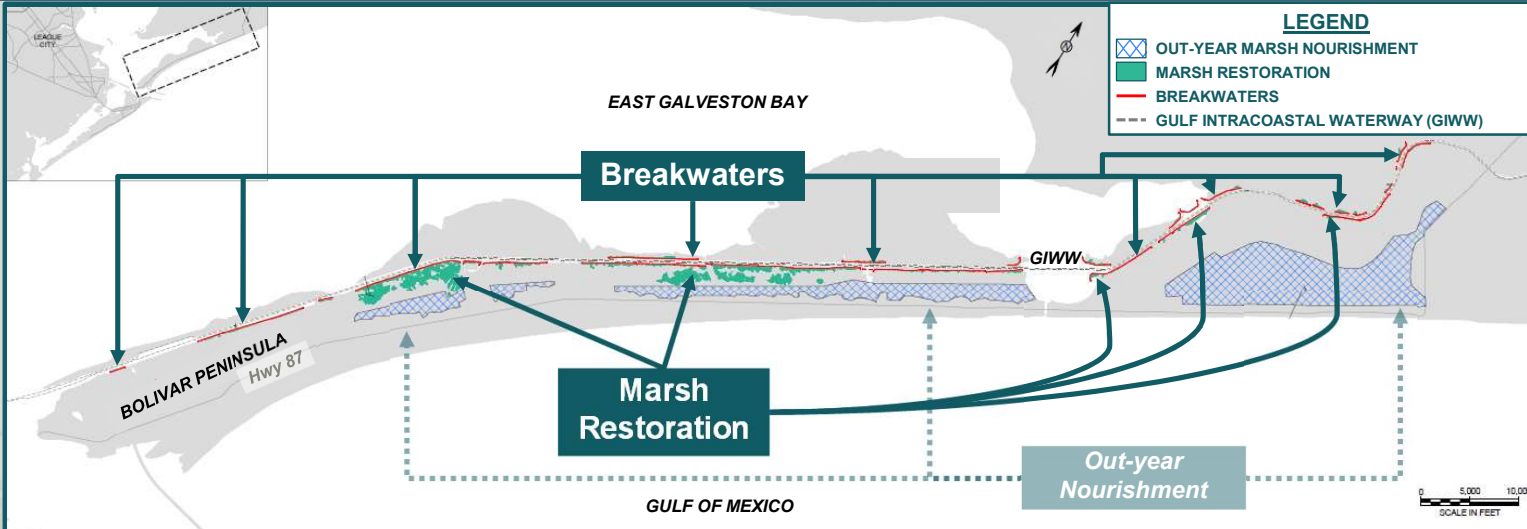
1. **Shoreline Protection** – Reduce/prevent shoreline erosion of barrier system shorelines, estuarine bay shorelines, and channel shorelines.
2. **Hydrologic Connectivity** – restore and/or create hydrologic connectivity of sensitive estuarine systems.
3. **Estuarine Bay Systems Restoration** – Restore, create, and/or protect critical estuarine wetlands, tidal flats, etc.
4. **Barrier Beach, Dune and Back Marsh Restoration** – Nourish and protect barrier beach, dune, and back mar
5. **Oyster Reef Restoration** – Restore and/or create important oyster reefs.
6. **Neotropical Migratory Bird Habitat Restoration** – Restore and/or create important habitat used by migratory birds
7. **Bird Island Rookeries Restoration** – Restore and/or create important islands used as bird rookeries.
8. **Restore Habitat Used by Species of Concern** – Restore and/or create habitat (important, critical, essential, and other habitat types) used by species of concern, such as federally- listed species, shorebirds, federally-managed aquatic species (e.g., essential fish habitat [EFH]), and others.





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G28 - BOLIVAR PENINSULA AND WEST BAY GIWW SHORELINE AND ISLAND PROTECTION



DESIGN CONCEPTS:

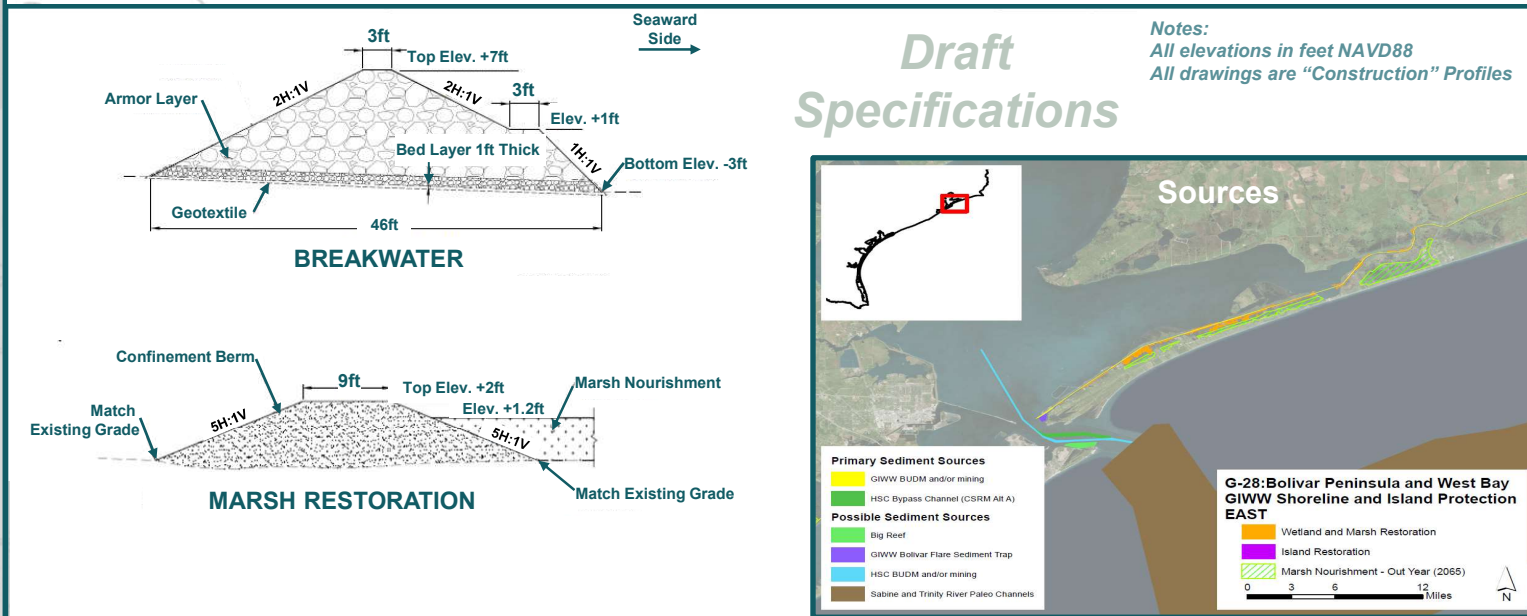
- Place breakwaters first
- Spaced to allow hydrologic exchange
- Adaptive out-year nourishments to maintain heights with RSLR (not in recommended plan)

Breakwaters: 27 miles

Alignment: North of GIWW in West Bay
Target Height: +7ft **Target Width:** 46ft
Slope: 2H:1V **Material Qties:** 1.9M tons
Primary Sourcing: Commercial sources

Marshes: 32 acres

Alignment: Behind breakwaters
Target Height: +2ft **Target Width:** Varies
Slope: 5H:1V **Material Qties:** ~23K cy
Primary Sourcing: GIWW BUDM and/or Mining
Other Options: Big Reef, GISS Bolivar Flare Sediment Trap, HSC BUDM and/or Mining, Sabine and Trinity River Paleo Channels





Environmental Impact Analysis

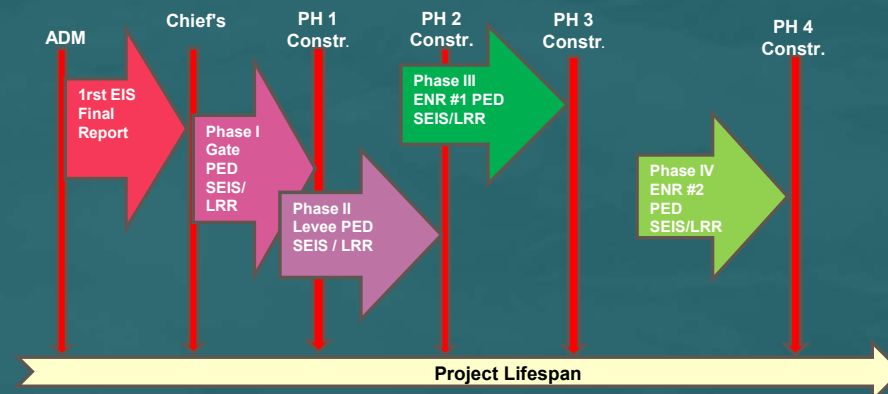
- NEPA is the nation's foremost environmental law
- NEPA drives our process by requiring the identification of direct, indirect and cumulative impacts
- Tiered NEPA has been authorized for this study

Analyses Underway

- Direct Impacts
 - Habitat Evaluation Procedures (HEP)
 - Quality x Quantity of Species Habitat
 - Advanced Hydrologic Modeling
 - Salinity, Velocity & Sediment Transport
 - Particle Track Modeling
 - Larval Movement & Recruitment Success
- Indirect & Cumulative Impacts

Mitigation Planning Underway

Conceptual Tiered NEPA Approach



Particle Track Modeling (PTM)



PUBLIC OUTREACH




- Formal Comment Period (45 days)
- Formal Meetings (NEPA Required)
- Public Open Houses
- CWGs
- Social Media
- Tech Talks
- Newsletters
- Email lists
- Stakeholder Briefings

More opportunities to engage are on the project horizonremember Tiered NEPA!

COASTAL TEXAS STUDY

STUDY UPDATE



ABOUT THE STUDY
Serving as an important economic and industrial hub for the United States, the Texas Gulf Coast is home to a coastal ecosystem vital to the national economy that provides valuable natural resources. The study area includes the entire Texas Gulf coast from the mouth of the Sabine River to the mouth of the Rio Grande, and includes the Gulf and tidal wetlands, barrier islands, estuaries, coastal wetlands, rivers and streams, and adjacent areas that make up the interrelated ecosystems along the coast of Texas.

COASTAL TEXAS STUDY

Community Work Group Fact Sheet

Version 1.5, Updated July 26, 2019

WE HEARD YOU!

The Coastal Texas Study has already begun considering the feedback received during the comment period for the Draft Integrated Feasibility Report and Environmental Impact Statement (DIFR-EIS). Based upon your input, the study team is:

- Establishing Texas General Land Office (GLO)-led Community Working Groups
- Dropping the barrier levee along Galveston Island and Bolivar Peninsula from the study completely, and investigating a dune-and-beach system along Bolivar Peninsula beach
- Re-aligning the Galveston Ring Barrier
- Evaluating non-structural measures on the west side of Bolivar Peninsula
- Exploring the use of structural measures on the west side of Bolivar Peninsula

Additionally, the study team will:

- Continue collaboration with the Galveston Bay Area Council on Planning & Evacuation from District 10 at Galveston
- Further storm modeling
- Coordinate and hold a public meeting in the summer of 2020 (including a design workshop)
- Evaluate feedback received during the design workshop

More information is available online at coastalstudy.texas.gov

COASTAL TEXAS STUDY

NOTHING BUT THE FACTS

Large, long-term studies like the Coastal Texas Study often face misconceptions. The purpose of this document is to clear up some of these misconceptions and provide you with "Nothing But the Facts."

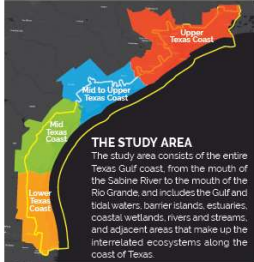
Misconception: The proposed plan would protect only highly populated areas and not all parts of the Texas coastline that have been impacted by past weather events.
The Coastal Texas Study includes a combination of ecosystem restoration (ER) and coastal storm risk management (CSR) measures located throughout the 18 coastal counties of the Texas Gulf Coast.

Misconception: The study would use eminent domain to acquire and demolish any property along the proposed barrier alignment.
The non-federal sponsor will have the responsibility of acquiring all necessary real estate interests for the project and ensuring that relocation of utilities and facilities is accomplished. Where necessary, voluntary relocations and acquisitions will be pursued, and eminent domain would only be imposed by a local sponsor as a last resort.

Misconception: The Coastal Texas Study is only considering past, historical flood events.
Over 600 storms that could potentially impact the Texas coast were modeled and analyzed. These possible tropical storms include the entire range of storm factors, such as storm intensity, storm size, forward speed and angle of approach on top of the landfall locations along the entire Texas coast. The storms range from very weak and small tropical storm events all the way to catastrophic strong and large Category 5 storms and beyond.

Based on this data, a sample of 170 storms was taken through the Advanced Circulation model (ADCIRC - Certified by the Federal Emergency Management Agency (FEMA) for use in performing storm surge analysis) to determine storm surge heights with and without the barrier systems. The storms that were selected were the most destructive scenarios for storm surge and wave conditions. Additional storm modeling is currently being conducted to optimize the plan.

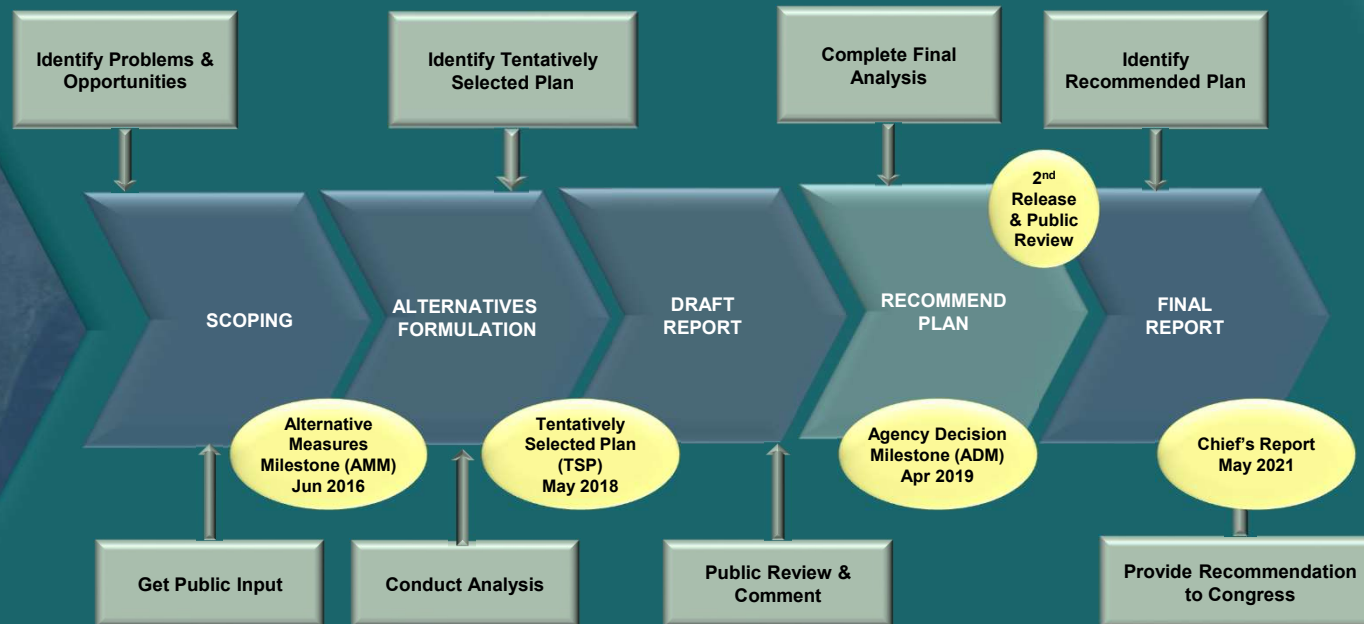
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THE STUDY AREA
The study area consists of the entire Texas Gulf coast from the mouth of the Sabine River to the mouth of the Rio Grande, and includes the Gulf and tidal wetlands, barrier islands, estuaries, coastal wetlands, rivers and streams, and adjacent areas that make up the interrelated ecosystems along the coast of Texas.

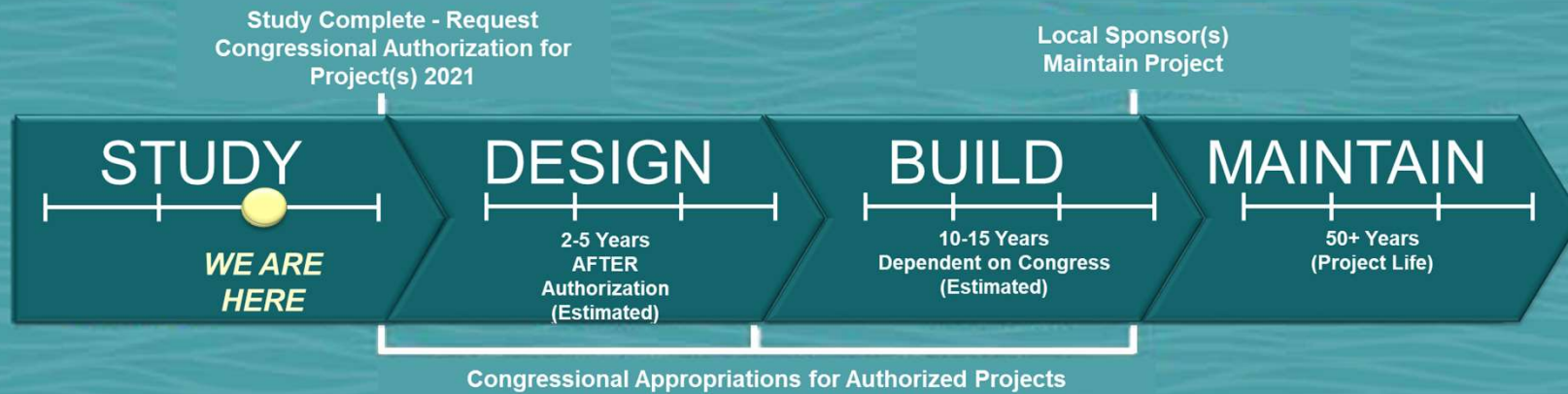


STUDY





ESTIMATED PROJECT SCHEDULE





WATCH THIS SPACE!!

<http://CoastalStudy.Texas.gov>

[f CoastalTXStudy](#)



COASTAL TEXAS STUDY

Overview Alternatives Get Involved Resources Contacts

Coastal Texas Protection & Restoration Feasibility Study

Planning and Environmental Documents for Public Review;
Draft Integrated Feasibility Report and Environmental Impact Statement

The community is invited to review the plans and participate in a series of public meetings:

[LEARN MORE](#)

The U.S. Army Corps of Engineers, in partnership with the Texas General Land Office, began an examination in November 2015 of the feasibility of constructing projects for coastal storm risk management and ecosystem restoration along the Texas coast.

The Coastal Texas Protection and Restoration Feasibility Study, also known as the Coastal Texas Study, will involve engineering, economic and environmental analyses on large-scale projects, which may be considered by Congress for authorization and funding.

The feasibility study and report will be complete in 2021. The Coastal Texas Study recommendations will enhance resiliency in coastal communities and improve our capabilities to prepare for, resist, recover and adapt to coastal hazards.

Coastal Storm Risk Management

Develop and evaluate coastal storm risk management solutions to reduce the damage from tropical storms and hurricanes incurred by coastal communities and industries.

[MORE](#)

Ecosystem Restoration

Increase the net quality and quantity of coastal ecosystem resources by maintaining, protecting and restoring coastal Texas ecosystems, and fish and wildlife habitat.

[MORE](#)

Environmental Impact Analyses

An environmental impact statement will be completed under the procedures of the National Environmental Policy Act (NEPA).

[MORE](#)

Coastal Texas Study

Like Following Share ...

Coastal Texas Study
July 30 at 12:10 PM

MISCONCEPTION: Rice University's SSPEED Center has proposed a less costly plan called the "Bay Park Plan" that can be built in less time and will have the same (or greater) level of protection with little or no environmental impacts.

While we believe the Bay Park Plan and our own Coastal Barrier Plan complement one another, more information is needed in order to make direct comparisons between them. Some key concerns include:

1) The Bay Park Plan is still in the concept pha... [See More](#)

You, Sharon Manzella Tirpak and 2 others

Like Comment Share

Write a comment...
Press Enter to post.

Coastal Texas Study
July 29 at 10:33 AM

We are utilizing a "multiple lines of defense" approach to develop a system of comprehensive, resilient, and sustainable coastal storm risk management solutions. For more information, please visit <http://coastalstudy.texas.gov/>.

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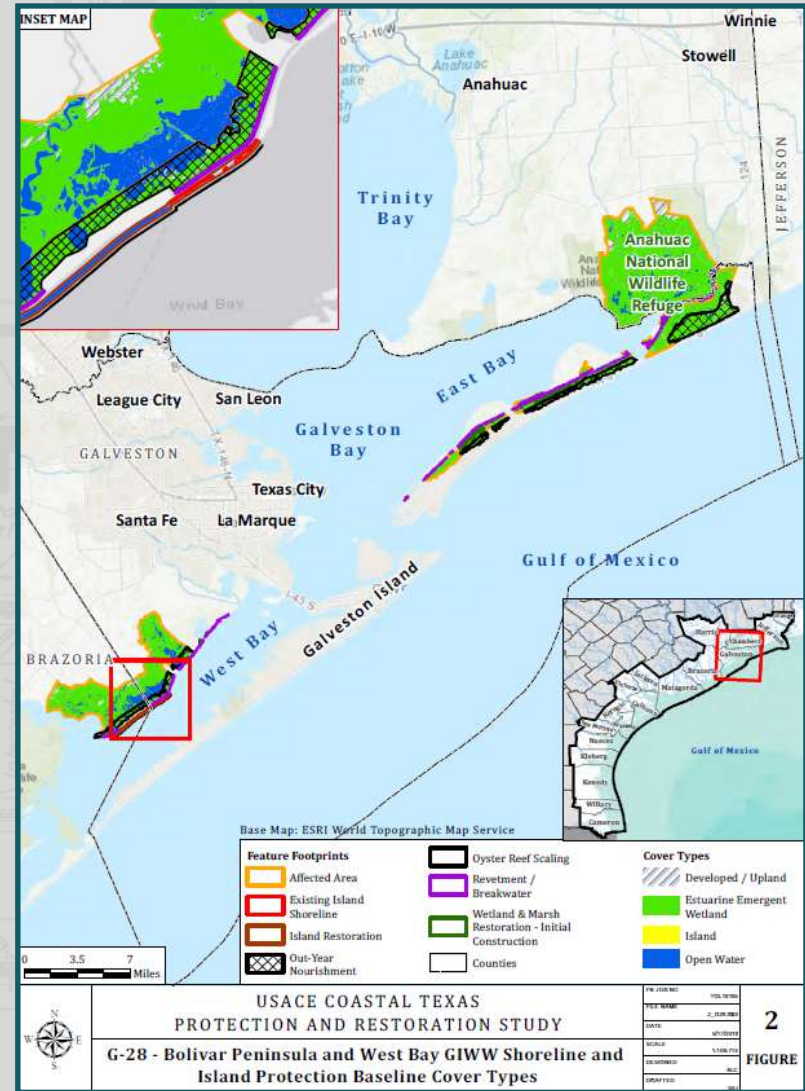
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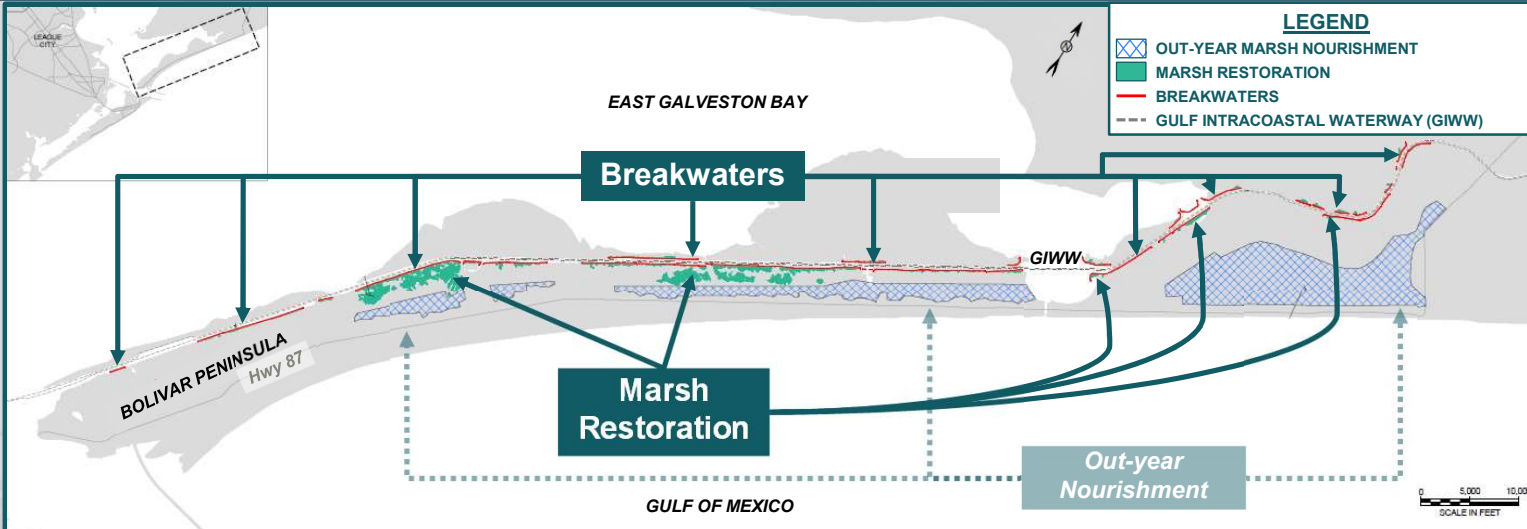
G28 - BOLIVAR PENINSULA AND WEST BAY GIWW SHORELINE AND ISLAND PROTECTION





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G28 - BOLIVAR PENINSULA AND WEST BAY GIWW SHORELINE AND ISLAND PROTECTION



DESIGN CONCEPTS:

- Place breakwaters first
- Slotted to allow hydrologic exchange
- Adaptive out-year nourishments to maintain heights with RSLR (not in recommended plan)

Breakwaters: 27 miles

Alignment: North of GIWW in West Bay

Target Height: +7ft **Target Width:** 46ft

Slope: 2H:1V **Material Qty:** 1.9M tons

Primary Sourcing: Commercial sources

Marshes: 32 acres

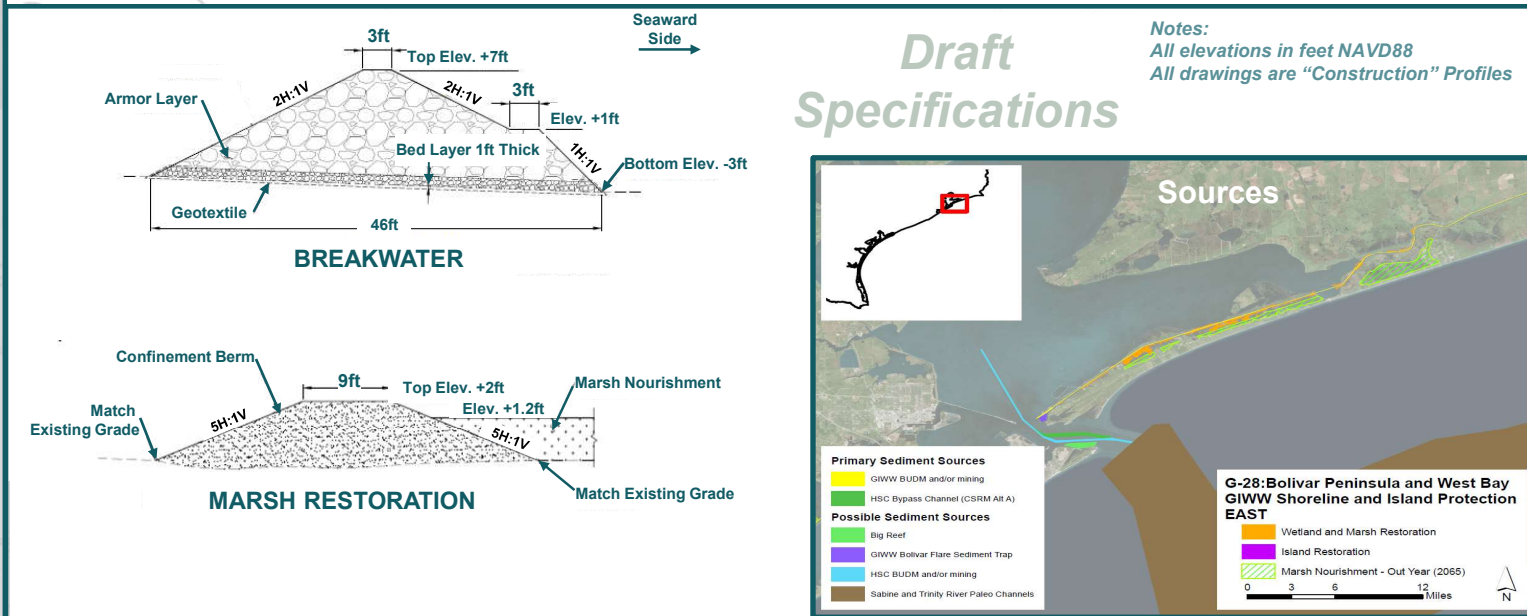
Alignment: Behind breakwaters

Target Height: +2ft **Target Width:** Varies

Slope: 5H:1V **Material Qty:** ~23K cy

Primary Sourcing: GIWW BUDM and/or Mining

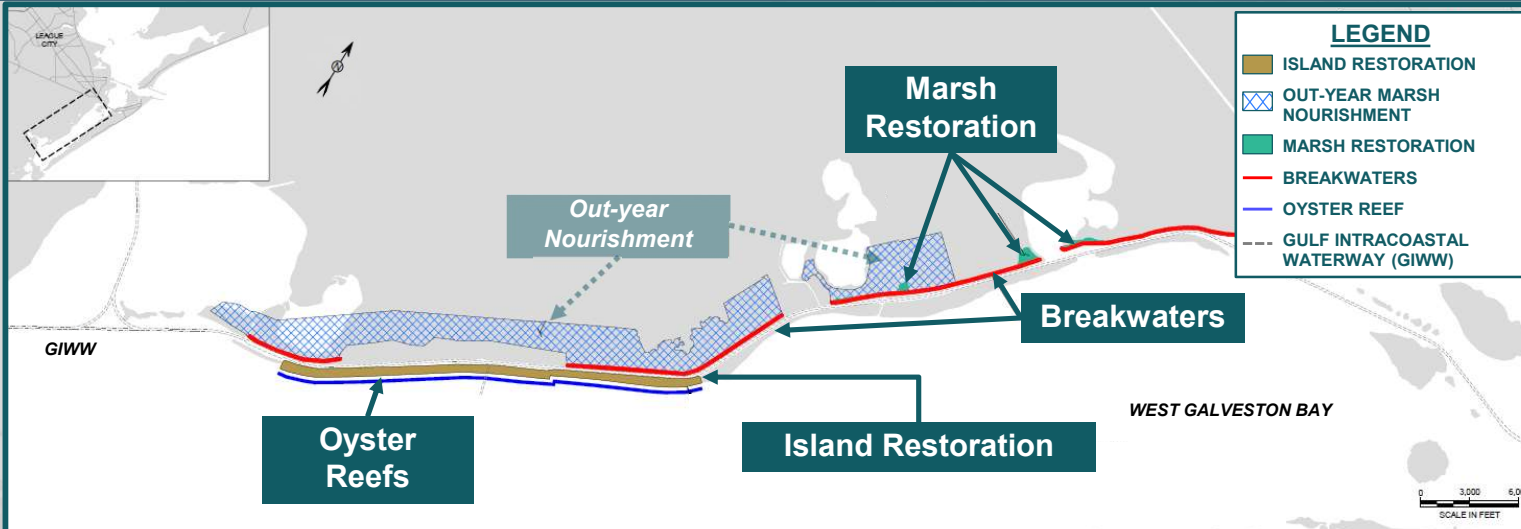
Other Options: Big Reef, GISS Bolivar Flare Sediment Trap, HSC BUDM and/or Mining, Sabine and Trinity River Paleo Channels





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G28 (WEST) - BOLIVAR PENINSULA AND WEST BAY GIWW SHORELINE AND ISLAND PROTECTION



DESIGN CONCEPTS:

- Place breakwaters first
- Slotted to allow hydrologic exchange
- Adaptive out-year nourishments to maintain heights with RSLR (not in recommended plan)
- Culch placed within reef template – final elevation and slopes TBD

Breakwaters: 9 miles

Alignment: North of GIWW in West Bay

Target Height: +7ft **Target Width:** 46ft

Slope: 2H:1V

Material Qtys: ~627K tons

Primary Sourcing: Commercial sources

Marshes: 640 acres

Alignment: Behind breakwaters

Target Height: +2ft **Target Width:** Varies

Slope: 5H:1V

Material Qtys: ~459K cy

Primary Sourcing: GIWW BUDM and/or Mining

Other Options: Big Reef, GISS Bolivar Flare Sediment Trap, HSC BUDM and/or Mining, Sabine and Trinity River Paleo Channels

Islands: 326 acres (5 mi long)

Alignment: South of GIWW in West Bay

Target Height: +9ft **Target Width:** 400-600ft

Slope: 5H:1V

Material Qtys: 5.8mcy

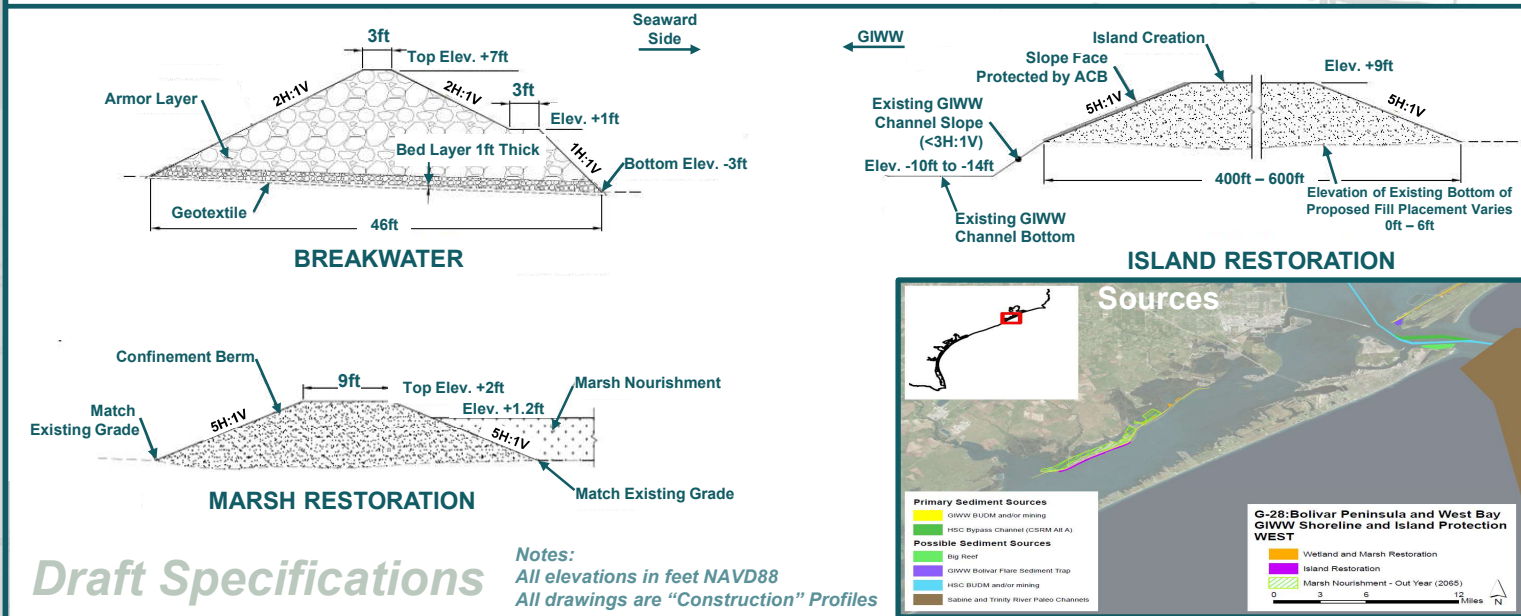
Primary Sourcing: Dredging

Oyster Reefs: 18 acres (26,280 linear ft)

Alignment: South of GIWW & islands complexes

Benefits: 589 Net AAHUs

Cost: \$757K - \$989K (w/o out-yr nourishments)



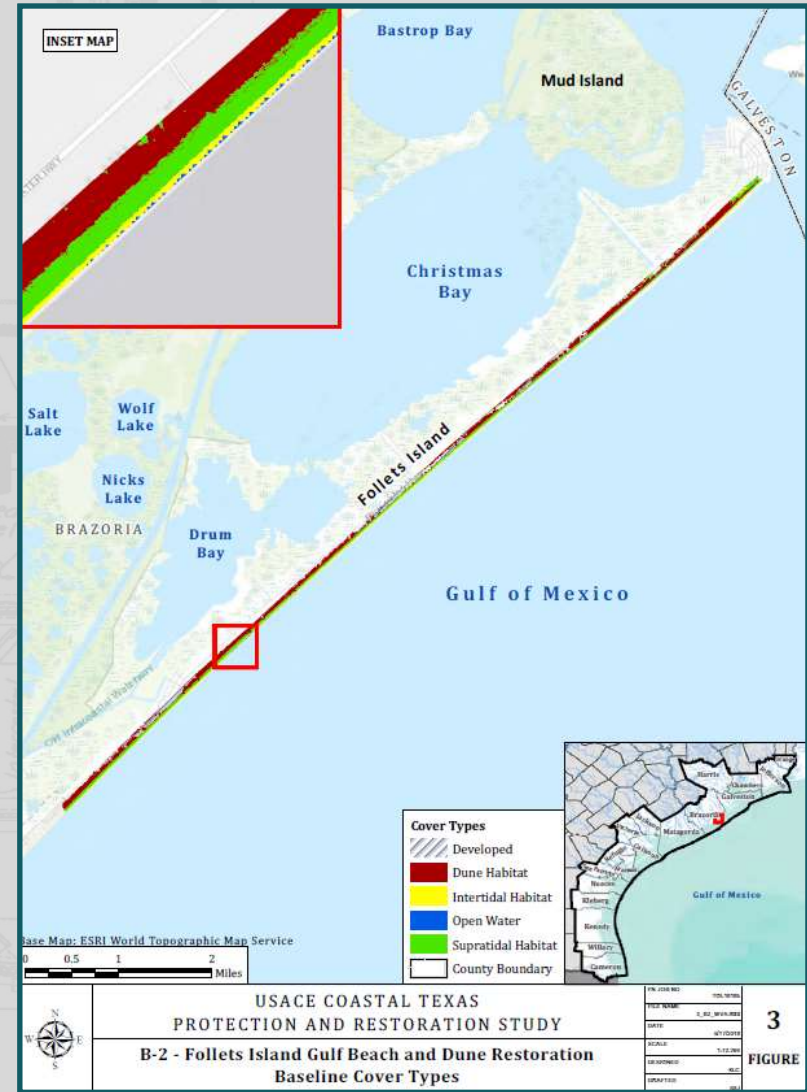
Draft Specifications

Notes:
All elevations in feet NAVD88
All drawings are "Construction" Profiles



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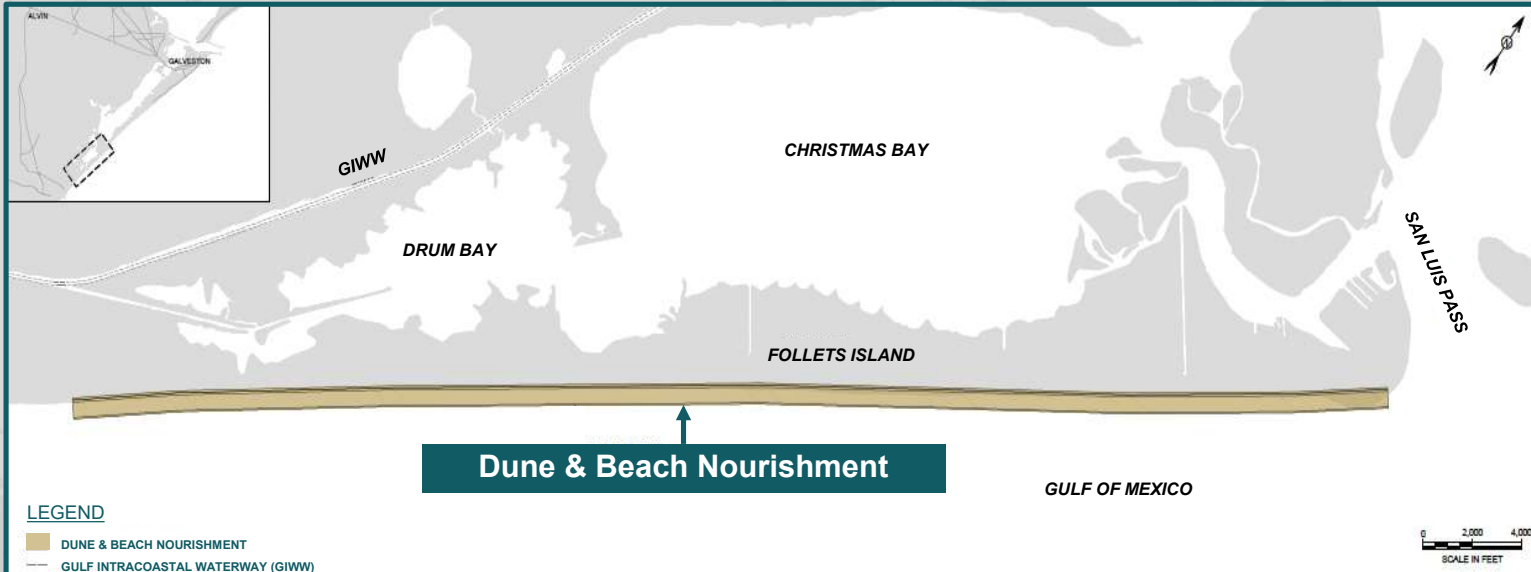
B2 - FOLLETS ISLAND GULF BEACH AND DUNE RESTORATION





US Army Corps of Engineers

B2 - FOLLETS ISLAND GULF BEACH AND DUNE RESTORATION



Beach & Dune Complexes: ~10.1mi (1,114 ac)

- Alignment:** Current dune line
- Target Dune Height:** 10-12ft
- Target Dune Width:** 150ft
- Target Beach Width:** 550-600ft
- Slope:** 10H:1V
- Material Quantities:** ~8.78mcy
- Primary Sourcing:** Shoreface dredging (purple)
- Other Options:** Sabine/Heald Banks (pink)

Design Concepts:

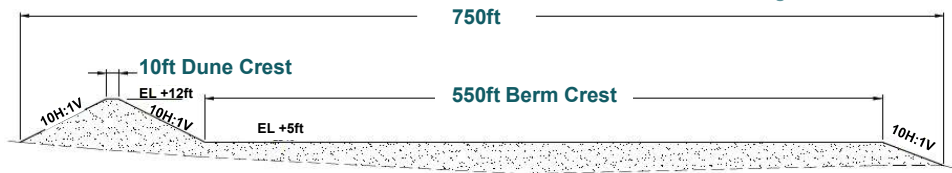
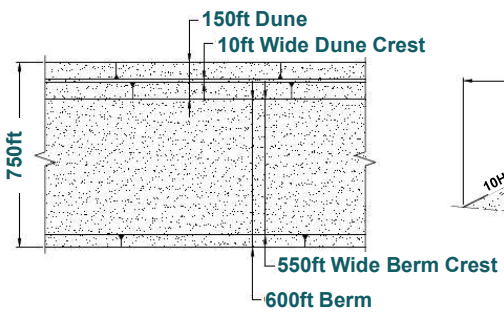
- Nourish with sand only - no engineered dunes
- Fill the road gaps roads
- Walk- & Drive-overs
- Must address drainage issues

Benefits: 200 Net AAHUs

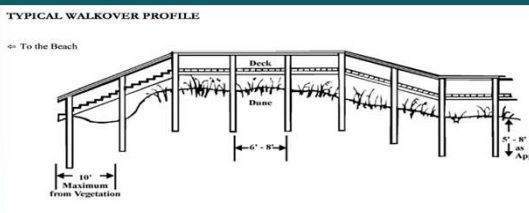
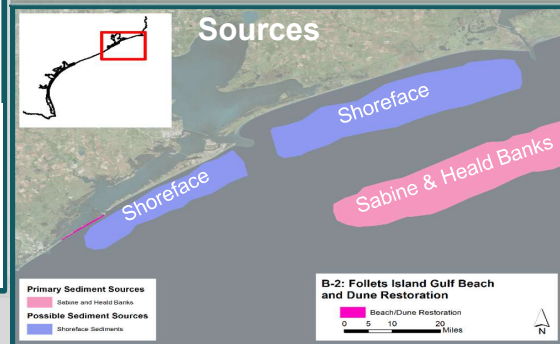
Cost: \$433K - \$600K (w/o out-yr nourishments)

Draft Specifications

Notes:
All elevations in feet NAVD88
All drawings are "Construction" Profiles



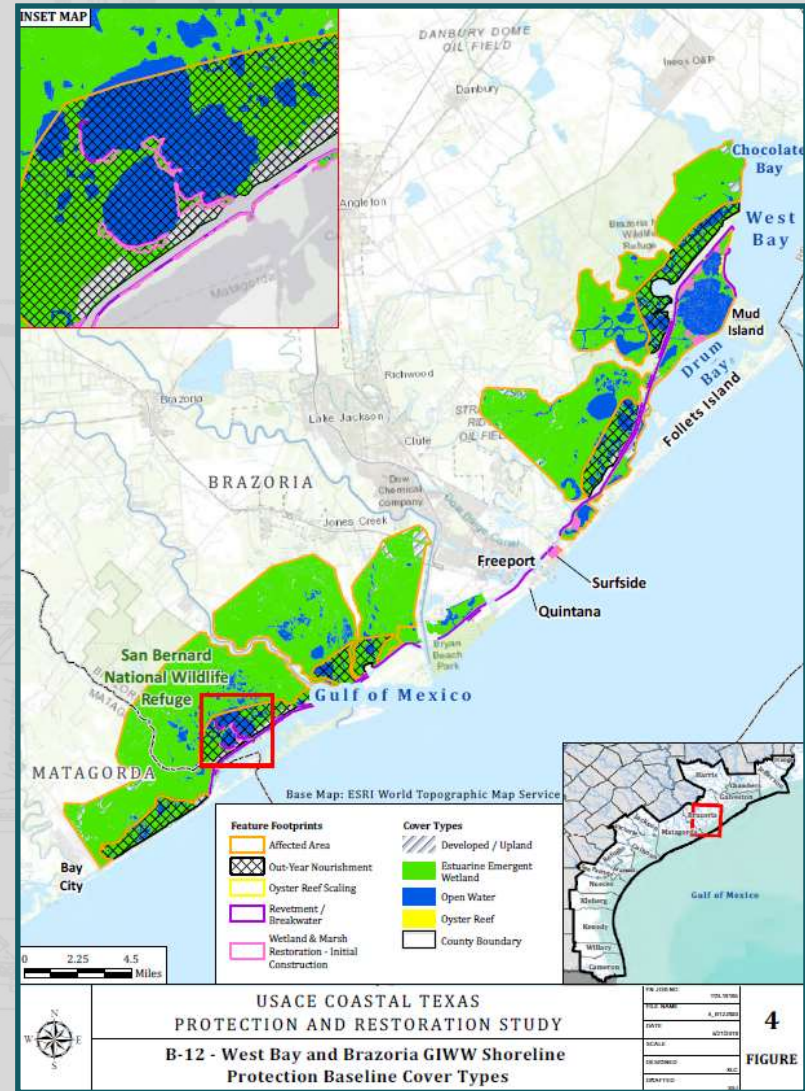
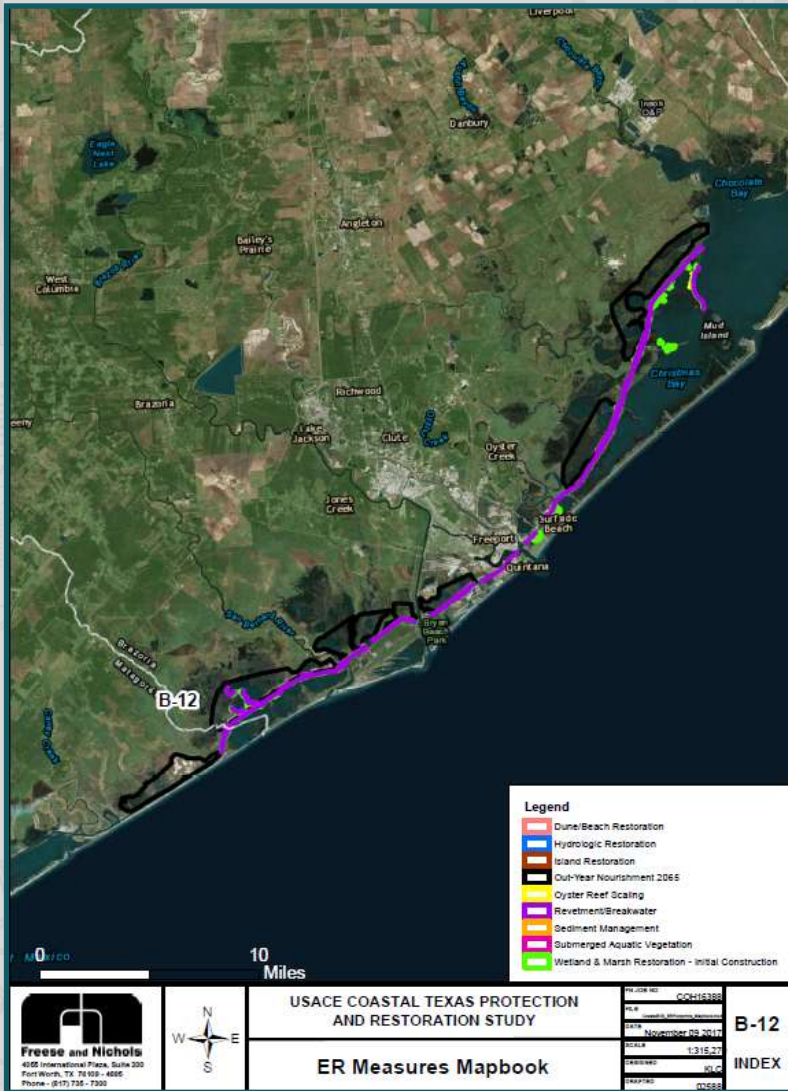
Drive-Over Example





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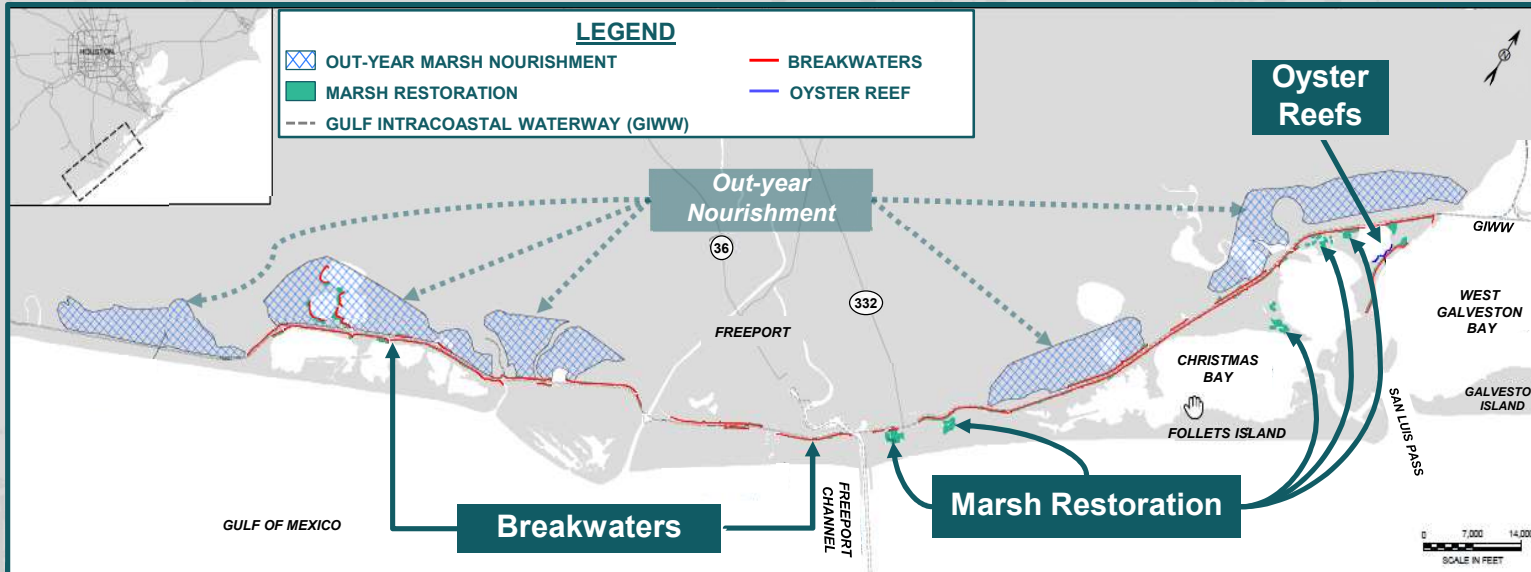
B12 - BASTROP BAY, OYSTER LAKE, WEST BAY, AND GIWW SHORELINE RESTORATION





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B12 - BASTROP BAY, OYSTER LAKE, WEST BAY, AND GIWW SHORELINE RESTORATION



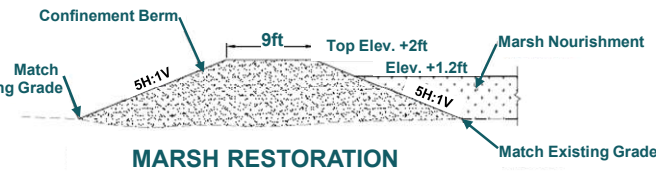
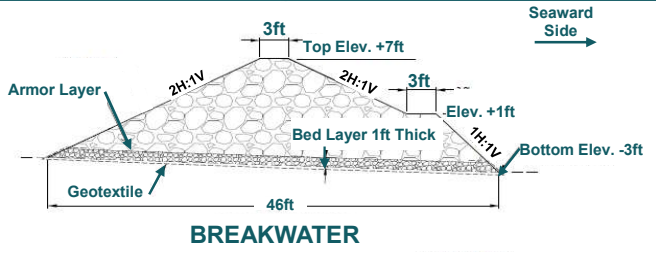
DESIGN CONCEPTS:

- Place breakwaters first
- Slotted to allow hydrologic exchange
- Adaptive out-year nourishments to maintain heights with RSLR (not in recommended plan)
- Culch placed within reef template – final elevation and slopes TBD

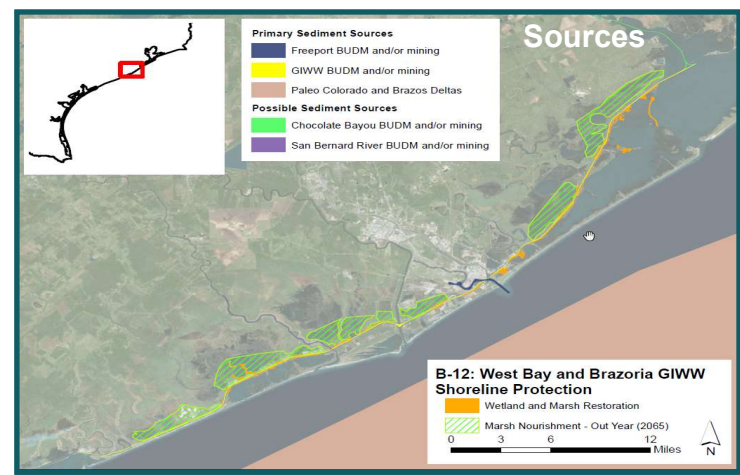
Breakwaters: 43.2 miles
Alignment: Western side of West Bay, and Cowtrap Lakes, and along selected segments of the GIWW in Brazoria County
Target Height: +7ft **Target Width:** 46ft
Slope: 2H:1V **Material Qty's:** ~3.0M tons
Primary Sourcing: Commercial sources

Marshes: 551 acres
Alignment: Behind breakwaters
Target Height: +2ft **Target Width:** Varies
Slope: 5H:1V **Material Qty's:** ~2mcy
Primary Sourcing: GIWW BUDM and/or Mining
Other Options: Big Reef, GISS Bolivar Flare Sediment Trap, HSC BUDM and/or Mining, Sabine and Trinity River Paleo Channels

Oyster Reefs: 3,708 linear ft
Alignment: Designed to reduce breaching of Oyster Lake into the West Bay
Benefits: 1,031 Net AAHUs
Cost: \$517K - \$718K (w/o out-yr nourishments)



Notes:
 All elevations in feet NAVD88
 All drawings are "Construction" Profiles

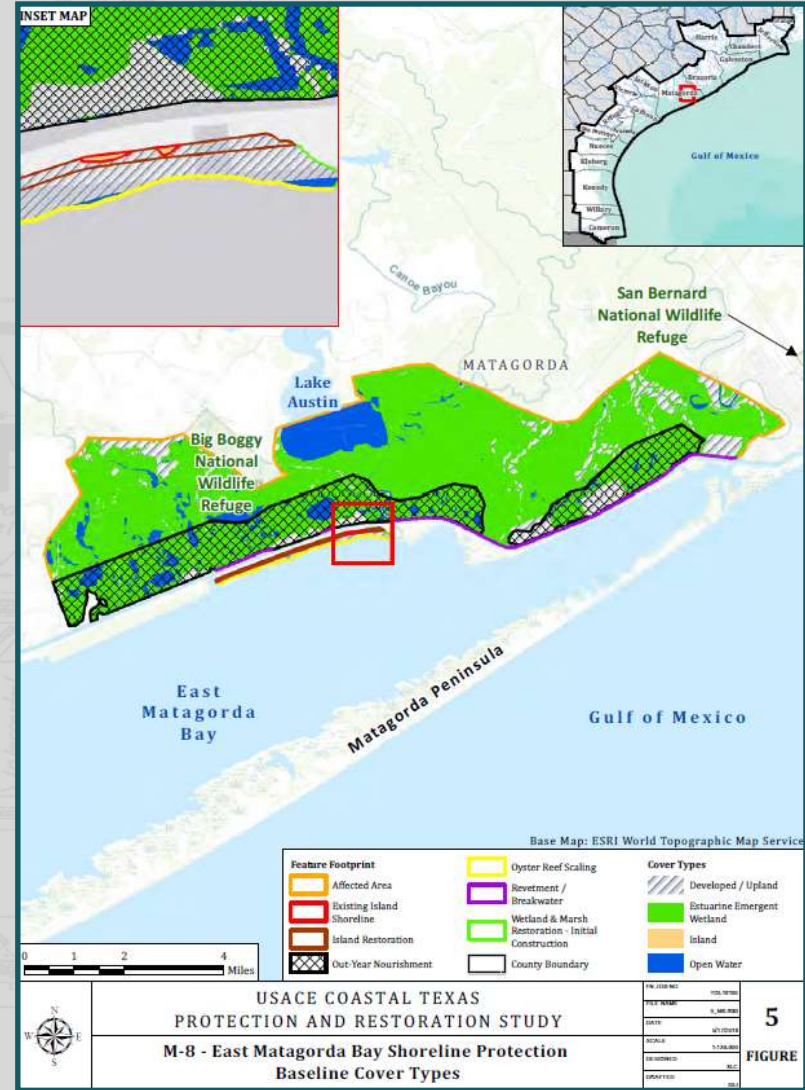


Draft Specifications



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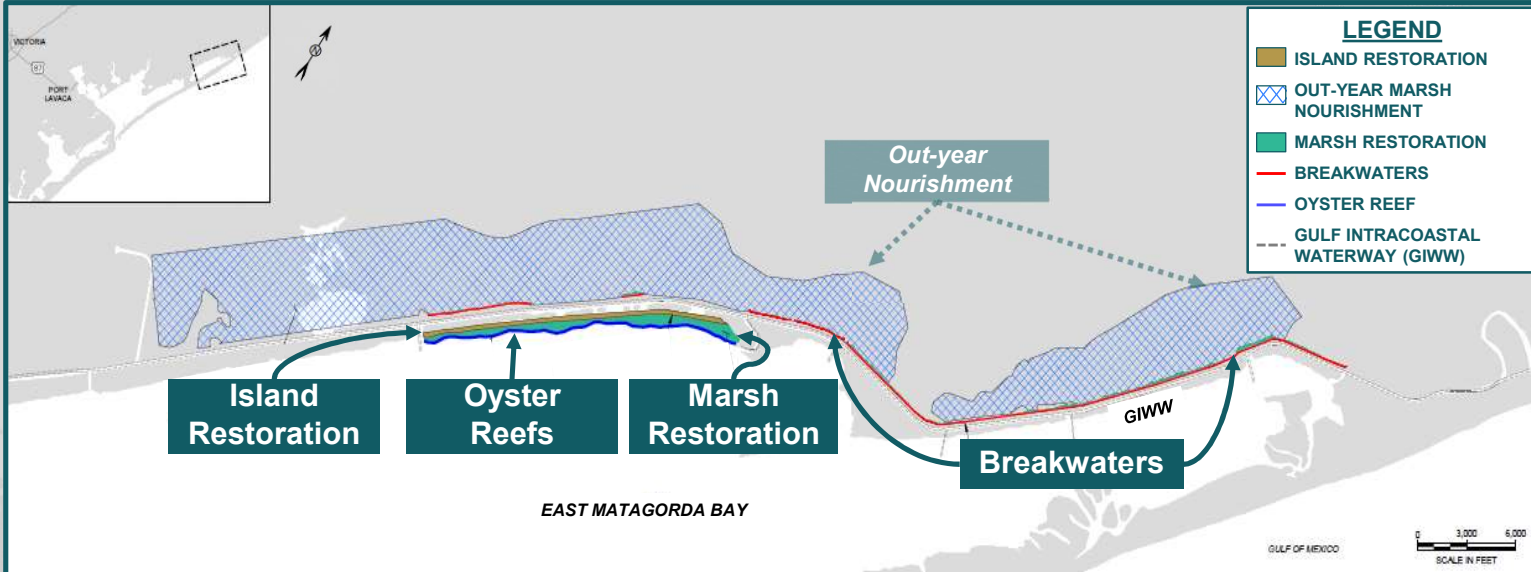
M8 - EAST MATAGORDA BAY SHORELINE PROTECTION





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M8 - EAST MATAGORDA BAY SHORELINE PROTECTION



DESIGN CONCEPTS:

- Place breakwaters first
- Slotted to allow hydrologic exchange
- Adaptive out-year nourishments to maintain heights with RSLR (not in recommended plan)
- Culch placed within reef template – final elevation and slopes TBD

Breakwaters: 8.9 miles

Alignment: Along unprotected segments of the GIWW, along the Big Boggy NWR shoreline, and eastward of the end of East Matagorda Bay (not where the GIWW is stabilized adjacent to PAs)

Target Height: +7ft **Target Width:** 46ft

Slope: 2H:1V **Material Qty:** ~634K tons

Primary Sourcing: Commercial sources

Marshes: 239 acres

Alignment: Behind breakwaters

Target Height: +2ft **Target Width:** Varies

Slope: 5H:1V **Material Qty:** ~670,000cy

Primary Sourcing: CO River Diversion Delta, GIWW BUDM and/or mining, Paleo Colorado/Brazos Deltas

Islands: 92.7 acres (3.5 miles)

Alignment: South of GIWW in West Bay

Target Height: +9ft **Target Width:** 400-600ft

Slope: 5H:1V **Material Qty:** 2mcy

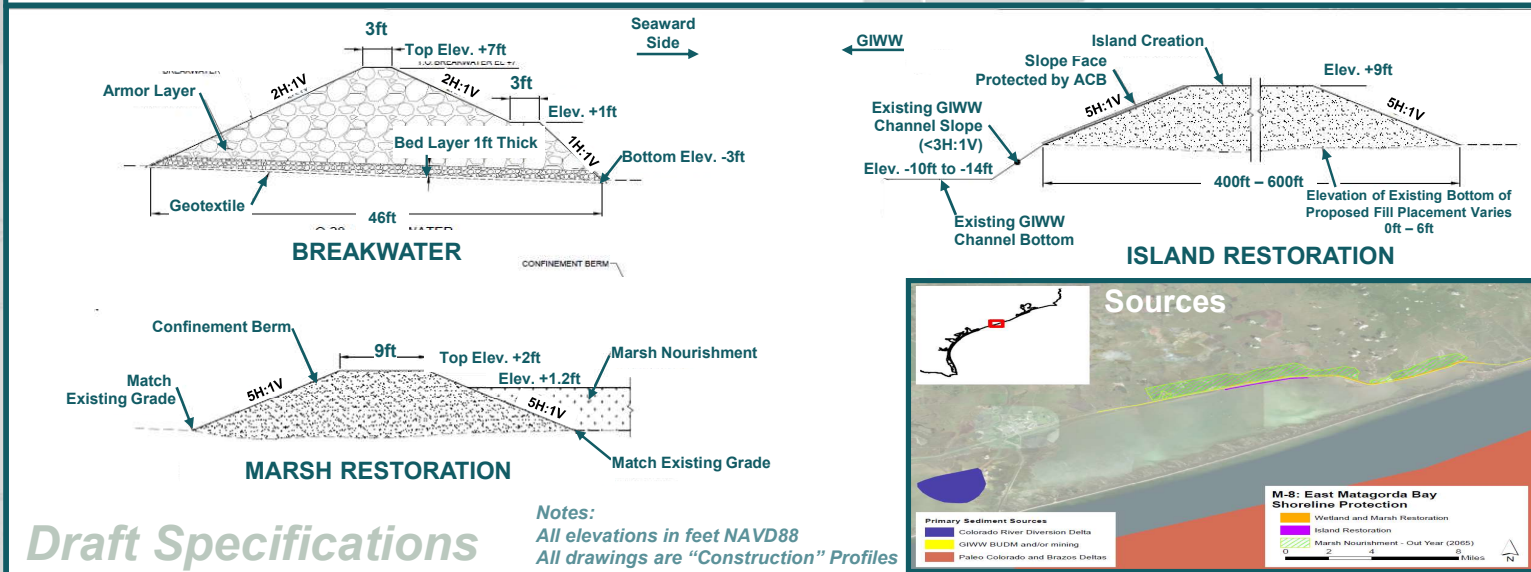
Primary Sourcing: Dredging

Oyster Reefs: 31,355 linear ft

Alignment: bayside of channel

Benefits: 144 Net AAHUs

Cost: \$150K - \$210K (w/o out-yr nourishments)

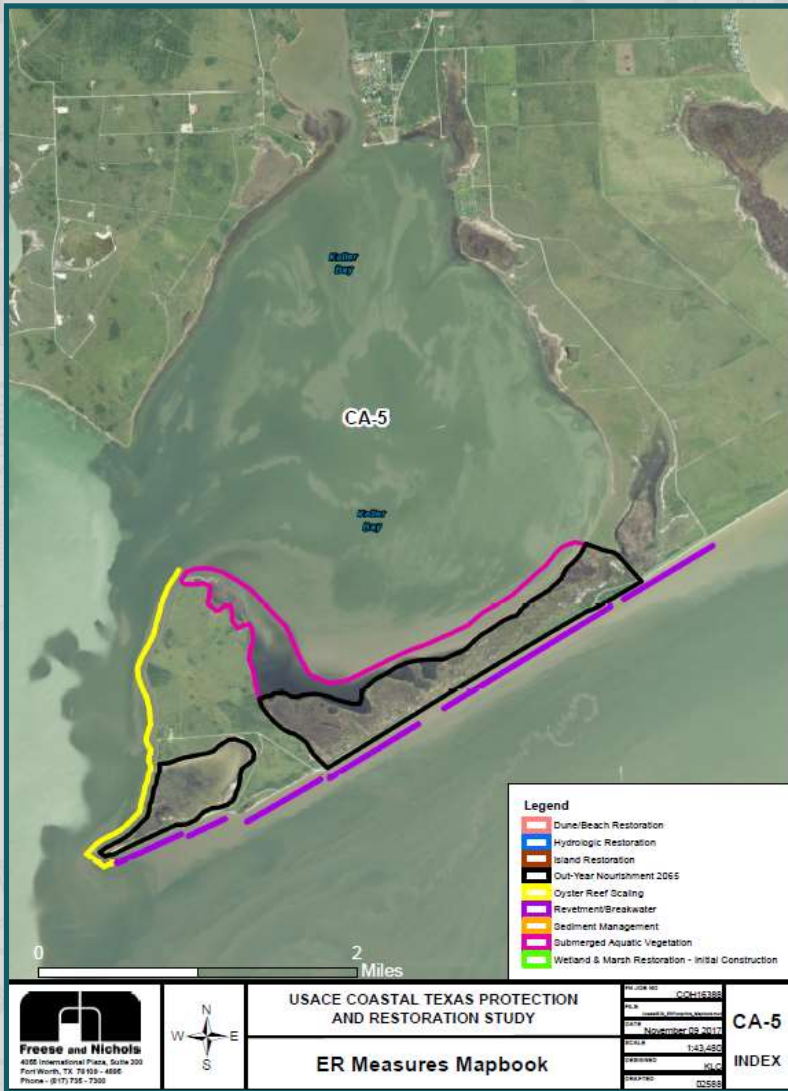


Draft Specifications



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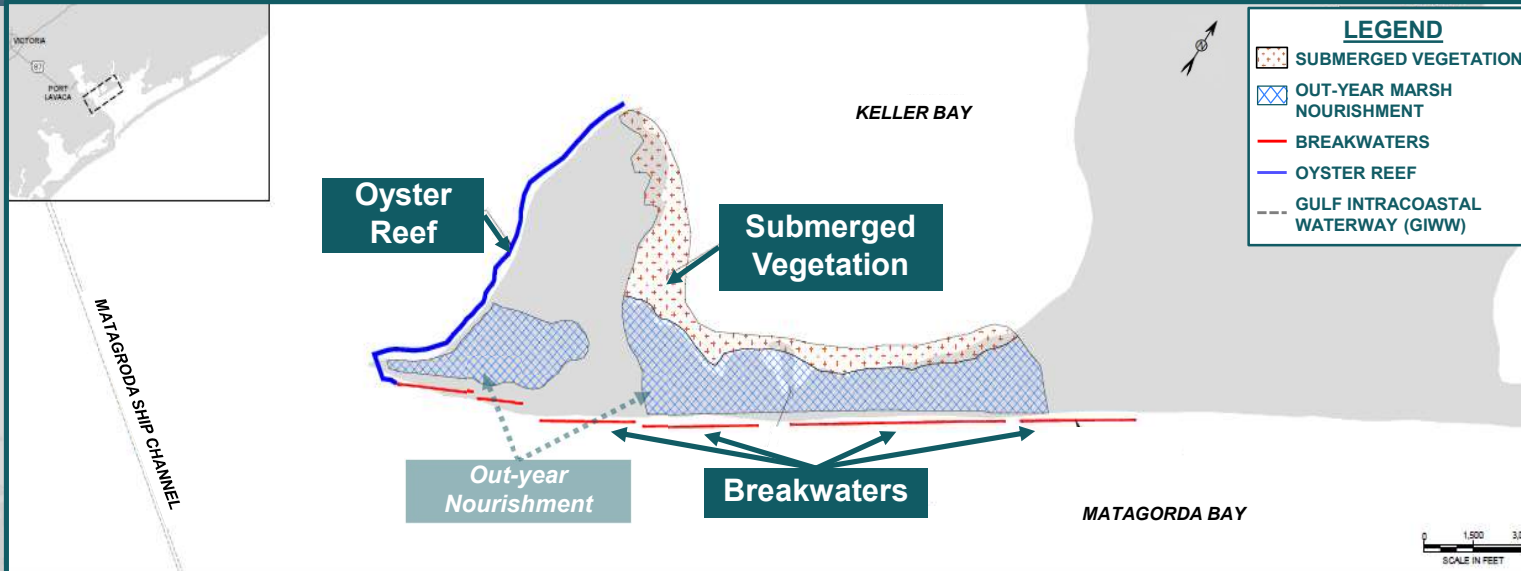
CA5 – KELLER BAY RESTORATION





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CA5 – KELLER BAY RESTORATION



DESIGN CONCEPTS:

- Place breakwaters first
- Slotted to allow hydrologic exchange
- Adaptive out-year nourishments to maintain heights with RSLR (not in recommended plan)
- Culch placed within reef template – final elevation and slopes TBD

Breakwaters: 3.8 miles

Alignment: Along Matagorda Bay side

Target Height: +7ft **Target Width:** 46ft

Slope: 2H:1V

Material Qty: 271K tons

Primary Sourcing: Commercial sources

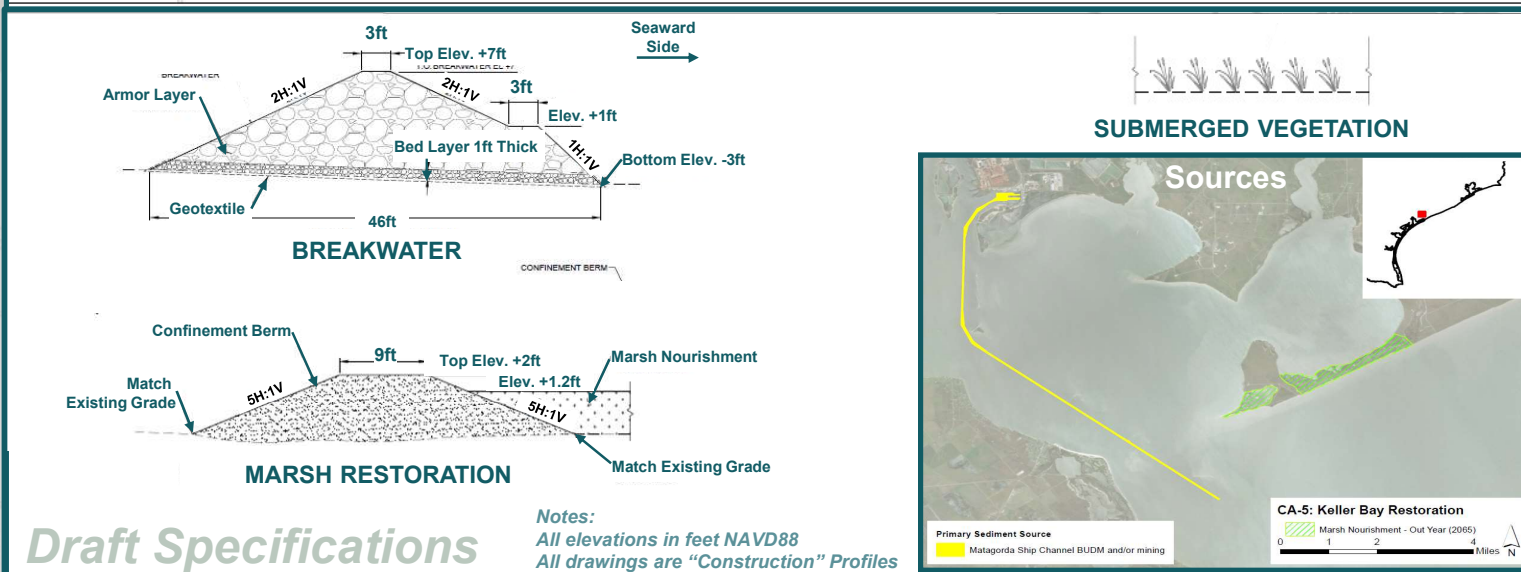
Submerged Vegetation: 296 acres

Configuration: Spacing and plant types TBD

Oyster Reefs: 12,213 linear ft

Benefits: 226 Net AAHUs

Cost: \$47K - \$66K (w/o out-yr nourishments)



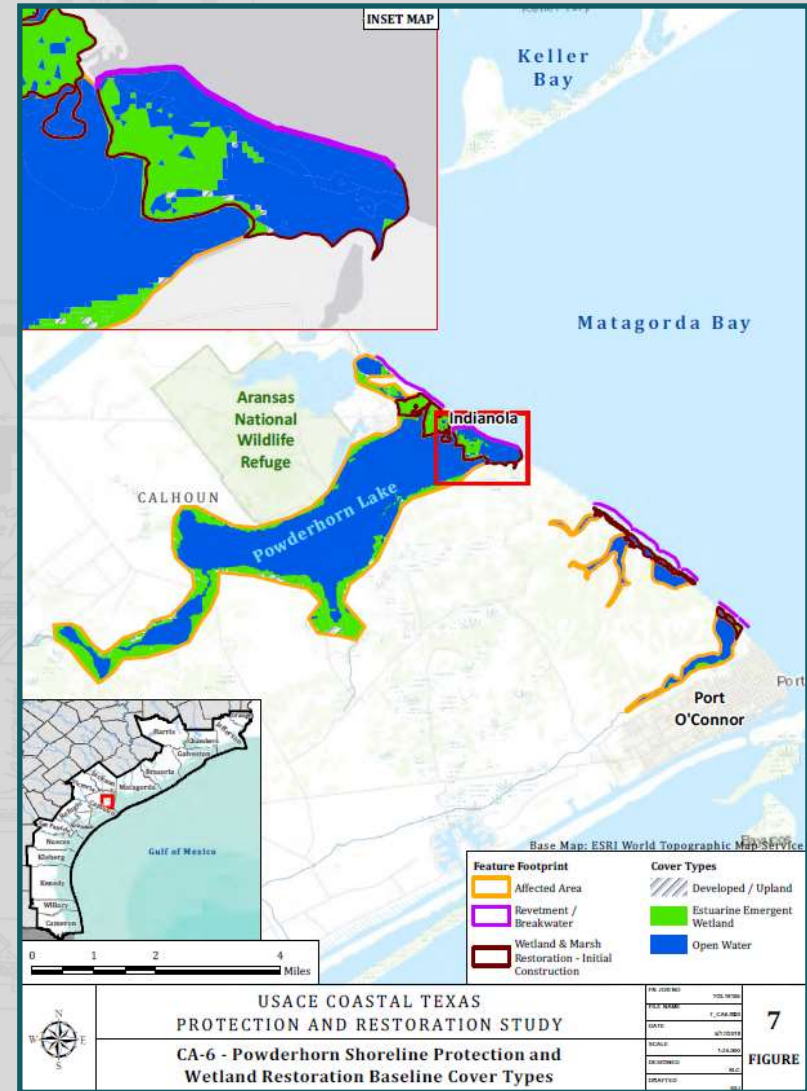
Notes:
All elevations in feet NAVD88
All drawings are "Construction" Profiles

Draft Specifications



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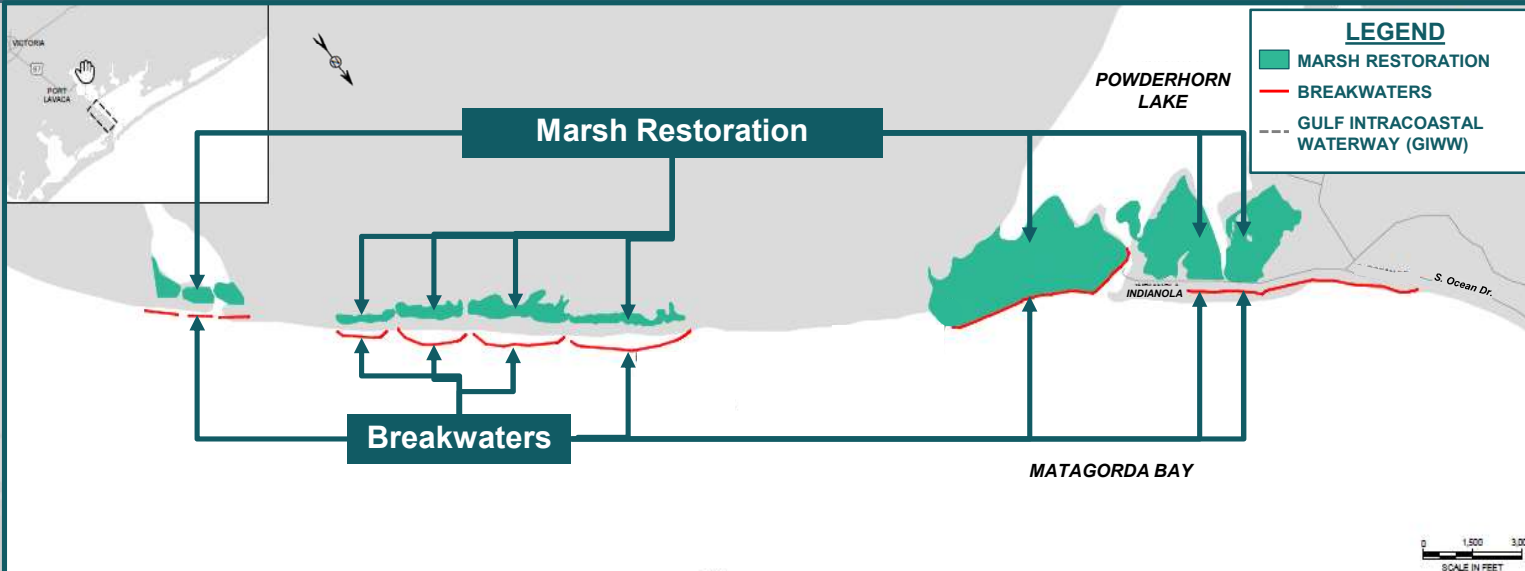
CA6 – MAGNOLIA TO PORT O'CONNOR SHORELINE PROTECTION AND RESTORATION





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CA6 – MAGNOLIA TO PORT O'CONNOR SHORELINE PROTECTION AND RESTORATION



DESIGN CONCEPTS:

- Place breakwaters first
- Slotted to allow hydrologic exchange
- Adaptive out-year nourishments to maintain heights with RSLR (not in recommended plan)
- Culch placed within reef template – final elevation and slopes TBD

Breakwaters: 5 miles

Alignment: For shoreline stabilization fronting portions of Indianola, Powderhorn Lake estuary, and TPWD's Powderhorn Ranch

Target Height: +7ft **Target Width:** 46ft

Slope: 2H:1V **Material Qty's:** 356K tons

Primary Sourcing: Commercial sources

Marshes: 531 acres

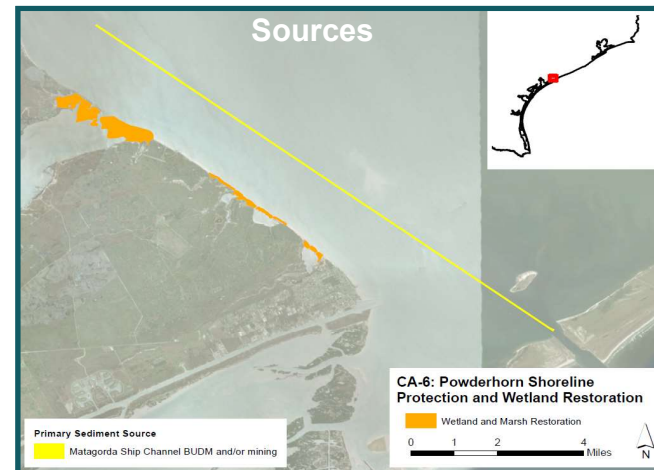
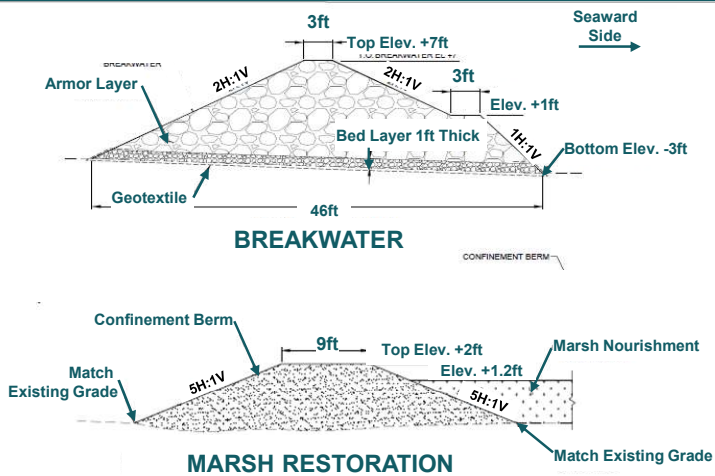
Alignment: Behind breakwaters

Target Height: +2ft **Target Width:** Varies

Slope: 5H:1V **Material Qty's:** ~641,000cy

Primary Sourcing: Matagorda Ship Channel BUDM and/or mining

Draft Specifications



Benefits: 20 Net AAHUs

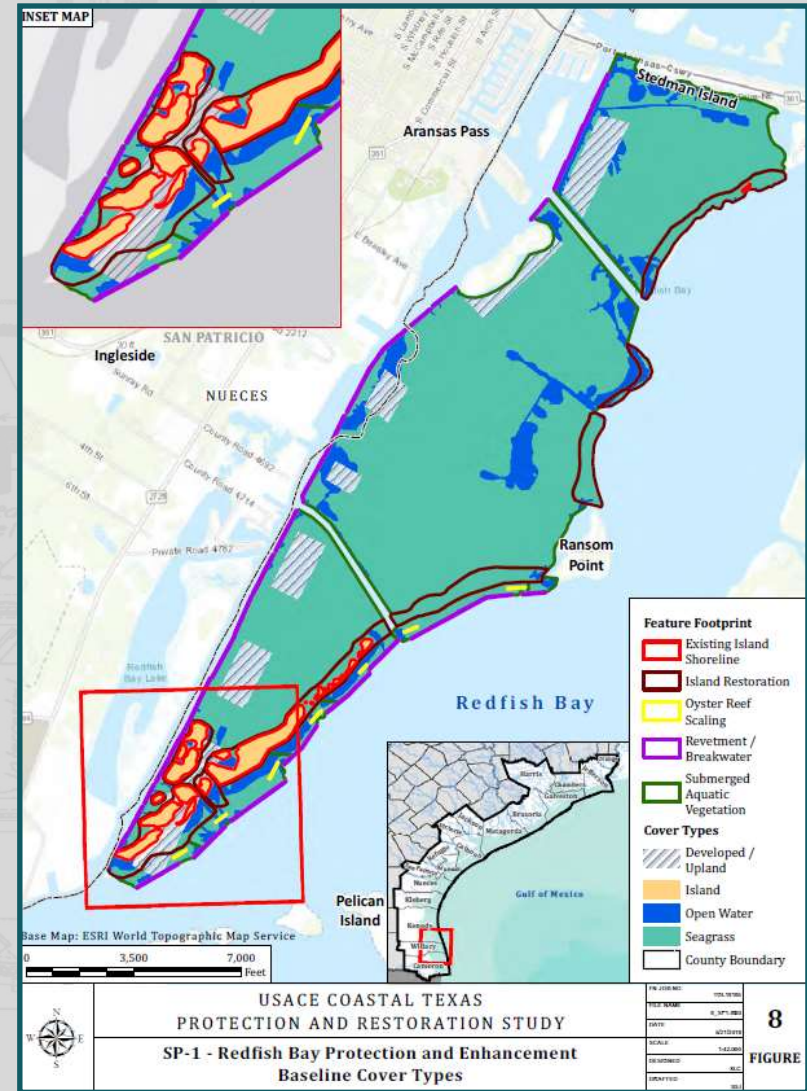
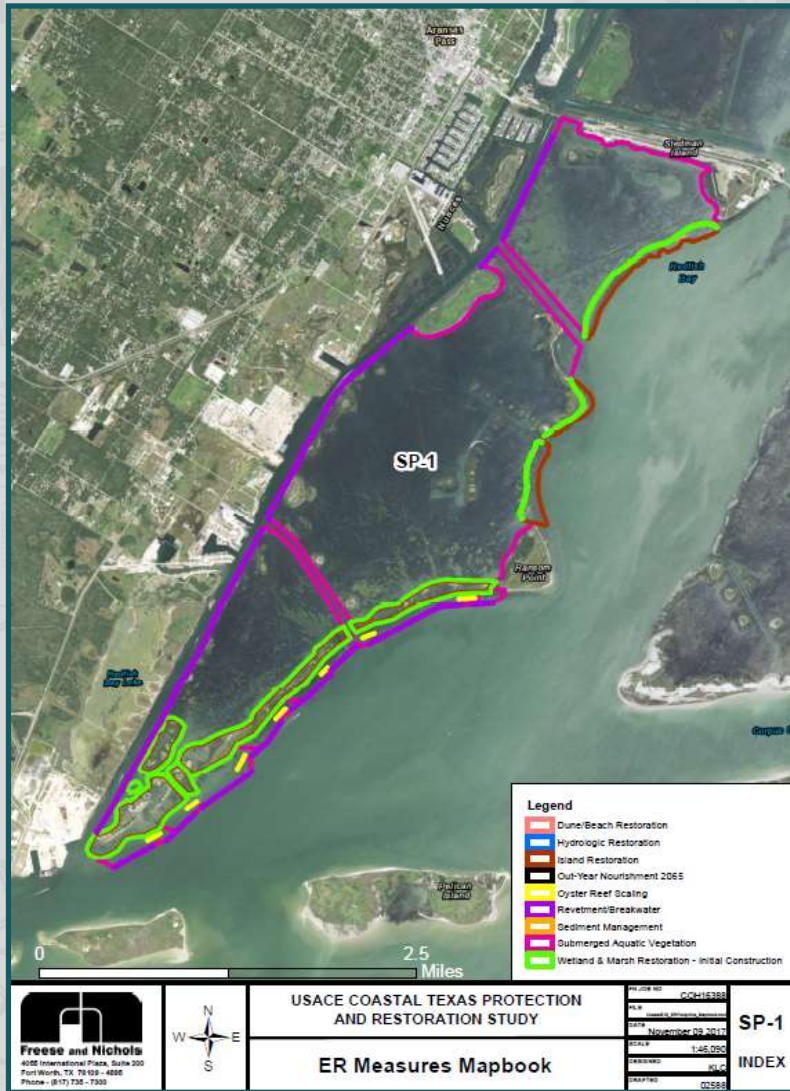
Cost: \$64K - \$88K (w/o out-yr nourishments)

Notes:
All elevations in feet NAVD88
All drawings are "Construction" Profiles



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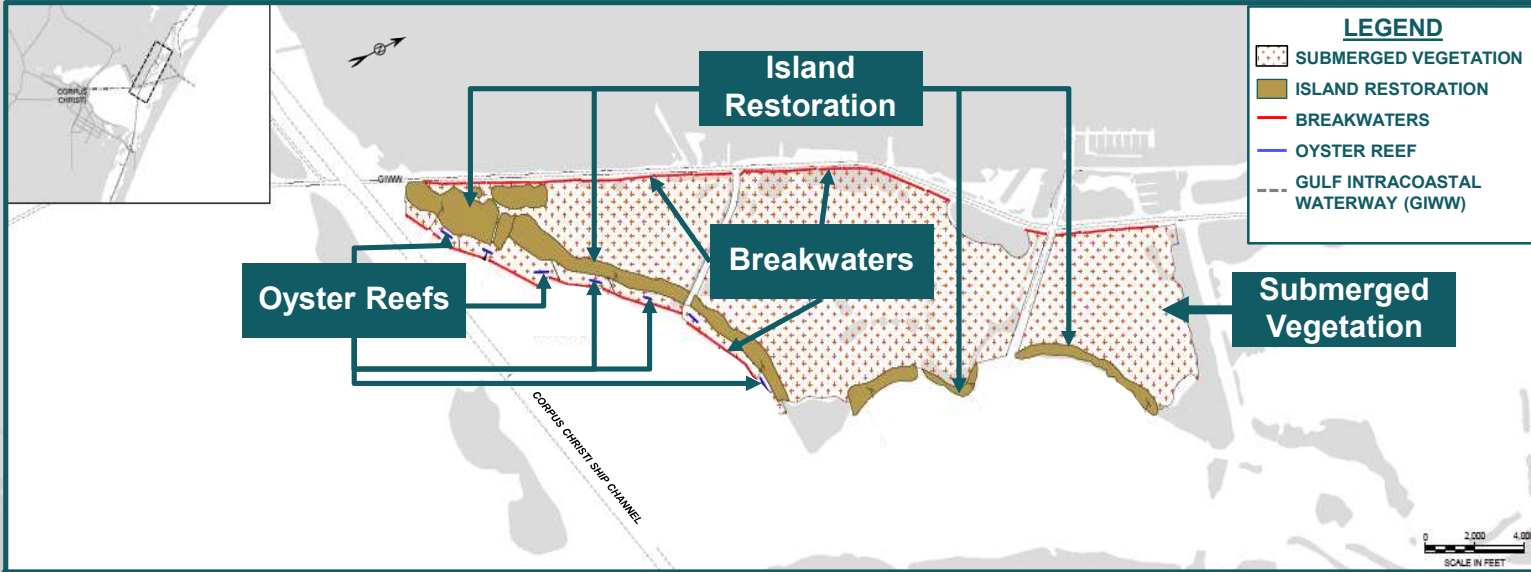
SP1 – REDFISH BAY PROTECTION AND ENHANCEMENT





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SP1 – REDFISH BAY PROTECTION AND ENHANCEMENT

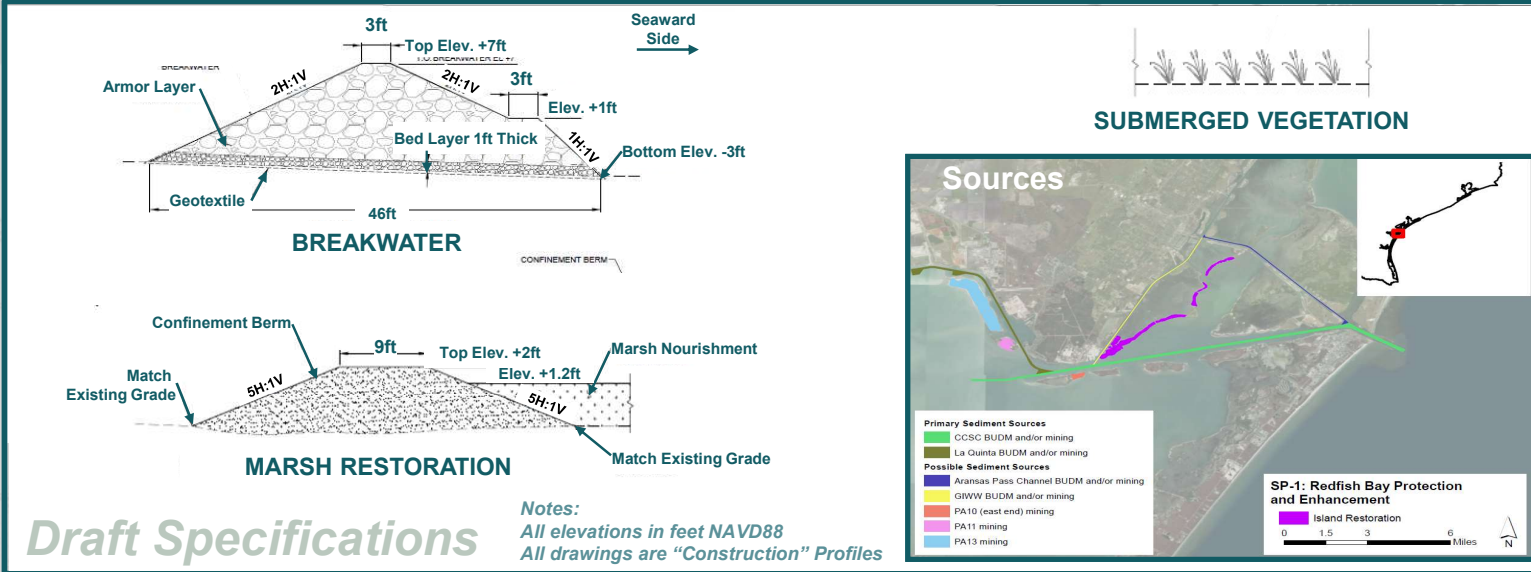


DESIGN CONCEPTS:

- Place breakwaters first
- Slotted to allow hydrologic exchange
- Adaptive out-year nourishments to maintain heights with RSLR (not in recommended plan)
- Culch placed within reef template – final elevation and slopes TBD

Breakwaters: 7.4 miles
Alignment: Along the unprotected GIWW shoreline, along the backside of Redfish Bay, and on the bayside of the restored islands
Target Height: +7ft **Target Width:** 46ft
Slope: 2H:1V **Material Qtys:** 524K tons
Primary Sourcing: Commercial sources

Islands: 391.4 acres
Alignment: South of GIWW in West Bay
Target Height: +9ft **Target Width:** 400-600ft
Slope: 5H:1V **Material Qtys:** 2mcy
Primary Sourcing: Dredgin



Submerged Vegetation: 3,026 acres
Configuration: Spacing and plant types TBD

Oyster Reefs: 7,392 linear ft

Benefits: 3,184 Net AAHUs
Cost: \$274K - \$384K (w/o out-yr nourishments)

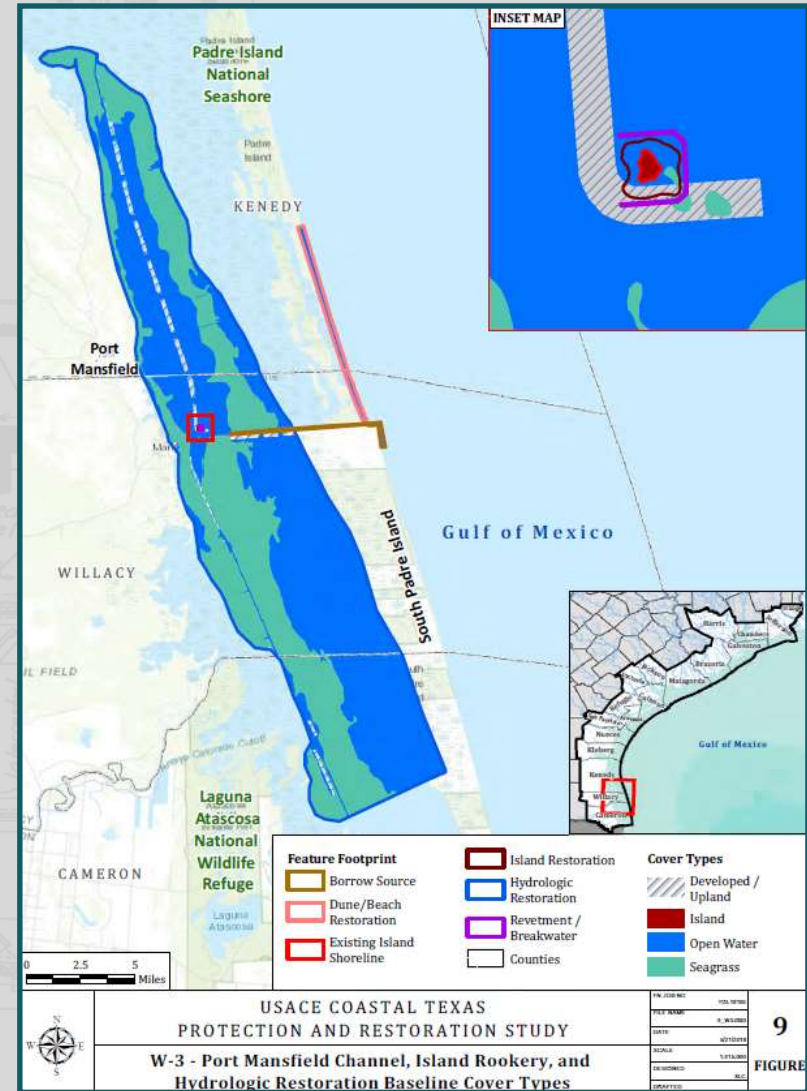
Draft Specifications

Notes: All elevations in feet NAVD88 All drawings are "Construction" Profiles



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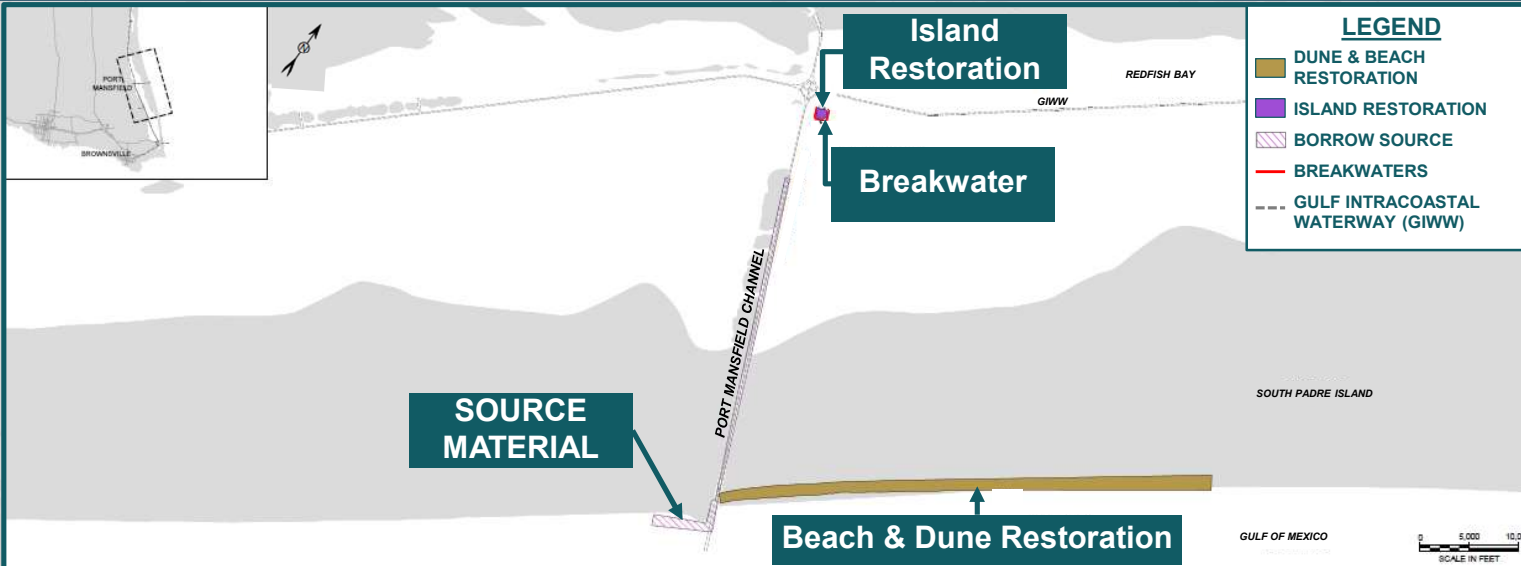
W3 - PORT MANSFIELD CHANNEL AND ISLAND ROOKERY RESTORATION





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W3 - PORT MANSFIELD CHANNEL AND ISLAND ROOKERY RESTORATION



DESIGN CONCEPTS:

- Restore circulation in the Lower Laguna Madre with dredging. The sediment from the dredging will be placed on a bird island and north of the Mansfield Pass jetty.

Beach & Dune Complexes: ~9.5mi

Alignment: Current dune line on the ocean-side of island/peninsula

Target Dune Height: 10-12ft

Target Dune Width: 150ft

Target Beach Width: 550-600ft

Slope: 10H:1V

Material Quantities: TBD

Primary Sourcing: TBD

Breakwaters: 0.70 miles

Alignment: Surrounding bird island

Target Height: +7ft **Target Width:** 46ft

Slope: 2H:1V

Material Qtys: 46.7K tons

Primary Sourcing: Commercial sources

Islands: 27.8 acres

Alignment: South of GIWW in West Bay

Target Height: +9ft **Target Width:** 400-600ft

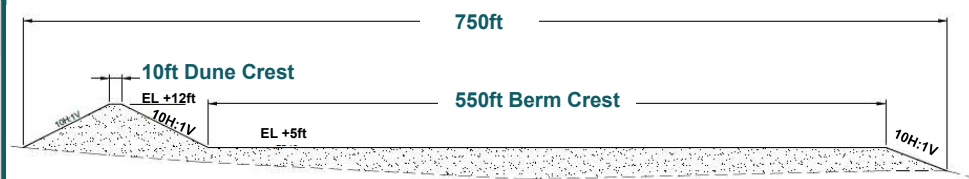
Slope: 5H:1V

Material Qtys: 488K cy

Primary Sourcing: Port Mansfield Channel

Benefits: 89 Net AAHUs

Cost: \$36K - \$50K (w/o out-yr nourishments)



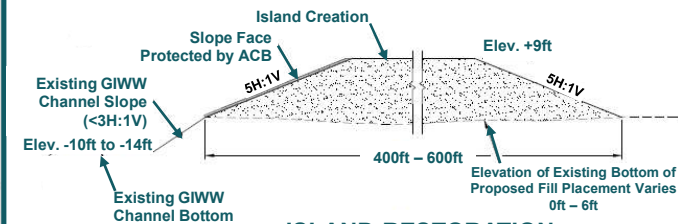
BEACH & DUNE RESTORATION

Draft Specifications

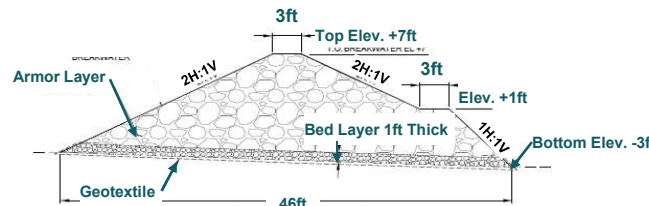
Notes:

All elevations in feet NAVD88

All drawings are "Construction" Profiles



ISLAND RESTORATION



BREAKWATER

STUDY UPDATE: HOW DID WE GET HERE?



ALT A: COASTAL BARRIER



ALT B: MODIFIED BARRIER (TX CITY)



ALT C: MID-BAY BARRIER



ALT D1: UPPER BAY (SH 146)



ALT D2: BAY RIM



PROJECT COSTS

IS IT WORTH IT?



The NED/NER Plan must balance:

- ✓ Engineering soundness
 - ✓ Environmental acceptability
 - ✓ Economically justifications
- Unity: Benefits Equal Cost
 - Benefits include quantitative, qualitative, monetized & non-monetized units
 - Locally Preferred Plan (LPP) is a plan that is preferred by the non-Federal sponsor over the NED/NER plan, and is sometimes recommended for project authorization instead (with caveats)
 - LPPs must be evaluated just as the Federal Plan (costs, impacts, benefits)

Projected Costs

Coastal Barrier:	\$14.2B-\$19.9B
Ecosys. Restoration:	\$8.9B-11.9B
South Padre CSRM:	<u>\$71.6-\$83.1M</u>
TOTAL:	\$23B - \$32B



Recovery Costs for Past Storms:

Hurricane Ike (2008):	\$38B
Hurricane Harvey (2017):	\$125B