

# Lessons Learned from Coastal Beneficial Use Features in Galveston Bay and Application to Engineering With Nature (EWN)

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1:45-2:15 pm, Tuesday, June 23, 2015



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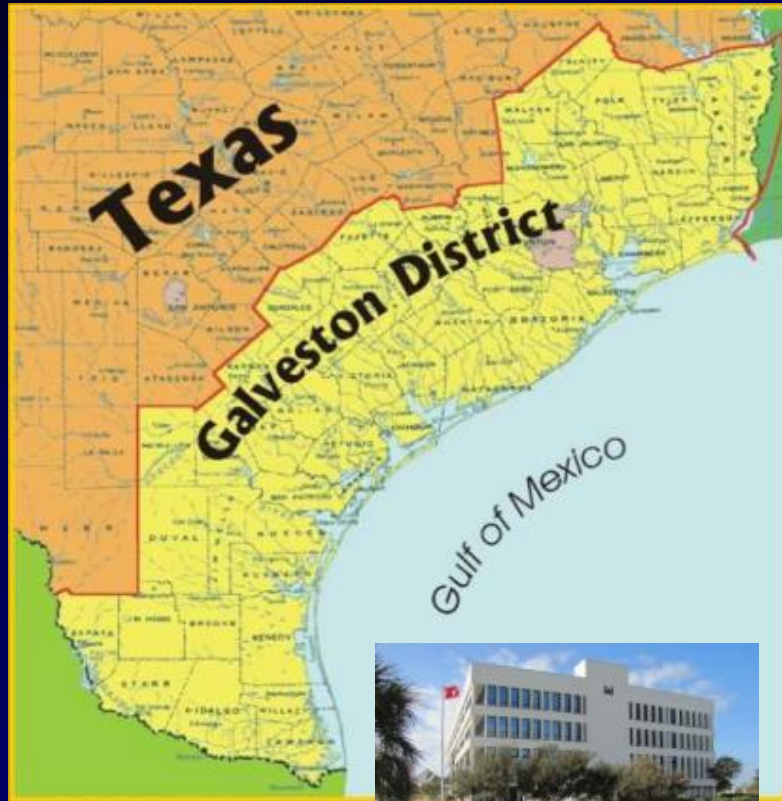
# Outline

- Galveston District Navigation-related Dredging Overview
- Beneficial Use (BU) of Dredged Materials (DM)  
Example: Houston-Galveston Navigation Channel
- Form Follows Function and Other Nature-based Performance Criteria
- Lessons Learned and Application to EWN
- Future BU Opportunities





# USACE Galveston District



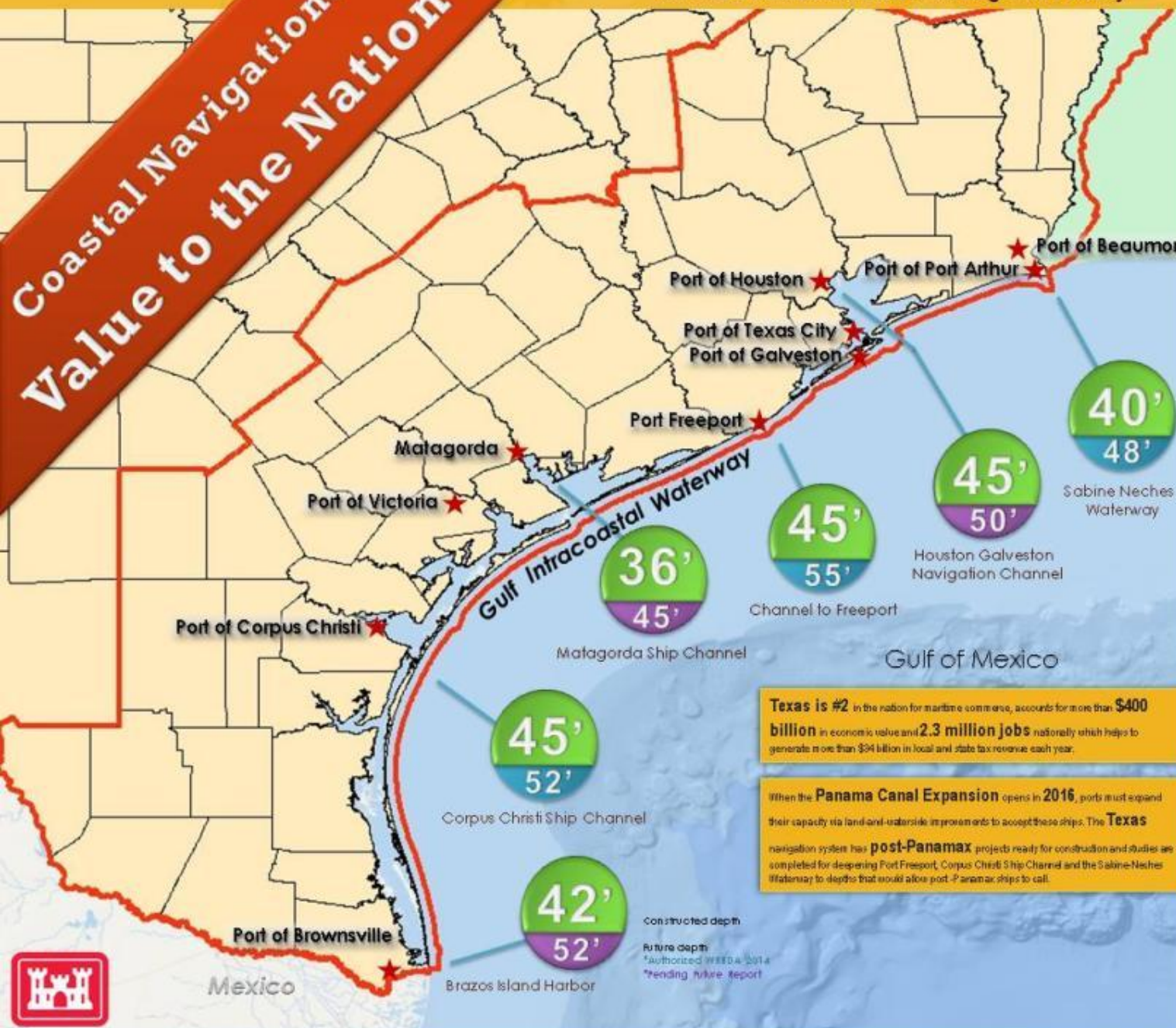
- 50,000 square mile district boundary encompassing the Texas coast
- 28 ports handling 400 million tons of commerce annually
- 1,000+ miles of channels
  - 750 miles shallow draft
  - 270 miles of deep draft
- 700 miles of coastline
- 30 to 40 million cubic yards of material dredged annually
- 16 Congressional districts
- 48 Texas counties
- 18 Coastal counties-bay/estuaries
- 9 watersheds
- 2 Louisiana parishes



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# USACE Southwestern Division Regional Priority

**Coastal Navigation:  
Value to the Nation**



## LEADING U.S. PORTS (2012 Tonnage)

**Houston (#2 – 238.2 million tons)**  
#1 Importing Port & #2 Total Tonnage

**Beaumont (#5 – 78.5 million tons)**  
#1 Military Outload Port in the World

**Gulf Intracoastal Waterway (73 million tons – Texas portion)**  
#3 Inland Waterway

**Corpus Christi (#7 – 69 million tons)**  
America's Energy Port

**Texas City (#11 – 56.7 million tons)**  
Services Largest Petrochemical Complex

**Port Arthur (#23 – 30.6 million tons)**  
Vital Strategic Port

**Freeport (#31 – 22.1 million tons)**  
World Class LNG Facility

**Galveston (#47 – 11.6 million tons)**  
#5 Cruise Ship Port

**Matagorda to include Port of Port Lavaca and Port of Point Comfort (#48 – 11.6 million tons)**  
Generates Annual Business Revenues of Nearly \$2 Billion

**Brownsville (#69 – 5.6 million tons)**  
#1 Ship Recycling Port

**Victoria (#78 – 4.5 million tons)**  
#2 Shallow-Draft Port for Domestic Crude Petroleum

**Texas is #2** in the nation for maritime commerce, accounts for more than **\$400 billion** in economic value and **2.3 million jobs** nationally which helps to generate more than **\$34 billion** in local and state tax revenue each year.

When the **Panama Canal Expansion** opens in **2016**, ports must expand their capacity via land and water-side improvements to accept these ships. The **Texas** navigation system has **post-Panamax** projects ready for construction and studies are completed for deepening Port Freeport, Corpus Christi Ship Channel and the Sabine-Naches Waterway to depths that would allow post-Panamax ships to call.

constructed depth  
future depth  
\*Authorized WFOA 2014  
\*tending future report





# Houston-Galveston Navigation Channel (HGNC) Complex



- The latest 45 ft x 530 ft channel improvement project performed 1998-2005
- 100+ MCY dredged
- \$500M+ channel improvement cost
- Collaborators:
  - Port of Houston Authority (PHA)
  - Inter-agency Coordination Team (ICT)
  - Beneficial Uses Group (BUG)



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# HGNC BU Example

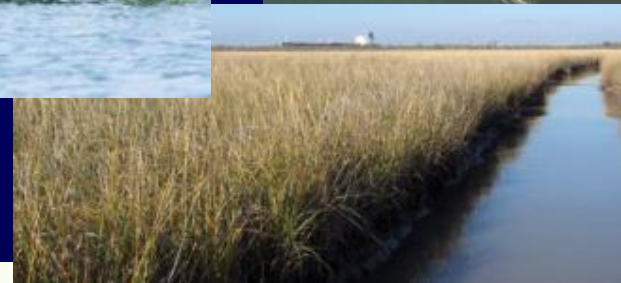
- Channel improvement project was outstanding opportunity to restore some marsh losses in Galveston Bay
- 4250 ac marsh planned at Atkinson, Mid Bay, and Bolivar
- Created over 2,800 ac of marsh and 6-ac bird habitat at Evia Island
- Environmental restoration costs ~ \$130 M at FY 15 price level
- Deferred environmental costs (post FY 07) ~ \$80 M





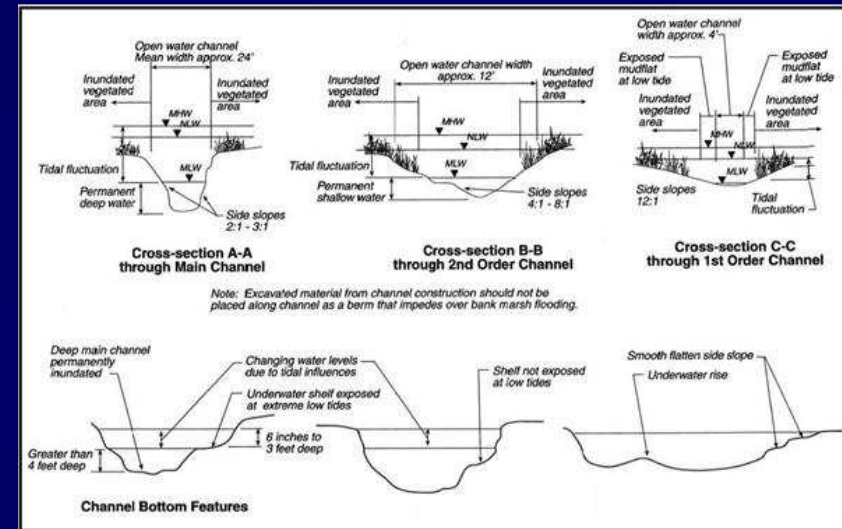
# Atkinson Island: Demo Marsh and Scaling Up BU

- Took performance criteria from reference marshes and other natural bay processes
- Set physical and biological design goals
- Engineered Placement Area (PA) dike cells
- Filled to establish a target elevation
- Achieved tidal exchange and circulation
- 1530 ac planned, 1842 ac at future completion of construction



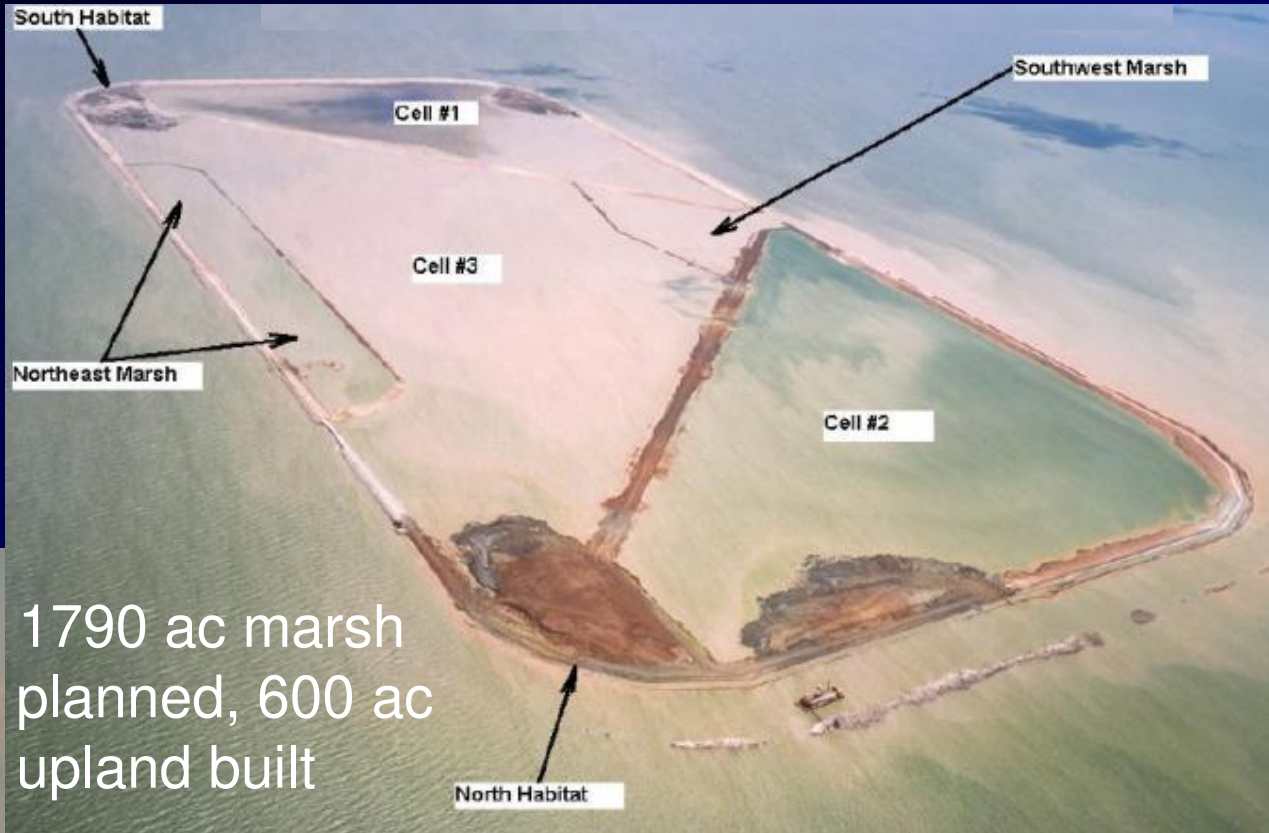
# Integrating Natural Systems and Processes with Engineered Features

- Tidal exchange, marsh flushing, related to energy and influenced by range physical attributes
- Targets
  - Adequate circulation through entire marsh
  - Create adequate edge
  - DM placement and incorporation of design features to achieve essential functions





# MidBay Island Site Construction and BU Challenges



- Initially a marsh and upland combination
- Became overfilled during a placement event
- Now valued mid bay upland habitat, resilient against sea level rise
- Increased size of Bolivar marsh creation as mitigation

# EWN HGNC BU Experience at Evia Island

- Mixture of scrub-shrub and wetland habitats for refuge and nesting
- Incorporation of quiescent lagoon with tidal flushing for foraging and rearing
- Creation of channelized perimeter fish habitat
- Rock armor provides algal substrate and crustacean habitat



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# EWN HGNC BU Experience at Evia Island (cont)

- Has become a diverse habitat in middle of an otherwise open water area with relatively less fish & wildlife activity
- National Marine Fisheries Service documented proof of ecosystem benefits and local community economic benefits



# EWN HGNC BU Experience at Bolivar Marsh

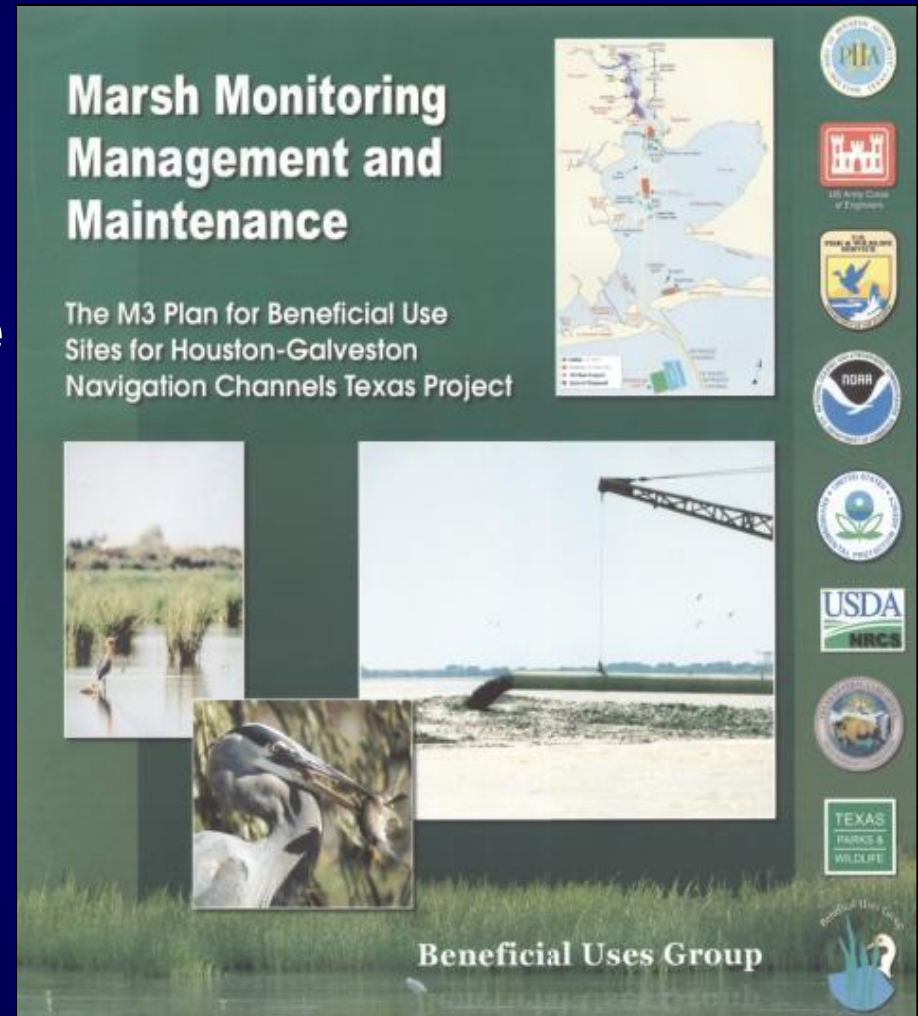
- Built with adapted channelization design
- 930 ac planned
- Actual:
  - 790 ac marsh
  - 200 ac pimple mounds





# Lessons Learned

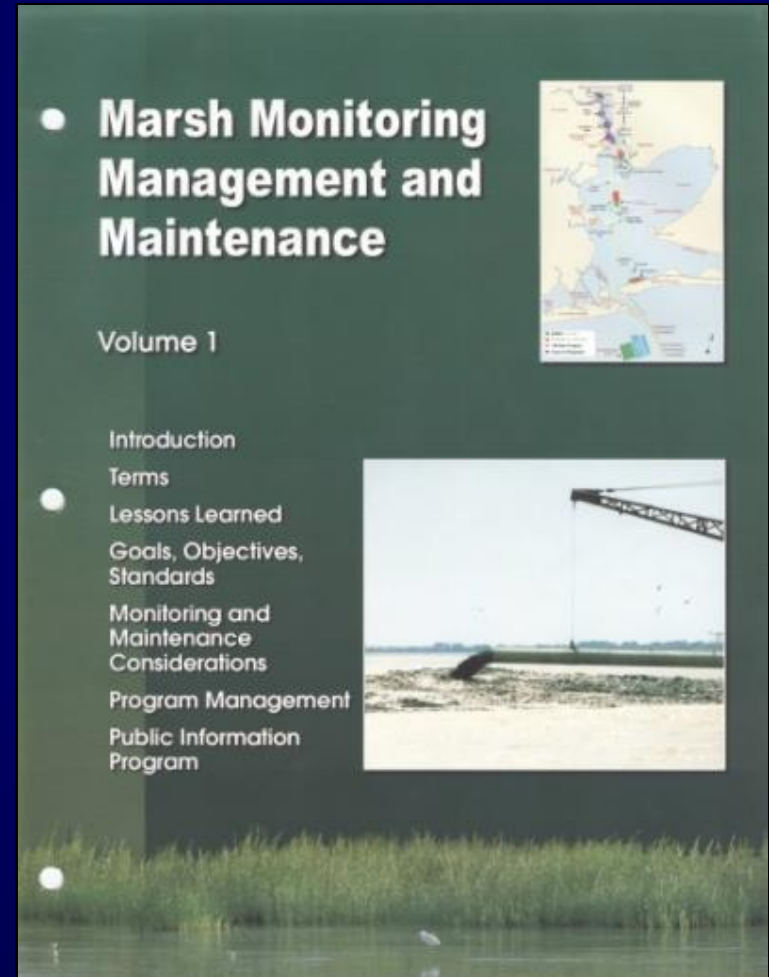
- Respond to local needs
- Engage stakeholders early and often for collaboration
- Form a team and assemble technical / social / economic experts
- Meet monthly as an overall team
- Meet weekly as sub-committees



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# Lessons Learned (cont)

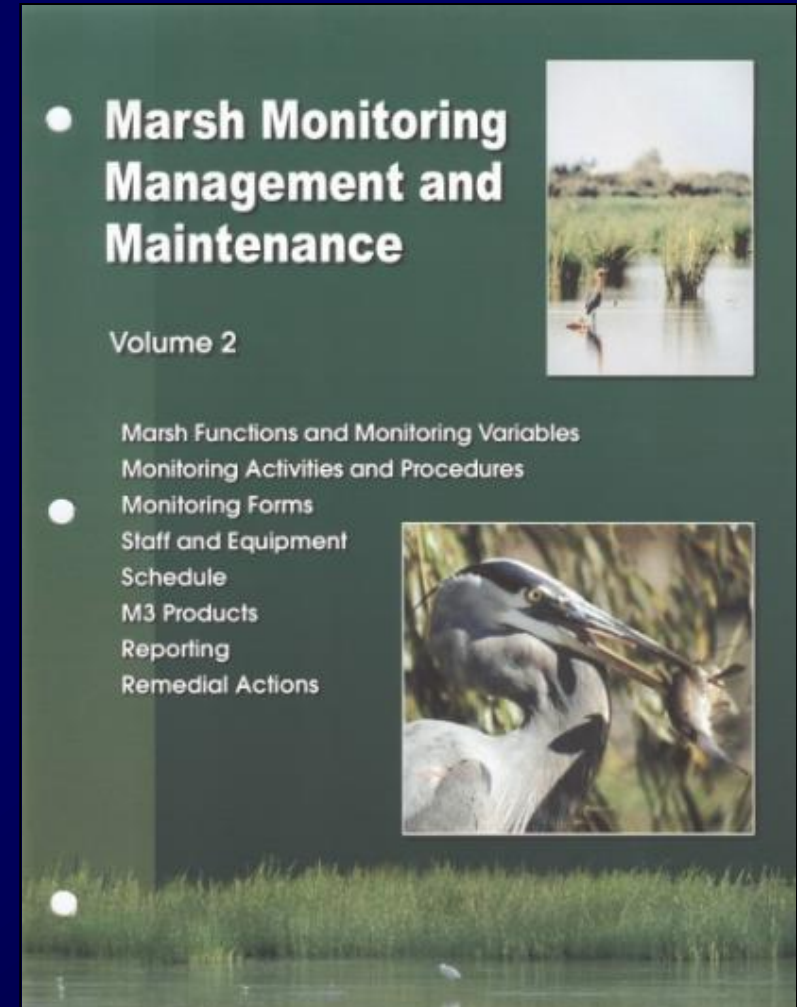
- Establish goals, objectives, performance criteria
- Develop a regional (bay-wide) plan
- Develop detailed habitat creation plans and supporting engineering and placement plans
- Conduct site surveys, sediment characterization studies, and settlement predictions





# Lessons Learned (cont)

- Undertake construction and be adaptable to changes
- Advance performance monitoring and reporting
- Continued local communication and financial planning is critical



# Future Potential Opportunities: Increase Scientific Understanding

- Performance of BU placement configurations
  - Mounds with edges
  - Marsh with edges
  - Contribution to coastal resilience (wider island)
  - Value of upland habitat and perched wetlands
- Communication of scientific findings to interested and affected parties for understanding and buy-in

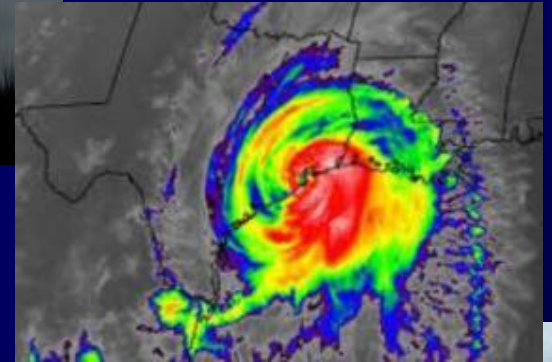


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# Future Potential Opportunities: Broaden the Regional Benefits

- Harvest and reuse materials from Confined Disposal Facilities (CDF) as a strategy for long-term PA sustainability
- Create natural and nature based elements via BUDM to promote:
  - Bay bottom restoration
  - Coastal resiliency
  - Recreation
  - Commercial fisheries



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# Future Potential Opportunities: Integrated Coastal Protection and Restoration

- Evolve science to close priority knowledge gaps via “Co-Development” between R&D and USACE district practice:
  - Engineering with Nature
  - Regional Sediment Management
  - Conservation Planning
- Transform practice for increased efficiency and effectiveness:
  - Pilot demo field test / refine innovative solutions
  - Deploy ready enabling technologies
  - Integrate / apply enterprise tools for leap-ahead decision support capabilities



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# Acknowledgements

- PHA
- BUG
- ICT
- Houston Audubon Society
- USACE SWG Project Delivery Team (PDT)



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