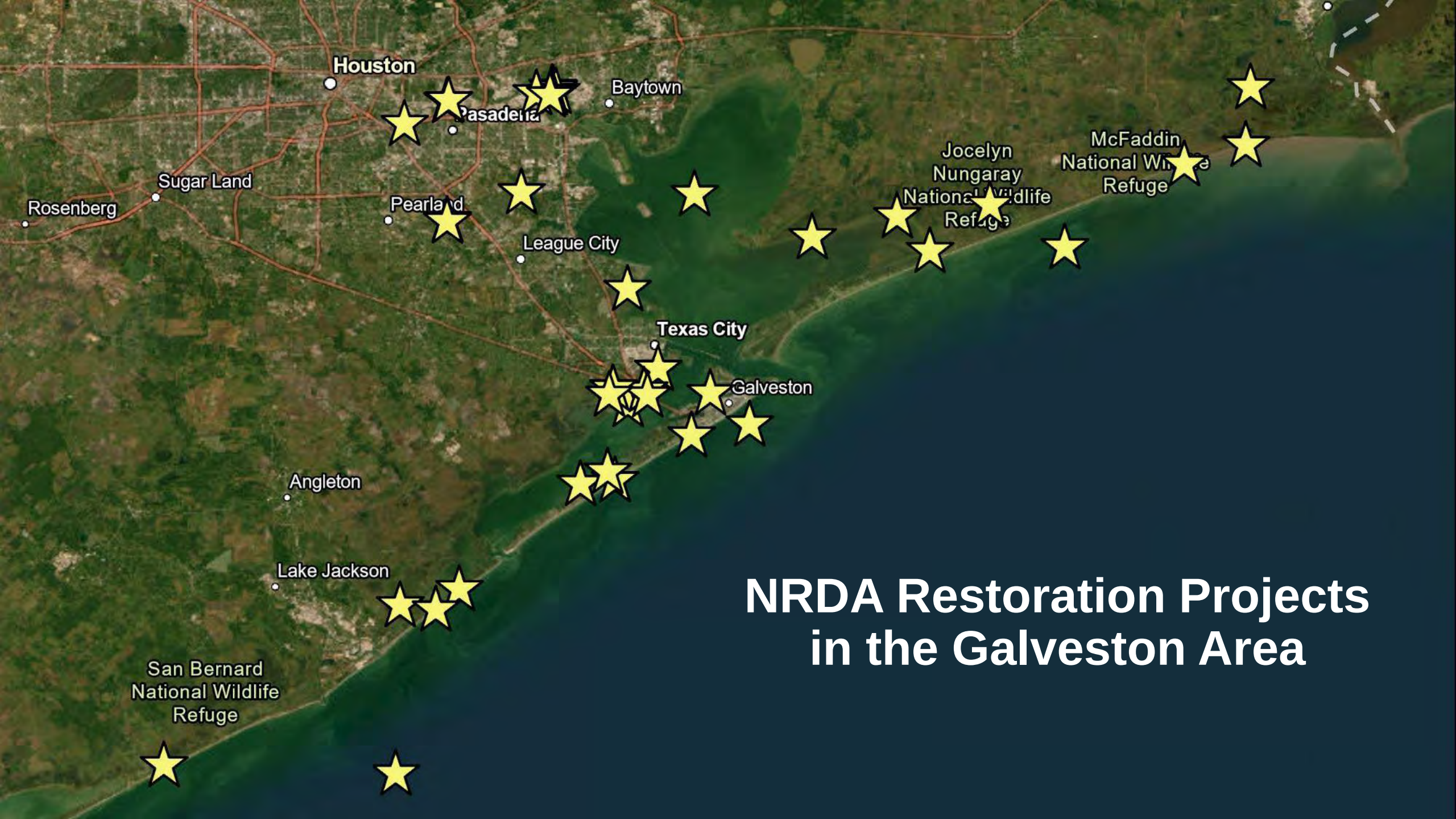
Natural Resource Damage Assessment (NRDA) and Restoration in Galveston Bay

Mike Cave
Natural Resource Trustee Program
Texas Commission on Environmental Quality

NRDA Restoration in Texas





NRDA Restoration Projects in the Galveston Area

Texas Natural Resource Trustees

State Trustees:

- Texas Commission on Environmental Quality
- Texas Parks and Wildlife Department
- Texas General Land Office

Federal Trustees:

- National Oceanic and Atmospheric Administration (Department of Commerce)
- U.S. Fish and Wildlife Service (Department of the Interior)

Getting to Restoration via a Natural Resources Damage Assessment

One Large Spill -> Multiple Projects
Marsh Restoration in Galveston Bay

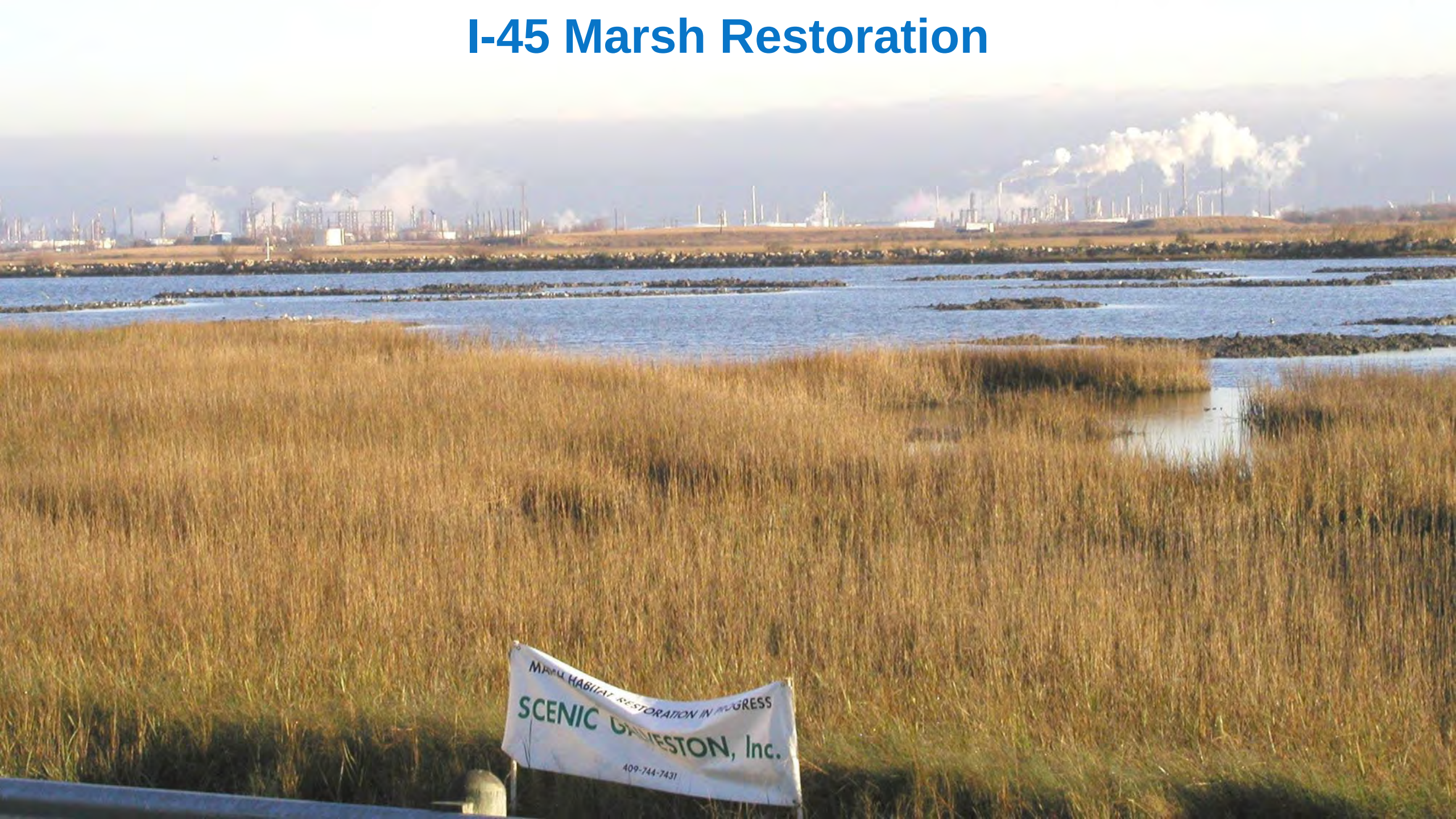
Apex Barges – Ship collision in the Houston Ship Channel resulting in a spill of catalytic feedstock oil

Pierce Marsh Restoration

Galveston Island State Park Marsh Restoration

San Jacinto State Park Marsh Restoration

I-45 Marsh Restoration



Multiple Spills -> One Project
Baytown Nature Center Wetlands

- **French Limited Superfund Site** – Contaminated waste carried by flood waters into Galveston Bay Estuary
- **San Jacinto River Spill** – Gasoline and diesel spill and fire in the San Jacinto River
- **Greens Bayou Release** – Hazardous substances including DDT released to Greens Bayou

Baytown Nature Center Wetlands

Baytown Nature Center Wetlands

Deepwater Horizon Oil Spill Restoration

NOAA Gulf Spill Restoration Website: Texas Restoration Area
https://www.gulfspillrestoration.noaa.gov/restoration-areas/texas

Follets Island Habitat Acquisition

Galveston Island Habitat Acquisition

Galveston Island State Park Beach Redevelopment

Deepwater Horizon NRDA
Texas Restoration Area

Deepwater Horizon

Natural Resource Damage Assessment & Restoration

Texas Trustee Implementation Group
2026 Annual Public Meeting

Photo: Biba, TPWD 2025

Thank you!

nrtp@tceq.texas.gov

Texas NRDA Restoration Projects Storymap

NOAA Gulf Spill Restoration Texas Restoration Area

Sea Turtle Restoration on the Upper Texas Coast:
Nesting, Rescue, Recovery, Rehabilitation & Habitat Restoration

Christopher D. Marshall, Ph.D.
Director Gulf Center for Sea Turtle Research
Regents Professor of Marine Biology
Department of Marine Biology
Texas A&M University at Galveston

Theresa L. Morris
Program Coordinator, Hospital Manager

Paige M. Breon
Nesting Program Assistant

Gina M. Corning
Rescue & Recovery Program Assistant

Carolyn M. Pope
Marine Debris, Habitat Restoration Program Assistant

GULF CENTER FOR SEA TURTLE RESEARCH

TEXAS A&M UNIVERSITY
GALVESTON CAMPUS

Why Sea Turtles?

We live in a coastal community

- Desire for resilient & sustainable coastal communities
- Promotes stability, quality of life & livelihoods
  - Blue economy requires healthy oceans
  - Sea turtles are a source for ecotourism

Indicators of Ocean Health

- Presence indicates healthy habitats & resilience
  - Promote healthy seagrasses
    - Nurseries of commercially & recreationally important fishes
  - Promote health of reef & other benthic habitats
    - Increase biodiversity of marine life

Culturally important to humans

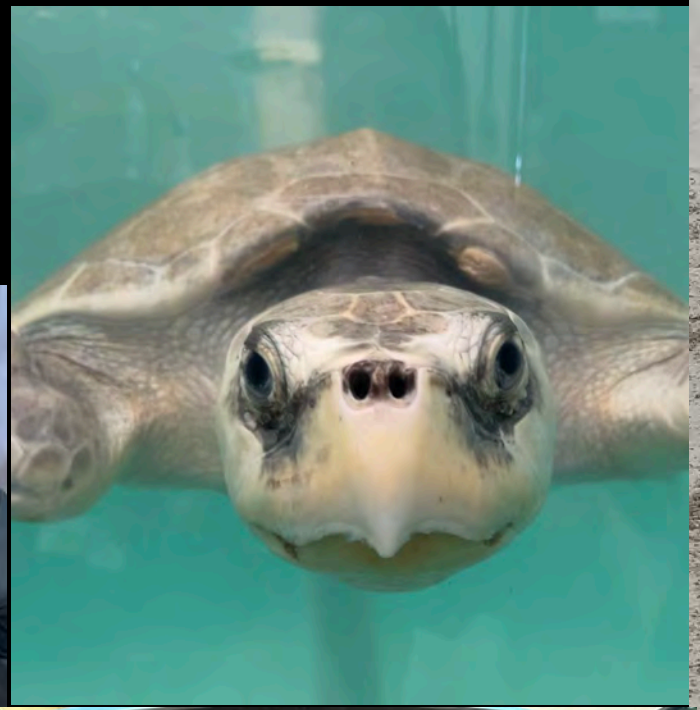
- Often capture the public's 1st interest in oceans
  - Promote marine conservation & stewardship

Sea Turtles In Galveston Bay & Upper Texas Coast

Many species of sea turtles on the UTC
- several life stages
- Galveston Bay, near-shore, offshore

5 of 7 species

- Kemp's ridley
- Loggerhead
- Green
- Hawksbills*
- Leatherback*



Gulf Center for Sea Turtle Research

Problem: Texas & the western Gulf of Mexico lacks the research capacity being conducted in other regions of the Gulf of Mexico

Mission: facilitate RESEARCH at all organizational levels

- molecular to population and ecosystem (research)
- that restore sea turtle populations (conservation)
- protection vital sea turtle habitats
- develop a thriving community of researchers

CONSERVATION Programs:

1) Sea Aggie Sea Turtle Patrol

2) Sea Turtle Rescue & Recovery

3) Sea Turtle Rehabilitation Hospital

Approved April 2019

- 6.5 years old!

Facebook: Gulf Center for Sea Turtle Research

Bluesky: @seaturtlecenter

Instagram: @gulfcenterforseaturtleresearch

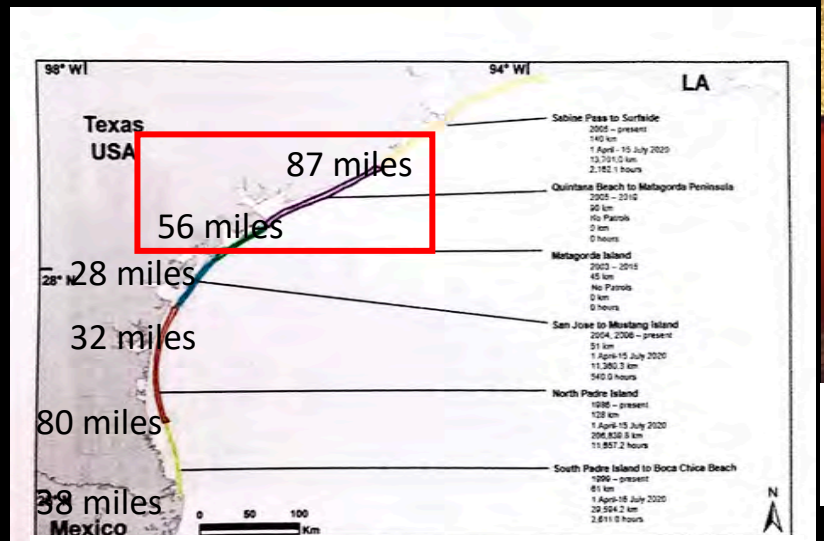
Sea Aggie Sea Turtle Patrol - TPWD NRDA-DWH Trustees

Mission: Locate Nests of Kemp's Ridley Sea Turtles

- Remove Nests for Transport to PAIS
  - Increase recruitment to adult population

TX-LA to Matagorda, TX

- 144 miles of beach
  - Kemp's ridley nests
    - April 1 – July 15th

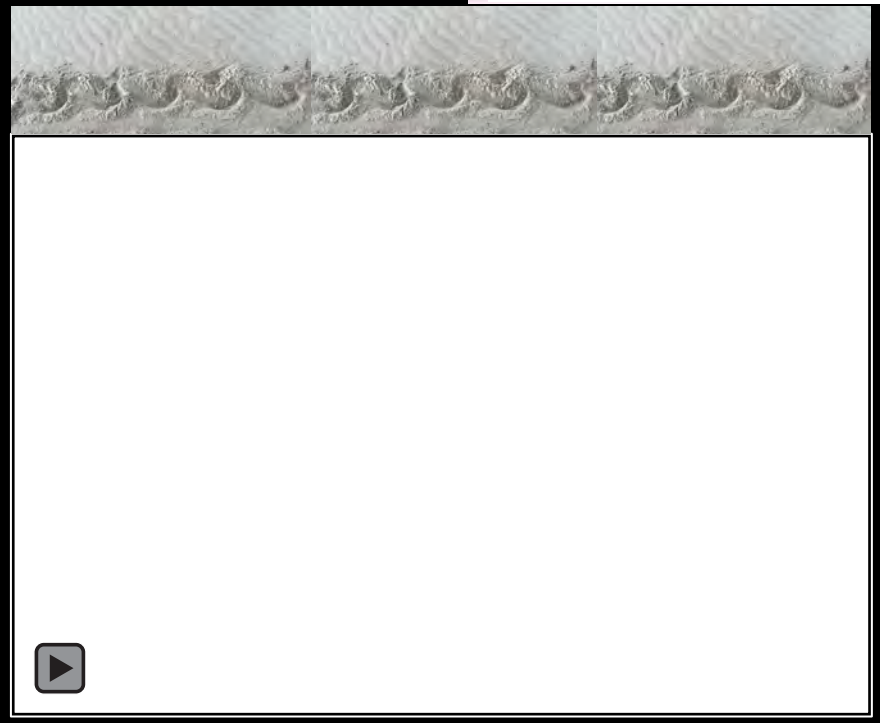


2 of 6 Sea Turtle Patrols in TX

Paige Breon
Program Assistant

Motorized and Walking Patrols

- 300 volunteers
  - find tracks
    - permitted response team



All nests are excavated

- critically endangered status
- protected in incubation facilities
  - increases hatching success rate

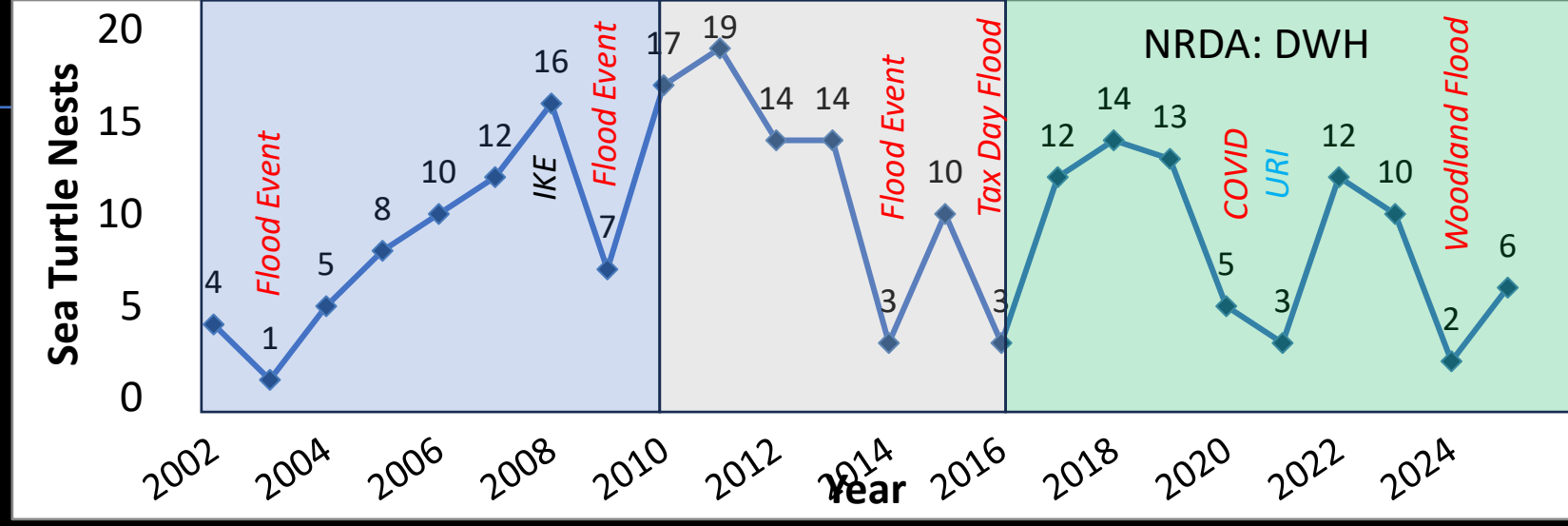
Sea Aggie Sea Turtle Patrol

Texas A&M University at Galveston
- USFWS Permit Holder since 2002
- Nest Detection
  - PI: Dr. Andre Landry 2002 w/Carole Allen (HEART)

NRDA/DWH Funding in 2015-2025
- PI: Dr. Christopher Marshall
  - USFWS Permit holder since 2015
- Established extensive systematic survey design

- Increased effort via:
  - number of survey routes
  - volunteer corps (~350/season)

Uniform and consistent data collection
- Total nests: 90 @100egg/nest = 9000 eggs
  - ~10 nests/season; 1000 eggs/season



Patrol Effort 2016-2025			
	Miles	Hours	Route Shifts
2016	15,094	2944	1902
2017	15,909	3083	2008
2018	19,822	3837	2557
2019	18,365	3882	1850
2020	8,058	1963	952
2021	18,596	3699	1809
2022	19,734	3942	1915
2023	17,840	3772	1855
2024	18,074	3919	1903
2025	20,510	4415	2078
Total	***172,002***	***35,456***	***18,829***
Mean	***17,200***	***3,546***	***1,883***
% Increase	***29***	***50***	***13***

TEXAS A&M UNIVERSITY GALVESTON CAMPUS. GULF CENTER FOR SEA TURTLE RESEARCH TEXAS Master Naturalist NATIONAL PARK SERVICE TEXAS PARKS & WILDLIFE Life's better outside. U.S. FISH & WILDLIFE SERVICE U.S. DEPARTMENT OF THE INTERIOR MARCH 3, 1849 TXGLO TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Rescue & Recovery (Sea Turtle Stranding) - TPWD NRDA-DWH Trustees

TAMUG is the lead for the UTC - 2020

- Respond to 50% of the Texas coast
- Ill, Hooked, Cold Stunned, Injured, Oiled, Entangled, Entrained & Deceased Turtles
- Necropsies important to management
- Live turtles ➡ sea turtle hospital

Program Assistant–Gina Corning

Rescue & Recovery (Sea Turtle Stranding)

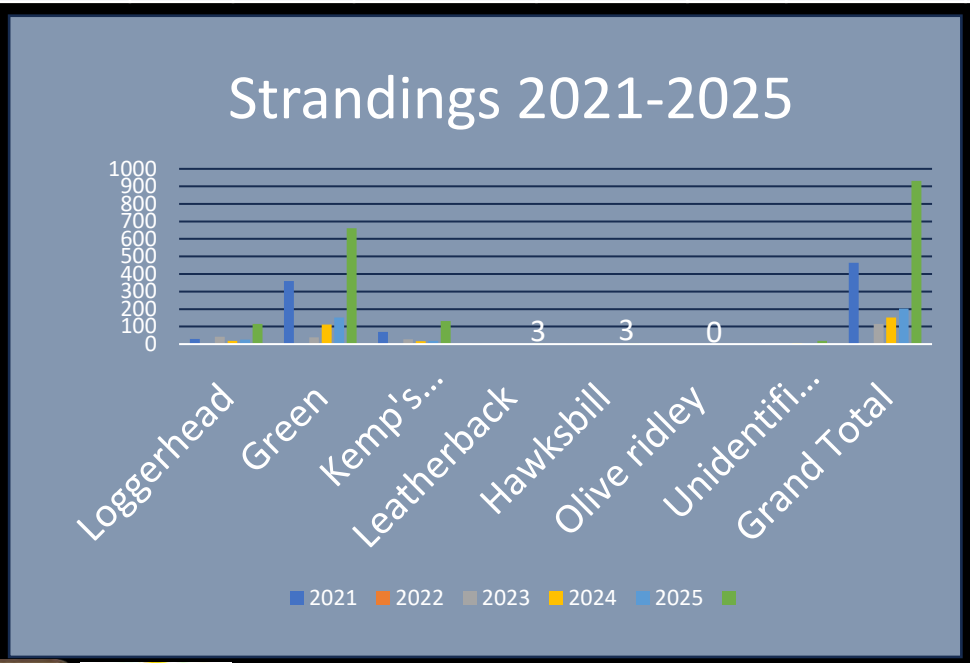
NRDA/DWH Funding in 2020
- PI: Dr. Christopher Marshall
- Established Call Center
  - Develop & execute rescue/recovery plan

- Built a core of 150 volunteers
  - Yearly training
    - Especially for cold stuns

Cold stun events 4 of 5/6 years of data
- Winter Storm Uri
  - Historical cold-stun event for Texas
    - ~13,500 stunned turtles statewide

The GCSTR has responded to 1000+ sea turtles since 2020

Strandings 2020-2025								
	Loggerhead	Green	Kemp's ridley	Leatherback	Hawksbill	Olive ridley	Unidentified	Grand Total
2020	GCSTR took on UTC Stranding Network in July 2020 – incomplete data							71
2021	30	360	69	2	1	0	2	464
2022	78	75	26	1	1	0	3	184
2023	42	38	28	0	1	0	6	115
2024	18	111	16	0	1	0	6	151
2025	25	152	19	1	0	0	5	202
Total	115	661	132	3	3	0	19	1003



TEXAS A&M UNIVERSITY GALVESTON CAMPUS. | GULF CENTER FOR SEA TURTLE RESEARCH | TEXAS Master Naturalist | NATIONAL PARK SERVICE | TEXAS PARKS & WILDLIFE Life's better outside | U.S. FISH & WILDLIFE SERVICE | U.S. DEPARTMENT OF THE INTERIOR MARCH 3, 1849 | TXGLO | TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Sea Turtle Rehabilitation Hospital & Recovery - TPWD NRDA-DWH Trustees

The NOAA sea turtle hospital closed in 2020
Phase 1: Short-term hospital (COMPLETE)

Sea Turtle Hospital on the TAMUG Campus
- 800+ sea turtles rehabilitated since 2020

Phase 2: Long-term Plan
Build a state of the art hospital & educational outreach center
- Academic-business venture
  - Ecotourism to provide financial stability

Galveston is a tourist destination
- tourists are looking for places to view sea turtles
- 8.1M tourists; cruise ship industry
- support conservation efforts into the future
- beneficial to the campus: awareness & retention

Raised $65,000 for Program of Requirement (PoR)

$23M Construction Goal Achieved

Theresa Morris
Program Coordinator;
Hospital Manager

Houston Zoo

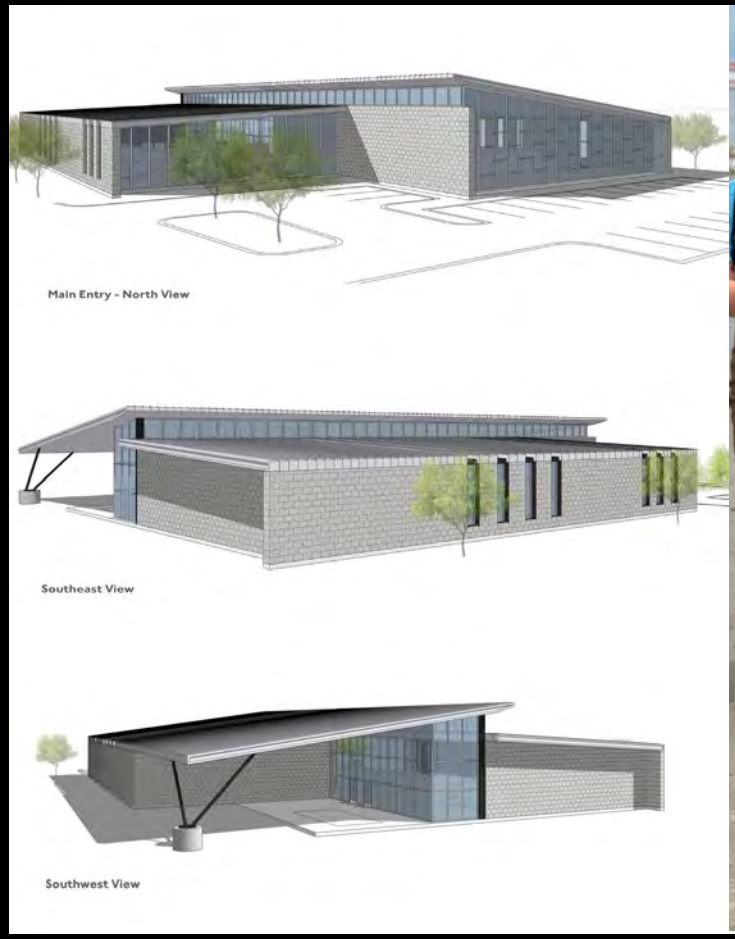
Cheryl Mellenthin Sea Turtle Rehabilitation Hospital and Educational Outreach Center

Funding: A Combination of NRDA, TAMU, & Private Funding

- $23M
- Received $13M in NRDA Restore Grants
  - $3M; NRDA TIG, Deep Water Horizon Gulf Regionwide
  - $2.5M; NRDA Texas TIG, Deep Water Horizon Texas
  - $7.5M; Texas Grant Land Office, GOMESA Funds
- Received $1.5M TAMU Chancellor's Office
- Received $8.5M philanthropic in donations

Cheryl Mellenthin

- driving factor in Private Funding
- TAMUS BoR Approval
- Facility name-sake



Facility Details:

- 16,000 ft^2 ;
- 2 hospital wards
- Quadruple current hospital space
- Sea Turtle Ambassadors
- Monterey Aquarium meets Smithsonian
- EcoTourism Destination

Habitat Restoration: DWH Region-Wide NRDA Trustees

Marine Debris Program:
Mission: Remove marine debris from beach but also in-water hotspots

- with a focus on both sea turtle and shorebird habitat restoration

Detailed, transect-based survey with computed CPUE

- many hotspots are cleaned twice/year
  - compute re-accumulation of marine debris

Carolyn Pope
Marine Debris,
Habitat Restoration
Program Assistant

7 Hotspots
760 lbs in 2025

Rettilon Road
North Jetty Shoreline/In-water
Texas City Dike
Seawolf Shoreline/In-water
Brazoria County Access 5

6 Cool Spot CleanUps

- 540 lbs

NestFest

- 4,800 lbs across 12 sites

Total Marine Debris Removed: 6,100 lbs

Survey Year 2025

Debris Category	Total Removal
Plastic	9214
Foam	802
Paper	0
Glass	88
Metal	827
Fishing	1214
Automotive	2
Smoking	154
Other	549
Total Count	12850

Total Volume (no. trash bags filled)	37
Total Weight (lbs)	760.51

Debris Category	Volume
Plastic	0.7170428
Foam	0.06241245
Paper	0
Glass	0.00684825
Metal	0.06435798
Fishing	0.09447471
Automotive	0.00015564
Smoking	0.01198444
Other	0.04272374

Habitat Restoration Optimal Nesting Habitat? GLO

Objectives

1) measure the temperature regime within simulated nests
2) determine the fate of *in situ* simulated nests
3) characterize beach geology
   - geomorphology of beaches
   - sand grain size distribution

6 UTC sites/1 PAIS reference nest

- 105 experimental nests
- Hobo MX 400 temp dataloggers
- RTK drone mapping

Results

1) Simulated nest temperatures are not elevated
2) All simulated nest would have been lost
   - saltwater inundation from high tides
3) UTC Elevation << reference site (PAIS)
   - contributes to saltwater inundation

Management Recommendation

Upper Texas Coast does NOT have optimal nesting habitat

- Nests excavation and transport should continue
  - to increase success of Kemp's ridley recovery
- UTC beach engineering/Coastal Spine should focus on:
  - Increasing beach elevation
  - Maintaining current sand grain size distribution
    - avoid non-sand sediment
      - clay, shell-hash

Provide data to decision makers – coastal spine

- Engineered beaches need to consider nesting turtles & restore nesting habitat


Questions?
GCSTR: Data Driven Science to
Conserve, Manage & Restore Sea Turtle
Populations in Galveston Bay & the UTC

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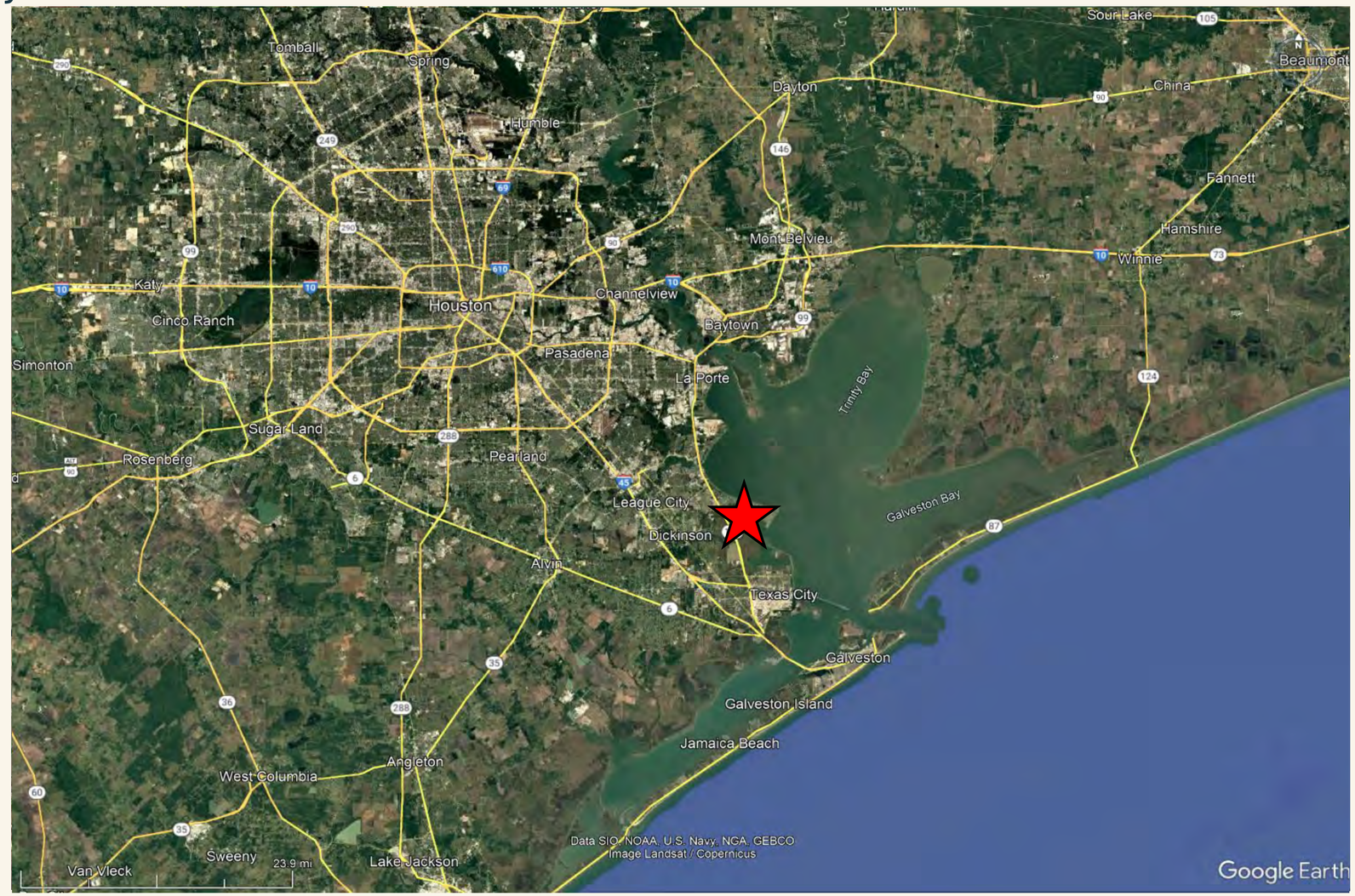
PROTECT TODAY. PRESERVE TOMORROW.

Construction and Monitoring of Dickinson Bay Island 2

Jeffrey Fato; Habitat Restoration Manager

Dickinson Bay Islands | *Location*



Dickinson Bay Islands | *1960's*

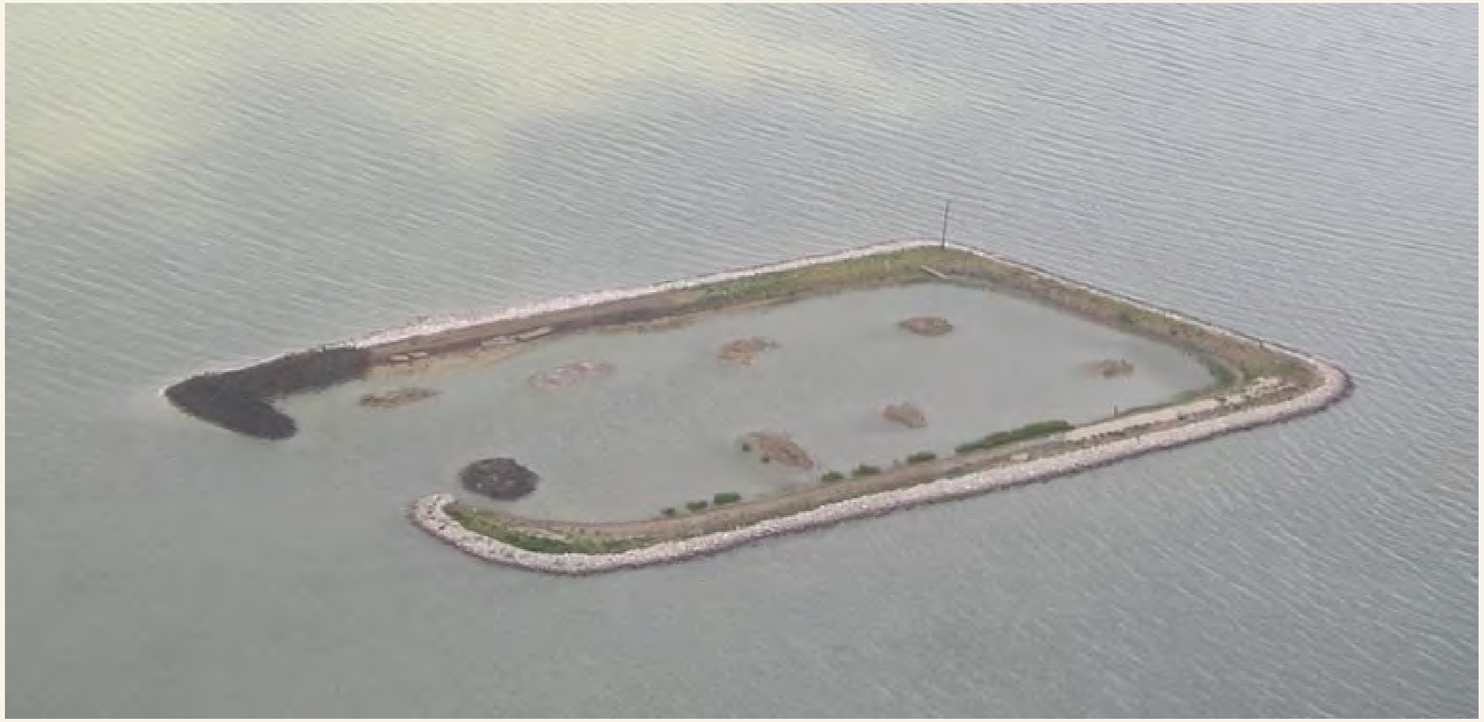
Dickinson Bay Islands | *1990's*

Dickinson Bay Island 1 | *Rookery Island Restoration*

Early 2000's partners began discussing restoration of rookery habitat in Dickinson Bay, with the idea to eventually restore all three islands.

Dickinson Bay Island 1 construction was completed in 2004 with funding from:

Galveston Bay Estuary Program/TCEQ, USFWS, EPA-Gulf of Mexico Program, Restore America's Estuaries, NOAA, NFWF, TNC, Shell Oil, and Reliant Energy.



Dickinson Bay Island 1 | *Rookery Island Restoration*

DBI-1 was designed to have intertidal marsh along the inner shoreline. Volunteers assisted with the transplanting of smooth cordgrass (*Sporobolus alterniflorus*) to the island.

Dickinson Bay Reef | *Oyster Reef Restoration*

~2 acres of oyster reef was restored adjacent to DBI-1.

The reef is still productive and GBF has further enhanced the area, expanding the reef restoration in 2018 and 2022.

The recent projects utilized recycled shell from GBF's Oyster Shell Recycling Program. This oyster reef is slated for further restoration in 2026.

Dickinson Bay Island 1 | *Colonial Nesting Waterbirds*

Since completion, DBI-1 has been successfully hosting nesting birds.

2021 and 2022 surveys estimate just over 3,000 nesting pairs utilizing the island.

Laughing gulls make up the majority, followed by cattle egret and brown pelican.

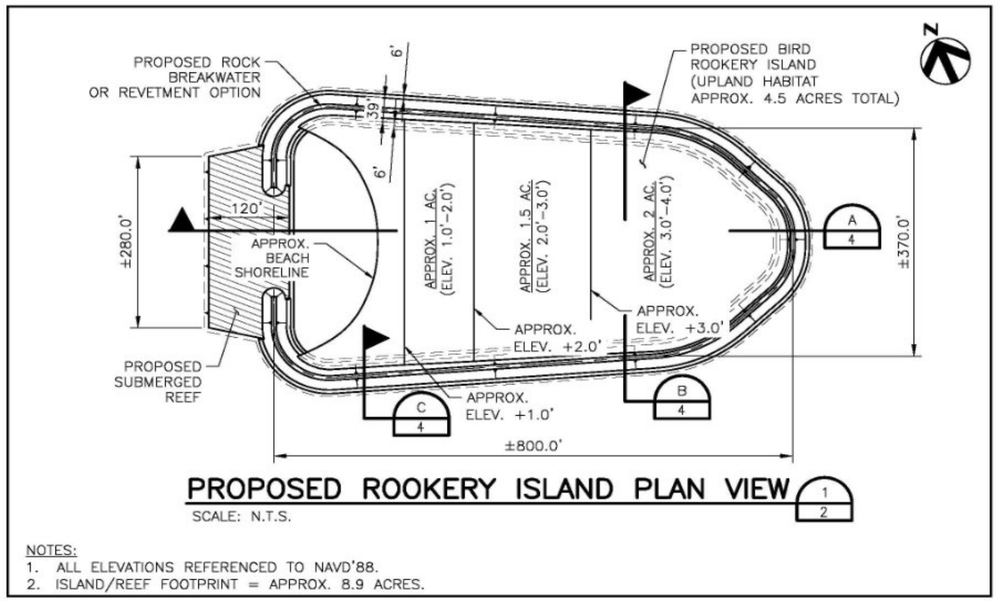


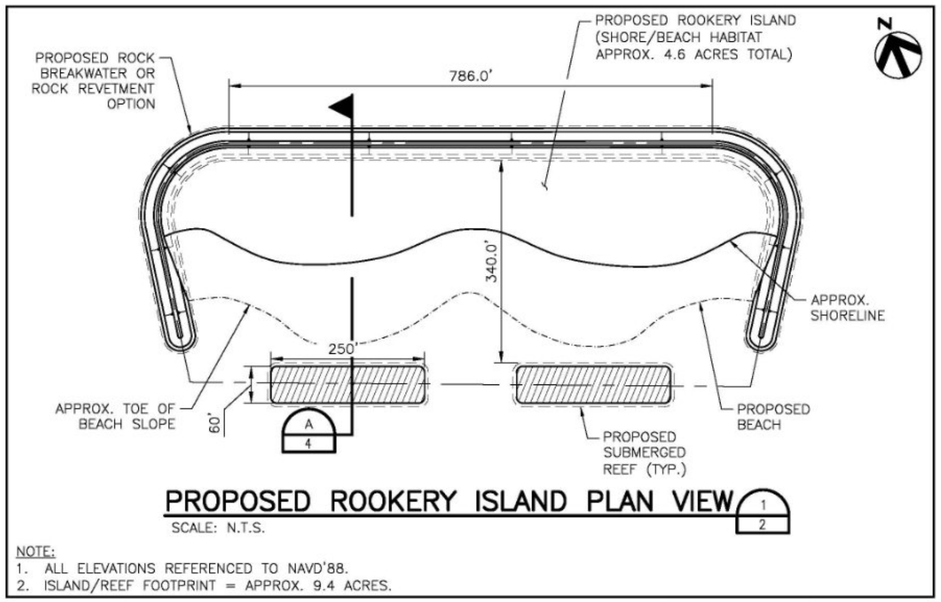



Dickinson Bay Islands | *Engineering & Design*

2012-2015, GBF with funding from GBEP/TCEQ, DOI/USFWS Coastal Program, Restore America's Estuaries, and NOAA, GBF and partners began data collection and preliminary design work for island two and three.

One island designed for brush nesters, and the other island designed for ground nesters.



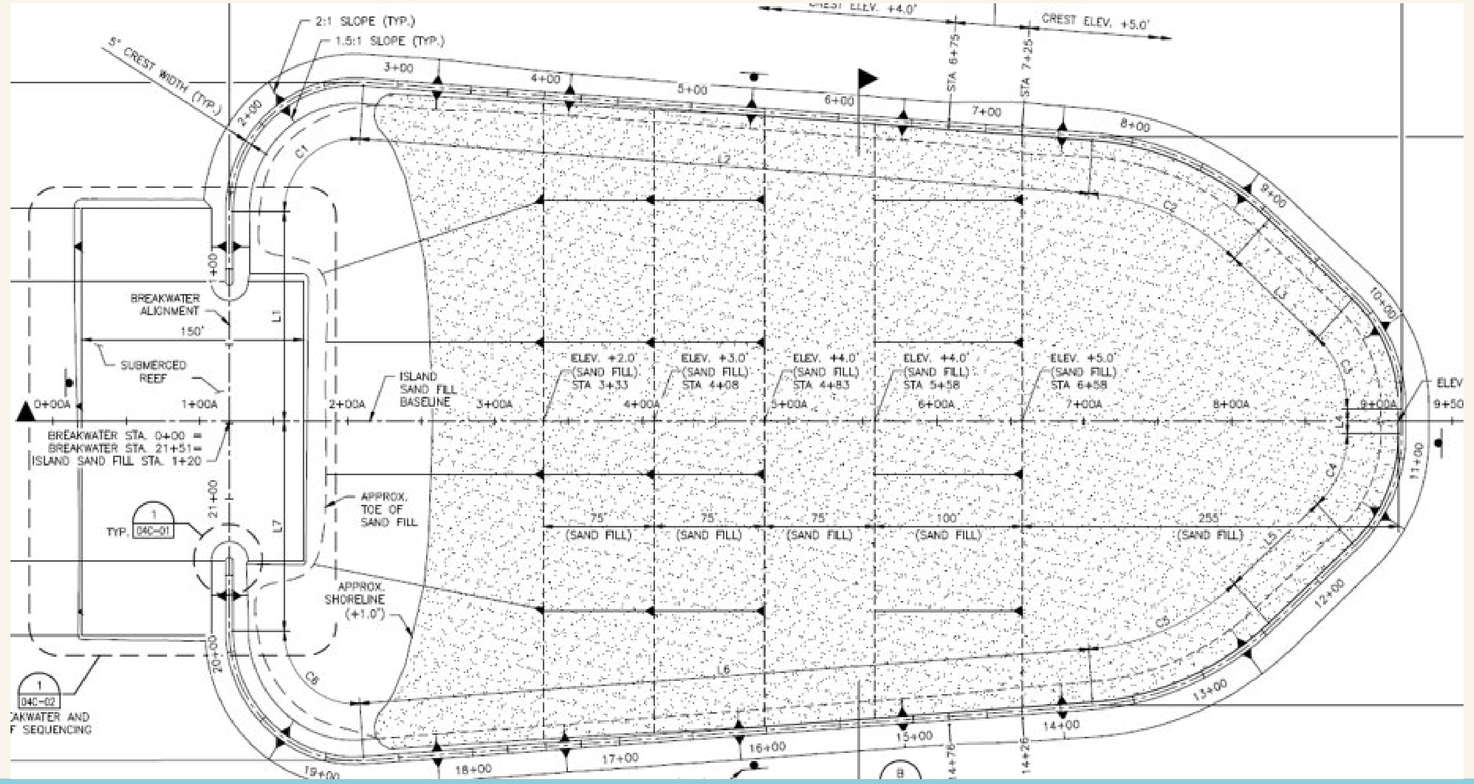


Dickinson Bay Island 2 | *NRDA Support*

GBF worked with NRDA Trustees from 2017-2021 to finalize design work for DBI-2. This included obtaining USACE permit and GLO lease for construction.

2021 the Trustees began construction procurement and construction was completed in 2022, with GLO leading the construction effort on behalf of the Trustees.

GBF has an agreement with the Trustees (DOI/USFWS) for transplanting vegetation, monitoring, and maintenance of DBI-2.



Dickinson Bay Island 2 | *Construction*

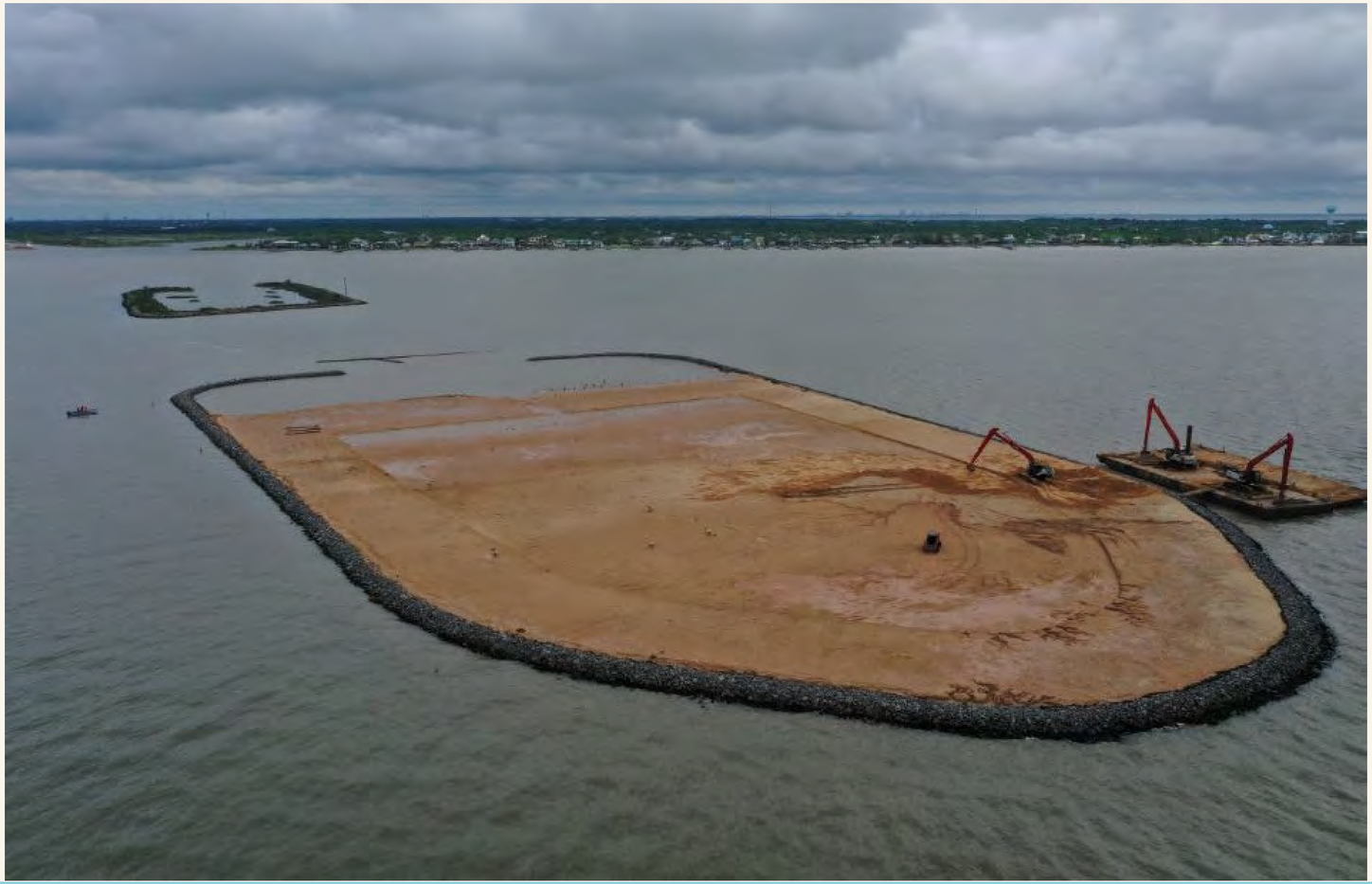
Ring levee constructed first to provide containment for sand fill material.

Project includes ~ 0.75-acre oyster reef component.

Dickinson Bay Island 2 | *Construction*

DBI-2 was constructed primarily with sand, except for the central ~ 2.5 acres of the island.

This area was topped with a thin layer of topsoil/sand mixture to provide additional nutrients for future tree and shrub transplanting.



Dickinson Bay Island 2 | *Construction*

During final walk through, the topsoil/sand area was filling in with nutgrass.

We did not anticipate that it would be difficult to manage nor interfere with transplanting efforts.

Dickinson Bay Island 2 | *Invasive Plant Species Management*

Primarily Johnson grass, some of which some reached ~ 10’ in height!

This was not anticipated and provided a challenging first step in managing the island.

Prior to any large planting efforts, the Johnson grass needed to be managed.

Dickinson Bay Island 2 | *Invasive Plant Species Management*

GBF was able to work with a local contractor to have the site mowed on September 9, 2022.

Dickinson Bay Island 2 | *Transplanting*

2,022 shrub/trees were planted on the island for nesting habitat from September 2022 through January 2023.

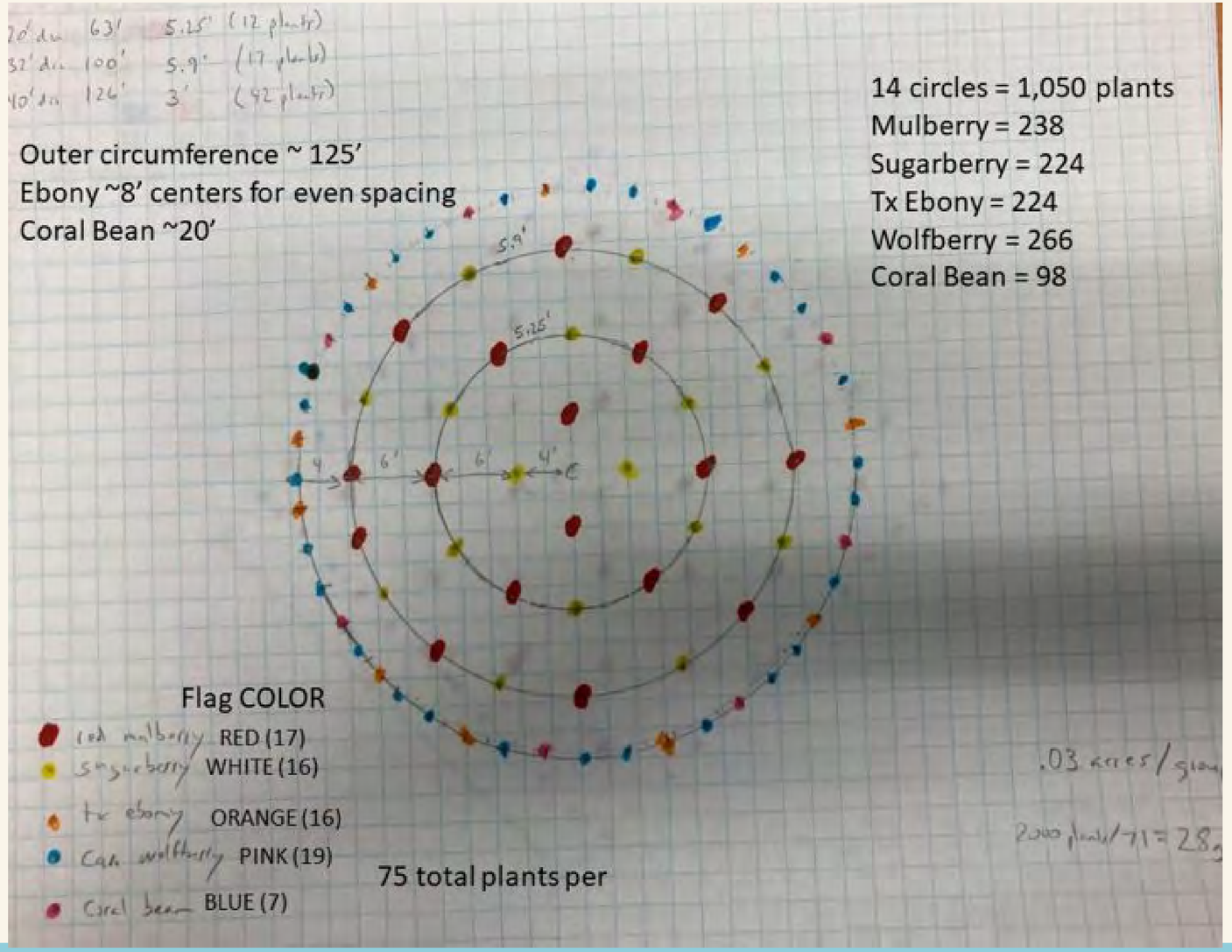
Plantings will be monitored annually for transplant survival %.

Species primarily consist of hackberry/sugarberry, red mulberry, Texas ebony, Carolina wolfberry, and coral bean.

Treated island with herbicide post mow.

After planting utilized targeted herbicide to not damage trees and pre-emergent.

Dickinson Bay Island 2 | *Transplanting Design*



Dickinson Bay Island 2 | *Transplanting Design*

2,022 trees/shrubs planted

Two large volunteer groups
planted ~1,400, the
remainder planted by staff
from GBF, NRCS, and DOI/USFWS

Red Mulberry *(M orus rubra)*: 508

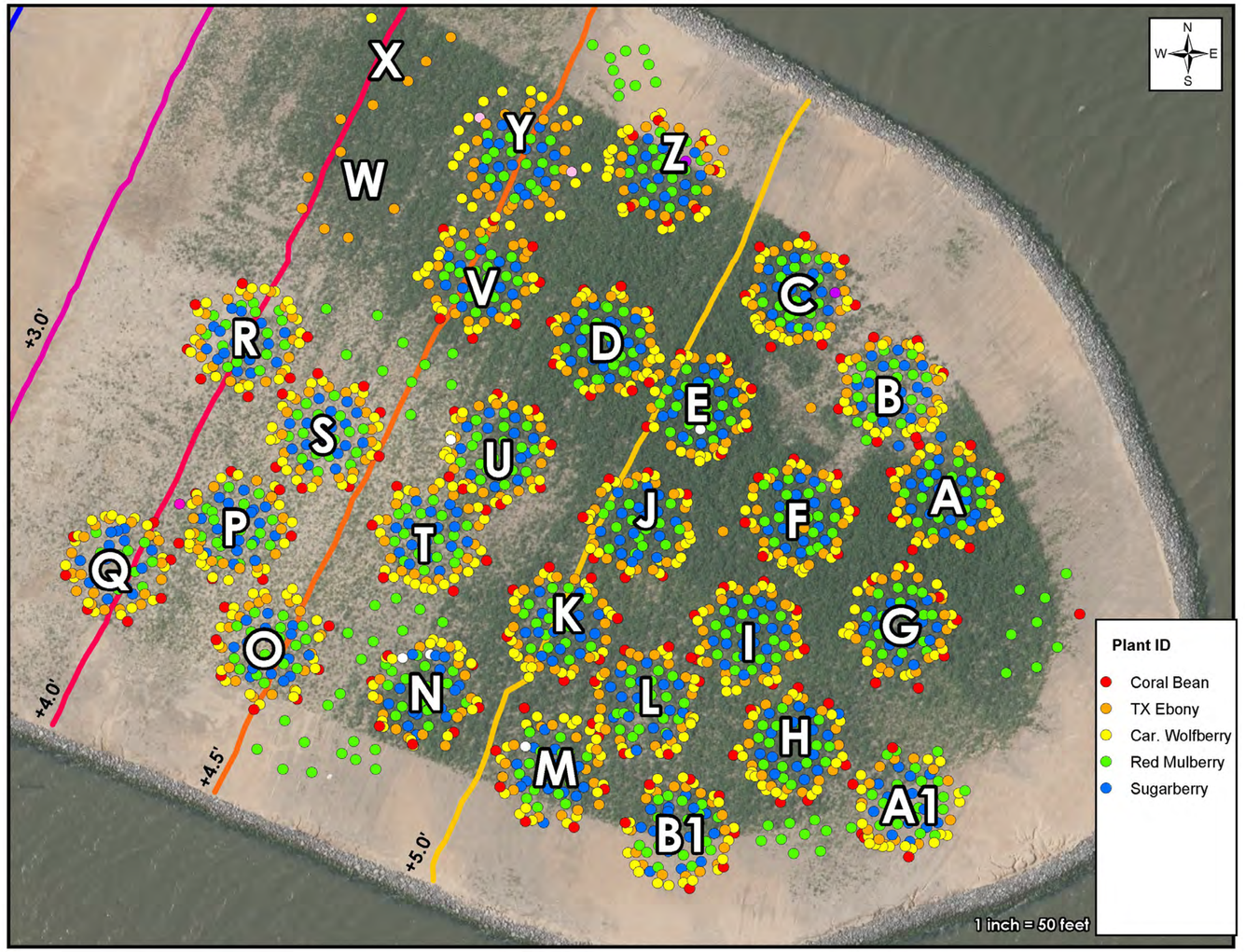
Sugar Hackberry *(Celtis laevigata)*: 413

Texas Ebony *(Ebenopsis ebano)*: 431

Carolina Wolfberry *(Lycium carolinianum)*: 491

Coral Bean *(Erythrina herbacea)*: 177

Lime Prickly Ash *(Zanthoxylum fagara)*: 2



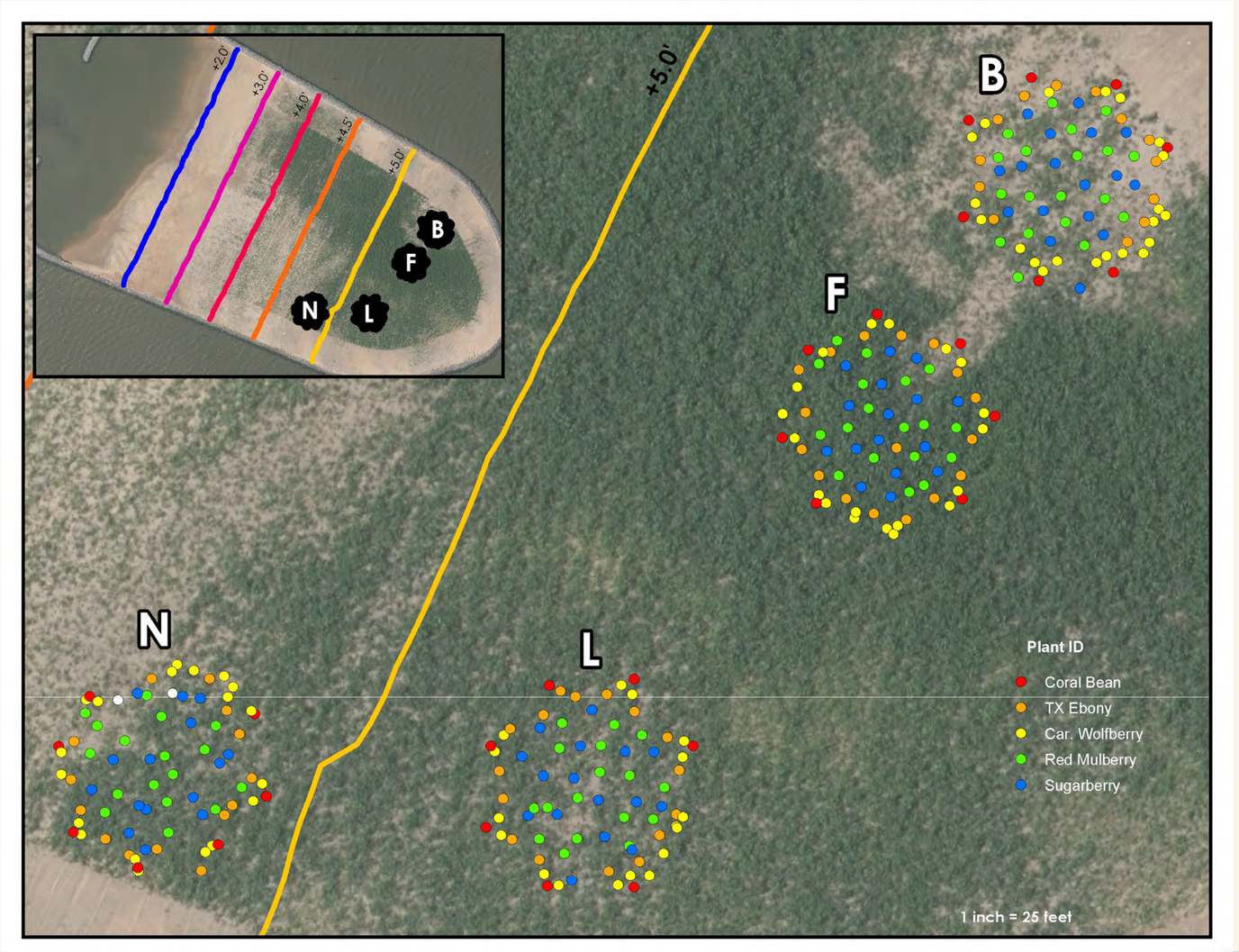
Dickinson Bay Island 2 | *Monitoring Requirements*

- Island Infrastructure
  - Visually inspect minimum once annually

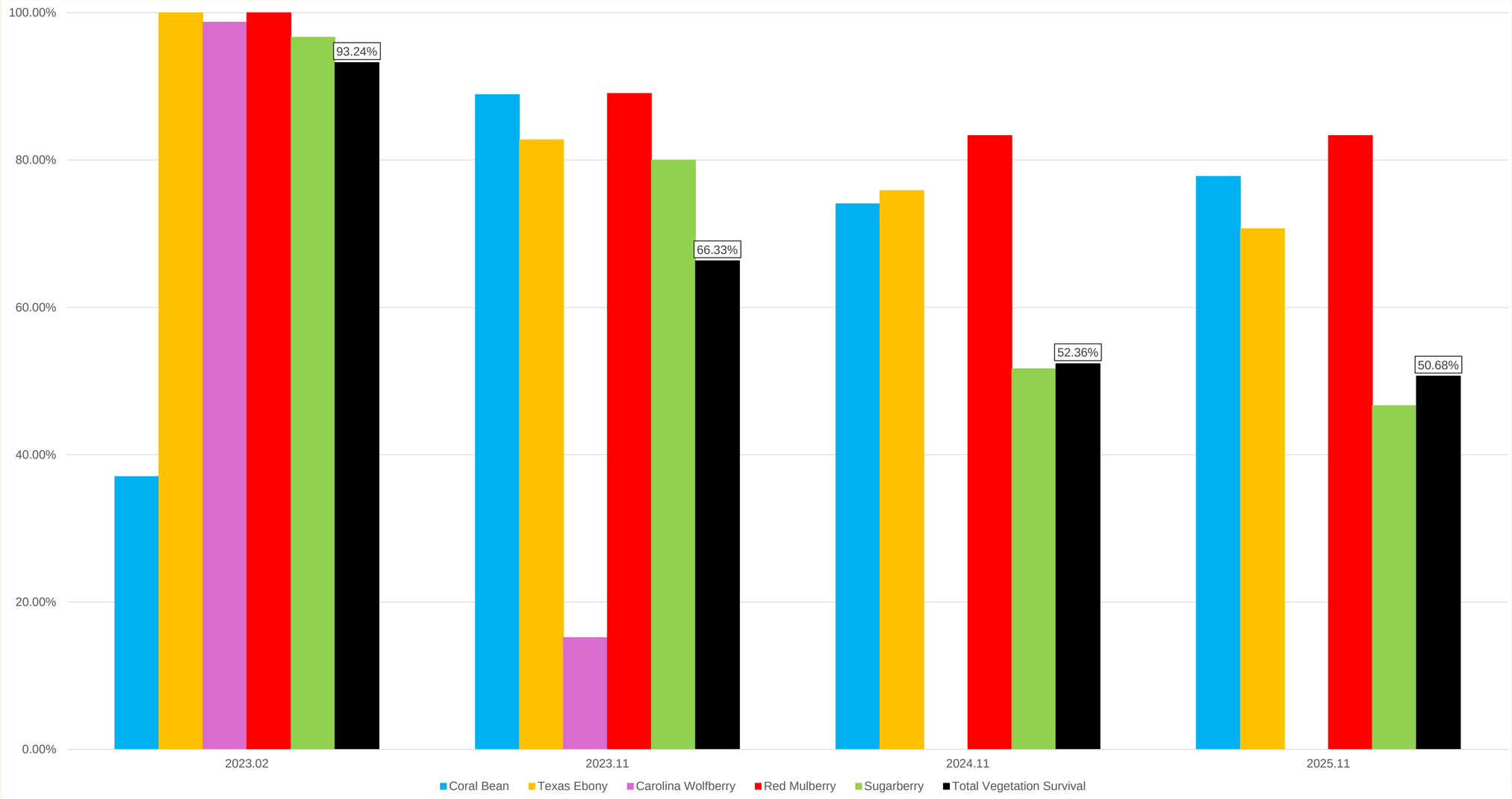
- Colonial Nesting Birds
  - Bird survey annually in April, May and June

- Vegetation Establishment
  - Transplant survival
    - Monitor transplanted area at least once annually
    - Percent survival target is 60%
  - Aerial Coverage
    - Analyze annual georeferenced aerial
    - Target 60% coverage above +2.0 NAVD 88

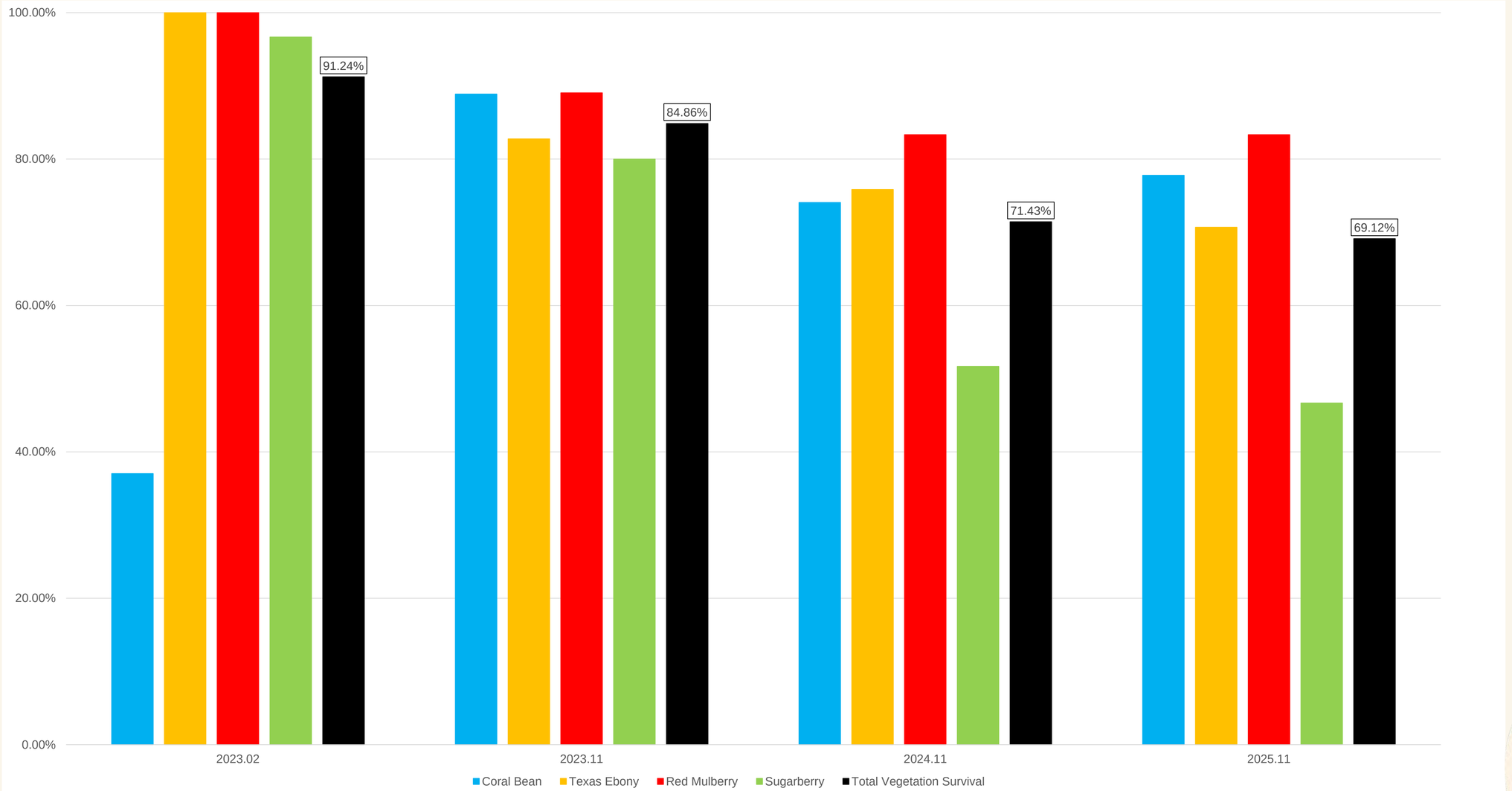
Dickinson Bay Island 2 | *Monitoring: Transplant Survival - Monitored Areas*



Dickinson Bay Island 2 | *Monitoring: Transplant Survival*



Dickinson Bay Island 2 | *Monitoring: Transplant Survival (Excluding Carolina Wolfberry)*



Dickinson Bay Island 2 | *Monitoring: Transplant Survival*

Right: Aerial photo of DBI-2 from July 2023

Above: Ground level view of typical vegetation October 2023

Dickinson Bay Island 2 | *Monitoring: Vegetation Coverage*

2023 = 77.8%

The vegetation makeup (not including transplants) of the island includes:

Bermuda grass (*Cynodon dactylon*), Western Ragweed (*Ambrosia psilostachya*), Giant Ragweed (*Ambrosia trifida*), Seaside Goldenrod (*Solidago sempervirens*), Johnson grass (*Sorghum halepense*), Saltmarsh Aster (*Symphyotrichum subulatum*), Rattlebush (*Sesbania drummondii*), Shoreline Purslane (*Sesuvium portulacastrum*), Groundseltree (*Baccharis halimifolia*), Annual Sunflower (*Helianthus annuus*), Saltgrass (*Distichlis spicata*), Saltcedar (*Tamarix ramosissima*), American Black Nightshade (*Solanum americanum*), Bastard Cabbage (*Rapistrum rugosum*), Carolina Crane's-bill (*Geranium carolinianum*), Japanese Climbing Fern (*Lygodium japonicum*), and Sea Ox-eye Daisy (*Borrichia frutescens*)

Dickinson Bay Island 2 | *Monitoring: Vegetation Coverage*

2024 = 77.6%

Vegetation cover was similar between 2023 and 2024.

Dickinson Bay Island 2 | *Monitoring: Vegetation Coverage*

Dickinson Bay Island 2 Site Conditions	
Project Name: Dickinson Bay Island 2	
Project Location: Dickinson Bay, Galveston County, TX	
Image Source: Terraflight RGB Aerial Imagery, July 2025	
Projection: NAD 1983 State Plane Texas South Central FIPS 4204 (US Feet)	
Date Drawn: 12/3/2025	Drawn by: Jeffrey Fato

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1725 Highway 146, Kemah, TX; (281) 332-3381

2025 = 80.2%

Vegetation cover was denser in 2025 than in years prior.

Dickinson Bay Island 2 | *Monitoring: 2023 Bird Surveys*

As anticipated, year one (2023) of colonial waterbird nesting surveys at DBI-2 consisted primarily of ground nesting species.

Dickinson Bay Island 2 | *Monitoring: 2023 Bird Surveys*

<u>May 2023 estimated nesting pairs</u>

4,320 Laughing Gull

29 Caspian Tern

315 Royal Tern

20 Sandwich Tern

4 Black Skimmer.

Dickinson Bay Island 2 | *Monitoring: 2023 Bird Surveys*

First year as active rookery (2023). Royal and Caspian terns counted by visual count and aerial use of UAV. Subset of aerial photo was counted and the % of royal/Caspian was used to estimate counts per species.