ROOKERY ISLAND RESILIENCY DESIGN GUIDE

About This Guide

Historically, the Texas coast has supported many waterbird nesting islands called rookery islands. These islands are critical nesting habitats for many species of coastal birds. Changes to Texas bays from relative sea level rise (RSLR), extreme weather events, erosion, habitat conversion for human uses, and sediment management practices have resulted in a decrease in waterbird nesting and foraging areas and have left coastal birds more susceptible to inland predators. The purpose of this guide is to provide concise guidance and best practices on how to design, restore, and create Texas coastal rookery islands.

Conceptual

Develop project goals and identify existing constraints. These are important factors that will shape the design and construction of a rookery island enhancement or creation project.

Determine project goals	Evaluate site characteristics	Determine basic design components
• Providing bird habitat • Providing fish habitat • Wave attenuation • Reducing predation • Maintaining ecosystem services • Maintaining island integrity	• Hydrodynamics: water depth, wave exposure, tide, currents, and RSLR • Topography and erosion • Salinity • Vegetation options • Substrate characteristics	• Budget • Timeline • Structure type(s) and configuration • Beneficial use of dredged material (BUDM) availability

Engineering/Design

Develop a detailed plan for configuration or enhancement of a new or existing rookery island that is based on the project goals and site constraints to provide a strong basis for a healthy rookery island.

Complete design and supporting calculations		Develop construction plan	Complete permit applications
• Geotechnical analysis • Surveys (e.g., topographic, bathymetric, presence/absence of habitats or special aquatic sites, etc.) • Hydrodynamic analysis	• Water quality analysis • Sunlight exposure analysis • BUDM availability • Planting types • Cost	• Schedule • Deployment logistics • BUDM coordination	• Permit-level plans • Address review comments

Permitting

Plan for and complete necessary permitting activities to ensure the project has a robust design that does not adversely impact the surrounding environment or socioeconomic activity. An engineer should also be identified during this step to complete permit-level (and subsequent) design/installation plans.

Identify project partners	Identify potential permits needed	Typical review agencies
• Federal • State • Local • Non-profit • University • *Tribal*	• **USACE Nationwide Permit** 27 Aquatic Habitat Restoration, Enhancement, and Establishment Activities • **TCEQ:** 401 Water Quality • **GLO:** Coastal Zone Management Consistency Certification and Surface Lease if located on State-owned submerged lands • Consultations for Essential Fish Habitat (EFH), the Endangered Species Act (ESA), the Migratory Bird Treaty Act, the Bald and Golden Eagle Protection Act, and the Marine Mammal Protection Act • BUDM Permits	• USACE • TPWD • EPA • USFWS • US Coast Guard • NMFS • THC • GLO

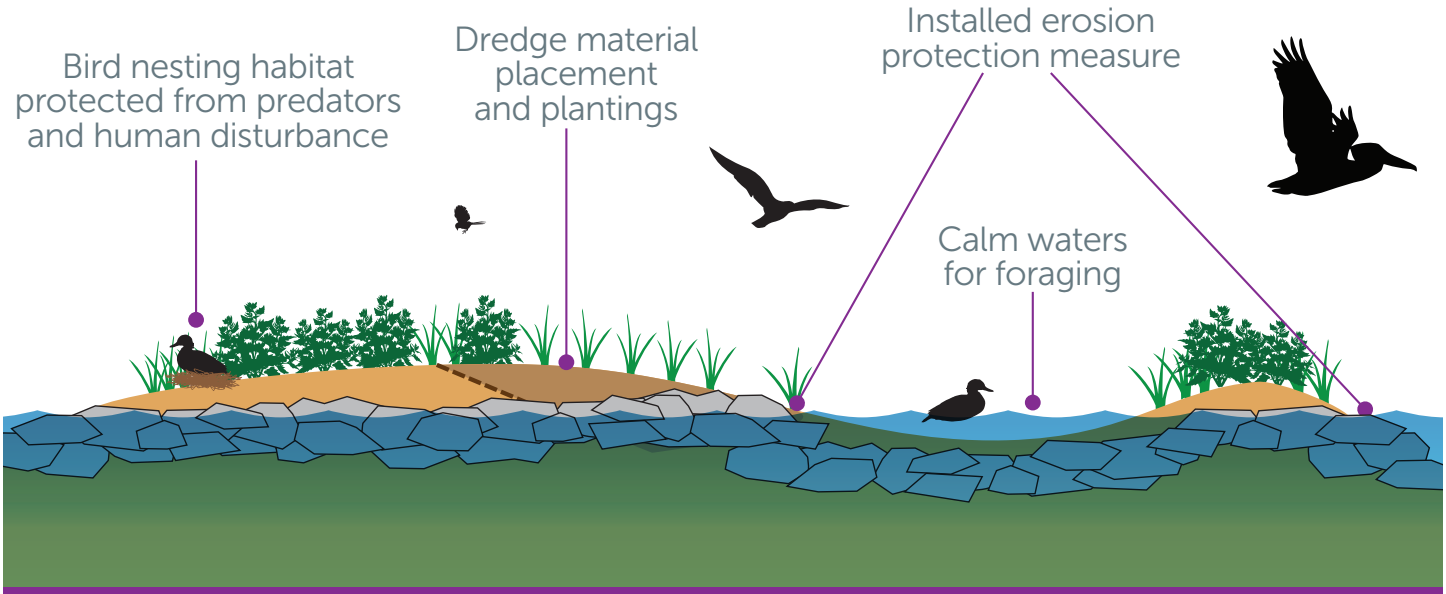
Monitoring

Continued monitoring of a rookery island restoration or creation project using metrics aligned with project goals can aid in tracking the success of the island after construction.

- Bird nesting and fish populations surveys
- Islands should be monitored for changes in elevation, shoreline, and vegetation to assess desired outcome
- Continue to monitor island elevations compared to RSLR rates
- Pre and post-storm event monitoring to establish a baseline for restoration/creation

Profile View

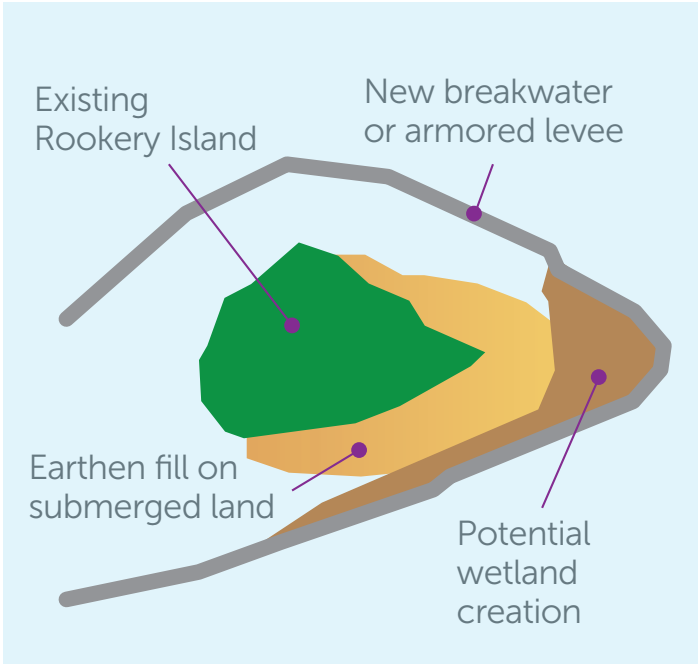
Profile view of a healthy rookery island.



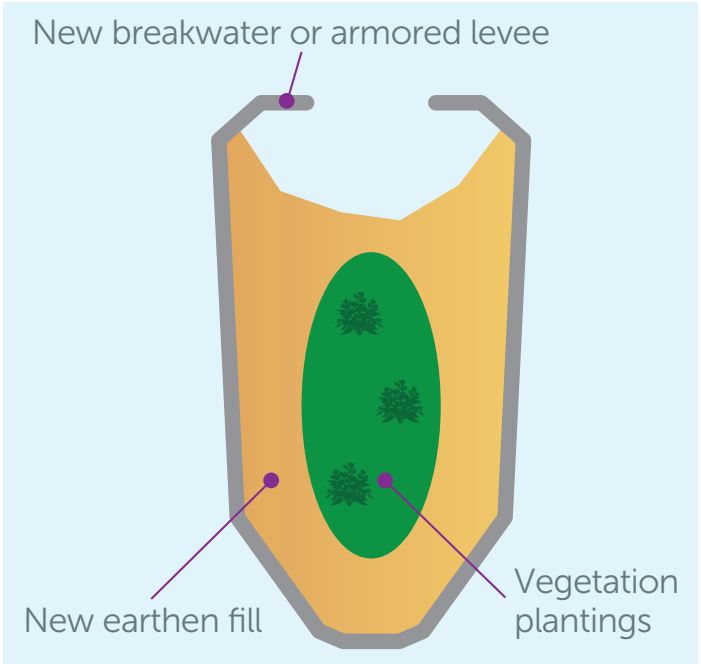
Rookery Island Creation & Restoration

Plan View

Plan view showing possible designs for BUDM placement and ways to enhance existing rookery islands or build new rookery islands.



Existing Rookery Island



New Rookery Island

Engineering Considerations for Rookery Island

Wave Climate

The site characteristics, including waves and hydrodynamic conditions, as well as the project budget and timeline, will be the primary considerations when designing a rookery island enhancement project.

Low Wave (≤ 2ft)	High Wave (> 2ft)
Areas with low wave action may be able to be built without significant structural protection. BUDM placement, plantings, and permitting should be considered.	Areas with higher wave action will require structural stabilization methods, including breakwaters, a revetment, or small armored levees. BUDM placement, plantings, and permitting should be considered.

PROJECT COST & ENGINEERING EFFORT →

BUDM

BUDM can be used to build up the base elevation of existing rookery islands or to create new islands. The project manager will need to coordinate with the BUDM supplier (USACE or a private entity) regarding the availability and quality of BUDM sources.

Design & Planing	Permitting	Soil Placement
Experienced coastal engineers design the placement areas. (~6-8 months)	Permitting and coordination with state and federal natural resource agencies. (~3-12 months)	Placement of material to create upland habitat to support the restoration or creation of a rookery island. (~1-2 months)

PROJECT TIMELINE →

Vegetation

Rookery island enhancement and stabilization will take time as vegetation is planted and allowed to grow.

6 months-2 years prior to construction	During construction	1+ years post-construction
As rookery islands become submerged due to erosion, land subsidence, and/or RSLR, plants die off and islands cannot function as bird habitat. The project designer needs to consider the salinity, water depth, erosion rates, desired species habitat goals, etc. when planning the type of vegetation to include.	After rookery island elevations are increased (for example, from BUDM combined with breakwater structures), vegetation needs to be replanted and monitored.	As the island elevation stabilizes and vegetation is established, bird and marine wildlife populations will be established.

ISLAND DEVELOPMENT TIMELINE →

Costs

Costs are based on averages of four rookery island enhancement projects from the 2019 Texas Coastal Resiliency Master Plan that have engineering designs and are beyond the conceptual phase.

Engineering & Design	Construction	Operations and Maintenance
• Average of $40/linear foot of shoreline (depending on complexity and permitting) » Estimate assumes economies of scale (10+ acres)	• Average of $1,600/linear foot of shoreline (depending on design) » Estimate includes mobilization, demobilization, and contingency	• Average of $52/linear foot of shoreline (depending on scale and design)

Resiliency for Rookery Island

	Concerns	Effect on Rookery Islands	Solutions
Salinity	• Droughts reduce freshwater input to bays and estuaries causing a spike in salinity • RSLR creates new hydraulic connections with higher-salinity Gulf of Mexico	• Vegetation have different levels of tolerance for salinity in the water	• Select sites with sufficient circulation, high/reliable freshwater inflows, and less likelihood for hydraulic change (for instance, as might be generated by channel realignment upstream of the island, large changes in tidal prism in the bays, etc.) to reduce susceptibility to salinity fluctuations
Subsidence	• Increased inundation of rookery island as land sinks	• Island size will decrease and erosion effects will increase as land sinks • Available sandy beach nesting habitat decreases	• Conduct monitoring program to determine impacts • Additional BUDM placements may be necessary in future years to offset subsidence
Relative Sea Level Rise	• Increased inundation of rookery island as sea levels rise	• Island size will decrease and erosion effects will increase as sea levels rise • Available sandy beach nesting habitat decreases	• Conduct monitoring program to determine impacts • Additional BUDM placements may be necessary in future years to offset RSLR • Include RSLR as a component of design water levels
BUDM Availability	• Wetland development using BUDM will require more complex permitting • Requires identification of BUDM source for initial construction and maintenance	• Permitting can take a substantial amount of time • BUDM may not always be available	• Work with experienced practitioners to streamline the permitting process • Coordinate with supplier early to ensure availability of BUDM • Renew permits in a timely manner
Bird Habitat	• Mortality of waterbirds due to predation by mammalian predators • Loss of nesting habitat from invasive vegetation colonization	• Invasive mammalian species (raccoons, coyotes, and hogs) and fire ants can have a detrimental effect on waterbird populations • Invasive grasses and shrubs make area unusable for nesting habitat	• Monitor islands for predators prior to nesting season and apply control measures as needed • Consider how to reduce predation during project design • Monitor islands for invasive plants prior to nesting season and apply control measures as needed
Extreme Weather	• Increased disturbance to rookery island shorelines and habitats as intensity and frequency of extreme weather events increases	• Island could become uninhabitable to waterbirds • Island upkeep would become more frequent and expensive	• Consider how to reduce susceptibility to future extreme weather events during project design • Monitor islands following storm events to assess impacts

Additional Information and Resources:

- **EPA Guidance on BUDM projects:** *https://www.epa.gov/sites/production/files/2015-08/documents/identifying_planning_and_financing_beneficial_use_projects.pdf*
- **USACE Engineering Manual 1110-2-5026 provides a summary of BUDM design:** *https://budm.el.erdc.dren.mil/guidance/EM_1110-2-5026.pdf*
- **Example Rookery Island Management Plan:** *https://www.cbbep.org/manager/wp-content/uploads/1403-San-Antonio-Bay-Rookery-Island-Management-97-.pdf*
- **USACE Engineering with Nature:** *https://ewn.el.erdc.dren.mil/*

Shamrock Island, TX
Source: Conrad Blucher Institute