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**LIST OF ACRONYMS**

ANWR	Aransas National Wildlife Refuge
CBLT	Coastal Bend Land Trust
CCA	Coastal Conservation Association
CCBNEP	Corpus Christi Bay National Estuary Program
CFR	Code of Federal Regulations
CMP	Coastal Management Plan
CNRAs	Coastal Natural Resource Areas
CZMA	Coastal Zone Management Act
ERD	Estuarine Reserves Division
GIS	Geographic Information System
GIWW	Gulf Intracoastal Waterway
GK-12	Graduate Teaching Fellows in K-12 Education
GLO	Texas General Land Office
K-12	Kindergarten through twelfth grade
MANERR	Mission-Aransas National Estuarine Research Reserve
MOU	Memorandum of Understanding
MRRP	Monofilament Recovery & Recycling Program
NERR	National Estuarine Research Reserve
NERRS	National Estuarine Research Reserve System
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NRCS	Natural Resources Conservation Service
OCRM	Ocean and Coastal Resource Management
PSF	Permanent School Fund
RAB	Reserve Advisory Board
RMC	Resource Management Code
RRC	Texas Railroad Commission
RMM	Rockport Maritime Museum
SLB	School Land Board
SWMP	System-wide Monitoring Program
TAMU	Texas A&M University
TAMU - CC	Texas A&M University - Corpus Christi
TCOON	Texas Coastal Oceanic Observation Network
TCEQ	Texas Commission of Environmental Quality
TNC	The Nature Conservancy
TNRIS	Texas Natural Resources Information Service
TPWD	Texas Parks and Wildlife Department
TWDB	Texas Water Development Board
TxDOT	Texas Department of Transportation
US	United States
USACE	United States Army Corps of Engineers
USC	United States Code
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UTMSI	University of Texas at Austin, Marine Science Institute
YETA	Youth and Environmental Training Area

## **EXECUTIVE SUMMARY**

The State of Texas has proposed to designate the Mission-Aransas Estuary as a National Estuarine Research Reserve (NERR). With passage of the Coastal Zone Management Act of 1972, the federal government officially recognized the national significance of coastal resources and authorized the federal Coastal Zone Management Program (CZMP) and the National Estuarine Research Reserve System (NERRS; or reserve system). In response to the CZMP, the state of Texas established the Texas Coastal Management Program (CMP), which was federally approved by National Oceanic and Atmospheric Administration (NOAA) in 1997. The Texas CMP coordinates state, local, and federal programs for the management of Texas coastal resources. Both the CZMP and NERRS are administered by NOAA. Since 1972, twenty-six estuaries have been designated as part of the NERR system. The NERRS works with existing federal and state authorities to establish and operate research Reserves and provide for their long term stewardship. The State of Texas has designated the University of Texas at Austin, Marine Science Institute (UTMSI) as the lead state agency for the Reserve.

Research and education are the main focus of the NERRS. Major goals are to: (1) ensure a stable environment for research through long-term protection of National Estuarine Research Reserve resources, (2) address coastal management issues identified as significant through coordinated estuarine research within the System, (3) enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation, (4) promote federal, state, public and private use of one or more Reserves within the System when such entities conduct estuarine research, and (5) conduct and coordinate estuarine research within the System, gathering and making available information necessary for improved understanding and management of estuarine areas.

The mission of the Mission-Aransas NERR is to develop and facilitate partnerships that enhance coastal decision making through an integrated program of research, education, and stewardship. The mission will enable us to fulfill the vision that the Mission-Aransas NERR will be a center of excellence to create and disseminate knowledge necessary to maintain a healthy Texas coastal zone. There are three goals that will be used to support the Reserve mission: (1) improve knowledge of Texas coastal zone ecosystems structure and function, (2) promote understanding of coastal ecosystems by diverse audiences, and (3) promote public appreciation and support for stewardship of coastal resources.

The Mission-Aransas NERR (185,708 acres or 751.5 km<sup>2</sup>) is located in the Mission-Aransas Estuary. The lands within the Reserve are managed by a combination of state, federal and private entities. The Texas General Land Office (GLO) own the majority of submerged lands (bays and open water) within the site (115,138 acres). The United States Fish and Wildlife Service own the Aransas National Wildlife Refuge, including Matagorda Island, which contains beach, estuarine marsh, and non-tidal coastal plain habitat (66,216 acres). The Texas Parks and Wildlife Department manages the Goose Island State Park (271 acres), which is owned by the GLO. Other private landholders with include the Coastal Bend Land Trust and Fennessey Ranch. The Coastal Bend Land Trust owns the Buccaneer Ranch Cove Preserve (728 acres), which includes a diverse suite of estuarine and non-estuarine habitats (many of high quality) that form an intact coastal watershed. Fennessey Ranch (3,324 acres) is composed of native tree/brush, prairie, freshwater wetlands, and Mission River riparian corridor. The Mission-Aransas Estuary also includes a number of archaeological sites (i.e., indian middens) and supports significant faunal and floral components. The site is relatively rural with limited industrial and community impacts.

The Mission-Aransas NERR will be administered by the University of Texas at Austin, Marine Science Institute (31 acres), the lead agency for the Reserve. Other key state partners of the Reserve include the Texas Department of Transportation (TxDOT), Coastal Bend Bays and Estuary Program, and a local governmental representative mutually agreed upon by Aransas County and the City of Rockport. TxDOT is the non-federal sponsor for the intracoastal waterway that bisects the Reserve. Designation of the Mission-Aransas NERR will not prohibit traditional uses of the area, as described in the management plan. However, NERR designation may activate additional requirements within existing federal permit applications. Current uses include boating, fishing, hunting, mining (gas and oil), shellfish harvesting, camping, and other recreational activities.

## 1.0 INTRODUCTION

The management plan describes how the Mission-Aransas National Estuarine Research Reserve (NERR; or Reserve) will be managed by the University of Texas at Austin, Marine Science Institute (UTMSI). This management plan is a compilation of subject specific plans that describe the management of the Reserve. The management plan entails how the Reserve will manage administration. The plan also describes the existing resource protection of areas within the proposed boundaries and areas adjacent to the boundary. A boundaries/acquisition plan describes the criteria, description and rationale of the boundary, as well as core and buffer areas, and future acquisitions/boundary expansion opportunities. The stewardship plan describes programs within the stewardship sector, which include site profile and ecological characterization of the Reserve, coastal training program, land management coordination, restoration and mitigation initiatives, animal rescue, and other specific types of programs and collaborations. The public access plan describes the National Estuarine Research Reserve System (NERRS; or reserve system) priorities for public access, the Reserve public access policy, present public access, and access needs. The facilities/construction plan describes the existing facilities and potential facility sites, facility needs, and a facility plan. The research and monitoring plan describes the research goals of the NERRS, National Oceanic and Atmospheric Administration (NOAA) research and monitoring funding priorities, background and research priorities of the Reserve, research and monitoring plan goals, objectives, and actions of the Reserve, policies and priorities, research and monitoring plan development, users and audience, evaluation and coordination procedures, research opportunities, cooperative efforts, and funding opportunities. The education/interpretation/outreach plan describes the education/interpretation/outreach goals of the NERRS, national guidelines and policies for education, background and education priorities of the Reserve, educational goals, objectives, and actions of the Reserve, framework of education, interpretation and outreach programs, existing UTMSI marine education programs, users and audience, types of programs, coordination of educational and outreach programs and initial priorities, and a needs assessment and evaluation. The volunteer plan describes the goals, objectives and actions of the Reserve volunteer program, the structure and coordination, and existing volunteer programs. The resource protection, restoration, and manipulation plan details existing protection, restoration, and manipulation of the Reserve resources.

### 1.1 NERRS Mission and Goals

The NERRS was created by the Coastal Zone Management Act (CZMA) of 1972, as amended, 16 U.S.C. Section 1461, to augment the Federal Coastal Zone Management (CZM) Program. The CZM Program is dedicated to comprehensive, sustainable management of the nation's coasts. The reserve system is a network of protected areas established to promote informed management of the Nation's estuaries and coastal habitats. The reserve system currently consists of 26 reserves in 21 states and territories, protecting over one million acres of estuarine lands and waters.

#### Mission

As stated in the NERRS regulations (Appendix 1), 15 CFR Part 921.1(a), the National Estuarine Research Reserve System mission is:

*the establishment and management, through Federal-state cooperation, of a national system of Estuarine Research Reserves representative of the various regions and estuarine types in the United States. Estuarine Research Reserves are established to provide opportunities for long-term research, education, and interpretation.*

#### Goals

Federal regulations, 15 CFR Part 921.1(b), provide five specific goals for the reserve system:

- (1) Ensure a stable environment for research through long-term protection of National Estuarine Research Reserve resources;
- (2) Address coastal management issues identified as significant through coordinated estuarine research within the System;

- (3) Enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation;
- (4) Promote Federal, state, public and private use of one or more Reserves within the System when such entities conduct estuarine research; and
- (5) Conduct and coordinate estuarine research within the System, gathering and making available information necessary for improved understanding and management of estuarine areas.

#### Strategic Goals 2003 - 2008

The reserve system began a strategic planning process in 1994 in an effort to help NOAA achieve its environmental stewardship mission to "sustain healthy coasts." In conjunction with the strategic planning process, Estuarine Reserve Division (ERD) and reserve staff has conducted a multi-year action planning process on an annual basis since 1996. The resulting three-year action plan provides an overall vision and direction for the reserve system.

Reserve System Strategic Plan Goals (revised 2002):

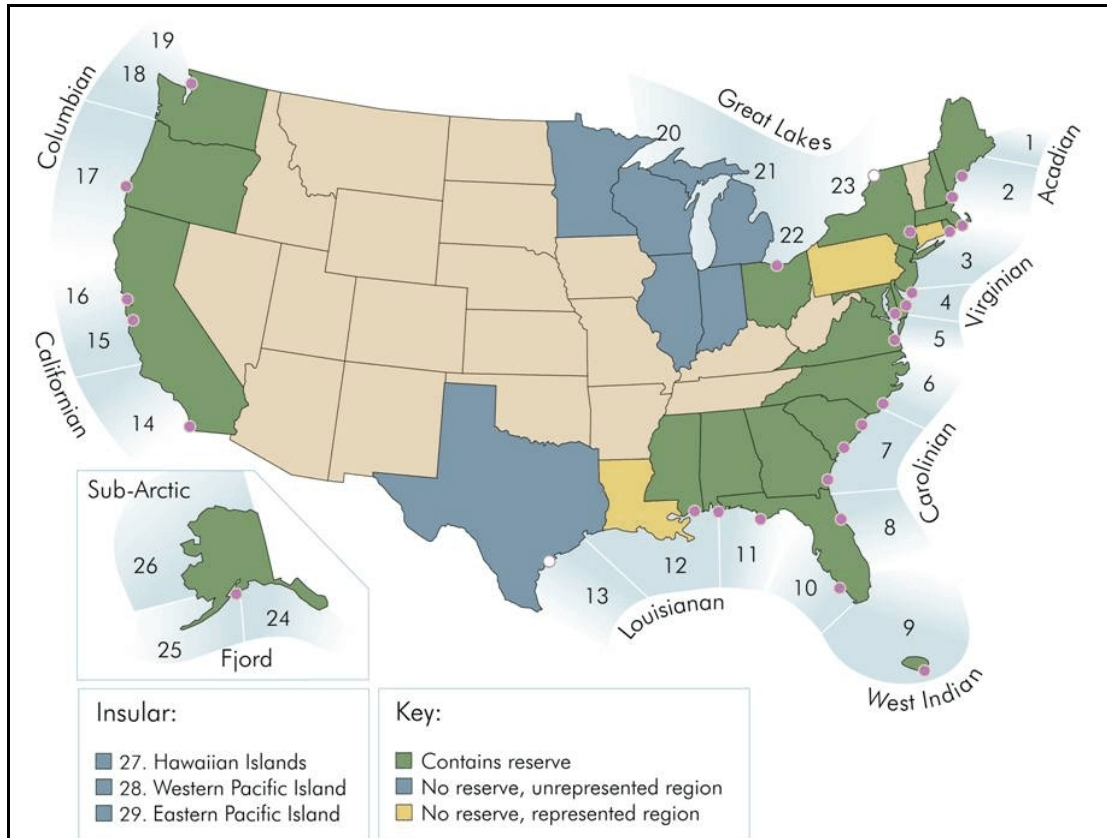
- (1) Improve coastal decision making by generating and transferring knowledge about coastal ecosystems.
- (2) Enhance and expand the National Estuarine Research Reserve System.
- (3) Increase awareness, use, and support of the reserve system and its estuarine science, education, and stewardship programs.

#### Biogeographic Regions

NOAA has identified eleven distinct biogeographic regions and 29 subregions in the U.S., each of which contains several types of estuarine ecosystems (15 CFR Part 921, Appendix I and II). When complete, the reserve system will contain examples of estuarine hydrologic and biological types characteristic of each biogeographic region. As of 2004, the reserve system includes twenty six reserves and two reserves in the process of designation (Figure 1).



Figure 1. Biogeographic regions and reserves of the NERR system. The reserves are listed below with their designation date.



<p>Acadian – Southern Gulf of Maine Wells Reserve, Maine (1984) Great Bay Reserve, New Hampshire (1989)</p> <p>Virginian - Southern New England Waquoit Bay Reserve, Massachusetts (1988) Narragansett Bay Reserve, Rhode Island (1980) Hudson River Reserve, New York (1982)</p> <p>Virginian – Middle Atlantic Jacques Cousteau Reserve, New Jersey (1998) Delaware Reserve (1993)</p> <p>Virginian – Chesapeake Bay Chesapeake Bay Reserve, Maryland (1985,1990) Chesapeake Bay Reserve, Virginia (1991)</p> <p>Carolinian – North Carolina North Carolina Reserve (1985,1991)</p> <p>Carolinian – South Atlantic North Inlet-Winyah Bay Reserve, South Carolina (1992) ACE Basin Reserve, South Carolina (1992) Sapelo Island, Georgia (1976)</p> <p>Carolinian – East Florida Guana Tolomato Matanzas Reserve, Florida (1999)</p> <p>West Indian – Caribbean Jobos Bay Reserve, Puerto Rico (1981)</p> <p>West Indian – West Florida Rookery Bay Reserve, Florida (1978)</p>	<p>Louisianan – Panhandle Coast Apalachicola Reserve, Florida (1979) Weeks Bay Reserve, Alabama (1986)</p> <p>Louisianan – Mississippi Delta Grand Bay Reserve, Mississippi (1999)</p> <p>Louisianan – Western Gulf Mission-Aransas Reserve, Texas (Proposed)</p> <p>Californian – Southern California Tijuana River Reserve, California (1982)</p> <p>Californian – Central California Elkhorn Slough Reserve, California (1979)</p> <p>Californian – San Francisco Bay San Francisco Bay, California (2003)</p> <p>Columbian – Middle Pacific South Slough Reserve, Oregon (1974)</p> <p>Columbian – Puget Sound Padilla Bay Reserve, Washington (1980)</p> <p>Great Lakes – Lake Erie Old Woman Creek, Ohio (1980)</p> <p>Great Lakes – Lake Ontario St. Lawrence River, New York (Proposed)</p> <p>Fjord – Aleutian Islands Kachemak Bay Reserve, Alaska (1999)</p>
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### Reserve Designation and Operation

Under Federal law (16 USC Section 1461), a state can nominate an estuarine ecosystem for Research Reserve status so long as the site meets the following conditions:

- (1) The area is representative of its biogeographic region, is suitable for long-term research and contributes to the biogeographical and typological balance of the System;
- (2) The law of the coastal State provides long-term protection for the proposed Reserve's resources to ensure a stable environment for research;
- (3) Designation of the site as a Reserve will serve to enhance public awareness and understanding of estuarine areas, and provide suitable opportunities for public education and interpretation; and
- (4) The coastal State has complied with the requirements of any regulations issued by the Secretary [of Commerce].

Reserve boundaries must include an adequate portion of the key land and water areas of the natural system to approximate an ecological unit and to ensure effective conservation.

If the proposed site is accepted into the reserve system, it is eligible for NOAA financial assistance on a cost-share basis with the state. The state exercises administrative and management control, consistent with its obligations to NOAA, as outlined in a memorandum of understanding. A reserve may apply to NOAA's ERD for funds to help support operations, research, monitoring, education/interpretation, stewardship, development projects, facility construction, and land acquisition.

### National Estuarine Research Reserve System Administrative Framework

The Estuarine Reserves Division of the Office of Ocean and Coastal Resource Management (OCRM) of NOAA administers the reserve system. The Division establishes standards for designating and operating reserves, provides support for reserve operations and system-wide programming, undertakes projects that benefit the reserve system, and integrates information from individual reserves to support decision-making at the national level. As required by Federal regulation, 15 CFR Part 921.40, OCRM periodically evaluates reserves for compliance with Federal requirements and with the individual reserve's Federally-approved management plan.

The Estuarine Reserves Division currently provides support for three system-wide programs: the System-Wide Monitoring Program, the Graduate Research Fellowship Program, and the Coastal Training Program. They also provide support for reserve initiatives on restoration science, invasive species, K-12 education, and reserve specific research, monitoring, education and resource stewardship initiatives and programs.

## **1.2 Reserve Mission, Vision, and Goals**

An important part of a management plan is to state a mission for the organization, a vision on how the mission will lead to the betterment of man and society, and specific goals to accomplish the mission. The topic of potential mission, goals and objectives of the Reserve were discussed in a workshop format by the Site Selection Committee on January 23, 2003 and are described in detail in the Site Nomination document (UTMSI 2003). The Reserve planners used this workshop documentation to create the mission, vision, and goals for the initial Reserve management plan (Table 1).

*The mission of the Mission-Aransas National Estuarine Research Reserve is to develop and facilitate partnerships that enhance coastal decision making through an integrated program of research, education, and stewardship.*

*The vision of the Mission-Aransas National Estuarine Research Reserve will be to develop a center of excellence to create and disseminate knowledge necessary to maintain a healthy Texas coastal zone.*

There are three goals that will be used to support the Reserve mission:

**Goal 1:** To improve understanding of Texas coastal zone ecosystems structure and function. Understanding of ecosystems is based on the creation of new knowledge that is primarily derived through basic and applied research. New knowledge is often an essential component needed to improve coastal decision making.

**Goal 2:** To increase understanding of coastal ecosystems by diverse audiences. Education and outreach are the primary delivery mechanisms to explain what coastal ecosystems are and how they work. It is essential that information is disseminated broadly within our society.

**Goal 3:** Promote public appreciation and support for stewardship of coastal resources. In many ways, stewardship is an outcome resulting from the integration of research and education. Research creates information that is communicated through education. This information forms the basis for an appreciation of the values of an environment, and that in turn promotes a public sense of ownership of natural resources.

The chapters that follow describe each Reserve program plan. In each program plan, the objectives to meet these goals are described in detail. Under the objectives are lists of specific actions or tasks that will be accomplished to meet the objective.

Overall, adopting and executing actions leads to the accomplishment of the goals. Because many of the actions are cross-cutting across the goals, this provides the integration necessary to accomplish the Reserve mission (Table 1).

Table 1. Matrix of goals and objectives for the Reserve management plan. *Objectives in italic font* are numbered by goal and objective.

<b>Mission:</b>	To develop and facilitate partnerships that enhance coastal decision making through an integrated program of research, education, and stewardship		
<b>Vision:</b>	A center of excellence to create and disseminate knowledge necessary to maintain a healthy Texas coastal zone		
<b>Plan:</b>	<b>Goal 1: Improve understanding of Texas coastal zone ecosystems structure and function</b>	<b>Goal 2: Increase understanding of coastal ecosystems by diverse audiences</b>	<b>Goal 3: Promote public appreciation and support for stewardship of coastal resources</b>
<b>Administrative</b>	<i>1-1 Provide oversight and support for research and monitoring activities</i>	<i>2-1 Support K-12 and stakeholder education and outreach activities</i>	<i>3-1 Provide oversight and support for stewardship activities</i>
<b>Acquisition</b>	<i>1-2 Protect the integrity of core areas for long-term research</i>		<i>3-2 Expand Reserve boundary to shorelines where adjacent property owners are agreeable</i>
			<i>3-3 Expand Reserve boundary to include key wetland habitats</i>
			<i>3-4 Expand Reserve boundary to protect key watershed areas</i>
<b>Stewardship</b>	<i>1-3 Update site profile and ecological characterization via ground-truthing of the GIS data base</i>	<i>2-2 Better inform coastal decision-makers</i>	<i>3-5 Monitor land management practices among Reserve partners</i>
	<i>1-4 Protect core areas for long-term research</i>	<i>2-3 Improve the capacity to engage in ecotourism activities</i>	<i>3-6 Develop partnerships with locally-based animal rescue programs</i>
		<i>2-4 Provide outdoor educational experiences to scouting and other community organizations</i>	<i>3-7 Support existing clean-up and recycling programs near the Reserve</i>
			<i>3-8 Promote Reserve initiatives at public events, fairs and expositions</i>
			<i>3-9 Initiate restoration and mitigation projects with appropriate partners</i>
<b>Public Access</b>	<i>1-5 Access to Reserve partner land and water areas for research activities</i>		<i>3-10 Public and group access to Reserve partner education/outreach facilities and environments</i>

<b>Plan:</b>	<b>Goal 1: Improve understanding of Texas coastal zone ecosystems structure and function</b>	<b>Goal 2: Increase understanding of coastal ecosystems by diverse audiences</b>	<b>Goal 3: Promote public appreciation and support for stewardship of coastal resources</b>
<b>Facilities</b>	<i>1-6 Provide facilities for the research and monitoring community</i>	<i>2-4 Provide access to UTMSI facilities for Reserve education programs</i>	<i>3-11 Create an Aransas Bay public outreach facility in partnership with the City of Rockport and others</i>
		<i>2-5 Create a Copano Bay public research and education center</i>	
		<i>2-6 Partner with USFWS to enhance visitor experience at the Aransas Wildlife Refuge</i>	
		<i>2-7 Complete the Wetland Education Center at UTMSI</i>	
		<i>2-8 Link Education and Outreach NERR facilities</i>	
<b>Research</b>	<i>1-7 Improve understanding of short and long-term changes within Texas coastal ecosystems</i>	<i>2-9 Disseminate coastal Texas research information and results to lay public</i>	<i>3-12 Promote public participation in research and monitoring programs</i>
	<i>1-8 Increase understanding of effects of anthropogenic activities on coastal ecosystems</i>	<i>2-10 Transfer research knowledge to K-12 teachers and classrooms</i>	<i>3-13 Increase public understanding of ecological values</i>
	<i>1-9 Increase graduate student participation in Reserve research and monitoring programs</i>	<i>2-11 Inform researchers and decision-makers of research results</i>	

<b>Plan:</b>	<b>Goal 1: Improve understanding of Texas coastal zone ecosystems structure and function</b>	<b>Goal 2: Increase understanding of coastal ecosystems by diverse audiences</b>	<b>Goal 3: Promote public appreciation and support for stewardship of coastal resources</b>
<b>Education</b>	<i>1-10 Increase K-12 student participation in Reserve research and monitoring</i>	<i>2-12 Enhance existing formal and informal education programs</i>	<i>3-14 Promote public appreciation of Texas coastal resources</i>
		<i>2-13 Increase science literacy for K-12 students by using science as a language to understand coastal habitats</i>	<i>3-15 Increase public awareness of the Reserve and the NERR System</i>
		<i>2-14 Increase public literacy about Texas coastal ecosystems</i>	<i>3-16 Provide outdoor educational experiences to scouting and other community organizations</i>
		<i>2-15 Enhance the transfer of knowledge, information, and skills to coastal-decision makers</i>	
<b>Volunteer</b>	<i>1-11 Increase the Reserve's monitoring capacity</i>	<i>2-16 Increase the Reserve's capacity to provide educational experiences to K-12 students</i>	<i>3-17 Foster a stewardship ethic within local communities</i>
			<i>3-18 Increase the Reserve's capacity to promote public appreciation of Texas coastal resources</i>

## 2.0 RESOURCE DESCRIPTION

### 2.1 General Description

The Western Gulf of Mexico consists of six major ecosystems. The Reserve contains a typical Western Gulf of Mexico estuary (Diener 1975). The estuarine system is composed of tertiary, secondary, and primary bays (Figure 2). Mission Bay is the only tertiary bay, and Port Bay is a minor tertiary bay. Copano Bay and St. Charles Bay are secondary bays. Mesquite, Aransas and Redfish Bay are primary bays because they are adjacent to the oceanic outlets. Copano Bay is a coastal plain estuary, composed of two drowned river mouths of the Mission and Aransas Rivers. Aransas, Redfish and Mesquite Bays are bar-built estuaries, in which an offshore sand bar partially encloses a body of water. Aransas Bay is the largest bay, followed by Copano and Mesquite Bay. The bay systems are shallow and the mean low water varies from 0.6 m in Mission Bay to 3 m in Aransas Bay (Chandler et al. 1981). Detailed information on the climate, geology, hydrography/oceanography, water quality, habitat types, significant fauna and flora, endangered species, and cultural aspects can be found in the site nomination document (<http://www.utmsi.utexas.edu/nerr/>).

#### Climate

The Reserve has a subhumid-to-semiarid east coast subtropical climate, with extreme variability in precipitation with generally high humidity and infrequent but significant killing frosts (Fulbright et al. 1990). Generally, the Reserve experiences high temperatures along with deficiencies in moisture. Major climatic influences are temperature, precipitation, evaporation, wind, tropical storms and hurricanes.

#### Hydrography / Oceanography

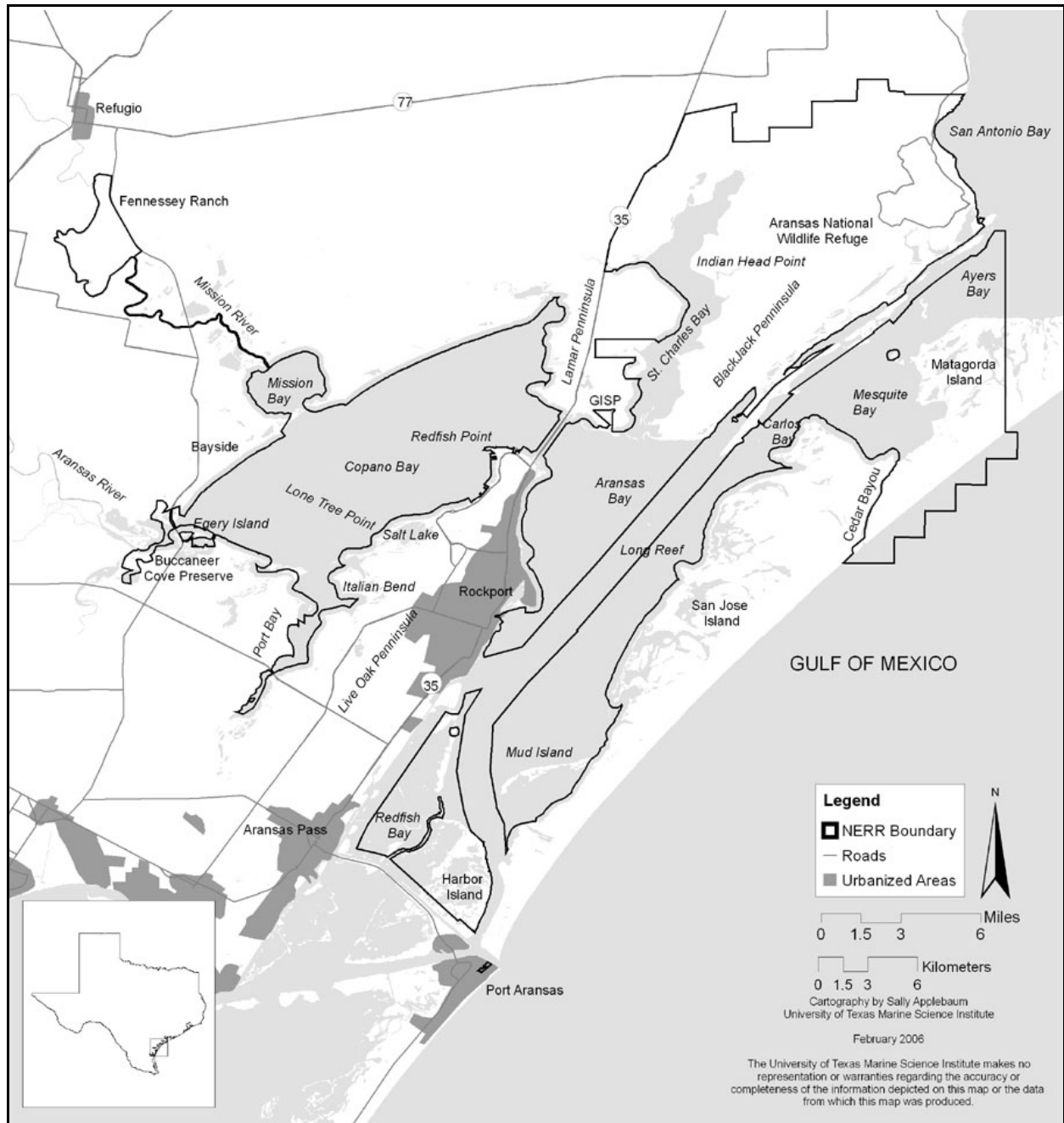
The primary climatic conditions that influence the hydrology in the Reserve are freshwater inflow and to a lesser extent tidal exchange. The Mission and Aransas rivers contribute the major freshwater inflows into the Reserve. All drainage of the Mission-Aransas Estuary share the major Gulf of Mexico connection at Port Aransas (Aransas Pass). Tidal exchange in the Aransas estuary is driven by astronomical tides, meteorological conditions, and density stratification (Armstrong 1987). Because of shallow bay depths (1 - 4 m at mid-tide) and a relatively small tidal prism, wind exerts a much greater influence on bay circulation than astronomical tides (Morton and McGowen 1980, Armstrong 1987, NOAA 1990a).

The Reserve has a large salinity gradient, with high salinities in Redfish Bay to lower salinities in Mission Bay. Salinity structure within the Reserve is determined by isolated freshwater pulses that, once introduced are retained within the system (NOAA 1993). Freshwater pulses tend to lower salinities for long periods of time because of the shallowness of the bay and the restricted inlet connection. Salinity stratification is common following fresh water impulses and usually occurs in Copano Bay (NOAA 1993). Salinity stratification can occur in secondary bays (e.g., Aransas Bay), in summer when winds subside and evaporation causes dense water to sink (Morehead et al. 2002).

The main sources of freshwater inflow into the Copano Bay, which is the main secondary bay in the Reserve are the Mission River and Aransas River (Figure 2). Whereas the Aransas River flows directly into Copano Bay, the Mission River flows into Mission Bay, which is connected to Copano Bay.

The San Antonio River enters the Guadalupe River just before the Guadalupe River enters San Antonio Bay. Thus the Guadalupe River has its main effect on San Antonio Bay, not Copano Bay or Aransas Bay. However, during large flood events freshwater moves along the southwest shoreline of San Antonio Bay (adjacent to the Reserve boundary) and can flow into Ayers Bay and Mesquite Bay in the northeastern boundary of the Reserve (Longley 1994). The higher elevation of flood waters in Mesquite Bay outflows to the Gulf of Mexico via Cedar Bayou. During rare extreme events the freshwater can also continue to flow southwest and enter Aransas Bay. During floods, inflow from San Antonio Bay can be a third source of freshwater to the Mission-Aransas Estuary. During dry periods, evaporation in Ayers Bay and Mesquite Bay keep water from flowing into the Reserve.

Figure 2. Geographical map with feature names of the Mission-Aransas Estuary.





### Geology

The shorelines of Copano Bay and Aransas Bay are in a state of erosion; whereas the bay side shoreline of San Jose Island is in a state of equilibrium or accretion (Chandler et al. 1981). The most common sediment type in the Mission-Aransas Estuary is mud, which is comprised of silt and clay (White et al. 1983). Mesquite Bay and St. Charles Bay is primarily comprised of sand to sandy silt (White et al. 1989). Aransas, and northern Copano Bay have a higher portion of clay, while the southern portion of Copano Bay has a higher portion of silt. Copano Bay also has areas where the sediments have as high as 75% shell material occurring near oyster reefs. The margins of Copano and Aransas Bay have a higher percentage of sand (White et al. 1983).

### Water Quality

Water quality in the Reserve ranges from good to moderate. There are low to medium ambient concentrations of nitrogen and phosphorus from agricultural runoff (NOAA 1977). Copano Bay, Port Bay, and Mission Bay are currently listed by the Texas Commission on Environmental Quality (TCEQ) as having high bacteria concentrations. The locations of impairment include the area along southern shoreline near Port Bay and the shoreline near the town of Bayside. Even though there are areas in the Reserve that are impaired by bacteria, the Mission-Aransas Estuary has a small area of impairment in comparison to other estuarine systems along the Texas coast, and the bacteria impairment in the Reserve is currently listed as a low urgency for a Total Maximum Daily Load (TMDL) analysis. The Texas Department of Health and Texas A&M Corpus Christi are currently sampling Copano Bay to determine the bacteria levels and the source.

### Habitat Types and Descriptions

Along with open-water habitats, the Reserve includes several types of wetlands: freshwater (palustrine), brackish, salt marshes, and mangrove communities (Figure 3 and Table 2). The wetland and open water habitats also support benthic and nektonic populations, as well as large areas of oyster reefs. Large areas of seagrass and mangroves are present in southern boundaries of the Reserve. Beach and tidal flat habitats are located along the ocean side of Matagorda Island. Several maritime forests are also located within the Reserve including coastal prairies, oak mottes, and riparian woodlands. All these habitats support endangered species and culturally important species, such as shrimp and fish.

Figure 3. Habitats within and nearby the Reserve.

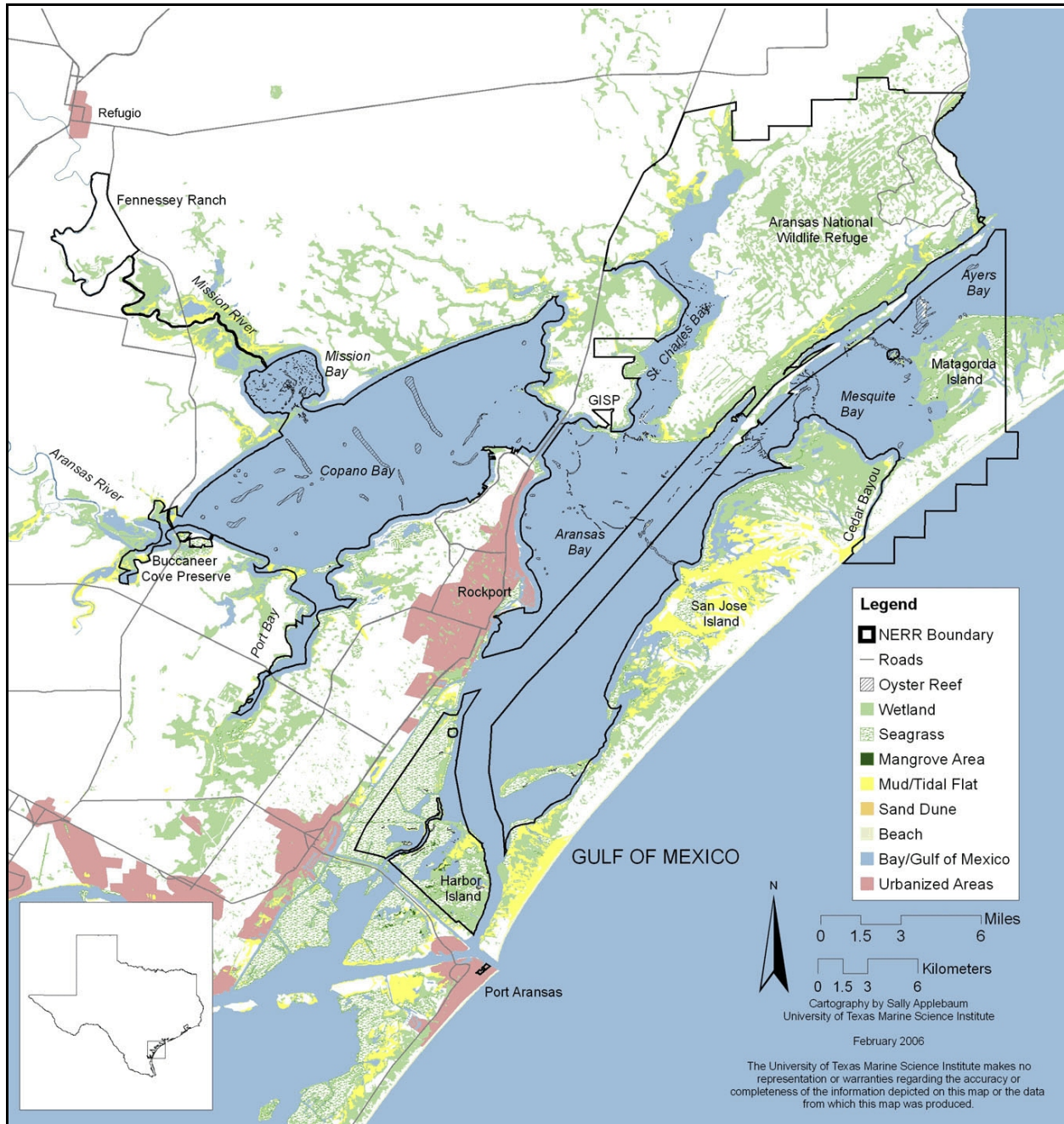


Table 2. Inventory of habitat areas (in acres) for each Reserve partner's land. Abbreviations: General Land Office (GLO), Aransas National Wildlife Refuge (ANWR), Coastal Bend Land Trust (CBLT), Goose Island State Park (GISP), and University of Texas at Austin, and Marine Science Institute (UTMSI).

Habitat	Total Boundary	GLO	ANWR	Fennessey Ranch	CBLT	GISP	UTMSI
Bay/Gulf of Mexico	105,706	103,961	1,625	0	108	12	0
Beach	332	90	242	0	0	0	0
Impounded Area	126	0	126	0	0	0	0
Intermittent Lake	16	16	0	0	0	0	0
Lake	607	191	135	281	0	0	0
Mangrove Area	65	65	0	0	0	0	0
Mud/Tidal Flat	1,950	589	1,320	0	41	0	0
Oyster Reef	96	96	0	0	0	0	0
River or Stream	62	0	62	0	0	0	0
Seagrass	8,717	7,081	1,435	0	141	60	0
Wetland	27,786	2,678	24,456	266	343	40	3
Terrestrial	40,246	372	36,815	2,777	95	159	28
Total Area	<b>185,708</b>	115,138	66,216	3,324	728	271	31
% of Area	100%	62%	35.66%	1.79%	0.39%	0.15%	0.02%

#### Endangered Species

There are several estuarine dependent species in the Reserve that are listed as endangered or threatened. One of the most well known endangered species that inhabits the Reserve is the whooping crane. This species winters along the south Texas coast at the Aransas National Wildlife Refuge (ANWR). The ANWR was established in 1937 and the whooping crane is making a comeback from a low of 15 birds in 1941 to a count of 216 in 2005 (Tom Stehn, personnel communication). The brown pelican is also a well known endangered bird species that is present within the Reserve. Brown pelican populations began declining in the 1930's and numbers dropped dramatically between 1952 and 1957 (Tunnell et al. 1996). The drastic decline in numbers were due to hurricanes, disease, and pesticides. Populations have been increasing since the 1970's and the increase is correlated with the discontinued use of DDT in 1972, along with conservation efforts.

#### Cultural aspects

Karankawa, Tamaulipecan, and Coahuiltecan Indians are the first known inhabitants of the Reserve (Martin 1972, Hester 1980). It is estimated that they lived here for at least 20,000 years and disappeared by the mid-1800's. The Karankawan tribe and those within their linguistic family had the highest population within the Reserve with their core range extending from Matagorda to Corpus Christi Bay (Hester 1980). There are several locations of archaeological sites (i.e., middens) from these tribes surrounding and within the Reserve (Hester 1980, Ricklis 1996). The decline of indigenous populations correlates with arrival of Spanish settlers when the first trading posts were established during the 1700's. Development and industrialism continued in the region resulting in the present day society.

Sites of historical interest are also present in the Reserve. The Aransas Pass Lighthouse was established as a lighthouse in 1855, and is listed in the National Historical Registry. The lighthouse is located in the Lydia Ann Channel. It was seriously damaged during a Confederate attack in December 1862, in which the top twenty feet of the tower was destroyed. It was rebuilt in 1867 and was decommissioned in 1952 (Holland 1972). The banks of the Cedar Bayou inlet also have remains of 19<sup>th</sup> century brickyards. At this site, large complexes of brick kilns, huge open cisterns, and associated brick foundations are present to account for relics of the industrial age (Fox 1983).

### 3.0 ADMINISTRATION PLAN

#### 3.1 Introduction

##### Relationship to Federal Government

A state, commonwealth, or territory and the federal government cooperate in operation of each National Estuarine Research Reserve (NERR). The federal interest is represented primarily by the Office of Ocean and Coastal Resource Management (OCRM), National Ocean Service (NOS), National Oceanic and Atmospheric Administration (NOAA). NOAA's mission includes management of the nation's coastal resources and promotion of global stewardship of the world's oceans and atmosphere through science and service. OCRM coordinates the National Estuarine Research Reserve System (NERRS) nationally and administers financial awards to individual Reserves.

The NERRS operates as a federal/state partnership. Although the management of a reserve, including development of site-specific policies and programs, is a state's responsibility, NOAA provides overall system policies and guidelines, cooperates with and assists the states in selecting, designating, and operating Reserves, and reviews state programs regularly. The purpose of the NOAA review is to ensure that a state is complying with federal NERRS goals, approved work plans and Reserve management plans. The primary mechanisms used by NOAA to assist the state, as well as NOAA responsibilities pertaining to reviews are discussed below.

The final environmental impact statement and the Reserve management plan must be approved by NOAA before the final version of each document is published. Upon designation, NOAA staff, in particular the program specialist assigned to the Reserve, communicates directly and regularly with the state reserve staff. Communication builds a level of trust between federal and state staff and familiarizes both the Estuarine Reserve Division (ERD) and state personnel with reserve management procedures and policies. This cooperative approach is needed for a reserve to be successful. Both oral and written communication is necessary and site visits are advisable.

Another component of NOAA oversight is its reserve funding program. NOAA provides different categories of grant funding to a reserve and works with reserve staff to ensure that funds are spent on projects and in areas where the most benefit can be achieved. Semi-annual grant progress reports and a final grant report are required. NOAA personnel carefully review the grant reports and associated communications to ensure compliance with program policies and specific grant conditions.

Pursuant to the Coastal Zone Management Act (CZMA) enabling legislation (Sections 312 and 315), OCRM must periodically conduct performance evaluations of the operation and management of each reserve while federal financial assistance continues. These reviews are a mechanism for identifying, discussing, and resolving concerns with reserve operation.

The state interest is usually represented through one or more state agencies, typically agencies charged with education, environmental, research, wildlife, or coastal management responsibilities. The state agency administers reserve personnel and day-to-day reserve management. The management for the Reserve will be through the University of Texas at Austin, Marine Science Institute as outlined in the administrative plan below.

##### Administrative Plan for the Reserve

The Reserve will be administered by the University of Texas at Austin, Marine Science Institute (UTMSI), the State of Texas-designated lead agency for the Reserve. The memorandum of understanding (MOU) between the UTMSI and NOAA establishes the roles and responsibilities of these agencies (Appendix 2). Other key state, federal and private partners of the Reserve include the Texas General Land Office (GLO), United State Fish and Wildlife Service (USFWS), Texas Parks and Wildlife Department (TPWD), Coastal Bend Land Trust (CBLT), The Nature Conservancy (TNC), Fennessey Ranch, Texas Department of Transportation (TxDOT), Coastal Bend Bays and Estuary Program (CBBEP), and a local governmental representative mutually agreed upon by Aransas County and the City of Rockport. These partnerships have been established based on mutual interest in the project and to provide a means by which key aspects of the program will function (i.e., research, education, monitoring, administration, resource protection, facility

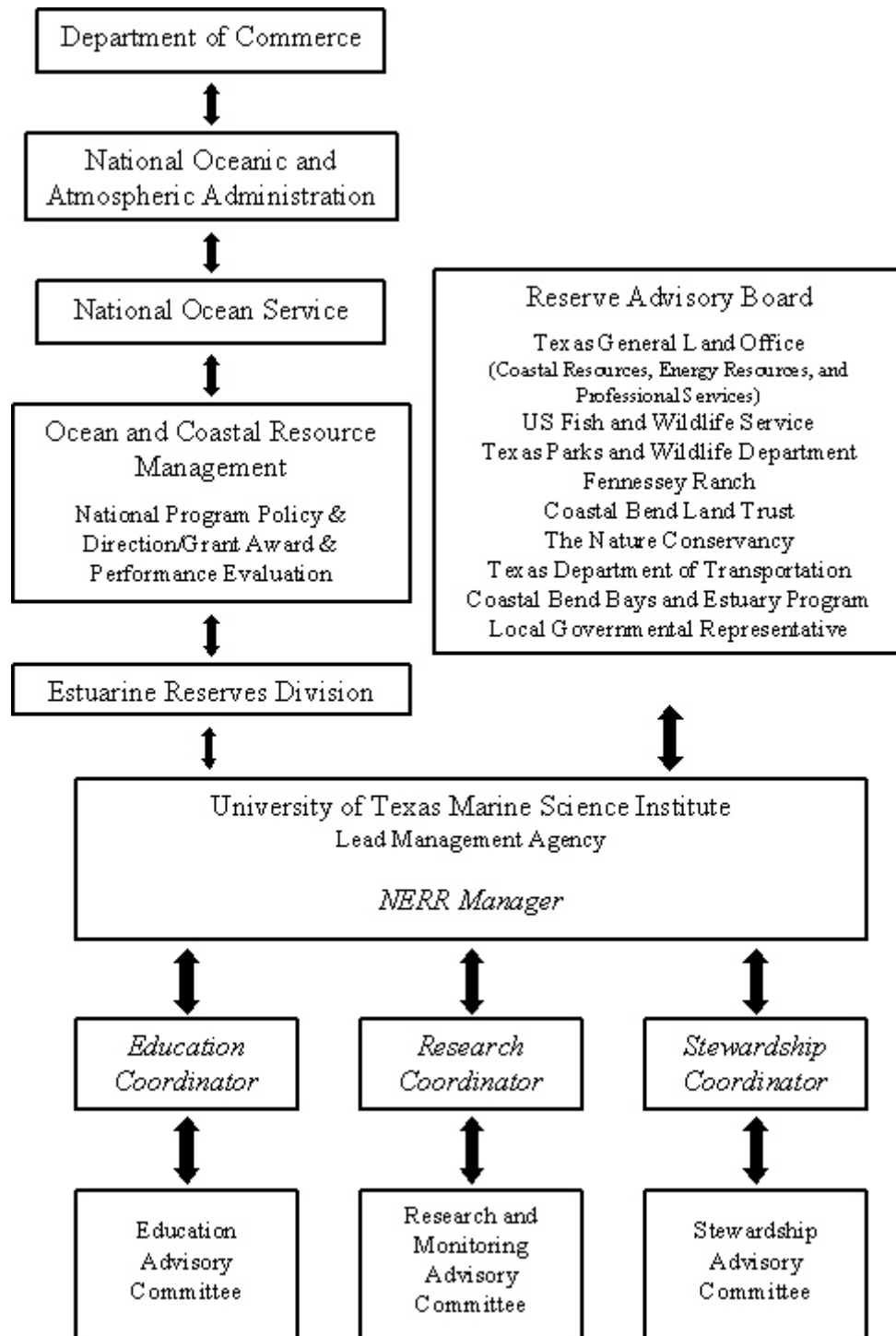
development and operation, and site security). Agreements that describe the relationships between these partners are provided in appendices and listed below:

- MOU between the UTMSI and the six partners: GLO, USFWS, TPWD, TNC, CBLT, Fennessey Ranch, TxDOT, CBBEP, and a local governmental representative mutually agreed upon by Aransas County and the City of Rockport (Appendix 3)
- Coastal Lease for Scientific Purposes from GLO to UTMSI (Appendix 4)

#### Administrative Framework

The administrative framework of the Reserve, including key partners, advisory committees and NOAA are shown in Figure 4. The roles and responsibilities of the primary partners are detailed below. Details about how these groups interact to manage the Reserve are provided below. Advisory groups will also be established to allow other interested parties input into the operation and implementation of the research, monitoring, education and stewardship programs of the Reserve. Three committees will provide advice on the operations and management of the Reserve and the research, monitoring and education programs.

Figure 4. Organizational framework for the Reserve. Principal Reserve staff are shown in italics. Other coordinator positions may be created, and other committees may be developed or changed as appropriate.



### 3.2 Program Goals and Objectives

The administrative plan is unique in that the same objectives are required to meet all three goals of the Reserve. This is because administrative objectives are basically the same for any goal that the Reserve might adopt. Administration typically plans, oversees, and supports all Reserve goals.

#### Goal 1: Improve understanding of Texas coastal zone ecosystems structure and function

##### *Objective 1-1: Provide oversight and support for research and monitoring activities*

Oversight of research and monitoring activities will be provided by the Reserve manager and the research coordinator. Support of research and monitoring activities, such as travel and overhead, will be provided for by Reserve funds.

##### **Action 1:** Develop, execute, and revise a Reserve management plan

The UTMSI will develop and execute the Reserve management plan. The UTMSI will revise the management plan every five years with advice from the Reserve Advisory Board. Revision of the management plan will update and create new objectives for the research and monitoring plan.

##### **Action 2:** Obtain advice on the program from the broader community

Advice on the program from the broader community will be obtained through the Reserve Advisory Board and the Research and Monitoring Advisory Committee. The first task of the advisory committee will be the development of a needs assessments for target audiences. Needs assessments are a systematic investigation of an audience to identify aspects of individual skills, knowledge, interests, attitudes, or abilities relevant to a particular issue, organizational goal or objective. Needs assessments are designed to collect sufficient information about a particular target group to design an effective program that addresses the group's needs and desires.

##### Reserve Advisory Board

The Reserve Advisory Board (RAB) will provide advice to Reserve staff for management, research/monitoring activities, stewardship objectives, and educational programs based on the approved Reserve management plan. The state, federal, and private organizations listed above are principal partners and have had principal roles throughout the site selection and designation process of the Reserve and have agreed to continue their involvement as described above and detailed in the agreements among these partners (Appendix 4). The Board shall be comprised of members from the principal partners. The General Land Office, shall have one representative from each of three divisions that have direct but distinct interests in the Reserve: Coastal Resources, Energy Resources, and Professional Services. Texas Parks and Wildlife Department, U.S. Fish and Wildlife Service, The Nature Conservancy, Coastal Bend Land Trust, Fennessey Ranch, Texas Department of Transportation, and Coastal Bend Bays and Estuary Program shall each have one representative on the Board. To provide an appropriate linkage to the broader community so the Reserve reflects the concerns and ideas of this regional constituency, a local governmental representative mutually agreed upon by Aransas County and the City of Rockport shall be a member of the Board. Further information on the key Reserve partners in the RAB is in Appendix 5. The RAB will elect a chairman annually from among the principal partners.

The RAB shall act on behalf of the agencies/entities having jurisdiction over sites comprising the Reserve. Members of the RAB will serve without compensation from the Reserve. The purpose of the RAB is to advise the University of Texas at Austin regarding implementation of the management plan. The RAB shall review the management plan every five (5) years and shall advise the University of Texas regarding modification of the management plan. The RAB may create committees or subcommittees to provide technical information or linkage to the broader community pertaining to the three main missions of Reserve: research, education, and stewardship. Members of committees or subcommittees will serve without compensation from the Reserve.

### Reserve Advisory Committees

Advisory committees will be established after designation of the Reserve to provide effective coordination and cooperation among key interests involved with the Reserve. At least three committees will be established: 1) research and monitoring advisory committee, 2) stewardship advisory committee, and 3) education advisory committee. These advisory committees will advise the respective coordinators on local issues related to research, monitoring, stewardship, and education. Advisory groups will include willing representation from all stakeholders and constituencies within the region.

Each committee will include representation from the research and education community, agencies, user groups, adjacent landowners, industry, and other groups as appropriate. Some cross-membership on committees is anticipated. The three committees will also meet together as appropriate, to ensure the most efficient use of available resources and to integrate the research, stewardship, and education goals.

### **Action 3:** Recruit and maintain staff

The UTMSI will implement the Reserve program by hiring, directing, and maintaining Reserve staff.

### Staff Requirements

Implementation of the goals and objectives for the Reserve is dependent upon adequate staffing levels. Although staffing levels may change through time and with availability of resources, a minimum staff is needed to manage and coordinate Reserve activities. Initially, the Reserve staff will consist of a Reserve manager, research coordinator, stewardship coordinator, education coordinator, and necessary technical and administrative support staff. The functions and responsibilities of the key positions are described below. Additional staff positions (Figure 5) will be incorporated in the program as adequate funding becomes available.

### Reserve Manager

The Reserve manager directs, coordinates and supervises all aspects of Reserve operations and management including administrative, research, stewardship, and education activities. The Reserve manager is directly responsible for the implementation of the Reserve management plan, supervision of Reserve staff, and acts as a liaison with federal, state, local, private entities, and advisory committees to achieve the goals of the Reserve. The Reserve manager will be a university-funded UTMSI position. The Reserve manager's duties and responsibilities will likely include:

- managing the Reserve operation on a day-to-day basis, prepare grant applications, proposal, budgets, reports and maintain necessary records;
- facilitating meetings of the RAB, research/monitoring, stewardship and education committees;
- representing the Reserve and its policies at public meetings and hearings;
- overseeing the research/monitoring, stewardship, and education programs of the Reserve;
- coordinating with other program managers on activities that might affect the Reserve;
- monitoring day-to-day operation of the Reserve and progress of research/monitoring, stewardship, and education plans;
- supervising Reserve staff members;
- overseeing facilities development, site selection and changes in Reserve boundaries with advice from RAB and other advisory committees;
- preparing required semi-annual, and annual reports and work plans for NOAA and other possible sources of funding
- directing and coordinating with NOAA on any changes in the Reserve management plan;
- working with NOAA in the development of national policy for the NERRS; and
- performing additional duties as required.



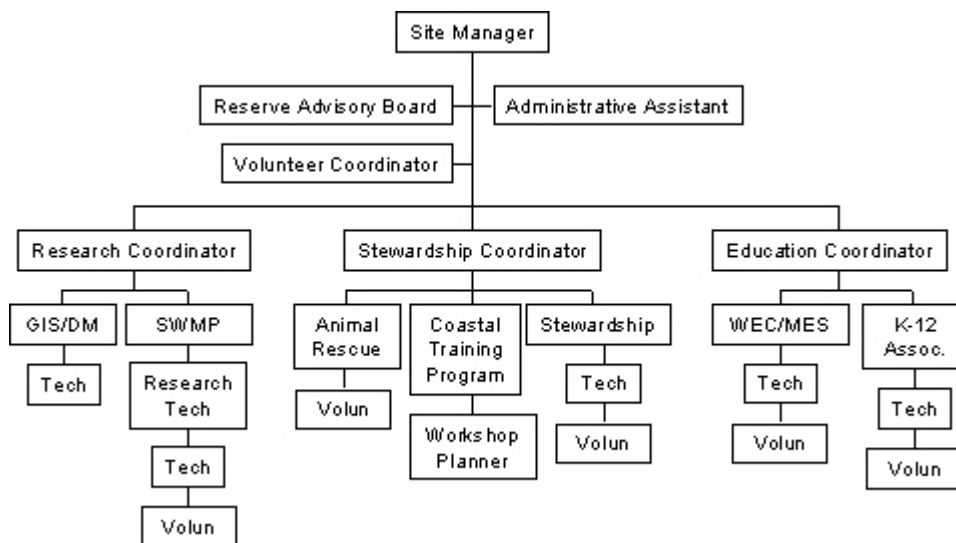
### Support Staff

Additional staff may become necessary to accomplish the goals and objectives set forth in this Reserve management plan (Figure 5). Clerical and other technical support staff are key to efficient operation of the Reserve’s programs. Clerical duties may include scheduling, public communications, office organization, web design and maintenance, minor accounting, and assistance in project production. Technical duties may include research assistance in sample and data collection and analysis, data interpretation and presentation, geographic information systems, data management, and training volunteers.

### Staff Qualifications

Reserve staff will be highly qualified individuals. The level of education and experience will vary with different levels of administrative responsibilities. The Reserve manager and coordinators will hold at least an M.S. in an appropriate field for their position, however, a Ph.D. is preferred for these positions. More highly trained and experienced technical staff are called research associates, and entry-level staff are called research assistant. Student training is accomplished by incorporating graduate research assistants and undergraduate assistants in the program. Volunteers will consist of the general public and are not required to have specific qualifications.

Figure 5. Reserve staff structure. Abbreviations: Volun = volunteer, DM = data management, WEC = wetland education center, MES = marine education services, and Tech = technical staff.



### Research Coordinator

The research coordinator oversees the operation and implementation of the Reserve research and monitoring programs, interacts with the Research and Monitoring Advisory Committee and other research institutions and individuals to fulfill the research objectives of the Reserve. The research coordinator reports to the Reserve manager and also coordinates with the Reserve education and stewardship coordinators to present scientific data in a user-friendly manner. In addition, the research coordinator will maintain close contact with and inform the OCRM of the progress of NOAA-funded research and monitoring activities. The research coordinator will be a university funded UTMSI position. The research coordinator’s duties and responsibilities will likely include:

- assisting the Reserve manager and other participating agencies and entities in preparing and updating an annual list of priorities for research and monitoring projects and conducting a peer review process for proposals when needed;
- evaluating the results of the peer review process for proposals and making recommendations to the Reserve manager and RAB;

- implementing the research program for the Reserve;
- serving as a liaison with the scientific community, promoting data utilization and acting as the primary contact for scientists performing research in the Reserve;
- providing staff support for the Research/Monitoring Advisory Committee
- coordinating all special studies and research activities within or related to the Reserve;
- coordination, interpretation, and application of research results;
- coordinating training of volunteers, research assistants and interns, and monitoring/evaluating their performance;
- recommending locations for research and monitoring stations within the Reserve and providing technical advice and assistance to scientists conducting research and monitoring as available;
- ensure that field journal and photographic records of on-going research activities are maintained;
- representing the Reserve at public meetings;
- working with the stewardship and education coordinator to develop suitable methods to disseminate Reserve-related information;
- working with NOAA on system wide projects (i.e., SWMP);
- developing additional research guidelines and policy statements as new issues arise;
- coordinating with the Reserve manager in the performance of these responsibilities; and
- participating in the development of research and monitoring facilities and the purchase of research and monitoring equipment.

**Action 4:** Solicit funds via grants

The Reserve staff will solicit additional funding through grants or contracts by actively seeking funding opportunities, preparing applications, and working with partners to leverage resources.

Many federal agencies periodically announce funding availability for projects that target the protection, preservation and management of coastal resources and estuarine areas. The Reserve will continually seek opportunities from these agencies. Examples of federal agencies that may fund/support research in the NERR include: the NOAA Office of Ocean and Coastal Resource Management, NOAA Sea Grant, NOAA Coastal Services Center, the Environmental Protection Agency, U.S. Geological Survey, the Department of the Interior and the Gulf of Mexico Program.

State agencies charged with protecting and regulating Texas's coastal resources occasionally provide funding opportunities to support research efforts. Examples of some of these agencies include: Texas General Land Office (GLO), Texas Parks and Wildlife Department (TPWD), Texas Commission of Environmental Quality (TCEQ), Texas Coastal Coordination Council and the Texas Coastal Management Plan, and the Coastal Bend Bays and Estuaries Program. Several private commercial and industrial businesses as well as non-profit organizations in South Texas support environmental research within the community through grants and contracts. Support for the Reserve by these businesses is strong. It is anticipated that sources of funding will exist through these businesses.

**Action 5:** Develop and operate a program for gifts to enhance Reserve activities

The UTMSI and Reserve manager will develop and operate a program to encourage gifts to the Reserve. A gift program can be accomplished by creating a Friends group, soliciting donations from organizations, and working with partners to identify potential donors and solicit gifts. A gift program will allow the Reserve to perform activities that enhance Reserve programs. Activities may include hosting notable researchers, recruiting staff, and funding graduate student fellowships.

**Action 6:** Foster partnerships for research

The Reserve offers a permanent place where research institutions may coordinate their projects and compare results. This benefit was recognized immediately and interest in forming partnerships to develop the Reserve began at this project's inception. Numerous opportunities exist to develop additional partnerships and cooperative working agreements with agencies and institutions. Existing positive relationships between universities already exist and will be strengthened through the development of mutually beneficial studies. A strong scientific interest in the Reserve exists and will

facilitate the development of cooperative agreements between the NERR and other agencies/institutions.

**Goal 2: Increase understanding of coastal ecosystems by diverse audiences**

*Objective 2-1: Support K-12 and stakeholder education and outreach programs*

Oversight of education and outreach activities will be provided by the Reserve manager and the education coordinator. Support of the following activities will be provided for by Reserve funds:

- Travel to relevant conferences and public seminars
- Obtain and maintain computer capabilities to support electronic linkage between on-site research and monitoring efforts and interested schools and other groups using the world-wide web (coordinated with research program).
- Identify and seek financial (funding), material (e.g., literature), and cooperative (e.g., personnel) resources that can support the educational programs of the Reserve
- Establish and maintain a listing of available coastal, estuarine, and anthropogenic related educational materials, resources, facilities, and coordinated program evaluation processes.

**Action 1:** Develop, execute, and revise a Reserve management plan

The UTMSI will develop and execute the Reserve management plan. The UTMSI will revise the management plan every five years with advice from the Reserve Advisory Board. Revision of the management plan will update and create new objectives for the education and outreach plan.

**Action 2:** Obtain advice on the program from the broader community

Advice on the program from the broader community will be obtained through the RAB and the Education Advisory Committee. The first task of the advisory committee will be the development of a needs assessments for target audiences. Needs assessments are a systematic investigation of an audience to identify aspects of individual skills, knowledge, interests, attitudes, or abilities relevant to a particular issue, organizational goal or objective. Needs assessments are designed to collect sufficient information about a particular target group to design an effective program that addresses the group's needs and desires. Education programs will be designed with evaluation components. Evaluation of programs allows for determination of effectiveness, achievement of stated goals, and an iterative process for improvement over time. Further information on the RAB and advisory committees can be found under objective 1-1, action 2.

**Action 3:** Recruit and maintain staff

The UTMSI will implement the Reserve program by hiring, directing, and maintaining Reserve staff. Further information on staff requirements, support staff, staff qualifications, and Reserve manager responsibilities is listed in objective 1-1, action 3.

**Education Coordinator**

The education coordinator oversees the operation and implementation of the Reserve education and volunteer programs including on-site and outreach activities. The education coordinator also interacts with the Education Advisory Committee and other environmental education institutions and individuals to fulfill the education objectives of the Reserve. The education coordinator reports to the Reserve manager and also coordinates with the Reserve education and stewardship coordinators to present scientific data in a user-friendly manner. The education coordinator will a university funded UTMSI position. The education coordinator will work with Reserve staff and an education advisory committee to determine the specific priorities of the Reserve. Reserve goals will form the core of the Action Plan for the Reserve's Education, Interpretation and Outreach Program. They will be tied into national goals and objectives as they will be pursued by the Reserve education program and draw upon the possibilities provided to the NERR by a combination of: 1) the physical and biological characteristics of the Reserve (e.g., habitat diversity), 2) the potential users of the Reserve (e.g., schools, general public) and 3) the groups of people that will assist with the implementation of these

programs including the state, federal and private partners and volunteer groups that will contribute to the operation the Reserve. The education coordinator's duties and responsibilities will likely include:

- assisting the participating agencies in preparing and updating an annual list of priorities for education, interpretation and visitor use programs to be developed for the Reserve;
- coordinating development of proposals for Reserve education, interpretation and visitor use programs and projects, and conduct a peer review process for the proposal received;
- coordinating approved education, interpretation and visitor use activities within the Reserve and communicating with other reserves, especially relating to education and volunteer programs;
- providing staff support for the Education Advisory Committee
- upon request, advising and coordinating government agencies on particular issues, questions or projects and their impacts on or relationship to the Reserve;
- assisting in training and supervising volunteers in education programs, and monitoring/evaluating their performance;
- keeping a photographic record of on-going education, interpretation and visitor use activities for use in slide presentations and exhibits;
- representing the Reserve at public meetings, civic groups, professional societies and other environmental organizations upon request, as available;
- working with the stewardship and education coordinator to develop suitable methods to disseminate Reserve-related information;
- working with NOAA to develop national education policy for the NERRS;
- coordinating with the Reserve manager in the performance of these responsibilities; and
- participating in the development of educational facilities, including trails and exhibits and the purchase of education and monitoring equipment.

**Action 4:** Solicit funds via grants

The Reserve staff will solicit additional funding through grants or contracts by actively seeking funding opportunities, preparing applications, and working with partners to leverage resources. Further detail on grant funding is listed in objective 1-1, action 4.

**Action 5:** Develop and operate a program for gifts to enhance Reserve activities

The UTMSI and Reserve manager will develop and operate a program to encourage gifts to the Reserve. A gift program can be accomplished by creating a Friends group, soliciting donations from organizations, and working with partners to identify potential donors and solicit gifts. A gift program will allow the Reserve to perform activities that enhance Reserve programs. Activities may include travel and housing scholarships for underserved K-12 schools.

**Action 6:** Foster partnerships for education

The Reserve offers a permanent place where research institutions may coordinate projects and compare results. This benefit was recognized immediately and interest in forming partnerships to develop the Reserve began at this project's inception. Numerous opportunities exist to develop additional partnerships and cooperative working agreements local K-12 schools, local and regional colleges and universities. Existing positive relationships between traditional education entities already exist and will be strengthened through the development of mutually beneficial studies. A strong scientific interest in the Reserve exists and will facilitate the development of cooperative agreements between the NERR and other agencies/institutions.

**Goal 3: Promote public appreciation and support for stewardship of coastal resources**

*Objective 3-1: Provide oversight and support for stewardship activities*

Oversight of stewardship activities will be provided by the Reserve manager and stewardship coordinator. Support of these activities, such as travel and overhead, will be provided for by Reserve funds.

**Action 1:** Develop, execute, and revise a Reserve management plan

The UTMSI will develop and execute the Reserve management plan. The UTMSI will revise the management plan every five years with advice from the Reserve Advisory Board. Revision of the management plan will update and create new objectives for the stewardship plan.

**Action 2:** Obtain advice on the program from the broader community

Advice on the program from the broader community will be obtained through the RAB and the Stewardship Advisory Committee. The first task of the advisory committee will be the development of a needs assessments for target audiences. Needs assessments are a systematic investigation of an audience to identify aspects of individual skills, knowledge, interests, attitudes, or abilities relevant to a particular issue, organizational goal or objective. Needs assessments are designed to collect sufficient information about a particular target group to design an effective program that addresses the group's needs and desires. Some stewardship programs will be designed with evaluation components. Evaluation of programs allows for determination of effectiveness, achievement of stated goals, and an iterative process for improvement over time. Further information on the RAB and advisory committees can be found under objective 1-1, action 2.

**Action 3:** Recruit and maintain staff

The UTMSI will implement the Reserve program by hiring, directing, and maintaining Reserve staff. Further information on staff requirements, support staff, staff qualifications, and Reserve manager responsibilities is listed in objective 1-1, action 3.

## Stewardship Coordinator

The stewardship coordinator oversees the operation and implementation of the Reserve stewardship programs, interacts with the Stewardship Advisory Committee and other institutions and individuals to fulfill the stewardship goals of the Reserve. The stewardship coordinator reports to the Reserve manager and also coordinates with the Reserve education and research coordinators to present scientific data in a user-friendly manner. In addition, the stewardship coordinator will maintain close contact with and inform the OCRM of the progress of NOAA-funded stewardship activities. The stewardship coordinator will be a university funded UTMSI position. The stewardship coordinator's duties and responsibilities will likely include:

- assisting the Reserve manager and other participating agencies and entities in preparing and updating an annual list of priorities for stewardship projects and conducting a peer review process for proposals when needed;
- implementing the stewardship program for the Reserve;
- serving as a liaison with the resource management community, promoting data utilization and acting as the primary contact for resource managers performing stewardship in the Reserve;
- providing staff support for the Stewardship Advisory Committee;
- overseeing the development of a site profile and ecological characterization of the Reserve;
- provide a forum for information exchange with local and state decision makers;
- coordinating all special studies and stewardship activities within or related to the Reserve;
- coordinating and overseeing habitat restoration activities within the Reserve;
- coordinating and overseeing animal rescue activities within the Reserve;
- developing the Coastal Training Program;
- assisting in the training of stewardship assistants and interns, and monitoring/evaluating their performance;
- providing technical advice and assistance to resource managers;
- keeping a field journal and photographic records of on-going stewardship activities;
- representing the Reserve at public meetings;
- working with the research and education coordinator to develop suitable methods to disseminate reserve-related information;
- working with NOAA on NERRS-related projects;
- developing additional stewardship guidelines and policy statements as new issues arise;
- coordinating with the Reserve manager in the performance of these responsibilities; and

- participating in the development of stewardship facilities and the purchase of stewardship equipment.

**Action 4:** Solicit funds via grants

The Reserve staff will solicit additional funding through grants or contracts by actively seeking funding opportunities, preparing applications, and working with partners to leverage resources. Further detail on grant funding is listed in objective 1-1, action 4.

**Action 5:** Develop and operate a program for gifts to enhance Reserve activities

The UTMSI and Reserve manager will develop and operate a program to encourage gifts to the Reserve. A gift program can be accomplished by creating a Friends group, soliciting donations from organizations, and working with partners to identify potential donors and solicit gifts. A gift program will allow the Reserve to perform activities that enhance Reserve programs. Activities may include purchasing land for conservation from willing sellers.

**Action 6:** Foster partnerships for stewardship

The Reserve offers a permanent place where research institutions may coordinate their projects and compare results. This benefit was recognized immediately and interest in forming partnerships to develop the Reserve began at this project's inception. Numerous opportunities exist to develop additional partnerships and cooperative working agreements with neighboring industries, businesses, agencies and institutions. Support from adjacent industries during the review and nomination process of the Reserve has been extensive. Existing positive relationships between environmental and regulatory groups and private-sector industries already exist and will be strengthened through the development of mutually beneficial studies. A strong interest in the Reserve exists and will facilitate the development of cooperative agreements between the NERR and other agencies/institutions.

## 4.0 BOUNDARIES/ACQUISITION PLAN

### 4.1 Introduction

#### Boundary Criteria

National Oceanic and Atmospheric Administration (NOAA) boundary requirements are outlined in the federal register (915 CFR 921.11). These requirements are summarized below:

- *Key Land and Water Areas that Approximate an Ecological Unit:* Reserve boundaries must “encompass and adequate portion of key land and water areas of the natural system to approximate an ecological unit...” and should encompass resources representative of the total biogeographic habitat.
- *Encompass Areas with Adequate controls:* NOAA regulations require that there be a level of control over uses and activities to ensure that the ecological integrity of the Reserve is maintained for sustained research and education. Specifically, the regulations state that Reserve boundaries must encompass the area within which adequate control has or will be established by the managing entity over human activities occurring within the Reserve.
- *Management Considerations:* The administrative burden and responsibility for operating a Reserve and associated research, stewardship, and educational programs were a significant consideration in the site selection process and in the delineation of the Reserve boundaries. Given the limited funds available to support Reserve programs, it is also important to develop a reasonable boundary that will establish a creditable Reserve without creating an overwhelming administrative burden.
- *Research/Monitoring and Education Needs and Goals:* The research/monitoring and education needs and goals of the Reserve are an important consideration in developing a boundary. These needs and goals define the purpose of establishing a Reserve, and should play a primary role in defining boundaries.

#### Boundary Description and Rationale

This plan must include an identification of ownership within the Reserve boundaries including land already in public domain (15 CFR Part 921.13(a7i)). Ownership of public land within the Reserve boundary includes Aransas National Wildlife Refuge (USFWS), open water / bays Texas General Land Office (GLO). Goose Island State Park (TPWD) is state owned submerged land and island, of which TPWD has a lease from GLO to use lands as a state park. As authorized by the Texas Coastal Management Plan (4a, p. 630) the University of Texas will hold a Coastal Lease for Scientific Purposes from GLO for state-submerged land within the Reserve boundary (Appendix 4). Ownership of private land within the Reserve includes Buccaneer Cove Preserve (Coastal Bend Land Trust), and the Fennessey Ranch. The northeastern and southeastern boundaries are defined by the Mission-Aransas estuary system.

The boundary of the Reserve is set back 1000 feet from the shoreline (easement) along more densely populated areas and adjacent to private lands (Figure 6). The area affected by the setback consists of submerged state owned land that is dedicated to the permanent school fund, some of which is already leased to private landholders, or property owned by local government entities. Some of this property is leased by GLO to private landholders to accommodate structures such as docks, piers, etc. Several private property owners have requested that the 1000-foot setback be removed along their property lines (Figure 9-14). This has occurred primarily along the shorelines of Redfish Point, southeastern Copano Bay and Port Bay. Letters from these property owners are included in Appendix 6.

In the public scoping meeting there were several requests to exclude the Gulf Intracoastal Waterway (GIWW), United States Army Corps of Engineers (USACE) dredge spoil sites, and Texas Department of Transportation in holdings from the boundary Appendix 7. The GIWW, USACE dredge spoil sites, and the Copano Bay Causeway were excluded from the boundary in the DPEIS (Figure 7). In the public hearings there were several requests for exclusions of the Gulf Intracoastal Waterway (GIWW) disposal easement zone (2150 feet from centerline of GIWW), TxDOT roadways, and leased cabins (FPEIS, Appendix 1). The following areas were excluded from the Reserve boundary (Figure 8-14):

- Gulf Intracoastal Waterway: 2150 feet from centerline of each side
- Copano Bay Causeway, highway 35: 750 feet from centerline of each side
- Cavasso Creek Bridge, highway 35: 150 feet from centerline of each side

Salt Creek Bridge, highway 35: 150 feet from centerline of each side  
Farm Road 136 bridge at Copano Bay: 150 feet from centerline of each side  
Farm Road 2678, bridge over Mission River: 150 feet from centerline of each side  
State Highway 188 Bridge at Port Bay: 150 feet from centerline of each side  
GLO leased cabins (4): 1000 feet around  
Shell Bank Island, private inholding

The GIWW, dredge spoil sites, and Copano causeway are long standing active areas that will require continued maintenance. All federally authorized navigation projects in the Mission-Aransas Estuary including but not limited to the GIWW, GIWW tributary channels, and the Corpus Christi Ship Channel are excluded from the Reserve boundary. A private land inholding (Shell Bank Island) within GLO submerged lands was brought to the awareness of UTMSI and NOAA during the public hearing process. Shell Bank Island was excluded from the Reserve boundary. Shell Bank Island (327 ac) is located adjacent to Corpus Christi Bayou in northern Redfish Bay. This private land is in GLO state tract 255 and 256. The GLO has four cabin leases within the Reserve Boundary that were also excluded. Cabin PC-1029 is located in southern Aransas Bay south of the City of Rockport in state tract 218. Cabins PC-1028, PC-1003, and PC-1041 are located in Mesquite Bay in state tract 24. These cabins occupy an approximately 11 acres.

During the public hearing process two separate parcels of property were included in the Reserve boundary. These properties will be the locations for the Copano Bay Research and Education Center and the Aransas Bay Public Outreach Facility. The Copano Bay Research and Education Center facility property is under negotiations for a gift to the University of Texas at Austin. The Aransas Bay Public Outreach Facility property is owned by the Aransas County Navigation District (ACND). A letter from the ACND requesting the inclusion of the property for the Aransas Bay Public Outreach Facility in the Reserve boundary is in Appendix 6. Further descriptions of both proposed facilities are in section 7.2.



Figure 6. Ownership designations of lands within the Reserve.

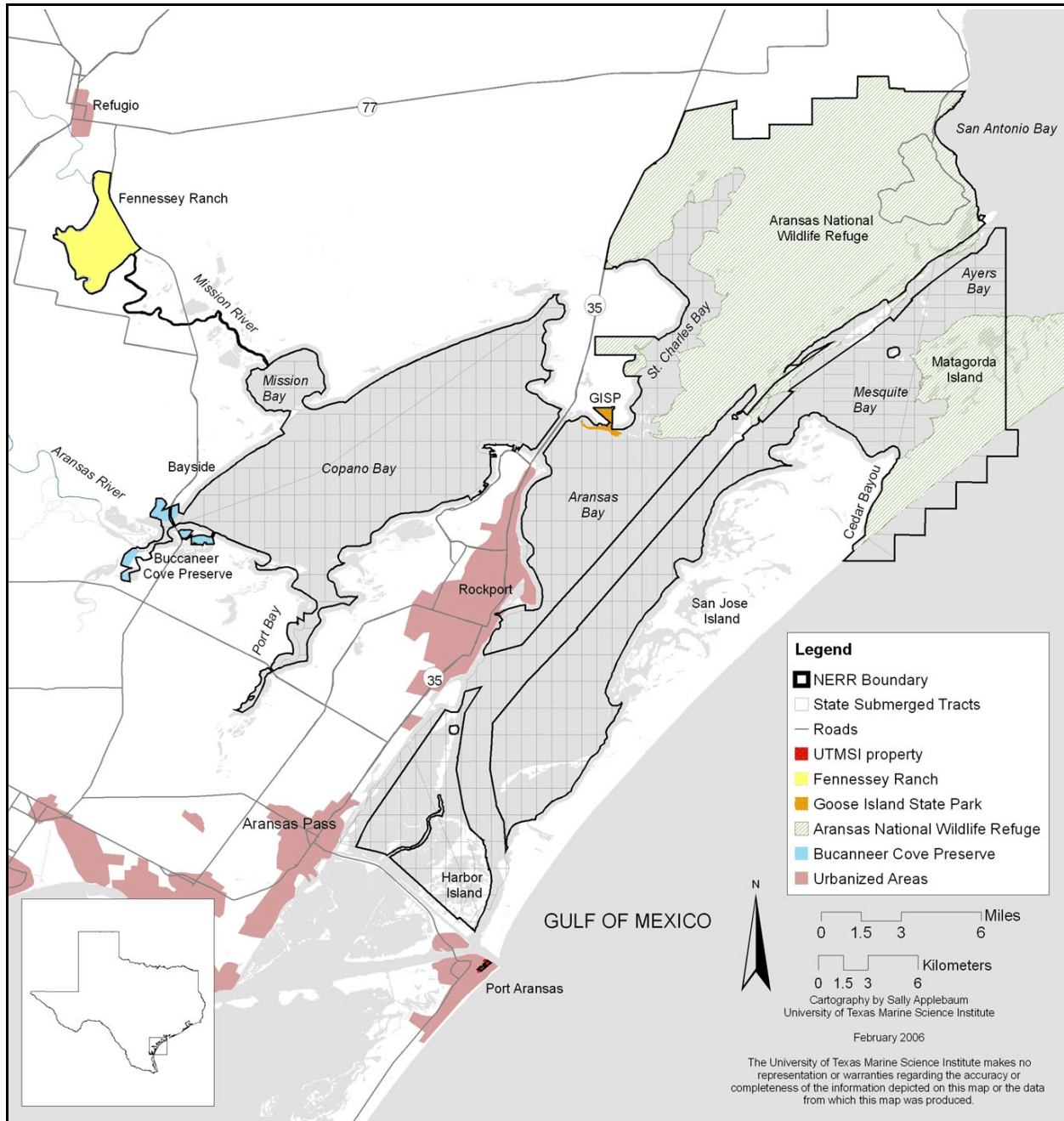


Figure 7. Gulf Intracoastal Waterway (GIWW) and USACE dredge spoil sites excluded from Reserve boundary proposed in the site nomination.

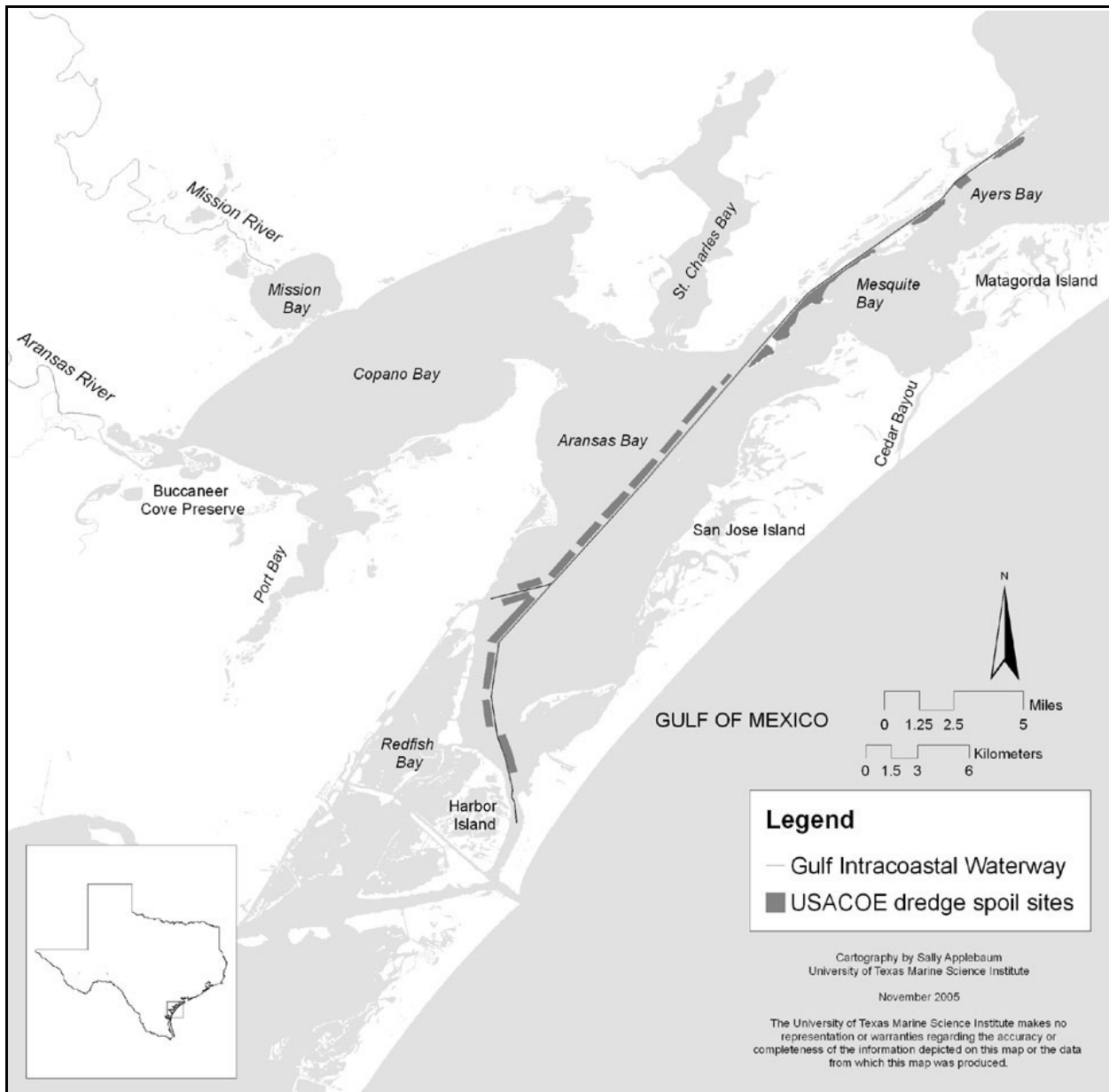


Figure 8. Reserve area and boundary. Abbreviations: GISP = Goose Island State Park, and UTMSI = University of Texas Marine Science Institute.

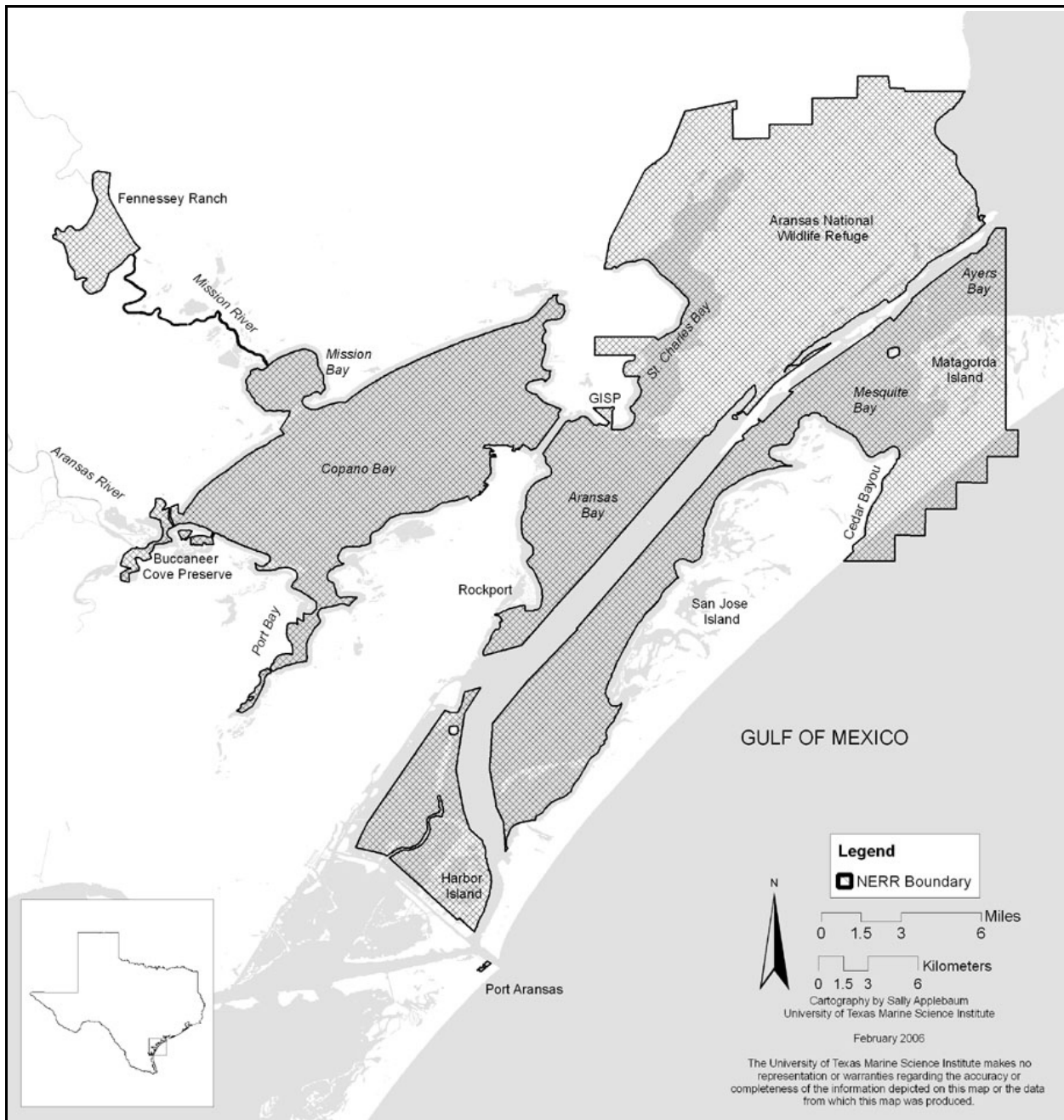


Figure 9. Detail of Reserve's southern area and boundary.

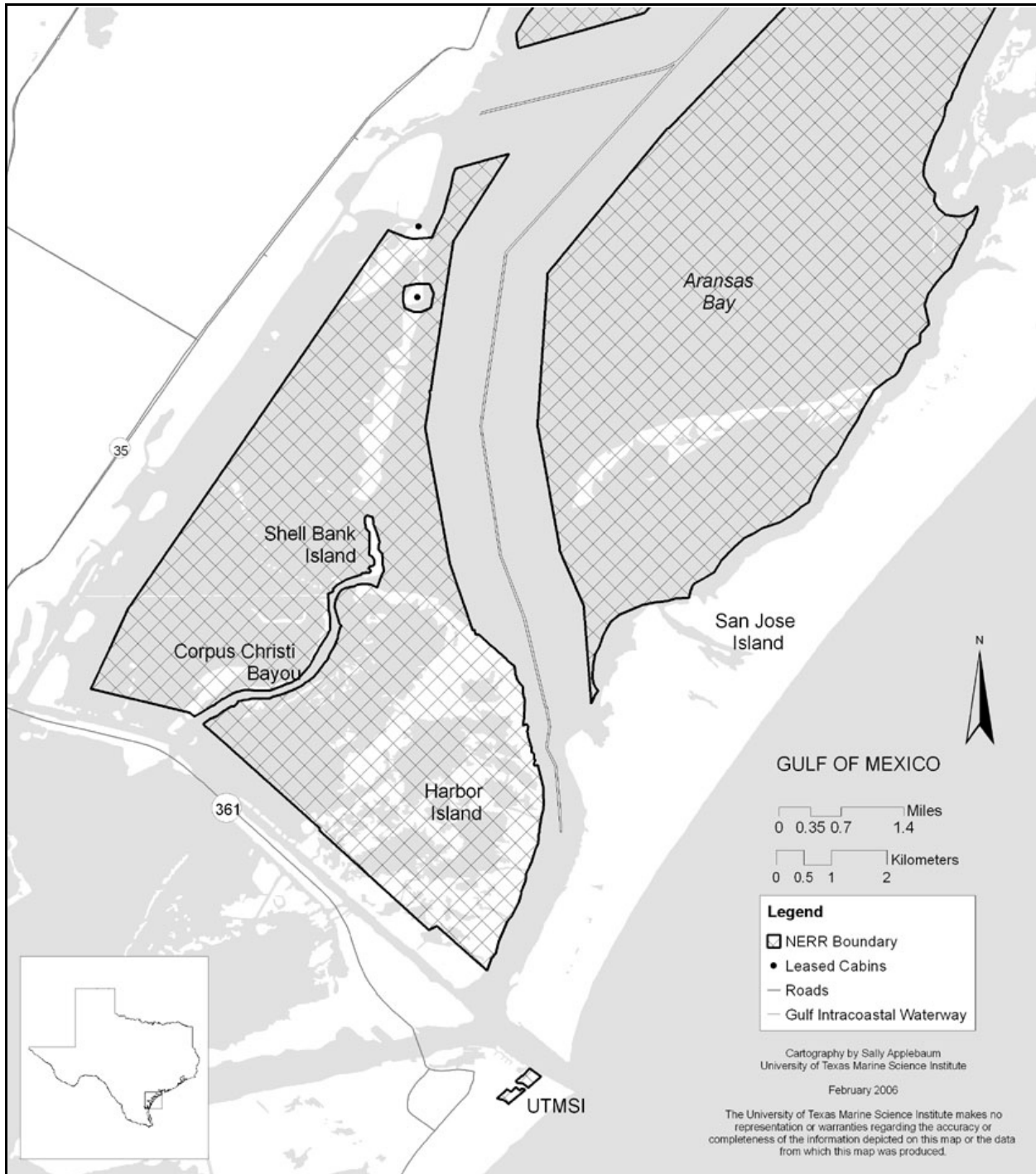


Figure 10. Detail of Reserve's center and location of two proposed facilities.

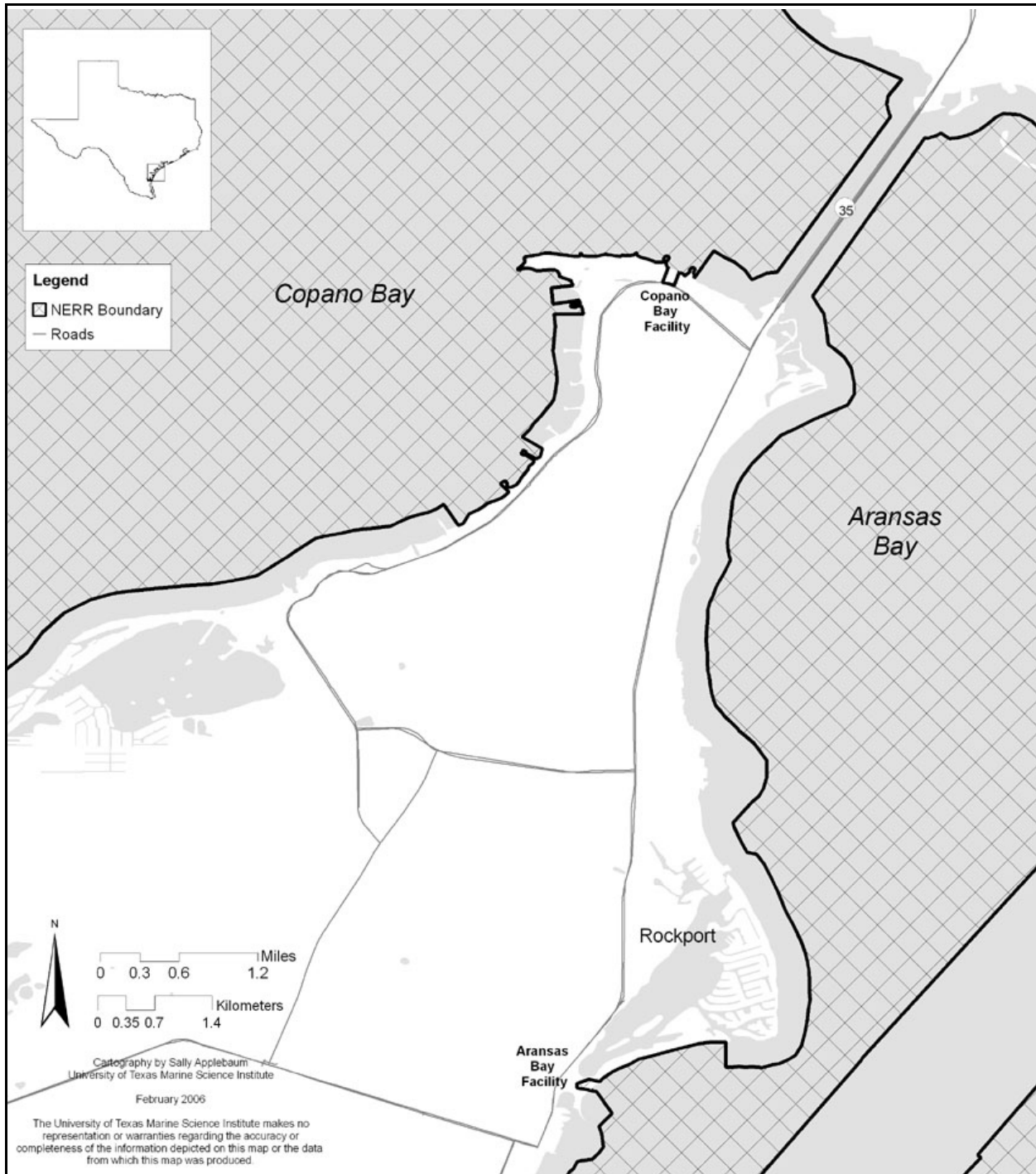


Figure 11. Detail of Reserve's southwestern area and boundary.

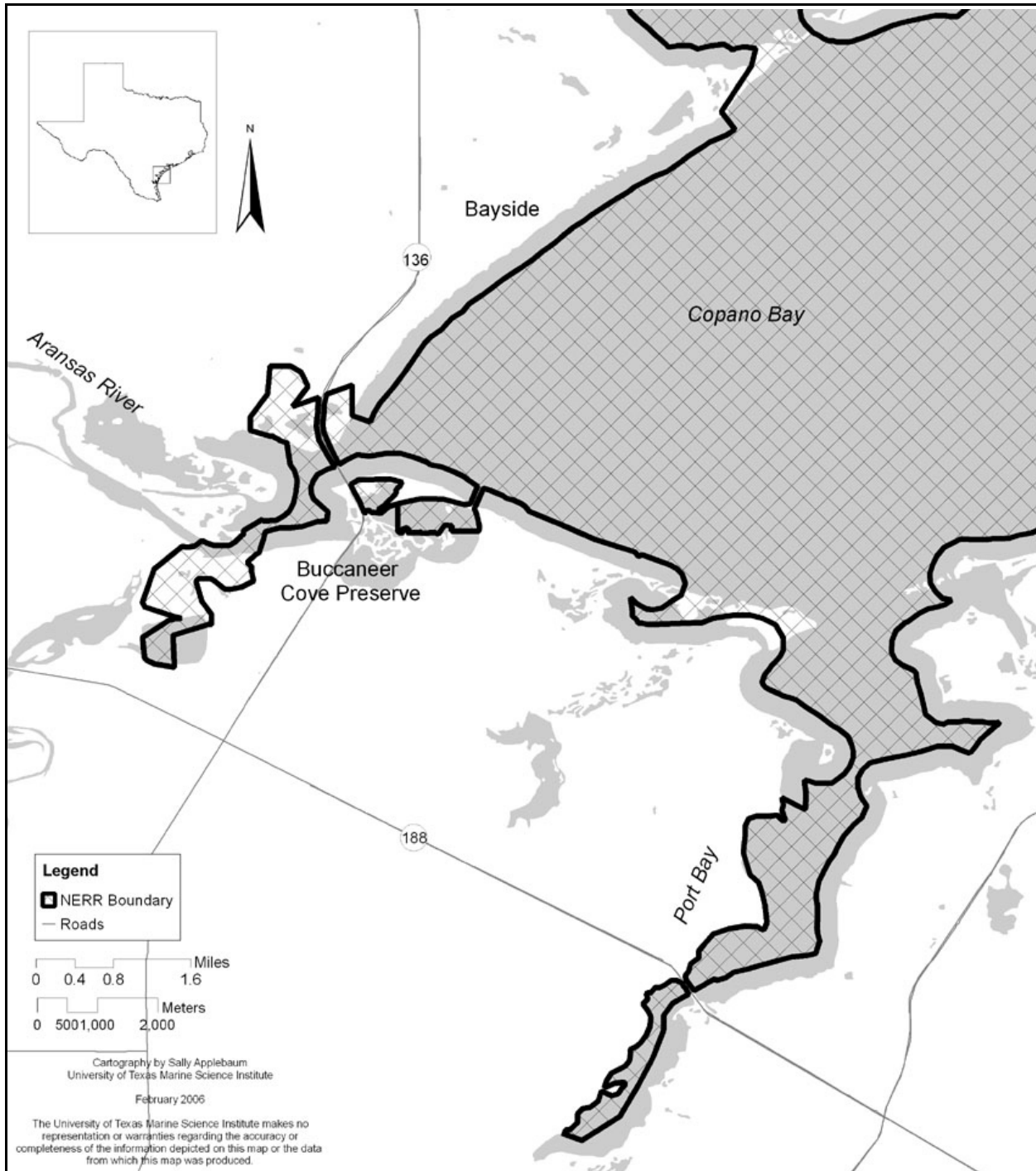


Figure 12. Detail of Reserve's western area and boundary.

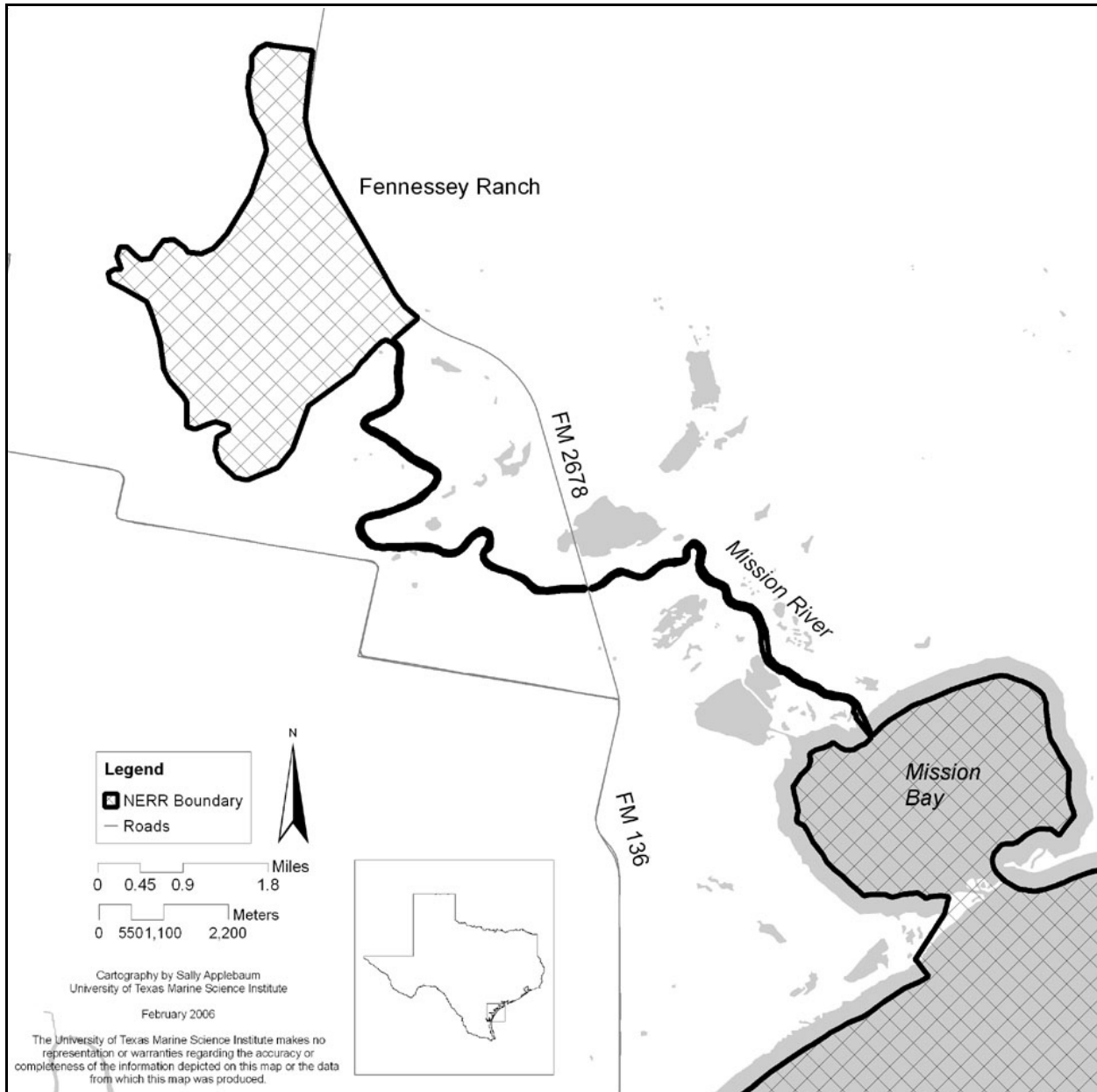


Figure 13. Detail of Reserve's northern area and boundary.

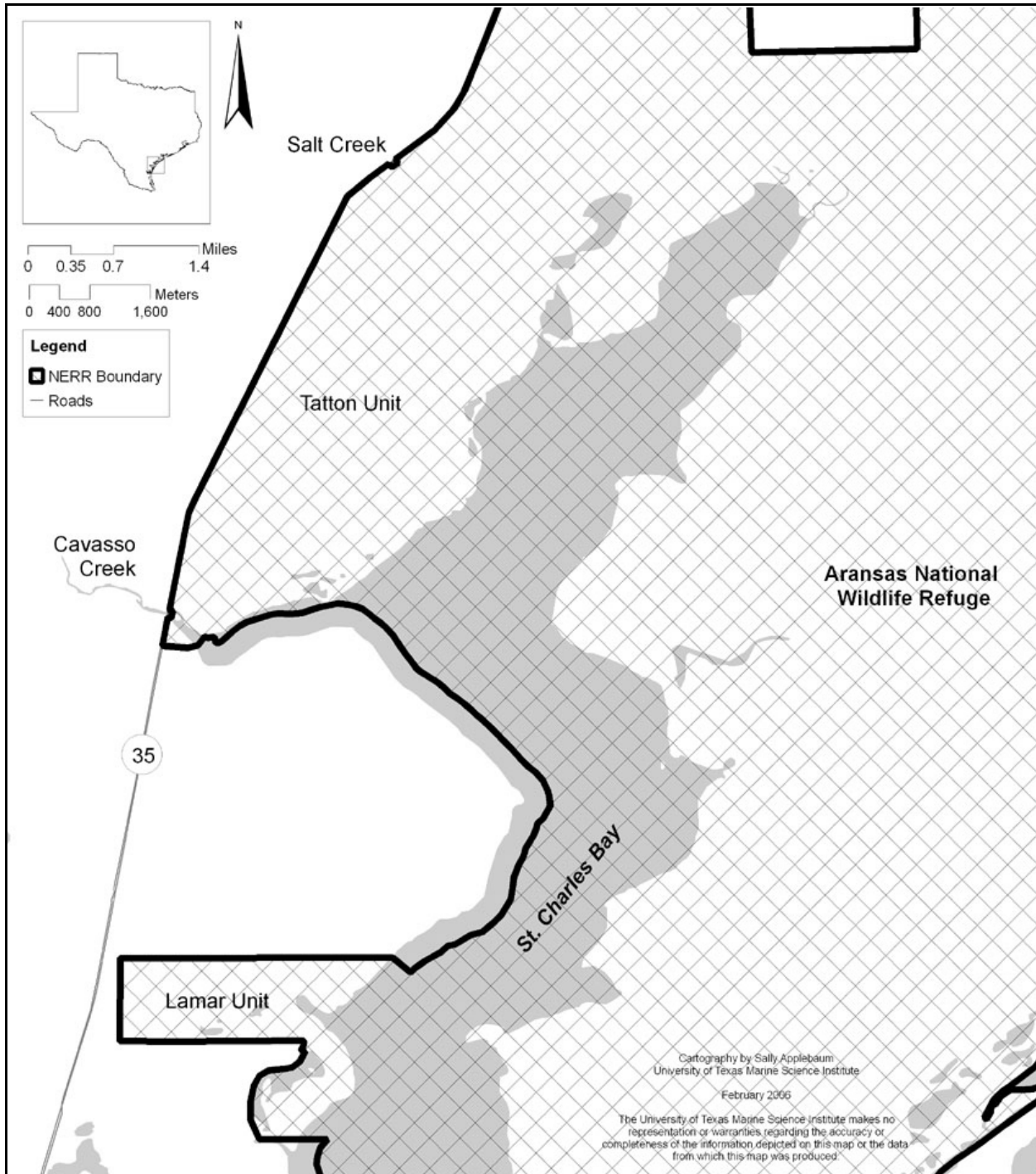
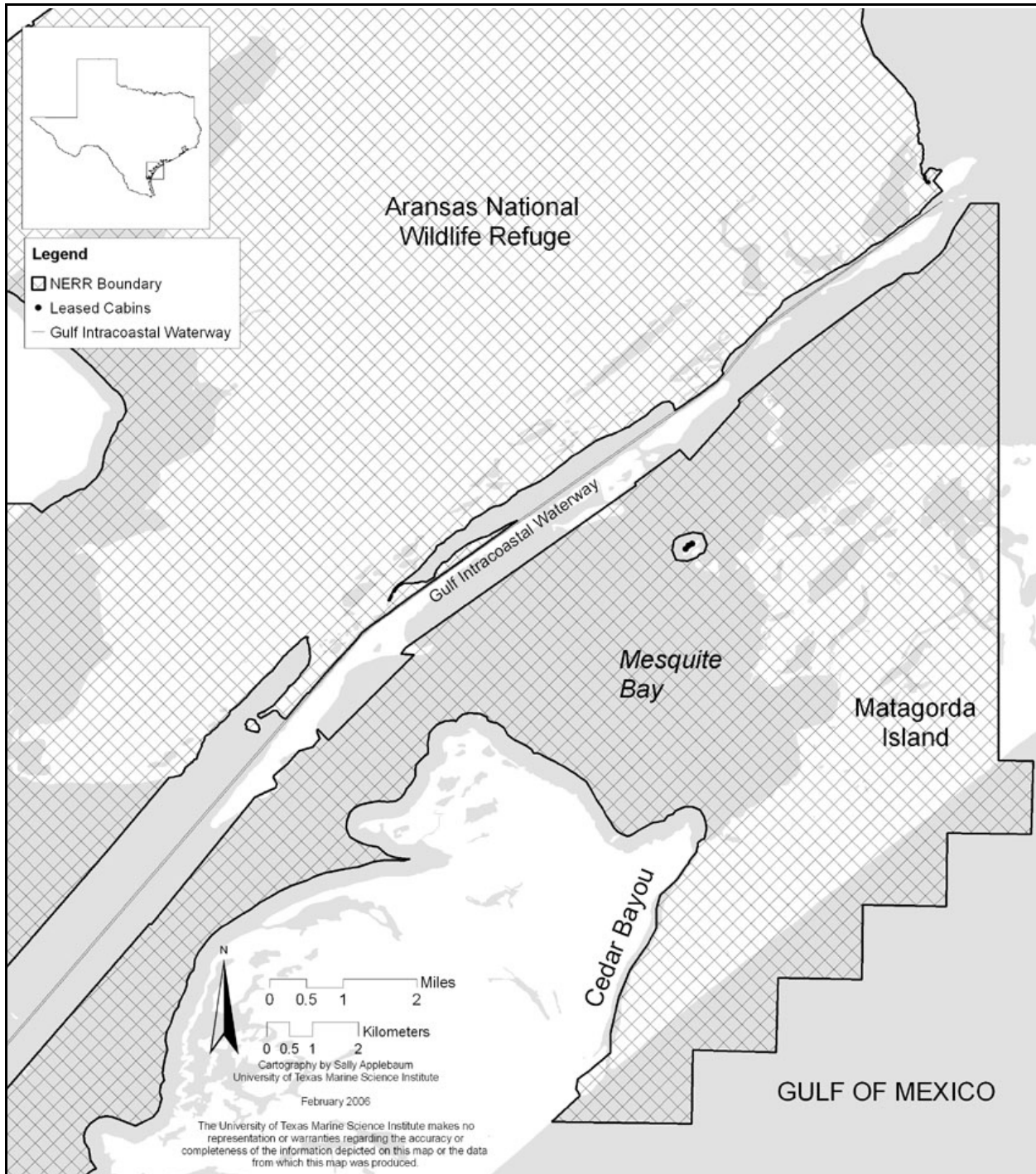




Figure 14. Detail of Reserve's northeastern area and boundary.



## 4.2 Program Goals and Objectives

### Goal 1: Improve understanding of Texas coastal zone ecosystems structure and function

#### *Objective 1-2: Protect the integrity of core areas for long-term research*

##### **Action 1:** Delineate core and buffer boundaries and identify existing protection

Knowledge of the Texas coastal zone ecosystems structure and function will improve through long-term research in core areas. Land and water core areas are determined based on specific scientific knowledge of the area, their representativeness of the total ecosystem, and which if compromised could endanger the research objectives of the Reserve (Figure 15).

As described at 15 CFR 921.11 (C)(3), NOAA research reserve boundaries generally include two subcategories: key land and water areas (called "core areas") and a buffer. NOAA defines core areas as ecological units of a natural estuarine system that preserve, for research purposes, a full range of significant physical, chemical and biological factors contributing to the diversity of fauna, flora and natural processes occurring within the estuary.

The term buffer refers to the areas within the Reserve boundary that are adjacent to or surrounding core land and water areas and are essential to their integrity. Buffer zones are the areas within the boundary that are not designated as land or water core. Buffer zones protect the core area and provide additional protection for estuarine-dependent species, including those that are rare or endangered. When determined appropriate by the state and approved by NOAA, the buffer zone may also include an area necessary for facilities required for research and interpretation. For example within the buffer zone, the UTMSI property in Port Aransas is an area where facilities will likely be constructed (Figure 16). Additionally, buffer zones should be established sufficient to accommodate a shift of the core area as a result of biological, ecological or geomorphological change which reasonably could be expected to occur.

##### Water Core

The water core areas in the Reserve were chosen based on level of state control, habitats present, presence of active oil and gas wells, existing long-term records of research, and location for freshwater inflow analysis (Figure 15). Level of state control and habitats were identified by resource management code definitions within state tracts. Water core designation will not cause additional limitations on state leasing and permitting activities.

The locations of the water core areas ensure adequate long-term state control. State control provides sufficient protection to ensure a stable environment for research. Resource management codes (RMCs) were created to assist potential users of the state-owned submerged lands during the permitting process by the United States Army Corps of Engineers (USACE) and are used to represent development guidelines (Table 3). The codes enhance protection of sensitive natural resources by providing recommendations for minimizing adverse impacts to sensitive natural resources from mineral exploration and development activities. The RMCs are based on recommendations from the United States Fish and Wildlife Service, National Marine Fisheries Service, Texas Parks and Wildlife Department (TPWD), Texas Historical Commission, and the USACE. The management codes indicate that only some of the area within the state tract contains those resources. Before beginning work on state submerged land, lessees may be required to conduct a survey for sensitive habitats and resources by the USACE. In most cases, tract development may proceed when an applicant demonstrates that the development plan is not inconsistent with the concerns listed in the codes. When impacts to sensitive habitats or resources are unavoidable, development may be allowed, subject to negotiation for mitigation.

RMCs were used to delineate core boundaries because not only do they enhance protection of natural resources, but they also indicate presence of essential habitats and ecological units of a natural estuarine system. In particular, state tracts with the RMCs that indicated presence of marsh, submerged aquatic vegetation, archeological resources, oyster or serpulid reef, and additional oil and gas drilling restrictions were used to help delineate core boundaries (Figure 17). Locations of important bird rookeries, such as Harbor Island and Ayers Bay, were also taken into consideration in delineation of core boundaries (Figure 18). The isolated state tract in Aransas Bay represents a long-term station and an ideal location for placement of a System-wide Monitoring Program (SWMP) station because of its distance from San

Antonio Bay and the Aransas Pass inlet to the Gulf of Mexico.

Buccaneer Cove Preserve is privately managed by the Coastal Bend Land Trust (CBLT), which ensures that long-term protection will occur. The primary goal of the CBLT is the preservation and enhancement of native wildlife habitat in the Coastal Bend. In addition, the Buccaneer Cove Preserve and Harbor Island/Redfish Bay are identified as a high priority coastal habitat area to be protected during oil or hazardous material spills (Figure 19). Mission Bay and part of the Ayers and St. Charles Bay core sites are identified as a medium priority coastal habitat area. Priority areas were identified and prioritized by TPWD and GLO personnel in cooperation with other entities and are prioritized by utilization of fish and birds, as well as amount of wetland habitat.

Figure 15. Reserve core and buffer areas.

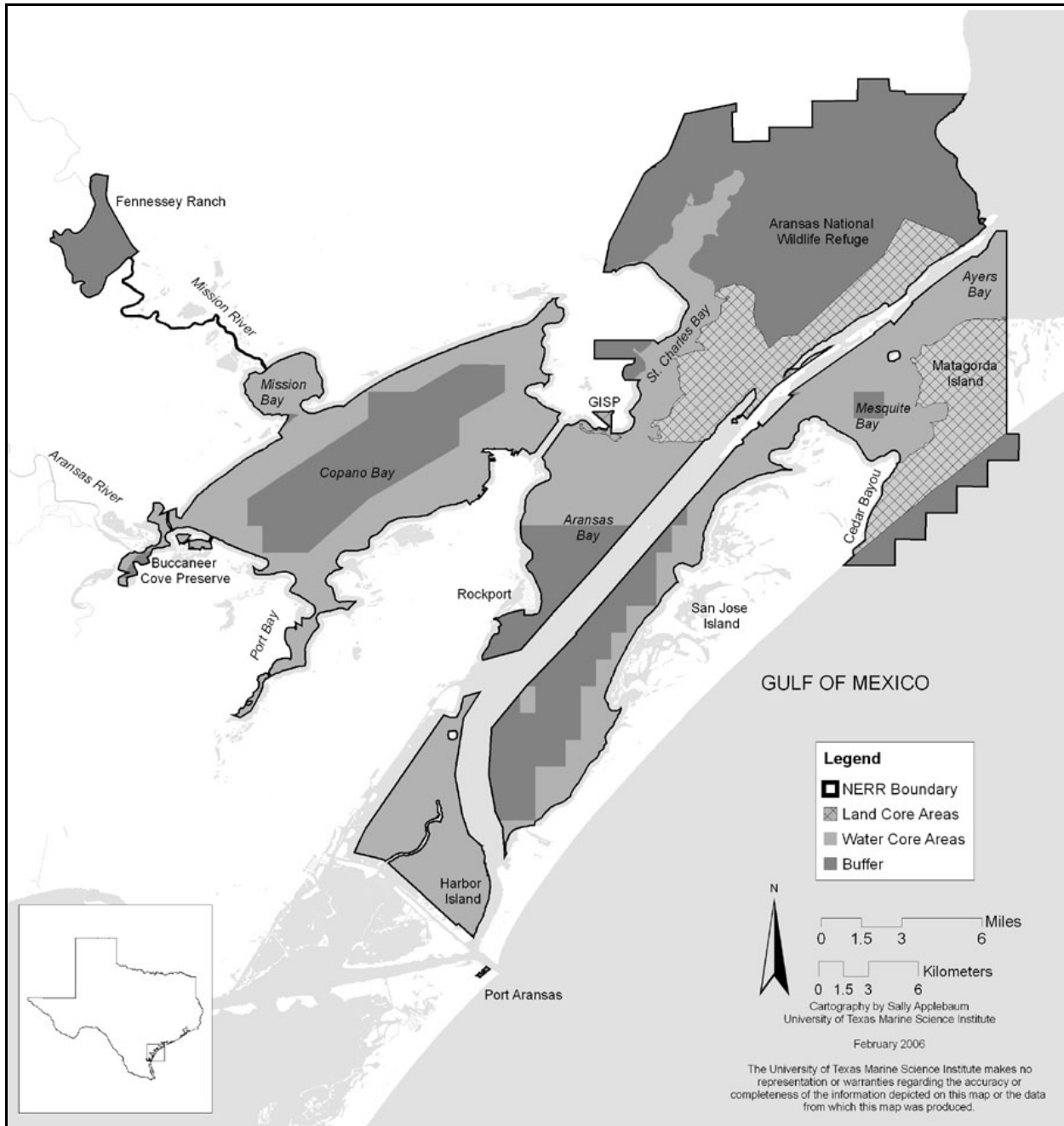


Figure 16. Closeup map of the UTMSI property within the NERR boundary.

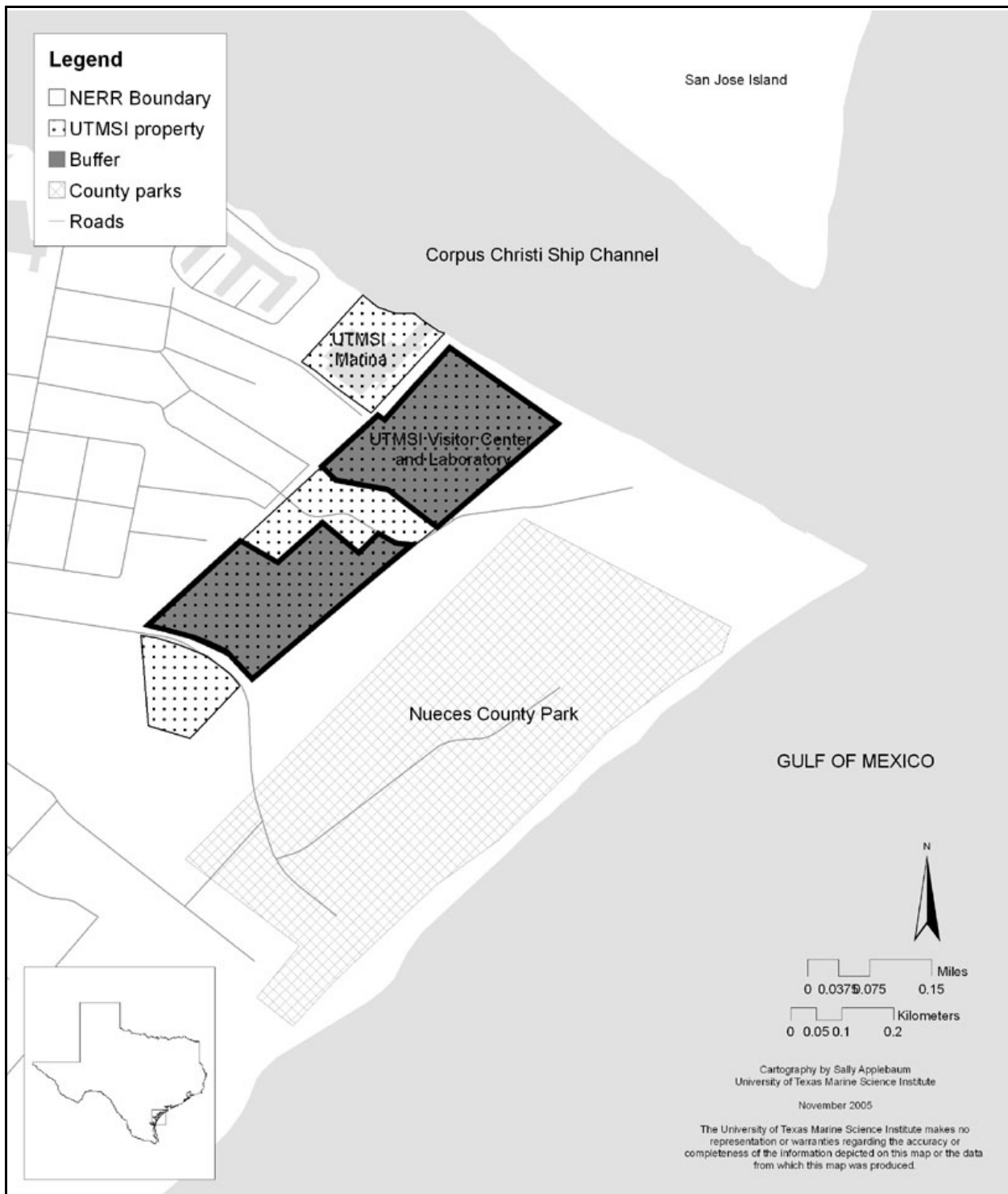


Figure 17. Resource management codes used to delineate water core boundaries.

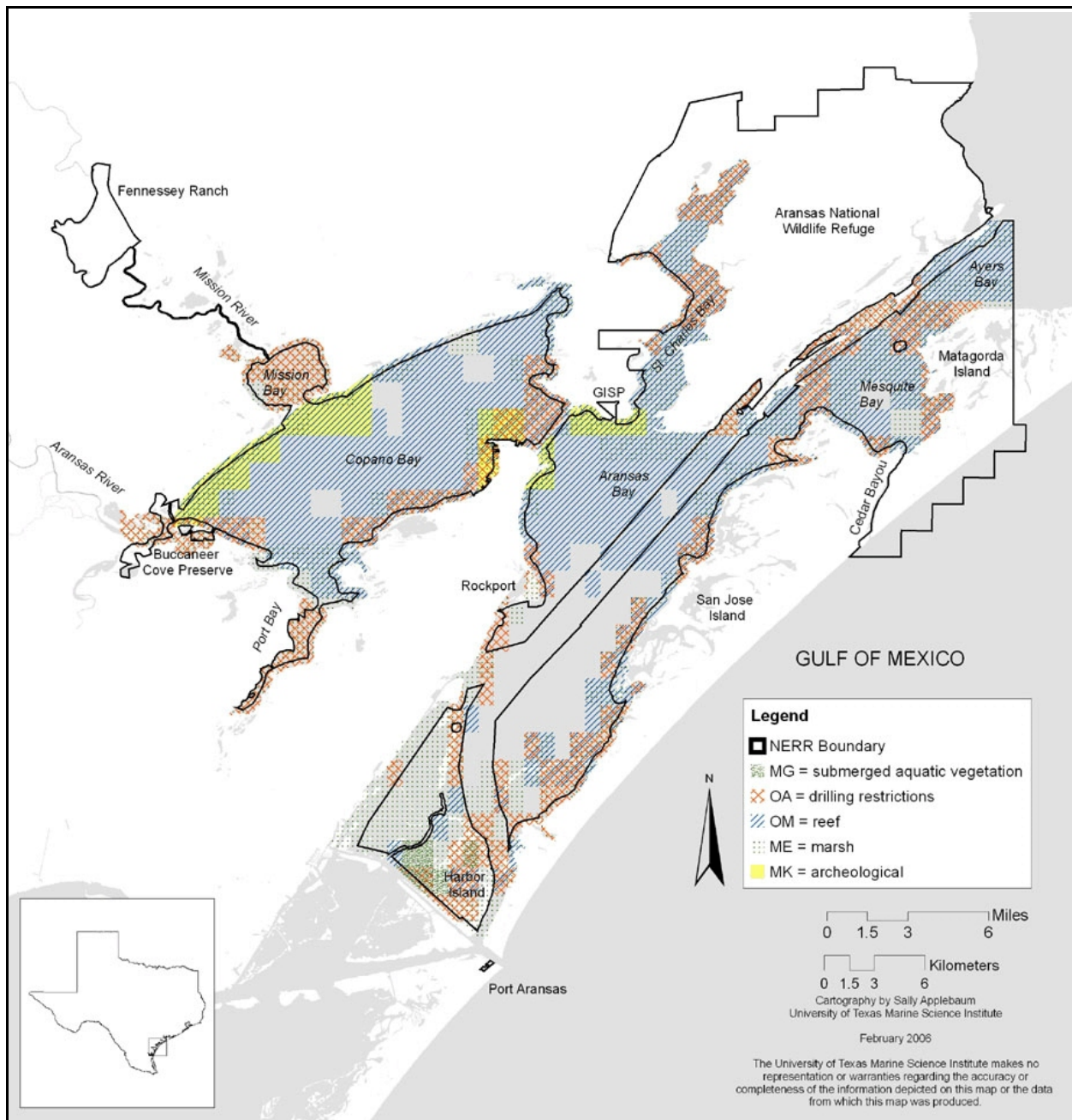


Figure 18. Bird rookeries nearby and within Reserve.

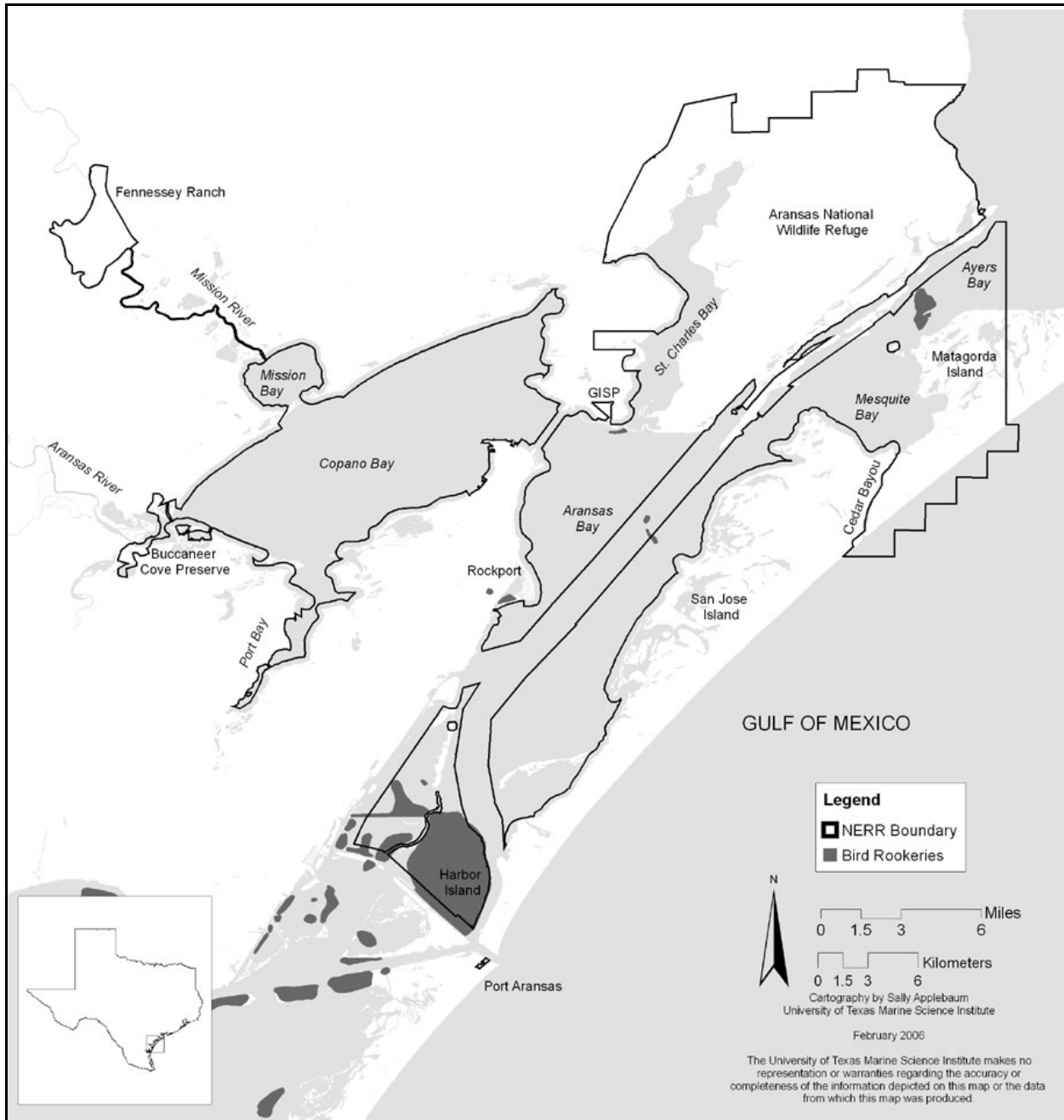
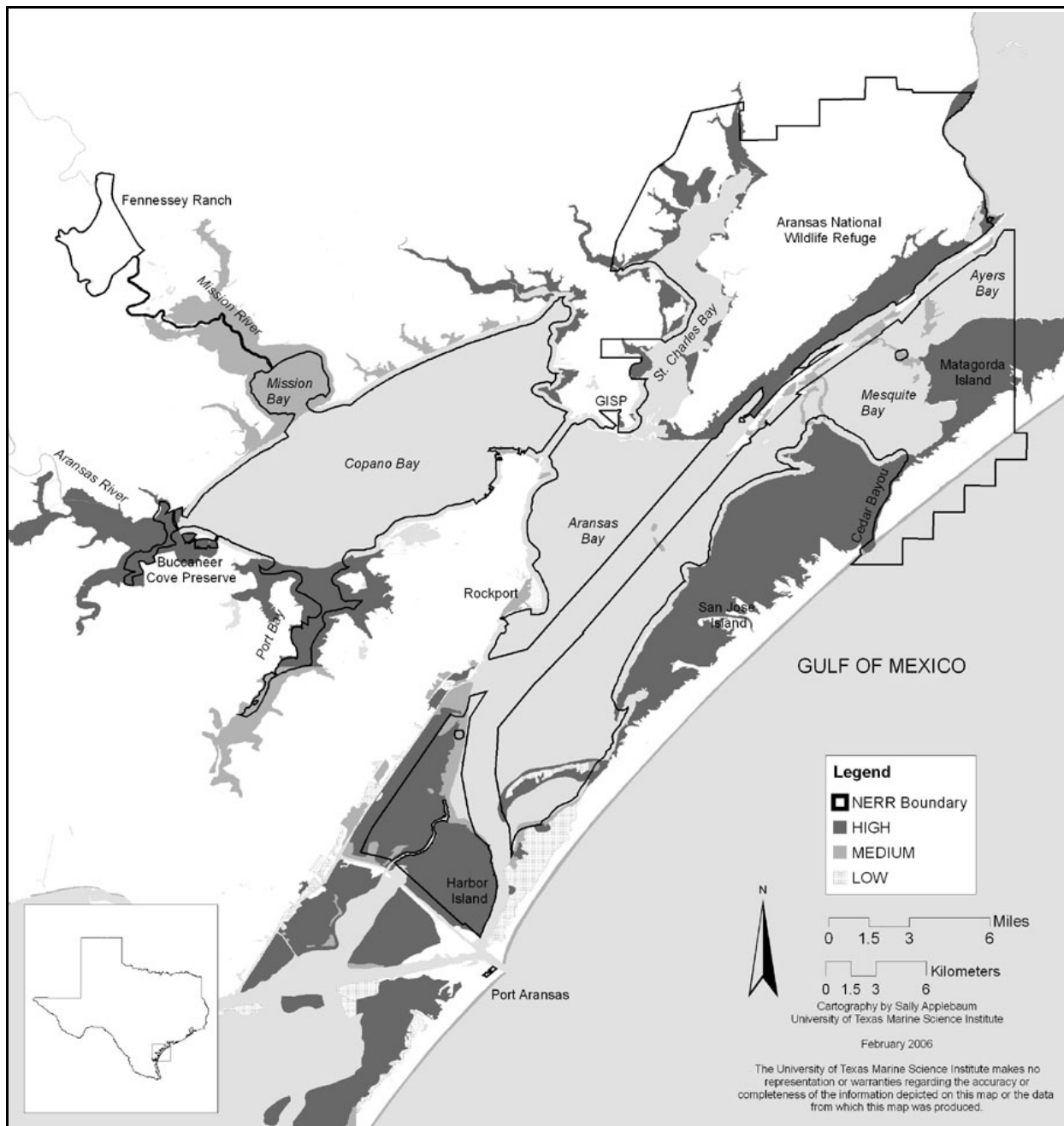


Table 3. Resource management code definitions. Codes in bold indicate essential habitats or restrictions that were used to delineate core boundaries. For more information on the Resource Management Codes, please contact the General Land Office. Last updated on 21 August 2001.

Code	Definition	Protection
CF	Channel Use	Vehicular access methods must be designed to avoid or minimize impacts on areas containing emergent marsh, submerged grassbeds or sand, mud, or algal flats.
DA	Dredging	Water depths on this tract may be sufficient for access without dredging. Dredging may destroy or degrade sensitive estuarine habitats and reduce the productivity of the bay.
DB	Dredging	No dredging in water less than 4 feet deep as measured from mean low water to protect shallow water areas which contain sensitive habitat.
<b>ME</b>	Marsh Habitat	Sensitive marine habitats exist within this tract, but oil and gas exploration and production activities, construction and operation activities, access routes, rights-of-way, and other activities may be permissible if sensitive areas are left undisturbed.
<b>MG</b>	Submerged Aquatic Vegetation	Seagrass has been documented on this tract, but oil and gas exploration and production activities, construction and operation activities, access routes, rights-of-way, and other activities may be permissible if sensitive areas are left undisturbed.
<b>MK</b>	Archeological Landmark	State archeological landmarks and/or other cultural resources protected by state law are known to be or may be located on this tract and should not be disturbed.
MR	Sedimentation	Reduce impacts of sedimentation on seagrass, marshes, oyster reefs, or other sensitive estuarine habitats in this tract.
<b>OA or OS</b>	Directional Drilling	Important marine habitat exists within this tract, and drilling activity and dredging of access channels may significantly damage the marine ecosystem. Directional drilling from off-tract locations may be required for mineral development of this tract.
OH	Depth Restriction	This tract has both deep (greater than 6 feet) and shallow water areas and/or adjacent uplands. To protect sensitive habitats in the shallow water, confine drilling activities to the deep-water areas or adjacent uplands.
<b>OM</b>	Oyster and Serpulid Reef	Avoid dredging, dredged material disposal, geophysical surveying, drilling, and pipeline and platform construction on the top or slopes of reefs, banks, hard bottoms, artificial reefs, historic reefs, serpulid reefs, or constructed reefs on this tract.
RW	Navigation	Navigational concerns such as navigational channels, dredged material placement areas, safety fairways, and anchorage areas exist within this tract.
TB	Time restriction	Tract contains whooping crane critical habitat. No construction, dredging, or drilling between October 15 and April 15. No permanent structures higher than 15 feet above mean water.
TC	Time restriction	Bird rookeries are located on or near this tract. No drilling, dredging, seismic exploration, construction activity, or watercraft landing within 1000 feet of a rookery during nesting season between February 15 and September 1.

Figure 19. Priority coastal habitat areas to be protected during oil or hazardous material spills as identified and prioritized by TPWD and GLO personnel in cooperation with other entities.





### Land Core

The land core areas provide essential key upland habitats and are divided into two different units: Goose Island State Park (GISP), and portions of the Aransas National Wildlife Refuge (ANWR) (Figure 15). GISP is located adjacent to the water core area of St. Charles Bay. The land core areas of GISP contains a wide variety of habitats including, live oak thickets or mottes, tidal salt marshes, and mud flats, that attract many migratory bird species. Goose Island State Park is managed by the Texas Parks and Wildlife Department (TPWD). The portion of the ANWR chosen as core area includes essential habitat (coastal prairie and marsh) for the endangered whooping crane. ANWR is managed by the United States Fish and Wildlife Service (USFWS).

Core land areas are under ownership and management of the TPWD, and USFWS. Existing regulations from TPWD and USFWS will ensure adequate long-term control and sufficient protection to ensure a stable environment for research. Regulations for mineral operations on TPWD and USFWS managed lands are bound to the goals and policies of the Coastal Management Plan (CMP) and Texas Railroad Commission (RRC) regulations. The Coastal Management Plan (CMP) has several pertinent policies for construction, operation, and maintenance of oil and gas exploration and production facilities in the Coastal Natural Resource Areas (CNRAs). Seagrasses, coastal wetlands, and tidal flats are identified and included in the CNRAs. If CNRAs are found in the area of proposed oil and gas exploration, applicants must take steps to avoid, minimize, restore, enhance, protect, or mitigate for any impacts. TPWD leases the land from GLO. The Texas Coastal Preserve System was created from the Coastal Public Lands Act, Section 33.001 which charges GLO with the responsibility to preserve the natural resources of the surface estate in coastal public land.

Upon acquiring a conservation easement, parts of the Fennessey Ranch may be considered as a core area. Fennessey Ranch is a privately owned wildlife habitat and is designed to be environmentally sound as well as an economically viable business. Environmental research is conducted on this land by the Environmental Protection Agency, Texas Commission on Environmental Quality, The University of Houston, The University of Texas, and other organizations. Ranch programs are dedicated to wetland enhancement and wildlife management. The University of Texas at Austin will hold the conservation easement. The conservation easement will ensure that Fennessey Ranch will be retained forever predominantly in its natural and scenic condition. The easement will protect native plants, animals, or plant communities on Fennessey Ranch and prevent any use that will significantly impair or interfere with the conservation values and assure that traditional uses are compatible with the conservation values of Fennessey Ranch.

### Goal 3: Promote public appreciation and support for stewardship of coastal resources

The objectives of 3-2, 3-3, and 3-4 describe future acquisition and boundary expansion opportunities that will promote public appreciation and support for stewardship of coastal resources by including properties necessary to protect the integrity of the Reserve for research purposes, and for those parcels required for research and interpretive support facilities or buffer purposes. Currently, Fennessey Ranch is the Reserve's primary acquisition priority, Appendix 8. A conservation easement is anticipated for Fennessey Ranch to ensure long-term protection. Future acquisitions and boundary expansions will occur under current law, with willing sellers, and at fair market value. Future acquisitions and boundary expansion opportunities will be identified through a conference hosted by the stewardship coordinator. The conference will employ The Nature Conservancy's strategic, science-based planning process, called Conservation by Design, to identify the highest-priority properties for acquisition or boundary expansion. This method uses conservation area planning to develop a strategy. Conservation area planning consists of the "5-S Framework":

- Systems - Identifying the species, native communities and ecosystems that will be the focus of observation in an area.
- Stresses - Determining how our conservation targets are threatened, such as by habitat reduction or fragmentation, changes in natural flow patterns of waterways, or changes in the number of species in a forest, grassland or coral reef.
- Sources - Identifying and ranking the causes of the stresses.
- Strategies - Finding practical ways to reduce or eliminate threats through acquisition of interests in land and water, adaptive management or restoration of lands and waters, public policies based upon sound science, and promotion of compatible human uses.
- Success - Assessing our progress in reducing threats and improving the biodiversity and ecological health of a conservation area.

After high priority areas are identified, an acquisition plan will be designed for each property. The acquisition plan will:

- Identify the methods of acquisition to establish long-term control (likely including the less-than-fee simple option (e.g., conservation easement), management agreement, fee simple property acquisition, or a combination of these approaches;
- Determine, with appropriate justification, the minimum level of control(s) required;
- Identify the level of existing state control(s);
- Identify the level of additional state control(s), if any, necessary;
- Examine all reasonable alternatives for attaining the level of control identified, perform a cost analysis of each;
- Rank, in order of cost, the methods (including acquisition);
- Include an estimate of the fair market value of any property interest-which is proposed for acquisition;
- Include a schedule estimating the time required to complete the process of establishing adequate state control of the Reserve;
- Involve only willing sellers;
- Include a discussion of any anticipated problems; and
- Identify possible funding sources, such as the NERRS facility and acquisition fund, and the Coastal and Estuarine Land Conservation Program (CELCP).

In addition, an assessment of the relative cost-effectiveness of control alternatives will include a reasonable estimate of both short-term costs (e.g., acquisition of property interests, regulatory program development including associated enforcement costs, negotiation, adjudication, etc.) and long-term costs (e.g., monitoring, enforcement, adjudication, management and coordination). In selecting a preferred method for establishing adequate state control over each parcel examined under the process described above, priority consideration will be given to the least costly method of attaining the minimum level of long-term control required. Generally, with the possible exception of buffer areas required for support facilities, the level of control required for buffer areas will be considerably less than that required for key land and water areas. This acquisition plan, after receiving the approval of NOAA, shall serve as a guide for negotiations with landowners.

*Objective 3-2: Expand boundary to shorelines where adjacent property owners are agreeable*

**Action 1:** Contact adjacent property owners

The boundary of the Reserve is set back 1000 feet from the shoreline (easement) along more densely populated areas and adjacent to private lands (Figure 6). The area affected by the setback consists of submerged state owned land that is dedicated to the permanent school fund, some of which is already leased to private landholders, or property owned by local government entities. Some of this property is leased from GLO to private landholders to accommodate structures such as docks, piers, etc. Several private property owners have requested that the 1000-foot setback be removed along their property lines. Letters from these property owners are included in Appendix 6. There is still a large amount of shoreline with critical mangrove, fringing marsh, and seagrass habitats. Using the Texas shoreline dataset generated by GLO staff (based on USGS 1:24000 scale hydro data, modified and updated by using DOQs (1995-96)) the total length of shorelines within the Reserve boundary is 290 miles or 1,529,188 feet. Expansion of the boundary to shorelines where adjacent property owners are agreeable will continue by contacting adjacent property owners who own large tracts of shoreline with valuable habitats.

**Action 2:** Expand boundary onto shoreline

The Reserve boundary will be expanded to the shoreline when adjacent property owner are agreeable and inform the Reserve by written notification.

*Objective 3-3: Expand boundary to include key wetland habitats*

**Action 1:** Identify key wetland habitats

Key wetland habitats will be identified by The Nature Conservancy's strategic, science-based planning process. Wetland habitats that are likely to be identified as key include shorelines along St. Charles Bay and Port Bay (Figure 20).

Objective 3-4: Expand boundary to protect key watershed areas

**Action 1:** Identify key watershed areas

Key watershed and adjacent upland areas will be identified by The Nature Conservancy’s strategic, science-based planning process. Watershed areas that are likely to be identified as key include the Aransas River Delta and property along the Mission River (Figure 21).

Figure 20. General wetland habitats that are likely to be identified as key areas for future acquisition.

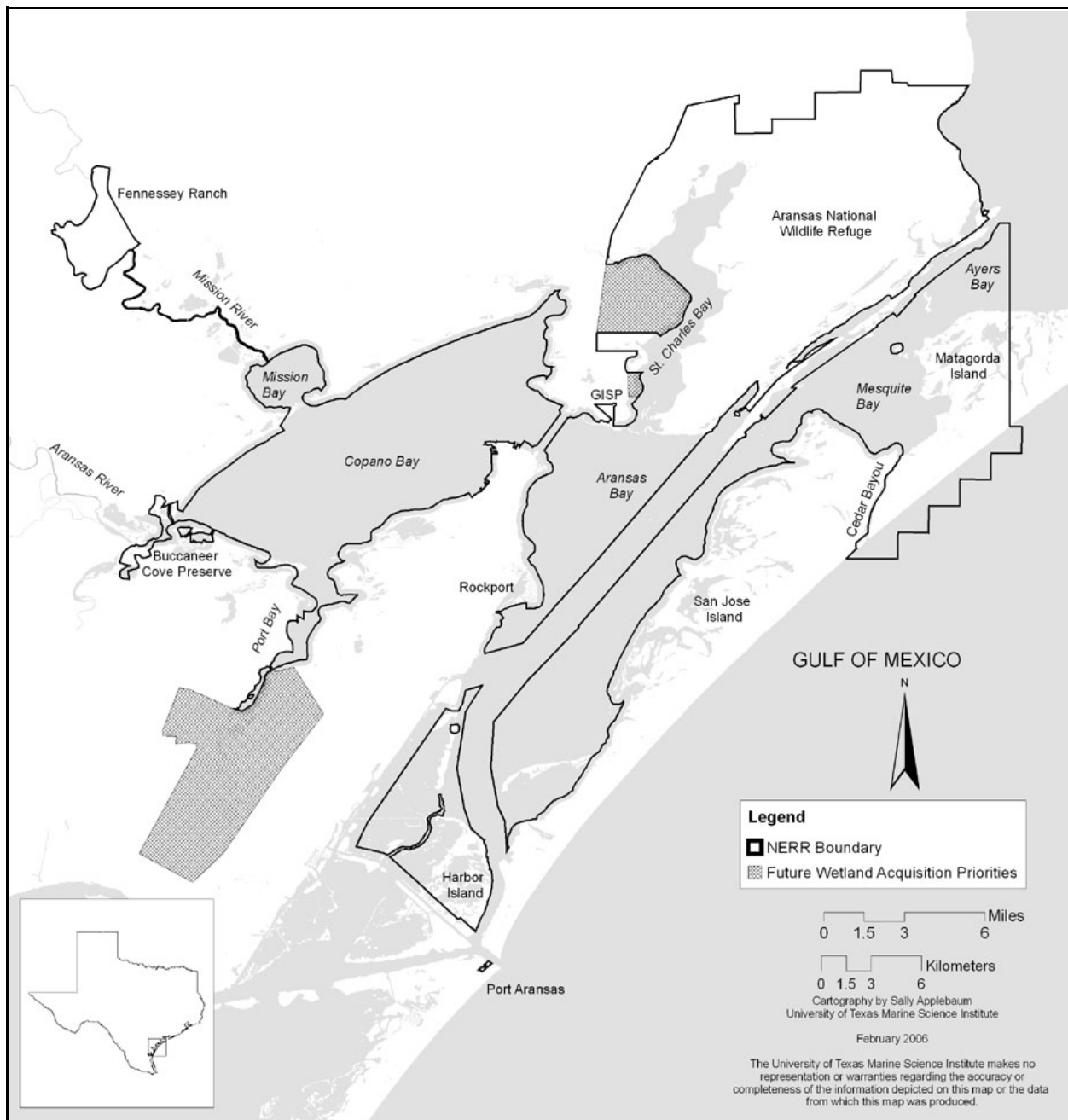
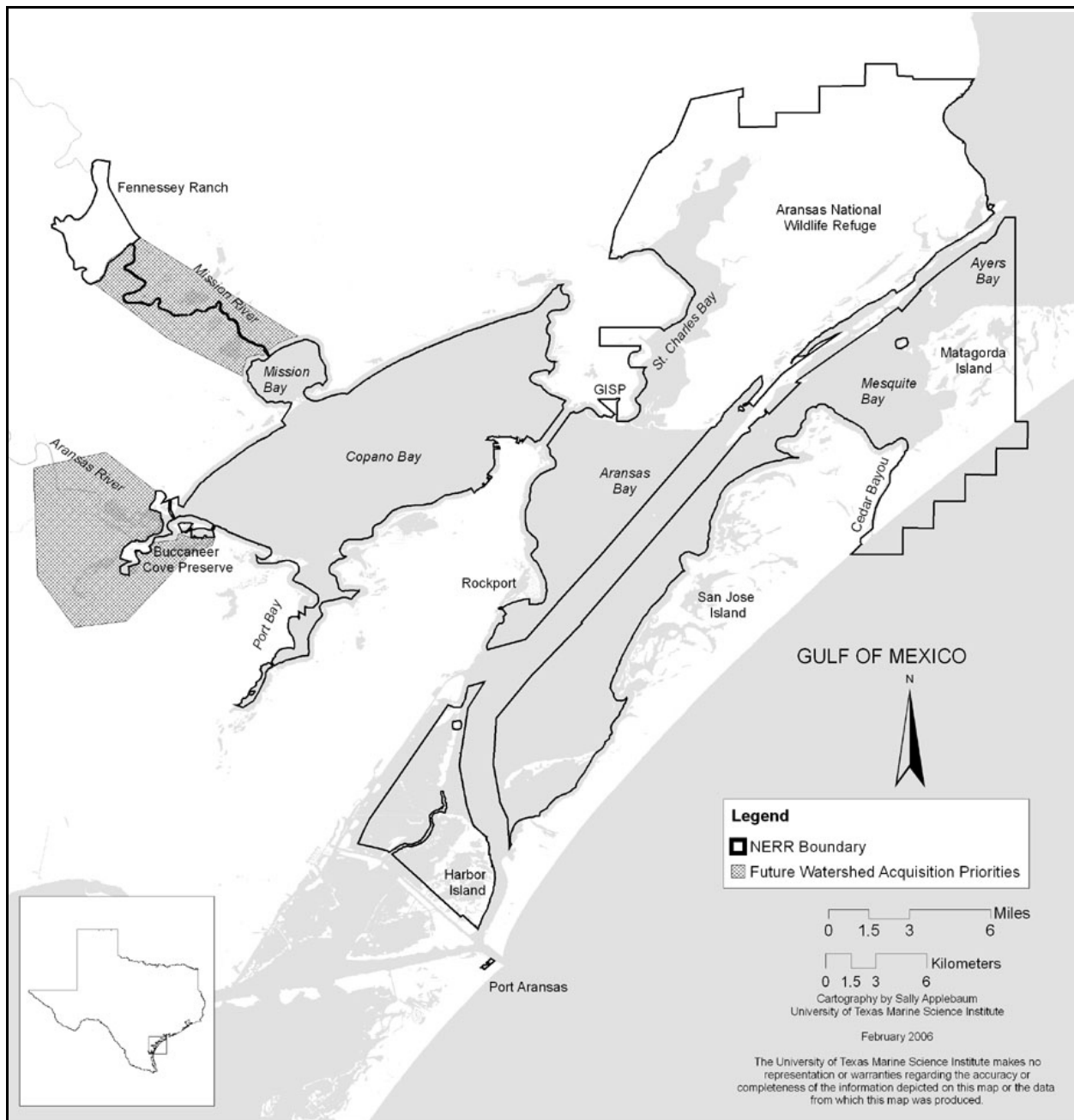


Figure 21. General watershed and adjacent upland areas that are likely to be identified as key areas for future acquisition.



## 5.0 STEWARDSHIP PLAN

### 5.1 Introduction

The stewardship plan outlines specific projects that the stewardship staff of the Reserve will develop and conduct. A site profile and ecological characterization of the Reserve will be created in three different parts that include a demographic characterization, environmental characterization, and a site profile development. Initial analyses and development for the Coastal Training Program will be conducted under the demographic characterization of the site profile. Land management coordination will be a key responsibility because land management will not be conducted by the University of Texas Marine Science Institute (UTMSI). The restoration and mitigation initiative of the Reserve will be conducted in three steps: literature review, restoration science and mitigation plan, and initiation of restoration or mitigation projects. Partnership with local animal rescue programs will also be responsibilities of the stewardship staff. In addition, other specific types of programs that the stewardship staff may conduct are listed in this stewardship plan. A key component of the stewardship plan is creation of a stewardship advisory committee to provide Reserve staff with community based input.

### 5.2 Program Goals and Objectives

#### Goal 1: Improve understanding of Texas coastal zone ecosystems structure and function

*Objective 1-3: Update site profile and ecological characterization via ground-truthing of the GIS data base*

The goal of developing a site profile is to enhance research efforts by developing habitat inventory information and assimilating baseline data concerning the estuarine resources and habitats within a Reserve. It accomplishes this by compiling and synthesizing all the existing information (both contemporary and historical) available for the Reserve. It captures into a single, comprehensive document all that is known and what is not known about a reserve's natural and cultural resources at a particular point in time. The site profile improves the usefulness of the National Estuarine Research Reserve System (NERRS) as a whole from both the local and national perspectives. The site profile for the Reserve will be completed in three stages: 1) Demographic Characterization, 2) Environmental Characterization, and 3) Site Profile Development.

#### **Action 1: Demographic Characterization**

Demographic characterization involves the initial analyses for the Coastal Training Program, which includes a market analysis, needs assessment, market plan, and strategic plan. The demographic characterization will also involve a land development pressure analysis to be used in prioritization of land acquisition, as well as an economic valuation of habitats within the Reserve. The economic valuation will help affix a dollar amount to our estuarine system, and in turn will be useful in several aspects of marine policy, such as mitigation. The characterization will be aided by regional social science workshops. Characterization will also include implementation of the NERRS social science strategy. Geo-referenced census data will also be collected and made available to National Oceanic and Atmospheric Administration (NOAA) partners and staff.

#### **Action 2: Environmental Characterization**

Environmental characterization involves a literature search and a review of all existing research/field data. All available information that describes the geology, biology, chemistry, geomorphology, hydrology, etc. of the Reserve and with surrounding areas will be compiled. Information on research projects in the Reserve will also be cataloged and made available for an internal Reserve research database. Aerial mapping of habitats will also be completed to provide a current footprint of the Reserve. This habitat mapping will use geographic information software (ArcView) to document change, and will strive to use the same classification system as other National Estuarine Research Reserve (NERR) sites.

#### **Action 3: Site Profile Development**

Site profile development involves a synthesis of information gathered during the demographic and environmental

characterization stage. The resultant document provides a picture of the Reserve in terms of its resources, management issues and constraints, and research needs.

The site profile will provide researchers, students, coastal zone managers, teachers, resource agency representatives and the public with a detailed summary of what is known about the Reserve, along with a discussion of issues of particular concern to the Reserve. Information contained in the Texas site profile will be particularly valuable to resource managers dealing with an issue affecting a Reserve but who may not have or need the individual research papers completed within the Reserve.

*Objective 1-4: Protect core areas for long-term research*

**Action 1:** Coordinate with Reserve partners to follow existing rules and regulations

Protection of core areas for long-term research will be achieved by the partner participation in the Reserve Advisory Board (RAB). The RAB will work toward the following objectives, to the maximum extent practicable, as governed by their individual missions, bylaws or other operating instruments:

- to ensure a conducive setting for research and monitoring through long-term protection of the Reserve,
- to enhance public awareness and understanding of the Reserve and provide public education opportunities,
- to provide an opportunity by which research and monitoring activities at the Reserve will be communicated to coastal decision makers,
- to protect the integrity of the Reserve through implementation of the Reserve management plan, and
- to assist with revision and updating of the management plan at least every five years.

Goal 2: Increase understanding of coastal ecosystems by diverse audiences

*Objective 2-2: Better inform decision-makers*

**Action 1:** Develop a Coastal Training Program

The coastal training program provides up-to-date scientific information and skill-building opportunities to individuals who are responsible for making decisions that affect coastal resources. Through this program, Reserves can ensure that coastal decision-makers have the knowledge and tools they need to address critical resource management issues of concern to local communities. This program is a strategic progression from very successful coastal decision-maker workshops sponsored by NERRS.

The goal of the Reserve coastal training program is to have better-informed decision-making regarding coastal resource issues, and improved coastal stewardship at local and regional levels. The coastal training program at the Reserve will provide professional training and focus on issues such as coastal habitat conservation and restoration, mitigation, biodiversity, water quality and quantity, energy resource development, and sustainable resource management. The program will target a range of audiences, including land-use planners, elected officials, regulators, land developers, engineers, community groups, environmental non-profits and coastal businesses. This training program will provide a range of opportunities for professionals to network across disciplines, and develop new collaborative relationships to solve complex environmental problems.

The coastal training program will provide information and skill-building opportunities through a variety of formats ranging from seminars, hands-on skill training, participatory workshops, lectures and technology demonstrations. Participants will benefit from opportunities to share experiences and network in a multidisciplinary setting, often with a reserve-based field activity.

The stewardship advisory committee will play a key part in determining coastal resource issues to address, as well as the identification of target audiences. This advisory committee will be critical in the exchange and sharing of expertise and resources to deliver relevant and accessible training programs that meet the needs of specific groups.

Initial analyses for the coastal training program will be conducted under the demographic characterization of the site

profile. Prior to launching a coastal training program, initial analysis will include: a market analysis to identify other training providers and partnership opportunities, target audience selection and assessment of their training needs, establishment of an advisory committee, and development of an implementation strategy and a marketing plan for the training program. Several NERR sites have completed these steps and are providing information and training based on audience needs. Audiences identified by other NERR sites include municipal and county officials, regulatory agency staff, realtors and developers, tourism and development community, community and civic groups (garden clubs, chambers of commerce), senior citizen groups, and recreational and commercial resource users. A coastal training program will provide information exchange and skill building and hopefully showcase successfully implemented applications of new scientific information and technologies.

In the public scoping meetings there was interest for a program investigating the socioeconomic impacts of marine transportation in our area. Education of decision-makers on the socioeconomic impacts of marine transportation could be an ideal training opportunity for the Coastal Training Program.

The Texas Cooperative Extension Service and Natural Resources Conservation Service (NRCS) currently offer a watershed program to help educate the agricultural community on effective rangeland management to help minimize erosion, sedimentation, and runoff. Other programs offered by Extension and NRCS that will mesh well with the coastal training program and NERR include:

- Brush management conference
- Controlled burn seminar
- Nature booths at county fair
- Ranch heritage day

Collaboration with programs such as these will be valuable when developing the coastal training program.

**Action 2:** Recruit and maintain staff to implement the Coastal Training Program

The Reserve will recruit and maintain staff as needed to implement the Coastal Training Program after program initiation.

*Objective 2-3: Improve the capacity to engage in ecotourism activities*

**Action 1:** Develop an ecotourism docent training program

Understanding of coastal ecosystems by diverse audiences will be promoted by the development of an ecotourism docent training program. This program will provide knowledge gained through NERR research and monitoring to individuals or organizations so that they can be better informed about the resources they utilize. Benefit to the public will be an increase in environmental awareness by tourists and other Reserve user groups, such as fishing, kayaking, and birding guides. A follow-up survey will be conducted to gauge the effectiveness of the workshop.

*Objective 2-4: Provide outdoor educational experiences to scouting and other organizations*

**Action 1:** Partner with organizations, such as the Aransas National Wildlife Refuge (ANWR), to provide educational experiences

The Stewardship Training program for Boy Scouts and Girl Scouts will be operated through the stewardship program. The ANWR currently operates scout trips through their Youth and Environmental Training Area (YETA). These scout trips focus on service and stewardship. This program can be expanded through NERR by incorporating estuarine based activities such as Oceanography Day. Oceanography Day was a one-day scouting event offered by UTMSI every three years to provide scouts the opportunity to earn an oceanography merit badge. The Oceanography Day schedule included a series of displays, films, lectures and laboratory work that took place at the UTMSI facilities and a trip aboard a research vessel. Scouts would be prepared for the trip by submitting a report, covering the first six requirements of the oceanography merit badge, to the Marine Science Institute prior to the trip. During this process, the scouts had to demonstrate their knowledge of the various branches of oceanography and the characteristics of different types of ocean waves. They had to understand and draw a cross-section of underwater topography and be familiar with various descriptive terms related to the ocean floor. They compared the depths of oceans to the heights of mountains on land.

The scouts learned about the properties of seawater and studied plants and animals that live in the sea. Perhaps the most interesting part of the adventure in Port Aransas was a trip in Corpus Christi Bay aboard the research vessels *Katy* and *Longhorn*. During the one-hour adventure scouts learned about the role of research vessels and observed some of research equipment in operation. The scouts were also able to observe plankton and nekton that had been previously captured by the crew of the vessels. The Oceanography Day concept could be conducted on National Estuaries Day. Integration of Oceanography Day and the YETA programs would be exciting for scouts and a means of educating young people about the value of estuarine systems and why it is important to become good stewards of the land/sea interface.

Goal 3: Promote public appreciation and support for stewardship of coastal resources

*Objective 3-5: Monitor land management practices among Reserve partners*

**Action 1:** Annual assessment of landowner management policies and practices

Coordination of management activities will involve all the responsible land owners within the Reserve. An annual assessment of landowner management policies and practices will be performed by Reserve staff and will emphasize coordinated projects, access, and information on key issues identified from the site profile analyses. Land management coordination will be accomplished by performing an analysis of this assessment to ensure that management policies and practices are consistent with the mission and goals of the Reserve.

**Action 2:** Monitor habitats and management practices on Fennessey Ranch

The Fennessey Ranch conservation easement requires regular monitoring of habitats and management practices. The monitoring program will be used to ensure responsible management of Fennessey Ranch. Changes to the Fennessey Ranch management plan will be based on sound science.

*Objective 3-6: Develop partnerships with locally-based animal rescue programs*

**Action 1:** Partner with local organizations to enhance rescue programs

The majority of animal rescue at the Reserve will be handled through cooperation and coordination with the Edith McAlister Animal Rehabilitation Keep (ARK) housed on the UTMSI campus. The ARK provides rehabilitation to injured animals endemic to the Mission-Aransas Estuary and its surrounding environs. The ARK got its start over 25 years ago and is currently the largest rehabilitation facility on the Texas coast. Facilities include a turtle laboratory, avian laboratory, raptor cages, all purpose cages, walk-in freezer, and several large turtle holding tanks. The ARK also participates in monitoring stranded animals along the Texas coast and cooperates with the Texas Marine Mammal Stranding Network and the Sea Turtle Stranding and Salvage Network. The ARK will also participate with volunteer coordination.

*Objective 3-7: Support existing clean-up and recycling programs*

**Action 1:** Partner with local organizations to enhance clean-up and recycling programs

The stewardship staff will look to expand the Monofilament Recovery & Recycling Program (MRRP). The MRRP is a statewide effort to educate the public on the problems caused by monofilament line left in the environment, to encourage recycling through a network of line recycling bins and drop-off locations, and to conduct volunteer monofilament line cleanup events. The MRRP is sponsored by the Texas Sea Grant Program. A stewardship goal of the Reserve is the expansion of this program to all the boat ramps, marianas, and other public access points within the Reserve.

A clean-up campaign will also be initiated to remove sunken boats and derelict structures from the bays. This campaign will partner with the Coastal Conservation Association (CCA) and the Saltwater-fisheries Enhancement Association (SEA) for funding and organization. Both of these local organizations are already currently involved in projects that remove derelict structures in and around the NERR boundary. The clean-up campaign could also include a beach debris



quantification survey. The Texas Commission of Environmental Quality (TCEQ) currently does an annual barrel cleanup on Matagorda Island. Collaboration with TCEQ would be valuable in expansion of the barrel cleanup on Matagorda Island.

*Objective 3-8: Promote Reserve initiatives at public events, fairs and expositions*

**Action 1:** Create and participate in public events, fairs and expositions

Creation of and participation in public events, fairs and expositions will promote public appreciation and support for stewardship of coastal resources. A likely public event that will be operated through stewardship is an annual “Bio-Blitz.” A bio-blitz will be a day long survey of habitats that will be conducted by the public and willing researchers. Coordination with the research coordinator and staff will help determine the agenda. This program will incorporate both public outreach and research. Findings will be incorporated into the environmental characterization of the site profile. The bio-blitz will allow Reserve staff to amass a large amount of knowledge on biodiversity in a relatively short amount of time.

Collaborations with other resource agencies and organizations for public events, fairs and expositions will also be a key responsibility of the stewardship staff. Such collaborations will include among others the General Land Office (GLO) beach cleanup, GLO Coastal Issues Conference, Coastal Bend Bays and Estuaries Habitat & Living Resources Implementation Team, Texas Cooperative Extension Service, and the GLO Coastal Texas 2020 program.

**Action 2:** Create and disseminate interpretative materials or signs at public access sites

Interpretive materials and signs promoting public appreciation and support for stewardship of coastal resources will be created and placed at public access sites.

*Objective 3-9: Initiate restoration and mitigation projects with appropriate partners*

The restoration and manipulation initiative of the Reserve will be completed in three stages: 1) Literature review, 2) Restoration Science and Mitigation Plan, and 3) Initiation of Restoration or Mitigation Projects.

**Action 1:** Literature review

Literature review involves a detailed literature review of restoration and mitigation projects of habitats found within the Reserve. The literature review also includes a review of the locations and results of all local mitigation and restoration projects within the Reserve.

**Action 2:** Develop a restoration and mitigation plan

The restoration and mitigation plan involves identification of the areas within the Reserve in need of restoration or mitigation and the methods of which to achieve restoration in the identified areas. The restoration and mitigation plan will also highlight gaps in the knowledge of restoration and mitigation science, and will work with the research coordinator on proposal to fill these gaps.

**Action 3:** Initiate restoration and mitigation projects

Restoration and mitigation projects identified in the restoration and mitigation plan will be initiated. All habitat restoration and manipulation activities at the NERR will be reviewed and accepted by the RAB and NOAA prior to initiation. A likely restoration project that will be initiated includes partnering with existing seagrass conservation science programs. A collaboration with existing seagrass conservation science programs will be likely initiated to look at the effect of propeller scars, and other factors that may influence seagrass production.

## 6.0 PUBLIC ACCESS PLAN

### 6.1 Introduction

#### National NERRS Priorities for Public Access

Section 921.13(a) of the National Estuarine Research Reserve System (NERRS) regulations requires a plan for public access as part of the Reserve management plan. Public access can be defined as the ability of all member of the community to pass physically and visually to, from, and along the ocean shore, other waterfronts, and over public lands. The ability to enjoy the oceans, bays and rivers is directly related to the ability to reach them from the uplands. A public access plan must try to allow for the long-term public use and enjoyment of the water and shoreline while minimizing damage to the resources themselves.

#### Reserve Public Access Policy

The Reserve public access policy will recognize the traditional uses and access to the Mission-Aransas Estuary as much as possible in an effort to maintain biological integrity of the area for these uses as well as for education, research, and monitoring. As outlined below traditional recreational and commercial activities that require access to the Reserve will continue to be allowed. This policy will be made compatible with the public access policy of each of the appropriate agencies having title to the lands in question (i.e., GLO, USFWS, TPWD, CBLT, and Fennessey Ranch). Specific polices for access for the purposes of education, stewardship, research and monitoring will be determined through coordination with each of these National Estuarine Research Reserve (NERR) programs. Acquirement of a conservation easement will likely increase public access to Fennessey Ranch. However, access may be limited or controlled in a equitable manner for resource protection, public safety, or for other reasonable causes.

### 6.2 Program Goals and Objectives

#### Goal 1: Improve understanding of Texas coastal zone ecosystems structure and function

*Objective 1-5: Access to Reserve partner land and water areas for research activities*

**Action 1:** Enhance access to land and water areas consistent with NERR purposes

Present public access to the Reserve is adequate (Table 4). Current boat access includes 20 boat ramps within or near the Reserve (Figure 22). Boat access for NERR activities will also include boat access from the University of Texas Marine Science Institute (UTMSI) boat ramp and dock. In addition to boating access, there are access points for fishing, picnicking, camping, and wind surfing. Improvements to access points may be needed in the future to ensure research access.

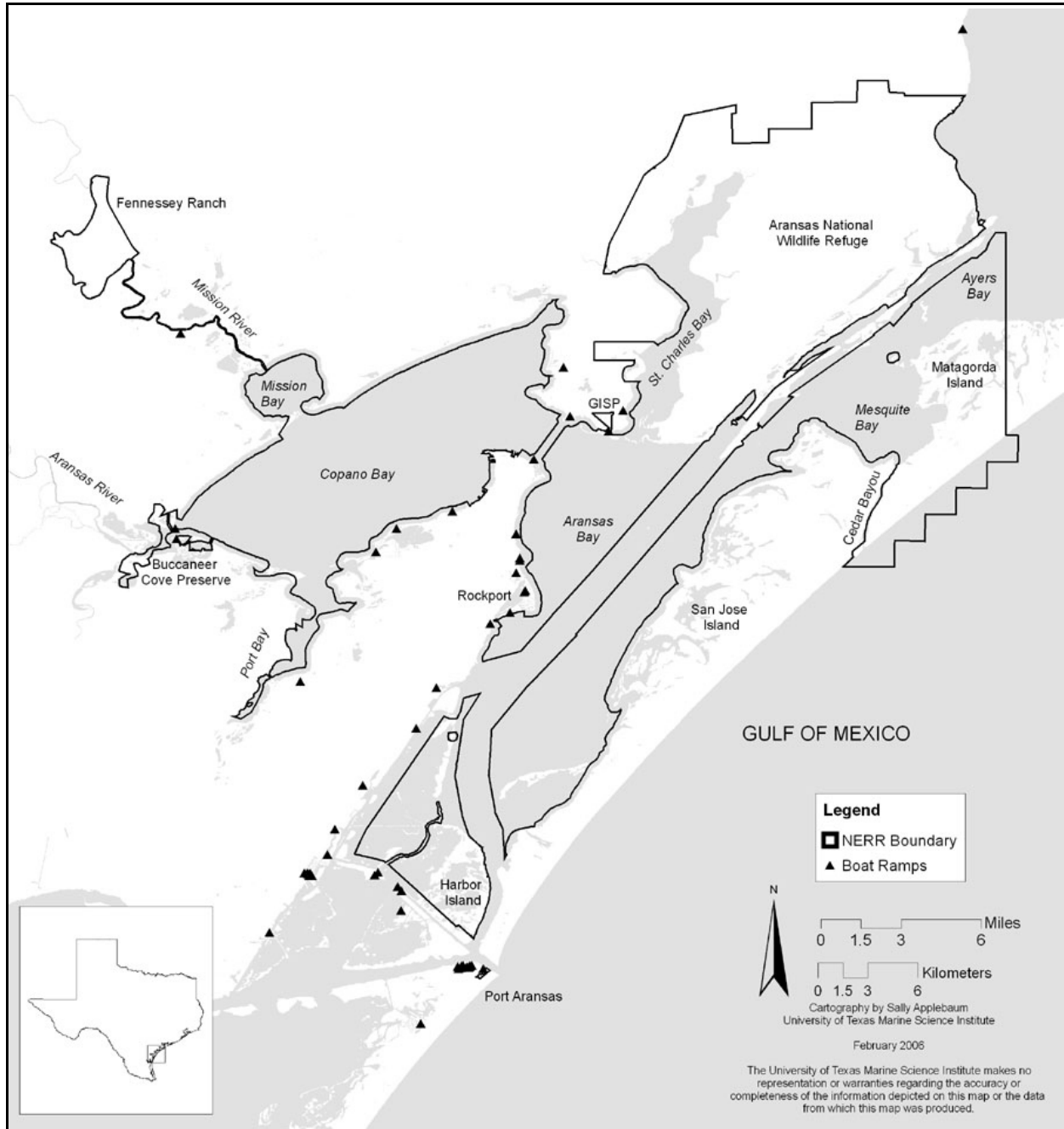
Table 4. Current public access sites within and near the Reserve with activities and facilities available.

Site/Area	Location	Fishing	Wildlife Viewing	Picnicking	Camping	Wind Surfing	Boat ramp	Boat Dock	Pier	Restroom	Electricity/ Lighting	Fresh Water	Concession	Entrance/ Parking Fee	Access for the Mobility Impaired	Bay/River /Lake Access
12th Street	End of 12th Street, Lamar	●														●
Bob's Place	Rattlesnake Point Road, Rockport						●				●			●		●
Beacon Bait Stand	302 South Fulton Beach Road, Rockport	●					●	●	●		●		●	●		●
Copano Bay Bridge – South End	Highway 136, Bayside	●	●													●
Copano Bay State Fishing Pier	State Highway 35, Rockport	●	●				●		●	●	●		●	●	●	●
Copano Causeway North	North Highway 35, Rockport	●	●													●
Copano Causeway South	South Highway 35, Rockport	●	●													●
Cove Harbor Marina	161 North Cove Harbor Drive,	●	●				●	●	●	●	●		●		●	●
Fulton Fishing Pier	250 Deforest Loop, Rockport	●							●	●	●		●	●	●	●
Goose Island State Park	202 Palmetto Avenue, Rockport	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Highway 188	At Port Bay, Rockport	●	●													●
Little Bay	Near Rockport Beach Park, Rockport	●	●			●										●

Site/Area	Location	Fishing	Wildlife Viewing	Picnicking	Camping	Wind Surfing	Boat ramp	Boat Dock	Pier	Restroom	Electricity/ Lighting	Fresh Water	Concesion	Entrance/ Parking Fee	Access for the Mobility Impaired	Bay/River /Lake Access
Palm Harbor Marina	151 Port Avenue, Rockport				●		●	●		●			●	●		●
Palmetto Road	East end of Palmetto Road, south of Fulton						●									●
Redfish Camp	5220 FM 881, Rockport		●		●		●	●		●			●	●		●
Rockport Beach Park	210 Seabreeze Drive, Rockport	●	●	●		●	●	●	●	●	●		●	●	●	●
Sand Dollar Bait House	918 North Fulton Beach Road, Rockport		●				●	●		●	●				●	●
Sea Gun Marina	5810 Highway 35 North, Rockport	●	●				●	●								●
St. Charles Bay Boat Launch	175 Lamar Beach Road, Rockport	●					●	●	●	●	●			●	●	●
Aransas River Boat Ramp	South of Bonnie View	●		●			●									●
Copano Bay Bridge	FM 136, Bayside	●	●													●
FM 2678 Bridge	North of Mission River, Refugio	●	●													●
Hopper's Landing	FM 2040 & Hopper Road, Austwell	●			●		●	●			●			●		●
Mission River Bridge	FM 2678, Refugio	●	●													●
Refugio County Park	Bayside	●	●													●

Site/Area	Location	Fishing	Wildlife Viewing	Picnicking	Camping	Wind Surfing	Boat ramp	Boat Dock	Pier	Restroom	Electricity/ Lighting	Fresh Water	Concesion	Entrance/ Parking Fee	Access for the Mobility Impaired	Bay/River /Lake Access
Texas Parks & Wildlife	Off of FM 136, Bayside	●	●				●	●							●	●
Roberts Point Park	J.C. Barr Boulevard and Cotter, Port	●	●	●			●	●	●	●	●				●	●
South Bay Bait and Charters	1950 Highway 361, Port Aransas	●			●		●	●	●	●	●		●	●		●
Woody's Sport Center	136 West Cotter, Port Aransas						●	●		●	●		●		●	●
P.J.'s Marina	Port Aransas Causeway	●		●	●		●	●	●	●	●		●	●		●
Lonyo's Cajun Marina	Highway 361, Port Aransas Causeway,	●			●		●	●		●	●		●			●
Aransas National Wildlife Refuge	Aransas National Wildlife Refuge	●	●	●		●				●				●	●	●

Figure 22. Boat ramp locations within and adjacent to the Reserve.



**Goal 3: Promote public appreciation and support for stewardship of coastal resources**

*Objective 3-10: Ensure public and group access to Reserve partner education facilities and environments*

**Action 1: Enhance access to land and water areas**

Apart from possible improvements to the existing access facilities, there is little need for development of additional boat access points. Minor access needs are limited to construction of interpretive trails, and board walks, i.e., at Matagorda Island, UTMSI wetland education center, and the Public Outreach and Research and Education Centers. Major access needs include construction of a boat ramp in east Copano Bay adjacent to the Aransas County Airport, as well as renovation of bulkheads at the proposed Public Research and Education Facility, and Matagorda Island Education center. As currently envisioned, these facilities will be located on lands within the buffer zone of the Reserve and would provide public access and multiple uses associated with education, research, and monitoring. Reserve programs will also have access to Reserve partner boat ramps of UTMSI, Aransas National Wildlife Refuge (ANWR), and the Copano Bay Research and Education Center, none of which are open to the public.

**Action 2: Seek funding for access vehicles for Reserve programs**

Marine Education Vessel - A vessel is required to transport classes to the Reserve. The requirement is for a 45-foot (plus motor-mounts and motors) vessel with a capacity for 40 guests, that has a shallow draft and can obtain high speed. It will be powered by two 225 hp, 4-stroke outboards to demonstrate the best available poll control. The deck will be 45' x 14'. Hull draft is 10" and with motors running 24". It will have a 140 gal. fuel capacity, a head with 60 gal. holding tank, and 60 gal. freshwater tank. It will list as 10 tons displacement and Coast Guard approved for 49 passengers. The total cost is \$270,000.

Matagorda Island Marine Education Vessel - A vessel is required to transport people to and from Matagorda Island. The requirement is for a 50-foot aluminum pontoon vessel with a capacity for 45 guests, that has a shallow draft and can obtain high speed. It will be powered by two 250 hp, 4-stroke outboards to demonstrate the best available poll control. Vessel will be maintained by ANWR personnel. An approximate price for boat and engines is \$80,000.

## 7.0 FACILITIES/CONSTRUCTION PLAN

### 7.1 Introduction

Facilities will enhance access to the Reserve and provide support for research and education programs. The Reserve is responsible for providing those facilities that are necessary to fulfill each Reserve's mission as established by federal and state laws, administrative rules, interagency agreements and the Reserve's management plan. Providing suitable facilities will promote achieving the educational and research goals of the Reserve and of the National Estuarine Research Reserve System (NERRS) as a whole. Facility development will proceed as funds become available, as prioritized in the Reserve's management plan. All facilities will be designed to comply with the Americans with Disabilities Act, create minimum visual or environmental impacts, comply with building and wastewater codes, comply with appropriate environmental requirements, satisfy local, regional and national priorities by soliciting input from user groups and allowing for future expansion to meet long range goals.

#### Existing Facilities and Potential Facility Sites

Facilities currently existing at the Reserve consist of facilities at the University of Texas at Austin, Marine Science Institute (UTMSI), Aransas National Wildlife Refuge (ANWR), Goose Island State Park, and Fennessey Ranch.

#### *University of Texas at Austin, Marine Science Institute Facilities*

The Institute's 83,000 sq. ft. central complex is located on 72 acres of beach-front land and consists of a series of interconnected buildings containing laboratories, classrooms, televideo instruction room, offices, a library, museum, exhibit halls, visitor's center, auditorium, seminar rooms, and workshops (Figure 23).

A 10,000 sq. ft. wet-laboratory is supplied with filtered running seawater. Other structures on the grounds of the Institute include 9,500 sq. ft. of dormitories, a cafeteria, physical plant complex, garages, greenhouses, walk-in freezers, and several outdoor pool/habitat tanks. The five-acre boat basin provides quick access for our research vessels to both the bay systems and the Gulf of Mexico.

A research pier allows direct access for research projects in the Aransas Pass tidal inlet connecting the Gulf with the bays. This 300 foot pier has a 1200 sq. ft. lab at its base and a 150 sq. ft. instrument room on the end. The terminus of the pier and instrument room house a weather station, tide gauge, current meter, and sensors for water temperature and salinity, all of which are transmitted to real time data displays in the Visitor's Center and main laboratory. The pier also has an electric winch for deploying sampling equipment such as plankton nets and large-mesh tide traps to study fluxes of biota through the inlet.

A mile west of the main building complex, the Fisheries and Mariculture Laboratory (FAML) occupies 26,000 sq. ft. of buildings on 10 acres adjacent to the ship channel. This facility includes four large laboratories which provide for temperature and photoperiod control. The FAML complex provides facilities for research on spawning and rearing of marine finfish and crustaceans and affords unique opportunities for research utilizing captive animals. Both the main laboratories and the FAML facility have office and laboratory space available for visiting scientists.

The Marine Science Institute's fleet of research vessels is led by its flagship, the R/V Longhorn, which is part of the University-National Oceanographic Laboratory System (UNOLS) fleet. The workhorse of UTMSI's bay operations is the R/V Katy, a 57-foot long trawler. The UTMSI research fleet is rounded out by several smaller boats, each with special capabilities for working in different habitats and performing different operations (Figure 23).



Figure 23. Overview of University of Texas Marine Science Institute.



### Research Vessel Specifications

#### The R/V Longhorn



A 103 ft general-purpose coastal oceanographic research vessel, is capable of a 3,000 nautical mile range, complete with: dry laboratory (400 ft<sup>2</sup>), wet laboratory (400 ft<sup>2</sup>), main winch, crane, davit, deck space is available for vans, and two or three smaller workboats (16' carolina skiff and 16' zodiac inflatable boat are available), laboratory saltwater supply, seawater tanks, freshwater supply, compressed air supply, ctd, niskin bottles, reversing thermometers, 35' and 40' shrimp (otter) trawls, 1-meter plankton nets, smith-mcintyre sediment samplers, box-corer, piston corers, rock dredge, and safety equipment.

#### The R/V KATY



The Katy is 57 feet long and has a top speed of 10 knots. Below decks living quarters include bunk space for six. There is a complete galley with refrigerator and electric range. All the quarters are air conditioned. In addition to the normal controls on the bridge, there is a stern steering station. A wet laboratory space is semi-enclosed off the work deck, A compartment immediately forward of the wet laboratory space can be used as a day room for personnel, or can be rigged as an instrument room for research projects. This vessel's primary utilization is as a stern trawler for class trips sponsored by the MES. The Katy will be used by the NERR educational and outreach program.

VIP - R/V In Lieu of Diamonds



A 27-ft “walkaround” VIP Cruiser powered by a 260 hp inboard/outdrive, capable of bay work and offshore work in good weather. It has a v-berth, galley, head and canvas enclosures. Maximum capacity: 8 people or 1,200 lbs.

Dr. Cleo



A 22-ft Boston Whaler center console with a 200 hp Mercury Optimax outboard engine. It is fully equipped with electronics and has a T-top. Suitable for bay and offshore (in calm weather) work, it has a capacity of 9 people or 1,650 lbs.

R/V Caesar Kleberg



A 24-ft Jefferson skiff powered by a 260 hp OMC Cobra Inboard/Outdrive. Maximum capacity: 8 people or 1,480 lbs.

R/V Shearwater



A 26-ft “landing craft” with a 150 hp outboard engine. It can carry an All Terrain Vehicle and gear or up to 14 people. Maximum carrying capacity: 2,600 lbs.

R/V Beachcomber



An 18-ft custom “air-boat” powered by a high performance 454 cu. in. Chevy engine. It is used for ultra shallow research and delta/marsh work. Maximum capacity: 6 people or 1,110 lbs.

Jet-Air



An 18-ft center console flat bottom skiff with an 80 hp outboard with a “water-jet” drive for shallow water operation. It has a large fuel capacity and can carry up to 5 people or 925 lbs.

## Lowe



An 18-ft aluminum "John boat" powered by a 45 hp outboard. Its large deck is suitable for working various gill nets, etc. Maximum capacity: 8 people or 1,085 lbs.

## Big Whaler



A 16-ft center console Boston Whaler with a 70 hp outboard. Maximum capacity: 5 people or 925 lbs.

## Montauk



A 17-ft center console Boston Whaler with a 110 hp outboard motor. Maximum capacity: 5 people or 925 lbs.

## Little Whaler



A 13-ft Boston Whaler with console, powered by a small outboard engine. Maximum capacity: 4 people or 600 lbs.

*Aransas National Wildlife Refuge Facilities*

Facilities at the Aransas National Wildlife Refuge include a wildlife interpretive center that offers refuge information, exhibits, environmental education, wildlife programs, and a nature bookstore. A 16-mile, paved auto tour loops through brushlands, grasslands, oak mottes, and brackish and freshwater marshes; complete with trailhead signs and exhibit panels. The 40-foot observation tower offers a panoramic view of San Antonio Bay and Mustang Lake. A boardwalk made of environmental friendly recycled "plastic lumber" meanders through a salt marsh to the shore. The refuge also offers several miles of walking trails that include observation platforms, telescopes, and a photo blind. Two picnic grounds with restrooms are also available. The refuge also has a headquarters complex, with offices, residences, and service area. A Youth Environmental Training Center (YETA) is used by youth groups and other organizations to promote environmental education. The YETA is composed of an assembly area, picnic shelter, restroom facilities, amphitheater and four primitive campgrounds for up to 250 - 300 people (Figure 24). A layout of the YETA facilities is in Appendix 9.

The Aransas National Wildlife Refuge also encompasses the southern end of Matagorda Island, which includes the old Wynne Ranch (Figure 25). USFWS is in the process of rehabilitating some buildings of the Wynne Ranch and converting them into environmental education facilities. Currently in use is the Enron Matagorda Island Environmental Education and Research Center. The center contains a 22 person capacity group barracks, kitchen, restroom, heat, laundry room, and laboratory. All facilities use solar power as well as a diesel gas generator. The USFWS is renovating the McAlister House to compliment the current research center. The McAlister house will have an eight person capacity, A/C, heat, and contain a kitchen, and restroom. Matagorda Island also a covered wagon for short-distance transportation, and several warehouses.

The refuge also has two boat dock and houses at Mustang Lake (9' dredged channel) and Matagorda Island. In addition there are two cabin cruiser boats, cathedral and "v" hulled, approximately 24 feet long. Each cruiser can hold 9-12 people.

Figure 24. Covered picnic shelter at the ANWR Youth Environmental Training Center.



Figure 25. Wynne Ranch complex on Matagorda Island.



### *Goose Island State Park Facilities*

Facilities at Goose Island State Park include shade shelter campsites ("open cabanas") with water and electricity, located on the island near the bay; campsites with water and electricity in a heavily, tree-shaded area; campsites with water in the shady area; a group area; picnic sites (some with shade shelters); restrooms with and without showers; a snack bar within two miles; a fish-cleaning shade shelter; a double-lane boat ramp; a 1620-foot, lighted fishing pier with 2 fish-cleaning tables; a group recreation hall with tables and chairs (no kitchen - capacity 50); playground areas; and a Texas State Park Store (Figure 26).

Figure 26. Aerial view of Goose Island State Park pier and island.



### *Fennessey Ranch Facilities*

Facilities at Fennessey Ranch include an open air pavilion at McGill Lake with electricity (Figure 27) and picnic tables, trailer that accommodates 35 people for tours, 4 photo blinds, boat launch, 14 artesian wells, and several outhouses located around the property (painted dark green to blend in with scenery).

Figure 27. Open air pavilion at McGill Lake.



## 7.2 Program Goals and Objectives

### Goal 1: Improve understanding of Texas coastal zone ecosystems structure and function

*Objective 1-6: Provide facilities for the research and monitoring community*

#### **Action 1:** Coordinate facility use for the research and monitoring community

As a means of supporting the objectives of the research plan for the Reserve, the following types of facilities and equipment are ideally envisioned. The research and monitoring program will be run out of the existing facilities of the University of Texas Marine Science Institute. There will be access to the following UTMSI facilities:

- Wet and Dry Laboratories
- Conference Room/Resource Room
- Auditorium
- Boat and Vehicle Support Facility

#### **Action 2:** Create a visiting scientist facility at UTMSI

The Reserve is far from many Texas cities and there is a need for affordable housing for visiting scientists and classes. Scientist needs are for medium-term visits from one week to three months. The plan is for an apartment complex of 10 units medium-term and a barrack style dormitory for short-term stays of 1-2 nights. The residence will be 14,000 square feet, and the "standard" rate for residence hall construction is \$140 per square foot. \$1,960,000 for basic construction is anticipated; however the building must be raised due to specifications for coastal regions, which will multiply the standard rate by 1.3 resulting in an adjusted estimate for local conditions of \$2,550,000. The total construction estimate is \$3,500,000 and is derived by multiplying by 1.35 for contingencies, engineering studies, and unknowns. The value of the land (2.915 acres) is \$1,749,000 at \$600,000/acre.

#### **Action 3:** Create a NERR headquarters facility at UTMSI

The Reserve staff will be scattered among several existing buildings on the UTMSI campus. There will be a need to create a Reserve headquarters on campus to integrate research, education, and stewardship personnel. This will also allow an expansion of the existing UTMSI visitor's center to accommodate increased visitations to the NERR site. The new headquarters building would be about 10,000 square feet, and include research laboratories for four NERR staff members, one laboratory for visiting scientists, offices for the Education and Stewardship Coordinators and staff, one classroom for use by visiting teachers and classes, and an expansion of the visitors center to house NERR exhibits and displays. The "standard" rate for laboratory construction is \$300 per square foot plus a 0.4 adjustment factor for contingencies, engineering studies, and unknowns for a total cost of \$3,400,00. In addition, site work, parking lots, and other outdoor improvements will be needed to complete the project, estimated at \$1,600,000. The total project cost of \$5,000,000 is matched by the value of the land (4.2 acres) worth \$2,500,000 at \$600,000/acre.

### Goal 2: Increase understanding of coastal ecosystems by diverse audiences

*Objective 2-4: Provide access to UTMSI facilities for Reserve education programs*

#### **Action 1:** Coordinate facility use for education programs

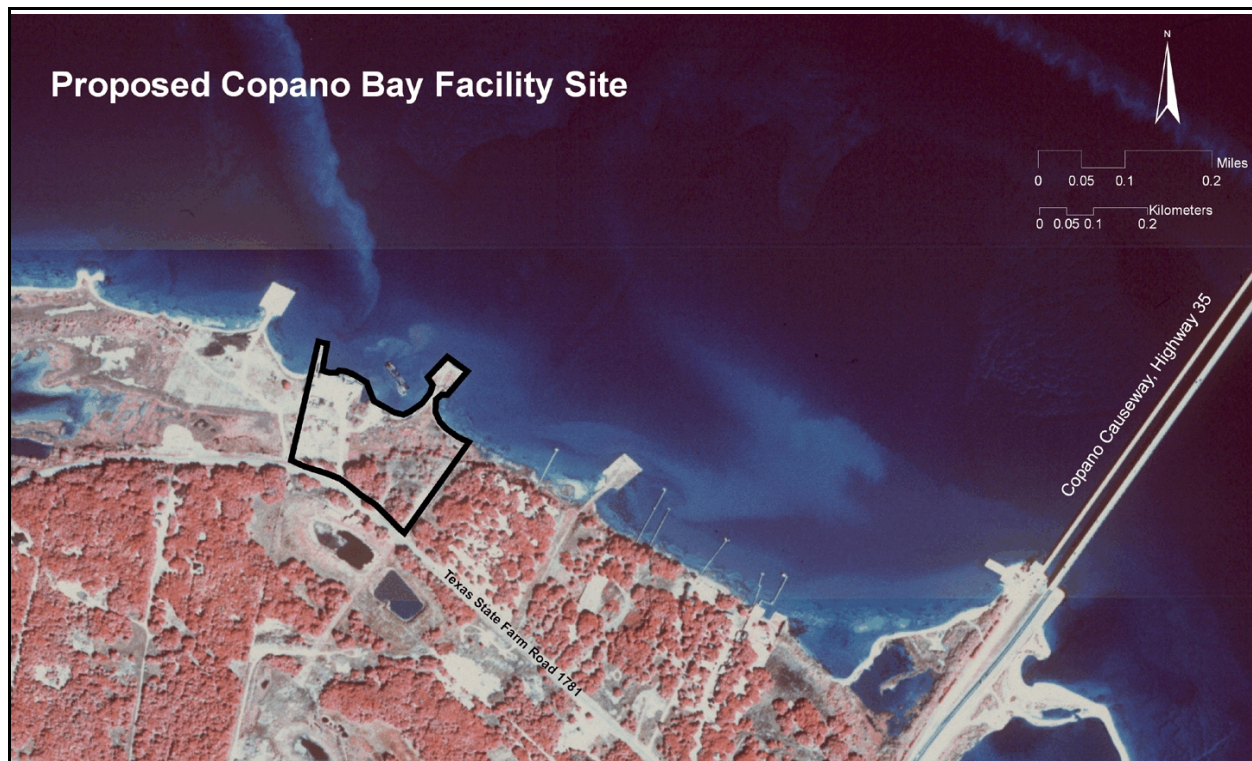
As a means of supporting the objectives of the Education/Outreach Plan of the Reserve, the education programs will have access to the following UTMSI facilities:

- Wet and Dry Laboratories
- Conference Room/Resource Room
- Auditorium
- Boat and Vehicle Support Facility
- Wetland Education Center
- Marine Science Library

*Objective 2-5: Create a Copano Bay research and education center*

The Copano Bay public research and education facility will focus on active, hands on education of research from the Reserve. The target audience for this facility will be organized K-12 classes. This facility will be located on NERR property adjacent to Copano Bay on Redfish Point (Figure 28). The facility will be in an ideal location to accommodate the general public, and local school groups. The property currently has a bulkhead with channel that needs to be repaired. Repairing this bulkhead will allow for the marine education vessel to dock and utilize not only the UTMSI but also the research and education facility. The Mission-Aransas Estuary is shallow (1 - 4 meters) and a bulkhead with existing channel is essential in utilizing Copano Bay in research and education programs. An additional docking location will also make field trips more accessible and allow for a much broader audience. The facility will focus on current research within the Reserve and give the public a chance to interact with real data and researchers. The majority of displays will be constructed for active participation. The facility will contain a parking lot, bulkhead, wetland pond with boardwalk, and a building. The building will be elevated above the flood zone and have an adjacent open air wet laboratory. The facility will be staffed by a researcher, naturalist, and volunteers. Construction will incorporate handicap accessible features. There is a sunken barge adjacent to the site that must be removed.

Figure 28. Proposed site to be included in the boundary for the Copano Bay public research and education facility.



**Action 1:** Coordinate facility use for the education and stewardship community

The education and stewardship community will have full access to the Copano Bay public research and education facility. Reserve staff at the facility will help coordinate and schedule education and stewardship programs.

**Action 2:** Create and disseminate interpretive materials and signs

Interpretive materials and signs promoting public appreciation and support for stewardship of coastal resources will be created to and placed at the Copano Bay public research and education facility.

**Action 3:** Use green building techniques in construction of facilities

As new facilities are built, the Reserve will strive to build in the most sustainable manner possible. Building sustainable or “green” buildings is the practice of creating healthier and more resource-efficient models of construction, renovation, operation, maintenance, and demolition. Building green will benefit the environment by reducing the impacts of natural resource consumption. Building green will also benefit the Reserve’s operational budget by improving the bottom line and minimizing energy and water consumption. The sustainability program will work to gain the Leadership in Energy and Environmental Design (LEED) certification as a green building. Elements of green building include:

- Energy - Designing and operating buildings to use energy efficiently and to use renewable sources of energy, including solar, wind, and biomass.
- Water- Designing and operating buildings to use water efficiently.
- Materials- Using building materials that, in comparison to competing brands, have a reduced effect on the environment throughout their life cycle (e.g. recycled content, low toxicity, energy efficiency, biodegradability, and/or durability).
- Waste - Reducing the waste from construction, remodeling, and demolition.
- Indoor Environment - Designing and operating buildings that are healthy for their occupants

**Action 4:** Develop a construction plan

A construction plan, including a proposed construction schedule, general descriptions of proposed developments and general cost estimates will be developed for the Copano Bay research and education center. Information will be generated to begin in the initial phase of construction and development.

*Objective 2-6: Partner with USFWS to enhance visitor experience at the Aransas Wildlife Refuge***Action 1:** Help create an environmental education building

The YETA currently has a building that is approximately 1000 square feet and is used for environmental education purposes but is very primitive. The refuge would like to replace this building with a 2000 square foot education center with electricity, air conditioning, running water, and restrooms to better accommodate school groups. The building would contain mostly classroom space to be used for a variety of environmental education programs. Because this area is located on the mainland, we would be able to accommodate a wide variety of groups interested in learning about the refuge and the coastal environment. Restrooms in this building would replace facilities that are over 20 years old and are constantly being repaired. The approximate cost is \$250,000.

**Action 2:** Help build a board walk on Matagorda Island

A board walk is required to facilitate Matagorda Island educational programs. The requirement is for materials for a boardwalk with the dimensions of 900 feet long by 5 foot wide. Construction of the boardwalk will be done by ANWR personnel and volunteers. Total cost for materials is \$100,000.



*Objective 2-7: Complete the Wetland Education Center at UTMSI***Action 1:** Construct the infrastructure of the Wetland Education Center

The Wetlands Education Center is a 2.6 acre facility with tidal channels, submerged seagrasses, and fringed with Black Mangrove and Smooth Marsh Cordgrass. The contract for construction of the marsh was awarded by the United States Army Corps of Engineers in January 2006, and has an estimated construction time of six months. Once the marsh is built, there will be a need for interpretive facilities. The NERR contribution is to construct the Education/Public Outreach Infrastructure, which includes a public boardwalk around the periphery of the marsh, an amphitheater, educational signage, and several overlook platforms. Cost estimate for the infrastructure is \$1,800,000.

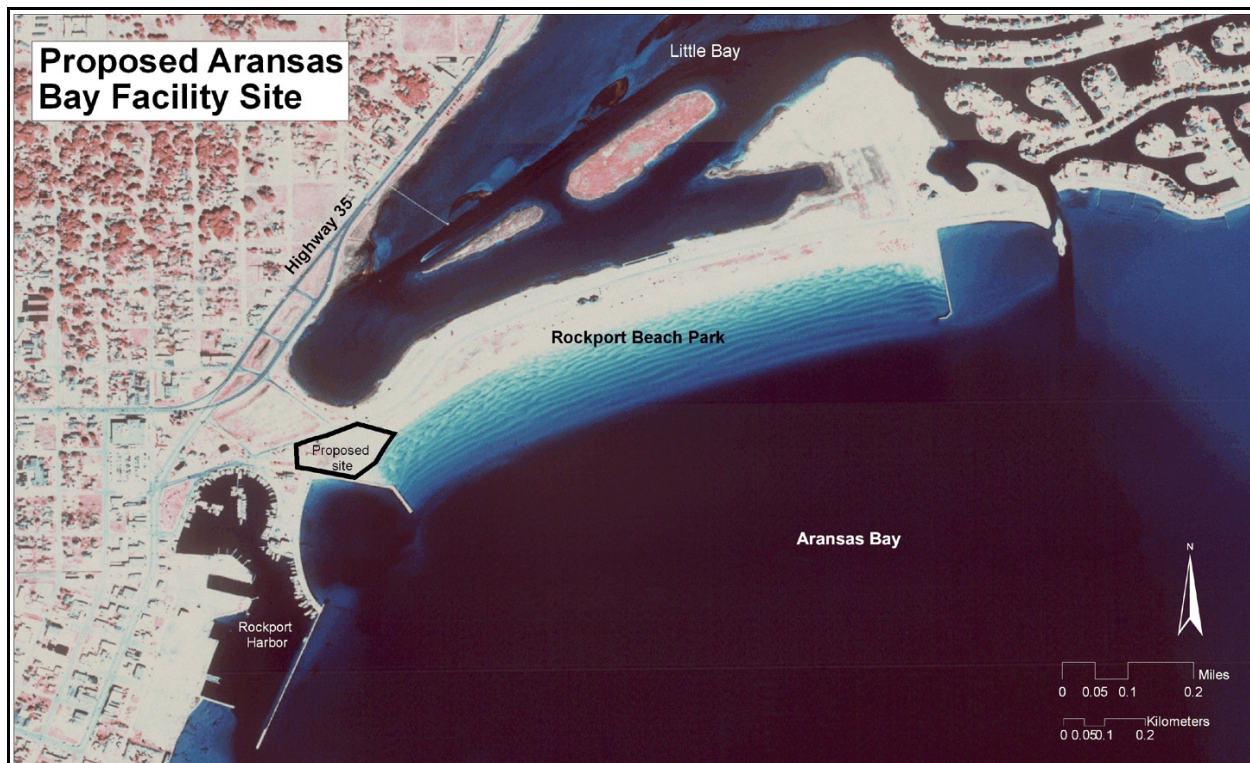
*Objective 2-8: Link Education and Outreach NERR facilities***Action 1:** Create a Mission-Aransas NERR education trail

The Reserve and its educational facilities are spread over a large area. There is a need to link and inform educational audiences of all Reserve facilities available. There are currently three proposals for education facilities that will be sited at ideal locations to serve the large area of the Reserve. The Wetland Education Center will be on the southern boundary of the Reserve in Port Aransas. The Copano Bay research and education center will be centrally located in the Reserve on Copano Bay. The ANWR environmental education building will be the northern link the Reserve on the shores of San Antonio Bay. The Mission-Aransas NERR education trail will be created to inform targeted audiences of the location and details of available facilities. A trail map with locations and descriptions will be created to link facilities and increase use and attendance.

**Goal 3: Promote public appreciation and support for stewardship of coastal resources***Objective 3-11: Create an Aransas Bay public outreach facility in partnership with the City of Rockport and others*

The Aransas Bay multi-purpose public outreach facility will be a joint effort between the City of Rockport, Aransas County Navigation District (ACND), Reserve, and the Rockport Chamber of Commerce. The target audience for this facility will be the general public and tourists. The building will be a single story containing the auditorium, public outreach NERR visitor center, an information kiosk, public restrooms, and offices for the ACND and City of Rockport. The Rockport Chamber of Commerce will help staff the visitor center with docents and volunteers. NERR funds will be used to construct the public outreach NERR center, public restrooms, and the auditorium. State match funds are also proposed for use on these components of the facility. The public outreach NERR center will contain passive and interpretive displays with the purpose to educate the public about the local estuarine ecosystem and the Reserve program. Displays will be created for the target audience, the general public and tourists. No staffing will be required to maintain displays. The auditorium will have room for 200 people with breakouts for 50 and 20. The auditorium will be used for meetings, public seminars, and workshops. The facility is currently proposed for location on Aransas County Navigation District owned property at the site of the current Aransas County Navigation District Office downtown at the Rockport Harbor (Figure 29). A location such as this in downtown Rockport is key for targeting all sectors of the general public. This location is already a significant tourist destination because it is adjacent to the Texas Maritime Museum, Rockport Center for the Arts, Rockport Beach Park, Rockport Fulton-Area Chamber of Commerce, Fishing Pier, and Cabanas. The TPWD building is within walking distance, and aquarium maintenance not be a problem. The facility, through its location, will have a high level of exposure and visibility and would thereby be easily found by those wishing to visit in addition to attracting visitors that may not have even been aware that the facility existed. The preliminary size estimate for the facility is 15,000 to 20,000 square feet. Conceptually, the ACND would occupy 5,000 square feet, the City of Rockport would occupy 5,000 square feet, and the NERR program would occupy 5,000 square feet. The remaining square footage is anticipated to be public or common area. Initial cost estimate are approximated at \$250 per square foot with a total project cost of 3 to 4 million dollars. With the considerations of location and multi-user design requirements it is anticipated that the construction timeline would include 6 months for design and up to 18 months for construction. The NERR facility will be composed of approximately 5,000 square feet totaling \$1,250,000.

Figure 29. Proposed site to be included in the boundary for the Aransas Bay public outreach facility.



**Action 1:** Create and disseminate interpretive materials and signs

Interpretive materials and signs promoting public appreciation and support for stewardship of coastal resources will be created to and placed at the Aransas Bay public outreach facility.

**Action 3:** Use green building techniques in construction of facilities

As new facilities are built, the Reserve will strive to build in the most sustainable manner possible. More information on sustainable building for Reserve facilities is described under objective 2-5, action 3.

**Action 4:** Develop a construction plan

A construction plan, including a proposed construction schedule, general descriptions of proposed developments and general cost estimates will be developed for the Aransas Bay public outreach facility. Information will be generated to begin in the initial phase of construction and development.

## 8.0 RESEARCH AND MONITORING PLAN

### 8.1 Introduction

The National Estuarine Research Reserve System (NERRS) was created to increase our ability to responsibly manage estuarine ecosystems through research and education. The NERRS provides a mechanism for addressing scientific and technical aspects of coastal management problems through a comprehensive, interdisciplinary and coordinated approach. Research and monitoring programs include the development of baseline information, which is the basis of this approach. Research and monitoring activities of the Reserve will be guided in part by national plans that identify goals, priorities and implementation actions for these programs. This approach, when effectively integrated with the education and outreach programs, will help ensure the availability of scientific information that has long-term, system-wide consistency and utility for managers and members of the public to use in conserving natural processes in their estuaries.

The Research and Monitoring Plan will result in greater scientific understanding of the estuarine system and its resources, and provide information for resource managers and policy decision makers to facilitate sound coastal management decisions. The Research Plan strives to promote individual as well as interdisciplinary research efforts not only within the National Estuarine Research Reserve (NERR) boundary but also throughout its watershed. This is accomplished by encouraging efforts in a variety of disciplines including inter habitat comparative studies, watershed studies, anthropogenic impact studies etc. Another goal of the Research Plan is the promotion of understanding of coastal ecosystems by diverse audiences.

#### Research Goals of the NERRS

The primary research objective for the NERRS is to determine the causes and effects of natural and anthropogenically-induced change in the ecology of estuarine and estuarine-like ecosystems. Research policy at the Reserve is designed in part to fulfill the NERRS goals as defined in the NERR program regulations. The research and monitoring goals of the NERRS include:

- addressing information needs of coastal management issues identified as significant through coordinated estuarine research within the system;
- promoting federal, state, public, and private use of one or more reserves within the system when such entities conduct estuarine research; and
- conducting and coordinating estuarine research within the system, gathering and making available information necessary for improved understanding, use and management of estuarine areas.

#### NERRS Policies and Priorities

The national research policy of the NERRS is to promote the use of individual NERR sites for short and long term studies and to develop a scientific information database to improve the management of estuarine resources. The long-term studies include the systematic monitoring of important estuarine variables throughout the NERR sites. An example of a short-term study may include a project that determines the composition or flow rates of groundwater to rivers and bays.

The research policy of the Reserve is to provide data and information needed by resource managers and policy makers to assist and guide them when making coastal management decisions. The priorities are to preserve and protect ecosystems in their natural state, and manage the Reserve in a manner that keeps it compatible with the traditional uses of the area. The following policies serve to support research objectives of the Reserve:

- All research funded through NERR grants conducted within the Reserve will be coordinated through the Research Coordinator and the Reserve Manager, with advice from the Reserve Advisory Board (RAB).
- All field work will be performed in the least destructive way with minimal or no impact on the environment.
- When a destructive impact of significant size ( $> 10\text{m}^2$ ) to the environment is unavoidable, restoration of the impact and notification to the Estuarine Reserves Division (ERD) is required.
- All research activities and/or collection of specimens must be approved in writing by the NERR research coordinator prior to commencing any work.
- All outside approvals/permits (federal and state) must be secured prior to obtaining written approval from the research coordinator to conduct work within the Reserve.
- Results of research conducted within the Reserve by scientists other than NERR staff does not necessarily have

the endorsement of the Reserve. All such NOAA funded research reports will contain an approved statement of disclaimer.

- Abstracts and copies of final reports of all research projects within the Reserve will be provided by the Research Coordinator and ERD for inclusion in the Reserve database and/or library.
- Site specific research data located with global positioning system coordinates are to be input into the Reserve geographic information system after appropriate reports and publications have been completed.
- Any proprietary data restrictions will be respected.
- Construction and operation of the System-wide Monitoring Program (SWMP) within the Reserve will be coordinated with ERD and other NERR sites.
- Researchers working within the Reserve must acknowledge the Reserve's role and support of the project in any written or oral papers or presentations.
- Researchers working within the Reserve should promote the use of the Reserve to the scientific community.

#### NOAA Research and Monitoring Funding Priorities

National Oceanic and Atmospheric Administration (NOAA) is a significant source of research funding for both independent and NERR staff researchers. Regulations of the NERRS (15 CFR Part 921.50(a)) specify the purposes for which research funds are being used, which include:

- support research that will both enhance scientific understanding of the Reserve ecosystem and help meet the information needs of managers;
- provide information needed by reserve managers and coastal ecosystem policy makers; and
- improve public awareness and understanding of estuarine ecosystems and management issues.

NOAA encourages coordinated research among reserves and other scientists and, when appropriate, preferentially funds research proposals on specific estuarine topics that it has identified as national priorities. This unified approach promotes the exchange of research findings among reserves, state and federal agencies, and members of the academic research community.

Research funding priorities for the NERRS were first established in 1984 when a group of leading scientists convened to evaluate the status of estuarine knowledge. The group identified a diverse set of estuarine issues that were to receive top priority for research funding. These included: (a) sediment management, (b) nutrients and chemical inputs, (c) coupling primary and secondary productivity, and (d) fishery habitat requirements. The NERRS research program was refined in 1991, 1994, and in 1996.

The primary research objective for the NERRS is the study of causes and effects of natural and human-induced change in the ecology of estuarine and estuarine-like ecosystems. NERRS research funded through NOAA should be designed to provide information of significant value to the development and implementation of resource management policy governing the U.S. coastal waters.

#### Users and Audience

The University of Texas Marine Science Institute (UTMSI) and Reserve will provide excellent opportunities for researchers. The Reserve is also within easy driving distance of all coastal towns in South Texas and the cities of Corpus Christi, Rockport, Refugio, Victoria, Houston, San Antonio, Austin, and its surrounding municipalities. It is anticipated that the majority of users will include non-profit institutions, and other users, such as, students of all ages, teachers, local residents and visitors. Another major user will be fellows from the Graduate Research Fellowship program sponsored by NOAA.

This Reserve has traditionally been an important area for commercial and recreational fishing, and hydrocarbon production, and will continue to be used by these interests. Designation of the Mission-Aransas NERR will not prohibit traditional uses of the area as described in the management plan. It is also anticipated that the Reserve will be used by various environmental interest groups, civic organizations, and private and professional societies for field trips and educational seminars.

### Evaluation and Coordination Procedures

Research projects initiated by the Reserve must be submitted for evaluation and written approval before the project can be initiated. Project proposals, plans, etc., submitted to the Reserve by researchers and scientists outside the NERR program will be evaluated and coordinated by the Research and Education Coordinators and the Reserve Manager prior to project initiation. All projects will be evaluated for consistency with the Reserve's research and education programs' goals, policies and priorities, and to ensure that the proposed research will not unduly interfere with other research or activities at the Reserve. Projects must demonstrate sound scientific inquiry and a sensitivity to protecting and preserving the environment during data collection efforts. Abstracts and copies of final reports of all research projects within the Reserve will be provided to the Research Coordinator and ERD for inclusion in the Reserve database and/or library. Appropriate permits and authorizations from state and/or federal agencies must be obtained prior to the conduct of research activities that may affect threatened or endangered species or archeological resources. The Reserve is obtaining a blanket scientific lease for any research activities conducted on lands and waters owned by Texas GLO, however should local permission be required from a local government, or property owner they will be obtained prior to the research activity occurring.

## **8.2 Program Goals and Objectives**

### Goal 1: Improve understanding of Texas coastal zone ecosystems structure and function

*Objective 1-7: Improve understanding of short and long-term changes within Texas coastal ecosystems*

#### **Action 1: Build and operate the System-Wide Monitoring Program**

NERRS operates a System-Wide Monitoring Program (SWMP) as a nationally-coordinated and standardized program. The goal of the SWMP is to develop quantitative measurements of short-term variability and long-term changes in the water quality, biotic diversity, and land-use / land-cover characteristics of estuaries and estuarine ecosystems for the purposes of contributing to effective coastal zone management.

The SWMP provides valuable long-term data on water quality and weather at 15 - 30 minute time intervals. Coastal managers have used this monitoring data to make informed decisions on local and regional issues, such as “no-discharge” zones for boats and measuring the success of restoration projects. The program currently measures water quality parameters, weather, and a suite of nutrients. As the program expands, plans include adding a biological monitoring component, such as submerged aquatic vegetation, benthos, and invasive species. Remote sensing is a component that will be used to track changes in vegetated or other habitats.

The current expectations of the SWMP are that each of the participating NERR sites own at least four water quality dataloggers and one weather station. Each Reserve should deploy two data loggers in pristine and impacted areas. Furthermore, each Reserve is expected to edit, document, and submit data and metadata from these two dataloggers in a timely manner to the NERR's CDMO. The reserve system's monitoring program currently measures pH, conductivity, temperature, dissolved oxygen, turbidity and water level. In addition, nutrient samples are taken at four of the datalogger stations on a monthly basis and monthly diel samples at one datalogger station. Analyses for ammonium, nitrate, nitrite (or nitrate+nitrite), ortho-phosphate and Chl a are conducted on-site at Reserve facilities. In addition, a weather station collects data on weather conditions (e.g., air temperature, wind direction and speed, barometric pressure and relative humidity). These variables are not only indicative of habitat quality for numerous estuarine species, but they establish health criteria and determine human uses.

Data management, quality control, and information delivery services are provided by the SWMP Centralized Data Management Office (CDMO) operated by the University of South Carolina. The CDMO manages the basic infrastructure and data protocol to support the assimilation and exchange of data, metadata and information within the framework of NERRS sites, state coastal zone management programs and NOAA/Ocean and Coastal Resource Management (OCRM), as well as other state and federally-funded education, monitoring and research programs.

The NERR-SWMP includes a rigorous Quality Assurance / Quality Control (QA/QC) program undertaken to ensure that the type, amount, and quality of data and ancillary numerical information are adequate to meet the study objectives.

Development of supporting metadata is also a critical element of the monitoring program. Initial QA/QC protocols were developed during the NERR-SWMP Phase I program (1995-2000). The NERR-SWMP Quality Control program currently includes standardized protocol for the routine calibration, deployment and recovery of automated dataloggers, and guidelines for the identification and treatment of outliers and spurious datasets.

Analysis of the Reserve SWMP datasets will be undertaken on an annual basis to summarize and simplify the acquired numerical information, conduct statistical tests of inherent variability and significant differences, evaluate alternative hypotheses, determine the consequences of ecological observations, and assess levels of uncertainty associated with the conclusions drawn from the Reserve SWMP datasets. The anticipated analytical and interpretive programs should be developed prior to data collection and should include identification of the statistical tests, power analysis, and modeling technique to ensure that the data analysis is appropriate to the scientific approach and methodology for the Reserve SWMP.

As previously mentioned, the SWMP plan contains some general areas for future monitoring including expansion including:

- Abiotic monitoring
- Eutrophication/nutrient monitoring, chlorophyll fluorescence and photopigment analysis
- Development of an integrated contaminant record (i.e., analysis of surficial sediment )
- Benthic intertidal and subtidal mapping
- Global sea level rise measurements
- Pore water chemistry and analysis

In addition, the SWMP program will coordinate with the stewardship program to integrate the land use and habitat change and the watershed land use mapping analyses.

SWMP station locations are proposed based on their distance from freshwater inflow sources, location in bay systems, and existing locations of Texas Coastal Ocean Observation Network (TCOON) stations and other long-term monitoring sites. SWMP station locations will also be reviewed by the SWMP oversight committee. Anticipated SWMP stations will be located in the following core areas: Copano Bay West, Copano Bay East, Aransas Bay South and Mesquite Bay (Figure 30). The weather station will likely be located at Copano Bay West because the precipitation gradient in Texas is from Northeast (high) to Southwest (low) and there are already weather stations in Port Aransas and San Antonio Bay.

The purpose of the Reserve SWMP stations are to gain information on climactic and hydrological patterns that influence freshwater inflow in the Mission-Aransas Estuary. SWMP station locations are based on their distance from freshwater inflow sources, location in bay systems, existing locations of TCOON stations, and other long-term monitoring sites. The Reserve encompasses a large area and to ensure adequate coverage SWMP station locations are widely spaced apart. Copano Bay West was chosen as a SWMP station because it will provide hydrological data that is influenced by the freshwater inflow source of the Aransas River. Copano Bay East is chosen as a SWMP station because it will provide hydrological data on water flow patterns between Copano and Aransas Bay. Mesquite Bay is chosen as a SWMP station because is a pristine site that can be used as a control. A station at Mesquite Bay will also provide data on water flow patterns that are affected by San Antonio Bay and the hydrological connection with Cedar Bayou and the Gulf of Mexico. Aransas Bay South is chosen as a SWMP station because it is a UTMSI long-term monitoring site and it will provide hydrological data on the hydrological connections between Aransas Pass and San Antonio Bay.

The Reserve SWMP program will have the advantage of integrating the water level and meteorological data collected within the TCOON (<http://lighthouse.tamucc.edu>). TCOON is operated by the Division of Nearshore Research (DNR) at Texas A&M University-Corpus Christi (TAMU-CC) and consists of 36 water level monitoring platforms along the Texas coast. TCOON is sponsored by the Texas General Land Office, Texas Water Development Board, United States Army Corps of Engineers (USACE), and NOAA's National Ocean Service. In addition to the TCOON project, DNR operates several monitoring platforms in the Reserve SWMP project area. These include meteorological, water quality, and water velocity projects sponsored by the Texas General Land Office (GLO), NOAA, Texas Water Development Board (TWDB), USACE-Galveston district, Port of Corpus Christi, and the Guadalupe Blanco River Authority (GBRA).

Collaboration with DNR will be advantageous to the Reserve SWMP program because:

- It will provide broader coverage because there are already two stations within the NERR boundary, including one NOAA station in Rockport

- It will provide real-time data to decision-makers and scientists in an already tested and proven web-based format
- Collaboration will benefit Texas and Gulf coast communities by providing coastal decision-makers with data with greater coverage
- Incorporation with TCOON will not hinder the availability or quality of data submitted to the NERR CDMO

In addition to the TCOON, Texas A&M University College Station (TAMU) has a high frequency (HF) radar station located on Matagorda Island. This radar system collects real-time measurements of surface circulation patterns, wave height/direction/period, and wind direction in the Gulf of Mexico, adjacent to the targeted water bodies. A unique feature of an HF Radar system is its ability to provide real-time surface current measurements out to 35km into the Gulf. There are currently five active TCOON stations within and directly adjacent to the Reserve boundary and one high frequency radar TAMU station (Figure 30). The data collected by each existing station is compared in Table 5.

Figure 30. Anticipated SWMP stations and active TCOON and TAMU stations within or adjacent to the Reserve boundary.

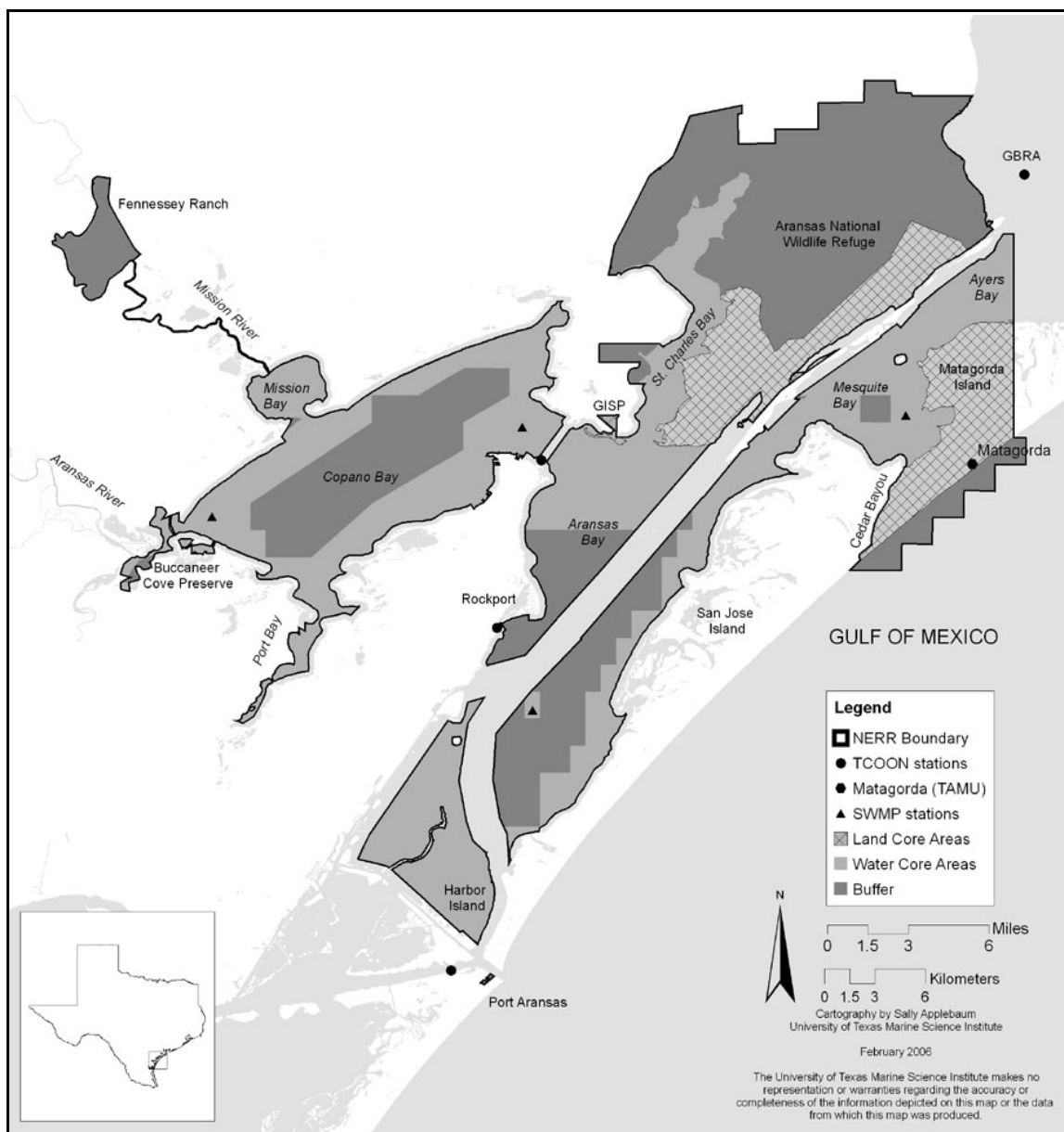


Table 5. Data available by TCOON and TAMU stations within or adjacent to the Reserve boundary.

Station	Location	Data Collected
Rockport (DNR 015)	Aransas Bay	Elevation and water temperature
Copano Bay (DNR 036)	West Copano Bay	Elevation and water temperature
GBRA 1 (DNR 127)	South San Antonio Bay	Meteorological, elevation, water quality
Port Aransas (DNR 009)	Port Aransas, Texas	Meteorological, elevation, air and water temperature
Port Aransas (DNR 109)	Port Aransas, Texas	Water velocity
Matagorda (TAMU MATA)	South Matagorda Island	Surface circulation patterns, (wave height/direction/period, and wind direction)

**Action 2:** Initiate a biological monitoring program with partners

The research program will also collaborate with partners to create a biological monitoring program. Collaboration with DermoWatch is an example of partnership to create and enhance biological monitoring. DermoWatch monitors oyster populations. DermoWatch provides recent and historical data on the occurrence and progression of Dermo disease in Texas and Louisiana through a website ([www.dermowatch.org](http://www.dermowatch.org)) that calculates a time to a critical level of disease. This is an estimate of the time that it would take the parasite (*Perkinsus marinus*) to reach a critical level, assuming no change in temperature and salinity. Collaboration with the NERR program will incorporate Aransas and Copano Bay into the DermoWatch website and allow users within the NERR area to utilize this valuable information source. The coupling of real-time temperature and salinity data from the SWMP will also increase the reliability of determining the time to a critical level of oyster disease. The research program will also collaborate with programs such as Texas Parks and Wildlife Department coastal fisheries monitoring, and the Coastal Bend Bays and Estuaries Program microbiological monitoring in Copano Bay.

**Action 3:** Initiate a freshwater inflow and groundwater program with partners

Water resource development is a critical human activity that alters environmental flows. A freshwater inflow and groundwater program will be initiated with partners to determine the effect on estuaries, including the balance of water, nutrients, and sediment, and effects on Cedar Bayou, which exchanges with the Gulf of Mexico. This program may partner with agencies such as the Texas Water Development Board, local river authorities, Texas Commission on Environmental Quality, Texas Parks and Wildlife Department, Texas A&M University, Texas State Soil and Water Conservation Board, Aransas National Wildlife Refuge, and Groundwater Conservation Districts. Studies may include research to determine the effect of freshwater inflow on secondary productivity (i.e., macrofaunal community structure and biomass) in the Reserve. Studies may also include research on the effect of freshwater inflow on blue crab abundance, which is a primary food source for whooping cranes. An important focus would be how climatic gradients and climatic variability affect benthos in coastal ecosystems. Results from these types of studies could provide information for water management decisions. Techniques used in these studies may include: systematics to determine diversity, geographic information systems (GIS) to understand community structure at different spatial scales, and simulation modeling of primary and secondary productivity.

**Action 4:** Assist in the development of the site profile

The site profile will be primarily developed through the stewardship program. The research program will assist primarily with the environmental characterization and site profile development. Development of a site profile will improve the understanding of short and long-term changes within Texas coastal ecosystems by providing an accurate and complete starting point of the habitat inventories.



*Objective 1-8: Increase understanding of effects of anthropogenic activities on coastal ecosystems***Action 1:** Initiate a program on oil and gas activities with partners

A oil and gas program will be initiated with partners to determine the effect of oil and gas activities on estuaries. This program may partner with agencies such as the Texas General Land Office, and local exploration and production industries. Projects could include the presence or absence of biological responses to contaminant exposure near oil and gas wells within the Reserve. Community structure (focusing on benthic species) would be a model analysis to identify ecological effects from oil and gas activities. Reproduction or population effects could also be used to identify sublethal effects. Toxicity or bioaccumulation of contaminants in estuarine food chains could also be studied.

**Action 2:** Initiate a climate change research program with partners

A climate change research program will be initiated with partners to determine the effect of climate change on the Mission-Aransas estuary. This program may partner with organizations such as the Coastal Bend Bays and Estuaries Program, Bureau of Economic Geology at the University of Texas at Austin, and Texas A&M University-Corpus Christi. Indicator species such as the black mangrove may be ideal candidates to determine the effect of climate change and relative sea level rise because the northern limit of black mangroves is in the Reserve boundary. Mangroves are also sensitive to changes in elevation and this program will also have a component on relative sea level rise and erosion. Techniques used in these studies will likely incorporate geographic information systems (GIS) and aerial photography to analyze long-term change.

*Objective 1-9: Increase graduate student participation in Reserve research and monitoring programs***Action 1:** Graduate student fellowships

The NERR system Graduate Research Fellowship program will be used to promote student participation in research. Beginning in 1997, NOAA began funding a competitive Graduate Research Fellowship program in the NERRS. The fellowship program is intended to produce high quality research conducted within the Reserve, and to be focused on improving coastal zone management while providing graduate students with hands-on experience in conducting coastal monitoring. This fellowship will provide graduate students with funding for 1 - 3 years to conduct their own research project, which are based on the Reserve local needs, the NERRS priorities, and the student's interest. Research projects must be conducted within the Reserve and enhance the scientific understanding of the Reserve's ecosystem.

As part of the ecological monitoring education program, students are asked to provide up to 15 hours per week of assistance to the Reserve. This program will be designed with the on-site staff and may include additional monitoring, research assistance, sampling and analyses at the Reserve. This training may take place throughout the school year or be concentrated during a specific season. Students are encouraged, but not required, to incorporate these training activities into their own research projects.

Goal 2: Increase understanding of coastal ecosystems by diverse audiences*Objective 2-9: Disseminate research results to lay public***Action 1:** Develop a website and other forms of media

Information gathered during research and monitoring efforts at the Reserve will be disseminated to the public through the Reserve website. Data from the SWMP program will be disseminated through the CDMO, but the Reserve website will serve as a mechanism to disseminate other research related information, such as posting reports. The Reserve website will be created and maintained by UTMSI, with its own domain name, as a vehicle to facilitate communication with the broader community as well as to provide internal cohesion for all participants in the Reserve program. This website will profile each Reserve component, the participants in the program, and link to other NERR sites as well as state and national sites. This website will be a coordinated effort with Education Program. Information gathered during research and monitoring efforts at the Reserve will also be disseminated to the lay public by:

- Creating signs and posters

- Participating in public workshops, conferences and meetings arranged by the Reserve
- Articles in journals or newsletters of local organizations
- Local educational and outreach programs (coordinated with the Education Program)
- News releases to local media
- Public lecture series

*Objective 2-10: Transfer research knowledge to K-12 teachers and classrooms*

**Action 1:** Partner with the National Science Foundation to enhance the GK-12 program

Research knowledge will be transferred to K-12 classroom with graduate students in the GK-12 program. The GK-12 Program is sponsored by the National Science Foundation to partner graduate students in the sciences with K-12 teachers to enhance science education through new classroom activities, workshops, and field projects. The project is designed to provide K-12 teachers and students with recent knowledge and innovative learning strategies in the areas of biology, environmental science, aquatic science, geology and oceanography. The current program provides support for graduate Fellows based at the Marine Science Institute (Port Aransas), the Environmental Science Institute (Austin), and the Institute of Geophysics (Austin). The field and classroom theme for the UTMSI component is bay and estuary education (UTMSI). Expansion of the GK-12 UTMSI program to additional local schools is a goal of the Reserve education and outreach plan.

*Objective 2-11: Inform researchers and decision-makers of research results*

**Action 1:** Develop an on-site resource center

Information gathered during research and monitoring efforts at the Reserve and the final reports from such work will be disseminated to decision-makers and available to all interested parties upon request. Copies of reports will also be submitted to ERD. The Reserve encourages the dissemination of research results by researchers, agencies, institutions, etc. An on-site resource center will include an on-site library, as well as botanical and zoological reference collections of local flora and fauna. Copies of reports from research performed within the Reserve will be submitted to the research coordinator for inclusion in the on-site library. This will assure a complete, comprehensive and indexed collection of research activities and results within the Reserve. Additional methods of disseminating information include:

- NOAA's computerized abstract service, keyed to NOAA contract numbers and revised annually (hard copies of the collected abstracts are available upon request to Reserve managers, other federal and state agencies, universities and individuals);
- Journal articles in peer-reviewed literature;
- Presentations at professional conferences;
- Special symposia hosted by NOAA or other NERR Reserves often in association with other meetings such as the biennial meetings of the Estuarine Research Federation or Coastal Zone Managers;
- Regular contact with representatives of other state and federal agencies, local government agencies and planning boards

Goal 3: Promote public appreciation and support for stewardship of coastal resources

*Objective 3-12: Promote public participation in research and monitoring programs*

**Action 1:** Develop a key species monitoring program

Public participation in research and monitoring will be promoted with the development and creation of a key species monitoring program. This program will utilize volunteers to conduct monitoring of charismatic species that will not be monitored by the biological monitoring program. This will focus primarily on non-fish marine vertebrates (e.g., birds, dolphins, and turtles), in contrast to the seagrass, oyster, and water quality monitoring projects from the biological monitoring program.

This monitoring program could also be used to enhance existing or create organism inventory programs (e.g., Christmas bird count, migratory songbird surveys, state heritage program non-indigenous species programs). Monitoring projects

will also, if applicable, coordinate with Environmental Protection Agency's Coastal Monitoring Assessment and other National Estuarine Programs, such as the Coastal Bend Bays and Estuaries Program, and Texas Parks and Wildlife Department. A list of on-site and off-site research and monitoring opportunities for interested persons or groups will be maintained. Students and volunteers will also be encouraged to present and publish the findings of their research or monitoring efforts. The stewardship program will also work with the research program to encourage participation in the keystone species monitoring program.

*Objective 3-13: Increase public understanding of ecological values*

**Action 1:** Develop a social science program to determine the economic valuation of estuaries and their habitats

A social science program will be initiated that will work to determine the economic valuation of estuaries and their habitats. Results of this research will be used to provide an understanding of ecological values to the public and therein promote public appreciation and support for stewardship of coastal resources.

## 9.0 EDUCATION/INTERPRETATION/OUTREACH PLAN

National Estuarine Research Reserve System was created in 1972, as a part of the Coastal Zone Management Act (CZMA, 16 U.S.C. 1451 et seq.), to increase our ability to manage estuarine ecosystems responsibly. A critical aspect of this mandate is the education, interpretation, and outreach component. In part, a Reserve must "...serve to enhance public awareness and understanding of estuarine areas, and provide suitable opportunities for public education and interpretation" (16 U.S.C. 1461 (b)(2)(C)). Although each Reserve educational program functions independently, they share common goals and assist each other's programs within the system. Each program tailors itself to the specific organizational and geographic needs of the region.

### 9.1 Introduction

The primary educational objective of the National Estuarine Research Reserve System (NERRS) is to foster coastal and estuarine education among a variety of audiences via formal, informal, and non-formal approaches. Each Reserve is dually challenged to not only meet the specific educational needs of their local and regional user groups, but also to develop and participate in national education initiatives that promote increased literacy of estuarine biology and ecology, human interactions with coastal systems, and citizen stewardship.

A recent formal inventory and assessment of the NERRS K-12 and educator professional development programs provided evidence that the NERRS is a national leader in coastal ocean literacy. Of the 26 Reserves, 24 have a full-time education coordinator, and 21 of the sites have a functional education facility. It is estimated that approximately 67,000 students (predominantly middle school) were involved in NERRS education programs nationally in 2002. Tens of thousands more participate annually in virtual estuarine field trips via the EstuaryLive webcast, with the number of participants increasing each year. In addition, approximately 2,000 K-12 educators were involved in professional development programs offered through NERRS sites in 2002.

A unique asset of the NERRS education community is access to Reserve scientists and the scientific data collected through the System-wide Monitoring Program. These data currently include abiotic measurements, and will soon include data related to biotic diversity, and watershed and land use characterizations. Recognizing the educational potential of this data, the NERRS education community seeks to identify and develop effective programs and products that bring this information to K-12 educators/students and the general public.

#### Education/interpretation/outreach goals of the NERRS

In 1993, NOAA and state Reserve representatives worked collaboratively to develop the first integrated, system-wide education plan for the reserve system. Completed in 1994, the education component of the strategic plan envisions the Reserve as a national system of resource centers specializing in estuarine and watershed education. The goal is to design and implement a comprehensive program of education and interpretation based on established scientific principles to strengthen the understanding, appreciation, and stewardship of estuaries and associated coastal habitats. This goal capitalizes on the reserve system's unique ability to link education, research, stewardship, resource management, and restoration activities. Within the Reserve program, each reserve is responsible for developing and implementing a program that links education to scientific research.

#### National Guidelines and Policies for Education

The National Estuarine Research Reserve Strategic Plan defined guiding principles for designing and implementing individual educational programs. These principles are to:

- Develop education programs that will further the goals of the system;
- Target a culturally diverse audience of educators and students, environmental professionals, coastal resource decision-makers, and resource users;
- Function as a "system of sites" to nationally coordinate estuarine education efforts;
- Develop the reserve system as resource centers specializing in estuarine and watershed education - taking into account the diversity of differences of each Reserve site;
- Capitalize on the reserve system's ability to directly link education, research, stewardship, resource management, and restoration;

- Ensure education priorities are based on program evaluation results; and
- Encourage Reserve education coordinators to be active participants in the education community.

Another guideline document, "National Estuarine Research Reserve Education: A Field Perspective," lists the following more specific education objectives for Reserves:

- Develop and operate as a system of sites;
- Link education programs with research, management, and stewardship;
- Develop programs that encourage citizen stewardship of estuaries;
- Develop Reserves as resource centers that address coastal issues of global, national, regional, state and local significance;
- Maintain a cadre of professional environmental educators in the reserve system; and
- Evaluate program quality and program cost effectiveness. (Program effectiveness is measured as it relates to education objectives and resource management goals).

#### Background and Education Priorities of the Reserve

The University of Texas at Austin is the lead agency the Reserve. Program offices for the Reserve will be housed at the University of Texas Marine Science Institute (UTMSI), established in 1946 and located on the central Texas Gulf coast. The Institute's missions are basic research, undergraduate and graduate education, and public outreach. The Marine Education Services (MES) program was created in 1974 and serves as the formal and informal outreach education program for UTMSI. MES program offices are located in a small visitors center that houses seven marine aquaria, an auditorium, and the library. Current program offerings include a visiting class program, teacher workshops, public seminars and movies, hands-on touch labs for elementary school groups, and the UT-Mustang Island Elderhostel program. In early 2005, a Wetlands Education Center (WEC) will be constructed on-site at UTMSI. The WEC, a joint program between the United States Army Corps of Engineers and UTMSI, will create a 2.5 acre high and low salt marsh with 1.5 acres of sheltering dunes adjacent to a 1200 sq. ft. pier laboratory.

#### Existing UTMSI Marine Education Programs

##### *Visiting Class Program*

The visiting class program annually hosts an average of 250, 5 - 12<sup>th</sup> grade class groups, as well as college and elderhostel groups, aboard a 57' research vessel, the RV KATY. Each cruise hosts a group of 25 participants on a 4-hour excursion into the local bays. Once onboard, participants collect and study coastal plankton, sediment samples and sort through otter trawls, examining the adaptations, form and function of a myriad of fish and invertebrates. The goal of this program is to create an awareness of the abundance and diversity of life in coastal bay systems and to gain an understanding of relationships between different trophic levels and the physical setting. Man's role and impact on the coastal environment is also stressed.

##### *Teacher Training*

The MES program currently hosts several K-12 teacher workshops each year as well as annual conferences for the Texas Council for Elementary Science (TCES), Texas Marine Educators Association (TMEA), and the Informal Science Educators Association (ISEA) of Texas. The current MES Education Director serves as the Marine Activities, Resources, and Education (MARE) Texas program trainer. MARE is a K-8th grade, habitat specific, marine education curriculum developed by Lawrence Hall of Science, University of California Berkeley. He also serves as the only Texas facilitator for the Fluid Earth and Living Ocean high school marine science curriculum disseminated through the University of Hawaii, Curriculum, Research, and Design Group. These curricula as well as site specific curricula and activities are used in the teacher training programs.

##### *UT-Mustang Island Elderhostel*

This program serves participants over 55 and focuses on Coastal and Marine Ecology and the abundant and diverse resident and migratory birds found along the Texas coast. There are currently over 23 weeks of programs offered which host over 450 participants each year. One of the Reserve partners, the Aransas National Wildlife Refuge (ANWR), hosts

the only wild, migratory flock of the endangered Whooping Cranes found in the nation. An opportunity to study the whooping cranes and other resident and migratory species also focuses participant's attention on a wide variety of coastal habitats and man's role and impact on them. Another Reserve partner is Fennessey Ranch. The 3,324 acre ranch is bordered by over nine miles of the Mission River, and includes access to a riparian forest. Currently, the Fennessey hosts Elderhostel wildlife and birding field trips and provides exciting opportunities for expanding outreach efforts related to the Reserve.

#### *Wetland Education Center*

The first stage of the WEC will create a 2.5 acre salt marsh on-site at UTMSI. Material excavated from the site will be used to create 1.5 acres of sheltering dunes around the site. Creating the WEC is a joint project between the USACE and The University of Texas under Section 206 of the Waterways Restoration Act. The second stage will include the construction of public boardwalks, an amphitheater, educational signage and floating educational program platforms. A K-12 curriculum has been developed for the WEC.

#### *Visitors Center and Auditorium*

The current center and auditorium hosts more than 25,000 visitors annually. There are seven marine aquaria in the lobby that provide a window into a variety of marine influenced habitats in the NERR. The auditorium supports conferences, public seminars, and daily video presentations open to visitors. Displays in an adjacent building highlight current research programs at UTMSI.

#### *GK-12*

The GK-12 Program is sponsored by the National Science Foundation to partner graduate students in the sciences with K-12 teachers to enhance science education through new classroom activities, workshops, and field projects. The project is designed to provide K-12 teachers and students with recent knowledge and innovative learning strategies in the areas of biology, environmental science, aquatic science, geology and oceanography. The current program provides support for graduate Fellows based at the Marine Science Institute (Port Aransas), the Environmental Science Institute (Austin), and the Institute of Geophysics (Austin). The field and classroom theme for the UTMSI component is bay and estuary education (UTMSI). Expansion of the GK-12 UTMSI program to additional local schools is a goal of the Reserve education and outreach plan.

The establishment of the Reserve will create opportunities to expand current MES program offerings as well as create new programs in cooperation with the partner organizations and land holders adjacent to the site. As outlined in the following sections, the education programs developed for this site will place priority on improving access to the wide range of habitats that make up the coastal watershed, open bays, marshes and the barrier island encompassed with the Reserve boundary.

The following site-specific goals and objectives expand upon current MES programs described earlier. These goals and objectives are also based on the following statements of guiding principals. The intent of the Reserve education program is to design an interdisciplinary and interactive program of education and interpretation that emphasizes the sites unique biological, geological, hydrological, archaeological characteristics and historical and cultural uses. A focus of the education program will be to place these assets in context with ongoing research, monitoring, and coastal management issues that have local, regional, and global significance.

## 9.2 Program Goals and Objectives

### Goal 1: Improve understanding of Texas coastal zone ecosystems structure and function

*Objective 1-10: Increase K-12 student participation in Reserve research and monitoring*

#### **Action 1:** Develop a key species monitoring program

Students and teachers will be encouraged to participate in the key species monitoring program described in objective 3-12, action 1.

### Goal 2: Increase understanding of coastal ecosystems by diverse audiences

*Objective 2-12: Enhance existing formal and informal education programs*

#### **Action 1:** Use partnerships to enhance existing programs

Partnerships between the Reserve and interested schools and educators will be established to facilitate on-site and outreach programs. The types formal and informal education programming currently offered through the UTMSI/MES programs were described earlier and will be incorporated into the Reserve education programs. Using those program formats, expanded programs will be specifically developed for the Reserve, while others are examples of existing programs that can be offered at specific partner sites. Existing programs are indicated with an asterisk (\*) along with the sponsoring agency or group.

#### Activities

- Interpretive Center Tours \*(UTMSI, ANWR, Rockport Maritime Museum [RMM])
- Nature Trail Tours \*(ANWR, Fennessey Ranch, Matagorda Island), WEC
- Boat Tours \*(UTMSI, ANWR)
- Lecture/Seminar Series \*(UTMSI, ANWR, RMM)
- Night-time Programs
- Self-Directed Programs
- Field Days/Special Events (UTMSI open house, Earth Day, Wonders of Wetlands)
- Group Research /Monitoring Programs
- On-Line Activities (website)

#### Workshops/Conferences

- Resource Management Workshops
- Scientific/Professional Conferences \*(Sea Grant, Coastal Research)
- Public and Private Sector Workshops, Conferences and Training Programs
- Professional Training Programs

#### Teacher Training

- K-12 MES program workshops \*(TMEA, TCES, ISEA)
- Project Wild \*(TPWD)
- Marine Activities, Resource and Education \*(UTMSI)
- Fluid Earth, Living Ocean Curriculum \*(UTMSI)

#### Exhibits \*(all at UTMSI, ANWR, RMM)

- Static Displays
- Touch Tanks
- Aquariums
- Research Results Bulletin Board / Poster Display
- Monitoring Results Bulletin Board / Display
- Visiting Displays
- Local Art and Photography

#### Trails

- Nature trails at WEC
- Trails/observation decks/areas at remote locations \*(ANWR, Matagorda Island, Fennessey Ranch)

*Objective 2-13: Increase science literacy for K-12 students by using science as a language to understand coastal habitats*

**Action 1:** Develop and enhance education programs for K-12 students

Science literacy for K-12 students will be increased with the promotion of education programs that use inquiry-based science as a language or way of understanding both basic estuarine science and applied topics relative to coastal management issues. Actions to meet this objective include:

- Establish and coordinate a seminar series that includes 1) presentations about specific results of basic and applied research conducted at the NERR (presented by researchers working there as required by the research program), and 2) presentations on a diverse range of basic estuarine topics and pertinent coastal resource issues (presented by invited speakers, coordinated with a NERR speakers bureau - see below) directed toward the general public. NOTE: This series will be promoted through the publication and dissemination of a "Calendar of Events" (separately or as part of a periodic NERR newsletter)
- Establish a speakers bureau consisting of names of local and regional
- Invitation of experts and others to make presentations as part of on-site or off-site programs
- Incorporate coastal management issues into on-site and outreach interpretive programs
- Expand K-5<sup>th</sup> programs available through the WEC
- Offer scholarships to needy schools for visiting class program
- Develop and expand on-site indoor and outdoor inquiry-based classroom/lab programs/activities for K-12 students
- Develop and expand outreach programs and exhibits
- Develop and expand interpretive displays/exhibits
- Develop and expand nature trail excursions
- Expand boat excursions/tours

**Action 2:** Increase visitations by underserved groups

Educational opportunities and programs will be developed that target a broad range of under-served audiences from throughout the public and private sectors. Efforts will be made to encourage participation from a diverse spectrum of ethnic and economic communities. In addition, needy local and regional schools will be targeted for transportation and housing scholarships. Funding mechanisms are listed under objective 2-1, action 5.

**Action 3:** Provide interpretive opportunities at public access sites

Interpretive materials and signs promoting public appreciation and support for stewardship of coastal resources will be created to and placed at public access sites.

*Objective 2-14: Increase public literacy about Texas coastal ecosystems*

**Action 1:** Develop and enhance community outreach programs

Community outreach programs will be developed and enhanced by the following actions:

- Add/develop innovative, hands-on, and interactive activities/field trips to existing Aransas National Wildlife Refuge, Matagorda Island Education center, Fennessey Ranch, and MES classroom and outdoor programs that emphasize inquiry-based science education methods.
- Identify and obtain the necessary materials (existing print, video, etc.) and funding resources to develop and maintain a mobile outreach and interpretation program (e.g., vehicle, equipment, resources, etc.), coordinated with NERR staff and volunteers.
- Develop a program for the dissemination of NERRS educational and research information and the environment through local, regional, and national print, electronic (world wide web) and video media (coordinated with the research and monitoring programs).
- Develop a process for evaluating on-site and off-site programs, results of which will be used to revise or direct future program improvements.
- Develop educational outreach programs for communities within NERR boundary watersheds, such as Refugio



and San Patricio county

*Objective 2-15: Enhance the transfer of knowledge, information, and skills to coastal-decision makers*

**Action 1:** Develop a Coastal Training Program

The Coastal Training Program will provide up-to-date scientific information and skill-building opportunities to individuals who are responsible for making decisions that affect coastal resources. Detailed information on this program is listed under objective 2-2.

Goal 3: Promote public appreciation and support for stewardship of coastal resources

*Objective 3-14: Promote public appreciation of Texas coastal resources*

**Action 1:** Enhance informal education programs and information dissemination

Public appreciation will be promoted through the new and existing education programs offered by the Reserve. Information will also be disseminated to inform the public about the Reserve, objective 3-15.

**Action 2:** Promote green building techniques to communities along the Texas coast

As new facilities are built, the Reserve will strive to build in the most sustainable manner possible. Building sustainable or “green” buildings is the practice of creating healthier and more resource-efficient models of construction, renovation, operation, maintenance, and demolition. Building green will benefit the environment by reducing the impacts of natural resource consumption. The sustainable plan and “green” facilities will also be used to educate the public on sustainable living.

*Objective 3-15: Increase public awareness of the Reserve and the NERR System*

**Action 1:** Develop and distribute materials about the Reserve and NERR system

Materials that may be developed to increase public awareness may include:

- Printed informational materials to be distributed or used in any of the above listed on-site or outreach programs
- A traveling exhibit/activities program for use in K-12 schools and/or festivals and other community events (scheduled and coordinated by NERR staffer volunteers)
- A portable informational display for use at local, regional or national meetings and other appropriate venues
- A video and/or slide show presentations that can be distributed to interested groups (e.g., schools, civic and private groups)

**Action 2:** Increase visitations by underserved groups

Educational opportunities and programs will be developed that target a broad range of underserved audiences from throughout the public and private sectors. Efforts will be made to encourage participation from a diverse spectrum of ethnic communities. In addition, needy local and regional schools will be targeted for transportation and housing scholarships. Funding mechanisms are listed under objective 2-1, action 5.

**Action 3:** Provide interpretive opportunities at public access sites

Interpretive materials and signs promoting public appreciation and support for stewardship of coastal resources will be created to and placed at public access sites.

*Objective 3-16: Provide outdoor educational experiences to scouting and other community organizations*

**Action 1:** Partner with organizations, such as the Aransas National Wildlife Refuge (ANWR), to provide educational experiences

The Stewardship Training program for Boy Scouts and Girl Scouts will be operated through the stewardship program. The ANWR currently operates scout trips through their Youth and Environmental Training Area (YETA). These scout trips focus on service and stewardship. This program can be expanded through NERR by incorporating estuarine based activities such as Oceanography Day. Oceanography Day was a one-day scouting event offered by UTMSI every three years to provide scouts the opportunity to earn an oceanography merit badge. The Oceanography Day schedule included a series of displays, films, lectures and laboratory work that took place at the UTMSI facilities and a trip aboard a research vessel. Scouts would prepare for the trip by submitting a report, covering the first six requirements of the oceanography merit badge, to the Marine Science Institute prior to the trip. During this process, the scouts had to demonstrate their knowledge of the various branches of oceanography and the characteristics of different types of ocean waves. They had to understand and draw a cross-section of underwater topography and be familiar with various descriptive terms related to the ocean floor. They compared the depths of oceans to the heights of mountains on land. The scouts learned about the properties of seawater and studied plants and animals that live in the sea. Perhaps the most interesting part of the adventure in Port Aransas was a trip in Corpus Christi Bay aboard the research vessels *Katy* and *Longhorn*. During the one-hour adventure scouts learned about the role of research vessels and observed some of research equipment in operation. The scouts were also able to observe plankton and nekton that had been previously captured by the crew of the vessels. Integration of Oceanography Day and the YETA programs would be exciting for scouts and a means of educating young people about the value of estuarine systems and why it is important to become good stewards of the land/sea interface.

## 10.0 VOLUNTEER PLAN

### 10.1 Introduction

The policy of the Reserve volunteer program will be to ensure that opportunities exist for any interested person or persons to volunteer. The policy would recognize that potential volunteers include persons with a wide range of backgrounds such as the local citizenry, local and regional schools, local and regional environmental and civic groups, and local and regional businesses and industries. The policy also recognizes that volunteers are crucial contributors to the success of any program. The goal of the volunteer program is to recruit as many interested persons as possible and to recognize and promote them as important to the success of the Reserve.

#### Existing Volunteer Programs

The Edith McAlister Animal Rehabilitation Keep (ARK) currently has an extensive volunteer program at the UTMSI. Operation of the ARK is greatly dependent on volunteer staff. A training program for ARK volunteers is already established. Expansion of the existing volunteer network of the ARK is a goal for the Reserve's volunteer plan.

### 10.2 Program Goals and Objectives

#### Goal 1: Improve understanding of Texas coastal zone ecosystems structure and function

*Objective 1-11: Increase Reserve's monitoring capacity*

##### **Action 1:** Develop a volunteer network

A volunteer network will be created by the volunteer coordinator. This network will be utilized to conduct monitoring of key species that will not be monitored by the biological monitoring program. The volunteer network will likely partner with existing programs such as Master Naturalist. More information on the keystone species monitoring program is listed under objective 3-12, action 1.

#### Goal 2: Increase understanding of coastal ecosystems by diverse audiences

*Objective 2-16: Increase the Reserve's capacity to provide educational experiences to K-12 students*

##### **Action 1:** Recruit and train docent/volunteers

Docents will be trained to increase their knowledge of estuaries. A cadre of docents/volunteers will be recruited and trained to increase educational capacity at Reserve sites including the Wetland Education Center, University of Texas Marine Science Institute (UTMSI) Visitors Center, and satellite Reserve facilities in the Rockport area. The central Texas coast is an ecotourism destination for winter visitors and retired professionals who are willing and eager to become involved in educational outreach efforts. Training of research and monitoring documentation, methods and techniques will be conducted through interpretive programs, lectures, and seminars.

##### **Action 2:** Develop a volunteer network

A volunteer network will be created by the volunteer coordinator. This network will be utilized to increase educational capacity at Reserve sites including the WEC, UTMSI Visitors Center, and satellite Reserve facilities in the Rockport area.

**Goal 3: Promote public appreciation and support for stewardship of coastal resources**

*Objective 3-17: Foster a stewardship ethic within local communities*

**Action 1:** Ensure public participation in stewardship activities

The volunteer coordinator will provide actions for encouraging membership in the volunteer network. Participation in stewardship activities will also be promoted through the Reserve website, coordinated events, and volunteer incentive and appreciation programs.

*Objective 3-18: Increase the Reserve's capacity to promote public appreciation of Texas coastal resources*

**Action 1:** Develop a Friends network

A Friends network will be created by the research manager. This network will be utilized to support the Reserve in promoting public appreciation of Texas coastal resources. The Friends network will target individuals who would like to support the Reserve in a capacity other than the research and education/outreach programs.

## 11.0 RESOURCE MANIPULATION, RESTORATION, AND PROTECTION PLAN

As part of the NERR designation process, Federal Regulations 15 CFR (Appendix I) Part 921.13(a)8 through Part 921.13(a)10 requires resource protection, restoration, and manipulation plans. These plan detail existing protection, restoration, and manipulation of the Reserve resources. The existing protections include applicable authorities, allowable uses, uses requiring a permit and permit requirements, restrictions on use of the Reserve, and existing surveillance and enforcement occurring in the Reserve boundaries. This plan also details pre-existing (i.e., prior to designation) resource manipulations that are occurring for reasons not related to research or restoration. The plan details the nature of such activities and justifies why such manipulations should be permitted to continue within the Reserve buffer. The plan also describes possible effects of these manipulations on key land and water areas and their resources. Whereas the Reserve management plan contains no restoration projects per se, restoration projects are ongoing in the Reserve buffer and these projects are described here. The Stewardship Plan (Chapter 5) describes the Reserve goals and objectives relating to resource manipulation, restoration and protection. Creation of Reserve restoration plan is one goal of the Stewardship Plan. For manipulation, restoration, and protection, the Reserve will collaborate with partners to provide information for decision making regarding resource management.

Existing resource protection, restoration, surveillance, and enforcement activities within the Mission-Aransas NERR is maintained by the regulatory programs and policies of the applicable authorities and appropriate government enforcement agencies for the allowable uses. The main activities are: oil and gas, recreational and commercial fishing, water uses and freshwater inflow, transportation; so the current plan focuses on these activities.

### 11.1 Existing Resource Manipulations

#### Oil and Gas Activities

The Western Gulf of Mexico Biogeographic Subregion is blessed with abundant hydrocarbon deposits, making this region the most economically advantaged in the nation in terms of mineral wealth. No part of the region is without oil or gas wells and pipelines, including all wetland and open water habitats (Warner 1939). In fact, the Texas Constitution requires that State owned lands including coastal submerged lands, be utilized to produce income to benefit the Public School Fund. Typically this entails the leasing of, exploration for, and production of geologic resources, mainly crude oil and natural gas, on State Lands including State Submerged Lands. Although much of the past production in the Reserve has depleted those deposits, recent drilling has been successful at deeper depths (10,000 to 15,000 feet) and it is likely that further exploration and drilling will be conducted in the area. In addition, technology is improving and interest is beginning to be seen that indicates even deeper depths (20,000 + feet) will be explored in the near future. Exactly where this deeper exploration will be focused is impossible to determine at this time. Offshore, the presence of oil and gas platforms can be environmentally beneficial because they create artificial reef habitats (Montagna et al. 2002). The effects of inshore activities on fish habitat are not well known, thus presenting a great opportunity for NERR studies.

#### *Current Activities in Texas Bays*

Estuaries along the Gulf of Mexico, including Texas, are rich in oil and gas deposits. Every estuary in the Western Gulf of Mexico Biogeographic Sub-region has oil and gas wells and pipelines. Much of the past production in the Mission-Aransas Estuary has been depleted. However, recent testing indicates that there is interest in deeper exploration and drilling in the area. As drilling technology continues to improve, deeper and deeper depths become prospective. Exactly where deeper drilling would be focused is impossible to tell before additional seismic data is obtained. In addition, the Texas coast has seen “waves” of seismic exploration. It is likely that there will be additional activity (seismic surveying, drilling, and production) in the future. Seismic operations are conducted in an area, and at a later date, when technology has improved the area is investigated with the new technology. There is no reason to believe that the future of seismic exploration will be any different from the past in terms of repeated “waves” of investigation. If so, the Reserve will most likely be investigated again.

Figure 31. Current state tracts that are leased within the Reserve.

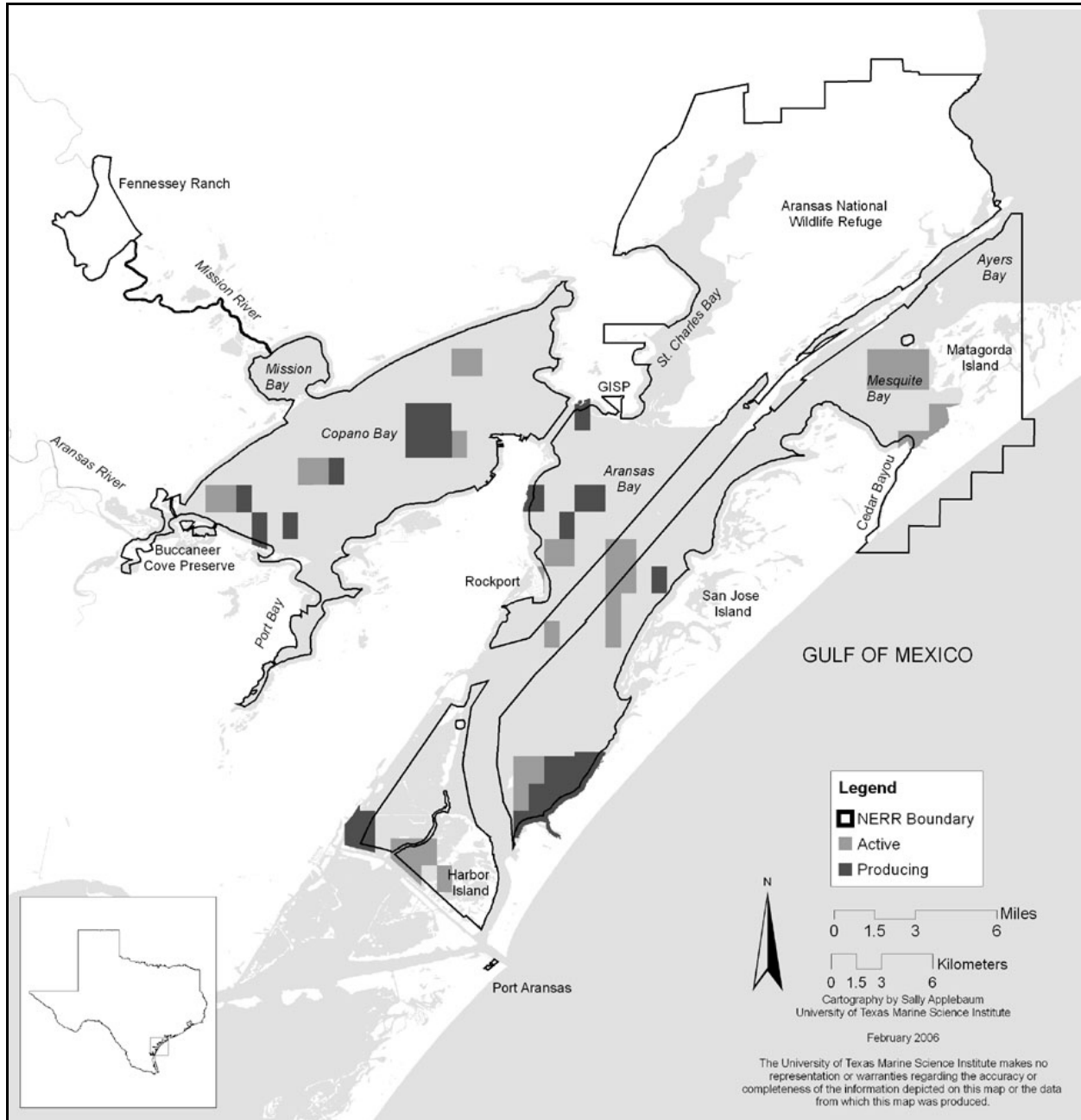
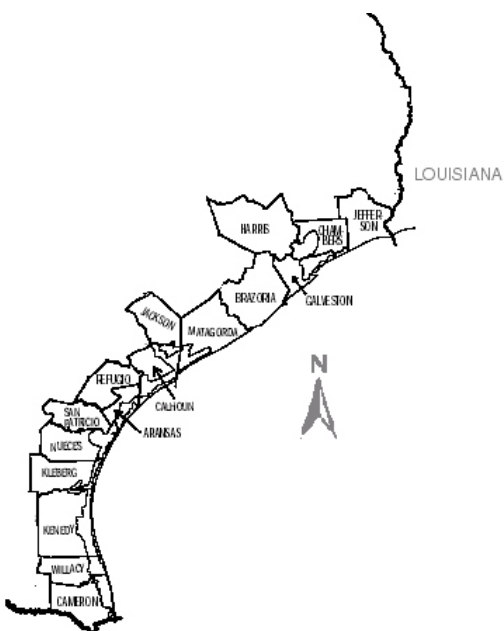


Table 6. Active and producing leases for estuaries along Texas Coast in 2004, listed northeast to southwest (<http://www.glo.state.tx.us/gisdata.html> Title:Subleases\_100604).

Estuary	Number of Leases	Total Acreage of Leases
Trinity - San Jacinto	215	74,864
Lavaca - Colorado	248	71,188
Guadalupe	41	16,122
<b>Mission - Aransas</b>	<b>67</b>	<b>19,260</b>
Nueces	131	44,538
Laguna Madre	215	31,319

Table 7. Production for onshore oil and gas wells in coastal Texas counties (northeast to southwest) for 2003. Abbreviations: Bbl = barrel (42 U.S. gallons), and Mcf = thousand cubic feet (GLO source, Peter Boone) (<http://www.lib.utexas.edu/maps/texas.html>).



County	Oil (Bbl)	Gas (Mcf)
Jefferson	782,161	24,218,894
Chambers	1,320,293	23,393,879
Harris	1,695,741	35,614,196
Galveston	926,999	19,018,766
Brazoria	1,797,263	46,854,613
Matagorda	1,321,553	27,886,934
Calhoun	497,802	6,920,556
<b>Aransas</b>	<b>79,025</b>	<b>10,759,407</b>
San Patricio	447,644	19,236,853
Nueces	657,847	75,514,672
Kleberg	78,353	49,417,045
Kenedy	144,848	60,333,471
Willacy	558,605	17,563,159
Cameron	758	853,609

Currently, the Mission-Aransas Estuary has a low number of current leases (Figure 31, Table 6) and little production in comparison to all other estuaries along the Texas coast (Table 7). In fact, the Mission-Aransas Estuary has the second lowest number of leases, and Aransas county has the second lowest production rates in comparison to all Texas coastal counties. The low activity of oil and gas in the Mission-Aransas Estuary, along with the representativeness and minimal human populations, makes this estuary an ideal NERR site for the Western Gulf of Mexico Biogeographic Sub-region.

#### *Past and Present Trends*

The Texas coast stretches nearly 370 miles along the Gulf of Mexico. Along the coastline and far out into the waters of the Gulf of Mexico, geological formations produce oil and gas that have been continually surveyed by exploration

companies. Despite a low record of offshore oil and gas production from areas along the Texas coast in the 1940s and 1950s, companies continued to conduct exploratory drilling throughout the 1960s. In 1966, sixty-nine offshore wells were drilled in Texas, though only one produced oil and one gas. Oil and gas production in Texas has been on a steady decline, although production in Aransas County is variable (Figures 32 and 33). The number of wells drilled in Aransas County has been relatively stable since the mid 1980's (Figures 34). Subsequently, economic, social, and political life in the state changed greatly. The petroleum industry, more than one-quarter of the state's economy in 1981, fell to half that level ten years later. One-third of oil and gas employment was lost between 1982 and 1994. State and local governments found that lower income from production and property taxes necessitated austere budgets, and affected communities launched searches for new revenue and increased efforts to diversify their economies. The proportion of state government revenue from the petroleum industry declined to 7 percent in 1993, one-quarter of its level ten years earlier. In the final decade of the twentieth century, a great industry and the aspects of Texas life that were related to it were downsizing. In 1994, Jebco Seismic, Incorporated, and Petroleum Geo-Services contracted with various oil companies to conduct the first 3-D seismic survey within Texas coastal waters in search of gas and oil deposits (<http://www.tsha.utexas.edu/handbook/online/articles/view/OO/doogz.html>).

The first well drilled in the Reserve was in 1940. To date, there have been 649 oil and gas wells drilled in the Reserve. Of these wells drilled, only 315 have produced oil or gas and there are currently 40 active producing wells within the Reserve (Figure 35). Data was provided by Dr. Peter Boone, GLO.

#### *Current Plans for Liquefied Natural Gas Terminals*

The liquefied natural gas (LNG) industry is growing in the US with creation both onshore and offshore terminals. There are currently four proposals for LNG facilities in San Patricio County along the La Quinta Channel:

- Cheniere Energy Incorporated and its partner Sherwin Alumina have a proposal to build a terminal on 1,100-acre industrial area west of Sherwin Alumina. This project issued a draft environmental impact statement in November 2004.
- ExxonMobil have a proposal to build a terminal (Vista del Sol) either on Welder Trust property in Ingleside between Oxychem and the Kiewit property or DuPont-owned land between its plant in Ingleside and the Sherwin Alumina plant in Portland. This project issued a draft environmental impact statement in December 2004.
- Occidental Petroleum Corporation has a proposal to build a terminal (Ingleside Energy) in Ingleside, but has yet to file a formal permit application. This project has not yet issued a draft environmental impact statement.
- ChevronTexaco has a proposal to build a storage tank for an offshore Port Pelican terminal on Harbor Island. Currently this project has been postponed.

If the environmental impact statements for one or more of these terminals are approved, then construction could begin immediately and the terminals could be operational by 2008.



Figure 32. Texas oil and gas production of shallow wells from 1972 through 2004. Abbreviations: Mbbbl = million barrels (1 barrel = 42 U.S. gallons), and Mcf = thousand cubic feet (<http://www.rrc.state.tx.us/divisions/og/information-data/oginfo.html>).



Figure 33. Aransas oil and gas production of shallow wells from 1993 through 2004 ([http://www.rrc.state.tx.us/interactive\\_data.html](http://www.rrc.state.tx.us/interactive_data.html)).

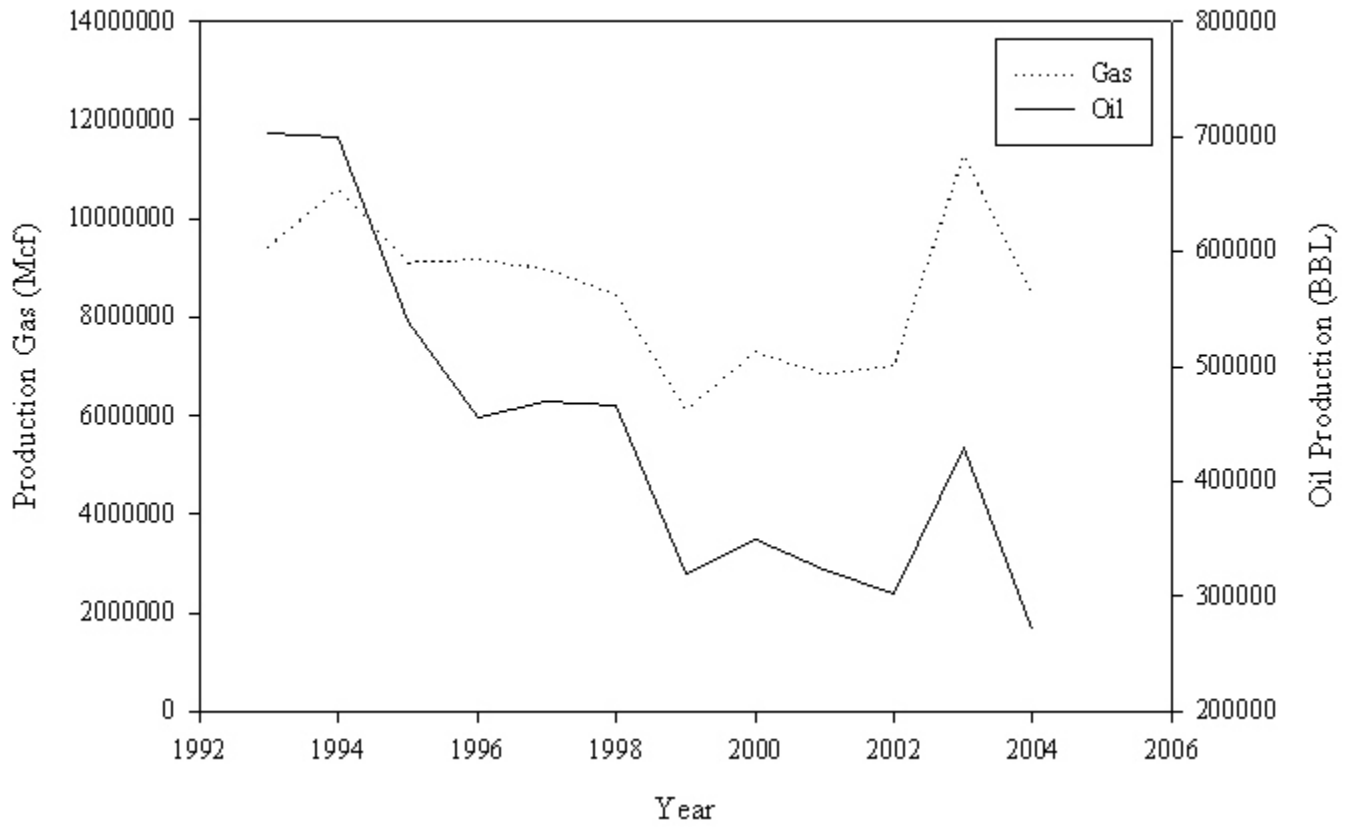


Figure 34. Number of shallow wells drilled and produced per year in the Reserve.

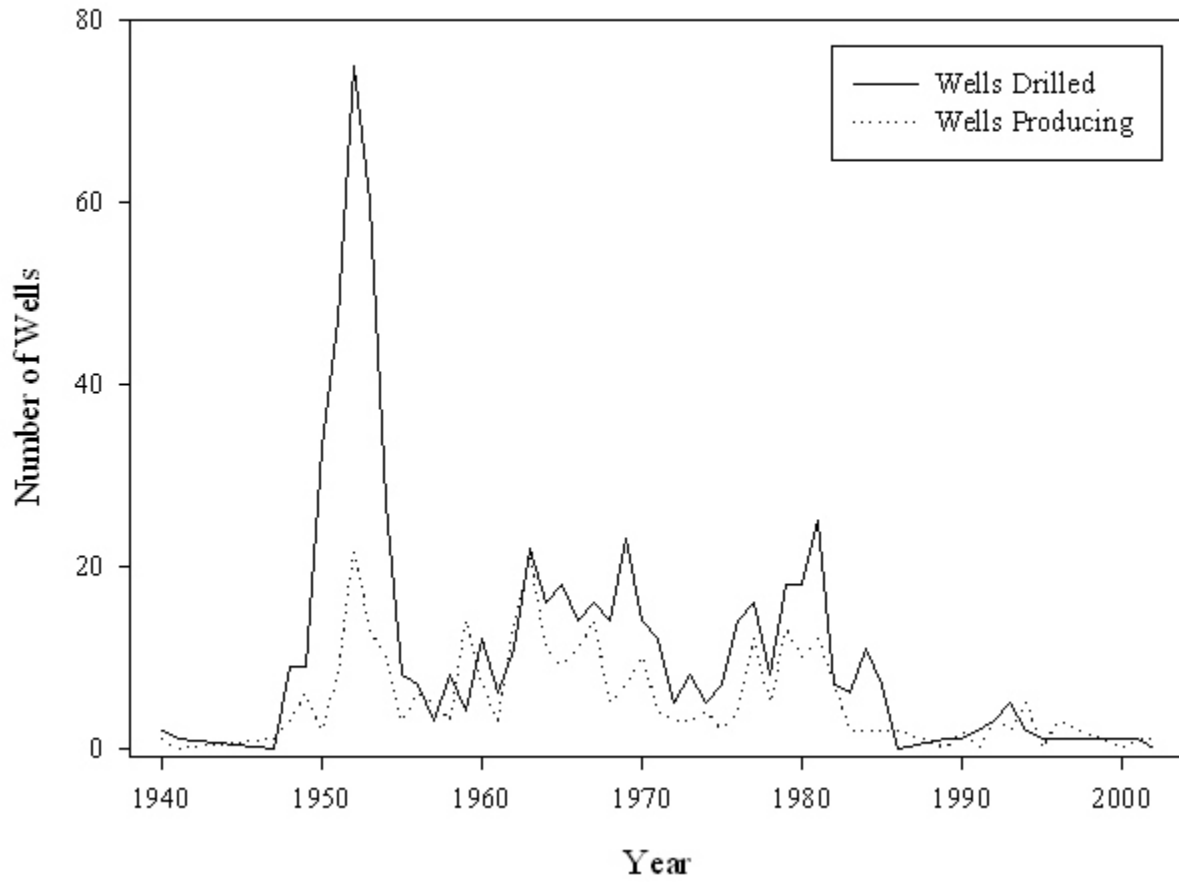
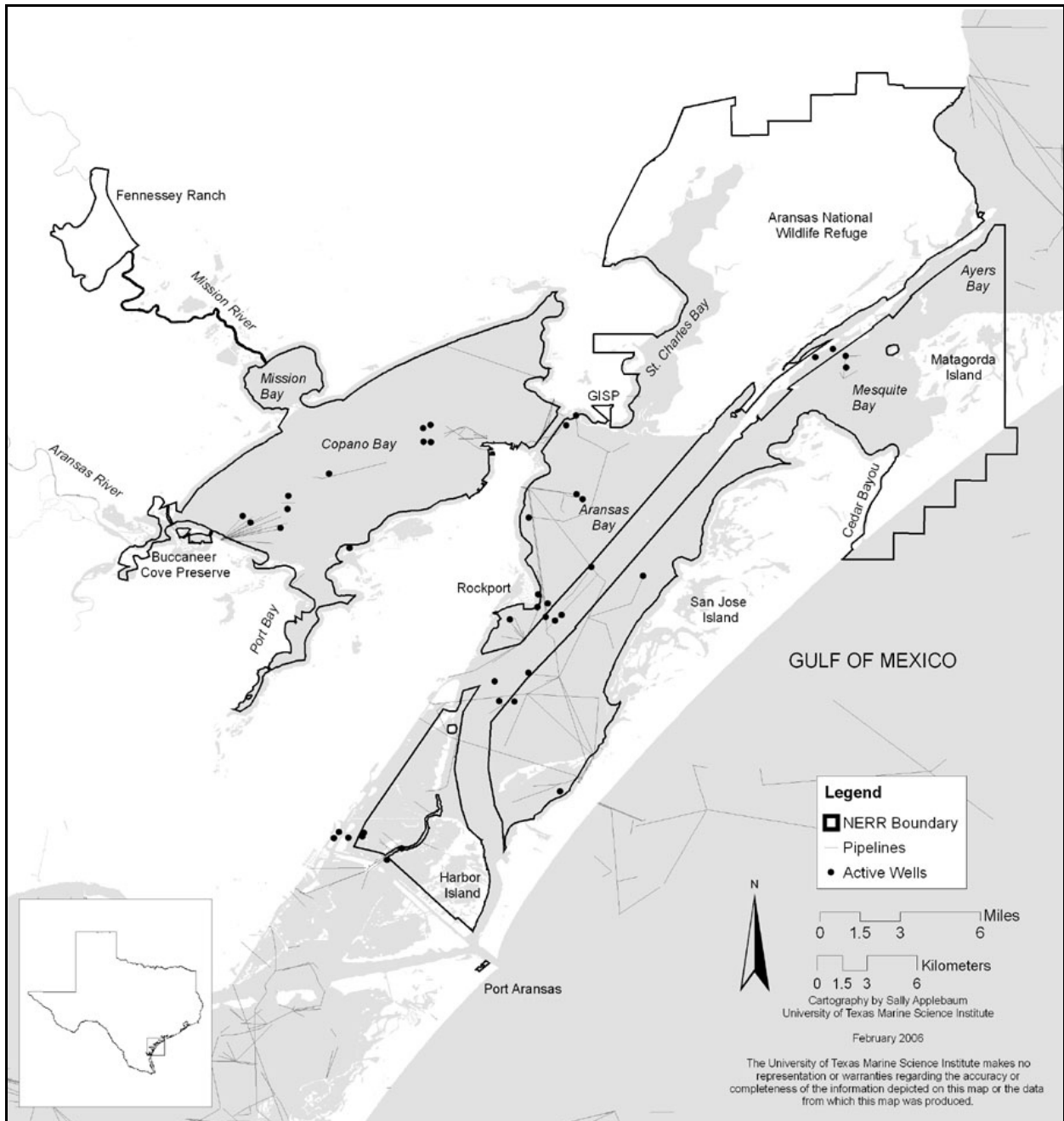


Figure 35. Pipelines and estimated active oil and gas wells in the Reserve.



### Oil and Gas Effects on the Marine Environment

Oil and gas activities can affect the marine and terrestrial environment. Disturbances can be caused by drill cuttings, drilling muds, produced water, physical disturbance, and oil spills. Drill cuttings are crustal materials brought to the surface during drilling, and can contain heavy metals. Drilling muds have two purposes, 1) to carry small bits of rock (cuttings) from the drilling process to the surface so they can be removed, and 2) to equalize pressure and prevent water or other fluids in underground formations from flowing into the wellbore during drilling. Water-based drilling mud is composed primarily of clay, water, and small amounts of chemical additives to address particular subsurface conditions that may be encountered. In deep wells, oil-based drilling mud is used because water-based mud cannot stand up to the higher temperatures and conditions encountered. The petroleum industry has developed technologies to minimize the environmental effects of the drilling fluids it uses, recycling as much as possible (Society of Petroleum Engineers, <http://www.spe.org>). The disposal oil-based drilling muds in Texas estuarine or offshore zones has been banned since 1969 (TAC, Title 16, Part 1, Ch 3, Rule §3.8(e)). Water-based drill muds have been shown to be relatively benign (Peterson et al. 1996).

Produced water is formation water that is brought to the surface during oil and gas production, and these waters usually contain elevated concentrations of salts and hydrocarbons (NRC 2003). The ratio of produced water to oil normally increases with the age of the well (D'unger et al. 1996). The effects of produced water in estuarine ecosystems is dependent upon the ecosystem. Shallow, turbid, confined systems with a high percentage of clay sediment such as Trinity Bay, Texas are more likely to have decreased diversity and species abundance near produced water outfalls (Armstrong et al. 1979). In a confined stream-like estuary at New Bayou, Texas, a depressed zone of macrobenthic populations extended from the produced water outfall 107 m downstream and 46 m upstream (Nance 1991). Sublethal effects from polyaromatic hydrocarbons (PAHs) were not found for sedimentary microbial and meiofaunal communities when exposed to high (sublethal) doses of PAHs from produced water (Carman et al. 1995). The amount of impact produced water has on estuarine ecosystems is dependent upon the ecosystem's characteristics. Produced water discharges can be toxic to organisms and decrease species abundance, however, current regulations in Texas state that produced waters must meet surface water quality standards adopted by the TCEQ prior to disposal. The amount of oil content in produced water has decreased in Texas and throughout the world (Table 8). The majority of studies that have shown a decrease in diversity and species abundance from produced waters occurred before the present day regulations were initiated.

Table 8. Estimates of oil discharges to the marine environment from produced water discharges (NCR 2003).

Country	Produced Water (1,000 bbl/yr)		Oil and Grease Discharge (tonnes/yr)	
	1979	1990	1979	1990
USA	311300	745000	2228	2500
Gulf of Mexico Offshore		473000		1700
Louisiana Territorial Seas		186000		600
Texas Territorial Seas		4300		4.5
UK	57400	1620000	486	5700
Norway		450000		2000
Netherlands		74200		230

Physical disturbance is another potential impact created by oil and gas activities. Physical disturbance can be caused by pipeline, access road, and platform construction. Backfilling from pipeline construction is a remediation method and in salt marshes recovery of cordgrass can be rapid, but full recovery of marsh macrofauna is slow and may take longer than four years (Knott et al. 1997). A study conducted on the Padre Island National Seashore documented vegetation recovery was incomplete after extraction operations (Carls et al. 1990). The slow recovery was primarily due to hard surfacing of sites (with oyster and caliche) and the alteration of site elevation. Drilling activities adjacent to Pelican

Island in Galveston Bay caused a decrease in bird abundance during drilling 1983 - 1985, but abundance increased in the next breeding season after drilling activities ceased (Mueller and Glass 1988).

Oil spills are another disturbance that can occur with the presence of wells and pipelines. From 1990-1999 forty-eight spills were recorded in the U.S. from coastal pipelines transporting refined products (NRC 2003). Crude oil induced spills had minimal to no effect on marsh macrophytes, macrofauna and meiofauna in Louisiana (Fleeger and Chandler 1983, DeLaune et al. 1984). Diesel fuel induced spills can cause reduced meiofaunal grazing and increased microalgal biomass, which was due to the reduced grazing (Carman et al. 1997). In the event of an oil spill, the GLO has adopted regulations pursuant to the Oil Spill Prevention and Response Act (OSPR). Since 1998 a total of 55.35 barrels of oil have been spilled in the waters of Aransas County (Table 9), and 74% of those spills were under 0.1 barrels. A relevantly large spill of 28.57 barrels occurred in Redfish Bay during 2002 from a vessel from Brown Water Towing. Although the majority of the spill sources are unknown, 31% of the spills in Aransas County were from vessels, and 5% were from facilities (mostly fishing related). Oil spill statistics for Aransas County were obtain from Ms. Peggy Spies at the GLO.

Table 9. Total amount of oil spilled per water body in Aransas County from 1998 through 2003.

<u>Water Body</u>	<u>Oil (Bbl)</u>
Aransas Bay	19.74
Copano Bay	0.72
Gulf of Mexico	0.13
Harbor Island	0.10
Little Bay	0.06
Redfish Bay	34.60
<u>Total in Aransas County</u>	<u>55.35</u>

There is an existing network of pipelines that transport oil and natural gas from wells to onshore facilities. There are two types of pipelines used in this transport. Gathering pipelines from individual wells feed into larger, main pipelines, which then transport the oil and natural gas to onshore collection sites. The onshore collection sites then distribute or store the oil and gas. Future activity of oil and gas may increase the number of pipelines to the existing network; however it is practice that whenever possible existing pipelines are used to prevent disturbance and minimize cost.

The overall effects of oil and gas on the marine and terrestrial environment appear to be minimal. Disturbance from produced water, drill muds, and drill cuttings are not significant factors because of present day regulations that prohibit and restrict these activities. Research offshore has shown that pollution due to current practices is so low that it is only detectable within 100-200 m of a platform (Montagna and Harper 1996, Kennicutt et al. 1996). The pollutant effects are indistinguishable from artificial reef effects (Montagna et al. 2002). The impacts of oil and gas on the terrestrial ecosystem are restricted to physical disturbance, especially to the beach ecosystem. Remediation of all physical disturbance from oil and gas activities is required by the CMP and can be achieved by methods such as backfilling, revegetation, fertilization, and construction of nesting sites. The OSPRA and the other regulations in place for the Texas Coast ensure that the effects of oil and gas on the marine environment will continue to be minimal.

#### Recreational and Commercial Fishing

The habitats in the Reserve support both commercial and recreational fisheries, including shrimp, crabs, oysters, and fin fish resources (Table 10) The life history strategies of these organisms are dependent upon estuarine-based life cycles. The estuary systems are nursery grounds for many of the commercially viable species, such as penaeid shrimp, in the Mission-Aransas Estuary. It has been estimated that up to 97.5% of the commercial fisheries in the Gulf of Mexico rely on estuaries for a portion of their life histories (Gunter 1967).

Commercial landings of finfish, shrimp, and shellfish appear to be on an upward trend in the Mission-Aransas Estuary (Figure 36). Abundance of finfish, shrimp, and blue crab harvests were nearly equal to each other from 1972 - 1976. After 1976, the percentage of finfish harvests began to decrease in relation to shrimp and blue crab harvests. After 1981, and up to the present time, shrimp harvests increased in relation to finfish and blue crab harvests, and are now the major fishery for the Mission/Aransas estuary (Robinson et al. 1994).

Commercial shrimping was a minor activity in the 1920's, but since then this fishery has grown rapidly. Brown shrimp (*Farfantepenaeus aztecus*), white shrimp (*Litopenaeus setiferus*), and pink shrimp (*Farfantepenaeus duorarum*), each are estuarine dependent species and usually concentrate in estuarine waters less than three feet deep where there is attached vegetation and or abundant detritus. For the shrimp fishery, a limited entry and buyback (license) management plan was established in 1995. Since implementation of the buyback plan TPWD had purchased and retired 815 commercial shrimp boat licenses (Cook 2002). Trawling can cause disturbance to benthic communities. The amount of disturbance is dependent on two factors: (1) time spent trawling (i.e., effort) and (2) the area covered per unit time (i.e. net size multiplied by towing speed ) (Montagna et al. 1998). Schubel et al. (1979) reported high levels of suspended sediment concentrations behind shrimp trawls and found levels comparable to that caused by dredge disposal activities. Some possible impacts of trawling include increased mortality, predation, bioavailability of toxic contaminants, reduction of food, changes in community structure, and stimulation of phytoplankton production (Messeih et al. 1991).

Recreational fishing is also a traditional use of the fisheries in the Reserve. Annual coastal wide private-boat fishing pressure in the Mission-Aransas Estuary has been increasing. Aransas Bay accounts for about 23% of the coast-wide landings and pressure of party-boat fishing (Warren et al. 1994). Small outboard motors are a common mode of transportation. It is known that 2-stroke motors discharge about 18% of the oil and gas used during operation. Disturbance to seagrass beds from propellers, known as "prop scarring," can also result from boating in shallow seagrass habitats. Twenty-three percent of the area in Redfish Bay has moderate to severe scarring (Montagna et al. 1998). Prop scarring can lead to loss of critical seagrass habitat, so it has been the subject of study and new regulations have been proposed.

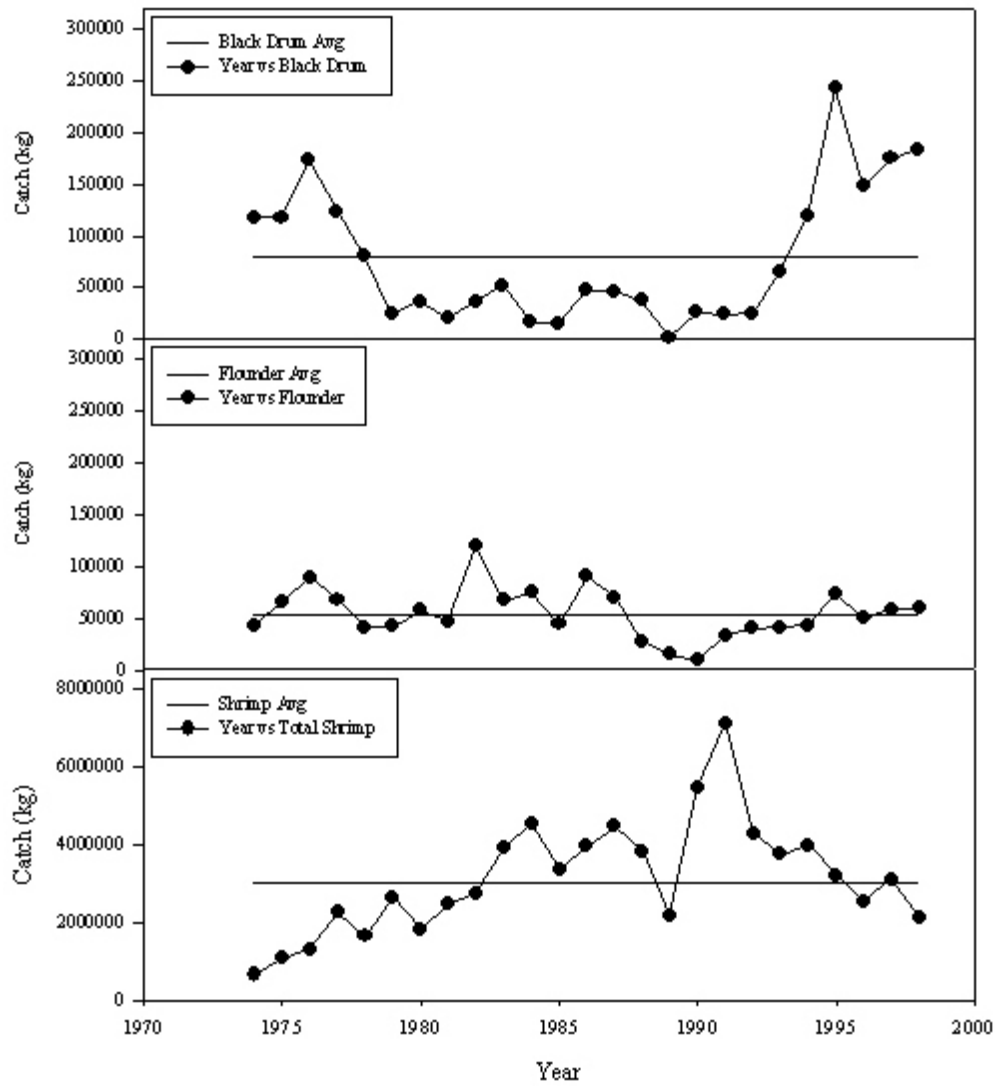
The fisheries appears to be well managed by the Texas Parks and Wildlife Department because overall, finfish abundances are either stable or increasing along the Texas coast.

Table 10. Mean catch rates and mean total lengths (mm) of selected fishes and blue crab caught in bay system during 1992 for commercial use. Mean catch rates are No./h for seasonal gill nets, trawls and dredge; annual bag seines are in No./ha. ND indicates no measurement taken. Table is adapted from Boyd et al. (1995).

Species	Gear	Aransas		Coast-wide	
		Mean catch	Length	Mean catch	Length
Total Finfish	gill net (spring)	7.1	412	7.0	414
Total Finfish	gill net (fall)	6.2	419	5.4	389
Total Finfish	18.3m bag seine	2622.0	57	4188.0	54
Total Finfish	6.1m trawl	443.0	97	281.0	111
Blue Crab	gill net (spring)	0.1	142	0.1	147
Blue Crab	gill net (fall)	0.1	140	0.1	144
Blue Crab	18.3m bag seine	140.0	34	103.0	37
Blue Crab	6.1m trawl	38.0	56	24.0	65
Brown Shrimp	18.3m bag seine	455.0	62	565.0	57
Brown Shrimp	6.1m trawl	64.0	81	37.0	84
Pink Shrimp	18.3m bag seine	32.0	53	38.0	57
Pink Shrimp	6.1m trawl	7.0	77	3.0	89
White Shrimp	18.3m bag seine	211.0	71	383.0	58
White Shrimp	6.1m trawl	53.0	93	36.0	94
Market Oyster	46 cm dredge	40.0	83	384.0	87



Figure 36. Commercial fishing trends in Mission-Aransas Estuary from 1974 through 1998. Data obtained from TPWD.



### Water Uses and Freshwater Inflow

There are several small watersheds in the Reserve (Figure 37). The Mission River watershed is Hydrologic Unit Codes (HUC) 1210046 and the Aransas River watershed is HUC 12100407. Most of these watersheds drain into Copano Bay, but one drains into Port Bay and one drains into St. Charles Bay (Figure 38). The Mission and Aransas Rivers are small and primarily coastal compared to other rivers in Texas. Texas law (first passed in 1957) ensures that sufficient flows are maintained for “receiving bay and estuary system that is necessary for the maintenance of productivity of economically important and ecologically characteristic sport or commercial fish and shellfish species and estuarine life upon which such fish and shellfish are dependent” (Texas Water Code, § 11.147).

About 40% of all the water used in Texas is supplied by surface water structures. The cities and towns in the region of the Mission-Aransas Estuary are largely served by the City of Corpus Christi and ground water (well-water) systems. The City operates two dams on the Nueces River, and is the major water wholesaler to municipal and county water resellers. Neither the Mission River nor the Aransas River has dams, or is used as water supplies for cities in the region. In fact, all the other major rivers in Texas have dams or other surface water supply structures. For this reason, the Mission-Aransas Estuary is an ideal location for the Mission-Aransas NERR.

Groundwater supplies 60% of the water used in Texas, but 81% of that use is for irrigation. The watersheds lie above the vast Gulf Coast Aquifer, which stretches the length of the entire coastal plain of Texas. The Gulf Coast Aquifer represents 15% of the groundwater in Texas and is the second largest aquifer after the Ogallala. Groundwater conservation districts are just in the beginning phases of operation in this region.

The Mission-Aransas Estuary is one of the few estuaries on the Texas coast that still has enough surface fresh water inflow to maintain a healthy estuary. The National Wildlife Federation recently published a report that described the health of Texas estuaries based on full use of existing freshwater permits (Johns 2004). Out of the seven bay systems studied, the Mission-Aransas Estuary was one of the two bay systems that received a good ranking (Figure 39). Existing water use permits for the Mission and Aransas Rivers authorize 1,900 acre-feet of surface water diversions. At the current time, surface waters in the Mission River and the Aransas River are not currently at risk. However, future growth of south Texas cities will require additional water resources, and thus provide great opportunities for the Reserve to study water resource issues.

Figure 37. Watersheds adjacent to the Reserve.

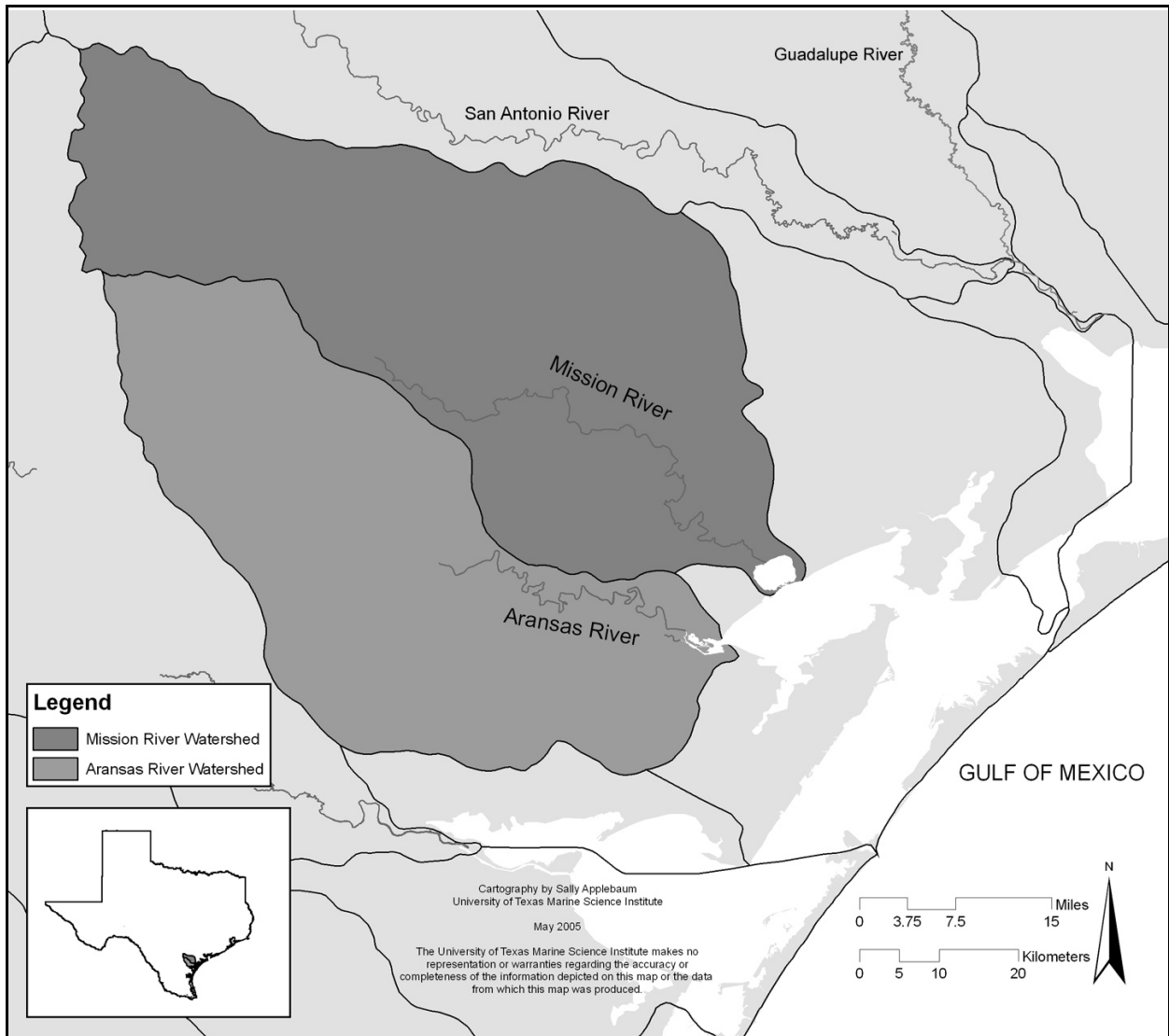


Figure 38. Hydrological features of the Reserve.

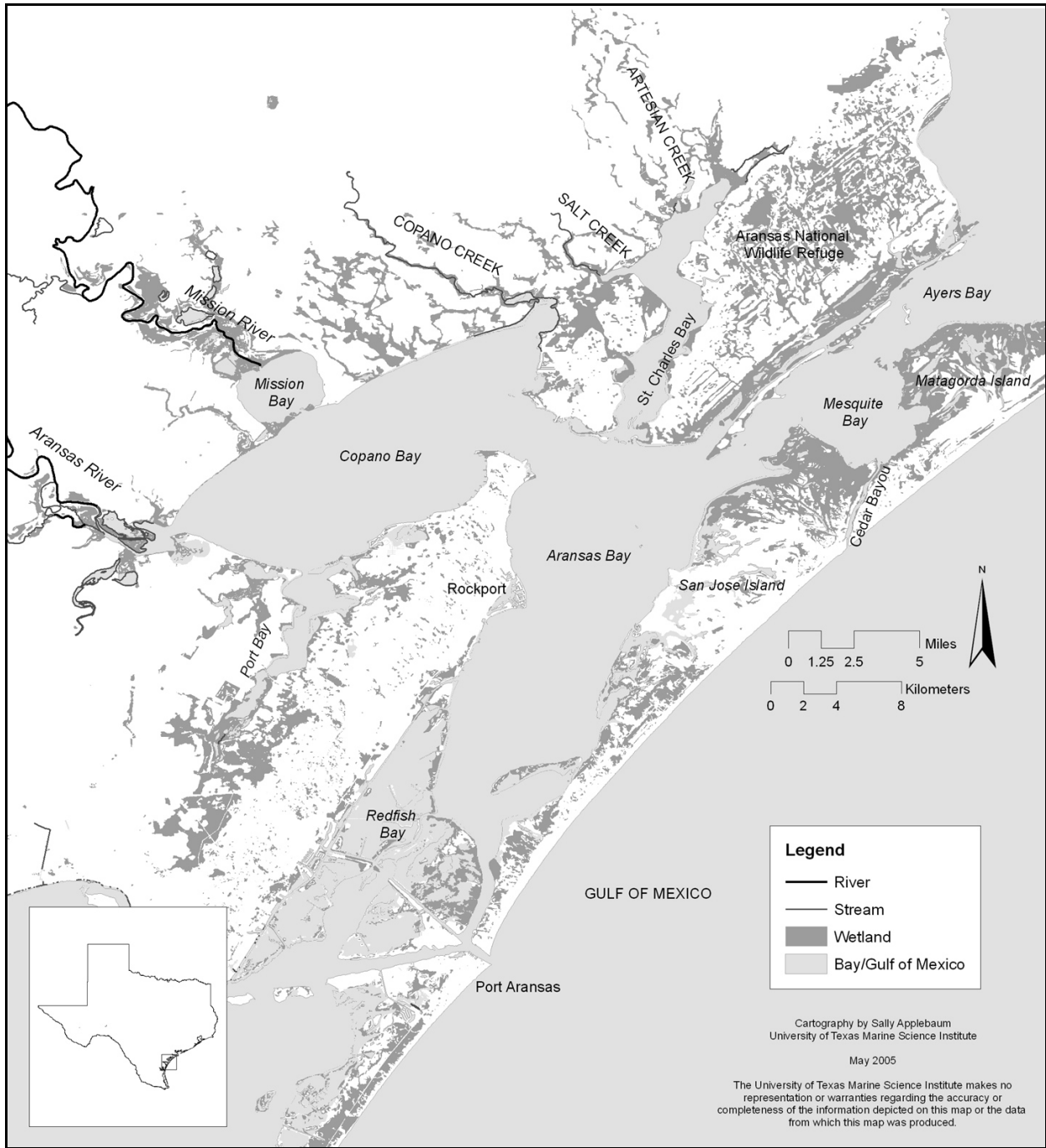
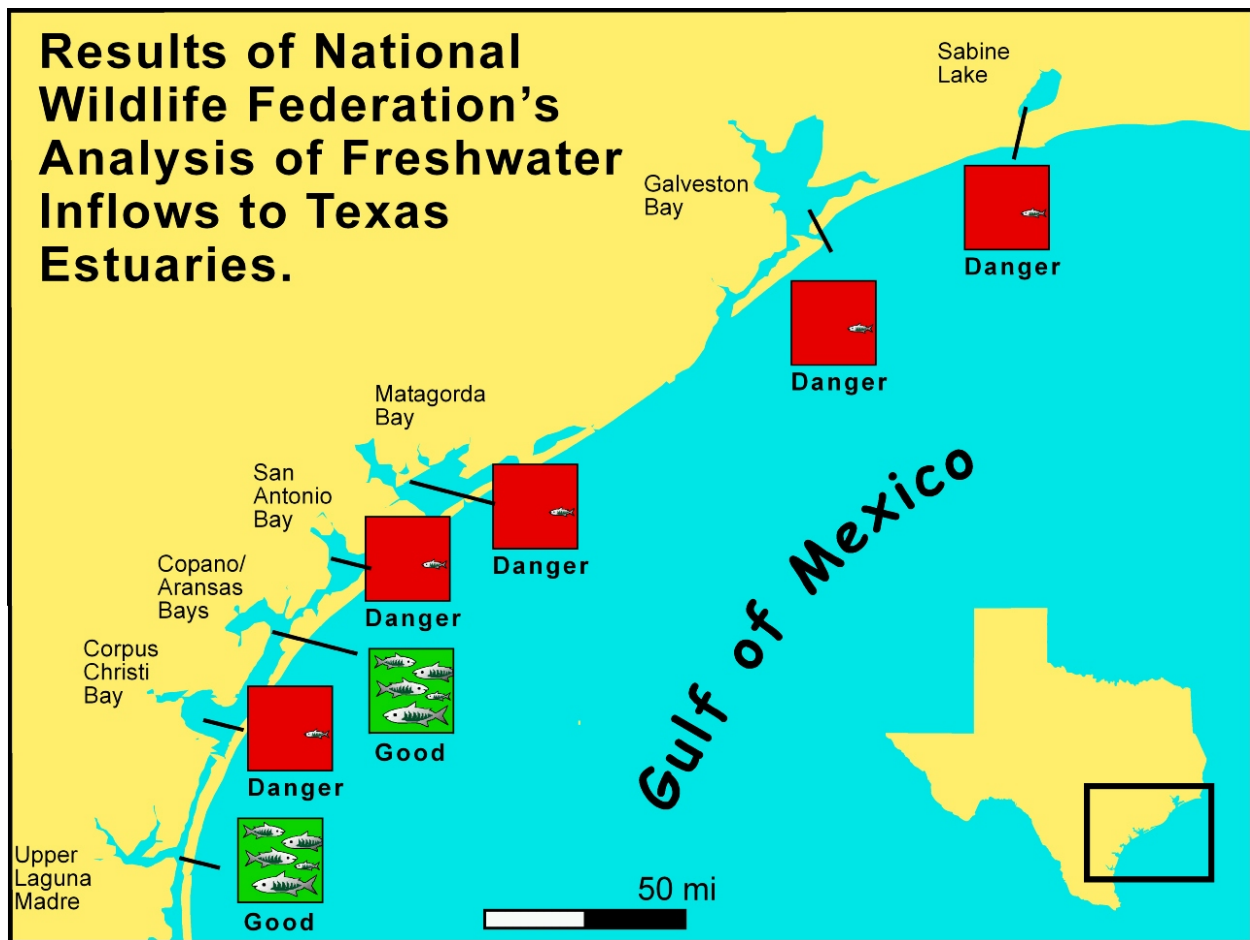


Figure 39. Results of the National Wildlife Federation's analysis of freshwater inflows to Texas estuaries. Source: Johns 2004.



## Water Use Adjacent to the Mission-Aransas NERR

### *Transportation*

#### Marine Navigation

The Gulf Intracoastal Waterway is a major industrial water transportation canal that bisects Aransas Bay, but outside the boundary of the Reserve. The waterway was first dredged in 1905 and is approximately 125 feet wide by 12 feet deep and links seaports along the Northern Gulf of Mexico. The easement for the waterway is 300 feet and there is 2150 feet of easement within the NERR site for dredge material disposal on either side of the GIWW centerline (Texas Governmental Code, Sec. 2204.601). The waterway serves many uses, such as a commercial trade link, national defense, and protective passage for recreational and working vessels (TxDOT 1996). It is economically imperative to the Texas Coast because it facilitates transporting petrochemicals and agricultural as well as industrial products that would otherwise be too costly or impossible transport by road. In 1994, over 78 million short tons were moved on the Texas waterway, which values up to twenty-two billion in revenue (TxDOT 1996). The US Army Corps of Engineers must annually dredge 8 million cubic yards of shoaled material to maintain authorized dimensions of the waterway (TxDOT 1996).

Maintaining the navigation channels through Texas' shallow bays systems plus vessel use creates localized impacts to the ecosystem, within 1000 feet of the channel (Scot Sullivan TxDOT, personnel communication). In areas with hard-bottom substrate, dredging has been shown to have detrimental effects to the benthos. However, a five year study conducted in soft-bottomed Corpus Christi Bay concluded that the present benthic communities have a high resilience to disturbance by dredging and trawling (Flint and Younk 1983). This resilience is likely because of a large source of colonist species.

Dredge spoil islands are present adjacent to the Reserve. The majority of the dredged spoil islands run along the west of the intracoastal, about 600 yards out, excluding Lydia Ann Channel. The section of the intracoastal waterway that extends along the ANWR shoreline contains the Dunham spoil island and levee to the east of the waterway. This spoil island was created to the east of the waterway so as not to impede upon whooping crane habitat. In November 1995, in a section 216 feasibility study, the Corps of Engineers addressed the 30 mile reach of the waterway that is adjacent to the ANWR. In this study, the following items were addressed: 1) evaluation of possible realignment of the waterway, 2) identified beneficial uses of dredged material, and 3) generated a plan for reducing the bank erosion along the ANWR (TxDOT 1996). Although habitat loss is caused by dredge spoil islands, these islands are also ideal nesting for several species of birds and usually contain plant communities of mesquite, salt cedar (*Tamarix* spp.), popinac (*Leucaena leucocephala*), granjeno (*Celtis laevigata*), and oleander (*Oleander* spp.) (Chaney et al. 1996). Besides the dredging of the intracoastal waterway additional dredging may occur from time to time to maintain the navigation channel to Goose Island State Park or to maintain other channels within the Reserve (Mary Perez and Scot Sullivan TxDOT, personnel communication).

There is likely incidental pollution associated with the use of outboard motors on the water but this is not regulated and applies to all outboard motors (pleasure craft, research vessels, etc.). It is known that 2-stroke outboard motors release 18% of the fuel and oil consumed. The UTMSI will endeavor to purchase only 4-stroke outboards and help promote the use of less polluting technology. The licensing of boats and motors in Texas is managed by TPWD.

#### Bridges and Runway Protection Zone

The Copano Bay Causeway bisects the Reserve between Aransas and Copano Bay. There are also numerous state roadways adjacent to the NERR boundary. These roadways include state highways, farm to market roads, and park roads. Periodic maintenance of these facilities will be occurring (Table 11). In addition, a parcel of land (~ 2500'x1750') west of the Rockport/Fulton Airport that extends out into Copano Bay is designated as a runway protection zone. A map of the airport and protection zones are provided in the site nomination document (<http://www.utmsi.utexas.edu/nerr/>).

Table 11. Future maintenance on state roadways adjacent to the Reserve. Setback dimensions are shown in parenthesis.

State Roadways	Future projects
State Highway 35 Copano Bay Causeway (750 ft from centerline of the Copano Causeway Fishing Pier to each side)	Scheduled for replacement, some dredging may be required during construction
State Highway 35 Cavasso and Salt Creek Bridges (150 ft from the centerline to each side)	Bridge replacement scheduled at Copano and Salt Creek Bridges
Farm Road 136 Bridge at Copano Bay (150 ft from the centerline to each side)	No projects scheduled
Farm Road 2678 Mission River Bridge (150 ft from the centerline to each side)	No projects scheduled
State Highway 188 Port Bay Bridge (150 ft from the centerline to each side)	Long term plans call for the bridge to be widened

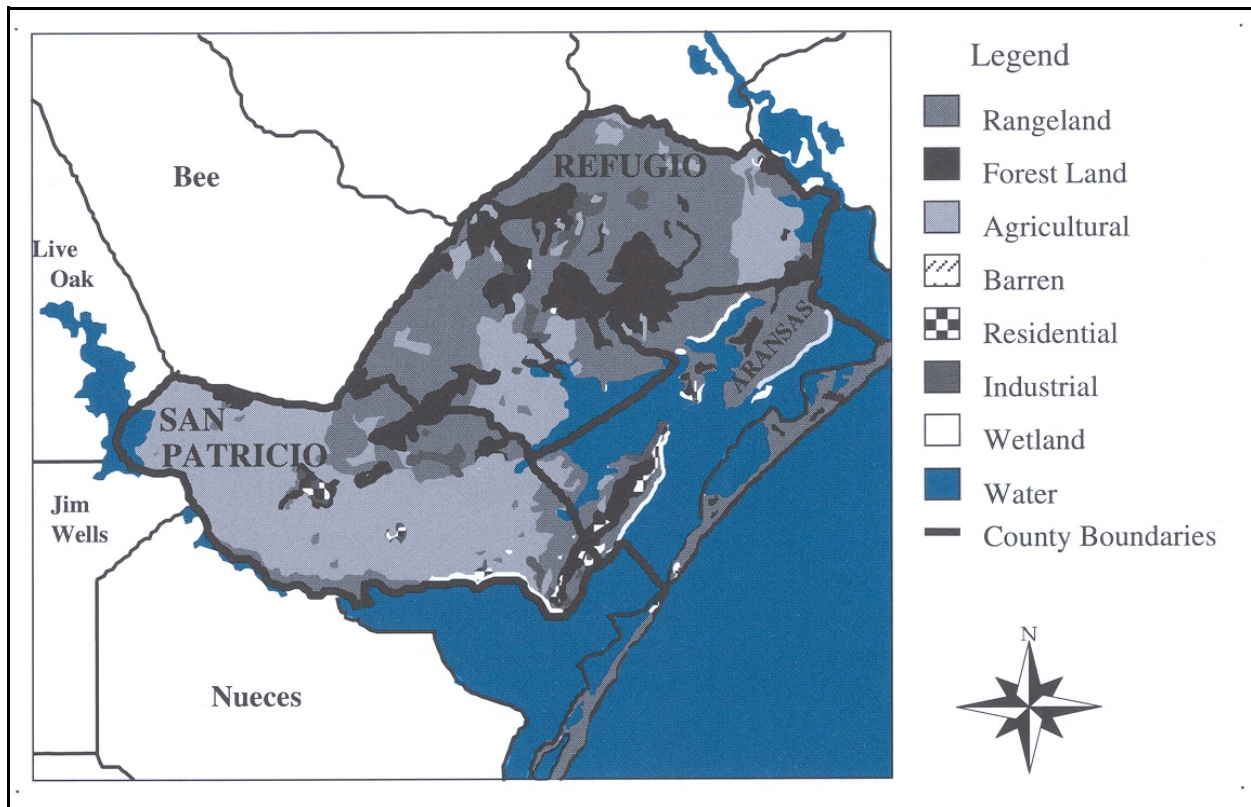
#### Land Use Adjacent to the Mission-Aransas NERR

Description of land use adjacent to the Reserve is largely based on a wetland conservation plan by Smith and Dilworth (1999). The majority of the land surrounding the Reserve is used for agriculture and rangeland for cattle (Figure 40). Land use around the Mission-Aransas Estuary is divided into six categories: developed lands, cultivated lands, grasslands, woodlands, shrublands, and bare lands.

San Patricio County, which encompasses a very small portion of the site including Buccaneer Cove Preserve and the southern tip of Port Bay, has the highest percentage of cultivated lands followed by Refugio and Aransas County, respectively (Figure 41). The Aransas River watershed includes Chiltipin Creek and other unnamed tributaries which drain approximately two-thirds of San Patricio County including the cities of Sinton, Odem, and Taft. This drainage includes more than 250,000 acres of intensely managed cotton and grain sorghum row crop farms. Much of the Aransas River watershed lies within the land holdings of the Welder Wildlife Foundation (7,800 acres), whose primary purpose is wildlife management and conservation.

In contrast, Aransas County has the highest percentage of both bare lands and developed lands. Most bare lands in this area are delineated as bay shoreline beaches, creating a significant tourism focus in the county and extensive urban development. Refugio has the most rural land use of the three counties, with the majority of the land identified as agriculture or ranching: limited urban development is centered around the towns of Refugio, Woodsboro, Bayside, Tivoli, and Austwell.

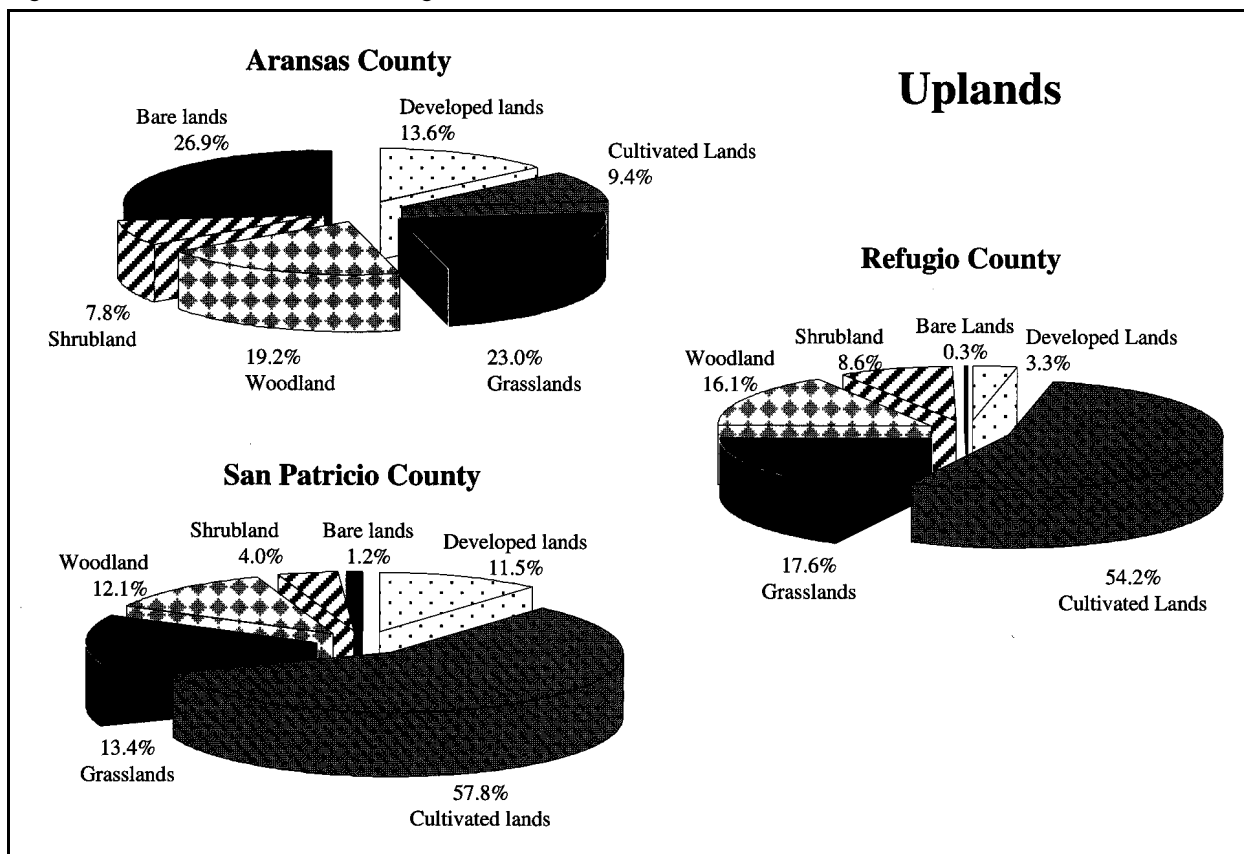
Figure 40. Land uses adjacent to the Reserve.



The City of Corpus Christi with a population of over 250,000 is the largest city in the area and as a result, the Nueces Estuary generally has more anthropogenic activities than the Mission-Aransas or Baffin Bay-Laguna Madre Estuary (Montagna et al. 1998). The Port of Corpus Christi is the sixth largest port in the United States, making marine transportation a dominant industry in the area. The Port of Corpus Christi houses several facilities including: liquid bulk docks, cargo terminals, Rincon Industrial Park, Ortiz Center, and a cold storage terminal. All ship traffic enters through the Aransas Pass, which lies just south of the Reserve.



Figure 41. Land uses of Aransas, Refugio and San Patricio Counties.



### 11.2 Existing Resource Restoration Activities

The current Reserve Management Plan does not contain any specific restoration plans. As part of the Stewardship Plan, the Reserve staff will create a restoration plan during the first five years of program implementation. However, there are several ongoing restoration efforts present in the Reserve boundary and it is expected that these will continue and that the Reserve will partner in some of these efforts.

#### Marsh and Shoreline Restoration

Wakes of boats and barges in the Intracoastal Waterway has eroded marshes and shorelines in the Lamar Peninsula along Goose Island State Park and the Aransas National Wildlife Refuge. Several restoration projects have take place and more are planned in the future. Typically, the projects either harden shorelines or plant marsh grass. These kinds of projects are likely to continue, but provide an excellent opportunity for Reserve staff to provide technical information needed to design the projects or monitor the outcome of the projects. Maintaining these marsh-edge shorelines benefits the core areas of the Reserve because it is the primary habitat for whooping cranes.

#### Removing Derelict Structures, Restoring Oil and Gas Fields

Because the region had very active oil and gas activities during the middle part of the 20<sup>th</sup> century, there are some abandoned structures, sunken boats and barges, and other submerged obstructions. There are several organizations interested in restoring wetlands and bay bottoms including the Texas Coastal Management Program and conservation groups. Removal of these structures would improve access to the Reserve and restoration of the bottom would improve habitats for organisms that live in the Reserve.

### Cedar Bayou

Cedar Bayou is a natural pass that has been manipulated several times during the past few decades both to protect the nursery grounds in Mesquite Bay from oil spills and to enhance migration of estuarine dependent species (Figure 42). There is some local support for maintaining and dredging Cedar Bayou Pass to preserve these ecological benefits. The whooping cranes found on the Aransas National Wildlife Refuge feed primarily on blue crabs, which have estuarine dependent life cycles. Thus, it appears that the whooping crane would also benefit by the pass being maintained. This natural pass was dredged in September 1987 and closed around 1999 to protect against oil entering the nursery. The dredging of Cedar Bayou was initiated by TPWD in effort to increase water flow through the pass to enhance fish, shrimp and crab abundances, as well as increase the public utilization of the bayou as a recreational fishing area (Heffernan 1985). Because of large floods in recent years in San Antonio Bay, Cedar Bayou has been open to the Gulf of Mexico. It is possible that without maintenance dredging the pass would again close during low flow periods. Maintaining an open pass would benefit the Reserve core areas. Save Cedar Bayou, Inc. has been a driving force behind the restoration of Cedar Bayou and Vinson Slough. The first phase of the restoration project has been completed (<http://www.coastharboreng.com/public/cedarbayou>). The next two phase will include: 2) optimization of preferred alternative, permitting, and final design, and 3) construction and post-construction monitoring.

Figure 42. Cedar Bayou entrance.



### 11.3 Existing Resource Protection

The following section describes the regulatory programs and policies of the applicable authorities and appropriate government enforcement agencies for the existing resource manipulations.

#### Oil and Gas

Since the state of Texas became independent in 1836, public lands have been given to settlers, soldiers, veterans, and railroads as recompense for service, but more importantly, 52 million acres of public lands were reserved for education, therein creating the Permanent School Fund (PSF). Since the initial donation, most of the school lands have been sold due to poor management and improper classification, but Texas still retains a mineral estate of more than 12 million acres. The Texas General Land Office (GLO) is directly responsible for the management of this land, which is dedicated to the PSF. The growth of the oil industry in the 20th century helped change the state's land policy from an emphasis on income through the sale of land to an emphasis on income through resource development. The GLO leases rights for oil and gas production on state lands, producing revenue and royalties that are funneled into the state's PSF. In 1939, the Texas legislature created the School Land Board (SLB) to help manage mineral lease awards on school lands, and the lands dedicated to the PSF. The legislature dedicated the mineral income from riverbeds, bays and submerged lands to the PSF. Although non-submerged school land can be sold today under the authority of the SLB, this is rarely done. Instead, the land is leased for resource development and the revenues earned are deposited in the PSF, which stands today at over \$7 billion. The interest earned on the PSF investments is deposited in the Available School Fund each year and distributed by the State Board of Education to every school district in Texas on a per-pupil basis. The land office also deposits in that fund fines on unpaid or late royalties, and commercial leasing revenues. Since the PSF was established in 1854, the GLO has deposited more than \$6.8 billion, mostly from oil and gas leases and real estate trades and sales.

In 1991, the Texas Legislature passed the Coastal Coordination Act, which directed the GLO to develop a long-range, comprehensive plan for the coast in cooperation with state agencies, local governments, and coastal citizens. The act prompted GLO to establish the Coastal Coordination Council (CCC), with the goal to oversee the development of the state's coastal management plan, adopt coast wide management policies, and to implement the plan and designate the physical boundaries for the coastal area. The GLO and CCC effort's resulted in the Coastal Management Plan (CMP), which is a networked program that links the regulations, programs, and expertise of state, federal, and local entities that manage various aspects of coastal resources (Coastal Management Program Guide).

In Texas, there are two primary state agencies that regulate the oil and gas industry. The GLO regulates the leasing, exploration, and development of oil and gas on state submerged lands by means of the provisions of the GLO oil and gas leases issued. The Texas Railroad Commission (RRC) regulates oil and gas production. Both the GLO and RRC have regulations which state that exploration, leasing and production of oil and gas must comply with the policies of the CMP. The CMP sets policies for oil and gas activities that occur within Coastal Natural Resource Areas (CNRA's). The proposed area for the Mission-aransas NERR encompasses numerous CNRA's within its boundaries, including tidal waters, submerged lands, coastal wetlands, submerged aquatic vegetation, oyster reefs, and coastal barriers (Table 12). The CMP states that oil and gas in navigable waters are to be conducted in such a manner as to avoid and otherwise minimize adverse effects. The majority of habitats in the Reserve are critical areas, which are defined as coastal wetlands, oyster reefs, hard substrate reefs, submerged aquatic vegetation, tidal sand flats, and mud sand flats. The CMP has already established explicit permit authority to which detailed guidelines apply for the operations of oil and gas that protect the natural resources within the Reserve.

Resource Management Codes (RMCs) are used by lessees of state-owned tracts in Texas bays and estuaries during the permitting process. These codes enhance protection of sensitive natural resources by providing recommendations for minimizing adverse impacts from mineral exploration and development activities. RMCs were created by state and federal resource agencies (U.S. Fish and Wildlife Service, National Marine Fisheries Service, Texas Parks and Wildlife Department, Texas Historical Commission, and U.S. Army Corps of Engineers). RMCs represent development guidelines for activities within the tracts. RMCs may assist state land lessees during the Corps permitting process by informing a prospective operator of restrictions that may be included in the Corps permit. Before beginning work on a state tract, lessees may be required to conduct a survey for sensitive habitats and resources. In most cases, tract development may proceed when an applicant demonstrates that the development plan is not inconsistent with the concerns listed in the codes. When impacts to sensitive habitats or resources are unavoidable, development may be

allowed, subject to negotiation for mitigation.

Table 12. Coastal natural resource areas as designated by the Coastal Coordination Act as the focus of the CMP (Coastal Management Program Guide).

CNRAs	Definition
Coastal barrier	An undeveloped area on a barrier island, peninsula, or other protected area, as designated by USFWS.
Coastal historical area	A site that is specifically identified in rules adopted by the Texas Historical Commission as being coastal in character and that is on the national register of historic places or a state archaeological landmark.
Coastal preserve	Any land that is owned by the state and subject to Parks and Wildlife Code, because it is a park, recreation area, scientific area, wildlife refuge, or historic site.
Coastal shore area	An area within 100 feet landward of the high water mark on submerged land.
Coastal wetlands	A wetland located seaward of the Coastal Facility Designation Line, within rivers and streams to the extent of tidal influence, or within one mile of the mean high tide line of rivers and streams.
Critical dune area	A protected sand dune complex on the Gulf shoreline within 1,000 feet of mean high tide.
Critical erosion area	An area designated by the Land Commissioner
Gulf beach	A beach bordering the Gulf of Mexico that is located inland from the mean low tide line to the natural line of vegetation bordering the seaward shore, or an area of public access.
Hard substrate reef	A naturally occurring hard substrate formation, including a rock outcrop or serpulid worm reef, living or dead, in an intertidal or subtidal area.
Oyster reef	A natural or artificial formation that is composed of oyster shell, live oysters, and other living or dead organisms; discrete, contiguous, and clearly distinguishable from scattered oyster shell or oysters; and located in an intertidal or subtidal area.
Special hazard area	An area having special flood, mudslide or mudflow, or flood-related erosion hazards.

### *Exploration and Leasing*

The Texas General Land Office (GLO) and the School Land Board (SLB) regulates the oil and gas exploration and leases in the Reserve. The GLO and SLB must also comply with the policies of the CMP when approving oil, gas, and other mineral lease and granting surface leases, easements, and permits and adopting rules under the Texas Natural Resources Code, Chapters 32, 33 and 51-53, governing oil and gas exploration and production on submerged lands (Texas Administrative Code (TAC), Title 31, Part 16, Ch 501, Rule §501.4).

Aside from the regulations of the CMP, the GLO also has its own regulations in reference to pollution, and other impacts to natural resources (TAC, Title 31, Part 1, Ch 9, Rule §9.11). The GLO states that exploration and leasing of state oil and gas shall be governed by these guidelines:

- All geophysical and geochemical exploration shall be conducted in compliance with all applicable state and federal statutes and regulations relating to pollution of land and water;
- Any physical modification of the surface including, but not limited to, mounding, cratering, or vehicle tracks shall be remedied upon completion of the work and coordinated with and approved by GLO.
- Persons using wheeled or tracked vehicles on state-owned lands shall use reasonable efforts to avoid impact to the area;
- No person operating a vessel, vehicle, or equipment operating under permit shall discharge solid waste (which includes, but is not limited to, non-biodegradable containers, rubbish, or refuse or garbage) into state waters or state-owned lands.

- No geophysical surveying or shooting shall be performed within 1,000 feet of a known bird rookery island, as depicted on maps maintained by GLO, between February 15th and September 1<sup>st</sup>.
- In accordance with Texas Parks and Wildlife Code, §12.301, a permittee or contractor is liable to the state for the value of fish or wildlife taken, killed, or injured by work under a permit.
- Staging areas must be approved by the GLO, and shall not be established in vegetated areas of tidal sand or mud flats, submerged aquatic vegetation, or coastal wetlands, as those terms are defined in §16.1 of this title (relating to Definitions and Scope), or vegetated dune areas.
- Shot holes shall be at least 120 feet below the mudline on submerged lands, unless otherwise authorized in writing by the commissioner.
- No high velocity energy source shall be discharged within 500 feet of any oyster reef, marked oyster lease, marked artificial reef, or marked red snapper bank, or within 500 feet of any dredged channel, dock, pier, causeway, or other structure. Assistance in locating oyster reefs and leases is available from TPWD.
- No shot in excess of 20 pounds shall be discharged within one mile of any pass, jetty, mouth of a river, or other entrance to the Gulf of Mexico from inland waters.

The GLO ensures compliance with the above guideline through permit conditions designed to: avoid adverse impacts to natural resources, minimize unavoidable impacts, and to compensate for those significant and adverse impacts that may occur during the permitted activity (TAC, Title 31, Part 1, Ch 9, Rule §9.11). The GLO and the SLB shall not take a major action that is inconsistent with the following goals or the policies of the TAC coastal protection chapter:

- to protect, preserve, restore, and enhance the diversity, quality, quantity, functions, and values of Coastal Natural Resource Areas (CNRAs);
- to ensure sound management of all coastal resources by allowing for compatible economic development and multiple human uses of the coastal zone;
- to balance the benefits from economic development and multiple human uses of the coastal zone, the benefits from protecting, preserving, restoring, and enhancing CNRAs, the benefits from minimizing loss of human life and property, and the benefits from public access to and enjoyment of the coastal zone.

In addition, the GLO and the SLB shall avoid and otherwise minimize the cumulative adverse effects to CNRAs of each of its major actions relating to the activity (TAC, Title 31, Part 1, Ch 16, Rule §16.2).

The GLO and SLB have thresholds for referral for actions of exploration and leases. Any action that exceeds these threshold levels will be referred to the Coastal Coordination Council (CCC) for consistency review to the CMP. The approval of a mineral lease exceeds the threshold for potential referral if the authorized activities would adversely affect CNRA acreage greater than the following in the Mission-Aransas Estuary (lower coast): one-half acre of oyster reef, 40 acres of submerged aquatic vegetation, five acres of coastal wetland, 20 acres of algal flat, 20 acres of tidal mud flat, 40 acres of tidal sand flat, 40 acres of waters in the open Gulf of Mexico, 40 acres of open bay waters under tidal influence, or 40 acres of upland area fitting the definition of coastal barrier, coastal shore area, gulf beach, critical dune area, special hazard area, critical erosion area, coastal historic area, or coastal park, wildlife management area, or preserve. The issuance of a geophysical permit for exploration for oil, gas, or other minerals on state-owned lands also exceeds the threshold if the permit authorizes one of the following: a shot in excess of 40 pounds of dynamite equivalent (upland areas), a shot in excess of 20 pounds of dynamite equivalent (submerged areas), a shot hole less than 120 feet below the mud line (submerged areas). In addition, any action described in §16.1 of this title that may adversely affect a CNRA that has not been specifically addressed in this section, exceeds the threshold if the action would adversely affect greater than 40 acres of any such CNRA. (TAC, Title 31, Part 1, Ch 16, Rule §16.4).

### *Production*

The RRC regulates the oil and gas production in the Reserve. In regard to access of property within the Reserve; the commission or its representatives has access to come upon any lease or property operated or controlled by an operator, producer, or transporter of oil, gas, or geothermal resources, and to inspect any and all leases, properties, and wells and all records of said leases, properties, and wells. Designated agents of the commission are authorized to make any tests on any well at any time necessary to conservation regulation, and the owner of such well is hereby directed to do all things that may be required of him by the commission's agent to make such tests in a proper manner (TAC, Title 16, Part 1, Ch 3, Rule §3.2).

Activities by the RRC of oil, gas, or geothermal resources in the coastal zone must be consistent with the Texas Coastal Management Program (CMP). Activities that must be consistent with the CMP include disposal of oil and gas waste in a pit, discharge of oil and gas wastes to surface waters, compliance with applicable water quality requirements for federal permits for development (including pipelines) in critical areas, dredging, and dredged material disposal. Aside from the regulations of the CMP, the RRC also has their own regulations in reference to pollution prevention. These regulations state that the operator of oil, gas, or geothermal resources shall not pollute the waters of the Texas offshore and adjacent estuarine zones (saltwater bearing bays, inlets, and estuaries) or damage the aquatic life therein. Particularly, the disposal of liquid waste material into the Texas offshore and adjacent estuarine zones shall be limited to saltwater and other materials which have been treated, when necessary, for the removal of constituents which may be harmful to aquatic life or injurious to life or property.

The Texas Commission of Environmental Quality (TCEQ) also requires that there be no discharge of oil and gas waste to surface waters which may cause a violation of the Texas Surface Water Quality Standards, codified at TAC, Title 30, Ch 307. TCEQ standards state that no discharge of oil, grease, or related residue is allowed that will produce a visible film of oil or globules of grease on the surface or coat the banks or bottoms of the watercourse; or cause toxicity to man, aquatic life, or terrestrial life. In reference to brine discharge, salinity gradients in estuaries shall be maintained to support attainable estuarine dependent aquatic life uses (TAC, Title 30, Ch 307, Rule §307.4). In addition, no oil or other hydrocarbons (including deck wash, and oil based drilling muds) in any form or combination with other materials or constituent shall be disposed of into the Texas offshore and adjacent estuarine zones. Immediate corrective action shall be taken in all cases where pollution has occurred. An operator responsible for the pollution shall remove immediately such oil, oil field waste, or other pollution materials from the waters and the shoreline where it is found. Such removal operations will be at the expense of the responsible operator (TAC, Title 16, Part 1, Ch 3, Rule §3.8).

#### *Coastal Management Plan*

The Coastal Management Program (CMP) was created by has several pertinent policies for construction, operation, and maintenance of oil and gas exploration and production facilities in Coastal Natural Resource Areas (CNRAs). CNRAs are located using several methods, depending on the resource: photointerpretation of aerial photography, along with field verification (seagrasses, coastal wetlands, tidal flats and other CNRAs); side-scan sonar (oyster reefs); field surveys (all CNRAs); or a combination of methods. One of the first steps applicants for permits, leases, or easements must take is to locate CNRAs (if any) within the area of the proposed action. If CNRAs are found, applicants must take steps to avoid, minimize, restore, enhance, protect, or mitigate for any impacts.

The goals of the Texas Coastal Management Program (CMP) are:

1. to protect, preserve, restore, and enhance the diversity, quality, quantity, functions, and values of CNRAs;
2. to ensure sound management of all coastal resources by allowing for compatible economic development and multiple human uses of the coastal zone;
3. to minimize loss of human life and property due to the impairment and loss of protective features of CNRAs;
4. to ensure and enhance planned public access to and enjoyment of the coastal zone in a manner that is compatible with private property rights and other uses of the coastal zone;
5. to balance the benefits from economic development and multiple human uses of the coastal zone, the benefits from protecting, preserving, restoring, and enhancing CNRAs, the benefits from minimizing loss of human life and property, and the benefits from public access to and enjoyment of the coastal zone;
6. to coordinate agency and subdivision decision-making affecting CNRAs by establishing clear, objective policies for the management of CNRAs;
7. to make agency and subdivision decision-making affecting CNRAs efficient by identifying and addressing duplication and conflicts among local, state, and federal regulatory and other programs for the management of CNRAs.
8. to make agency and subdivision decision-making affecting CNRAs more effective by employing the most comprehensive, accurate, and reliable information and scientific data available and by developing, distributing for public comment, and maintaining a coordinated, publicly accessible geographic information system of maps of the coastal zone and CNRAs at the earliest possible date;
9. to make coastal management processes visible, coherent, accessible, and accountable to the people of Texas by providing for public participation in the ongoing development and implementation of the Texas CMP; and

10. to educate the public about the principal coastal problems of state concern and technology available for the protection and improved management of CNRAs.

Oil and gas exploration and production on submerged lands shall also comply with the CMP, including the following policies. In or near critical areas, facilities shall be located and operated and geophysical and other operations shall be located and conducted in such a manner as to avoid and otherwise minimize adverse effects, including those from the disposal of solid waste and disturbance resulting from the operation of vessels and wheeled or tracked vehicles, whether on areas under lease, easement, or permit or on or across access routes thereto. Where practicable, buffer zones for critical areas shall be established and directional drilling or other methods to avoid disturbance, such as pooling or unitization, shall be employed. In addition, lessees, easement holders, and permittees shall construct facilities in a manner that avoids impoundment or draining of coastal wetlands, if practicable, and shall mitigate any adverse effects on coastal wetlands impounded or drained in accordance with the sequencing requirements in this subsection. Upon completion or cessation of operations, lessees, easement holders, and permittees shall also remove facilities and restore any significantly degraded areas to pre-project conditions as closely as practicable, unless facilities can be used for maintenance or enhancement of CNRAs or unless restoration activities would further degrade CNRAs (TAC, Title 31, Part 16, Ch 501, Rule §501.14).

In reference to discharges of wastewater and waste disposal from oil and gas exploration and production activities, the CMP dictates the following regulations. No new commercial oil and gas waste disposal pit shall be located in any CNRA. Oil and gas waste disposal pits shall be designed to prevent releases of pollutants that adversely affect coastal waters or critical areas. All discharges shall comply with all provisions of surface water quality standards established by the TCEQ. To the greatest extent practicable, new wastewater outfalls shall be located where the discharge will not adversely affect critical areas. Existing wastewater outfalls that adversely affect critical areas shall be either discontinued or relocated so as not to adversely affect critical areas within two years of the June 15, 1995 (TAC, Title 31, Part 16, Ch 501, Rule §501.14).

The CMP also states that GLO regulations governing prevention of, response to and remediation of coastal oil spills shall provide for measures to prevent coastal oil spills and to ensure adequate response and removal actions. The GLO regulations for certification of vessels and facilities that handle oil shall be designed to ensure that vessels and facilities are capable of prompt response and adequate removal of unauthorized discharges of oil. The GLO regulations adopted pursuant to the Oil Spill Prevention and Response Act (OSPRA), Texas Natural Resources Code, Chapter 40, shall be consistent with the State Coastal Discharge Contingency Plan adopted pursuant to OSPRA; and the National Contingency Plan adopted pursuant to the Federal Water Pollution Control Act, 33 United States Code Annotated, Chapter 26. GLO also rules under OSPRA governing the assessment of damages to natural resources injured as the result of an unauthorized discharge of oil into coastal waters shall provide for reasonable and rational procedures for assessing damages and shall take into account the unique circumstances of the spill incident. The costs of assessing the damages shall not be disproportionate to the value of the injured resources. Plans for the restoration, rehabilitation, replacement or acquisition of equivalent resources shall provide for participation by the public and shall be designed to promote the restoration of the injured resources with all deliberate speed.

The GLO rules must be consistent with other state rules and policies and with the CMP goals and policies (TAC, Title 31, Part 16, Ch 501, Rule §501.14). Consistency review is often required to ensure that all agencies (local, state, and federal) comply with CMP goals and policies. The process for conducting consistency reviews addresses four questions:

- Is the proposed project within the CMP boundary?
- Will the proposed project adversely affect CNRAs?
- Is the proposed project subject to review?
- Is the proposed project consistent with the goals and policies of the CMP?

Local consistency review includes coastal cities and counties with authority under Texas Open Beaches Act (TEX. NAT. RES. CODE ANN. Ch. 61), Dune Protection Act (TEX. NAT. RES. CODE ANN. Ch. 63), and Land Office's beach/dune rules (31 TAC Ch. 15). These coastal cities and counties are responsible for permitting and issuing certificates in the beach/dune system and must ensure that CNRAs will not be adversely affected by a proposed action. These actions are limited to construction in the beach/dune, coastal shore protection, and closure, relocation, or reduction in public beach access. State consistency review includes the networked state agencies and subdivisions. Each state agency proposing

an action subject to the CMP must ensure that the action is consistent in writing, such as an order, permit, or other document approving or authorizing the document. Federal consistency review includes actions undertaken, licensed, permitted, or funded by a federal agency. The following listed actions are subject to consistency review: federal actions - licenses or permits issued by federal agencies, federal activities and development projects - functions performed by or for a federal agency, and federal assistance - state and local government applications for federal assistance.

Resources management codes assist potential users of state-owned submerged lands with their project planning efforts. State and federal resource agencies assign codes to state-owned tracts in Texas bays and estuaries and Gulf of Mexico waters, representing development guidelines for activities within the tracts. The codes provide recommendations for minimizing adverse impacts to sensitive natural resources from mineral exploration and development activities.

#### *Oil and Gas Permits*

Oil and gas operations are regulated by the GLO and RRC, but before any operation can begin, permit(s) must be obtained from the U.S. Army Corps of Engineers (<http://www.swg.usace.army.mil/reg/permits.asp>). The Nationwide Permits (NWP) required for oil and gas operations in bays and estuaries include NWP 6 for seismic activities and NWP 44 for mining activities. The NWPs have several general conditions relevant to environmental protection. Some of these conditions include compliance with laws regarding water quality, coastal zone management, endangered species, historic properties, shellfish beds, mitigation, waterfowl breeding areas, and designated critical resource waters. The water quality and endangered species laws are two laws that more readily hold up permit approval. In Texas, mining permit activities must be authorized by TCEQ, which sets the state water quality standards for discharges. These standards are based on the Clean Water Act and require discharges to be consistent with the Coastal Management Plan (CMP). The Endangered Species Act of 1973 requires any seismic or mining permit that may allow adverse impacts to threatened or endangered species or their corresponding critical habitats to be approved by the U.S. Fish and Wildlife Service (USFWS) before the permit is authorized. General conditions of NWP designate a NERR site as a critical resource water. Because NERR sites are designated as critical resource waters, no discharges of dredged or fill material are allowed within the site unless it is authorized by the USFWS for compliance with threatened or endangered species. In addition compliance with the Coastal Zone Management Act through the CMP is required for seismic and mining permit approval (33 CFR 330.4(d)). A general permit is also required for directional drilling (permit 14114). A directional drilling permit is also bound by laws regarding endangered species, historic properties, mitigation, and waterfowl breeding areas. Further information on Corps of Engineers permits required for activities in the Reserve can be found at <http://www.swg.usace.army.mil/reg/permits.asp>.

#### *Specific Reserve Land Owner Policies*

##### Aransas National Wildlife Refuge

Economic uses of the Aransas National Wildlife Refuge (including Matagorda Island) (ANWR) are primarily cattle grazing, and oil and gas development. Grazing is permitted on Myrtle-Foester Whitmire Unit of 3,240 acres. Grazing is permitted not for economic returns, but as a management tool. With the exception of a few scattered tracts, mineral rights on the Aransas and Matagorda Island are still outstanding. Approximately 5 producing wells exist on the Aransas tract (Figure 43), along with the necessary pipelines, storage, and processing facilities (Figures 44 and 45). Regulations for mineral operations on the ANWR are bound to the GLO and RRC regulations. In addition, the mineral recovery operations on the ANWR shall be conducted so as to minimize impact. Several years ago, State and Federal biologists got together, at the request of the GLO, and compiled a list of restrictions for each tract on the refuge. There are now drilling restrictions in many parts of the refuge, including St. Charles Bay, during October 15<sup>th</sup> through April 15<sup>th</sup> (Figure 46). There is no seismic exploration allowed on whooping crane management units between October 15<sup>th</sup> and April 15<sup>th</sup>. Restrictions on the tracts surrounding the refuge are such that development of oil and gas resources is almost impossible from within the tracts. Oil companies bidding on these tracts are well aware of the restrictions, but hope that the US Fish and Wildlife Service (USFWS) will permit certain activities on refuge lands. By law, no Federal agency may authorize any action that may jeopardize an endangered species or adversely modify critical habitat or habitat that may in the future be critical to the survival and recovery of an endangered species. It is believed by the USFWS that the zoning and special restrictions of the refuge imposed on the operator will protect endangered species utilizing the refuge (ANWR 1986).



Figure 43. Designated units of Aransas National Wildlife Refuge.

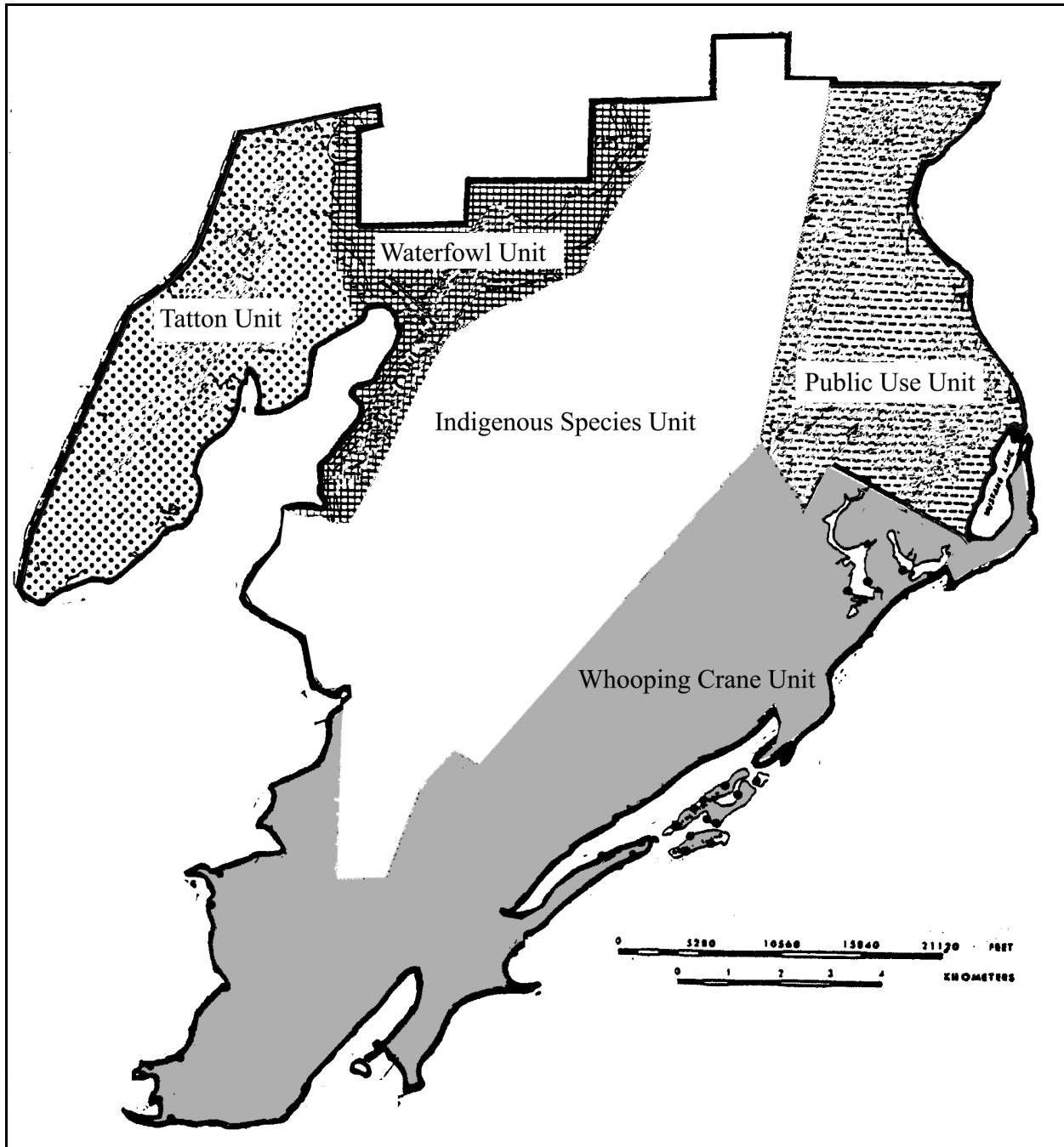


Figure 44. Historical gas and oil wells on the Aransas National Wildlife Refuge. Map provided by ANWR.

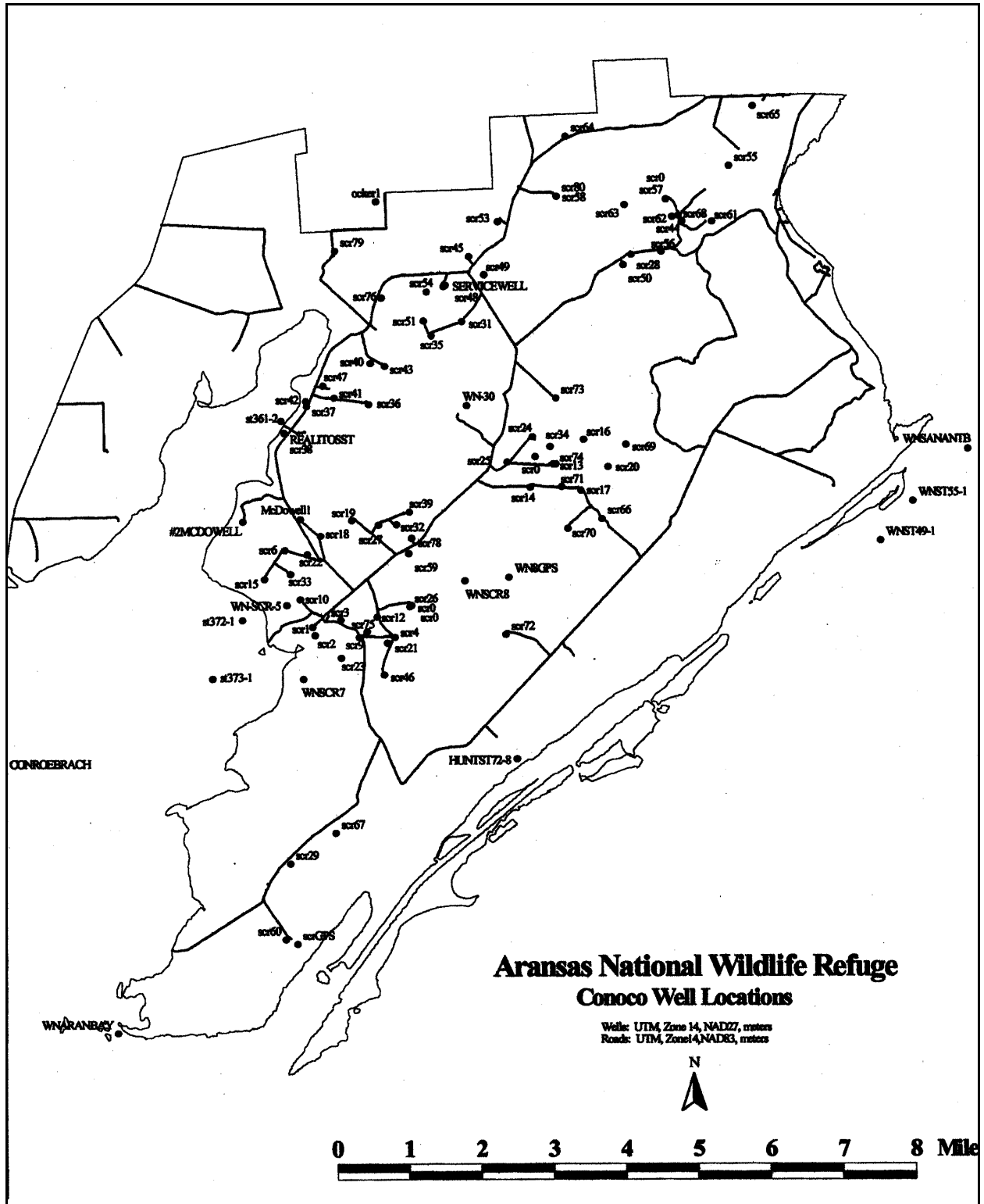


Figure 45. Historical and current gas and oil pipelines on the Aransas National Wildlife Refuge. Map provided by ANWR.

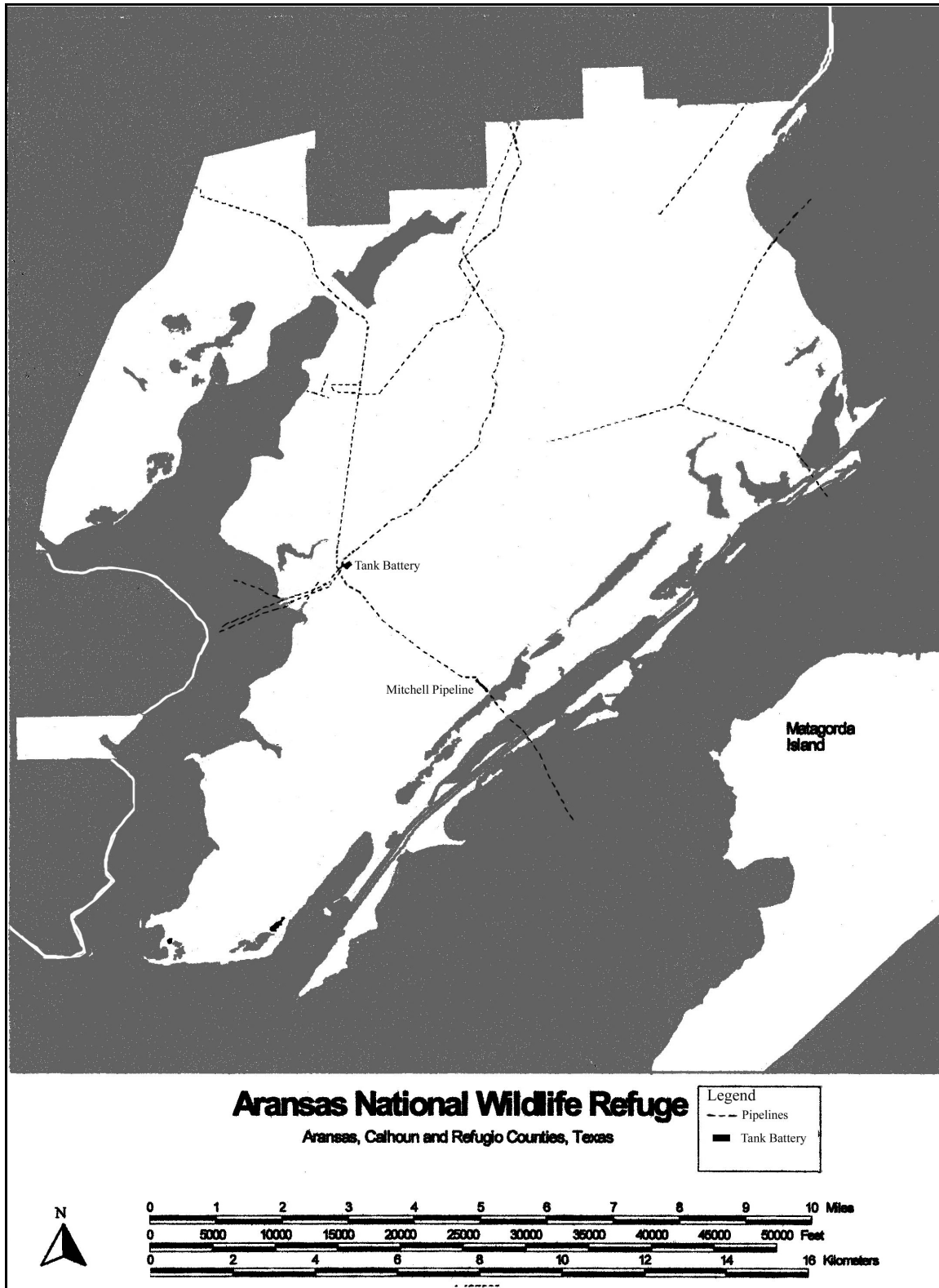
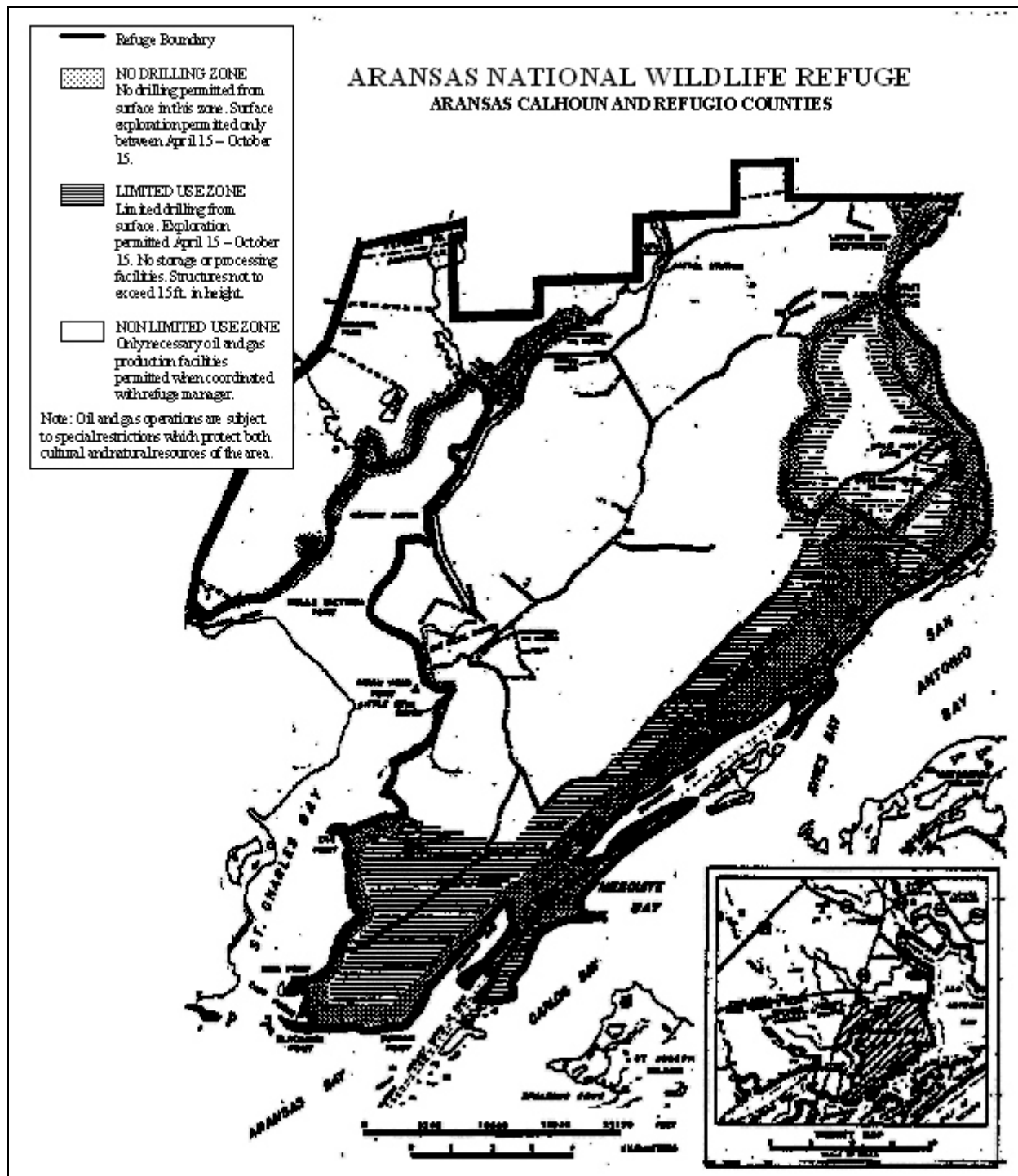


Figure 46. ANWR zones designated by the Oil and Gas Plan (ANWR 1986).



### Texas Parks and Wildlife Department

Goose Island State Park is managed by the Texas Parks and Wildlife Department (TPWD). Regulations for mineral operations on TPWD managed lands are bound to the goals and policies of the CMP and RRC regulations. Oil and gas development on TPWD lands requires a surface lease agreement between the mineral rights owner and TPWD. It is in this surface lease agreement that access routes, staging areas, times of work, and compensation for potential impacts to natural and cultural resources and visitor experiences are worked out. In addition, the staff guidelines for mineral recovery operations on TPWD lands state that operations shall be conducted so as to minimize impact and shall be approved by the land manager. Under general provisions, the guidelines state that TPWD retains the right to make special provisions to protect sensitive resources or to minimize potentially adverse impacts (TPWD staff guidelines gen. provisions *p*). The general provisions also state that reasonable precautions, including consultation with the land manager, shall be taken to avoid disturbance of fish, wildlife or critical plant resources during mineral recovery operations (TPWD staff guidelines gen. provisions *q*). Mineral operations may also be prohibited during nesting, breeding or migration activities of specific species identified by the land manager (TPWD staff guidelines gen. provisions *r*). Restoration of activity sites to preconstruction condition is also required on TPWD managed lands.

### Texas General Land Office Oil Spill Prevention and Response

The Oil Spill Prevention and Response Act of 1991 (OSPR) designated the Texas General Land Office as the lead state agency for preventing and responding to oil spills in the marine environment. In a typical year, the agency's Oil Spill Prevention and Response Program (OSPR) responds to between 850 and 1,000 reported oil spills. A two-cent-per-barrel fee on crude oil loaded or off-loaded in Texas ports funds the OSPR program, which deposits fee proceeds in the Coastal Protection Fund Account. As indicated in its name, the OSPR program emphasizes both the prevention of and response to oil spills. The program maintains an active outreach education effort, visiting schools, associations, and interest groups, teaching that many small, chronic spills can be as detrimental as one large spill. As another prevention step, the OSPR program has completed construction of four oily bilge water reception facilities along the coast. The Oily Bilge Water Reception Facility Program provides operators of pleasure and commercial boats with places to dispose of oily water. To date, over 200,000 gallons of used engine oil have been recycled. Further prevention efforts include increased boat and harbor patrols, which have heightened the Texas General Land Office's presence on the waterfront. The OSPR program maintains a comprehensive, unannounced oil spill drill and audit program designed to measure the readiness level of all sectors of the oil handling community: deep draft vessels, pipelines, and shore-based facilities. Facilities and vessel operators are required to address prevention issues, such as leak detection systems, maintenance, and testing and inspection schedules in Oil Spill Prevention and Response plans, the specifics of which are outlined in regulations developed by the program. The second focus of the OSPR program highlights spill response resources directed at stopping, containing, and cleaning oil spills. The program has compiled a massive spills databank that is used to determine resource allocation, preparedness levels, spill profiles, and corrective activities. In preparation for spills, the program has pre-staged response equipment in sensitive and geographically advantageous locations. The program also maintains a substantial inventory of response equipment including mobile command posts, husbandry and wildlife rehabilitation trailers, fire boom, skimmers, vehicles and vessels. The OSPR program also focuses on research and development, Texas automated buoy system (TABS), clean gulf conference and exhibition, on-line vessel database, regulation review, oil spill prevention task, and the Texas oil spill planning and response toolkit (<http://www.glo.state.tx.us/oilspill/>).

Regulations of the Oil Spill Prevention and Response Act of 1991 is found in the Natural Resource Code Ch. 40; Texas Administrative Code 31 Ch. 19. It is the policy of the state to protect these natural resources and to restore, rehabilitate, replace, and/or acquire the equivalent of these natural resources with all deliberate speed when they have been damaged. It is the intent of the legislature that natural resource damage assessment methodologies be developed for the purpose of reasonably valuing the natural resources of the State of Texas in the event of an oil spill and that the state recover monetary damages or have actions commenced by the spiller as early as possible to expedite the restoration, rehabilitation, and/or replacement of injured natural resources. The OSPRA contains statutes regarding the following:

§ 40.001. Short Title	§ 40.152. Use of Fund
§ 40.002. Policy	§ 40.153. Reimbursement of Fund
§ 40.003. Definitions	§ 40.154. Coastal Protection Fee; Administrative Costs
§ 40.004. Administration of Oil Spill Response and Cleanup	§ 40.155. Determination of Fee
§ 40.005. Administration of Hazardous Substance Spill Response and	§ 40.156. Administration of Fee
§ 40.006. Interagency Council	§ 40.157. Liability of the Fund
§ 40.007. General Powers and Duties	§ 40.158. Exceptions to Liability
§ 40.008. Railroad Commission Authority	§ 40.159. Claims From Discharges of Oil
§ 40.051. Notification	§ 40.160. Payment of Awards
§ 40.052. Hazardous Substances Discharges	§ 40.161. Reimbursement of Fund
§ 40.053. State Coastal Discharge Contingency Plan	§ 40.162. Awards Exceeding Fund
§ 40.101. Notification and Response	§ 40.201. Financial Responsibility
§ 40.102. Response Coordination	§ 40.202. Response Costs and Damages Liability
§ 40.103. Assistance and Compensation	§ 40.203. Liability for Natural Resources Damages
§ 40.104. Qualified Immunity for Response Actions	§ 40.204. Defenses
§ 40.105. Equipment and Personnel	§ 40.205. Third Parties
§ 40.106. Refusal to Cooperate	§ 40.251. Penalties
§ 40.107. Natural Resources Damages	§ 40.252. Administrative Penalties
§ 40.108. Derelict Vessels and Structures	§ 40.253. Cumulative Enforcement
§ 40.109. Registration of Terminal Facilities	§ 40.254. Orders and Hearings
§ 40.110. General Terms	§ 40.255. Actions
§ 40.111. Information	§ 40.256. Individual Cause of Action
§ 40.112. Issuance	§ 40.257. Venue
§ 40.113. Suspension	§ 40.258. Federal Law
§ 40.114. Contingency Plans for Vessels	§ 40.301. Interstate Compacts
§ 40.115. Entry into Port	§ 40.302. Institutions of Higher Education
§ 40.116. Audits, Inspections, and Drills	§ 40.303. Oil Spill Oversight Council
§ 40.117. Regulations	§ 40.304. Small Spill Education Program
§ 40.151. Coastal Protection Fund	

### *Liquefied Natural Gas*

The liquefied natural gas (LNG) terminal activities are is regulated by the Federal Energy Regulatory Commission (FERC). The Commission's responsibilities include:

- Regulation of pipeline, storage, and liquefied natural gas facility construction;
- Regulation of natural gas transportation in interstate commerce;
- Issuance of certificates of public convenience and necessity to prospective companies providing energy services or constructing and operating interstate pipelines and storage facilities;
- Regulation of facility abandonment;
- Establishment of rates for services;
- Regulation of the transportation of natural gas as authorized by the NGPA (Natural Gas Policy Act) and the OCSLA (Outer Continental Shelf Lands Act); and
- Oversight of the construction and operation of pipeline facilities at U.S. points of entry for the import or export of natural gas.

The FERC also helps safeguard the environment by managing permits through the NEPA process. FERC also determines the range of environmental issues requiring analysis and holds scoping meetings when appropriate.

### Recreational and Commercial Fishing

Management regulations from the Texas Parks and Wildlife Department (TPWD) have become increasingly restrictive over time in an attempt to offset the commercial and recreational fishing pressures. In an attempt to increase species abundance, several fish species were designated as a game species and then banned against sale (Red Drum, Goliath Grouper, Blue Marlin, White Marlin, Muskellunge, Northern Pike, Sailfish, Sauger, Spotted Seatrout, Snook, Longbill Spearfish, Tarpon, and Walleye).

In particular, commercial fishing rules for time, area and gear type have also been enacted and enforced within the Reserve (Table 13).

Although recreational and commercial fishing exert pressures on the fisheries there are sufficient rules and regulations by state agencies to maintain a sustainable yield and manage the fisheries present in the Reserve. In most cases, stocks and catches are higher today than they were prior to 1975 (Figure 36). The current bag and length limits for recreational and commercial fishing that are regulated by TPWD are listed in Tables 15 and 14.

Table 13. History of area and gear restrictions on commercial harvest of finfish in the Reserve. Table is adapted from Tunnell et al. (1996) and contains the effective date (month/year) of the regulation.

Date	Regulation
11/1977	Nets and trotlines prohibited on weekends (1 pm Fridays to 1 pm Sundays)
12/1979	Fish taken incidental to shrimp harvest may be retained EXCEPT red drum and spotted seatrout caught in inside waters with a trawl between 16 Dec. and 28 Feb.
7/1980	Monofilament nets banned
9/1980	Gill nets banned in state waters of Gulf
10/1980	Trammel nets, gill nets and drag seines prohibited in waters of Port Bay, St. Charles Bay, and Aransas County portions of Copano and Redfish Bays. All remaining waters of Aransas County closed to gill nets.
5/1981	Commercial sale of red drum and spotted sea trout prohibited
9/1982	Illegal to keep red drum or spotted seatrout caught in any net except a dip net
9/1982	Illegal to retain red drum or spotted seatrout caught in trotline other than a sail line
9/1988	Gill nets, trammel nets and bag seines banned in Texas coastal waters
3/1991	Summer trotline ban is repealed

Table 14. Recreational bag and length limits for saltwater fish, crabs, and oyster from TPWD 2004-2005.

Species	Daily Bag	Length in Inches (Minimum-Maximum)
Amberjack, Greater	1	32 - No limit
Bass: striped, its hybrids and subspecies	5 (in any combination)	18 - No limit
Catfish: channel and blue catfish, their hybrids and subspecies	25 (in any combination)	12 - No limit
Catfish, flathead	5	18 - No limit
Catfish, gafftopsail	No limit	14 - No limit
Cobia	2	37 - No limit
Drum, black	5	14 - 30
Drum, red*	3	20 - 28*
Flounder: all species, their hybrids and subspecies	10 (in any combination)	14 - No limit
Grouper, goliath (formerly called Jewfish)	0	Catch and release only
Mackerel, king	2	27 - No limit
Mackerel, Spanish	15	14 - No limit
Marlin, blue	No limit	131 - No limit
Marlin, white	No limit	86 - No limit
Mullet: all species, their hybrids and subspecies**	No limit	No limit - 12** (during Oct., Nov., Dec. & Jan.)
Sailfish	No limit	84 - No limit
Seatrout, spotted***	10	15 - 25***
Shark: all species, their hybrids and subspecies	1	24 - No limit
Sheepshead	5	12 - No limit
Snapper, lane	No limit	8 - No limit
Snapper, red	4	15 - No limit
Snapper, vermilion	No limit	10 - No limit
Snook	1	24 - 28
Tarpon****	0	Catch and release only****
Blue Crab	none	5
Stone Crab (right claw only)	none	2.5 inch claw
Ghost shrimp	20	none
Oyster	2 bushels	3 -14

\* Red drum special regulation: One red drum over the stated maximum length limit may be retained when affixed with a properly completed Red Drum Tag and one red drum over the stated maximum length limit may be retained when affixed with a properly completed Bonus Red Drum Tag.

\*\* May not take from public waters, or possess on board a boat, mullet over 12 inches during October, November, December, and January. No limits apply during other months.

\*\*\* No more than one spotted seatrout over the stated maximum length may be retained per person per day and counts as part of the daily bag and possession limit.

\*\*\*\* Tarpon special regulation: One tarpon 80 inches or larger in length may be retained during a license year when affixed with a properly executed Tarpon Tag.



Table 15. Commercial finfish fishery bag, possession and length limits from TPWD 2004 - 2005.

Species	Bag Limit	Possession Limit	Length in Inches (Minimum- Maximum)
Amberjack, greater	1	2	32 - No limit
Drum, black*	No limit	No limit	14 - 30
Catfish: blue & channel	25***(In any combination)	50 (In any combination)	14 - No limit
Catfish, gafftopsail	No limit	No limit	14 - No limit
Cobia	2	4	37 - No limit
Flounder <sup>o</sup>	60	60	14 - No limit
Mackerel, king	2	4	37 - No limit
Mackerel, Spanish	15	30	14 - No limit
Mullet: all species their hybrids & subspecies**	No limit	No limit	No limit - 12** (during Oct., Nov., Dec. & Jan.)
Snapper, lane	No limit	No limit	8 - No limit
Snapper, red	4	8	15 - No limit
Snapper, vermilion	No limit	No limit	10 - No limit
Shark: All species their hybrids & subspecies	1	2	24 - No limit
Sheepshead*	No limit	No limit	12 - No limit

<sup>o</sup>Special Regulation: The daily bag and possession limit for the holder of a valid commercial finfish fisherman's license is 60 flounder, except on board a licensed commercial shrimp boat the limit is 10 per person and is subject to the 50% bycatch rule.

\*Only the holder of a commercial finfish fisherman's license is exempt from recreational bag and possession limits while commercial fishing for black drum or sheepshead.

\*\*May not take from public waters or possess on board a boat mullet over 12 inches during October, November, December and January. No limits apply during other months.

There is a Scientific Area in Redfish Bay (Figure 21 in the FPEIS), parts of which are within the Reserve boundary and regulated by the TPWD. Recently, the TPWD has authorized additional measures to protect seagrasses in the Scientific Area near Rockport, Texas. The rules take effect May 1, 2006 and make it illegal to uproot seagrass anywhere within the state scientific area. Violations would be a Class C misdemeanor punishable by a fine of up to \$500. A separate proposal to create three smaller propeller up or "no prop" zones inside the state scientific area were proposed, but not approved by the TPWD commission. Alongside the new rules, TPWD staff will continue and expand a concerted public education campaign, including extensive efforts to identify and mark access points into the area to minimize seagrass loss. This is another example of an opportunity for Reserve staff to participate in education and training.

#### *Criminal Penalties and Civil Value Recovery*

Penalties are severe. Violation of fish and wildlife laws require civil restitution, and may also require:

- be fined (Class C - \$25-\$500; Class B - \$200-\$2000; Class A - \$500-\$4000; State Jail Felony, \$1500-\$10,000);
- be jailed (Class B and higher offenses);

- face automatic suspension or revocation of licenses for up to 5 years;
- forfeit hunting gear, including firearms, used to commit a violation.

In addition to the criminal penalty for hunting and fishing violations, the TPWD will seek the civil recovery value for the loss or damage to wildlife resources. The civil restitution cost is payable to TPWD and is in addition to the fine assessed by the court. Failure to pay the civil recovery value will result in the department's refusal to issue a license, tag, or permit. An individual who hunts or fishes after the refusal commits a class A misdemeanor which is punishable by a fine not less than \$500 or more than \$4,000; punishment in jail not to exceed one year; or both fine and confinement.

The general law states that anyone fishing in fresh water must possess a freshwater fishing stamp endorsement issued by the department. It is unlawful to take, attempt to take, or possess wildlife resources within a protected length limit, in greater numbers, by other means, or at any time or place, other than as indicated within this guide. A person who is hunting, fishing, or trapping must carry on their person and have available for inspection a valid license and any applicable stamp endorsements or permits unless the person is exempt from license, stamp, or permit requirements. A reasonable effort must be made to retrieve all wounded game birds and game animals and they must be killed immediately and become a part of the legal bag limit. It is a violation to fail to keep all edible portions of a game bird, game animal, or fish in an edible condition. For whitetail and mule deer, pronghorn antelope, and desert bighorn sheep, the violation is a Class A misdemeanor.

#### *Equipment Regulations*

In fresh water, it is unlawful to fish with more than 100 hooks on all devices combined, to take game fish and nongame fish sections of rivers lying totally within boundaries of a state park with any other gear besides pole and line, to take fish with a hand operated device held underwater except that a spear or speargun may be used to take nongame fish.

A cast net may be used to take nongame fish and shrimp only, may not be greater than 14 feet in diameter, and in salt water, nongame fish may be taken for bait purposes only. A dip net may be used to take nongame fish only, may be used to aid in the landing of fish caught on other legal devices, and in salt water, nongame fish may be taken for bait purposes only. A gaff may only be used to aid in the landing of fish caught on other legal devices, means or methods. Fish landed with a gaff may not be below the minimum, above the maximum, or within a protected length limit. A gig may be used to take nongame fish only. A jugline may only be used in freshwater, and may only be used to take nongame fish, channel catfish, blue catfish and flathead catfish only. Lawful archery equipment (longbow, recurved bow, compound bow and crossbow) may be used to take nongame fish only. A minnow trap may be used to take nongame fish only. The trap may not exceed 24 inches in length or with a throat larger than one by three inches, and in salt water, gear tag valid for only 30 days must be visibly attached. A perch trap is for use in salt water only, may be used to take nongame fish only, may not exceed 18 cubic feet, must be marked with a floating visible orange buoy not less than 6 inches in height and 6 inches in width. The buoy must have a gear tag valid only for 30 days attached, and must be equipped with a degradable panel sewn or tied with untreated jute twine or untreated steel wire less than 20 ga in the sidewall of the trap. Buoys or floats may not be made of plastic bottle(s) of any color or size. It is unlawful to place any type of trap within the area in Cedar Bayou between a department sign erected where Mesquite Bay flows into Cedar Bayou and the department sign erected near the point where the pass empties into the Gulf of Mexico. It is unlawful to take or attempt to take fish with one or more hooks attached to a line or artificial lure used in a manner to foul-hook a fish (snagging or jerking). A fish is foul-hooked when caught by a hook in an area other than the fish's mouth.

A sail line is for use in salt water only. Nongame fish, red drum, spotted seatrout, and sharks may be taken with a sail line. No more than 1 sail line may be used per fisherman. The sail line must be attended at all times the line is fishing, and may not be used by the holder of a commercial fishing license. The sail line must have a valid Saltwater Trotline Tag for each 300 feet of mainline or fraction thereof being fished. A sail line may not exceed 1800 feet from reel to sail, sail and the most shoreward float must be bright orange or red color and all other floats must be yellow. No float may be more than 200 feet from the sail. A seine may be used to take nongame fish and shrimp only, may not be longer than 20 feet, may not have mesh exceeding 1/2-inch square, must be manually operated, and in salt water nongame fish may be taken by seine for bait purposes only. A shad trawl is for use in freshwater only and may be used to take nongame fish only, may not be longer than 6 feet or with a mouth larger than 36 inches in diameter, may be equipped with a funnel or throat and must be towed by boat or hand. A spear and speargun may be used to take nongame fish only. A throwline

is for use in fresh water only. Components of a throwline may also include swivels, snaps, rubber and rigid support structures, may be used to take nongame fish, channel catfish, blue catfish and flathead catfish only. An individual bait-shrimp trawl is for use in salt water only and only nongame fish (except those species regulated by bag or size limits) taken incidental to legal shrimping operations may be retained. "Legal shrimping operations" means the use of a legal trawl in places, at times and in manners as authorized by the Texas Parks and Wildlife Department. A maximum of 200 nongame fish taken with an individual bait-shrimp trawl may be retained per person for bait purposes only. Only nongame fish, channel catfish, blue catfish, and flathead catfish may be taken by trotline. An umbrella net may be used to take crabs and nongame fish only, and may not have within the frame an area that exceeds 16 square feet.

#### Water Uses and Freshwater Inflow

There are several state agencies that regulate water use and freshwater inflow. The Texas Commission on Environmental Quality (TCEQ) sets the standards for surface water quality for bodies of water in the state (subject to approval by the U. S. Environmental Protection Agency) and implements those standards by monitoring and assessing surface water resources and by regulating sources of pollution. Restoration efforts to improve impaired water supplies attempt to bring sub-quality water up to the respective standards. In the water quantity area, TCEQ is responsible for processing and acting on applications for permits to use the state's surface water (known as "water rights"), including any applications to transfer surface water from one river basin to another (known as "interbasin transfers"). TCEQ is also responsible for developing models (known as "Water Availability Models" or "WAMs") to determine available amounts of surface water in the various river basins of the state.

The Texas Parks and Wildlife Department (TPWD) is designated as the state trustee for aquatic resources, but it has no direct regulatory authority to ensure water quality and quantity for fish, wildlife, and recreational sources. TPWD provides recommendations to TCEQ on scheduling of instream flows and freshwater inflows, as well as recommendations regarding permit conditions and mitigation requirements to protect fish and wildlife resources.

The Texas Water Development Board (TWDB) is responsible for water planning and administering water financing for the state. The mission of the Water Development Board is to provide leadership, technical services and financial assistance to support planning, conservation and development of water for Texas. The Reserve is in water planning district N, the Coastal Bend Region (TWDB 2002). There are no new reservoirs planned for this region through 2050, but several small desalination projects are planned.

The Texas State Soil and Water Conservation Board (TSSWCB) implements the Texas Soil Conservation Law, which was enacted to combat soil erosion. In the 1970s the agency was designated as the lead state agency for addressing non point source pollution from agricultural operations.

There are also regional entities although have little to no regulatory authority, play critical roles in make decisions about water sources. Groundwater Conservation Districts (GCD) provide groundwater management and conservation and are authorized by the Texas Legislature to provide for the conservation, preservation, protection, recharge, and prevention of waste of groundwater and groundwater reservoirs. They are the state's preferred method of managing groundwater resources. While no state agency has the right to regulate the production or use of groundwater, districts can provide some local controls. GCDs are required by law to develop and adopt a groundwater management plan. The goals of this plan are to provide for efficient use of groundwater, control and prevent waste and subsidence (the lowering of land elevation due to extracting too much water beneath it), and address issues such as conjunctive water use, natural resources, drought conditions, and conservation.

River Authorities are another regional entity that is designed to protect and monitor Texas' rivers for the state's inhabitants and ecosystems. There are more than 20 river authorities in Texas and, their primary function is to distribute and conserve the state's surface water. River authorities are monitored by TCEQ and are accountable to the Texas Legislature. Currently the Mission and Aransas Rivers do not have river authorities.

### Transportation

The United States Army Corps of Engineers (USACE) is one of the regulatory agencies for waterway transportation. The primary objectives of the USACE are:

- (1) Plan, design, and construct river and harbor, multiple purpose, and flood control works;
- (2) Operate and maintain flood control and navigation facilities and installations;
- (3) Administer laws for the protection and preservation of navigable waters and wetlands.

The NERR site is within the Galveston District of the Southwestern Division. The Galveston District, administers the federal regulatory program, governing work on structures in navigable waters of the U.S. and controlling discharge of dredged or fill material in coastal and inland waters and wetlands. The Galveston district puts every project through rigorous environmental scrutiny designed to protect and enhance the area's well-being.

The USACE, under the authority of the Flood Control Act of 1970, has initiated various Section 216 Studies. These studies review and look at specific water resources projects that may have changed because of physical or economic reasons. The Texas Department of Transportation (TxDOT) acts as the nonfederal sponsor for the studies involving the Gulf Intracoastal Water Way (GIWW) in Texas. For the Texas portion of the GIWW, the waterway was divided into five separate Section 216 study areas. The NERR site falls into the Port O'Connor to Corpus Christi Section 216 Study area, which is estimated to be completed in 2007. The entire GIWW is excluded from the Reserve boundary, but it is adjacent to the Reserve core and buffer areas.

The TxDOT is the state agency charged with providing the safe, effective and efficient movement of people and goods. The primary objectives TxDOT for the GIWW are:

- (1) Support the marine commerce and economy of this state by providing for the shallow draft navigation of the state's coastal waters in an environmentally sound manner;
  - (2) Prevent waste of publicly and privately owned natural resources;
  - (3) Prevent or minimize adverse impacts on the environment; and (4) maintain, preserve, and enhance wildlife and fisheries.
- (Texas Transportation Code Title 4. Navigation Subtitle A. Waterways and Ports, Ch 51. Texas Coastal Waterway Act § 51.001. Acts 1995, 74th Leg., ch. 165, § 1, eff. Sept. 1, 1995)

The placement of dredged material is important to the Texas coast because of large abundances of seagrass beds. TxDOT advocates that dredged material is to be used beneficially when possible and that the Texas Coastal Management Program develop rules that a) reward sponsors of environmental beneficial usage of dredged material projects with mitigation credits and b) eliminate long-term maintenance requirements for sponsors of beneficial usage of dredged material projects. In 2002, 2,228,000 cubic yards were dredged and placed on spoil islands along Aransas Bay (GIWW 2002). Additional dredging and placement still needs to occur adjacent to the Aransas National Wildlife Refuge (ANWR). The ANWR team has currently completed their EIS and Dredged Material Management Plan (DMMP) and is now designing various beneficial use of dredged material projects to be built over the next several dredging cycles.

### *Emergency Response*

There are several emergency response procedures in the event of an accident from marine traffic on the GIWW. If the accident is primarily a navigation hazard, the Coast Guard and USACE will notify the vessel owner. If the vessel owner fails to remove the hazard, then the USACE will work with the Coast Guard to remove it.

In the event of an oil spill from a barge, the GLO handles the response and remediation through their Oil Spill Prevention and Response Program. Further details on this program are in section 3.4.1. In addition, the Coast Guard requires that certain vessels prepare approved Vessel Response Plans and/or Shipboard Oil Pollution Emergency Plans. Certain vessels carrying noxious liquid substances are required to prepare and submit Shipboard Marine Pollution Emergency Plans to the Coast Guard.

The Coast Guard is responsible for cleanup and organization of emergencies that occur during the water transport of hazardous chemicals. The Coast Guard has developed a Chemical Hazards Response Information System (CHRIS)

manual to provide information needed for decision-making during emergencies that occur during the water transport of hazardous chemicals ([www.chrismanual.com](http://www.chrismanual.com)). The CHRIS also provides much information that can be used by the Coast Guard in its efforts to achieve better safety procedures and so prevent accidents.

In addition to the Coast Guard, the US National Response System is also involved in the event of an accident. In Texas, Regional Response Team (RRT) 6 is the federal component of the National Response System. The Region 6 RRT is composed of representatives from sixteen federal departments and agencies. The Region 6 RRT is responsible for preparedness activities including planning, training, and exercising to ensure an effective response to releases of hazardous substances and oil spills. The RRT also provides assistance as requested by the On-Scene Coordinator during an incident.

#### Surveillance and Enforcement within the Mission-Aransas NERR

##### *Texas Parks and Wildlife Department*

Currently, enforcement of natural resource regulations within the Mission-Aransas Estuary is conducted by the TPWD Law Enforcement Division. The Division provides a comprehensive statewide law enforcement program to protect Texas' wildlife, other natural resources, and the environment. The Division also provides safe boating and recreational water safety on public waters by ensuring compliance with applicable state laws and regulations. Texas Game Wardens are responsible for enforcement of the Parks and Wildlife Code, all TPWD regulations, the Texas Penal Code and selected statutes and regulations applicable to clean air and water, hazardous materials and human health. Wardens fulfill these responsibilities through educating the public about various laws and regulations, preventing violations by conducting high visibility patrols, and apprehending and arresting violators. Operation Game Thief provides citizens with a toll-free number to report poaching and other violations. The Law Enforcement Division employs about 500 wardens throughout the state and operates 27 field offices that sell licenses, register boats, and provide the public with local information across the state. The Reserve is served by Region 10, and there is a District office in Rockport, Texas.

##### *U.S. Coast Guard*

The United States Coast Guard, stationed in Port Aransas, Texas also provides surveillance and enforcement of boat traffic in the NERR area. The Coast Guard is a military, multi-mission, maritime service and one of the nation's five Armed Services. Its mission is to protect the public, the environment, and U.S. economic interests in the nation's ports and waterways, along the coast, on international waters, or in any maritime region as required to support national security. The Coast Guard is a first responder during oil spills.

##### *U.S. Fish and Wildlife Service*

The U.S. Fish and Wildlife Service (USFWS) provides surveillance of the Aransas National Wildlife Refuge and the Matagorda Island National Wildlife Refuge. The Office of Law Enforcement contributes to the USFWS efforts to manage ecosystems, save endangered species, conserve migratory birds, preserve wildlife habitat, restore fisheries, combat invasive species, and promote international wildlife conservation. The USFWS law enforcement focuses on threats to wildlife resource-illegal trade, unlawful commercial exploitation, habitat destruction, and environmental contaminants. The Office of Law Enforcement investigates wildlife crimes, regulates wildlife trade, helps Americans understand and obey wildlife protections laws, and works in partnership with international, state, and tribal counterparts to conserve wildlife resources.

##### *The University of Texas at Austin*

The University of Texas Police Department provides patrols of the UTMSI property in Port Aransas that will be included as a buffer area of the Reserve. The UT police act in concert with local law enforcement. Local city police and county sheriff patrols provide the another source of periodic policing in the buffer areas.

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