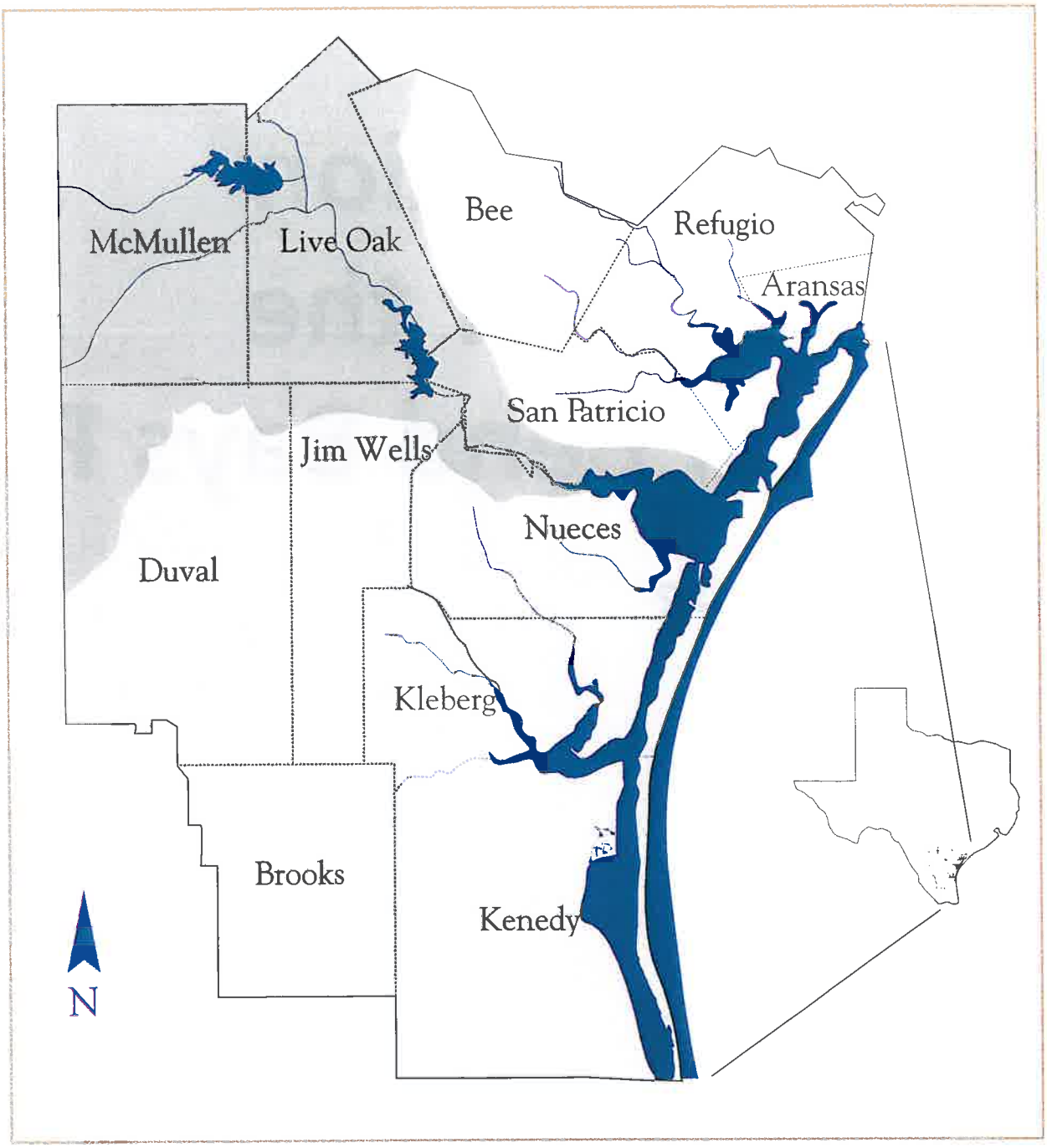
Implementation Strategy for the Coastal Bend Bays Plan

August 1998

SFR-60/CBBEP-2



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Implementation Strategy for the Coastal Bend Bays Plan

To Conserve and Manage the Coastal Bend Bays of South Texas

A product of the Coastal Bend Bays and Estuaries Program, Publication #CBBEP-2

August 1998

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SFR-60

Corpus Christi Bay
NATIONAL ESTUARY PROGRAM

July 30, 1998

The Honorable George W. Bush
P.O. Box 12428
Austin, TX 78711

RE: Completion and approval of the *Coastal Bend Bays Plan*

Dear Governor Bush:

We are proud to submit the ***Coastal Bend Bays Plan*** for your approval. Over 40,000 volunteer hours contributed by concerned stakeholders have resulted in this comprehensive and scientifically-grounded plan to enhance the value of our natural resources while allowing for a sustainable economic base in South Texas. The ***Bays Plan*** exemplifies your vision of bringing local participation and leadership into the State's resource management efforts. Moreover, the Plan is fully consistent with state programs and requirements, including the Texas Coastal Management Program. We look forward to your approval and the state's submittal of the ***Bays Plan*** to the EPA Administrator for approval and continued federal funding. Your continued support for implementation of the actions contained in the ***Bays Plan*** is most appreciated.

Commissioner John Baker, TNRCC
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Acronyms

ACCP	Aransas Corpus Christi Pilots
AGC	Association of General Contractors
ANWR	Aransas National Wildlife Refuge
APTF	Action Plan Task Force
BEG	Bureau of Economic Geology
BMP	Best Management Practice
BOT	Board of Trade
BUG	Beneficial Uses Group
CAC	Citizens Advisory Council
CBBEP	Coastal Bend Bays and Estuaries Program
CBBF	Coastal Bend Bays Foundation
CBCOG	Coastal Bend Council of Governments
CBCOG-RTAC	Coastal Bend Council of Governments – Regional Technical Advisory Committee
CBECC	Coastal Bend Environmental Coordinating Committee
CBI	Conrad Blucher Institute
CCA	Coastal Conservation Association
CCBNEP	Corpus Christi Bay National Estuary Program
CCC	Coastal Coordinating Council
CCS	Center for Coastal Studies
CDC	Center for Disease Control
CGI	Common Gateway Interface
CMC	Center for Marine Conservation
COAST	Cabin Owners Association of Texas
COC	Chamber of Commerce
CPL	Central Power and Light
CZMA	Coastal Zone Management Act
DPH	Department of Public Health
EDF	Environmental Defense Fund
EIS	Environmental Impact Statement
EMC	Event Mean Concentration
EQIP	Environmental Quality Incentives Program
GCCBA	Greater Corpus Christi Business Alliance
GIS	Geographic Information System
GIWW	Gulf Intracoastal Waterway
GLCI	Grazing Lands Conservation Initiative
GOMP	Gulf of Mexico Program
GPS	Global Positioning System
HAB	Harmful Algal Blooms
HAZMAT	Hazardous Material
ICT	Interagency Coordination Team
IOTB	Ingleside-on-the-Bay
LEPC	Local Emergency Planning Committee
MC	Management Committee
NADP	National Atmospheric Deposition Program

Acronyms *(cont.)*

NEAC	Nueces Estuary Advisory Committee
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service
NRI	Natural Resources Inventory
NWI	National Wetlands Inventory
NWS	National Weather Service
OMSA	Offshore Marine Supply Association
OPUS	Organization for the Protection of an Unblemished Shoreline
OSSF	On-Site Sewage Facility
PCCA	Port of Corpus Christi Authority
PICC	Port Industries of Corpus Christi
PINS	Padre Island National Seashore
PSA	Public Service Announcement
RSPA	Research and Special Programs Administration, an agency of the federal Department of Transportation
RTC	Regional Tourism Council
STAC	Scientific and Technical Advisory Committee
SPMWD	San Patricio Municipal Water District
STCZAC	South Texas Coastal Zone Advisory Committee
STSSN	Sea Turtle Stranding and Salvage Network
SWCD	Soil and Water Conservation District
TAES	Texas Agriculture Experiment Station
TAEX	Texas Agricultural Extension Service
TAMU	Texas A&M University
TAMU – CC	Texas A&M University – Corpus Christi
TCOON	Texas Coastal Oceanic Observation Network
TCMP	Texas Coastal Management Program
TDA	Texas Department of Agriculture
TDH	Texas Department of Health
TEA	Texas Education Association
TGLO	Texas General Land Office
TMDL	Total Maximum Daily Load
TMMSN	Texas Marine Mammal Stranding Network
TNC	The Nature Conservancy
TNRCC	Texas Natural Resource Conservation Commission
TNRIS	Texas Natural Resources Information Service
TPWD	Texas Parks and Wildlife Department

Acronyms *(cont.)*

TRC	Texas Railroad Commission
TSA	Texas State Aquarium
TSPA	Texas Seafood Producers Association
TSN	Turtle Stranding Network
TSSWCB	Texas State Soil and Water Conservation Board
TWDB	Texas Water Development Board
TWOA/AWO	Texas Waterway Operators Association/American Waterway Operators
TXDOT	Texas Department of Transportation
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USNPS	United States National Park Service
UTBEG	University of Texas Bureau of Economic Geology
UTMSI	University of Texas Marine Science Institute
WILD	Wildlife in Learning Design Project

Glossary

Atmospheric deposition: A complex phenomenon that occurs when emissions of sulfur, nitrogen compounds, and other substances are transformed by chemical processes in the atmosphere and then deposited on earth in either a dry or wet form.

Aquaculture: The production of stocks of marine or estuarine organisms by rearing in a controlled environment. A controlled environment provides and maintains throughout the rearing process one or more of the following: predator protection, food, water circulation, salinity, or temperature controls.

Benthic: Referring to the community of plants and animals that live on the bottom of waterbodies.

Best Management Practice (BMP): A method, activity, maintenance procedure or other practice for reducing the amount of pollution entering a waterbody.

Bioaccumulation: The uptake of toxic chemicals leading to elevated concentrations of those substances within plant or animal tissue.

Bycatch: The unintended taking of a species while net fishing for another species.

Contact recreation: Activities that cause people to contact water, such as swimming, boating, windsurfing, etc.

Ecosystem: An ecological community and its environment functioning as a unit in nature.

Glossary *(cont.)*

Entrainment: Occurs when an organism is drawn into a water intake and cannot escape.

Epidemiological: Relating to the science of addressing the incidence, distribution, and control of disease in a population.

Estuary: A coastal waterbody, with tidal mixing, where fresh water from rivers mixes with salt water from the ocean.

Eutrophication: The process during which a waterbody becomes highly loaded with nutrients, (primarily nitrogen and phosphorous), sometimes causing oxygen depletion from algal overgrowth or blooms.

Geographic Information System (GIS): A computer system that enables one to create and analyze electronic maps that depict various types of data, such as wetland coverages, toxic waste sites, etc.

Hypersaline: Extremely high levels of salinity.

Impingement: Occurs when an entrapped organism is held in contact with the intake screen and is unable to free itself.

National Pollutant Discharge Elimination System (NPDES): A provision of the Clean Water Act which prohibits discharge of pollutants into waters of the U.S. unless a special permit is issued by U.S. EPA or a state.

Nonpoint Source: An indirect discharge, not from a pipe or other specific source. Includes water running off the land's surface directly into waterbodies or running off streets or other paved areas into a centralized collection system.

Nutrient: Any substance assimilated by living things that promotes growth.

Pathogenic organisms: Biological agents, such as bacteria and viruses, that cause sickness or disease.

Phytoplankton: Microscopic algae that are freely floating in aquatic systems.

Planktonic: Referring to tiny plants and animals that live in water.

Point Source: A specific source or point of origin, such as a discharge pipe or outfall.

Riparian: Habitat occurring along the bank of a river, lake, stream, or creek.

Glossary *(cont.)*

Sustainable economic growth: Growth that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Stakeholder: One who is interested in or impacted by a project.

Turbidity: A cloudy condition in water due to suspended silt or organic matter.

Watershed: The land area that drains into a stream, river, estuary, or other waterbody; same as drainage area.

Xeriscape: The use of native plants and other vegetation for landscaping.

Vision

As the stewards of the bays and estuaries, we acknowledge that our values and actions must reflect our interdependence with the bay. We envision a Coastal Bend which supports a high quality of life for its inhabitants and a thriving bay system which is sustained throughout all generations. We hold ourselves responsible for the management of our precious resource, the bay system.

Our guiding principles:

- Promote healthy and diverse economic, social, and ecological systems.
- Facilitate enlightened public action through education and dialogue with all interested parties.
- Maintain a balance of people and nature.
- Achieve equity among competing uses.
- Seek and implement sustainable solutions.

To achieve this vision, we promise to work cooperatively with all interests to forge lasting relationships, based on mutual respect, which provide for the needs of all inhabitants of the Coastal Bend.

Corpus Christi Bay National Estuary Program
Management Conference

Management Conference Operating Principles

- Incorporate into the comprehensive plan a balanced consideration of the interdependence of natural processes and human uses operating within upper watersheds, bays and estuaries, and the Gulf of Mexico.
- Obtain sound data from an adequately funded regional monitoring and applied research program.
- Maintain clean water and sediment, and the diversity of native living resources and habitat.
- Maintain essential freshwater inflows to the estuaries.
- Provide safe waters for swimming, clean beaches for recreation, and sustainable supplies of safe seafood for residents and visitors.
- Preserve open space, with free and easy public access to meet the needs of a growing population.
- Manage the bay system so that it can survive catastrophic events and adapt to changing conditions.

Statement of Purpose

In April 1992, as a result of growing local concerns about the health and productivity of the bay system, the Texas Coastal Bend Bays were nominated for inclusion in the National Estuary Program (NEP). The bay system was designated an "estuary of national significance" in October 1992, and a Management Conference was convened. The Corpus Christi Bay National Estuary Program (CCBNEP) was thus established in late 1993 -- a four-year, community-based, consensus-building effort to identify problems facing the bay system, and to develop a long-term comprehensive conservation and management plan, called the ***Coastal Bend Bays Plan***.

This ***Implementation Strategy*** for the ***Coastal Bend Bays Plan*** provides highlights of the project area (see Figure 1) -- its physical and biological setting, population, land use, and economy; an overview of the Management Conference structure and how the plan was developed; and detailed Action Plans related to a set of Priority Issues.

The Action Plans were initially developed at a January 1996 workshop, and have been subsequently refined and further developed through the cumulative efforts of more than 325 individuals representing over 100 organizations. Fourteen Task Forces, comprised of interested stakeholders on a self-assigned or invited basis, have led the detailed planning effort. Meanwhile, Management Conference members have provided direction through discussions within their committees and at three All-Conference Workshops designed to focus on the emerging Plan. During the February/March 1998 public comment period on the draft ***Bays Plan*** and ***Implementation Strategy***, four Town Hall meetings were held with participation by 130 people. Over 185 comments were received and these comments were individually reviewed and considered in the revision to the two documents. Altogether, the ***Bays Plan*** is the product of more than 35,000 volunteer hours; a broad-based consensus is inherent in its framework for action.

The ***Bays Plan*** is designed to complement and coordinate existing resource management programs and plans. CCBNEP is now restructuring and preparing to implement the Plan under the auspices of the Coastal Bend Bays and Estuaries Program (CBBEP), as described in Chapter 8. Consensus has emerged on a set of guiding principles for the CBBEP. For example, the CBBEP will <u>not</u> have regulatory or taxing authority, will <u>not</u> have a formal permit review role, and will <u>not</u> affect private property rights nor supersede existing local, state, and federal authority in any way. Rather, the Program will help focus limited

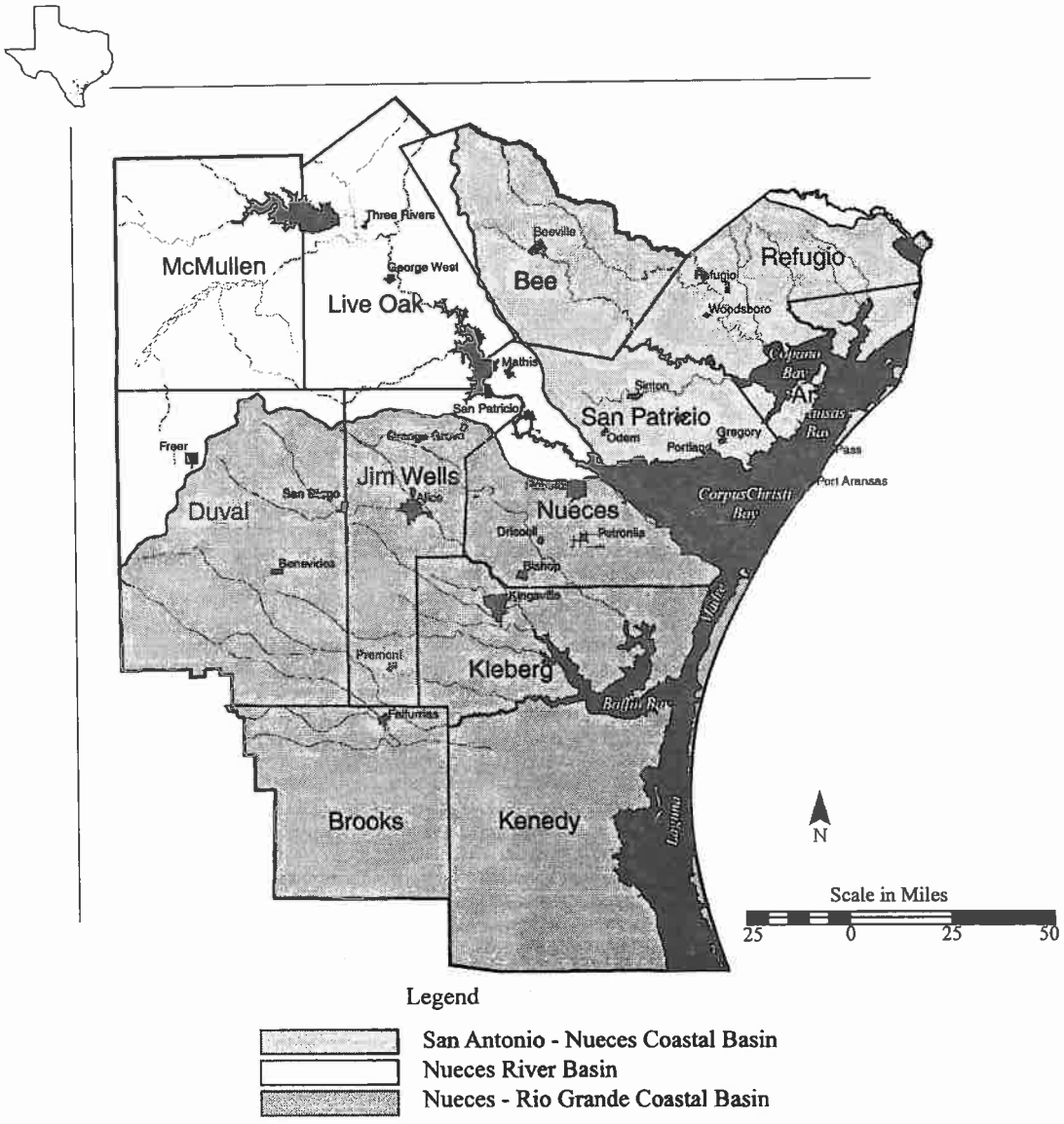


FIGURE 1 Map of the Project Area

technical and financial resources in a goal-directed manner to effect resource management at the regional scale.

The CBBEP's fundamental purpose is to protect, restore, or enhance the quality of the water, sediments, and living resources found in the bay system. The ***Bays Plan*** is based on technical assessments of the bay system's ecological health and its present and future economic values, including the value of its ecological services. These free ecological services include, at a minimum, the maintenance of wildlife and fisheries populations, control of sediment run-off, flood control, protection against storm surge and wind damage, nutrient and chemical cycling, maintenance of biological diversity, and water quality enhancement.

The 50 priority actions described in this ***Implementation Strategy*** reflect a consensus of the Management Conference that they are: justified, based on sound science; technically and economically feasible; a benefit to the environment; and politically acceptable with wide community support.

CHAPTER 1
Introduction

An Estuary of National Significance

The enormous physical and geological forces that sculpt their shores define coastal regions. Wind and waves, the flow of freshwater from the land, evaporation, and the ebb and flow of tides place these areas at the center of a huge energy transfer. The result is tremendous biological productivity.

Estuaries are the cylinders of this massive engine and the transition zone between fresh and salt water. They are among the most dynamic and robust of nature's ecosystems. The Latin root *estuare* means 'surge, boil, or be in commotion', and conjures images of a surf zone at the mouths of rivers. Here, a continual supply of sediments and nutrients, and a salinity gradient to which only certain organisms have adapted, provide both sustenance and refuge from predators.

Along the Texas coast are seven major estuaries. Together, these 5,439 square kilometers (2,100 square miles) of sheltered water exhibit a remarkable diversity in geography, resources, climate, and industry. Waters and lands adjacent to this coast are richly endowed with petroleum reserves, agricultural land, wildlife, fisheries resources,

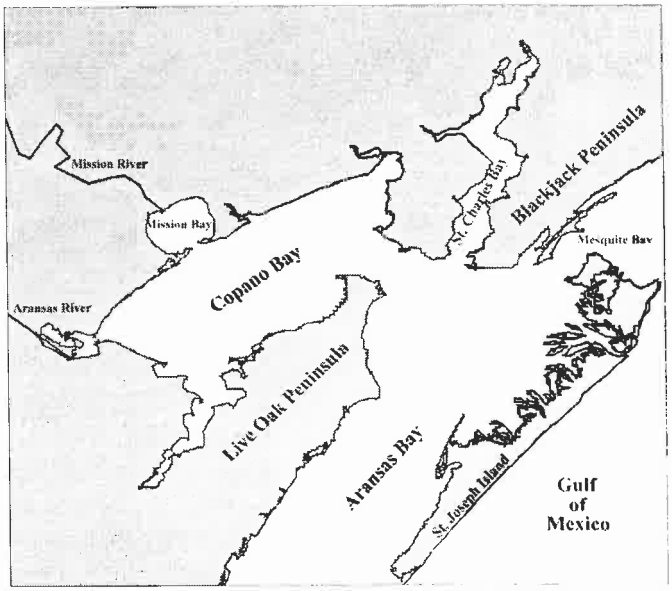


FIGURE 2 Aransas Estuary

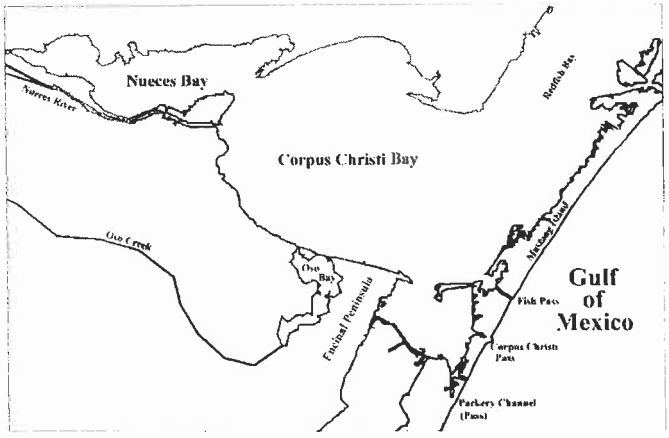


FIGURE 3 Corpus Christi Estuary

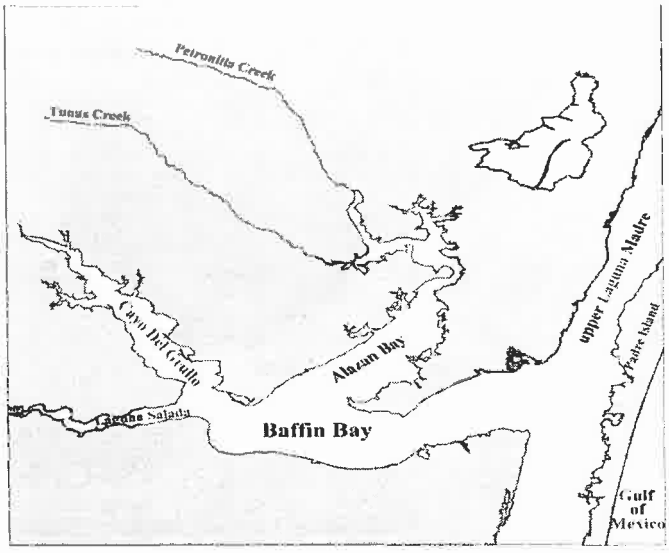
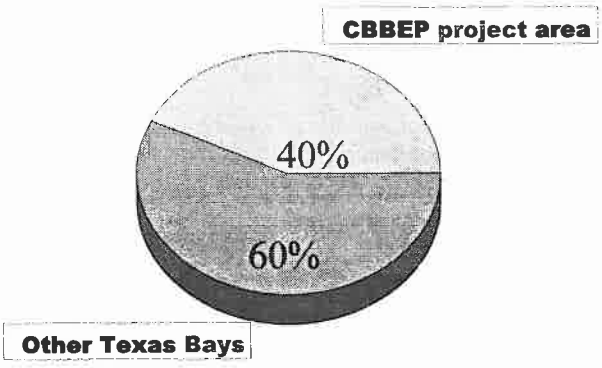


FIGURE 4 Upper Laguna Madre Estuary

recreational opportunity, and expansive, open lands in proximity to major population centers. One-third of the state's population and one-third of its economic resources are concentrated along this narrow width of land, which comprises only six percent of the total area of the state (Brown, *et al.,* 1976).

The Coastal Bend is blessed with three of the seven Texas estuaries -- the Aransas, Corpus Christi, and upper Laguna Madre estuaries (see Figures 2, 3, and 4 on page 1). Broad belts of mostly flat coastal prairies, chaparral pastureland, and farmlands adjacent to expansive bays characterize this transition zone between the mid- and lower-coast. A nearly unbroken string of barrier islands provides definition to the bays, estuaries, and one of only three hypersaline lagoons in the world.

More than 490 species of birds and 234 species of fish attest to the region's enormous biological diversity (Tunnel, *et al.*, 1996). Several major habitat types underlie this display of wealth, but seagrass meadows are of special significance and central to the high productivity of these estuaries. The Coastal Bend harbors 40 percent of the state's total seagrass acreage (Pulich, *et al.,* 1997) (see Figure 5).



Forty percent of the seagrass in Texas is found within the CBBEP project area.

FIGURE 5 Seagrass in Texas

Bay and Gulf commercial fisheries (shrimp and finfish combined) directly benefit from a productive bay system, and together generate $45 million in total output (sales) plus another $31.5 million in value-added to the region.[1] In 1995, commercial shrimping accounted for more than 900 local jobs (Jones, *et al.,* 1997).

Fishing for fun, tourism, and other recreational activities are big business. Over 30 percent of the state's saltwater fishing occurs in the region, where anglers spend millions of dollars each year on food, lodging, transportation, and fishing equipment. Meanwhile, nearly five million people visit these shores each year, with ecotourism becoming an increasingly important component of the travel industry (State Task Force on Texas Nature Tourism, 1996). Scenic views of the bays and the Gulf, pleasant climate, swimming, fishing, hunting, camping, boating, and growing opportunities for nature study, such as the Great Texas Coastal Birding Trail, together provide great allure for

[1] Value-added refers to the value of all goods and services produced, and is analogous to Gross Domestic Product as reported at the national level. Hence, value-added within a region may be referred to as Gross Regional Product.

for visitors from all parts of the globe. In 1995, tourism and related industries provided $470 million in output (sales), $286 million in value-added for the region, and generated more than 10,800 local jobs (Jones, *et al.*, 1997).

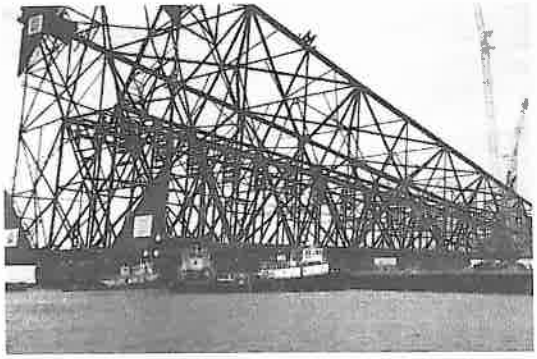
The presence of a deepwater port is of strategic economic importance. Corpus Christi Bay is gateway to the nation's sixth largest port and the third largest refinery and petrochemical complex. In addition to petroleum refining, there are many industries or activities that use the bays for navigation or transportation, including chemical industries, oil and gas extraction, transportation services, and the military's mine warfare center at Ingleside. In 1995, these activities generated over $2.4 billion in total output, another $1 billion in value-added for the region, and nearly 18,800 high-paying local jobs. Agriculture, including row crop farming and ranching, also benefits from the nearby port, generating an additional $520 million in total output, $430 million in value-added, and 9,300 jobs for the region (Jones, *et al.*, 1997).

Altogether, in 1995, bay related economic activities in the Coastal Bend provided over $4.1 billion in output (sales) to the regional economy, $2.3 billion in value-added, and generated more than 53,000 jobs for local residents (approximately one-third of all jobs in the region) (Jones, *et al.*, 1997).

Because of the increasing values, development pressures, and environmental impacts to the Coastal Bend Bays and the need to maintain a healthy economy, area citizens initiated a drive in early 1992 to nominate the bay system for inclusion in the National Estuary Program (NEP) (Texas Water Commission, 1992). Subsequently, the bay system was designated 'an estuary of national significance', and the Corpus Christi Bay National Estuary Program (CCBNEP) was established. Over a four year period, this community-based, consensus-building program identified problems facing the bays and estuaries, and developed a long-term comprehensive conservation and management plan, called the ***Coastal Bend Bays Plan***. This document, called the ***Implementation Strategy***, is the more detailed companion piece for the ***Bays Plan***. With the completion of the ***Bays Plan***, the CCBNEP is preparing to implement the Plan under the auspices of the Coastal Bend Bays and Estuaries Program (CBBEP) (see Chapter 8).

The ***Bays Plan*** focuses on the CBBEP 'project area', which includes all of the open water, submerged habitat, emergent wetland, and upland environments of the 12-county area known as the Coastal Bend (see Figure 1 in the Statement of Purpose). The 12 counties -- Refugio, Aransas, San Patricio, Nueces, Kleberg, Kenedy, Bee, Live Oak,

Altogether, in 1995, bay related economic activities in the Coastal Bend provided over $4.1 billion in output (sales) to the regional economy, $2.3 billion in value-added, and generated more than 53,000 jobs for local residents.



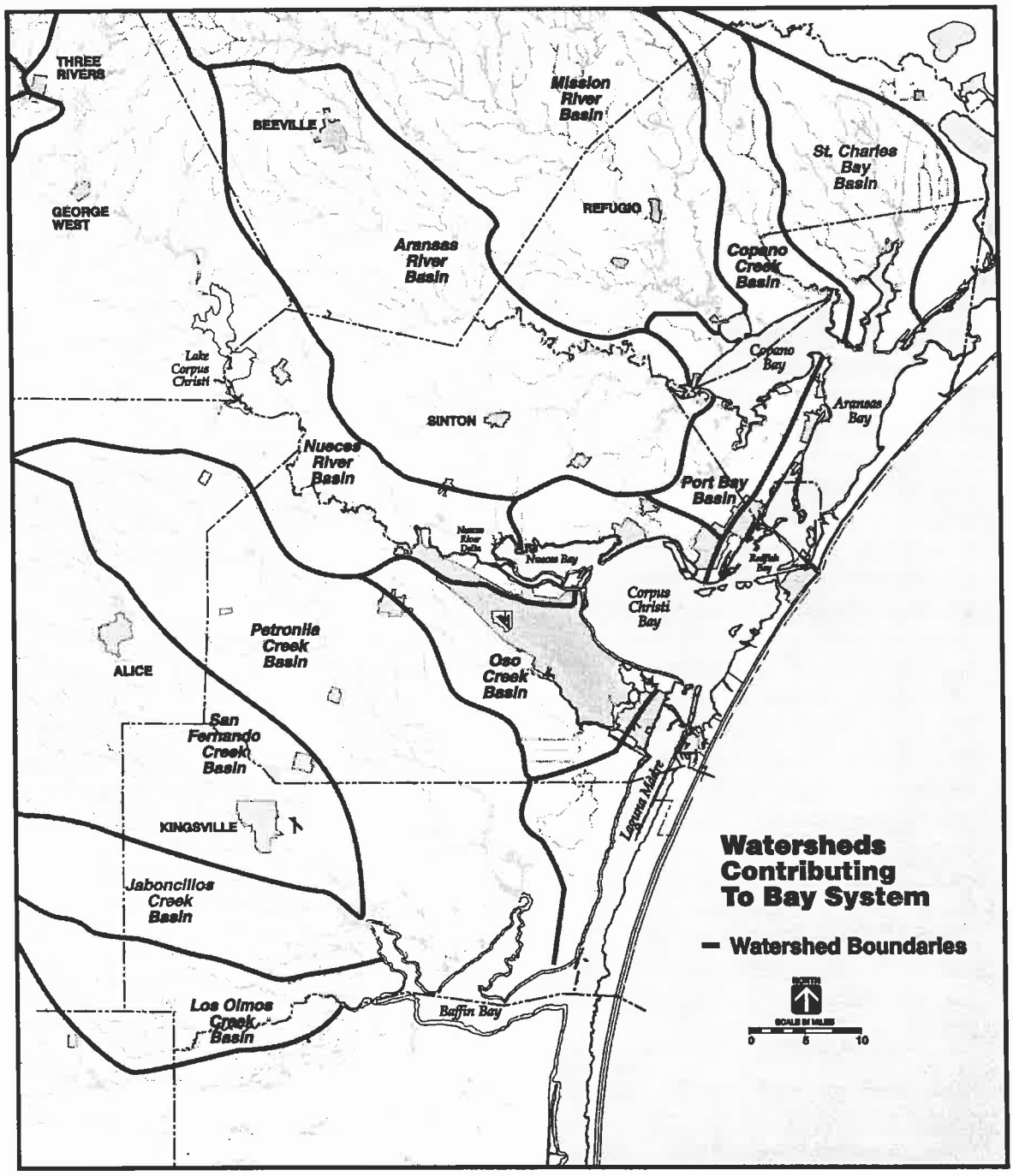


FIGURE 6 Watersheds Contributing to Bay System

McMullen, Jim Wells, Duval, and Brooks -- comprise more than 29,785 square kilometers (11,500 square miles) and are home to over 550,000 residents. The term 'bay system' refers specifically to all marine and estuarine waters (saline and brackish waters) behind the Gulf surf line from the eastern edge of Mesquite Bay (in San Antonio Bay) to the 'land cut' south of Baffin Bay in the upper Laguna Madre.

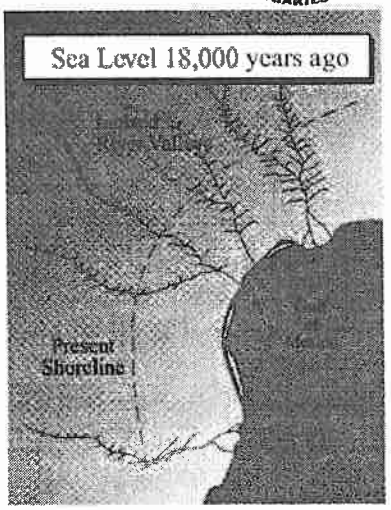
This delineation of the bay system's boundaries is based on the knowledge that these areas are physically linked, share a common connection with the Gulf of Mexico, and that the living resources of these bays are affected by human activities in all of these counties. Thus, while the ***Bays Plan*** addresses environmental issues within the bay system, the Action Plans are geared as appropriate to the watersheds and tributaries within the project area that drain into the bay system (see Figure 6 on page 4).

Regional Ecology

The three estuaries include 1,331 square kilometers (514 square miles) of bay surface waters and one major tidal pass to the Gulf of Mexico (the Aransas Pass). The Mission, Aransas, and Nueces rivers contribute the primary freshwater inflow, but overall the system receives limited inflow in proportion to its drainage area [comprised of three river basins totaling 58,521 square kilometers (22,595 square miles)]. The region has two reservoirs: Lake Corpus Christi and Choke Canyon Reservoir.

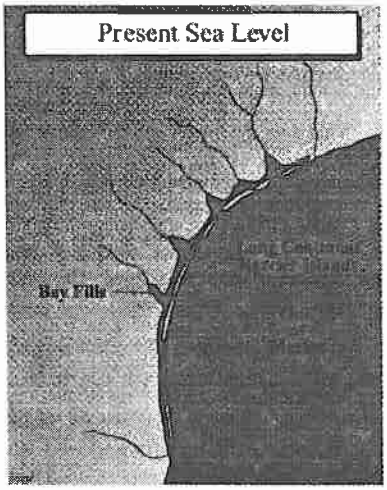
Geologically, the region is a product of the Ice Age or Pleistocene epoch. As the last glacial period diminished about 18,000 YBP (years before present), sea level began to rise across the present continental shelf. Between 2,800 to 2,500 YBP, sea level reached its approximate present level drowning the old river valleys. Longshore currents distributed sediments from the eroding river banks to form barrier islands, which allowed for semi-enclosed systems (bays and lagoons) to form where salinity gradients (from fresh to saline waters) created today's estuaries (see Figure 7).

The composition and distribution of the habitats and biota of the Coastal Bend are greatly influenced by climate. Regional climate is characterized as sub humid-to-semiarid, and subtropical, with extreme variability in precipitation and generally high humidity and infrequent but significant killing frosts. The project area mirrors on a small scale the north-to-south, moist-to-dry gradient characteristic of the entire Texas coast. Generally, the area experiences high temperatures along with deficiencies in moisture, especially to the south. Major



During the last glacial advance, sea level was 300 to 450 feet lower than today.

Barrier islands were typically short and segmented 2,800 years ago.



Present coastal conditions are marked by long, continuous barrier islands.

FIGURE 7 Sea Level Changes
[Source: Bureau of Economic Geology]

climatic factors are temperature, precipitation and evaporation, wind, tropical storms, and hurricanes.

Average winter low temperatures north to south range from 47-48° F, and average summer highs range from 92-96° F. Yearly averages range from 71-73° F. Average annual rainfall along the coast ranges from 36 inches in the north to 29 inches in the south. However, evaporation can exceed precipitation by as much as 60 percent in the south. In addition, rainfall comes typically at two times during a year (late spring and early fall), and variability between years can be dramatic (e.g., Corpus Christi: 5 inches in 1917 to 50 inches in 1992), causing droughts during consecutive years of low rainfall.

Southeasterly winds dominate the Coastal Bend wind regime, broken by northwesterly and northeasterly winds as cold fronts pass. Tropical storms or hurricanes occur on average every 1.5 years, and can be responsible for significant alterations to habitats and impacts on living resources (both positive and negative), in addition to losses of both life and property. These storms are most frequent during the months of August and September.

Hydrographic conditions are influenced primarily by climatic conditions, freshwater inflow, and, to a lesser extent, tidal exchange. Freshwater inflows, with attendant nutrients and sediments, are vital to sustaining the health of the estuaries. Great variability in these inflows is characteristic of the area and, coupled with increased water needs by an expanding human population, has reduced water availability for both humans and the bays in low-flow years.

Astronomical tides within the project area are predominantly diurnal (one high and one low per day), but they also have a semi-diurnal component (two highs and two lows per day). Average tidal range is about 1.5 ft. on the Gulf beaches and generally less than 0.5 ft. in the bays. Seasonal high tides occur during the spring (May) and fall (October), and seasonal lows occur during winter (February) and summer (July). Tidal exchange between the estuaries and Gulf of Mexico is due to astronomical tides, as well as meteorological conditions (winds, barometric pressure). Due to shallow bay depths and a relatively small tidal prism, wind exerts a greater influence on bay circulation than astronomical tides (Ward, 1997).

The habitats and living resources of the Coastal Bend are unique and diverse. The project area is at the crossroads of species from the east and west on land, as well as the north and south (temperate and tropical) on both land and in the estuaries. Species diversity is due to the wide array of land and aquatic habitat types: arid chaparral, riparian forests, oak savannas, oxbow lakes and swales, river deltas, coastal marshes and ponds, oyster reefs, seagrass beds, open bay bottoms, barrier islands, jetties and other hard substrates, and sandy beaches. Aerial coverage of selected habitats is found in Table 1.

The northern part of Padre Island (the longest barrier island in the world), and the upper Laguna Madre, a seagrass dominated ecosystem, are located in the southern portion of the project area and are of international significance. A persistent, harmful algal bloom, known as the Texas Brown Tide, plagued the upper Laguna Madre from January 1990 through 1997, the longest term for a marine algal bloom recorded worldwide. Although significantly diminished, pocket concentrations of the brown tide are still in evidence as the ***Bays Plan*** goes to press.

TABLE 1
Total area of selected habitats in the CBBEP project area.

Habitat (source)	Aerial coverage (ac)
Open water (Tunnell, *et al.*, 1996)	328,320
*Emergent wetland (White, *et al.*, 1998)	116,337
Wind-tidal flat (Withers and Tunnell, 1998)	39,585
Seagrass (Pulich, *et al.*, 1997)	92,509

*Does not include the area of the upper Laguna Madre south of Pita Island.

Living resources in the project area include 3,178 documented species of plants (836) and animals (2,342) recorded from eight habitat types: open bay, oyster reef, hard substrate, seagrass meadow, coastal marsh, tidal flat, barrier island, and Gulf beach (Tunnel, *et al.*, 1996). Of the 31 phyla and divisions (major groups), the diatoms and vascular plants are the most diverse plant groups, and the chordates, arthropods, molluscs, and segmented worms are the most diverse animal groups.

The region is one of the premier bird watching spots in the world with 494 recorded species of which 60 to 70 percent are migratory. The Aransas National Wildlife Refuge (NWR) has accounted for 393 species of birds, including the endangered whooping crane. This Refuge also has the second largest bird checklist in the NWR system, the first being the Laguna Atascosa NWR, a short distance to the south.

Thirty-five state listed endangered or threatened species inhabit or use the twelve-county area. Of these, 20 are also federally listed. Nineteen of the 35 state-listed species utilize estuaries, including the whooping crane; Arctic and American peregrine falcons; piping and snowy plovers; brown pelicans; Eskimo curlew; reddish egrets; opossum pipefish; and Kemp's Ridley, green, hawksbill, leatherback, and loggerhead sea turtles. The diamondback terrapin and the Gulf saltmarsh snake are two additional species of concern, although these are not federally or state listed. Certain marine mammals, such as the bottle-nosed dolphin which is common in the Aransas Pass area, are also protected species found here (Tunnel, *et al.*, 1996).

Oyster catcher

Invasion of terrestrial habitats by non-native species, such as fire ants, Africanized bees, and certain grasses is well documented, but less is known about introduced aquatic species in the area. Recently, the edible brown mussel has invaded jetties and other hard substrates in inlets and along the outer coast. Although this mussel has fluctuated widely in population numbers since its appearance in 1989 or 1990, it has not had a recognizable adverse impact on native populations or habitats. Even less is known about the range, numbers, and impacts of nutria, an introduced marsh dwelling rodent that was first seen here in the late 1970s.

Brown pelican

The Human Role -- Past and Present

The history of human settlement along the shores of Corpus Christi Bay and in the surrounding area is a story of change, both in the coastal environment, and in ways early people used the rich resources of these bays and lagoons.

Karankawa and Malaquite Indians were the first known inhabitants to fish these waters and hunt bison and deer on inland prairies. The hardy tribes handily adapted to a desolate, harsh environment. Some anthropologists estimate that native Indians lived here for 9,000 years, maybe more, yet their disappearance was complete by the mid-1800s (Ricklis, 1997).

Spanish explorer Alonzo de Pineda is credited with discovering Corpus Christi Bay in 1519, naming it after the Roman Catholic feast day on which he arrived. Two hundred years would pass before Spanish settlers established the first trading posts, laying claim to vast sections of a barren land named *El Desierto de los Muertos*, Desert of the Dead. As trading posts sprang up, bands of high seas pirates prospered smuggling contraband in and out of Corpus Christi Bay.

In the first half of the 19th century, the lands north of the Nueces River were settled through land grants from the King of Spain who recruited immigrants from Ireland to develop 'San Patricio'. By the 1840s, towns sprang up wherever a living could be made in the territory between the Nueces and the Rio Grande, land claimed by both Mexico and the Republic of Texas.

Karankawa Indian
[Illustration courtesy of McGregor Photo Collection of the Corpus Christi Museum]

By the late 1870s, commercial harvesting of oysters and turtles prospered. Inland, the King and Kenedy ranches made their starts in the sun-baked western and southern counties. Corpus Christi claimed one of the largest wool markets in America with more than a million sheep grazing in Nueces and Duval Counties. Within a decade, soaring land and cattle prices forced many shepherds to sell or move their herds (Jones, *et al.*, 1996).

Causeway between Corpus Christi and Portland in 1930.

Bayside Amusement Park on Corpus Christi Beach in the 1930s.
[Photo courtesy of McGregor Photo Collection of the Corpus Christi Museum]

Downtown Corpus Christi in 1939 before construction of the seawall.
[Photo courtesy of McGregor Photo Collection of the Corpus Christi Museum]

As Corpus Christi grew, increased shipping through a deepened channel bolstered the region's economy. Coastal factories processed and shipped tallow, hides, and pickled beef on schooners destined for New Orleans, Cuba, and England. The arrival of railroads in the mid-1880s opened new markets for agricultural produce. By the turn of the century, commercial fishermen harvested some three million pounds of seafood from the bay system each year. Turtles and oysters comprised one-third of the catch.

Despite devastating hurricanes and droughts, deadly yellow fever epidemics and bloody wars, both foreign and domestic, the area flourished. By 1926, the population had grown to 35,000. Agricultural commerce provided the impetus for constructing the deep-water Port of Corpus Christi. After the discovery of oil and natural gas, the Port quickly adapted to the needs of that industry too.

The military came to the region in a big way in 1941. Pilot training was the only mission in the early years, but aircraft overhaul and repair grew in importance after World War II. Today the region is home to the world's largest naval aircraft pilot training center, the nation's only mine warfare training center, and the world's largest military helicopter repair facility. Military operations in Corpus Christi, Ingleside, and Kingsville generate nearly 15,500 regional jobs and $406 million in personal income (Jones, *et al.*, 1997).

During a heyday of expansion, the Naval Air Station, the Corpus Christi seawall, and causeways to Portland and North Padre Island were built. But, by 1960, regional development slowed dramatically, foreshadowing an economic downturn that would be punctuated by a March 1986 crash of world oil prices. The crash shattered the region's economic base, and precipitated five years of staggering unemployment and low wages (Jones, *et al.*, 1997).

Since 1988, and now approaching the turn of the millennium, the region's economy has rebounded with renewed vigor -- and new challenges.

Regional Economy and Demography

The economy of the Coastal Bend region today is more diverse than ever and relies on several important sectors:

- Petroleum refining
- Chemical manufacturing
- Military training and aircraft maintenance
- Farming and ranching
- Commercial shrimping
- Visitor services (including recreational fishing)
- Energy exploration and production
- Food processing

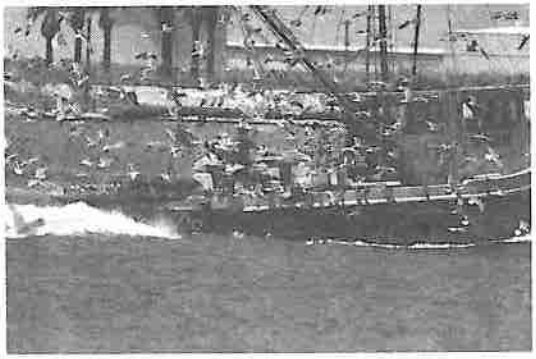
Most elements of this economy are dependent in some major or minor way on the bay system. Even farm prices are influenced by the availability of export markets that can be reached through the Port of Corpus Christi.

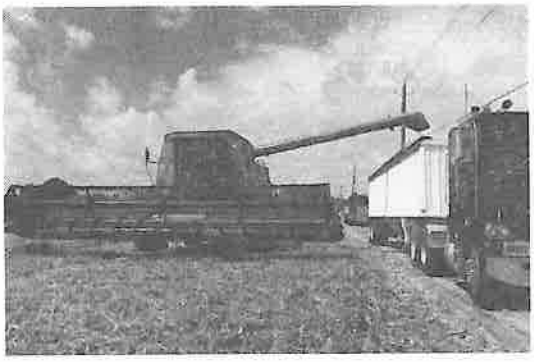
A significant portion of the manufacturing in the region is in capital intensive facilities that are made possible by the economics of efficient transportation by ship and barge over the bays. Originally, manufacturing plants were established to take advantage of local raw materials. Since 1970, however, these industries have become increasingly less dependent on local resources. Imported crude oil, bauxite, and other ores are delivered, processed here, and exported as bulk commodities.

Industries, which use the Corpus Christi Ship Channel and Intracoastal Waterway as their lifeline, have made the Port of Corpus Christi the sixth busiest in the nation in terms of tonnage. The total for 1996 was a record 80 million tons, up 260 percent since 1970, a period of higher oil imports and increased refining capacity. More than 99 percent of that total is moved as bulk cargo. Corpus Christi, with a 45-foot deep ship channel, has consistently led other Gulf ports in water depth. Deeper channels and berths are needed for the large bulk carriers and tankers to efficiently transport bulk cargoes.

The region is home to the third largest refinery and petrochemical complex in the U.S. in terms of production. Coastal Bend refineries have the combined capacity to process more than 700,000 barrels per day of crude oil, accounting for approximately 13 percent of Texas production and 5 percent of the U.S. total. While all port-related manufacturing industries create approximately 9,750 jobs, some 30 to 40 percent of the 155,000 total jobs in the region are directly or indirectly dependent on these industries.

Agriculture has always been an important part of the Coastal Bend economy despite the highly variable rainfall. Much of the agricultural land is managed as rangeland. This rangeland is used for a variety of purposes, including livestock production, wildlife habitat, and recreation. Rangeland watersheds are a major source of freshwater inflows for the area's bays and estuaries. Row crops include cotton, grain sorghum, and corn. Agriculture accounted for $448 million in value-added to the region in 1995 (Jones, *et al.*, 1997).





Onshore and offshore energy development continues to be important, both in jobs and in terms of royalty payments that flow to individuals in the region. Dozens of oil and gas fields and thousands of producing wells operate in the region. Energy exploration has been a highly cyclical industry throughout its 85-year history in South Texas. Total output and value of production continue a long-term decline as existing fields are depleted.

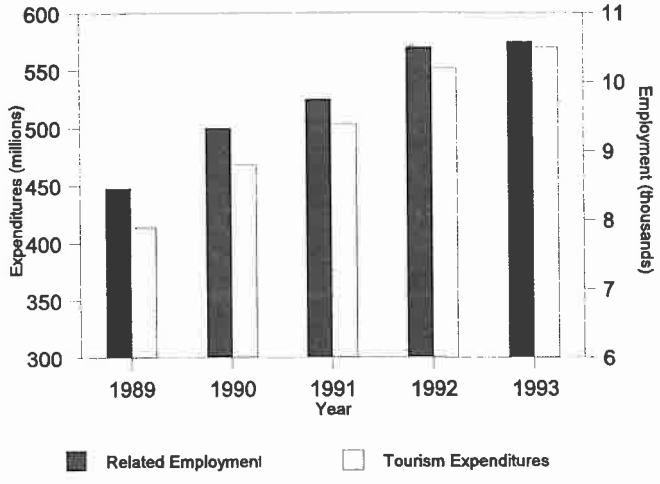


FIGURE 8 Tourism and Related Employment in the Coastal Bend

The Corpus Christi area is the second most frequented vacation destination in Texas with 5 million visitors annually. Leisure visitors come for the scenic bay vistas, island and bay beaches, fishing, hunting, windsurfing, birdwatching, and a set of major attractions including the Texas State Aquarium, the Museum of Science and History, the Columbus Fleet, and the USS Lexington Museum. The region also hosts dozens of large and small conventions each year. The visitor industry supports approximately 10,880 direct local jobs (Jones, *et al.*, 1997) (see Figure 8).

The region is second in the state in terms of total seafood landings by weight and economic value. Commercial fishermen in the waters around the Coastal Bend land approximately eight million pounds of seafood each year.

Few components of the regional economy are completely detached from the bay system. Among these are some agricultural activities, inland energy development, military helicopter repair, electronics and telecommunications services, and some food processing. It has been estimated, however, that more than 70 percent of the region's economy is either directly or indirectly dependent on the bay system (Jones, *et al.*, 1997).

In 1995, the region's population was nearly 550,000, with projections of nearly 1 million people by 2050 (see Figure 9). More than 50,000 new single family homes are projected to be built in the metropolitan area in the next 30 years. By 2050, water demand for residential and business uses is expected to increase by about 50 percent, while industrial water use is projected to double.

It is recognized that solving the Priority Issues of the Coastal Bend will be difficult without allowing for continued growth of the regional economy, which in turn will provide stakeholders the economic wherewithal to address environmental issues. It is also recognized that the state and federal governments must continue as partners in the management of these natural resources, and that local governments cannot, and should not be expected to, implement the ***Bays Plan*** alone. Clearly, the bay system has value and economic impact that extends well beyond the region (see Table 2).

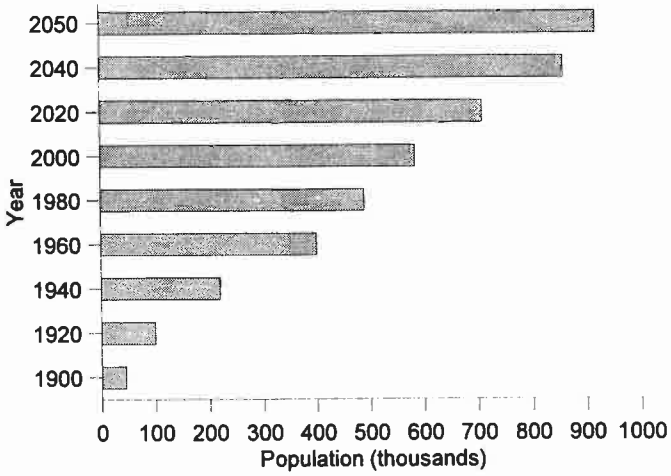


FIGURE 9 Coastal Bend Population Trend

Coastal Bend Bays Priority Issues

- Altered Freshwater Inflows into Bays and Estuaries
- Condition of Living Resources
- Loss of Wetlands and Estuarine Habitats
- Degradation of Water Quality
- Altered Estuarine Circulation
- Bay Debris
- Public Health Issues

TABLE 2
Estimated Impacts of Coastal Bend Industries on the Texas Economy, 1995 (Jones, *et al.*, 1997).

Aggregated Sector	Economic Impact Variable				
	Output	Personal Income	Value Added	Employment	Per Capita Income
	($ millions)			Jobs	($ thousands)
Oil and Gas Extraction	58.70	15.99	41.38	542	29.5
Mining and Quarrying of Non-Metallic Minerals	1.79	0.59	1.09	18	32.8
Chemical and Allied Products	912.44	227.55	439.72	5,547	41.0
Petroleum Refining and Related Industries	1,172.73	167.61	412.16	4,211	39.8
Ship and Boat Building and Repairing	46.38	18.11	25.49	539	33.6
Water Transportation and Services	115.96	35.12	51.49	1,113	31.6
Commercial Fishing (bay systems and gulf by area caught)	49.24	15.22	33.96	1,097	13.9
Seafood and Miscellaneous Food Preparations	78.28	16.88	33.99	776	21.8
Tourism and Related Industries (leisure)	520.46	208.32	320.05	10,880	19.1
Agriculture	565.45	155.99	447.90	12,367	12.7
Heavy Construction	281.97	129.97	190.69	4,279	30.4
Federal Government (military)	644.46	430.65	510.13	19,094	22.6
State Government (education and non-education)	25.49	17.04	20.18	641	26.6
Total	4,473.37	1,439.03	2,528.23	61,104	

The *Coastal Bend Bays Plan* -- A Regional Framework

Today's Problems Require A Different Approach

Until the last decade, resource management in the United States was largely driven by regulations developed with little public participation. In the past, major improvements were possible with relatively simple (if expensive) regulation of municipal and industrial discharges. While there will always be an appropriate role for regulation and enforcement, management of coastal areas today requires a fundamentally different approach -- an integrated, ecosystems approach (see Figure 10).

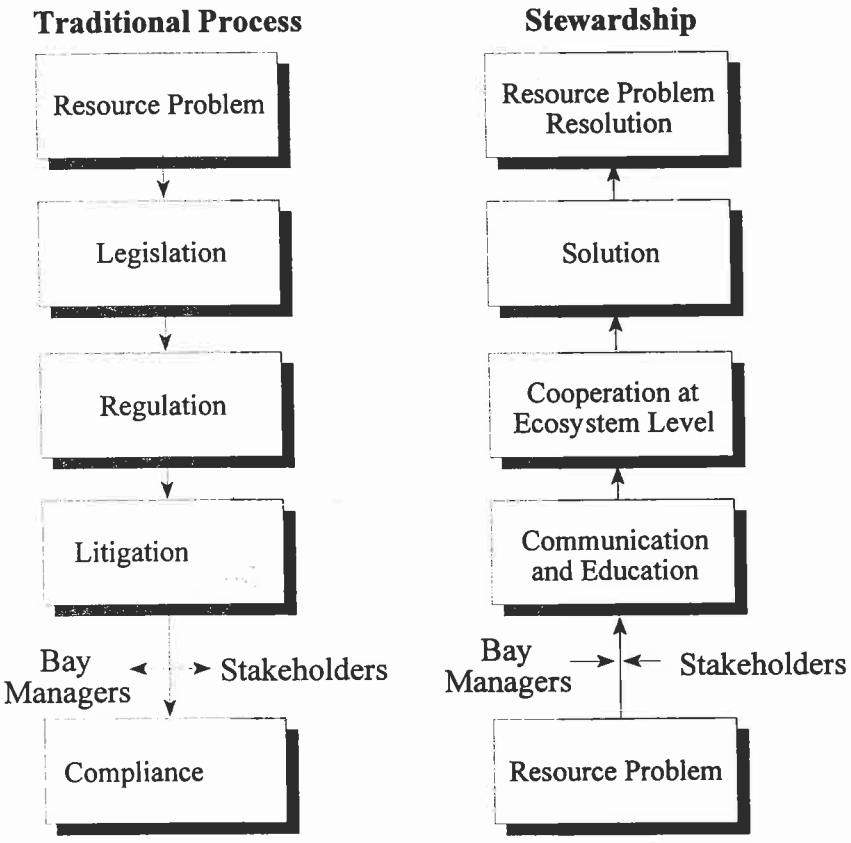


FIGURE 10 Traditional vs. Stewardship Process

Pervasive habitat loss, diffuse sources of pollution (called nonpoint source pollution), and changes to freshwater inflow are examples of issues that must be dealt with at a regional level and by many political jurisdictions at the same time. These types of problems are complex and interrelated, and involve not only the bays, but also the creeks, rivers, and entire watersheds that drain into the estuaries.

With the advent of the National Estuary Program, Congress gave recognition to the fact that nonpoint sources of pollution and the cumulative impacts associated with development must be managed if we are to enjoy the benefits that result from maintaining high coastal water quality. It was recognized that those residents whose livelihood and leisure are dependent on the health of coastal waters represent our best hope as stewards of these resources. Congress thus established the NEP as a stakeholder participation process. A principal mission of the NEP is to involve local residents at all stages in the development and implementation of a regional plan.

Program participants recognized early that such an ecosystems approach is both appropriate and necessary for this bay system. They worked hard to develop a common vision of that goal, dedicating their first 'All Conference Workshop' to the task of creating a Vision Statement that could be agreed upon by all. That Vision Statement and a set of Operating Principles are reproduced at the beginning of this Strategy and continue to serve as a reminder of the interdependent roles of the economy and the environment, and thus the ultimate goal to attain a sustainable balance between the needs of the environment and those of the human community.

How Was the *Bays Plan* Created?

The Management Conference Structure and Plan Development Process

The approach in developing the ***Bays Plan*** recognizes the importance of collaborative decision making for long-term success. While this consensus building process is difficult and takes time, the end result should be a product for which stakeholders feel personal responsibility and commitment. Local representatives of industry, commercial shrimping, agriculture, ranching, recreational activities, environmental organizations, municipal and county governments, scientists, and federal and state resource managers have all been volunteers in this effort. To date, these volunteers have invested more than 35,000 hours in the design, review, and discussion of more than 30 characterization studies and early-action projects.

These stakeholders participated in the development of the ***Bays Plan*** through a group of committees collectively referred to as the Management Conference. The Management Conference includes a Policy Committee, a Management Committee, a Program Implementation Committee, and Advisory Committees for science and technical issues, citizen input, local government input, and financial planning (see Figure 11).

Fourteen Action Plan Task Forces provided community and stakeholder input on potential actions for bay tourism and recreation, public health, bay debris, shoreline management, brown tide/harmful algal blooms, habitat and living resources, dredging, maritime commerce, freshwater resources, water and sediment quality, point source discharges, urban runoff, agricultural runoff, and public outreach. Appendix D presents the Management Conference membership.

The members of the Management Conference understand that:

- increasing regional population without supporting infrastructure will cause adverse impacts to resources of the bay system;
- future growth will cost more than necessary unless responsible government and private partners use a coordinated ecosystems approach to manage the bay system; and
- the Management Conference must accept a stewardship role in conserving and, where possible, enhancing resources of the bay system.

Participants at Bay Summit meeting.

The Conference worked cooperatively to identify Priority Issues and specific actions to reverse negative short- and long-term environmental impacts (see Appendix B). They held themselves to the standard that each Action Plan must be based on sound, scientific evidence. To accomplish this, the characterization studies previously mentioned were based on the analysis of data collected during the last several decades. These studies and a handful of early-action projects, which are briefly described in Appendix F, were selected and designed to answer key questions related to the seven Priority Issues.

The draft ***Coastal Bend Bays Plan*** and ***Implementation Strategy*** were revised, not only through public comment but through numerous meetings with local governments, state and federal agencies, and key stakeholders who all have a part to play in implementing the Plan. During the February/March 1998 public comment period, four Town Hall meetings were held with participation by 130 people. Over 185 comments were received on the draft ***Bays Plan*** and ***Implementation Strategy***, and these comments were individually reviewed and considered in the revision to the two documents.

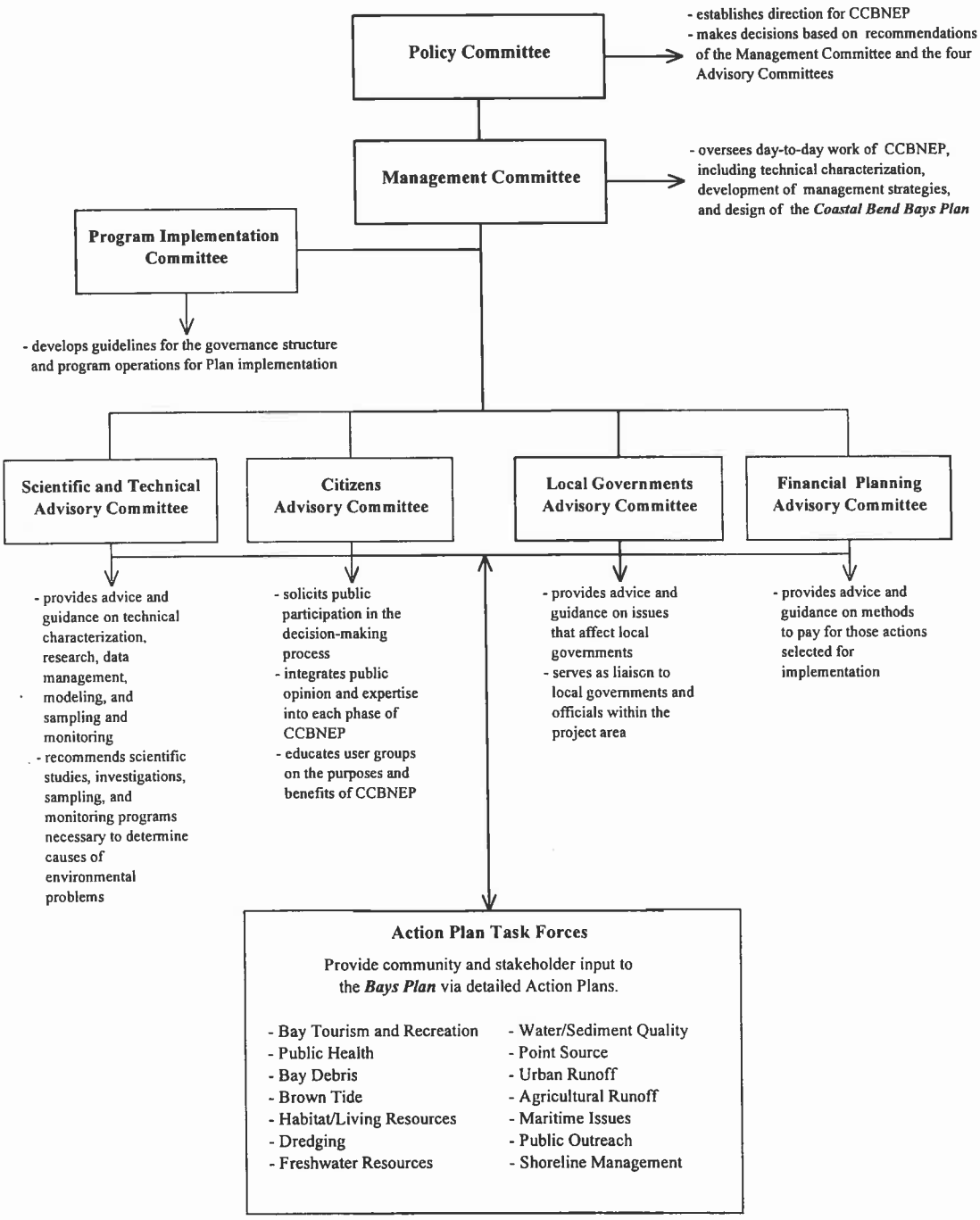


FIGURE 11 CCBNEP Management Conference

Upon approval of the Plan by the Governor and USEPA Administrator, the Program will be eligible to receive continued federal funding support to assist in the implementation of the ***Bays Plan***.

Relation to Other Plans and Programs

The ***Coastal Bend Bays Plan*** has been developed by the people who will be affected by its actions -- local industry and agriculture, cities and counties, conservation and other key stakeholder groups, and state and federal agencies. It is a detailed, yet flexible, regional framework for action that will be used by implementing partners to realign their own resources and programs to voluntarily participate in Plan implementation. The Program will continue to build local understanding and consensus on key management issues within the context of the needs of the ecosystem. Implementation of the Plan will benefit local governments, the private sector, and communities in a number of ways (see sidebar). It will not carry with it any regulatory, enforcement, or taxing authority.

Other plans and programs exist that complement the ***Bays Plan*** in important ways. First among these is the **Texas Coastal Management Program** (CMP), approved in 1997 as a means to improve interagency coordination and increase government accountability to citizens. The CMP establishes the overarching policy framework for the entire Texas coast and serves as a forum for regulatory agencies and the public to resolve inconsistencies or major use conflicts. The Program has statutory authority and relies on a set of rules as the basis for its decision-making. In short, the CMP coordinates the review and permitting of certain types of activities and requires that federal actions (e.g., permitting, sponsored programs, and direct activities, such as dredging, construction, and other resource uses in the coastal zone) be consistent with the goals and objectives of the state plan. The CMP annually funds approximately $2 million worth of projects on the coast. It will be necessary for the ***Bays Plan*** to be consistent with the CMP (see Chapter 8). Clearly, the larger geographical scope and the regulatory aspect of the CMP are key differences with the CBBEP.

Another related program is TNRCC's **Clean Rivers Program**. A primary focus of the Clean Rivers Program is water quality monitoring and assessment. This program works in partnership with river authorities and provides additional opportunities for stakeholder participation. The Clean Rivers Program has its authority grounded in state legislation and is funded by fees assessed to wastewater and water use permit holders. The Clean Rivers Program has worked to expand upon the upland (watershed) component of the characterization studies sponsored thus far by the CBBEP. Biennial updates of the river basin assessments are a principal goal, a task that will continue to be of relevance for those

Benefits from Implementing the *Bays Plan*

- Greater consistency and continuity in regional and/or local decision-making
- Public support for local government initiatives
- Technical assistance
- Ability to address cumulative impacts at the regional scale
- Forum to address cross-boundary issues and solutions
- Local voice in planning and priority goal-setting
- Greater efficiency in use of existing (local, state, and federal) resources
- Public understanding of the critical linkages between the economy and environment
- Leverage of local dollars with state, federal, and private foundation dollars
- Forum for conflict resolution
- Decision-making based on sound science (and consensus)
- Local consensus and thus an ability to apply a concerted voice on state or federal regulatory agencies for greater regulatory flexibility
- Federal consistency review
- Local plans and solutions with state and federal commitments for implementation partnerships

components of the ***Bays Plan*** that deal with watershed management. In short, the goals of the two programs are highly complementary, although the CBBEP will have a much larger set of management issues to address in implementing the Plan.

Thirdly, the **Gulf of Mexico Program** (GOMP) is a complementary resource management program encompassing the five Gulf states and a possible source of implementation funding for specific components of the ***Bays Plan***. The GOMP also uses stakeholder participation to guide the development of its management framework, which is more focused on the large-scale marine ecosystems of the Gulf. Hypoxia (a condition of low dissolved oxygen), shellfish bed closures, the introduction of exotic species, and habitat protection are the four principal management issues under investigation by the GOMP.

These three programs, while distinct from one another in mission and objectives, do not represent a duplication of effort. Rather, they will continue to serve important complementary roles in furthering the mission of the CBBEP.

A Bright Future for Coastal Bend Bays and Estuaries

Resource management in the final decade of the 20th century is fundamentally different than in decades past. It is less about resource managers applying their technical knowledge through mandated regulations and enforcement, and more about local communities broadening their own knowledge base. In the process, local communities are helped to become true stewards of their own resources. This trend must continue if the multi-jurisdictional issues of today are to be effectively tackled. Clearly, if fragmented habitat at the regional scale undermines the survival of important species, then only through a coordinated, regional approach can local governments succeed to make needed adjustments in their own land use planning efforts in ways that will contribute to a regional resolution of such an issue. There are other examples, but in general the ability to address cumulative impacts at the regional scale is a long-term goal toward which the ***Bays Plan*** lays an important, initial foundation.

The Program's analysis of the existing bay management structure shows that the Priority Issues are, by-and-large, already covered under one or another agency's authority or mission. Missing, however, has been a full understanding of the 'big picture' with respect to the interactive elements of the complex ecosystems that comprise these three estuaries. That big picture is beginning to emerge, but it is clear that there are many data gaps that prevent our completing the picture any time soon. While it is the intent

of the ***Bays Plan*** to identify and coordinate efforts and resources to close those data gaps in a prioritized manner, the truth is that we will never have 100 percent complete information. Regardless, today's policy-makers, resource managers, and local governments must effectively manage natural resources based on the best data and science available.

Equally important, however, are answers to these types of questions: What are our management goals and objectives? Have we taken into account the needs or desires of all user groups? Is there a gap between these management goals and the general public's understanding of them that will impede progress toward effective resource management?

Answers to these questions require public involvement and the forging of consensus around previously unasked questions. Like policy-making of any type, resource management policy, to be successful, must be a public process and open to participation by all interested stakeholders. That foundation has been laid with the completion of the initial ***Bays Plan***, which must be seen as a starting point for further discussion and revision. Implementation of the Plan will provide a continued forum for interested stakeholders, and an opportunity for conflict resolution and consensus-building among user groups.

With a doubling of the region's population projected over the next 50 years, immense savings can be achieved if proper planning and infrastructure is in place prior to that development. And just as one area of the country can benefit through lessons learned from another area, communities can learn from each other here within the Coastal Bend. Thus, a spin-off of the coordinated, partnership approach is the benefit of technology transfer and a sharing of experience with various funding mechanisms. The Program has initiated this process through its work with several communities in the design and implementation of 'demonstration projects', the results of which can be shared and hopefully replicated throughout the region.

Creating efficiencies in the way today's public dollars are spent on resource management is at the heart of the ***Bays Plan*** goals. For example, efficiencies in future monitoring and research will be realized as the goal-directed, regional framework of the Plan is utilized by implementing partners to focus their own future work plans. Moreover, as the Plan is endorsed by regional partners, state and federal agencies should be willing to invest more of their own limited resources in the region, knowing that the actions of the ***Bays Plan*** have been developed with a sound, technical basis and are supported by broad-based consensus. This aspect of implementation, leveraging local dollars with state, federal, and private foundation dollars, should bring new opportunities to minimize the cost of remedial measures in the long-term.

The bottom line for all of this is that now, for the first time, the Coastal Bend has before it a regional framework for action. Not a blueprint, the ***Bays Plan*** is simply the basis for both action today and a continuing dialogue regarding an incremental approach to achieve regional resource management goals. The 'structured flexibility' of the Plan sets the stage for a bright future for this bay system, one that will find balance in its multiple human uses, regional social development, successful long-term environmental management, and sustainable economic growth.

Introduction to Action Plans

The following six chapters of this ***Implementation Strategy*** for the ***Coastal Bend Bays Plan*** (Chapters 2 through 7) present Action Plans to solve identified problems in the project area. Fifty specific actions are described within 11 Action Plans:

Chapter	Action Plans
Chapter 2 Human Uses	Bay Tourism and Recreation Bay Debris Public Health Shoreline Management
Chapter 3 Maritime Commerce and Dredging	Maritime Commerce Dredging
Chapter 4 Habitat and Living Resources	Habitat and Living Resources
Chapter 5 Water and Sediment Quality	Water and Sediment Quality Nonpoint Source Management
Chapter 6 Freshwater Resources	Freshwater Resources
Chapter 7 Public Education and Outreach	Public Education and Outreach

Each Action Plan is presented in a standard format:

Overview of the Action Plan

A listing of objectives and actions. For each action, the action number, title, and page number is provided.

Key Findings

A concise description of what is currently known about the issue.

Actions

Each action includes the following information:

- **Action Number** (Note: The numbering of actions is not indicative of relative priority within the overall ***Implementation Strategy***. Rather, all of the actions contained in this final version of the Strategy are considered to be priority actions, and have been selected and further developed from an original list of more than 290 actions first proposed.) Implementation of these actions will necessarily depend on available financial and human resources, and the mutual interest of several entities. All of the actions contained in this final ***Implementation Strategy*** have been selected based on several criteria, including whether or not the action is:
  - Justified, based on sound science,
  - Technically and economically feasible (both in the short and long term),
  - A benefit to the environment, and
  - Politically acceptable with wide community support.
- **Why**
  A short justification for the action.
- **How**
  The process involved in taking action, described through a series of steps.
- **Lead**
  The agency or organization with the primary responsibility for the action.
- **Other Partners**
  Other agencies or organizations that have some responsibility for carrying out the action.
- **Anticipated Costs**
  Best estimates of costs, identified by step and by action.
- **Measures of Success**
  Suggested parameters by which future progress can be measured.
- **Related Actions**
  An identification of other actions that need to be closely coordinated with the subject action.

Appendix A provides a flow chart of the goals, objectives, and actions for each of the 11 Action Plans. Appendix G provides a summary table for each of the 11 Action Plans and Appendix H presents actions by implementing entity.

CHAPTER 2
Human Uses

Goals

Maintain and expand tourism and recreational opportunities in a way that enhances the local economy and protects the natural resources of the bays.

Reduce bay debris in the Coastal Bend to ensure minimal impact to people, aquatic life, and natural resources.

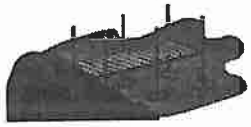
Ensure public health associated with contact recreation and seafood consumption.

Minimize impacts to bay resources from development or activities occurring within the coastal shore area.

Bay Tourism and Recreation Action Plan

Bay Debris Action Plan

Public Health Action Plan



Shoreline Management Action Plan

Introduction

The Coastal Bend bays and estuaries contain a wealth of resources for people to enjoy and appreciate. Indeed, these resources are central to the quality of life for many who live or come to recreate here. But our use of these waters -- what we put into them and what we take from them -- must be monitored to ensure that the bay system remains healthy and productive (see Figure 12 for issues relating to our use of the bay system).

Principal goals of the Human Uses Action Plans are to ensure that people continue to benefit from a safe, clean bay system environment and to promote stewardship of bay system resources. To do this, it is important to inform the citizens of this community and our millions of visitors with a consistent message about how to enjoy the resources without degrading them.

It is also important to plan for the ever-increasing number of people who visit the region to enjoy its natural resources. Well-planned and well-managed access areas will do much to curtail resource damage while providing enough parks and facilities for the growing numbers of users.

Ensuring that the waters are safe to swim in and that the fish, crabs, and shrimp are safe to eat are important goals. Equally, an efficient method of communication to the public is needed in case problems do arise.

Enhancing the Economy while Protecting Resources

The bays and estuaries support an enormous segment of the local economy, supplying us with recreation and dollars. To enhance the area's attraction, the Program and the Regional Tourism Council will encourage and assist tourism organizations to adopt a 'theme' of resource protection and stewardship in their promotions of the Coastal Bend. The Program will work to improve existing public access sites and develop the appropriate number of well-managed sites in order to protect the coastal resources and ensure their longevity for future bay users (see Figure 13 for existing public access sites). This will be done in partnership with other agencies, including the Texas General Land Office which is responsible for preparing a Coastwide Shoreline Access Plan, and local governments that issue beach access and dune protection permits.

Other actions will include working with state agencies and the private sector to develop educational campaigns for specific user groups. Keeping the public informed is the goal, so that individuals can assist, for example, in preventing disturbance to birds during nesting season and losses to seagrasses from propeller scarring. In this regard, it is important to ensure that visitors to

Principal goals of the Human Uses Action Plans are to ensure that people continue to benefit from a safe, clean bay environment and to promote stewardship of bay resources.

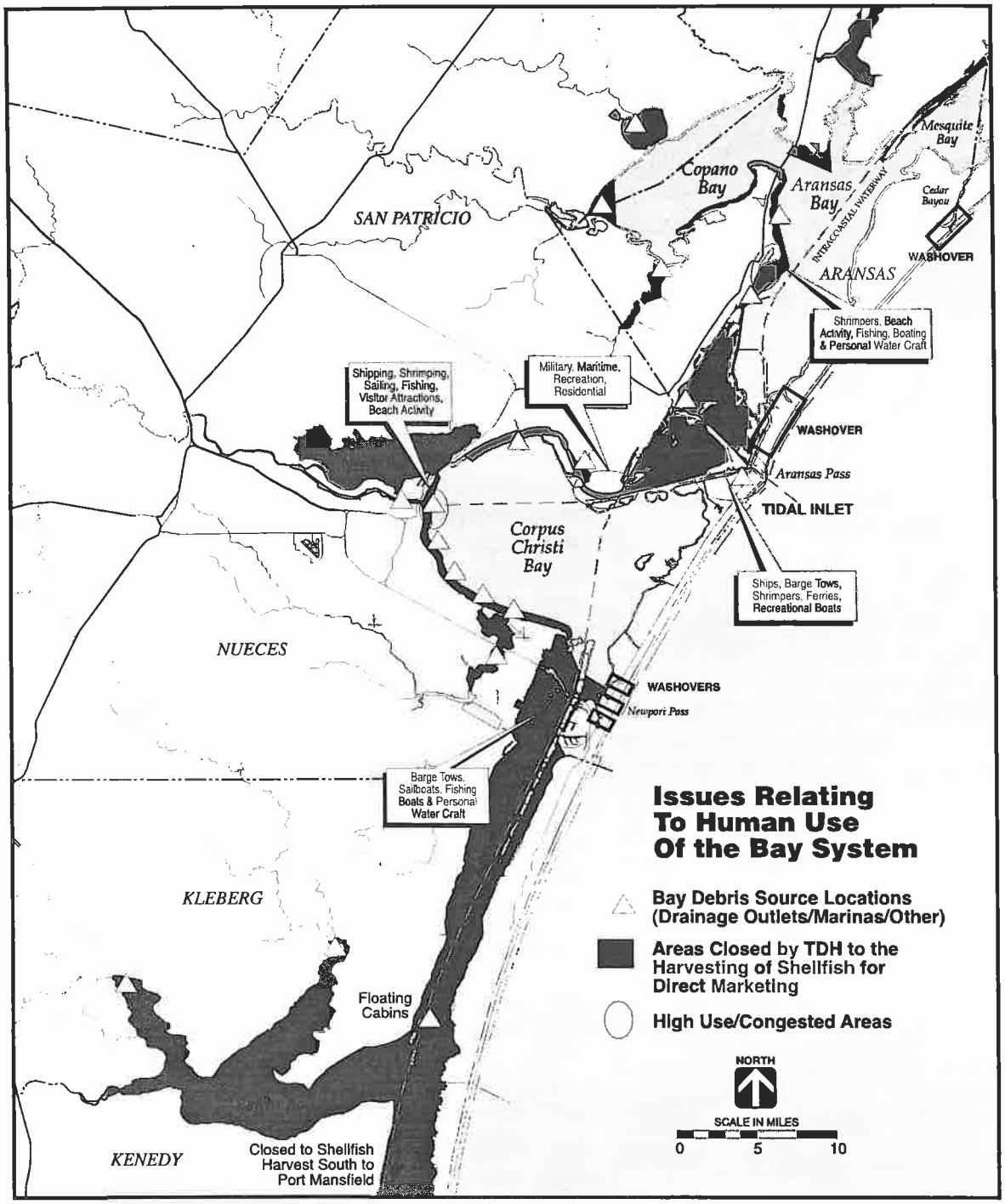


FIGURE 12 Issues Relating to Human Use of the Bay System

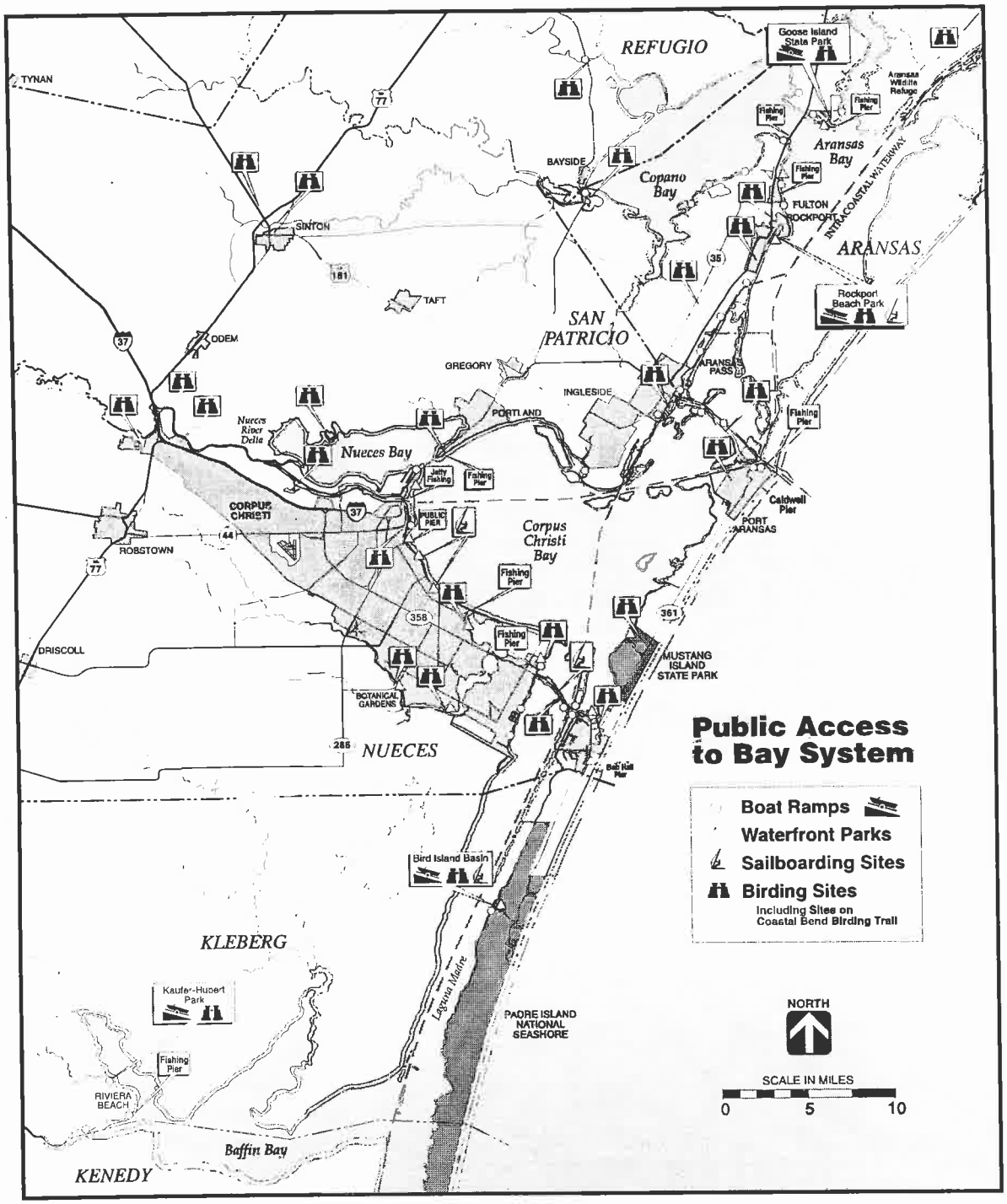


FIGURE 13 Public Access to Bay System

the area are familiar with the location of seagrass beds and other sensitive habitats. Taking inventories and assessing the environmental impacts of these and other activities will lead to the development of appropriate educational materials for specific audiences.

The increasing number of water craft using the bay system calls for additional attention to the kind and amount of services available to support this use. The Program will work with the owners and operators of marinas to develop plans and funding options to make improvements to solid waste, sanitary pump-out, or fueling facilities. The Program will also work to ensure that commercial haul-out facilities have applied the appropriate controls to minimize the potential for the release of paint scrapings to receiving waters.

Likewise, the Program will work with owners of floating cabins (over-water cabins), land-based cabins, and the responsible state agencies to develop management guidelines that are practical and meaningful for the continued enjoyment of all who use the bay system.

Hunting and fishing cabins located in upper Laguna Madre.

In addition to monitoring and promoting better stewardship by the bays' many user groups, the Program will work to enhance the recreational fishery. By developing a plan for a system of well-placed and appropriately designed artificial reefs or restored natural reefs, recreational fishing will be enhanced for the long-term.

Debris found along Corpus Christi Bay.

Reducing Harmful Bay Debris

Bay debris poses public health risks and reduces the aesthetic appeal of the bay system. It can degrade habitats and ensnare aquatic and wildlife species. These impacts result in costs: to the shrimper who tears his net by hanging up on debris; to the windsurfer who steps on a broken bottle; to the tourism industry when hotel rooms are unfilled because potential visitors would rather visit cleaner beaches; and to agencies and organizations who devote thousands of hours to cleaning the beaches along the bays.

The debris in our bays comes from many sources -- runoff from land, including the debris carried by storm sewers and tributaries; debris discarded or blown from vessels and

offshore operations; the trash that blows out of a pick-up truck; the trash that beach goers leave behind; and the debris that washes and blows into the bays from festivals held on the shoreline. Bay debris is a large, multi-faceted, solid waste management problem.

Since prevention is generally more cost-effective than clean-up, the Program will work with local governments to improve solid waste management and to educate citizens on ways they can assist to achieve our goal of a cleaner environment.

Ensuring Public Health

While significant threats to public health from water contact or seafood consumption are NOT found in the project area, shellfish closures and isolated cases of waterborne illness have occurred. Fortunately, there are already several county, state, and federal agencies working to safeguard public health from bay-related maladies. Better public education on a variety of health issues could avoid unnecessary problems and provide important, positive information about the overall health of the bay system. Such assurance is desired by residents and visitors alike.

Regarding contact recreation (e.g., wading, swimming, windsurfing), professionals debate which type of water quality indicator(s) is most appropriate to gauge water contact safety. A first action will facilitate consensus among health officials throughout the region regarding the most appropriate indicators, sampling and analytical protocol, and risk tolerance level for contact recreation. Through such discussion and review of programs in use elsewhere, participants will decide whether or not it will be feasible to move forward with a regional framework to assess recreational water quality.

Another action will focus on the consumption of fish and shellfish. Although the government tightly regulates commercial seafood harvesting, little is known about the safety of consuming recreationally caught seafood. We need analyses of fish and shellfish tissue to determine the presence and concentration of harmful substances, such as polychlorinated biphenyls (PCBs), metals, and pesticides. The data will be submitted to the Texas Department of Health for a risk assessment evaluation.

To ensure their value, coastal waters must not be polluted since clean water and attractive beaches are important to a healthy ecosystem and a strong tourist industry.

Because of the need for greater information sharing among health officials, a third action calls for the establishment of a reporting and information retrieval system that will focus on bay-related epidemiological and injury data.

Fishkills may occur because of natural events or because of accidental spills. Regardless of the reason, improving protection of public health during these episodes is vital to continued recreational use of our bays.

Environment-friendly Shoreline Development

Long-range comprehensive shoreline management is necessary for wise coastal development. Projected development of the Padre and Mustang barrier islands calls for long-range planning to ensure that the natural shore processes are maintained and cost-effective strategies are in place to minimize coastal erosion and loss of life and property. Environmental impacts from poorly planned shoreline development can result in unnecessary habitat loss, reduced public access, altered bay circulation, and degraded water and sediment quality.

The Program will work with local governments, landowners, and key resource management agencies to develop 'Guidelines for Shoreline Management for use by Local Governments.' A major player in this action will be the Texas General Land Office (TGLO), the designated state lead agency on coastal erosion response. The handbook will be consistent with TGLO's Coastwide Erosion Response Plan, and will include siting criteria for future development that acknowledges the dynamic nature of bay and barrier island shorelines and sea level rise. Guidelines will recognize private property owners' needs, as well as the planning, zoning, and permitting authorities of local governments, while promoting a regional approach to shoreline management. The Program will establish a Regional Shoreline Advisory Council that will study 'lessons learned' from other areas of the country so that avoidable mistakes will not be made here.

Wherever practical, the preservation of natural shoreline functions and features, at both public and privately owned facilities, will be encouraged to take advantage of natural defenses against wave and wind energy. Tax-paying citizens and users of the bay beaches, as well as private property owners along the shoreline, will benefit from the sound development and use of coastal shore areas.

Action Plan
BAY TOURISM AND RECREATION

Overview

Key Findings

- The natural resources of the Coastal Bend Bays provide for many recreational activities including fishing, windsurfing, birdwatching, waterfowl hunting, camping, jet skiing, kayaking, canoeing, surfing, swimming, sailing, power boating, shelling, beach combing, walking, and running. These recreational activities result in tremendous economic benefits. Even using conservative estimates of participation, sport-boat fishing, bird watching, and windsurfing contribute more than $90 million per year to the economy. The majority of these benefits are from sport-boat fishing (Wellman and Noble, 1997).

- The total economic impact from tourism and related businesses, including leisure and business travel, is over $950 million and 21,358 jobs. This represents nearly ⅓ of the total of bay-related jobs (Jones, *et al.*, 1997).

- The Coastal Bend Bays recreational fishery contributed about 28 percent of the total catch from all Texas bays between 1976 and 1991; however, the success rate (catch per unit effort) of individual fishermen appears to be declining (Tunnell, *et. al,* 1996). Declines in success rates are due mainly to more stringent size and bag limits put in place during the 1976 to 1991 period.

- The ever increasing number of bay users has resulted in impacts to natural resources. There is evidence that bay bottoms have been disturbed by recreational boating and other human-related activities (Montagna, *et al.,* 1998b). For example, aerial photography of north Redfish Bay from 1975 and 1994 reveals a network of cuts through the seagrass beds, suggesting that boat propellers have contributed to the loss of seagrass in this bay (Pulich, *et al.,* 1997).

BTR-1 Encourage and assist regional tourism organizations to adopt a 'theme' of resource protection and stewardship in their promotion of tourism.

Why The number of visitors and residents using the bays is projected to increase in the future resulting in more pressure on coastal natural resources.

How **STEP 1 —** Establish a 'Friend of the Bay' program, that would allow participants to use Program designed logos and other packaged graphics in tourism marketing and promotional literature. The goals are to promote ecotourism, work with facility owners to implement environmentally friendly practices, and achieve resource stewardship.

STEP 2 — With the assistance of regional tourism councils and boards (and other officials as appropriate), inventory, develop, and maintain a database (including an internet web site) of bay-related recreational uses, groups, and events. Coordinate scheduling of these events and provide public access to this information. Provide appropriate resource protection educational materials.

STEP	Lead	Other Partners	Anticipated Costs
1	CBBF	RTC, GCCBA, Area COC, USCG (Waterways Management Section)	$10,000
2	CBBEP	GCCBA, Area COC, USCG (Waterways Management Section), TPWD, other partners	$10,000

Total Anticipated Costs $20,000 per year.

Measures of Success

- Natural resource protection themes are incorporated in promotional literature by the tourism industry.
- Community and local government stewardship of public access sites is increased.
- An increasing number of people visit the Coastal Bend based on its 'ecotourism' reputation.

Related Actions PEO-1, PEO-2

CBBF Coastal Bend Bays Foundation
RTC Regional Tourism Council
GCCBA Greater Corpus Christi Business Alliance
COC Chamber of Commerce
USCG United States Coast Guard
CBBEP Coastal Bend Bays and Estuaries Program
TPWD Texas Parks & Wildlife Department

BTR-2 Provide for the appropriate number of improved, well-managed public access sites.

BTR-2

Why The lack of well-planned access points and inadequate public facilities in some areas has resulted in damage to habitat, especially shoreline wetlands.

How STEP 1 — Based on completed CBBEP reports and other references, and with the assistance of local governments, landowners, and adjacent business owners, develop funding and implementation strategies for site-specific public access improvement plans. Encourage the stewardship of publicly-owned access sites through informal alliances of local businesses.

STEP	Lead	Other Partners	Anticipated Costs
1	CBBEP/TGLO/ CCC/Local governments	TPWD, CCA, CBBF, USFWS	To be determined on a project-by-project basis

Total Anticipated Costs To be determined on a project-by-project basis.

Measures of Success

- The number and quality of public access sites are increased.
- An increasing percentage of existing public access sites have well-managed facilities and parking.
- No declines in natural resources are observed due to improvements in public access sites.

Related Actions SM-3, PEO-3

CBBEP Coastal Bend Bays and Estuaries Program
TGLO Texas General Land Office
CCC Coastal Coordinating Council
TPWD Texas Parks and Wildlife Department
CCA Coastal Conservation Association
CBBF Coastal Bend Bays Foundation
USFWS United States Fish and Wildlife Service

BTR-3 Develop and implement management strategies to reduce or avoid impacts from recreational uses.

Why Some recreational uses have adverse impacts on coastal natural resources. Through education and proper management, many of these impacts can be minimized.

How **STEP 1** — Assess the impact of increased human intrusion into critical habitat of the endangered whooping crane, especially the back portions of St. Charles Bay and Matagorda Island marshes. Develop and implement consensus-based management strategies.

STEP 2 — Support the continued development and implementation of the Texas Seagrass Conservation Plan, focusing on the voluntary educational components that address impacts from recreational boating.

STEP 3 — Inventory and assess seasonal impacts on bird rookery islands related to recreational use disturbance, and develop management plans.

STEP 4 — In conjunction with owners/operators, assess the operations of marinas to determine the types and scale of pollutant loadings and other impacts. Work with owners/operators to identify funding sources, and develop and implement site-specific BMPs. Encourage the installation and use of pump-out stations and trash receptacles at appropriate locations. Develop and implement training programs, as necessary, for the proper handling and disposal of hazardous materials.

STEP 5 — Facilitate the development of management guidelines to accommodate the continued use of floating cabins (over-water cabins) in regard to siting, size, density, solid waste management, sanitation, anchoring, commercial use, and derelict cabin removal.

STEP 6 — Increase the level of compliance with the existing rules and regulations pertaining to cabins located on dredged material islands.

STEP 7 — Encourage responsible recreational fishing practices through the promotion of catch-and-release practices and proper waste management.

BMP Best Management Practice

BTR-3

STEP	Lead	Other Partners	Anticipated Costs
1	ANWR	CCA, Sierra Club, CBBF, USFWS, NMFS, TPWD, USCG, Local governments, TGLO, CBBEP	$5,000
2	TPWD/TGLO	CBBF, Sierra Club, Local governments, NMFS, Marina owners, CCA	$15,000
3	Audubon/TGLO	USFWS, CCA, CBBF, Sierra Club, Local governments	$20,000
4	TGLO	TNRCC, CBBF, Sierra Club, Local governments, USCG, USEPA, Marina owners, CCA	$25,000 for the assessment, plus to be determined per project
5	CBBEP/ TGLO	CBBF, Local governments, USCG, USEPA, Marina owners, CCA, TNRCC, USACE, COAST, TGLO	$5,000 plus ¼ person/year
6	TGLO	COAST, CCA, TNRCC, CBBF, Sierra Club, Local governments	¼ person/year
7	TPWD/CCA	CBBF, Sierra Club, Local governments, USCG, Marina owners	$10,000

Total Anticipated Costs $80,000 plus ½ person/year.

Measures of Success

- The impacts of recreational boating on seagrasses are reduced.
- The impacts of human intrusion into the critical habitat of the whooping crane are reduced.
- The impacts of recreational activities on bird rookery islands are reduced.
- The impacts of recreational fishing on recreational fishery species populations are reduced.
- The Texas Seagrass Conservation Plan is implemented.
- An increasing number of pump-out stations are installed at marinas and waterside subdivisions.

Related Actions BD-1, HLR-4

ANWR	Aransas National Wildlife Refuge
CCA	Coastal Conservation Association
CBBF	Coastal Bend Bays Foundation
USFWS	United States Fish and Wildlife Service
NMFS	National Marine Fisheries Service
TPWD	Texas Parks and Wildlife Department
USCG	United States Coast Guard
TGLO	Texas General Land Office
CBBEP	Coastal Bend Bays and Estuaries Program
TNRCC	Texas Natural Resource Conservation Commission
USEPA	United States Environmental Protection Agency
USACE	United States Army Corps of Engineers
COAST	Cabin Owners Association of Texas

BTR-4 Enhance the recreational fishery through artificial reefs or restored natural reefs as appropriate.

Why Increasing recreational fishing coupled with the loss of natural hard substrate reefs has resulted in 'boater overcrowding' on the remaining structures in the bay.

How **STEP 1** — Review and evaluate results from ongoing studies related to the potential for recreational fishery enhancements through the use of in-bay artificial reefs.

STEP 2 — Develop a plan, if appropriate, for a system of artificial reefs (which may include the restoration of natural reefs), considering environmental parameters, user conflicts, and vessel safety issues.

STEP 3 — If appropriate, design and implement an artificial reef pilot project, and monitor its (positive and negative) environmental impacts and recreational fishery impact.

STEP	Lead	Other Partners	Anticipated Costs
1	TPWD/ Texas Sea Grant	TGLO, CCA, NMFS, CBBF	To be determined
2	TPWD	TGLO, CCA, NMFS, CBBF, USCG	$25,000
3	TPWD	TGLO, CCA, NMFS, CBBF, USCG	To be determined

Total Anticipated Costs $25,000 initially.

Measures of Success

- The number and quality of reefs (both natural and, if appropriate, artificial) are increased.
- Positive environmental impacts from artificial reefs are increased and negative environmental impacts are reduced.

Related Actions HLR-2

TPWD Texas Parks and Wildlife Department
TGLO Texas General Land Office
CCA Coastal Conservation Association
NMFS National Marine Fisheries Service
CBBF Coastal Bend Bays Foundation
USCG United States Coast Guard

Action Plan
BAY DEBRIS

Overview

Page

Objective: Reduce the amount of debris entering the bays and estuaries throughout the Coastal Bend.

Key Findings

- Debris is obvious throughout the Coastal Bend Bays, but the amounts and distribution have not been quantified. Most data is related to Gulf beaches. There is also a lack of consistency in the methodologies used to collect data (Amos, *et al.,* 1997).

- Although bay debris clearly has an aesthetic impact on visitors to the bays and beaches, other impacts of bay debris in the project area have not been cataloged (Amos, *et al.,* 1997).

BD-1 Reduce the amount of debris reaching the bays due to improper trash disposal or inadequate solid waste management.

Why Bay debris has an aesthetic impact and can be harmful to wildlife, damaging to habitats, and a concern to public health.

How **STEP 1** — Develop and implement improved solid waste management procedures for urban, rural, and unincorporated areas. Efforts should address illegal dumping of white goods (refrigerators, etc.) and household hazardous waste.

STEP 2 — Enhance efforts to remove improperly disposed of solid waste from stormwater drainage systems and bay shoreline areas. Use volunteers or community service debtors where possible, and implement pilot demonstration projects as appropriate.

STEP 3 — Work with elected officials and legal authorities to improve law enforcement efforts and encourage public assistance (rewards programs, neighborhood watch programs, etc.).

STEP	Lead	Other Partners	Anticipated Costs
1	CBCOG/Local governments	Solid waste management professionals, TNRCC, CBBEP, other stakeholders	To be determined on a project-by-project basis
2	Drainage districts/ Local governments	TNRCC, TGLO, CBBF	To be determined on a project-by-project basis
3	CBCOG/Local Governments	Elected officials	To be determined on a project-by-project basis

Total Anticipated Costs To be determined on a project-by-project basis.

CBCOG Coastal Bend Council of Governments
TNRCC Texas Natural Resource Conservation Commission
CBBEP Coastal Bend Bays and Estuaries Program
TGLO Texas General Land Office
CBBF Coastal Bend Bays Foundation

BD-1

Measures of Success

- The overall quantity of bay debris in the project area is decreased.
- The amount of debris in the vicinity of stormwater outfalls is decreased.
- The number of illegal dumpsites in the project area is decreased.
- The amount of solid waste received at landfills, recycling centers, and composting facilities is increased.
- The number of boat ramp owners providing solid waste trash disposal facilities is increased.
- The number of communities cooperating in a regional bay debris monitoring program is increased.

Related Actions

BTR-3, PEO-5

Action Plan
PUBLIC HEALTH

Overview

Key Findings

- While some diseases can be contracted from eating raw oysters, *Vibrio* infections are of most concern because these infections are potentially lethal. On average, there is only one reported infection per year in the project area and one death every 8 years. *Vibrio* bacteria occur naturally in bay waters and have no known relation to human uses or wastewater. There is a need for a better indicator of risk from *Vibrios* and other natural pathogens (Jensen and Su, 1996).

- Water-related accidents (including injuries and fatalities) are a public health and safety concern, averaging almost 12 deaths per year in the project area. Two-thirds of the fatalities are from recreational activities and one-third are from commercial operations. Reliable data are not available for water-related injuries, but these are much more common (Jensen and Su, 1996).

- Within the bay system, Nueces and Copano Bays have the highest fish tissue concentrations of toxic contaminants; however, the only documented public health threat is from the consumption of oysters from Nueces Bay due to zinc contamination. In addition to zinc, tissue levels of cadmium, copper, and lead are all highest in Nueces Bay. Blue crabs from Redfish and Baffin Bays have elevated levels of several metals (Ward and Armstrong, 1997b).

PH-1 Facilitate a regional approach to recreational water quality management.

PH-1

Why The public wants to know that it is safe to get in the water. While the limited data available do not indicate a problem now, even the suggestion of waterborne illness and disease can disrupt the recreational and visitor industry in the Coastal Bend. A public health concern anywhere in the area can have economic repercussions throughout the region. The best way to avoid such a situation is to have a proactive regional approach to assess and monitor recreational waters, and thus be able to address any situation before it becomes a public concern.

How **STEP 1** — Establish a contact recreation workgroup of public health officials to address recreational water quality assessment and monitoring needs. Review existing data and quality indicators, including USEPA's recommended contact recreation water quality indicator (enterococcus) and existing coliform indicators.

STEP 2 — Identify popular recreation areas and establish dry/wet weather monitoring programs. Develop a predictive model based on appropriate indicators and environmental conditions to assess contact recreation in high use areas.

STEP 3 — Based on the predictive model and actual monitoring, develop strategies for local governments to communicate information to the public and respond to any public health threats that may arise.

STEP	Lead	Other Partners	Anticipated Costs
1	CBBEP	County and municipal health officials, TDH, TNRCC, USEPA, TPWD, Contact recreation associations	<$5,000
2	Contact recreation workgroup/CBBEP		$75,000
3	Contact recreation workgroup/CBBEP	Elected officials	$0

Total Anticipated Costs $80,000

Measures of Success

- A contact recreation advisory plan is implemented by Coastal Bend communities.
- A predictive model is developed and tested.

Related Actions HLR-9, WSQ-1, WSQ-5, PEO-1

USEPA	United States Environmental Protection Agency	TNRCC	Texas Natural Resource Conservation Commission
CBBEP	Coastal Bend Bays and Estuaries Program	TPWD	Texas Parks and Wildlife Department
TDH	Texas Department of Health		

PH-2 Conduct health risk assessments associated with consumption of seafood in suspect areas.

Why Several local and state agencies are working to ensure the safety of commercially caught seafood. Information regarding the safety of recreationally caught seafood is presently inadequate for all seafood types and areas.

How **STEP 1** — Collect sufficient fish and shellfish tissue data to be used in a human consumption risk assessment from selected subsections of the project area (at a minimum to include Nueces Bay delta and Corpus Christi Inner Harbor). Analyze the tissue in a laboratory acceptable to Texas Department of Health for volatiles, semivolatiles, metals, pesticides, and PCBs. Submit data to Texas Department of Health for risk assessment consultation. Disseminate results of risk assessment to the public.

STEP 2 — If risk is deemed unacceptable, determine sources of pollutants and implement controls.

STEP 3 — Review shellfish harvest area classification processes to ensure responsiveness to water quality improvements, while maintaining adequate public health protection. Reopen closed shellfish areas where information supports this action.

STEP	Lead	Other Partners	Anticipated Costs
1	TDH	USEPA, TNRCC, County and municipal health officials, PICC, Universities, Sierra Club	To be determined
2	TNRCC	USEPA, County and municipal health officials, Universities, Sierra Club	To be determined
3	TDH	TNRCC, TPWD, County and municipal health officials	To be determined

Total Anticipated Costs To be determined.

Measures of Success

- The fish tissue study and risk analysis are completed for selected areas.
- A determination is made whether the risk to human health from consumption of fish and shellfish from known or suspected problem areas in the project area exceeds regulatory levels for consumption advisories or closures.
- Permanently closed shellfish areas are evaluated for reclassification.

Related Actions HLR-9, WSQ-1

PCBs	Polychlorinated biphenyls	TNRCC	Texas Natural Resource Conservation Commission
TDH	Texas Department of Health	PICC	Port Industries of Corpus Christi
USEPA	United States Environmental Protection Agency	TPWD	Texas Parks and Wildlife Department

PH-3 Develop and implement a method to collect epidemiological and injury data from regional and local health care providers.

PH-3

Why The lack of available epidemiological and injury data for bay related activities restricts the ability of health professionals to adequately address trends and respond to episodic events. The single largest health risk identified is from injuries.

How STEP 1 — Recruit regional health care providers to participate in data collection focusing on bay related epidemiological and injury information. Use and customize TDH/CDC electronic reporting software for this purpose.

STEP 2 — Interpret and compile reported data. Periodically post data for use by health care professionals. Integrate health data with the regional monitoring strategy database. Investigate trends and correlations between health and water quality data. Develop a management strategy to reduce public health risks identified by the trend analysis.

STEP	Lead	Other Partners	Anticipated Costs
1	TAMU-CC/ College of Science	TDH, CDC, Nueces County DPH, Health care providers	To be determined
2	TAMU-CC/ College of Science	TDH, Nueces County DPH, Health care providers	To be determined

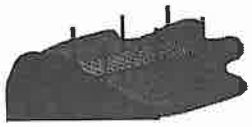
Total Anticipated Costs To be determined.

Measures of Success

- The database from health care providers on illnesses and accidents from outdoor recreational activities is increased.
- A determination is made whether there are temporal or spatial trends in bay-related diseases or injuries in the project area.

Related Actions

TDH Texas Department of Health
CDC Center for Disease Control
TAMU-CC Texas A&M University – Corpus Christi
DPH Department of Public Health



Action Plan
SHORELINE MANAGEMENT

Overview

Page

Objective: Assist local governments to strengthen local planning and permitting operations regarding shoreline management.

[Note: The actions of this section will be closely coordinated with the *Texas Coastwide Erosion Response Plan: A Report to the 75th Legislature* (TGLO, 1996)].

Key Findings

- Approximately 320 km (199 miles) of the Coastal Bend Bays shoreline are hardened or protected by seawalls, solid structures (concrete, wood, or metal), riprap, and piers, and 1,800 km (1,118 miles) of the shoreline are natural (White, *et al.,* 1998).

- Jetties provide the primary artificial hard substrate habitat in the region. The Aransas Pass jetties extend for 2.55 km (1.58 miles) (north jetty) and 1.89 km (1.17 miles) (south jetty). The Fish Pass jetties are each 30 m (98 ft) wide and 261 m (856 ft) long. In contrast, providing natural hard substrate are 16 km^2 (3,954 acres) of serpulid reefs in the project area (Tunnell, *et al.,* 1996). Data has not been provided on the area for groins, breakwaters, and bulkheads.

- Wetland restoration, enhancement, and creation projects should be incorporated in landscape-level planning for long-term sustainability of the natural resources in the project area (Smith, *et al.,* 1997). Preservation and restoration of remaining woody areas along waterways and bay shorelines, where possible, should be incorporated into landscape-level planning as well.

SM-1 Conduct a shoreline inventory to gain a site-specific understanding of shoreline management needs.

Why Environmental impacts from poorly planned shoreline development can include unnecessary wetland and upland habitat loss, reduced public access, altered bay circulation, and/or degraded water and sediment quality. With a site-specific understanding of environmental issues and needs, planners and decision-makers can prioritize how best to utilize limited resources to make needed improvements.

How **STEP 1** — Assess the relative degree of shoreline erosion, habitat loss, and potential for coastal hazards (i.e., vulnerability to sea level rise, storm surge, wave energy), through the use of aerial photos, maps, characterization reports, and other resources. Conduct ground-truthing of areas as necessary.

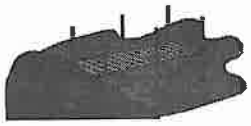
STEP 2 — Develop preliminary plans for site improvements and rank them for follow-up action, taking into account partnership opportunities with landowners, future development plans, cost estimates for needed improvements, and other information. Update these plans every 10 years.

STEP 3 — Implement site improvement projects as funds or other opportunities become available.

STEP	Lead	Other Partners	Anticipated Costs
1	CBBEP/TGLO	USFWS, SWCD, NRCS, PCCA, Navigation districts, Local governments	$15,000
2	CBBEP (contractor)	USFWS, SWCD, NRCS, PCCA, Navigation districts, Local governments	$150,000
3	Regional Shoreline Advisory Council	USFWS, SWCD, NRCS, PCCA, Navigation districts, Local governments	As available

Total Anticipated Costs $165,000

CBBEP Coastal Bend Bays and Estuaries Program
TGLO Texas General Land Office
USFWS United States Fish and Wildlife Service
SWCD Soil and Water Conservation District
NRCS Natural Resources Conservation Service
PCCA Port of Corpus Christi Authority



Measures of Success

- Impacts to bay resources from development or activities within the coastal shore area over time are determined.
- Changes over time in the degree of shoreline erosion, habitat loss, vulnerability to sea level rise, storm surge, and wave energy are determined.
- The percentage of shoreline attributed to hardened, developed, open, natural, mitigated, and filled conditions is determined.
- The rate of shoreline change, including erosion/accretion at target sites, is determined.

Related Actions

SM-2 Assist local governments with shoreline management issues.

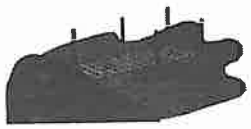
Why Local governments are responsible for land use planning, building codes, and permitting. With a consistent regional framework to guide shoreline development, planners and decision-makers can minimize environmental impacts while increasing real property values associated with new shoreline development.

How **STEP 1** — Convene an initial workshop of interested local governments, landowners, resource agencies, and other stakeholders to highlight issues, 'lessons learned', and guidelines used elsewhere. Establish a Regional Shoreline Advisory Council. Address mutual concerns with the help of resource agencies, and develop a list of funding opportunities and technical assistance programs. Establish a clearinghouse for information on shoreline management technologies and planning frameworks.

STEP 2 — Develop, produce, and distribute a set of 'Guidelines for Shoreline Management for use by Local Governments' through a consultative process that involves periodic workshops, individual meetings with local officials, and input from resource management agencies. Incorporate siting criteria and technical guidelines for future development improvements (e.g., water-dependent, water-related, and other compatible uses), that acknowledge the dynamic nature of bay and barrier island shorelines and projected sea level rise.

STEP 3 — Convene a series of workshops with a focus on local government officials to introduce the 'Guidelines', and provide information about technical and financial assistance programs, and other resources available to strengthen local capabilities.

STEP 4 — Establish an ongoing technical assistance program along the coast, and continue to seek ways to improve shoreline management and reduce coastal hazards. Demonstrate technologies that mitigate adverse impacts with non-structural designs and accommodation of beneficial uses.



STEP	Lead	Other Partners	Anticipated Costs
1	CBBEP/TGLO	SWCD, USFWS, OPUS, PCCA, Navigation districts, TPWD, Texas Sea Grant, Landowners, USACE, PICC, AGC, CBBF, Local governments	<$5,000
2	TGLO/CBCOG/ Regional Shoreline Advisory Council	SWCD, USFWS, OPUS, PCCA, Navigation districts, TPWD, Texas Sea Grant, Landowners, USACE, PICC, AGC, CBBF, Local governments	$50,000
3	TGLO/CBBEP	Regional Shoreline Advisory Council	$20,000
4	SWCD/TGLO/ CBBEP	Regional Shoreline Advisory Council	$60,000/year

Total Anticipated Costs $75,000 initially plus $60,000 per year thereafter.

Measures of Success

- A Regional Shoreline Advisory Council of local governments, landowners, and resource agencies is created.
- A user-friendly 'Guidelines for Shoreline Management for use by Local Governments' is produced and distributed to local governments.
- An increasing percentage of new development is consistent with the 'Guidelines'.

Related Actions SM-3

CBBEP	Coastal Bend Bays and Estuaries Program
TGLO	Texas General Land Office
SWCD	Soil and Water Conservation District
USFWS	United States Fish and Wildlife Service
OPUS	Organization for the Protection of an Unblemished Shoreline
PCCA	Port of Corpus Christi Authority
TPWD	Texas Parks and Wildlife Department
USACE	United States Army Corps of Engineers
PICC	Port Industries of Corpus Christi
AGC	Association of General Contractors
CBBF	Coastal Bend Bays Foundation
CBCOG	Coastal Bend Council of Governments

SM-3 Establish a locally administered Land Trust Fund to augment public access, sensitive habitat protection, and open space preservation.

Why The development of a Land Trust Fund will facilitate acquisition of sensitive shoreline areas in conjunction with conservation easements through a locally driven process. The goal of the fund is preservation of habitat (including 'buffer' areas to enhance water quality), open space, and public access. Participation in the Land Trust Fund will be through voluntary negotiations and there will be no condemnation of property.

How **STEP 1** — Establish the Land Trust Fund and develop operating protocols and the local governance structure for administration of the fund.

STEP 2 — Work closely with the workgroup indicated in HLR-1 and HLR-2 for the identification of shoreline areas to preserve, and work with the Regional Shoreline Advisory Council indicated in SM-2.

STEP 3 — Prioritize acquisition of identified areas.

STEP	Lead	Other Partners	Anticipated Costs
1	CBBF	Local governments, Nature Conservancy, Audubon Society, USFWS, TPWD, TGLO	$20,000/yr
2	CBBF	Regional Shoreline Advisory Council, Habitat and Living Resources Workgroup	
3	CBBF	Regional Shoreline Advisory Council, Habitat and Living Resources Workgroup	

Total Anticipated Costs $20,000 per year.

Measures of Success

- A public Land Trust Fund for land acquisition is established.

Related Actions BTR-2, SM-2, HLR-1, HLR-2

CBBF Coastal Bend Bays Foundation
USFWS United States Fish and Wildlife Service
TPWD Texas Parks and Wildlife Department
TGLO Texas General Land Office

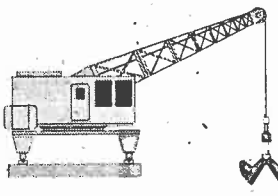
CHAPTER 3
Maritime Commerce and Dredging

Goals

Enhance maritime traffic safety while reducing the rate of maritime incidents from shipping, terminal operations, and marine pipelines.

Ensure that all dredging activities are planned and conducted in ways that consider the cost effectiveness of the operation, while minimizing ecological impacts and maximizing the beneficial uses of dredged material.

Maritime Commerce Action Plan



Dredging Action Plan

Introduction

Maritime commerce is vital and will continue as the cornerstone of the region's economy. Every year, some 80,000 vessels of all types cross the bays of the Coastal Bend (Jones, *et al.*, 1996). The possibility of an accident that could impact the marine environment must be minimized through practical and cost-effective strategies.

Dredging is required to maintain the region's navigation channels and help keep maritime commerce flowing safely (see Figure 14 for dredged navigable waterways). A resolution is needed to the continuing debate about the best way to manage dredging and placement of dredged material. With proper planning, it is possible to minimize negative environmental impacts and maximize benefits to the bays and the regional economy.

Ensuring Safety for the Maritime Commerce Industry

More than half of the economic activity in the region is linked to waterborne commerce via the use of shipping or pipelines (see Figures 15 and 16). Given the increase in vessel size and numbers over the years, and the widespread use of marine pipelines, there is a potential for accidents that could impact the marine environment, threaten human health and safety, and cause economic loss.

There have been relatively few vessel collisions or major spills in the bay system. The soft bottoms onshore and offshore are relatively forgiving to ships or barges that run aground. Moreover, accidents have generally been concentrated within the Corpus Christi Inner Harbor where it is relatively easy to contain a spill and minimize damage to wildlife and the marine environment. Nevertheless, accidents involving both ships and pipelines have occurred, and incidents in recent years have increased awareness that we must do everything practical to minimize the potential for additional accidents.

There have been relatively few vessel collisions or major spills in the bay system.

Operators of all waterborne craft including ships, barges, towboats, harbor tugs, shrimp trawlers, passenger vessels, supply boats, ferries, Navy ships, and recreational vessels are part of the mix that is involved in channel traffic safety. Several agencies are involved in maritime safety. The U.S. Coast Guard Marine Safety Office located in Corpus Christi is responsible for enforcing vessel safety and operational rules along the entire South Texas coast. It is assigned specific responsibility for inspection of vessels, crewmembers, bridges, and dock operations, to help avoid accidents and prevent pollution. It

More than half of the economic activity in the Coastal Bend region is linked to or finds its origins in waterborne commerce.

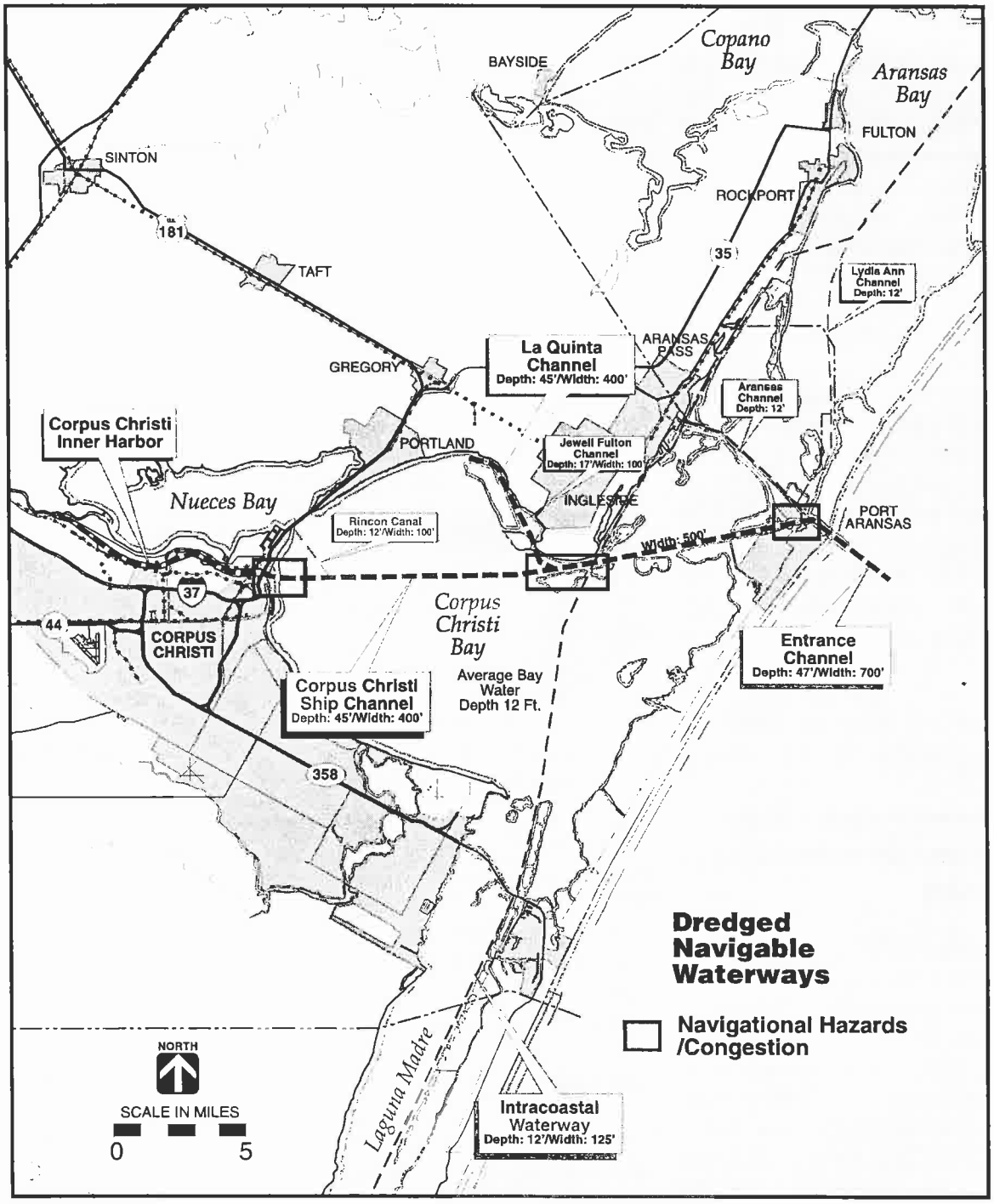


FIGURE 14 Dredged Navigable Waterways

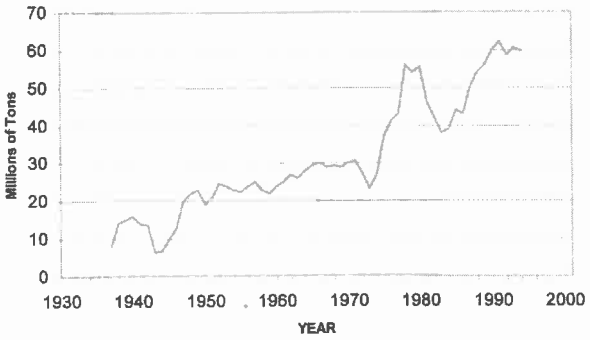


FIGURE 15 Port of Corpus Christ Freight 1933-1993
[Source: U.S. Army Corps of Engineers]

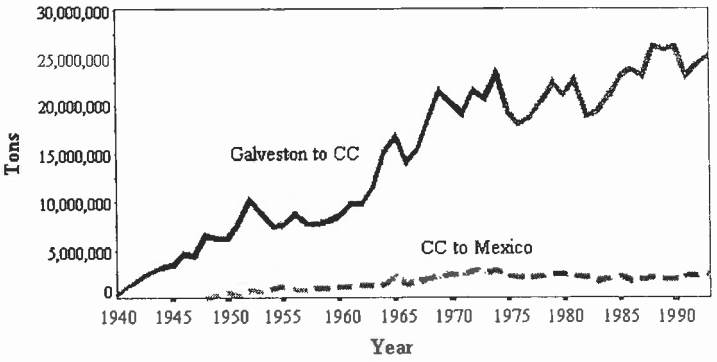


FIGURE 16 Total Tons of Shipping Traffic on the GIWW, Galveston to Corpus Christi and Corpus Christi to Mexico [Source: U.S. Army Corps of Engineers]

is also assigned the task of maintaining adequate aids to navigation and issuing safety-warning notices to mariners.

Members of the local harbor pilots association, tug operators, line handlers, the Harbormaster, and even operators of the Tule Lake Lift Bridge play a role in preventing accidents. The Coast Guard, the Port Authority, and the Pilots Association have historically ensured that traffic safety in the ship channel is a high priority. For instance, when tankers above a certain size are underway, only one-way traffic is allowed in the channel. The Port of Corpus Christi Authority operates the Harbormaster's Office round-the-clock to assist mariners with traffic management.

Participants in developing the ***Bays Plan*** recognize that additional safety improvements can be achieved. The actions call for the Pilots Association to provide continuing education and training for its members. Another action calls for the pilots, the Port of Corpus Christi, the Coast Guard, and others to collaborate on improvements to navigational ranges and the area's Vessel Traffic System. In addition, the Plan calls for support of a Port of Corpus Christi Authority initiative to create a 'barge shelf' that will significantly reduce the potential for vessel collision along that route.

The Corpus Christi Ship Channel leads the way from the Gulf Of Mexico to the Port of Corpus Christi, the sixth largest port in the U.S.

The Coast Guard serves as the federal on-scene coordinator responding to petroleum or chemical spills into the marine environment. The Texas General Land Office has responsibility as the state oil spill response coordinator and has been instrumental to ensure that substantial resources are prepositioned to reduce spill response times. Established in 1970 by the Port Authority and local industries, the Corpus Christi Area Oil Spill Control Association was a pioneer in oil spill response, active well before the

advent of specialty private cleanup contractors. The association responds to accidents in the Inner Harbor with equipment and trained personnel.

With respect to spill response, the Plan calls for continued refinement of the area's oil spill contingency plan, improved response technologies, and enhanced public awareness of response plans and notification networks. There are, of course, many partners to these actions, including the Texas Railroad Commission which has jurisdiction for certain spills of 240 barrels or less. The Texas General Land Office and the Coast Guard share the lead on actions related to oil spill response.

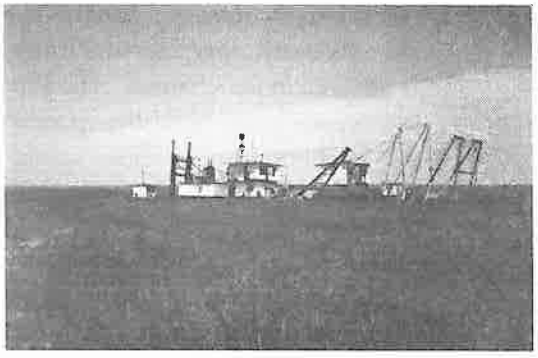
The Texas Natural Resource Conservation Commission (TNRCC) is the state chemical spill response coordinator. This responsibility is shared with the Coast Guard. The Local Emergency Planning Committee works with TNRCC to improve hazardous material spill response planning.

Meanwhile, the Texas Railroad Commission will lead efforts to establish an interagency forum to coordinate pipeline mapping and contingency planning. Information on marine pipelines, such as ownership, condition, and content, is not readily available in a consolidated source for use by response agencies. The Program will work to integrate pipeline information sources, and develop a Geographic Information System that will facilitate planning and response.

Finally, minimizing the potential for the introduction of non-native species through ship ballast water will be the target of another set of actions.

Maximizing Benefits from Dredging

Until the 1970s, almost all of the dredged material excavated in channel construction and maintenance was placed in unconfined areas, generally a short distance from the channel. This created 'spoil' islands (now referred to as dredged material placement areas) and covered large areas of shallow bay bottoms, creating either short-term or permanent disruption of biological productivity in these areas. Such material created much of the land on the north side of the Inner Harbor and on the west end of Harbor Island. Dozens of islands created by dredged material placement exist along the ship channel west of Port Aransas, on the west side of La Quinta Channel, and along the Intracoastal Waterway, especially in the Laguna Madre.



Dredged material alongside coastal marsh habitat can be used beneficially to enhance existing habitats or for erosion control purposes.

Despite losses of bay bottom habitat (largely due to the burial of seagrasses during dredging), dredged material placement has produced notable environmental enhancements, including the creation of nesting habitat on material placement islands. One such island, Pelican Island, is the largest brown pelican nesting area in Texas.

During the 1970s, minimizing wetland losses became an important public policy goal. The outcome was increased coordination between state and federal agencies regarding dredged material placement practices (i.e., levee-confined areas). Concern about the release of potentially harmful contaminants trapped in bottom silts in the Inner Harbor was also a factor in the design of material placement areas. However, dredged material must be tested using nationally approved methods to ensure sediment quality is adequate for in-bay or Gulf placement. Not all dredged material must be confined; for example, material excavated during channel maintenance across Corpus Christi Bay and in the Gulf entrance channel is placed in designated open water areas.

Dredge and fill activities not specifically authorized by the United States Congress cannot be conducted without an approved federal permit under Section 10 of the Rivers and Harbors Act and, in most cases, a permit under Section 404 of the Clean Water Act. A permit is needed whether the job is a ship channel or a shallow residential canal planned by a single landowner. These and other permitting requirements provide the current management framework for dredging. Project sponsors must apply to the U.S. Army Corps of Engineers, which seeks review and comment from federal and state natural resource agencies and the public. If it appears that a project will have significant impacts, an environmental assessment or an environmental impact statement is required. Each project is viewed individually in this management system; however, assessing the long-term cumulative impacts of multiple and interrelated dredging projects has been difficult.

One action of the ***Bays Plan*** calls for the creation of an interagency and public stakeholder committee that will examine the 'big picture' for maintenance dredging and give special attention to the possible beneficial use of clean dredged material. This 'Beneficial Uses Group' will identify opportunities to increase the volume of dredged material that is put toward beneficial uses. Such uses might include habitat creation or renourishment with suitable dredged material, or shore protection against erosive wave energy. The group will work to identify potential funding sources to achieve these goals.

The Port of Corpus Christi Authority is the local sponsor of the Corpus Christi Ship Channel and the branch La Quinta Channel. The Program will support the Port, in conjunction with the Corps of

Engineers and other stakeholders, to achieve consensus on a long-term dredged material management plan that will make use of sound dredging practices and maximize the beneficial use of dredged material.

Working in parallel fashion, the Program will assist the Texas Department of Transportation to achieve consensus among stakeholders on a long-term dredged material management plan for the Gulf Intracoastal Waterway (GIWW). Both the Corpus Christi Ship Channel and the GIWW are federal projects authorized by Congress, administered by the U.S. Army Corps of Engineers, and funded primarily through federal appropriations. Local sponsors of the dredging projects are responsible for development of long-term plans to manage dredged material and provide upland sites for dredged material placement when practical. The ***Bays Plan*** will assist to achieve consensus on the best overall plan for these and other future dredging projects.

The largest private dredge and fill project in the region is the waterfront residential subdivision on North Padre Island. More than 10 miles of canals have already been built and more are allowed under an existing permit. The Padre Island Property Owners Association is responsible for maintenance dredging of most of these canals. However, no areas for placement of maintenance dredging material have been designated or permitted. Residential subdivisions with dredged canals are also located in Ingleside, Aransas Pass, Port Aransas, and Rockport.

Action Plan
MARITIME COMMERCE

Overview

Key Findings

- Analysis of U.S. Army Corps of Engineers data on vessel traffic shows increasing trends for freight transported (about 60 million tons in 1992), increasing numbers of vessel trips (about 80,000 trips from all types of vessels in 1993), and a decreasing average size of shipments (to about 1,800 tons per vessel trip) (Jones, *et al.*, 1996).

- Oil and petrochemicals make up more than 90 percent of the cargo tonnage moved by ship and barge on the waters of the Coastal Bend Bays. The number of oil and chemical spills has decreased since about 1990, primarily due to the enactment of the Oil Pollution Act of 1990 which imposed new requirements for vessel construction, crew licensing, and financial responsibility for damages. There are about 5.5 oil spills for every chemical spill in the area from the Colorado River to Brownsville (Jones, *et al.,* 1996).

- Ballast water may be the source of the largest volume of foreign organisms released on a daily basis into American ecosystems. There is a concern that the invasive edible Brown Mussel (*Perna perna*) recently found in the project area could infest and partially sink navigation buoys, thus affecting maritime safety (Tunnell, *et al.,* 1996).

MC-1 Support construction of a 125 foot wide barge shelf on both sides of the ship channel to a depth of 15 feet.

Why The number of vessels using the Corpus Christi Ship Channel continues to grow. The construction of a barge shelf will significantly reduce the potential for collisions between deep-draft vessels and tow barges.

How **STEP 1** — Evaluate environmental impacts. Ensure coordination with environmental evaluations of other dredging projects within the region.

STEP 2 — Obtain Congressional authorization for the project.

STEP 3 — Coordinate, with USACE and USCG, the creation of the barge shelf adjacent to the main ship channel.

STEP	Lead	Other Partners	Anticipated Costs
1	PCCA	USACE, Commercial and recreational vessel operators, Aransas-Corpus Christi Pilots, 404 permit reviewers	$2,000,000
2	PCCA	USACE, Commercial and recreational vessel operators, Aransas-Corpus Christi Pilots, 404 permit reviewers	To be determined
3	PCCA	USACE, Commercial and recreational vessel operators, Aransas-Corpus Christi Pilots, 404 permit reviewers	To be determined (one person/year for 2 years)

Total Anticipated Costs $2,000,000 plus 1 full-time person for 2 years

Measures of Success

- The 125 foot wide barge shelf is funded and constructed.
- The number and frequency of maritime collisions and groundings is reduced.

Related Actions

USACE United States Army Corps of Engineers
USCG United States Coast Guard
PCCA Port of Corpus Christi Authority

MC-2 Modify the height, size, position, and light intensity of existing navigation ranges and add new ranges where necessary.

Why Existing navigation ranges are in need of updating to maintain safe vessel operations. Ongoing channel modifications and night lights from urban areas call for assessment of the proper placement and adequacy of ranges.

How **STEP 1** — Survey existing ranges and determine shortcomings. Report to USCG.

STEP 2 — Determine priorities for updating ranges and determine which ranges require high intensity day and night lights. Submit this information to USCG.

STEP 3 — Obtain fiscal commitments from USCG to make recommended improvements within 5 years, and coordinate on follow through with range improvements.

STEP	Lead	Other Partners	Anticipated Costs
1	Aransas-Corpus Christi Pilots	PCCA, USCG	$0
2	Aransas-Corpus Christi Pilots	PCCA, USCG	$0
3	PCCA	Aransas-Corpus Christi Pilots, USCG	$12,500 plus ⅛ person/year

Total Anticipated Costs $12,500 per year plus ⅛ full-time person until completed.

Measures of Success

- The range improvement plan is implemented.
- The number and frequency of maritime collisions and groundings are reduced.

Related Actions

USCG United States Coast Guard
PCCA Port of Corpus Christi Authority

MC-3 Modernize the vessel traffic system and aids to navigation.

Why The existing vessel traffic system and aids to navigation, especially for deep draft vessels, need to be updated to maintain safe vessel operations.

How **STEP 1** — Coordinate the location, installation, and modification of electronic monitors in Corpus Christi Bay and its approaches to provide real-time wind, tide, and current information to mariners via a phone or radio link.

STEP 2 — Assess available technology (including digital GPS and transponder technology) and implement a vessel traffic information system. Establish goals for the Vessel Traffic System.

STEP 3 — Establish federal authorization for the Vessel Traffic System.

STEP	Lead	Other Partners	Anticipated Costs
1	PCCA	TGLO, TCOON, NOAA, Aransas-Corpus Christi Pilots, USCG, Blucher Institute, Vessel operators, PICC	<$5,000
2	PCCA	Aransas-Corpus Christi Pilots, USCG, Blucher Institute, Vessel operators, PICC	To be determined
3	PCCA	Aransas-Corpus Christi Pilots, USCG, Blucher Institute, Vessel operators, PICC	To be determined

Total Anticipated Costs <$5,000 plus ½ full-time person. $139,000 already committed by PCCA for STEP 1.

Measures of Success

- The number and frequency of maritime accidents and spills are reduced.
- The Vessel Traffic System is implemented.

Related Actions

GPS	Global Positioning System
PCCA	Port of Corpus Christi Authority
TGLO	Texas General Land Office
TCOON	Texas Coastal Oceanic Observation Network
NOAA	National Oceanic and Atmospheric Administration
USCG	United States Coast Guard
PICC	Port Industries of Corpus Christi

MC-4 Increase vessel operator training regarding safe operating procedures, rules of the road, and local navigation hazards.

Why The single largest contributor to vessel accidents and spills from marine vessels is human error.

How **STEP 1** — Ensure continuing education and training of all ship pilots. Establish and self-enforce minimum standards based upon recognized international studies and standards. Formalize training schedule utilizing internationally recognized facilities.

STEP 2 — Conduct training workshops for all operators of commercial vessels, including tugs and barges, fishing vessels, and offshore supply vessels.

STEP 3 — Raise operator awareness about shorelines that are highly susceptible to erosion caused by vessel wakes.

STEP	Lead	Other Partners	Anticipated Costs
1	Aransas-Corpus Christi Pilots	Shipping companies, TGLO, USCG, TSPA, Texas Shrimpers Association, Texas Waterway Operators, OMSA, U.S. Navy	$55,000/yr
2	Aransas-Corpus Christi Pilots	Shipping companies, TGLO, USCG, TSPA, Texas Shrimpers Association, Texas Waterway Operators, OMSA, U.S. Navy	$15,000/yr
3	Aransas-Corpus Christi Pilots	Shipping companies, TGLO, USCG, TSPA, Texas Shrimpers Association, Texas Waterway Operators, OMSA, U.S. Navy	To be determined

Total Anticipated Costs Approximately $70,000/yr.

Measures of Success

- The ratio of maritime collisions and groundings to traffic volumes is reduced.

Related Actions

TGLO Texas General Land Office
USCG United States Coast Guard
TSPA Texas Seafood Producers Association
OMSA Offshore Marine Supply Association

MC-5 Maintain and improve regional oil spill response capability.

Why Oil spills have the potential for catastrophic environmental impacts. Rapid and effective spill response can greatly reduce impacts associated with spills.

How **STEP 1** — Continue to evaluate and prioritize high-risk areas based on environmental, social, and public health vulnerabilities. Incorporate this information into contingency planning documents.

STEP 2 — Explore and evaluate alternative spill response equipment and technologies in conjunction with equipment deployment. Develop guidelines and recommendations for spill responders.

STEP 3 — Increase public awareness of oil spill response plans and the notification network, including working with LEPC efforts. Provide opportunities for key public servants to participate in spill drills.

STEP	Lead	Other Partners	Anticipated Costs
1	USCG/TGLO	TNRCC, STCZAC, TRC, USEPA, NOAA, PICC	To be determined
2	USCG/TGLO	PICC, TNRCC, STCZAC, TRC, USEPA, NOAA	To be determined
3	USCG/TGLO	PICC, LEPC, TRC	To be determined

Total Anticipated Costs To be determined.

Measures of Success

- Oil spill response resources are being coordinated through cooperative agreements.
- The response to spills in environmentally sensitive areas is improved.

Related Actions

LEPC	Local Emergency Planning Committee
USCG	United States Coast Guard
TGLO	Texas General Land Office
TNRCC	Texas Natural Resource Conservation Commission
STCZAC	South Texas Coastal Zone Advisory Committee
TRC	Texas Railroad Commission
USEPA	United States Environmental Protection Agency
NOAA	National Oceanic and Atmospheric Administration
PICC	Port Industries of Corpus Christi

MC-6 Coordinate hazardous material spill response planning and resources to ensure adequate public protection.

Why Hazardous materials are moved daily across the bay by maritime transport. Efforts to protect the public in the eventuality of spills are of paramount importance.

How **STEP 1** — Develop a regional contingency plan in accordance with applicable regulations. Determine areas where the public is at greatest risk from accidental spills/releases of hazardous materials. Expand public input for plan development through the LEPC.

STEP 2 — Improve and expand the regional community alert/notification network. Ensure public awareness of emergency plans including evacuation routes, notification network, and emergency public communications.

STEP 3 — Establish a cooperative framework to coordinate deployment of response equipment and resources.

STEP	Lead	Other Partners	Anticipated Costs
1	USCG/TNRCC	City of Corpus Christi, LEPC, PICC, STCZAC, USEPA	To be determined
2	LEPC	City of Corpus Christi, TNRCC, PICC, STCZAC, USEPA	To be determined
3	USCG/TNRCC	City of Corpus Christi, LEPC, PICC, STCZAC, USEPA	To be determined

Total Anticipated Costs To be determined.

Measures of Success

- A HAZMAT regional plan is established in a cooperative framework.
- The effectiveness of hazardous material spill response is increased.
- Public awareness of emergency plans is increased.

Related Actions

LEPC Local Emergency Planning Committee
USCG United States Coast Guard
TNRCC Texas Natural Resource Conservation Commission
PICC Port Industries of Corpus Christi
STCZAC South Texas Coastal Zone Advisory Committee
USEPA United States Environmental Protection Agency

MC-7 Establish an interagency forum to coordinate pipeline mapping and contingency planning.

Why Information on marine pipelines (e.g., ownership, condition, and content of pipes) is not consolidated and readily available at a single source. Therefore, response time during a marine pipeline incident can be delayed.

How **STEP 1** — Establish a regional forum of pipeline stakeholders to address pipeline management. Identify all pipeline regulatory stakeholders and determine information gaps, duplicative requirements, and overlapping jurisdictions. Utilize interagency memoranda of understanding to streamline and coordinate regional pipeline oversight.

STEP 2 — Compile existing marine pipeline GIS databases including pipeline attributes such as composition, dimension, product carried, activity level, ownership, and location. Make the GIS database available to all interested parties via the Internet or some other network system.

STEP	Lead	Other Partners	Anticipated Costs
1	TRC	City of Corpus Christi, PICC, Pipeline companies, LEPC, TGLO, USACE, RSPA	To be determined
2	TRC	City of Corpus Christi, PICC, Pipeline companies, LEPC, TGLO, USACE, RSPA	To be determined

Total Anticipated Costs To be determined.

Measures of Success

- The percent of target pipelines mapped in the project area is increased.

Related Actions

GIS	Geographic Information System
TRC	Texas Railroad Commission
PICC	Port Industries of Corpus Christi
LEPC	Local Emergency Planning Committee
TGLO	Texas General Land Office
USACE	United States Army Corps of Engineers
RSPA	Research and Special Programs Administration

MC-8 Prevent the introduction of non-native species through improved ballast water management.

Why The introduction of non-native species through ballast water discharges can result in catastrophic environmental impacts. Introduced species can dramatically alter the composition and function of biological communities and result in significant economic loss.

How **STEP 1** — Support the implementation of the National Invasive Species Act locally by educating ship owners, charter parties, PICC, and vessel operators frequenting the project area about the potential impacts of ballast operations.

STEP 2 — Identify vessels with the highest potential for introduction of invasive species based on trade routes, cargo/ballast operations, safety records, and regulation compliance.

STEP 3 — Coordinate this information with the USCG Marine Safety Information System database and develop a regional invasive species strategy plan for marine vessels. Prioritize educational efforts and compliance evaluation based on vessels with the highest potential for introduction of invasive species.

STEP	Lead	Other Partners	Anticipated Costs
1	USCG/CBBEP	TPWD, USFWS, Texas Sea Grant, Vessel owners and operators, Charter parties, PICC	<$5,000
2	ACCP/CBBEP	USCG, USFWS, Texas Sea Grant, Vessel owners and operators, Charter parties, PICC	$20,000
3	USCG	TPWD, USFWS, Texas Sea Grant, Vessel owners and operators, Charter parties, PICC	To be determined

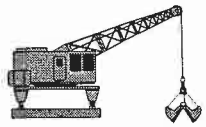
Total Anticipated Costs $25,000 initially.

Measures of Success

- Introductions of non-native species from ballast water are prevented.

Related Actions HLR-10

PICC Port Industries of Corpus Christi
USCG United States Coast Guard
CBBEP Coastal Bend Bays and Estuaries Program
TPWD Texas Parks and Wildlife Department
USFWS United States Fish and Wildlife Service
ACCP Aransas Corpus Christi Pilots



Action Plan
DREDGING

Overview

Page

Objective: Improve dredging techniques and dredged material management practices.

Key Findings

- Dredging is an ongoing activity necessary to maintain navigable waterways in the Coastal Bend Bays. There are 284 km (176 miles) of transportation canals within the bays and estuaries of the project area (Tunnell, *et al.*, 1996).

- There is a lack of consensus about the beneficial and adverse effects, both economic and ecological, of new dredging projects and maintenance dredging, and the handling and placement of dredged material. Program studies have documented some impacts:

  - The Redfish Bay area lost 795 ha (1,964 acres) of seagrass between 1958 and 1994, attributed to dredged material deposition and channel impacts. An additional 407 ha (1,006 acres) were gained during the same time period for a net loss of 388 ha (958 acres). These losses were primarily related to construction of the Gulf Intracoastal Waterway through the Redfish Bay area and the resulting discharge of dredged material directly onto seagrass beds (Pulich, *et al.*, 1997).

  - Marshes have been lost in the project area, although these are limited in extent and have been offset by large gains due to localized sea level rise. Marshes have been converted to agricultural and urban land or lost as a result of dredging, excavating, filling, draining, and leveeing (White, *et al.*, 1998).

  - Bay bottoms have been affected by human-related activities, including dredging and commercial tug and barge operations (Montagna, *et al.*, 1998b).

D-1 Establish a proactive Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material.

Why Dredged material has been used beneficially for shoreline stabilization and habitat creation projects. The availability of dredged material coupled with the need to dispose of it in an environment-friendly manner call for the formation of a Beneficial Uses Group to recommend creative ways to beneficially use dredged material.

How **STEP 1** — Establish a Beneficial Uses Group (BUG) to guide plan development.

STEP 2 — Assess the results of related research on beneficial uses of dredged material.

STEP 3 — Identify potential funding sources for beneficial use projects and recycling incentives.

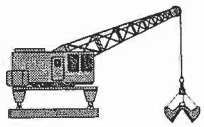
STEP 4 — Design and implement beneficial use projects.

STEP 5 — Monitor the success of beneficial use projects.

STEP	Lead	Other Partners	Anticipated Costs
1	CBBEP	PCCA, USACE, TGLO, TNRCC, TPWD, NMFS, USEPA, TXDOT, USFWS, UTMSI, TAMU-CC, TWDB, Texas Sea Grant, Dredging industry, CBBF, CCA	To be determined
2	PCCA	USACE, TGLO, TNRCC, TPWD, NMFS, USEPA, TXDOT, USFWS, UTMSI, TAMU-CC, TWDB, Texas Sea Grant, Dredging industry, CBBF, CCA, CBBEP	To be determined
3	PCCA	USACE, TGLO, TNRCC, TPWD, NMFS, USEPA, TXDOT, USFWS, UTMSI, TAMU-CC, TWDB, Texas Sea Grant, Dredging industry, CBBF, CCA, CBBEP	To be determined
4	PCCA	USACE, TGLO, TNRCC, TPWD, NMFS, USEPA, TXDOT, USFWS, UTMSI, TAMU-CC, TWDB, Texas Sea Grant, Dredging industry, CBBF, CCA, CBBEP	To be determined
5	PCCA	USACE, TGLO, TNRCC, TPWD, NMFS, USEPA, TXDOT, USFWS, UTMSI, TAMU-CC, TWDB, Texas Sea Grant, Dredging industry, CBBF, CCA, CBBEP	To be determined

Total Anticipated Costs To be determined.

CBBEP	Coastal Bend Bays and Estuaries Program
PCCA	Port of Corpus Christi Authority
USACE	United States Army Corps of Engineers
TGLO	Texas General Land Office
TNRCC	Texas Natural Resource Conservation Commission
TPWD	Texas Parks and Wildlife Department
NMFS	National Marine Fisheries Service
USEPA	United States Environmental Protection Agency
TXDOT	Texas Department of Transportation
USFWS	United States Fish and Wildlife Service
UTMSI	University of Texas Marine Science Institute
TAMU-CC	Texas A&M University – Corpus Christi
TWDB	Texas Water Development Board
CBBF	Coastal Bend Bays Foundation
CCA	Coastal Conservation Association



Measures of Success

- The number of projects implementing beneficial use of dredged material is increased.
- The percentage of dredged material used beneficially is increased.

Related Actions

HLR-2

D-2 Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.

Why Dredging is an ongoing activity necessary to maintain navigable waterways for the support of maritime commerce along the Corpus Christi Ship Channel. Management plans for dredging activities and dredged material handling and disposal are essential to minimize impacts to natural resources.

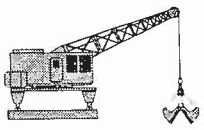
How **STEP 1** — Coordinate, in conjunction with the USACE and ICTs, the development of an economically feasible, 50 year dredged material management plan (to be updated every five years). Ensure that the plan reflects the goal of using Best Management Practices for handling dredged materials, and focuses on minimizing environmental impacts during all stages of dredging operations and during the handling and placement of materials.

STEP 2 — Create a dredging information repository for use by the implementing partners that includes a bibliography of current and historic research, accesses existing databases of permit actions, and accesses existing models for predicting impacts.

STEP	Lead	Other Partners	Anticipated Costs
1	PCCA	USACE, TGLO, TNRCC, TPWD, NMFS, USEPA, TXDOT, USFWS, UTMSI, TAMU-CC, TWDB, Texas Sea Grant, Dredging industry, CBBF, CCA	To be determined
2	CBBEP	PCCA, USACE, TGLO, TNRCC, TPWD, NMFS, USEPA, TXDOT, USFWS, UTMSI, TAMU-CC, TWDB, Texas Sea Grant, Dredging industry, CBBF, CCA	To be determined

Total Anticipated Costs To be determined.

USACE	United States Army Corps of Engineers	TXDOT	Texas Department of Transportation
ICT	Interagency Coordination Team	USFWS	United States Fish and Wildlife Service
PCCA	Port of Corpus Christi Authority	UTMSI	University of Texas Marine Science Institute
TGLO	Texas General Land Office	TAMU-CC	Texas A&M University – Corpus Christi
TNRCC	Texas Natural Resource Conservation Commission	TWDB	Texas Water Development Board
TPWD	Texas Parks and Wildlife Department	CBBF	Coastal Bend Bays Foundation
NMFS	National Marine Fisheries Service	CCA	Coastal Conservation Association
USEPA	United States Environmental Protection Agency	CBBEP	Coastal Bend Bays and Estuaries Program



Measures of Success

- A dredging oversight group to monitor dredging activities is established.
- A bibliography of current and historical research on dredging is assembled for use by implementation partners.
- Dredging techniques and dredged material management practices are improved.
- The need for dredged material disposal areas that are not beneficial use sites is reduced.

Related Actions

HLR-4

D-3 Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.

D-3

Why Dredging is an ongoing activity necessary to maintain navigable waterways for the support of maritime commerce and recreational boating along the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas. Management of dredging activities and dredged material handling and disposal is essential to minimize impacts to natural resources.

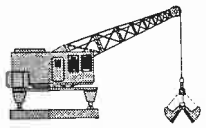
How **STEP 1** — Coordinate, in conjunction with the USACE and ICTs, the development of an economically feasible, 50 year dredged material management plan (to be updated every five years). Ensure that the plan reflects the goal of using Best Management Practices for handling dredged materials, and focuses on minimizing environmental impacts during all stages of dredging operations.

STEP 2 — Create a dredging information repository for use by the implementing partners that includes a bibliography of current and historic research, accesses existing databases of permit actions, and accesses existing models for predicting impacts (same as for D-2).

STEP	Lead	Other Partners	Anticipated Costs
1	TXDOT (GIWW) Others as appropriate	PCCA, USACE, TGLO, TNRCC, TPWD, NMFS, USEPA, USFWS, UTMSI, TAMU-CC, TWDB, Texas Sea Grant, Dredging industry, CBBF, CCA, Residential developers, Local governments	To be determined
2	CBBEP	PCCA, USACE, TGLO, TNRCC, TPWD, NMFS, USEPA, TXDOT, USFWS, UTMSI, TAMU-CC, TWDB, Texas Sea Grant, Dredging industry, CBBF, CCA, Local governments	To be determined

Total Anticipated Costs To be determined.

USACE	United States Army Corps of Engineers
ICT	Interagency Coordination Team
TXDOT	Texas Department of Transportation
GIWW	Gulf Intracoastal Waterway
PCCA	Port of Corpus Christi Authority
TGLO	Texas General Land Office
TNRCC	Texas Natural Resource Conservation Commission
TPWD	Texas Parks and Wildlife Department
NMFS	National Marine Fisheries Service
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UTMSI	University of Texas Marine Science Institute
TAMU-CC	Texas A&M University - Corpus Christi
TWDB	Texas Water Development Board
CBBF	Coastal Bend Bays Foundation
CCA	Coastal Conservation Association
CBBEP	Coastal Bend Bays and Estuaries Program



Measures of Success

- A dredging oversight group to monitor dredging activities is established.
- A bibliography of current and historical research on dredging is assembled for use by implementation partners.
- Dredging techniques and dredged material management practices are improved.
- The need for dredged material disposal areas that are not beneficial use sites is reduced.

Related Actions

HLR-4

CHAPTER 4
Habitat and Living Resources

Goals

Increase and preserve the quantity, quality, and diversity of habitats and living resources.

Habitat and Living Resources Action Plan

Introduction

A diversity of tidally-influenced habitats is found within and adjacent to Coastal Bend bays and estuaries. These habitats and their populations of fauna and flora comprise ecosystems that are unique to South Texas (for example, see Figure 17 on locations of seagrasses and rookeries). Recognizing that high quality, functional habitat is the foundation for a healthy bay system, the ***Bays Plan*** adopts an 'ecosystems approach' to evaluate and implement the various conservation and management measures necessary to ensure long-term productivity of these resources.

The Program has worked to assess the status and trends of selected habitats and living resources, and to evaluate strategies to ensure continued productivity for the three estuaries. A complete list of characterization studies can be found in Appendix F.

Although results indicate that the bay system is in moderate to good overall health, there is a considerable lack of data with respect to many of the ecosystem components. Despite this lack of certain data on the ecological functioning of parts of the estuarine system, participants have identified several actions that can and should be undertaken in order to ensure long-term resource sustainability.

Ensuring a Diversity of Functional Habitat

The Coastal Bend is comprised of eight major tidally-influenced habitat types essential to native living resources and a productive estuarine ecosystem. These habitats are coastal marshes, wind tidal flats, seagrass meadows, open bays, oyster and serpulid worm reefs, barrier islands, and freshwater marshes. Although losses have been incurred by every type of habitat, offsetting gains have also taken place in some cases. Wind tidal flats have suffered the most significant losses, but habitat acreage is, in general, fairly stable over the long-term.

Coastal marsh grass provides a habitat for many estuarine organisms.

The great blue heron feeds on crabs, shrimp, and fish in and around coastal marshes.

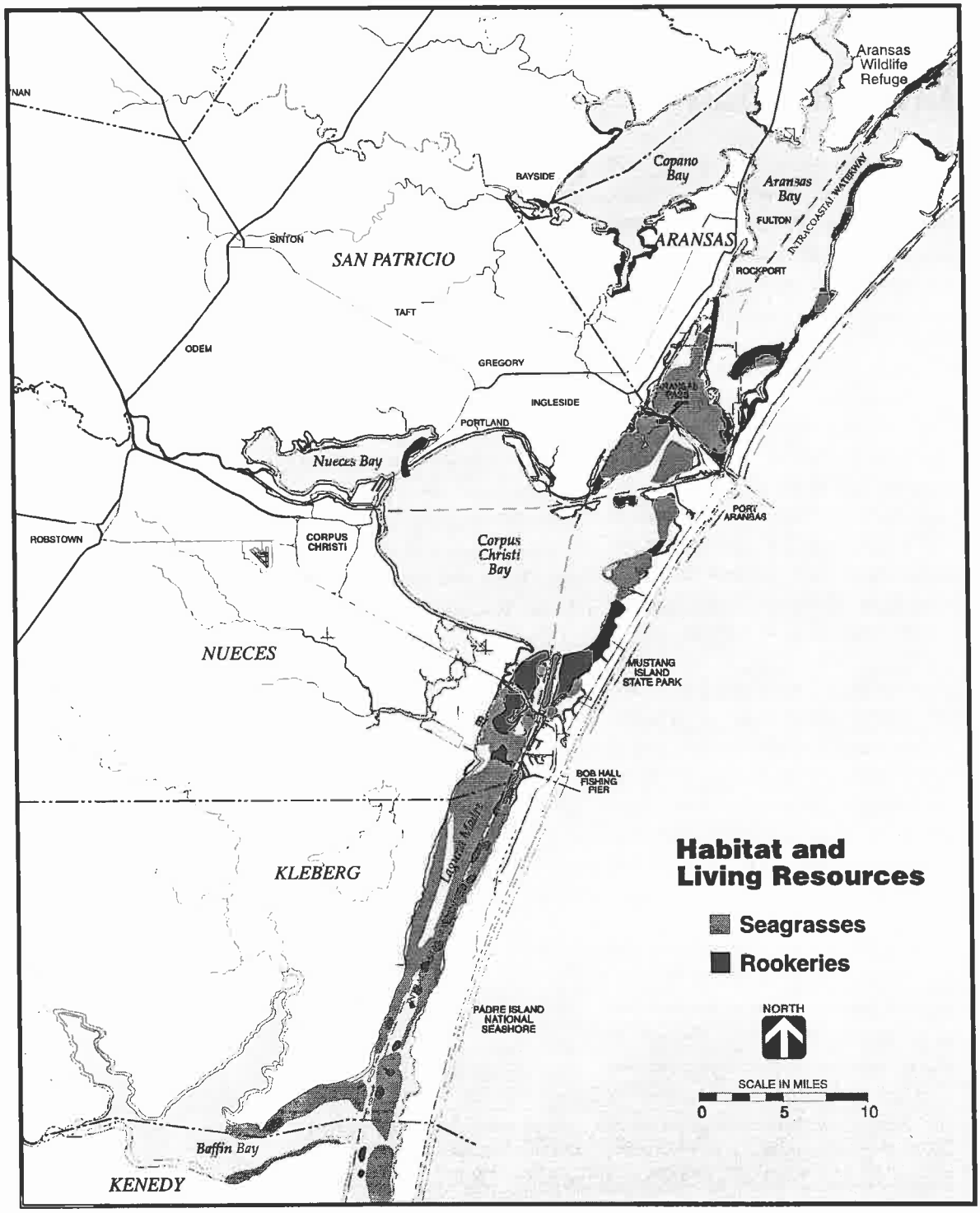


FIGURE 17 Habitat and Living Resources

The quality and functionality of habitat is, however, a different and perhaps more important indicator of overall health and productivity. And while much additional monitoring and assessment is needed to make accurate, quantifiable statements regarding habitat function, evidence suggests that certain habitat types are stressed and at risk. Changes in circulation patterns from freshwater inflow alteration, dredging and filling, shoreline alteration, and road construction have altered the hydrology of some areas. In addition, point and nonpoint source discharges can degrade habitat as can activities associated with seismic exploration for oil and gas. For example, past (point source) brine discharges have degraded habitat at White's Point in Nueces Bay, and nonpoint source pollution from some urban stormwater outfalls has altered the chemistry of bay sediments and may have affected their biological communities (Carr, *et al.*, In review).

The ***Bays Plan*** calls for efforts to identify habitat types that are most at risk and to work with landowners and local and state governments on ways to preserve sufficient, functional acreage of those habitats. Various tools can be employed to attain this goal, including the use of conservation easements, tax abatements, or land acquisition. Once set aside, habitat management plans will be developed and implemented.

Habitat destruction, degradation, and fragmentation have been documented by various Program studies. Factors contributing to the loss of habitats include conversion to other land uses, dredge and fill activities, natural erosion, altered freshwater inflow, and degraded water quality.

Declines in living resource populations relate to the loss, degradation, or fragmentation of essential habitats and, at times, over-exploitation. The development and implementation of site-specific plans for habitat creation or restoration will be pursued, again through cooperative efforts of landowners, local governments, and resource agencies with available technical and/or financial assistance. The following species of concern have been identified that would potentially benefit from the restoration, enhancement, creation, or better management of habitats: whooping cranes, neotropical migratory birds, colonial waterbirds including the brown pelican and snowy and piping plovers, shrimp, blue crabs, larval fish, and many others.

The largest nesting population of the endangered brown pelican in Texas can be found within the CBBEP project area at Pelican Island in Corpus Christi Bay.

Survivability for Species of Concern

There are some cases where providing sufficient, high-quality habitat is not enough to ensure the survivability of a species. Other impacts, such as over-harvesting, invasion by non-native species, or decreased reproductive rates due to the persistence of a certain chemical in the environment, can be equally or more threatening to a given species. In such cases, a targeted species recovery or management plan is needed, and its actions put into full implementation throughout the species' range.

The ***Bays Plan*** calls for a vigilant and continuing look at such species of concern, and the development and implementation of management plans as necessary. Thus, coordinated with the habitat workgroup that will oversee essential habitat plans, stakeholders will address species of concern and develop management plans for birds, aquatic species (including marine mammals and reptiles), and plants on an as-needed basis. Coupled with this action, stakeholders will work to improve the existing network of animal rescue and rehabilitation programs, and secure stable funding and human resources to fulfill their missions.

Collaborative Management of the Shrimp Fishery

Few intensively utilized fishery resources in the world exist without conflict among competing users. The shrimp fishery in South Texas is no exception. Bay, bait, and Gulf shrimpers all have their own ways of doing business and views on existing regulations. Environmental groups, recreational fishermen, and even the maritime transport industry also have something to say about how the present management regime could be improved. Although the Texas Parks and Wildlife Department (TPWD) has worked very hard to stay abreast of the ever-evolving dynamics of the fishery, the fact remains that few stakeholders are satisfied with the present management system.

The ***Bays Plan*** will work to facilitate consensus among all stakeholders on a regional approach to effectively manage bay and bait shrimping. To accomplish this, relevant stakeholders will be invited to participate in a series of workshops and meetings, the goal of which will be to develop a regional framework and recommendations for presentation to the TPWD and existing state shrimp fishery advisory boards.

Shrimp are the most important commercial seafood in Texas, annually accounting for over 90% of the value of all reported seafood landings.

There are many issues to be dealt with, one of which is the question of how best to minimize the incidental catch of non-shrimp species while trawling. This 'bycatch', as it is called, can result in environmental and economic losses of considerable dimension. The Program has worked with TPWD and members of the Texas Seafood Producers Association to test alternative designs for an effective Bycatch Reduction Device (BRD). The ***Bays Plan*** calls for continued assessment of the optimal BRD design and its eventual voluntary use by bay shrimpers.

Other Management Issues and Needs

Additional issues affect living resource populations and/or habitats that have been partly addressed by resource managers or industry. These issues deserve at least some continued assessment and possible management action: impingement or entrainment of organisms by cooling water intakes; harmful algal blooms; and the introduction of non-native species.

Aquatic organisms are lost when they are drawn through the cooling water apparatus of power generating plants or other industrial operations. The most significant user of marine cooling water in the project area is Central Power and Light (CPL) and the company has already employed state-of-the-art technology at its Barney-Davis Power Plant to minimize losses due to impingement or entrainment. Similar equipment is not employed at its Nueces Bay plant. Cooling water for that plant is drawn from the Inner Harbor. It is not known how (if at all) significant the issue may be for that bay segment. The Plan simply calls for CPL to take the lead on further evaluation of impacts as a result of its operations within the project area, and to determine if any additional, cost-effective technologies can be employed.

Algal blooms are considered harmful if they threaten human health, cause economic loss, or result in detrimental changes to an ecosystem. Environmental mechanisms that trigger and sustain these blooms are not fully understood, preventing effective forecasting and/or management of harmful algal blooms (HABs). Research and monitoring programs are necessary to assess both short- and long-term effects of blooms, and to seek management practices that could reduce their severity or prevent their occurrence.

Red tides occur under natural conditions. But the occurrence of these events has increased around the country, especially near heavily urbanized areas.

Since 1980, four well-documented harmful algal blooms have occurred in the Coastal Bend. Red tide blooms occurred in 1986, 1996, and 1997, and killed millions of marine organisms. During these blooms, the Texas Department of Health prohibited the harvest of oysters from area bays, which resulted in economic loss to oyster fishermen. Local processing houses and many area beaches were also closed. From 1990 through late 1997, the upper Laguna Madre experienced a persistent bloom of a microscopic phytoplankton species generally referred to as the Brown Tide. The turbid, brown-colored water resulted in environmental impacts to the underlying seagrass meadows. Laboratory and field studies have also shown that high concentrations of the Brown Tide organism are toxic to the eggs and larvae of at least some finfish species. To date, however, no statistically significant declines in finfish stocks have been observed.

Unfortunately, scientists and resource managers have not, as yet, solved all the mysteries of algal blooms. Knowing with certainty their cause and reasons for perpetuation is a prerequisite to developing effective management strategies. The ***Bays Plan*** recognizes this need for continued research (including demonstration projects on possible mitigation measures), and calls for ongoing attention to the issue in the hope of reducing the occurrence and impacts of future blooms.

Finally, the invasion of non-native species into native habitats can alter both habitat structure and function, and disrupt or displace native species. Heightened concern over the increased introduction of non-native species, which are causing multi-million dollar control problems in some areas of the country, led to the passage of the Invasive Species Act of 1996. The only local aquatic invasive species of concern identified to date, the edible brown mussel, has fluctuated greatly in population numbers since its introduction in 1989 or 1990, but no significant adverse impacts have been recorded to date. The ***Bays Plan*** calls for the identification of techniques and practices to control new introductions of non-native species.

Action Plan
HABITAT AND LIVING RESOURCES

Overview

Key Findings

Habitat

- Extensive changes in intertidal flats occurred between the 1950s and 1979, during which time more than 10,000 ha (24,710 acres) were converted to other habitat classes. Almost 55 percent of the change was due to permanent inundation of the flats and their replacement by either open water or seagrass beds attributed to a rise in sea level. About 20 percent of the intertidal flats were converted to marshes, and another 20 percent were converted to uplands (White, *et al.*, 1998).

- Marshes have been lost in the project area, although these are limited in extent and have been offset by large gains. Among the notable losses were pothole wetlands on the coastal prairie and on the barrier strandplain ridge, the Live Oak Peninsula/Ridge. Palustrine marshes had their largest gains on the barrier islands. Marshes have been converted to agricultural and urban land or lost as a result of dredging, excavating, filling draining, and leveeing (White, *et al.,* 1998).

Living Resources

- A review of state listed species in 1994 documented 39 threatened or endangered species, 19 of which utilize estuaries. The only natural population of the endangered Whooping Crane winters in the marshes in the Aransas National Wildlife Refuge. Over 20 species of shorebirds have been recorded on wind-tidal flats, including several endangered species. Causes for decline include over-exploitation or habitat degradation and loss (Tunnell, *et al.,* 1996). (NOTE: At the time the ***Bays Plan*** went to press, the number of state listed species was 35). See Table 3 on page 84.

- The project area is one of the richest fisheries resources in Texas. An average of 8.4 million pounds per year of finfish, shrimp, crab, and other aquatic species were harvested between 1972 and 1992 (Tunnell, *et al.,* 1996). Data suggest, however, some population declines in Atlantic croaker, southern flounder, Gulf menhaden, white shrimp, and adult blue crab (Lacson and Lee, 1997).

- There are 494 known bird species inhabiting or migrating through the project area. This enormous diversity is attributed to the numerous food and habitat types, key geographical location for migration, and multiple nesting areas. However, except for the brown pelican, nesting populations of colonial waterbirds have decreased. The U.S. Fish and Wildlife Service is concerned about two issues that impact neotropical migrant birds: rapid habitat loss in other countries and the need to preserve wooded riparian corridors and coastal prairies along the Gulf coast (Tunnell, *et al.,* 1996).

- There is some evidence of an increasing trend in dolphin strandings, particularly the bottlenose dolphin (Tunnell, *et al.,* 1996).

- The benthic communities of Corpus Christi, Baffin, and Nueces Bays are characterized by low diversity, dominance by pioneer species, and high variance of community and physical variables (Montagna, *et al.,* 1998b).

Other potential management actions address shrimping, harmful algal blooms, and non-native species:

Shrimping

- Shrimp is currently the dominant catch in the project area (primarily Aransas and Corpus Christi Bays), representing between 60 and 90 percent of the commercial harvest between 1988 and 1993. Bycatch as a result of shrimp trawling may comprise 1.5 to 7 times the weight of shrimp caught in these bays (Tunnell, *et al.,* 1996).

- Preliminary findings suggest that various designs of Bycatch Reduction Devices (BRDs) have potential conservation benefits to bay ecosystems without undue loss of shrimp or commercial revenues. Three BRDs are currently being evaluated for their potential to reduce bycatch (Fuls, *et. al.*, In review).

- Bay bottoms have been affected by human-related activities, including shrimp trawling (Montagna, *et al.*, 1998b).

Harmful Algal Blooms

- The Brown Tide has caused a recent loss of 10 km^2 (2,471 acres) of seagrass coverage in upper Laguna Madre and other impacts such as decreased abundance, biomass, and diversity of benthic fauna, and reduced larval fish populations (Buskey, *et al.*, 1996).

- There is a lack of consistent data on red tide conditions before, during, and after a bloom (i.e., *in situ* water sampling of temperature, salinity, winds and currents, nutrients, cell counts, and biologically active organic compounds), both offshore and inshore (Buskey, *et al.*, 1996).

Non-native Species

- The introduced edible brown mussel expanded a distance of 1,300 km (808 miles) south between its first observation in 1990 and 1994. Its invasive nature has raised concern that it may have the potential to overcome native species inhabiting the limited artificial hard substrate found within the project area (Tunnell, *et al.*, 1996). To date, no significant adverse affects have been recorded.

- The nutria, an exotic herbivore, appears to be extending its range into the project area, and could impact marsh vegetation (Tunnell, *et al.*, 1996).

- Data is lacking on the effects of invasive non-native fire ants on reproduction of brown pelicans, sea turtles, and other species (Tunnell, *et al.*, 1996).

TABLE 3
State and federal listed threatened and endangered species (exclusive of whales and dolphins) in 12-county project area.

Species	Federal list	State list
REPTILES/AMPHIBIANS		
Kemp's Ridley Sea Turtle*	E	E
Leatherback Sea Turtle*	E	E
Green Sea Turtle*	T	T
Loggerhead Sea Turtle*	T	T
Hawksbill Sea Turtle*	E	E
Texas Tortoise		T
Texas Horned Lizard		T
Scarlet Snake		T
Indigo Snake		T
Northern Cat-eyed Snake		T
Smooth Green Snake		T
Black-spotted Newt		T
South Texas Siren		T
FISH		
Oppossum Pipefish*		T
BIRDS		
Eskimo Curlew (probably extinct)*	E	E
Northern Aplomado Falcon	E	
American Peregrine Falcon*	E	
Arctic Peregrine Falcon*	T	T
Brown Pelican*	E	E
Whooping Crane*	E	E
Piping Plover*	T	T
Reddish Egret*		T
Sooty Tern*		T
White-faced Ibis*		T
Wood Stork*		T
Attwater's Greater Prairie-Chicken	E	E
Bald Eagle	T	T
Cactus Ferruginous Pygmy Owl		T
American Swallow-tailed Kite		T
White-tailed Hawk		T
MAMMALS		
West Indian Manatee*	E	E
Jaguarundi	E	E
Ocelot	E	E
White-nosed Coati		T
PLANTS		
Slender Rush-pea	E	E
South Texas Ambrosia	E	E
Black Lace Cactus	E	E

*denotes estuarine dependent species

HLR-1 Preserve functional, natural habitats of all major types.

Why The Coastal Bend encompasses a wide diversity of coastal habitats that are essential to native living resources. The preservation of these habitats is fundamental to the health and productivity of the native flora and fauna.

How **STEP 1** — Based on characterization studies and with guidance from a workgroup of interested stakeholders, facilitate the identification and prioritization of habitat types and locations for preservation efforts.

STEP 2 — Encourage private landowners to preserve essential habitat by providing funding incentives for conservation easements, acquisition, or other preservation techniques. Provide technical assistance to develop and implement management plans for these areas.

STEP	Lead	Other Partners	Anticipated Costs
1	CBBEP	TPWD, TGLO, Center for Coastal Studies, USFWS, TNC, CBBF, Audubon, PCCA, UTMSI, USCG, NRCS, USGS, TSSWCB, SWCDs, Local governments, Landowners, other stakeholders	<$5,000
2	TPWD/CBBF	CBBEP, TGLO, Center for Coastal Studies, USFWS, TNC, Audubon, PCCA, UTMSI, USCG, NRCS, USGS, TSSWCB, SWCDs, Local governments, Landowners, other stakeholders	$20,000 plus ½ person/year, plus implementation funds to be determined by projects

Total Anticipated Costs $25,000 plus implementation funds to be determined on a project-by-project basis.

Measures of Success

- The area of preserved habitat is increased.
- The number of Project Wild certifications is increased.

Related Actions SM-3, HLR-3, WSQ-5

CBBEP	Coastal Bend Bays and Estuaries Program
TPWD	Texas Parks and Wildlife Department
TGLO	Texas General Land Office
USFWS	United States Fish and Wildlife Service
TNC	The Nature Conservancy
CBBF	Coastal Bend Bays Foundation
PCCA	Port of Corpus Christi Authority
UTMSI	University of Texas Marine Science Institute
USCG	United States Coast Guard
NRCS	Natural Resources Conservation Service
USGS	United States Geological Survey
TSSWCB	Texas State Soil and Water Conservation Board
SWCD	Soil and Water Conservation District

HLR-2 Create new habitats and/or restore degraded habitats where feasible.

HLR-2

Why Habitat destruction, degradation, and fragmentation have been documented by various Program studies. Factors contributing to the loss of habitats include conversion to other land uses, dredge and fill activities, natural erosion, altered freshwater inflow, and degraded water quality.

How **STEP 1** — Based on Program studies and with guidance from a workgroup of interested stakeholders, facilitate the identification and prioritization of habitat types and locations for creation or restoration efforts.

STEP 2 — Develop and implement site-specific plans for creation and restoration, including appropriate follow-up monitoring and assessment.

STEP	Lead	Other Partners	Anticipated Costs
1	CBBEP	TGLO, TPWD, Center for Coastal Studies, CBBF, UTBEG, UTMSI, USFWS, USGS, PCCA, CCA, NMFS, USACE	<$5,000
2	CBBEP/TGLO/ TPWD	Center for Coastal Studies, CBBF, UTBEG, UTMSI, USFWS, USGS, PCCA, CCA, NMFS, USACE	$20,000 plus funds on a project-by-project basis

Total Anticipated Costs $25,000 plus implementation funds to be determined on a project-by-project basis.

Measures of Success

- The area of restored or created habitat is increased.

Related Actions BTR-4, SM-3, D-1, HLR-3, WSQ-1, FW-2

CBBEP	Coastal Bend Bays and Estuaries Program
TGLO	Texas General Land Office
TPWD	Texas Parks and Wildlife Department
CBBF	Coastal Bend Bays Foundation
UTBEG	University of Texas Bureau of Economic Geology
UTMSI	University of Texas Marine Science Institute
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
PCCA	Port of Corpus Christi Authority
CCA	Coastal Conservation Association
NMFS	National Marine Fisheries Service
USACE	United States Army Corps of Engineers

HLR-3 Determine and manage the impact(s) of seismic activities and operations requiring state and/or local permits on coastal habitats and associated fauna.

Why An increasing demand for permits to perform seismic oil and gas exploration activity in the CBBEP project area has prompted concerns from natural resource managers regarding the potential for impacts to highly productive coastal habitats and associated living resources. Reports of fish kills in the vicinity of seismic activity have also raised concerns regarding impacts to fisheries resources and other fauna.

How **STEP 1** — Develop a working group to identify and prioritize habitats and associated fauna highly susceptible to seismic activity impacts.

STEP 2 — Develop and implement demonstration projects to evaluate impacts to coastal habitats (i.e., seagrass beds, unvegetated tidal flats, oyster reefs, open bay bottoms, coastal marshes, barrier islands, and Gulf beaches) and living resources (i.e., fisheries, benthos, oysters, etc.).

STEP 3 — Evaluate the current seismic permitting process to ensure minimal impacts to natural resources based on demonstration project findings.

STEP	Lead	Other Partners	Anticipated Costs
1	CBBEP	TGLO, TPWD, CCS, CBBF, UTBEG, UTMSI, USFWS, USGS, NMFS, TRC, Seismic industry, City of Corpus Christi	<$3,000
2	CBBEP	TGLO, TPWD, CCS, CBBF, UTBEG, UTMSI, USFWS, USGS, NMFS, TRC, Seismic industry, City of Corpus	$60,000
3	TGLO	TPWD, CCS, CBBF, UTBEG, UTMSI, USFWS, USGS, NMFS, TRC, Seismic industry, City of Corpus Christi	<$5,000

Total Anticipated Costs $68,000

CBBEP	Coastal Bend Bays and Estuaries Program
TGLO	Texas General Land Office
TPWD	Texas Parks and Wildlife Department
CCS	Center for Coastal Studies
CBBF	Coastal Bend Bays Foundation
UTBEG	University of Texas Bureau of Economic Geology
UTMSI	University of Texas Marine Science Institute
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
NMFS	National Marine Fisheries Service
TRC	Texas Railroad Commission

Measures of Success

- The permitting process is modified to ensure adequate measures are taken to minimize impacts to coastal habitats.

Related Actions

HLR-1, HLR-2, HLR-4

HLR-3

HLR-4 Develop management plans to ensure sustainability for species of concern.

Why Based on Program studies, a number of species exhibit declining population trends. The cause for these declines varies by species, but may be due to such factors as habitat loss, human disturbance, predation, and over-harvesting.

How **STEP 1** — Develop and implement management plans for bird species of concern.

STEP 2 — Develop and implement management plans for fish and shellfish species of concern.

STEP 3 — Develop and implement management plans for marine mammal species of concern.

STEP 4 — Develop and implement management plans for marine reptile species of concern.

STEP 5 — Develop and implement management plans for plant species of concern.

STEP	Lead	Other Partners	Anticipated Costs
1	Audubon Sanctuaries Program	TPWD, USFWS, TGLO, Audubon Society, Sierra Club, CBBF, TNC, Universities, Canadian Wildlife Service	$50,000
2	TPWD/CCA	NMFS, TNC, TGLO, Sierra Club, CBBF, Universities, Texas Sea Grant	$50,000
3	NMFS/TMMSN	TPWD, TGLO, TNC, Universities, USFWS, PINS	$5,000
4	NMFS/STSSN	TPWD, PINS, TGLO, Universities, USFWS, TNC, PCCA, USCG, CCA	$5,000
5	USFWS/Coastal Bend Botanical Gardens	TPWD, TGLO, TNC, NRCS Plant Material Center	$5,000

Total Anticipated Costs $115,000

TPWD	Texas Parks and Wildlife Department
USFWS	United States Fish and Wildlife Service
TGLO	Texas General Land Office
CBBF	Coastal Bend Bays Foundation
TNC	The Nature Conservancy
CCA	Coastal Conservation Association
NMFS	National Marine Fisheries Service
TMMSN	Texas Marine Mammal Stranding Network
PINS	Padre Island National Seashore
STSSN	Sea Turtle Stranding and Salvage Network
PCCA	Port of Corpus Christi Authority
USCG	United States Coast Guard
NRCS	Natural Resources Conservation Service

HLR-4

Measures of Success

- The number of species management plans developed and implemented for species of concern is increased.
- The population of species of special concern, (e.g., shorebirds, brown pelicans, whooping cranes) in the project area is increased over time.

Related Actions

BTR-3, D-2, D-3, HLR-3, WSQ-4, WSQ-5, PEO-1, PEO-3, PEO-4, PEO-5

HLR-5 Improve animal rescue and rehabilitation programs.

Why Animal rescue and rehabilitation programs decrease animal mortality, provide important information on species of concern, and increase public awareness about the marine environment. Existing programs are poorly funded and often must rely on the use of borrowed facilities.

How **STEP 1** — Conduct a workshop to establish a coordinated network of communication among professionals and volunteers involved with animal rescue and rehabilitation.

STEP 2 — Develop and implement a plan to stabilize funding and human resource needs for the Texas Marine Mammal Stranding Network (TMMSN).

STEP 3 — Develop and implement a plan to stabilize funding and human resource needs for the Sea Turtle Strandings Network (STSSN).

STEP 4 — Develop and implement a plan to stabilize funding and human resource needs for bird rescue and rehabilitation.

STEP	Lead	Other Partners	Anticipated Costs
1	CBBEP	STSSN, TMMSN, TSA, USFWS, NMFS, TPWD, TAMU-CC, UTMSI, PINS, USGS, Private conservation groups, Citizens	<$5,000
2	TMMSN	TSA, USFWS, NMFS, TPWD, TAMU-CC, UTMSI, PINS, Private conservation groups, Citizens	To be determined
3	STSSN	TSA, USFWS, NMFS, TPWD, TAMU-CC, UTMSI, PINS, Private conservation groups, Citizens	To be determined
4	TSA	USFWS, TPWD, TAMU-CC, UTMSI, PINS, Private conservation groups, Citizens	To be determined

Total Anticipated Costs <$5,000 initially plus additional costs to develop plans.

CBBEP	Coastal Bend Bays and Estuaries Program
STSSN	Sea Turtle Stranding and Salvage Network
TMMSN	Texas Marine Mammal Stranding Network
TSA	Texas State Aquarium
USFWS	United States Fish and Wildlife Service
NMFS	National Marine Fisheries Service
TPWD	Texas Parks and Wildlife Department
TAMU-CC	Texas A&M University – Corpus Christi
UTMSI	University of Texas Marine Science Institute
PINS	Padre Island National Seashore
USGS	United States Geological Survey

HLR-5

Measures of Success

- The number and quality of animal rehabilitation facilities are increased.
- The number of volunteers for animal rehabilitation facilities is increased.
- The mortality rate for species of concern is decreased.

Related Actions

PEO-5

HLR-6 Facilitate consensus on a regional approach to effective management of bay and bait shrimping.

Why Almost no one involved in the issues of bay and bait shrimping is satisfied with the existing management system. Input from all stakeholders and consensus regarding local needs and management concerns are fundamental to the development of a regional strategy to manage bay and bait shrimping.

How **STEP 1** — Facilitate a series of workshops and meetings to bring together all stakeholders in order to identify management concerns and possible management options. Establish a formal/informal regional shrimping advisory board.

STEP 2 — Develop recommendations for presentation to TPWD and existing advisory boards.

STEP 3 — Implement recommendations on a regional management approach.

STEP	Lead	Other Partners	Anticipated Costs
1	CBBEP	TPWD, NMFS, Texas Sea Grant, TGLO, TSPA, Texas Shrimpers Association, Universities, CBBF, CCA, Sierra Club, other stakeholders	<$5,000
2	Regional Shrimping Advisory Board	TPWD, NMFS, Texas Sea Grant, TGLO, TSPA, Texas Shrimpers Association, Universities, CBBF, CCA, Sierra Club, other stakeholders	To be determined
3	TPWD/TSPA/ Texas Shrimpers Association	NMFS, Texas Sea Grant, TGLO, Universities, CBBF, CCA, Sierra Club, other stakeholders	To be determined

Total Anticipated Costs <$5,000 initially plus additional costs to develop and implement a shrimp management plan.

Measures of Success

- The number of conflicts between segments of the shrimp industry is reduced.
- Profits from bay shrimping are increased.
- Sustainable levels of shrimp harvest are achieved and shrimp stocks are stabilized.

Related Actions

TPWD	Texas Parks and Wildlife Department	TSPA	Texas Seafood Producers Association
CBBEP	Coastal Bend Bays and Estuaries Program	CBBF	Coastal Bend Bays Foundation
NMFS	National Marine Fisheries Service	CCA	Coastal Conservation Association
TGLO	Texas General Land Office		

HLR-7 Reduce bycatch from bay shrimp trawling.

Why Bycatch mortality from current shrimping practices is a concern for resource management. TPWD reports that shrimp-to-bycatch weight ratios range from as high as 7:1 to 3:1 in Corpus Christi Bay. The industry and resource managers need to continue their collaboration to reduce bycatch in an economically feasible manner.

How **STEP 1** — Based on the ongoing CBBEP bycatch reduction demonstration project and future studies as needed, determine the optimal Bycatch Reduction Device (BRD) design that will reduce bycatch in an economically feasible manner.

STEP 2 — Seek funding to purchase BRDs and encourage voluntary use of the best gear choice by the bay shrimping industry.

STEP	Lead	Other Partners	Anticipated Costs
1	TPWD/TSPA	Texas Sea Grant, NMFS, CCA, Universities, CBBF, CBBEP	To be determined based on need for additional studies
2	CBBEP/TPWD/ TSPA	Texas Sea Grant, NMFS, CCA, Universities, CBBF, CBBEP	$10,000

Total Anticipated Costs $10,000, plus additional funds to be determined based on need for additional studies.

Measures of Success

- Shrimp trawling bycatch is reduced by 50% within 10 years.

Related Actions

TPWD	Texas Parks and Wildlife Department
CBBEP	Coastal Bend Bays and Estuaries Program
TSPA	Texas Seafood Producers Association
NMFS	National Marine Fisheries Service
CCA	Coastal Conservation Association
CBBF	Coastal Bend Bays Foundation

HLR-8 Reduce impacts on living resources associated with industrial cooling water intake.

Why Due to increased public concern regarding declining living resource populations, organism mortality from impingement and entrainment on industrial cooling water intakes should be reduced through improved technology.

How **STEP 1** — Evaluate impacts as a result of impingement and entrainment of organisms at cooling water intakes.

STEP 2 — Determine potential mechanism to reduce impingement and entrainment.

STEP 3 — Evaluate incentives to encourage voluntary use of these mechanisms by industry.

STEP	Lead	Other Partners	Anticipated Costs
1	CPL	TPWD, NMFS, TNRCC, USEPA	$40,000
2	CPL	TPWD, NMFS, TNRCC, USEPA	$10,000
3	CPL	TPWD, NMFS, TNRCC, USEPA	$10,000

Total Anticipated Costs $60,000

Measures of Success

- The rate of impingement and entrainment associated with industrial cooling water intakes is reduced by 50% within 10 years.

Related Actions

CPL Central Power and Light
TPWD Texas Parks and Wildlife Department
NMFS National Marine Fisheries Service
TNRCC Texas Natural Resource Conservation Commission
USEPA United States Environmental Protection Agency

HLR-9 Minimize the impacts and reduce the occurrence of harmful algal blooms.

HLR-9

Why Harmful algal blooms (HABs) can threaten human health, cause economic loss, and result in detrimental changes in an ecosystem. Although much scientific attention has been given to HABs, effective management measures are as yet unknown. Continued development of management practices should be undertaken that prevent the occurrence or reduce the severity of HABs.

How **STEP 1** — Organize an advisory team to identify potential factors that could reduce impacts from HABs.

STEP 2 — Conduct a risk assessment (including a cost/benefit analysis) of the proposed management options.

STEP 3 — Identify potential demonstration projects that would evaluate inhibitory compounds, nutrient manipulations, and biological controls on HABs.

STEP 4 — Identify a funding mechanism to implement demonstration projects.

STEP 5 — Implement demonstration projects and evaluate best management practices for minimizing impacts of HABs on native living resources and seagrass productivity.

STEP 6 — Provide updates to the research consortium and the public to further increase awareness of HABs.

STEP	Lead	Other Partners	Anticipated Costs
1	CBBEP	State and federal resource agencies, Research institutions	<$5,000
2	UTMSI	CBBEP (through advisory team)	$25,000
3	UTMSI	CBBEP (through advisory team)	$10,000
4	UTMSI	CBBEP (through advisory team)	$10,000
5	UTMSI	CBBEP (through advisory team)	To be determined
6	UTMSI	CBBEP (through advisory team)	<$5,000

Total Anticipated Costs $55,000 plus implementation funds to be determined on a project-by-project basis.

CBBEP Coastal Bend Bays and Estuaries Program
UTMSI University of Texas Marine Science Institute

Measures of Success

- The number of and total funding for HAB demonstration projects are increased.
- Using a HAB monitoring program, the frequency of harmful algal blooms is decreased over time.
- The percentage of the project area affected by harmful algal blooms is decreased over time.
- The impacts of HABs are decreased over time.

Related Actions

PH-1, PH-2

HLR-9

HLR-10 Develop management plans to minimize introductions and impacts from non-native species.

HLR-10

Why Invasion of non-native species can alter both habitat structure and function, resulting in the displacement of native flora and fauna.

How **STEP 1** — Identify the distribution and ecological impacts associated with existing non-native species.

STEP 2 — Identify techniques for the control of problematic non-native species, and conduct demonstration projects to determine the effectiveness of these techniques.

STEP 3 — Implement control methods (including public education) through existing programs.

STEP	Lead	Other Partners	Anticipated Costs
1	CCS	USFWS, NMFS, TPWD, NRCS, Research institutions, Conservation groups, USGS, TAES, Texas Sea Grant, GOMP	$25,000
2	CCS/TPWD	USFWS, NMFS, NRCS, Research institutions, Conservation groups, USGS, TAES, Texas Sea Grant, GOMP	To be determined
3	TPWD	USFWS, NMFS, NRCS, Research institutions, Conservation groups, USGS, TAES, Texas Sea Grant, GOMP	To be determined

Total Anticipated Costs $25,000 plus additional funds for demonstration and control projects.

Measures of Success

- A list of non-native species which can affect the project area and effective control measures are developed.
- The distribution and range of existing non-native species are reduced over time.

Related Actions MC-8, WSQ-2

CCS Center for Coastal Studies
USFWS United States Fish and Wildlife Service
NMFS National Marine Fisheries Service
TPWD Texas Parks and Wildlife Department
NRCS Natural Resources Conservation Service
USGS United States Geological Survey
TAES Texas Agriculture Experiment Station
GOMP Gulf of Mexico Program

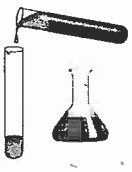
CHAPTER 5
Water and Sediment Quality

Goals

Maintain and/or enhance water and sediment quality.

Understand total loadings and the transport pathways and biological effects of loadings to the bay system.

Improve management of all loadings to the bay system.



Water and Sediment Quality Action Plan

Nonpoint Source Management Action Plan

Introduction

Maintaining the quality of water and sediment in the face of expanding population is important to human health, aquatic life, and the economic vitality of the region (see Figure 18 for factors contributing to water quality degradation).

Fortunately, overall bay water quality has significantly improved during the past 25 years. The advent of the Clean Water Act in 1972, and the subsequent control of point source discharges, has brought steady improvement to several conventional water quality parameters in certain, previously impaired segments. Despite a 42 percent increase in municipal and industrial discharge volumes between 1980 and 1995 for the region, there has been a 60 percent decrease in Biochemical Oxygen Demand (BOD_5) loadings and a 47 percent decrease in Total Suspended Solids (TSS) over that period (Armstrong and Ward, 1997). Industries and municipalities have invested and worked hard to do their part to achieve coastal water quality standards. Today, point source discharges are frequently reused to offset freshwater supply demands, including beneficial return flows to the estuaries.

Many factors contribute to water and sediment quality. In addition to discharges from municipal and industrial wastewater treatment plants (point sources), we must also consider the diffuse runoff from urban and rural areas (nonpoint sources) (see Figure 19 for locations of point source discharges and major nonpoint source inflow sites). Point sources and some nonpoint sources already fall under a regulatory management framework, and the state is obligated to develop a coastal nonpoint source pollution control program under the Texas Coastal Management Program. Successful management practices must be continued and extended to a wider area in order to maintain or enhance water and sediment quality in the future.

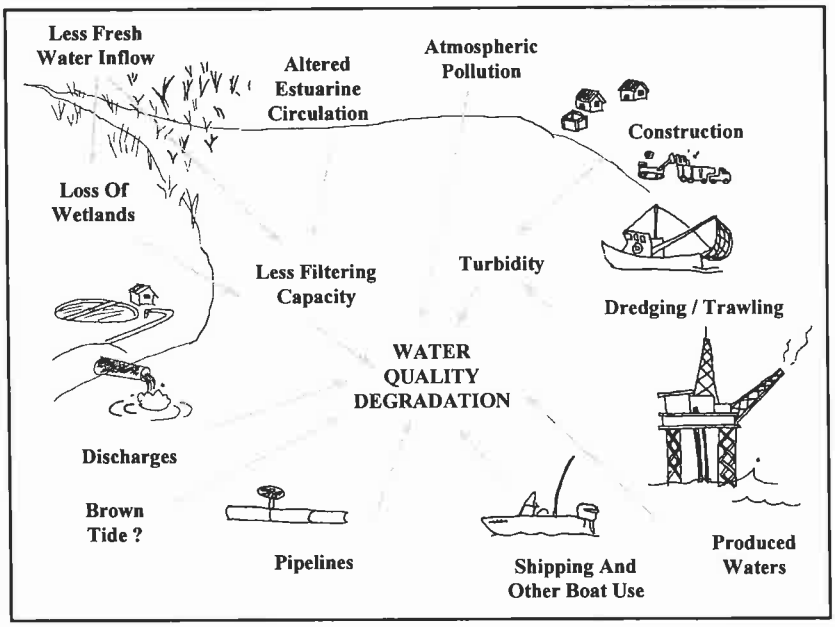


FIGURE 18

The most productive marine ecosystems thrive in areas with clean water and an optimal level of suspended solids.

Increasing the amount of contaminants or turbidity in the water can decrease productivity, or even human health. Human activities, such as agriculture, dredging, and trawling can increase water turbidity, which limits photosynthesis. Limiting the flow of water in an estuary or limiting freshwater inflow can inhibit the natural properties that wetlands have to filter contaminants from water. Many human activities have the potential to contaminate water, from oil spills to runoff from streets following a storm.

Water and sediment quality in the Coastal Bend bays and estuaries is generally good and has improved over the past two decades.

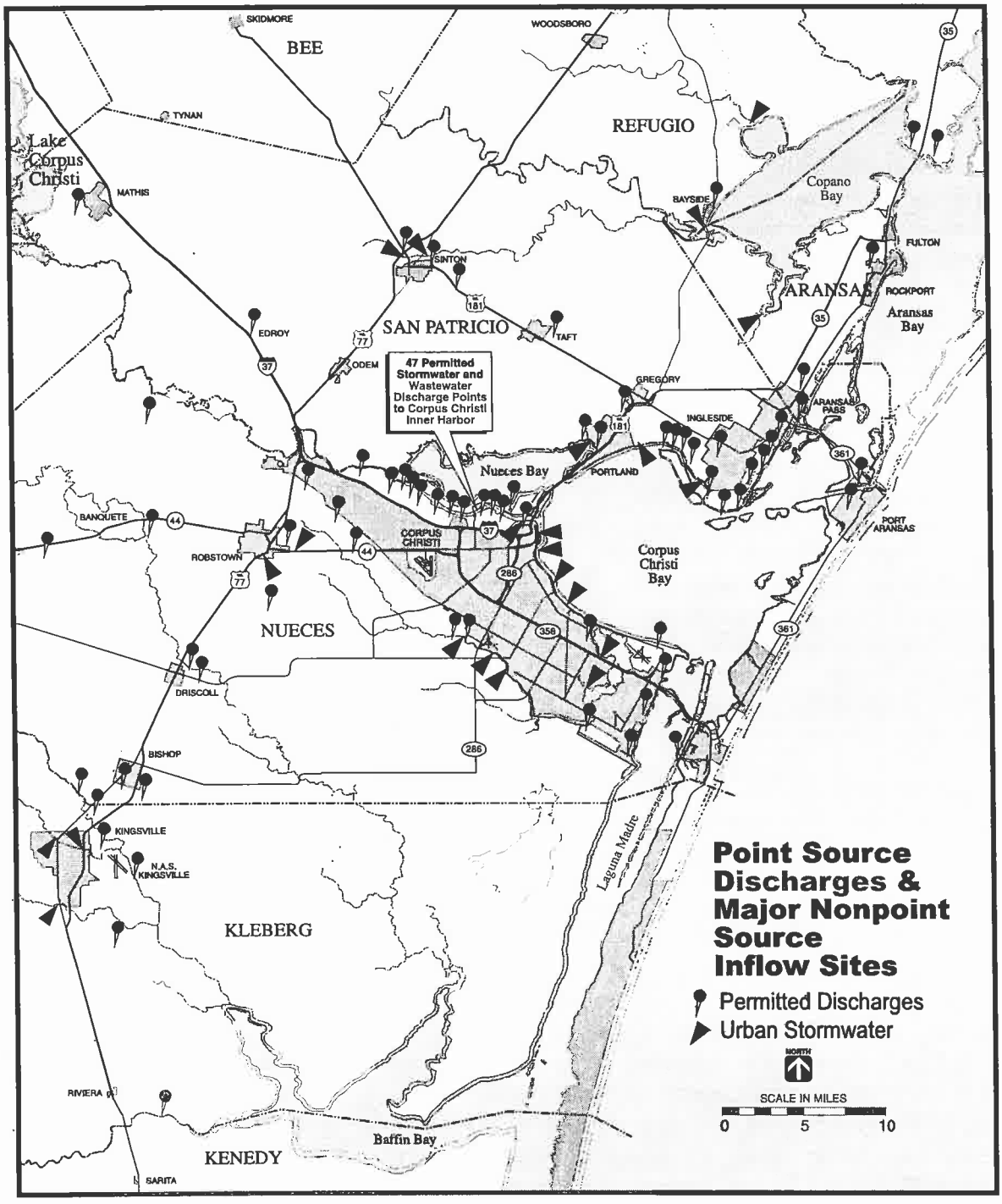


FIGURE 19 Point Source Discharges and Major Nonpoint Source Inflow Sites

Sediment quality is important because sediments are a 'sink' or repository for pollutants such as metals and pesticides. Sediments accumulate and concentrate pollutants over a long period of time. When activities such as dredging disturb contaminated sediments the result can be a reintroduction of pollutants into the water column.

Water and sediment quality is important to estuarine productivity, wildlife habitats, and the aesthetic appeal of bays and shorelines. Maintaining the water quality improvements made during the past 25 years will be a challenge in the years ahead as the regional population increases. While there are larger natural forces at work that impact the bay system, it is possible to enhance water and sediment quality through pollution prevention and other Best Management Practices.

Improving Impaired Segments and Achieving Appropriate Standards

Urbanization and industrial development came relatively late to the Coastal Bend, and concerns about water quality did not surface until the 1950s. Collection of water quality data began around that time and intensified after 1965; data collection on sediments started in the 1970s. These historical data are limited, thus making it difficult to draw a detailed picture of water and sediment quality trends or to quantify 'total loadings' to the bay system.

Although there are many gaps in the historical record of water and sediment quality, the available data indicate at least a few specific areas that deserve further investigation. The ***Bays Plan*** calls for a closer investigation of the sources of water and sediment quality problems found in several areas and the design of strategies to reverse negative trends. In particular, elevated concentrations of zinc, copper, nickel, chromium, and fecal coliforms, and depressed concentrations of dissolved oxygen have been reported in several areas. Working with various local governments, industries, agencies, and stakeholder groups, the Program will facilitate a focused assessment for these priority areas of concern.

A relatively new industry to Texas, shrimp farming has until recently not been subject to controls on discharges to receiving waters. This has caused concerns for water quality and the possible introduction of non-native shrimp or disease to the bay system. Whether such concerns are real or perceived, such discharges should be subject to the same high standards as the permitting process for other point sources. The ***Bays Plan*** supports the implementation of the existing aquaculture regulations and more local input on the siting and discharge requirements for future operations.

Concerns about water quality in the Coastal Bend did not surface until the 1950s. Historical data are limited, thus making it difficult to draw a detailed picture of water and sediment quality trends.

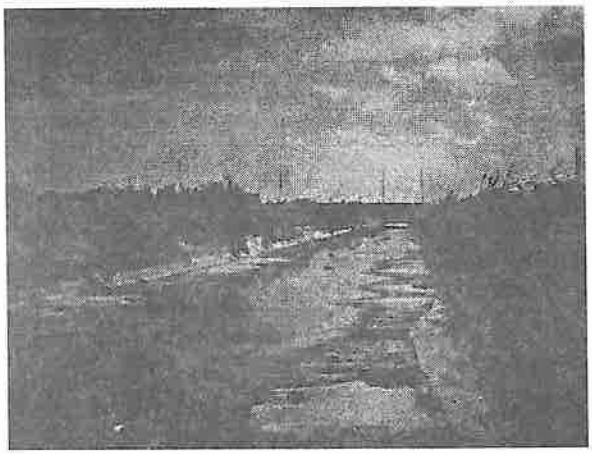
Understanding the contribution of 'total loadings' to the bay system and the transport pathways and biological effects of those loadings is a fundamental goal of the Water and Sediment Quality Action Plan. To accomplish this, the Program will continue to refine the 'total loadings model', working with partner agencies, local governments, and the private sector to obtain more data for that purpose. The effort will involve new data collection projects designed to determine relative contributions from various land use types and sources. Once areas of concern are identified, additional investigation will be carried out to determine the biological effects (including biotoxicity) of those pollutants of greatest concern.

The approach of the ***Bays Plan*** is to develop ways to get ahead and stay ahead of water and sediment quality problems before they pose risk to people or the environment. Knowing more about the quality, volume, and biological effects of loadings will allow stakeholders to provide educated input during the state's triennial review of water quality standards. Such knowledge may also drive the development of sediment quality and/or biological criteria guidelines as additional tools to assess ecosystem health. It will also allow stakeholders to participate in a variety of important water quality management programs, including the development of basin watershed management plans, identification of priority water bodies, and the development and implementation of Total Maximum Daily Load (TMDL) allocations for impaired water segments.

Although the ***Bays Plan*** does not indicate a specific action related to brine discharges, the Management Conference calls for support of efforts already underway by the U.S. Environmental Protection Agency and the Texas Railroad Commission to eliminate harm from surface discharges into coastal waters of brine water from oil and gas production wells. These hypersaline discharges are an unavoidable product of oil and gas well operations, and are known to have negative impacts on the coastal environment. Recognizing this, the U.S. Environmental Protection Agency and the Texas Railroad Commission are working together with industry on subsurface re-injection of these coastal brine discharges. Recent actions by the U.S. Environmental Protection Agency require all coastal discharges of produced brine water in Texas to cease on or before December 31, 1998.

Managing Nonpoint Source Runoff

When chemicals in rainwater runoff exceed certain concentrations they become pollutants and result in reduced water and sediment quality. Stormwater runoff picks up and carries not only pollutants (e.g., oil and grease from vehicles, lawn and garden chemicals, animal wastes, and street litter), but also ecologically important nutrients, sediments, and freshwater. Excessive nutrients or other chemicals not fully utilized by the ecosystem become pollutants.



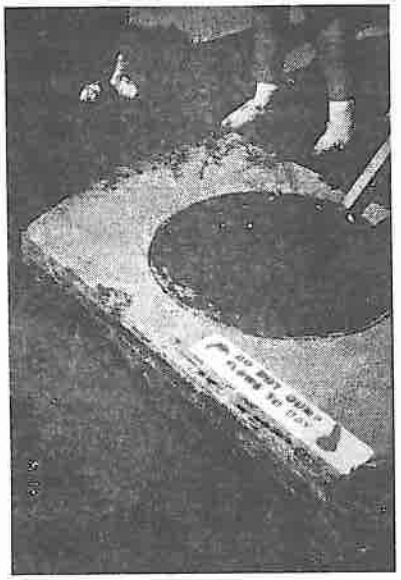
A typical drainage way found in the Coastal Bend designed to drain rain water. These systems not only move the water quickly but pick up pollutants from surrounding property.

Urban Runoff

Urban runoff is an important factor in bay water and sediment quality. In addition to the populated areas within city limits, urban runoff is generated by rural subdivisions, highways, industrial and military activities, and construction sites throughout the region. Urbanized areas have impervious surfaces and drainage systems that increase the volume of runoff and deliver loads faster to the bays. Stormwater drainage ditches can create linear freshwater wetlands, vegetated with marsh plants that can function to help slow water movement, trapping sediment and contaminants, and filtering some of the constituents before they reach the estuaries, while providing habitat for some wildlife species.

On-site sewage facilities (OSSF), or septic systems as they are more commonly known, can contribute to fecal coliform contamination and nutrient enrichment of receiving waters. Many septic systems are improperly installed or maintained and the clay and sand soils in a large part of the project area are not well-suited to efficient septic system operation.

Debris from urban runoff accumulated at the edge of Corpus Christi Bay after a heavy rain.



Inlet stencilled with a message to prevent debris from being improperly discarded.

Illegal dumping contributes to the problems of nonpoint source pollution found in urban runoff.

The City of Corpus Christi has moved ahead of other Texas cities with populations of greater than 100,000 with implementation of its National Pollutant Discharge Elimination System (NPDES) stormwater permit. Under the permit, the City implements programs to monitor discharges, identify sources of contamination, establish and enforce ordinances aimed at reducing pollution, and educate residents, construction site managers, and others on how to improve stormwater quality. Additional programs -- such as street sweeping, maintenance of marsh vegetation and erosion control in drainage ditches, cleaning of catch basins and storm sewers, litter abatement, household hazardous waste collection, and curbside recycling -- assist in the management of urban runoff.

The ***Bays Plan*** calls for the development of a regional handbook to assist local governments to implement urban nonpoint source control programs. The handbook will likely contain many examples from the City of Corpus Christi's stormwater program. Stakeholders will also work to provide compliance assistance to small businesses and industries on ways to help achieve urban runoff objectives. Finally, a program will be established to assist local governments to more effectively manage on-site sewage facilities. One obvious starting point for all of these activities is public education, to help people understand that they can improve environmental quality by simple changes in the way they manage their homes and businesses.

Agricultural Runoff

Agricultural uses, ranging from cattle grazing to rowcrop farming, are found on 88 percent of the land in the Coastal Bend. Nutrients, pesticides, organic matter, and animal wastes can be carried to the bays by stormwater. Preliminary studies indicate that the edge-of-field concentrations and loads of such pollutants may in fact be relatively low. A combination of flat terrain and the use of improved chemicals and application techniques are already at work to minimize the amount of material carried away by stormwater.

Management programs implemented for many years in the region include erosion control and integrated crop management. These and other programs have helped to improve agricultural runoff water quality. While many of these practices were developed for economic reasons, they have had the effect of reducing the amount of sediment, organic material, and chemicals that are washed into the bay system.

The ***Bays Plan*** calls for the continued and expanded implementation of agricultural conservation assistance programs as authorized and funded by state and federal law. Implementing partners will provide technical assistance, seek additional funding, and encourage landowners to continue or expand upon their use of Best Management Practices to minimize and improve the quality of agricultural runoff.

Action Plan
WATER AND SEDIMENT QUALITY

Overview

Key Findings

The quality of water and sediment within the project area is generally good to moderate. Program reports and state agencies, however, have identified areas that exhibit poor quality and may benefit from source reduction activities, although specific sources of loadings affecting water and sediment quality have not yet been identified.

- Water does not move quickly through the Corpus Christi Bay system and, therefore, has a greater tendency to concentrate waterborne substances, including pollutants (Ward, 1997).

- The central bays (Nueces and Corpus Christi Bays) receive the majority of point source loads of most constituents; the lower bays (Baffin Bay and Laguna Madre) receive the next highest amount, while the upper bays (Redfish and Copano/Aransas Bays) receive the least (Armstrong and Ward, 1997). Nonpoint source loadings are not as well understood, but a 'total loadings' model under development will assist to identify the relative contributions from both point and nonpoint sources, including those from atmospheric deposition.

- More specifically, the Corpus Christi Inner Harbor (CCIH) and Oso Bay have historically and continue to receive the greatest point source loads (Armstrong and Ward, 1997). The Inner Harbor generally exhibits the highest levels of pollutants including sediment metals (especially sediment zinc and copper), sediment PCBs, sediment organics, and fecal coliforms. Oso Bay has elevated fecal coliforms and low dissolved oxygen (DO) levels (Ward and Armstrong, 1997b). Some of these constituents may also come from nonpoint sources, as discussed in the following Action Plan.

- The highest sediment PCB levels are in Redfish Bay. Sediment PCBs and PAHs exhibit very high levels in the Inner Harbor (Ward and Armstrong, 1997b).

- Nueces Bay is consistently elevated in metals in both the water column and sediments. Elevated metal concentrations are also found in Baffin and Copano Bays, around the Bird Islands in the Laguna Madre, the La Quinta channel, and in Redfish Bay near Aransas Pass. However, data are generally insufficient to determine whether or not these metals concentrations pose a threat to aquatic life or whether violations of water quality standards are more frequent than what current data have revealed. Reliable trends in water phase metals concentrations (either increasing or decreasing) have not been established (Ward and Armstrong, 1997b).

- A possible increase in zinc concentrations is noted in large portions of Corpus Christi Bay and Baffin Bay. Sediment zinc levels in the Inner Harbor are an order of magnitude higher than those found in the Houston Ship Channel (Ward and Armstrong, 1997b).

- Because some Coastal Bend bays are naturally warm and highly saline, natural dissolved oxygen saturation values in the project area are only slightly above the state water quality standard of 5 ppm, which has been established to avoid biological stress to living resources. This implies that the bay system has little assimilative capacity to handle additional wasteloads (Ward and Armstrong, 1997b). Statewide dissolved oxygen standards may not be appropriate for some shallow, saline Coastal Bend bays.

WSQ-1 Implement plans to improve water and sediment quality in identified segments.

Why Program reports and the state 303(d) list have identified water segments that exceed state water quality standards and do not support designated uses. Identifying the cause of the problems and restricting migration of pollutants are critical. Of equal importance is understanding the environmental and human health effects of contaminants. In each case, steps need to be taken to reduce pollutant levels through a watershed management approach that coordinates with Watershed Action Plans developed for Total Maximum Daily Loads (TMDLs) under Section 303(d) of the Clean Water Act, Municipal Water Pollution Control and Abatement Programs developed under Section 26.177 of the Texas Water Code, the state's Coastal Nonpoint Source Program developed under Section 6217 of the Coastal Management Act, and the state's Nonpoint Source Management Program developed under Section 319 of the Clean Water Act.

How **STEP 1** — Facilitate the development and implementation of plans to improve water and sediment quality in segments that do not meet TNRCC or USEPA standards (e.g., the state 303(d) list), such as the Corpus Christi Inner Harbor (CCIH) for water column copper and depressed dissolved oxygen. [Note: Although the CCIH also exhibits elevated sediment zinc and there is currently no state regulatory standard for sediment quality, exceedances of TNRCC screening levels and NOAA guidance levels have occurred.] Facilitate the development of TMDL allocations for priority 303(d) listed segments. Conduct ongoing evaluations of new data and coordinate with TNRCC on revisions (additions or deletions) to the 303(d) list.

STEP 2 — Facilitate the development and implementation of plans to address elevated levels of water and sediment metals where identified for specific bay segments. Segments identified for additional investigation of copper, nickel, and zinc include: Nueces Bay, Corpus Christi Bay, Baffin Bay, Laguna Madre (near Bird Island), La Quinta Channel, and Redfish Bay (near Aransas Pass). Copano Bay has elevated concentrations of chromium, in addition to the above listed metals.

STEP 3 — Facilitate the development and implementation of plans to address depressed dissolved oxygen (DO) levels and elevated fecal coliform levels in Oso Bay.

TNRCC Texas Natural Resource Conservation Commission
USEPA United States Environmental Protection Agency
NOAA National Oceanic and Atmospheric Administration

WSQ-1

STEP	Lead	Other Partners	Anticipated Costs
1	CBBEP/TNRCC	PICC, City of Corpus Christi, other Local governments, USEPA, TPWD, CBBF, USFWS, Sierra Club, other stakeholders	$5,000 plus implementation costs (to be determined)
2	CBBEP/TNRCC	Local governments, USEPA, TPWD, CBBF, Sierra Club, NMFS, USFWS, USGS, Industries, other stakeholders	$5,000 plus implementation costs (to be determined)
3	CBBEP/TNRCC	City of Corpus Christi, other Local governments, TPWD, USFWS, NMFS, CBBF, Sierra Club, other stakeholders	$5,000 plus implementation costs (to be determined)

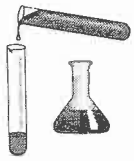
Total Anticipated Costs $15,000 to support a focused assessment process for the project area. Assessment coincides with TNRCC and USEPA programs. Remediation measures will require additional funding. Use of the State Revolving Fund (SRF) will be explored for the implementation of management actions.

Measures of Success

- Water quality in impaired or stressed segments improves over time.
- Sediment quality in impaired or stressed segments improves over time.
- The number of segments on the state 303(d) list is reduced.

Related Actions PH-1, PH-2, HLR-2, NPS-1, NPS-2, NPS-3, NPS-4

CBBEP	Coastal Bend Bays and Estuaries Program
TNRCC	Texas Natural Resource Conservation Commission
PICC	Port Industries of Corpus Christi
USEPA	United States Environmental Protection Agency
TPWD	Texas Parks and Wildlife Department
CBBF	Coastal Bend Bays Foundation
USFWS	United States Fish and Wildlife Service
NMFS	National Marine Fisheries Service
USGS	United States Geological Survey



WSQ-2 Support the implementation of permitting rules for shrimp farms and other aquaculture facilities.

Why Aquaculture is a growing industry in Texas with discharges that generate not only water and sediment quality concerns, but also the real risk of exotic species and disease introductions. Such introductions could have catastrophic consequences on native species.

How **STEP 1** — Ensure that aquaculture facilities currently discharging within the coastal zone apply for authorization to discharge in accordance with 30 TAC Chapter 321, Subchapter O, and that proper permits are issued. Ensure that seafood processing facilities that discharge are subject to the same standards for disease control monitoring and response, as well as discharge limits.

STEP 2 — Implement an existing TPWD/TNRCC memorandum of understanding (MOU) related to interagency coordination on permitting issues, disease control monitoring and response, and investigations of aquaculture facilities. Utilize TPWD recommendations to set appropriate discharge limits.

STEP 3 — Ensure proper implementation of public notice requirements for permitting and registration of aquaculture facilities. Educate local governments and the public on such requirements and procedures.

STEP 4 — Work with permittees to development site-specific plans to minimize the potential for escape of non-native species and/or diseases.

STEP	Lead	Other Partners	Anticipated Costs
1	TNRCC	USEPA, TPWD, Local governments, CBBF, CCA, EDF, Bay shrimpers, Texas Shrimp Association, other stakeholders	$0
2	TPWD/TNRCC	USEPA, Local governments, CBBF, CCA, EDF, Bay shrimpers, Texas Shrimp Association, other stakeholders	$0
3	TNRCC	Local governments, Public organizations	$0
4	TPWD	Aquaculture permittees	

Total Anticipated Costs Programs are already in effect to address aquaculture. New costs should be minimal.

TPWD Texas Parks and Wildlife Department
TNRCC Texas Natural Resource Conservation Commission
USEPA United States Environmental Protection Agency
CBBF Coastal Bend Bays Foundation
CCA Coastal Conservation Association
EDF Environmental Defense Fund

WSQ-2

Measures of Success

- Opportunities for public comment on proposed permitting and rule-making for aquaculture facilities are increased.
- The percentage of aquaculture facilities discharging in the project area that have state wastewater discharge permits is increased.
- The environmental impacts associated with aquaculture facilities are reduced.
- The potential for escape of non-native species and/or diseases from aquaculture facilities is reduced.

Related Actions HLR-10

WSQ-3 Quantify total constituent loadings.

Why An understanding of relative contributions and total loads entering the bay system allows for continued refinement of resource management strategies. Management actions must be based on accurate information and good science. This action integrates assessment-related components of the Water and Sediment Quality and Nonpoint Source Management Action Plans. While this action requires data collection, it is the analysis component that is the most critical.

How **STEP 1** — Identify needs and coordinate additional data acquisition to determine relative contributions and loadings from cropland, rangeland, urban nonpoint sources, industrial nonpoint sources, point sources, atmospheric deposition, groundwater, and natural or background sources.

STEP 2 — Initiate voluntary data collection to replace typical pollutant values used in the total loadings model with actual data collected using 'clean techniques', and seek to include additional self-reporting data on effluent constituents as necessary to support further refinement of the 'total loadings model'.

STEP 3 — Further refine the 'total loadings model' developed under the auspices of the CCBNEP/CBBEP, using additional relevant data and refined Event Mean Concentrations (EMCs) as they become available. Assess the consistency of the 'total loadings model' with those used in the state's TMDL process, and the usefulness of alternative models.

STEP	Lead	Other Partners	Anticipated Costs
1	TNRCC/ TSSWCB	TDA, USEPA, NRCS, USGS, UTMSI, City of Corpus Christi, other local governments, CBBEP	$250,000 over five years for source-specific data collection projects
2	TNRCC	USEPA, Point source discharge permittees	Some additional analytical costs to permittees
3	CBBEP/TNRCC/ TSSWCB	Every local/state/federal/academic entity involved in data collection and monitoring, CBBF, Sierra Club, other stakeholders	$50,000 initially; repeat the analysis on 5-10 year cycles

Total Anticipated Costs $300,000 over 5-10 years

CCBNEP	Corpus Christi Bay National Estuary Program
CBBEP	Coastal Bend Bays and Estuaries Program
TMDL	Total Maximum Daily Load
TNRCC	Texas Natural Resource Conservation Commission
TSSWCB	Texas State Soil and Water Conservation Board
TDA	Texas Department of Agriculture
USEPA	United States Environmental Protection Agency
NRCS	Natural Resources Conservation Service
USGS	United States Geological Survey
UTMSI	University of Texas Marine Science Institute
CBBF	Coastal Bend Bays Foundation

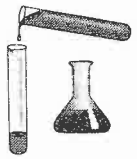
Measures of Success

- Total loadings are quantified to the greatest extent possible.
- The number of TMDLs developed and implemented for impaired segments is increased.

Related Actions

WSQ-3

TMDLs Total Maximum Daily Loads



WSQ-4 Undertake an analysis of the biological and ecological effects of selected constituents.

Why Information is generally unavailable related to the transport, fate, and biological effects of literally thousands of constituents dumped into the bay system. An understanding of the biological effects of pollutant loads is necessary for the continued refinement of water and sediment quality standards.

How **STEP 1** — Based on information provided from the 'total loadings model' to identify types of loadings and geographic areas of concern, assess the transport, fate, and biological effects of targeted loadings. Analyses should include interactions between various constituents.

STEP 2 — Perform tests to determine the reaction/response of key life stages of marine/estuarine fauna to varying constituent concentrations.

STEP	Lead	Other Partners	Anticipated Costs
1	TNRCC/CBBEP	USEPA, TPWD, Local governments, other stakeholders	<$75,000
2	TNRCC/TDA	USEPA, UTMSI, Texas Sea Grant, TPWD, NMFS, TSSWCB, NRCS, USGS, Local governments, other stakeholders	$150,000 (variable based on number of constituents of concern)

Total Anticipated Costs $225,000 (variable based on constituents of concern)

Measures of Success

- An understanding of the effects and pathways of harmful constituents is improved.
- The number of management measures initiated to minimize negative impacts is increased.

Related Actions HLR-4

TNRCC Texas Natural Resource Conservation Commission
CBBEP Coastal Bend Bays and Estuaries Program
USEPA United States Environmental Protection Agency
TPWD Texas Parks and Wildlife Department
TDA Texas Department of Agriculture
UTMSI University of Texas Marine Science Institute
NMFS National Marine Fisheries Service
TSSWCB Texas State Soil and Water Conservation Board
NRCS Natural Resources Conservation Service
USGS United States Geological Survey

WSQ-5 Ensure that water quality standards and sediment quality criteria are adequate and appropriate.

WSQ-5

Why Established Water Quality Standards (WQS) do not in all cases account for natural variability with measured parameters (e.g., dissolved oxygen levels are naturally low in some segments during the summer months). In some cases, this may result in overly strict wastewater discharge limits, or misidentification of segments as being impaired. In addition, because sediments are the long-term repository for pollutants, they are important indicators of changes to the system over time, and deserve attention and a framework for analysis through the development of sediment quality criteria. A look at the health of biological communities – through the use of biological criteria – is another useful analytical tool to assess if water and sediment quality standards and criteria are effective in the long-term.

How **STEP 1** — Review and develop recommended changes to WQS for various portions of the project area to coincide with the state's triennial review process, or as needed.

STEP 2 — Review sediment quality guidelines for their applicability to the project area, and work to develop appropriate sediment quality criteria.

STEP 3 — Review and assess the development of biological criteria guidelines for their applicability to the project area, and work to develop appropriate biological criteria.

STEP	Lead	Other Partners	Anticipated Costs
1	TNRCC/CBBEP	USEPA, PICC, City of Corpus Christi, CBBF, Sierra Club, TPWD, USGS, NMFS, other stakeholders	To be determined
2	TNRCC/CBBEP	USEPA, PICC, City of Corpus Christi, CBBF, Sierra Club, TPWD, USGS, NMFS, other stakeholders	To be determined
3	TNRCC/TPWD/ CBBEP	USEPA, PICC, City of Corpus Christi, CBBF, Sierra Club, USGS, NMFS, other stakeholders	To be determined

Total Anticipated Costs To be determined.

Measures of Success

- State water quality standards are evaluated and amended as needed.
- Area-specific biological standards are developed and established for specific estuarine communities.

Related Actions PH-1, HLR-1, HLR-4

TNRCC Texas Natural Resource Conservation Commission
CBBEP Coastal Bend Bays and Estuaries Program
USEPA United States Environmental Protection Agency
PICC Port Industries of Corpus Christi
CBBF Coastal Bend Bays Foundation
TPWD Texas Parks and Wildlife Department
USGS United States Geological Survey
NMFS National Marine Fisheries Service

Action Plan
NONPOINT SOURCE MANAGEMENT

Overview

Objective: Coordinate and implement a nonpoint source management plan throughout the region.

Key Findings

Based on preliminary information from the project area and evidence from other estuary programs, urban nonpoint source runoff can have detrimental effects on rivers, lakes, bays, and estuaries. Urban nonpoint source pollutants may include oil and grease, pathogenic microorganisms, pesticides, nutrients, trash, and heavy metals. These pollutant loadings will increase as urban areas expand and the population increases unless prudent management actions are taken.

- Localized declines in seagrass are related to increased amounts of algae, perhaps due to increased nutrient loading from adjacent mainland developments (Pulich, *et al.*, 1997).

- Atmospheric deposition on land contributes significantly to loadings found in nonpoint source runoff (Baird, *et al.*, 1996).

- Preliminary data suggest that some storm drain outfall sites have elevated concentrations of contaminants which can be toxic to sensitive life stages of organisms and may result in localized decreases in species diversity. Some sites adjacent to industrial and municipal outfalls and dredged material placement operations may also have elevated levels of contaminants (Carr, *et al.*, In review).

- The most impacted sites in the project area are the storm drain sites in the Corpus Christi marina near the L-head, Cole Park, and the Padre Island outfall (Carr, *et al.*, In review).

- Septic tank systems are the most common on-site sewage facilities (OSSFs) in the project area. Problems associated with septic tank systems include the following: soils that are unsuited for conventional septic systems; lot sizes that are too small, resulting in soil saturation; and sites that are located in floodplain areas where the water table is too shallow to allow for proper drainage (Michael, *et al.*, 1998).

- The most common public complaints received by all project area counties are raw sewage bypasses and inadequate or non-existent on-site sewage facilities.

- Agricultural production significantly influences the economy and environment of the project area. Agricultural runoff can have either good or bad effects on receiving waters (Baird, *et al.*, 1996). Preliminary studies indicate, however, that edge-of-field concentrations of both nutrients and most pesticides may, in fact, be relatively low.

NPS-1 Develop a regional handbook of urban nonpoint source pollution Best Management Practices for voluntary use by local governments seeking to implement nonpoint source pollution prevention programs.

Why The voluntary implementation of prudent, low cost urban nonpoint source Best Management Practices (BMPs) by coastal communities will protect bay resources and help to avoid future costly remediation.

How **STEP 1** — Create a regional technical advisory committee to develop a handbook of recommended urban nonpoint source Best Management Practices.

STEP 2 — Provide technical assistance to coastal communities implementing urban nonpoint source pollution prevention strategies and help identify potential funding sources for those efforts.

STEP	Lead	Other Partners	Anticipated Costs
1	CBBEP	CBCOG, Local governments, TXDOT, TGLO, USFWS, other stakeholders	$25,000
2	CBBEP/TNRCC	Local governments, TXDOT, CBCOG, TGLO, other stakeholders	$20,000

Total Anticipated Costs $45,000

Measures of Success

- A regional technical advisory committee is established to coordinate nonpoint source Best Management Practices.
- A handbook of urban Best Management Practices is completed and distributed to participating partners.
- Water quality improvements attributable to urban BMPs are detected.

Related Actions WSQ-1

CBBEP Coastal Bend Bays and Estuaries Program
CBCOG Coastal Bend Council of Governments
TXDOT Texas Department of Transportation
TGLO Texas General Land Office
USFWS U.S. Fish and Wildlife Service
TNRCC Texas Natural Resource Conservation Commission

NPS-2 Provide compliance assistance to small businesses and industries in the region that are subject to the NPDES permit program or have nonpoint source control needs.

NPS-2

Why Many small businesses and industries are subject to NPDES regulation in the Coastal Bend but may not be aware of this. This action proposes a way for these businesses/industries to come into compliance while avoiding enforcement action.

How **STEP 1** — Identify local businesses that are subject to NPDES programs or have nonpoint source control needs that have not implemented pollution prevention plans.

STEP 2 — Conduct permitting assistance and compliance assistance workshops for businesses/industries identified in STEP 1 to educate and assist them about obtaining permits and compliance assistance strategies. Seek USEPA, TNRCC, and TGLO sponsorship of the workshops.

STEP	Lead	Other Partners	Anticipated Costs
1	CBBEP	Local governments, County/rural stakeholders, TXDOT, TGLO	<$5,000
2	CBBEP/USEPA/ TNRCC/TGLO	Business/civic organizations, Local governments, Industries	$10,000

Total Anticipated Costs $15,000

Measures of Success

- The number of industries/businesses that successfully come into compliance with the help of compliance assistance programs is increased.
- Nonpoint source loadings from businesses/industries using BMPs are reduced.

Related Actions WSQ-1

NPDES National Pollutant Discharge Elimination System
USEPA United States Environmental Protection Agency
TNRCC Texas Natural Resource Conservation Commission
TGLO Texas General Land Office
CBBEP Coastal Bend Bays and Estuaries Program
TXDOT Texas Department of Transportation

NPS-3 Assist local governments to implement On-Site Sewage Facility (OSSF) programs.

Why Rural and outlying urban areas rely primarily on septic systems for waste treatment. As population increases there is a greater demand for installation of approved septic systems, and compliance programs that increase local health department responsibilities and resource needs. This action intends to facilitate these resource needs through enhanced grant opportunities and compliance data management systems.

How **STEP 1** — Provide grant application assistance to local governments and help develop local 'in-kind' contributions.

STEP 2 — Utilize available resources to assist local governments with enhancing On-Site Sewage Facility (OSSF) compliance and data management systems.

STEP 3 — Facilitate efforts to provide increased surface and groundwater monitoring at colonias.

STEP	Lead	Other Partners	Anticipated Costs
1	CBCOG	Local governments, TNRCC, CBBEP	$30,000/year (grant writer hours)
2	CBCOG	TNRCC, CBBEP, Local governments	
3	CBCOG	TNRCC, CBBEP, Local governments	

Total Anticipated Costs $30,000/year (grant writer hours). This action will facilitate the acquisition of grant funds at a minimum cost.

Measures of Success

- The total number of grants and amount of funding received by local governments to implement effective OSSF programs are increased.
- Water quality improvements attributable to OSSF programs are detected.

Related Actions WSQ-1

CBCOG Coastal Bend Council of Governments
TNRCC Texas Natural Resource Conservation Commission
CBBEP Coastal Bend Bays and Estuaries Program

NPS-4 Coordinate and implement agricultural water quality management programs necessary to meet water quality standards.

NPS-4

Why Rangeland, pastureland, and row crop agriculture comprise 88 percent of total land area within the project area. The Best Management Practices that ranchers and farmers employ are important to minimizing sediment and constituent loads from these lands to receiving bay waters.

How **STEP 1** — Develop and implement water quality management plans as authorized by Senate Bill 503, by providing technical assistance and cost-share funding to interested landowners.

STEP 2 — Coordinate provisions of federal legislation, such as the 1996 Farm Bill, that address water quality, including EQIP, Conservation Reserve Program, GLCI, etc.

STEP 3 — Assist local SWCDs with educational workshops on Best Management Practices and other data pertaining to water quality management and agricultural runoff.

STEP 4 — Seek Section 319 funds and other funds for demonstration projects, or other water quality implementation projects, on agricultural Best Management Practices that are practicable, economically achievable, and enhance water quality.

STEP	Lead	Other Partners	Anticipated Costs
1	TSSWCB	Local SWCDs, NRCS, TAEX, USEPA, Cooperating agricultural producers	$966,000
2	TSSWCB	Local SWCDs, NRCS, TAEX, USEPA, Cooperating agricultural producers	$1,312,000
3	TSSWCB	Local SWCDs, NRCS, TAEX, USEPA, Cooperating agricultural producers	$7,000
4	TSSWCB	Local SWCDs, NRCS, TAEX, USEPA, Cooperating agricultural producers	$250,000

Total Anticipated Costs $2,535,000 over 7 years (includes $966,000 from existing TSSWCB sources, and $1,569,000 from new sources). Investigate the use of SRF for additional funding.

EQIP Environmental Quality Incentives Program
GLCI Grazing Lands Conservation Initiative
SWCD Soil and Water Conservation District
TSSWCB Texas State Soil and Water Conservation Board
SWCD Soil and Water Conservation District
NRCS Natural Resources Conservation Service
TAEX Texas Agricultural Extension Service
USEPA United States Environmental Protection Agency

Measures of Success

- The number of agricultural producers voluntarily participating in agricultural water quality management programs is increased.
- The area of agricultural land voluntarily placed under agricultural water quality management programs is increased.
- Agricultural water quality management programs are effective in meeting water quality standards.

Related Actions

WSQ-1

NPS-4

CHAPTER 6
Freshwater Resources

Goals

Develop a regional water management plan that will meet both human and environmental needs of freshwater for the long-term.

Introduction

Freshwater was in short supply in South Texas even before people established ranches, towns, railroads, and industries in the semi-arid region. In the face of increasing population and more industry, this scarcity of locally available freshwater means there will always be competing demands on this limited resource.

Freshwater that flows into Coastal Bend bays comes from rivers, creeks, drainage structures, and wastewater treatment plants. These inflows create a salinity gradient that is important to the productivity of the bay system. Adding to this beneficial effect, they also contribute nutrients and sediments. However, construction of two reservoirs and other smaller impoundments have altered the volume and timing of freshwater inflows and diminished nutrient and sediment supplies to the bay system (see Figure 20).

Municipal and industrial water demand in the region will continue to grow. Competing needs for finite water resources have prompted stakeholders to develop management strategies to balance the human and environmental needs for freshwater. Many citizens do not understand the environmental needs and that continued demand for freshwater for human use makes such a balance an expensive challenge. This makes it difficult for elected decision-makers and regulators to develop acceptable strategies that meet household and business needs while maintaining the vitality of the bay system during periods of drought.

Substantial concern has been expressed about whether the public understands the water supply situation and the need to balance the human and environmental needs for available freshwater.

Importance of Freshwater Inflows (see Figure 21 on page 125)

Freshwater inflows perform three major functions that are essential for sustaining a productive estuary. First, they blend with the Gulf's seawater to provide a range of salt concentrations. Many of the animals that live in the estuary need water with different levels of salt concentrations during the various stages of their life cycles. As many as 95 percent of important marine species depend on estuaries during at least part of their life cycles. Some can live nowhere else. Without estuaries, for example, there would be no oysters.

Second, freshwater inflows bring nutrients essential to the total productivity of estuarine ecosystems. Nutrients (nitrogen, phosphorus, and decomposing organic matter) are carried by surface runoff into the bays and estuaries. Microscopic phytoplankton, plants upon which the entire food web depend, need dissolved nutrients to survive and multiply. Larger plants that live in the bays and estuaries also need nutrients to grow. Those plants then provide food and breeding, hatch-

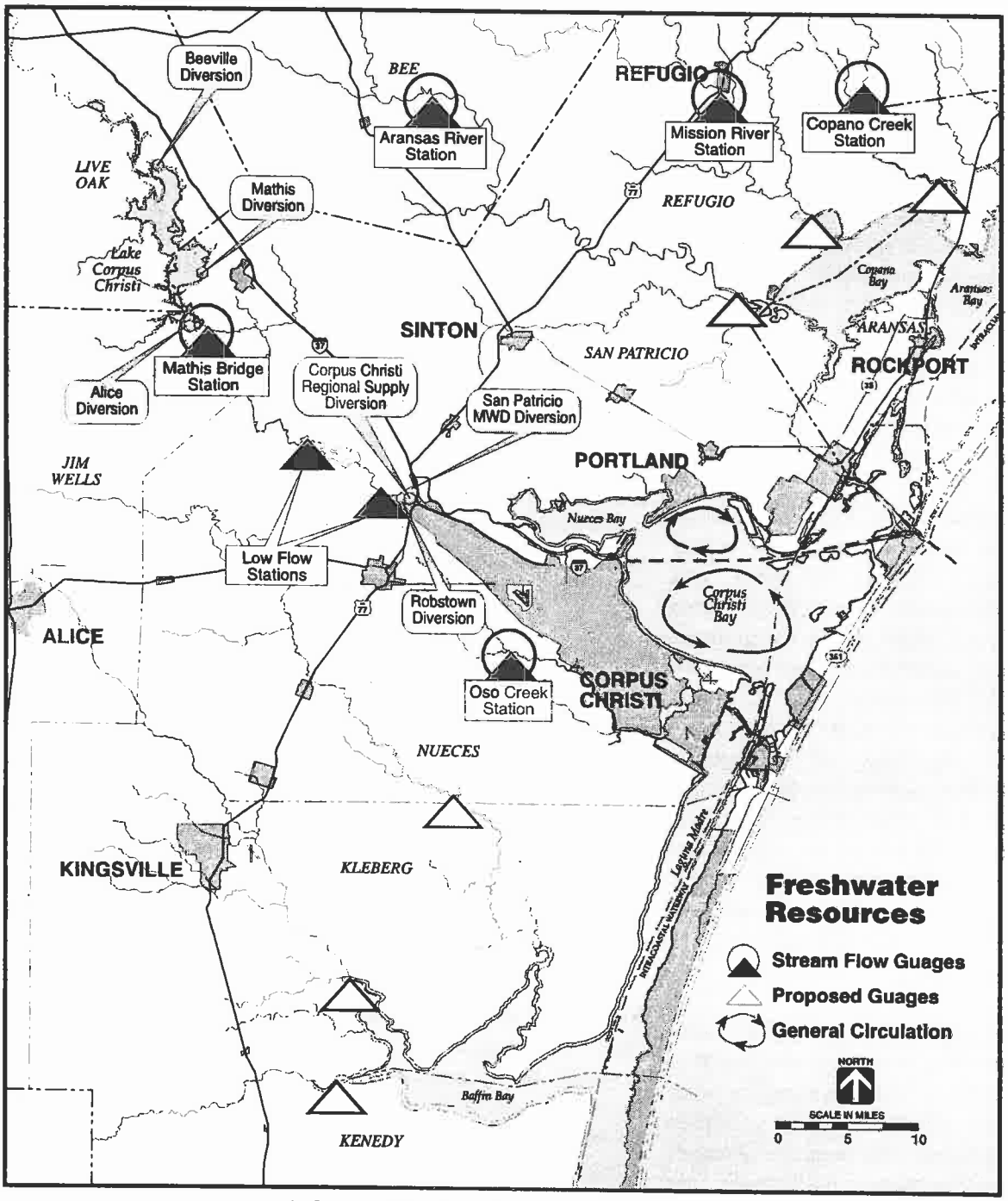


FIGURE 20 Freshwater Resources

ing, resting, and protective areas for many forms of aquatic and terrestrial animals. Ultimately, the nutrients are converted to foods and other products that are useful to people.

Third, rivers and streams bring in sediments to the estuaries. They deposit sand, silt, and clay as their waters slow down upon entering bays, lagoons, and the Gulf. The muddy deltas and sandy barrier islands formed by these deposits help create and maintain back bays and coastal marshes. Without the replenishment of sediments, wave action eventually would wash away the existing wetlands and begin to erode coastal uplands.

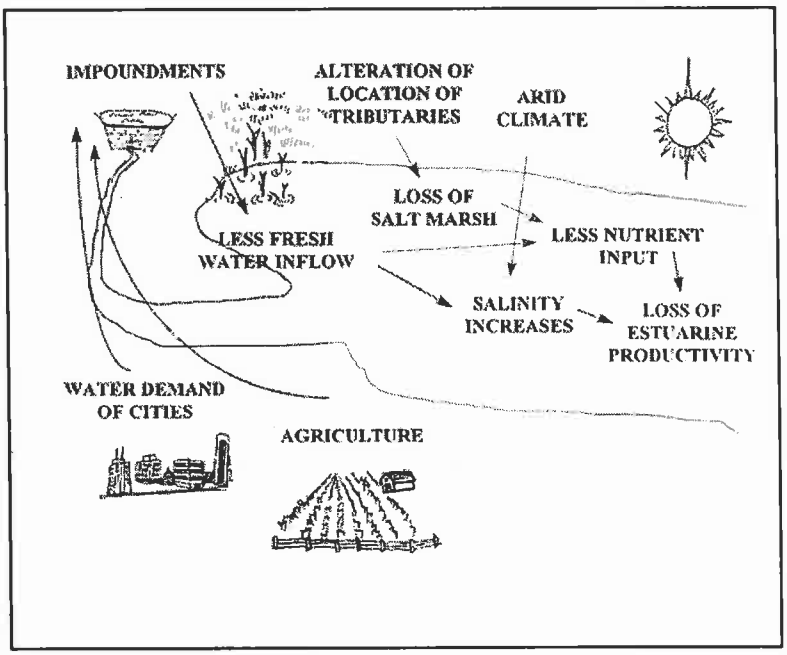


FIGURE 21 Importance of Freshwater Inflows
Brackish water can support more productive organisms than marine water. Therefore, when fresh water inflow to an estuary decreases, the estuary generally becomes less productive. Freshwater can be diverted for a number of reasons, including industrial, residential, and agricultural uses. Although humans need water too, it is important to remember that the only source of freshwater to an estuary is through rivers and creeks, particularly in an area with low rainfall, such as South Texas.

Regional Demand for Water

Several significant processes have been at work in the past 65 years that have increased demand for water from the Nueces River and decreased the amount flowing to the Nueces Estuary. First among these has been the shift from an economy based on agriculture to one based on oil and gas related activity, manufacturing, transportation, and government services. This has helped to encourage population growth both internally and from other areas. The percentage of the region's population depending on the Nueces River has increased as towns have converted from the use of groundwater to surface water.

Development of the petroleum and chemical process industries in Nueces and San Patricio Counties would not have been possible without adequate high quality water. Moreover, the population of counties served by the Nueces River water supply system grew from less than 100,000 in 1930 to more than 400,000 by 1990. In the first half of the century, the majority of growth was from newcomers. In recent decades, internal growth based on high birth rates and migration from rural to urban areas of South Texas has been a major factor. Forecasts

Several significant processes have been at work in the past 65 years that have increased demand for water from the Nueces River: a shifting economy, population growth, and conversions from groundwater to surface water.

by the Texas Water Development Board indicate that growth rates in the Coastal Bend are likely to be below the statewide average in the next several decades, but will still result in a doubling of population by the year 2050. The Trans-Texas Water Program projects that residential and business use of water will increase by about 50 percent while industrial water use will double in that time.

Toward a Comprehensive Regional Water Management Plan

The ***Bays Plan*** provides a means for taking a 'holistic' view in developing a regional water management plan that will meet both human and environmental needs well into the future. Through the ongoing efforts of state agencies, the Coastal Bend Regional Water Planning Group, the City of Corpus Christi, and other stakeholders, participants in this process will refine their understanding of the environmental and human needs of freshwater. An evaluation of demonstration projects and an ongoing monitoring and modeling program will be principal tools in this effort. As scientific understanding progresses, so will refinements to the reservoir system operating plan. The result will be to maximize both the firm yield of reservoir storage or other supplies, and the biological productivity of bays and estuaries.

Freshwater inflow into bays and estuaries is not wasted water; it supports bay and estuary ecosystems so they can continue to provide the abundant resources that our fishing industry and wildlife need.

A second component of this strategy is to maximize the beneficial use of treated wastewater by moving such 'return flows' to strategic discharge points that will provide for environmental enhancements. While part of the regional supply of water is consumed as it is used, an estimated 47 percent of the original volume is treated and discharged to the bay system. These return flows help satisfy part of the freshwater needs of the Nueces Estuary.

In taking the lead to develop a regional water management plan, as required under 1997 state legislation for all areas of the state, the Coastal Bend Regional Water Planning Group and implementing partners will investigate ways to maximize beneficial uses of treated wastewater. The City of Corpus Christi has undertaken a demonstration project that diverts two million gallons per day of wastewater from its Allison Wastewater Treatment Plant to a point in the Nueces Delta. Additional proposals have been advanced for substituting much larger quantities of wastewater effluents in place of pass-through requirements that will also serve to enhance estuarine productivity. This concept has been supported by several studies indicating that primary productivity will increase because of the nutrient content of the wastewater effluent. Examples of already successful return flow projects are the Hans Suter Wildlife Refuge on Oso Bay and the Port Aransas Wildlife Viewing Area.

Finally, the ***Bays Plan*** calls for continued and expanded efforts to conserve the region's valuable freshwater supply. Already the most successful region in the state at water conservation, there are of course additional ways to conserve water and achieve greater public awareness of the part we can all play. Equally important, every effort will be made to increase the public's understanding of the issues, plans, and programs to meet both human and environmental needs for freshwater. The 'bottom line' is that, by definition, an estuary must have freshwater inflows. With additional water supply available from Lake Texana in 1998, there is a new opportunity to develop a truly comprehensive regional freshwater management plan that will absolutely minimize the economic and environmental impacts of future low-flow years.

The Plan is intended to encourage the assessment of what the future freshwater inflow needs will be and to seek ways to meet those needs, including the reuse of treated wastewater and water conservation practices.

Action Plan
FRESHWATER RESOURCES

Overview

Page

Objective: Develop and implement a water management plan based on best available data.

Key Findings

Local governments are working to ensure that there will be adequate water resources in the project area to meet anticipated long-term demand. The challenge is to strike an appropriate balance between the human and environmental needs for freshwater. Program studies provide the following information:

- Annual streamflow for the Nueces River near the Mathis gauging station shows a downward trend over the past 57 years (1940-1996). This trend is more of a 'step' trend than a linear one. The step occurred approximately in 1982 and is associated with the completion of Choke Canyon reservoir. The post-Choke Canyon mean streamflow [34,429 ha-m/yr (279,000 acre-ft./yr.)] at the Mathis gauging station represents a 55 percent reduction from the pre-Choke Canyon mean streamflow [76,014 ha-m/yr (616,000 acre-ft./yr.)] (Asquith, *et al.,* 1997). However, further analysis of annual streamflow in the Nueces River basin not involving Choke Canyon reservoir indicated significant downward trends in streamflow for approximately the same time period. Consequently, the downward trend for the Nueces River near the Mathis gauging station is a combination of several factors, including completion of Choke Canyon reservoir, increased consumptive water use in the basin (Green and Slade, 1995), a decrease in rainfall, and other complex hydrologic issues.

- Water-budget and streamflow analyses show that storage in and evaporation from Choke Canyon Reservoir account for an annual streamflow reduction of about 28 percent of the total post-Choke Canyon (1983-1996) decrease in annual streamflow (Asquith, *et al.,* 1997).

Finally, the ***Bays Plan*** calls for continued and expanded efforts to conserve the region's valuable freshwater supply. Already the most successful region in the state at water conservation, there are of course additional ways to conserve water and achieve greater public awareness of the part we can all play. Equally important, every effort will be made to increase the public's understanding of the issues, plans, and programs to meet both human and environmental needs for freshwater. The 'bottom line' is that, by definition, an estuary must have freshwater inflows. With additional water supply available from Lake Texana in 1998, there is a new opportunity to develop a truly comprehensive regional freshwater management plan that will absolutely minimize the economic and environmental impacts of future low-flow years.

The Plan is intended to encourage the assessment of what the future freshwater inflow needs will be and to seek ways to meet those needs, including the reuse of treated wastewater and water conservation practices.

Action Plan
FRESHWATER RESOURCES

Overview

Objective: Develop and implement a water management plan based on best available data.

Key Findings

Local governments are working to ensure that there will be adequate water resources in the project area to meet anticipated long-term demand. The challenge is to strike an appropriate balance between the human and environmental needs for freshwater. Program studies provide the following information:

- Annual streamflow for the Nueces River near the Mathis gauging station shows a downward trend over the past 57 years (1940-1996). This trend is more of a 'step' trend than a linear one. The step occurred approximately in 1982 and is associated with the completion of Choke Canyon reservoir. The post-Choke Canyon mean streamflow [34,429 ha-m/yr (279,000 acre-ft./yr.)] at the Mathis gauging station represents a 55 percent reduction from the pre-Choke Canyon mean streamflow [76,014 ha-m/yr (616,000 acre-ft./yr.)] (Asquith, *et al.*, 1997). However, further analysis of annual streamflow in the Nueces River basin not involving Choke Canyon reservoir indicated significant downward trends in streamflow for approximately the same time period. Consequently, the downward trend for the Nueces River near the Mathis gauging station is a combination of several factors, including completion of Choke Canyon reservoir, increased consumptive water use in the basin (Green and Slade, 1995), a decrease in rainfall, and other complex hydrologic issues.

- Water-budget and streamflow analyses show that storage in and evaporation from Choke Canyon Reservoir account for an annual streamflow reduction of about 28 percent of the total post-Choke Canyon (1983-1996) decrease in annual streamflow (Asquith, *et al.*, 1997).

- For all bay systems combined, there has been a 19 percent reduction in total annual inflow. The difference between total return and diversion flow is negative [−6,293 ha-m (−51,000 acre-ft.)], which amounts to a loss of about 4 percent (Asquith, *et al.,* 1997).

- The available data for estimating inflows are adequate but not optimum. The addition of seven gauges would increase the gauged inflows from about 23 percent of the total to about 70 percent of the total (Asquith, *et al.,* 1997).

- Freshwater replacement time for the bay system is about 50 months -- quite long relative to most other estuarine systems (Ward, 1997).

FW-1 Improve scientific understanding of the freshwater needs of the estuaries.

Why Freshwater inflows are critical to the health and productivity of estuaries. Coastal Bend estuaries are unique in that freshwater inflows vary greatly from year to year. The combined effect of naturally occurring droughts and increasing human demand has the potential to severely impact the estuaries. A better understanding of freshwater inflow needs will be critical for future regional water planning.

How **STEP 1** — Continue use of current, cost effective, and scientifically accepted methods to monitor salinity; productivity of bays; inflow quantity and quality; direct bay rainfall; and climate trends and forecasting.

STEP 2 — Determine needs for freshwater inflows that provide sediments, nutrients, and salinity levels that are necessary to maintain the ecological health and productivity of the Coastal Bend bays and estuaries. Continue to develop and assess methods for measuring estuary and bay productivity.

STEP 3 — Continue to refine the reservoir system operating plan based on best available information.

STEP 4 — Assess and coordinate overall data collection needs, identify locations, and deploy new streamflow and rainfall gauges throughout the project area as needed.

STEP 5 — Create a data and information repository and make it available to the public and governmental organizations.

STEP	Lead	Other Partners	Anticipated Costs
1	TWDB	TNRCC, TGLO, TPWD, City of Corpus Christi	
2	TNRCC, TPWD, TWDB	TGLO, City of Corpus Christi	
3	TNRCC/City of Corpus Christi	NEAC, TPWD, TWDB, TGLO, CBBF, other stakeholders	
4	USGS	TNRCC, TWDB, TPWD, TGLO, City of Corpus Christi, USEPA	
5	CBBEP	TNRCC, TPWD, TWDB, TGLO, TDH, USEPA, City of Corpus Christi	

TWDB	Texas Water Development Board	CBBF	Coastal Bend Bays Foundation
TNRCC	Texas Natural Resource Conservation Commission	USGS	United States Geological Survey
TGLO	Texas General Land Office	USEPA	United States Environmental Protection Agency
TPWD	Texas Parks and Wildlife Department	CBBEP	Coastal Bend Bays and Estuaries Program
NEAC	Nueces Estuary Advisory Committee	TDH	Texas Department of Health

Total Anticipated Costs This action coincides with existing programs. New monitoring will require some funding.

Measures of Success

- Changes in the amount, timing, and location of freshwater inflows over time are determined.
- Monitoring of salinity, rainfall, sediment, and nutrient loading, and productivity of the bays is expanded.

Related Actions PEO-1

FW-2 Assist the Coastal Bend Regional Water Planning Group and regional water managers to incorporate the needs of estuaries in comprehensive planning.

Why Texas State Senate Bill 1 (SB1) requires that water regions in the state develop regional water management plans. The intent of this action is to assist the Coastal Bend Regional Water Planning Group and other regional freshwater stakeholders in such efforts.

How **STEP 1** — The Coastal Bend Regional Water Planning Group will lead the development of a regional water plan based on Senate Bill 1 with the assistance of a regional advisory board of freshwater stakeholders.

STEP 2 — Continue to implement projects and assess the ecology and economics of beneficial reuses of wastewater. Possibilities include recycling effluent back into industrial processes, municipal uses, freshwater inflow enhancement, habitat creation/enhancement, and other non-potable uses. Support the effort to divert treated wastewater to the Nueces delta.

STEP 3 — Encourage water conservation measures and investigate alternative freshwater supply sources such as desalinization and aquifer recharge.

STEP 4 — Identify new innovative rates, programs, building codes, and incentives to encourage conservation.

STEP	Lead	Other Partners	Anticipated Costs
1	Coastal Bend Regional Water Planning Group	TNRCC, PICC, TPWD, City of Corpus Christi, other stakeholders	
2	City of Corpus Christi, Coastal Bend Regional Water Planning Group	TNRCC, TWDB, TPWD, PICC, other stakeholders	
3	City of Corpus Christi, Coastal Bend Regional Water Planning Group	TNRCC, TWDB, TGLO, PICC, other stakeholders	
4	City of Corpus Christi, Coastal Bend Regional Water Planning Group	TNRCC, TWDB, PICC, other stakeholders	

TNRCC Texas Natural Resource Conservation Commission
PICC Port Industries of Corpus Christi
TPWD Texas Parks and Wildlife Department
TWDB Texas Water Development Board
TGLO Texas General Land Office

Total Anticipated Costs

Costs for plan development will be provided primarily by the Texas Water Development Board and citizens of the Coastal Bend Regional Water Planning area. Initiation of reuse projects will require funding.

Measures of Success

- A regional water plan based on Senate Bill 1 is developed, implemented, and effective in meeting estuary needs.
- The number of wastewater reuse projects and volume of wastewater reused are increased.
- The current reservoir freshwater pass through, including treated wastewater reuse, is effective in meeting all stakeholder needs.

FW-2

Related Actions

HLR-2, PEO-4

FW-3 Support efforts that directly contribute to increased freshwater flow events into the bays and estuaries of the Coastal Bend.

Why The coastal wetland marshes of the bays and estuaries depend upon periodic freshwater flooding and inundating of the river delta system to maintain ecological functions.

How **STEP 1** — Inventory possible projects that would increase freshwater inflows to the bays and estuaries and determine their feasibility.

STEP 2 — Support the U.S. Bureau of Reclamation in the accomplishment of the Rincon Bayou Project and its objectives.

STEP	Lead	Other Partners	Anticipated Costs
1	CBBEP	Private landowners, USGS, TWDB, U.S. Bureau of Reclamation	To be determined
2	U.S. Bureau of Reclamation	Private landowners, University of Texas Marine Science Institute, USGS, TWDB, City of Corpus Christi	To be determined

Total Anticipated Costs To be determined.

Measures of Success

- The opportunity for flooding into the Nueces River delta over the long term is increased.

Related Actions

CBBEP Coastal Bend Bays and Estuaries Program
USGS United States Geological Survey
TWDB Texas Water Development Board

FW-4 Effectively communicate the purpose and results of ongoing freshwater plans and programs.

Why The issue of freshwater is very important to Coastal Bend residents, and it is therefore important to keep people informed of developing information and changes to reservoir system operating agreements. The intent of this action is to focus on communicating the purpose and process for development of various freshwater related plans and programs, including the environmental needs of freshwater inflow.

How **STEP 1** — Implement procedures for conveying information to the public regarding freshwater supply issues. Focus should be on the scientific need for freshwater inflows to the estuaries and the justification for any changes to the reservoir system operating plan.

STEP	Lead	Other Partners	Anticipated Costs
1	City of Corpus Christi, Coastal Bend Regional Planning Group	TNRCC, TPWD, TWDB, CBBEP	

Total Anticipated Costs Minimal.

Measures of Success

- Public understanding of the purpose and results of ongoing freshwater plans and programs is increased.
- Public support for the efficient use of water in the project area is increased.

Related Actions PEO-1, PEO-4

TNRCC Texas Natural Resource Conservation Commission
TPWD Texas Parks and Wildlife Department
TWDB Texas Water Development Board
CBBEP Coastal Bend Bays and Estuaries Program

CHAPTER 7

Public Education and Outreach

Goals

Implement an innovative and measurable education and outreach strategy to improve public understanding and support for effective management of bay resources.

Public Education and Outreach Action Plan

Introduction

One of the most important goals of the ***Bays Plan*** is to educate citizens about the ecology of the bay system, its many environmental and economic values, and how an individual can make a positive difference to ensure its long-term health. To accomplish this, the Public Education and Outreach Action Plan is designed to:

- Raise the public's environmental awareness;
- Foster community stewardship of bay resources; and
- Increase individual involvement in bay resource management issues.

Helping residents and visitors to understand the complex issues concerning bay resource management will be a priority. In addition to understanding how the bay system functions, it is important that citizens develop a sound appreciation for the significant value and economic impact derived from the renewable resources of the bays.

A Regional Approach to Public Outreach

Before the Program begins this outreach mission it will be necessary to identify and evaluate the effectiveness of existing public education efforts. After gaps are identified, Program partners will develop a comprehensive regional strategy that will utilize and coordinate existing programs to reach people of all ages. Community stewardship through a sense of individual responsibility will be the goal.

Several techniques will be used to achieve the goals of the regional strategy, including effective use of the media, the development of user-friendly educational materials, and the establishment of an electronic clearinghouse on bay-related resource information. These and other tools will be developed and refined with strong emphasis given to the science which supports the actions of the ***Bays Plan***.

Bringing family fun into play, partners will work to establish an annual 'Bay Day' celebration that will exhibit the appropriate mix of education, seafood, and bay-related, hands-on fun.

Educating the public – and especially the youth – will help ensure that our resources are not taken for granted. Ultimately, the condition of our bays and estuaries will depend on public understanding and appreciation of our natural resources.

Educating Tomorrow's Leaders

One of the strongest messages the public has put forth in the development of the ***Bays Plan*** is that efforts to educate tomorrow's leaders must begin today. The Plan thus calls for the design and implementation through school districts of environmental curricula on bay resource issues. Other actions will expand upon and promote the use of outdoor educational facilities that exist throughout the region (see Figure 22), as well as identify new sites or opportunities to build or develop additional 'outdoor laboratories'.

These 'outdoor laboratories', together with the necessary supporting resources and teacher training, can result in considerable 'return on investment' for our next generation of leaders.

Public participation is a cornerstone of building support for protection of our resources. Hands-on experience gives citizens immediate feedback on how their actions can affect the bays and estuaries.

Achieving Stewardship

Other actions of the ***Bays Plan*** will focus on how best to achieve stewardship through individual involvement and responsibility for sound environmental practices. A 'Coastal Bend Environmental Citizen's Guide' will be developed that will provide practical information on the many positive actions that any individual can do to help. Coupled with this will be an environmental stewardship recognition program, with appropriate awards and public recognition given to those individuals and groups who have demonstrated environmental leadership.

By working to promote public/private partnerships in this fashion, the ***Bays Plan*** will achieve its educational goals more quickly and with more lasting success.

But there will always be the need for continued dialogue between competing user groups, and thus the need for a relaxed, public forum to allow for individual input into the public policy debate. The Coastal Bend Bays Foundation, a local nonprofit organization dedicated to the health and productivity of these bays and estuaries, has served such a function for several years. The Plan calls for continued involvement in this regard from the Bays Foundation, as the region prepares itself for ever-increasing numbers of people wanting to make use of the bays and estuaries. Minimizing conflict through informed discussion will help achieve the overall objective of ensuring the public's safety, health, and enjoyment of our bays and estuaries.

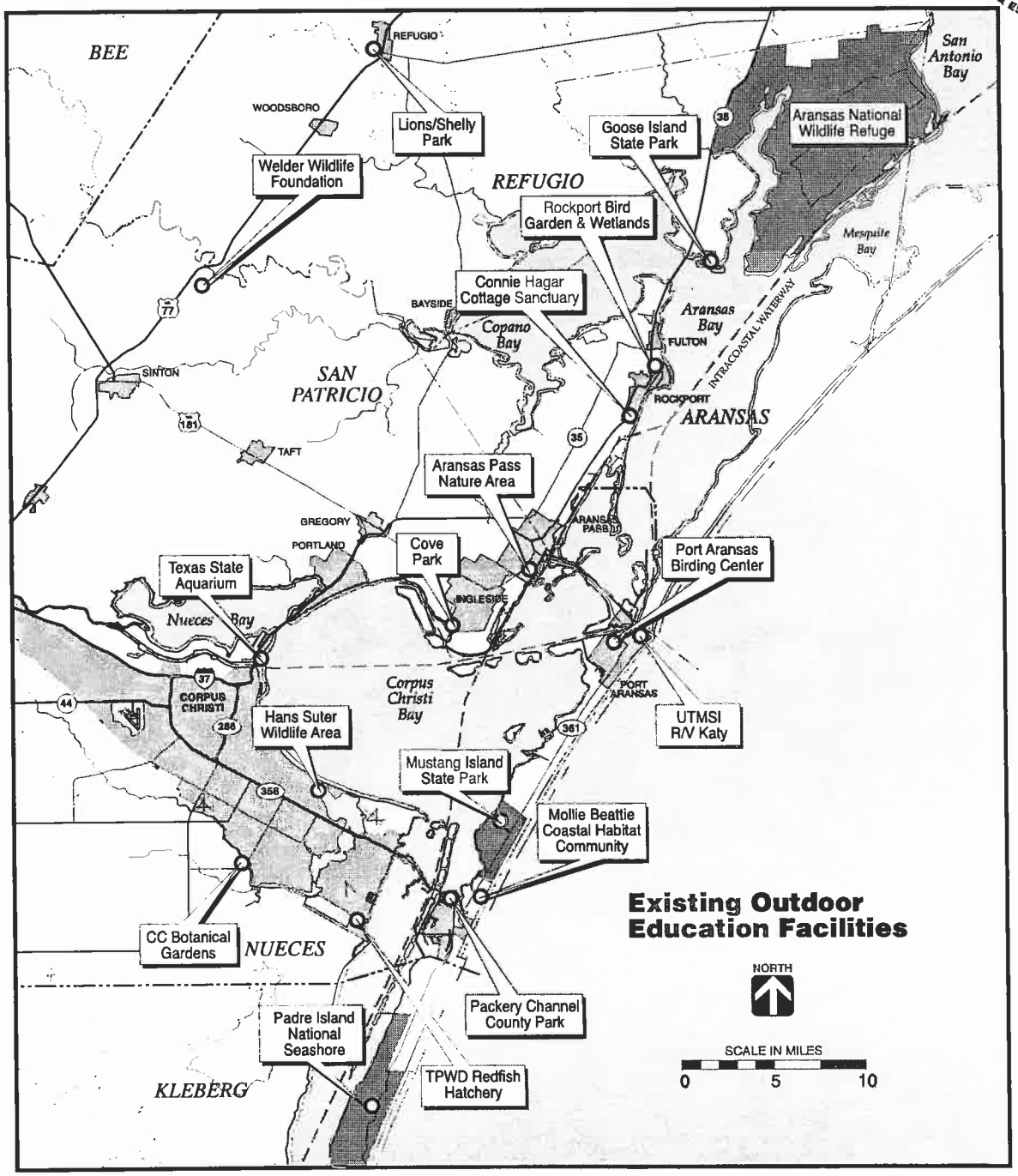


FIGURE 22 Existing Outdoor Education Facilities

Target Audiences and Subjects

The development of the Public Education and Outreach Action Plan has occurred on many parallel levels. The Action Plan reflects Management Conference consensus on educational issues that need attention. The Action Plan provides a framework and a process for developing a Regional Outreach Strategy. Most of the Action Plan focuses on how to accomplish that goal.

Tables 4 and 5 provide a summary of educational subjects and targeted audiences that can serve as a starting point for implementing this component of the ***Bays Plan***. The list can and should be revised with other issues and audiences as they are identified.

TABLE 4
Public Education and Outreach: Issues and Audiences

Issue	General Public	Recreational Users	Gov't Officials	Schools/Youth Groups	Commerce/ Industry
HUMAN USES					
Pollution and environmental damage reporting	X				
Littering and illegal dumping	$X_{3, 2}$, and pickup & boat owners		X		
Marina pollution abatement		X	X		X
Angler education		X			
Public health issues	X_1	$X_{1, 2, 7}$	X	X_1	
Shoreline management	X		X		
MARITIME COMMERCE AND DREDGING					
Boating safety		X			
Maritime/port value	X				
Dredging	X_1				
HABITAT AND LIVING RESOURCES					
Exotic species	$X_{1, 2, 6}$		X_1	X_1	
Algal blooms				$X_{1, 8}$	
Fisheries management		X			
Estuarine ecology and health	X				
WATER AND SEDIMENT QUALITY					
Point source discharges	X_9				
Nonpoint source runoff	X				
Water/sediment quality	$X_{1, 2, 7}$			X_1	
Urban runoff	X		X		
FRESHWATER RESOURCES					
Freshwater inflows	X_1		X	X_1	
Water conservation/ efficiency and demand activities	$X_{6, 9}$			X	
Xeriscape	X_6				
Summary of regional forums, conferences, and workshops			$X_{1, 4, 5}$		

[1]Print Material
[2]Public Service Announcement
[3]Speakers Bureau
[4]Newsletter
[5]Fact Sheet
[6]Display
[7]News Release
[8]Internet
[9]Multimedia

TABLE 5

Public Education and Outreach: Messages

SUBJECT	MESSAGE
HUMAN USES	
Pollution and environmental damage reporting	Encourage public reporting of pollution and other resource damaging activities. Educate the public about spill prevention and reporting.
Littering and illegal dumping	Discourage littering and illegal dumping. Educate on adverse impacts of bay debris. Encourage the 3R's: Reduce, Reuse, and Recycle. Recycling information clearinghouse.
Marina pollution abatement boating operations	Promote use of pump-out stations and operational measures to control release of pollutants during boat bottom cleaning/painting. Promote the proper disposal of hazardous materials. Promote seagrass awareness and reduce prop scarring.
Angler education	Promote stewardship of fisheries resource and fisheries management practices.
Public health issues	Provide the general public with accurate information regarding health concerns associated with utilization of bay resources (e.g., contact recreation & seafood consumption).
Shoreline management	Provide private sector assistance/understanding for shoreline management goal.
MARITIME COMMERCE AND DREDGING	
Boating safety	Increase recreational boat operator awareness of Rules of the Road, especially in regard to deep draft vessels.
Maritime/port value	Increase public understanding of the Port and marine channel industries.
Dredging	Increase public understanding of the dredging process, funding alternatives, beneficial uses of dredged material, benefits, alternate dredged material disposal areas, and cost/benefit of channel operation.
HABITAT AND LIVING RESOURCES	
Exotic species	Educate the public about negative impacts of exotic species in the coastal ecosystems.
Algal blooms	Educate the public about algal blooms and their impact on the public.
Estuarine ecology and health	Provide information about the economic and environmental importance of a healthy bay system. Increase basic understanding of the function of an estuary.
WATER AND SEDIMENT QUALITY	
Point source discharges	Educate the public about the quality and status of point source discharges, their beneficial effects, and the public's contribution to pollution discharged from Municipal Wastewater Treatment plants and what can be done to minimize them.
Nonpoint source (urban) runoff	Develop a public awareness program about the need to contain and reduce polluted nonpoint source (urban) runoff.
Water/sediment quality	Provide information to the public regarding water and sediment quality issues. Rapidly respond to media events with accurate information.
FRESHWATER RESOURCES	
Freshwater inflows	Stress protection of the bay system and identify the need for freshwater inflow.
Water conservation, efficiency, supply, and demand	Educate the public on regional water supply issues and the need for continuous water conservation.
Xeriscape	Encourage use of xeriscapes and natural vegetation to reduce water consumption, pesticides, and herbicides.

Action Plan
PUBLIC EDUCATION AND OUTREACH

Overview

Present Status

Although environmental issues are receiving increased public attention in the Coastal Bend, public understanding of ecosystem processes and linkages in the bay system is generally poor. There is no strong sense of ownership or stewardship of the estuaries, resulting in a lack of broad support for necessary action. A vigorous and adequately funded public education and outreach program is needed to increase individual involvement in bay resource management issues.

PEO-1 Develop and implement a regional Public Education and Outreach Strategy.

Why A coordinated regional approach will reduce costs and improve the effectiveness of all efforts.

How **STEP 1** — Form a Public Outreach Advisory Committee to identify and evaluate existing outreach programs as measured against ***Coastal Bend Bays Plan*** issues and audiences (see Tables 4 and 5). Establish or enhance outreach efforts where gaps exist. Conduct baseline survey to gage public awareness of issues.

STEP 2 — Designate a media point person to promote accurate mass-media coverage of environmental issues through coordination of frequent media events, press releases, and press conferences. Utilize mass media at least once per month and respond to major environmental events through all available means.

STEP 3 — Identify and target high traffic areas where information can be distributed most effectively. Coordinate displays and interactive exhibits at malls, fairs, conferences, and scientific workshops.

STEP 4 — Establish and promote an information resource center including Internet site, virtual library, newsgroup, and information hotline.

STEP 5 — Develop and distribute materials to achieve objectives of the Public Education Outreach Strategy. Print materials include 'Environmental Citizen's Guide', newsletter, and 'State of the Bay Report'. Also included are visual and interactive displays, videos, and public service announcements. Use languages other than English where appropriate.

STEP	Lead	Other Partners	Anticipated Costs
1	CBBEP	TPWD, Texas Sea Grant, Texas State Aquarium, City of Corpus Christi, School districts	$10,000 plus ¼ person/ year
2	CBBEP	TPWD, Texas Sea Grant, Texas State Aquarium, City of Corpus Christi, School districts	$5,000 plus ¼ person/ year
3	CBBEP	TPWD, Texas Sea Grant, Texas State Aquarium, City of Corpus Christi, School districts	¼ person/year
4	CBBEP	TPWD, Texas Sea Grant, Texas State Aquarium, City of Corpus Christi, School districts	$30,000 plus ¾ person/ year
5	CBBEP	TPWD, Texas Sea Grant, Texas State Aquarium, City of Corpus Christi, School districts	$75,000 plus ½ person/ year

PEO-1

Total Anticipated Costs $120,000 per year plus 2 full-time personnel

Measures of Success

- Public surveys are completed every 3 years to evaluate stewardship.
- The resource center, hotline, and Internet site are completed and operational.
- Public awareness of Coastal Bend Bays issues is increased.

Related Actions BTR-1, PH-1, HLR-4, FW-1, FW-4

CBBEP Coastal Bend Bays and Estuaries Program
TPWD Texas Parks and Wildlife Department

PEO-2 Establish a Bay Day celebration to focus attention on bay resources and uses.

PEO-2

Why Currently, the many festivals that take place throughout the region do not highlight the full value of or environmental issues related to the bay system.

How **STEP 1** — Establish a Bay Day Committee to guide and oversee event. Develop list of co-sponsors and participants. Evaluate host sites working within the context of existing public events.

STEP 2 — Develop an event work plan. Organize participants, funding partners, displays, entertainment, and concessions. Conduct an advertising campaign.

STEP 3 — Evaluate the effectiveness of the event.

STEP	Lead	Other Partners	Anticipated Costs
1	CBBEP	City of Corpus Christi, Regional Chambers of Commerce, Local governments, Resource agencies, Civic groups	To be determined
2	CBBEP	City of Corpus Christi, Regional Chambers of Commerce, Local governments, Resource agencies, Civic groups	To be determined
3	CBBEP	City of Corpus Christi, Regional Chambers of Commerce, Local governments, Resource agencies, Civic groups	To be determined

Total Anticipated Costs To be determined

Measures of Success

- The number of people exposed to educational messages is increased over time.

Related Actions BTR-1

CBBEP Coastal Bend Bays and Estuaries Program

PEO-3 Provide curricula for all levels of environmental education and promote greater use of outdoor educational facilities as a means of reaching children, young people, and adults.

Why Educating children on the importance of conserving natural resources will help ensure that future generations will be prepared to make wise decisions on resource management.

How **STEP 1** — Promote use of existing curricula with emphasis on local ecology. Survey school districts to determine extent and success of materials currently used. Work with school administrations to identify needs and coordinate development of new materials, if necessary. Coordinate development with K through 12, state, and national science standards. Focus on issues identified in the ***Coastal Bend Bays Plan***. Distribute education materials.

STEP 2 — Coordinate with federal, state, local, and private entities to identify and promote development and/or enhancement of outdoor educational facilities for school groups and other appropriate user groups. Identify existing sites and amenities, and develop an improvement plan for prioritized sites. Integrate use of sites with environmental education curricula.

STEP 3 — Conduct workshops and teacher training courses that focus on training key educators and leaders within the project area to subsequently train others within their organizations or community.

STEP 4 — Conduct surveys of environmental education teachers and receive feedback on success of curricula. Continually evaluate and use, where appropriate, alternative technologies such as satellite communications, videoconferencing, computer software, and Internet to extend education opportunities.

PEO-3

STEP	Lead	Other Partners	Anticipated Costs
1	Texas State Aquarium	Educational Service Center, Texas Environmental Advisory Council, Curriculum coordinators, TEA Region 2 & 3, TPWD, USEPA	$35,000 per year plus ¼ person/year
2	TPWD	TGLO, USFWS, Landowners, City/county parks and recreation safety officer and representative	To be determined per site plus ¼ person/ year
3	CBBEP	PICC, TNRCC, Center for Coastal Studies, TPWD, Educational Service Center, Texas Environmental Advisory Council, Curriculum coordinators, TEA Region 2 & 3, USEPA	$50,000 per year plus ⅛ person/year
4	CBBEP	Educational Service Center, Texas Environmental Advisory Council, Curriculum coordinators, TEA Region 2 & 3, TPWD, USEPA	$1,000 per year plus ⅛ person/year

Total Anticipated Costs $86,000 per year plus ¾ full-time person.

Measures of Success

- A regionally focused environmental curriculum is established in all project area school districts.
- The number of education sites in the project area and users of the sites are increased.
- Surveys of education site users reveal that they are satisfied with their experience.

Related Actions BTR-2, HLR-4

TEA	Texas Education Association
TPWD	Texas Parks and Wildlife Department
USEPA	United States Environmental Protection Agency
TGLO	Texas General Land Office
USFWS	United States Fish and Wildlife Service
CBBEP	Coastal Bend Bays and Estuaries Program
PICC	Port Industries of Corpus Christi
TNRCC	Texas Natural Resource Conservation Commission

PEO-4 Conduct public forums to increase dialogue between resource managers and users.

Why Continued growth of the region's population will result in greater utilization and demand for natural resources. Public participation in the decision-making process is important to achieve effective management and to minimize conflict.

How **STEP 1** — Coordinate an annual public forum and other forums as needed on regional resource management issues. Utilize existing opportunities such as TGLO's Coastal Issues Symposium, Bayfest, or Bay Day events.

STEP 2 — Develop and sponsor Internet newsgroups focused on regional issues identified in the ***Coastal Bend Bays Plan***. These newsgroups could be enhanced through electronic town meetings. Develop a list of co-hosts with expertise in issue areas.

STEP	Lead	Other Partners	Anticipated Costs
1	CBBF	Resource agencies, General public, Conservation organizations, User groups	$10,000/yr plus ⅛ person/year
2	CBBEP	CBBF, Resource agencies, Conservation organizations, TAMU-CC, User groups	$3,500 /yr plus ⅛ person/year

Total Anticipated Costs $13,500 per year plus ¼ full-time person

Measures of Success

- Participation in public forums on bay management is increased over time.

Related Actions HLR-4, FW-2, FW-4

TGLO Texas General Land Office
CBBF Coastal Bend Bays Foundation
CBBEP Coastal Bend Bays and Estuaries Program
TAMU-CC Texas A&M University – Corpus Christi

PEO-5 Promote public participation and recognition programs to protect the bay system and its resources.

PEO-5

Why Personal involvement in the environment promotes stewardship of the natural resources.

How **STEP 1** — Promote citizen involvement in bay resource management through existing environmental programs and the development of new programs that encourage public participation. Partner with CBCOG and other sponsoring organizations to coordinate citizen monitoring programs to maximize coverage and increase the value of collected data. Inventory, promote, and develop environmental volunteer award programs including commercial partnerships.

STEP 2 — Institutionalize a 'Clean the Bay Day' as part of a coordinated, regional volunteer trash-off event.

STEP 3 — Inventory and promote the use of educational, industrial, local, and national grant award programs for environmental stewardship in the project area. Develop local grant proposals (and funding) for education and industry to promote environmental stewardship in the project area. Utilize the CBBEP public contact system (e.g. Internet, newsletters, fact sheets) and other communication networks, as available, to share success stories.

STEP	Lead	Other Partners	Anticipated Costs
1	CBBEP	CBCOG, Volunteer programs such as Adopt-a-Wetland, Adopt-a-Habitat, Bay Cleanup, Shoreline restoration projects, Major Rivers, Aquatic Wild, Texas Watch	To be determined
2	CBBEP	City of Corpus Christi, Civic groups, Schools	To be determined
3	CBBF	PICC, Resource agencies	To be determined

Total Anticipated Costs To be determined.

CBCOG Coastal Bend Council of Governments
CBBEP Coastal Bend Bays and Estuaries Program
CBBF Coastal Bend Bays Foundation
PICC Port Industries of Corpus Christi

Measures of Success

- The percentage of the project area covered by citizen monitoring programs is increased.
- The number of bay-related environmental volunteer award programs is increased.
- The number of 'Clean the Bay' days and the amount of trash collected are increased.
- The number of educational, industrial, and national grant award programs for environmental stewardship in the project area is increased.

Related Actions

BD-1, HLR-4, HLR-5

CHAPTER 8
Implementing and Funding the *Coastal Bend Bays Plan*

The Existing Institutional Framework

In addition to efforts to characterize the health of the bay system and issues related to environmental degradation, the Management Conference undertook an effort to characterize the management framework that is currently in place to deal with those issues (Richard, *et al.*, 1996). This study describes the activities of 69 federal, state, regional, local, and non-governmental organizations involved to varying degrees in natural resource management efforts related to the project area. Information is provided regarding each institution's mission, activities, and programmatic resources. In addition, there is a more detailed analysis of 37 institutions whose missions most closely relate to the Program's priority issues (see Appendix B).

Results of the analysis indicate that the current management framework is fairly effective at managing area resources. The organizations have sufficient authority and resources to carry out their responsibilities. With a few notable exceptions, the framework of institutions together covers the priority issues identified by the Management Conference. Involvement from local and regional organizations needs to be strengthened as these organizations are critical to maintaining long term efforts to protect the estuary and its resources. Currently, federal and state agencies are contributing the major portion of the resources to address the program's priority issues.

Those priority issues or contributing factors that are not sufficiently addressed by the management framework include the following:

1) water conservation, reuse, and technology advances;
2) over-utilization of living resources;
3) disturbance of submerged habitats from trawling, prop washing, and other activities;
4) persistent brown tide events in the upper Laguna Madre;
5) tidal discharge of oil field produced waters;
6) atmospheric pollution;
7) modifications to natural passes and benthic features;
8) artificial barriers to water circulation;
9) industrial intakes/discharges;
10) oil exploration/production facilities;

The current management framework is fairly effective at managing area resources. Federal and state institutions have the strongest presence, while regional and local entities are somewhat less involved in problem resolution related to the Program's priority issues.

11) industrial and construction sites;
12) deposition of bioaccumulating toxic substances into the estuary; and
13) existing sediment sources of toxics.

The final report contains recommendations on how to fill these gaps, as well as other recommendations for efficient use of the institutional framework to support implementation of the ***Bays Plan***. This includes an assessment of each institution's ability to expand its existing role or mission to potentially fill a management gap.

The analysis concludes that, in choosing institutions to address issues that are not currently adequately covered, the Program should consider institutions that:

- are most heavily involved in addressing contributing factors to environmental problems;
- have broad legal authority to address priority issues and can expand that authority;
- are doing less than the scope of their missions allow;
- are operating effectively;
- can secure additional funding;
- can secure additional workloads; and
- are not impeded by political factors.

The analysis resulted in recommendations to seek increased involvement from regional and local entities, to obtain commitments from active institutions to maintain efforts and continue beneficial programs and activities, and to make full use of local educational and research institutions that can conduct activities related to virtually any contributing factor as well as play a coordinating role for activities.

In developing the Action Plans, Task Forces dealt with the recommendations regarding specific priority issues or gaps related to contributing factors. In addition, information regarding organizational mission was used to match lead implementors with specific activities outlined in the Action Plans, Chapters 2 through 7 of this document.

Proposed Implementation Structure

The long term success of the ***Coastal Bend Bays Plan*** is dependent on an effective implementation organization. To address this need, the CCBNEP established a Program Implementation Committee made up of representatives from the Policy and Management Committees and local officials (see Appendix D).

The Committee discussed four basic functions for any proposed implementation structure: governance, identifying and securing resources to implement the ***Bays Plan***, ongoing planning, and overall administration (see Figure 23).

Fifteen basic implementation principles were adopted. First, it was agreed that the structure would not have taxing authority, regulatory authority, or a formal permit review role.

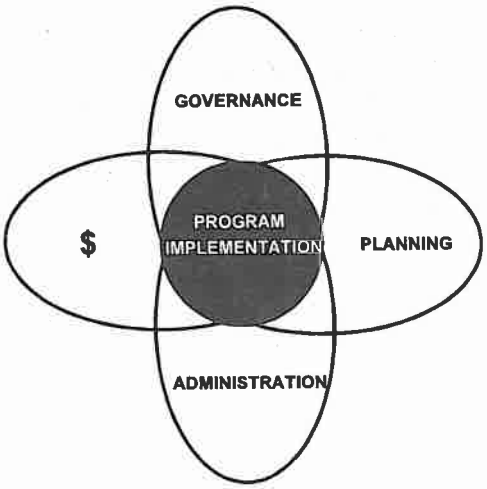


FIGURE 23
Functions: Program Implementation Structure

Fifteen Basic Program Implementation Principles

- No taxing authority
- No regulatory authority
- No formal permit review role
- Continue oversight by stakeholders, including local governments
- Voluntary participation by stakeholders, with right to withdraw at any time subject to current year financial commitments
- Conduct biennial priority goal setting
- Minimize overhead
- Receive/administer state/federal funds
- Receive/administer tax-exempt contributions
- Administer interagency agreements
- No communications/publications policy constraints
- Comment authority for consistency determinations
- Close coordination with Coastal Coordination Council
- Ensure ***Coastal Bend Bays Plan*** is consistent with Texas Coastal Management Plan
- Ensure ***Bays Plan*** continues to be a consensus-based framework approved by the Governor of Texas and the U.S. Environmental Protection Agency

Using these principles, the Committee looked at the full range of options, from establishing a new regional authority to doing nothing, with several criteria in mind: a dominant local government role; involvement by non-governmental organizations and other key stakeholders as well as state and federal agencies; ensuring accountability; and maintaining a strong coordination/catalyst function. The Committee's recommendation was subsequently endorsed by the Management and Policy Committees and is provided in Figure 24. The newly named Coastal Bend Bays and Estuaries Program will be run by an Estuary Council that includes all units of local general government that financially contribute to the program, as well as other stakeholders including the Regional Water Planning Group. An interlocal agreement will be developed to outline the roles and responsibilities of the local government participants in program implementation. The Estuary Council will handle all routine business of the program.

The Estuary Council includes two tiers: an Executive Council and a Bays Council.

Executive Council

The Executive Council will be the ultimate approval authority and will serve as the business council for the program. It will deal with personnel and budget issues and serve as the final approval level for program outputs. Any controversial item may, at the request of any member

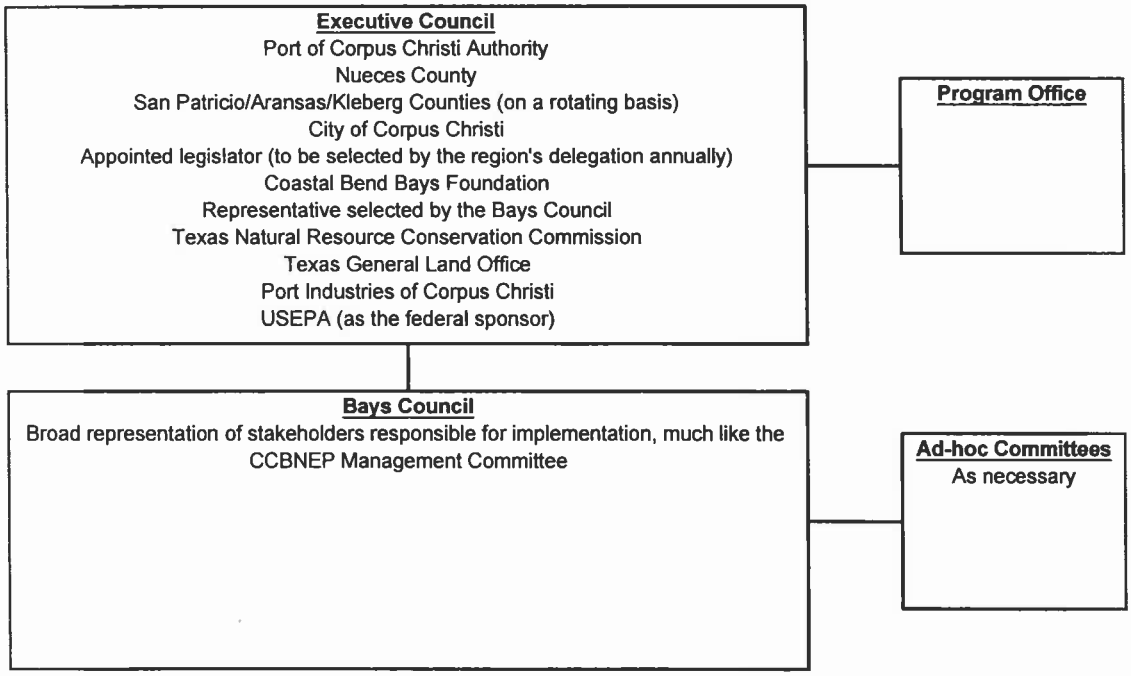


FIGURE 24
New Implementation Structure:
The Coastal Bend Bays and Estuaries Program

of the Estuary Council, be elevated to the Executive Council. In order for a project or issue to be passed, there must be a positive vote of 83 percent of the voting members present and voting. Six members constitute a quorum for the Executive Council.

Bays Council

The Bays Council will develop programs and projects to implement the ***Coastal Bend Bays Plan***, develop annual workplans, and otherwise carry out the daily operations to implement the program. The annual workplan development process should start in January of each year for the following fiscal year.

Ad hoc committees may be added as necessary to include broader participation or specific expertise.

Decision-making Process

Operating procedures and bylaws will be developed for both councils and all Bays Council meetings will conform to Texas Open Meetings Act requirements.

All projects will require the approval of the unit(s) of local general government in which the project(s) falls either totally or partially. Approval is assumed unless a unit of local government specifically issues an objection.

Based on periodic progress reviews and other information developed by the Program, the ***Coastal Bend Bays Plan,*** including the ***Implementation Strategy***, federal project review strategy, and monitoring strategy, shall be formally updated and revised every five years. Any change to the ***Bays Plan*** will require consent from 83 percent of those members present and voting at an Executive Council meeting. Any proposed changes to the ***Bays Plan*** prior to the five-year formal revision shall require the unanimous approval of the Executive Council.

All of the signatories to an interlocal agreement, including those groups which may sign an appendix to an agreement (nonprofit organizations, state and federal agencies), agree that participation is completely voluntary and that any participant, including any unit of local general government, has the total and complete inviolate right to withdraw at any time subject only to those fiscal commitments made by that participant within that participant's fiscal year.

Anticipated Roles of a Program Office and Implementing Partners

In general, overall tracking and coordination for implementing the ***Bays Plan*** will be the responsibility of the Program Office. However, the implementation of individual actions will be the responsibility of the implementing partners as indicated in the Plan.

Legislative Needs

Implementation of some of the Plan's recommendations could require legislation at the federal and state level. The Program Office will work closely with implementing partners to assure passage of any legislative initiatives contained in the ***Bays Plan***.

Memoranda of Understanding

Several actions in the Plan could require establishment of a formal Memorandum of Understanding (MOU) between two or more agencies to coordinate regulatory or other programs. The Program Office will help initiate the MOU negotiations, however, it will be the responsibility of the agencies involved to actually implement the MOU, provide appropriate public notice, and issue rules, if necessary.

Local Ordinances

A number of actions in the Plan could be implemented through local ordinances. The Program Office will help link local governments with appropriate technical assistance resources in developing their ordinances.

Measuring Results

Under the new structure, implementing partners will be asked to participate in semi-annual or annual progress review conferences, and supply periodic updates for an implementation progress report. This report will be tied to the steps identified in the Plan. The report will provide an evaluation of implementation successes and obstacles and suggestions on how the overall implementation strategy should be modified for the next biennium.

The Program Office will also prepare a biennial report to include:

- A summary and overall assessment of implementation efforts;
- A brief status report on each action in the Plan;
- A financial report;
- Committee reports, noting work completed and issues addressed; and
- A report on implementation needs for the coming biennium.

Each implementing partner will be encouraged to assign a Coastal Bend Bays and Estuaries Program liaison to coordinate with the Estuary Council and Program Office. Even as formal reporting requirements are established, the importance of routine informal communication among

staff of involved agencies should not be underestimated. The most direct method of ensuring implementation commitments is to link continued receipt of implementation funds to performance. Any pass-through funding or contract funds under the auspices of the Coastal Bend Bays and Estuaries Program could be conditioned based on performance.

Program Office Roles	Implementing Partners Roles
• Acquire, manage, and disperse funds to implement the ***Bays Plan***. • Develop and implement partnership projects vis-à-vis local governments, state and federal agencies, and private organizations. • Monitor, track, and report on implementation performance by implementing partners, and work to maintain implementation commitments. • Coordinate the environmental monitoring and assessment of Plan implementation effectiveness; develop and oversee a data and information management plan that coordinates the accessibility of relevant future monitoring and assessment. • Provide communication and coordination with the Texas Coastal Management Program and the Coastal Coordination Council, the Gulf of Mexico Program, the Texas Clean Rivers Program, and other relevant coastal/watershed programs. • Develop and utilize outreach and educational materials to increase public awareness and foster local stewardship; maintain web site(s) and respond to public requests for information. • Provide communication and coordination among state and federal resource agencies for cross-jurisdictional issues. • Coordinate the review of proposed actions and federal, state, and local projects in an open process for consistency with the ***Bays Plan***. • Undertake the USEPA-required biennial review of the Program. • Develop a prioritized biennial work plan and budget for Estuary Council review and approval. • Coordinate the periodic update of the ***Bays Plan***, the State-of-the-Bay Report, the ***Implementation Strategy***, and other key documents of the Program. • Provide a forum for technical and stakeholder input during implementation of the ***Bays Plan*** and the biennial review process. • Track legislative initiatives and issues and bring forth policy or legislative recommendations for Estuary Council action. • Provide logistical support for all meetings, workshops, symposia, and special events related to Program mission.	• Enter into an implementation agreement vis-à-vis other implementation partners, and take the lead role in implementing, evaluating, and reporting to the Estuary Council on results of action implementation. • Allocate staff and budgetary resources for the implementation of specific actions identified in the ***Bays Plan***. • For some partners: allocate budgetary resources for Base Program Support. • Assist to identify, design, and implement new or revised regulations or ordinances. • Identify and assist with legislative initiatives. • Enter into Memoranda of Understanding (non-binding instruments that target specific goals and responsibilities) with the Program and other implementing partners. • Adopt resolutions of support for the regional goals and objectives of the ***Bays Plan***; solicit citizen involvement for specific actions.

Costs and Financing

There are two types of costs associated with **Bays Plan** *implementation: maintaining a small program office staff and implementing individual actions contained in the Plan.*

The National Estuary Program provides funding for the development of management plans under Section 320 of the Clean Water Act, but it does not provide full funding for the implementation of the plans. It is anticipated that federal funding will drop to $300,000 per year for the first four years of implementation.

The CCBNEP established a Financial Planning Advisory Committee (see Appendix D) to develop a funding strategy that includes an assessment of existing revenue sources and the identification of potential new sources of funding to implement the ***Bays Plan***.

The Committee focused on generating a full range of potential options for generating new revenue, categorizing these options by the types of actions that they could support, and reaching general agreement on the subset of funding options that are feasible to continue pursuing within the Estuary Council.

To determine feasibility, the Committee agreed to consider four criteria:

- political viability;
- efficiency (adequacy), defined as revenues collected exceed the cost of collection;
- equity, or the concept that beneficiaries or users pay; and
- responsible party pays.

Results of this analysis are provided in Table 6.

There are two types of costs associated with ***Bays Plan*** implementation. The first cost is associated with maintaining a small program office staff as described in the previous section. The cost to maintain this staff function is estimated to be $400,000 to $450,000 per year for a six person staff.

The second type of cost is the cost to implement actions in the ***Bays Plan***. Anticipated costs have been allocated to each step of each action contained in Chapters 2 through 7 of this Strategy. These estimated costs are intended to be 'ballpark' estimates only; that is, they are not intended to represent final budgetary allocations. Such final adjustments of cost will necessarily be done during the implementation of an action, when more detailed information about existing level of efforts, available funds, and other design criteria can be more accurately assessed. The accuracy of the anticipated cost estimates contained in this ***Implementation Strategy*** are therefore limited by the quality of current information. In many cases, the cost is based solely on 'best professional judgement', but nevertheless is provided as a piece of information to give some idea of the 'level of effort' implied in the Action Plan. To proceed at an acceptable pace with project implementation, additional funding in the amount of $750,000 to $1.5 million per year is being sought.

TABLE 6 Potential Funding Sources

		H - high	M - medium	L - low	X - unacceptable
Source* \ Criteria		Political Viability	Efficiency (Adequacy)	Equity Beneficiary/ User pays	Responsible Party pays
Sea Grant	?	H	L	-	-
Dingle Johnson\Act Funds	?	L	L	M	-
FEDERAL - USEPA		M	M	-	-
Federal - Other	?	M	M	-	-
~~pesticide taxes~~		X	H	-	H
~~ad valorem tax (property)~~		X	H	L	L
~~beer tax~~		X	H	L	L
~~container deposit tax~~		L	L	H	H
~~boat sale tax~~		L	L	H	H
~~other sales tax~~		L	H	?	?
~~scenic view tax~~		X	L	H	M
additional hotel tax	?	L	M	M	M
~~marine fuel tax~~		X	L	H	H
~~cleaning products tax~~		L	L	H	H
~~toilet paper tax~~		X	L	-	H
~~airport departure tax~~		L	M	-	-
~~salt water hunting tax~~		X	L	H	H
toll at Kennedy causeway/ferry	?	L	L	M	M
parking fee for beach users	?	M	H	H	H
~~fishing guide license~~		L	L	H	H
~~fishery license~~		X	L	H	H
~~vehicle registration fee~~		X	H	-	-
~~boaters license fees~~		L	L	M	M
~~additional marina slip fees~~		M	L	H	H
~~boat registration fee (coastal surcharge)~~		L	H	H	H
vanity license plates	?	M	L	-	-
~~dredging fees~~		L	H	H	H
~~polluting vehicles fee~~		X	L	L	L
enforcement (fees/fines)	?	M	H	-	H
~~water commerce fees~~		X	M	M	M
~~industrial water use fee~~		L	H	H	H
~~septic tank permit fee~~		L	L	H	M
~~pumping fee~~		L	L	L	L
~~solid waste collection fee~~		L	L	M	M
~~coastal resident fee~~		X			
development impact fee	?	L	M	M	M
~~real estate transfer fee~~		X	H	M	H
~~stormwater utility fee~~		M	M	H	H
~~agricultural products fees~~		X	H	M	M
~~extraction surcharge (add'l fee on non-renewables)~~		X	L	M	L
~~wastewater discharge fee~~		L	L	H	H
~~preferential/favorable treatment~~		M	H	M	H
benefit assessment (fees generated from improvements)	?	L	H	H	-
special appropriation-state/general revenue	?	L	H	L	L
STATE AGENCY PROGRAMS, GEN REV		M	M	-	-
LOCAL AGENCY PROGRAMS, GEN REV		L	M	-	-
"adopt an estuary"	?	H	L	-	-
university research	?	H	L	-	-
volunteer funding/contributions	?	H	L	-	-
~~tax deduction - donations~~		L	H	-	-
~~tax deduction - new tax treatment~~		L	L	-	-
Estuary Investment Fund (trust fund)	?	H	L	-	-
Coastal Protection Fund	?	M	H	H	H

*Results of the rankings and discussions are summarized as follows: Sources in bold caps are likely sources of future funding, and sources with a question mark are possible future sources of funding. All other sources have been rejected as a source of future funding.

Local contributions are projected to be up to $445,000 per year. A specific strategy for soliciting local funding is under development by the Program. The remainder would be a combination of state and federal grants that the Program would hope to secure, along with an ongoing state and federal commitment for at least the first four years of implementation. Private contributions are anticipated as well.

The Port of Corpus Christi will serve as the fiscal agent and all funds will be received and administered by the Port. Program Office staff may be employed by and housed at the Port Office, but will remain responsible to the Coastal Bend Bays and Estuaries Program and its Council. This new Program arrangement will begin in FY 2000. For FY 1999, USEPA and TNRCC will remain as co-sponsors. An MOU will be developed with the Port to solidify commitments for reporting and program reviews relative to USEPA's NEP requirements.

The current ***Implementation Strategy*** does not imply any responsibility by a given entity to necessarily assume the financial burden for implementing an action. In reality, as the Program moves forward to implement the ***Bays Plan***, lead and partnering organizations will meet to jointly develop a more detailed work plan that will include more definitive costs and sources of those funds. Whereas all implementing partners will be called upon to assist in the identification of potential funding sources, including sources within their own existing budgets, completion of the Plan does not in itself confer financial burden on any entity. In addition, it is envisioned that Program Office staff will play a prominent role in identifying funds for Plan implementation. Activities could involve grant writing, solicitation of funds from private foundations, and several other activities to round out a total 'portfolio' of revenue sources for Plan implementation.

All actions in the **Bays Plan** *focus on the cost effective use of existing resources and a clear return on investment.*

Some of the proposed actions in the ***Bays Plan*** can be accomplished with existing resources or by redirecting current funding allocations to better address the needs of the project area. Additionally, a number of actions seek to improve coordination and planning among local governments and agencies and may actually result in cost savings for currently funded activities.

Although the total costs for implementing the ***Coastal Bend Bays Plan*** have not yet been fully determined, all actions focus on the cost effective use of existing resources and a clear return on investment. Any additional funds required will be subject to public review to ensure that issues of affordability, accountability, and environmental responsibility are given a fair hearing.

In keeping with this theme, the CBBEP advocates the following approach for funding the comprehensive management plan for the Coastal Bend Bays:

- Maintain existing levels of expenditures for programs making cost-effective contributions to the goals.
- Evaluate programs that fall short of plan objectives and investigate opportunities to redirect resources to accomplish more with existing funds.
- Promote public-private partnerships with the potential for bottom line benefits for the estuary and the economy.
- Pursue state and federal funding opportunities for environmental improvement.
- Pursue new funding sources only if the above strategies fail to achieve adequate progress toward improvement.

Overview of Federal Consistency

Federal consistency review is important to the successful implementation of the ***Coastal Bend Bays Plan***, as it identifies opportunities for CBBEP to be involved in the planning process of potentially inconsistent federal actions. Another important element of the consistency review process is identifying federal actions that may further the purposes and objectives of the ***Bays Plan***, and highlighting possible avenues of cooperative action among federal programs for ***Bays Plan*** implementation.

The Federal Consistency Report (available under separate cover) has three primary functions:

(1) Develop a comprehensive **inventory** of federal assistance programs and direct federal development projects that may impact, either beneficially or adversely, the purposes and objectives of the ***Coastal Bend Bays Plan***.

(2) Conduct a **one-time consistency assessment** of the programs and projects in the inventory to identify those that support (i.e., sustain or further) and/or potentially conflict with (i.e., are potentially inconsistent with) the purposes and objectives of the ***Coastal Bend Bays Plan***. Where conflicts exist, propose potential solutions to these conflicts.

(3) Develop a **continuing federal project review strategy** to review future proposed federal actions for consistency with the purposes and objectives of the ***Coastal Bend Bays Plan*** and specify those federal actions that are subject to this continuing project review.

Inventory of Programs and Projects

Because of the large number and varied scope of federal assistance programs and direct federal development projects, it was necessary to identify an inventory of programs and projects that could impact, either beneficially or adversely, implementation of the ***Coastal Bend Bays Plan***. Programs and projects were selected for inclusion in the Inventory according to specific criteria. The Inventory contains 294 federal assistance programs and 45 direct federal development projects.

One-Time Consistency Assessment

The one-time consistency assessment was conducted in order to develop a clear understanding of how the federal assistance programs and direct federal development projects in the Inventory may affect implementation of the ***Coastal Bend Bays Plan***. The objective of each program and project in the Inventory was reviewed to determine if it was applicable to implementation of the ***Bays Plan***. Where a program or project was considered applicable, it was determined if it:

- Supports (i.e., sustains or furthers) the purposes and objectives of the ***Bays Plan***.
- Has the potential to conflict with (i.e., is potentially inconsistent with) the purposes and objectives of the ***Bays Plan***.

Of the 294 federal assistance programs in the Inventory, it was determined that 274 support the ***Coastal Bend Bays Plan***, 4 have the potential to conflict with the ***Bays Plan***, and 20 are not applicable. Of the 45 direct federal development projects in the Inventory, it was determined that 41 support the ***Bays Plan***, 2 have the potential to conflict with the ***Bays Plan***, and 4 are not applicable. Note that some programs/projects both support and conflict with the purposes and objectives of the ***Bays Plan***. The following federal actions were determined to have the potential to conflict with the ***Bays Plan***:

- Department of Commerce, Fisheries Obligation Guarantee Program (CFDA number 11.415)
- Department of Defense, Navigation Projects (CFDA number 12.107)
- Department of Defense, Protection, Clearing and Straightening Channels Projects (CFDA number 12.109)
- Department of Energy, Nuclear Waste Disposal Siting (CFDA number 81.065)
- Department of Defense, Navigation and Navigation-Related Projects (direct federal development projects)
- Department of Interior, Coastal Barrier Resources System (direct federal development projects to modify boundaries of System units)

Actions under the three programs/projects administered by the Department of Defense are eligible for EO 12372 review and are subject to review through the Texas Review and Comment System (TRACS; the State of Texas' EO 12372 review process). For actions under these programs/projects, CBBEP could use the TRACS process for its consistency review. Because the USACE, a CBBEP Estuary Council member, administers all of these programs and projects, there could be opportunities for joint planning to ensure that they are consistent with the purposes and objectives of the ***Coastal Bend Bays Plan***.

Actions under the programs/projects administered by the Departments of Commerce, Energy, and Interior are not eligible for EO 12372 review, nor are they subject to review through TRACS. CBBEP, with support from key stakeholders from the Estuary Council, could petition the TRACS administrator to include these programs for regular review. If this is not feasible, CBBEP, in collaboration with Estuary Council members, could provide a forum to discuss future actions under these programs/projects to ensure that they are consistent with the purposes and objectives of the ***Bays Plan***.

Continuing Federal Project Review

The implementation period for the ***Coastal Bend Bays Plan*** begins after final approval of the ***Bays Plan*** by the Governor of Texas and the Administrator of USEPA and extends for the next 20 years. The Federal Consistency Report recognizes the need for the CBBEP to be involved in the planning processes of future (1) potentially inconsistent federal actions and (2) beneficial federal actions. The current Management Conference has selected 72 specific federal programs and projects to be subject to continuing federal project review. The CBBEP will utilize components of the Texas Review and Comment System (TRACS) to facilitate the review of future actions related to these federal programs and projects, for consistency with the ***Bays Plan***.

TRACS, the State of Texas' U.S. Office of Management and Budget-approved EO 12372 federal consistency review process, has established mechanisms for (1) notifying affected state and local entities about proposed federal actions and (2) submitting official State Process Recommendations (SPR) to the sponsoring federal agency. The state coordinator for TRACS, the Single Point of Contact (SPOC), serves as the central contact for all consistency matters. Applications for statewide federal assistance and notices of intent for direct federal development projects received by the SPOC, are sent to affected state agencies and all Texas Councils of Governments, including the Coastal Bend Council of Governments (CBCOG). The review of applications and notices of intent for federally sponsored actions in the Coastal Bend has been delegated to the CBCOG. In this case, the CBCOG prepares the SPR, except where there is a request for accom-

modation included in the SPR or the CBCOG is the local applicant for federal assistance.

Notification Process –
The Program has requested that the SPOC revise the list of actions eligible for TRACS review to include the 72 programs and projects selected by the Management Conference for continuing federal project review. The SPOC has agreed to make the these additions to the TRACS list and will be responsible for notifying the CBBEP about proposed future actions related to these 72 programs and projects.

Review and Response Process – The CBBEP Program Office Director will serve as the Program's point of contact for federal project review activities. For each application or notice of intent received from the SPOC, the CBBEP Program Office Director will conduct a preliminary review of the proposed action based on designated criteria. The preliminary review will place an action on one of two tracks.

Track 1: For actions deemed not likely to affect implementation of the ***Coastal Bend Bays Plan***, the CBBEP Program Office Director will log in and file the application or notice of intent at the CBBEP Office.

Track 2: For actions deemed to have the potential to affect implementation of the ***Coastal Bend Bays Plan***, either beneficially or adversely, the CBBEP Program Office Director will prepare a Review Summary that includes descriptive information about the action and recommended revisions to the action. The completed Review Summary will be provided to the Federal Project Review Group, a representative subset of the Estuary Council, who will generate a recommendation regarding CBBEP comments (and a request for accommodation, if appropriate). Using this recommendation, the CBBEP Program Office Director will forward an official comment letter (and a request for accommodation, if appropriate) to the appropriate entity.

This CBBEP review process will meet the 60-day TRACS time frame. It is intended that Memoranda of Understanding (MOU) will be established with the SPOC and CBCOG to formalize the procedures for notifying the CBBEP of federal actions subject to its review and for delivering CBBEP comments to the respective federal agencies.

In an effort to minimize the workload associated with the review of future federal actions, it is expected that the majority of comment letters will focus on actions that have the potential to adversely impact implementation of the ***Bays Plan***. Certainly the CBBEP can present a specific endorsement or suggested improvements to an action which may be consistent with the ***Bays Plan***, and it is expected this opportunity will be taken where appropriate. As a general rule, if no comments are generated within the 60-day TRACS time frame, this should be considered as an endorsement of the federal action by the CBBEP.

Inconsistency Resolution Process –

As a mechanism for addressing actions with the potential to adversely impact implementation of the ***Coastal Bend Bays Plan*** (i.e., potentially inconsistent actions), it is proposed that the CBBEP will coordinate with Estuary Council members from the federal agencies sponsoring the action in question. Every attempt will be made to resolve inconsistencies through these Estuary Council members. When necessary, CBBEP will provide an official, structured forum for resolution discussions.

CHAPTER 9
Regional Monitoring Strategy

Overview

The CCBNEP developed a Regional Monitoring Strategy (RMS) as a component of the ***Coastal Bend Bays Plan***. The purpose of the Regional Monitoring Strategy is twofold: 1) to assess the effectiveness of ***Bays Plan*** implementation over time, and 2) to assess future trends in the overall environmental health of bay ecosystems in the project area. The RMS development process was rigorous, building upon more than 30 Program characterization and demonstration studies and interactions with many scientific and technical experts. The strategy was developed with the participation of a Scientific and Technical Advisory Committee (STAC) Monitoring Subcommittee, technical resource agency staff, and the 14 Action Plan Task Force team leaders. Frequent contacts were maintained, throughout strategy development, with the various agency monitoring staffs who are actively collecting data and information in the project area.

About 40 federal, state, local, private, and academic organizations currently collect environmental and related data and information in the project area, as part of more than 30 mandated programs. This occurs at more than 1,000 monitoring stations, at an annual cost of more than $3 million. The frequency of data collection ranges from continuous to annual sampling. It is believed that the core of the Regional Monitoring Strategy can be formed largely from these current monitoring programs -- if coordination can be achieved among the responsible agencies. To begin the process of coordination, a series of Monitoring Workshops were held by the Program, beginning in 1995 and culminating in an April 1998 workshop where the contractor presented a draft RMS. Additional workshops were held to refine the draft RMS.

To assess the effectiveness of the ***Coastal Bend Bays Plan***, a series of monitoring objectives were established. These objectives are based on principles contained in USEPA's report, EPA 842-B-92-004, Monitoring Guidance of the National Estuary Program. The monitoring objectives address both programmatic and environmental monitoring purposes. *Programmatic monitoring objectives* are those dealing with specific actions to change program processes which are needed to improve coordination and communication or to enhance implementation of certain activities. *Environmental monitoring objectives* address the collection of scientific data and information in order to assess changes or trends in water quality, living resources, habitats, or other physical

The purpose of the Regional Monitoring Strategy is twofold: 1) to assess the effectiveness of* Bays Plan *implementation over time, and 2) to assess future trends in the overall environmental health of bay ecosystems in the project area.

components of an ecosystem. Each monitoring objective has a set of related data types designed to answer questions over time, such as:

1. Are the goals of the 11 Action Plans with their associated 50 specific actions being met?

2. Are commitments made by the various implementing partners being fulfilled over time?

3. Is the implementation of 50 specific actions having the desired effect on bay ecosystems over time?

Establishing these quantifiable, programmatic and environmental monitoring objectives with their related data types sets the stage for measuring program implementation and associated changes and improvements in bay ecosystem parameters. In some cases, the data will support the development of testable hypotheses about bay health and productivity. In most cases, simple statistical trend analyses can be applied to the databases resulting from the implementation of the RMS. These analyses will be a fundamental part of the biennial review of the ***Bays Plan*** required by USEPA.

Below is a summary of monitoring objectives and activities related to the 11 Action Plans in the ***Coastal Bend Bays Plan***. Details of the Regional Monitoring Strategy can be found in the report, CCBNEP-28, available from the CBBEP Program Office.

Summary of the Regional Monitoring Strategy

Bay Tourism and Recreation Action Plan

The Bay Tourism and Recreation Action Plan includes four specific actions. Programmatic monitoring objectives of the RMS include determining the number of 'resource themes' adopted by local governments over time, documenting the number and quality of public access sites, and documenting the number and quality of artificial and restored reefs and changes in fisheries over time. Environmental monitoring objectives include detecting any impact of recreational boating on seagrass meadows and detecting any impact of human intrusion (e.g., debris or vegetation damage), on bird rookery islands.

Data types: number of access sites, number of ecologically-friendly boat maintenance sites, aerial photographic measures of habitat area, and TPWD fisheries population estimates.

Bay Debris Action Plan

The Bay Debris Action Plan has one specific action. Programmatic and environmental monitoring objectives of the RMS are to detect changes in bay debris over time at key locations, including urban outfalls, drainage ditches, and illegal dump sites. A baseline bay debris survey will be conducted, including the current debris collection programs of the City of Corpus Christi and TXDOT.

Data types: tonnage of trash collected at marinas, number of boat ramp owners who provide solid waste disposal facilities, and number of littering cases prosecuted.

Public Health Action Plan

The Public Health Action Plan contains three specific actions. Programmatic monitoring objectives of the RMS include determining the level of risk to human health from fish and shellfish consumption and documenting databases from health care providers on illness and accidents from bay recreation. Environmental monitoring objectives include determining if water quality criteria for contact recreation are exceeded at contact recreation sites, performing studies to define and test improved bacterial indicators, and implementing a TPWD/TDH fish and shellfish tissue monitoring program.

Data types: bacterial data for recreational swimming areas, weather and disease incidence, and areas closed to contact recreation.

Shoreline Management Action Plan

Three specific actions are included in this Action Plan. The RMS has mostly programmatic monitoring objectives, such as tracking the number of workshops held on 'Guidelines for Shoreline Management' and determining if a Land Trust Fund is implemented. Environmental monitoring objectives include determining the impacts of development on bay resources and determining changes over time in the degree of shoreline erosion, habitat loss, etc.

Data types: wetland areas, building permits, reef construction, and satellite imagery data.

Essential to these monitoring objectives is a GIS system to capture and portray the wide variety of data and information in a time and space format.

Maritime Commerce Action Plan

The Maritime Commerce Action Plan contains nine specific actions, requiring mostly programmatic monitoring. These objectives include documenting progress on a number of planned actions, including a 125 foot-wide barge shelf, improvements to navigation aids, improvements in the Vessel Traffic System, and assurances that all

ballast water on in-bound vessels has been exchanged at sea.

Data types: vessel accident information, pollution incidents, ratios of collisions and groundings to traffic volume, HAZMAT response time and area contained, pipeline records recorded in GIS format, and documentation of ballast exchanges by the USCG.

Dredging Action Plan

This Action Plan contains three specific actions, all with programmatic monitoring objectives such as documenting the Beneficial Users Group (BUG) status over time and detecting any change in frequency of maintenance dredging over time.

Data types: percentage of dredged material used beneficially, volume of dredged material, number of sites used, and habitat gains, losses, or modifications at sites.

Habitat and Living Resources Action Plan

The Habitat and Living Resources Action Plan contains 10 specific actions. ***When viewed with the Water and Sediment Quality, Nonpoint Source Management, Freshwater Resources, and possibly the Bay Debris Action Plans, this Action Plan is at the 'core' of the bays ecosystem health and productivity. The actions in these five Action Plans provide the major input and response features of the RMS, and account for most of the monitoring cost of the*** **Bays Plan.**

Programmatic monitoring objectives of the RMS for Habitat and Living Resources include detecting changes in the quality of coastal habitats over time; changes in primary recreational fisheries; changes in the area and quality of restored, created, or natural habitats by type; changes in shrimp trawling over time; and detecting changes in the areal extent, frequency, and type of harmful algal blooms (HAB) over time. Environmental monitoring objectives are closely linked to the programmatic objectives and include detecting changes in the areal extent, frequency, and type of HABs over time and determining by monitoring the effects of an approved bycatch reduction device.

Data types: areal extent of coastal habitat types formatted for GIS, TPWD fisheries population estimates, number of habitat management plans in effect, and HAB fauna, chemistry, and area-affected parameters.

Water and Sediment Quality Action Plan

The Water and Sediment Quality Action Plan includes five specific actions. Programmatic monitoring objectives focus on aquaculture permitting rules, biological effects standards, and implementation of appropriate water and sediment standards over time. Environmental monitoring objectives include detecting changes in water and sediment quality; detecting changes in bay eutrophication based on fishkills, drift algal occurrence, and the estuarine index developed by NOAA;

detecting changes in indicator bacteria in proximity to bay inflows and runoff sources; and detecting changes in total constituent loadings over time. Another objective is to perform a point source and ambient water sampling effort using clean techniques during one year.

Data types: water and sediment chemistry, tissue, and benthos parameters; percentage of water bodies not meeting standards; number of segments on 303(d) list; wastewater flow and concentrations; number of Total Maximum Daily Load (TMDL) analyses performed; and number of BMPs established and monitored.

The RMS also calls for the establishment of an annual coordination meeting of all monitoring agencies; an intensive, high-quality sediment, water, and tissue monitoring effort for toxics and habitat quality every two years; and for three additional, continuous datasonde monitoring sites.

Nonpoint Source Management Action Plan

This Plan contains four specific actions and calls for the establishment of a multi-land use urban watershed monitoring station to augment existing MS4 monitoring stations, a new rangeland agricultural nonpoint source monitoring station, and continuation of two cropland monitoring stations. It also calls for a Regional Technical Advisory Committee to coordinate urban and agricultural nonpoint source action plans and needs. Programmatic monitoring objectives of the RMS include tracking efforts at providing assistance to small businesses for NPDES permitting and determining the status of implementation of On-site Sewage Facility (OSSF) programs. Environmental monitoring objectives include determining changes in urban and industrial nonpoint source loadings to bays and estuaries and detecting changes in agricultural runoff loadings to bays and estuaries over time.

Data types: urban runoff volumes and EMCs, number of operating urban BMPs, percentage reduction in stormwater debris, number of operating highway BMPs, number of septic systems converted to city treatment facilities, and agricultural runoff volumes and loadings.

Freshwater Resources Action Plans

The Freshwater Resource Action Plan includes four specific actions. Programmatic and environmental monitoring objectives include detecting changes in the amount, timing, and location of freshwater inflows; detecting changes in the volume of wastewater reused in the project area; and determining freshwater overflows entering marshlands in the upper Nueces estuary over time.

Data types: daily flows by watershed, percentage of total freshwater by watershed that is return flows, daily rainfalls, and daily nutrient and sediment loadings.

The RMS also calls for the establishment of at least two new stream gauging stations to increase the percentage of gauged streamflow to the bays, the addition of ten rain gauges in coastal watersheds with real-time rain gauges at USGS gauging stations to aid Doppler Radar calibration, and the monitoring of sediment and water quality at all USGS streamflow stations.

Public Education and Outreach Action Plan

This Action Plan contains five specific actions that are primarily programmatic in nature and makes use of public events, forums, educational efforts, and citizen monitoring to achieve its goals.

Other Elements of the Regional Monitoring Strategy

The additional cost of the Regional Monitoring Strategy over that of current agency monitoring programs is estimated to be about 25 to 30 percent of the current annual monitoring programs of all monitoring agencies.

A key effort for the future is to encourage all monitoring agencies to post their data on web pages available to technical staffs and link the monitoring web pages together in a common system.

The RMS also addresses issues associated with Quality Assurance/ Quality Control, database management, a costing analysis of the RMS, and a projected timeline for RMS implementation.

Each monitoring agency has published a Quality Assurance/Quality Control Plan which guides data collection under the various mandated programs. Because of differences in these mandated monitoring programs, it is not possible to establish a uniform QA/QC plan for the RMS. A valuable goal for the future is to coordinate similar aspects of the programs and be certain that the methods used are well documented and have appropriate levels of quality. All monitoring agencies have a web page for agency programs and several have web-based data management systems which present provisional data. A key effort for the future is to encourage all agencies to post their provisional data on web pages available to technical staffs and link the monitoring web pages together in a common system. Future data analyses to describe the ongoing status of bay health and productivity will be greatly facilitated by a common web-based data management system available to all monitoring agencies and to the CBBEP Program Office.

During the first quarter of calendar year 1999, the CBBEP will convene a workshop to coordinate monitoring activities with all monitoring partners. The purpose of this workshop is to identify ways to improve on the efficiency of existing monitoring programs based on recommendations from the final Regional Monitoring Strategy.

CHAPTER 10
Public Involvement in Developing the *Coastal Bend Bays Plan*

Since its inception, the CCBNEP has conducted a vigorous and organized public involvement and outreach campaign. The Management Conference consistently maintained over 300 individuals, representing over 100 organizations from throughout the Coastal Bend. Highlighted below are short descriptions of several key public participation tools, which the Program used to steer the development of the *Coastal Bend Bays Plan*.

The CCBNEP has conducted a vigorous and organized public involvement and outreach campaign through a Management Conference representing over 100 organizations from throughout the Coastal Bend.

Distribution of Draft *Coastal Bend Bays Plan*

The *Coastal Bend Bays Plan* was subject to a 60 day public comment period and the Program worked hard to get copies of the Plan to the general public. Copies were taken to as many public places as possible, including chambers of commerce, public libraries, public schools, bookstores, and local banks. Copies were also mailed to Management Conference members and community leaders.

Management Conference Activities

The CCBNEP Management Committee played an integral role in the Program's overall operations and met regularly on the first Thursday of each month. In addition, special meetings or workshops were called as needed for the Management Committee.

Three committees were appointed soon after NEP designation to advise the Management Committee on various issues and to offer different perspectives pertaining to the development of the *Bays Plan*. The Management Committee selected members for these committees through a nomination and selection process. All meetings of these Committees were advertised in the Texas Register, TNRCC's calendar of events, the local newspaper (meeting notice section), the Program's newsletter, and website address. Each member received a meeting agenda at least two weeks in advance and was encouraged to submit a proxy if not able to attend. Committee meetings were held at various locations throughout the community, such as city hall or the local university.

- The **Scientific & Technical Advisory Committee** (STAC) was established to advise the Management Committee on characterization studies and key findings for the *Bays Plan*. Individuals were selected for a STAC

'slot' using a list of relevant and desired expertise and a nomination process (see Appendix D for membership). This committee met over 30 times during the development of the ***Bays Plan***.

- The **Local Governments Advisory Committee's** (LGAC) role was to advise the Management Committee on how issues and actions might pertain to county, city, or other governmental structures and/or their operations. Members for this committee were appointed by the top officials within each county and city, based on a request from the Program (see Appendix D for membership). This committee met over 10 times, sometimes jointly with the Citizens Advisory Committee.

- The **Citizens Advisory Committee** (CAC) worked to build consensus among the user groups, local, state, and federal agencies, private industries, environmental groups, the science community, and the general public concerning the implementation of public participation work plans and the contents of the ***Bays Plan***. Members were appointed by the directors of relevant stakeholder groups, based on a request from the Program (see Appendix D for membership). This committee met over 12 times and worked closely with staff in the development of outreach materials.

Key Public Participation Tools

- *Distribution of Draft* **Coastal Bend Bays Plan**
- *Management Conference Activities*
- *Priority Issues Public Meetings*
- *Action Plan Task Forces*
- *Environmental Goals Workshop*
- *Bay Summits*
- *All-Conference Workshops*
- *Stakeholder Workshops*
- *Town Hall Meetings*
- *Regional Monitoring Strategy Workshop*
- *Speaker's Bureau*
- *12 Page Newspaper Insert*

Priority Issues Public Meetings

In early 1994, the CCBNEP hosted 13 public meetings throughout the Coastal Bend to gather input on the most critical issues facing the bays and estuaries. These meetings were posted in the Texas Register and the local newspaper. Through this process, seven 'priority issues' and numerous contributing factors (see Appendix B) emerged and were later officially confirmed by the Management Committee to be the focus for characterization and planning. Initially, only six issues were identified as 'priorities' but due to concern from citizens about **public health,** this issue was added.

Action Plan Task Forces

In 1996, 14 issue-specific task forces were established to provide community input on sections of the ***Bays Plan***. Task Force membership included stakeholders such as local governments, industry, and recreational users (see Appendix D for membership). The charge to the Task Forces was to recommend goals, objectives, and actions for their respective issues to the Management Committee. Information from characterization studies was incorporated in Task Force deliberations when applicable or available. The outcome from this public participation process established the basis for the ***Bays Plan***.

Environmental Goals Workshop

Early in the process of outlining the work of the Action Plan Task Forces, members convened to establish a consensus on the goals and objectives for the ***Bays Plan***. This forum served as an important step in developing the central themes of the ***Bays Plan*** and highlighted issues that required a coordinated approach between Task Forces. The public was invited to participate in the workshop through an announcement in the local newspaper.

Bay Summits

The CCBNEP hosted Bay Summits in 1994, 1996, and 1998. These workshops provided for an animated exchange of information on the state of the Coastal Bend bays and estuaries as portrayed by regional scientists. Summaries of completed characterization studies were presented. The final Bay Summit, in April 1998, focused on the economic value of the bay system and the contents of the draft ***Coastal Bend Bays Plan***. The public was invited to attend through an announcement in the local newspaper and a local radio public service announcement. Approximately 120 people attended each Bay Summit.

All-Conference Workshops

Each year, the CCBNEP hosted an All-Conference Workshop to bring together the many diverse participants in the Management Conference. More than 100 conference members representing industry, local governments, citizens, scientists, and others engaged in candid interaction, shared information, clarified interests, and developed a better understanding of alternative viewpoints pertaining to the bays and estuaries.

Stakeholder Workshops

Prior to the release of the draft ***Bays Plan***, a series of stakeholder workshops were held to entertain feedback from recreational users, local governments, and industry on the development of the plan and proposed actions. Several hundred invitations were sent to stakeholders from throughout the area, and an extra effort was made to bring in people/organizations not familiar with the CCBNEP and the ***Bays Plan***. An announcement was also placed in the local newspaper about the recreational user stakeholder meeting. Approximately 150 people participated in discussions about the ***Bays Plan*** through these workshops.

Town Hall Meetings

A series of town hall meetings were held in Rockport, Kingsville, Port Aransas, and Corpus Christi during the 60 day public comment period on the draft ***Coastal Bend Bays Plan***. These forums provided the opportunity for citizens to hear a presentation about the contents of the ***Bays Plan*** and ask questions. A postcard was mailed to over 4,500 citizens and ads were placed in local papers to help stimulate attendance.

Approximately 130 people participated, most of whom had not been involved in the development of the ***Bays Plan***.

Regional Monitoring Strategy Workshop

The CCBNEP hosted a workshop in 1998 to evaluate the draft Regional Monitoring Strategy (RMS) and to determine if the actions described in the RMS address the needs of the area. Action Plan Task Forces identified monitoring data gaps/ needs in their subject areas and forwarded these for inclusion in the RMS. Approximately 40 people attended this workshop.

Speaker's Bureau

Over 8,100 people have been reached throughout the project area through scheduled presentations. These presentations have been an important medium to gather input and feedback pertaining to the ***Bays Plan*** and the CCBNEP. Both program staff and volunteers serving on the Management Conference have given presentations at these events.

12 Page Newspaper Insert

A 12 page insert appeared in the largest newspaper in the Coastal Bend and reached over 70,000 homes. This insert was a summary of the contents of the draft ***Bays Plan***. The insert included a coupon that could be mailed to receive a copy of the draft ***Bays Plan***. Anyone ordering a copy of the Plan was invited to attend the Town Hall meetings during the public comment period. Extra copies of the insert were available to the public upon request.

Other Public Involvement Opportunities

A variety of presentations, briefings, and public forums were hosted by the CCBNEP throughout the plan development process in addition to those described above.

These included:

- Co-hosting a constructed wetlands videoconference;
- Participating in a nonpoint source pollution workshop;
- Co-hosting red and brown tide workshops;
- Hosting a water and sediment quality workshop;
- Conducting a briefing to legislative/governor's offices about the ***Bays Plan***;
- Conducting a briefing to USEPA headquarters about the ***Bays Plan***;
- Displaying program materials at local festivals; and
- Participating in local TV/radio talk shows.

Public Outreach Materials

Most of the outreach materials listed below were used by members of the Citizens Advisory Committee and staff to communicate information on priority issues and the ***Bays Plan*** to the public.

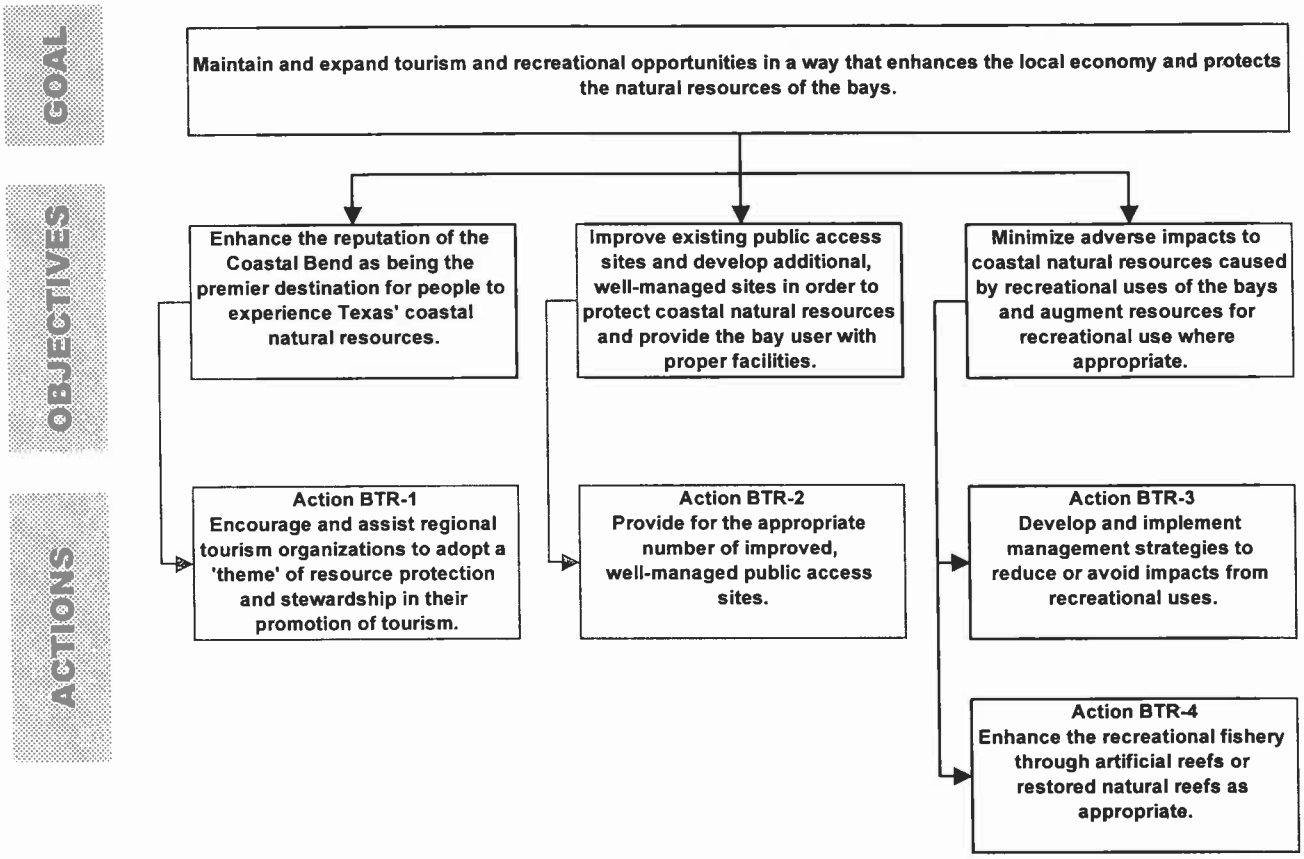
- Program Videos
- 20 Quarterly Newsletters
- Radio and TV PSAs
- Slide Shows
- Press Conferences/Press Releases
- Environmental Education Teacher Curriculum Guides
- Bay Users Guide
- Fact Sheet Series
- Bay Guidebook
- Texas State Aquarium Display

Responses to Public Comments on the Jan. '98 Draft *Bays Plan* and *Implementation Strategy*:

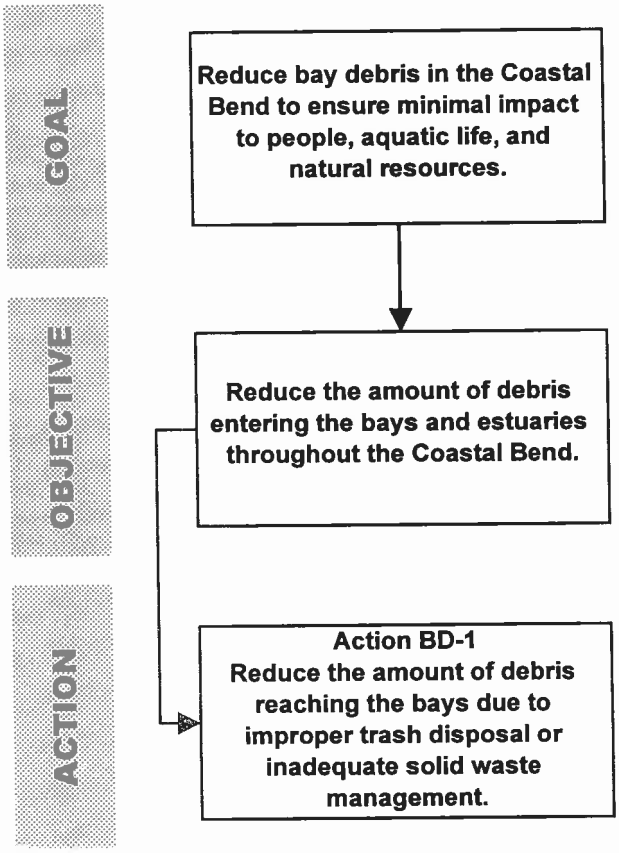
Over 185 comments were received on the draft ***Bays Plan*** and ***Implementation Strategy***. These comments were individually reviewed and considered in the revision to the two documents. A summary of the comments and Management Conference responses is available from the CBBEP Program Office.

APPENDIX A
Action Plan Flowcharts

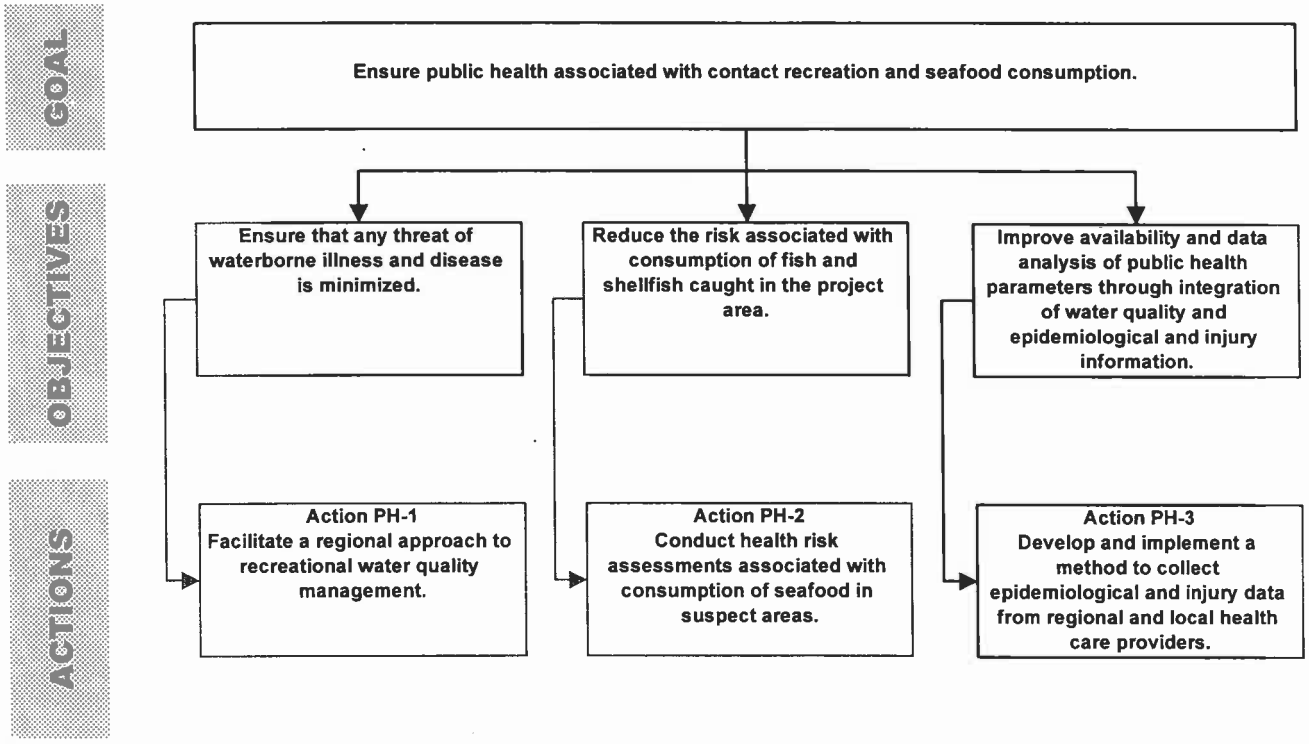
Bay Tourism and Recreation Action Plan Flowchart



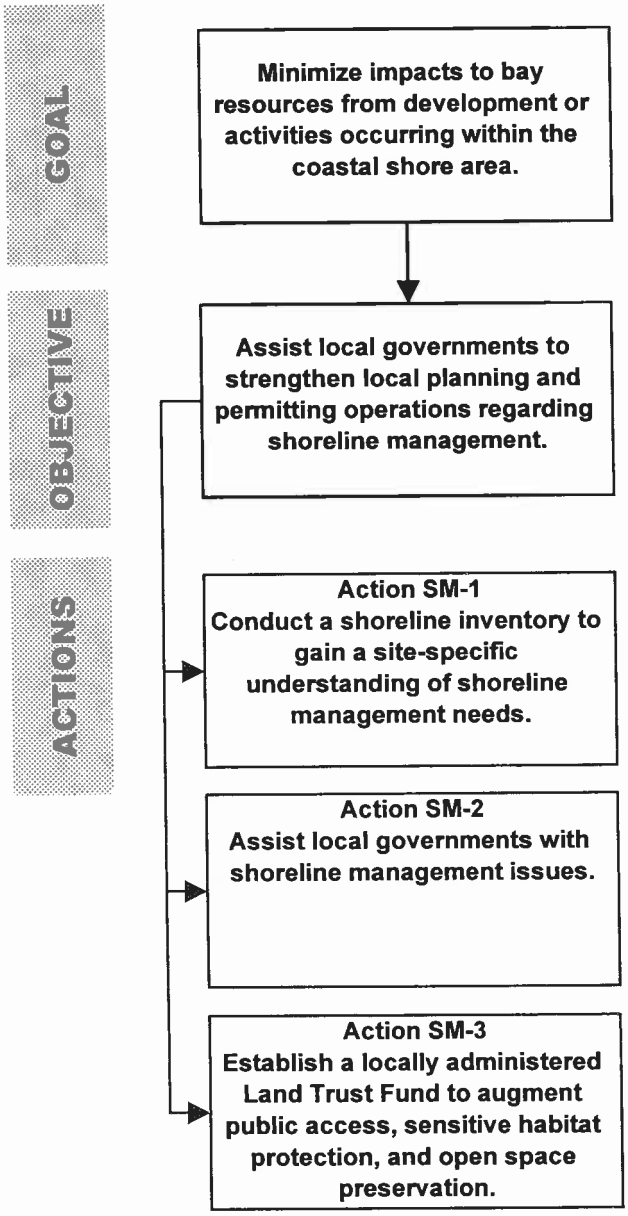
Bay Debris Action Plan Flowchart



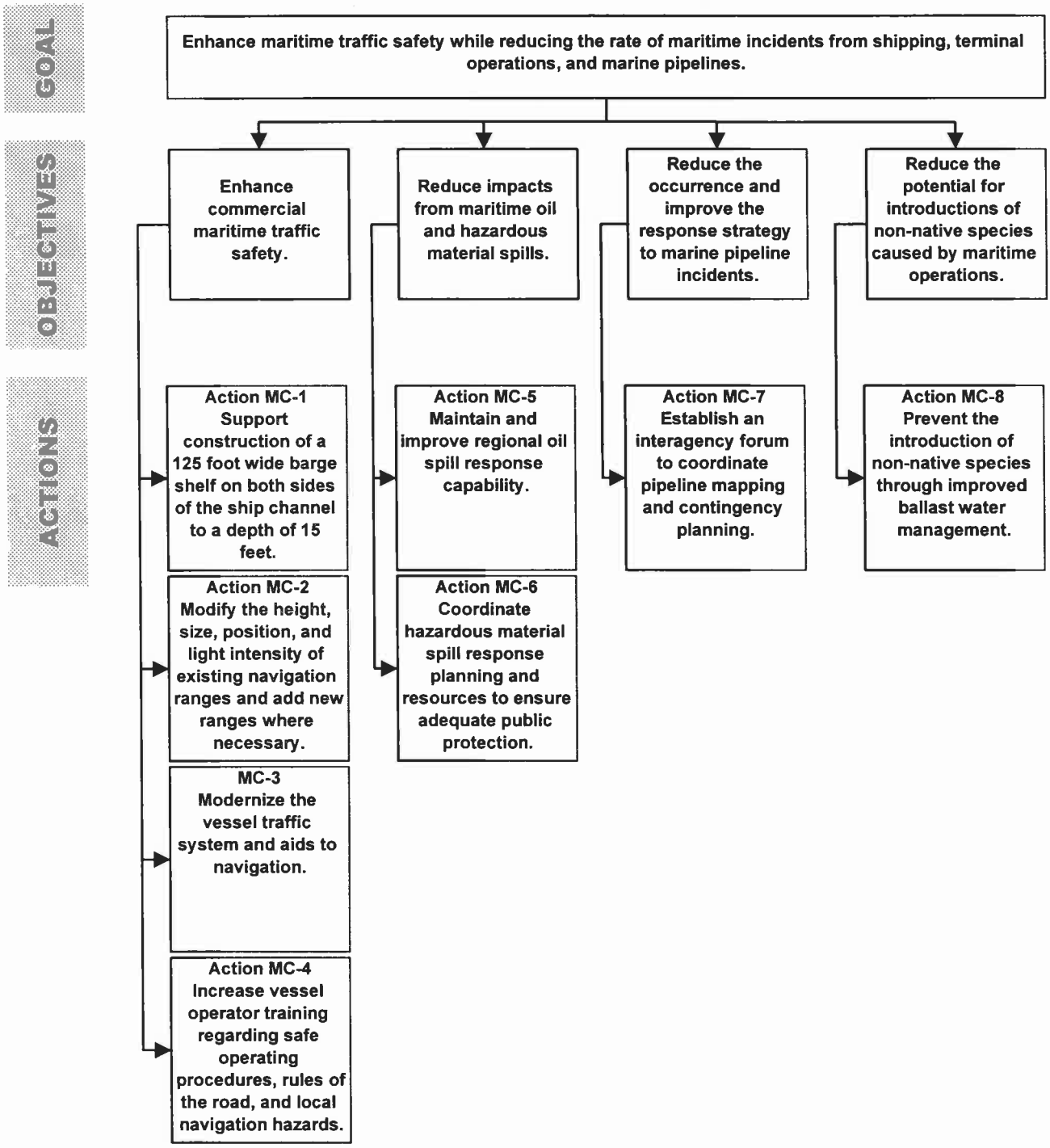
Public Health Action Plan Flowchart



Shoreline Management Action Plan Flowchart



Maritime Commerce Action Plan Flowchart

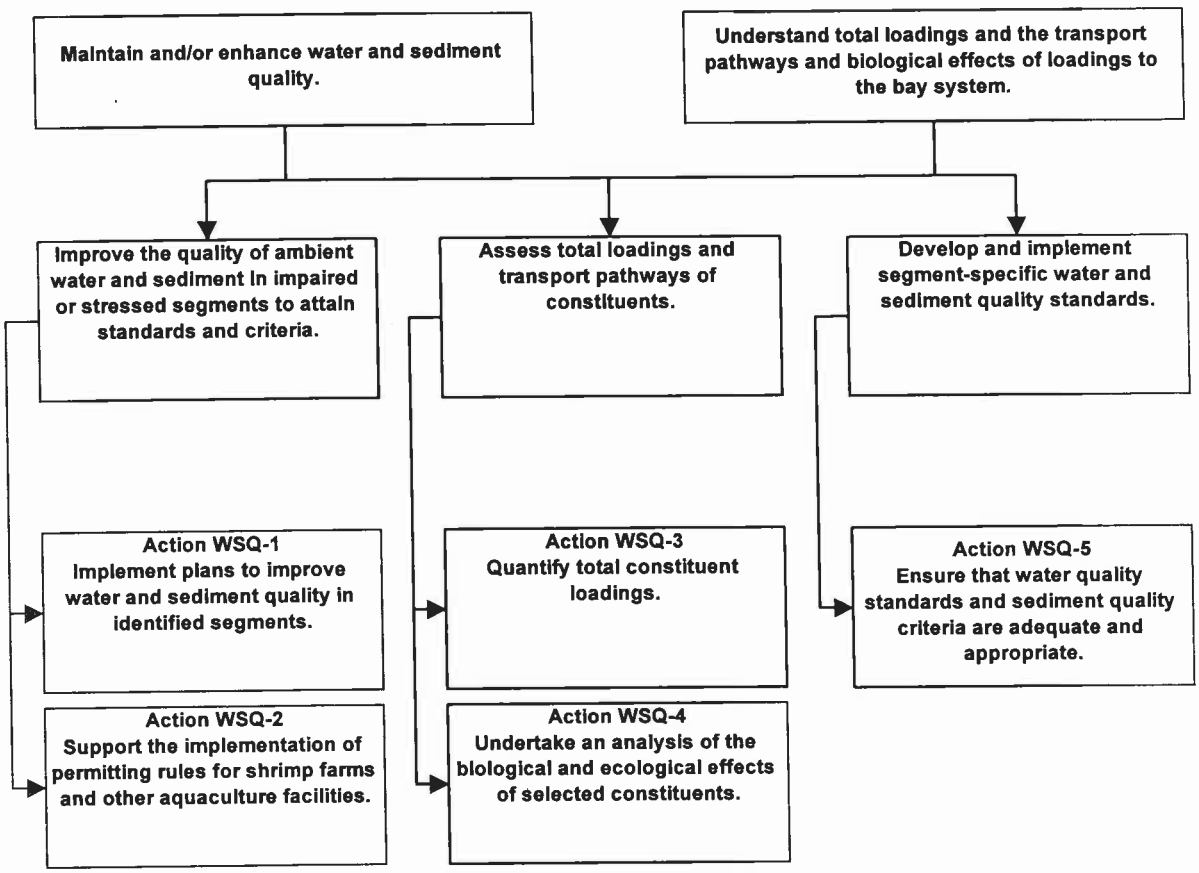


Water and Sediment Quality Action Plan Flowchart

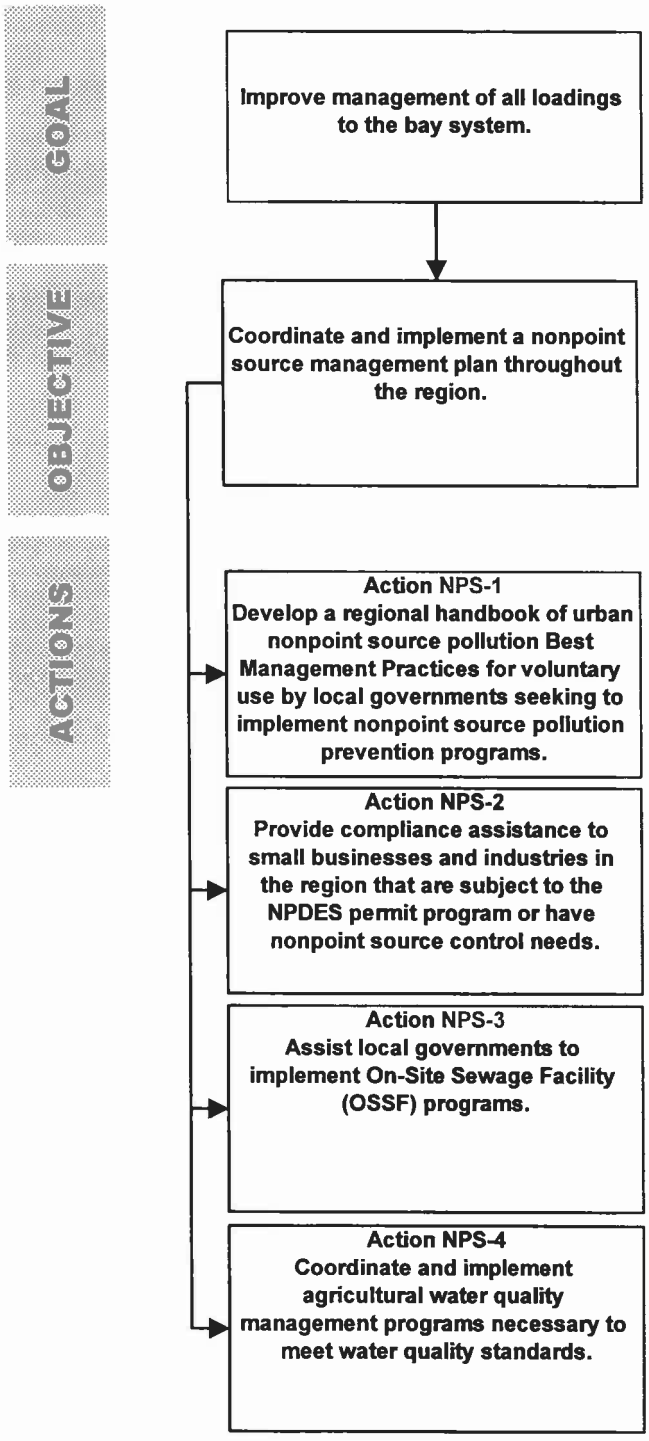
GOALS

OBJECTIVES

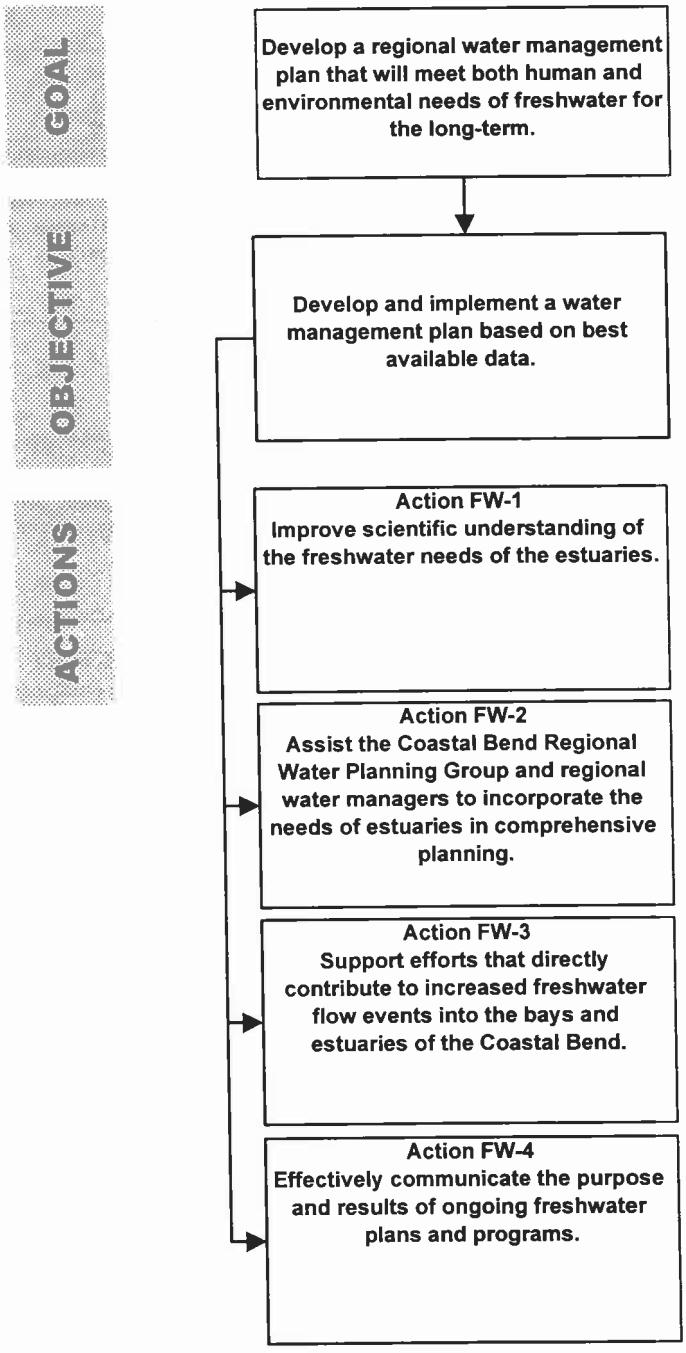
ACTIONS



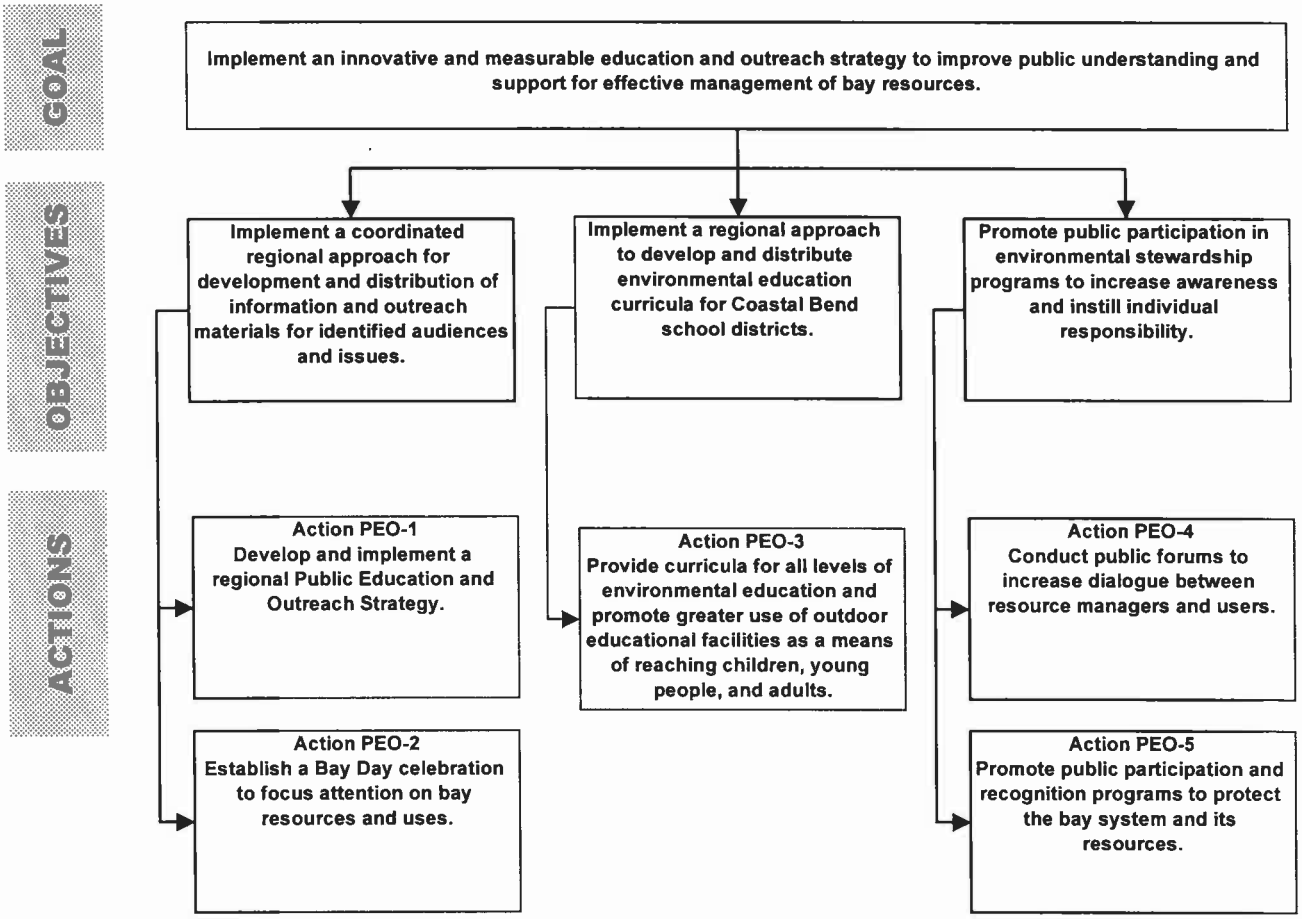
Nonpoint Source Management Action Plan Flowchart



Freshwater Resources Action Plan Flowchart



Public Education and Outreach Action Plan Flowchart



APPENDIX B
Priority Issues of the Coastal Bend Bays

When the Governor nominated the Coastal Bend Bays for inclusion in the National Estuary Program, the following were listed as critical issues for study and action:

- limited freshwater inflow to the bay system;
- loss of wetlands and critical habitat;
- oil field brine discharges into estuaries;
- negative impacts to the estuary from dredging and disposal of dredged material;
- impacts of persistent brown tide;
- degradation of water quality in the estuary and its tributaries;
- marine mammal die-offs and strandings;
- determination of cumulative impacts of planned water development, drainage, channelization and navigation improvement projects on the estuary; and
- protection of endangered species.

The nomination also listed objectives and actions for dealing with each critical issue.

The list of Priority Issues evolved as citizens and stakeholders were brought into the program and scientific information was collected to determine the status and trends of these issues. A Scientific and Technical Advisory Committee (STAC) was established and included local experts, stakeholders, and resource agency representatives appropriate for each issue.

The Priority Issues were analyzed with respect to contributing factors, sources, and impacts to the system. A revised list was developed and was the focus of a series of public meetings in each of the coastal counties in the project area. Public comments resulted in the addition of 'public health' to the list of priority issues. Although the Management Conference felt comfortable that issues related to public health were sufficiently covered under existing priority issues, citizens felt that exclusion of public health would deemphasize the 'human factor'. As a result, the list of Priority Issues and contributing factors, as shown in Table 7, was produced. This list has served as the focus of scientific investigation and action planning since January 1995.

TABLE 7
Priority Issues of the Coastal Bend Bays

Priority Issues	Concerns	Contributing Factors
Altered Freshwater Inflows into Bays and Estuaries	■ maintenance of adequate freshwater inflows to support ecological health and productivity and environmental quality ■ sedimentation process, delta building, and loss of marsh ■ adequate water supplies for current and future societal needs ■ economic concerns and impacts ■ nutrient input	■ current water demand and increases in water demand due to water development projects ■ alterations in timing and volume of tributary flow due to existing impoundments and withdrawals ■ alteration of the location of tributary flows ■ natural conditions (semi-arid climate) ■ conservation, reuse, and technology advances
Condition of Living Resources	■ protection and/or enhancement of ecologically and economically important estuarine species characteristic to the project area ■ protection and enhancement of endangered, threatened, and protected species ■ recent declines or die-offs in indigenous species	■ habitat destruction and degradation ■ degradation of water quality due to eutrophication, industrial effluents, agricultural pesticides, chemical/petroleum spills, bay debris, and dredging ■ persistent brown tide in the Upper Laguna Madre ■ over-utilization of living resources ■ altered estuarine circulation ■ altered freshwater inflows
Loss of Wetlands and Estuarine Habitats	■ maintenance of ecological health and characteristic productivity of the estuarine system ■ degradation of important wetland functions including fishery and wildlife habitat, flood mitigation, pollutant trapping, etc ■ maintenance of critical habitats for the protection of endangered, threatened, and protected species and ecologically and commercially important species ■ destruction and alteration of bay bottom habitats	■ dredging and disposal of dredged materials ■ loss of coastal vegetation due to subsidence, sea level rise, erosion and bulkheading ■ persistent brown tide events in the Upper Laguna Madre contributing to loss of seagrasses ■ commercial and residential development including bridge and highway development ■ point sources of pollutants from municipal and industrial activities ■ nonpoint sources of pollution including urban and agricultural sources ■ disturbance of submerged habitats from trawling, prop washing, and other activities ■ altered freshwater inflows and accompanying sediment and nutrient inputs
Degradation of Water and Sediment Quality	■ maintenance of the environmental quality of the estuary ■ maintenance of designated uses ■ protection of human and ecological health	■ dredging and disposal of dredged materials ■ point sources of pollutants from stormdrains and municipal/industrial wastewater treatment ■ nonpoint sources of pollution including urban and agricultural sources ■ persistent brown tide events in the Upper Laguna Madre ■ tidal discharges of oil field produced waters ■ discharge and spillage of pollutants, sewage, and solid wastes ■ loss of wetlands ■ altered circulation ■ freshwater inflows ■ atmospheric pollution

TABLE 7 *(continued)*
Priority Issues of the Coastal Bend Bays

Priority Issues	Concerns	Contributing Factors
Altered Estuarine Circulation	■ localized concentration of pollutants due to reduced tidal exchange and flushing ■ altered exchange within the Laguna Madre and between bays and the Gulf of Mexico ■ recruitment of living resources	■ channelization and other navigational improvements ■ natural processes ■ modifications to natural passes and benthic features ■ dredging and disposal of dredged materials ■ artificial barriers to water circulation ■ altered freshwater inflow ■ industrial intakes/discharges
Bay Debris	■ protection of human health from potentially hazardous debris and wastes ■ ingestion and entanglement by local fauna ■ degradation of the aesthetic quality of the bays	■ land-based sources of debris including wash-off from urban areas and floatables from point sources ■ littering from recreational and commercial boating operations ■ oil exploration and production facilities ■ meteorological events including wind and floods ■ converging ocean currents ■ natural sources such as dead animals, driftwood, seagrass, and natural hydrocarbon seepage ■ tourists and local population ■ industrial construction sites ■ public attitude, lack of education, and lack of enforcement of existing laws
Public Health Issues	■ protection of human health from contaminated seafood ■ health problems related to contact with polluted water ■ shellfish bed closures due to contamination with enteric bacteria and viruses	■ deposition of bioaccumulating toxic substances into the estuary ■ pathogenic organisms from inadequate sewage treatment, septic systems, or marine sanitation devices ■ existing sediment sources of toxic substances ■ point sources ■ nonpoint sources

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APPENDIX D
Management Conference Membership

NAME	AFFILIATION	REPRESENTING
Policy Committee		
Mr. Ray Allen	Central Power & Light	Local Citizen
Commissioner John Baker	Texas Natural Resource Conservation Commission	
Mr. Gregg Cooke	USEPA - Region 6	
Commissioner John R. Clymer	Texas Parks & Wildlife Commission	
Commissioner Noe Fernandez	Texas Water Development Board	
The Honorable Vilma Luna	Texas House of Representatives	Elected State Official
Commissioner Garry Mauro	Texas General Land Office	
The Honorable Josephine Miller	County Judge of San Patricio	Local Public Official
The Honorable Loyd Neal	Mayor, City of Corpus Christi	Local Public Official
Mr. Bernard Paulson		Local Citizen
The Honorable Carlos Truan	Texas State Senate	Elected State Official
Management Committee		
Mr. Ray Allen		CCBNEP Policy Committee
Mr. Tobin Armstrong	Kenedy County	Large Land Holder
Mr. John Barrett		Row Crop Producer
Mr. Tony (Duke) Bonilla, Jr.	Bonilla & Berlanga	Recreational Fisheries
Mr. Richard L. Bowers	Western Pigments and Minerals, Inc.	Port of Corpus Christi Authority
Mr. Allan Colwick	Natural Resources Conservation Service	
Mr. Robert Corrigan	Citizens Advisory Committee	
Dr. Sally Davenport	Texas General Land Office	
Mr. Ted Grabowski	U.S. Navy Station - Ingleside	U.S. Navy
CAPT. Adan Guerrero	U.S. Coast Guard	
Ms. Sally Gutierrez	Texas Natural Resource Conservation Commission	
Mr. Mike Hightower	Texas Sea Grant College Program	
Mr. Edward (Ted) Jones	Nueces River Authority	
Dr. Tommy Knowles	Texas Water Development Board	
Mr. Pat McCrary	Padre Island National Seashore	
Mr. Rick Medina	U.S. Army Corps of Engineers	
Mr. James Moore	Texas State Soil & Water Conservation Board	
Dr. Joe C. Moseley	Shiner, Moseley & Assoc., Inc.	Environmental Engineer
Mr. Frank Newchurch	Reynolds Metals, Inc.	
Mr. George Ozuna	U.S. Geological Survey	
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Mr. Jay Reining	City of Corpus Christi	Citizens Advisory Committee
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Mr. Bill Seawell	U.S. Fish and Wildlife Service	
Ms. Patricia H. Suter		Environmental Advocate
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Mr. Richard Thompson	Texas Dept. of Health	
Ms. Mary J. Thorpe	Del Mar College	Coastal Bend Council of Governments
Mr. Tom Utter	City of Corpus Christi	
Mr. Robert B Wallace, Jr.	Wallace & Wallace, L.L.P.	Coastal Bend Bays Foundation
Ms. Becky Weber	USEPA - Region 6	
Mr. Roger F. Welder		Ranching

NAME	AFFILIATION	REPRESENTING
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Dr. Terry E. Whitledge	UT Marine Science Institute	Scientific/Technical Advisory Committee
Dr. Roger Zimmerman	National Marine Fisheries Service	
Local Governments Advisory Committee		
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Mr. Tommy M. Brooks	City of Port Aransas	
Ms. Sue Burck	Ingleside On The Bay	
Mr. Leon Decker	Nueces County Dept. of Public Health	
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Mr. James A. Dodson	City of Corpus Christi	
Mr. Daniel D. Durnan	Town of Bayside	
Mr. John Ford	Kenedy County	
Judge Joe B. Garcia	Brooks County	
Dr. Donald A. Hegwood	Texas A&M University	City of Kingsville
Mr. Bill Hennings	City of Corpus Christi	
Mr. Marshall Holybee	Guadalupe-Blanco River Authority	
Ms. Kay Jenkins	Aransas County	
Mr. Paul Martinez	City of Austwell	
Mr. Jim Massey	Kingsville Farmers Co-Op	Kleberg County
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Mr. Carlton (Buddy) Stanley	Texas Natural Resource Conservation Commission	
Commissioner Jimmy Strause	Live Oak County	
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Ms. Mary Campbell	Port Aransas Rod & Reel	
Mr. Chuck Cazalas	Citgo Corpus Christi Refinery	
Mr. Robert Corrigan	Ducks Unlimited	
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Mr. John Fails	Coastal Bend Guides Association	
Mr. James B. Gafford	Valero Refining	
Ms. Corando Gallegos	Hispanic Women's Network of Texas Association	
Mr. William Goldston	Goldston Engineering, Inc.	Coastal Bend Bays Foundation
Mr. Richard Gonzales	New America Marketing	
Ms. Grace Gonzalez		LULAC Council #1
Mr. Frank Hankins	OPUS	
Mr. Scott Hedges	National Audubon Society	
Mr. Thomas B. Henderson, Jr.	Geologist	
Mr. John Craig Hill	Hoechst Celanese	
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Mr. August Meinrath	AARP	
Mr. Harold Moore	NAACP	
Mr. Joe P. Mueller	Mueller Engineering Corp.	Oil and Gas Producers
Mr. Ancel Newman	Save Lake Corpus Christi Foundation	

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CAPT. Jay Reining (Ret.)	Coastal Bend Bays Foundation	
Ms. Cecilia Riley	Gulf Coast Bird Observatory	Biologist
Mr. Stuart Sasser	Texas SW Cattle Raisers Association	Ranching
Mr. Allen Shifley, P.E.	Betz Industrial	Industrial Water Treatment
Ms. Mary Pat Slavik	OPUS	
Mr. Jack Solka	Architect	
Mr. Hal Suter	Tax Payers Association	
Mr. Butch Thompson	King Ranch	
Ms. Judith Tor	Sierra Club	
Mr. Leroy J. Wieting	Reynolds Metals	
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Mr. Bob Bass	U.S. Army Corps of Engineers	
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Ms. Robyn A. Cobb	U.S. Fish and Wildlife Service	
Mr. Mike Cox	Valero Refining Company	
Mr. Philip A. Crocker	USEPA Region 6	
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CAPT. Mike Kershaw		
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Dr. Russ Miget	Texas Sea Grant Program	
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Mr. George W. Pollitt	Mine Warfare Command	
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Ms. Cecilia C. Rhoades		
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STAC Ex-Officio Directory		
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Mr. Darwin J. Anderson		
Mr. Charlie Belaire	Belaire Consulting, Inc.	
Dr. Ed Buskey	UT Marine Science Institute	
Dr. Scott Carr	National Biological Service	
Mr. Chris Caudle	Texas Natural Resource Conservation Commission	
Mr. Terry J. Cody	Texas Parks and Wildlife Department	
Dr. Hudson R. DeYoe	UT - Pan American	
Dr. Quenton R. Dokken	Texas A&M University - Corpus Christi	

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Dr. Robert J. Edwards	UT - Pan American
Mr. Carlos Garcia	Texas General Land Office
Mr. Scott A. Holt	UT Marine Science Institute
Mr. David A. Jensen	National Spill Control School
Dr. Paul A. Montagna	UT Marine Science Institute
Mr. Darwin Ockerman	U.S. Geological Survey
Mr. Ken Roberts	Hoechst Celanese
Mr. C.J. Romero	Citgo Refinery
Mr. Harold Stone	Texas Agricultural Extension Service
Ms. Christina Thompson	Texas A&M University - Corpus Christi

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Ed Hegen, *Texas Parks & Wildlife*
Kay Jenkins, *Aransas County*
Stan Kotzer, *Texas Seafood Association*
Christopher Lawrence, *Nueces County*
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Paula Sales, *Texas Department of Transportation*
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Peggy White, *Industry*
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Brown Tide

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Jay Evans, *Rancher*
Jon Fails, *Fishing Guide*

Brown Tide *(cont.)*

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Nancy Elliott, *Native Plant Society of Texas*
Mark Fisher, *Texas Natural Resource Conservation Commission*
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Stan Kotzer, *Texas Seafood Association*
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John Miller, *Padre Island National Seashore*
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Marc Woodin, *Bird Watchers*
Roger Zimmerman, *National Marine Fisheries Service*

Dredging

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Greg Brubeck, *Port of Corpus Christi Authority*
Raul Cantu Jr, *Texas Department of Transportation*
Pat Clements, *U.S. Fish & Wildlife Service*
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Dredging *(cont.)*

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Troy Williamson, *Coastal Conservation Association*

Urban Runoff

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Arthur Talley, *Texas Natural Resource Conservation Commission*
Tom Utter, *City of Corpus Christi*
Jane Ward, *City of Ingleside*
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Agricultural Runoff

John Barrett, *Row Crop Producers*
Clyde E. Bohmfalk, *Texas Natural Resource Conservation Commission*
John Bremer, *Texas Agricultural Extension Service*
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Kate McAfee, *Texas General Land Office*
Lloyd Mullins, *Texas General Land Office*
Fermin Munoz, Jr., *Texas Railroad Commission*
Frank Newchurch, *Port Industries of Corpus Christi*
Jay Reining, *City of Corpus Christi*
Alfred Robbins, *Ingleside-On-The-Bay*
C. J. Romero, *Industry*
Leroy Wieting, *Industry*
Phil Woods, *Industry*

Public Outreach

Darrin Bauer, *Texas Agricultural Extension Service*
Jim Baxter, *Coastal Conservation Association*
Terry Branch (Team Leader), *U.S. Environmental Protection Agency*
Dorothy Browne, *Texas General Land Office*
Will Cohen, *Texas Agricultural Extension Service*
Javier Colmenero, *Media*
Christina Conner, *Texas Parks & Wildlife*
Sally Davenport, *Texas General Land Office*
Hillis Dominguez, *City of Rockport*
Mindy Durham, *Texas Maritime Museum*
Kathleen Fleming, *Elementary Education*
Susan Foore, *Kingsville Public Education*
John Giles, *Coastal Bend Council of Governments*
Richard Gonzales, *Marketing*

Public Outreach *(cont.)*

Melinda Gonzales, *CCISD Health Services*
Vick Hines, *Senator Truan's Office*
Diane Kiddy, *High School Education*
Scott Kucera, *CCISD/Administration/Energy*
Patricia Lacombe, *U.S. Coast Guard*
Debbie Lindsey-Opel, *H.E.B.*
Pearl Love, *Industry*
Yolanda Marruffo, *Corpus Christi Water Department*
Shannon Mayo, *Texas State Aquarium*
Paul Montagna, *UT Marine Science Institute*
Joe Mueller, *Oil & Gas Producers*
Elane Murray, *Coastal Bend Audubon*
Ray O'Brien, *City of Rockport*
Dottie O'Neal, *Desk & Derrick Club*
Karen Owens, *Texas Mid-Continental Oil & Gas Association*
Catherine Porter, *The Nature Conservancy*
Kit Price, *Texas A&M University-Corpus Christi*
Cecilia Rhoades, *Concerned Citizen*
Tara Schultz (Team Leader), *Texas State Aquarium*
Ron Smith, *Adopt-A-Wetlands*
Glenda Swierc, *Education*
Kathy Tallent, *Childhood Development*
Carter Tate, *Coastal Conservation Association*
Rick Tinnin, *UT Marine Science Institute*
Rich Tuttle, *Port Industries of Corpus Christi*

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Mr. Jeff Foster, *Program Administrator*
Ms. Alice Laningham, *Administrative Coordinator*
Mr. Richard Volk, *Director*

Shoreline Management

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Ray Allen, *Local Citizen*
Pat Clements, *U.S. Fish & Wildlife Service*
Dave Coggins, *Padre Island Business Association*
Quenton Cook, *Corpus Christi Marina*
Frank Hankins, *Organization for the Preservation of an Unblemished Shoreline*
Norb Hart, *City of Corpus Christi*
Brandol Harvey, *City of Corpus Christi*
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Brandy Kratz, *Corpus Christi Board of Realtors*
Roy Lehman, *Center for Coastal Studies*
John Lloyd-Reilly, *Industry*
Joe Moseley, *Shiner, Moseley & Associates*
Lloyd Mullins, *Texas General Land Office*
Jennifer Prouty (Team Leader), *Texas A&M University-Corpus Christi*
Stan Russell, *Environmental Engineer*
Patricia Suter, *Environmental Advocate*
Olga Torres, *Metorpolitan Planning Organization*
Mary Ellen Vega, *Texas Parks & Wildlife*
Leroy Wolff, *Natural Resources Conservation Service*

APPENDIX E
Stakeholders

Academia
Adopt-A-Wetlands
Agriculture
Aker Gulf Marine
American Association of Retired Persons
American Chrome & Chemical
Aransas County
Aransas Co. Navigation District I
Architects
Audubon Society
Bay Area Council
Bay Shrimpers
Biologists
Bird Watchers
Brooks County
Bureau of Reclamation
Caesar Kleberg Foundation
Center for Coastal Studies
Citgo Refinery
City of Austwell
City of Corpus Christi
City of Corpus Christi Marina
City of Ingleside
City of Kingsville
City of Mathis
City of Port Aransas
City of Portland
City of Rockport
Clean Rivers Program
Clean-Up Programs
Coastal Bend Audubon Society
Coastal Bend Bays Foundation
Coastal Bend Council of Governments
Coastal Bend Guides Association
Coastal Conservation Association
Coastal Refinery
Commercial Fishing
Conrad Blucher Institute
Contractors
Corpus Christi Board of Realtors
Corpus Christi Botanical Society
Corpus Christi ISD
CCISD Health Services
Corpus Christi Taxpayers Association
Corpus Christi Yacht Club
County Extension Services
Desk & Derrick Club
Ducks Unlimited
Ecotourism
Elected State and Local Officials
Environmental Advocates
Environmental Defense Fund
Family Farmers
Fishing Guides
Geologists
Goldston Engineering
Guadalupe-Blanco River Authority
Gulf Coast Association of SWCD
H.E.B.
Hispanic Women's Network of Texas
Hollywood Marine Service
Ingleside-on-the-Bay
Industry
Island Moorings
Jim Wells County
Kayakers
Kenedy County
Kenedy Foundation
King Fisher Marine Service
King Ranch
Kingsville Farmers Coop
Kingsville ISD
Kleberg County
Kleberg Wildlife Research Institute
Koch Gathering Systems
Koch Refining
Large Landowners
League of Women Voters
Live Oak County
Local Citizens
Local Developers
Local Educators
Local Newspapers
Local Sailors
LULAC #1
Major Industries
Marine Spill Response - Gulf Region
Marketing
Media/Communications
Metropolitan Planning Organization
NAACP
National Biological Service
Naval Air Station Public Works Office
National Spill Control School
Naval Operations/Military Construction
NBS-Southern Science Center
Naismith Engineering
National Marine Fisheries Service
Native Plant Society
Nature Conservancy
Nueces County
Nueces Co. Department of Public Health
Nueces County Water Improvement #4
Nueces River Authority
Offshore Platforms Industry
Oil & Gas Producers
OPUS
OxyChem
Padre Island National Seashore
Padre Island Property Owners Assoc.
Pilots Association
Port Aransas Rod and Reel
Port Industries of Corpus Christi
Port of Corpus Christi
Public Education, Marine Science
Public Relations
Ranching
Recreational Fishing
Refining Industry
Restaurant Association
Reynolds Metals
Rockport Chamber of Commerce
Rodman Company
Row Crop Farmers
Russell-Veteto Engineering
San Jose Cattle Company
San Patricio County
San Patricio Drainage District
San Patricio Municipal Water District
Save Lake Corpus Christi Coalition
Shiner, Moseley & Assoc.
Science Museum
Shipping Industry
Sierra Club
Small Businesses
Small Municipalities
South Texas Association of SWCD
South Texas Cotton & Grain Assoc.
South Texas Water Authority
Steamship Agents
Texas A&M University-Corpus Christi
Texas Agricultural Experiment Station
Texas Agricultural Extension Service
Texas Department of Agriculture
Texas Department of Health
Texas Department of Transportation
Texas General Land Office
Texas Maritime Museum
Texas Nature Tourism Association
Texas Parks and Wildlife
Texas Railroad Commission
Texas Seafood Association
Texas Sea Grant College Program
Texas Southwest Cattle Raisers Assoc.
Texas State Aquarium
Texas State Soil & Water Conservation Board
Texas Water Development Board
Texas Waterway Operators Association
Texas Mid Cont. Oil and Gas Association
Texas Natural Resource Conservation Commission
Town of Bayside
U.S. Army Corps of Engineers
U.S. Coast Guard
U.S. Environmental Protection Agency
U.S. Fish & Wildlife Service

U.S. Geological Survey
U.S. Natural Resources Conservation Service
U.S. Navy
U.S. Army Corps of Engineers
UT Bureau of Economic Geology
UT Center for Water Research
UT Marine Science Institute
Valero Refinery
Welder Wildlife Foundation
Windsurfing Association
Wingfield-Smith

APPENDIX F
List of Program Projects

Status and trends of ambient water, sediment, fish, and shellfish tissue quality: This project is the first step of an analysis of environmental and ecological problems in the project area associated with the presence of water and sediment contaminants. Focus is on identifying significant or potential contamination of the ambient environment as evidenced by trends in degraded water, sediment, fish, and shellfish tissue quality. Future projects will attempt to describe specific sources of pollutants based upon results of this effort. (Completed)

Status and trends of living resources: This project characterizes the current status and spatial and temporal variability in abundance and distribution of populations of: 1) economically and ecologically important estuarine species; 2) endangered, threatened, protected, and exotic estuarine species; and 3) resident marine mammals. The assessment is entirely reliant upon available data and a review of existing scientific literature. Negative resource conditions as indicated by declining (desirable species) or increasing (undesirable introduced species) population trends are targeted for future analysis of specific causative factors. Existing monitoring programs and coverage are evaluated for adequacy in determining resource condition. (Completed)

Status and trends of freshwater inflows: This project characterizes the current status and spatial and temporal variability in freshwater inflows to the project area. Considerable effort is being expended on this issue by the TNRCC, the Texas Water Development Board, and the Texas Parks & Wildlife Department. The intent of this project is not to duplicate those efforts. Rather, this project compiles the results of all previous efforts to evaluate, analyze, and project inflows, uses, and needs. Existing data and reports are compiled into a comprehensive assessment of the sources, volumes, and timing of freshwater inflows to the bays of the project area. This project also reviews current freshwater withdrawals, impoundments, reservoir release practices, water rights and uses, and other activities affecting freshwater inflows to the bays. (Completed)

Chronology of alterations to bay circulation: This project synthesizes existing information describing historical and recent estuarine circulation patterns, and alterations in those patterns due to human activity and natural phenomena. Circulation changes influenced by the presence of navigation channels and other navigational improvements, modifications to natural passes, placement of artificial barriers, changes in freshwater inflow and tidal exchange, plus other changes are examined and assessed for their relative contributions to the sum of changes to circulation patterns over time. The results of this project will be coupled with the efforts of the Texas Water Development Board to complete the description of estuarine circulation within the project area. (Completed)

Status and trends of phytoplankton blooms: This project describes and discusses the occurrence and spatial and temporal variability of persistent brown and red tide nuisance algal blooms occurring within the upper Laguna Madre and the adjacent bays and estuaries throughout the project area. Probable causes of the events are proposed and discussed. A comparison of the Texas brown tide

with similar brown tide events occurring in other coastal systems is made. Ecological and environmental effects of the blooms are investigated. (Completed)

Status and trends of bay debris: This project characterizes the sources, types, and extent of floating, submerged, and shoreline debris in the project area. While studies have been completed in the Gulf of Mexico, little is understood about the occurrence, magnitude, distribution, and effects of debris on biological communities and the water quality of local bays. This study compiles existing data sets from volunteer citizen groups, the Coastal Fisheries Sampling program, and other sources. The data analysis and a literature review are synthesized into a report discussing the occurrence and significance of bay debris to the project area. (Completed)

Characterization of nonpoint source loadings: This project begins to identify waterborne nonpoint sources of pollution contributing to loadings of receiving waters within the project area. Literature and existing data are reviewed with respect to eight categories of land use and several pollutant parameters. Land use categories include: 1) industrial/commercial; 2) transportation; 3) urban; 4) residential; 5) agricultural cropland (dryland and irrigated); 6) rangeland; 7) undeveloped/open; and 8) marinas. This first phase (Year 1) portion of the assessment of nonpoint source pollutant loadings focuses on the derivation of Event Mean Concentrations (EMCs) of various pollutants associated with each of the above eight land use categories. (Completed)

Identification of human uses of the project area: This project provides a baseline characterization of the social values and related economic trends, by describing the historical, current, and probable future human uses of the various estuarine resources found within the project area. This project provides the basis for future socioeconomic evaluations of conflicting bay-dependent activities and proposed management strategies contained in the Coastal Bend Bays Plan. (Completed)

Development of a conceptual ecosystem model: This project develops a conceptual ecosystem model, both pictorial and narrative, of the project area. The model demonstrates linkages at all trophic levels and substrate types, and provides a conceptual framework with which to assess ecological and environmental impacts (both episodic and cumulative) associated with external influences. The model is based upon current scientific consensus regarding the modeling of estuarine ecosystem components, and data and information regarding these relationships within the project area. The model is developed to two levels of detail: 1) a detailed model suitable for the scientific and technical community; and 2) a simple model suitable for use in CCBNEP public documents and management conference deliberations. (Completed)

Analysis of the effects of structures and practices on circulation and salinity patterns: This project characterizes the effects of structures (e.g., causeways, navigation channels, and Gulf passes) and practices (e.g., recirculation of bay waters for industrial cooling) on the circulation and salinity patterns of the project area. These structures and practices can potentially alter estuarine circulation and the transport of salts, sediments, nutrients, and plankton within the estuary. A preliminary modeling study was previously conducted by the TWDB in 1991. This project expands on our capability to model hydrodynamic impacts of existing structures and future practices throughout the project area. (Completed)

Base Programs Analysis: This project serves to characterize the existing resource management framework for the project area. Historical and current regulatory and non-regulatory approaches to

resource management are examined, and significant gaps or overlaps in organizational roles and authorities are identified. Efforts were made to coordinate the Base Programs Analysis with that for the Galveston Bay NEP, the Texas Coastal Management Program, and other similar projects, to both build upon and ensure that efforts were not duplicated. (Completed)

Action Plan Demonstration Project: Assessment of surface runoff water for sediment, nutrients, and chemicals from a set of Best Management Practices (BMPs) on agricultural croplands. The results of this four-year effort will provide information on the effectiveness of various agricultural BMPs in the context of local environmental conditions, plus information on economic cost/benefit data to support future BMP implementation efforts. The project involves the collection of water quality data on runoff collected and analyzed following rain events. The latter data will provide much needed information on local conditions and practices and the quality of agricultural nonpoint source (NPS) runoff specific to the project area, which will enhance the Program's efforts to characterize contributions from NPS loadings. (Scheduled completion: August 1998).

Seagrass mapping for Aransas and Copano Bays and their tributary embayments and trend analysis for selected areas. This project completes Submerged Aquatic Vegetation (SAV) mapping within the project area for the Aransas and Copano Bay Systems (including their tertiary bays), as well as Mesquite Bay. A second part of the project addresses SAV historical trend analysis for selected areas within the project area. (Completed)

Analysis of point source discharges (including oil field brine discharges). The project area contains a significant number of municipal and industrial point source discharges which have an undetermined effect on the quality of receiving waters. This project develops a comprehensive understanding of point source loadings by characterizing the quantity and quality of discharges and identifying, where possible, the linkages with "trouble spots" as identified in the study on ambient water/sediment quality. (Completed)

Status and trends of selected marine fauna. This project examines the spatial distribution of selected marine fauna within the project area using Geographical Information System (GIS) techniques. The project provides numerical and statistical analyses of existing Texas Parks and Wildlife Fisheries Resource Monitoring Program multi-year data sets of sample catches of selected shellfish and finfish to determine population status and trends and causative factors. (Completed)

Characterization of the effects of anthropogenic and natural influences on vegetated and unvegetated bay bottom habitats. Several human-induced factors have been identified as sources of disturbance to vegetated and unvegetated submerged bay bottom habitats in the project area. These include, but are not limited to, the following: shrimp harvesting, commercial tug and barge operations, recreational boating, historic shell dredging, and activities associated with navigation channel dredging. This project describes the relative extent, magnitude, and periodicity of effects of human-induced activities on the physical, chemical, and biological characteristics of submerged habitats (including reef structures) and compares such effects to historic and current impacts from natural disturbances. (Completed)

Investigation of selected public health issues. This study utilizes historical data to identify the occurrence and/or extent of negative health effects associated with the use of estuary resources. The degree of contamination of seafood (shellfish and fish) by bioaccumulative toxicants is assessed for the entire project area. The estuary waters and tributaries are examined to assess their suitability for both contact and non-contact recreation as determined by levels of contaminants and bacterial indicators. Possible sources of contaminants and indicator organisms are discussed as data allow. (Completed)

Analysis of agricultural nonpoint source runoff to Baffin Bay and its possible role in the perpetuation of the brown tide phytoplankton bloom. This project will enhance a much larger, concurrent project undertaken by the Texas Agricultural Experiment Station (TAES) to obtain data on rainfall and runoff events within a major portion of the lower reaches of the Nueces-Rio Grande Coastal Basin known as the King Ranch. While that project will focus on event surface runoff, this project will extend the assessment to include: 1) an analysis of actual loadings to Baffin Bay; and 2) an analysis of chemical and biological impacts associated with such loadings. (Scheduled completion: August 1998)

Supplement to the above project. The purpose of this supplementary project is to coordinate the TAES study with the in-bay study to be conducted by the University of Texas Marine Science Institute (UTMSI). Since the projects are complementary, it is critical that they be coordinated in their field activities and in report preparation in order to obtain maximum benefit. (Scheduled completion: August 1998)

Action Plan Demonstration Projects: Urban nonpoint source pollution reduction for two small municipalities. These two projects involve the demonstration of urban nonpoint source control Best Management Practices (BMPs) for the cities of Refugio and Ingleside. After the construction of BMPs, improvements to surface water quality are monitored and reported. (Completed)

Wetlands restoration planning. Wetlands loss is a concern because of the essential role that wetlands play in fisheries production, groundwater replenishment, flood control, erosion prevention, protection of water quality, and recreation. This collaborative project with the Texas General Land Office and the Center for Coastal Studies identifies and evaluates potential sites in the Corpus Christi/Nueces Bay area for wetland restoration, enhancement, or creation and develops sound, scientifically-based plans to restore, enhance, or create wetland functions and values. (Completed)

Economic valuation of selected recreational activities. Bay-related recreational activities continue to grow in total numbers of participants and in total expenditures. This project collects expenditure data on three subsets of the recreational user population: 1) bird watchers; 2) wind-surfers; and 3) recreational (boating) fishermen. Data collection was completed in April 1997, and the data was analyzed through the use of a travel cost model. (Completed)

Total pollutant loadings to the project area. This project develops a model to estimate nonpoint source loadings within the project area, and includes known point source loadings for a calculation of total loadings by water segment. The project, coordinated with the above described point sources inventory project, produces, through a GIS-based model, estimates of the mean annual loadings of

the principal water quality constituents to the various segments of the bay system, and a break-out for each system of the portion of the loadings attributable to the various point and nonpoint sources. (Completed)

Sediment quality assessment of storm drain outfalls and other targeted sites. This project samples, analyzes, and assesses sediment quality at sites associated with stormdrain outfalls, industrial discharges, maritime facilities, produced water discharges, and recreational and commercial marinas. Sediment toxicity is determined for various parameters using common, bulk sediment bioassays. The final report contains a description of sediment chemistry, toxicity, and effects on benthic community structure in an integrated fashion. (Completed)

Status and trends of selected estuarine and coastal habitats. Five habitat categories are the subject of status and trends assessment, including: freshwater and saltwater wetlands; natural and dredged material islands; riparian wooded wetlands and woodlands along stream corridors; unconsolidated natural shorelines and artificially hardened shorelines; and tidal flats, including sand, mud, and algal flats. The project relies on comparisons between distribution, areal extent, and types of these habitats as mapped by the National Wetlands Inventory using 1950s, 1979, and 1993-94 aerial photography, along with NOAA navigation charts, USGS topographic quads, and other pertinent information. (Completed)

Identification of tidal flat alterations and effects on biological productivity. The biological significance of wind-tidal flats as foraging habitat for aquatic birds, and as a component of atmospheric nitrogen fixation, is not fully understood. This project compiles and synthesizes information concerning the ecology, geology, and hydrology of wind-tidal flats in the project area. The type and extent (where possible) of human and natural disturbance are identified, and an assessment strategy explored regarding how best to determine productivity of this habitat type for both baseline and disturbance monitoring. Management needs and implications are also addressed. (Completed)

Species-habitat relational database. One component of a previous project (Status and trends of estuarine living resources) is a checklist of species known to occur within the project area. The checklist was designed as a comprehensive resource document for managers and trustees of coastal resources, for planners contemplating coastal development, for researchers, and for teachers and students interested in estuarine biology. A tabular format was used to present the original information for a total of 3,178 species. This project creates an electronic relational database using the existing information contained in the checklist, in order to facilitate an examination of species richness within each habitat type, a relative comparison between habitats, and identification of selected species which require multiple habitats for their survival. (Completed)

Evaluation of shrimp trawl bycatch reduction devices. Shrimp trawl bycatch in the bay shrimp industry is of growing concern to the industry, management agencies, and concerned citizen groups. Bycatch reduction through the use of in-trawl devices is one viable option to address the issue. Studies have been conducted to assess bycatch, but no studies have been conducted (in Texas bays) to assess the effectiveness of alternative bycatch reduction devices. This demonstration project is a cooperative effort with the bay shrimp industry, and regulatory and research entities. Its goals are

to evaluate, through paired trawl studies, the effectiveness of three bycatch reduction devices, and to estimate the cost of installing and using each device. (Scheduled completion: August 1998)

Atmospheric deposition monitoring and assessment. The study will be the first attempt to characterize atmospheric deposition in the vicinity of local bays, and to estimate loading rates of selected parameters in wet-fall and dry-fall. Two monitoring stations will be established to collect data for one year on a weekly basis, using methodology established by and consistent with the National Atmospheric Deposition Program (NADP). (Scheduled completion: August 1998)

Estimation of regional and statewide economic impacts. Recreation and commercial values associated with natural resources are often overlooked or understated, especially where decisions must be made about location or operation of development projects that may alter, modify, or destroy such resources. Since commercial developments are marketed through organized private treaty markets, their values are readily determined and widely known. Conversely, many uses of the bays and estuaries are nonconsumptive uses and common property uses. As such, the assignment or estimation of economic values for these types of uses are generally understated and the economic impacts of these resource uses generally undervalued. This project derives direct, indirect, and induced economic impacts associated with three categories of economic activities: bay-dependent; bay-related (through maritime transportation needs); and other basic activities. Impacts are aggregated at the 12 county regional level and statewide. (Completed)

Assessment of on-site sewage system facilities (OSSF). Many residential subdivisions have been located beyond the limits of organized water and sewerage facilities, causing residents to rely on individual OSSFs, sometimes in areas unsuitable for conventional septic systems. Widespread soil saturation, malfunctioning of treatment units, improper maintenance, visible sewerage on ground surface and in roadside ditches, and strained relations with neighbors are but a few of the many impacts. The environmental and/or public health impacts are not well known. This project assesses the current programs, problems, and needs related to OSSFs in four counties (Aransas, Nueces, Refugio, and San Patricio) and makes recommendations to help improve OSSF management in the context of the state's recent changes to the OSSF rules. (Completed)

Regional monitoring strategy (RMS). The monitoring strategy provides the means to evaluate the effectiveness of the ***Coastal Bend Bays Plan*** (CBBP). It will: 1) Provide data necessary to measure the effectiveness of the CBBP and 2) Provide data that can be used to redirect and refocus the CBBP. A comprehensive environmental monitoring program will generate data that can be used to: 1) Identify trends in water/sediment quality, natural resources, and uses of the estuaries; and 2) Identify possible causes of these trends. The proposed monitoring program may largely be accomplished by improving coordination of existing monitoring programs in the project area, to the extent that is possible, and by using data already being collected for other purposes. (Completed)

Action Plan Demonstration Project: Oso Creek/Parkway protection and enhancement. The City of Corpus Christi owns considerable property along Oso Creek that has problems with illegal dumping and disturbance to mudflats and wetlands. This project is intended to provide measures that minimize disturbance to sensitive areas, and to create a system of nature trails, observation platforms, and interpretive informational signage. This project will be an example of integrating resource protection, access, and environmental education. (Scheduled Completion: March 1999)

Public Access Plan. This project addresses the need to improve existing public access sites and/or develop additional well-managed sites in order to protect coastal natural resources while providing the bay user with an enjoyable experience. The public access plan profiles each public access site and includes type of access and facilities, general condition, level of use, adjacent activities, and environmental conditions. Included are recommended site improvement plans for key sites that have been identified in coordination with local representatives from the area and possible funding sources with which to make the improvements. (Completed)

State of the Bay Report. This report synthesizes the results of approximately 30 CCBNEP characterization reports and uses this information to assess the ecological health of the bays and estuaries that comprise the project area. The report includes a historical perspective of the land and the people, a primer on ecological processes, an explanation of the importance of estuaries, consequences of reducing the integrity of the bay system, the role of the CCBNEP/CBBEP, and an overview of the state of the bay and where we stand today. Such priority issues as public health, habitat and living resources, freshwater inflow, and water quality are all discussed. The report concludes with recommendations for improving the state of the bay in areas that have proven to be degraded. (Completed)

APPENDIX G
Action Plan Summary Tables

Bay Tourism and Recreation Action Plan — Summary Table

Action	Title	Partners	Total Anticipated Cost
BTR-1	Encourage and assist regional tourism organizations to adopt a 'theme' of resource protection and stewardship in their promotion of tourism.	CBBF, CBBEP, RTC, GCCBA, Area COC, USCG (Waterways Management Section), TPWD, other partners	$20,000 per year
BTR-2	Provide for the appropriate number of improved, well-managed public access sites.	CBBEP, TGLO, CCC, Local governments, TPWD, CCA, CCBF, USFWS	To be determined on a project-by-project basis
BTR-3	Develop and implement management strategies to reduce or avoid impacts from recreational uses.	ANWR, TPWD, TGLO, Audubon, CBBEP, CCA, Sierra Club, CBBF, USFWS, NMFS, USCG, Local governments, Marina owners, TNRCC, USEPA, USACE, COAST	$80,000, plus ½ person/year
BTR-4	Enhance the recreational fishery through artificial reefs or restored natural reefs.	TPWD, Texas Sea Grant, TGLO, CCA, NMFS, CBBF, USCG	$25,000 initially

Bay Debris Action Plan — Summary Table

Action	Title	Partners	Total Anticipated Cost
BD-1	Reduce the amount of debris reaching the bays due to improper trash disposal or inadequate solid waste management.	CBCOG, Local governments, Drainage districts, Solid waste management professionals, TNRCC, CBBEP, other stakeholders, TGLO, CBBF, Elected officials	To be determined on a project-by-project basis

Public Health Action Plan — Summary Table

Action	Title	Partners	Total Anticipated Cost
PH-1	Facilitate a regional approach to recreational water quality management.	CBBEP, Contact recreation workgroup, County and municipal health officials, TDH, TNRCC, USEPA, TPWD, Contact recreation associations, Elected officials	$80,000
PH-2	Conduct health risk assessments associated with consumption of seafood in suspect areas.	TDH, TNRCC, USEPA, County and municipal health officials, PICC, Universities, Sierra Club, TPWD	To be determined
PH-3	Develop and implement a method to collect epidemiological and injury data from regional and local health care providers.	TAMU-CC/College of Science, TDH, CDC, Nueces County DPH, Health care providers	To be determined

Shoreline Management Action Plan — Summary Table

Action	Title	Partners	Total Anticipated Cost
SM-1	Conduct a shoreline inventory to gain a site-specific understanding of shoreline management needs.	CBBEP, TGLO, Regional Shoreline Advisory Council, USFWS, SWCD, NRCS, PCCA, Navigation districts, Local governments	$165,000
SM-2	Assist local governments with shoreline management issues.	CBBEP, TGLO, CBCOG, Regional Shoreline Advisory Council, SWCD, USFWS, OPUS, PCCA, Navigation districts, TPWD, Texas Sea Grant, Landowners, USACE, PICC, AGC, CBBF, Local governments	$75,000 initially, plus $60,000 per year thereafter
SM-3	Establish a locally administered Land Trust Fund to augment public access, sensitive habitat protection, and open space preservation.	CBBF, Local governments, Nature Conservancy, Audubon Society, Fish and Wildlife Service, TPWD, TGLO, Regional Shoreline Advisory Council, Habitat and Living Resources Workgroup	$20,000 per year

Maritime Commerce Action Plan — Summary Table

Action	Title	Partners	Total Anticipated Cost
MC-1	Support construction of a 125 foot wide barge shelf on both sides of the ship channel to a depth of 15 feet.	PCCA, USACE, Commercial and recreational vessel operators, Aransas-Corpus Christi Pilots, 404 permit reviewers	$2,000,000 plus 1 full- time person for 2 years
MC-2	Modify the height, size, position, and light intensity of existing navigation ranges and add new ranges where necessary.	Aransas-Corpus Christi Pilots, PCCA, USCG	$12,500 per year plus ⅛ full-time person until completed
MC-3	Modernize the vessel traffic system and aids to navigation.	PCCA, TGLO, TCOON, NOAA, Aransas-Corpus Christi Pilots, USCG, Blucher Institute, Vessel operators, PICC	<$5,000, plus ½ full-time person. $139,000 already committed by PCCA for STEP 1.
MC-4	Increase vessel operator training regarding safe operating procedures, rules of the road, and local navigation hazards.	Aransas-Corpus Christi Pilots, Shipping companies, TGLO, USCG, TSPA, Texas Shrimpers Association, Texas Waterway Operators, OMSA, U.S. Navy	Approximately $70,000/yr
MC-5	Maintain and improve regional oil spill response capability.	USCG, TGLO, TNRCC, STCZAC, TRC, USEPA, NOAA, PICC, LEPC	To be determined
MC-6	Coordinate hazardous material spill response planning and resources to ensure adequate public protection.	USCG, TNRCC, LEPC, City of Corpus Christi, PICC, STCZAC, USEPA	To be determined
MC-7	Establish an interagency forum to coordinate pipeline mapping and contingency planning.	TRC, City of Corpus Christi, PICC, Pipeline companies, LEPC, TGLO, USACE, RSPA	To be determined
MC-8	Prevent the introduction of non-native species through improved ballast water management.	USCG, CBBEP, ACCP, TPWD, USFWS, Texas Sea Grant, Vessel owners and operators, Charter parties, PICC	$25,000 initially

Dredging Action Plan — Summary Table

Action	Title	Partners	Total Anticipated Cost
D-1	Establish a proactive Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material.	CBBEP, PCCA, USACE, TGLO, TNRCC, TPWD, NMFS, USEPA, TXDOT, USFWS, UTMSI, TAMU-CC, TWDB, Texas Sea Grant, Dredging industry, CBBF, CCA	To be determined
D-2	Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	PCCA, CBBEP, USACE, TGLO, TNRCC, TPWD, NMFS, USEPA, TXDOT, USFWS, UTMSI, TAMU-CC, TWDB, Texas Sea Grant, Dredging industry, CBBF, CCA	To be determined
D-3	Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	TXDOT (GIWW),CBBEP, PCCA, USACE, TGLO, TNRCC, TPWD, NMFS, USEPA, USFWS, UTMSI, TAMU-CC, TWDB, Texas Sea Grant, Dredging industry, CBBF, CCA, Residential developers, Local governments, others as appropriate	To be determined

Habitat and Living Resources Action Plan — Summary Table

Action	Title	Partners	Total Anticipated Cost
HLR-1	Preserve functional, natural habitats of all major types.	CBBEP, TPWD, CBBF, TGLO, Center for Coastal Studies, USFWS, TNC, Audubon, PCCA, UTMSI, USCG, NRCS, USGS, TSSWCB, SWCDs, Local governments, Landowners, other stakeholders	$25,000 plus implementation funds to be determined on a project-by-project basis
HLR-2	Create new habitats and/or restore degraded habitats where feasible.	CBBEP, TGLO, TPWD, Center for Coastal Studies, CBBF, UTBEG, UTMSI, USFWS, USGS, PCCA, CCA, NMFS, USACE	$25,000 plus implementation funds to be determined on a project-by-project basis
HLR-3	Determine and manage the impact(s) of seismic activities and operations requiring state and/or local permits on coastal habitats and associated fauna.	CBBEP, TGLO, TPWD, CCS, CBBF, UTBEG, UTMSI, USFWS, USGS, NMFS, TRC, Seismic Industry, City of Corpus Christi	$68,000
HLR-4	Develop management plans to ensure sustainability for species of concern.	Audubon Sanctuaries Program, TPWD, CCA, NMFS, TMMSN, STSSN, USFWS, Coastal Bend Botanical Gardens, TGLO, Audubon Society, Sierra Club, CBBF, TNC, Universities, Canadian Wildlife Service, Texas Sea Grant, PINS, PCCA, USCG, NRCS Plant Material Center	$115,000
HLR-5	Improve animal rescue and rehabilitation programs.	CBBEP, TMMSN, STSSN, TSA, USFWS, NMFS, TPWD, TAMU-CC, UTMSI, PINS, USGS, Private conservation groups, Citizens	<$5,000 initially plus additional costs to develop plans
HLR-6	Facilitate consensus on a regional approach to effective management of bay and bait shrimping.	CBBEP, Regional Shrimping Advisory Board, TPWD, TSPA, Texas Shrimpers Association, NMFS, Texas Sea Grant, TGLO, Universities, CBBF, CCA, Sierra Club, other stakeholders	<$5,000 initially plus additional costs to develop and implement a shrimp management plan
HLR-7	Reduce bycatch from bay shrimp trawling.	TPWD, TSPA, CBBEP, Texas Sea Grant, NMFS, CCA, Universities, CBBF	$10,000 plus additional funds to be determined based on need for additional studies
HLR-8	Reduce impacts on living resources associated with industrial cooling water intake.	CPL, TPWD, NMFS, TNRCC, USEPA	$60,000
HLR-9	Minimize the impacts and reduce the occurrence of harmful algal blooms.	CBBEP, UTMSI, State and federal resource agencies, Research institutions	$55,000 plus implementation funds to be determined on a project-by-project basis
HLR-10	Develop management plans to minimize introductions and impacts from non-native species.	CCS, TPWD, USFWS, NMFS, NRCS, Research institutions, Conservation groups, USGS, TAES, Texas Sea Grant, GOMP	$25,000 plus additional funds for demonstration and control projects

Water and Sediment Quality Action Plan — Summary Table

Action	Title	Partners	Total Anticipated Cost
WSQ-1	Implement plans to improve water and sediment quality in identified segments.	CBBEP, TNRCC, PICC, City of Corpus Christi, other Local governments, USEPA, TPWD, CBBF, USFWS, Sierra Club, other stakeholders, NMFS, USGS, Industries	$15,000 to support a focused assessment process for the project area. Assessment coincides with TNRCC and USEPA programs. Remediation measures will require additional funding. Use of the State Revolving Fund (SRF) will be explored for the implementation of management activities.
WSQ-2	Support the implementation of permitting rules for shrimp farms and other aquaculture facilities.	TNRCC, TPWD, USEPA, Local governments, CBBF, CCA, EDF, Bay shrimpers, Texas Shrimp Association, other stakeholders, Public organizations, Aquaculture permittees	Programs are already in effect to address aquaculture. New costs should be minimal.
WSQ-3	Quantify total constituent loadings.	TNRCC, TSSWCB, CBBEP, TDA, USEPA, NRCS, USGS, UTMSI, City of Corpus Christi, other Local governments, Point source discharge permittees, every local/state/federal/academic entity involved in data collection and monitoring, CBBF, Sierra Club, other stakeholders	$300,000 over 5-10 years
WSQ-4	Undertake an analysis of the biological and ecological effects of selected constituents.	TNRCC, CBBEP, TDA, USEPA, TPWD, Local governments, other stakeholders, UTMSI, Texas Sea Grant, NMFS, TSSWCB, NRCS, USGS	$225,000 (variable based on constituents of concern)
WSQ-5	Ensure that water quality standards and sediment quality criteria are adequate and appropriate.	TNRCC, CBBEP, TPWD, USEPA, PICC, City of Corpus Christi, CBBF, Sierra Club, USGS, NMFS, other stakeholders	To be determined

Nonpoint Source Management Action Plan — Summary Table

Action	Title	Partners	Total Anticipated Cost
NPS-1	Develop a regional handbook of urban nonpoint source pollution Best Management Practices for voluntary use by local governments seeking to implement nonpoint source pollution prevention programs.	CBBEP, TNRCC, CBCOG, Local governments, TXDOT, TGLO, USFWS, other stakeholders	$45,000
NPS-2	Provide compliance assistance to small businesses and industries in the region that are subject to the NPDES permit program or have nonpoint source control needs.	CBBEP, USEPA, TNRCC, TGLO, Local governments, County/rural stakeholders, TXDOT, Business/civic organizations, Industries	$15,000
NPS-3	Assist local governments to implement On-Site Sewage Facility (OSSF) programs.	CBCOG, Local governments, TNRCC, CBBEP	$30,000/year (grant writer hours). This action will facilitate the acquisition of grant funds at a minimum cost.
NPS-4	Coordinate and implement agricultural water quality management programs necessary to meet water quality standards.	TSSWCB, Local SWCDs, NRCS, TAEX, USEPA, Cooperating agricultural producers	$2,535,000 over 7 years (includes $966,000 from existing TSSWCB sources, and $1,569,000 from new sources). Investigate use of SRF for additional funding.

Freshwater Resources Action Plan — Summary Table

Action	Title	Partners	Total Anticipated Cost
FW-1	Improve scientific understanding of the freshwater needs of the estuaries.	TWDB, TNRCC, TPWD, City of Corpus Christi, USGS, CBBEP, TGLO, NEAC, CBBF, other stakeholders, USEPA, TDH	This action coincides with existing programs. New monitoring will require some funding.
FW-2	Assist the Coastal Bend Regional Water Planning Group and regional water managers to incorporate the needs of estuaries in comprehensive planning.	Coastal Bend Regional Water Planning Group, City of Corpus Christi, TNRCC, PICC, TPWD, other stakeholders, TWDB, TGLO	Costs for plan development will be provided primarily by the Texas Water Development Board and citizens of the Coastal Bend Regional Water Planning area. Initiation of reuse projects will require funding.
FW-3	Support efforts that directly contribute to increased freshwater flow events into the bays and estuaries of the Coastal Bend.	CBBEP, U.S. Bureau of Reclamation, Private landowners, USGS, TWDB, University of Texas Marine Science Institute, City of Corpus Christi	To be determined
FW-4	Effectively communicate the purpose and results of ongoing freshwater plans and programs.	City of Corpus Christi, Coastal Bend Regional Water Planning Group, TNRCC, TPWD, TWDB, CBBEP	Minimal

Public Education and Outreach Action Plan — Summary Table

Action	Title	Partners	Total Anticipated Cost
PEO-1	Develop and implement a regional Public Education and Outreach Strategy.	CBBEP, TPWD, Texas Sea Grant, Texas State Aquarium, City of Corpus Christi, School districts	$120,000 per year plus 2 full-time personnel
PEO-2	Establish a Bay Day celebration to focus attention on bay resources and uses.	CBBEP, City of Corpus Christi, Regional Chambers of Commerce, Local governments, Resource agencies, Civic groups	To be determined
PEO-3	Provide curricula for all levels of environmental education and promote greater use of outdoor educational facilities as a means of reaching children, young people, and adults.	Texas State Aquarium, TPWD, CBBEP, Educational Service Center, Texas Environmental Advisory Council, Curriculum coordinators, TEA Region 2 & 3, USEPA, TGLO, USFWS, Landowners, City/county parks and recreation safety officer and representative, PICC, TNRCC, Center for Coastal Studies	$86,000 per year plus ¾ full-time person
PEO-4	Conduct public forums to increase dialogue between resource managers and users.	CBBF, CBBEP, Resource agencies, General public, Conservation organizations, User groups, TAMU-CC	$13,500 per year, plus ¼ full-time person
PEO-5	Promote public participation and recognition programs to protect the bay system and its resources.	CBBEP, CBBF, CBCOG, Volunteer programs (such as Adopt-a-Wetland, Adopt-a-Habitat, Bay Cleanup, Shoreline restoration projects, Major Rivers, Aquatic Wild, Texas Watch), City of Corpus Christi, Civic groups, Schools, PICC, Resource agencies	To be determined

APPENDIX H
Potential Implementing Entities

404 Permit Reviewers

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Maritime Commerce Action Plan				
MC-1	Support construction of a 125 foot wide barge shelf on both sides of the ship channel to a depth of 15 feet.	59		Steps 1-3

ACCP

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Maritime Commerce Action Plan				
MC-8	Prevent the introduction of non-native species through improved ballast water management.	66	Step 2	

AGC

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Shoreline Management Action Plan				
SM-2	Assist local governments with shoreline management issues.	48		Steps 1 and 2

Agricultural Producers

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Nonpoint Source Management Action Plan				
NPS-4	Coordinate and implement agricultural water quality management programs necessary to meet water quality standards.	120		Steps 1-4

ANWR

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-3	Develop and implement management strategies to reduce or avoid impacts from recreational uses.	35	Step 1	

Aquaculture Permittees

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Water and Sediment Quality Action Plan				
WSQ-2	Support the implementation of permitting rules for shrimp farms and other aquaculture facilities.	109		Step 4

Aransas-Corpus Christi Pilots

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Maritime Commerce Action Plan				
MC-1	Support construction of a 125 foot wide barge shelf on both sides of the ship channel to a depth of 15 feet.	59		Steps 1-3
MC-2	Modify the height, size, position, and light intensity of existing navigation ranges and add new ranges where necessary.	60	Steps 1 and 2	Step 3
MC-3	Modernize the vessel traffic system and aids to navigation.	61		Steps 1-3
MC-4	Increase vessel operator training regarding safe operating procedures, rules of the road, and local navigation hazards.	62	Steps 1 and 2	

Audubon Sanctuaries Program

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Habitat and Living Resources Action Plan				
HLR-4	Develop management plans to ensure sustainability for species of concern.	89	Step 1	

Audubon Society

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-3	Develop and implement management strategies to reduce or avoid impacts from recreational uses.	35	Step 3	
Shoreline Management Action Plan				
SM-3	Establish a locally administered Land Trust Fund to augment public access, sensitive habitat protection, and open space preservation.	50		Step 1

Habitat and Living Resources Action Plan				
HLR-1	Preserve functional, natural habitats of all major types.	85		Steps 1 and 2
HLR-4	Develop management plans to ensure sustainability for species of concern.	89		Step 1

Bay Shrimpers

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Water and Sediment Quality Action Plan				
WSQ-2	Support the implementation of permitting rules for shrimp farms and other aquaculture facilities.	109		Steps 1 and 2

Blucher Institute

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Maritime Commerce Action Plan				
MC-3	Modernize the vessel traffic system and aids to navigation.	61		Steps 1-3

Canadian Wildlife Service

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Habitat and Living Resources Action Plan				
HLR-4	Develop management plans to ensure sustainability for species of concern.	89		Step 1

CBBEP

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-1	Encourage and assist regional tourism organizations to adopt a 'theme' of resource protection and stewardship in their promotion of tourism.	33	Step 2	
BTR-2	Provide for the appropriate number of improved, well-managed public access sites.	34	Step 1	
BTR-3	Develop and implement management strategies to reduce or avoid impacts from recreational uses.	35	Step 5	Step 1

Bay Debris Action Plan				
BD-1	Reduce the amount of debris reaching the bays due to improper trash disposal or inadequate solid waste management.	39		Step 1
Public Health Action Plan				
PH-1	Facilitate a regional approach to recreational water quality management	42	Steps 1-3	
Shoreline Management Action Plan				
SM-1	Conduct a shoreline inventory to gain a site-specific understanding of shoreline management needs.	46	Steps 1 and 2	
SM-2	Assist local governments with shoreline management issues.	48	Steps 1, 3, and 4	
Maritime Commerce Action Plan				
MC-8	Prevent the introduction of non-native species through improved ballast water management.	66	Steps 1 and 2	
Dredging Action Plan				
D-1	Establish a proactive Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material.	68	Step 1	Steps 2-5
D-2	Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	70	Step 2	
D-3	Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	72	Step 2	
Habitat and Living Resources Action Plan				
HLR-1	Preserve functional, natural habitats of all major types.	85	Step 1	Step 2
HLR-2	Create new habitats and/or restore degraded habitats where feasible.	86	Steps 1 and 2	
HLR-3	Determine and manage impact(s) of seismic activities and operations requiring state and/or local permits on coastal habitats and associated fauna.	87	Steps 1 and 2	
HLR-5	Improve animal rescue and rehabilitation programs.	91	Step 1	
HLR-6	Facilitate consensus on a regional approach to effective management of bay and bait shrimping.	93	Step 1	
HLR-7	Reduce bycatch from bay shrimp trawling.	94	Step 2	Step 1
HLR-9	Minimize the impacts and reduce the occurrence of harmful algal blooms.	96	Step 1	Steps 2-6
Water and Sediment Quality Action Plan				
WSQ-1	Implement plans to improve water and sediment quality in identified segments.	107	Steps 1-3	
WSQ-3	Quantify total constituent loadings.	111	Step 3	Step 1
WSQ-4	Undertake an analysis of the biological and ecological effects of selected constituents.	113	Step 1	
WSQ-5	Ensure that water quality standards and sediment quality criteria are adequate and appropriate.	114	Steps 1-3	

Nonpoint Source Management Action Plan				
NPS-1	Develop a regional handbook of urban nonpoint source pollution Best Management Practices for voluntary use by local governments seeking to implement nonpoint source pollution prevention programs.	117	Steps 1 and 2	
NPS-2	Provide compliance assistance to small businesses and industries in the region that are subject to the NPDES permit program or have nonpoint source control needs.	118	Steps 1 and 2	
NPS-3	Assist local governments to implement On-Site Sewage Facility (OSSF) programs.	119		Steps 1-3
Freshwater Resources Action Plan				
FW-1	Improve scientific understanding of the freshwater needs of the estuaries.	130	Step 5	
FW-3	Support efforts that directly contribute to increased freshwater flow events into the bays and estuaries of the Coastal Bend.	134	Step 1	
FW-4	Effectively communicate the purpose and results of ongoing freshwater plans and programs.	135		Step 1
Public Education and Outreach Action Plan				
PEO-1	Develop and implement a regional Public Education and Outreach Strategy.	144	Steps 1-5	
PEO-2	Establish a Bay Day celebration to focus attention on bay resources and uses.	146	Steps 1-3	
PEO-3	Provide curricula for all levels of environmental education and promote greater use of outdoor educational facilities as a means of reaching children, young people, and adults.	147	Steps 3 and 4	
PEO-4	Conduct public forums to increase dialogue between resource managers and users.	149	Step 2	
PEO-5	Promote public participation and recognition programs to protect the bay system and its resources.	150	Steps 1 and 2	

CBBF

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-1	Encourage and assist regional tourism organizations to adopt a 'theme' of resource protection and stewardship in their promotion of tourism.	33	Step 1	
BTR-2	Provide for the appropriate number of improved, well-managed public access sites.	34		Step 1
BTR-3	Develop and implement management strategies to reduce or avoid impacts from recreational uses.	35		Steps 1-7
BTR-4	Enhance the recreational fishery through artificial reefs or restored natural reefs as appropriate.	37		Steps 1-3

Bay Debris Action Plan				
BD-1	Reduce the amount of debris reaching the bays due to improper trash disposal or inadequate solid waste management.	39		Step 2
Shoreline Management Action Plan				
SM-2	Assist local governments with shoreline management issues.	48		Steps 1 and 2
SM-3	Establish a locally administered Land Trust Fund to augment public access, sensitive habitat protection, and open space preservation.	50	Steps 1-3	
Dredging Action Plan				
D-1	Establish a proactive Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material.	68		Steps 1-5
D-2	Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	70		Steps 1 and 2
D-3	Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	72		Steps 1 and 2
Habitat and Living Resources Action Plan				
HLR-1	Preserve functional, natural habitats of all major types.	85	Step 2	Step 1
HLR-2	Create new habitats and/or restore degraded habitats where feasible.	86		Steps 1 and 2
HLR-3	Determine and manage impact(s) of seismic activities and operations requiring state and/or local permits on coastal habitats and associated fauna.	87		Steps 1-3
HLR-4	Develop management plans to ensure sustainability for species of concern.	89		Steps 1 and 2
HLR-6	Facilitate consensus on a regional approach to effective management of bay and bait shrimping.	93		Steps 1-3
HLR-7	Reduce bycatch from bay shrimp trawling.	94		Steps 1 and 2
Water and Sediment Quality Action Plan				
WSQ-1	Implement plans to improve water and sediment quality in identified segments.	107		Steps 1-3
WSQ-2	Support the implementation of permitting rules for shrimp farms and other aquaculture facilities.	109		Steps 1 and 2
WSQ-3	Quantify total constituent loadings.	111		Step 3
WSQ-5	Ensure that water quality standards and sediment quality criteria are adequate and appropriate.	114		Steps 1-3
Freshwater Resources Action Plan				
FW-1	Improve scientific understanding of the freshwater needs of the estuaries.	130		Step 3

Public Education and Outreach Action Plan				
PEO-4	Conduct public forums to increase dialogue between resource managers and users.	149	Step 1	Step 2
PEO-5	Promote public participation and recognition programs to protect the bay system and its resources.	150	Step 3	

CBCOG

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Debris Action Plan				
BD-1	Reduce the amount of debris reaching the bays due to improper trash disposal or inadequate solid waste management.	39	Steps 1 and 3	
Shoreline Management Action Plan				
SM-2	Assist local governments with shoreline management issues.	48	Step 2	
Nonpoint Source Management Action Plan				
NPS-1	Develop a regional handbook of urban nonpoint source pollution Best Management Practices for voluntary use by local governments seeking to implement nonpoint source pollution prevention programs.	117		Steps 1 and 2
NPS-3	Assist local governments to implement On-Site Sewage Facility (OSSF) programs.	119	Steps 1-3	
Public Education and Outreach Action Plan				
PEO-5	Promote public participation and recognition programs to protect the bay system and its resources.	150		Step 1

CCA

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-2	Provide for the appropriate number of improved, well-managed public access sites.	34		Step 1
BTR-3	Develop and implement management strategies to reduce or avoid impacts from recreational uses.	35	Step 7	Steps 1-6
BTR-4	Enhance the recreational fishery through artificial reefs or restored natural reefs as appropriate.	37		Steps 1-3

Dredging Action Plan				
D-1	Establish a proactive Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material.	68		Steps 1-5
D-2	Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	70		Steps 1 and 2
D-3	Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	72		Steps 1 and 2
Habitat and Living Resources Action Plan				
HLR-2	Create new habitats and/or restore degraded habitats where feasible.	86		Steps 1 and 2
HLR-4	Develop management plans to ensure sustainability for species of concern.	89	Step 2	Step 4
HLR-6	Facilitate consensus on a regional approach to effective management of bay and bait shrimping.	93		Steps 1-3
HLR-7	Reduce bycatch from bay shrimp trawling.	94		Steps 1 and 2
Water and Sediment Quality Action Plan				
WSQ-2	Support the implementation of permitting rules for shrimp farms and other aquaculture facilities.	109		Steps 1 and 2

CCC

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-2	Provide for the appropriate number of improved, well-managed public access sites.	34	Step 1	

CCS

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Habitat and Living Resources Action Plan				
HLR-1	Preserve functional, natural habitats of all major types.	85		Steps 1 and 2
HLR-2	Create new habitats and/or restore degraded habitats where feasible.	86		Steps 1 and 2
HLR-3	Determine and manage impact(s) of seismic activities and operations requiring state and/or local permits on coastal habitats and associated fauna.	87		Steps 1-3
HLR-10	Develop management plans to minimize introductions and impacts from non-native species.	98	Steps 1 and 2	

Public Education and Outreach Action Plan				
PEO-3	Provide curricula for all levels of environmental education and promote greater use of outdoor educational facilities as a means of reaching children, young people, and adults.	147		Step 3

CDC

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Public Health Action Plan				
PH-3	Develop and implement a method to collect epidemiological and injury data from regional and local health care providers.	44		Step 1

Charter Parties

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Maritime Commerce Action Plan				
MC-8	Prevent the introduction of non-native species through improved ballast water management.	66		Steps 1-3

Citizens/Stakeholders/Public Organizations/Civic Groups

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Debris Action Plan				
BD-1	Reduce the amount of debris reaching the bays due to improper trash disposal or inadequate solid waste management.	39		Step 1
Habitat and Living Resources Action Plan				
HLR-1	Preserve functional, natural habitats of all major types.	85		Steps 1 and 2
HLR-5	Improve animal rescue and rehabilitation programs.	91		Steps 1-4
HLR-6	Facilitate consensus on a regional approach to effective management of bay and bait shrimping.	93		Steps 1-3

Water and Sediment Quality Action Plan				
WSQ-1	Implement plans to improve water and sediment quality in identified segments.	107		Steps 1-3
WSQ-2	Support the implementation of permitting rules for shrimp farms and other aquaculture facilities.	109		Steps 1-3
WSQ-3	Quantify total constituent loadings.	111		Step 3
WSQ-4	Undertake an analysis of the biological and ecological effects of selected constituents.	113		Steps 1 and 2
WSQ-5	Ensure that water quality standards and sediment quality criteria are adequate and appropriate.	114		Steps 1-3
Nonpoint Source Management Action Plan				
NPS-1	Develop a regional handbook of urban nonpoint source pollution Best Management Practices for voluntary use by local governments seeking to implement nonpoint source pollution prevention programs.	117		Steps 1 and 2
NPS-2	Provide compliance assistance to small businesses and industries in the region that are subject to the NPDES permit program or have nonpoint source control needs.	118		Step 2
Freshwater Resources Action Plan				
FW-1	Improve scientific understanding of the freshwater needs of the estuaries.	130		Step 3
FW-2	Assist the Coastal Bend Regional Water Planning Group and regional water managers to incorporate the needs of estuaries in comprehensive planning.	132		Steps 1-4
Public Education and Outreach Action Plan				
PEO-2	Establish a Bay Day celebration to focus attention on bay resources and uses.	146		Steps 1-3
PEO-4	Conduct public forums to increase dialogue between resource managers and users.	149		Steps 1 and 2
PEO-5	Promote public participation and recognition programs to protect the bay system and its resources.	150		Step 2

City/County Parks and Recreation Safety Officer and Representative

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Public Education and Outreach Action Plan				
PEO-3	Provide curricula for all levels of environmental education and promote greater use of outdoor educational facilities as a means of reaching children, young people, and adults.	147		Step 2

City of Corpus Christi

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Maritime Commerce Action Plan				
MC-6	Coordinate hazardous material spill response planning and resources to ensure adequate public protection.	64		Steps 1-3
MC-7	Establish an interagency forum to coordinate pipeline mapping and contingency planning.	65		Steps 1 and 2
Habitat and Living Resources Action Plan				
HLR-3	Determine and manage impact(s) of seismic activities and operations requiring state and/or local permits on coastal habitats and associated fauna.	87		Steps 1-3
Water and Sediment Quality Action Plan				
WSQ-1	Implement plans to improve water and sediment quality in identified segments.	107		Steps 1 and 3
WSQ-3	Quantify total constituent loadings.	111		Step 1
WSQ-5	Ensure that water quality standards and sediment quality criteria are adequate and appropriate.	114		Steps 1-3
Freshwater Resources Action Plan				
FW-1	Improve scientific understanding of the freshwater needs of the estuaries.	130	Step 3	Steps 1, 2, 4, and 5
FW-2	Assist the Coastal Bend Regional Water Planning Group and regional water managers to incorporate the needs of estuaries in comprehensive planning.	132	Steps 2-4	Step 1
FW-3	Support efforts that directly contribute to increased freshwater flow events into the bays and estuaries of the Coastal Bend.	134		Step 2
FW-4	Effectively communicate the purpose and results of ongoing freshwater plans and programs.	135	Step 1	
Public Education and Outreach Action Plan				
PEO-1	Develop and implement a regional Public Education and Outreach Strategy.	144		Steps 1-5
PEO-2	Establish a Bay Day celebration to focus attention on bay resources and uses.	146		Steps 1-3
PEO-5	Promote public participation and recognition programs to protect the bay system and its resources.	150		Step 2

COAST

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-3	Develop and implement management strategies to reduce or avoid impacts from recreational uses.	35		Steps 5 and 6

Coastal Bend Botanical Gardens

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Habitat and Living Resources Action Plan				
HLR-4	Develop management plans to ensure sustainability for species of concern.	89	Step 5	

Coastal Bend Regional Water Planning Group

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Freshwater Resources Action Plan				
FW-2	Assist the Coastal Bend Regional Water Planning Group and regional water managers to incorporate the needs of estuaries in comprehensive planning.	132	Steps 1-4	
FW-4	Effectively communicate the purpose and results of ongoing freshwater plans and programs.	135	Step 1	

COC

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-1	Encourage and assist regional tourism organizations to adopt a 'theme' of resource protection and stewardship in their promotion of tourism.	33		Steps 1 and 2
Public Education and Outreach Action Plan				
PEO-2	Establish a Bay Day celebration to focus attention on bay resources and uses.	146		Steps 1-3

Commercial and Recreational Vessel Operators/Owners

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Maritime Commerce Action Plan				
MC-1	Support construction of a 125 foot wide barge shelf on both sides of the ship channel to a depth of 15 feet.	59		Steps 1-3
MC-3	Modernize the vessel traffic system and aids to navigation.	61		Steps 1-3
MC-8	Prevent the introduction of non-native species through improved ballast water management.	66		Steps 1-3

Conservation Organizations/Private Conservation Groups

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Habitat and Living Resources Action Plan				
HLR-5	Improve animal rescue and rehabilitation programs.	91		Steps 1-4
HLR-10	Develop management plans to minimize introductions and impacts from non-native species.	98		Steps 1-3
Public Education and Outreach Action Plan				
PEO-4	Conduct public forums to increase dialogue between resource managers and users.	149		Steps 1 and 2

Contact Recreation Associations

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Public Health Action Plan				
PH-1	Facilitate a regional approach to recreational water quality management	42		Step 1

Contact Recreation Workgroup

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Public Health Action Plan				
PH-1	Facilitate a regional approach to recreational water quality management	42	Steps 2 and 3	

County and Municipal Health Officials

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Public Health Action Plan				
PH-1	Facilitate a regional approach to recreational water quality management	42		Step 1
PH-2	Conduct health risk assessments associated with consumption of seafood in suspect areas.	43		Steps 1-3

CPL

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Habitat and Living Resources Action Plan				
HLR-8	Reduce impacts on living resources associated with industrial cooling water intake.	95	Steps 1-3	

Curriculum Coordinators

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Public Education and Outreach Action Plan				
PEO-3	Provide curricula for all levels of environmental education and promote greater use of outdoor educational facilities as a means of reaching children, young people, and adults.	147		Steps 1, 3 and 4

Drainage Districts

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Debris Action Plan				
BD-1	Reduce the amount of debris reaching the bays due to improper trash disposal or inadequate solid waste management.	39	Step 2	

Dredging Industry

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Dredging Action Plan				
D-1	Establish a proactive Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material.	68		Steps 1-5
D-2	Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	70		Steps 1 and 2
D-3	Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	72		Steps 1 and 2

EDF

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Water and Sediment Quality Action Plan				
WSQ-2	Support the implementation of permitting rules for shrimp farms and other aquaculture facilities.	109		Steps 1 and 2

Educational Service Center

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Public Education and Outreach Action Plan				
PEO-3	Provide curricula for all levels of environmental education and promote greater use of outdoor educational facilities as a means of reaching children, young people, and adults.	147		Steps 1, 3 and 4

Elected Officials

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Debris Action Plan				
BD-1	Reduce the amount of debris reaching the bays due to improper trash disposal or inadequate solid waste management.	39		Step 3
Public Health Action Plan				
PH-1	Facilitate a regional approach to recreational water quality management.	42		Step 3

GCCBA

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-1	Encourage and assist regional tourism organizations to adopt a 'theme' of resource protection and stewardship in their promotion of tourism.	33		Steps 1 and 2

GOMP

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Habitat and Living Resources Action Plan				
HLR-10	Develop management plans to minimize introductions and impacts from non-native species.	98		Step 3

Habitat and Living Resources Workgroup

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Shoreline Management Action Plan				
SM-3	Establish a locally administered Land Trust Fund to augment public access, sensitive habitat protection, and open space preservation.	50		Steps 2 and 3

Health Care Providers

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Public Health Action Plan				
PH-3	Develop and implement a method to collect epidemiological and injury data from regional and local health care providers.	44		Steps 1 and 2

Industries

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Water and Sediment Quality Action Plan				
WSQ-1	Implement plans to improve water and sediment quality in identified segments.	107		Step 2
Nonpoint Source Management Action Plan				
NPS-2	Provide compliance assistance to small businesses and industries in the region that are subject to the NPDES permit program or have nonpoint source control needs.	118		Step 2

Landowners

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Shoreline Management Action Plan				
SM-2	Assist local governments with shoreline management issues.	48		Steps 1 and 2
Habitat and Living Resources Action Plan				
HLR-1	Preserve functional, natural habitats of all major types.	85		Steps 1 and 2
Freshwater Resources Action Plan				
FW-3	Support efforts that directly contribute to increased freshwater flow events into the bays and estuaries of the Coastal Bend.	134		Steps 1 and 2
Public Education and Outreach Action Plan				
PEO-3	Provide curricula for all levels of environmental education and promote greater use of outdoor educational facilities as a means of reaching children, young people, and adults.	147		Step 2

LEPC

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Maritime Commerce Action Plan				
MC-5	Maintain and improve regional oil spill response capability.	63		Step 3
MC-6	Coordinate hazardous material spill response planning and resources to ensure adequate public protection.	64	Step 2	Steps 1 and 3
MC-7	Establish an interagency forum to coordinate pipeline mapping and contingency planning.	65		Steps 1 and 2

Local Governments

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-2	Provide for the appropriate number of improved, well-managed public access sites.	34	Step 1	
BTR-3	Develop and implement management strategies to reduce or avoid impacts from recreational uses.	35		Steps 1-7
Bay Debris Action Plan				
BD-1	Reduce the amount of debris reaching the bays due to improper trash disposal or inadequate solid waste management.	39	Steps 1-3	

Shoreline Management Action Plan				
SM-1	Conduct a shoreline inventory to gain a site-specific understanding of shoreline management needs.	46		Steps 1-3
SM-2	Assist local governments with shoreline management issues.	48		Steps 1 and 2
SM-3	Establish a locally administered Land Trust Fund to augment public access, sensitive habitat protection, and open space preservation.	50		Step 1
Dredging Action Plan				
D-3	Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	72		Steps 1 and 2
Habitat and Living Resources Action Plan				
HLR-1	Preserve functional, natural habitats of all major types.	85		Steps 1 and 2
Water and Sediment Quality Action Plan				
WSQ-1	Implement plans to improve water and sediment quality in identified segments.	107		Steps 1-3
WSQ-2	Support the implementation of permitting rules for shrimp farms and other aquaculture facilities.	109		Steps 1-3
WSQ-3	Quantify total constituent loadings.	111		Step 1
WSQ-4	Undertake an analysis of the biological and ecological effects of selected constituents.	113		Steps 1 and 2
Nonpoint Source Management Action Plan				
NPS-1	Develop a regional handbook of urban nonpoint source pollution Best Management Practices for voluntary use by local governments seeking to implement nonpoint source pollution prevention programs.	117		Steps 1 and 2
NPS-2	Provide compliance assistance to small businesses and industries in the region that are subject to the NPDES permit program or have nonpoint source control needs.	118		Steps 1 and 2
NPS-3	Assist local governments to implement On-Site Sewage Facility (OSSF) programs.	119		Steps 1-3
Public Education and Outreach Action Plan				
PEO-2	Establish a Bay Day celebration to focus attention on bay resources and uses.	146		Steps 1-3

Local/State/Federal/Academic Entities involved in data collection and monitoring

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Water and Sediment Quality Action Plan				
WSQ-3	Quantify total constituent loadings.	111		Step 3

Local SWCDs

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Nonpoint Source Management Action Plan				
NPS-4	Coordinate and implement agricultural water quality management programs necessary to meet water quality standards.	120		Steps 1-4

Marina Owners

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-3	Develop and implement management strategies to reduce or avoid impacts from recreational uses.	35		Steps 2, 4, 5, and 7

Navigation Districts

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Shoreline Management Action Plan				
SM-1	Conduct a shoreline inventory to gain a site-specific understanding of shoreline management needs.	46		Steps 1-3
SM-2	Assist local governments with shoreline management issues.	48		Steps 1 and 2

NEAC

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Freshwater Resources Action Plan				
FW-1	Improve scientific understanding of the freshwater needs of the estuaries.	130		Step 3

NMFS

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-3	Develop and implement management strategies to reduce or avoid impacts from recreational uses.	35		Steps 1 and 2
BTR-4	Enhance the recreational fishery through artificial reefs or restored natural reefs as appropriate.	37		Steps 1-3

Dredging Action Plan				
D-1	Establish a proactive Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material.	68		Steps 1-5
D-2	Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	70		Steps 1 and 2
D-3	Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	72		Steps 1 and 2
Habitat and Living Resources Action Plan				
HLR-2	Create new habitats and/or restore degraded habitats where feasible.	86		Steps 1 and 2
HLR-3	Determine and manage impact(s) of seismic activities and operations requiring state and/or local permits on coastal habitats and associated fauna.	87		Steps 1-3
HLR-4	Develop management plans to ensure sustainability for species of concern.	89	Steps 3 and 4	Step 2
HLR-5	Improve animal rescue and rehabilitation programs.	91		Steps 1-3
HLR-6	Facilitate consensus on a regional approach to effective management of bay and bait shrimping.	93		Steps 1-3
HLR-7	Reduce bycatch from bay shrimp trawling.	94		Steps 1 and 2
HLR-8	Reduce impacts on living resources associated with industrial cooling water intake.	95		Steps 1-3
HLR-10	Develop management plans to minimize introductions and impacts from non-native species.	98		Steps 1-3
Water and Sediment Quality Action Plan				
WSQ-1	Implement plans to improve water and sediment quality in identified segments.	107		Steps 2 and 3
WSQ-4	Undertake an analysis of the biological and ecological effects of selected constituents.	113		Step 2
WSQ-5	Ensure that water quality standards and sediment quality criteria are adequate and appropriate.	114		Steps 1-3

NOAA

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Maritime Commerce Action Plan				
MC-3	Modernize the vessel traffic system and aids to navigation.	61		Step 1
MC-5	Maintain and improve regional oil spill response capability.	63		Steps 1 and 2

NRCS

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Shoreline Management Action Plan				
SM-1	Conduct a shoreline inventory to gain a site-specific understanding of shoreline management needs.	46		Steps 1-3
Habitat and Living Resources Action Plan				
HLR-1	Preserve functional, natural habitats of all major types.	85		Steps 1 and 2
HLR-4	Develop management plans to ensure sustainability for species of concern.	89		Step 5
HLR-10	Develop management plans to minimize introductions and impacts from non-native species.	98		Steps 1-3
Water and Sediment Quality Action Plan				
WSQ-3	Quantify total constituent loadings.	111		Step 1
WSQ-4	Undertake an analysis of the biological and ecological effects of selected constituents.	113		Step 2
Nonpoint Source Management Action Plan				
NPS-4	Coordinate and implement agricultural water quality management programs necessary to meet water quality standards.	120		Steps 1-4

Nueces County DPH

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Public Health Action Plan				
PH-3	Develop and implement a method to collect epidemiological and injury data from regional and local health care providers.	44		Steps 1 and 2

OMSA

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Maritime Commerce Action Plan				
MC-4	Increase vessel operator training regarding safe operating procedures, rules of the road, and local navigation hazards.	62		Steps 1 and 2

OPUS

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Shoreline Management Action Plan				
SM-2	Assist local governments with shoreline management issues.	48		Steps 1 and 2

PCCA

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Shoreline Management Action Plan				
SM-1	Conduct a shoreline inventory to gain a site-specific understanding of shoreline management needs.	46		Steps 1-3
SM-2	Assist local governments with shoreline management issues.	48		Steps 1 and 2
Maritime Commerce Action Plan				
MC-1	Support construction of a 125 foot wide barge shelf on both sides of the ship channel to a depth of 15 feet.	59	Steps 1-3	
MC-2	Modify the height, size, position, and light intensity of existing navigation ranges and add new ranges where necessary.	60	Step 3	Steps 1 and 2
MC-3	Modernize the vessel traffic system and aids to navigation.	61	Steps 1-3	
Dredging Action Plan				
D-1	Establish a proactive Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material.	68	Steps 2-5	Step 1
D-2	Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	70	Step 1	Step 2
D-3	Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	72		Steps 1 and 2
Habitat and Living Resources Action Plan				
HLR-1	Preserve functional, natural habitats of all major types.	85		Steps 1 and 2
HLR-2	Create new habitats and/or restore degraded habitats where feasible.	86		Steps 1 and 2
HLR-4	Develop management plans to ensure sustainability for species of concern.	89		Step 4

PICC

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
	Public Health Action Plan			
PH-2	Conduct health risk assessments associated with consumption of seafood in suspect areas.	43		Step 1
	Shoreline Management Action Plan			
SM-2	Assist local governments with shoreline management issues.	48		Steps 1 and 2
	Maritime Commerce Action Plan			
MC-3	Modernize the vessel traffic system and aids to navigation.	61		Steps 1-3
MC-5	Maintain and improve regional oil spill response capability.	63		Steps 1-3
MC-6	Coordinate hazardous material spill response planning and resources to ensure adequate public protection.	64		Steps 1-3
MC-7	Establish an interagency forum to coordinate pipeline mapping and contingency planning.	65		Steps 1 and 2
MC-8	Prevent the introduction of non-native species through improved ballast water management.	66		Steps 1-3
	Water and Sediment Quality Action Plan			
WSQ-1	Implement plans to improve water and sediment quality in identified segments.	107		Step 1
WSQ-5	Ensure that water quality standards and sediment quality criteria are adequate and appropriate.	114		Steps 1-3
	Freshwater Resources Action Plan			
FW-2	Assist the Coastal Bend Regional Water Planning Group and regional water managers to incorporate the needs of estuaries in comprehensive planning.	132		Steps 1-4
	Public Education and Outreach Action Plan			
PEO-3	Provide curricula for all levels of environmental education and promote greater use of outdoor educational facilities as a means of reaching children, young people, and adults.	147		Step 3
PEO-5	Promote public participation and recognition programs to protect the bay system and its resources.	150		Step 3

PINS

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Habitat and Living Resources Action Plan				
HLR-4	Develop management plans to ensure sustainability for species of concern.	89		Steps 3 and 4
HLR-5	Improve animal rescue and rehabilitation programs.	91		Steps 1-4

Pipeline Companies

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Maritime Commerce Action Plan				
MC-7	Establish an interagency forum to coordinate pipeline mapping and contingency planning.	65		Steps 1 and 2

Point Source Discharge Permittees

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Water and Sediment Quality Action Plan				
WSQ-3	Quantify total constituent loadings.	111		Step 2

Regional Shoreline Advisory Council

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Shoreline Management Action Plan				
SM-1	Conduct a shoreline inventory to gain a site-specific understanding of shoreline management needs.	46	Step 3	
SM-2	Assist local governments with shoreline management issues.	48	Step 2	Steps 3 and 4
SM-3	Establish a locally administered Land Trust Fund to augment public access, sensitive habitat protection, and open space preservation.	50		Steps 2 and 3

Regional Shrimping Advisory Board

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Habitat and Living Resources Action Plan				
HLR-6	Facilitate consensus on a regional approach to effective management of bay and bait shrimping.	93	Step 2	

Research Institutions

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Habitat and Living Resources Action Plan				
HLR-9	Minimize the impacts and reduce the occurrence of harmful algal blooms.	96		Step 1
HLR-10	Develop management plans to minimize introductions and impacts from non-native species.	98		Steps 1-3

Residential Developers

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Dredging Action Plan				
D-3	Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	72		Step 1

RSPA

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Maritime Commerce Action Plan				
MC-7	Establish an interagency forum to coordinate pipeline mapping and contingency planning.	65		Steps 1 and 2

RTC

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-1	Encourage and assist regional tourism organizations to adopt a 'theme' of resource protection and stewardship in their promotion of tourism.	33		Step 1

Schools

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Public Education and Outreach Action Plan				
PEO-1	Develop and implement a regional Public Education and Outreach Strategy.	144		Steps 1-5
PEO-5	Promote public participation and recognition programs to protect the bay system and its resources.	150		Step 2

Seismic Industry

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Habitat and Living Resources Action Plan				
HLR-3	Determine and manage impact(s) of seismic activities and operations requiring state and/or local permits on coastal habitats and associated fauna.	87		Steps 1-3

Shipping Companies

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Maritime Commerce Action Plan				
MC-4	Increase vessel operator training regarding safe operating procedures, rules of the road, and local navigation hazards.	62		Steps 1 and 2

Sierra Club

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-3	Develop and implement management strategies to reduce or avoid impacts from recreational uses.	35		Steps 1-4, 6, and 7
Public Health Action Plan				
PH-2	Conduct health risk assessments associated with consumption of seafood in suspect areas.	43		Steps 1 and 2
Habitat and Living Resources Action Plan				
HLR-4	Develop management plans to ensure sustainability for species of concern.	89		Steps 1 and 2
HLR-6	Facilitate consensus on a regional approach to effective management of bay and bait shrimping.	93		Steps 1-3

Water and Sediment Quality Action Plan				
WSQ-1	Implement plans to improve water and sediment quality in identified segments.	107		Steps 1-3
WSQ-3	Quantify total constituent loadings.	111		Step 3
WSQ-5	Ensure that water quality standards and sediment quality criteria are adequate and appropriate.	114		Steps 1-3

Solid Waste Management Professionals

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Debris Action Plan				
BD-1	Reduce the amount of debris reaching the bays due to improper trash disposal or inadequate solid waste management.	39		Step 1

State and Federal Resource Agencies

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Habitat and Living Resources Action Plan				
HLR-9	Minimize the impacts and reduce the occurrence of harmful algal blooms.	96		Step 1
Public Education and Outreach Action Plan				
PEO-2	Establish a Bay Day celebration to focus attention on bay resources and uses.	146		Steps 1-3
PEO-4	Conduct public forums to increase dialogue between resource managers and users.	149		Steps 1 and 2
PEO-5	Promote public participation and recognition programs to protect the bay system and its resources.	150		Step 3

STCZAC

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Maritime Commerce Action Plan				
MC-5	Maintain and improve regional oil spill response capability.	63		Steps 1 and 2
MC-6	Coordinate hazardous material spill response planning and resources to ensure adequate public protection.	64		Steps 1-3

STSSN

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Habitat and Living Resources Action Plan				
HLR-4	Develop management plans to ensure sustainability for species of concern.	89	Step 4	
HLR-5	Improve animal rescue and rehabilitation programs.	91	Step 3	Step 1

SWCD

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Shoreline Management Action Plan				
SM-1	Conduct a shoreline inventory to gain a site-specific understanding of shoreline management needs.	46		Steps 1-3
SM-2	Assist local governments with shoreline management issues.	48	Step 4	Steps 1 and 2
Habitat and Living Resources Action Plan				
HLR-1	Preserve functional, natural habitats of all major types.	85		Steps 1 and 2

TAES

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Habitat and Living Resources Action Plan				
HLR-10	Develop management plans to minimize introductions and impacts from non-native species.	98		Steps 1-3

TAEX

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Nonpoint Source Management Action Plan				
NPS-4	Coordinate and implement agricultural water quality management programs necessary to meet water quality standards.	120		Steps 1-4

TAMU-CC

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Public Health Action Plan				
PH-3	Develop and implement a method to collect epidemiological and injury data from regional and local health care providers.	44	Steps 1 and 2	
Dredging Action Plan				
D-1	Establish a proactive Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material.	68		Steps 1-5
D-2	Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	70		Steps 1 and 2
D-3	Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	72		Steps 1 and 2
Habitat and Living Resources Action Plan				
HLR-5	Improve animal rescue and rehabilitation programs.	91		Steps 1-4
Public Education and Outreach Action Plan				
PEO-4	Conduct public forums to increase dialogue between resource managers and users.	149		Step 2

TCOON

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Maritime Commerce Action Plan				
MC-3	Modernize the vessel traffic system and aids to navigation.	61		Step 1

TDA

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Water and Sediment Quality Action Plan				
WSQ-3	Quantify total constituent loadings.	111		Step 1
WSQ-4	Undertake an analysis of the biological and ecological effects of selected constituents.	113	Step 2	

TDH

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Public Health Action Plan				
PH-1	Facilitate a regional approach to recreational water quality management.	42		Step 1
PH-2	Conduct health risk assessments associated with consumption of seafood in suspect areas.	43	Steps 1 and 3	Step 2
PH-3	Develop and implement a method to collect epidemiological and injury data from regional and local health care providers.	44		Steps 1 and 2
Freshwater Resources Action Plan				
FW-1	Improve scientific understanding of the freshwater needs of the estuaries.	130		Step 5

TEA Region 2 & 3

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Public Education and Outreach Action Plan				
PEO-3	Provide curricula for all levels of environmental education and promote greater use of outdoor educational facilities as a means of reaching children, young people, and adults.	147		Steps 1, 3 and 4

Texas Environmental Advisory Council

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Public Education and Outreach Action Plan				
PEO-3	Provide curricula for all levels of environmental education and promote greater use of outdoor educational facilities as a means of reaching children, young people, and adults.	147		Steps 1, 3 and 4

Texas Sea Grant

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-4	Enhance the recreational fishery through artificial reefs or restored natural reefs as appropriate.	37	Step 1	

Shoreline Management Action Plan				
SM-2	Assist local governments with shoreline management issues.	48		Steps 1 and 2
Maritime Commerce Action Plan				
MC-8	Prevent the introduction of non-native species through improved ballast water management.	66		Steps 1-3
Dredging Action Plan				
D-1	Establish a proactive Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material.	68		Steps 1-5
D-2	Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	70		Steps 1 and 2
D-3	Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	72		Steps 1 and 2
Habitat and Living Resources Action Plan				
HLR-4	Develop management plans to ensure sustainability for species of concern.	89		Step 2
HLR-6	Facilitate consensus on a regional approach to effective management of bay and bait shrimping.	93		Steps 1-3
HLR-7	Reduce bycatch from bay shrimp trawling.	94		Steps 1 and 2
HLR-10	Develop management plans to minimize introductions and impacts from non-native species.	98		Steps 1-3
Water and Sediment Quality Action Plan				
WSQ-4	Undertake an analysis of the biological and ecological effects of selected constituents.	113		Step 2
Public Education and Outreach Action Plan				
PEO-1	Develop and implement a regional Public Education and Outreach Strategy.	144		Steps 1-5

Texas Shrimpers Association

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Maritime Commerce Action Plan				
MC-4	Increase vessel operator training regarding safe operating procedures, rules of the road, and local navigation hazards.	62		Steps 1 and 2
Habitat and Living Resources Action Plan				
HLR-6	Facilitate consensus on a regional approach to effective management of bay and bait shrimping.	93	Step 3	Steps 1 and 2
Water and Sediment Quality Action Plan				
WSQ-2	Support the implementation of permitting rules for shrimp farms and other aquaculture facilities.	109		Steps 1 and 2

Texas Waterway Operators

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
	Maritime Commerce Action Plan			
MC-4	Increase vessel operator training regarding safe operating procedures, rules of the road, and local navigation hazards.	62		Steps 1 and 2

TGLO

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
	Bay Tourism and Recreation Action Plan			
BTR-2	Provide for the appropriate number of improved, well-managed public access sites.	34	Step 1	
BTR-3	Develop and implement management strategies to reduce or avoid impacts from recreational uses.	35	Steps 2-6	Steps 1 and 5
BTR-4	Enhance the recreational fishery through artificial reefs or restored natural reefs as appropriate.	37		Steps 1-3
	Bay Debris Action Plan			
BD-1	Reduce the amount of debris reaching the bays due to improper trash disposal or inadequate solid waste management.	39		Step 2
	Shoreline Management Action Plan			
SM-1	Conduct a shoreline inventory to gain a site-specific understanding of shoreline management needs.	46	Step 1	
SM-2	Assist local governments with shoreline management issues.	48	Steps 1-4	
SM-3	Establish a locally administered Land Trust Fund to augment public access, sensitive habitat protection, and open space preservation.	50		Step 1
	Maritime Commerce Action Plan			
MC-3	Modernize the vessel traffic system and aids to navigation.	61		Step 1
MC-4	Increase vessel operator training regarding safe operating procedures, rules of the road, and local navigation hazards.	62		Steps 1 and 2
MC-5	Maintain and improve regional oil spill response capability.	63	Steps 1-3	
MC-7	Establish an interagency forum to coordinate pipeline mapping and contingency planning.	65		Steps 1 and 2

Dredging Action Plan				
D-1	Establish a proactive Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material.	68		Steps 1-5
D-2	Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	70		Steps 1 and 2
D-3	Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	72		Steps 1 and 2
Habitat and Living Resources Action Plan				
HLR-1	Preserve functional, natural habitats of all major types.	85		Steps 1 and 2
HLR-2	Create new habitats and/or restore degraded habitats where feasible.	86	Step 2	Step 1
HLR-3	Determine and manage impact(s) of seismic activities and operations requiring state and/or local permits on coastal habitats and associated fauna.	87	Step 3	Steps 1 and 2
HLR-4	Develop management plans to ensure sustainability for species of concern.	89		Steps 1-5
HLR-6	Facilitate consensus on a regional approach to effective management of bay and bait shrimping.	93		Steps 1-3
Nonpoint Source Management Action Plan				
NPS-1	Develop a regional handbook of urban nonpoint source pollution Best Management Practices for voluntary use by local governments seeking to implement nonpoint source pollution prevention programs.	117		Steps 1 and 2
NPS-2	Provide compliance assistance to small businesses and industries in the region that are subject to the NPDES permit program or have nonpoint source control needs.	118	Step 2	Step 1
Freshwater Resources Action Plan				
FW-1	Improve scientific understanding of the freshwater needs of the estuaries.	130		Steps 1-5
FW-2	Assist the Coastal Bend Regional Water Planning Group and regional water managers to incorporate the needs of estuaries in comprehensive planning.	132		Step 3
Public Education and Outreach Action Plan				
PEO-3	Provide curricula for all levels of environmental education and promote greater use of outdoor educational facilities as a means of reaching children, young people, and adults.	147		Step 2

TMMSN

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Habitat and Living Resources Action Plan				
HLR-4	Develop management plans to ensure sustainability for species of concern.	89	Step 3	
HLR-5	Improve animal rescue and rehabilitation programs.	91	Step 2	Step 1

TNC

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Shoreline Management Action Plan				
SM-3	Establish a locally administered Land Trust Fund to augment public access, sensitive habitat protection, and open space preservation.	50		Step 1
Habitat and Living Resources Action Plan				
HLR-1	Preserve functional, natural habitats of all major types.	85		Steps 1 and 2
HLR-4	Develop management plans to ensure sustainability for species of concern.	89		Steps 1-5

TNRCC

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-3	Develop and implement management strategies to reduce or avoid impacts from recreational uses.	35		Steps 4-6
Bay Debris Action Plan				
BD-1	Reduce the amount of debris reaching the bays due to improper trash disposal or inadequate solid waste management.	39		Steps 1 and 2
Public Health Action Plan				
PH-1	Facilitate a regional approach to recreational water quality management	42		Step 1
PH-2	Conduct health risk assessments associated with consumption of seafood in suspect areas.	43	Step 2	Steps 1 and 3
Maritime Commerce Action Plan				
MC-5	Maintain and improve regional oil spill response capability.	63		Steps 1 and 2
MC-6	Coordinate hazardous material spill response planning and resources to ensure adequate public protection.	64	Steps 1 and 3	Step 2

Dredging Action Plan				
D-1	Establish a proactive Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material.	68		Steps 1-5
D-2	Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	70		Steps 1 and 2
D-3	Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	72		Steps 1 and 2
Habitat and Living Resources Action Plan				
HLR-8	Reduce impacts on living resources associated with industrial cooling water intake.	95		Steps 1-3
Water and Sediment Quality Action Plan				
WSQ-1	Implement plans to improve water and sediment quality in identified segments.	107	Steps 1-3	
WSQ-2	Support the implementation of permitting rules for shrimp farms and other aquaculture facilities.	109	Steps 1-3	
WSQ-3	Quantify total constituent loadings.	111	Steps 1-3	
WSQ-4	Undertake an analysis of the biological and ecological effects of selected constituents.	113	Steps 1 and 2	
WSQ-5	Ensure that water quality standards and sediment quality criteria are adequate and appropriate.	114	Steps 1-3	
Nonpoint Source Management Action Plan				
NPS-1	Develop a regional handbook of urban nonpoint source pollution Best Management Practices for voluntary use by local governments seeking to implement nonpoint source pollution prevention programs.	117	Step 2	
NPS-2	Provide compliance assistance to small businesses and industries in the region that are subject to the NPDES permit program or have nonpoint source control needs.	118	Step 2	
NPS-3	Assist local governments to implement On-Site Sewage Facility (OSSF) programs.	119		Steps 1-3
Freshwater Resources Action Plan				
FW-1	Improve scientific understanding of the freshwater needs of the estuaries.	130	Steps 2 and 3	Steps 1, 4, and 5
FW-2	Assist the Coastal Bend Regional Water Planning Group and regional water managers to incorporate the needs of estuaries in comprehensive planning.	132		Steps 1-4
FW-4	Effectively communicate the purpose and results of ongoing freshwater plans and programs.	135		Step 1
Public Education and Outreach Action Plan				
PEO-3	Provide curricula for all levels of environmental education and promote greater use of outdoor educational facilities as a means of reaching children, young people, and adults.	147		Step 3

TPWD

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-1	Encourage and assist regional tourism organizations to adopt a 'theme' of resource protection and stewardship in their promotion of tourism.	33		Step 2
BTR-2	Provide for the appropriate number of improved, well-managed public access sites.	34		Step 1
BTR-3	Develop and implement management strategies to reduce or avoid impacts from recreational uses.	35	Steps 2 and 7	Step 1
BTR-4	Enhance the recreational fishery through artificial reefs or restored natural reefs as appropriate.	37	Steps 1-3	
Public Health Action Plan				
PH-1	Facilitate a regional approach to recreational water quality management	42		Step 1
PH-2	Conduct health risk assessments associated with consumption of seafood in suspect areas.	43		Step 3
Shoreline Management Action Plan				
SM-2	Assist local governments with shoreline management issues.	48		Steps 1 and 2
SM-3	Establish a locally administered Land Trust Fund to augment public access, sensitive habitat protection, and open space preservation.	50		Step 1
Maritime Commerce Action Plan				
MC-8	Prevent the introduction of non-native species through improved ballast water management.	66		Steps 1 and 3
Dredging Action Plan				
D-1	Establish a proactive Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material.	68		Steps 1-5
D-2	Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	70		Steps 1 and 2
D-3	Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	72		Steps 1 and 2

Habitat and Living Resources Action Plan				
HLR-1	Preserve functional, natural habitats of all major types.	85	Step 2	Step 1
HLR-2	Create new habitats and/or restore degraded habitats where feasible.	86	Step 2	Step 1
HLR-3	Determine and manage impact(s) of seismic activities and operations requiring state and/or local permits on coastal habitats and associated fauna.	87		Steps 1-3
HLR-4	Develop management plans to ensure sustainability for species of concern.	89	Step 2	Steps 1 and 3-5
HLR-5	Improve animal rescue and rehabilitation programs.	91		Steps 1-4
HLR-6	Facilitate consensus on a regional approach to effective management of bay and bait shrimping.	93	Step 3	Steps 1 and 2
HLR-7	Reduce bycatch from bay shrimp trawling.	94	Steps 1 and 2	
HLR-8	Reduce impacts on living resources associated with industrial cooling water intake.	95		Steps 1-3
HLR-10	Develop management plans to minimize introductions and impacts from non-native species.	98	Steps 2 and 3	Step 1
Water and Sediment Quality Action Plan				
WSQ-1	Implement plans to improve water and sediment quality in identified segments.	107		Steps 1-3
WSQ-2	Support the implementation of permitting rules for shrimp farms and other aquaculture facilities.	109	Steps 2 and 4	Step 1
WSQ-4	Undertake an analysis of the biological and ecological effects of selected constituents.	113		Steps 1 and 2
WSQ-5	Ensure that water quality standards and sediment quality criteria are adequate and appropriate.	114	Step 3	Steps 1 and 2
Freshwater Resources Action Plan				
FW-1	Improve scientific understanding of the freshwater needs of the estuaries.	130	Step 2	Steps 1 and 3-5
FW-2	Assist the Coastal Bend Regional Water Planning Group and regional water managers to incorporate the needs of estuaries in comprehensive planning.	132		Steps 1 and 2
FW-4	Effectively communicate the purpose and results of ongoing freshwater plans and programs.	135		Step 1
Public Education and Outreach Action Plan				
PEO-1	Develop and implement a regional Public Education and Outreach Strategy.	144		Steps 1-5
PEO-3	Provide curricula for all levels of environmental education and promote greater use of outdoor educational facilities as a means of reaching children, young people, and adults.	147	Step 2	Steps 1, 3, and 4

TRC

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Maritime Commerce Action Plan				
MC-5	Maintain and improve regional oil spill response capability.	63		Steps 1-3
MC-7	Establish an interagency forum to coordinate pipeline mapping and contingency planning.	65	Steps 1 and 2	
Habitat and Living Resources Action Plan				
HLR-3	Determine and manage impact(s) of seismic activities and operations requiring state and/or local permits on coastal habitats and associated fauna.	87		Steps 1-3

TSA

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Habitat and Living Resources Action Plan				
HLR-5	Improve animal rescue and rehabilitation programs.	91	Step 4	Steps 1-3
Public Education and Outreach Action Plan				
PEO-1	Develop and implement a regional Public Education and Outreach Strategy.	144		Steps 1-5
PEO-3	Provide curricula for all levels of environmental education and promote greater use of outdoor educational facilities as a means of reaching children, young people, and adults.	147	Step 1	

TSPA

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Maritime Commerce Action Plan				
MC-4	Increase vessel operator training regarding safe operating procedures, rules of the road, and local navigation hazards.	62		Steps 1 and 2
Habitat and Living Resources Action Plan				
HLR-6	Facilitate consensus on a regional approach to effective management of bay and bait shrimping.	93	Step 3	Steps 1 and 2
HLR-7	Reduce bycatch from bay shrimp trawling.	94	Steps 1 and 2	

TSSWCB

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Habitat and Living Resources Action Plan				
HLR-1	Preserve functional, natural habitats of all major types.	85		Steps 1 and 2
Water and Sediment Quality Action Plan				
WSQ-3	Quantify total constituent loadings.	111	Steps 1 and 3	
WSQ-4	Undertake an analysis of the biological and ecological effects of selected constituents.	113		Step 2
Nonpoint Source Management Action Plan				
NPS-4	Coordinate and implement agricultural water quality management programs necessary to meet water quality standards.	120	Steps 1-4	

TWDB

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Dredging Action Plan				
D-1	Establish a proactive Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material.	68		Steps 1-5
D-2	Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	70		Steps 1 and 2
D-3	Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	72		Steps 1 and 2
Freshwater Resources Action Plan				
FW-1	Improve scientific understanding of the freshwater needs of the estuaries.	130	Steps 1 and 2	Steps 3-5
FW-2	Assist the Coastal Bend Regional Water Planning Group and regional water managers to incorporate the needs of estuaries in comprehensive planning.	132		Steps 2-4
FW-3	Support efforts that directly contribute to increased freshwater flow events into the bays and estuaries of the Coastal Bend.	134		Steps 1 and 2
FW-4	Effectively communicate the purpose and results of ongoing freshwater plans and programs.	135		Step 1

TXDOT

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
	Dredging Action Plan			
D-1	Establish a proactive Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material.	68		Steps 1-5
D-2	Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	70		Steps 1 and 2
D-3	Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	72	Step 1 (GIWW)	Step 2
	Nonpoint Source Management Action Plan			
NPS-1	Develop a regional handbook of urban nonpoint source pollution Best Management Practices for voluntary use by local governments seeking to implement nonpoint source pollution prevention programs.	117		Steps 1 and 2
NPS-2	Provide compliance assistance to small businesses and industries in the region that are subject to the NPDES permit program or have nonpoint source control needs.	118		Step 1

Universities

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
	Public Health Action Plan			
PH-2	Conduct health risk assessments associated with consumption of seafood in suspect areas.	43		Steps 1 and 2
	Habitat and Living Resources Action Plan			
HLR-4	Develop management plans to ensure sustainability for species of concern.	89		Steps 1-4
HLR-6	Facilitate consensus on a regional approach to effective management of bay and bait shrimping.	93		Steps 1-3
HLR-7	Reduce bycatch from bay shrimp trawling.	94		Steps 1 and 2

University of Texas Marine Science Institute

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Public Health Action Plan				
FW-3	Support efforts that directly contribute to increased freshwater flow events into the bays and estuaries of the Coastal Bend.	134		Step 2

USACE

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-3	Develop and implement management strategies to reduce or avoid impacts from recreational uses.	35		Step 5
Shoreline Management Action Plan				
SM-2	Assist local governments with shoreline management issues.	48		Steps 1 and 2
Maritime Commerce Action Plan				
MC-1	Support construction of a 125 foot wide barge shelf on both sides of the ship channel to a depth of 15 feet.	59		Steps 1-3
MC-7	Establish an interagency forum to coordinate pipeline mapping and contingency planning.	65		Steps 1 and 2
Dredging Action Plan				
D-1	Establish a proactive Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material.	68		Steps 1-5
D-2	Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	70		Steps 1 and 2
D-3	Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	72		Steps 1 and 2
Habitat and Living Resources Action Plan				
HLR-2	Create new habitats and/or restore degraded habitats where feasible.	86		Steps 1 and 2

U.S. Bureau of Reclamation

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Public Health Action Plan				
FW-3	Support efforts that directly contribute to increased freshwater flow events into the bays and estuaries of the Coastal Bend.	134	Step 2	Step 1

USCG

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-3	Develop and implement management strategies to reduce or avoid impacts from recreational uses.	35		Steps 1, 4, 5, and 7
BTR-4	Enhance the recreational fishery through artificial reefs or restored natural reefs as appropriate.	37		Steps 2 and 3
Maritime Commerce Action Plan				
MC-2	Modify the height, size, position, and light intensity of existing navigation ranges and add new ranges where necessary.	60		Steps 1-3
MC-3	Modernize the vessel traffic system and aids to navigation.	61		Steps 1-3
MC-4	Increase vessel operator training regarding safe operating procedures, rules of the road, and local navigation hazards.	62		Steps 1 and 2
MC-5	Maintain and improve regional oil spill response capability.	63	Steps 1-3	
MC-6	Coordinate hazardous material spill response planning and resources to ensure adequate public protection.	64	Steps 1 and 3	
MC-8	Prevent the introduction of non-native species through improved ballast water management.	66	Steps 1 and 3	Step 2
Habitat and Living Resources Action Plan				
HLR-1	Preserve functional, natural habitats of all major types.	85		Steps 1 and 2
HLR-4	Develop management plans to ensure sustainability for species of concern.	89		Step 4

USCG (Waterways Management Section)

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-1	Encourage and assist regional tourism organizations to adopt a 'theme' of resource protection and stewardship in their promotion of tourism.	33		Steps 1 and 2

USEPA

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-3	Develop and implement management strategies to reduce or avoid impacts from recreational uses.	35		Steps 4 and 5
Public Health Action Plan				
PH-1	Facilitate a regional approach to recreational water quality management	42		Step 1
PH-2	Conduct health risk assessments associated with consumption of seafood in suspect areas.	43		Steps 1 and 2
Maritime Commerce Action Plan				
MC-5	Maintain and improve regional oil spill response capability.	63		Steps 1 and 2
MC-6	Coordinate hazardous material spill response planning and resources to ensure adequate public protection.	64		Steps 1-3
Dredging Action Plan				
D-1	Establish a proactive Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material.	68		Steps 1-5
D-2	Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	70		Steps 1 and 2
D-3	Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	72		Steps 1 and 2
Habitat and Living Resources Action Plan				
HLR-8	Reduce impacts on living resources associated with industrial cooling water intake.	95		Steps 1-3
Water and Sediment Quality Action Plan				
WSQ-1	Implement plans to improve water and sediment quality in identified segments.	107		Steps 1 and 2
WSQ-2	Support the implementation of permitting rules for shrimp farms and other aquaculture facilities.	109		Steps 1 and 2
WSQ-3	Quantify total constituent loadings.	111		Steps 1 and 2
WSQ-4	Undertake an analysis of the biological and ecological effects of selected constituents.	113		Steps 1 and 2
WSQ-5	Ensure that water quality standards and sediment quality criteria are adequate and appropriate.	114		Steps 1-3
Nonpoint Source Management Action Plan				
NPS-2	Provide compliance assistance to small businesses and industries in the region that are subject to the NPDES permit program or have nonpoint source control needs.	118	Step 2	
NPS-4	Coordinate and implement agricultural water quality management programs necessary to meet water quality standards.	120		Steps 1-4

Freshwater Resources Action Plan				
FW-1	Improve scientific understanding of the freshwater needs of the estuaries.	130		Steps 4 and 5
Public Education and Outreach Action Plan				
PEO-3	Provide curricula for all levels of environmental education and promote greater use of outdoor educational facilities as a means of reaching children, young people, and adults.	147		Steps 1, 3 and 4

USFWS

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Bay Tourism and Recreation Action Plan				
BTR-2	Provide for the appropriate number of improved, well-managed public access sites.	34		Step 1
BTR-3	Develop and implement management strategies to reduce or avoid impacts from recreational uses.	35		Steps 1 and 3
Shoreline Management Action Plan				
SM-1	Conduct a shoreline inventory to gain a site-specific understanding of shoreline management needs.	46		Steps 1-3
SM-2	Assist local governments with shoreline management issues.	48		Steps 1 and 2
SM-3	Establish a locally administered Land Trust Fund to augment public access, sensitive habitat protection, and open space preservation.	50		Step 1
Maritime Commerce Action Plan				
MC-8	Prevent the introduction of non-native species through improved ballast water management.	66		Steps 1-3
Dredging Action Plan				
D-1	Establish a proactive Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material.	68		Steps 1-5
D-2	Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	70		Steps 1 and 2
D-3	Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	72		Steps 1 and 2

Habitat and Living Resources Action Plan				
HLR-1	Preserve functional, natural habitats of all major types.	85		Steps 1 and 2
HLR-2	Create new habitats and/or restore degraded habitats where feasible.	86		Steps 1 and 2
HLR-3	Determine and manage impact(s) of seismic activities and operations requiring state and/or local permits on coastal habitats and associated fauna.	87		Steps 1-3
HLR-4	Develop management plans to ensure sustainability for species of concern.	89	Step 5	Steps 1, 3, and 4
HLR-5	Improve animal rescue and rehabilitation programs.	91		Steps 1-4
HLR-10	Develop management plans to minimize introductions and impacts from non-native species.	98		Steps 1-3
Water and Sediment Quality Action Plan				
WSQ-1	Implement plans to improve water and sediment quality in identified segments.	107		Steps 1-3
Nonpoint Source Management Action Plan				
NPS-1	Develop a regional handbook of urban nonpoint source pollution Best Management Practices for voluntary use by local governments seeking to implement nonpoint source pollution prevention programs.	117		Step 1
Public Education and Outreach Action Plan				
PEO-3	Provide curricula for all levels of environmental education and promote greater use of outdoor educational facilities as a means of reaching children, young people, and adults.	147		Step 2

USGS

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Habitat and Living Resources Action Plan				
HLR-1	Preserve functional, natural habitats of all major types.	85		Steps 1 and 2
HLR-2	Create new habitats and/or restore degraded habitats where feasible.	86		Steps 1 and 2
HLR-3	Determine and manage impact(s) of seismic activities and operations requiring state and/or local permits on coastal habitats and associated fauna.	87		Steps 1-3
HLR-5	Improve animal rescue and rehabilitation programs.	91		Step 1
HLR-10	Develop management plans to minimize introductions and impacts from non-native species.	98		Steps 1-3

Water and Sediment Quality Action Plan				
WSQ-1	Implement plans to improve water and sediment quality in identified segments.	107		Step 2
WSQ-3	Quantify total constituent loadings.	111		Step 1
WSQ-4	Undertake an analysis of the biological and ecological effects of selected constituents.	113		Step 2
WSQ-5	Ensure that water quality standards and sediment quality criteria are adequate and appropriate.	114		Steps 1-3
Freshwater Resources Action Plan				
FW-1	Improve scientific understanding of the freshwater needs of the estuaries.	130	Step 4	
FW-3	Support efforts that directly contribute to increased freshwater flow events into the bays and estuaries of the Coastal Bend.	134		Steps 1 and 2

U.S. Navy

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Maritime Commerce Action Plan				
MC-4	Increase vessel operator training regarding safe operating procedures, rules of the road, and local navigation hazards.	62		Steps 1 and 2

UTBEG

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
Habitat and Living Resources Action Plan				
HLR-2	Create new habitats and/or restore degraded habitats where feasible.	86		Steps 1 and 2
HLR-3	Determine and manage impact(s) of seismic activities and operations requiring state and/or local permits on coastal habitats and associated fauna.	87		Steps 1-3

UTMSI

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
	Dredging Action Plan			
D-1	Establish a proactive Beneficial Uses Group (BUG) to maximize beneficial uses of dredged material.	68		Steps 1-5
D-2	Develop a long-term (50 year) dredged material management plan and strategy for the Corpus Christi Ship Channel.	70		Steps 1 and 2
D-3	Develop a long-term (50 year) dredged material management plan and strategy for the Gulf Intracoastal Waterway, channel subdivisions, and private and public marinas.	72		Steps 1 and 2
	Habitat and Living Resources Action Plan			
HLR-1	Preserve functional, natural habitats of all major types.	85		Steps 1 and 2
HLR-2	Create new habitats and/or restore degraded habitats where feasible.	86		Steps 1 and 2
HLR-3	Determine and manage impact(s) of seismic activities and operations requiring state and/or local permits on coastal habitats and associated fauna.	87		Steps 1-3
HLR-5	Improve animal rescue and rehabilitation programs.	91		Steps 1-4
HLR-9	Minimize the impacts and reduce the occurrence of harmful algal blooms.	96	Steps 2-6	
	Water and Sediment Quality Action Plan			
WSQ-3	Quantify total constituent loadings.	111		Step 1
WSQ-4	Undertake an analysis of the biological and ecological effects of selected constituents.	113		Step 2

Volunteer Programs such as Adopt-a-Wetland, Adopt-a-Habitat, Bay Cleanup, Shoreline restoration projects, Major Rivers, Aquatic Wild, Texas Watch

Action	Title	Page Number	Lead Implementing Organization	Implementing Partner
	Public Education and Outreach Action Plan			
PEO-5	Promote public participation and recognition programs to protect the bay system and its resources.	150		Step 1

Endorsements

"The approval of the Plan will ensure the preservation of our Coastal Bend wetlands; a natural treasure that requires protection for the approaching millennium!" - Carlos F. Truan, Dean of the Texas Senate

"[We] commend the Coastal Bend Bays Plan for its integrated approach towards action to achieve conservation, protection, and judicious development of our natural resources." - Peggy Duran, President, The League of Women Voters of Corpus Christi

"As more and more people come to our area... we must have a plan to protect and conserve, but also sustainably use these resources..." - John Wes Tunnell, Director, Center for Coastal Studies

"Considering the scope and complexity of the mission and the relatively short period of time allotted to complete it, this has been a formidable task." - Frank Hankins, OPUS

"The Coastal Bend Bays Plan will go a long way in ensuring the ecological and economic vitality of the Coastal Bend bays and estuaries." - Vilma Luna, House of Representatives

"[We] fully support the Plan's bottom-up, consensus based approach to natural resource management..." - John Barrett, Row Crop Producers

"The approach used to build the Coastal Bend Bays Plan...is commendable." - Agnes A. Harden, County Judge of Aransas County

"We believe the fundamentals of good science have prevailed...to achieve a sound Bays Plan." - Frank N. Newchurch, III, Chairman, Port Industries of Corpus Christi

"[The Bays Plan] truly represents a thorough outline for a coordinated approach for addressing the future management of the bay and adjacent study areas." - Mike Highower, Deputy Director, TAMU Sea Grant College Program

"The conservation of Texas' fish and wildlife resources is [our] primary legislative mandate. The Plan represents an important mechanism to help meet that responsibility..." - Dr. Larry McKinney, Texas Parks & Wildlife

"The effort to gather the best scientific information to help shape public policy has resulted in an outstanding guide for bay resource protection in the 21st century." - Ray Allen, Chairman, Coastal Bend Bays Foundation

"The Sierra Club ...believes that [the Plan] has given the area an excellent knowledge of existing conditions and has shown where possible problems lie or may occur in the future." - Patricia H. Suter, Chairman

"The estuaries of the Coastal Bend region of Texas are key elements in contributing to coastal living marine resources of the Gulf of Mexico and our nation." - National Marine Fisheries Service, Southeast Fisheries Science Center

"The Texas State Aquarium believes strongly in what the Estuary Program represents and we pledge our contribution to educate residents and visitors on the conservation and wise use of our estuaries." - Steve Ordahl, Executive Director, Texas State Aquarium

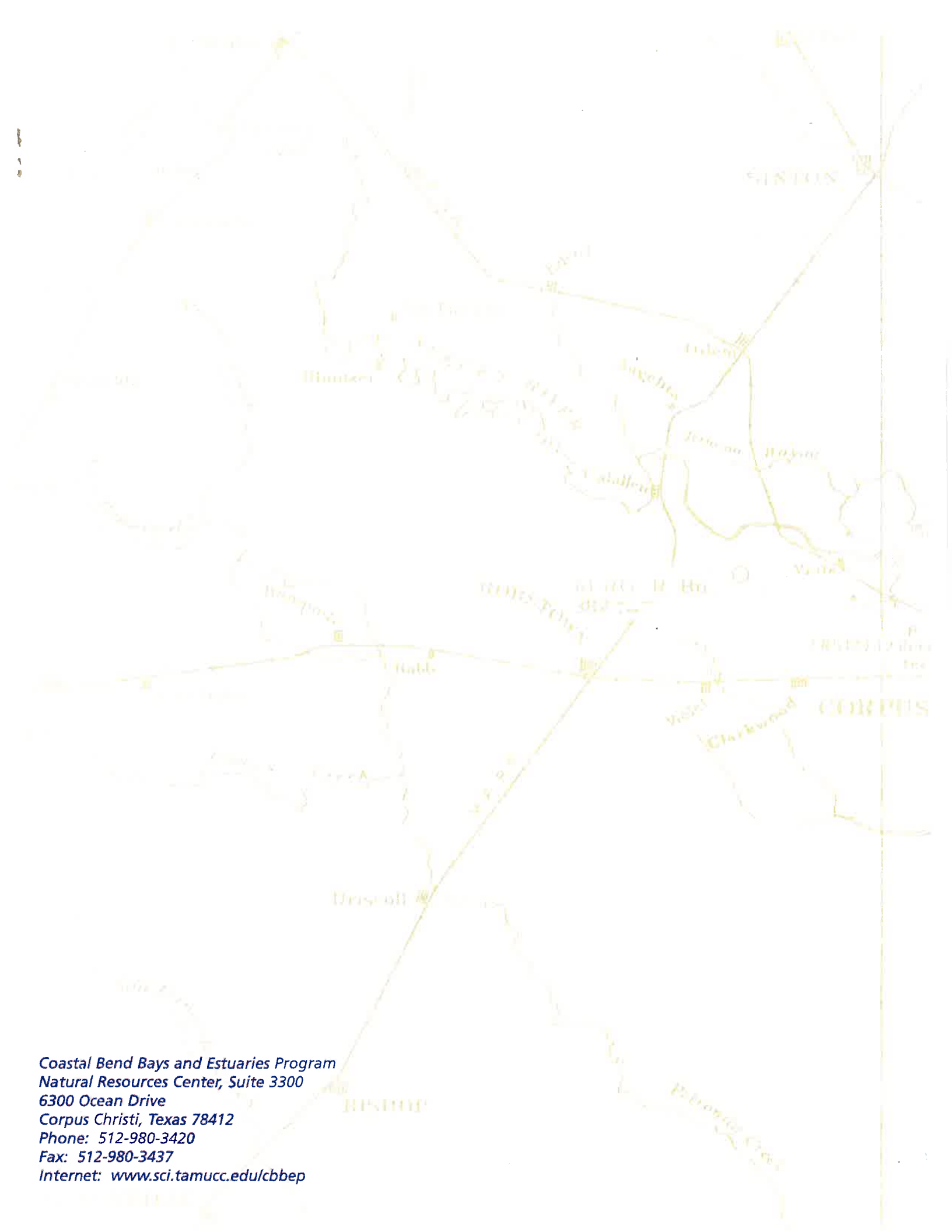
"Successful completion of the plan reflects the dedication and wisdom of the Texas Coastal Bend community and a strong commitment to its implementation." - Peter M. Emerson, Environmental Defense Fund

"Now is the time for our entire community to support... and advocate the implementation of the Plan. We have the opportunity to make a significant contribution." - Robert N. Corrigan, Jr., Co-Chair, Citizens Advisory Committee

"The strong local commitment and sense of ownership that led to the development of the Plan will surely lead to swift implementation of its actions." - Bill Hathaway, USEPA Region 6

"This overarching plan should help to address preservation and enhancement of many of the values of the bays systems of Texas' Coastal Bend Region." - Robyn Cobb, U.S. Fish & Wildlife Service

"The resultant Plan initiatives are consensus based, supported by sound science, and reflect fiscal and political reality." - John LaRue, Executive Director, Port of Corpus Christi



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