Galveston Bay

Charting the Course to 2015:
Galveston Bay Strategic Action Plan

GALVESTON BAY ESTUARY PROGRAM

A PROGRAM OF THE TCEQ

GI-385 4/09

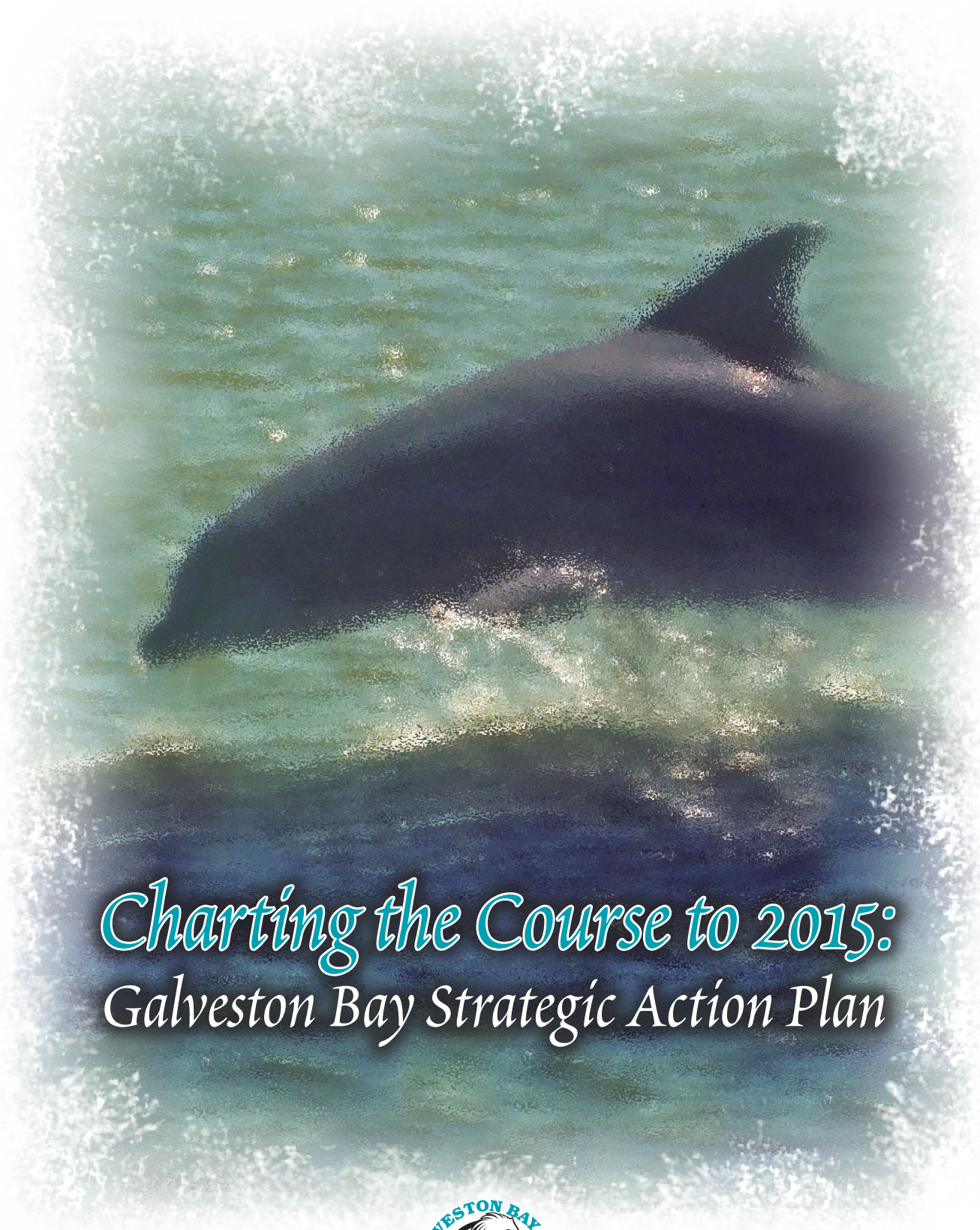
The GBEP Strategic Action Plan especially depends on the strength and synergy of Galveston Bay Plan partners. Through the Galveston Bay Council and its subcommittees, environmental groups, individual citizens, local governments and industry have been empowered to work cooperatively, as a single community, to protect and preserve both the economic and ecological value of the Galveston Bay Ecosystem. I am very proud to be a part of that.

Lori Gernhardt
Galveston Bay Council Chair
2006–2007
Gulf Coast Waste Disposal Authority

Front cover photo-

Canoeing in West Galveston Bay near North Deer Island.

photo by Jarret "Woody" O. Woodrow, Jr.



Charting the Course to 2015:
Galveston Bay Strategic Action Plan

GALVESTON BAY ESTUARY PROGRAM

A Program of the Texas Commission on Environmental Quality

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By Phone

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Galveston Environmental Data:

<galvbaydata.org> or <www.gbep.state.tx.us>

Galveston Bay research, bibliographies and archives:

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From the Galveston Bay Council

Local stakeholders rallied to secure a promising future for Galveston Bay in 1988 by advocating Galveston Bay's inclusion into the National Estuary Program. Recognizing the bay's importance, Congress accepted Galveston Bay into the program and funded a local, stakeholder-based program to develop and implement a comprehensive conservation and management plan. This plan, known as The Galveston Bay Plan, has been implemented by local governments, conservation organizations, recreational anglers, commercial fisherman, citizens, industries, and federal and state agencies for the past 10 years.

Through science, collaborative partnerships, public education, and hard work, Estuary Program partners have made great progress in protecting the bay's ecological and economic health—as well as the public health. But, just as the bay ecosystem is a dynamic and evolving environment, so are the threats to its health.

So, as we reach the midpoint of our management plan's 20-year timeline and with significant public input and participation, we have taken a reflective look at our priorities and ambitions for the next 10 years. This document, *Charting the Course to 2015*, is the result of this reexamination.

Laid out in the pages of this document is what we have identified as the most urgent priorities for implementing our management plan over the next 10 years and for building lasting partnerships necessary to sustain the bay's future. We are enthusiastic about the work ahead of us and about all we will achieve together for the benefit of generations yet to come.

Sincerely,

Lori Gernhardt, Gulf Coast Waste Disposal Authority
Preceding Galveston Bay Council Chair (term)

Carl Masterson, Houston-Galveston Area Council
Current Galveston Bay Council Chair

Woody Woodrow, TPWD
NRU Subcommittee Chair

Sarah Metzger, City of Pasadena
WSQ Subcommittee Chair

Nancy Parra, EIH
PPE Subcommittee Chair

Jim Lester, HARC
Monitoring and Research Subcommittee Chair

Estuary Program Mission and Purpose

Our Mission

To preserve Galveston Bay for generations to come.

Our Purpose

To provide comprehensive ecosystem management through collaborative partnerships and to ensure preservation of the bay's multiple uses.

Our Vision

The Galveston Bay Estuary Program is a partnership of local governments, academia, business and industry, conservation organizations, citizens, bay users, and resource agencies. We regard people, habitat and wildlife as interconnected resources of the Galveston Bay ecosystem. This ecosystem is the rich and productive foundation for the social and economic fabric of the Houston-Galveston region. Conserving the natural benefits produced by Galveston Bay is essential to sustaining and enhancing our cultural and natural heritage and the region's economic vitality. Our efforts to preserve Galveston Bay for generations to come are sustained by our vision for the bay and the communities that depend on it.

We envision a prosperous region that practices active stewardship of the estuary and the natural areas surrounding our unique bayou-to-bay system.

We envision an estuary that is accessible to all citizens.

We envision an estuary of rich and diverse fish and wildlife resources and quality wetlands and other habitats that will ensure that richness and diversity.

We envision a region of communities working together to conserve upland areas such as forests and prairies that protect water quality, reduce flooding, and support one of the world's premier birdwatching areas.

We envision a region of diverse partnerships collaborating for a better bay, and a public that is directly connected to nature's opportunity and bounty in the greater Galveston Bay region.

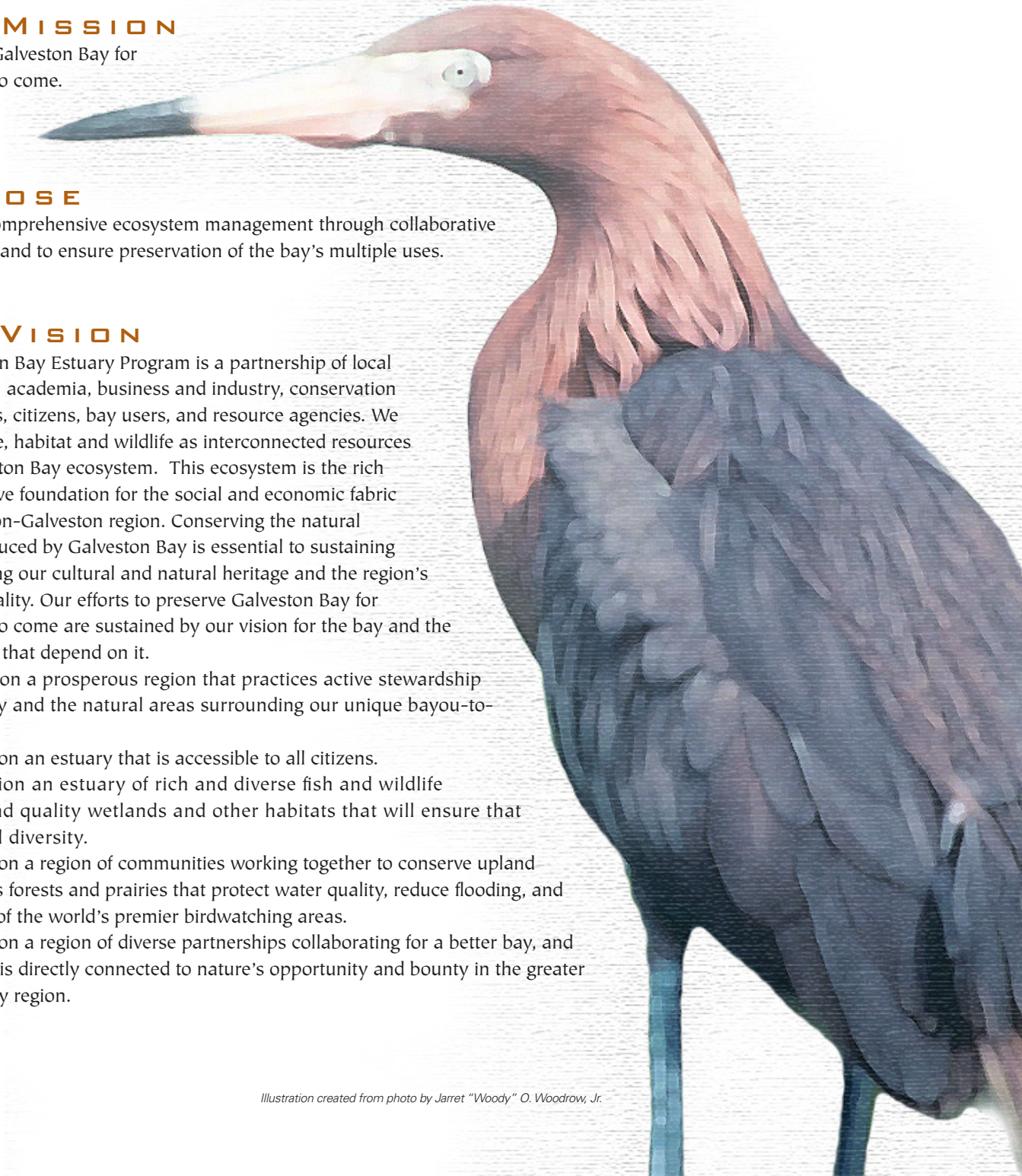

Illustration created from photo by Jarret "Woody" O. Woodrow, Jr.

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photo by Jarret "Woody" O. Woodrow, Jr.

Executive Summary

The Galveston Bay Estuary Program

The Galveston Bay Estuary Program is administered by the Texas Commission on Environmental Quality and cosponsored by the National Estuary Program of the U.S. Environmental Protection Agency. A partnership of local governments, business and industry, conservation organizations, bay users, and resource agencies, the Estuary Program is charged with implementing *The Galveston Bay Plan*—the comprehensive conservation and management plan for the Galveston Bay ecosystem. *The Galveston Bay Plan* was approved by the governor of Texas and the U.S. Environmental Protection Agency in 1995. It was designed to be implemented over a 20-year period with evaluations every five years.

The Galveston Bay Strategic Action Plan

Progress has been made on all 82 actions originally identified in *The Galveston Bay Plan*. Those actions address the 17 most pressing problems facing the bay, and the Estuary Program will continue implementing the most urgent among them. Inevitably, however, funding limitations, population growth, changes as environmental regulatory programs progress, and new issues have emerged over time. This document, *Charting the Course to 2015: Galveston Bay Strategic Action Plan*, was created not to replace *The Galveston Bay Plan*, but to help focus and guide its implementation over the next 10 years, in consideration of increasing human demands affecting the ecosystem and limited financial resources.

At the heart of the *Strategic Action Plan* are three sections that highlight the priority focus areas identified during a series of stakeholder meetings held in 2005 and 2006.

- Ecosystem and Human Health—protecting and improving the Galveston Bay ecosystem for people, fish and wildlife

Galveston Bay's watershed reaches as far north as Dallas–Forth Worth. Water from that area drains to the Trinity River, which drains to the bay.

- Public Participation and Education—building the capacity of citizens, businesses, local governments, and community-based groups to engage in decision making and to play an active role in protecting the health of Galveston Bay
- Monitoring and Research—maximizing effectiveness by assessing environmental improvements, fostering ecosystem-based knowledge for improved resource management, evaluating efficacy of actions, communicating results, and taking corrective action

In each of the priority focus areas, the issues of greatest concern are characterized and a series of associated goals and objectives are identified. The goals and objectives are designed to guide Estuary Program partners as they plan, fund, and implement policies and programs over the next 10 years. As the *Strategic Action Plan* priority focus areas were developed using *The Galveston Bay Plan* as a starting foundation, its goals and objectives address one or more of the priority problems originally enumerated in *The Galveston Bay Plan*. As shown in Table 2, *Strategic Action Plan* goals were prioritized by stakeholders as very high, high, medium, and low. Objectives were developed for the very high- and high-priority goals. Objectives were not developed for medium- and low-priority goals.

Last, the section Fostering Implementation discusses the importance of commitment and coordination among all natural resource agencies and bay stakeholders to implementing the *Strategic Action Plan*. Included in this section is a list of the specific actions the Estuary Program partnership will undertake from 2007 through 2009 to address goals and objectives set forth to address the priority focus areas.

Introduction

It's important to protect these things now, because some things you just can't replace. Once it's gone, it's gone.

— *John Manlove, mayor of Pasadena*

Galveston Bay is a dynamic and important coastal resource to Texas and is an estuary of national significance. It is the most monumental natural resource in the Houston-Galveston area, and its ecological services and quality-of-life value are intricately entwined in the social and economic fabric of the region.

The bay and its vast network of tributaries form a unique and significant coastal landscape. Covering more than 1,500 shoreline miles of bay area, meandering streams, creeks, bayous and channels, the Galveston Bay system drains land from Dallas to Houston—land inhabited by nearly half of Texas' population. It is also the second most productive estuary in the nation, claims one of the most diverse bird populations on earth, and is a prime resource underpinning our region's prosperity.

Today, there are 4.5 million residents in the lower Galveston Bay Watershed. The region has grown since the late 1800s from a few small towns to a region containing the fourth largest city in the United States, quaint bayside cities, and a vibrant barrier island city that successfully recovered from the deadliest natural disaster in U.S. history. The region is also home to a world-class port, the second largest recreational boating community in the nation, and an industrial complex that produces more than one-third of the nation's petrochemicals.

Nearby, you'll find NASA's Lyndon B. Johnson Space Center, from which the nation's space missions are controlled, the world-renowned Texas Medical Center, and more than 60 degree-granting colleges, universities, institutes, and technical schools.

The multitude of activities that thrive along the shoreline of the bay and its river and bayou tributaries are crucial to the economy and quality of life of Galveston Bay region residents.

Economic Health

Preserving the region's natural capital is essential for a sustainable and vibrant economy.

Galveston Bay supports recreation, tourism, industry, commercial fishing, and trade through shipping, and has substantial ecological and aesthetic value supportive to a sustainable and healthy quality of life. As a resource that offers unique services important to both industry and residents' quality of life, Galveston Bay is a viable unifying force connecting the region's cities and towns and propelling its global value.

While offering recreational opportunities and unspoiled landscapes in the backyard of this large metropolitan area, the bay supports some of the most productive fishing and shellfish-harvesting waters in the country, as well as one of the most diverse populations of birds. This rich and productive habitat also supports a rapidly growing eco-tourism industry.

One-third of the state's commercial fishing (valued at $350 million annually) and over half of its recreational fishing (valued at $2.8 billion annually) occurs in Galveston Bay. About one-third of the blue crabs caught commercially in Texas are harvested in Galveston Bay. It is also the state's most important oyster fishery. In 2004, it produced 4.8 million pounds of oysters, with a dockside wholesale value of $13 million.

Those living near bay waters witness the forces of nature that continually reshape its habitat and coastline. The bay, its shoreline, and many upland channels play a vital role in tempering the safety risks and economic impacts of the most devastating of these forces, including hurricanes and tropical storms.

Tropical Storm Allison, Hurricane Katrina, and Hurricane Rita shed new light on the value and function of coastal resources. Many of these resources, including Galveston Bay and its associated habitats, provide natural capital and ecosystem services in direct support of economic health. Natural capital and ecosystem services refer to the functions and value provided by the Galveston Bay estuary that, if lost, would have to be replaced at immense capital expense.

For example, wetlands store clean water and protect against shoreline erosion. Estuaries and wetlands are important nursery habitats for commercial and recreationally important fishes as well as for the abundant wildlife that boosts tourism. And the many channels and floodplains that drain the lands around Galveston Bay protect buildings, infrastructure, and property values in the

adjoining upland areas. Open-space protection for flood-damage mitigation and other collateral benefits are now recognized as essential ecological services.

Without healthy natural ecosystems in the Galveston Bay region, the local economy would lose these valuable services and face the heavy financial burden of replacing them and forgo an opportunity to enhance the region's value.

The Galveston Bay Plan

Area stakeholders developed *The Galveston Bay Plan* (the Plan) to ensure long-term preservation of the bay's health. The Plan (also known as the Comprehensive Conservation and Management Plan for Galveston Bay), was crafted over a five-year period with the expert knowledge and input of hundreds of dedicated people. Additionally, public feedback from more than 3,000 citizens was considered before approval by the Governor of Texas and the EPA. The Galveston Bay Council, a 41-member advisory committee to the Texas Commission on Environmental Quality, oversees implementation. Table 1 lists the stakeholder groups represented on the Council. A program director and seven professional staff members are responsible for implementing the Plan.

From 1996 through 1998 the Estuary Program was jointly administered by the Texas General Land Office and the TCEQ, with the General Land Office funding the program from its Oil Spill Fund. In 1999, the Texas Legislature passed the Texas Estuaries Act (HB 2561), which identifies the TCEQ as the lead administrator.

Progress Through Partnerships

Given the multiple regulations and regulating bodies that inform bay-related policy, coordinated management of a broad range of interests is needed. The Estuary Program thus works cooperatively with local governments, businesses, ports, commercial fisheries, recreational anglers, environmental organizations, and state and federal natural-resource agencies. The contributions of these many partners shape the success of Plan initiatives and the sustainable future of Galveston Bay.

Ten Years of Accomplishment

In the first 10 years of Plan implementation, Estuary Program partners made notable achievements in improving water quality, restoring wetlands, protecting unique habitats, and educating the public. Those achievements include:

▼ **Creating, restoring, and protecting important coastal habitats.**

- Restored and protected an estimated 8,000 acres of wetlands and important coastal habitats since 1995.
- Successfully used dredged material to restore more than 2,000 acres of wetlands, bird-nesting uplands, and oyster reefs.
- Maintained a nursery that produces 350,000–500,000 wetland plants each year so that restoration projects no longer need plants from established wetlands nor cultured plants that are purchased, thereby lowering the cost of restoration.

Freshwater marsh restoration at Sheldon Lake State Park.

photo by Jarrett "Woody" O. Woodrow, Jr., U.S. F&WS

The nation's ocean and coastal resources offer many opportunities for beneficial uses but are also affected by the cumulative impacts of human activities that span cities, counties, states, and sometimes nations. To move toward an ecosystem-based management approach, government should have the institutional capacity to respond to ocean and coastal issues in a coordinated fashion across jurisdictional boundaries.

—An Ocean Blueprint for the 21st Century Final Report of the U.S. Commission on Ocean Policy, 2004

▼ **Supporting local water-management initiatives.**

- Formed the Galveston Bay Freshwater Inflows Group in 1996 to develop management strategies that will strike a balance between human needs and those of the estuary. Through this group, the Estuary Program supports and coordinates, on a local level, the state's consensus-based, regional approach to integrating environmental flow protection into the water-allocation process while assuring that human needs are satisfied. The group began drafting potential strategies in 2005, but disagreement regarding the scientific study that forms the basis of target inflows to the bay stalled these efforts. Once the scientific issues are resolved, the group will examine the potential strategies drafted previously and begin developing management recommendations based on strategies identified as being feasible.

▼ **Managing threats from invasive species.**

- Established the Invasive Species Work Group as part of the five-year plan review, to coordinate invasive-species management in Galveston Bay.
- In 2002, completed a comprehensive risk assessment of threats posed by invasive species already present and expected to appear in the Galveston Bay area.
- Conducted several important projects on invasive-species control, research, and public outreach.
- Completed a field guide to invasive plants in the bay area, and distributed over 4,000 copies to nurseries and landscape managers.

▼ **Protecting and improving water quality.**

- Implemented pollution prevention practices, such as conservation landscaping, vegetative buffers along waterways, and storm water detention basins supplemented with wetlands.
- Conducted workshops with local governments and developers to identify mutually beneficial sustainable development practices that reduce construction related pollution. Workshop discussions led to increased collaboration between some local governments that resulted in adoption of uniform construction guidelines.
- Financially supported and participated in local watershed protection initiatives to address impaired water bodies including Total Maximum Daily Loads.
- Supported and participated in community-based waterway and shoreline trash cleanups. From 1994 to 2005, 50,000 volunteers have collected 1,558 tons of trash and 2,400 tires from waterways throughout the Houston-Galveston area.

▼ **Protecting public health.**

- Collected and analyzed fish tissue and data to assess the safety of seafood caught in Galveston Bay. Seafood-safety advisories have been expanded in some areas, and made less stringent or removed in other areas, since the initiation of this effort in 1997.

▼ **Building public stewardship through education and involvement.**

- Conducted over 300 presentations and exhibits to schools, local community events, and workshops

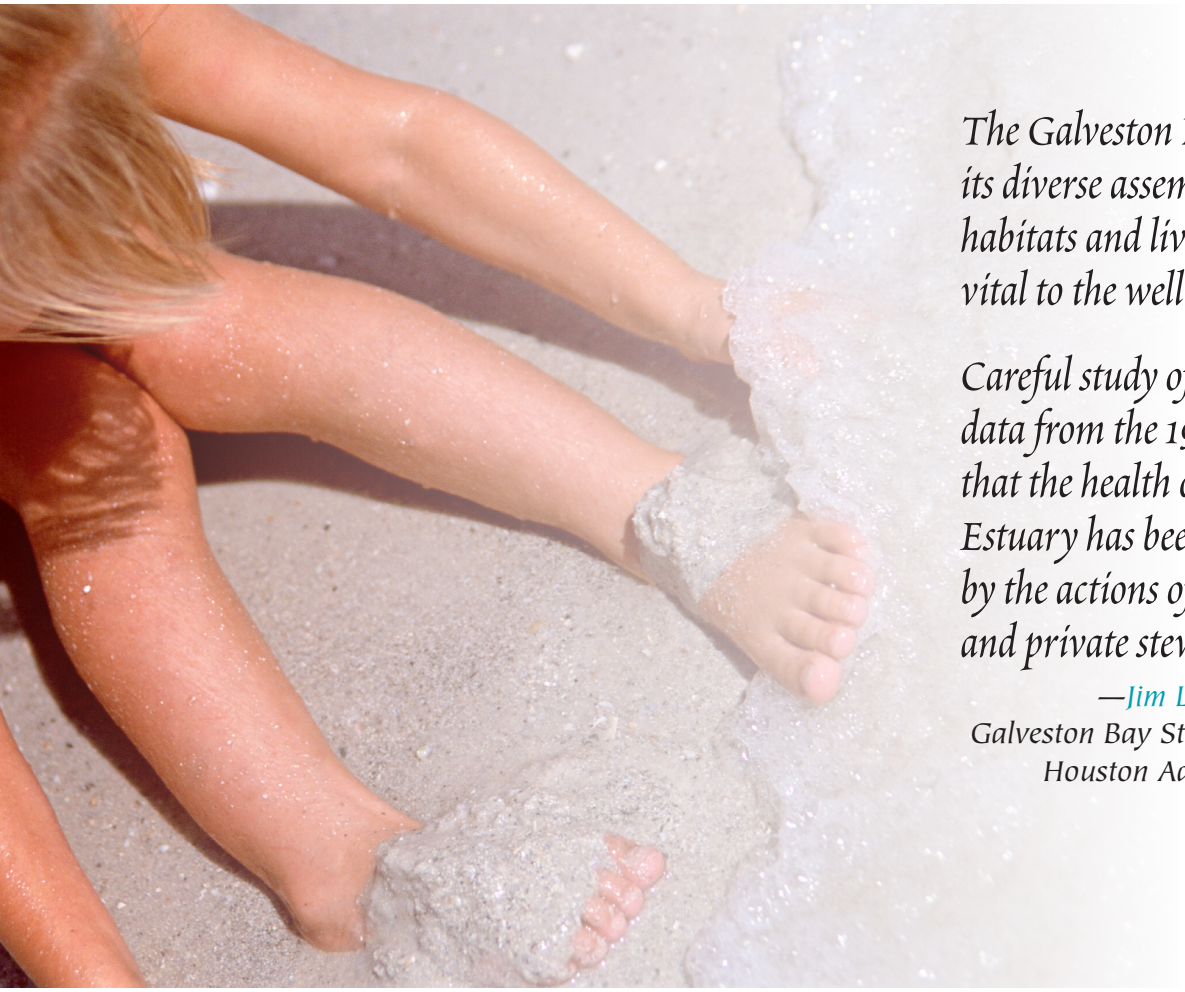
and conferences, reaching nearly 10,000 adults and students since 1995. Held seven biennial State of the Bay Symposia since 1991, hosting a combined audience of approximately 2,000 stakeholders and citizens.

- Held seven community-centered environmental-education open houses in 2006 to give citizens access to informal one-on-one discussions with resource-protection experts from three federal agencies, five state agencies, several local and county governments, and recreation and conservation organizations. Over 650 citizens participated.
- Educated over 40 Rotary and Lions clubs, neighborhood associations, and other community-based groups in 2006, reaching approximately 850 adults and 450 children.
- Exhibited at 101 events in 2006, reaching approximately 500 adults and 1,600 children.
- Hosted a Gulf of Mexico Alliance community workshop in 2005 to secure local stakeholder and citizen input into the Gulf of Mexico Alliance Governors' Action Plan.

▼ **Levering additional dollars and expertise through cooperative partnerships.**

- The Estuary Program dedicated $5 million to on-the-ground resource-conservation and education projects and levered $38 million (an estimate) since 2002, resulting in an average annual leverage ratio of $7.6 to $1.

While progress on the Plan was being made, the Houston-Galveston region changed. On the positive side, there are now permit requirements for the management of urban, industrial and construction-site storm water and related pollution abatement. On a less encouraging note, fewer wetlands are protected as a result of federal judicial rulings and subsequent interpretation that limit federal jurisdiction over certain wetlands associated with migratory-bird use. In addition, more habitat has been lost to residential and commercial development, and the region has experienced continuous growth and several natural disasters. In anticipation of these kinds of change, the Plan was developed with the expectation that periodic reviews would be required. A thorough review was initiated in 2004, and this document summarizes the results of that 2½-year effort.



The Galveston Bay Estuary, with its diverse assemblage of coastal habitats and living resources, is vital to the well-being of the region.

Careful study of the monitoring data from the 1970s to today shows that the health of the Galveston Bay Estuary has been largely preserved by the actions of public managers and private stewards.

—Jim Lester and Lisa Gonzalez
Galveston Bay Status and Trends Project, Houston Advanced Research Center

Ecosystem and Human Health

Protecting and improving the Galveston Bay ecosystem for people, fish, and wildlife

The Plan denoted 17 priority problems to be addressed over a 20-year period, most of which have been partially or fully addressed over the past 10 years. Habitat loss, degraded water quality, public health, freshwater availability and species protection, through habitat conservation and invasive-species control, remain high priorities and have been identified as priorities for the next 10 years.

The following sections characterize the issues of greatest concern within the Ecosystem and Human Health focus area. These issues address one or more of the priority problems originally enumerated in the Plan, and have associated goals and objectives designed to guide Estuary Program partners as they plan, fund, and implement policies and programs to address the priority problems over the next 10 years. The goals and objectives were developed in consideration of ongoing and new challenges presented in the region today.

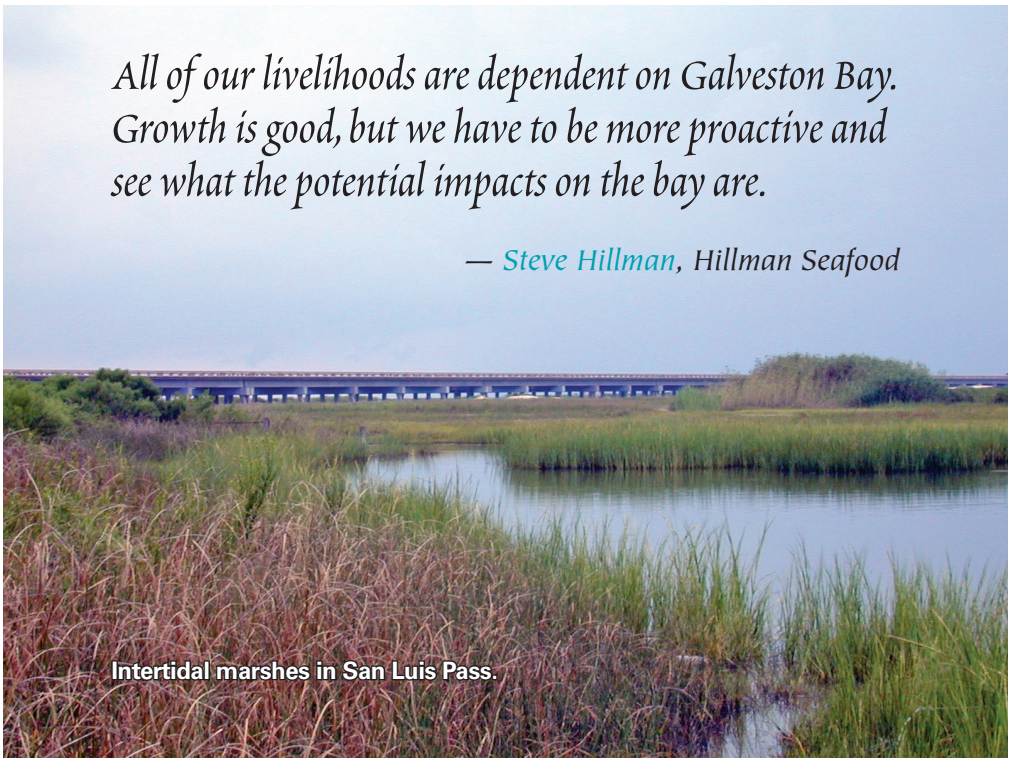
Challenges

- Green space for humans and natural habitat for fish and wildlife continues to be lost: over 2,900 acres of estuarine wetlands and over 9,000 acres of freshwater wetlands were lost from 1992 through 2002 alone.
- Remaining habitat is increasingly fragmented as it is converted to other land uses, such as commercial and residential development: current planning for contiguity is not common practice, and the cost for conservation is increasing.
- Over 384 municipal wastewater treatment plants have been built and more are expected as population grows: effective oversight and management are challenged by limited resources.
- Many aging wastewater-treatment collection systems are leaking, particularly when rain falls: defective systems are infiltrated with rainwater, exceeding their carrying capacity and resulting in overflows that discharge sewage into local waterways.
- An estimated 80,000 of the 400,000—or 20 percent—of septic systems in the region are failing and occasionally discharge sewage into local waterways.
- Water pollution has made many bayous and creeks and portions of the upper bay unsuitable for fishing and swimming due to low dissolved oxygen and the presence of bacteria.
- Legacy pollutants and other pollutants from unknown sources contaminate some small areas in the Houston Ship Channel and Upper Galveston Bay, resulting in restricted consumption of seafood in those areas.
- There are 296 known aquatic and terrestrial invasive species present or expected to be introduced to the bay area, posing serious threats to a healthy functioning ecosystem.
- Demands on a finite water supply will continue to increase as water consumption increases and population grows: a healthy bay requires freshwater.

Goals identified to address the issues of greatest concern were categorized as being of very high, high, medium, or low priority. Objectives were developed for the very high– and high-priority goals, so only the highest priorities are delineated in the following core sections. Objectives were not developed for medium and low priority goals, but those goals are listed in the Summary of Strategic Action Plan Goals and Associated Galveston Bay Plan Priority Problems at the end of this document.

Habitat and Landscape-Level Conservation

Habitat loss poses the greatest threat to ecosystem health. From the 1950s through the 1980s, the Galveston Bay system experienced a net loss of nearly 35,000 acres (19 percent) of its wetlands, and 1,800 acres (70 percent) of its sea grasses, from a variety of natural and human causes. Passage of the Clean Water Act in 1972 offered federal protection for critical wetlands in the Galveston Bay ecosystem, but this protection has been reduced by recent



Intertidal marshes in San Luis Pass.

photo by Steven R. Johnston, GBEP

U.S. Supreme Court rulings. Due to population growth in the watershed, wetlands continue to be lost, especially in inland areas where many wetlands receive no regulatory protection. Consequently, wetland and habitat preservation is of particular importance in light of rapid growth, escalating land values, and other factors that will make conservation increasingly challenging in the future.

Upland areas such as forests and prairies also contribute greatly to the health of the ecosystem as providing habitat and protectors of water quality. Though loss of these habitats has not been as closely monitored by estuary resource managers, the watershed is losing uplands in the face of growth. Special consideration should be also given to other particularly valuable areas, such as stream corridors, that are exceptionally valuable to habitat, water quality, and recreation.

Fragmentation, the breaking up of large, contiguous expanses of habitat into smaller tracts, degrades the quality of wetland and upland habitats and their ability to support an abundance and diversity of plants and animals. Conversion of Galveston Bay's diverse habitats to human uses continues to fragment remaining natural areas, which will likely exacerbate the effects of habitat loss and reduce water quality.

Ecosystem health depends on preserving an intact, contiguous mosaic of diverse habitats. The Estuary Program and its partners are seeking to protect and restore important coastal habitats on a large (landscape or regional) scale while preserving their ecological, cultural, historic, aesthetic, and agricultural values.

The Estuary Program and its partners will strategically pursue worthy individual habitat-conservation efforts—particularly in conjunction with local communities—seeking where possible to establish interconnected corridors along bayous and other natural features. Estuary Program partners will expand access to quality natural areas, which is essential for building stewardship of coastal natural resources.

Priority Problems (from the Plan) Addressed:

- Vital Galveston Bay habitats such as wetlands have been lost or reduced in value by a range of human activities, threatening the bay's future productivity.
- Some bay shorelines are subject to high rates of erosion and loss of stabilizing vegetation due to past subsidence, rise in sea level and current human impacts.
- Shoreline management practices frequently do not address negative environmental consequences to the bay, or the need for environmentally compatible public access to its resources.
- Certain species of marine organisms and birds have shown a declining population trend.

The following goals and objectives reflect the highest priorities identified to address these problems.

Goal 1: Protect existing coastal habitats in the Lower Galveston Bay Watershed.

- **Objective A:** Identify important coastal habitats to target for long-term conservation, with particular attention to those at risk of loss to land-use conversion, erosion, or other immediate threats.
- **Objective B:** Place 2,500 acres of important coastal habitats under long-term conservation through fee-simple acquisition, placement of conservation easements, purchase of development rights, and other mechanisms.
- **Objective C:** Protect 2,500 acres of important coastal habitat from further loss due to erosion.
- **Objective D:** Develop or support outreach initiatives that promote habitat conservation.

Goal 2: Restore and enhance coastal habitats in the Lower Galveston Bay Watershed.

- **Objective A:** Identify important coastal areas to target for restoration and enhancement of lost or degraded coastal habitats.
- **Objective B:** Restore and enhance 5,000 acres of lost or degraded coastal habitats.

Water and Sediment Quality

Degraded water quality in urban tributaries, some near shore areas and around marinas, is the second-highest-priority problem facing the Galveston Bay ecosystem. Nonpoint source (NPS) pollution is introduced into area bayous through rainfall containing contaminants from a large number of land-based sources. For example, pollutants may be washed off lawns, construction areas, septic system drain fields, parking lots, or highways during a heavy rain, collected in a ditch or local storm drain, and transported to area bayous and the bay. This kind of pollution is difficult to control because it comes from everyday human activities.

Unlike nonpoint source pollution, point source pollution comes in large amounts from a discrete, single source, such as a municipal or industrial treatment plant. Also, once NPS pollution reaches storm water collection systems it is often considered a point source under Phase I or Phase II requirements of the Texas Pollution Discharge Elimination System. Although point sources are for the most part regulated, bypasses and unauthorized overflows from municipal sewerage systems remain a concern for the region. Even when unauthorized activities are successfully controlled, the rapidly growing population will continue to challenge collection and treatment systems that are aging and often reaching capacity. In addition, the growing number of small-scale publicly owned treatment works struggle to optimally manage costs and meet performance standards. The growing number of pollution-control facilities also taxes government's capability for effective oversight.

Estuary Program partners will combine watershed-based management and targeted source reduction to address the issues of greatest concern related to nonpoint and point source pollution. Specifically, nonpoint source management strategies will integrate structural and non-structural practices that address multiple concerns in the bay community, including flooding, water quality, habitat protection, quality-of-life issues, recreation, and education. Management strategies for point sources will involve supporting regional planning efforts that address infrastructure needs and challenges presented by a growing population.

Priority Problems (from the Plan) Addressed:

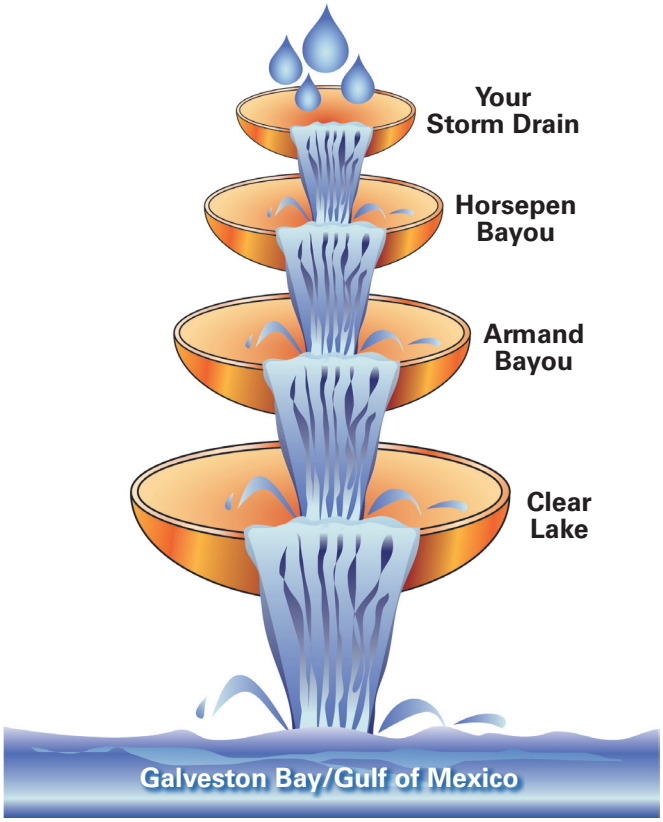
- Contaminated runoff from nonpoint sources degrades the water and sediments of bay tributaries and some areas near shore.
- Water and sediments are degraded in and around marinas from boat sewage and introduction of dockside wastes from nonpoint sources.
- Illegal connections to storm sewers introduce untreated wastes directly into bay tributaries.
- Raw or partially treated sewage and industrial waste enter Galveston Bay due to wastewater-treatment-plant design and operational problems, especially as a result of rainfall runoff.
- Dissolved oxygen is reduced in certain tributaries and side bays, harming marine life.
- Illegal dumping and waterborne and shoreline debris degrade the water quality and aesthetics of Galveston Bay.

The following goals and objectives reflect the highest priorities identified to address these problems.

Goal 1: Reduce NPS Pollutant Loads.

- **Objective A:** Support development and implementation of Watershed Protection Plans and Total Maximum Daily Load (TMDL) Implementation Plans.
- **Objective B:** Coordinate an effective NPS campaign with the Public Participation and Education

Lower Galveston Bay Watershed



Subcommittee to foster public awareness of the consequences of human activities, including inappropriate disposal of sewage by boaters.

- **Objective C:** Support development and implementation, in coordination with the Monitoring and Research Subcommittee, of effective structural and nonstructural NPS best management practices.
- **Objective D:** Support a regional approach to implementation of storm water management plans, including development of programmatic and numerical baselines. Coordinate with the Estuary Program Monitoring and Research Subcommittee to identify baselines in local tributaries for common pollutants to better monitor and track results.
- **Objective E:** Support and foster dialogue between registered sanitarians and other sanitary-waste specialists to encourage improvement in septic systems.
- **Objective F:** Support and foster dialogue among marinas, boaters, local and state government, and others as appropriate to expand, maintain, and operate a network of marine sanitation-device pumpout facilities.

Goal 2: Maintain the capacity and integrity of municipal sanitary sewer collection systems to eliminate sewage bypasses and unauthorized overflows.

- **Objective A:** Identify systems with deficiencies and promote TCEQ efforts to enter into compliance agreements with municipalities with sanitary-sewer overflows.
- **Objective B:** Collaborate with owners and operators of Phase I and Phase 2 municipal separate storm sewer systems (MS4s) on development and implementation of storm water management programs to eliminate unauthorized discharges into the MS4s.

Goal 3: Eliminate pollution problems from poorly operated sewage treatment plants and promote regionalization of small wastewater-treatment plants, including publicly owned treatment works.

- **Objective A:** Support no-notice compliance inspections of wastewater treatment facilities by the TCEQ.
- **Objective B:** Support and foster dialogue among Estuary Program partners, state and local governments, and the real-estate development community to encourage the regionalization of wastewater collection and treatment facilities.

Public-Health Protection

High bacteria levels in open bay waters periodically close portions of the bay to oystering, and a number of bay tributaries exceed standards for safe contact recreation. Sediment is contaminated with toxic agents in localized areas, and portions of the Houston Ship Channel and upper Galveston Bay exceed fish-tissue quality criteria for select contaminants, increasing health risks associated with consuming contaminated seafood from those areas.

The Estuary Program and its partners will protect the public health through monitoring and public-education initiatives. Programs that detect and identify contaminants of concern and communicate risks associated with contacting contaminated water and consumption of seafood from problem areas will be supported.

Priority Problems (from the Plan) Addressed:

- Some tributaries and near-shore areas of Galveston Bay are not safe for contact recreation such as swimming, wade-fishing, and sailboarding due to risk of bacterial infection.
- About half of the bay is permanently or provisionally closed to the harvesting of shellfish because of high levels of fecal coliform bacteria that indicate risk to shellfish consumers.
- Certain toxic substances have contaminated the water and sediment and may have a negative effect on aquatic life in those contaminated areas.
- Seafood from some areas in the bay may pose a public-health risk to consumers of subsistence- or recreational-catch seafood as a result of the potential presence of toxic substances.

The following goals and objectives reflect the highest priorities identified to address these problems.

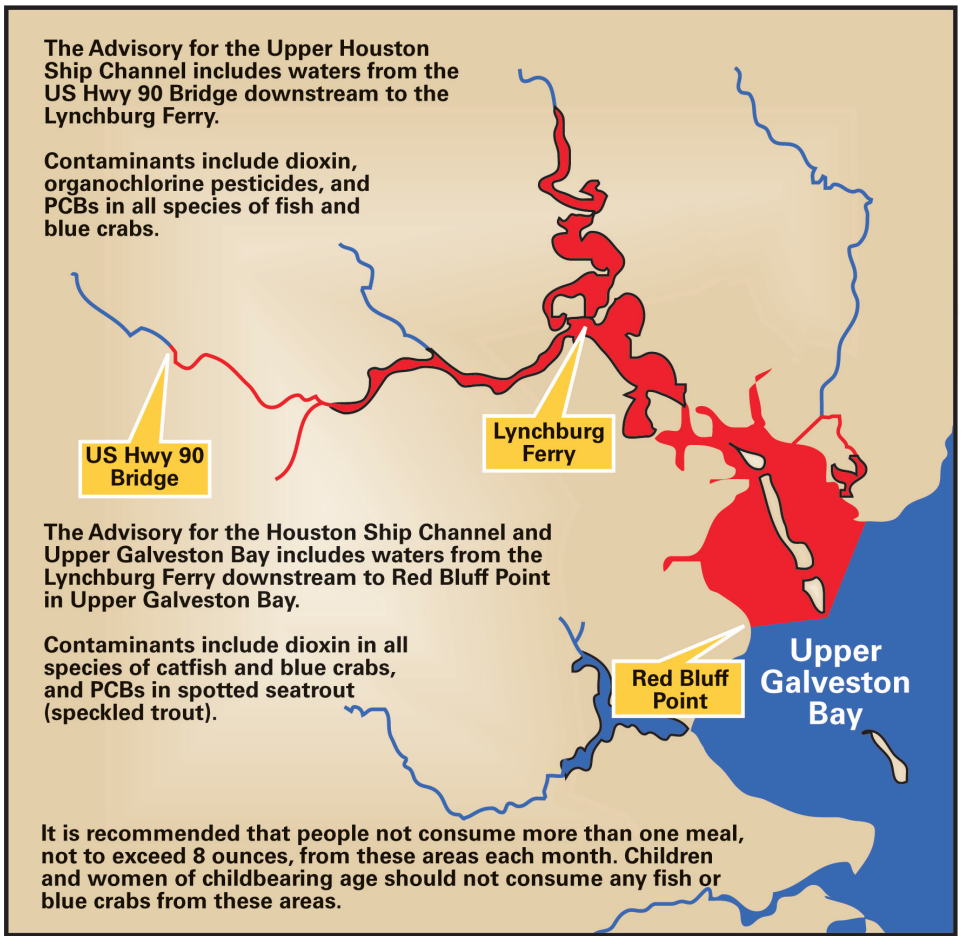
Goal 1: Minimize risk of waterborne illness resulting from contact recreation.

- **Objective A:** In coordination with the Public Participation and Education Subcommittee, support public outreach regarding risks from contact recreation due to waterborne pathogens.
- **Objective B:** Support and facilitate development and implementation of TMDL programs consistent with the goals of the Plan.
- **Objective C:** Coordinate with the Monitoring and Research Subcommittee to sponsor research to characterize the contact-recreation risks from waterborne pathogens.

Goal 2: Reduce the concentration of toxins in key species of concern.

- **Objective A:** Support and facilitate development and implementation of TMDLs consistent with the goals of the Plan.
- **Objective B:** Coordinate with the Monitoring and Research Subcommittee to characterize pollutant loads from air deposition.

Seafood Advisory Map



Goal 3: Reduce human health risk resulting from consumption of seafood contaminated with toxic substances.

- **Objective A:** Continue to support a seafood-consumption advisory program in coordination with the Monitoring and Research Subcommittee.
- **Objective B:** Coordinate with the Public Participation and Education Subcommittee to support an effective public-outreach seafood-advisory campaign.

Freshwater Inflow and Bay Circulation

Freshwater inflow defines any estuarine system, and is a critical element in maintaining the health and productivity of Galveston Bay. While the bay currently receives adequate freshwater inflows, forecasts for high growth in the region in coming years will likely result in an increased demand for water. This, in turn, will likely alter the quantity of freshwater the bay receives, as well as change the timing and location of freshwater inflows. Finding a way to accommodate increased demands while ensuring adequate inflows to the bay will be very challenging.

The Estuary Program and its partners seek to ensure that the bay's needs are incorporated into regional water management, and that bay circulation is not altered to the detriment of the ecosystem.

Priority Problem (from the Plan) Addressed:

- Future demands for freshwater and alterations to circulation may seriously affect productivity and overall ecosystem health.

The following goals and objectives reflect the highest priorities identified to address these problems.

Goal 1: Ensure freshwater inflows necessary to maintain the balance of salinity, nutrients, and sediments required to support a productive estuary.

- **Objective A:** Support the Galveston Bay Freshwater Inflows Group to provide a forum for discussion on regional and state water-management policy, and to develop and implement strategies for ensuring adequate freshwater inflows to Galveston Bay.
- **Objective B:** Support further research to understand the annual and seasonal freshwater-inflow needs for Galveston Bay, as well as information needed to develop management strategies.
- **Objective C:** Develop or support outreach initiatives that promote water conservation and educate the public on the value and importance of freshwater inflows.

Sustaining Species Populations

The proliferation of invasive species also threatens to degrade remaining natural areas. Problems such as the spread of Chinese tallow pose a serious threat to upland and freshwater wetland habitats, while water hyacinth, among other invaders, degrades freshwater aquatic systems. More saline areas within the estuary have been relatively pest-free, but the potential for introductions of harmful organisms is very real.

The Estuary Program and its partners seek to maintain viable populations of native species and to manage invasive species effectively. Effective species management is largely supported through protecting and restoring habitat, ensuring freshwater inflows, and protecting water quality, along with other measures. However, special attention should be given to management of declining species and species of particular ecological or economic importance.

Priority Problems (from the Plan) Addressed:

- Certain species of marine organisms and birds have shown a declining population trend.
- Some exotic and opportunistic species (e.g., nutria and grass carp) threaten desirable native species, habitats, and ecological relationships.

The following goals and objectives reflect the highest priorities identified to address these problems.

Goal 1: Sustain and restore native species populations.

- **Objective A:** Identify declining or threatened native species to target for management action.
- **Objective B:** Support implementation of existing plans or the development of new plans to support declining species.
- **Objective C:** Consider species needs in developing habitat protection and restoration activities.
- **Objective D:** Support research identifying habitat and environmental needs of declining species.
- **Objective E:** Develop or support public outreach and education on the identification of native species and their importance.

Goal 2: Eradicate or reduce populations of exotic invasive species and prevent new invasions.

- **Objective A:** Support invasive-species management on public and private lands under conservation management.
- **Objective B:** Support research on invasive-species issues, including control techniques, risk assessments, ballast-water management and prevention of introductions.
- **Objective C:** Support public education on invasive-species identification and distribution, and on the economic and ecological threats posed by invasive species.

Non-native and invasive tallow tree.

photo by Houston Advanced Research Center

photo by Jarrett "Woody" O. Woodrow, Jr.

photo by Jarrett "Woody" O. Woodrow, Jr., TP&WD

Above: Roseate Spoonbill and Snowy Egret.

Left: Cordgrass planting at West Bay Bird Island Restoration.

Public Participation and Education

Creating public collaboration and partnerships that maximize available resources and energy for bay conservation

Aerial of intertidal marshes in West Galveston Bay.

photo by Jarrett "Woody" O. Woodrow, Jr., U.S. F&WS

The Galveston Bay Plan identifies public participation and education as critical elements for long-term successful management of Galveston Bay and its associated habitats and landscapes. Given constraints on funding by government and the private sector alike, an educated and motivated public can offer critical expertise, time, effort, and leadership to conservation efforts. The vast, complex, and diverse nature of residents in a major and fast growing metropolitan area such the Galveston Bay region presents opportunities and challenges for public participation and education.

The human capital afforded a region of this nature offers ample opportunity to garner and lever volunteers and engage many in conservation activities. Conversely, communicating effectively and relevantly across the region in such a dynamic environment presents considerable challenges.

Public stewardship, public awareness, public education, and partnerships were named as priority issues for the next 10 years. In the following sections, each is characterized and a set of goals and objectives—designed to guide Estuary Program partners, as they plan, fund, and implement policies and programs related to public involvement over the next 10 years—is identified.

Public Stewardship

Stewardship means protecting and preserving the bay. It is everyone's business because we all benefit from the natural resources the bay provides; the bay is used for recreation and the harvesting of seafood and supports a variety of jobs and other economic endeavors.

Estuary Program partners will create campaigns that unify bay communities and garner support for region-wide action that sustains all uses. The following goals and objectives reflect the highest priorities identified to build public stewardship.

Goal 1: Create a sense of personal ownership and shared responsibility among all cultural components of the community, including the public, industry, and government.

- **Objective A:** Create a broad, compelling Estuary Program campaign message that indicates the estuary's value and illustrates citizens' positive and negative effects on the bay.
- **Objective B:** Develop and promote programs and events to encourage all cultural components of the community to participate in activities relating to stewardship of the bay.

Public Awareness

There are many sources of information on Galveston Bay and estuary priorities, but a coordinated, efficient system of communication is needed. Additionally, a clear message communicating the connection between individual day-to-day decisions and activities and subsequent effects on environmental quality is essential to encouraging simple changes in individual behavior that may go a long way toward improving and sustaining the natural resources of Galveston Bay.

In support of a coordinated system, Estuary Program partners will develop and periodically evaluate its communications by collecting and evaluating data on community attitudes, public involvement, and stewardship. Information will identify abilities to adapt and adjust to needs of the public.

The following Goals and Objectives reflect the highest priorities identified to increase awareness.

Goal 1: Obtain information to develop and evaluate Estuary Program communication efforts.

- **Objective A:** Identify Estuary Program audiences.
- **Objective B:** Identify avenues to disseminate the Estuary Program message.
- **Objective C:** Identify and employ metrics to evaluate communications efforts.

Goal 2: Facilitate broad public involvement in Estuary Program policy, management, and implementation.

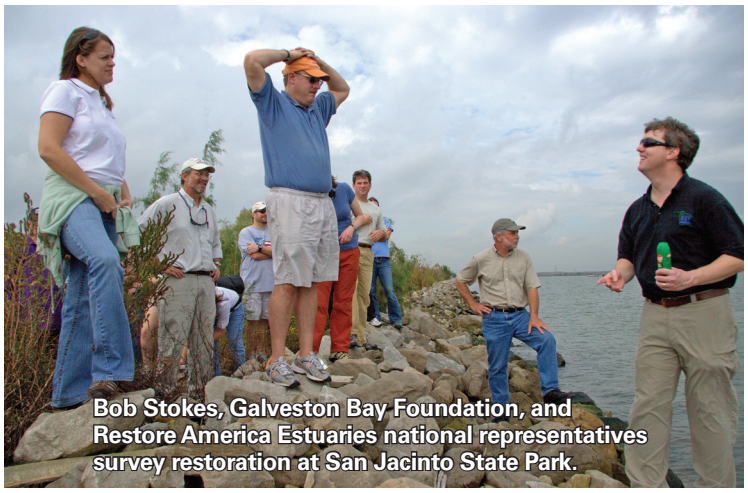
- **Objective A:** Continue and expand the biennial State of the Bay Symposia to ensure that key target audiences are reached.
- **Objective B:** Develop and promote initiatives, programs, and events that reach all cultural components of the community and specific target audiences.

Public Education

Long-term, lasting success in environmental stewardship programs requires continuing, enhanced education for all stakeholder interests. Estuary Program partners will create issue-specific materials and launch education campaigns tailored to maximize effectiveness for specific audiences. The following goals and objectives reflect the highest priorities identified to increase public application of environmentally sustainable practices in everyday life.

Goal 1: Ensure that stakeholders receive the knowledge necessary to act on the Estuary Program's priorities in ways that benefit the bay and the entire community.

- **Objective A:** Develop and distribute K–12 Galveston Bay Estuary–related curricular materials for use in regional schools.
- **Objective B:** Develop estuary educational campaigns, programs, or both, aimed at the general public and specific stakeholder audiences, about key issues, including (but not limited to) habitat and water conservation, freshwater inflows, native vs. invasive species, nonpoint sources of pollution, risks from contact recreation, and seafood-consumption safety.



Bob Stokes, Galveston Bay Foundation, and Restore America Estuaries national representatives survey restoration at San Jacinto State Park.

photo by Jarrett "Woody" O. Woodrow, Jr., U.S. F&WS

Expanding Partnerships

The Estuary Program and its partners have had great success conducting outreach to students, teachers, and other educational audiences. Estuary Program partners will continue to extend such outreach to a wider audience, from the general public to business partnerships, nonprofit alliances and diverse media outlets. Weaving additional audiences into existing networks will improve the capacity to connect and resonate with diverse groups and organizations within the bay community. Estuary Program partners will engage the public at community-wide events as well as through the media, ensuring that all audiences receive a coordinated set of messages and tools. Additionally, decisions made at the local level directly and indirectly affect the bay, making local governments integral partners.

The following goals and objectives reflect the highest priorities to increase and enhance collaborative partnerships.

Goal 1: Increase participation of local governments in Estuary Program initiatives.

- **Objective A:** Enlist the support of local government via proclamations, resolutions, and presentation opportunities for Estuary Program initiatives and events.
- **Objective B:** Ensure that local government and personnel, land-use planners, and development interests are knowledgeable about key estuary issues, common interests, and new information as it becomes available.
- **Objective C:** Assist local governments with the development of grant proposals that support Estuary Program initiatives.

Goal 2: Increase the number of partners actively involved in Estuary Program initiatives.

- **Objective A:** Identify and engage partners that enhance bay health.
- **Objective B:** Publicize partner projects and accomplishments.

Monitoring and Research

Maximizing effectiveness by increasing understanding of the ecosystem, assessing environmental health, improving resource management, evaluating efficacy of actions, communicating results, and recommending corrective action

Galveston Bay is a complex, dynamic system that is most effectively managed with support from a structured research and monitoring program and its supporting partner organizations. This program specifically supports the ecosystem-based approach to resource management that is realized through implementation of The Galveston Bay Plan.

Monitoring and research are related but serve two distinct purposes. First, analysis of monitoring data helps determine if the health of the ecosystem is changing. Data are assembled from state and local monitoring partners, analyzed, and distributed to all potential users electronically. When monitoring information fails to generate better understanding, the program directs limited resources for targeted applied research. Second, applied research is directly tied to the Galveston Bay ecosystem and the Plan. Projects usually focus upon the data gaps found when trying to make management decisions with existing monitoring data. This research improves our knowledge of the bay and its relation to human uses, and strengthens the connection between scientists and resource managers. Management action plans are adapted according to the findings of monitoring and research.

photo by Jarrett "Woody" O. Woodrow, Jr., TP&WD

Texas Parks & Wildlife Department staff monitoring freshwater inflows in the Trinity River Delta.

The purpose of the monitoring and research program is to maximize the effectiveness of Plan implementation by increasing understanding of the bay ecosystem, assessing environmental health (or conditions), improving resource management, evaluating the efficacy of actions, communicating results, and recommending corrective action. To carry out this purpose, a data system is maintained, environmental and programmatic assessments are conducted as needed, data gaps are identified, applied research needs are prioritized, and a State of the Bay Symposium is supported biennially.

The following goals and objectives reflect the highest monitoring and research priorities.

Goal 1: Increase understanding of the Galveston Bay ecosystem

- **Objective A:** Collaborate with research institutions to fill gaps in our knowledge of the ecosystem's biological and physical components.
- **Objective B:** Support the dissemination of monitoring and research results to GBEP partners and the public.

Goal 2: Make available information needed by the public, Galveston Bay Council members, and GBEP subcommittee members to support implementation of the Galveston Bay Plan.

- **Objective A:** Obtain, analyze, and synthesize the data needed to determine the status and trends of parameters directly related to the health of the bay.
- **Objective B:** Obtain, analyze, and synthesize the data needed to determine the influence of stressors on the status and trends of parameters directly related to the health of the bay.
- **Objective C:** Support applied research and monitoring projects needed by the Natural Resource Uses Subcommittee and the Water and Sediment Quality Subcommittee.
- **Objective D:** Identify and support significant applied research programs relevant to the goals of the GBEP and not within the purview of other GBEP subcommittees.

Fostering Implementation

Ensuring that all partners effectively and efficiently work in concert for the bay's protection, enhancement, and sustainability

Diverse concerns relating to aquatic habitat, wildlife, resource usage, water quality, and human health cannot be adequately addressed without the involvement of multiple natural-resource agencies and bay stakeholders. Problems of a regional nature—those affecting the entire ecosystem—require regionally coordinated actions and a strong commitment to partnership.

Recent documents, such as the Gulf of Mexico Alliance Governors' Action Plan (2006); the Greater Houston Partnership's 2005 Strategic Plan; and the National Oceanic and Atmospheric Administration's 2006 Discussion Paper, Current and Future Challenges for Coastal Management all affirm the importance of partnerships to successful implementation.

In fact, partnerships have played an integral role in the Estuary Program's success to date. Its many partnerships are cultivated through the Galveston Bay Council, the advisory committee to the TCEQ for the Estuary Program. The GBC was created in 1995 specifically to foster partnerships and offer a forum for coordinating Plan implementation. The 41 GBC members represent a broad range of interests including local governments, businesses, ports, commercial fisheries, recreational anglers, environmental organizations, and state and federal natural-resource agencies.

The GBC established four standing subcommittees to address the day-to-day project needs and advise on specific scientific, technical, and management issues. The four subcommittees include Natural Resources Uses (NRU), Water and Sediment Quality (WSQ), Monitoring and Research (MR), and Public Participation and Education (PPE).

The NRU Subcommittee handles habitat and species protection, freshwater inflows, damage to natural resources from oil spills, and shoreline management. The WSQ Subcommittee addresses ambient water and sediment quality, point and nonpoint sources of pollution, seafood safety, contact recreation, and debris removal. The MR Subcommittee works to improve understanding of the Galveston Bay ecosystem, assess its overall health, and track progress of management actions. The PPE Subcommittee facilitates public involvement in the Estuary Program and partner programs.

In addition, there are the GBC-formed Budget and Priorities (B&P) and Consistency Review (CR) subcommittees. The B&P Subcommittee provides a forum for coordination between subcommittees and advises the GBC on financial and programmatic matters. The CR Subcommittee reviews federally funded projects for consistency with the Plan.

Following are actions and commitments the GBC will carry out to support further implementation of the Plan and to foster effective bay management.

Great blue heron at Brazos Bend State Park.

photo by Jarrett "Woody" O. Woodrow, Jr.

Actions and Commitments (2007–09)

- Implement projects to protect habitat, water quality, and living resources that address specific objectives identified in this Strategic Action Plan, and further specific actions originally identified in The Galveston Bay Plan.
- Convene quarterly meetings of the GBC to resolve problems, address challenges, and ensure commitments in the Plan as identified here.
- Secure and dedicate funding to implement tangible resource-management projects.
- Convene a biennial State of the Bay Symposium to discuss the latest successes and lessons learned in natural-resource management, research findings related to coastal ecosystems and estuaries, and changes in coastal policy.
- Communicate priorities to, and further collaborate with, industry, business, and local governments.
- Host a series of community open houses–presentations throughout the Houston-Galveston area to foster a dialogue with the public regarding progress and needs.
- Coordinate collection of data by local, state, and federal authorities on water quality, habitat, and living resources, and present progress on a select group of environmental indicators.
- Develop and implement a multi-partner, ecosystem-based biennial work plan.

Expected Outcomes (2007–09)

- Protect and restore vital natural resources by supporting and continuing projects to protect habitat, water quality, and living resources.
- Lever funding, reduce duplication and enhance coordination among federal, state, and local authorities.
- Increase accountability and improve monitoring and reporting.
- Foster ongoing public input and involvement in resource management.
- Advance integration of community-based concerns (such as parks, flooding, and neighborhood beautification) and regional needs (such as improved water quality and conservation and restoration of contiguous habitat landscapes).
- Increase and expand cooperative partnerships.

Table 1.
Galveston Bay Council Representation

Federal Agencies
NOAA National Marine Fisheries Service
U.S. Army Corps of Engineers
U.S. Coast Guard
U.S. Environmental Protection Agency
U.S. Fish and Wildlife
U.S. Geological Survey
USDA Natural Resources Conservation Service
Regional and Local Governments
City of Houston Gulf Coast Waste Disposal Authority
Houston-Galveston Area Council
large local governments (populations > 500,000) representative
medium-sized local governments (populations 25,000–500,000) representative
Port of Houston Authorit
San Jacinto River Authority
small local governments (populations < 25,000) representative
Trinity River Authority
State Agencies
Texas Commission on Environmental Quality
Texas Department of Agriculture
Texas Department of State Health Services
Texas Department of Transportation
Texas General Land Office
Texas Parks and Wildlife Department
Texas Railroad Commission
Texas State Soil and Water Conservation Board
Texas Water Development Board
Environmental and Citizens' Groups
citizens at large representative
Coastal Conservation Association
Galveston Bay Foundation
League of Women Voters
low-income citizens representative
minorities representative
other conservation organizations representative
Private Sector
commercial fisheries representative
East Harris County Manufacturers Association
Galveston County Chambers of Commerce
Greater Houston Partnership
industry representative
marinas representative
utilities representative
Academia
major universities representative
Texas Sea Grant

Table 2.

Summary of Strategic Action Plan Goals and Associated Galveston Bay Plan Priority Problems

Strategic Action Plan Priority Focus Area	Strategic Action Plan Issue	Strategic Action Plan Goal[1]	Galveston Bay Plan Priority Problem[2]
Ecosystem and Human Health	Habitat and Landscape-Level Conservation	**#1 Priority: Protect existing coastal habitats in the Lower Galveston Bay Watershed. (VHP)** **#3 Priority: Restore and enhance coastal habitats in the lower Galveston Bay Watershed. (VHP)** Increase sustainable recreational opportunities and access to the bay and its tributaries. (MP) Restore, protect, and manage bird nesting sites. (LP)	(#1) Vital Galveston Bay habitats like wetlands have been lost or reduced in value by a range of human activities, threatening the bay's future sustained productivity. (#14) Some bay shorelines are subject to high rates of erosion and loss of stabilizing vegetation due to past subsidence and sea-level rise and current human impacts. (#7) Shoreline-management practices frequently do not address negative environmental consequences to the bay, or the need for environmentally compatible public access to bay resources. (#6) Certain species of marine organisms and birds have shown a declining population trend.
	Freshwater Inflow	**#4 Priority: Ensure freshwater inflows necessary to maintain the balance of salinity, nutrients and sediments required to support a productive estuary. (VHP)** Ensure that alterations do not negatively affect productivity and ecosystem health. (MP)	(#4) Future demands for freshwater and alterations to circulation may seriously affect productivity and overall ecosystem health.
	Sustaining Species Populations	**Eradicate or reduce populations of exotic invasive species, and prevent new invasions. (HP)** **Sustain and restore native-species populations. (HP)**	(#6) Certain species of marine organisms and birds have shown a declining population trend. (#17) Some exotic/opportunistic species (e.g. nutria and grass carp) threaten desirable native species, habitats, and ecological, relationships.

[1] Strategic Action Plan Goal: goals in bold are of the highest priority; numbers represent the goals' ranking by priority. VHP = very high priority; HP = high priority; MP = medium priority; LP = low priority
[2] Galveston Bay Plan priority problem: numbers represent the priority problems' ranking

Table 2. continued

Strategic Action Plan Priority Focus Area	Strategic Action Plan Issue	Strategic Action Plan Goal	Galveston Bay Plan Priority Problem
Ecosystem and Human Health	Water and Sediment Quality—NPS	**#5 Priority: Reduce NPS pollutant loads. (VHP)**	(#2) Contaminated runoff from nonpoint sources degrades the water and sediments of the bay tributaries and some near-shore areas. (#13) Water and sediments are degraded in and around marinas from boat sewage and introduction of dockside wastes from nonpoint sources. (#11) Dissolved oxygen is reduced in certain tributaries and side bays, harming marine life. (#15) Illegal dumping and waterborne and shoreline debris degrade the water quality and aesthetics of Galveston Bay.
	Water and Sediment Quality—PS	**# 7 Priority: Maintain the capacity and integrity of municipal sanitary sewer collection systems to eliminate sewage bypasses and unauthorized overflows. (VHP)** **Eliminate pollution problems from poorly operated sewage treatment plants and promote regionalization of small wastewater treatment plants, including publicly owned treatment works. (HP)** Eliminate harm from produced brine discharges. (LP)	(#10) Illegal connections to storm sewers introduce untreated wastes directly into bay tributaries. (#3) Raw or partially treated sewage and industrial waste enters Galveston Bay due to design and operational problems, especially during rainfall runoff. (#5) Certain toxic substances have contaminated water and sediment and may have a negative effect on aquatic life in contaminated areas.

Table 2 continued on next page.

Table 2. continued

Strategic Action Plan Priority Focus Area	Strategic Action Plan Issue	Strategic Action Plan Goal	Galveston Bay Plan Priority Problem
Ecosystem and Human Health	Public Health	**# 8 Priority: Minimize the risk of waterborne illness resulting from contact recreation. (VHP)** Maximize safe access for contact recreation. (LP) Reduce oyster-reef closures. (MP) **Reduce the concentration of toxins in key species of concern (HP)** **Reduce human-health risk resulting from consumption of seafood contaminated with toxic substances. (HP)**	(#16) Some tributaries and near-shore areas of Galveston Bay are not safe for contact-recreational activities such as swimming, wade-fishing, and sailboarding due to the risk of bacterial infection. (# 7-SM) Shoreline management practices frequently do not address negative environmental consequences to the bay, or the need for environmentally compatible public access to bay resources. (#12) About half of the bay is permanently or provisionally closed to the taking of shellfish because of high levels of fecal coliform bacteria that may indicate risk to shellfish consumers. (#5) Certain toxic substances have contaminated water and sediment and may have a negative effect on aquatic life in contaminated areas. (#9) Seafood from some areas in Galveston Bay may pose a public-health risk to consumers of subsistence- or recreational-catch seafood as a result of the potential presence of toxic chemicals.
Public Participation and Education	Public Stewardship	**# 2 Priority: Create a sense of personal ownership and shared responsibility for all cultural components of the community including the public, industry and government. (VHP)**	N/A—CCMP support action
	Public Awareness	**# 6 Priority: Obtain information to develop and evaluate Estuary Program communication efforts. (VHP)** Facilitate broad public involvement in Estuary policy, management, and implementation.(MP)	N/A—CCMP support action

Table 2. continued

Strategic Action Plan Priority Focus Area	Strategic Action Plan Issue	Strategic Action Plan Goal	Galveston Bay Plan Priority Problem
Public Participation and Education	Educate Stakeholders	**Ensure that stakeholders receive the knowledge necessary to act on estuary priorities in ways that benefit the bay and the entire community. (HP)**	N/A—CCMP support action
	Expand Partnerships	**Increase participation of local government in Estuary Program initiatives. (HP)** **Increase the number of partners actively involved in Estuary Program initiatives. (HP)**	N/A—CCMP support action
Monitoring and Research	Monitoring and Research	**#9 Priority: Supply the council and its members with the information and assessments they need to protect and manage the resources of the Galveston Bay ecosystem. (VHP)**	N/A—CCMP support action
		Provide the Water and Sediment Quality Committee and the Natural Resource Committee with the information they need to achieve the goals of the Plan for which they are responsible. (HP)	N/A—CCMP support action
		Achieve a complete understanding of the Galveston Bay ecosystem. (MP)	N/A—CCMP support action

Aerial of Delehide Cove Marsh Restoration Project.
photo by Jarrett "Woody" O. Woodrow, Jr., U.S. F&WS

Shrimp boat.
photo by Texas Sea Grant

Great Egret at High Island.
photo by Jarrett "Woody" O. Woodrow, Jr.

Lily pads.
photo by Jarrett "Woody" O. Woodrow, Jr.

Barge in Intracoastal Waterway near North Deer Island.
photo by Jarrett "Woody" O. Woodrow, Jr.

Birds at Bolivar Flat.
photo by Jarrett "Woody" O. Woodrow, Jr.

Back cover photo by Jarret "Woody" O. Woodrow, Jr.