TEXAS COASTAL MANAGEMENT PROGRAM
SECTION 309 ASSESSMENT AND STRATEGIES REPORT:
2021-2025

May 2020

Texas Coastal Management Program
Texas General Land Office

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List of Acronyms

ADA – Americans with Disabilities Act
BOEM – Bureau of Ocean Energy Management
BRD – Bycatch reduction devices
CEPRA – Coastal Erosion Planning and Response Act
CFR – Code of Federal Regulations
CMP – Texas Coastal Management Program
CWA – Federal Clean Water Act
CZM – Coastal Zone Management
CZMA – Coastal Zone Management Act
ENOW – Economic: National Ocean Watch
ERCOT – Electric Reliability Council of Texas
FEMA – Federal Emergency Management Agency
FERC – Federal Energy Regulatory Commission
GIS – Geographic Information Systems
GLO – Texas General Land Office
GOMA – Gulf of Mexico Alliance
HABs – harmful algal blooms
HRI – Harte Research Institute
LNG – Liquefied Natural Gas
NMFS – National Marine Fisheries Service
NOAA – National Oceanic and Atmospheric Administration
NPS – Non-point source pollution
OCM – Office for Coastal Management
OPEC – Organization of Petroleum Exporting Countries
OTEC – Ocean Thermal Energy Conversion
PUC – Public Utility Commission of Texas
RSLR – Relative Sea Level Rise
SAMP – Special Area Management Plan
TAC – Technical Advisory Committee
TCEQ – Texas Commission on Environmental Quality
TPWD – Texas Parks and Wildlife Department
TSSWCB – Texas State Soil and Water Conservation Board
USACE – U.S. Army Corps of Engineers
USDA – U.S. Department of Agriculture
USEPA – U.S. Environmental Protection Agency
USFWS – U.S. Fish and Wildlife Service
USGS – U.S. Geological Survey

Introduction

The Coastal Zone Management Act (CZMA) of 1972 established the National Coastal Zone Management (CZM) program to preserve, protect, restore and enhance the nation's coastal resources. The CZM program, administered by the National Oceanic and Atmospheric Administration (NOAA), is a voluntary federal-state partnership that provides the basis for protecting, restoring and responsibly managing the nation's diverse coastal resources. To address the need for a comprehensive approach to the management of coastal natural resources in Texas, the Texas Coastal Management Program (CMP) was developed. The Texas CMP was accepted into the national CZM program in 1997, after the Texas Legislature passed the Coastal Coordination Act in 1991. The Texas General Land Office (GLO) administers the CMP, which is a networked program of the state natural resource agencies. The mission of the CMP is to improve the management of the state's coastal natural resource areas and to ensure the long-term ecological and economic productivity of the coast.

Section 309 of the CZMA, as amended in 1990 and 1996, establishes a voluntary grants program to encourage states with federally approved coastal management programs, to conduct a self-assessment to identify, develop and implement strategies to strengthen and enhance their programs in nine areas. These enhancement areas include: 1) wetlands, 2) coastal hazards, 3) public access, 4) marine debris, 5) cumulative and secondary impacts, 6) special area management plans, 7) ocean resources, 8) energy and government facility siting, and 9) aquaculture. As a condition of receiving 309 CMP grant funding, the CMP must submit a Section 309 Assessment and Strategies Report to NOAA every five years. The report provides an assessment of the CMP in the nine enhancement areas, identifies program priorities, and proposes strategies that lead to tangible program enhancements for the identified high priority areas over the subsequent five years. The 309 Assessment & Strategies process provides an opportunity for the Texas CMP, with input from key stakeholders and the public, to determine where strategic opportunities exist for enhancing the CMP in identified high priority enhancement areas.

The Section 309 Assessment process is broken down into a high-level Phase I evaluation performed for all nine enhancement areas, and an in-depth Phase II assessment and strategy development performed for high priority areas identified through the Phase I process.

The Phase I (High-Level) Assessment of the CMP will evaluate the nine enhancement areas, using key stakeholder input and analysis of available data, to rank the enhancement areas as a high, medium, or low priority for Texas' program. The Phase I Assessment (1) determined the extent to which problems and opportunities for program enhancement exist within each of the enhancement area objectives; (2) determined the effectiveness of existing management efforts to address identified problems; and (3) identified high priority needs for program enhancement in coordination with the Office for Coastal Management (OCM), key stakeholders and the GLO. For assessment areas ranked medium or low, no further assessment is required. For enhancement areas ranked as high priority, a second Phase II (In-Depth) Assessment was completed, followed by strategy development for those areas.
The Phase II (In-Depth) Assessment and Strategies development explores potential problems, opportunities for improvement, and specific needs of high priority enhancement areas; designed to lead to one or more program change that address high priority needs (as defined by 15 CFR 923.123a see "Eligible Activities" in Section 3).

Executive Summary

The Phase I (High-Level) Assessment includes a characterization of the resource and changes since the 2016-2020 assessment; a management characterization of current and recent changes of statutes, regulations, polices or case law as well as relevant programs; and a prioritization of high, medium, or low with an explanation for the prioritization. The table below summarizes the prioritization for all enhancement areas. Enhancement areas ranked as "High Priority" were further assessed during the Phase II evaluation process. Following the Phase II

assessment, strategies were developed to address high priority issues identified in the assessments.

Enhancement Area	Prioritization
Wetlands	High
Coastal Hazards	High
Public Access	Medium
Marine Debris	Medium
Cumulative & Secondary Impacts	Medium
Special Area Management Planning	N/A
Ocean Resources	High
Energy & Government Facilities	Medium
Aquaculture	Low

Wetlands

Wetlands are coastal areas that are inundated or saturated in sufficient duration such that they support vegetation and life adapted for saturated soil conditions. Wetlands serve as valuable habitat and storm surge buffers, enhance water quality, supply food, and provide recreation and cultural value. This valuable habitat, though, is disappearing at an increasing rate due to development, agriculture, barren land, and open water. Wetlands also are negatively impacted by reduced water quality and quantity, increased contamination due to runoff, development, subsidence resulting from water withdrawal, and hydrologic changes. During the Technical Advisory Committee meetings for the Texas Coastal Resiliency Master Plan in 2017, the issue most closely related to wetlands, Altered, Degraded, or Lost Habitat, scored the second highest out of all issues polled. Given these findings, wetlands are assessed as a high priority enhancement area for the CMP; therefore, a Phase II assessment was conducted and strategies were developed to address identified priorities and needs.

Coastal Hazards

Texas is subject to significant coastal hazards that include flooding, coastal storms (and associated storm surge), shoreline erosion (including bluff and dune erosion), relative sea level rise, and drought. To a lesser extent, Texas is vulnerable to land subsidence, saltwater intrusion, tornadoes, and possible geological hazards (e.g., tsunamis, earthquakes). Coastal hazards are of particular concern due to a growing population that will be in harm's way, the importance of coastal economic activity, and the value of our natural coastal ecosystems. Coastal hazards are assessed as a high priority enhancement area for the CMP and warrant resiliency planning and coastal hazard mitigation to protect and preserve the vitality of the Texas coast. A Phase II assessment was conducted and strategies were developed to address identified priorities and needs.

Public Access

Public access takes into account increased opportunities for use of Texas beaches and shoreline, including recreational opportunities such as boat access sites, scenic area access, fishing access points, and coastal trails and boardwalks. Public Access to beaches in Texas is taken seriously through many different laws, such as the Open Beaches Act. Public access is assigned as a medium priority enhancement area for the CMP due to all the recent

work undertaken by the GLO in previous 309 strategies.

Marine Debris

Marine debris on the Texas coast originates from land-based and ocean-based sources. Marine debris is a significant issue worldwide, as well as in Texas. The Ocean Conservancy continues its efforts at the federal level to address this challenge, these challenges and at the state level, successful marine debris removal programs include the GLO's Adopt-A-Beach Program and the Monofilament Recovery and Recycling Program, which is coordinated by Texas Sea Grant. While federal and state marine debris programs are effective, more education and outreach funding is needed to advance the discussion about the harmful and lasting effects of marine debris. Expanding this effort would greatly enhance the goals of these programs. The funding limitations prescribe a medium priority for this enhancement area, and a phase II assessment is not necessary.

Cumulative & Secondary Impacts

Cumulative and secondary impacts of coastal growth and development include the collective effect on various individual uses or activities on coastal resources, such as coastal wetlands and fishery resources. These impacts pose threats to ecosystem health and function, and the services they provide to human populations. Significant coastal population increases, with a similar rise in housing construction, have led to substantial land cover change, stressing already sensitive coastal environments. Despite all these stressors, the Texas CMP made large strides towards tackling these issues in the last 309 Assessment with the success of its coastal non-point source pollution strategy. Given continued effort towards implementation of this program, this enhancement area was rated as a medium priority.

Special Area Management Planning

The Texas Legislature amended the Coastal Coordination Act in 1995 to specifically prohibit the Coastal Management Program from developing or approving a special area management plan, including a plan for an area designated under the national estuary program. No action to change that has been taken since. Thus, a priority assessment for this enhancement area is not applicable in Texas, and a phase II assessment is not necessary.

Ocean Resources

Ocean resources, including fish and wildlife, commercial and recreational fishing, oil and gas exploration, shipping, and tourism have a high economic value and human demand; the livelihood of coastal populations depends on these resources. Oil Production in Texas has exploded in the last 5 years, with huge demand from oil companies to build export terminals and install thousands of miles of pipeline (see Energy and Government Facility Siting). This expected growth in the oil export industry will put enormous stress on ocean resources. Given this, ocean resources are designated as a high priority enhancement area for the Texas CMP because of the booming oil industry and the large amount of restoration expected to take place in the State over the next decade. A Phase II assessment was conducted and strategies were developed to address identified priorities and needs.

Energy & Government Facility Siting

Energy and government facility siting encompasses energy transport (pipelines, electrical grid, ports, etc.), energy facilities (for oil and gas, natural gas, coal, nuclear, and renewable energy technologies), and government facilities. These facilities are of tremendous economic importance to the state and the nation. Technological advances and newly discovered and tapped resources enable continued growth in the energy sector. A recent U.S. Navy facility closure is also being refurbished to serve the energy industry. Energy and government resources are identified as a medium priority enhancement area, as the energy industry is currently addressing issues in these areas. Therefore, a phase II assessment is not necessary.

Aquaculture

With future population increases and demand for sustainable sources of protein, aquaculture will continue to grow in importance. Current aquaculture of both marine and freshwater species is entirely land-based. An imminent concern is in regard to off-shore aquaculture and the ramifications this might have on ocean resources, making the enhancement area a low priority. A phase II assessment is not necessary.

Proposed Strategy

The strategy to enhance the CMP and address the identified three high priority enhancement areas will involve the development of the Sediment Management Plan and obtaining a Regional General Permit for beach nourishment projects.

Stakeholder and Public Comment

Input for Phase I and II review was requested through emails and a survey to networked resource agencies, selected stakeholders, and coastal partners. The final document then underwent a 30-day public comment period, and the final document herein addresses all comments received.

Conclusion

This assessment and prioritization of enhancement areas, coupled with the proposed strategies, derived through collaboration and input of coastal stakeholders, will address the most critical issues identified along the Texas coastal zone and strengthen the Texas Coastal Management Program. Through the Section 309 funding, the GLO will continue to further the commitment to protect, enhance and restore the state's coastal natural resource areas. The GLO also will coordinate with applicable networked agencies and coastal partners to procure and produce the proposed strategies in the most economical and efficient manner.

Summary of Completed Section 309 Projects

Program update for the cumulative and secondary impacts strategy carried out with the 2001 – 2005 309 funding:

The 2001 to 2005 Cumulative and Secondary Impacts strategy was to develop Total Maximum Daily Loads (TMDLs) within the Armand Bayou, Oso Bay, and Nueces Bay watersheds to improve water quality resulting from enhanced management of cumulative and secondary impacts. The Nueces Bay Zinc in Oyster Tissue TMDL was approved by the Texas Commission on Environmental Quality (TCEQ) and Environmental Protection Agency (EPA) in 2006. The Oso Bay TMDL was approved by the TCEQ and EPA in 2008.

In Armand Bayou high concentrations of bacteria have been observed. The presence of these bacteria poses risks for contact recreation under the Texas Surface Water Quality Standards. Under this strategy, a contractor collected water quality and biological data to characterize the dissolved oxygen regime and biota during hot weather and low flows, in the area of transition from nontidal to tidal conditions. Data and information provided by the study supported the assessment by the TCEQ on the current level of water quality impairment, and the evaluation of appropriateness of existing water quality standards or assessment criteria, to turn support the development of a TMDL or other appropriate management strategies for the Bayou. A final report summarizing the data collection results was submitted to the TCEQ. In 2010, 2 segments of Oso Bay were reported to be meeting the state standard for dissolved oxygen. The results were written up as an EPA success story for nonpoint source pollution.

Program change progress: the Armand Bayou Stakeholder Coordination Committee petitioned the regional Bacteria Implementation Group (BIG) to join its Implementation Plan, and was approved by the TCEQ in 2013 and the BIG in 2014. The Implementation Plan addresses bacteria impairments in many water bodies in the greater Houston area, and covers an area directly adjacent to the Armand Bayou watershed.

Program updates for strategies carried out with 2006 – 2010 309 funding:

Saving our Coastal Heritage - Texas Rural County Demonstration Project/ Chambers County Greenprint

Under this strategy, the GLO contracted with the Trust for Public Land for GIS mapping to identify high priority areas for public access, habitat conservation and restoration, and other community identified priorities for Chambers County. The results published as a "greenprint" concluded that preserving natural habitat, protecting water quality, and targeting restorable native habitats, protection and restoration of natural drainage and creation of more public access for recreation were the highest conservation priorities. The "greenprint" was intended to prioritize local actions and to enhance the potential for leveraging funds and for protecting contiguous or connected areas for greater habitat value for wildlife and for greater public access and enjoyment. The "greenprint" also provides a model for work in other rural coastal counties not engaged in community-based natural resource and public access planning.

The Chambers-Liberty Counties Navigation District and Chambers County purchased the Preserve in 2012 from a real estate development company and land use of the property was restricted to activities that are beneficial to wildlife and plant communities, while allowing for the development of low impact public access infrastructure to facilitate nature-based recreation and environmental education. The Galveston Bay Foundation was made a project partner to assist with: planning, development, and implementation of habitat restoration and public access strategies, engagement of stakeholder groups, and development of a habitat and water quality management plan. In March 2015, the "Turtle Bayou Nature Preserve Natural Resources Management and Public Access and Education Plan" was published. This plan directs future management of natural resources, public access and nature-based recreation, and maintenance of preserve infrastructure within the 514 acres of the Turtle Bayou

Nature Preserve.

Geohazards Mapping of South Padre Island

Harte Research Institute was contracted to develop a geohazards map of South Padre Island delineating critical environments and features (e.g. wetlands, dunes, and washover channels) that protect against and/or are vulnerable to certain geological processes or geohazards, such as hurricanes and relative sea level rise. The map projects where these critical environments and features are likely to be in 60 years, as sea level rise and shoreline retreat continue. The goal of this project was to allow for more effective planning and increase public awareness of the natural processes.

The data from this project was used in the development of the "South Padre Island Plan 2010," which includes a preliminary analysis in a high hazard zone of current and future property-at-risk and recommends the implementation of a hazard mitigation and response plan. The rules for local Erosion Response Plans under Chapter 31 of the Texas Administrative Code, §15.17 require that Erosion Response Plans (ERP) address post- storm recovery plans. The city's ERP, adopted in 2012, includes a program for pre-storm monitoring.

Calhoun County Bay Access Master Plan

This project was intended to serve as a comprehensive extension of a bay access improvement plan developed by Westside Calhoun County Navigation District for the southern part of Calhoun County. The county contracted with Atkins to create the "Calhoun County Texas Shoreline Access Plan." An analysis was conducted on the current inventory of existing public or semi-public bay and estuary shoreline access points and their available infrastructure for recreational activities and recommendations for improvements to enhance recreational opportunities and use. The plan, published in 2012, identifies and catalogs current and potential bay access sites and proposes strategies and recommendations for improving existing access points and for increasing low-impact, low-cost bay access (for example, kayaking trails and fishing piers).

Brazoria County Erosion Response Plan

The purpose of this project was to develop a local Erosion Response Plan to amend the existing County Beach Access and Dune Protection Plan. Tasks associated with formulation of the plan include development of a Set-Back Line, identification of opportunities for mitigation, and public outreach. In May 2012, the GLO approved the Erosion Response Plans for Brazoria County, Village of Surfside Beach, Town of Quintana, and City of Freeport.

Program updates for strategies carried out with 2010 – 2015 309 funding:

Under the Texas Coastal Management Program's Section 309 Assessment and Strategies Report 2011 – 2015 the Texas CMP developed a framework for a long-term coastwide planning process utilizing coastal and marine spatial planning though identification of key resources and needs along the coast for protection and management to balance coastal economic growth with the protection of critical habitats and ecosystems.

This still underway initiative incorporates a more integrated and comprehensive approach to planning, managing and preventing conflict within the state's coastal and marine areas to enhance the various economic and ecologic activities, and bring stakeholders to the table to identify goals and objectives. The outcome of this effort is intended to guide state and local policy makers to achieve a sustainable balance among ecological, social, economic and governance objectives, create greater certainty and less risk for users, and streamline the permitting process.

To launch the planning initiative and to identify current regional issues of concern along the coast, the GLO conducted a comprehensive literature review of public comments, grants and project proposals. This data discovery resulted in a list of unfunded or partially-funded projects that could help address the challenges facing the coast. Next, the GLO collaborated with the Harte Research Institute (HRI) to establish an evaluation process that included an assessment of

the project's expected benefit and feasibility, along with the likelihood of economic, community and environmental losses that would result if the project did not occur.

The GLO formed a Technical Advisory Committee (TAC) of coastal experts representing 40 different public, private and non-governmental sectors to evaluate the projects and identify the most pressing threats to each of the four regions of the Texas coast. During a series of regional meetings held throughout September 2012 in Corpus Christi, South Padre Island, Galveston, and Victoria, the TAC reviewed and evaluated the projects that had the potential to address to each region's issues of concerns.

HRI compiled the data and drafted an analysis report by region resulting in a list of featured projects. CB&I developed a project costing model, and verified and updated the information for each featured project to provide a detailed analysis and cost estimate.

The GLO teamed up with Marmillion + Company to synthesize information from the TAC evaluation to produce an overview report, The Texas Coast: Shoring Up Our Future, which highlights the ecologic and economic features along the Texas coast, and identifies the primary issues of concern threatening its sustainability. The report was presented to the 83rd Texas Legislature and the Texas members of Congress. The report is available at, www.Shoring UpTexas.org, which will be expanded to include specifics on the information gathered from meetings with local elected officials and stakeholders. This education and outreach effort brings attention to wetland and habitat loss, impacts to fish and wildlife, gulf beach, bay and dune erosion, water quality and quantity degradation, impacts to recreation and local economy, flooding and storm surge, public access and community resiliency.

In the summer of 2013, the GLO and Marmillion + Co., presented this information to local elected officials in the coastal regions and discussed the coastal issues that are relevant to their communities. The five Coastal Issues Forums were held in July and August 2013 in Beaumont, Galveston, Port Lavaca, Corpus Christi and Port Isabel. The forums provided the GLO an opportunity to meet with elected officials and discuss the critical coastal areas in their regions, the issues affecting them, and examine the economic benefits and social value of their coastal communities. There were 130 attendees at the local officials meetings

After hosting the local officials meeting, the GLO turned its attention to updating the Resource Management Codes (RMCs), which are assigned to state-owned tracts in Texas bays and Gulf waters, and promote best management practices for activities within the tracts to minimize adverse impacts to sensitive natural resource areas. HRI assisted GLO to establish a process to update, streamline and standardize the RMCs for inclusion on a newly-developed GIS viewer. Last fall, the team formed the Data Standards Committee (DSC), a workgroup made up of representatives from the CMP-networked resource agencies, federal agencies, GLO Energy Resources and GLO GIS Teams, who routinely met over the course of a year to examine and redefine each code, identify needed data sets and develop the data driven code-assigning criteria. Data sets were compiled and processed to construct the RMC GIS viewer to assist resource managers and coastal stakeholders in planning for the use and sustainability of the ecologic, economic and social assets of the Texas coast. The viewer can be found on the GLO website at: http://www.glo.texas.gov/what-we-do/energy-and-minerals/resource-management-codes/index.html.

Building on the outreach and awareness strategies, the GLO convened a series of resiliency forums, which were facilitated by Marmillion + Co. on the topic of coastal resiliency. Held in three coastal locations during the week of Dec. 7, 2014, these forums furthered our efforts to engage coastal leaders and stakeholders to raise statewide awareness of the Texas coast's tremendous value, and its increasing economic and environmental vulnerabilities due to a number of factors, such as population growth, larger and longer-lasting storms, and shoreline erosion. The purpose of the forums was to introduce community leaders to a number of planning tools and technologies that would help them prepare for changing conditions along the coast and to discuss with them their top coastal concerns. Coastal experts

were on hand to showcase the planning tools, which helped identify risks associated with those threats. The discussion also centered on the link between economic and environmental health, especially the management of critical coastal infrastructure and its reliance on healthy bays, wetlands and barrier islands.

In 2017, the Texas Coastal Resiliency Master Plan was adopted by the GLO. The Plan provides a framework for community, socio-economic, ecologic and infrastructure protection from coastal hazards, including short-term direct impacts (e.g., flooding, storm surge) and long-term gradual impacts (e.g., erosion, habitat loss).

Program updates for strategies carried out with 2016 – 2020 309 funding:

The CMP developed six strategies to tackle during the 2016-2020 309 Assessment period:

Assessment & Data Collection to Enhance Permitting, Leasing, and Monitoring for Coastal Activities

In the previous assessment, one of the strategies developed by the CMP was to develop a coastal mobile data collection platform and applications to streamline and improve the efficiency of data collection, management, and distribution for coastal-related activities and decision-making. Data collected targeted through this strategy would include but not be limited to uses for: coastal lease permitting, wetland mitigation monitoring, enforcement, derelict structures and vessel identification, beach & bay access point inspections, and Coastal Erosion Protection and Response Act construction activities. This strategy would revise the field collection methods and overall management approach for issuing leases and permits for submerged land use activities; moving towards online interactive permitting with the future goal of issuing leases in the field. The strategy had two parts: 1) Develop a Coastal Mobile Data Collection Platform and Applications for Decision-Making; and 2) Develop and Conduct Rapid Assessments of Mitigation (RAM) Projects on State Owned Submerged Lands.

This strategy created a Data Collector App User Guide for Storm Debris and Derelict Structure Assessments. These new guides will change the methodology the GLO's Field Operations (Field Ops.) team uses when assessing projects on state owned submerged land. A RAM has been developed by GLO staff with input from academic experts at Texas A&M Corpus Christi to track the success of mitigation projects along the coast. This data will be used to assist staff when evaluating proposed mitigation projects. Staff is in the process of conducting a baseline RAM for each coastal wetland mitigation site and refining the details of the RAM with university staff.

In addition to making enhancements to the Data Collection Platform and Application (App.), this strategy also created a new method of storing and categorizing data collected via the Data Collector App. that will change how photos and data for the GLO's Coastal Resources (CR) division is housed into the future. The GLO, in partnership with SenseCorp, implemented the use of SharePoint to manage Collector App data and system information as the GLO shifts toward using Microsoft Office 365 SharePoint as an enterprise content management solution.

Beach and Dune Protection

This strategy was developed to update beach and dune administrative rules and policies that affect the Gulf shoreline, which will assist local communities with coastal hazard mitigation and restoration. The changes will enhance ADA access to the water (beach) of Gulf-facing beaches in Texas and create more protective standards for dune protection and mitigation. General updates and administrative changes are also being made to Chapter 15 of the Texas Administrative Code.

To improve the understanding of the beach and dune system and emphasize the importance of beach access for those with mobility impairments, the GLO will update two guidance documents; the Texas Dune Protection and Improvement Manual and the Texas Beach Accessibility Guide. Local governments use the Texas Beach Accessibility Guide to help ensure that Gulf beach access points and facilities are accessible to persons with disabilities and are compliant with federal and state guidelines, which have changed since the publication of the document. The Texas

Dune Protection and Improvement Manual is an educational publication that raises awareness of the fragile beach/dune system and provide concise guidelines for dune protection and improvement along the Texas Gulf Coast. The Manual provides local governments, stakeholders and the public information to help enhance dune protection along the Gulf coast through restoration methods and minimization of impacts. Updates to the Manual will include strengthened dune walkover construction standards and additional directions on appropriate dune mitigation techniques that are required when adverse effects to critical dunes occur.

Integration of Coastal Resources Grant Programs

To advance the GLO's coastal priorities, under the Grant Integration Strategy, the GLO's CR grant programs have been working to align their goals and objectives to create an integrated grant program with the common mission of funding projects to improve management of the state's coastal resources and ensure the long-term ecologic and economic resiliency of the Texas Coast. The GLO's Texas Coastal Resiliency Master Plan (Master Plan) outlines projects with the goal of protecting, restoring and enhancing the Texas coast through an efficient and cost-effective approach to achieve a resilient coast. Streamlining and integrating CR grant programs, policies and their associated funding sources, under one mission will aid in implementation of the Master Plan.

Progress towards this strategy is still ongoing. Currently, CMP and Coastal Erosion Planning and Resource (CEPRA) are developing a joint application platform and working to synchronize funding schedules. There is also plans to develop a joint database to house projects from the CMP and CEPRA programs.

Implementation of the 2019 Coastal Resiliency Master Plan

A major recent success of the CMP was the GLO's production and release of the Texas Coastal Resiliency Master Plan (Plan) in 2017. The Plan was developed under a 309 strategy from the 2011-2015 CMP Assessment and Strategies document, at the time called the Coastal and Marine Spatial Planning effort. The Plan provides a framework for community, socio-economic, ecologic and infrastructure protection from coastal hazards, including short-term direct impacts (e.g., flooding, storm surge) and long-term gradual impacts (e.g., erosion, habitat loss). The Plan lays out 11 Actions at the state and regional level to increase long-term resilience. To bring about these 11 actions along the entire Texas coast, the Plan lists 123 recommended Tier 1, high priority projects. Working together, the GLO and its partners are striving to receive funding to implement these needed Tier 1 projects and to develop new, effective and long-term processes and relationships to make our collective vision of a resilient coastal Texas a reality.

The GLO continues to improve its outreach efforts to bring the plan to a local and national audience. Implementation of the Plan will make coastal communities more resilient to future coastal hazards. However, local coastal planning efforts may not yet revolve around the Plan because communities are not yet aware of this state-led planning effort and prioritization of projects by coastal experts and the resources available to implement projects at the local level. The GLO is currently using 309 funding to implement the Plan through a series of stakeholder outreach events along the Texas coast.

Living Shoreline Protection

The goal of this strategy was to increase the use of living shorelines by local governments and private property owners along the bay to address erosion issues and to enhance and restore the habitat and water quality. It involved four parts: 1) Assessment of Living Shorelines; 2) Updates and Improvements to Estuarine Shoreline Assessment; 3) Living Shoreline Recommendations for Texas; and 4) Living Shoreline Outreach and Education. This strategy works to streamline the living shoreline permitting process by providing the GLO's Permit Service Center with additional outreach materials they can use to provide technical assistance to entities interested in living shoreline use. The GLO will also make changes to Texas Administrative Code 155 to waive fees for applicants proposing to complete a living shoreline projects. The new TAC code will have state that structures associated with living shorelines will have no rent. The CMP is also working to develop a Living Shorelines Guidance Document for homeowners, local municipalities, and

contractors for education purposes.

Implementation of Coastal Nonpoint Source Management

One of the strategies developed by the CMP was to implement a coastal nonpoint source (NPS) pollution program. Development of a Coastal NPS Management Strategy would provide the framework for addressing and managing NPS pollution and resulting water quality issues that degrade the coastal environment. The strategy had a goal of creating new management measures related to: 1) Administration; 2) Roads, Highways, and Bridges and New and Existing Site Development; 3) Septic Systems Regulatory Inspections; and 4) Watershed Protection. The Texas Coastal NPS programs enhances nonpoint source pollution management by working with networked agencies, regional planning groups, local municipalities, and researchers to develop local policy and planning elements; conduct retrofit planning; and deliver training and technical assistance. The program also collaborates to improve understanding of coastal watersheds through funding and conducting studies that informs decisions.

The most significant change implemented because of this program is that the State of Texas has completed development of final Coastal Zone Act Reauthorization Amendments (CZARA) management measures. As of August 23, 2019, the final seven management measures are still under review by NOAA and EPA. Program implementation is under development, partner collaboration with various agencies and NGOs is occurring, and supplemental funding is being applied for. Once EPA and NOAA approve of the State's approach to enhancing the management of NPS in the CZB, then it will be formalized by Texas and implemented by networked agencies.

As of July 2019, the State has finally completed a 20-year process of completing the development of all CZARA management measure actions. While not fully approved yet, staff have received positive remarks from review agency staff. The State is poised to respond if corrective action comments are issued by the federal review team. By the end of this strategy in 2021, the Coastal NPS CZARA program will attain full, unconditional approval. The creation of program development will be finalized. Program implementation will occur. Coastal NPS will have enhanced management and NPS loading will be mitigated through projects or abated through policy.

Phase I (High-Level) Assessment

Wetlands

Section 309 Enhancement Objective: Protection, restoration, or enhancement of the existing coastal wetlands base, or creation of new coastal wetlands. §309(a)(1)

Note: For the purposes of the Wetlands Assessment, wetlands are "those areas that are inundated or saturated at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." [33 CFR 328.3(b)]. See also pg. 174 of the CZMA Performance Measurement Guidance[1] for a more in-depth discussion of what should be considered a wetland.

Resource Characterization:

1. *Using provided reports from NOAA's Land Cover Atlas,[2] please indicate the extent, status, and trends of wetlands in the state's coastal counties. You can provide additional or alternative information or use graphs or other visuals to help illustrate or replace the table entirely if better data are available.*

Because the 2016 NOAA Land Cover Atlas data was not available for use at the time of the publication of this report, and the GLO's most recent wetland mapping data dates back to 2010, we will use the Coastal Wetlands Status and Trends data from 2011 to make inferences as to how any trends have changed over the past 5 years.

Coastal Wetlands Status and Trends		
Current state of wetlands in 2011 (acres)		
Percent net change in total wetlands (% gained or lost)	from 1996-2011 -**2.21**	from 2006-2011 **-1.11**
Percent net change in non-tidal (% gained or lost)	from 1996-2011 **-2.45**	from 2006-2011 **-1.41**
Percent net change in tidal (estuarine) wetlands (% gained or lost)	from 1996-2011 **+0.12**	from 2006-2011 **+0.06**

How Wetlands Are Changing		
Land Cover Type	**Area of Wetlands Transformed to Another Type of Land Cover between 1996-2010 (Sq. Miles)**	**Area of Wetlands Transformed to Another Type of Land Cover between 2006-2010 (Sq. Miles)**
Development	-36.59	-14.19
Agriculture	-5.67	-0.52
Barren Land	-6.89	-4.85
Water	-3.56	-4.55

2. *If available, briefly list and summarize the results of any additional state- or territory-specific data or reports on the status and trends of coastal wetlands since the last assessment to augment the national data sets.*

[1] https://coast.noaa.gov/czm/media/czmapmsguide2018.pdf
[2] https://coast.noaa.gov/digitalcoast/tools/lca.html. Note that the 2016 data will not be available for all states until later Summer 2019. NOAA OCM will be providing summary reports compiling each state's coastal county data. The reports will be available after all of the 2016 data is available.

NOAA C-CAP Wetland Change Assessment

This wetland change assessment is largely based on the NOAA Coastal Services Center County Landcover Change Reports for the time period of 1996-2010 & 2006-2010 (data from 2010-2015 not yet available). NOAA C-CAP reports were obtained for each of the 18 coastal counties and summary data was tabulated (see Appendices A and B). In Texas, wetlands account for a significant portion of the land area within the 18 coastal counties – covering 2,580 square miles or 1,651,782 acres, in 2010. Wetlands serve as floral and faunal habitat, support biodiversity, provide ecosystem services (such as water quality enhancement, nursery and foraging resource, and storm surge buffers), function as recreational areas, and add cultural value to the coastal-living experience. In Texas, coastal counties, a total of 58.27 square miles of wetland have been lost from 1996-2010 (data from NOAA C-CAP) and 28.97 square miles were lost from 2006-2010. Observation of NOAA C-CAP wetland change data show that wetland loss varies by county and may be the result of loss to open water, which is most common in the southernmost counties, or loss to development, as is the case in the northeast Harris and Jefferson counties (see Appendices A and B). From 2010-2019, we can assume that a similar trend of wetland loss has occurred, if not slightly more due to accelerating sea level rise (Craft et al. 2009).

The southern-most Texas counties include Cameron, Willacy, Kenedy, and Kleberg counties. This region boasts extensive tidal flats that serve as critical environment for the endangered piping plover population, as well as large amount of important estuarine habitat such as the Laguna Madre and Bahia Grande wetland basins. All of these counties have experienced minimal wetland losses, except for Cameron County. Cameron County has lost a total of 10.21 sq. mi from 1996-2010, corresponding to unconsolidated shore converted to open water, associated with shoreline erosion. This is due primarily to re-flooding and hydrologic restoration of the Bahia Grande in 2005. Although changes from a wetland class to open water are generally considered a loss of wetland in the C-CAP classification, this area in particular was restored to its previous hydrologic state.

The Central Texas region, counties of Nueces, San Patricio, Refugio, Aransas, Calhoun, Victoria and Jackson, contain numerous bays, including Corpus Christi, Aransas, and Copano bays, as well as barrier islands of North Padre Island and Mustang Island. Wetland environments in the region support diverse fish and wildlife, fishing, hunting, birding, and other recreational activities. The region also experienced minimal wetland losses (less than 2 sq. mi from 1996-2010). Refugio, Aransas, and Calhoun counties gained wetland area. In Nueces County, 2.03 sq. mi of wetlands were lost from 1996-2010. A significant loss occurred near the mouth of the Nueces River mostly to unconsolidated shore and on portions of Mustang Island due to development. In Calhoun County, the most significant losses and gains seem to occur in the prairie pothole wetland area of the Ingleside strand plain and beach shoreline erosion on Matagorda Peninsula. In Victoria Country, most of the wetland losses are associated with wetland conversion to open water in the area of Rupley Lake. Lastly, in Jackson County, 0.15 sq. mi were lost from 1996-2010. Most of the wetland losses were associated with palustrine forest (-0.58 sq. mi) and are attributed to conversion to open water (-0.14 sq. mi) near the northern portion of Lake Texana. The wetlands in the Central Texas counties are critical to the economy as they are home to numerous wildlife management areas and migratory and recreational birds.

The region of the upper Texas coast, including the counties of Matagorda, Brazoria, Galveston, Harris, Chambers, Jefferson, and Orange, collectively have experienced some of the largest wetland losses in the state. Erosion, subsidence, and relative sea level rise combined with insufficient freshwater inflows, heavy shipping traffic, and other industrial uses are causing rapid wetland loss in the region. One notable difference in the upper Texas coast is that much of the wetland changes are due to development. In Galveston County, wetland losses to development accounted for -5.08 sq. mi of wetland area, observed mostly within Galveston Island and Bolivar Peninsula, as well as in the vicinity of League City. In Harris County, wetland losses from 1996-2010 amounted to -19.86 sq. mi; the largest cumulative wetland loss of all Texas coastal counties. Most losses are in the category of Palustrine Forested (-17.07 sq. mi) and are attributed to development (-18.25 sq. mi). In Chambers County, 1.10 sq. mi of wetlands were lost from 1996-2010. Although significant wetland losses due to development (-1.79 sq. mi) and agriculture (-

2.6 sq. mi) occurred, the area gained unconsolidated shore due to the expansion of Trinity River Delta. In Jefferson County, 13.80 sq. mi of wetlands were lost, primarily to development (-3.89 sq. mi) on the northeastern part of the county, and to open water (-3.58 sq. mi) in the vicinity of Sea Rim State Park. The Gulf shoreline of Texas Point National Wildlife Refuge experiences some of the highest Gulf-shoreline retreat rates in Texas and continues to lose wetland area to marine processes. Also, from 1996-2010, some of the lakes experienced wetland loss to open water, in particular Blind Lake and Eagle Lake. In Orange County, 7.78 sq. miles of shoreline were lost from 1996-2010 and 4.14 sq. mi were lost from 2006-2010. Some significant losses occurred from the conversion of wetlands to open water (-0.43 sq. mi) in the Lower Neches Wildlife Management area on the northeast part of Sabine Lake, as well as losses to development. Matagorda County is an exception where wetland area increased from 1996-2010 which is mostly attributed to a gain in unconsolidated shore due to the conversion of open water to wetland and the expansion of the Colorado River Delta.

Other Wetland Assessment Reports:

The NOAA C-CAP data is a great resource for assessing wetland loss due to conversion to open water, development, or agriculture. Many of the changes in wetlands are due to their conversion to another wetland type, or even gained through restoration and mitigation practices. Although, wetlands gained as a result of restoration cannot be readily quantified with C-CAP, further analysis of C-CAP data can provide information of wetland-to-wetland change. For example, it is of high priority and concern that some shrub-scrub areas in Cameron County be restored to the historical ecosystem of high marsh grasses (personal communication, Lower Rio Grande Valley National Wildlife Refuge, 2019). Similarly, low marsh environments in the Central coast are changing from predominantly Spartina grasses to increasingly greater densities of mangroves (Montagna et al., 2007).

A more recent report from the United States Geological Survey (USGS) and Environmental Protection Agency (EPA), "Emergent Wetlands Status and Trends in the North Gulf of Mexico," summarized available literature since the 1970s (EPA 2015). From the report, Texas has 112,758 hectares (435.4 sq. mi.) of estuarine emergent wetlands and 222,212 hectares (857.97 sq. mi.) of palustrine emergent wetlands in coastal Texas. The report also indicates that Texas experienced an average annual net loss of 2,185 hectares (8.4 sq. mi.) of all vegetated coastal wetlands from the mid-1950s to the early 1990s, and projected sea level rise places an additional 314,554 hectares (1,214.5 sq. mi.) of coastal wetlands at risk. The loss of estuarine emergent wetlands in Texas has been caused by loss or conversion to estuarine subtidal bays, palustrine emergent wetlands, lacustrine reservoirs, and other forms of land development. These changes have occurred as a result of submergence, erosion, and subsidence caused by underground water, oil and gas extraction, and the creation of dredge spoil sites, roads, levees, and other man-made developments along the coast. The loss of palustrine emergent wetlands results from loss or conversion to agricultural land, urban and rural development; palustrine farmed land, lacustrine reservoir construction, and natural succession to scrub-shrub and forested land. Some emergent wetland change was caused by the invasion of the non-native species.

In the performance measures from 2019, it was calculated that the 1155 acres of wetland were lost and a total of 3663 acres of wetlands were gained due to activities subject to CZM regulatory programs.

The GLO reported in 2019 the number of wetland acres restored with assistance from CZM funding to be 50 acres. The number of acres of tidal wetlands protected by acquisition or easement with assistance from CZM funding or staff is 0 acres. Lastly, the number of acres of other types of habitat protected by acquisition or easement with assistance from CZM funding or staff is 5.4 acres.

Management Characterization:

1. *Indicate if there have been any significant changes at the state or territory level (positive or negative) that could impact the future protection, restoration, enhancement, or creation of coastal wetlands since the last assessment.*

Significant Changes in Wetland Management

Management Category	Significant Changes Since Last Assessment (Y or N)
Statutes, regulations, policies, or case law interpreting these.	Y
Wetlands programs (e.g., regulatory, mitigation, restoration, acquisition)	Y

2. *For any management categories with significant change, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:*
    a. *Describe the significance of the changes;*
    b. *Specify if they were 309 or other CZM-driven changes; and*
    c. *Characterize the outcomes or likely future outcomes of the changes.*

In 2001, the U.S. Supreme Court decision in Solid Waste Agency of Northern Cook County v. the Army Corps of Engineers eliminated Clean Water Act (CWA) jurisdiction over isolated waters that are intrastate and non-navigable, where the sole basis for asserting CWA jurisdiction is the actual or potential uses of the waters by migratory birds that cross state lines. The 2001, and subsequent Supreme Court rulings, left isolated wetlands with limited protection. In 2015, the EPA and U.S. Army Corps of Engineers (USACE) jointly released a proposed rule to clarify the scope of "Waters of the Unites States" (WOTUS) with the aim to increase jurisdictional protection under the Clean Water Act for streams and wetlands. The proposed change aimed to clarify the jurisdiction of the CWA and have a positive impact on the management and protection of wetlands.

In 2019, the EPA and USACE published a proposed rule change to the WOTUS definition. The new rule would only provide protection to wetlands if the wetland has direct hydrologic connection to another WOTUS, as opposed to being "adjacent" to a WOTUS. Under this proposed rule change, the USGS estimated that the rule would remove federal protections for 18 percent of stream and river miles and 51 percent of wetlands (E&E News 2018). These are not CZM-related changes but are significant for the protection of isolated wetlands as would be addressed through the federal consistency process and issuance of USACE permits.

Living Shorelines strategy

The Living Shoreline Protection 309 strategy was planned for 5 years and revolved around 4 sub-strategies: 1) Assessment of Living Shorelines; 2) Updates and Improvements to Estuarine Shoreline Assessment; 3) Living Shoreline Recommendations for Texas; and 4) Living Shoreline Outreach and Education.

This strategy strives to increase the use of living shorelines by local governments and private property owners to address erosion issues and enhance and restore habitat and water quality. The GLO is working to streamline the living shoreline application and permitting process and generally promote the use of living shorelines via guidance documents and technical assistance to communities and decision-makers as an alternative to traditional erosion management efforts. The GLO has been promoting the use of living shorelines as an alternative shoreline management technique through a series of living shoreline workshops work to improve the general public's understanding of the

benefits of living shorelines, provide an idea of the feasibility of living shoreline implementation, and give them ideas on how they can make policies and management practice changes that would promote the use of living shorelines in their communities. The GLO's Permit Service Center (PSC) staff are providing enhanced technical assistance to advising local governments, private-property owners and other interested parties on how to implement a living shoreline and spending more time walking them through the living shoreline permitting process. The GLO also conducted a survey of public opinions on shoreline management strategies and is creating new Texas specific living shoreline outreach material. Having data and materials that highlight the benefits of incorporating a living shoreline will assist the PSC staff in their work of informing permit applicants of all associated options.

This strategy has resulted in the creation of the following documents:

- Literature review of existing living shoreline resources applicable to Texas bay shorelines
- Public opinion survey with survey results analysis
- Texas living shoreline guidance document ("Texas Living Shorelines: An Implementation Guide for Property Owners, Municipalities and Professionals")
- Living shoreline permitting tip sheet for property owners
- 4-page living shoreline public outreach brochure
- List of native Texas plants suitable for living shoreline use

This strategy works to streamline the living shoreline permitting process by providing the GLO's PSC with additional outreach materials they can use to provide technical assistance to entities interested in living shoreline use. The GLO will also make changes to Texas Administrative Code 155 to waive fees for applicants proposing to complete a living shoreline projects. The new TAC code will have state that structures associated with living shorelines will have no rent. Hopefully this will encourage people to build living shorelines. The GLO is also providing a public guidance document to the promote living shoreline use as an alternative to traditional erosion control structures and is establishing a pilot program with the GLO's Surveying department to establish large areas of pre-surveyed land so that interested living shoreline applicants would not be required to pay for a costly Coastal Boundary Survey (CBS) CBSs are one of the most expensive aspects of building a living shoreline so this pilot program will hopefully be a strong incentive to not only use living shorelines but also get groups of property owners in the same area to work together to implement larger-scale living shoreline projects.

As of July 2019, the following activities have been complete:

- Review of existing living shoreline literature and practices and identification of best practices and procedures
- Summary report of findings from existing literature review on current shoreline management strategies and examples of living shoreline best management practices and procedures from comparable states
- Public awareness and opinion survey about shoreline management strategies
- Data analysis based on survey results
- A suggested Native Vegetation Planting List, with variation by coastal habitat
- Living Shoreline Permitting Tip Sheet for Property Owners
- Three Outreach Workshops (Corpus Christi, Victoria, Texas City)
- Living Shoreline Permitting Process Guidance

By the end of the strategy (early 2021), the following items will be complete:

- A comprehensive Living Shoreline Management Guide
- Thematic maps of the Texas coastline will be included in the Guide to help readers evaluate shoreline conditions in their region. In collaboration with the GLO staff and the Harte Research Institute (HRI), a link to the HRI geospatial analysis of shoreline suitability would be added to the content of the Guide.
- Identify up to three target locations for demonstration projects. Conceptual plans will be developed for each demonstration projects to help communities advance the use of a living shoreline strategy.

- Living Shoreline Management Incentives and Policy Recommendations Report

Large-scale wetland restoration (NRDA, NFWF, RESTORE)

As a result of the Deepwater Horizon Oil Spill Settlement, numerous resources have become available to the state of Texas to invest in wetland restoration and land acquisition. Below is a short summary of some of the work related to wetlands that has been done with funds so far:

National Fish and Wildlife Foundation (NFWF)
To date, NFWF has awarded more than $155 million from the Gulf Environmental Benefit Fund for 48 restoration projects in the state of Texas. These projects were selected for funding following extensive consultation with the Texas Parks and Wildlife Department, the Texas Commission on Environmental Quality, the Texas General Land Office, the U.S. Fish & Wildlife Service (USFWS) and NOAA. A full list of projects can be found here.

RESTORE Act

- Texas Beneficial Use/Marsh Restoration ($948k)
    - The State of Texas Beneficial Use of Dredged Material (BUDM), Project Design Fund Phase I project is located in Orange, Jefferson and Galveston Counties Texas. It will facilitate BUDM through careful site selection, survey data collection, preparation of engineering and design plans, environmental compliance and permitting. The primary goal is to create shovel-ready restoration sites that, when fully implemented, will transform areas that have subsided into open waters back to tidally influenced coastal wetlands.
- Matagorda Bay System Priority Landscape Conservation ($6M)
    - Matagorda Bay System Priority Landscape Conservation Project aims to conserve strategic lands adjacent to the Matagorda Bay/San Antonio Bay complex to help ensure long-term native diversity, productivity and resiliency of the entire bay estuary complex. In this activity, the State of Texas is expected to acquire approximately 6,500 plus acres of high quality coastal habitats including emergent marshes, tidal flats, lagoons and coastal prairie with several miles of frontage on the Matagorda Bay system.

Natural Resource Damage Assessment (NRDA)
The Texas Trustee Implementation Group has released its first restoration plan, selecting 13 restoration projects to compensate for injuries to natural resources caused by the Deepwater Horizon oil spill. The Texas Trustee Implementation Group Final 2017 Restoration Plan and Environmental Assessment: Restoration of Wetlands, Coastal, and Nearshore Habitats; and Oysters was published on October 18, 2017 and prioritizes restoration projects for oysters and wetlands, coastal, and nearshore habitats with a total estimated cost of $45,761,000.

Enhancement Area Prioritization:

1. *What level of priority is the enhancement area for the coastal management program?*

    High _X___
    Medium _____
    Low _____

2. *Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.*

In 2017, the GLO convened the Technical Advisory Committee (TAC), a group of coastal experts representing the public, private and non-governmental sectors, to participate in a needs assessment of the Texas coast. Regional workshops were hosted by the GLO to provide input into the second phase of the Texas Coastal Resiliency Master Plan (2019 update).

During each meeting, the TAC provided information on issues of concern (IOC) for each of the regions. Potential IOCs (see Table 1) were evaluated on a 5-level scale from "not concerned (0)" to "extremely concerned (4)." An average level of concern was derived using all the acquired responses for each of the IOCs. The issue most closely related to wetlands, Altered, Degraded, or Lost Habitat (ADLH), scored the second highest out of all issues polled.

As a part of the Enhancement Area Prioritization process, we sent out a poll to 23 members of the Coastal Coordination Advisory Committee and GLO Coastal Resources and asked them to rate each enhancement area as high (3), medium (2), or low (1). Results in this and the rest of the sections below reflect the average ranking of 13 of these stakeholders. Wetlands scored a 2.6, second highest out of all the enhancement areas.

Because of the valuable ecosystem services that wetlands provide (improve water quality, shoreline stabilization, critical habitat, wave attenuation, etc.) and the high value placed on wetlands by stakeholders, Wetlands are viewed as a High level of Enhancement Prioritization.

Table 4-3: Statistical Summary of Prioritized Issues of Concern

Issue of Concern	ADLH	ADVSD	BSE	CFD	EFCSSD	GBEDD	ICR	IWQQ
Subregion Average	2.70	0.98	1.91	2.09	2.15	2.80	2.42	2.36

Table 1. Summary of Prioritize Issues of Concern for the entire Texas coast. ADLH = Altered, Degraded, or Lost Habitat; ADVSD = Abandoned or Derelict Vessels, Structures, or Debris; BSE = Bay Shoreline Erosion; CFD = Coastal Flood Damage; EFCSSD = Existing and Future Coastal Storm Surge Damage; GBEDD = Gulf Beach Erosion and Dune Degradation; ICR = Impact on Coastal Resources; and IWQQ = Impact on Water Quality and Quantity.

Coastal Hazards

SECTION 309 ENHANCEMENT OBJECTIVE: Prevent or significantly reduce threats to life and property by reducing development and redevelopment in high-hazard areas, managing development in other hazard areas, and anticipating and managing the effects of potential sea level rise. §309(a) (2)

Note: For purposes of the Hazards Assessment, coastal hazards include the following traditional hazards and those identified in the CZMA: flooding; coastal storms (including associated storm surge); geological hazards (e.g., tsunamis, earthquakes); shoreline erosion (including bluff and dune erosion); sea level rise; Great Lake level change; land subsidence; and saltwater intrusion.

Resource Characterization:

1. *In the table below, indicate the general level of risk in the coastal zone for each of the coastal hazards. The following resources may help assess the level of risk for each hazard. Your state may also have other state-specific resources and tools to consult.*

General Level of Hazard Risk in the Coastal Zone

Type of Hazard	General Level of Risk[3] (H, M, L)
Flooding (riverine, stormwater)	H
Coastal storms (including storm surge)	H
Geological hazards (e.g., tsunamis, earthquakes)	L
Shoreline erosion	H
Sea level rise	H
Land subsidence	L
Saltwater intrusion	M
Other -Tornado	L-M
Other - Drought	M-H

2. *If available, briefly list and summarize the results of any additional data or reports on the level of risk and vulnerability to coastal hazards within your state since the last assessment. The state's multi-hazard mitigation plan or climate change risk assessment or plan may be a good resource to help respond to this question.*

The Coastal Hazard assessment is primarily based on the State of Texas Hazard Mitigation Plan (2018 Update). Other regional hazard mitigation plans were also referenced including: The South East Texas Regional Planning Commission Regional Hazard Action Plan (2004), Houston-Galveston Area Council Regional Hazard Mitigation Plan (2011), Texas Colorado River Floodplain Coalition Mitigation Plan (2011), Guadalupe-Blanco River Authority Hazard Mitigation Plan (2018), Coastal Bend Mitigation Action Plan (2011) and the Hazard Mitigation Action Plan for the Rio Grande Border (2011). The regional coverage for each of the hazard mitigation plans is shown in Figure 1.

The following sections provide a review of the major hazards associated with Texas coastal counties. The Federal Emergency Management Agency (FEMA) Disaster Declarations Summary categorizes the federally declared

[3] Risk is defined as "the estimated impact that a hazard would have on people, services, facilities and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage." *Understanding Your Risks: Identifying Hazards and Estimating Losses. FEMA 386-2. August 2001*

disasters in the coastal zone from 1953-2019 (see Table 2). Hurricane and tropical storms account for the greatest number of declared disasters, followed by floods, fire and wildfire hazard, severe storms and tornados, and freezes. Other hazards reviewed in the various hazard mitigation plans and relevant to this discussion include geologic hazards, shoreline erosion, relative sea level rise, land subsidence, saltwater intrusion, and drought.

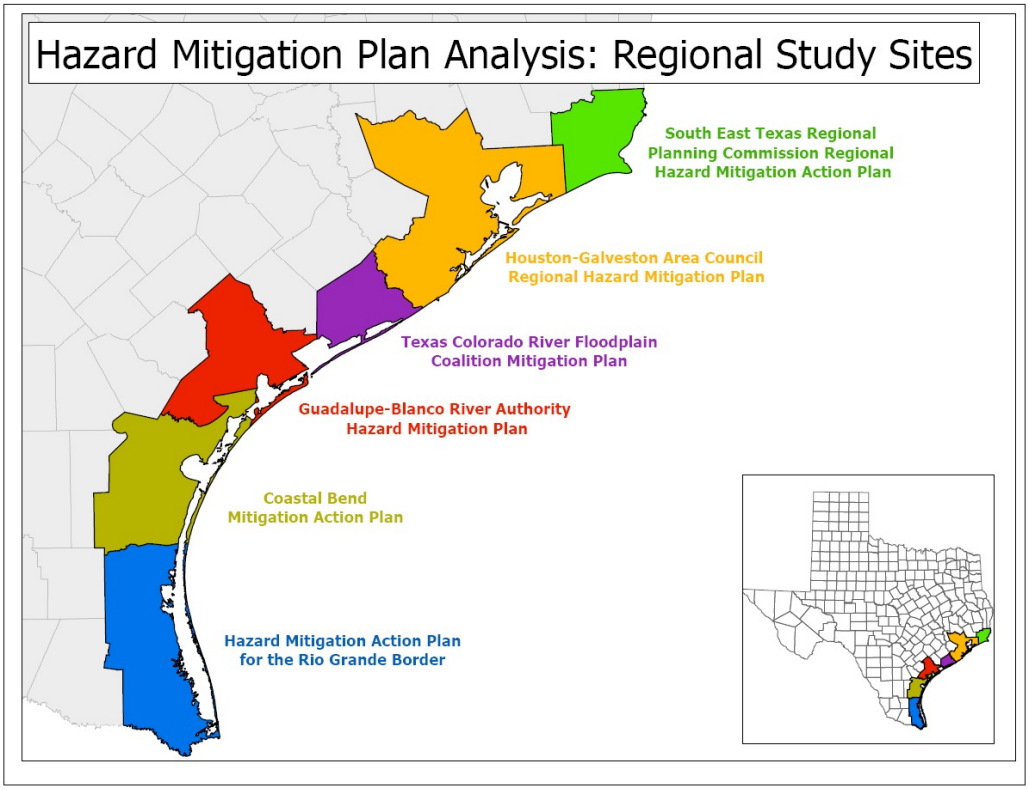

Figure 1. Coastal hazard mitigation plans by region (from Peacock et al. 2009).

Table 2. Summary of Disaster Declaration for Texas Coastal Counties 1953-2019. Note that a single disaster could have resulted in declarations from multiple counties. Data from FEMA[4].

Summary of FEMA Disaster Declarations for the Texas Coastal Counties				
Tropical storms and hurricanes	Fire and Wildfire	Floods	Freezes	Severe Storms and Tornado
228	41	75	4	38

Flooding

Floods are defined as the accumulation of water within a water body and the overflow of excess water into the adjacent floodplain lands. Historically, floods, including flooding due to hurricanes/tropical storms, are one of the most frequent, destructive, and costly natural hazards affecting Texas, constituting 57 percent of the disaster damage experienced in the state from 1996-2016 (Texas Hazard Mitigation Plan, 2018). The State's Hazard Mitigation Plan reports riverine flooding costing an estimated $268 million in state annualized physical losses. Figure 2 presents the historical riverine flooding costs (property plus crop losses) in each of the Texas counties between 1996 and 2017. Counties in the upper (Harris, Jefferson, Orange) and lower (Willacy, Cameron) coastal regions have had relatively high flooding costs since 1996.

[4] FEMA Disaster Declarations Summary – Open Government Dataset available at https://www.fema.gov/media-library/assets/documents/28318

The risk of flood for coastal Texas counties is high because they are likely to occur at least once every three years, the warning time for floods is generally short 3-6 hours, and when a flood does occur the impact is high because there is a greater potential for loss of human life and destruction and damage to infrastructure (Texas Hazards Mitigation Plan, 2018). Flood events can last a few hours to several days or even months if certain weather conditions combine to allow precipitation to continue. This can cause shutdown of critical public safety, transportation, and utility facilities for up to 30 days or more.

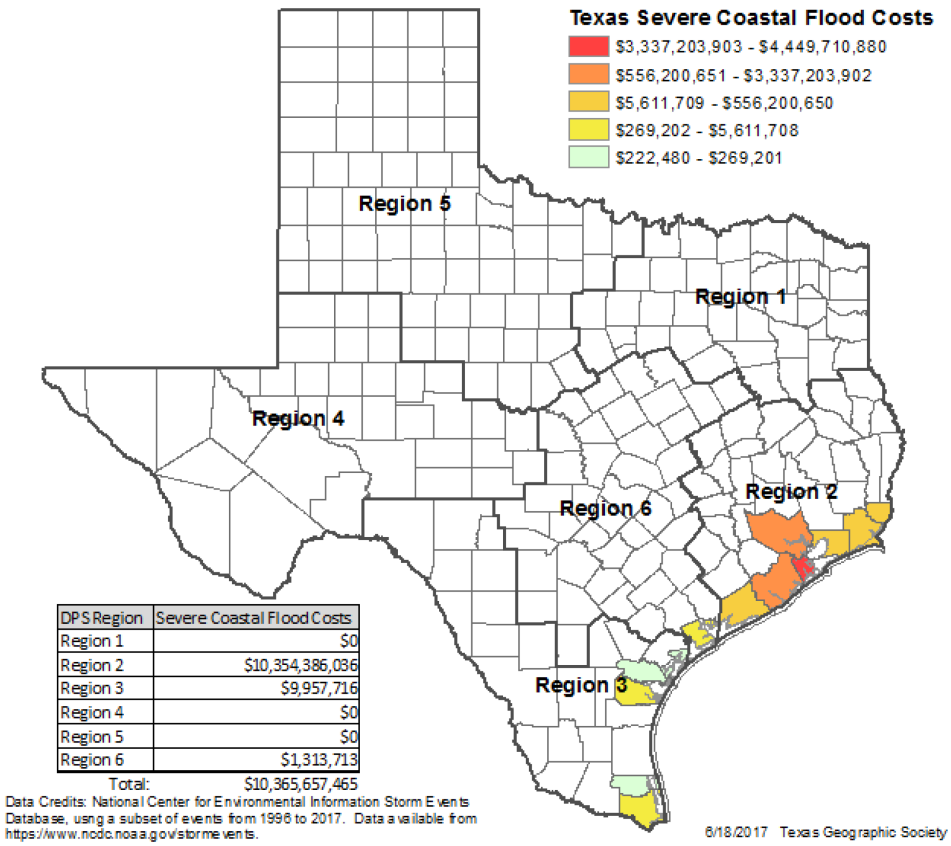

Figure 2. This map was obtained from the Texas Hazard Mitigation plan (2018) and features the historical severe coastal flooding costs per county from 1996-2017 as reported by the National Center for Environmental Information Storm Events Database.

Coastal Storms

Coastal storms, including hurricanes and tropical storms, are one of the most devastating natural hazards in the Texas coastal zone; exposing large areas of the coast, people, and infrastructure to the effects of flooding and wind damage (see Figure 3). A tropical storm is defined as a low-pressure area of closed circulation winds that originates over tropical waters. Coastal storms in Texas have been designated as a high-risk factor because they may result in major injuries or deaths, complete shutdown of critical facilities for days or even weeks, and they may cause major or complete destruction of property. Further, as of 2013, approximately 1 million people in Texas coastal counties live in the floodplain and may be exposed to the flood damage and property loss (NOAA, 2019). Sixty percent of the federal disaster declarations in Texas coastal counties have been due to hurricanes or tropical storms (see Table 2) and the probability of occurrence is likely every 1.3 years (Texas Hazard Mitigation Plan 2018). Although storm warning systems have improved, allowing more than 12 hours of warning, evacuation of all residents is a challenge.

In 2017, Hurricane Harvey made landfall as a category 4 hurricane in Aransas county with observed wind gusts of

up to 132 mph near Port Aransas. Harvey caused extensive wind and storm surge damage near landfall then. moved slowly across the Texas coastline, dumping massive amounts of rain in some coastal counties (up to 60 inches). Between 25 and 30 percent of Harris County – which covers approximately 444 square miles and is home to 4.5 million people - was flooded. First responders faced large volumes of distress calls during the flooding. By August 29, 2017, approximately 13,000 people had been rescued with countless more awaiting help. Over 30,000 people had been displaced. Hurricane Harvey damaged 204,000 homes (Texas Hazard Mitigation Plan 2018). Three-fourths of these homes were outside of the 100-year flood plain and most of those homeowners did not have flood insurance. Overall, Hurricane Harvey caused an estimated $125 billion in damage, second only in cost to Hurricane Katrina (Amadeo 2019).

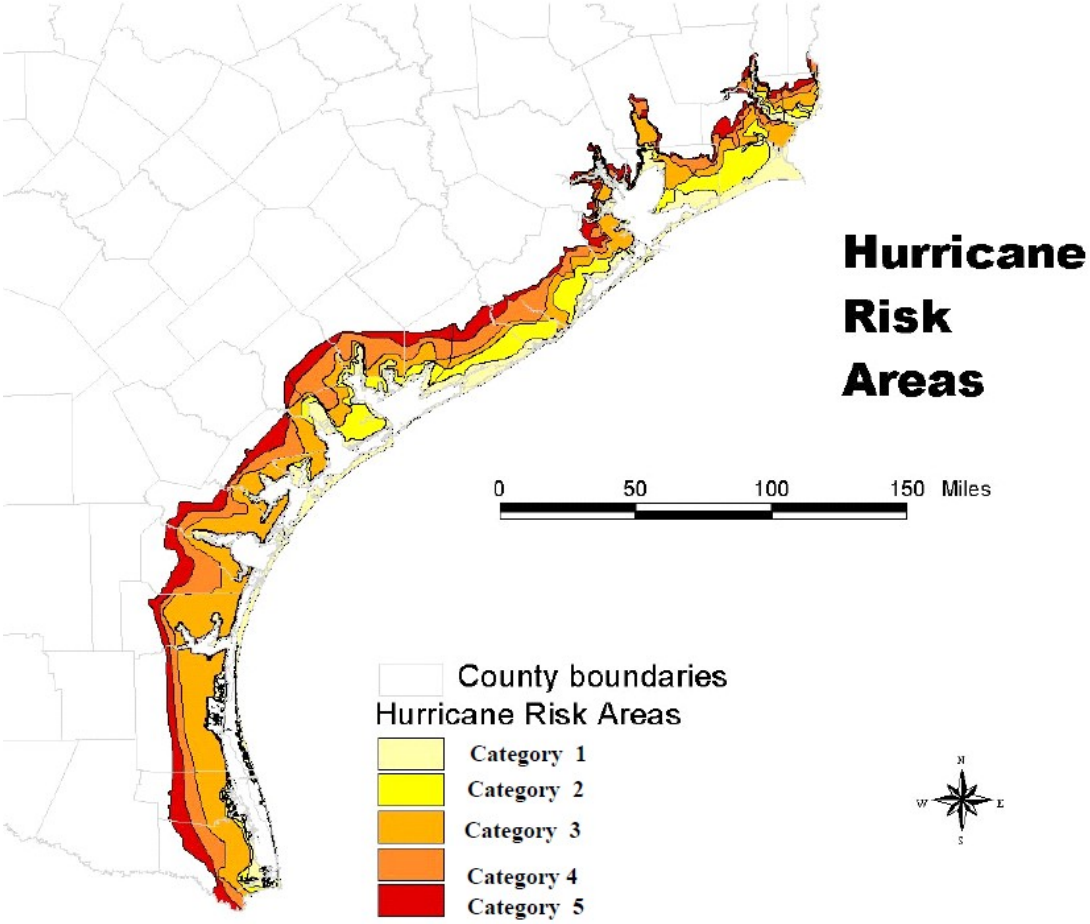

Figure 3. Hurricane Risk Areas for Texas Coastal Counties (Texas Hazard Mitigation Plan 2010-2013).

Geologic Hazards

Overall, Texas is at low risk of geologic hazards such as earthquake or tsunamis. Texas coastal counties have minimal risk of earthquakes or tsunamis (see Figure 4), which can occur because of submarine landslides (Peterson et al. 2018).

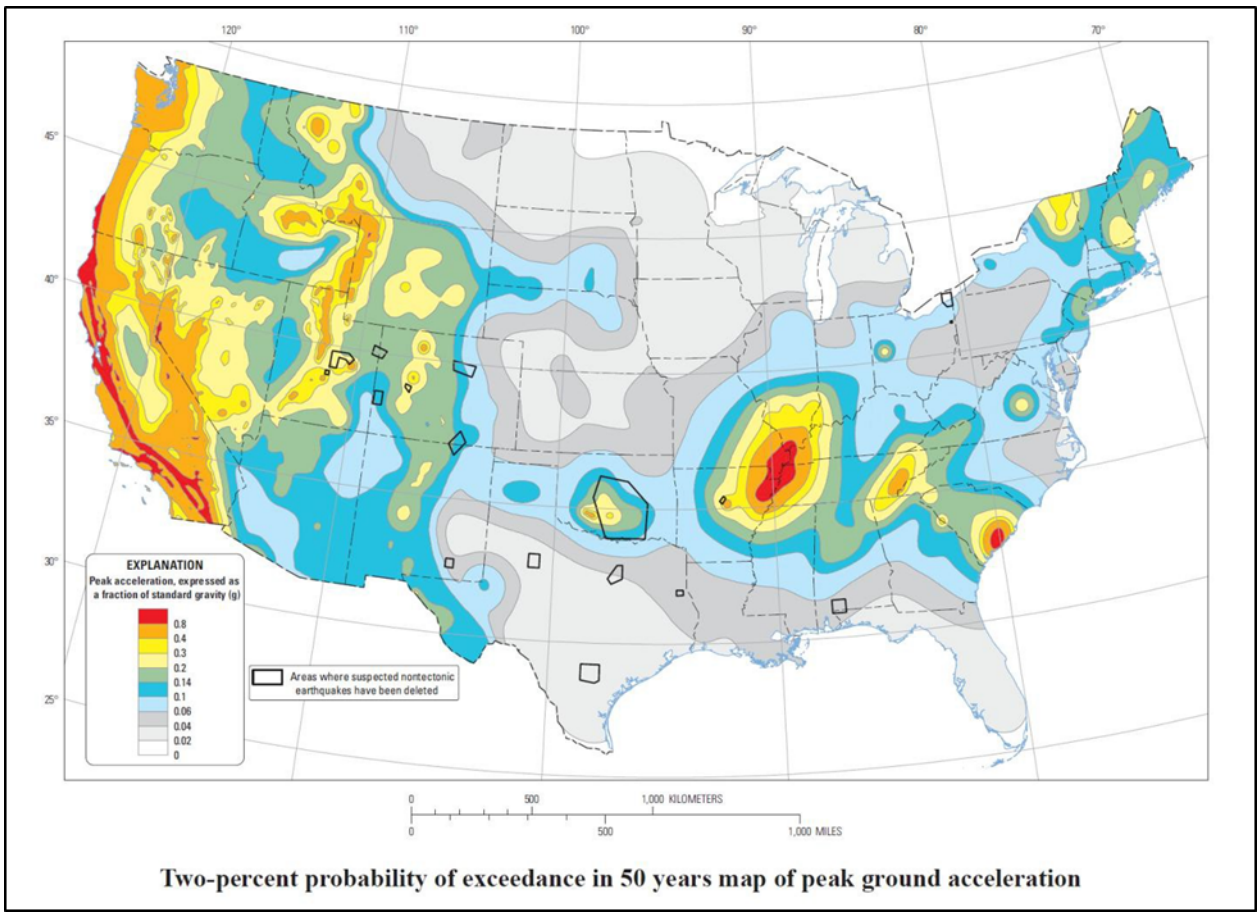

Figure 4. 2014 United States National Seismic Hazard Map (Image from USGS).

Shoreline Erosion

Coastal erosion is a hydrologic hazard defined as the wearing away of land and loss of beach, shoreline, or dune material because of natural coastal processes or manmade influences. Erosion can occur as a slow continuous process or as a response to waves and currents that accompany tropical storms and hurricanes, which in turn exposes property and infrastructure to storm surge. Texas has the sixth longest coastline in America coupled with some of the highest rates of coastal erosion. Approximately 80 percent of the Gulf shoreline is considered critically eroding, losing an area of 178 acres of shoreline each year (Paine et al. 2014). Shoreline change analysis after Hurricane Ike in 2008 revealed that many areas of the Texas upper coast experienced over 20 m of shoreline retreat, with a few areas such as the Sea Rim State Park experiencing retreat of 50 to 100 m (Gibeaut et al, 2012). Storm surge induced erosion and inundation on Bolivar Peninsula and sections of Galveston Island destroyed many homes and caused large-scale destruction of roads and other infrastructure and facilities (Figure 5). Erosion is ranked as high hazard because of the potential damage to infrastructure and facilities along the Gulf and Bay shorelines resulting from highly probable and frequent tropical storm activity or storm occurrence.

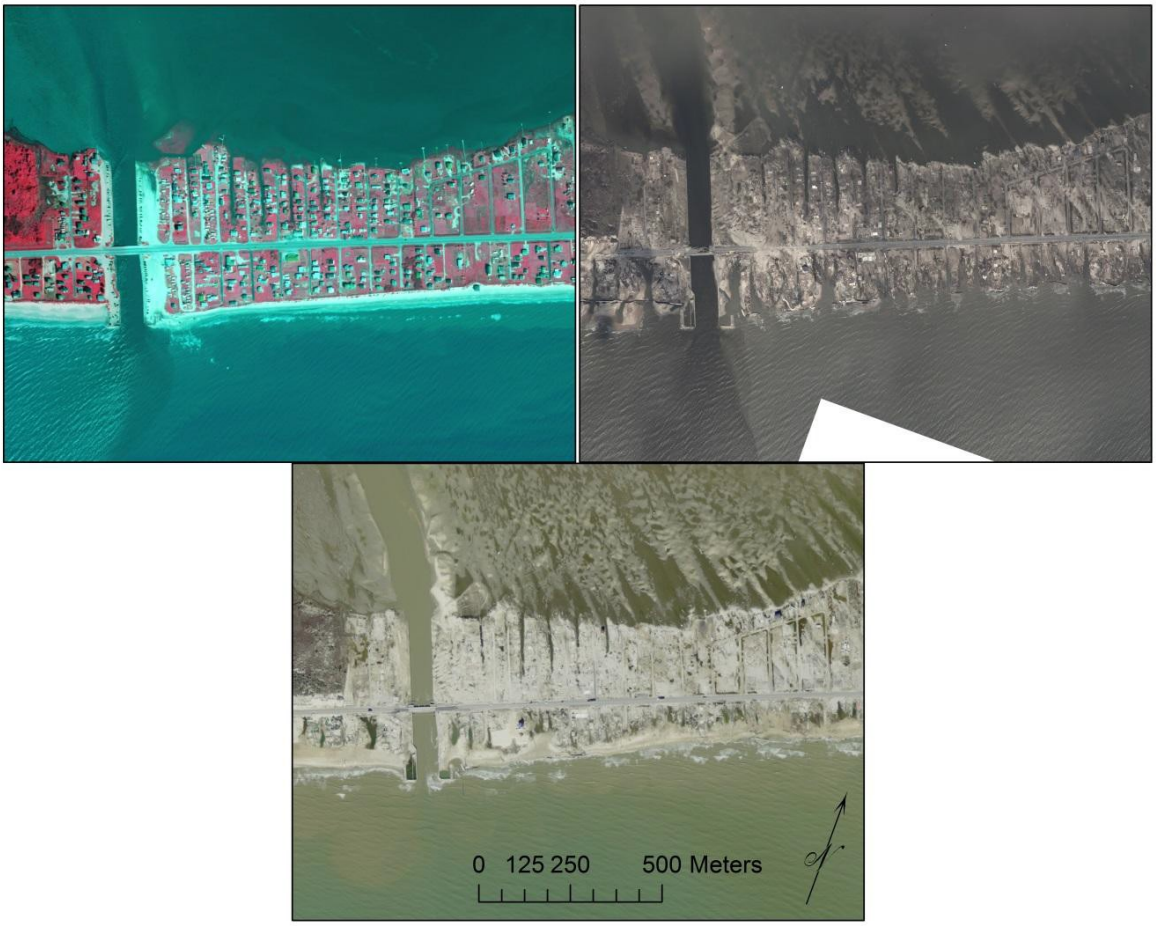

Figure 5. Imagery of Rollover Pass in Bolivar Peninsula Pre-Ike 2008 (top left), post Ike 2008 (top right), and the recovering shoreline in 2009. Images obtained from Texas Natural Resource Information System.

Whether the erosion is caused by the lack of sediments to balance the long-term losses within the coastal compartments, or the episodic erosion brought on by storms or human activities, planning and implementation of erosion response and sediment management practices is essential to the sustainability of the shoreline and public beaches. The upper Texas coast from Sabine Pass to Rollover Pass, the Brazos-Colorado headland from Quintana to Sargent Beach, and sections of South Padre Island have the greatest erosion rates along the Texas Gulf shoreline (see Figure 6). In many of these locations, sufficient sand for dune restoration or beach nourishment is not available and other erosion mitigation methods may be needed. From the Initial Needs Assessment for the Texas coast, it was found that coastal erosion is as one of the top three issues of concern and priorities for all regions of the Texas coast (Gibeaut et al., 2014).

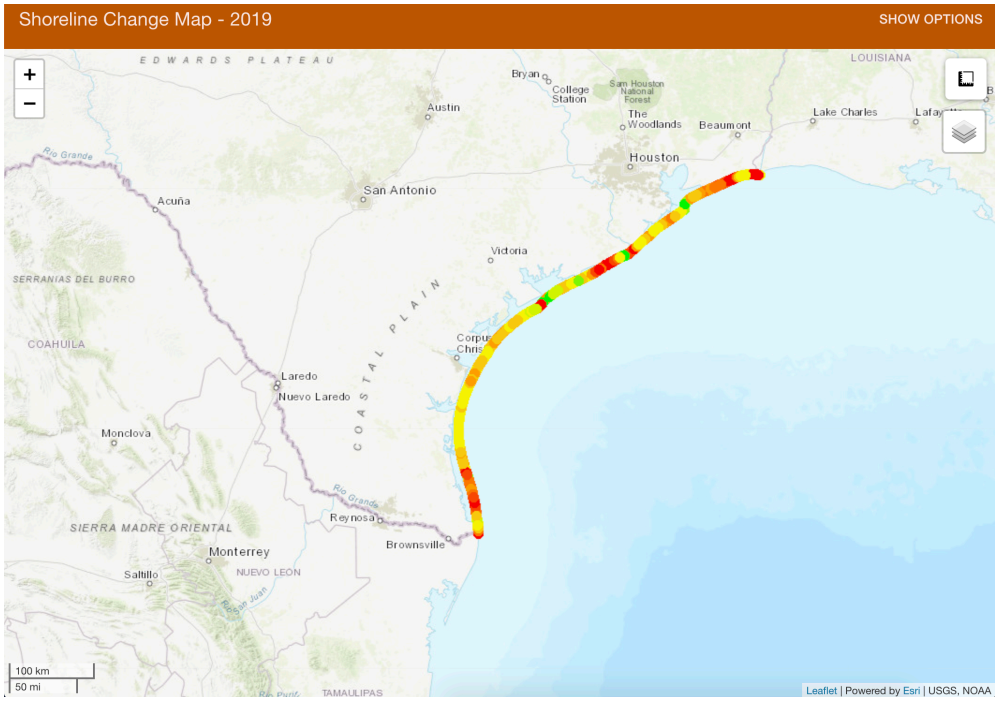

Figure 6. Map of coastal erosion rates from 1950s to 2019. From the Texas Bureau of Economic Geology.

Relative sea level rise

Sea level rise is occurring through the entire Texas coast (see Figure 7) and exacerbates coastal erosion, inundates shallow estuarine depositional environments, and exposes infrastructure and critical facilities to wave energy or inundation. The vulnerability of the Texas coast to sea level rise as reported in the USGS Coastal Vulnerability Index (CVI) is very high (USGS, 2019). The CVI defines vulnerability as the relative risk that physical changes will occur as sea-level rises based on tidal range, wave height, coastal slope, shoreline change, geomorphology, and historical rate of relative sea-level rise. Although sea level rise is a slow process that does not immediately threaten human life, the potential ecosystem and economic costs and impacts are expected to be significant therefore, sea level rise is assigned as a medium hazard risk.

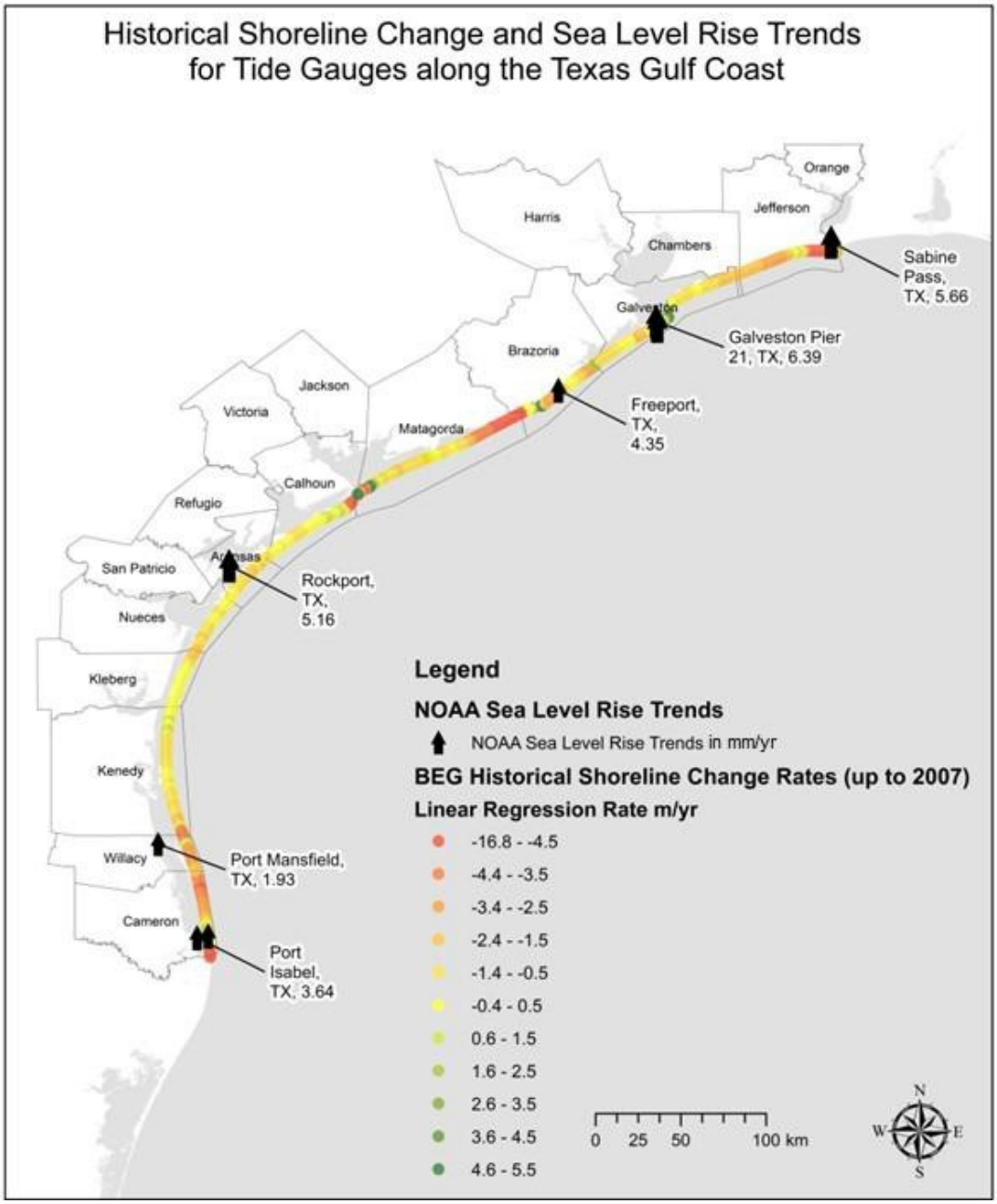

Figure 7. This map shows historical sea-level rise trends as published by NOAA (http://tidesandcurrents.noaa.gov/sltrends/) and historical shoreline change rates as calculated by the BEG (http://www.beg.utexas.edu/coastal/morphodynamics.php). Larger arrows signify negative or landward movement of the shoreline.

Land Subsidence

Land subsidence is defined as the loss of surface elevation due to the removal of subsurface support. Subsidence can take place from regional lowering of the land to localized collapsing. The occurrence of land subsidence is particularly high in the coastal counties relative to the rest of the state due to compaction of the underlying sediments, comprised of alluvial, estuarine, coastal and deeper marine sediments. This stack of sediment may be 10-15 km thick and compacting at a rate of 0.05 mm/yr (Montagna et al., 2007). Additional land subsidence may be caused by groundwater withdrawal and oil and gas extraction. Review of the regional hazard mitigation plans for the Texas Gulf coast reveals that subsidence is of low hazard concern; three out of five hazard plans acknowledge the hazard but state the occurrence of significant subsidence in their plan-area is low. Because subsidence rates are

minimal (0.05 mm/yr) and localized, the relative threat of land subsidence is classified as low, although it has the potential to augment the impacts of the sea level rise. Currently, subsidence alone has limited potential for injury or damage to critical facilities or infrastructure.

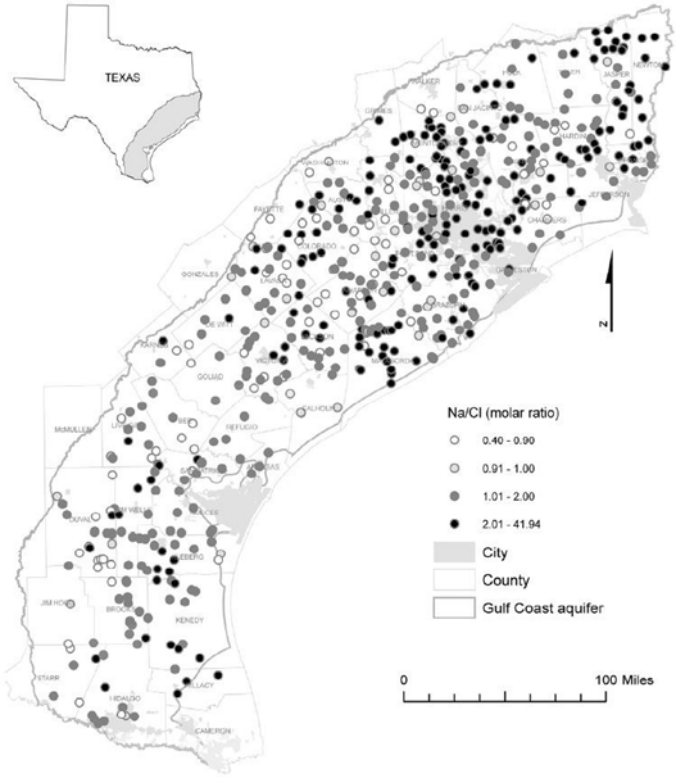

Figure 8. Distribution of Na/Cl molar ratio in the Gulf Coast aquifer of Texas (Chrowdhury et al., 2006). Na/Cl ratios of saltwater intrusion are usually lower than the marine values (~0.86 molar ratio) and high molar ratios (>1) typically characterize anthropogenic sources (Baer, 1999). Saltwater intrusion is documented for the Texas coast but, its occurrence is not likely to cause significant injury or loss to facilities or infrastructure and is found to be a medium risk hazard.

Saltwater Intrusion

Intrusion of saltwater into groundwater and other freshwater systems, particularly in estuaries, is a concern along coastal communities as it threatens municipal water supplies and affects freshwater environments, including plants and other living organisms. Saltwater intrusion into an aquifer can occur if water from the aquifer is extracted faster than it is replenished. Saltwater intrusion can also result from elevated storm surge from tropical storms and hurricanes (Steyer et al., 2007). Although its occurrence is not likely to cause significant injury or loss to facilities or infrastructure, it may have significant impact on communities and natural ecosystems. Saltwater intrusion has been documented along parts of the Texas Gulf Coast and found to result from aquifer pumping and subsequent lowering of the water table, particularly in Kleberg, Matagorda and Brazoria counties (Chowdhury et al., 2006) (see Figure 8). The threat of saltwater intrusion is currently a medium risk.

Severe Storms and Tornados

A tornado is defined as a rapidly rotating vortex or funnel of air extending groundward from a cumulonimbus cloud. Tornadoes occur most frequently in the northern part of Texas and are associated with cool frontal systems moving to the east (see Figure 9); however, tornadoes may also result from tropical storms in coastal counties. The severity of the impact of a large tornado is high because of the number of injuries and destruction that may take place with minimal warning time. According to FEMA Disaster Declarations database (see Table 2), the Texas coastal zone had 38 emergency declarations due to severe storms tornadoes from 1953 to 2019, a much lower

number when compared to coastal storms or floods. Thus, the relative risk of a tornado in Texas coastal counties is low-medium.

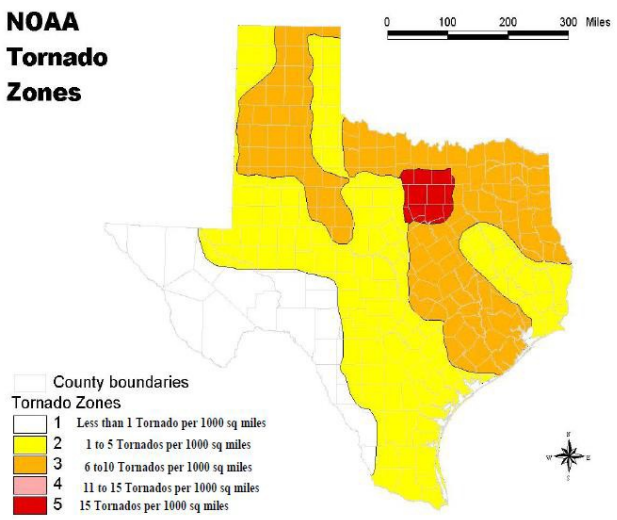

Figure 9. The map was obtained from the Texas Hazard Mitigation Plan (2018) and features tornado zones for Texas. Most of the Texas coastal counties lie within the low to low-medium range of tornado activity.

Drought

Drought is defined as the consequence of a natural reduction in the amount of precipitation expected over an extended period, usually a season or more in length. Due to the geographic location of the state, as much as two-thirds of the state's counties, including coastal counties, lie within an arid or semi-arid climatic zone and are highly vulnerable to drought. During the past 15 years, Texas received more than 2,921 declarations for multi- county or regional drought; the Gulf Basin experiencing varying degrees of drought at least once every 5 years.
According to the FEMA Disaster Declarations database, coastal counties do not have a federal declaration of drought, but many of the coastal counties have had Secretarial Drought Designation (see Figure 10) in the last decade. The U.S. Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency loans to agricultural producers suffering losses in those counties.

Drought is prevalent in the coastal region and a cause of agricultural losses; yet, it has a low probability of causing death or injuries and has more minor impacts in the coastal region relative to other threats. Perhaps the biggest impact of drought to the coastal region is its impact to freshwater inflows into the bay systems. Drought within counties in or adjacent to a coastal watershed may lead to decreased input of freshwater to estuarine systems, causing increased salinities stressing environments and coastal resources like wetlands, oysters, and marine fauna. Therefore, drought is ranked as a medium to high risk hazard.

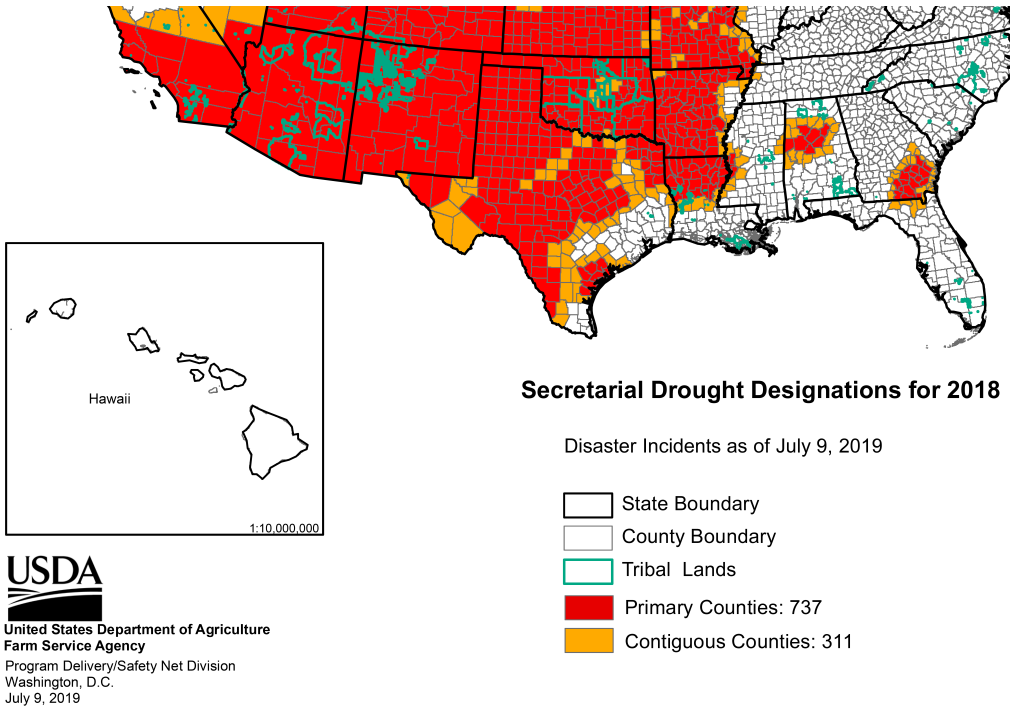

Figure 10. Secretarial Drought Designation Map.

Management Characterization:

1. In the tables below, indicate if the approach is employed by the state or territory and if significant state- or territory-level changes (positive or negative) have occurred that could impact the CMP's ability to prevent or significantly reduce coastal hazards risk since the last assessment.

Significant Changes in Hazards Statutes, Regulations, Policies, or Case Law

Topic Addressed	Employed by State or Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Changes Since Last Assessment (Y or N)
Elimination of development/redevelopment in high-hazard areas[5]	N	Y	N
Management of development/redevelopment in other hazard areas	N	Y	N
Climate change impacts, including sea level rise	N	Y	N

Significant Changes in Hazards Planning Programs or Initiatives

[5] Use state's definition of high-hazard areas.

Topic Addressed	Employed by State or Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Changes Since Last Assessment (Y or N)
Hazard mitigation	Y	Y	Y
Climate change impacts, including sea level rise	N	Y	N

Significant Changes in Hazards Mapping or Modeling Programs or Initiatives

Topic Addressed	Employed by State or Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Changes Since Last Assessment (Y or N)
Sea level rise	Y	Y	N
Other hazards	Y	N	N

2. *Briefly state how "high-hazard areas" are defined in your coastal zone.*

Special hazard areas

The Texas Natural Resources Code, §33.203, Management of Public Land, describes a special hazard area as a coastal natural resource area "[…] designated under 42 U.S.C. Section 4001 et seq. as having special flood, mudslide or mudflow, or flood-related erosion hazards and shown on a flood hazard boundary map or flood insurance rate map as Zone A, AO, A1-30, AE, A99, AH, VO, V1-30, VE, V, M, or E."

3. *For any management categories with significant changes briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:*
   a. *Describe the significance of the changes;*
   b. *Specify if they were 309 or other CZM-driven changes; and*
   c. *Characterize the outcomes or likely future outcomes of the changes.*

Texas Coastal Resiliency Master Plan

A major recent success of the CMP was the GLO's production and release of the Texas Coastal Resiliency Master Plan (Plan) in 2017. The Plan was developed under a 309 strategy from the 2011-2015 CMP Assessment and Strategies document, at the time called the Coastal and Marine Spatial Planning effort. The Plan provides a framework for community, socio-economic, ecologic and infrastructure protection from coastal hazards, including short-term direct impacts (e.g., flooding, storm surge) and long-term gradual impacts (e.g., erosion, habitat loss). The Plan lays out 11 Actions at the state and regional level to increase long-term resilience. To bring about these 11 actions along the entire Texas coast, the Plan lists 123 recommended Tier 1, high priority projects. Working together, the GLO and its partners are striving to receive funding to implement these needed Tier 1 projects and to develop new, effective and long-term processes and relationships to make our collective vision of a resilient coastal Texas a reality.

The first iteration of the Resiliency Plan, released in March 2017, highlighted the value of the Texas coast, its resources, and the Issues of Concern that endanger coastal communities. These Issues of Concern included storm surge, flooding, erosion, loss of habitat, negative impacts on wildlife and fisheries, degradation of water quality and quantity, and the adverse impacts from abandoned or derelict vessels, structures and debris. The 2017 Resiliency Plan also presented Resiliency Strategies and recommended funding nature-based projects to mitigate the impacts of the Issues of Concern that threaten the vitality and productivity of the coastal area.

In the fall of 2017, the GLO began work on the 2019 version of the Resiliency Plan, which has a broader scope to address both natural and built environments as they pertain to resiliency for coastal communities. Using a "multiple lines of defense" approach, the 2019 Resiliency Plan identifies Actions that can be performed at the state and regional level to increase long-term resiliency. The 2019 Resiliency Plan presents an expanded list of nature-based projects and introduces resilient coastal infrastructure projects. All projects underwent expert review and evaluation by the Technical Advisory Committee (TAC) to prioritize the most advantageous and feasible project to advance the Texas coast toward greater ecological and societal resilience.

With a ready list of vetted Tier 1 projects identified through the planning process, the GLO will use the 2019 Resiliency Plan to guide long-term coastal management initiatives. This will strengthen and advance the overall mission of the GLO to safeguard the state's coastal resources and communities. Furthermore, the Resiliency Plan can be used by local governments and elected officials to highlight the Issues of Concern in their coastal communities, and to take action to make their communities more resilient.

The Plan has three primary goals and associated objectives:

> **Goal 1: The GLO will use the Resiliency Plan to direct its authority to identify, select and fund projects that address the Issues of Concern and restore, enhance and protect the Texas coast.**

The development of the Plan has directed programs within the GLO, such as the CMP and the Coastal Erosion Planning and Resource Act (CEPRA), to work together to align their goals and objectives to create an integrated grant program with the common mission of funding projects to improve management of the state's coastal resources and ensure the long-term ecologic and economic resiliency of the Texas Coast (*see Grant Integration, Cumulative and Secondary Impacts*). The Plan is also being used to inform priorities within the GLO's Community Development and Revitalization division's coastal portion of the allocation of federal Community Development Block Grant funds and will continue to do so in the coming years.

> **Goal 2: Develop an adaptable Resiliency Plan that accommodates changing coastal conditions. The Resiliency Plan will provide long-term, multiple lines of defense solutions to restore, enhance and protect coastal habitats, infrastructure and communities.**

The Plan is an ever-evolving document as the conditions along the Texas coast and hazards faced by those communities also change. The Plan's goal is to secure steady funding streams to implement projects and continually update the Plan in four-year intervals.

> **Goal 3: Communicate the environmental and economic value of the Texas coast to state and national audiences.**

The GLO continues to improve its outreach efforts to bring the plan to a local and national audience. Implementation of the Plan will make coastal communities more resilient to future coastal hazards. However, local coastal planning efforts may not yet revolve around the Plan because communities are not yet aware of this state-led planning effort and prioritization of projects by coastal experts and the resources available to implement projects at the local level. The GLO is currently using 309 funding to implement the Plan through a series of stakeholder outreach events along the Texas coast.

Data Management 309 strategy

In the previous assessment, one of the strategies developed by the CMP was to develop a coastal mobile data collection platform and applications to streamline and improve the efficiency of data collection, management, and

distribution for coastal-related activities and decision-making. Data collected targeted through this strategy would include but not be limited to uses for: coastal lease permitting, wetland mitigation monitoring, enforcement, derelict structures and vessel identification, beach & bay access point inspections, and Coastal Erosion Protection and Response Act construction activities. This strategy would revise the field collection methods and overall management approach for issuing leases and permits for submerged land use activities; moving towards online interactive permitting with the future goal of issuing leases in the field.

The Assessment & Data Collection to Enhance Permitting, Leasing, and Monitoring for Coastal Activities 309 strategy was planned for 5 years and revolved around 2 sub-strategies: 1) Develop a Coastal Mobile Data Collection Platform and Applications for Decision-Making; and 2) Develop and Conduct Rapid Assessments of Mitigation (RAM) Projects on State Owned Submerged Lands.

This strategy created a Data Collector App User Guide for Storm Debris and Derelict Structure Assessments. These new guides will change the methodology the GLO's Field Operations (Field Ops.) team uses when assessing projects on state owned submerged land. A RAM has been developed by GLO staff with input from academic experts at Texas A&M Corpus Christi to track the success of mitigation projects along the coast. This data will be used to assist staff when evaluating proposed mitigation projects. Staff is in the process of conducting a baseline RAM for each coastal wetland mitigation site and refining the details of the RAM with university staff.

In addition to making enhancements to the Data Collection Platform and Application (App.), this strategy also created a new method of storing and categorizing data collected via the Data Collector App. that will change how photos and data for the GLO's Coastal Resources (CR) division is housed into the future. The GLO, in partnership with SenseCorp, implemented the use of SharePoint to manage Collector App data and system information as the GLO shifts toward using Microsoft Office 365 SharePoint as an enterprise content management solution.

The GLO and SenseCorp met with CR users to discuss the desired requirements for photo and data management in SharePoint to ensure the design of the photo and data management solution in SharePoint could be leveraged by photos taken and data collected using the Collector App. SenseCorp created a detailed taxonomy for photos and file storage that was adopted by CR. SenseCorp also built a custom workflow to upload photos into SharePoint and tag them with the appropriate and available metadata values based on the Taxonomy. A SharePoint How-To guide for CR was also developed as well as a training video to teach new CR staff how to use the Data Collector App and SharePoint.

Erosion Response Plans:

The 76th Texas Legislature enacted CEPRA in 1999 as a funding mechanism to manage and mitigate damages caused by coastal erosion. The development of the ERP is a significant change, where local communities can establish or reinforce previously established setbacks for management of development in high hazard areas and mitigation of relative sea level rise. Administered by the GLO, the program has been successful in using state funding to leverage federal, state, local and private resources. The CEPRA program contributes up to 75 percent of the funding for beach nourishment and dune restoration projects, and 60 percent for wetland and habitat restoration projects, shoreline protection projects, and erosion studies.

Changes from the 81st legislature, H.B. 2073 (2009), require local governments to adopt an Erosion Response Plan (ERP) to reduce public expenditures for erosion and storm damage losses of public and private property. Adoption of an ERP is a consideration for CEPRA funds (Texas General Land Office, 2011). In addition, some ERPs discuss development standards and opportunities for mitigation and restorations. Most ERPs were developed with the assistance of the CMP through grants to local governments.

The previous 2016-2020 Strategy and Assessment report details specific erosion response plans per coastal

municipality. In the past 5 years, there has only been one update:

- Cameron County (2018) – After several years of stakeholder input and revisions to draft versions of the ERP, Cameron County adopted an ERP in December 2018 that included a 230-foot Building Setback Line landward of the line of vegetation. The County established an Exemption Petition Process for authorization of construction seaward of the BSL, and specifications for a recommended storm protection dune.

Enhancement Area Prioritization:

1. *What level of priority is the enhancement area for the coastal management program?*

   High X
   Medium
   Low

2. *Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.*

The Coastal Hazards Enhancement area is of high priority due to increasing population and development in a coastal zone that is eroding, subsiding, subject to relative sea level rise, and prone to storm impacts. Storms such as Harvey and Ismelda have stressed infrastructure and shown that much work is still needed to protect coastal areas from hazards.

In 2017, the GLO adopted the Texas Coastal Resiliency Master Plan (The Plan), a document that began as a strategy under the 2010-2015 Texas 309 Assessment and Strategies Report. The Plan lists 11 Actions and 123 projects that would go a substantial way towards protecting the Texas coast from a variety of hazards. The GLO and the Texas CMP will continue to work closely together to continue progress on the 2023 update to The Plan.

In developing strategies to manage coastal natural resources, it is important to focus on coastal resilience so that we can continue to enjoy and benefit from all the resources and services provided the coast. To achieve this, it is important to increase our understanding of ecosystem services, and to both quantify and value ecosystem services to better understand how they are provided, what represents a threat to such provisions, and what needs to be done to ensure their long-term sustainability. By monetarily valuing ecosystem services, we make relevant their importance in a common currency understood by everyone and that allows comparison to other monetarily defined competing uses. Monetarily valuing ecosystem services will be one of the main components of the 2023 update to the Texas Coastal Resiliency Master Plan.

Developing resiliency along the Texas coast will help communities recover from hazardous events and protect economic and natural assets. Coastal leaders and planners see great value in many of the new and existing resiliency planning tools and actively participate in planning efforts. However, there are also instances where planners understand resiliency, but sometimes lack the support of elected officials to implement the type of policies that lead to more sustainable long-term economies and infrastructure due to development pressures. Community officials along the coast are beginning to work together to address these challenges, but they believe the GLO is in the best position to give voice to the importance of the Texas coast – and to take the lead on major issues that have become critical to the nation's future.

Coastal hazards were the highest issue of concern from the TAC (Table 1) and scored highest from stakeholders polled for this assessment, scoring a 2.7 out of a possible 3. Developing strategies and plans to tackle coastal hazard resilience will continue to be a priority for the Texas CMP.

Public Access

Section 309 Enhancement Objective: Attain increased opportunities for public access, taking into account current and future public access needs, to coastal areas of recreational, historical, aesthetic, ecological, or cultural value. §309(a) (3)

PHASE I (HIGH-LEVEL) ASSESSMENT:

Purpose: To quickly determine whether the enhancement area is a high priority enhancement objective for the CMP that warrants a more in-depth assessment. The more in-depth assessments of Phase II will help the CMP understand key problems and opportunities that exist for program enhancement and determine the effectiveness of existing management efforts to address those problems.

Resource Characterization:

1. *Use the table below to provide data on public access availability within the coastal zone.*

Public Access Status and Trends

Type of Access	Current number[6]	Changes or Trends Since Last Assessment[7][8] (↑, ↓, –, unkwn)	Cite data source
Public beach access sites	203[9]	unknown	GLO, 2019
Shoreline (other than beach) access sites	286 bay 45 bayou 69 river	unknown	Txcoasts.com
Recreational boat (power or nonmotorized) access sites	154	unknown	Txcoasts.com
Number of designated scenic vistas or overlook points	Not tracked	–	–
Number of fishing access points (i.e. piers, jetties)	554	unknown	Txcoasts.com

[6] Be as specific as possible. For example, if you have data on many access sites but know it is not an exhaustive list, note "more than" before the number. If information is unknown, note that and use the narrative section below to provide a brief qualitative description based on the best information available.
[7] If you know specific numbers, please provide. However, if specific numbers are unknown but you know that the general trend was increasing or decreasing or relatively stable or unchanged since the last assessment, note that with a ↑ (increased), ↓ (decreased), – (unchanged). If the trend is completely unknown, simply put "unkwn."
[8] Dramatic changes in public access sites is due to long-range update in information, not the loss or creation of multiple access sites over 5 years.
[9] Cumulative number of public Gulf-facing beach access points per local governments' Beach Access and Dune Protection Plans.

Type of Access	Current number[6]	Changes or Trends Since Last Assessment[78] (↑, ↓, –, unkwn)	Cite data source
Coastal trails/ boardwalks *(Please indicate number of trails/boardwalks and mileage)*	# of trails = 107	unknown	Txcoasts.com
Number of acres parkland/open space	Not tracked	–	–
Access sites that are Americans with Disabilities Act (ADA) compliant[10]	90 (ADA compliant)	unknown	Txcoasts.com
Other: Beach Watch	164 stations, 61 beaches	↓ (3 stations)	https://cgis.glo.texas.gov/Beachwatch/

2. Briefly characterize the demand for coastal public access and the process for periodically assessing demand. Include a statement on the projected population increase for your coastal counties.

In 2010, the Texas coastal population was 6.1 million people and was projected to increase to 9.3 million by 2050 (NOAA, 2013). In 2017, the Gulf Coast Region's estimated total population was more than 7 million, or nearly 25 percent of the state's total population. That is an increase of about 16 percent since the 2010 census (Texas Comptroller 2019). While the population along the coast increases, there will be increased pressure on our coastal resources and an increased pressure to access and use beaches and other public coastal recreational areas. Additionally, there is an increasing need to continue to enhance access to these recreational sites for members of the public who qualify under the Americans with Disabilities Act (ADA) or have mobility impairments.

In 2013, Texas Sea Grant's Coastal Planning Program received 309 funding to update and enhance the Texas Coast Public Access Inventory. The goal of this project was to update the Texas Public Access Inventory and provide the information online through the TxCoasts.com website. This project addressed the needs of Texas Sea Grant's strategic planning efforts to bring awareness to public access and access planning, while also addressing the needs of GLO's 309 Project Enhancement Strategy for Public Access. In the 309 Enhancement Strategy for Public Access section, GLO states the need for "conducting a comprehensive inventory of coastal public access in Texas to support access planning." Further, the main effort to do this in Texas has been by GLO; conducted in 1989-1999, and updated in 2003. Since significant time had passed, it was of utmost importance to update the Public Access Inventory, as there had been changes seen along Texas beaches and bays (the creation of new access sites, the loss of once existing sites, population growth, and increases in tourism). The report was published in 2014.

After extensive review of the 2014 report by the Beach Access and Dune Protection Program in 2019, it was

[10] For more information on ADA see *www.ada.gov*.

determined that there were discrepancies between what the report identified as public beach access points in local governments' Beach Access and Dune Protection Plans and the correct interpretation of those access points by Beach/Dune rules and state law. The 2014 report and therefore the number of beach access points identified in the previous 5-year CMP assessment also erroneously included numerous private beach access pathways that were not accessible to the public and likely should not have been included in the previous assessment. In addition, the 2014 report identified numerous access sites on Texas bays as being beach access sites. These discrepancies account for the significant change in number of beach access sites in the state compared to the 2015-2020 report. There was no overall reduction in the number of actual beach access sites since the last assessment. Information from the 2014 report was verified as accurate before being incorporated into the Txcoasts.com website.

The verified information from the 2014 report was subsequently provided to the public as an interactive website (Txcoasts.com). As of 2019, there has not been a comprehensive update to Txcoasts.com since its inception, but the online inventory is frequently and regularly updated as changes to coastal access sites occur.

3. *If available, briefly list and summarize the results of any additional data or reports on the status or trends for coastal public access since the last assessment.*

No status and trends reports have been conducted since the last assessment. However, an assessment of all the beach and bay access points was conducted by Texas Sea Grant's Coastal Planning Program in 2014 and has been made available online. See discussion above in resource characterization.

Management Characterization:

1. *Indicate if the approach is employed by the state or territory and if there have been any significant state- or territory-level management changes (positive or negative) that could impact the future provision of public access to coastal areas of recreational, historical, aesthetic, ecological, or cultural value.*

Management Category	**Employed by State or Territory** (Y or N)	**CMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Statutes, regulations, policies, or case law interpreting these	Y	Y	Y
Operation/maintenance of existing facilities	Y	Y	Y
Acquisition/enhancement programs	Y	Y	Y

2. *For any management categories with significant changes, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:*
   a. *Describe the significance of the changes;*
   b. *Specify if they were 309 or other CZM-driven changes; and*
   c. *Characterize the outcomes or likely future outcomes of the changes.*

Cities and counties along the coast are required to adopt laws to protect the public's beach access rights. Usually, these local laws are adopted as a dune protection and beach access plan. The state reviews local beach access

plans and certifies that they meet the minimum state standards set forth in the GLO Beach/Dune Rules.

To enhance ADA access, the Beach and Dune Program worked with the CMP to purchase Mobi-mats and/or Mobi-Chairs for 8 coastal communities to allow persons with disabilities easier access to public beaches.

In Texas, public access to Gulf Coast beaches is not just the law, it is a constitutional right. The Texas Land Commissioner, by law, protects this public right for all Texans by enforcing the Texas Open Beaches Act (OBA). Under the Texas Open Beaches Act, the public has the free and unrestricted right to access and use the State's beaches, which are located on what is commonly referred to as the "*wet beach,*" from the water to the line of mean high tide; the dry sandy area that extends from the "*wet beach*" to the natural line of vegetation can be privately owned, and may be subject to a public beach easement.

Recently passed Texas House Bill 1628 gives commissioners courts of counties that border the Gulf of Mexico the authority to adopt by order reasonable rules on camping, access, litter, resource protection, or waste disposal in an island or beach park or on any part of the public beach so long as those rules do not conflict with the OBA. The primary effect this bill will have on public beach access is that it will allow counties to limit the number of days people can camp on the beach. Cities already have this authority.

Beach and Dune Strategy

In the previous assessment, one of the strategies developed by the CMP was to update beach and dune administrative rules and policies that affect the Gulf shoreline, which will assist local communities with coastal hazard mitigation and restoration.

The Beach and Dune Protection 309 strategy was planned for 5-years with 3 sub-strategies: 1) Renew the Texas Administrative Code Update Process; 2) Coastal Partnerships; and 3) Public Awareness. The changes will enhance ADA access to the water (beach) of Gulf-facing beaches in Texas and create more protective standards for dune protection and mitigation. General updates and administrative changes are also being made to Chapter 15 of the Texas Administrative Code.

As a part of the ongoing strategy, the GLO's Beach Access and Dune Protection Program will review the beach and dune administrative rules and policies found in Title 31, Chapter 15 of the Texas Administrative Code that affect Gulf shoreline access and management. The Program will develop strategies for implementing changes to the existing rules and guidance documents. GLO staff will review current rules, regulations, and guidance to identify necessary revisions that accommodate the evolving management practices of coastal local governments. Stakeholders and local governments will be engaged to provide input on proposed amendments. As necessary, the GLO will host meetings and workshops with project partners to address rule revisions concerning beach access enhancements, ADA requirements, dune protection projects, and other erosion response measures. Beach and Dune Program staff will provide technical assistance to local coastal leaders to implement the amendments that are appropriate for their community into their local Beach Access and Dune Protection Plans, guidance documents and programs.

A draft "tracked changes" version of Chapter 15 of the Texas Administrative Code with proposed amendments and a corresponding justification document explaining the technical reasoning for the proposed changes has been created but is not yet considered complete. Beach Dune Program and Legal staff will continue to draft proposed changes to rules and guidance documents and meet with internal workgroups to finalize the amendments before presenting them to stakeholders and local governments. Semiannual progress reports that provide updates on the drafting and implementation of amendments to Chapters 15 have been drafted and submitted.

Specifically, the Beach Access and Dune Protection rules found in Title 31, Chapter 15 of the Texas Administrative Code

will be clarified and revised to make them more applicable to the changing management practices of the coastal local governments. Rule amendments will include the requirement for enhancements to ADA access to the public beach in areas where vehicles have been prohibited from the beach by local government regulations. The desired outcome is for persons with mobility impairments to have access to a slip resistant surface and accessible pathway to the water line; not only to the dry beach area. A second priority is to incorporate provisions relating to best management practices for construction of dune walkovers currently found in GLO guidance documents into rule, thereby strengthening the requirements for critical dune protection in Texas.

To improve the understanding of the beach and dune system and emphasize the importance of beach access for those with mobility impairments, the GLO will update two guidance documents; the Texas Dune Protection and Improvement Manual and the Texas Beach Accessibility Guide. Local governments use the Texas Beach Accessibility Guide to help ensure that Gulf beach access points and facilities are accessible to persons with disabilities and are compliant with federal and state guidelines, which have changed since the publication of the document. The Texas Dune Protection and Improvement Manual is an educational publication that raises awareness of the fragile beach/dune system and provide concise guidelines for dune protection and improvement along the Texas Gulf Coast. The Manual provides local governments, stakeholders and the public information to help enhance dune protection along the Gulf coast through restoration methods and minimization of impacts. Updates to the Manual will include strengthened dune walkover construction standards and additional directions on appropriate dune mitigation techniques that are required when adverse effects to critical dunes occur.

As of 2019, progress is still underway to accomplish this strategy. In 2016, a staff member was hired to assist the existing Beach and Dune Program with the 309 strategy and later resigned from the GLO. A second staff member was hired to assist with the 309 strategy and later transitioned to a different program within the Coastal Resources department of the GLO. In May of 2018 a third staff member was hired to assist with the 309 strategy. An internal workgroup composed of the GLO Beach and Dune Program technical staff and General Counsel staff was formed and has met regularly over the past approximately two years to discuss potential rule amendments and draft language. This working group has made significant progress in amending the Beach and Dune Rules in Chapter 15 of the Texas Administrative Code. In addition, one meeting has been held with the City of South Padre Island to discuss the impacts of potential rule amendments on that local government's coastal resource management program.

At the end of this strategy in 2022, a final copy of the proposed rule amendments will be shared with coastal local governments for their input, suggestions, and feedback. The Beach and Dune Program may, as necessary, host meetings to provide technical assistance to coastal local governments to guide them through the proposed amendments and to eventually incorporate applicable rules into their local beach access and dune protection plans and best management practices. The Proposed Rulemaking Action will be posted in the Texas Register for a 30-day public comment period, and the GLO will respond to all comments in writing in the Final Adopted Rulemaking Action which will also be posted in the Texas Register. After second posting in the Texas Register, the rules will be effective and local coastal governments will be required to implement them.

The approved Beach and Dune Rule amendments will later be integrated into GLO Beach and Dune guidance publications and are subject to change based on public stakeholder input. Both the Texas Dune Protection and Improvement Manual and Texas Beach Accessibility Guide will be updated and published on the GLO website, as well as translated into Spanish for the large Spanish speaking population of Texas. All these accomplishments are anticipated to be achieved by the end of the available funding period for this strategy.

3. Indicate if your state or territory has a publicly available public access guide. How current is the publication and

how frequently it is updated?[11]

Public Access Guide	Printed	Online	Mobile App
State or territory has? (Y or N)	N	Y	N
Web address (if applicable)	N	Txcoasts.com	N
Date of last update	N	2019	N
Frequency of update	N	Plans for update TBD	N

Enhancement Area Prioritization:

1. *What level of priority is the enhancement area for the coastal management program?*

High _____
Medium **X**
Low _____

2. *Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.*

Coastal access is important both economically and ecologically as these areas contribute to ecosystem health as well as coastal tourism and recreation. As public access is required by statute and state rules, it has been a high priority for the Texas CMP in the past. One of the crucial strategies from the 2016-2020 Assessment and Strategies report was to update the Texas Administrative Code related to Beach and Dune Protection (see above). Because of the GLO's continued work and successes to provide and maintain coastal public access to everyone, Public Access has been identified as a medium priority for the 2021-2025 period. This was in agreement with our stakeholder polling, which scored a 1.8 out of 3.

[11] Note some states may have regional or local guides in addition to state public access guides. Unless you want to list all local guides as well, there is no need to list additional guides beyond the state access guide. You may choose to note that the local guides do exist and may provide additional information that expands upon the state guides.

Marine Debris

Section 309 Enhancement Objective: Reducing marine debris entering the Nation's coastal and ocean environment by managing uses and activities that contribute to the entry of such debris. §309 (a) (4)

Phase I (High-Level) Assessment:
Purpose: To quickly determine whether or not marine debris is a priority enhancement objective for the CMP that warrants a more in-depth assessment to understand key problems and opportunities that exist for program enhancement as well as the effectiveness of existing management efforts to address those problems.

Resource characterization:

1. *In the table below, characterize the existing status and trends of marine debris in the state's coastal zone based on the best available data.*

Existing Status and Trends of Marine Debris in Coastal Zone

Source of Marine Debris	**Significance of Source** (H, M, L, unknwn)	**Type of Impact**[12] (aesthetic, resource damage, user conflicts, other)	**Change Since Last Assessment** (↑, ↓, –, unkwn)
Beach/shore litter	H	aesthetic, resource damage, tourism, economic conditions, human health	-
Land-based dumping	unknown	unknown	-
Storm drains and runoff	H	aesthetic, resource damage,	↑
Land-based fishing (e.g., fishing line, gear)	H (data not specific to land-based/ocean-based)	aesthetic, resource damage	↑
Ocean/Great Lakes-based fishing (e.g., derelict fishing gear)	H (data not specific to land-based/ocean-based)	aesthetic, resource damage	↑
Derelict vessels	H	aesthetic, resource damage	Unknown
Vessel-based (e.g., cruise ship, cargo ship, general vessel)	unknown	aesthetic, resource damage	Unknown
Hurricane/Storm	H	all impacts	-
Tsunami	unknown	unknown	-

(Note: information for questions 1 and 2 of Resource Characterization was obtained through personal communication with the Texas General Land Office Adopt-A-Beach Program; the Beach Access and Dune Protection Program, Coastal Resources Division; Marine Debris Reimbursement Program; and Oil Spill Prevention and Response Division and Professional Services throughout the month of July, 2019.)

2. *If available, briefly list and summarize the results of any additional state or territory-specific data or reports on the status and trends or potential impacts from marine debris in the coastal zone since the last assessment.*

Source of Marine Debris	**Summary of results since last assessment:**

[12] You can select more than one, if applicable.

Land-based	
Beach/shore litter	NOAA created a marine debris blog: (http://marinedebrisblog.wordpress.com/) to highlight marine debris cleanup efforts, programs and partnerships across the country. The GLO's Adopt-A-Beach Program provided information on the number of miles cleaned, volunteers and tons collected. Debris details such as cigarette butts and bottle caps are also provided (see Table 3 and Table 4).
Dumping	Dumping data is not available.
Storm drains and runoff	Determined by local jurisdiction (local initiatives). General trend is upwards (personal communication, GLO, 2019) and must be mitigated through local jurisdictions. The implementation of the coastal NPS program will affect future storm drain and runoff policy (See Cumulative and Secondary Impacts)
Fishing (e.g., fishing line, gear)	Texas Parks and Wildlife Department administers the Crab Trap Removal Program. Since 2002, 35,481 derelict crab traps have been hauled from Texas bays (Texas Parks and Wildlife Department) (see Table 5).

Source of Marine Debris	Summary of results since last assessment:
Other (please specify)	The Texas Sea Grant Program coordinates the Clean Texas Marina Program, which has a marine debris component. There are 92 marinas now certified and 40 are now pledged, up from 19 and 12 respectively, from the last assessment. The GLO administers the Beach Maintenance Reimbursement Program, which provides state reimbursement to qualified city and county governments for certain expenses incurred while maintaining clean and safe public beaches. The 2014-2015 Progress Report on the Implementation of the Marine Debris Research, Prevention, and Reduction Act was released in December 2016. This report provides an update on the activities federal agencies have undertaken between January 2014 and December 2015 to address marine debris. (This is the third progress report following a report that was released in 2011-2012.)
Ocean-based	
Fishing (e.g., derelict fishing gear)	See Fishing (e.g. fishing line, gear) section above.
Derelict vessels	Since 2005, a total of 956 derelict vessels have been documented coastwide. With funding from a Coastal Impact Assessment Program grant, a total of 739 vessels have been removed, with approximately 217 remaining. Funding for this project ends December 2016. There is not a dedicated funding stream for this effort. (Personal communication, GLO, Oil Spill Prevention and Response Division, April 2015, see Figure 11 below).
Vessel-based (e.g., cruise ship, cargo ship, general vessel)	See discussion in "Derelict Vessels" section above and Figure 11 below.
Hurricane/storm	In 2017, Hurricane Harvey devastated the Texas coast with strong winds and record-setting rainfall. In 2018, the GLO received $3.8 million in funding from the NOAA Marine Debris Program to remove debris from areas of recreational and commercial value where debris poses a navigation hazard and threat to health and safety or natural habitat, including parts of the Mission-Aransas National Estuarine Research Reserve. Debris identified for removal includes; 3500 sq. ft. derelict oil platform; derelict well infrastructure, derelict septic tanks, and 5.6 miles of geotube debris exposed by Hurricane Harvey; 184 ft long pier; and 581 acres of scattered hurricane debris including household goods, building materials, personal belongings, etc.
Tsunami	No data available.

Table 3. Texas Adopt-A-Beach Program beach clean-up results, 2015 –2018.

Coastal Counties in Texas	Miles Cleaned	Volunteers	Tons Collected	Comments
Spring 2015	143	4,371	24	Thunderstorms
Fall 2015	116	7,427	105	Red Tide Conditions, many sites cancelled
Winter 2015	26	735	5	
Spring 2016	151	6,757	57	Flooding Conditions
Fall 2016	169	8,236	86	Thunderstorms and Red Tide Conditions, many sites cancelled
Winter 2016	32	798	14	
Spring 2017	146	6,772	78	Sandfest competition in Port Aransas, forced site to close
Fall 2017	69	5,046	40	One month after Hurricane Harvey, many sites cancelled
Winter 2017	35.5	1,451	36	
Spring 2018	134	4,924	40	Post Harvey, sites still recovering, cold weather, rain and flooding
Fall 2018	129	5,199	38	Tropical Depression forced to reschedule
Winter 2018	26.5	932	15	
Totals:	**1,177**	52,648	**538**	

Table 4. Texas Adopt-A-Beach Program trash data, 2015 – 2018.

Year:	Item:	Total Items:	Percentage:
Fall 2015	Cigarette Butts	37171	24.89%
	Bottle Caps (Plastic)	20519	13.74%
	Beverage Bottles (Plastic)	10646	7.13%
	Food Wrappers (candy, chips, etc.)	10275	6.88%
	Beverage Cans	6413	4.29%
	Straws, Stirrers	6412	4.29%
	Bottle Caps (Metal)	5596	3.75%
	Other Plastic/Foam Packaging	4534	3.04%
	Lids (Plastic)	4430	2.97%
	Grocery Bags (Plastic)	4049	2.71%
	Top Ten Total	**110045**	**73.68%**
Fall 2016	Cigarette Butts	64895	27.22%
	Plastic Pieces	42807	17.96%
	Bottle Caps (Plastic)	29299	12.29%
	Foam Pieces	14599	6.12%
	Beverage Bottles (Plastic)	9841	4.13%
	Food Wrappers (candy, chips, etc.)	7727	3.24%
	Straws, Stirrers	7089	2.97%
	Lids (Plastic)	6289	2.64%
	Glass Pieces	5218	2.19%
	Bottle Caps (Metal)	4892	2.05%
	Top Ten Total	**192656**	**80.81%**
Fall 2017	Plastic Pieces	26588	21.09%
	Bottle Caps (Plastic)	14522	11.52%
	Foam Pieces	11020	8.74%
	Cigarette Butts	10739	8.52%
	Bottle Caps (Metal)	7083	5.62%
	Beverage Bottles (Plastic)	6128	4.86%

	Food Wrappers (candy, chips, etc.)	5870	4.66%
	Straws, Stirrers	4008	3.18%
	Lids (Plastic)	3278	2.60%
	Beverage Cans	2995	2.38%
	Top Ten Total	**92231**	**73.17%**
Fall 2018	Plastic Pieces	16254	21.43%
	Bottle Caps (Plastic)	11155	14.71%
	Cigarette Butts	9621	12.69%
	Foam Pieces	5222	6.89%
	Food Wrappers (candy, chips, etc.)	3349	4.42%
	Beverage Bottles (Plastic)	2742	3.62%
	Straws, Stirrers	2480	3.27%
	Glass Pieces	2435	3.21%
	Bottle Caps (Metal)	2267	2.99%
	Rope (1yd = 1 piece)	1738	2.29%
	Top Ten Total	**57263**	**75.52%**

Table 5. Annual Crab Trap Removal Program results: 2010 – 2018.

Crab Traps Removed:	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sabine Lake	81	101	82	75	73	99	121	75	150
Galveston Bay	363	568	171	408	342	192	363	386	337
Matagorda Bay	7	64	41	45	8	3	88	5	54
San Antonio Bay	666	554	138	274	277	232	258	570	997
Aransas Bay	349	116	35	61	30	20	72	71	52
Corpus Christi Bay	121	34	25	18	18	6	2	8	71
Up Laguna Madre	1	3	0	3	0	0	0	0	0
Low Laguna Madre	0	51	7	13	40	4	8	0	0
Totals:	**1588**	**1491**	**499**	**897**	**788**	**556**	**912**	**1115**	**1661**

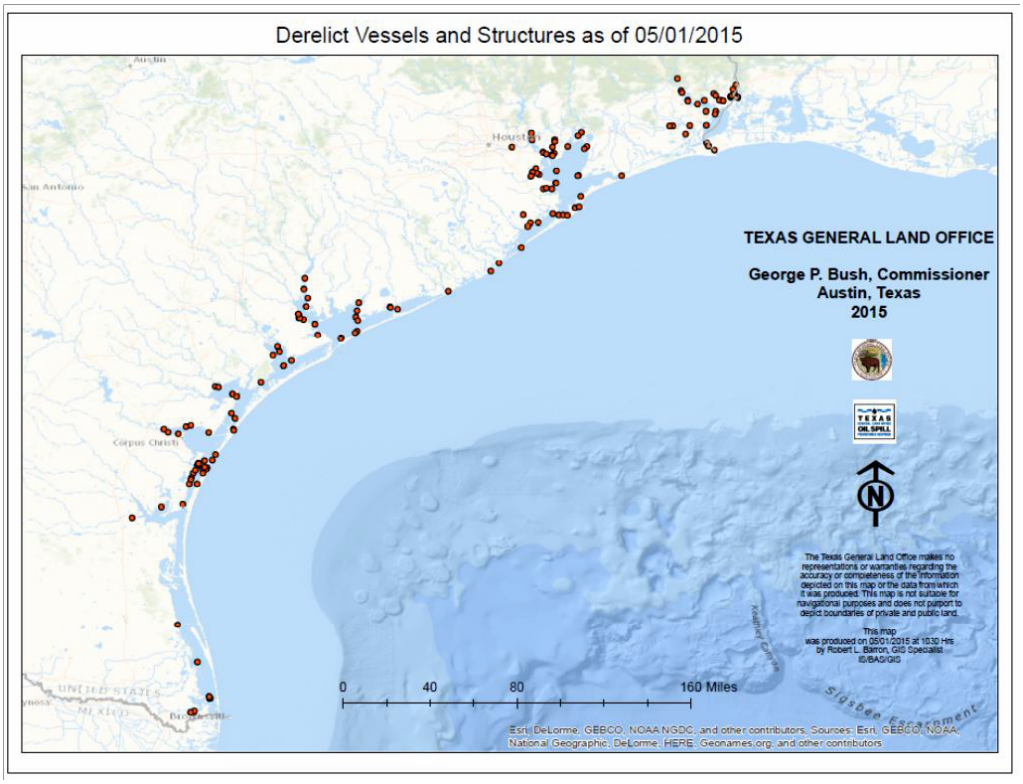

Figure 11. This map shows the locations of the remaining 217 derelict vessels in the coastal environment that have been documented by the GLO, Oil Spill Prevention and Response Division.

Management Characterization:

1. *Indicate if the approach is employed by the state if there have been any significant state level management changes (positive or negative) for how marine debris is managed in the coastal zone.*

Management Category	**Employed by State** (Y or N)	**CMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Marine debris statutes, regulations, policies, or case law interpreting these	Y	Y	N
Marine debris removal programs	Y	Y	N

2. *For any management categories with significant changes briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:*
    a. *Describe the significance of the change;*

    b. *Specify if it was a 309 or other CZM-driven change; and*

    c. *Characterize the outcomes and/or likely future outcomes of the changes(s).*

Enhancement Area Prioritization:

1. *What level of priority is the enhancement area for the coastal management program?*
   High _____
   Medium__X___
   Low _____

2. *Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.*

Marine debris is not only a worldwide issue; it is also a significant concern in Texas. Storms and their aftermath, such as Harvey, have helped garner interest in removing marine debris. The GLO served as the primary FEMA contact for marine debris and coordinated environmental requirements, addressed contractor issues, worked with city, county, and federal governments, and worked with the public on issues associated with marine debris removal.

Incentives should be considered for coastal communities who actively participate in regulation and enforcement of anti-littering laws in an effort to reduce marine debris on Texas shores. Texas Adopt-a-Beach, tracks data collection at beach cleanup sites, which is reported in an online system that is used by various entities. This data can be used to produce educational materials for region specific areas that can be distributed throughout the Texas coastal zone for Texans of all ages.

Cumulative and Secondary Impacts

Section 309 Enhancement Objective: Development and adoption of procedures to assess, consider, and control cumulative and secondary impacts of coastal growth and development, including the collective effect on various individual uses or activities on coastal resources, such as coastal wetlands and fishery resources.§309(a)(5)

Phase I (High-level) Assessment:
Purpose: To quickly determine whether or not cumulative and secondary impacts is a priority enhancement objective for the CMP that warrants a more in-depth assessment to understand key problems and opportunities that exist for program enhancement as well as the effectiveness of existing management efforts to address those problems.

Resource Characterization:

1. Using National Ocean Economics Program Data on population and housing,[13] please indicate the change in population and housing units in the state's coastal counties between 2012 and 2017. You may wish to add additional trend comparisons to look at longer time horizons as well (data available back to 1970), but at a minimum, please show change over the most recent five-year period data is available (2012-2017) to approximate current assessment period.

Trends in Coastal Population and Housing Units

	2012	2017	Percent Change (2012-2017)
Number of people	6,334,400	6,836,779	7.93%
Number of housing units	2,469,323	2,658,138	7.65%

The chart above shows an increase in the state's coastal population by half a million over a five-year span (2012-2017), with an increase of almost 200,000 in total number of housing units over the same five-year period. This information is highlighted in the housing density maps (see **Figure 12**), from 1970 to a projected 2030. Reviewing the following map of Texas Priority Conservation Areas, Environmentally Sensitive Shoreline, and Ecologically Unique Rivers map (see Figure 13; showing what is potentially threatened by projected increases in population and housing density in core urban areas), combined with the potential continued growth in population, it should be noted that the increasing areas in population and housing development will impact these vital natural resources (see Figure 14).

In addition to the potential threat to ecologically sensitive areas, the increase in population and housing units will increase the need for infrastructure and energy, which could increase the density of wind turbines (see Figure 15, March 2012) and the need for space for waste via landfills (see Figure 16, April 2007).

The Texas coastal zone lies in a floodplain (see Figure 17) which will be susceptible to sea level rise in the future (see 309 Assessment Coastal Hazards Section, **Figure 7**). Finally, as discussed in the Wetlands section, wetland habitat is a vital component of the Texas coastal region. USACE has jurisdiction over wetland delineation permits, and as seen in Figure 19 and Figure 20, these permits are extensive. Wetlands along this region are critical to storm buffering, in addition to serving as flora and fauna habitat, supporting biodiversity, providing

[13] www.oceaneconomics.org/Demographics/PHresults.aspx. Enter "Population and Housing" section and select "Data Search" (near the top of the left sidebar). From the drop-down boxes, select your state, and "all counties." Select the year (2012) and the year to compare it to (2017). Then select "coastal zone counties."

ecosystem services, functioning as recreational areas and adding cultural value to the coastal-living experience (citing 309 Phase I Assessment Wetlands Section, Resource Characterization 2). Coastal Hazards, including flooding, coastal storms and shoreline erosion, have been identified as a high priority by the Texas CMP, and these are all directly affected by the survival of the regional wetlands and their environmental support as a buffer zone.

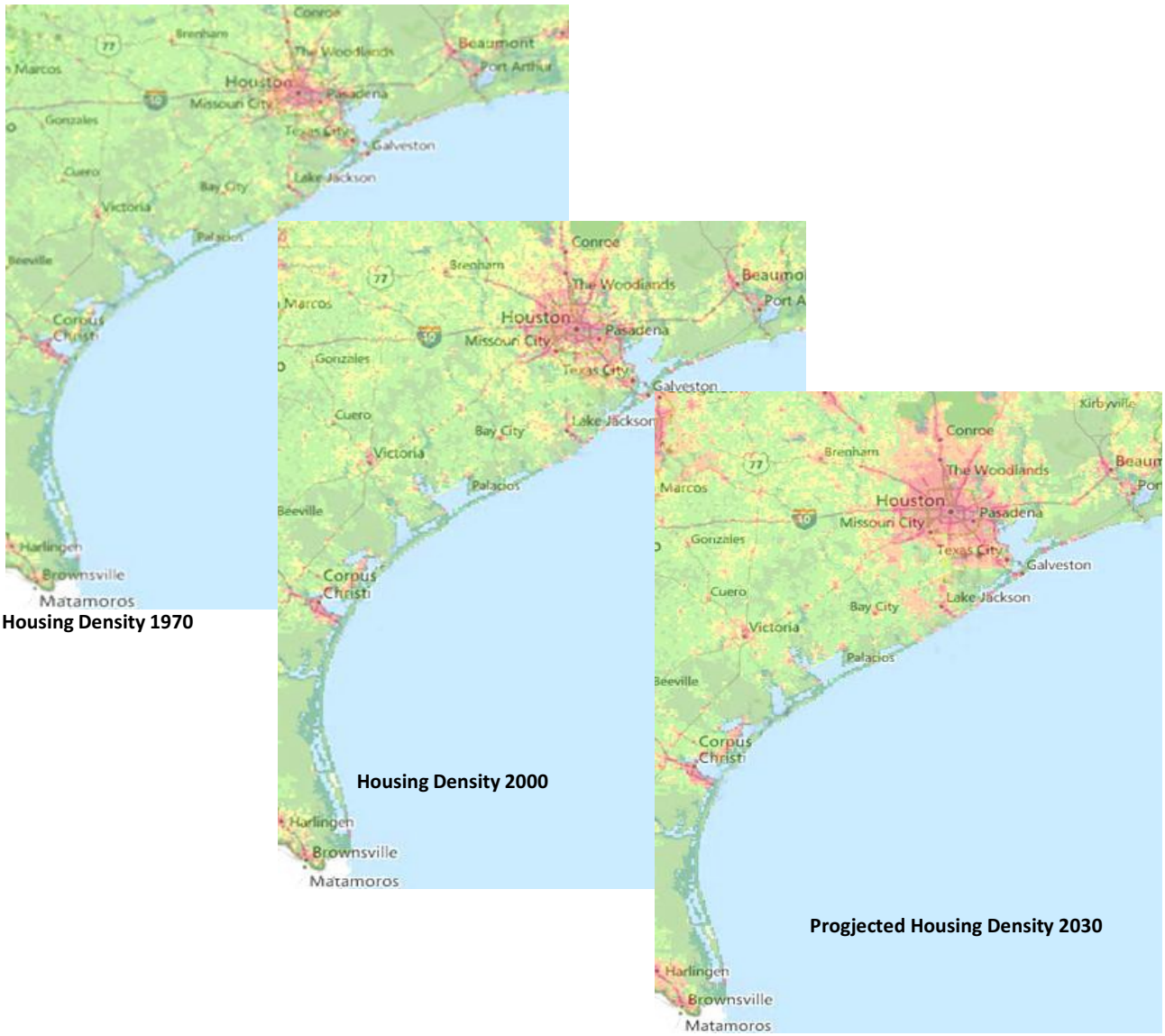

Figure 12. Housing density maps, showing a visual increase in population density from the years 1970, 2000, and 2030. Source: Landscope America Atlas, 2014 (NatureServe).

The maps present a clear picture of how coastal development threatens the coastal system. Specifically, the maps show hot spots of high housing density in red, with low density in green. From 1970 to 2000, housing density increased dramatically in the three core coastal urban areas (Houston-Galveston, Corpus Christi and Brownsville-South Padre). The projections for 2030 show an even more significant increase in housing density in these core areas. These areas, while home to core coastal urban centers, are also home to many essential habitats in which coastal species thrive (see Figure 13). In addition, these increases in housing density also describe the increased population that will appear along the coast in the future. This dynamic has direct impacts on coastal hazards because of the number of people and built infrastructure that are put in harm's way.

Figure 13. Texas Priority Conservation Areas, Environmentally Sensitive Shoreline, and Ecologically Unique Rivers. Source: Landscope America Atlas, 2014 (NatureServe), defined by The Nature Conservancy.

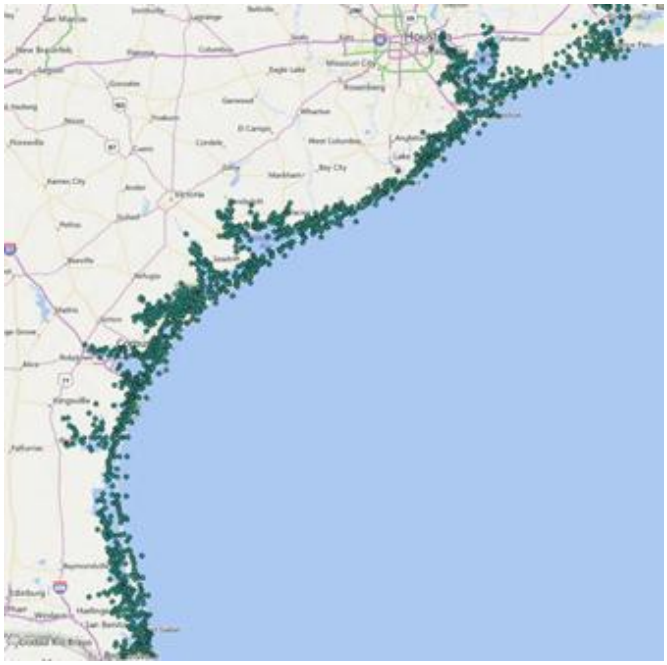

Figure 14. Texas Species Critical Habitat along the Texas coastal shore. Source: Landscope America Atlas, 2014 (NatureServe). Texas General Land Office created the Texas Gulf Coast Species / Habitat layer in 1995.

This map describes an inventory of specific places of coastal habitat and the species that use them. When comparing this map to housing density projections, there is concern as to the consequences in these special habitats.

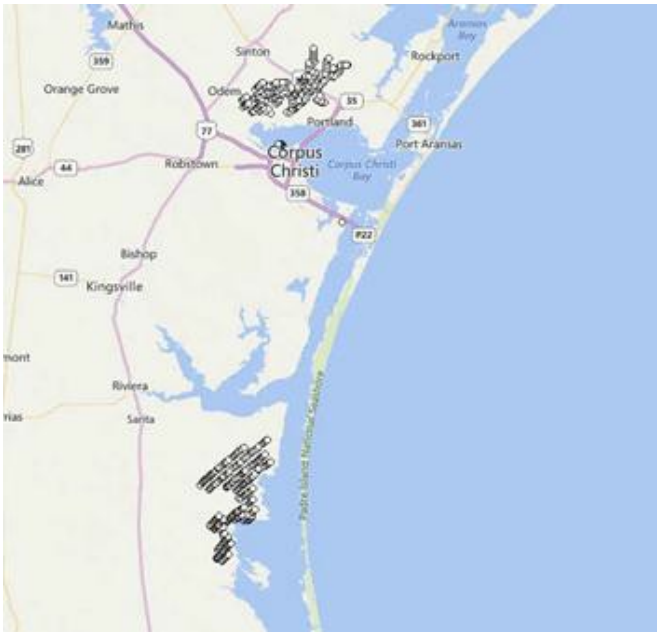

Figure 15. Texas Wind Turbines (FAA). Source: Landscope America Atlas, 2014 (NatureServe). The Federal Aviation Administration (FAA) created the Texas Windmills layer, Updated March 2012.

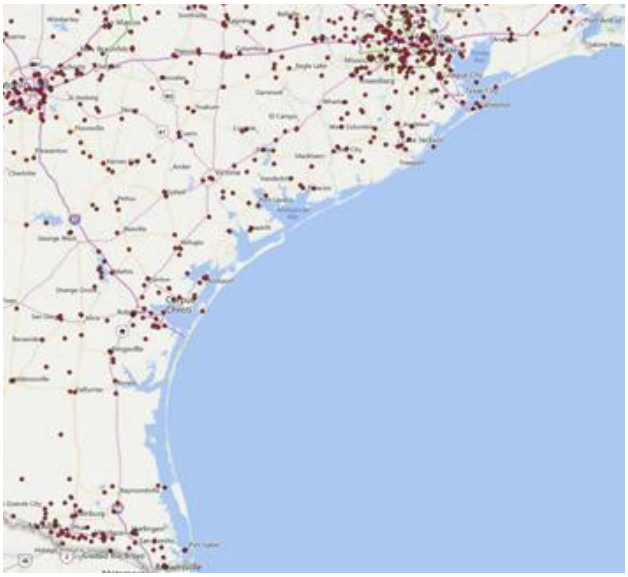

Figure 16. Texas Municipal Solid Waste Sites and Landfills. Landscope America Atlas, 2014 (NatureServe). The Texas Commission on Environmental Quality (TCEQ) created the Municipal Solid Waste Sites and Landfills Layer in April 2007.

Waste and landfills are located throughout the entire state but are also concentrated in our core coastal urban areas. In addition, some are located very close to species habitats as seen in the species habitat map. As housing density and population continue to rise, more waste will increase landfill needs, further threatening the coastal environment by taking up valuable space better suited to other activities and causing potential pollution through landfill gas, leachate, or runoff.

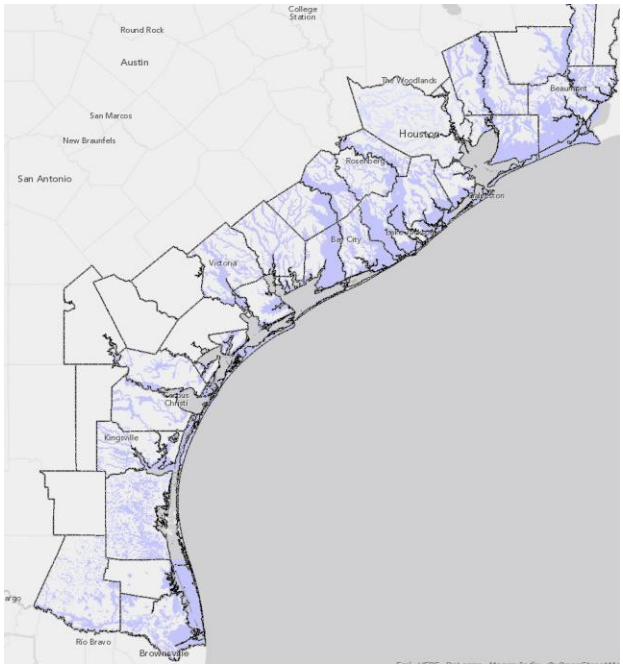

Figure 17. 100 year floodplain. Source: Texas Coastal Community Planning Atlas, 2014.

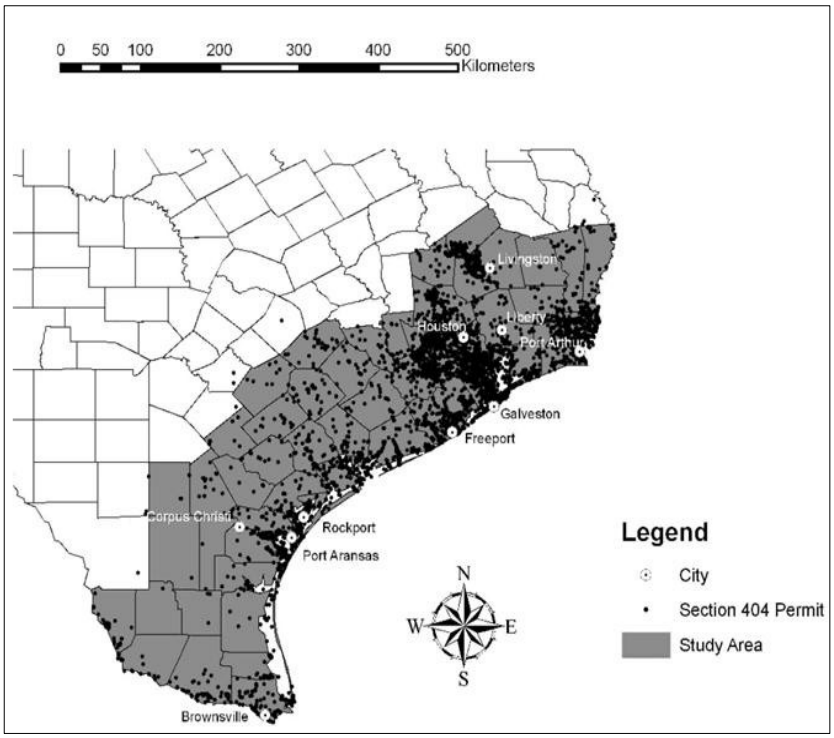

Figure 18. Location of Section 404 wetland permits, designated by the U.S. Army Corps of Engineers jurisdiction, indicating permits for development in the Texas Coastal Zone, 1991-2002 (Brody 2008).

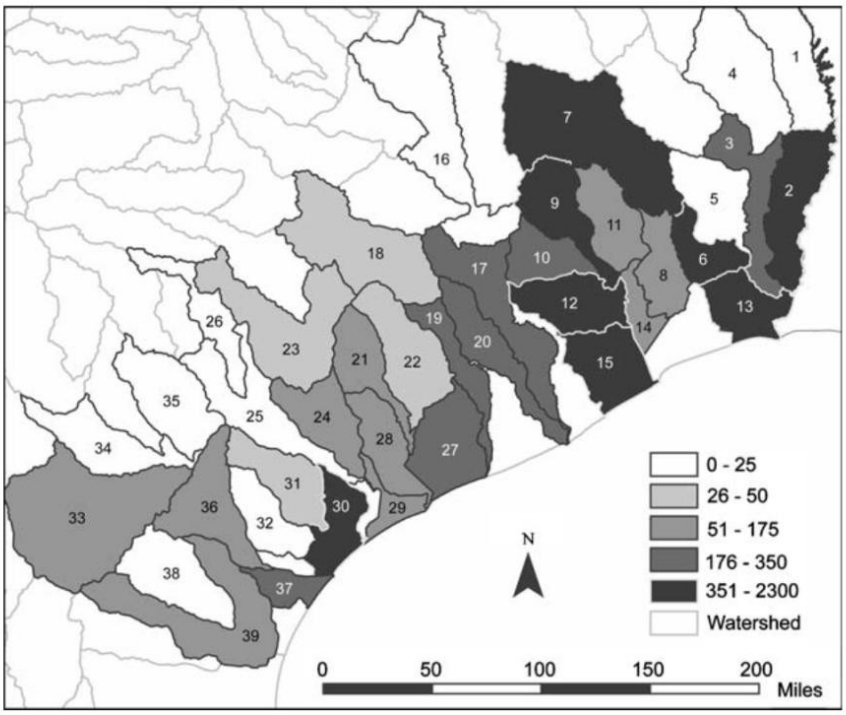

Figure 19. Wetland permit counts by watershed, Texas Coastal Zone, 1991–2002 (Brody 2007).

Management Characterization:

1. Indicate if the approach is employed by the state or territory and if there have been any significant state-level changes (positive or negative) in the development and adoption of procedures to assess, consider, and control cumulative and secondary impacts of coastal growth and development, including the collective effect on various individual uses or activities on coastal resources, such as coastal wetlands and fishery resources, since the last assessment.

Management Category	**Employed by State or Territory** (Y or N)	**CMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Statutes, regulations, policies, or case law	Y	Y	N
Guidance Documents	Y	Y	Y
Management Plans (including SAMPs)	N	Y	Y

Cities and counties Beach Access and Dune Management Plans and Erosion Response Plans address development and access in coastal areas. (See the Wetlands Enhancement section for more information). The state reviews local beach access plans and certifies that they meet the minimum state standards set forth in the General Land Office Beach/Dune Rules. These plans can address land use, development, and impervious surfaces, but are under the authority of local municipalities and counties. Changes taking place at the local level do not constitute state-level changes.

2. *For any management categories with significant changes, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:*
    a. *Describe the significance of the changes;*
    b. *Specify if they were 309 or other CZM-driven changes; and*
    c. *Characterize the outcomes or likely future outcomes of the changes.*

Grant Integration

To advance the GLO's coastal priorities, under the Grant Integration Strategy, the GLO's CR grant programs have been working to align their goals and objectives to create an integrated grant program with the common mission of funding projects to improve management of the state's coastal resources and ensure the long-term ecologic and economic resiliency of the Texas Coast. The GLO's Texas Coastal Resiliency Master Plan (Master Plan) outlines projects with the goal of protecting, restoring and enhancing the Texas coast through an efficient and cost-effective approach to achieve a resilient coast. Streamlining and integrating CR grant programs, policies and their associated funding sources, under one mission will aid in implementation of the Master Plan.

Prior to the implementation of this 309 strategy, each CR program has functioned independently under its own set of policies, procedures and timelines, typically focused on enhancing specific features within the coastal zone, i.e. erosion and shoreline stabilization, public access, wetland restoration, etc. This approach has prevented effective collaboration between program areas and often prohibits programs from working together to complete comprehensive, large-scale projects, such as those identified in the Master Plan.

The strategy has been assessing all CR funding programs and examine each program's legal and administrative requirements, rules and statues, funding sources, reporting mechanisms, associated technologies and outreach practices. To aid in efficient implementation of projects in the Master Plan, the GLO will utilize various funding streams such as: CMP, CEPRA, and the Gulf of Mexico Energy Security Act (GOMESA). To most efficiently utilize funding, CR has been working towards eliminating the current method of funding projects from a single funding source and strategically developing a more integrative and streamlined approach for implementing the goals and priorities of the Master Plan.

Progress toward grant integration has been made with the following steps:

- Established a grant integration working group to direct integration
- Amended CEPRA rules to update, reorganize, and streamline them to increase transparency and clarify the GLO's review and evaluation process in selecting CEPRA projects
- Determined methodology to funnel GOMESA funds through the CMP and CEPRA programs
- Created a public-facing CEPRA Guidance document with mention of the methodology to funnel the GOMESA funds
- Added a new funding category to the CMP Guidance document to funnel GOMESA funds
- Created a joint application usable by the CMP and CEPRA programs
- Hosted CEPRA workshops for the first time in 10 years to raise awareness of the CEPRA program and the availability of GOMESA funds
- Created a GOMESA policy and procedures document

Future steps toward grant integration will include:

- Synching the CMP and CEPRA funding schedules
- Developing a joint database to house projects from the CMP and CEPRA programs

Coastal Nonpoint Source Pollution

In the previous assessment, one of the strategies developed by the CMP was to implement a coastal nonpoint source (NPS) pollution program. Development of a Coastal NPS Management Strategy would provide the framework for addressing and managing NPS pollution and resulting water quality issues that degrade the coastal environment.

The Coastal NPS 309 strategy was planned for 5-years with 4 sub-strategies with the goal of creating new management measures: 1) Administration; 2) Roads, Highways, and Bridges and New and Existing Site Development; 3) Septic Systems Regulatory Inspections; and 4) Watershed Protection.

The Texas Coastal NPS programs enhances nonpoint source pollution management by working with networked agencies, regional planning groups, local municipalities, and researchers to develop local policy and planning elements; conduct retrofit planning; and deliver training and technical assistance. The program also collaborates to improve understanding of coastal watersheds through funding and conducting studies that informs decisions.

The most significant change implemented because of this program is that the State of Texas has completed development of final CZARA management measures. As of August 23, 2019, the final seven management measures are still under review by NOAA and EPA. Program implementation is under development, partner collaboration with various agencies and NGOs is occurring, and supplemental funding is being applied for. Once EPA and NOAA approve of the State's approach to enhancing the management of NPS in the CZB, then it will be formalized by Texas and implemented by networked agencies.

This strategy has created many management documents, including: Guidance for Sustainable Stormwater Drainage on the Texas Coast; completion of the State of Texas Coastal NPS policy document addressing seven remaining

management measure elements; several guidance documents for residents related to "How residents can help water" in English and Spanish and the "Handbook – Coastal Water Protection"; model ordinance language; and a website is under development.

As of July 2019, the State has finally completed a 20-year process of completing the development of all CZARA management measure actions. While not fully approved yet, staff have received positive remarks from review agency staff. The State is poised to respond if corrective action comments are issued by the federal review team. By the end of this strategy in 2021, the Coastal NPS CZARA program will attain full, unconditional approval. The creation of program development will be finalized. Program implementation will occur. Coastal NPS will have enhanced management and NPS loading will be mitigated through projects or abated through policy.

Enhancement Area Prioritization:

1. *What level of priority is the enhancement area for the coastal management program?*

   High _____
   Medium X_____
   Low _____

2. *Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.*

The coastal population in Texas is increasing and this trend is predicted to continue in the future leading to increased demand for and use of coastal resources. This leads to expanded cumulative and secondary impacts to coastal communities and the local environments on which they depend.

The cumulative and secondary impacts enhancement area is deemed medium priority because significant changes to the coastal environment pose threats to ecosystem health and function, the services they provide to human populations, and the overall resilience of coastal and marine systems. Impacts to natural resources are projected to remain high due to increasing development in the coastal zone, coupled with projected regional relative sea level rise effects. Stakeholders agreed with a medium-high assessment of this enhancement area, with an average score of 2.3 out of 3.

However, the Texas CMP made large strides towards tackling this issue in the last Assessment with the success of its coastal non-point source pollution strategy (see above). Future Implementation of the Coastal NPS pollution program through various other funding streams will help tackle many of the current cumulative and secondary impacts affecting coastal resources today.

Special Area Management Planning

Section 309 Enhancement Objective: Preparing and implementing special area management plans for important coastal areas. §309(a)(6)
The Coastal Zone Management Act defines a Special Area Management Plan (SAMP) as "a comprehensive plan providing for natural resource protection and reasonable coastal-dependent economic growth containing a detailed and comprehensive statement of policies; standards and criteria to guide public and private uses of lands and waters; and mechanisms for timely implementation in specific geographic areas within the coastal zone. In addition, SAMPs provide for increased specificity in protecting natural resources, reasonable coastal-dependent economic growth, improved protection of life and property in hazardous areas, including those areas likely to be affected by land subsidence, sea level rise, and improved predictability in governmental decision making."

PHASE I (HIGH-LEVEL) ASSESSMENT:
Purpose: To quickly determine whether the enhancement area is a high priority enhancement objective for the CMP that warrants a more in-depth assessment. The more in-depth assessments of Phase II will help the CMP understand key problems and opportunities that exist for program enhancement and determine the effectiveness of existing management efforts to address those problems.

Resource Characterization:

1. *In the table below, identify geographic areas in the coastal zone subject to use conflicts that may be able to be addressed through a special area management plan (SAMP). This can include areas that are already covered by a SAMP but where new issues or conflicts have emerged that are not addressed through the current SAMP.*

Geographic Area	Opportunities for New or Updated Special Area Management Plans Major conflicts/issues
Coastal Zone	Opportunities exist for development of SAMPs, but SAMPs are not currently authorized in Texas*

Note: The Texas Legislature amended the Coastal Coordination Act in 1995 to prohibit development of a special area management plan, including a plan for an area designated under the national estuary program. No action to change that has been taken since.

2. *If available, briefly list and summarize the results of any additional state- or territory-specific data or reports on the status and trends of SAMPs since the last assessment.*

This is not applicable in Texas.

Management Characterization:

1. *Indicate if the approach is employed by the state or territory and if there has been any significant state- or territory-level management changes (positive or negative) that could help prepare and implement SAMPs in the coastal zone.*

Management Category	Employed by State or Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Changes Since Last Assessment (Y or N)
SAMP policies, or case law interpreting these	N	N	N
SAMP plans	N	N	N

This section is not applicable, as development and approval of SAMPs is prohibited.

2. *For any management categories with significant changes, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:*
    a. *Describe the significance of the changes;*
    b. *Specify if they were 309 or other CZM-driven changes; and*
    c. *Characterize the outcomes or likely future outcomes of the changes.*

None.

Enhancement Area Prioritization:

1. *What level of priority is the enhancement area for the coastal management program?*

(no priority given, as SAMPs are prohibited by the Texas Legislature.)

High _____
Medium__
Low_____

2. *Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.*

This section is not applicable, as development and approval of SAMPs by the CMP is prohibited.

Ocean Resources

Section 309 Enhancement Objective: Planning for the use of ocean resources.§309(a)(7)

Phase I (High-level) Assessment:

Purpose: To quickly determine whether or not ocean resources is a priority enhancement objective for the CMP that warrants a more in-depth assessment to understand key problems and opportunities that exist for program enhancement as well as the effectiveness of existing management efforts to address those problems.

Resource Characterization:

1. Understanding the ocean and Great Lakes economy can help improve management of the resources it depends on. Using Economics: National Ocean Watch (ENOW),[14] indicate the status of the ocean economy as of 2015 (the most recent data) in the tables below. Include graphs and figures, as appropriate, to help illustrate the information.

Status of Ocean Economy for Coastal Counties (2015)

	All Ocean Sectors	Living Resources	Marine Construction	Ship & Boat Building	Marine Transportation	Offshore Mineral Extraction	Tourism & Recreation
Employment (# of Jobs)	*192,067*	*6,902*	*7,021*	*3,779*	*31,910*	*92,272*	*50,182*
Establishments (# of Establishments)	*6,197*	*426*	*148*	*99*	*752*	*2,482*	*2,290*
Wages (Millions of Dollars)	*$19,000*	*$146.3*	*$462.2*	*$232.1*	*$1,900*	*$15,400*	*$884.4*
GDP (Millions of Dollars)	*$71,800*	*$482.3*	*$946.3*	*$493.7*	*$4,200*	*$63,800*	*$1,900*

Change in Ocean Economy for Coastal Counties (2005-2015)[15]

	All Ocean Sectors	Living Resources	Marine Construction	Ship & Boat Building	Marine Transportation	Offshore Mineral Extraction	Tourism & Recreation
Employment (# of Jobs)	*+26,395*	*+1,638*	*+618*	*-1,051*	*+3,163*	*+10,230*	*+11,799*
Establishments (# of Establishments)	*+1,254*	*+172*	*-21*	*-18*	*+82*	*+613*	*+426*
Wages (Millions of Dollars)	*+$6,932*	*+$98.9*	*+$179.9*	*+$52.2*	*+$550.7*	*+$5,677*	*+$372.4*
GDP (Millions of Dollars)	*+$5,080*	*+$333.1*	*+$377.4*	*+$234.9*	*+$1,115*	*+$2,380*	*+$781.1*

[14] www.coast.noaa.gov/digitalcoast/tools/enow.html. If you select any coastal county for your state, you are directed to various data displays for that county, In the upper left of the screen, click the "State" box, to the left of the county box so that the state name will be highlighted. Now the data will reflect statewide data for all of the state's coastal counties. Make sure "2015" is selected for the year (top right corner). You can then click through the sector types by selecting the icons along the top and the type of economic data (employment, wages, GDP, etc), by clicking through the icons on the left.

[15] The trend data is available at the bottom of the page for each sector and type of economic data. Mouse over the data points for 2005 and 2015 to obtain the actual values and determine the change by subtracting 2005 data from 2015.

2. Understanding existing uses within ocean waters can help reduce use conflicts and minimize threats when planning for ocean resources. Using Ocean Reports[16], indicate the number of uses within ocean waters off of your state. For energy uses (including pipelines and cables, see the "Energy and Government Facility Siting" template following). Add additional lines, as needed, to include additional uses that are important to highlight for your state.

Uses within Ocean Waters

Type of Use	Number of Sites
Federal sand and gravel leases *(Completed)*	N/A
Federal sand and gravel leases *(Active)*	N/A
Federal sand and gravel leases *(Expired)*	N/A
Federal sand and gravel leases *(Proposed)*	N/A
Beach Nourishment Projects	37
Ocean Disposal Sites	519
Principle Ports *(Number and Total Tonnage)*	2 / 181,740,900
Coastal Maintained Channels	276
Designated Anchorage Areas	19
Danger Zones and Restricted Areas	1
Other (please specify)	

3. *In the table below, characterize how the threats to and use conflicts over ocean resources in the state or territory's coastal zone have changed since the last assessment.*

Significant Changes to Ocean Resources and Uses

Resource/Use	Change in the Threat to the Resource or Use Conflict Since Last Assessment (↑, ↓, –, unkwn)
Benthic habitat (including coral reefs)	↑
Living marine resources (fish, shellfish, marine mammals, birds, etc.)	↑
Sand/gravel	↑
Cultural/historic	↑
Other (please specify)	
Transportation/navigation	↑
Offshore development[17]	↑
Energy production	↑
Fishing (commercial and recreational)	↑
Recreation/tourism	↑
Sand/gravel extraction	↑
Dredge disposal	–
Aquaculture	–
Other (please specify)	

[16] www.coast.noaa.gov/digitalcoast/tools/ort.html. Go to "Quick Reports" and select the "state waters" option for your state or territory. Some larger states may have the "Quick Reports" for their state waters broken into several different reports. Use the icons on the left hand side to select different categories: general information, energy and minerals, natural resources and conservation, oceanographic and biophysical, transportation and infrastructure, and economics and commerce. Then scroll through each category to find the data to complete the table.

[17] Offshore development includes underwater cables and pipelines, although any infrastructure specifically associated with the energy industry should be captured under the "energy production" category.

4. *For the ocean resources and uses in the table above that had an increase in threat to the resource or increased use conflict in the state's or territory's coastal zone since the last assessment, characterize the major contributors to that increase. Place an "X" in the column if the use or phenomenon is a major contributor to the increase.*

Major Contributors to an Increase in Threat or Use Conflict to Ocean Resources

	Land-based development	Offshore development	Polluted runoff	Invasive species	Fishing (Comm and Rec)	Aquaculture	Recreation	Marine Transportation	Dredging	Sand/Mineral Extraction	Ocean Acidification	Other (Specify)
Benthic Habitat		X	X					X	X			
Living marine resources	X	X	X	X	X		X	X			X	
Cultural/historic	X		X						X			
Offshore Development[31]		X	X									
Energy Production		X	X									
Fishing (Commercial and Recreational)			X	X	X						X	
Recreation and Tourism			X								X	

5. *If available, briefly list and summarize the results of any additional state- or territory-specific data or reports on the status and trends of ocean resources or threats to those resources since the last assessment to augment the national data sets.*

Commercial fishery landings have slightly increased since 2014 (NOAA, 2019b). The traditional threats to fisheries have been overfishing, bycatch, harmful algal blooms (HABs), hypoxia/water quality, agrarian pesticides, and habitat degradation. Additional threats include decrease in freshwater inflows, loss of nursery habitat, and non-point source discharges. Oyster landings in Texas, on the other hand, decreased significantly in 2015 but rebounded to near-normal levels in 2016 and 2017 (NOAA, 2019b). The decline in 2015 was most likely due to a large rainfall and freshwater runoff year which resulted in a large oyster die off. Threats to oysters also include water quality and lack of shell replenishment, decrease in freshwater inflow and habitat loss. Looking at other commercially important species, landings for red snapper and black drum increased since 2014, while landings for brown shrimp remained the same (NOAA, 2019b).

Continuous threats to maintaining viable populations of all oceanic species include erosion and relative sea level rise, marine habitat loss, bycatch, HABs, invasive species, non-point source pollution, hypoxia, decreased freshwater inflows, and ocean acidification which are described below.

Erosion and Relative Sea Level Rise (RSLR) are stressors to ocean resources as they change environmental conditions and lead to habitat loss. Ocean resources provide a suite of ecosystem services including the provision of habitat, protection against storms and flooding, erosion control, food, recreational opportunities, and water purification (waste and nutrient regulation). Erosion and RSLR are direct threats to these services, along with other factors such as decreased river discharges, alteration of water flows, development and damage from commercial and recreational use, non-point source pollution, invasive species, and climate change.

Habitat loss can have significant impacts on marine species populations and may result from erosion and RSLR, decrease in river discharges, alteration of water flows, and damage from commercial and recreational use among other things. The removal of oil platforms can also contribute to loss of marine habitat. An alternative to their

complete removal is to convert these platforms into artificial reefs. The Department of Interior's Bureau of Safety and Environmental Enforcement developed a "Rigs-to-Reefs" national policy that allows non-producing oil platforms to be converted into artificial reefs, creating marine habitat. The program has been popular among fishermen, the oil industry, and regulators around the Gulf of Mexico. Texas has an Artificial Reef Plan and Program that allows the TPWD to enhance, promote, maintain and monitor the artificial reefs off the Texas coast. There are currently 93 artificial reef sites in Texas (up from 66 in the last assessment) representing a total of 7,590 acres (up from 3,440) of important habitat supporting activities such as commercial and recreational fishing and diving (Personal communication, Texas Parks and Wildlife Department, 2019).

Bycatch from commercial trawl and other fisheries threatens non-target species in all life history stages, such as juvenile finfish and endangered and threatened species such as marine mammals and sea turtles. As a response to this threat, in 1998 the National Marine Fisheries Service (NMFS) implemented the use of bycatch reduction devices (BRD) by Gulf shrimp trawlers in their nets. This implementation followed the Gulf of Mexico Fishery Management Council recommendations and is estimated to save millions of juvenile red snapper and other finfish from being caught in shrimp trawls (Fletcher, 2014). To reduce regulatory conflict between state and federal mandates and to ensure shrimp vessels can fish in both state and federal waters, Texas Parks and Wildlife mandates shrimp trawlers be equipped with BRDs and it classifies as "*approved devices*" only those previously approved by NMFS (Riechers, 2010).

Harmful algal blooms (HABs) continue to be a threat to oceanic and estuarine resources along the Texas coast and although some are thought to be caused by naturally occurring conditions, some may be linked to invasive species, pollution, ocean acidification, and overfeeding (when nutrients such as nitrogen, phosphorus, and carbon flow downriver to the ocean at a fast rate that "overfeeds" the algae that exists naturally in the ecosystem), (NOAA, 2019c; Errera et al., 2014). In the winter and summer of 2012, TPWD reported multiple occurrences of HABs in Matagorda, Aransas/Copano Bay, Bolivar peninsula, Galveston, and Surfside that led to over 1 million fish killed and posed health hazards to coastal inhabitants. TPWD provides regular reports on HAB tests and occurrences (Texas Parks and Wildlife Department, 2019a). In the U.S., HABs usually cost about $82 million every year in economic losses to the restaurant, seafood, and tourism industry (NOAA, 2019c). In Texas, there is no information concerning annual economic losses, but one of the biggest impacts is to the closure of commercial oyster industry (Evans & Jones, 2001). Tourism is also hurt by HABs, as tourists avoid the coast when beaches are contaminated by these events. A report in 2000 indicated that a HAB event in Galveston County had a direct negative economic impact of approximately $10.7 million (Evans & Jones, 2001).

Invasive species are known to pose a threat to indigenous habitats, food webs, and marine species. Although some invasive species arrive because of warming temperatures, most invasive species are transported by commercial vessels ballast water, ship hulls, or by accidental or intentional release from marine aquaria and aquaculture facilities. The Texas Invasive Species Coordinating Committee was established in 2009 to coordinate state agencies efforts and prevent and manage invasive species in Texas (Texas Parks and Wildlife Department, 2019b; Texas Invasives, 2019).

Water quality and quantity, which are crucial for healthy ocean resources and coastal populations, are continuously affected by development, non-point source pollution and decreased freshwater inflows. Non-point source pollution (NPS) is all water-related pollution that does not originate from regulated point sources such as waste water treatment facilities, concentrating animal feeding, and municipal storm water systems. NPS water pollution originates when rainfall flows off roads, buildings, land, and other landscape features carrying pollutants into lakes, rivers, aquifers, drainage ditches, wetlands, and bays.

As population increases and land-use and impervious surfaces intensify, so do the impacts of NPS. The infamous "dead zone" in the Gulf of Mexico (off the coast of Louisiana and part of Texas) illustrates the environmental impact NPS can have (Clemons, 2005). Dead zones occur when fertilizer runoff congests waterways with nutrients,

such as nitrogen and phosphorous, leading to an explosion of microbes that consume oxygen and deplete the water of oxygen, killing fish and other marine life. The CWA requires the states to develop a program to protect water resources from NPS pollution. In Texas, the NPS Management Program is cooperatively administered by the Texas State Soil and Water Conservation Board (TSSWCB) and the Texas Commission on Environmental Quality (TCEQ) and involves partnerships among different organizations and across political boundaries to prevent and reduce NPS pollution.

The Texas Parks and Wildlife Department's Kills and Spills Team (KAST) investigate fish and wildlife kills consequent of pollution and natural events. KAST assesses the impacts to fish and wildlife, and investigates the causes of the incidents, which are divided in two broad categories: natural causes and human activities. In Texas, the most common natural cause of fish kills is low dissolved oxygen, i.e. hypoxia, since if there is not enough oxygen in the water, fish cannot breathe. Concerning human activities, the most common causes of fish kills include toxic releases of chemicals, fertilizers, crude oil, used oil, sewage, and pesticides.

Freshwater inflows determine water quality by transporting nutrients and diluting salinities in estuaries, and balancing erosion rates by delivering sediments. These fresh water, nutrients, and sediments are all necessary to sustain estuarine and marine life (The Texas Water Development Board, 2015). However, a growing population has led to the diversion of water from rivers and streams and to reduced freshwater inflows to the coast. A decrease in freshwater inflows can also cause loss of habitat, productivity, and biodiversity. Thus, as the upstream demand for freshwater continues, the ability to effectively manage freshwater inflows becomes increasingly critical (Harte Research Institute, 2019).

Ocean acidification occurs due to changes in the ocean's chemistry as seawater absorbs much of the carbon dioxide that is in the atmosphere and as carbon enters the water from land-based sources. As a result, there is an increase in CO_2 concentration, a decrease in pH, and a change in the inorganic carbon chemistry of seawater. This increase in acidity (decrease in pH) alters conditions required for oysters, clams, corals, and other animals that build shells and skeletons and is thought to promote shifts in community structure, specifically in marine phytoplankton (Errera et al., 2014; Ocean Conservancy, 2014). In 2009, Congress approved the Federal Ocean Acidification Research and Monitoring Act to oversee and gain a better understanding of how acidification affects important national fisheries. Without relevant information, industries that depend on fish and shellfish populations won't know how to protect their businesses. If acidification harms fisheries that are important to the Gulf of Mexico's food web, this could have significant impacts in the state of Texas' seafood industry, which is important not only locally, but nationally (NRDC, 2014).

Looking at future threats, the increase in offshore oil development planned for the Western Gulf of Mexico offshore from Texas will increase threats to living marine resources in the Coastal Zone (Faucon, 2013). From 2015 to 2019, the Department of Interior's Bureau of Ocean Energy Management (BOEM) held 2 lease sales for the Western Gulf of Mexico covering a total of 328,000 acres for oil and gas development in the U.S. Outer Continental Shelf (OCS) offshore Texas. There are 3 more Western Gulf of Mexico sales scheduled prior to 2023. Increased offshore drilling will increase the risks of oil spills and associated environmental damage, so this poses an increasing threat to marine resources in the coming years.

There are currently several threatened and endangered species in the Coastal Zone, including 6 species of amphibians, 25 species of birds, 9 species of fish, 1 species of insects, 7 species of mammals, 12 species of mollusks, 6 species of plants, and 18 species of reptiles. The Rare, Threatened, and Endangered Species of Texas by County Online Application from Texas Parks and Wildlife provides a list of current endangered species including marine mammals, coastal fisheries, crustaceans, waterbirds, and shorebirds (Texas Parks and Wildlife Department, 2019c).

Management Characterization:

1. *Indicate if the approach is employed by the state or territory and if any significant state- or territory-level changes (positive or negative) in the management of ocean resources have occurred since the last assessment?*

Management Category	**Employed by State or Territory** (Y or N)	**CMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Statutes, regulations, policies, or case law interpreting these	Y	N	N
Regional Comprehensive Ocean Management Plans	Y	Y	N
State Comprehensive Ocean Management Plans	N	N	Y
Single-sector Management Plans	Y	Y	Y

2. *For any management categories with significant changes briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:*

   a. *Describe the significance of the change;*
   b. *Specify if it was a 309 or other CZM-driven change; Non-CZM efforts.*
   c. *Characterize the outcomes and/or likely future outcomes of the changes(s).*

<u>Single-Sector Management Plan</u>

Texas Parks and Wildlife Department has enacted these new saltwater fishing regulations since the last assessment (TPWD 2019d):

- 2016
  - Recreational maximum size limit for black drum clarified to 30 inches, and the recreational minimum total length limit on greater amberjack is 38 inches.
- 2017
  - To reduce confusion, Texas modified harvest regulations for certain offshore species to be in line with federal rules.
  - The minimum length for scalloped, smooth and great hammerhead sharks is 99 inches, total length.
  - The minimum length for gag grouper is 24 inches, total length.
  - The daily bag limit for black grouper is four fish, with a daily bag limit of four fish.
  - For Nassau grouper, a threatened species, no harvest is allowed.
- 2018
  - To reduce confusion, Texas modified king mackerel harvest regulations to be in line with federal rules. The daily bag limit for king mackerel is being increased to 3 fish per day.
  - The private recreational red snapper season in federal waters will be managed by Texas again in 2018. This will allow TPWD to set the season opening date and maximize angling opportunity.

These referenced management plans were non-CZM efforts but were driven by the need to continue to protect and enhance coastal habitat, particularly those in decline or that are threatened.

In 2017, Texas GLO adopted the Coastal Resiliency Master Plan (updated in 2019). This was a 309 strategy (see Coastal Hazards section for specifics).

3. *Indicate if your state or territory has a comprehensive ocean Management Plan.*

Comprehensive Ocean Management	**State Plan**	**Regional Plan**
Completed plan (Y/N) (If yes, specify year completed)	Y (2017, 2019)	N
Under development (Y/N)	Y (2023 release)	N
Web address (if available)	http://www.glo.texas.gov/coast/coastal-management/coastal-resiliency/index.html	N/A
Area covered by plan	Texas	Gulf of Mexico Region

Enhancement Area Prioritization:

1. *What level of priority is the enhancement area for the coastal management program?*

High X
Medium
Low

2. *Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.*

Ocean resources, including fish and wildlife, commercial and recreational fishing, oil and gas exploration, shipping, and tourism have a high economic value and human demand; the livelihood of coastal populations depends on these resources. Oil Production in Texas has exploded in the last 5 years, with huge demand from oil companies to build export terminals and install thousands of miles of pipeline (see Energy and Government Facility Siting). This expected growth in the oil export industry will put enormous stress on ocean resources.

Ocean resources are designated as a high priority enhancement area for the Texas CMP because of the booming oil industry and the large amount of restoration expected to take place in the State over the next decade and beyond. With the Deepwater Horizon settlement and the Texas Legislature providing a dedicated funding source for dune restoration through CEPRA, the need for ocean-based sand and sediment will be at an all-time high. Determining how to prioritize projects and sediment resources will be an important issue within coastal resource agencies, and the Texas CMP envisions a strategy to help determine how to find sediment sources and how to prioritize their use. Our stakeholders generally agreed with this level, giving ocean resources a score of 2.3 (Medium-High).

Energy and Government Facility Siting

Section 309 Enhancement Objective: Adoption of procedures and enforceable policies to help facilitate the siting of energy facilities and Government facilities and energy-related activities and Government activities which may be of greater than local significance. §309(a)(8)[18]

Phase I (High-Level) Assessment: (Must be completed by all states and territories.)
Purpose: To quickly determine whether the enhancement area is a high-priority enhancement objective for the CMP that warrants a more in-depth assessment. The more in-depth assessments of Phase II will help the CMP understand key problems and opportunities that exist for program enhancement and determine the effectiveness of existing management efforts to address those problems.

Resource Characterization:

1. In the table below, characterize the status and trends of different types of energy facilities and activities in the state's or territory's coastal zone based on best-available data. If available, identify the approximate number of facilities by type. For ocean-facing states and territories (not Great Lakes states), Ocean Reports[19] includes existing data for many of these energy facilities and activities.

Status and Trends in Energy Facilities and Activities in the Coastal Zone

[18] CZMA § 309(a)(8) is derived from program approval requirements in CZMA § 306(d)(8), which states:
"The management program provides for adequate consideration of the national interest involved in planning for, and managing the coastal zone, including the siting of facilities such as energy facilities which are of greater than local significance. In the case of energy facilities, the Secretary shall find that the State has given consideration to any applicable national or interstate energy plan or program."
NOAA regulations at 15 C.F.R. § 923.52 further describe what states need to do regarding national interest and consideration of interests that are greater than local interests.

[19] www.coast.noaa.gov/digitalcoast/tools/ort.html. Select "Quick Reports" and then enter your state. Select the Quick Reports for "coastal waters" off of your state. Depending on the size of the state, there may be more than one "coastal waters". If so, you will need to add the data from all reports to complete the table. Click on the wind turbine icon on the left ("Energy and Minerals") for information on energy facilities. While outside your coastal zone, you may also want to consider facilities/activities in "Federal Waters" that may have effects on your coastal zone.

Type of Energy Facility/Activity	Exists in Coastal Zone (# or Y/N)	Change in Existing Facilities/Activities Since Last Assessment (↑, ↓, –, unkwn)	Proposed in Coastal Zone (# or Y/N)	Change in Proposed Facilities/Activities Since Last Assessment (↑, ↓, –, unkwn)
Pipelines	Y	↑	Y	↓
Electrical grid (transmission cables)	Y	↑	Y	↓
Ports	Y	–		
Liquid natural gas (LNG) import and export terminals	Y (1-E, 2-I)	unkwn	Y (10-E, 1-I)	↑
Propane and crude export facility	1	↑	1	↑
Oil and gas	Y (51)	↑	unkwn	unkwn
Natural Gas Power Plants	Y (66)	↑	unkwn	unkwn
Coal	N	–	N	–
Nuclear	Y(1)	–	N	–
Wind	Y(15)	↑	Y	
Wave	N	–	N	–
Tidal	N	–	N	–
Current (ocean, lake, river)	N	–	N	–
Hydropower	N	–	N	–
Ocean thermal energy conversion	N	–	N	–
Solar	N	–	N	–
Biomass	Y (2)	↓	N	–

All data is referenced from https://www.eia.gov/state/maps.php except LNG import and export terminals (https://www.ferc.gov/industries/gas/indus-act/lng.asp)

2. *If available, briefly list and summarize the results of any additional state- or territory-specific information, data, or reports on the status and trends for energy facilities and activities of greater than local significance in the coastal zone since the last assessment*

Pipelines

Major pipelines (>50 miles) constructed or under construction 2015-2019 (Company – Length - Coastal Counties) (Texas Railroad Commission 2019)

- Energy Transfer Company – 562 miles – Chambers
- KINDER MORGAN TEJAS PIPELINE LLC – 50 miles – Jackson
- Valley Crossing Pipeline LLC – 167 miles – Kleberg, Kenedy, Willacy, Cameron, Nueces
- Enterprise Products Operating LLC – 571 miles – Harris, Chambers
- TARGA NGL PIPELINE COMPANY LLC – 622 miles – Chambers
- DCP Operating Company – 94 miles – Jackson
- Magellan Pipeline Company LP – 128 miles – Harris
- Lavaca Pipe Line Company – 110 miles – Calhoun, Jackson, Matagorda, Brazoria, Galveston, Harris
- Epic Consolidated OPS LLC – 131 miles - Nueces, San Patricio, Refugio, Calhoun, Victoria, Matagorda, Jackson
- Epic Consolidated OPS LLC – 95 miles – San Patrico, Nueces
- Epic Consolidated OPS LLC – 118 miles - San Patricio, Refugio, Calhoun, Victoria, Matagorda, Jackson
- Energy Transfer Company – 62 miles – Chambers, Jefferson

- AMP NGL Pipeline LLC – 98 miles – Brazoria
- Epic Consolidated OPS LLC – 138 miles - San Patricio, Refugio, Calhoun, Victoria, Matagorda, Jackson

Only two major pipelines were reported in the previous assessment:

- Magellan Midstream Partners L.P.'s BridgeTex Pipeline System with 400 miles of pipe
- Sunoco Logistics Partners L.P.'s Permian Express II Pipeline System with 334 miles of pipe

In addition, since the previous assessment there is one proposed/pending major gas pipeline project (FERC, 2019):

- PORT ARTHUR LNG, LLC, Port Arthur Pipeline, LLC, PALNG Common Facilities Company, LLC; Liquefaction Project, Pipeline Facilities Project, Louisiana Connector Project – 170 miles – Jefferson

Electric Grid Major changes/improvements since last report

The Electric Reliability Council of Texas (ERCOT) acts as the independent organization under the Public Utility Regulatory Act and is responsible for coordinating market transactions, system-wide transmission planning and network reliability, and ensuring the reliability and suitability of the regional electric network. Every year, ERCOT assesses the transmission system by addressing issues of reliability of transmission lines, economic transmission needs, and recommendations for future improvements. One thing ERCOT and the Transmission Service Providers have been trying to address is the increase in electricity demand consequent of oil and gas exploration and production in Texas. Energy prices have been declining for the past 7 years because of the rise of renewable energy, such as wind energy (ERCOT, 2018).

Load increase in the Houston area has also been the cause of congestion in transmission lines; costing approximately $170 million (up from $38.5 million in the last assessment) in congestion rent in 2017. To rectify this problem, transmission improvement projects went into effect in 2018, leading to a decrease in congestion rent in 2018 to $66 million (ERCOT, 2018).

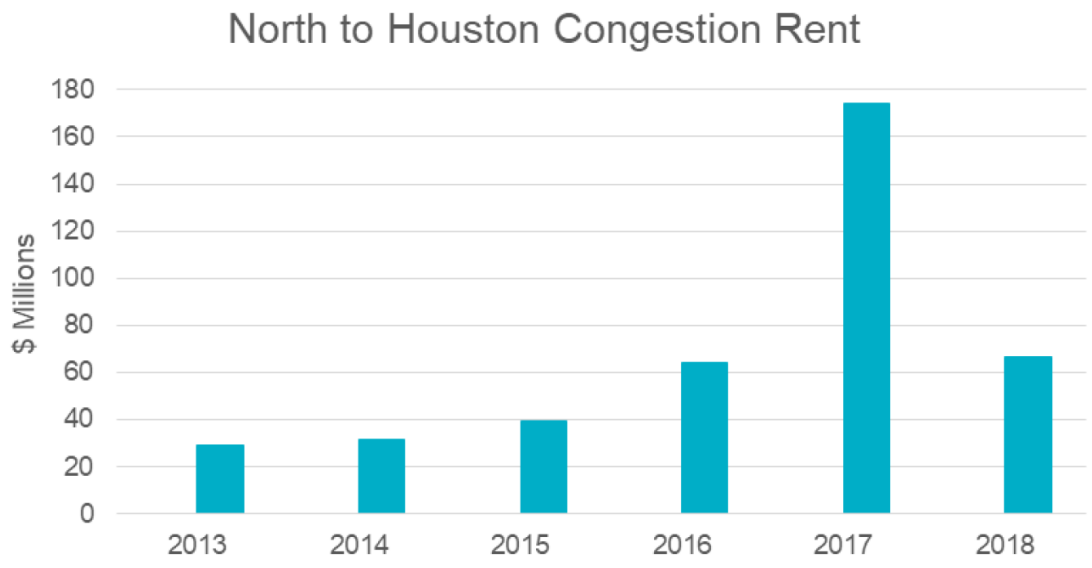

Figure 20. North to Houston Congestion Rent by Year. From ERCOT 2018.

In the last assessment, there were two planned improvements for the coastal region. In this assessment, there is only one planned improvement for 2019-2023 in the coastal region:

New transmission lines (345 kV) from Bailey to Jones Creek would supply power to the growing industrial sectors in the Freeport, TX area. The transmission lines would travel through Brazoria and Matagorda counties and is expected to be completed in 2022 (ERCOT 2018).

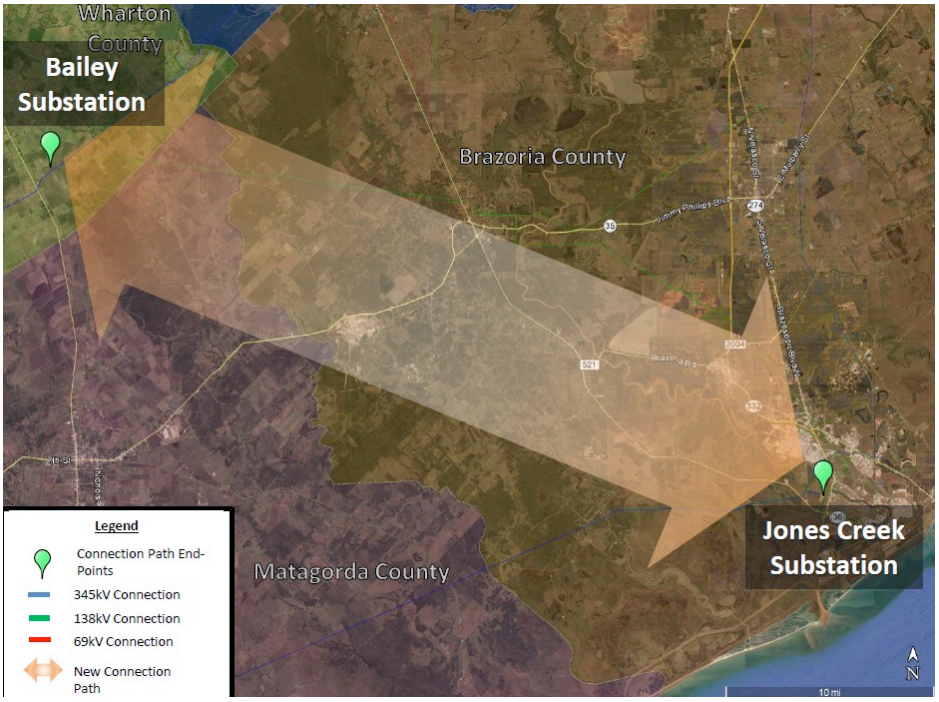

Figure 21. Map of the proposed Bailey – Jones Creek transmission lines. From CenterPoint Energy 2019.

Ports

Texas ports (marine terminals where marine cargo and cruise activity occurs) play a crucial role in the State's transportation system and are a critical part of the State's economy. According to Texas Ports Association, Texas ports generate $369 billion in economic activity (up from $278 billion in last assessment) and $6.9 billion in state and local taxes (up from $6.5 billion) (Texas Department of Transportation, 2019). They handle over 563 million tons of foreign and domestic cargo yearly, which is 25 per cent of the country's port tonnage (Texas Department of Transportation, 2019; Bureau of Transportation 2019). According to the U.S. Department of Transportation, seven of the Texas ports are among the top 50 U.S. ports in terms of annual tonnage, including Houston (2nd), Beaumont (5th), Corpus Christi (6th), and Texas City (15th). The vacation cruise market is also present in the Gulf with the Port of Galveston placed as the fourth-largest U.S. cruise market based on embarkation, with more than 834,000 passengers in 2015. Forecasts indicate that the use of Texas waterways will continue to increase, spurred by growing population, increasing worldwide waterborne trade, and the scheduled expansion of the Panama Canal which will double the capacity of the canal and allow some of the world's largest ships to pass through (Texas Department of Transportation, 2019).

Texas Ports have not seen any major change since the previous assessment, but to accommodate larger ships as a result of the Panama Canal expansion, some ports may need to invest in new cranes, dredging, bigger freight yards, and improved connections to railheads (Boske and Harrison 2017). In fact, Texas ports are expected to invest $48 billion over 2017-2022 (Texas Comptroller 2017). In 2019, the Port of Corpus Christi began a $380 million project to deepen the ship channel to 54 ft; the project is expected to be completed in 2022 (Chapa 2019).

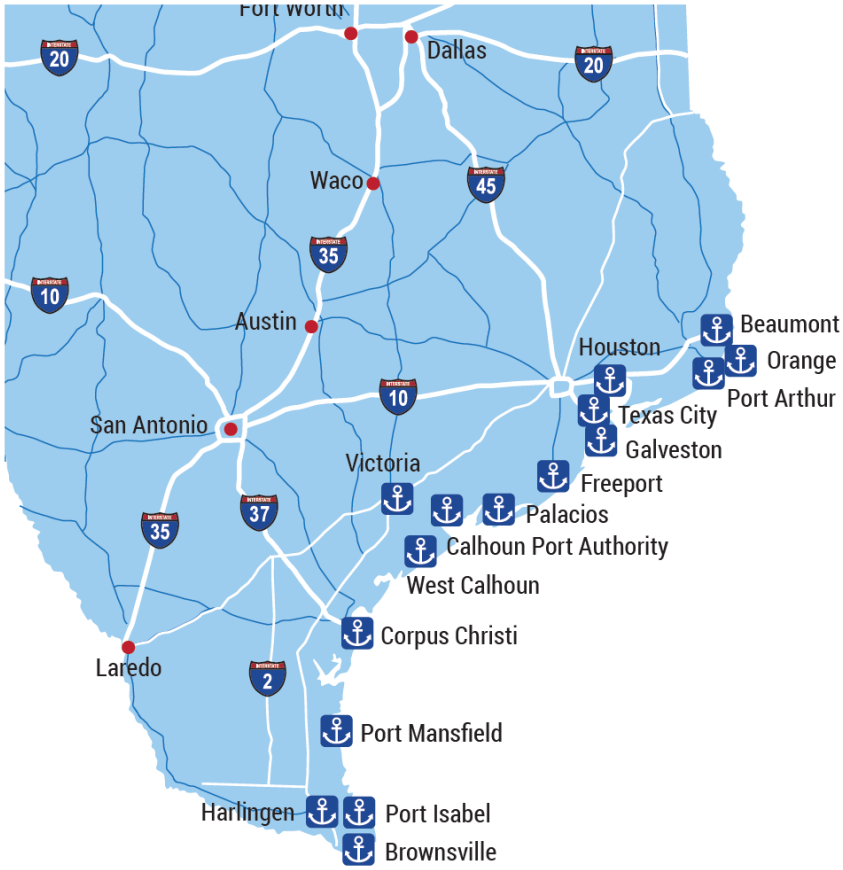

Figure 22. Texas Sea Ports. Source: businessintexas.com

Since the last assessment, there has been interest in constructing deepwater ports in federal waters off the Texas coast. The Deepwater Port Act of 1974 created a regulatory framework for construction and operation of deepwater ports located beyond U.S. territorial sea. Deepwater ports are offshore terminals for oil and gas loading/unloading. Initially designed to promote importation of oil to the U.S., the law was amended to also include natural gas imports and exports. In separate legislation, known as the Consolidated Appropriations Act of 2016, U.S. restrictions on domestic oil exports were repealed to allow for the export of U.S. crude oil. The 2016 changes substantially enhanced interest in development of U.S. deepwater ports.

The Maritime Administration (MARAD) is the federal agency charged with administering the 1974 Deepwater Port Act. MARAD works with the U.S. Coast Guard (USCG) to review deepwater port applications and coordinates with both federal and state regulatory entities. MARAD's role includes ensuring applicants meet financial requirements. The USCG evaluates environmental and navigational aspects to ensure compliance with the National Environmental Policy Act. Other federal agencies involved in licensing include the Department of Energy, Pipeline and Hazardous Material Administration/Department of Transportation, and Environmental Protection Agency, among others. The approval timeline for the federal act is 365 days.

States (referred to as "Adjacent States") also have regulatory authority over deepwater port projects. The 1995 Texas Deepwater Port Procedures Act established a state regulatory framework and licensure process for deepwater ports connecting a Texas onshore storage tank facility with an offshore facility in U.S. (federal) waters. The Texas law requires a deepwater port to be approved by the governor and sets out an evaluation process by state and local agencies that have regulatory authority over the port's building and operation. Approval of deepwater license applications under the Texas Deepwater Port Procedures Act is primarily administered by the GLO.

The GLO also conducts a federal consistency review under the CZMA as well as determines consistency with the Texas CMP. However, review and evaluation time for CZMA and CMP extends past the deadlines established for submitting the required report to the governor's office and requires completion of a Draft Environmental Impact Statement (EIS) in conjunction with the federal Deepwater Port License application process. The Draft EIS is a component that usually contains National Environmental Policy Act information which is necessary information for purposes of conducting a timely consistency review.

In 2018, the first deepwater port application for off the coast of Texas was received by the GLO. In 2019, an additional 6 applications were received or are expected to be received.

Liquefied Natural Gas (LNG)

The Federal Energy Regulatory Commission (FERC) is the authorizing agency for the siting and construction of onshore and near-shore LNG import and export facilities under Section 3 of the Natural Gas Act. As part of the requirements set by the National Environmental Policy Act, FERC prepares environmental assessments or impact statements for proposed LNG facilities under its jurisdiction. Once the projects are approved and built, they are overseen by FERC for as long as they are in operation. Currently, FERC regulates twenty-four LNG facilities (FERC, 2019b).

The Coastal Zone has the following LNG terminals (FERC, 2019b):

- *Existing*
  - 1 Export Terminal
    - Corpus Christi, TX: 0.71 Bcfd (Cheniere – Corpus Christi LNG Train 1)
  - 2 Import Terminals
    - Freeport, TX: 1.5 Bcfd (Cheniere/Freeport LNG Dev.)
    - Sabine Pass, TX: 2.0 Bcfd (ExxonMobil – Golden Pass) (Phase I & II)
- *Approved, Not Yet Built*
  - 5 Export Terminals
    - Under Construction
      - Freeport, TX: 2.14 Bcfd (Freeport LNG Dev/Freeport LNG Expansion/FLNG Liquefaction) (CP12-509) (CP15-518)
      - Corpus Christi, TX: 1.4 Bcfd (Cheniere – Corpus Christi LNG) (CP12-507)
      - Sabine Pass, TX: 2.1 Bcfd (ExxonMobil – Golden Pass) (CP14-517)
    - Not Under Construction
      - Port Arthur, TX: 1.86 Bcfd (Port Arthur LNG) (CP17-20)
      - Freeport, TX: 0.72 Bcfd (Freeport LNG Dev) (CP17-470)
  - 1 Import Terminal
    - Not Under Construction
      - Corpus Christi, TX: 0.4 Bcfd (Cheniere – Corpus Christi LNG) (CP12-507)
- *Proposed Terminals*
  - 5 Export terminals
    - Brownsville, TX: 0.55 Bcfd (Texas LNG Brownsville) (CP16-116)
    - Brownsville, TX: 3.6 Bcfd (Rio Grande LNG – NextDecade) (CP16-454)
    - Brownsville, TX: 0.9 Bcfd (Annova LNG Brownsville) (CP16-480)
    - Corpus Christi, TX: 1.86 Bcfd (Cheniere Corpus Christi LNG) (CP18-512)
    - Galveston Bay, TX: 1.2 Bcfd (Galveston Bay LNG) (PF18-7)

Propane and crude export facilities

In 2018, Moda Midstream, LLC acquired the Ingleside, TX propane and crude export facility from Occidental Petroleum (Oxy) Ingleside Energy Center, LLC (Marketwatch, 2018). The facility began operation in 2015 and store

approximately 2.1M barrels of oil.

There are 2 proposed propane and crude export facilities along the Texas coast. In 2018, the Texas Gulf Terminals Project was proposed for near Corpus Christi, TX. This facility would a single point mooring buoy system to allow for the export of oil to Very Large Crude Carriers via pipelines. Sentinel Midstream proposed in 2019 a deepwater crude oil export terminal near Freeport, TX. This proposed facility would export up to 1.2M barrels of oil per day.

Oil and Gas

At the beginning of 2019, Texas' oil production surpassed the production of every Organization of Petroleum Exporting Countries (OPEC) country, except for Saudi Arabia and Iraq. Texas' production, mainly driven by Eagle Ford Shale in South Texas, the Permian Basin in West Texas, and Barnett Shale in North Texas, is approximately 4.6 million barrels a day. It will not be long until the State surpasses Iraq's daily output (4.7 million barrels per day), only outpaced by Russia and Saudi Arabia (Perry, 2019).

As of January 2013, Texas leads the nation in crude oil refining capacity with 30 (21 on the coast) petroleum refineries (27 in the previous assessment) with a capacity of over 5.7 million barrels of crude oil per day (5.1 million in the previous assessment), accounting for approximately 31 percent of total U.S. refining capacity (29 percent in the previous assessment. Texas also leads the nation in natural gas production accounting for approximately 24 percent of the U.S. marketed natural gas production in 2013. In the Texas coastal zone, there are a total of 21 petroleum refineries and 9 natural gas processing plants (U.S. Energy Information Administration, 2019a).

No new major refinery has been built in the U.S. since 1976, primarily due to environmental concerns. However, with an increase in oil extraction from Texas, Oklahoma, and North Dakota, companies are planning to expand existing plants and to build small processors around the country. Since the last assessment, 5 new small capacity refineries (<50,000 barrels per day) have been built in Corpus Christi, Houston, Galena Park, and Channelview, TX (U.S. Energy Information Administration, 2019b).

There are currently 51 oil and gas energy facilities (up from 30 last assessment) along the coast, including: 3 petroleum power plants, 21 petroleum refineries, 9 natural gas processing plants, and 18 ethylene cracker plants.

Lastly, a new project to capture CO_2 produced from the W.A. Parish power plant (a coal-burning facility) began operations in 2017. This joint venture between NRG and JX Nippon Oil and Gas Exploration is only one of two power plant in the world to use the new Petra Nova Carbon Capture System. The system captures about 33% of the total emissions released by Unit 8. Once captured, the CO_2 is injected via an enhanced oil recovery operation into Hilcorp's West Ranch Oilfield located in Jackson County (U.S. Energy Information Administration, 2019c)

Natural Gas Power Plants

Since the last assessment, there are approximately 12 additional natural gas power plants. Thus, in addition to processing plants and refineries, the coastal zone has 66 natural gas power plants.

Coal

Texas is the seventh largest coal producer in the country and number one lignite producer. Currently, Texas only produces lignite, the lowest grade of coal, with the majority of lignite reserves found in the Texas Gulf Coast region. Texas is also the leading State in coal consumption with its emissions of carbon dioxide and sulfur dioxide the highest among the nation (U.S. Energy Information Administration, 2019a).

Now, there are no coal power plants in the coastal zone, but two are very close to the region: (1) WA Parish Power Plant located outside Houston in Fort Bend County and (2) Coleto Creek Power Plant located in Fannin, Goliad County (U.S. Energy Information Administration, 2019a). Of the eight coal plants proposed for the coastal zone at the time of the previous assessment, none has been approved. In Texas, there are a total of 18 coal power plants,

but the development of new ones may prove challenging given the availability and lower price of natural gas, coal emissions of atmospheric pollutants and greenhouse gases, and the federal regulatory requirements for lower emissions (Wright, 2013). As of 2019, 6 of Texas's current coal-fired power plants have closed or have announced their closure (Druzin, 2018).

Nuclear

Texas has two nuclear power plants, one of which is in the coastal zone, the South Texas project nuclear power plant located in Matagorda County. The South Texas project plant has two reactors and two additional ones are proposed, and, despite receiving approval in 2016, construction has not begun on the two additional reactors and is not planned for the near future (U.S. Energy Information Administration, 2019a; U.S. Nuclear Regulatory Commission, 2019b). At the time of the previous assessment there was one other proposed plant, the Victoria County Station with two reactors, but that license application has been suspended (U.S. Nuclear Regulatory Commission, 2019a).

In 2019, Nuclear energy provided about 2 percent of the state's electricity, behind natural gas, crude oil, coal, and renewable energy (U.S. Energy Information Administration, 2019a)

Wind

Texas is the leading state in wind energy generation, with more installed capacity, more jobs, and wind turbines than any other State (American Wind Energy Association, 2019). The state provided almost one-fifth of the total U.S. utility-scale electricity generation from all nonhydroelectric renewable sources in 2018, more than any other state (U.S. Energy Information Administration, 2019a). The percentage of Texas' electricity provided by wind has been increasing reaching 15.9 percent in 2018 (9.9 percent in 2013); the equivalent of powering 7.3 million average American homes (American Wind Energy Association, 2019).
Currently in the coastal zone there are:

- 15 wind farms (10 in last assessment) with a total net summer capacity of 2806 MW (U.S. Energy Information Administration, 2019a); as compared to 10 wind farms at the time of the previous assessment with a combined capacity of 1829MW

Compared to onshore wind, offshore wind has the advantage that it peaks during the day, when demand for power is highest. To support this kind of energy and diversify Texas' energy portfolio, GLO signed two lease agreements to allow research and construction of two offshore wind farms: Galveston and GOWind (Rhame, 2007). Meanwhile in May of 2014, the developing company Baryonyx withdrew its permit application to build its GOWind project and this project was canceled (4COffshore, 2014); plans to build the Galveston Offshore Wind remain inactive as of 2019 (First Choice Power, 2019).

Wave

According to the Texas Comptroller of Public Accounts, although lengthy, the Texas coastline and Gulf of Mexico offshore conditions are neither suitable nor cost-effective to ocean and wave power technologies due to shallow waters and the semi-enclosed nature of the basin (Window on State Government, 2014a). The previous two assessments mention that GLO had granted the first offshore lease to Texas-based Renew Blue Inc. to use ocean water and waves to produce bottled desalinated water in Freeport (with the Seadog Pump technology). However, as of 2019, there has been no progress towards this project. There are currently no known proposed wave energy projects.

Tidal, Current, Hydropower, and Ocean thermal energy conversion (OTEC)

The Texas coast in currently unsuitable for tidal, current, hydropower, and OTEC energy (Moreno et al., 2008; Window on State Government, 2014a, 2014b).

Solar

Texas has the largest potential for solar energy in the country due to size and abundant sunshine; however, other states lead in the solar energy generation mainly due to favorable state policies and incentives that encourage solar system installation: California, New Jersey, Arizona, Colorado, and New York (Window on State Government, 2014c). Despite this, Texas consistently ranks as one of the top solar-producing states (2nd in 2018, 6th in 2019) and its production rate is growing rapidly. As of 2019, there is 2,957 MW of solar installed in Texas, with 994 MW of this capacity installed just in 2018 (Solar Energy Industries Association 2019).

However, there are no existing solar power plants in the coastal zone and none are proposed despite the state's tremendous solar energy potential. Most investment in solar power plants is occurring in central and west Texas due to much higher daily solar irradiance compared to the coast (National Renewable Energy Laboratory 2019).

Biomass
Biomass is any animal or plant matter used to produce energy. The most common resource is wood, but other sources include grasses, food crops, agriculture residues, manure, and methane from landfills. As an agricultural state, Texas has a great potential as producer of this kind of energy (Window on State Government, 2014d). There are currently 2 biomass power plants in the coastal zone, down from 6 in the last assessment and no proposed plant (U.S. Energy Information Administration, 2019a).

Geothermal
Geothermal energy is obtained by using high temperatures underground to produce electricity from heated water or other direct uses (e.g. hot springs spas or aquaculture) (Window on State Government, 2014e). Traditionally, geothermal energy generation has been restricted to Western states; however, with the rise in electric and oil prices and improvements in technology, more attention has turned to the State's potential for geothermal energy. Drilling for geothermal resources (drilling for water) is like drilling for oil and gas, which means Texas can use its decades of experience with oil and gas extraction. The state also has an advantage in access to detailed heat data resources, reservoirs, and deep water due to oil and gas drilling practices (Geothermal Energy Association, 2014). A study by Southern Methodist University's Geothermal Laboratory estimates that within ten years, the State could have between 2,000 to 10,000 MW in geothermal energy generating capacity accessed through oil and gas wells.

Currently there are no geothermal power plants in the coastal zone; however, this area is one of five major regions with the strongest potential for geothermal electric power generation in the state (U.S. Energy Information Administration, 2019a)

3. *Briefly characterize the existing status and trends for federal government facilities and activities of greater than local significance[20] in the state's coastal zone since the last assessment.*

Nothing to report.

Management Characterization:

1. *Indicate if the approach is employed by the state or territory and if significant state or territory-level changes (positive or negative) that could facilitate or impede energy and Government facility siting and activities have occurred since the last assessment.*

[20] The CMP should make its own assessment of what Government facilities may be considered "greater than local significance" in its coastal zone, but these facilities could include military installations or a significant federal government complex. An individual federal building may not rise to a level worthy of discussion here beyond a very cursory (if any at all) mention).

Management Category	Employed by State or Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Changes Since Last Assessment (Y or N)
Statutes, regulations, policies, or case law interpreting these	Y	Y	N
State Comprehensive Siting Plans/Procedures*	N	N	N

*In regard to siting of energy facilities, different agencies can address siting through public hearings (PUC, TCEQ, Texas RRC. ERCOT), but the ability of the Coastal Coordination Council (CCC) or any agency to deny a project based on siting is in question. In Texas, specifically for renewable energy projects, the issue of siting is of concern for onshore and offshore projects, the latter being of lesser concern. Clear siting authority for both onshore and offshore facilities would be beneficial.

2. *For any management categories with significant changes briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:*

   a. Describe the significance of the change;

Offshore Oil Exploration Leases
From 2015 to 2019, the Department of Interior's BOEM held 2 lease sales for the Western Gulf of Mexico covering a total of 328,000 acres for oil and gas development in the OCS offshore Texas. In addition, 3 more Western Gulf of Mexico sales are scheduled before 2022 (BOEM, 2019). With these leases being sold, there is a likely chance for an increase in offshore drilling and oil and gas production in the Texas coastal zone.

   b. Specify if it was a 309 or other CZM-driven change; and Non-CZM

The efforts are not driven by CZM.

   c. Characterize the outcomes and/or likely future outcomes of the changes(s).

Concerning the sale of Western Gulf of Mexico Offshore Oil Exploration Leases, the likely outcome will be an increase in offshore drilling and oil and gas production in the Texas coastal zone.

Enhancement Area Prioritization:

1. *What level of priority is the enhancement area for the coastal management program?*

   High _____
   Medium X
   Low _____

2. *Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.*

Energy production is vitally important in the coastal zone, the state, the nation, and world-wide. By the end of 2019, Texas' oil production could surpass the production of every OPEC country, except for Saudi Arabia, and it will reach approximately 4.7 million barrels a day, making Texas surpass Iraq and Iran in production. As of 2019, Texas leads the nation in crude oil refining capacity with 30 petroleum refineries accounting for approximately 31 percent of total U.S. refining capacity. Given the trends in oil production in Texas, these numbers are likely to increase, bringing more money and jobs to the economy.

We prioritize this enhancement area as a medium priority as the energy industry is currently addressing issues in the area. One area of concern though is the recent interest in developing offshore, deepwater oil export terminals off the coast of Texas. As of late 2019, there are currently 7 applications with the GLO for deepwater ports along the Texas coast. GLO staff is currently assessing these projects in terms of federal consistency and will be monitoring their progress as they apply for the necessary permits. Stakeholders agreed with our assessment of this category as Medium, with an average score of 1.6.

Aquaculture

Section 309 Enhancement Objective: Adoption of procedures and policies to evaluate and facilitate the siting of public and private aquaculture facilities in the coastal zone, which will enable states to formulate, administer, and implement strategic plans for marine aquaculture. §309(a)(9)

Phase I (High-level) Assessment:
Purpose: To quickly determine whether or not aquaculture is a priority enhancement objective for the CMP that warrants a more in-depth assessment to understand key problems and opportunities that exist for program enhancement and the effectiveness of existing management efforts to address those problems.

Resource Characterization:

1. In the table below, characterize the existing status and trends of aquaculture facilities in the state's coastal zone based on the best-available data. Your state Sea Grant Program may have information to help with this assessment.[21]

Status and Trends of Aquaculture Facilities and Activities

Type of Facility/Activity	Number of Facilities[22]	Approximate Economic Value	Change Since Last Assessment (↑, ↓, –, unknown)
Catfish	54 farms / 10.5M fish sold / 2,450 ac. / 22.0M lbs.	$21,521,000 (USDA 2013) / $26,950,000 (Treece 2017)	↑
Red Drum	6 farms / 1,100 ac. / 2.15M lbs.	$7,150,000 (Treece 2017)	↓
Hybrid Striped Bass	11 farms / 1,900 ac. / 2.6 M lbs.	$25,674,000 (USDA) / $9,017,000 (Treece 2017)	↑
Water Gardens	Unknown	$7,000,000+ (Treece 2017)	–
Marine Shrimp	9 farms / 990 ac. / 2.9M lbs.	$8,280,826 (Treece 2017)	↑
Sport fish (not red drum)	44 farms / 576 ac. /13.2M fish sold	$4,182,000 (Treece 2017)	–
Trout	3 farms	N/A (USDA)	–
Crawfish	20 farms / 1,500 ac. / 0.8M lbs.	$1,000,000 (Treece 2017)	–

[21] While focused on statewide aquaculture data rather than just within the coastal zone, the *Census of Aquaculture* (*www.agcensus.usda.gov/Publications/Census_of_Aquaculture/*) may help in developing your aquaculture assessment. The census is conducted every 10 years and the last report was released in 2013. The report provides a variety of state-specific aquaculture data to understand current status and recent trends. .
[22] Be as specific as possible. For example, if you have specific information of the number of each type of facility or activity, note that. If you only have approximate figures, note "more than" or "approximately" before the number. If information is unknown, note that and use the narrative section below to provide a brief qualitative description based on the best information available.

Tilapia (food fish)	3 farms	$799,000 (USDA 2013)	↑

Type of Facility/Activity	# of Facilities	Approximate Economic Value	Change Since Last Assessment (↑, ↓, –, unkwn)
Tilapia (recreational stocking)	13 operators / ac. ? / lbs. ?	$ value unknown.	Unknown (same number of operators)
Ornamentals	27 operators / 40 ac. / lbs. ?	$892,000 (USDA)	–
Baitfish	25 operators / 20 ac. / 81,000 lbs.	$398,000 (USDA)	–
Alligators	12 operators / ac. ? / lbs. ? /	$100,000 (USDA)	–
Carp	7 farms	N/A (USDA)	Unknown
Aquatic nurseries	5 / ac. ?	$ Value unknown.	–
Other food fish	20 farms / 6,916,000 lbs.	$14,692,000 (USDA)	–
Other aquatic products	16 farms / only 5 farms responded to USDA survey	Unknown.	–

2. *If available, briefly list and summarize the results of any additional state or territory-specific data or reports on the status and trends or potential impacts from aquaculture activities in the coastal zone since the last assessment.*

The Texas Aquaculture Association was cited in the last assessment (Treece 2014), and there has been one updated report since then (Treece 2017). The data cited in the table above was acquired from the most recent 2017 report.

Table 6. Aquaculture updates since last assessment (Treece, 2014, 2017)

Information cited in last report (Treece 2014)	Updated information (Treece 2017)
Texas Aquaculture industry annually produces close to 30 million pounds of aquaculture products from 180 operations	No Change

The industry has a net worth of approx. $60 million (includes the sale of water garden plants, ornamentals, filters, stocker tilapia fingerlings, etc.) (These items are not included in annual production weight.)	No Change

Information cited in last report (Treece 2014):	Updated information (Treece 2017)
The aquaculture industry is estimated to contribute over $360 million to the Texas economy when jobs, feed, and other economic benefits are included.	No Change
Channel catfish has remained the largest aquaculture crop in Texas since 2008.	Production for catfish was 2-3% higher in 2016 than in 2015.
Previously, the Pacific white shrimp industry was the second most valuable crop, but it peaked in 2003 and has been declining, with only 3.73 million pounds produced in 2008. 2009: 3.2 million lbs.; 2010: approx. 2.5 million lbs. 2011: approx. 2.2 million lbs.; 2012: approx. 2.9 million lbs.; and 2013: approx. 2.5 million lbs.	2014: approx. 3.6 million lbs., 2015: approx. 3.0 million lbs., 2016: approx. 3.0 million lbs.
From 2004 to 2007 marine shrimp production declined; but went up in 2008 and back down in 2009 and down even more in 2010.	The state survival average was low at 47% in 2013 and even lower at 43% in 2014 and even lower again in 2015 at 38.83%. The average Texas shrimp survival in 2016 was 43%.
The increase in redfish production has increased the farm gate price from $2.78/lb. in 2009. Sales slowed in 2010 and 2011 due to the BP oil blowout affecting the tourist trade in the Gulf.	Red drum producers are contending with the fact that there are more redfish along to Texas and Louisiana coast than there have been at any other time in recorded history, commercial harvest quotas for wild fish are increasing, and angler bag limits and angler success have been increasing, so there is less demand for redfish

Texas Aquaculture - A Regulatory Guide, produced by the Texas GLO

Summary: A trifold brochure including a summary of the Texas Department of Agriculture, TCEQ, TPWD, and the GLO.

A list of Texas aquaculture facilities (Texas Aquaculture Association)

Summary: Client legal name, DBA, Physical Address, City, State, Zip

The Census of Aquaculture (USDA) has extensive detailed information about aquaculture in Texas via tables.

Summary: Values of Aquaculture products by type with details on water sources, aquaculture methods, product sales, distribution, and employment and payroll (2005 and 1998).

Management Characterization:

1. Indicate if the approach is employed by the state or territory and if there have been any state or territory-level changes (positive or negative) that could facilitate or impede the siting of public or private

aquaculture facilities in the coastal zone.

Management Category	**Employed by State or Territory** (Y or N)	**CMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Aquaculture comprehensive siting plans or procedures	Y (The Texas Department of Agriculture coordinates the licensing of aquaculture facilities and vehicles transporting (live) cultured species, in partnership with Texas Parks & Wildlife Department and the Texas Commission on Environmental Quality.) (Texas Agriculture Code § 12 et seq.)	Y	N
Other aquaculture statutes, regulations, policies, or case law interpreting these	Y	Y	Y

2. *For any management categories with significant changes briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:*
   Describe the significance of the change;
   b. Specify if it was a 309 or other CZM-driven change; and
   c. Characterize the outcomes and/or likely future outcomes of the changes(s).

New Oyster Aquaculture law

With the recent approval of HB1300 allowing cultivated oyster mariculture in Texas and SB682 allowing penalties relating to cultivated oyster mariculture, oyster farming is now legal. Texas was the last remaining coastal state that did not allow oyster aquaculture, a practice long-established in other states where it has stabilized oyster supplies and reduced fishing pressure on natural oyster reefs.

Permitting: As with other states that practice oyster aquaculture, permits will be required before aquaculture can begin. Currently, the permitting process is being developed in the regulations and will be governed by state and federal agencies. The exact date of the permit regulations has not been released yet. TPWD is currently drafting permitting and other regulations related to the oyster aquaculture law. Rules for oyster aquaculture in Texas are expected to be in place by late 2020.

Enhancement Area Prioritization:

1. *What level of priority is the enhancement area for the coastal management program?*

High _____
Medium__X___
Low _____

2. *Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.*

The level of priority is suggested as medium for this enhancement area, with emphasis placed on careful monitoring of offshore aquaculture initiatives. Stakeholders agree that this deserves a low-medium priority, with an average score of 1.6. Given the data available in the Texas coastal region, it seems there is valid pressure to move aquaculture services offshore. Also, given the new oyster aquaculture law in Texas, aquaculture is poised to become more of a presence on the Texas coast. It is worth seeing how the new law plays out over the next 5 years to see if there is an opportunity in the future for the Texas CMP to develop a strategy around aquaculture.

Phase II (In-Depth) Assessment

Wetlands

In-Depth Resource Characterization:

Purpose: To determine key problems and opportunities to improve the CMP's ability to protect, restore, and enhance wetlands.

1. What are the three most significant existing or emerging physical stressors or threats to wetlands within your coastal zone? Indicate the geographic scope of the stressor, i.e., is it prevalent throughout your coastal zone, or are there specific areas that are most threatened? Stressors can be development/fill; hydrological alteration/channelization; erosion; pollution; invasive species; freshwater input; sea level rise/Great Lakes level change; or other (please specify). When selecting significant stressors, also consider how climate change may exacerbate each stressor.

	Stressor/Threat	**Geographic Scope** (throughout coastal zone or specific areas most threatened)
Stressor 1	Development	Near current urban areas throughout the state (Galveston, Brazoria, Aransas, Nueces and Cameron counties)
Stressor 2	Sea level rise	Coastwide
Stressor 3	Erosion	Coastwide, but exacerbated in ship channels

2. Briefly explain why these are currently the most significant stressors or threats to wetlands within your coastal zone. Cite stakeholder input and/or existing reports or studies to support this assessment.

   The previous two 309 Assessment and Strategies documents highlight specific issues facing wetlands in Texas. The CMP funded a series of studies that culminated in the *Wetland Status and Trends reports* (Tremblay 2010; Tremblay 2011; White et al. 1999; White et al. 2004; White et al. 2005; White et al. 2006; White et al. 2007). These reports offer information regarding wetland change for most of the coastal regions within the CMZ in Texas. These reports indicate that major historical wetland loss and wetland change has been caused by change in climatic patterns, change in sediment supply, land subsidence, RSLR, and land use changes (agriculture, development, building of channels and canals). Expected increases in coastal population are likely to exacerbate current wetland stressors in Texas including development, SLR and erosion, and climatic change. Although no new report has been commissioned specifically for Texas, the findings of these reports and the stressors facing wetlands in Texas are expected to still hold true today. A list of the most prevalent causes of wetland change by region is presented in Table 7 below.

Table 7. Historical causes of wetland change from Status and Trends reports*

Location	Report Date	Historical causes of wetland change (Since 1950's)
Upper Coast Strandplain	2007	Climatic change, Relative Sea Level Rise (RSLR), subsidence (active faults), erosion (Gulf side) and construction of levees and dikes.
Beaumont-Port Arthur	2009	RSLR (including subsidence), channelization and subsequent reduction in sediment supply, clearing for agriculture, industry and urban development.
Bolivar Peninsula	2004	Active surface faults, subsidence, and local development.
Galveston Island	2004	Subsidence, development, and cattle trails.
Follets Island	2004	RSLR and subsidence on active faults.
Freeport Area	2005	Sediment supply changes (Brazos River diversion), Gulf Intracoastal Waterway dredging and dredge material disposal, erosion, and development.
Matagorda Bay area	2010	Historical climate change (extreme drought 1956- subsequent vegetation recovery), localized subsidence from subsurface fluid withdrawal and RSLR (localized).
Matagorda Island/Peninsula	2002	RSLR, morphological change cause by Hurricane Carla, surface faults (subsidence), and change in sediment supply from river diversion (delta development).
Corpus Christi	2010	Climatic change (vegetation recovery from drought and expansion of mangroves), development, RSRL, excavation of quarries.
Barriers of Coastal Bend	2006	RSLR, climatic change, and agricultural practices.
Padre Island National Seashore	2007	Climatic change (recovery of vegetation on flats) and dune migration over flats.
South Padre Island	2005	Climatic change (mangrove expansion and lower estuarine water level) and development.
Brownsville-Harlingen	2011	Climatic Change (lower estuarine water level less marsh in deflation troughs), clearing for agriculture/grazing, dredging and dredge material disposal.

**Source: (Tremblay 2010; Tremblay 2011; White et al. 1999; White et al. 2004; White et al. 2005; White et al. 2006; White et al. 2007)*

Development and Increasing Population

The population of Texas has been booming over the past decade. Texas, the second-most populous state, currently leads the nation in population growth, adding almost 400,000 people in 2018, a 1.3% increase to a state with an estimated population of ~29 million people. Today, the Texas coastal region has reached a population of 6.7 million and is only expected to grow over the next several decades (2019 Master Plan). This increase in population has helped stimulate the economy of Texas but, at the same time, put more pressure and stress on coastal water bodies. Population projections show that by the year 2070 (Figure 23) many of the Texas coastal counties will have grown by 50 to 100 percent. This is one of the fastest growing coastal regions in the country and increased tourism, recreation, commercial and industrial projects will accelerate wetland alteration (Brody 2008). Accompanying concerns include the increase in

water demand, increased non-point source pollution, habitat fragmentation, increased impervious cover, and impacts resulting from increased energy development.

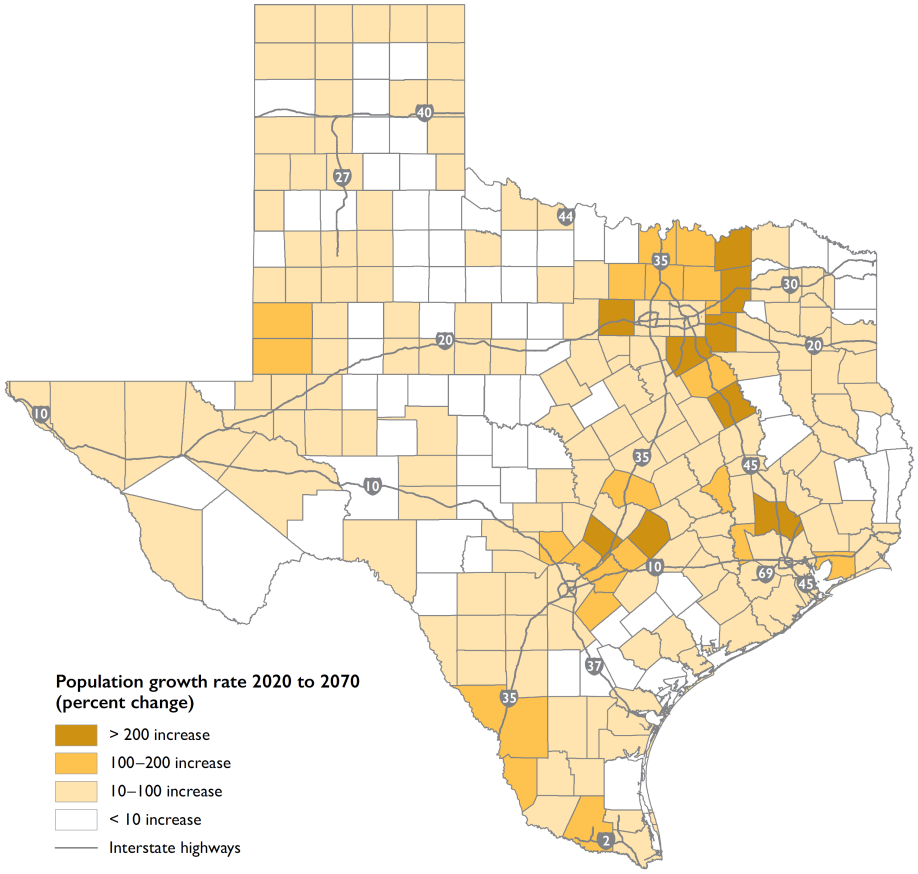

Figure 23. Projected population growth in Texas Counties. Image from Water for Texas 2017 State Water Plan

Development also leads to a loss of wetland habitat. In Harris County alone, 30 percent of freshwater marshes and swamps have been lost since 1992, primarily to development, and many of these freshwater habitats lying outside the 100-year floodplain are unprotected by the federal regulatory system (Geotechnology Research Institute, 2014). Rising population density is also associated with an increase in impervious surfaces; the alteration of natural wetlands leads to loss of habitat and natural water retention within the watershed unit. Brody et al. (2007) analyzed wetland permit data from 1991-2002 (Figure 24) as well as watershed flooding occurrences for the same period and found that an increase of impervious surfaces within a watershed corresponds with a significant increase in the degree of flooding. Also, increased development leads to other issues such as changes in hydrology, habitat fragmentation, and spread of invasive species. While population growth and development may not be curtailed, planning and conservation of priority wetlands may help improve community resilience.

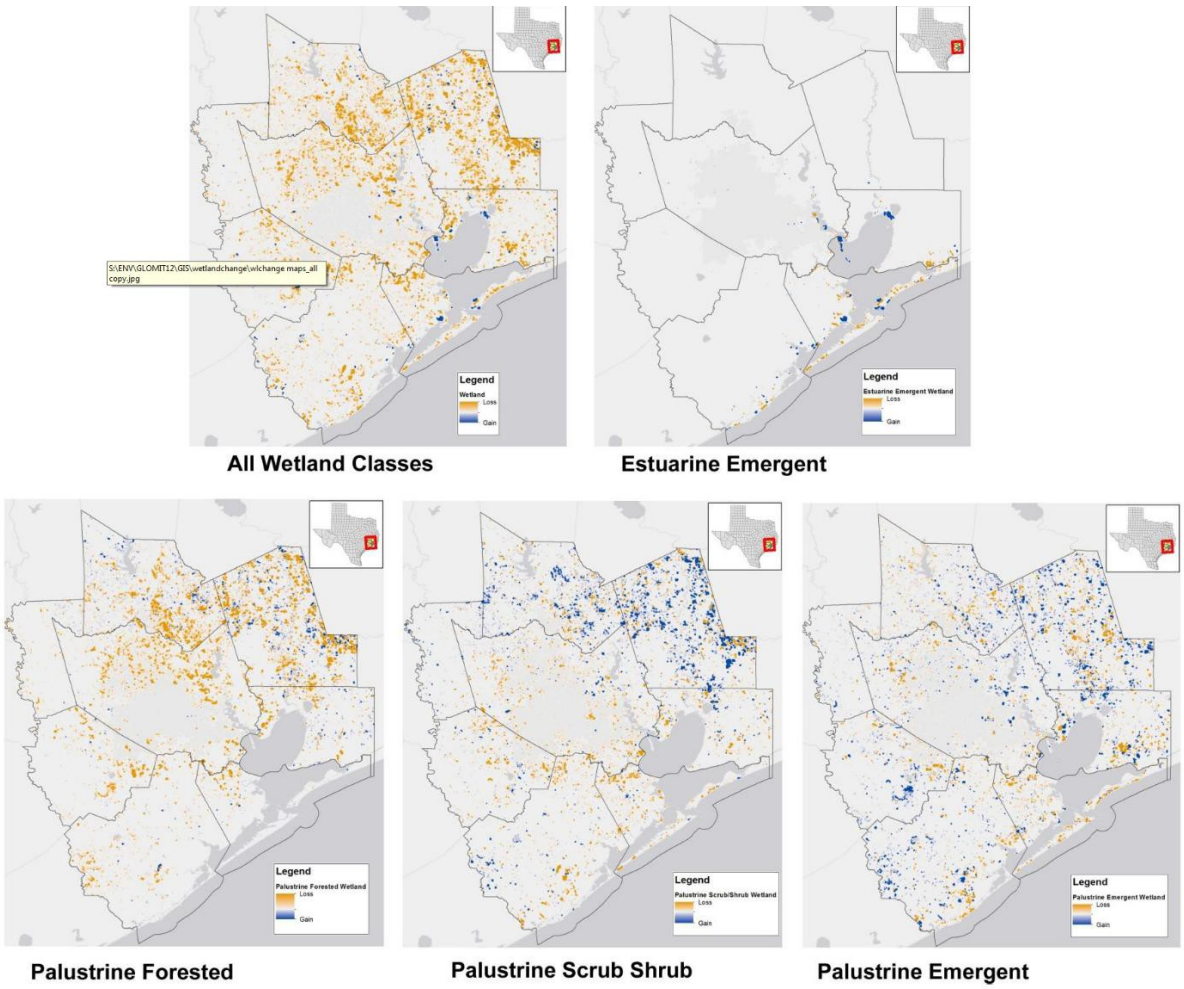

Figure 24. Heat map showing net loss (orange) and gain (blue) of various wetland classes between 1996-2010 in the upper Texas coast including coastal counties of Brazoria, Harris, Galveston, and Chambers. Image from (Geotechnology Research Institute, 2014).

With increased development there is an accompanying increase in water demand. This may lead to decreased flow into estuarine environments, having profound effects on these ecosystems. The projected increase of water demand is associated with increasing consumption as well as growing sectors like mining (including the exploration, development and extraction of oil, gas coal and other materials) steam-electric power generators, agricultural irrigation, and livestock water needs (State Water Plan 2017).

Increased urban development along the coast also poses a threat to wetlands in the face of SLR: barriers to landward migration (Enwright et al. 2016). Historically, wetlands have moved landward and seaward as sea level has changed. However, with increasing development, hard infrastructure prevents wetlands from migrating inland. This creates a "coastal squeeze" where wetlands transform into open water without inland migration, exacerbating wetland loss compared to what would occur naturally (Borchert et al. 2018).

Sea Level Rise

Relative SLR, including subsidence, is one of the highest reported causes of wetland loss (White

and Tremblay. 1995; Ravens et al. 2009; Cline et al. 2011) in Texas and, wetland loss to subsidence is expected to continue. Wetlands provide a suite of ecosystem services, including the provision of habitat, water purification, recreational opportunities, and protection against storms and flooding. All these important benefits are at risk with the threat posed by RSLR. In addition, climatic change may exacerbate the magnitude of RSLR rates which in turn may cause wetland loss through erosion or inundation (Brunn 1962; Leatherman et al. 2000).

For wetlands to remain in their current extent or expand, marsh sedimentation rates must be equal to or surpass those of RSLR (Brinson et al. 1995). It is unlikely that sedimentation rates along Texas estuarine wetlands can keep up with RSLR as the construction of upstream dams and reservoirs has reduced the quantity of sediments reaching the coast (White et al. 2002). Table 8 shows a comparison of marsh sedimentation rates of three fluvial-deltaic system in the upper Texas coast (White et al. 2002) and current RSLR rates from the National Oceanic and Atmospheric Administration (NOAA), which shows that wetland sedimentation is less than observed rates of RSLR. In the case that wetlands do not accrete at a rate to compete with RSLR, migration inland and upslope may occur. Landward migration of wetlands is possible in areas that are undeveloped and have gentle slopes. However, many barriers to upland migration exist (see previous section).

Table 8. Sedimentation rate of Texas Fluvial-Deltaic Systems and RSLR rates.

Watershed	Sedimentation Rate (mm/yr)*	Closest Tide Gauge	Relative sea level rise Rate (mm/yr)**
Trinity	5.1	Galveston	6.6
Lavaca-Navidad	3.3	Freeport	4.4
Nueces	2.6	Rockport	5.6

*Source White et al (2002)

** Source NOAA Sea Level Trends http://tidesandcurrents.noaa.gov/sltrends/sltrends.html. Accessed 11/21/2019.

Drought and Climate Change

Drought has historically affected the distribution of wetlands as it impacts soil moisture and estuarine water levels. Although drought may be a temporary and periodic event (Figure 25) for many areas, it is an ongoing issue in South Texas where more frequent drought spells prevent the necessary amount of fresh water from reaching freshwater wetlands in the coastal area. This is a challenging situation for land and local wildlife refuge managers who may not have the ability to acquire, move, or store fresh water for wetlands in time of drought. The availability of fresh water is important for wildlife, wading birds, and waterfowl; as well as to maintain healthy estuarine water quality. Additionally, the drying of wetlands promotes encroachment of invasive plant species, presenting additional management challenges.

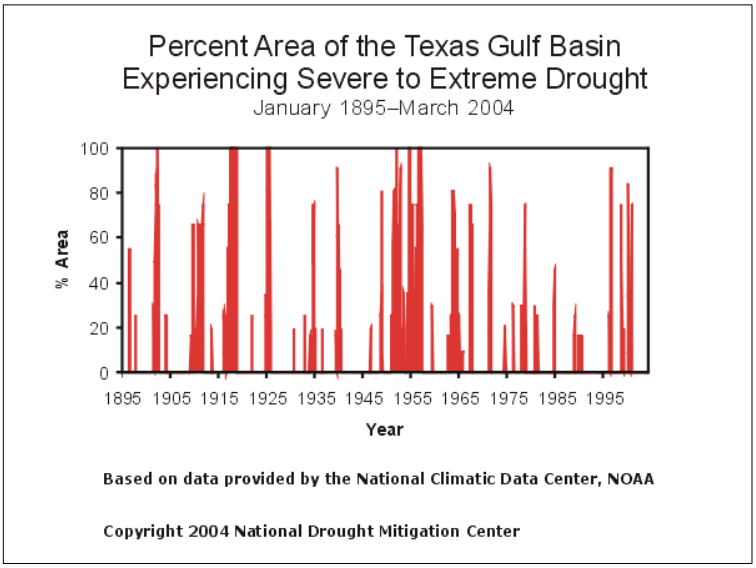

Figure 25. Image from the National Drought Mitigation Center at University of Nebraska Lincoln available online at http://drought.unl.edu/Planning/Monitoring/HistoricalPDSIMaps/HistoricalPDSIGraphs.aspx.

3. Are there emerging issues of concern but which lack sufficient information to evaluate the level of the potential threat? If so, please list. Include additional lines if needed.

Emerging Issue	Information Needed
Energy Development	Information is needed on potential impacts to wetlands and other critical habitats that result from mining, processing, and transportation of energy products including injection wells, pipeline and facility construction, and plan operations.
Freshwater Inflows	Evaluate the potential impacts and benefits of established flow standards on fresh water inflows to estuarine habitats and organisms.

Fresh Water Inflow Standards

In the previous assessment, a short introduction of Senate Bill 3 was presented. Senate Bill 3 (2007) implemented a stakeholder led process to determine environmental flow standards for river basins and bay systems that are adequate to support a sound ecological environment, to the maximum extent reasonable considering other public interests (TCEQ 2014). Through this process, stakeholder committees, scientific teams, and state resource agencies are tasked with developing a set of recommendations which are submitted to TCEQ for consideration of formal standards for each of the 11 bay/basin areas (seven of which are on the Texas Coast). To date, four of seven coastal basins have made recommendations. Environmental flow standards adopted by TCEQ consist of a seasonal schedule of flow quantities that address subsistence flow, base flow, and one level of high flow pulses. One issue that has emerged from this process is the need for increased monitoring and data collection in coastal areas. Recommendations have been impacted especially by lack of data, or out-of-date data on water circulation, important estuarine species, and hydrogeologic change. This includes transdisciplinary research that integrates biological, hydrological, land use, and policy analysis.

In-Depth Management Characterization:

Purpose: To determine the effectiveness of management efforts to address identified problems related to the wetlands enhancement objective.

1. For each additional wetland management category below that was not already discussed as part of the Phase I assessment, indicate if the approach is employed by the state or territory and if significant state- or territory-level changes (positive or negative) have occurred since the last assessment.

Significant Changes in Wetland Management

Management Category	Employed By State or Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Changes Since Last Assessment (Y or N)
Wetland assessment methodologies	Y	Y	Y
Wetland mapping and GIS	Y	Y	N
Watershed or special area management plans addressing wetlands	Y	Y	Y
Wetland technical assistance, education, and outreach	Y	Y	N

2. For management categories with significant changes since the last assessment, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information.
    a. Describe significant changes since the last assessment;
    b. Specify if they were 309 or other CZM-driven changes; and
    c. Characterize the outcomes or likely future outcomes of the changes.

Wetland Assessment and Mapping

A 309-driven initiative to develop a RAM tool for projects on state owed submerged lands was talked about in detail in Phase 1 (see Data Management 309 Strategy in Coastal Hazards). This is one method that will change how wetlands are assessed by the GLO's Field Operations team in the future.

In the past, the CMP has relied on NOAA's OCM and the Coastal Change Analysis Program (C-CAP) tool for mapping wetland change in Texas. As such, Texas has no updated data on wetland mapping going back to 2010. Therefore, there is a need for more detailed wetland mapping data along the Texas coast. This could possibly help the Texas Coastal Resiliency Master Plan (CRMP) and the effort to quantify ecosystem services gained by implementing projects. The CMP is currently funding a project titled "Texas Wetlands Status and Trends Online GIS Viewer" which will develop a user-friendly, interactive, web-based display of GIS-based maps of historical and current Texas wetland types, boundaries, and distribution. The new interface and website will allow users to view, analyze, and download the data.

Watershed or Special Area Management

Some changes have occurred regarding freshwater inflow standards (please see Question 3 in this

section). These are not CZM-driven changes but may have an impact on wetland health and other estuarine environments.

The TCEQ and TSSWCB support the development and implementation of watershed protection plans (WPPs) that have the potential to prevent or manage nonpoint source pollution. Several WPPs have been developed with local stakeholder groups, usually with funding and technical assistance from the TCEQ and/or the TSSWCB, along with the EPA. These plans are highly localized and could be expanded and coordinated for comprehensive coastal protection and targeted watershed areas under the coastal non-point source pollution program. WPPs along the Texas Coastal Zone include:

- Arenosa and Garcitas
- Arroyo Colorado
- Baffin Bay, Petronila/San Fernando Creeks
- Bastrop Bayou
- Carancahua Bay
- Cedar Bayou
- Clear Creek Tidal
- Double Bayou
- Hidalgo Main
- Highland and Marchand Bayous
- Lavaca River
- Lower Laguna Madre
- Lower Nueces River
- Mission and Aransas
- North Floodway
- Raymondville Drain
- San Bernard
- Tres Palacios

In 2017, the Texas Water Development Board (TWDB) adopted the State Water Plan to provide a roadmap for how to address the water needs that accompany huge population growth by identifying water management strategies and their associated costs for communities across the state. It provides a regional approach to water management planning around the state. This is a non-CZM driven change.

Wetland Technical Assistance, Education, and Outreach

The TPWD aids landowners who are interested in developing and managing wetland habitats on their property through programs like the Texas Prairie Wetlands Project, the Coastal Program, and the Landowner Incentive Program. Depending on eligibility, some programs offer cost-share assistance to build and manage wetlands, technical guidance from local biologists and other guidance information. This is not a CZM-driven effort.

CMP is funding many education and outreach programs such as Boater Waste Education Campaign, Green Infrastructure for Texas, and The Texas Coastal Monitoring program, all of which provide a hands-on learning experience to participating members of the community. These programs educate individuals on coastal environments, monitoring techniques and practices and help foster appreciation and understanding of the services provided by wetlands and other coastal habitats. These are CZM-driven efforts.

Wetland Protection and Restoration

As of 2019, 48 wetland enhancement and protection projects were funded through the Gulf Environmental Benefit Fund from NFWF (See Wetlands, Phase I). The projects address high priority conservation needs (some identified in the Texas Coastal and Estuarine Land Conservation Program Plan and from TAC feedback) and represent important efforts to protect and enhance natural and living resource along the Texas coast. Funded projects include a combination of land/marsh acquisition and estuarine and shoreline restoration and enhancement. This is not a CZM-driven effort.

Other GLO funding to protect, restore, and study wetlands include CEPRA. CEPRA is a state-sponsored program that funds studies to reduce the effects of coastal erosion as well as infrastructure and shoreline development to mitigate erosion impacts. Through this non-CZM program, the state of Texas funds projects which aid in management and enhancement of wetlands.

Some CMP funded Wetland Enhancement Projects since 2014 include:

- Toward Wetland Protection in the Houston-Galveston Region: Assessing Mitigation Practices and Facilitating Watershed-Based Decision Making
- Nueces Delta Wetland Functionality Study
- Nueces Bay Marsh Volunteer Plantings
- San Benito Wetlands Project, Phases 1-4
- Exploration Green Public Access Development and Ecosystem Restoration
- Mangrove Expansion Alters Sediment and Water Quality and Affects Biodiversity in Texas Wetlands
- Restoration of the Slop Bowl Marsh, Brazoria National Wildlife Refuge: Phase I Planning
- Assessment and economic valuation of nitrogen mitigation in Texas Coastal Bend restored marsh
- Green Infrastructure for Texas: Educating Coastal Stakeholders on the Role of Green Infrastructure
- Texas Wetlands Status and Trends Online GIS Viewer
- Analysis of Erosion and Subsidence in Texas Coastal Wetlands
- Understanding Ecosystem Responses to the Closure of Rollover Pass on Bolivar Peninsula
- Boggy Bayou Nature Park Improvements

In addition, the CMP is current funding a $1,600,000 wetland land acquisition project in Dollar Bay. These are CZM-driven changes aimed at enhancing coastal wetlands and providing information for future wetland management.

3. Identify and describe the conclusions of any studies that have been done that illustrate the effectiveness of the state's or territory's management efforts in protecting, restoring, and enhancing coastal wetlands since the last assessment. If none, is there any information that you are lacking to assess the effectiveness of the state's or territory's management efforts?

   The State has established successful programs for the protection, restoration, and enhancement of coastal environments including wetlands. State programs previously mention, CEPRA and CMP, work in tangent to fund various research and wetland enhancement efforts. The CEPRA program has invested over $157 million since its inception in 1999 for mitigation of coastal erosion (GLO, 2019). CEPRA funded 97 bay and gulf erosion-mitigation projects from 2012-2019.

Identification of Priorities:

1. Considering changes in wetlands and wetland management since the last assessment and stakeholder input, identify and briefly describe the top one to three management priorities where there is the greatest opportunity for the CMP to improve its ability to more effectively respond to significant wetlands stressors. *(Approximately 1-3 sentences per management priority.)*

   For all management priorities identified in Phase II, a poll was sent out to stakeholders asking them to rank each as either High Priority (3 points), Medium Priority (2 points), Low Priority (1 point), or Not a Priority (0 points). The score for each priority is listed in the description.

   Management Priority 1: Find resources for future wetland restoration projects by identifying sediment sources

   Wetland restoration is a huge priority in Texas, with tens of millions of dollars available through CMP, NRDW, RESTORE Act, and NFWF. However, sediment is at a premium, and there is likely not enough currently identified sediment available for all planned wetland restoration projects. It is necessary to invest in finding new sediment sources for future restoration projects. Stakeholders rated this priority 2.8/3.

   Management Priority 2: Enhance management processes to provide for wetland resilience through policies, restoration, and outreach

   Faced with various coastal issues such as climate change, relative SLR, erosion, and population growth, there is a need to mitigate impacts as well as prevent future wetland degradation. Often engineering solutions are sought to mitigate some of these issues. More recently, resilient coastal solutions have been employed to address wetland and shoreline erosion. Texas has a special opportunity in that a large percentage of its shoreline is undeveloped, so future construction can adopt coastal resiliency principles, like living shorelines, that not only mitigate for hazards, but maintain their ecological function and ecosystem-services provided by coastal wetlands. Outreach is essential in building a support for healthy and resilient communities. Education and outreach can be provided to private land owners on the benefits of living shorelines for shoreline protection instead of bulkheads and other engineered hard structures. The Texas CRMP offers the State a vision and framework on how to move forward towards a sustainable coast with resilient wetlands. Stakeholders rated this priority 2.3/3.

   Management Priority 3: Better quantify economic benefits of wetland restoration through development of an ecosystem valuation tool

   With CMP, CEPRA, and other programs receiving dozens of ecosystem restoration project proposals every year, there is need for a robust tool to quantify the economic benefits of restoration projects by evaluating the gain or loss of ecosystems services with and without project. Stakeholders rated this priority 1.9/3.

   Management Priority 4: Continue to promote living shorelines as a better alternative to hardened shoreline structures, where appropriate

The CMP has made strides to promote living shorelines as a viable alternative to hardened structures during a previously funded 309 project (See Phase I). Continuing to include this as a high priority in future CMP projects and planning will ensure that the momentum the CMP has made is not lost. Stakeholders rated this priority 2.3/3.

2. Identify and briefly explain priority needs and information gaps the CMP has to help it address the management priorities identified above. The needs and gaps identified here do not need to be limited to those items that will be addressed through a Section 309 strategy but should include any items that will be part of a strategy.

Priority Needs	**Need?** (Y or N)	**Brief Explanation of Need/Gap**
Research	Y	More research in wetland processes such as sedimentation, ecology, ecosystem services, and hydrodynamic processes
Mapping/GIS	Y	Maintain and update bathymetry and topography
Data and information management	Y	Improved database on coastal related activities including restoration and mitigation monitoring and tracking
Training/capacity building	Y	Training professionals in living shorelines. Staff training on mitigation and restoration tracking and evaluation.
Decision-support tools	Y	Comprehensive management – consolidate multiple plans; increase policy acceptance through greater stakeholder coordination and involvement.
Communication and outreach	Y	Education and outreach wetland functions and ecosystem services and living shorelines.

Enhancement Area Strategy Development:

1. Will the CMP develop one or more strategies for this enhancement area?
   Yes _____
   No __X____

2. Briefly explain why a strategy will or will not be developed for this enhancement area.

Restoring wetlands remains a priority for coastal management in Texas. The CMP will continue to encourage and fund wetland restoration projects under its 306 and 306A programs. Additionally, several other entities with larger funding resources are taking an active role in wetland restoration in Texas. With millions of dollars available for restoration through NRDA, RESTORE Act, NFWF, and other funding sources being directed by the Texas Trustee Implementation Group and others, the CMP does not feel the need to develop a strategy related to wetlands. The CMP will continue to monitor wetland trends and restoration efforts in Texas and provide input when necessary.

Coastal Hazards

In-Depth Resource Characterization:

Purpose: To determine key problems and opportunities to improve the CMP's ability to prevent or significantly reduce coastal hazard risks by eliminating development and redevelopment in high-hazard areas and managing the effects of potential sea level rise and Great Lakes level change.

1. Based on the characterization of coastal hazard risk, what are the three most significant coastal hazards within your coastal zone? Also indicate the geographic scope of the hazard, i.e., is it prevalent throughout the coastal zone, or are there specific areas most at risk?

	Type of Hazard	**Geographic Scope** (throughout coastal zone or specific areas most threatened)
Hazard 1	Coastal Storms	Coast-wide
Hazard 2	Flooding/Storm Surge	Coast-wide
Hazard 3	Erosion and RSLR	Coast-wide – Gulf shoreline and bay front communities

2. Briefly explain why these are currently the most significant coastal hazards within the coastal zone. Cite stakeholder input and/or existing reports or studies to support this assessment.

Coastal Storms

FEMA Disaster Declarations from 1953-2019 have occurred in 11 of the 18 coastal counties. Coastal storms present an imminent threat to people and property living near the coast and many of the impacts to communities, natural environments, and the economy are long lasting (see Phase 1 Coastal Hazards for summary of coastal storms). Hurricane return periods are shown in Figure 26 and return periods for major hurricanes in Figure 27. Counties of the Texas coast, on average, experience a hurricane once every 9-13 years and a major hurricane (≥Category 3) once every 25-40 years (Blake and Gibley 2011). Because hurricanes may occur any year, it is essential for communities to plan and mitigate for impacts yearly and prior to hurricane season. Tropical storms and hurricanes can lead to dramatic rain events that can cause large-scale devastation (see the section below on Flooding).

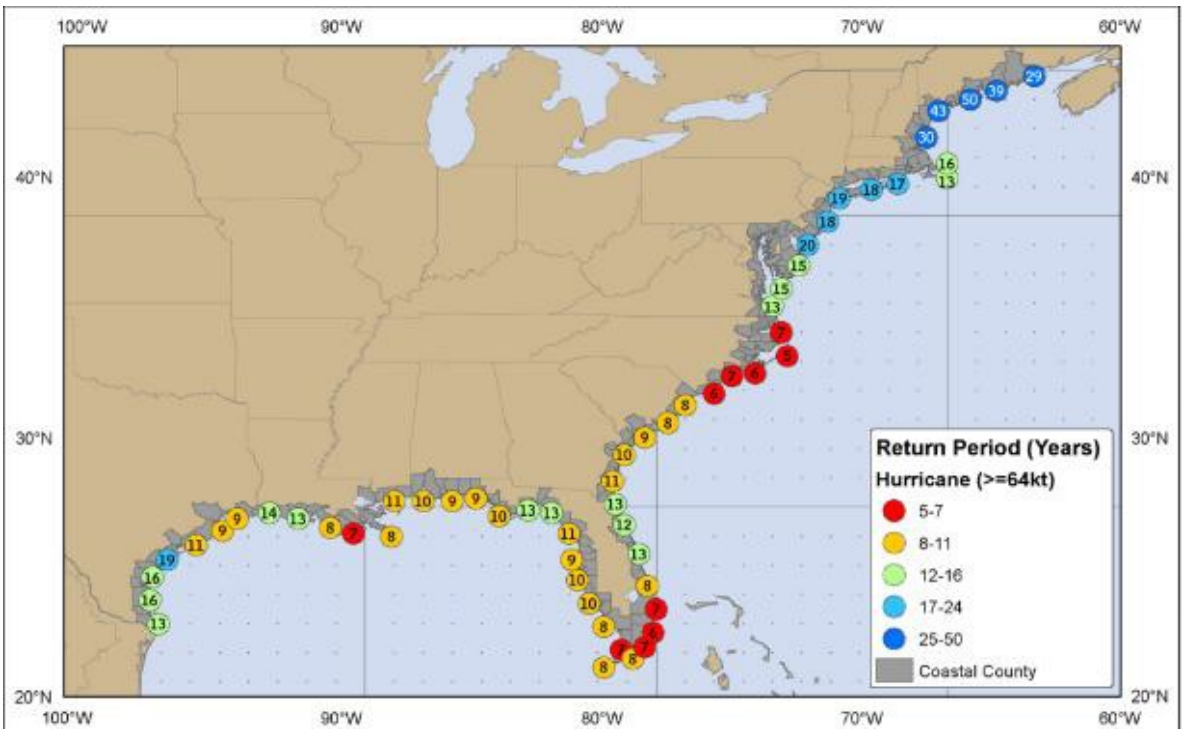

Figure 26. Estimated return period in years for hurricanes passing within 30 nautical miles of various locations on the U.S. coast. Image from Blake and Gibley (2011).

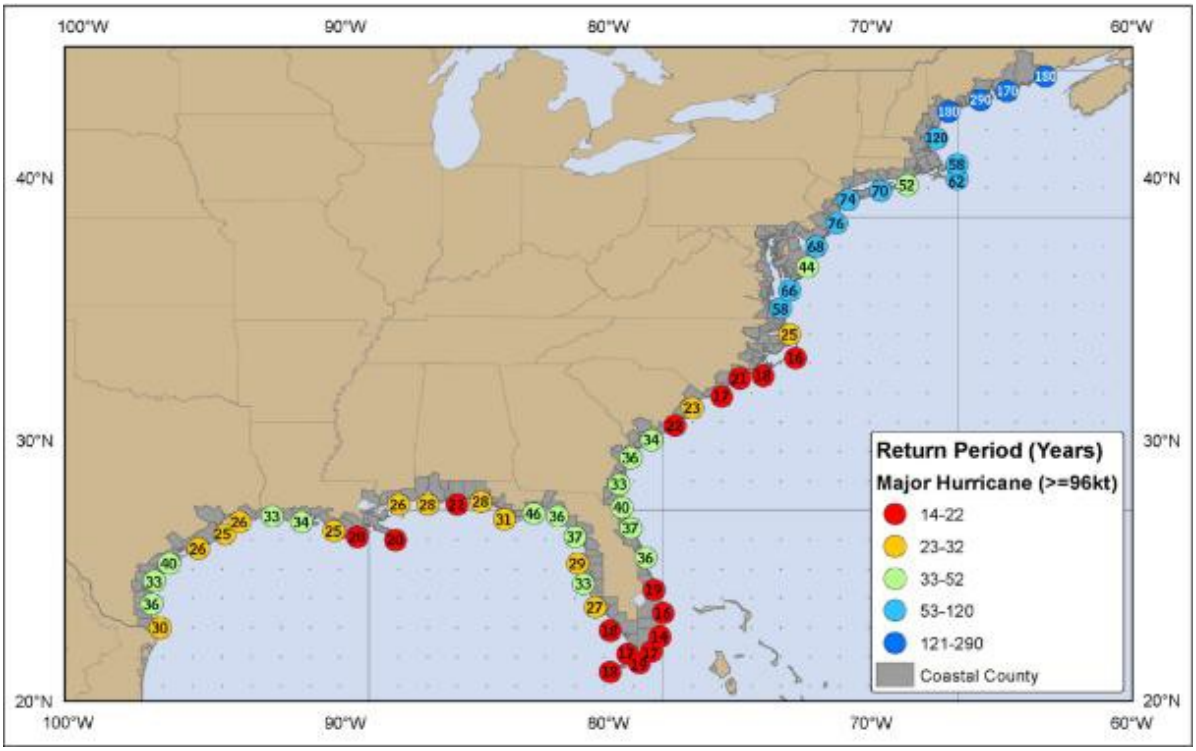

Figure 27. Estimated return period in years for major hurricanes passing within 50 nautical miles of various locations on the U.S. Coast. Image from Blake and Gibley (2011).

Flooding

Flooding has historically been a major hazard in Texas and is the most frequent and costliest hazard for the state of Texas (see Phase 1 assessment). Most Texas coastal counties have experienced over 16 floods from 1960-2012; and Harris, Galveston, and Brazoria Counties experienced over $500 million in severe coastal flood costs from 1996-2017 (see Figure 3 in Phase 1). Harris and Galveston Counties have the highest amount of land development within the FEMA floodplain (Appendix A). This information is supported by the study of Brody et al. (2007), who found the highest number of federal wetland permits (between 1991-2002) occurred in watersheds encompassing major urban areas of the Houston-Galveston area. In addition, their study shows that larger numbers of wetland permits issued within a watershed and an increase in impervious surface correlates with a significantly higher increase in the degree of flooding, runoff volumes and pollutant loadings.

Hurricane Harvey introduced an unprecedented rain event in Texas that affected nearly six million people. In just under five days, rainfall counts surpassed fifty-one inches, making Harvey the most extreme rain-fall event recorded for the contiguous United States. Because Houston is situated on a low-lying coastal plain with clay-based soil that makes drainage of overflow waters a slow process, the' built' environment may play a larger role in excessive flooding. The increased development of this rapidly growing city has altered natural drainage patterns, sending floodwaters into streets, homes, and businesses. Compounding the issue, Houston does not have a levee system in place, relying instead on its bayous to drain floodwater which increases the risk of damaging communities downstream. Between 25 and 30 percent of Harris County – which covers approximately 444 square miles and is home to 4.5 million people - was flooded.

Large amounts of resources from a variety of different sources are currently being used to address flooding and coastal hazard mitigation in the central and upper Texas coasts. For example, a recent $4 billion grant from the U.S. Department of Housing and Urban Development (HUD) will be used to improve coastal infrastructure to reduce impacts from hazards in the future. The Texas Hazard Mitigation Plan (2018), put together by the Texas Department of Public Safety, is an extremely detailed guide to coastal hazards affecting coastal Texas and contains resources for best practices.

Erosion and Relative sea level rise

Long-term, continuous shoreline erosion and episodic shoreline change is a serious hazard on the Texas coast, threatening homes, infrastructure, commercial establishments, and coastal habitats (see Phase 1 assessments for maps and descriptions). Erosion is attributed to processes like wave and current removal of unconsolidated sediment along shorelines, as well as ship wakes, storms, and relative SLR. Erosion impacts are compounded due to the natural lack of sufficient sediment supply to the coast, coastal development activities along the edges of shorelines, and navigation structures. Erosion threatens beach use and access, habitat loss, roadways and infrastructure, like evacuation routes, and natural storm protection from dunes and barrier islands. It is estimated the state of Texas has lost almost 60,000 acres of saltwater wetlands since the 1950's. The Texas coast is also estimated to have some of the highest coastal erosion rates in the country with some areas losing more than 55 feet per year and averaging four feet per year coastwide (CEPRA 86th Leg. Report). The GLO monitors shoreline change rates via a project with the Bureau of Economic Geology at the University of Texas at Austin that continuously updates bay shoreline data erosion rates.

3. Are there emerging issues of concern, but which lack sufficient information to evaluate the level of the potential threat? If so, please list. Include additional lines if needed.

Emerging Issue	Information Needed
Increased coastal pollution events	Adoption rate of coastal nonpoint source pollution management measures in local communities, especially those in central Texas

In the previous assessment, one of the strategies developed by the CMP was to implement a coastal NPS pollution program. The aim of this program is to reduce coastal pollution through retrofit planning, education, new research, and new policies and initiatives. A detailed description of this can be found in Phase I, Cumulative and Secondary Impacts.

In-Depth Management Characterization:

Purpose: To determine the effectiveness of management efforts to address identified problems related to the coastal hazards enhancement objective.

1. For each coastal hazard management category below, indicate if the approach is employed by the state or territory and if there has been a significant change since the last assessment.

Significant Changes in Coastal Hazards Statutes, Regulations, and Policies

Management Category	Employed by State/Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Change Since the Last Assessment (Y or N)
Shorefront setbacks/no build areas	Y	Y	Y
Rolling easements	Y	N	N
Repair/rebuilding restrictions	Y	Y	N
Hard shoreline protection structure restrictions	Y-beach/dune	Y	N
Promotion of alternative shoreline stabilization methodologies (i.e., living shorelines/green infrastructure)	N	Y	Y
Repair/replacement of shore protection structure restrictions	Y	N	N
Inlet management	Y	Y	N
Protection of important natural resources for hazard mitigation benefits (e.g., dunes, wetlands, barrier islands, coral reefs) (other than setbacks/no build areas)	Y	Y	N
Repetitive flood loss policies (e.g., relocation, buyouts)	Y	Y	N
Freeboard requirements	N	Y	N
Real estate sales disclosure requirements	Y	Y	N

Management Category	Employed by State/Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Change Since the Last Assessment (Y or N)
Restrictions on publicly funded infrastructure	Y	Y	N
Infrastructure protection (e.g., considering hazards in siting and design)	Y	Y	Y
Other (please specify)			

Significant Changes to Coastal Hazard Management Planning Programs or Initiatives

Management Category	Employed by State/Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Change Since the Last Assessment (Y or N)
Hazard mitigation plans	Y	Y	Y
Sea level rise/Great Lake level change or climate change adaptation plans	N	Y	N
Statewide requirement for local post-disaster recovery planning	N	Y	N
Sediment management plans	Y	Y	N
Beach nourishment plans	Y	Y	Y
Special Area Management Plans (that address hazards issues)	Y	Y	N
Managed retreat plans	N	Y	N
Other (please specify)			

Significant Changes to Coastal Hazard Research, Mapping, and Education Programs or Initiatives

Management Category	Employed by State/Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Change Since the Last Assessment (Y or N)
General hazards mapping or modeling	Y	Y	Y
Sea level rise mapping or modeling	Y	Y	Y
Hazards monitoring (e.g., erosion rate, shoreline change, high-water marks)	Y	Y	N
Hazards education and outreach	Y	Y	Y
Other (please specify)			

Statutes, Regulations, and Policies:

Most hazard mitigation in Texas is largely the responsibility of city governments because the state and county levels of government have limited control over land use and building standards (Peacock et al. 2011). In the coast environment, however, Texas employs the Dune Protection Act, Open Beaches Act to authorize GLO to establish and enforce minimum standards for coastal protection and planning by city and county governments. Under these acts, GLO oversees and advises local governments on the planning and permitting of coastal development and overall erosion response planning in gulf facing areas. CEPRA and the CMP aid and fund many hazard management efforts throughout the coastal zone.

Shorefront setbacks
Refer to Phase 1, Coastal Hazards, Management Characterization for more details.

Promotion of alternative shoreline stabilization methodologies (i.e., living shorelines/green infrastructure)
A strategy in the previous 309 assessment was related to living shorelines education (see Phase 1 Wetlands). Although this has not led to a policy change, the CMP will continue to advocate for living shorelines over hardened structures.

Infrastructure Protection
In the previous 309 assessment, the USACE Galveston District was in the reconnaissance phase of the *Coastal Texas Storm Damage Risk Management and Ecosystem Restoration Study*, now the *Coastal Texas Protection & Restoration Feasibility Study* (Coastal Texas Study). The Coastal Texas Study involves engineering, economic, and environmental analyses on large-scale projects, which may be considered by Congress for authorization and funding. Formal public meetings for the study were hosted in fall 2018, and – since this time – the U.S. Army Corps of Engineers and the GLO worked together to refine the study based on public comments received at these meetings. Additional public open houses will be held in early 2020 to provide the public with updates regarding the study process and findings. Following a second public review and comment period in fall 2020 (which will include formal public meetings led by the U.S. Army Corps of Engineers and the GLO), the feasibility study and report will be complete in 2021. The Coastal Texas Study recommendations will enhance resiliency in coastal communities and improve our capabilities to prepare for, resist, recover and adapt to coastal hazards.

Management Planning Programs or Initiatives:

Hazard mitigation plans
Updates to the State's Hazard Mitigation Plan were completed by the Texas Division of Emergency Management in 2018 (Phase 1 assessment).

Coastal Resiliency Master Plan
In 2019, the GLO released its updated version of the Texas CRMP, a list of 123 coastal hazard projects (see Phase 1 assessment, Coastal Hazards).

Beach Nourishment Plans
In 2019, during the 86th legislature session, Texas passed House Bill 6, which set up a dedicated funding stream to CEPRA. Over the next ten years, CEPRA will receive 2% of all coastal counties' hotel occupancy tax. This is the first such dedicated funding stream for CEPRA and will allow the program to better plan for future beach and dune nourishment projects.

Research, Mapping, and Education Programs or Initiatives:

The CMP has funded several projects related to hazards mapping over the past five years, including Prioritization of Critical Marsh Conservation and Restoration Areas based on Future Sea Level Rise Scenarios, GIS Analysis and Modeling of Texas Rookery Island Erosion Risk along the Gulf Intercoastal Water Way (GIWW), and Data Development and Management for Coastal Protection and Resiliency Planning (Living Shorelines-GIS Tool).

Another mapping and web-mapping tool available is the Coastal Resilience Tool from The Nature Conservancy (TNC). The TNC tool offers information and data for SLR, inundation scenarios for select location, Sea Level Effect on Marshes model results and results of Exposure and Vulnerability Index.

As a part of a current 309 Living Shorelines Strategy, the CMP is working with the Harte Research Institute to develop a living shorelines site suitability tool. When fully developed, coastal landowners will be able to plus their address into the tool and see if and what type of living shoreline would be appropriate to install on their property. This tool takes into consideration many factors, such as channel width, wave height and energy, and ship traffic.

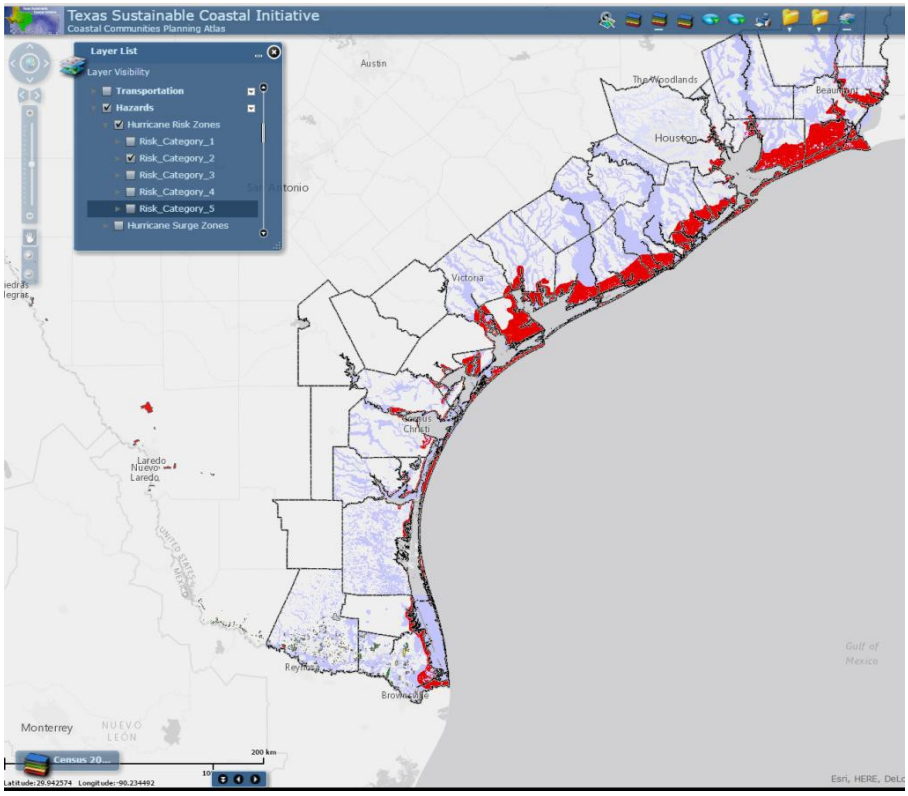

Figure 28. Screen view of the Coastal Communities Planning Atlas featuring FEMA 100 yr flood risk zones (purple) and hurricane risk zones (category 2).

Hazards education and outreach

Under Cycle 23, the CMP is current funding the "Texas Citizen Planner, Local Coastal Planning in the wake of Hurricane Harvey" project. As Texas coastal communities continue to grow at unprecedented rates, local officials are faced with the daunting task of ensuring their communities develop in a way that

is safe and resilient from both an economic and ecological perspective. However, local officials do not always have the skills, resources and long-range picture to plan for the future. Often, existing local ordinances, laws, zoning and plans are in place but not being utilized in a manner that most efficiently enhances the resiliency and vibrancy of the community and its economy. This project is working with local citizen planners to deliver information on planning in the coastal zone. Participants are learning how they can make local laws, plans and ordinances work together to create a resilient coastal community.

During the development of the Texas CRMP, TAC, and public outreach meetings were held to gather stakeholder input on which projects to include in the plan based on their potential to protect from future hazards. This process will again take place for the upcoming 2023 CRMP update. This will involve meetings with four different groups during 2020-2022: the public, the TAC, targeted conceptual projects, and the Technical Working Group.

Research & Restoration

The State funds projects which mitigate coastal hazards through programs such as the GOMESA, the CEPRA, and Community Development and Revitalization Program (CDR) through HUD Community Development Block Grant funds. Through these programs, coastal communities can mitigate hazard impacts by employing projects related to beach nourishment, wetland and shoreline protection and restoration, planning, and outreach activities.

The CEPRA program funds projects to reduce the effects of coastal erosion as well as infrastructure and shoreline development to mitigate erosion impacts. CEPRA projects during the last funding period include beach nourishment, studies/monitoring, and shoreline stabilization work mostly concentrated on the upper Texas coast that is still recovering from the erosion impacts from Hurricane Ike. The Coastal Bend and lower coast CEPRA projects focused on marsh/habitat restoration near Corpus Christi and beach nourishment along South Padre Island.

The GLO's CDR program works with Texas coastal communities to recover from hurricane damage and construct resilient infrastructure features. CDR is currently developing an Action Plan to spend $4 billion on coastal hazard and infrastructure projects (see In Depth Resource Characterization).

CMP funded projects during the last assessment period which aid in mitigation of hazards include:

- The Texas Coastal Resiliency Master Plan
- Prioritization of Critical Marsh Conservation and Restoration Areas based on Future Sea Level Rise Scenarios
- GIS Analysis and Modeling of Texas Rookery Island Erosion Risk along the GIWW
- Toward Wetland Protection in the Houston-Galveston Region: Assessing Mitigation Practices and Facilitating Watershed-Based Decision Making
- Causeway Rookery Island - Protection and Restoration
- Exploration Green
- San Benito Wetlands
- Implementation of Coastal Nonpoint Source Management
- Data Development and Management for Coastal Protection and Resiliency Planning (Living Shorelines-GIS Tool)
- Salt Bayou Watershed Restoration Efficacy Research - Phase

- Construction and Enhancement of Artificial Reefs in the Northeastern Gulf of Mexico
- Texas Sediment Management Plan Study
- Green Infrastructure for Texas: Educating Coastal Stakeholders on the Role of Green Infrastructure
- Texas Citizen Planner, Local Coastal Planning in the wake of Hurricane Harvey
- Dagger Island Restoration Project
- Houston Botanic Garden Stormwater Wetlands
- Assessment of Stormwater Infrastructure for Mitigating Flooding and Non-point Source Pollution
- Fulton Beach Road Living Shoreline
- Improving Stormwater Management in Port Aransas
- Nonpoint Source Nutrient Pollution Study in Baffin Bay Texas, Phase I
- The Efficacy of Living Shorelines for Restoring Shoreline Habitat and Stability
- White Sands Street Drive-Over and Storm Surge Barrier Design and Construction

2. Identify and describe the conclusions of any studies that have been done that illustrate the effectiveness of the state's management efforts in addressing coastal hazards since the last assessment. If none, is there any information that you are lacking to assess the effectiveness of the state's management efforts?

Given the aftermath of Hurricane Harvey, the State's ability to respond to coastal hazards is being tested. Currently, billions of dollars are being spent on disaster mitigation and coastal resiliency. A detailed analysis of how these funds were spent and the effectiveness that they will have at preventing future hazards should be identified.

Identification of Priorities:

1. Considering changes in coastal hazard risk and coastal hazard management since the last assessment and stakeholder input, identify and briefly describe the top one to three management priorities where there is the greatest opportunity for the CMP to improve its ability to more effectively address the most significant hazard risks. *(Approximately 1-3 sentences per management priority.)*

Management Priority 1: Identify resources for coastal restoration projects through creation of a comprehensive sediment management plan

The Texas CRMP identifies 123 Tier 1 projects necessary to reduce impacts from future coastal hazards along the Texas coast. Most of these projects call for marsh, beach, and dune restoration, which requires a lot of high-quality sand and beneficial use of dredge material. However, there is currently a high demand for this sediment, and demand will soon outpace supply, if it has not already, unless steps are taken to research new sediment sources and develop a sediment management plan to prioritize use of available resources for use by state and local entities. Stakeholders rated this priority 2.3/3.

Management Priority 2: Continue to promote outreach to coastal communities on coastal resiliency and preparedness and provide hazard planning assistance & tools.

Continue to educate and promote best management practices and programs to enhance the

preservation of natural shorelines for coastal hazard mitigation planning, like building living shorelines. Incorporate ecosystem services and community resiliency into public outreach programs. Provide technical assistance and planning tools to communities for vulnerability assessments and pre-storm planning. Pilot studies where ecosystem services are valued and including in project selection could also be beneficial. Stakeholders rated this priority 2.6/3.

Management Priority 3: Track implementation of the Texas Coastal Nonpoint Source Pollution program

NOAA and EPA approval of the Texas Coastal NPS Pollution program is a monumental step for the program and the CMP. The next phase is a 15-year implementation process to ensure management measures are voluntarily adopted by various municipalities. In order to gauge the success of these measures, a tracking system needs to be created. Reducing NPS pollution is tied to coastal hazards reduction because infrastructure improvements that address NPS pollution often also address coastal hazards issues. Stakeholders rated this priority 2.4/3.

Management Priority 4: Acquire a USACE general permit for coastal restoration projects

With the potential for dozens of CRMP projects to be funded over the next five years, a large hurdle and potential holdup in future project implementation is the time and resources it will take to acquire USACE permits for each project. If the GLO were able to obtain general permits from the USACE for a variety of different project types, projects could be completed more efficiently, and the coast could benefit from new coastal hazards reduction projects sooner. This management priority was suggested by several stakeholders during the 309 outreach process.

2. Identify and briefly explain priority needs and information gaps the CMP has for addressing the management priorities identified above. The needs and gaps identified here should not be limited to those items that will be addressed through a Section 309 strategy but should include any items that will be part of a strategy.

Priority Needs	Need? (Y or N)	Brief Explanation of Need/Gap
Research	Y	Analyze resilience: social, economic, ecological and infrastructure ; community barriers (i.e. colonias)
Mapping/GIS/modeling	Y	Improve topographic and bathymetry models. Develop and update infrastructure maps in GIS format for communities which still rely on paper records.
Data and information management	Y	Continue to populate GLO's coastal database and enhance data management platforms for on-site hazards response and assessments.
Training/Capacity building	Y	Green building/infrastructure for improved hydrology
Decision-support tools	Y	Community targeted decision-support tools
Communication and outreach	Y	Continue efforts to bring necessary data, tools, and professional assistance to local communities.
Other (specify)		

Enhancement Area Strategy Development:

1. Will the CMP develop one or more strategies for this enhancement area?

   Yes __X____
   No _____

2. Briefly explain why a strategy will or will not be developed for this enhancement area.

   Texas has taken a large step forward in tackling coastal hazards with the GLO's adoption of the CRMP. A suite of projects working in tandem provides great potential to mitigate from future hazards. However, more planning needs to be done to ensure that the correct resources are being allocated to the correct projects. The CMP will take on the challenge of developing a sediment management plan and acquiring general restoration permits for future coastal restoration projects.

Ocean Resources

In-Depth Resource Characterization:

Purpose: To determine key problems and opportunities to enhance the ability of state CMP to better address ocean and Great Lakes resources.

1. What are the three most significant existing or emerging stressors or threats to ocean and Great Lakes resources within your coastal zone? Indicate the geographic scope of the stressor, i.e., is it prevalent throughout the coastal zone, or are specific areas most threatened? Stressors can be land-based development; offshore development (including pipelines, cables); offshore energy production; polluted runoff; invasive species; fishing (commercial and/or recreational); aquaculture; recreation; marine transportation; dredging; sand or mineral extraction; ocean acidification; or other (please specify). When selecting significant stressors, also consider how climate change may exacerbate each stressor.

	Stressor/Threat	**Geographic Scope** (throughout coastal zone or specific areas most threatened)
Stressor 1	Unmapped Sediment Resources	Coastwide
Stressor 2	Characterization and Allocation of Sediments	Coastwide
Stressor 3	Inventory and Policy of Manmade Upland and Seafloor Hazards	Coastwide

2. Briefly explain why these are currently the most significant stressors or threats to ocean and Great Lakes resources within the coastal zone. Cite stakeholder input and/or existing reports or studies to support this assessment.

Texas has recently released various restoration plans that focus on massive coastwide ecosystem restoration projects. These projects, totaling billions of dollars, will require enormous volumes of sediment. Currently, potentially available sediments in Texas, especially offshore, are poorly mapped, not characterized, and lack a policy to govern how to prioritize for restoration projects.

To successfully complete these restoration goals and protect Texas ocean resources, Texas needs to develop a Sediment Management Plan. The Sediment Management Plan will enhance the mapping and inventorying of these crucial sediment resources coastwide. Once mapped, the sediments will be characterized and allocated to projects by priority. Important policy development and monitoring of sediment usage will be significant steps in the Plan's synthesis to ensure this critical resource is utilized the most efficient manner possible. Policy development will include CMP consistency reviews of oil and gas infrastructure emplacements and recommendations for decommissioning. Significant coordination efforts will be made with local stakeholders and regulatory stakeholders such as USFWS, USACE, BOEM, TPWD, Texas Historical Commission, and Rail Road Commission (RRC).

Another potential issue related to identifying and extracting sediments revolves around pipelines and other utility infrastructure. Specifically, Texas has one of the largest pipeline networks in the nation that includes infrastructure located and leased on state-owned submerged lands throughout bay systems and stretching as far as 10 nautical miles offshore, the extent of state jurisdiction over submerged lands (Figure 29). Derelict pipelines and other infrastructure currently present potential obstacles to

harvesting sediments needed for restoration and resiliency projects where they cross sediment sources that are suitable for beach nourishment, dune restoration, and other similar projects. Two regulatory agencies are involved with pipeline leasing and removal in Texas. The GLO owns the submerged land and issues leases for oil and gas structures. The RRC is the regulatory arm with jurisdiction over structure emplacement. Much of the current infrastructure in place in state waters was leased by now defunct companies, complicating issues involving the enforcement of proper structure removal. Moving forward, there is a need to enhance GLO oil and gas leasing standards and oversight of lessee structure removals and coordinate GLO sediment identification efforts with RRC's pipeline burial and structure placement programs in order to ensure newly discovered sediment sources will not be made physically or economically inaccessible by oil and gas structures. Communication between GLO and RRC is going to be key to manage sediment resources and areas free of structures.

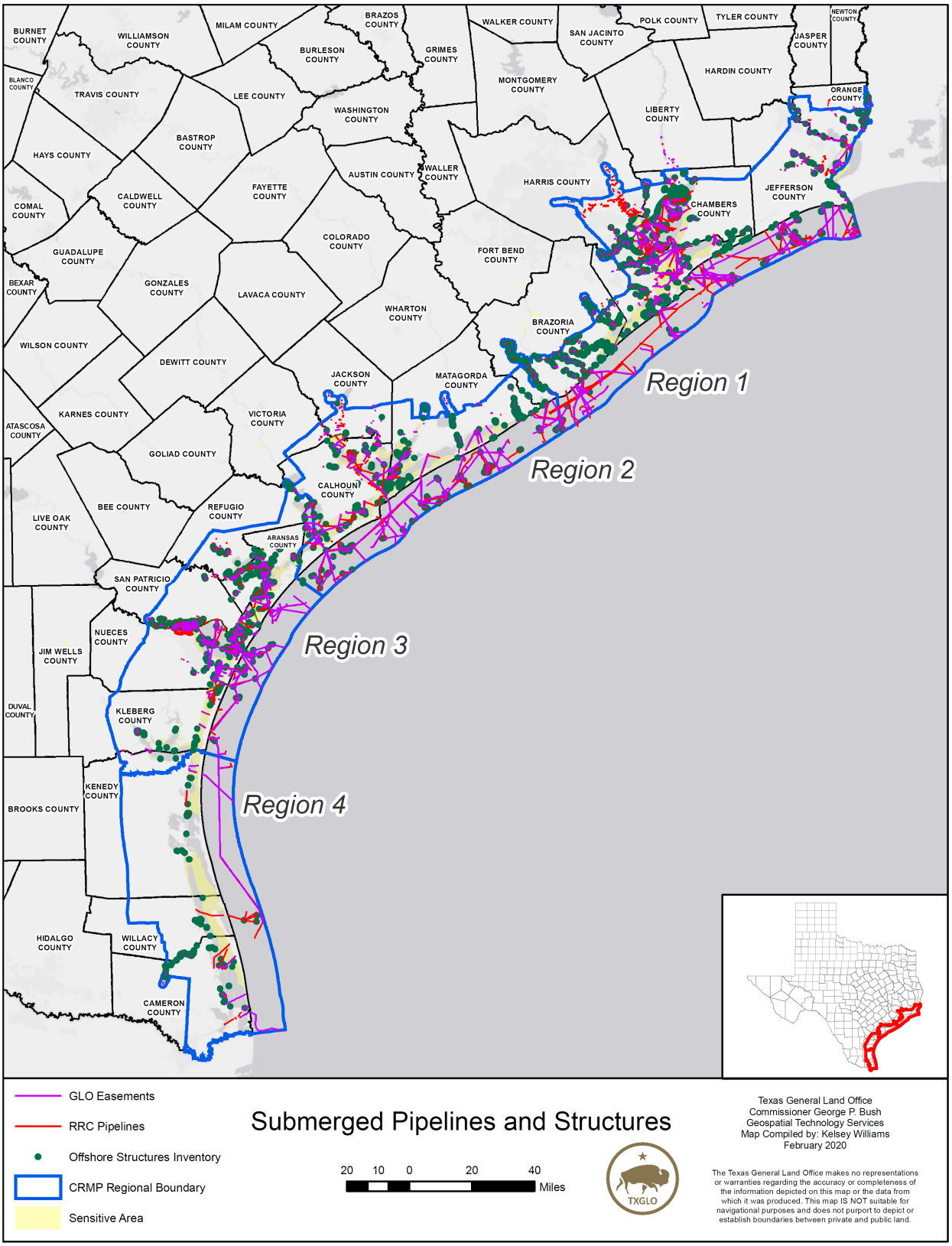

Figure 29. Map of all known pipelines and pipeline easements in the Texas Coastal Zone, Region 1.

Table 9. Number of known offshore structures and miles of pipelines and easements in Texas state waters.

Offshore Structures Inventory	
Offshore Structures Inventory in Sensitive Areas	1006
Offshore Structures Inventory Outside Sensitive Areas	2299
Total :	3305
Oil & Gas Wells in Sensitive Areas	2309
Railroad Commission Pipelines	
Length of RRC Pipelines in Sensitive Areas (Miles)	498.04
Length of RRC Pipelines Outside of Sensitive Areas (Miles)	4498.81
Total:	**4996.85**
GLO Issued Easements	
Length of GLO Easements in Sensitive Areas (Miles)	546.65
Length of GLO Easements Outside of Sensitive Areas (Miles)	2124.89
Total:	**2671.54**

3. Are there emerging issues of concern, but which lack sufficient information to evaluate the level of the potential threat? If so, please list. Include additional lines if needed.

Emerging Issue	Information Needed
Sediment Shortage / Competition	Sediment mapping surveys, allocation plans, cost-benefit analyses, policy
Limited capacity for reviewing permits	General Permits
Lack of information on offshore structures	Full inventory offshore pipeline and structures

An emerging issue the CMP foresees is a lack of capacity of GLO to apply for and amend, and USACE to review, dozens of individual permits for many restoration projects that it and its project partners require. Most construction projects within the coastal zone must be reviewed by USACE and USFWS for issues related to Waters of the U.S. and Endangered Species Act. With increases in funding that have become available for coastal restoration projects in Texas many more projects are coming up for permit development and review. Meetings with USACE and USFWS have revealed that as more projects go from the conceptual phase to construction, it will become harder to review them in a timely fashion that does not lead to a lengthy project timeline. A solution to this would be for the GLO to obtain a general permit related to a specific project type from USACE.

Regional General Permits (RGP) are issued for work that will result in only minimal adverse effects. A RGP is issued for a specific geographic area by an individual USACE District. Each RGP has specific terms and conditions, all of which must be met for project-specific actions to be verified. For example, a RGP for beach and dune nourishment would allow any beach nourishment projects, after they are confirmed to comply with conditions laid out in the RGP, to proceed to construction without having to obtain an individual permit. RGPs reduce bureaucracy while ensuring that all environmental laws are followed. With all the restoration projects currently being planned for the Texas coast (Master Plan 2019), obtaining RGPs is essential to ensure timely restoration success.

In-Depth Management Characterization:

Purpose: To determine the effectiveness of management efforts to address identified problems related to the ocean and Great Lakes resources enhancement objective.

1. For each of the additional ocean and Great Lakes resources management categories below that were not already discussed as part of the Phase I assessment, indicate if the approach is employed by the state or territory and if significant state- or territory-level changes (positive or negative) have occurred since the last assessment.

Significant Changes in Management of Ocean and Great Lakes Resources

Management Category	Employed by State or Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Changes Since Last Assessment (Y or N)
Ocean research, assessment, monitoring	Y	Y	Y
Ocean GIS mapping/database	Y	Y	Y
Ocean technical assistance, education, and outreach	Y	Y	Y
Other (please specify)			

2. For management categories with significant changes since the last assessment, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information.
    a. Describe significant changes since the last assessment;
    b. Specify if they were 309 or other CZM-driven changes; and
    c. Characterize the outcomes or likely future outcomes of the changes.

Ocean research, assessment, monitoring

GOMESA funds are currently being utilized to supplement funding for the local partner cost share of CEPRA projects that have been deemed to be of 'Tier 1' status per the GLO's Texas CRMP. These Tier 1 projects have been vetted and ranked as high priority to alleviating coastal issues of concern by members of the TAC (a group of over 200 coastal experts from a variety of coastal-related disciplines). The construction of many of these projects will lead to the identification of sediment source needs, therefore a structured sediment planning process is necessary. The CMP is also using GOMESA funding to fund large-scale (>$1M) research, restoration, and land acquisition projects it has not been able to fund in the past.

Ocean GIS mapping/database

The GLO has an extensive GIS database that includes products related to ocean resources such as: Oil & Gas Land Leases, Resource Management Codes, Lidar data, and Hard Minerals.

In terms of resources available for sediment identification, *TxSED* (https://cgis.glo.texas.gov/txsed/index.html) is a GLO hosted web viewer that shows sediment sampling sites in the Gulf of Mexico (GOM) and provides related information but requires expansion and adaptation to the large-scale sediment demands. The GLO is funding studies for analysis of longshore transport and sediment mapping of all sediments in the GLO's Master Plan Region 1 (Upper Coast)

including the paleo-Trinity River Basin.

The main challenges for TXSED include: legacy data location, diversity in formats and mediums and limited resources (GLO staff timing and funding). Early design considerations included: focus on geotechnical data available, finding common denominators for GIS attribute tables (ex. sand/silt/clay percentages), and data presented "as is" with no added interpretations. The original technologies used were ESRI ArcGIS and Xerox DocuShare. Workflow included data processing, databases, web servers and an interface for use by the public. The GLO tries to use the best available data, which includes metadata and all supporting documentation. The process was time consuming with students-interns scanning, digitizing, and drafting metadata. The GLO intends to analyze ways to synthesize existing databases into one that will allow better project planning and sediment source allocation to restoration projects. The updated database will include all geophysical and geotechnical data, sensitive areas, onshore and offshore manmade hazards, and potential cultural resources that will be updated monthly with any new information resulting from projects or CMP consistency reviews.

Ocean technical assistance, education, and outreach
Please see below for information about a GLO-run workshop on sediment management throughout the GOM.

3. Identify and describe the conclusions of any studies that have been done that illustrate the effectiveness of the state's or territory's management efforts in planning for the use of ocean and Great Lakes resources since the last assessment. If none, is there any information that you are lacking to assess the effectiveness of the state's or territory's management efforts?

From August 20 to 22, 2019 the GLO's Coastal Resources Program and the USACE Galveston District H&H Group hosted the Texas Coastal Sediment Workshop, coordinated by Freese and Nichols, Inc. The workshop brought together GOM experts in large-scale sand source investigations and environmental restoration projects that use large amounts of GOM sediments. This was a CZM funded effort (CMP Cycle 23 18-127-027-B474).

The goal of the workshop was to educate stakeholders and local coastal engineering firms on how large-scale restoration projects are being developed on the Texas coast and throughout the GOM. These coastal protection and restoration projects will require large amounts of sediment that will have to be transported from as far as 20 and 50 miles away from the project site.

The workshop covered two main goals:

- Identify large scale potential sand sources available in the GOM Region for future investigations and restoration projects.
- Identify specific goals and data collection needs to expedite the project delivery and completion of coastal protection and restoration projects.

The participants of the workshop were:

- Texas General Land Office (GLO)
- US Army Corps of Engineers Galveston District (USACE)
- US Army Corps of Engineers Engineering Research and Development Center (ERDC)
- Bureau of Environmental Management, Department of the Interior (BOEM)
- US Fish and Wildlife Service (USFWS)
- National Ocean and Atmospheric Administration (NOAA) Marine Fisheries Program

- Texas Parks and Wildlife Department (TPWD)
- Texas Historical Commission
- Texas Commission for Environmental Quality

At the end of the workshop, the group had suggestions on a path forward. There was a consensus to develop a Texas Sediment Working Group with a lead agency. The GLO volunteered to lead and support the group of stakeholders. More Texas sediment presentations and workshops will be developed through the Texas American Shoreline and Beach Preservation Association chapter. The RRC and U.S. Bureau of Safety and Environmental Enforcement would also be included in these meetings. Finally, the GLO would determine the needs assessment which will drive the funding in the short- and long-term. There was agreement that these workshops needed to be held annually to let each organization update each other and build momentum for future policy.

A full description of the recommended actions, listed here, are found in the Final Technical Memo for the project:

1. In-Situ Sediment Borrow Sources Investigations Program
2. Innovative Technologies for Sediment Delivery Program
3. Dredged Material Placement Area Sediment Borrow Source Investigations Program
4. Sediment Science and Technology Task Force
5. Regional Beneficial Use of Dredge Material Task Force
6. "Engineering with Nature" Program
7. Funding Strategies for Regional Sediment Management and BUDM Programmatic Efforts
8. Post-Storm Sediment Management Program
9. Expansion of TxSED Program
10. Adopting successful policies from other Gulf states

Identification of Priorities:

1. Considering changes in threats to ocean and Great Lakes resources and management since the last assessment and stakeholder input, identify and briefly describe the top one to three management priorities where there is the greatest opportunity for the CMP to improve its ability to effectively plan for the use of ocean and Great Lakes resources. *(Approximately 1-3 sentences per management priority.)*

   Management Priority 1: Identification and allocation of ocean bottom sediment sources for coastal restoration projects

   Implementing CRMP projects is a priority for Texas. However, given the large number of marsh, beach, and dune restoration projects planned, there is a dire lack of sediments identified to bring projects to completion. Research into potential sediment sources, as well as a comprehensive plan on what to do with identified resources, needs to be established. Stakeholders rated this priority 2.4/3.

   Management Priority 2: Receive state-wide general permits from the US Army Corps of Engineers for different types of coastal restoration projects

   See Coastal Hazards Management Priority 4

2. Identify and briefly explain priority needs and information gaps the CMP has to help it address the management priorities identified above. The needs and gaps identified here do not need to be limited to those items that will be addressed through a Section 309 strategy but should include any items that will be part of a strategy.

Priority Needs	Need? (Y or N)	Brief Explanation of Need/Gap
Research	Y	Identification of locations and quality of sediment
Mapping/GIS	Y	Updated and expanded sediment source maps; data synthesis, data sharing
Data and information management	Y	Updated, expanded, and integrated sediment database
Training/Capacity building	N	
Decision-support tools	Y	Prioritization of projects for known sediment sources
Communication and outreach	N	
Other (specify)		

Enhancement Area Strategy Development:

1. Will the CMP develop one or more strategies for this enhancement area?
   Yes __X____
   No _____

2. Briefly explain why a strategy will or will not be developed for this enhancement area.

To complete and maintain the USACE and Texas restoration projects, millions of cubic yards of sediments need to be identified. This sediment will need to be cataloged into a database which can be used to develop a comprehensive sediment management plan. It is also necessary to establish general restoration permits with the USACE to expedite permitting and accelerate coastal restoration. This will require large-scale multi-agency collaboration and new dedicated resources. This is a ripe challenge for the CMP to take on during this 309 funding cycle.

Proposed Strategies for CMP Enhancement

Texas Sediment Management Plan

I. *Issue Areas*

The proposed strategy or implementation activities will support the following high-priority enhancement areas *(check all that apply)*:

- ☐ Aquaculture
- ☐ Energy and Government Facility Siting
- ☒ Coastal Hazards
- ☒ Ocean/Great Lakes Resources
- ☐ Special Area Management Planning
- ☐ Cumulative and Secondary Impacts
- ☐ Wetlands
- ☐ Marine Debris
- ☐ Public Access

II. Strategy Description

A. The proposed strategy will lead to, or implement, the following types of program changes *(check all that apply):*

- ☐ A change to coastal zone boundaries;
- ☐ New or revised authorities, including statutes, regulations, enforceable policies, administrative decisions, executive orders, and memoranda of agreement/understanding;
- ☐ New or revised local coastal programs and implementing ordinances;
- ☐ New or revised coastal land acquisition, management, and restoration programs;
- ☐ New or revised special area management plans (SAMP) or plans for areas of particular concern (APC) including enforceable policies and other necessary implementation mechanisms or criteria and procedures for designating and managing APCs; and,
- ☒ New or revised guidelines, procedures, and policy documents which are formally adopted by a state or territory and provide specific interpretations of enforceable CZM program policies to applicants, local government, and other agencies that will result in meaningful improvements in coastal resource management.

B. ***Strategy Goal:*** _____.

State the goal of the strategy for the five-year assessment period. The goal should be the specific program change to be achieved or be a statement describing the results of the project, with the expectation that achieving the goal would eventually lead to a program change. For strategies that implement an existing program change, the goal should be a specific implementation milestone. For example, work with three communities to develop revised draft comprehensive plans that consider future sea level rise or, based on research and policy analysis, present proposed legislation on wetland buffers to state legislature for consideration. Rather than a lofty statement, the goal should be achievable within the time frame of the strategy.

The goal of this strategy is to enhance and streamline coastal restoration and resiliency in Texas by creating a Texas Sediment Management Plan (SMP) to promote the preservation of biological, cultural, and economic resources needed to rebuild coastlines, safeguard state assets, delineate resources to inform long term planning and ensure protection from activities that might otherwise permanently obstruct access to resources. Through strategic resource management planning and early coordination with regulatory officials, the Texas General Land Office will develop a SMP that characterizes sediment resources in GLO-owned uplands and submerged land tracts, expand current policy related to sediment

sources, and allow Texas to have a plan to acquire, allocate, and utilize sediments for coastal restoration projects.

One of the key components of the SMP is improving the permitting of sand sources and identifying ways to eliminate obstacles to acquiring sand for coastal restoration projects. To do this, the GLO will work with the USACE to develop a Regional General Permit (RGP) for beach and dune nourishment projects. It is critical that the GLO develop a standardized method for applying for a USACE RGP permit for these projects, and has successfully utilized the RGP process to accomplish this in the past. The goal is to clearly identify all information that is required to obtain a RGP, provide that to the USACE in a standardized manner, and get the review from the USACE and other agencies in a defined amount of time. Having a standardized means of getting an RGP will allow for better planning of projects, and minimize the time needed to implement these critical projects when funding becomes available.

In tandem, a SMP and RGPs would lead to multiple program enhancements that would increase management efficiency by reducing regulatory overburden which would result in more frequent construction of coastal restoration projects along the Texas coast, saving money along the way. Many steps must be taken to achieve these two goals including:

a) Identifying a conceptual framework for the sediment needs of the Texas coast
b) Identifying and characterizing sediment resources
c) Establishing borrow areas for project utilization
d) Updating and expanding current databases and applications with sediment and borrow area data and useful project planning tools for internal and public use
e) Updating and expanding current policy on sediment resources, newly identified sensitive areas and cultural resources, and manmade hazards
f) Expanding outreach through workshops, sister agency engagement, and publicly available databases
g) Creation and adoption of the Texas Sediment Management Plan
h) Obtaining an RGP for beach and dune nourishment projects

C. *Describe the proposed strategy and how the strategy will lead to and/or implement the program changes selected above. If the strategy will only involve implementation activities, briefly describe the program change that has already been adopted, and how the proposed activities will further that program change. (Note that implementation strategies are not to exceed two years.)*

Texas has several master plans, including the Texas Coastal Resiliency Master Plan (CRMP) and the Texas Coastal Study, that strive to enhance the resiliency and protection of Texas coastal ecosystems. To accomplish the goals and projects delineated within these master plans, millions of cubic yards of sediment will be required. In addition to the GLO, federal, state, and local entities also have Texas coastal restoration projects that will require sediment and would benefit from the creation of the SMP and acquisition of RGPs related to beach and dune nourishment.

To further coastal restoration efforts, the CMP will facilitate the creation of a SMP. The SMP will allow the state to characterize offshore sediment resources, enhance existing sediment databases, prioritize projects, and create new policy related to offshore resources and infrastructure, and provide Texas with a systematic way to ensure a healthy coast for decades.

Along with the creation of the SMP, the CMP will also facilitate obtaining RGPs from USACE for various coastal restoration activities. RGPs establish a checklist of environmental compliance and regulatory requirements that, if a project complies with, will not require the project to seek an individual USACE permit. This allows project implementers to accelerate project timelines by not having to go through the regulatory process of applying for an USACE permit for each individual project. Pairing the creation of the SMP together with obtaining RGPs is a crucial step to accelerate building up resiliency along the Texas coast.

Creating the SMP and obtaining RGPs will involve intense coordination between state and federal resource agencies, universities, contractors, local and state stakeholders, and other experts.

III. Needs and Gaps Addressed

Identify what priority needs and gaps the strategy addresses, and explain why the proposed program change or implementation activities are the most appropriate means to address the priority needs and gaps. This discussion should reference the key findings of the assessment and explain how the strategy addresses those findings.

The SMP developed under this strategy will address many identified gaps and needs including: identifying offshore sediment resources, characterizing those resources, and creating policy to maximize efficient use of the resources. In addition, obtaining RGPs will remove potential barriers to project implementation. Unknown sediment sources will be identified using known data and geomorphological information to plan and survey for additional sediment sources. Due to the complexity and scale of sediment needs and assumed deficiencies in Texas, a SMP and the use of RGPs are the best ways to address the priority needs for coastal resiliency. Coordinating efforts across multiple agencies now will increase efficiency in the future as more coastal restoration projects are implemented. Creating the SMP could reduce end-user conflicts for available sediment, accelerate post-storm recovery efforts, and enact cost savings by grouping projects into regionally delineated sediment source areas.

IV. Benefits to Coastal Management

Discuss the anticipated effect of the strategy, including the scope and value of the strategy, in advancing improvements in the CMP and coastal management, in general.

Creating a SMP and obtaining RGPs will greatly benefit resiliency efforts and the management of the Texas coast by:

- Identifying, characterizing, and allocating available sediment sources for restoration projects
- Providing secondary identification of sensitive areas and cultural resources
- Increasing coordination between state agencies
- Increasing coordination between state and federal agencies
- Developing new policies related to coastal sediments and project development
- Expanding and updating a centralized sediment database
- Creating of new sediment- and project-related tools
- Expediting coastal restoration projects through RGPs

This strategy will expand upon the success of the CRMP, an initiative started under the 2011-2015 309

strategy. The CRMP, finalized in 2017, identified 123 high-priority projects to enhance coastal resiliency. Many of those projects have moved into the design and construction phases. The adoption of the SMP, which will identify sand for beach and dune nourishment projects, along with the RGP, which will allow for accelerated coastal restoration, will allow Texas to shore up its beaches to protect from future hazards and provide recreation to the public at a rate it has never done in the past.

V. Likelihood of Success

Discuss the likelihood of attaining the strategy goal and program change (if not part of the strategy goal) during the five-year assessment cycle or at a later date. Address the nature and degree of support for pursuing the strategy and the proposed program change, as well as the specific actions the state or territory will undertake to maintain or build future support for achieving and implementing the program change, including education and outreach activities.

Creating a Texas SMP will be an ambitious undertaking requiring extensive coordination and resources beyond what may be directly funded under a 309 strategy. The GLO recognizes the importance of establishing an SMP to better facilitate the CMP and other programs within the GLO's Coastal Resources Division. Many aspects of the plan will be funded under alternative funding streams, and those are being identified internally at the GLO. The momentum behind the development of this plan is high, and the CMP is confident about the creation of a plan within five years.

VI. Strategy Work Plan

Using the template below, provide a general work plan that includes the major steps that will lead toward or achieve a program change or implement a previously achieved program change. For example, even if the final adoption of the program change is outside of the CMP's control, what steps will be included in the work plan so the CMP ensures the program change is considered, reviewed, and hopefully adopted by the outside entity? Who are the other stakeholders or elected officials that need to be engaged, and how and when during the strategy development process? What is the decision-making or voting process that is involved in the adoption of the program change, and how will the CMP interact with this process to ensure that the proposed program change is considered? If the state intends to fund implementation activities for the proposed program change, describe those in the plan as well. The plan should identify a schedule for completing the strategy and include major projected milestones (key products, deliverables, activities, and decisions) and budget estimates. If an activity will span two or more years, it can be combined into one entry (i.e., Years 2-3 rather than Year 2 and then Year 3). While the annual milestones are a useful guide to ensure the strategy remains on track, OCM recognizes that they may change somewhat over the course of the five-year strategy due to unforeseen circumstances. The same holds true for the annual budget estimates. Further detailing and adjustment of annual activities, milestones, and budgets will be determined through the annual cooperative agreement negotiation process.

Strategy Task 1: Creation and Adoption of the Texas Sediment Management Plan

Years: 1 - 5

Total Budget: $1,970,000

Year: 1

Description of Activities:
The GLO's Coastal Resources division will establish a SMP work group consisting of subject matter experts related to sediments, natural resources, and policy. The work group will create a table of contents outlining the structure of the SMP and, based on the table of contents, the GLO will either contract out or create in-house a series of technical memos that will contribute data and information needed to successfully complete the SMP.

The first technical memo will delineate all known programs and plans that oversee or provide funds for coastal restoration that will require sediment now and in the future. The programs and plans will be established on the basis and type of need; restoration, recurring, and resiliency. The document will layout case studies of each for the reader to gain a better sense of what each category means.

A second technical memo will consist of a literature review that provides a geological history of Texas and Texas offshore environment; giving insight into Texas' many ecosystems and environments of deposition from which sediment will be mapped. The memo will rank geographical areas in order of need for identification and any current or ongoing sediment mapping efforts will be noted. The memo will also establish the types of sediment typically found in these locations and develop a lithological characterization for sediment mapping based on sediment quality.

The third technical memo will provide a literature review of other state's SMPs and a list of recommended actions for Texas to take when developing its SMP.

In order to identify data needed to create the SMP, the GLO will host a workshop to gather input from external stakeholders and keep our partners up to date on development of the SMP. This workshop may be related to sediment sourcing, policy, or other issues. A final report from the workshop will capture the discussion of the workshop, sediment source investigation and management proposals formulated during the workshop, and recommendations and justifications for future sediment source investigations.

The workshop that the GLO will host early in Year 1 is expected to identify any currently unforeseen data or information gaps that are needed to create the SMP. This could potentially be a sand source investigation or a desktop information study. The CMP will potentially fund at least one of these studies and produce a technical memo that will be incorporated into the SMP.

The GLO currently oversees the Texas Sediment Database (TxSED) which allows the public to access data and reporting efforts from previous sediment mapping and coring efforts from studies funded by the GLO, USACE, and universities. The database will be updated with new data, upgraded to be better integrated with other external databases, and the resource management codes for sediment data layer will be updated. The GLO will work with its GIS and Enterprise Technology Solutions (ETS) departments to determine the best course of action for updating TxSED. TxSED needs an upgrade to make it more compatible with other sediment databases, such as BOEM's Marine Minerals Information System (MMIS). Another goal is to make the database more user-friendly and intuitive, and to add sediment source mapping capabilities for specific projects. The GLO is expected to hire a business analyst, who will work in conjunction with GIS, ETS, and CMP to update and upgrade TxSED. The goal is to make inputting new data into the database easy and complementary to previously existing data. There is also a need to build out

the database into a GIS format, such as switching the database to a format such as ArcGIS. Ultimately, the database should mesh together TxSED, RMC Code Viewer, and Offshore Structures Applications with a project planning tool to aid the public and professionals when designing projects. GIS will hire an intern to help out with any TxSED improvement work.

In order to develop policy measures related to sediments, the CMP will engage internal GLO divisions and sister agencies. Policy regarding seismic permitting, oil and gas infrastructure, environmental compliance, and permitting borrow areas will be prioritized. In particular, the GLO will explore specific policies related to special conditions related to pipelines in borrow source areas and sand source tracks. These policies will compliment current efforts to reduce pipeline leasing lengths on state-owned submerged lands to five years. The CMP will also establish Geographic Location Descriptions (GLD) to characterize OCS areas where Federal Consistency Reviews should be conducted related to unlisted activities. In Year 1, the GLO will form a sediment policy workgroup.

Key Products/deliverables

- Establish work group
- Spreadsheet containing list of all resources the GLO currently has related to sediment resources and what resources still need to be identified
- Table of contents for SMP
- Conceptual framework memo
- Geological Background and Geographical Locations Memo
- Other State's SMP literature review memo
- Report from sediment workshop
- Mutual agreement between CMP, GIS, and ETS on a path forward for updating TXSED
- Hire GIS intern
- Sediment policy workgroup members list and meeting notes
- Draft GLD memo

Budget: $225,000

Year: 2
Description of Activities:
The GLO will continue to work with the business analyst on upgrading TxSED.

The workshop that the GLO will host in Year 1 is expected to identify any currently unforeseen data or information gaps that are needed to create the SMP. This could potentially be a sand source investigation or a desktop information study. The CMP will fund at least one of these studies and produce a technical memo that will be incorporated into the SMP.

The sediment policy workgroup will continue to meet to formulate policy related to the SMP. A list of recommended policy changes will be developed.

Key Products/deliverables

- Business analyst hired to lead TxSED upgrade
- Progress report on TxSED upgrade
- Technical memo from expected study
- Sediment policy workgroup members list and meeting notes

- List of recommended policy changes

Budget: $425,000

Year 3:
Description of Activities:
The GLO will continue to work with the business analyst on upgrading TxSED.

The workshop that the GLO will host in Year 1 is expected to identify any currently unforeseen data or information gaps that are needed to create the SMP. The CMP will fund at least one of these studies and produce a technical memo that will be incorporated into the SMP.

In order to identify data needed to create the SMP, the GLO will host a workshop to gather input from external stakeholders and keep our partners up to date on development of the SMP. This workshop may be related to sediment sourcing, policy, or other issues. A final report from the workshop will capture the discussion of the workshop, sediment source investigation and management proposals formulated during the workshop, and recommendations and justifications for future sediment source investigations.

The sediment policy workgroup will continue to meet to formulate policy related to the SMP. Approved policies will be incorporated into the draft SMP.

Key Products/deliverables

- Progress report on updating TxSED
- Technical memo from expected study
- Report from sediment workshop
- Sediment policy workgroup update

Budget: $425,000

Year: 4
Description of Activities:
The TxSED database will continue to be updated with new data as it comes in. The database will also continue to be converted to a more user-friendly GIS format.

The workshop that the GLO will host in Year 3 is expected to identify any currently unforeseen data or information gaps that are needed to create the SMP. The CMP will fund at least one of these studies and produce a technical memo that will be incorporated into the SMP.

The sediment policy workgroup will continue to meet to formulate policy related to the SMP. Approved policies will be incorporated into the draft SMP.

Key Products/deliverables

- Progress report on updating TxSED
- Technical memo from expected study
- Summary of engagement with relevant agencies and stakeholders
- Sediment policy workgroup update
- Draft SMP

Budget: $430,000

Year: 5
Description of Activities:
The TxSED update will be completed during this year. A user manual will detail its contents and give users information on accessibility.

The GLO will host a workshop to roll out the SMP to our stakeholders and inform them of updated policies. Stakeholders will be encouraged to continue to provide input on the implementation phase of the SMP.

All products from previous goals will lead into the creation of the SMP document. The SMP will be developed by the GLO with input from outside agencies. While the CMP will compile the document, we will hire a contractor to do the layout for the final plan.

Key Products/deliverables

- TxSED user manual
- Approved policies included in the SMP
- Report from sediment workshop
- Final SMP

Budget: $470,000

Strategy Goal 2: The GLO will acquire a regional general permit for beach nourishment projects from USACE

Total Years: 1-5
Total Budget: $605,000

In February 2020, the GLO, USFWS, and USACE held an initial meeting to discuss the feasibility of obtaining RGPs for systematic coastal restoration in Texas. The GLO wanted to ensure the USFWS and USACE would be willing to support RGPs if all environmental and regulatory compliance were included in the RGPs. Based on positive feedback from this meeting, the CMP decided to pursue this endeavor as a strategy to compliment the creation of the SMP and enhance coastal restoration efforts in Texas. The CMP will initially facilitate the GLO's efforts to pursue a RGP for beach nourishment projects in years 1-5. The RGP will establish success, permitting, and monitoring criteria. Based on lessons learned from this first coordination effort with USFWS and USACE, the CMP has the potential to facilitate the GLO's efforts to obtain RGPs for borrow source identification and living shorelines.

Year: 1
Description of activities:
The GLO will continue to coordinate with the USFWS and USACE in obtaining a RGP for beach nourishment. This will involve communicating with all relevant agencies as the permit is developed to ensure all environmental and regulatory compliance is included.

Based on early coordination with the USACE and USFWS, one potential barrier to regulatory approval for a beach nourishment RGP would be the current lack of data on how benthic fauna respond following beach nourishment. Therefore, the GLO will fund a study to investigate and gather data related to benthic faunal response to beach nourishment in Texas. This study will look at the benthic community from several different beaches that have been nourished over the past several years (anywhere from 3 months post nourishment to 5 years) and compare that to the benthic community of a pristine, non-nourished reference beach. The CMP will coordinate with the USFWS and USACE to determine specific sampling protocols that would satisfy RGP requirements. The CMP will potentially begin work to acquire RGPs for borrow source identification and living shorelines with priority focused on acquisition of the beach nourishment RGP.

Major Milestone(s):
- Notes from coordination meetings with USFWS and USACE
- Benthic surveys

Budget: $290,000

Year: 2
Description of activities:
The GLO will continue to closely coordinate with the USACE and USFWS on obtaining a RGP for beach nourishment projects. The GLO will hire a contractor to begin gathering information to address USACE and USFWS concerns and begin drafting a permit.

The GLO expects the results from the benthic surveys in Year 2.

As able, the CMP will potentially begin work to acquire RGPs for borrow source identification and living shorelines with priority focused on acquisition of the beach nourishment RGP.

Major Milestone(s):

- Notes from coordination meetings with USFWS and USACE
- Contractor selected to write permit
- Final report from benthic surveys

Budget: $90,000

Year: 3
Description of activities:
The GLO will continue to closely coordinate with USACE and USFWS on obtaining a RGP for beach nourishment projects. The contractor will continue to aid with research and permit writing. As able, the CMP will potentially begin work to acquire RGPs for borrow source identification and living shorelines with priority focused on acquisition of the beach nourishment RGP.

Major Milestone(s):

- Notes from coordination meetings with USFWS and USACE
- Report from contractor

Budget: $90,000

Year: 4
Description of activities:
The GLO will continue to closely coordinate with USACE and USFWS on obtaining a RGP for beach nourishment projects. A draft permit will be drafted for internal and stakeholder review. As able, the CMP will potentially begin work to acquire RGPs for borrow source identification and living shorelines with priority focused on acquisition of the beach nourishment RGP.

Major Milestone(s):

- Notes from coordination meetings with USFWS and USACE
- Draft permit completed

Budget: $90,000

Year: 5
Description of activities:
The GLO will continue to closely coordinate with USACE and USFWS on obtaining a RGP for borrow source identification. The GLO will submit its permit to USACE for approval. As able, the CMP will potentially begin work to acquire RGPs for borrow source identification and living shorelines with priority focused on acquisition of the beach nourishment RGP.

Major Milestone(s):

- Draft permit submitted to USACE

Budget: $45,000

I. ***Fiscal and Technical Needs***

A. Fiscal Needs: *If 309 funding is not sufficient to carry out the proposed strategy, identify additional funding needs. Provide a brief description of what efforts the CMP has made, if any, to secure additional state funds from the legislature and/or from other sources to support this strategy.*

Creating a Texas SMP will be a complicated effort needing input and guidance from a variety of technical stakeholders and with contributions from multiple funding streams. The strategy work plan above only mentions tasks that will have designated CMP 309 funding. Other efforts related to completing the SMP, such as funding research and data collection, are expected to cost $10M+ and will be funded through alternative funding sources, such as the Gulf of Mexico Energy Security Act and GLO's surface damage funding. All of these activities will be acknowledged in progress reports as they are also crucial to the creation of the SMP.

B. Technical Needs*: If the state does not possess the technical knowledge, skills, or equipment to carry out all or part of the proposed strategy, identify these needs. Provide a brief description of what efforts the CMP has made, if any, to obtain the trained personnel or equipment needed (for example, through agreements with other state agencies).*

The GLO is fortunate to have many sediment and geologic experts on its staff and has the available knowledge to identify the components that will go into the SMP. However, the GLO's capacity is limited. There will be certain parts of the plan that will be contracted outside of the agency. Those are all identified in the strategy work plan.

II. ***Projects of Special Merit (Optional)***

If desired, briefly state what projects of special merit the CMP may wish to pursue to augment this strategy. (Any activities that are necessary to achieve the program change or that the state intends to support with baseline funding should be included in the strategy above.) The information in this section will not be used to evaluate or rank projects of special merit and is simply meant to give CMPs the option to provide additional information if they choose. Project descriptions should be kept very brief (e.g., undertake benthic mapping to provide additional data for ocean management planning). Do not provide detailed project descriptions that would be needed for the funding competition.

The CMP will apply for projects of special merit to supplement the SMP, as its creation will be more expensive than allocated 309 funding. Projects will likely be to conduct further studies to map benthic areas to identify sediment resources. Other projects may also be explored as they arise.

5-Year Budget Summary by Strategy

At the end of the strategy section, please include the following budget table summarizing your anticipated Section 309 expenses by strategy for each year. Generally, CMPs should only develop strategies for activities that the state intends to fund and work on given their anticipated level of Section 309 funding. However, in some circumstances, CMPs may wish to use the assessment and strategy development process as a broader strategic planning effort for the CMP. In that case, the CMP may elect to include additional strategies that exceed the state's anticipated Section 309 funding over the five-year period. If the CMP chooses this approach, it should still clearly indicate which strategies it anticipates supporting with Section 309 funding and which strategies it anticipates supporting through other funding sources.

Strategy Title	Anticipated Funding Source (309 or Other)	Year 1 Funding	Year 2 Funding	Year 3 Funding	Year 4 Funding	Year 5 Funding	Total Funding
Creation and Adoption of the Texas Sediment Management Plan	309	**$515,000**	**$515,000**	**$515,000**	**$515,000**	**$515,000**	**$2,575,000**
Total Funding		**$515,000**	**$515,000**	**$515,000**	**$515,000**	**$515,000**	**$2,575,000**

Stakeholder and Public Engagement

Stakeholder Input

Input for Phase I was requested through phone calls and emails to selected stakeholders and coastal partners. These stakeholders and partners, formally known as the Coastal Coordination Advisory Committee (CCAC), represented State agencies and local government including: Texas Sea Grant, Texas Commission on Environmental Quality, Texas Parks & Wildlife Department, Texas Water Development Board, the General Land Office, Texas Railroad Commission, and Texas Department of Transportation. Pertinent information and data was added to various sections of Phase I based on input. For example, TPWD provided crab trap data, while the GLO's Beach Cleanup team provided information on marine debris. After Phase I was drafted in October 2019, the CCAC was sent a draft to provide any further comments on and to rank each priority area as either high, medium, or low. All comments were addressed and incorporated into Phase I, and each priority area was given a designation based on CCAC input.

Input for Phase II was conducted differently. In order to increase CCAC participation and decrease time burdens for review, the CMP compiled dozens of different potential management priorities and polled stakeholders on their perceived importance. Stakeholders were asked to rank each management priority as either High Priority (3 points), Medium Priority (2 points), Low Priority (1 point), or Not a Priority (0 points). The score for each priority was calculated and used to list out 3-4 management priorities for Wetlands, Coastal Hazards, and Ocean Resources.

Based on CCAC voting and input on the potential management priorities, it was clear that the best action the CMP could take over the next 5 years would be to develop a strategy around sediment management. The CMP convened a workgroup in January 2020 to begin to formulize the work plan for a Sediment Management Plan (SMP). This involved input from various stakeholders, including many divisions within the GLO (CEPRA, CMP, NRDA, Oil and Gas, ETS, Legal) and other outside entities, such as BOEM. Many more stakeholders will be brought in to assist with the development of the SMP once the strategy kicks off.

The CCAC was sent a draft of Phase II and the SMP strategy in April, and all comments have been incorporated into this document.

On May 22, 2020, the final 309 document was made available for public comment through the Texas Register. The public comment period closed on June 22, 2020.

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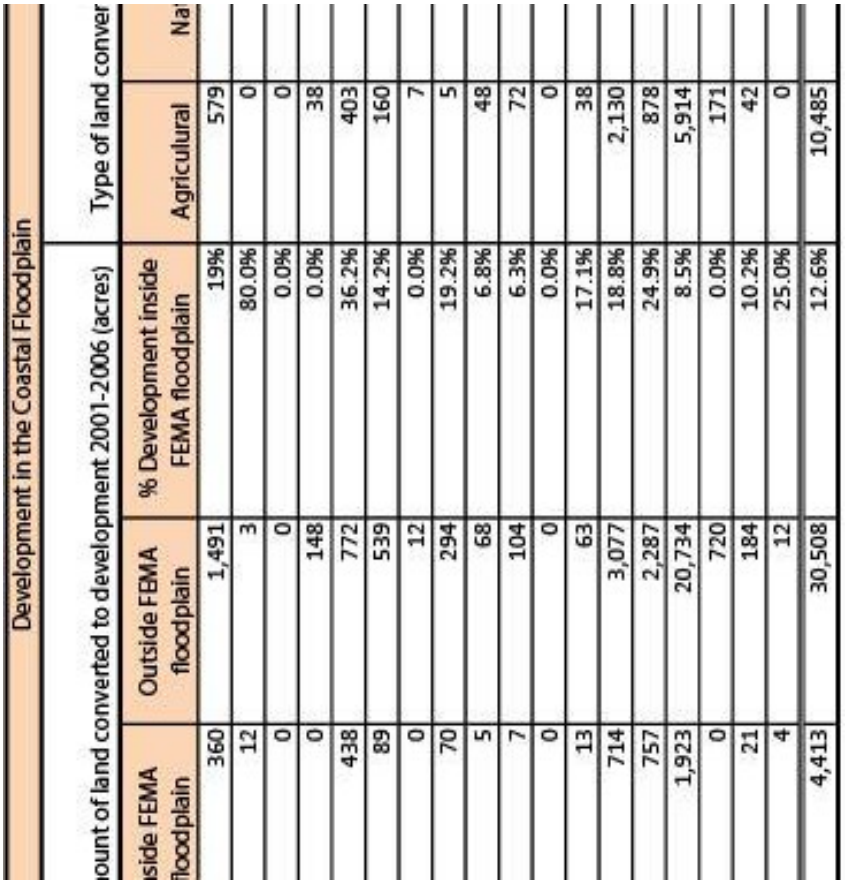
Appendices

Appendix A: Land conversion in the coastal floodplain



Development in the Coastal Floodplain				Type of land conver	
nount of land converted to development 2001-2006 (acres)					
nside FEMA floodplain	Outside FEMA floodplain	% Development inside FEMA floodplain	Agricultural	Na
360	1,491	19%	579	
12	3	80.0%	0	
0	0	0.0%	0	
0	148	0.0%	38	
438	772	36.2%	403	
89	539	14.2%	160	
0	12	0.0%	7	
70	294	19.2%	5	
5	68	6.8%	48	
7	104	6.3%	72	
0	0	0.0%	0	
13	63	17.1%	38	
714	3,077	18.8%	2,130	
757	2,287	24.9%	878	
1,923	20,734	8.5%	5,914	
0	720	0.0%	171	
21	184	10.2%	42	
4	12	25.0%	0	
4,413	30,508	12.6%	10,485	