

# **Guadalupe-Blanco River Authority**

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## **COMPREHENSIVE LAND AND CONSERVATION EASEMENT MAPPING PLAN**

**April 2021**

*Prepared for*



**Guadalupe-Blanco River Authority**

*Prepared by*

**Blanton  
& Associates**

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## 1.0 INTRODUCTION

The Guadalupe-Blanco River Authority (GBRA) initiated this plan as a tool for identifying comprehensive land and conservation easement protection opportunities within the Guadalupe River basin and the coastal bays and estuaries that depend on the river. The primary emphasis of this plan is to provide an effective means to direct future habitat protection for the whooping crane (*Grus americana*).

The GBRA and The Aransas Project (TAP) developed a shared concept toward protecting the overall health of the Guadalupe River system and San Antonio Bay in February 2016 (GBRA-TAP 2016a). The initial agreement included several specific focal points, such as water reallocation and management, habitat for various federally protected species, Guadalupe River Delta preservation and restoration, and market-based mechanisms that would determine the cost of surface water and could be used to make changes to the watershed. This joint concept would be implemented by utilizing federal, state, and private funding to conduct research activity around these focal points, which in turn would be used to develop concrete proposals to solve problems.

In November 2016, the agreement was restructured to focus on two major topic areas: 1) habitat, endangered species, and land stewardship; and 2) the future of water supply and water development within the watershed (GBRA-TAP 2016b). The changes to the agreement stem from past conflicts between development of water supplies to meet the needs of a growing population and economy and needs of the lower Guadalupe Basin ecosystem, the San Antonio Bay fishery, and rare and endangered species that occupy these regions.

The GBRA and TAP also worked together in 2017, under a grant from the Mitchell Foundation, to develop four key concepts to implement the agreement. These are (1) whooping crane habitat expansion, (2) realizing the potential of the Guadalupe River Delta, (3) ensuring sufficient fresh water inflows to maintain a refugium area in San Antonio Bay during drought conditions, and (4) working with landowners within the watershed to establish a market for buying and selling ecosystem services that would, among other things, augment base flows in the Guadalupe and San Antonio River systems (GBRA-TAP 2018).

The primary purpose of this comprehensive land and easement mapping plan is for use in implementing the GBRA-TAP agreement and as an initial step in the future development of a comprehensive Guadalupe River Habitat Conservation Plan (GRHCP). This comprehensive land and easement mapping plan is intended to facilitate identification of areas suitable for expanding the important coastal and inland habitats for wintering whooping cranes in San Antonio Bay and the Guadalupe River basin. As discussed above, this habitat expansion objective is a key component of the GBRA-TAP agreement, which includes habitat expansion for the whooping crane beyond the traditional boundaries of the Aransas National Wildlife Refuge (ANWR) in order to provide the species with opportunities for greater resiliency against critical environmental conditions, such as drought.

## 2.0 STUDY AREA

The study area for this project included San Antonio Bay, Aransas Bay, Copano Bay, Lavaca Bay, Matagorda Bay, Mission River subbasin, the Lower Guadalupe River basin, and Keller Branch-Lavaca



River subbasin, which includes Aransas County, Calhoun County, and parts of Refugio, Jackson, Matagorda, Wharton, San Patricio, DeWitt, Victoria, Bee, Karnes, Goliad, and Lavaca counties (**Figure 2**, all maps are included in **Appendix A**).

The Guadalupe River begins as the spring-fed streams of the North Fork and South Fork in western Kerr County, which merge near Kerrville. From there, the river crosses the Edwards Plateau and leaves the Balcones Escarpment at New Braunfels. The Guadalupe River then crosses the coastal plain of Texas and is joined by the San Antonio River just above its mouth at San Antonio Bay. Major tributaries are the spring-fed San Marcos and Comal rivers. Total length of the Guadalupe River is 431.6 miles from the mouth of the river to the confluence of the North and South Forks in Kerr County. The Guadalupe River basin encompasses 3,800,131 acres (5,938 square miles), and of this, GBRA's statutory district includes 2,899,159 acres (4,530 square miles) of the basin (76.29 percent).

The study area was subdivided by watershed to provide a basis for review of smaller areas (**Figure 2**). The 8-digit Hydrologic Unit Codes (HUCs) described by the U.S. Geological Survey (USGS) and U.S. Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS) are a nationally standardized delineation of watershed boundaries and were used to divide the study area into subbasins for more refined analysis (USGS and USDA NRCS 2013). Two 10-digit HUCs were included as well: Mission River (HUC 1210040603) and Keller Branch-Lavaca River (HUC 1210010104). These 10-digit HUCs were included to encompass more of the coastal regions within the project area.

This section summarizes the regional priorities by subbasins within the study area to aid in identifying areas that may provide future habitat for expanding whooping crane populations. The subbasins were assigned a priority level of either 1 or 2, based on current whooping crane use, proximity to wintering habitat, and proximity to fresh water (see **Section 4.1.1**). Additionally, sea level rise was taken into consideration as low-lying coastal areas are at risk of flooding and inundation (Smith et al. 2012). Lateral shifts in bayside marshes due to sea level rise could replace uplands 1-2 kilometers inland on the Texas coast (Montagna et al. 2007). As such, upland areas near the coast were also considered.

## **2.1 Coastal Subbasins**

The study area consisted of eight subbasins primarily along the Gulf coast because of the opportunities offered in these subbasins to further habitat conservation efforts for the whooping crane (**Figure 2**). These eight subbasins are located in several ecoregions and consist of the Lower Guadalupe (HUC 12100204), Central Matagorda Bay subbasin (HUC 12100401), West Matagorda Bay (HUC 12100402), East San Antonio Bay (HUC 12100403), West San Antonio Bay (HUC 12100404), Aransas Bay subbasin (HUC 12100405), Mission River (HUC 1210040603) and Keller Branch-Lavaca River (HUC 1210010104).

### **2.1.1 Area Description**

Aransas Bay, West San Antonio Bay, East San Antonio Bay, West Matagorda Bay, Mission River subbasin, and Central Matagorda Bay lie within portions of the Mid-Coast Barrier Islands and Coastal Marshes (34h) ecoregion, as well as the Southern Subhumid Gulf Coastal Prairies (34b) (Griffith et al. 2007). The Mid-Coast Barrier Islands and Coastal Marshes ecoregion encompasses primarily Holocene deposits with saline, brackish, and freshwater marshes, barrier islands with minor washover fans, and tidal flat sands and clays.

Some older Pleistocene barrier island deposits occur in the inland section from Matagorda Bay to Corpus Christi Bay. Vegetation in this region consists of mostly brackish and saltwater marsh vegetation of grasses, sedges, and rushes, with few to no trees. Land use is a mixture of marshland, wildlife habitat, recreation, commercial and sport fishing, oil and gas production, and some urban and residential development.

Portions of East San Antonio Bay (which includes Green Lake and Espiritu Santo Bay), Central Matagorda Bay, and West Matagorda Bay lie within the Northern Humid Gulf Coastal Prairies (34a) (Griffith et al. 2007). In the Northern Humid Gulf Coastal Prairies, quaternary-age deltaic sands, silts, and clays underlie much of this gently sloping, mostly flat, coastal plain. Most of this region has been converted to cropland, rangeland, pasture, or urban and industrial land uses. Additionally, invasive species like Chinese tallow tree (*Triadica sebifera*) and Chinese privet (*Ligustrum sinense*) have spread across this region.

The northern portions of the Aransas Bay, Mission River subbasin, and West San Antonio Bay subbasins are in the Southern Subhumid Gulf Coastal Prairies. The West San Antonio Bay subbasin includes Hynes Bay and Mesquite Bay. This ecoregion's physiography consists of low, flat plains, with some low gradient entrenched streams with sandy, silty, and clayey substrates. Land use consists of cropland with grain sorghum, cotton, and corn; rangeland, pastureland, and urban and industrial development.

The Aransas Bay, Mission River, and West San Antonio Bay subbasins are located within Aransas, Bee, Goliad, and Refugio counties. The Aransas River is the most prominent river in the Aransas Bay subbasin and flows into Swan Lake/Copano Bay, and the Mission River flows into Mission Bay/Copano Bay. Other prominent streams in this subbasin include Cavasso Creek, Salt Creek, Twin Creek (confluence of Artesian Creek and Willow Creek), and Burgentine Creek. St. Charles Bay on the west side of the Blackjack Peninsula is a major bay in this subbasin. The West San Antonio Bay subbasin borders the Guadalupe River. Prominent water features within the West San Antonio Bay consist primarily of large marshes and sloughs along the bay. Within the Mission River subbasin, prominent water features include Melon Creek, Sous Creek, Devil's Run, Dry Creek, and Cottonwood Hollow.

East San Antonio Bay and West Matagorda Bay are located within Calhoun, Jackson, and Victoria counties. Central Matagorda Bay is located within Jackson, Matagorda, and Wharton counties. Lavaca Bay, Carancahua Bay, and Tres Palacios Bay are the largest secondary bays in Matagorda Bay. Within East San Antonio Bay, major waterbodies include the Guadalupe River, Black Bayou, Hog Bayou, Schwings Bayou, and Green Lake. Major waterbodies in the West Matagorda Bay subbasin are Garcitas Creek, Arenosa Creek, Willow Creek, Brown Creek, Haines Flat Creek, Leona Creek, Dry Creek, Casa Blanca Creek, Mercado Creek, Aguila Creek, Arroyo Palo Alto, Kentucky Mutt Creek, Ninemile Creek, Placedo Creek, Venado Creek, Chocolate Bayou, and East and West Coloma Creek. Within Central Matagorda Bay, major waterbodies include Tres Palacios River, East and West Carancahua Creek, Little Carancahua Creek, Willow Creek, Juanita Creek, Lunis Creek, Moccasin Creek, Reed Creek, Turtle Creek, Buttermilk Slough, Pelican Slough, Willow Dam Slough, Wilson Creek, West Branch Colorado River, Colorado River, Robbins Slough, Mad Island Slough, and Mad Island Lake.

The Lower Guadalupe subbasin and Keller Branch-Lavaca River subbasin consist mostly of the Southern Post Oak Savanna (33b) and Southern Blackland Prairie (32b) ecoregions, with small portions of the

Northern Humid Gulf Coastal Prairies and the Floodplains and Low Terraces (34c) ecoregions to the south (Griffith et al. 2007). Major streams within these subbasins include the Guadalupe River, Fifteenmile Creek, Coletto Creek, Perdido Creek, Lavaca River, Keller Branch, Kerr Branch, Milby Branch, and Dry Creek.

In addition to the whooping crane, other federally listed, candidate, and proposed threatened species in the study area include the northern aplomado falcon (*Falco femoralis septentrionalis*), piping plover (*Charadrius melodus*), red knot (*Calidris canutus rufa*), Attwater's greater prairie-chicken (*Tympanuchus cupido attwateri*), black rail (*Laterallus jamaicensis*), ocelot (*Leopardus pardalis*), Houston toad (*Anaxyrus houstonensis*), and black lace cactus (*Echinocereus reichenbachii* var. *albertii*). Existing protected lands in the Aransas Bay subbasin include the ANWR, the first refuge specifically for the whooping crane, which overwinters in the Aransas Bay subbasin. Establishment of the ANWR was initiated under President Franklin D. Roosevelt in 1937, at a time when only 15 to 20 whooping cranes were known in the wild (Brinkley 2016).

### **2.1.2 Importance to the Whooping Crane**

These subbasins were selected for several reasons. They are located within and adjacent to current wintering habitat of the Aransas-Wood Buffalo population of the whooping crane, in particular, the ANWR. This area is characterized by coastal wetlands and tidal marshes used by the whooping crane for food, refuge, and mate selection (Smith 2016). It is also a region of Texas with a growing human population, resulting in the loss of native habitats as they are converted to development areas. Other species that could benefit from protecting lands for the whooping crane in this area include the piping plover, Attwater's greater prairie-chicken, black rail, and red knot.

The Lower Guadalupe subbasin is relatively close to the coast and could be an important region to protect due to the potential for lateral shifts in coastal marshes from increasing sea levels. Protection of the Guadalupe River also protects downstream estuaries and bays and their associated aquatic life. In the subbasins away from the coastal areas where the whooping crane overwinters, portions of this area could be preserved to protect wetlands along the whooping crane's migratory corridor, as well as to increase freshwater flows downstream into the higher priority areas.

Within the study area, specific areas for conservation should be selected based on the proximity to existing whooping crane range and occupied territories, as they are more likely to be utilized in the near future (Smith et al. 2012). Areas within the migratory corridor should also be prioritized for conservation to minimize obstructions or coastal barriers that may limit the establishment of coastal marsh environments as water levels increase (Smith et al. 2012).

## **2.2 Federally Listed Species**

Nine federally listed species and two candidate species are recognized by the U.S. Fish and Wildlife Service (USFWS) (2020a) as having the potential to occur in one or more counties in the study area. A list of those species is provided in **Table 2-1**, indicating their current federal and state status and their potential occurrence for each county. For the purposes of this report, the species in **Table 2-1** will be referred as Priority Species.

Thirteen additional federally listed species are excluded from **Table 2-1**: oceanic whitetip shark (*Carcharhinus longimanus*), sperm whale (*Physeter macrocephalus*), Sei whale (*Balaenoptera borealis*), blue whale (*Balaenoptera musculus*), Gulf of Mexico's Bryde's whale (*Balaenoptera edeni*), humpback whale (*Megaptera novaeangliae*), North Atlantic right whale (*Eubalaena glacialis*), West Indian manatee (*Trichechus manatus*), loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), Atlantic hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's Ridley sea turtle (*Lepidochelys kempii*), and leatherback sea turtle (*Dermochelys coriacea*). These marine species are federally listed for Matagorda, Refugio, Jackson, Calhoun, Aransas counties (USFWS 2020a). However, these species are unlikely to occur on land in the study area, other than nesting sea turtles, therefore they have been excluded from **Table 2-1**. Additionally, the Texas pimpleback (*Cyclonaias petrina*), Texas fatmucket (*Lampsilis bracteata*), and Texas fawnsfoot (*Truncilla macrodon*) were excluded from **Table 2-1** because while they are reported for some of the counties listed in **Table 2-1**, they are only native to the Colorado, Brazos, and Trinity river basins, which are not part of the study area. The false spike (*Fusconaia mitchelli*) and the Guadalupe orb (*Cyclonaias necki*) were included in **Table 2-1** because they are currently under review for listing and have the potential to occur in DeWitt, Victoria, Calhoun, and Refugio counties.

**Table 2-1. Federally Listed and Candidate Species of Known or Potential Occurrence in Counties of the Study Area**

Common Name	Scientific Name	Status <sup>1</sup>		County Listed
		Federal	State	
<b>AMPHIBIANS</b>				
Houston toad	<i>Anaxyrus houstonensis</i>	E	E	Lavaca
<b>BIRDS</b>				
Whooping Crane	<i>Grus americana</i>	E	E	Bee, Karnes, DeWitt, Victoria, Goliad, Calhoun, Jackson, Refugio, Aransas, Matagorda, Wharton, Lavaca
Northern Aplomado Falcon	<i>Falco femoralis septentrionalis</i>	E	E	Calhoun, Aransas
Piping Plover	<i>Charadrius melodus</i>	T	T	Bee, Karnes, Dewitt, Victoria, Goliad, Calhoun, Jackson, Refugio, Aransas, Matagorda, Wharton, Lavaca
Red Knot	<i>Calidris canutus rufa</i>	T	T	Bee, Karnes, DeWitt, Victoria, Goliad, Calhoun, Jackson, Refugio, Aransas, Matagorda, Wharton, Lavaca
Attwater's Greater Prairie Chicken	<i>Tympanuchus cupido attwateri</i>	E	E	Victoria, Goliad, Refugio, Wharton
Black Rail	<i>Laterallus jamaicensis</i>	T	T	Bee, DeWitt, Victoria, Goliad, Calhoun, Jackson, Refugio, Aransas, Matagorda, Wharton, Lavaca
<b>MAMMALS</b>				
Ocelot	<i>Leopardus pardalis</i>	E	E	Bee, Karnes, Refugio, Aransas
<b>MOLLUSKS</b>				
False Spike	<i>Fusconaia mitchelli</i>	UR	T	DeWitt, Victoria, Calhoun, Refugio
Guadalupe Orb	<i>Cyclonaias necki</i>	UR	T	DeWitt, Victoria, Calhoun, Refugio
<b>PLANTS</b>				
Black Lace Cactus	<i>Echinocereus reichenbachii</i> var. <i>albertii</i>	E	E	Refugio

<sup>1</sup>E – Endangered; T – Threatened; C – Candidate; UR – Under Review



### 3.0 PROJECT APPROACH

The purpose of this project was to develop a tool for habitat prioritization as an integral part of the effort to expand the coastal and inland habitats for wintering whooping cranes. This comprehensive land and easement plan will be utilized in the process of implementing GBRA-TAP agreement and developing a comprehensive Guadalupe River Habitat Conservation Plan (GRHCP). This two-part purpose was the guidance to developing evaluation criteria applicable to both the coastal bay and estuaries and the Guadalupe River basin as a whole.

The primary focus of this effort was directed towards developing criteria for whooping crane habitat conservation. The initial step in the development of this plan required assembling and reviewing all previous background documents relating to the purpose, goals and objectives, data sources, feasibility assessments, and other relevant documents. Key documents reviewed were the “White Paper: Water, Habitat, Economy - A Shared Vision of the Future for the Guadalupe River System and San Antonio Bay” (GBRA-TAP 2016a), the “Affirmation and Restructuring of the Shared Vision for the Guadalupe River System and San Antonio Bay” (GBRA-TAP 2016b), and “Implementing the GBRA-TAP Agreement” (GBRA-TAP 2018).

Project meetings with GBRA and B&A staff on May 21 and June 12, 2020 included discussion of expanding the original study area to encompass more of the coastal zone, including the areas surrounding Lavaca Bay, Matagorda Bay, and Aransas Bay, primarily for the benefit of the whooping crane.

#### 3.1 Contact Agencies, Conservation Organizations and Soil & Water Conservation Districts

The study team identified state and federal agencies and non-profit organizations to contact for information on their activities and recommendations for land and habitat prioritization (**Table 3-1**). Most of the agencies and organizations listed in **Table 3-1** were contacted again for follow-up discussions after the initial conversation, and in many cases multiple individuals with the agency or organization were consulted. The study team sought input from the listed entities to assist in the identification of important coastal and inland habitats for wintering whooping cranes. Additionally, discussions with the agencies and organizations included the role of climate change and sea level rise on coastal management needs, opportunities for partnership, and requested suggestions. **Table 3-1** summarizes the questions discussed and organizations contacted.

**Table 3-1. Questions Presented to Agencies and Nonprofit Conservation Organizations**

Agency or Organization	Questions
U.S. Fish and Wildlife Service Texas Parks and Wildlife Department (TPWD) Natural Resource Conservation Service International Crane Foundation The Nature Conservancy Aransas First	(1) Does your organization currently have any land acquisition or conservation easement plans for whooping crane habitat? If so, would you be willing to share information?  (2) Are you aware of any land acquisition or conservation easement plans of other organizations that we should also review?

**Table 3-1. Questions Presented to Agencies and Nonprofit Conservation Organizations**

Agency or Organization	Questions
Audubon Texas Coastal Bend Bays and Estuaries Program Ducks Unlimited Guadalupe-Blanco River Trust San Antonio Bay Partnership Texas Ornithological Society Texas State Soil and Water Conservation Board	(3) Does your organization use any set of criteria or variables to help select additional whooping crane habitat? If not, what do you believe are the most important aspects of whooping crane habitat to examine when planning future land acquisition or conservation easements?  (4) Does your organization have a plan for implementing management measures on conservation lands to improve suitability for whooping cranes? Do you have any additional whooping crane surveys or research efforts planned for habitat conditions, food sources, or other elements?  (5) Does your organization use a climate change/sea rise model to estimate changes to whooping crane habitat in the future? What timeframes and distances does your planning include?  (6) Do you have any suggestions about opportunities for the GBRA to assist the efforts of your organization?  (7) Do you have any other recommendations or ideas for GBRA to consider?  (8) Are there other agencies, organizations, or individuals that you recommend we consult?

In addition to the agencies and nonprofits identified in **Table 3-1**, the study team contacted five Soil and Water Conservation Districts (SWCDs) in the coastal subbasins to solicit input from their stakeholders. **Table 3-2** lists the SWCDs contacted and the questions they were presented.

**Table 3-2. Questions Presented to Soil and Water Conservation Districts**

Soil and Water Conservation District (SWCD)	Questions
San Patricio SWCD Copano Bay SWCD (Refugio and Aransas counties) Calhoun SWCD Victoria SWCD Matagorda County SWCD	(1) Do whooping cranes occur on private land in your District?  (2) Do you keep records of whooping cranes sighted in your District?  (3) Does your District include whooping cranes in any type of routine District program activities?  (4) Does your District (or landowners in the District) take advantage of any state or federal landowner assistance program related to whooping cranes? (E.g., USFWS Partners for Fish and Wildlife)  (5) Do you have any suggestions about opportunities for the GBRA to assist the efforts of your District?

All agency and organization staff and personnel contacted were helpful and cooperative. In many cases, the initial contact with an agency or organization answered question and provided information, then recommended contacting other members of their organization. Information received from all contacts was used in subsequent development of the evaluation criteria. Agencies and organizations that own conservation land or hold conservation easements on land were also asked for geographic data on those properties for inclusion in the geographic information system (GIS) database for this project.

### **3.2 Review of Other Land Conservation Programs**

The initial focus of contacting the agency and organization staff listed in **Tables 3-1 and 3-2** was to obtain their suggestions and input on habitat conservation programs in the coastal areas, especially for the whooping crane. In addition to those ideas and recommendations, B&A reviewed the land conservation programs of multiple Texas habitat conservation plans (HCPs) and aquifer protection programs that are not targeted specifically at coastal habitat protection. The programs reviewed included useful information on evaluation criteria for all parts of this study. Land conservation programs included in this effort were as follows:

- City of San Antonio Edwards Aquifer Protection Program (COSA EAPP)
- Balcones Canyonlands Conservation Plan (BCCP)
- Southern Edwards Plateau Habitat Conservation Plan (SEP-HCP)
- Hays County Water Quality Protection Lands Program
- Hays County Habitat Conservation Plan (Hays Co. HCP)
- NRCS Agricultural Conservation Easement Program (ACES)
- NRCS Grassland of Special Environmental Significance
- NRCS Wetland Reserve Easement (WRE) Program
- Guadalupe-Blanco River Trust (GBRT) Land Conservation Policy
- Ducks Unlimited

### **3.3 Selection of Evaluation Criteria**

All suggestions for evaluation criteria received from contacts with agencies and organizations were compiled and reviewed. Many individuals contacted offered similar recommendations, especially regarding the whooping crane.

Evaluation criteria were grouped into **Mapped Criteria** or **Property-Specific Criteria**. Mapped Criteria were those that can be used with available data to identify large geographical target areas within a particular planning area for more detailed review. Where appropriate, preference in this category was given to data sources and types of data that have been vetted by others and regularly updated, as needed. Mapped Criteria were also selected that can be applied to evaluation of specific properties for land and habitat prioritization. A list of **Additional Considerations for Conservation Easements** was also included, though they were

not assigned a numerical weight in the ranking criteria. These Additional Considerations for Conservation Easements account for potential issues that may impact the decision to use a particular property for conservation.

Property-Specific Criteria were developed to evaluate and compare individual properties. Property-Specific Criteria are not easily mappable from available data and will entail some further evaluation by GIS or in consultation with species experts and/or agency personnel (e.g., NRCS, TPWD, or USFWS).

The evaluation form and spreadsheet are included in **Appendix B**. Relative weights were assigned for each criterion and included in the spreadsheet for each region.

#### **4.0 RECOMMENDED EVALUATION CRITERIA**

This section describes the recommended evaluation criteria for the study area and how they are applied. The Mapped Criteria can be used with available data to identify large geographical target areas within a particular planning area for more detailed review. Geographic data are provided to the GBRA with this report to generate individual maps for each of the Mapped Criteria in any given location. The data provided will require periodic update and should be reviewed annually. The Mapped Criteria focus primarily on the whooping crane and can be used to identify high priority conservation areas for that species.

The Property-Specific Criteria are generally not mappable with available data, but they can be evaluated for individual properties with moderate effort. These criteria are designed to assist in ranking alternative properties under consideration for future conservation action.

An evaluation form and spreadsheet for the Coastal Subbasins are provided in **Appendix B**. The relative weight of each criterion is indicated on the spreadsheet and is stated in the following sections. The maximum total value for any analysis is 100 points (67 points for Mapped Criteria and 33 points for Property-Specific Criteria). The evaluation forms and spreadsheets also include a list of Additional Considerations for Conservation Easements, although these are not assigned any weight in evaluation and their use is at the discretion of the user.

Existing protected areas in the Coastal Subbasins are shown in **Figure 3** and the acreage of these areas are summarized in **Table 4-1**. “Protected Areas” as used in this context includes all publicly owned park land, preserve land, recreational land, land protected for other non-transportation uses, and land that is covered by a conservation easement that may be held by a government agency or land trust.

The existing protected areas were excluded from the evaluation criteria because of their current status as conserved land. Sources for the data shown and comments are provided below.

- Protected Areas Database – U.S. (PAD-US 2020). PAD-US is the official national inventory of U.S. terrestrial and marine protected areas for the preservation of biological diversity and for other natural, recreation and cultural uses. Includes data for the Trust for Public Land, Ducks Unlimited/Wetlands America Trust, and other non-governmental organizations.



- Natural Resources Conservation Service - Agricultural Conservation Easement Program (NRCS-ACEP) (NRCS 2020a). Most of the NRCS-ACEP properties were included in the PAD-US data, but some were not.
- Texas Parks and Wildlife Department, Land & Water Resources Conservation & Recreation Plan statewide inventory (LWRCRP). Most of the LWRCRP properties were included in the PAD-US data, but some were not.
- The Nature Conservancy (TNC) protected areas data (Lederle, pers. comm.). Some of the TNC property data were included in the PAD-US data, but some were not.
- Guadalupe-Blanco River Trust (GBRT) protected areas data (Sanderson, pers. comm.). Not included in PAD-US.
- Other state and local land trusts. Not included in PAD-US. All organizations listed in **Table 3-1** were asked for data on protected lands owned or managed by their organization. Data were received by email, with subsequent searching on appraisal district websites, if necessary. Respondents in this category were:
  - Aransas First (Matthew, pers. comm.)
  - Texas Ornithological Society (TOS) Magic Ridge Preserve (Hargis, pers. comm.)

**Table 4-1. Acreage of Protected Area in the Coastal Subbasins**

Subbasin (8-digit or 10-digit HUC)	Acres
Lower Guadalupe (HUC 12100204)	5,436
Central Matagorda Bay (HUC 12100401)	14,568
West Matagorda Bay (HUC 12100402)	25,168
East San Antonio Bay (HUC 12100403)	71,573
West San Antonio Bay (HUC 12100404)	28,519
Aransas Bay (HUC 12100405)	34,615
Mission River (HUC 1210040603)	1,391
Keller Branch-Lavaca River (HUC 1210010104)	0
<b>Total</b>	<b>181,270</b>

## 4.1 Mapped Criteria

### 4.1.1 Coastal Subbasin Planning Areas

This criterion assigns the Subbasin 8-digit HUC or 10-digit HUC with values of either 8 or 10 points, as shown in **Figure 2** and listed in **Table 4-2**. The highest values (10 points) are given to West Matagorda Bay (HUC 12100402), East San Antonio Bay (HUC 12100403), West San Antonio Bay (HUC 12100404), and Aransas Bay (HUC 12100405), reflecting the higher importance of whooping crane conservation in these subbasins.

**Table 4-2. Planning Areas in the Coastal Subbasins**

Subbasin and 8-digit HUC)	Priority	Area (acres)	Area (sq km)	Counties	Priority Species
Lower Guadalupe (HUC 12100204)	2	644,887	2,610	Dewitt, Goliad, Victoria,	Whooping crane, Piping plover, Red knot, Interior least tern, Black rail, Attwater's greater prairie-chicken
Central Matagorda Bay (HUC 12100401)	2	818,541	3,313	Jackson, Matagorda, Wharton	Whooping crane, Northern aplomado falcon, Piping plover, Red knot, Interior least tern, Attwater's greater prairie-chicken, Black rail
West Matagorda Bay (HUC 12100402)	1	572,821	2,318	Calhoun, Jackson, Victoria	Whooping crane, Northern aplomado falcon, Piping plover, Red knot, Interior least tern, Attwater's greater prairie-chicken, Black rail
East San Antonio Bay (HUC 12100403)	1	250,822	1,015	Calhoun, Jackson, Victoria	Whooping crane, Northern aplomado falcon, Piping plover, Red knot, Interior least tern, Attwater's greater prairie-chicken, Black rail
West San Antonio Bay (HUC 12100404)	1	93,720	379	Aransas, Refugio	Whooping crane, Northern aplomado falcon, Piping plover, Red knot, Attwater's greater prairie chicken, Black rail, Ocelot, Black lace cactus
Aransas Bay (HUC 12100405)	1	543,332	2,199	Aransas, Refugio	Whooping crane, Northern aplomado falcon, Piping plover, Red knot, Attwater's greater prairie chicken, Black rail, Ocelot, Black lace cactus
Mission River (HUC 1210040603)	2	224,054	2,199	Bee, Goliad, Refugio	Whooping crane, Piping plover, Red knot, Interior least tern, Black rail, Attwater's greater prairie-chicken, Ocelot, Black lace cactus
Keller Branch-Lavaca River (HUC 1210010104)	2	224,054	907	Calhoun, Jackson, Lavaca	Whooping crane, Northern aplomado falcon, Piping plover, Red knot, Black rail, Interior least tern, Houston toad
<b>Total</b>	-	<b>3,242,687</b>	<b>13,123</b>	-	-

#### 4.1.2 Estimated Current Carrying Capacity of Whooping Cranes

**Background.** Several conservation planning efforts were reviewed and evaluated for application to this project. Multiple whooping crane conservation and habitat evaluation plans over the last decade have included factors for sea level rise and changes to coastal habitat (Lumb 2014, Smith et al. 2014, Smith 2016, Davis 2019). The Coastal Bend Bays and Estuaries Program (CBBEP) completed a comprehensive planning effort for the area encompassing San Antonio Bay which included public access, ecotourism, and commercial and recreational fisheries as major considerations (Stanzel et al. 2014).

**USFWS Planning Efforts.** The USFWS is currently working on a Land Protection Plan (LPP) for the Texas Mid-Coast Refuge Complex (McDowell, pers. comm.), building on a draft Texas Coastal Bend Landscape Conservation Design (LCD) completed in 2016 (USFWS 2016). The draft LCD describes the development of a decision support tool for identification of whooping crane habitat that was published online in October

2020 (Metzger et al. 2020). The decision support tool will be used to guide conservation and restoration actions in the region (USFWS 2017, 2020b). The whooping crane habitat decision support tool is the latest, most comprehensive effort to identify areas for sustainable whooping crane habitat conservation and is supported by conservation organizations including the International Crane Foundation and the Nature Conservancy (Smith pers. comm., Francell pers. comm.).

Decision Support Tool. The whooping crane habitat decision support tool (Metzger et al. 2020) was developed to identify the highest quality and most sustainable wintering habitat for whooping cranes through 2100 using three projections of sea level rise (0.6, 1.0 and 2.0 meters [m] by 2100) and two scenarios of future urban development. Key elements of the Metzger decision support tool are as follows:

- The study area included all or parts of the Coastal Subbasins except for the northernmost extents of Central Matagorda Bay (HUC 12100401), West Matagorda Bay (HUC 12100402), Keller Branch-Lavaca River (HUC 1210010104), and the Lower Guadalupe (HUC 12100204) upstream of Victoria. The Metzger study area also extended to south of Nueces Bay, outside of the study area for this report.
- The model uses the Sea Level Affecting Marshes Model v 6.0 (SLAMM, Warren Pinnacle Consulting, Inc. 2006), which is the model adopted by the USFWS to plan for the effects of sea-level rise. The SLAMM model inputs and the specific data sources used by Metzger et al. (2020) were:
  - Digital elevation model (DEM) from the National Elevation Dataset; and
  - Land cover data from the National Wetlands Inventory (NWI) and the Coastal Change Analysis Program (C-CAP, NOAA 2011)
  - Sea-level rise projections of 0.6 m, 1.0 m, and 2.0 m by 2100.
- Two land development scenarios used were based on land cover change from 1996 to 2010 (LC1 scenario) and from 1996 to 2006 (LC2 scenario). Land cover change was modeled based on actual change histories between 1996 and 2010 (LC1) and 1996 and 2006 (LC2) to develop specific sub-models (e.g., pasture to developed land).
- Habitat suitability modeling was based on the actual habitat used by whooping cranes fitted with GPS-capable transmitters from 2010 to 2014, and home ranges were estimated for 52 marked birds.
- Density of whooping cranes was estimated using aerial survey data from 623 km of transects in six sampling blocks (Butler et al. 2016).
- Raster resolution is 10 m.
- Habitat suitability was found to increase with greater area of salt marsh and greater distance from urban development.

Current carrying capacity estimated by the Metzger model study area was 4,414 cranes (95% CI: 4,096-4,789). By 2100, carrying capacity increased to 5,382 (95% CI: 4,949-5,904) at current sea level rise rates (0.6 m by 2100), without development. When development was included, potential carrying capacity

declined under both scenarios LC1 (4,182; 95% CI: 3,962-4421) and LC2 (4,795; 95% CI: 4,402-5,269). The current carrying capacity is shown in **Figure 4**.

Estimated Current Carrying Capacity. The evaluation criteria assign a maximum value of 16 points to the estimated current carrying capacity of whooping cranes, as determined by the habitat modeling method developed for the Texas Coastal Bend Landscape Conservation Design (Metzger et al. 2020) (**Figure 4**). The values assigned to each density estimate in the evaluation matrix are as follows:

- High: Greater than 1.00 whooping cranes per square kilometer (WHCR/sq km), 16 points
- Medium-High: 0.75 to 1.00 WHCR/sq km, 12 points
- Medium: 0.50 to 0.75 WHCR/sq km, 8 points
- Low: 0.02 to 0.50 WHCR/sq km, 4 points

Examples of the application of this criterion to specific properties in the region are given in **Section 4.1.3**, after discussion of the estimated future carrying capacity criterion.

#### **4.1.3 Estimated Future Carrying Capacity of Whooping Cranes, assuming 1 m sea level rise and with urbanization**

Key elements of the whooping crane habitat decision support tool (Metzger et al. 2020) are discussed in **Section 4.1.2**. In addition to estimating the current carrying capacity, the model identifies the highest quality and most sustainable wintering habitat for whooping cranes through 2100 using three projections of sea level rise (0.6, 1.0 and 2.0 m by 2100) and two scenarios of future urban development.

When the Metzger model was applied to the scenario of sea level rise of 1 m by 2100, carrying capacity for whooping cranes was predicted to increase by 12% from current predictions without development (4,934; 95% CI: 4,742-5,141) (**Figure 5**), decreased by 19% under development scenario LC1 (3,559; 95% CI: 3,352-3,791) (**Figure 6**), and decreased 11% under scenario LC2 (3,926; 95% CI: 3,695-4,185).

In the 2 m sea level rise scenario, carrying capacity was predicted to decline by 6% without development. With development included, the decline was 44% compared to current levels under LC1 (2,480; 95% CI: 2,375-2,592) and 15% under LC2 (3,749; 95% CI: 3,540-3,991).

Estimated Future Carrying Capacity. The evaluation criteria assign a maximum value of 16 points to the estimated carrying capacity of whooping cranes in 2100, assuming 1 m sea level rise and with urbanization (LC1 model), as determined by the method described by Metzger et al. (2020) (**Figure 6**). The values assigned to each density estimate in the evaluation matrix are as follows:

- High: Greater than 1.00 whooping cranes per square kilometer (WHCR/sq km), 16 points
- Medium-High: 0.75 to 1.00 WHCR/sq km, 12 points
- Medium: 0.50 to 0.75 WHCR/sq km, 8 points
- Low: 0.02 to 0.50 WHCR/sq km, 4 points



Examples of Carrying Capacity Estimates. In addition to the data shown in **Figures 4, 5, and 6**, USFWS personnel analyzed the specific properties shown in **Figure 7**. The properties shown in **Figure 7** were selected based on their size, distribution throughout the study area (with one outside the study area), and their current status as protected either by fee-simple acquisition or conservation easement. All of these properties except the Welder Wildlife Foundation Park are also shown in **Figure 3** and included in **Table 4-1**. **Table 4-3** shows the estimated carrying capacity for each specific property shown in **Figure 7** for the current condition, the 2100 estimate with 1 m sea-level rise without development, and the 2100 estimate with 1 m sea-level rise with development based on the LC1 scenario.

**Table 4-3. Examples of Carrying Capacity Estimates**

Property Name	Map no.	Area (acres)	Estimated Carrying Capacity of Whooping Cranes for Property		
			Current	2100 Without Development <sup>1</sup>	2100 With Development <sup>1,2</sup>
NRCS WRP 6674421000YQK CE	1	5,784	27.46	23.38	26.51
Runnells Family Mad Island Marsh Preserve	2	6,132	21.67	15.83	19.95
Johnson Ranch CE	3	584	2.83	1.74	2.55
Aransas First	4	105	0.49	0.41	0.42
TOS Magic Ridge (approximate boundaries)	5	324	1.26	0.69	0.76
Welder Wildlife Foundation Park	6	2,058	0.00	0.00	5.70

<sup>1</sup>Both future predictions use 1m sea-level rise.

<sup>2</sup>The 2100 with development prediction uses the LC1 scenario.

#### 4.1.4 Coastal Prairie and Marsh Habitat

Consideration of habitat type is implicit in the Metzger model discussed in **Sections 4.1.2** and **4.1.3**. This criterion reflects the estimation of coastal prairie and marsh habitat derived from LANDFIRE Existing Vegetation Type (LF-EVT) (LANDFIRE 2020), based on the ecological classifications of NatureServe (2009a, 2018). The LF-EVT coastal prairie and marsh habitat is shown in **Figure 8**.

For this criterion, coastal prairie and marsh habitat is defined and evaluated using the LF-EVT categories listed in **Table 4-4**. The values assigned in the evaluation matrix are based on an estimate of the percentage of the property that meets the habitat requirement, resulting in the following quality estimates and assigned values:

- High quality (67 percent or more of property meets requirement), 9 points
- Moderate quality (33 to 67 percent of property meets requirement), 6 points
- Low quality (less than 33 percent of property meets requirement), 3 points

**Table 4-4. Coastal Prairie and Marsh Habitat Types and Acreages in the Coastal Subbasins**

Coastal Prairie and Marsh Habitat	Acres
Southeastern Coastal Plain Interdunal Wetland	6,608
Texas-Louisiana Coastal Prairie	12,467
Texas-Louisiana Coastal Prairie Pondshore	10,366
Texas Coast Fresh and Oligohaline Tidal Marsh	40,683
Texas Coast Fresh and Oligohaline Tidal Marsh Shrubland	1,890
Texas Coast Salt and Brackish Tidal Marsh	52,080
Texas Coast Salt and Brackish Tidal Marsh Shrubland	17,125
Texas Saline Coastal Prairie	84,986
<b>Total</b>	<b>226,204</b>

Source: LANDFIRE Existing Vegetation Type (LANDFIRE 2020).

#### 4.1.5 Known Occurrence of Whooping Crane

Two datasets for whooping crane occurrence data are publicly available from the USFWS and are mapped in **Figures 9** and **10**. Whooping crane data for 38,332 observations collected on paper maps during aerial surveys from winter 1950–1951 through winter 2010–2011 were compiled by Taylor et al. (2015); the observations within the Coastal Subbasins are shown in **Figure 9**.

**Figure 10** shows the locations of 68 whooping cranes that had been fitted with GPS-enabled leg-mounted transmitters from 2009 to 2018, conducted by a cooperative project between the Canadian Wildlife Service, Crane Trust, Platte River Recovery Implementation Program, USFWS, and USGS (Pearse et al. 2020).

This criterion uses whooping crane occurrence data from the sources described above to assign a value of 10 points if whooping cranes are known to occur on a property or 5 points if not known to occur. A property should also be assigned a value of 10 points if other recent verifiable data indicates that whooping cranes are known to occur on a property.

#### 4.1.6 Priority Habitats of the Gulf Coast Prairie and Marshes Ecoregion

The Texas Conservation Action Plan (TCAP) for the Gulf Prairies and Marshes Ecoregion (TCAP 2012a) identifies Priority Habitats for the area including the Coastal Subbasins. Those Priority Habitats are shown in **Figure 11** and **Table 4-5** and provide data to identify large geographical target areas within each planning area or to evaluate specific properties. This criterion counts for assigns a value of 6 points for occurrence of these priority habitats.

**Table 4-5. Priority Habitats of the Gulf Coast Prairies and Marshes Ecoregion in the Coastal Subbasins**

Priority Habitats <sup>1,2</sup>	Acres <sup>3</sup>
Central and South Texas Coastal Fringe Forest and Woodland	60,602
East-Central Texas Plains Post Oak Savanna and Woodland	188,568
Southeastern Coastal Plain Interdunal Wetland	6,608
Tamaulipan Mixed Deciduous Thornscrub	7,425
Texas-Louisiana Coastal Prairie	12,467
Texas-Louisiana Coastal Prairie Pondshore	10,366

**Table 4-5. Priority Habitats of the Gulf Coast Prairies and Marshes Ecoregion in the Coastal Subbasins**

<b>Priority Habitats</b> <sup>1, 2</sup>	<b>Acres</b> <sup>3</sup>
Texas Coast Beach	3,060
Texas Coast Dune and Coastal Grassland	29,516
Texas Coast Fresh and Oligohaline Tidal Marsh	40,683
Texas Coast Fresh and Oligohaline Tidal Marsh Shrubland	1,890
Texas Coast Salt and Brackish Tidal Marsh	52,080
Texas Coast Salt and Brackish Tidal Marsh Shrubland	17,125
Texas Saline Coastal Prairie	84,986
<b>Total</b>	<b>515,375</b>

<sup>1</sup>Priority habitats identified in the Texas Conservation Action Plan Gulf Coast Prairies and Marshes Ecoregion Handbook (TCAP 2012a).

<sup>2</sup>Ecological systems identified by NatureServe (2009a).

<sup>3</sup>Mapped data from LANDFIRE Existing Vegetation Type (LANDFIRE 2020).

## **4.2 Property-Specific Criteria**

Property-Specific Criteria are not easily mappable from available data and will entail some further evaluation by GIS or in consultation with species experts and/or agency personnel (e.g., NRCS, TPWD, or USFWS).

### **4.2.1 Other Priority Species Identified for the Subbasin**

This criterion has a value of 8 points in the evaluation matrix for known occurrence of other Priority Species, as identified by the USFWS (2020a) and listed in **Table 2-1**, on an individual property. If the property is not known to be occupied but the habitat is suitable and bordering, adjacent, or neighboring habitat is occupied, 4 points are assigned in the matrix. This criterion only applies to federally listed species, though consideration for state-listed species may be added in future revisions of this plan.

### **4.2.2 Coastal Prairie Coalition Grazing Lands Conservation Initiative (GLCI) Programmatic Safe Harbor Agreement**

If the subject property is enrolled in the Coastal Prairie Coalition Grazing Lands Conservation Initiative (GLCI) Programmatic Safe Harbor Agreement (Aransas, Calhoun, Goliad, Refugio, Victoria counties), 4 points are assigned in the evaluation matrix (USFWS 2007).

### **4.2.3 Contiguity with Other Protected Property**

Proximity of protected lands to each other is a common element of conservation ranking systems. Some measure of contiguity was included in every set of criteria reviewed for this study. **Table 4-7** defines values of 2 to 8 points for four possible conditions for an evaluation of any given property.

**Table 4-6. Ranking Criteria for Contiguity with Other Protected Property**

Condition	Points
Bordering: The subject property is bordering existing protected lands with a shared boundary for a substantial length of at least one side.	8
Adjacent: The subject property is close to existing protected land but does not share any boundary.	6
Neighboring: The subject property is not bordering or adjacent, but is sufficiently close to other protected land to provide some degree of added habitat for Priority Species, if there is no substantive current or future threat from degrading land use in the intervening land, and it makes a substantive contribution to total protected area in the vicinity.	4
Isolated: Not Bordering, Adjacent, or Neighboring.	2

#### 4.2.4 Total Area of Subject Property within 100 meters of the Edge

External effects on conservation lands can often be harmful and increase management costs of the preserve land. The size and shape of a parcel influence the amount of edge of the parcel, and management problems are fewer with multiple bordering, adjacent, and neighboring properties, as the preceding “contiguity” criterion is intended to assess. The size and shape of a parcel are the two major variables affecting the amount of edge, with larger, rounder parcels having a lower percent of edge.

This criterion is designed to assess the amount of edge of a property and inherently includes considerations of size and shape. The categories and their point scores are shown in **Table 4-8**. This criterion is most easily evaluated using ArcGIS “Buffer” tool and entering a value of -100 m to create an internal polygon rather than external, then calculating the percentage of the buffered area to the original polygon. In calculating this criterion, the edge of the property being evaluated is not counted as edge where it borders protected lands or large open water (rivers, canals, bays, or other water bodies). Building envelopes reserved by conservation easement grantors should not be included as part of the edge.

**Table 4-7. Value for Percent of Property Within 100 m of the Edge for the Coastal Subbasins**

Condition	Points
High quality: less than 10 percent of subject property within 100 m of the edge	7
Medium quality: 10 to 20 percent of subject property within 100 m of the edge	5
Low quality: Greater than 20 percent of subject property within 100 m of the edge	2

#### 4.2.5 Invasive Species

Properties that are minimally affected by invasive species are assigned a value of 6 points if no significant portion of important habitat is dominated by invasive plant species to an extent that would affect viability of the subject property for the species of concern. In some cases, scoring for this criterion may be benefitted by getting input from knowledgeable biologists, local experts, and/or agency staff (e.g., TPWD, NRCS, and USFWS).

### 4.3 Additional Considerations for Conservation Easements

Conservation easements can be a very cost-effective way to conserve land without acquiring full ownership and taking responsibility for all associated costs for future land management. However, there are multiple other considerations that should be evaluated for conservation easements. The following list is not meant to be comprehensive for all conservation easement programs but is included for initial consideration. None of the considerations listed below have been assigned a numerical weight in the ranking criteria. This list is adapted primarily from the Ducks Unlimited Preliminary Property Inspection (PPI) Report (Revised August 2019).

- **Public Access.** Inclusion of provisions in conservation easement to allow opportunities for compatible public access.
  - No Public Access (most common): Landowner reserves the right to allow or disallow members of the general public onto the property.
  - Open Access (uncommon): Landowner will allow certain public access to the property.
- **Conservation Values.** The Internal Revenue Code 170(h)(4)(A) requires that a donated easement must be made exclusively for one of the following conservation purposes to be qualified as a charitable contribution.
  - Preservation of land areas for outdoor recreation by, or the education of, the general public.
  - Protection of a relatively natural habitat for fish, wildlife, or plants, or a similar ecosystem.
  - Preservation of open space for the scenic enjoyment of the general public, or pursuant to a Federal, State, or local governmental conservation policy.
  - Preservation of historically important land area or certified historic buildings.
- **Endowment.** Landowner will provide an endowment for donated easement sufficient to monitor the subject property in perpetuity and uphold all other terms of the easement.
- **Known Title Issues**
  - Conflicting easements on property
  - Easement required to access property
  - Mortgages
  - Mineral leases
  - Severed mineral rights
  - Tax liens
  - Disputed boundaries/boundary encroachment
  - Water rights issues
- **Possible Adverse Conditions on Property**

- Recognized Environmental Condition (REC) identified in Phase I Environmental Site Assessment.
- Dump or trash pit
- Gravel or mining operations
- Other reserved rights to potentially incompatible use.
- Oil/gas well or pipeline
- Adjacent commercial or residential development

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# **Appendix A**

## **Figures**



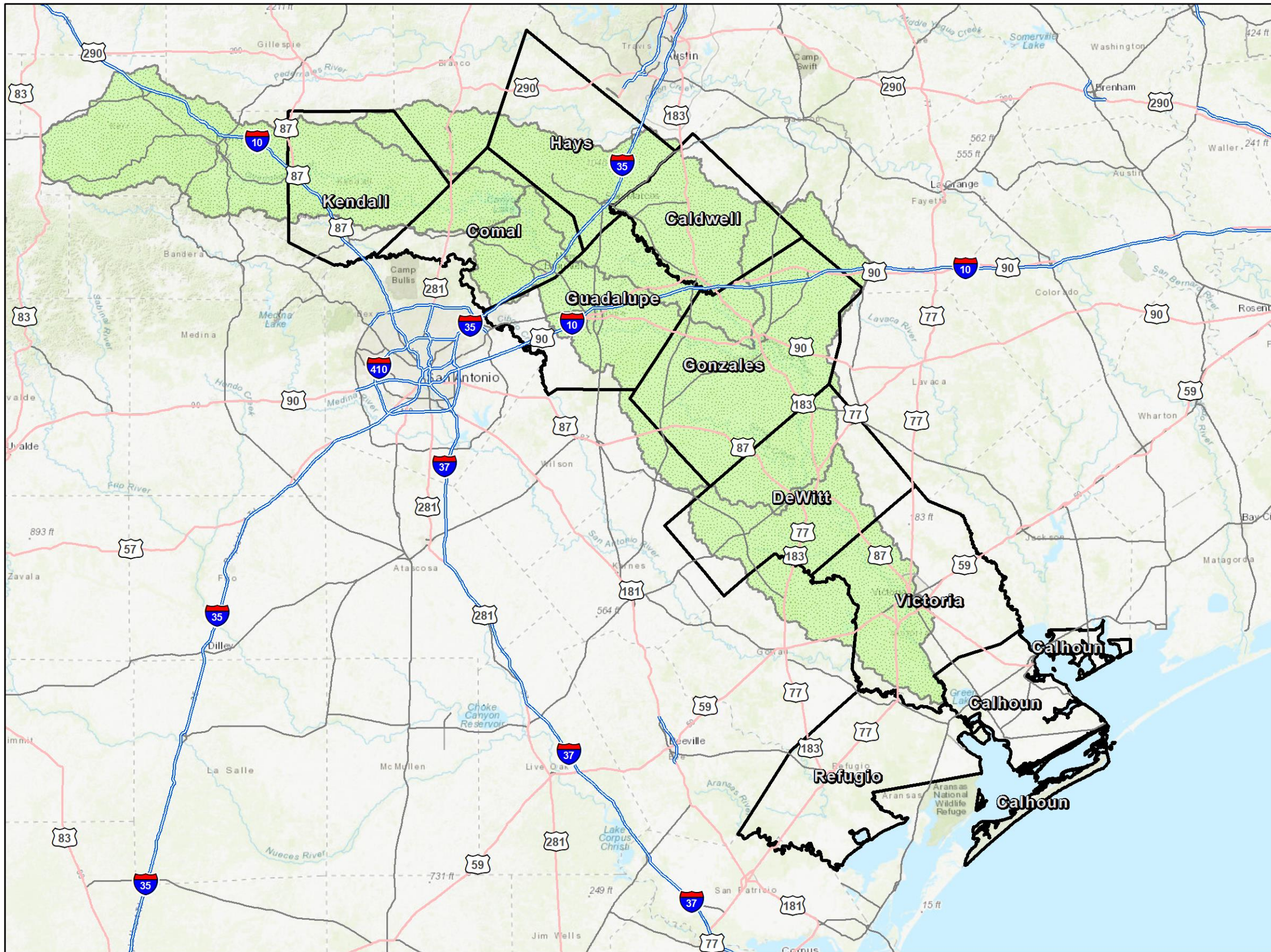




Figure 1  
 Guadalupe-Blanco River Authority  
 Statutory District and  
 Guadalupe River Basin

-  Guadalupe-Blanco River Authority Statutory District
-  Guadalupe River Basin




1:1,267,200  
 0 10 20  
 Miles  
 1 in = 20 miles

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community



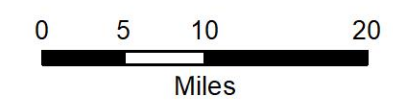


Figure 2  
 Guadalupe-Blanco River Authority  
 Comprehensive Land and  
 Conservation Easement Mapping Plan  
 Study Area

-  Study Area Subbasins
- Lower Guadalupe (12100204)
- Central Matagorda Bay (12100401)
- West Matagorda Bay (12100402)
- East San Antonio Bay (12100403)
- West San Antonio Bay (12100404)
- Aransas Bay (12100405)
- Mission River (HUC 1210040603)
- Keller Branch-Lavaca River (HUC 1210010104)



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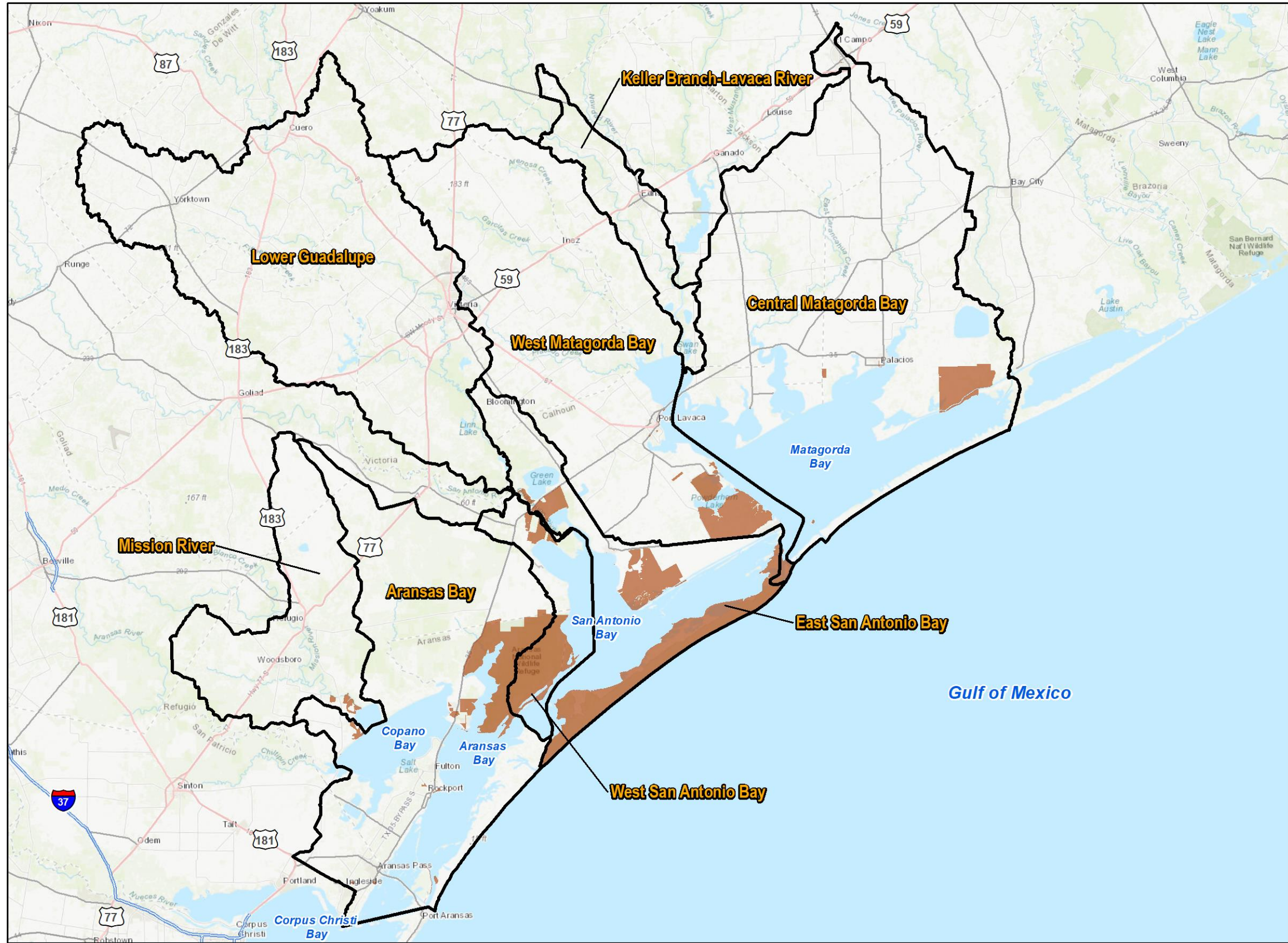
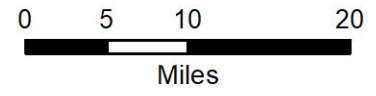


Figure 3  
 Guadalupe-Blanco River Authority  
 Comprehensive Land and  
 Conservation Easement Mapping Plan  
 Protected Areas

- Study Area Subbasins
- Protected Area



1:750,000





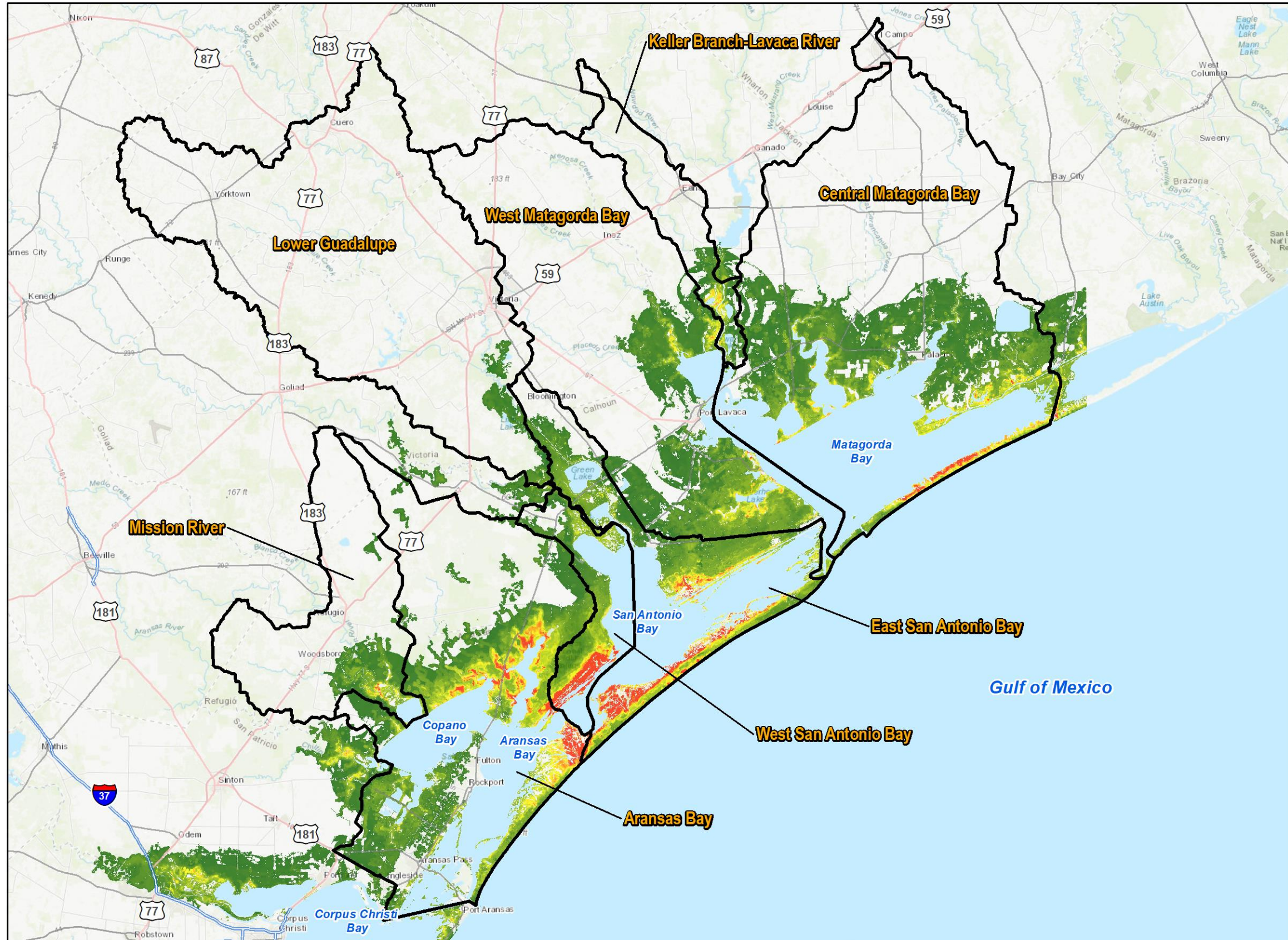


Figure 4  
 Guadalupe-Blanco River Authority  
 Comprehensive Land and  
 Conservation Easement Mapping Plan  
 Estimated Carrying Capacity  
 of Whooping Cranes  
 Current Conditions in Year 2020

Study Area Subbasins

Carrying Capacity (whooping cranes per square kilometer (WHCR/sq km))

- High: Greater than 1.00
- Medium-High: 0.75 to 1.00
- Medium: 0.50 to 0.75
- Low: 0.02 to 0.50

Source: Metzger et al. 2020

1:750,000

Miles

0 5 10 20



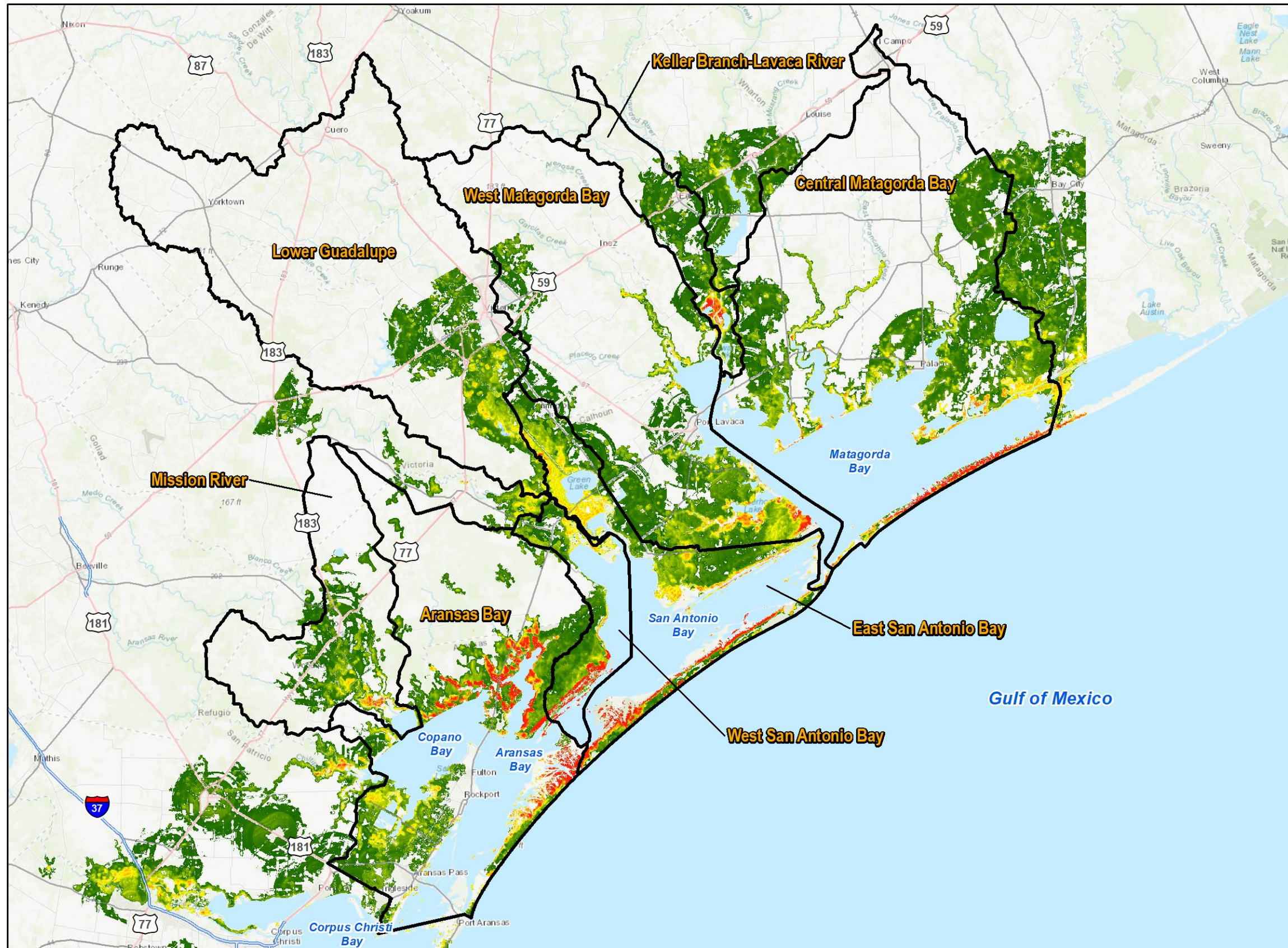
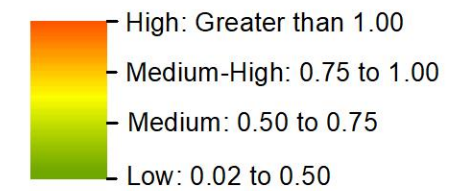


Figure 5  
 Guadalupe-Blanco River Authority  
 Comprehensive Land and  
 Conservation Easement Mapping Plan  
 Estimated Carrying Capacity  
 of Whooping Cranes  
 Year 2100 with 1 meter Sea Level Rise,  
 Without Further Urbanization

Study Area Subbasins

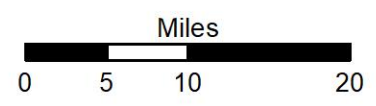
Carrying Capacity (whooping cranes  
 per square kilometer (WHCR/sq km))



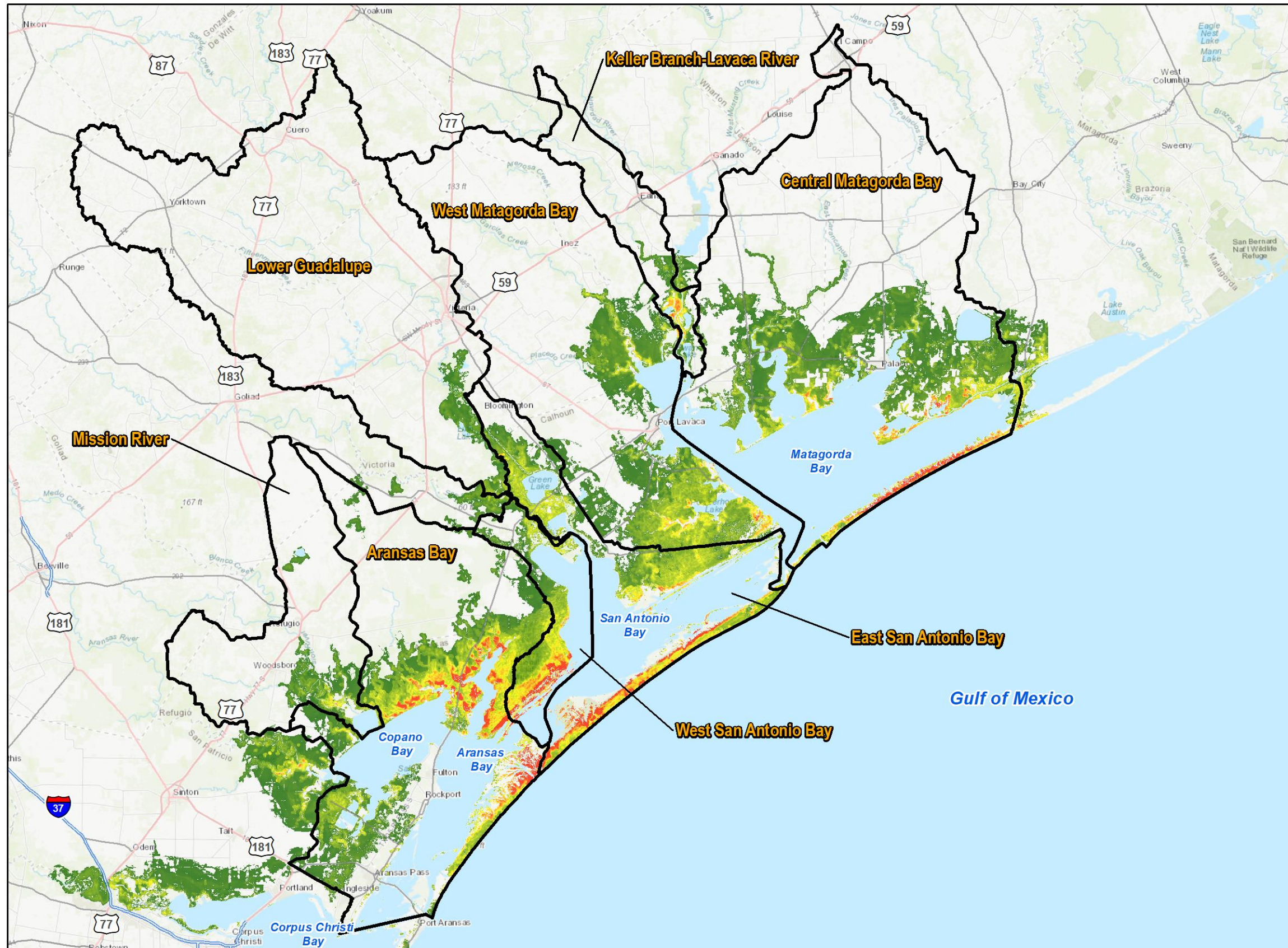
Source: Metzger et al. 2020




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**Figure 6**  
 Guadalupe-Blanco River Authority  
 Comprehensive Land and  
 Conservation Easement Mapping Plan  
 Estimated Carrying Capacity  
 of Whooping Cranes  
 Year 2100 with 1 meter Sea Level Rise,  
 With Projected Urbanization

 Study Area Subbasins

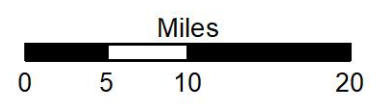
**Carrying Capacity (whooping cranes per square kilometer (WHCR/sq km))**

-  High: Greater than 1.00
-  Medium-High: 0.75 to 1.00
-  Medium: 0.50 to 0.75
-  Low: 0.02 to 0.50

Source: Metzger et al. 2020



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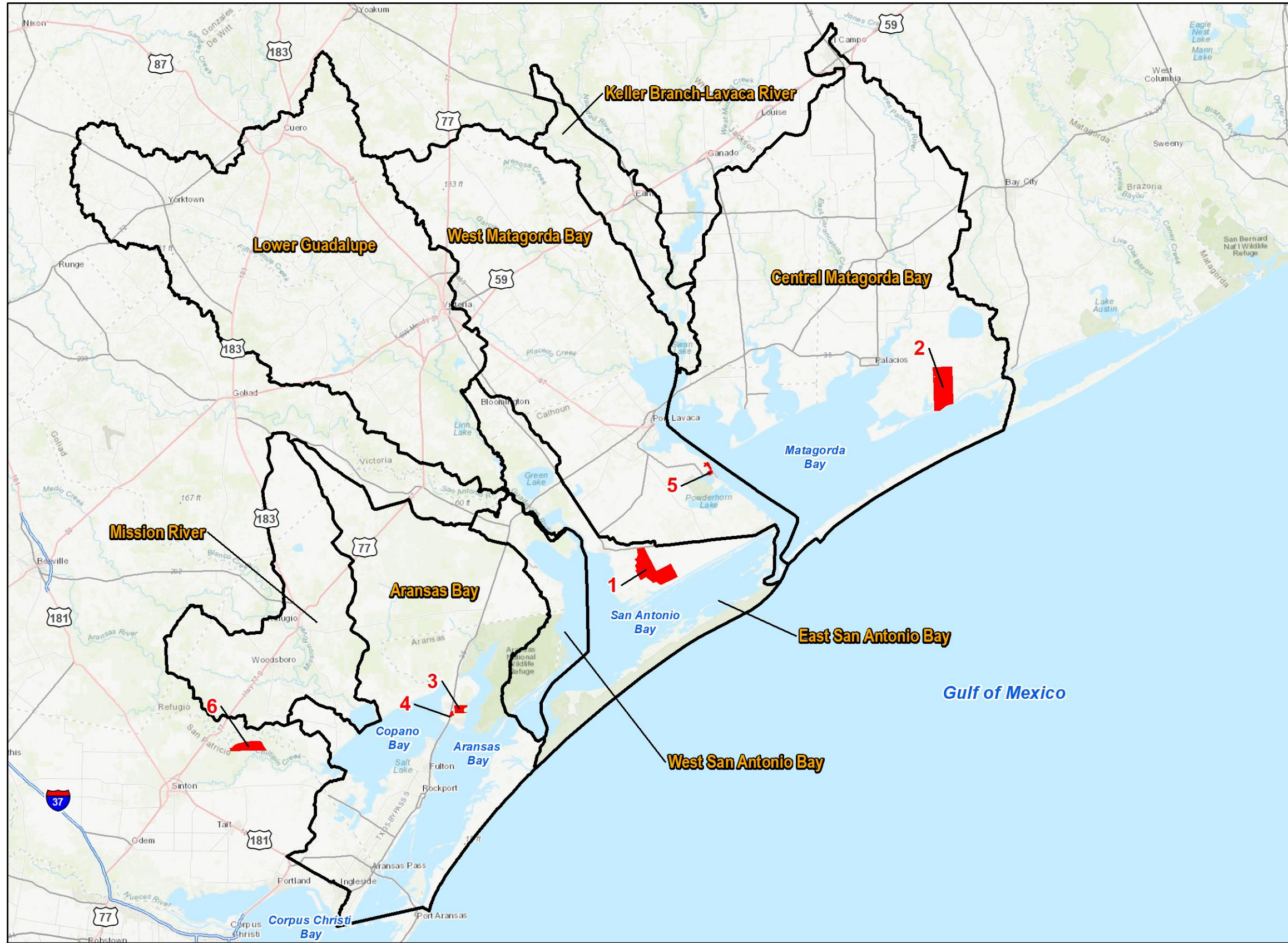




Figure 7  
 Guadalupe-Blanco River Authority  
 Comprehensive Land and  
 Conservation Easement Mapping Plan  
 Sample Areas for Whooping Crane  
 Habitat Model

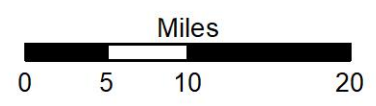
 Study Area Subbasins  
 Habitat Model Sample Area

**Sample areas reviewed with  
 Whooping Crane Habitat Model**  
 (Metzger et al. 2020)

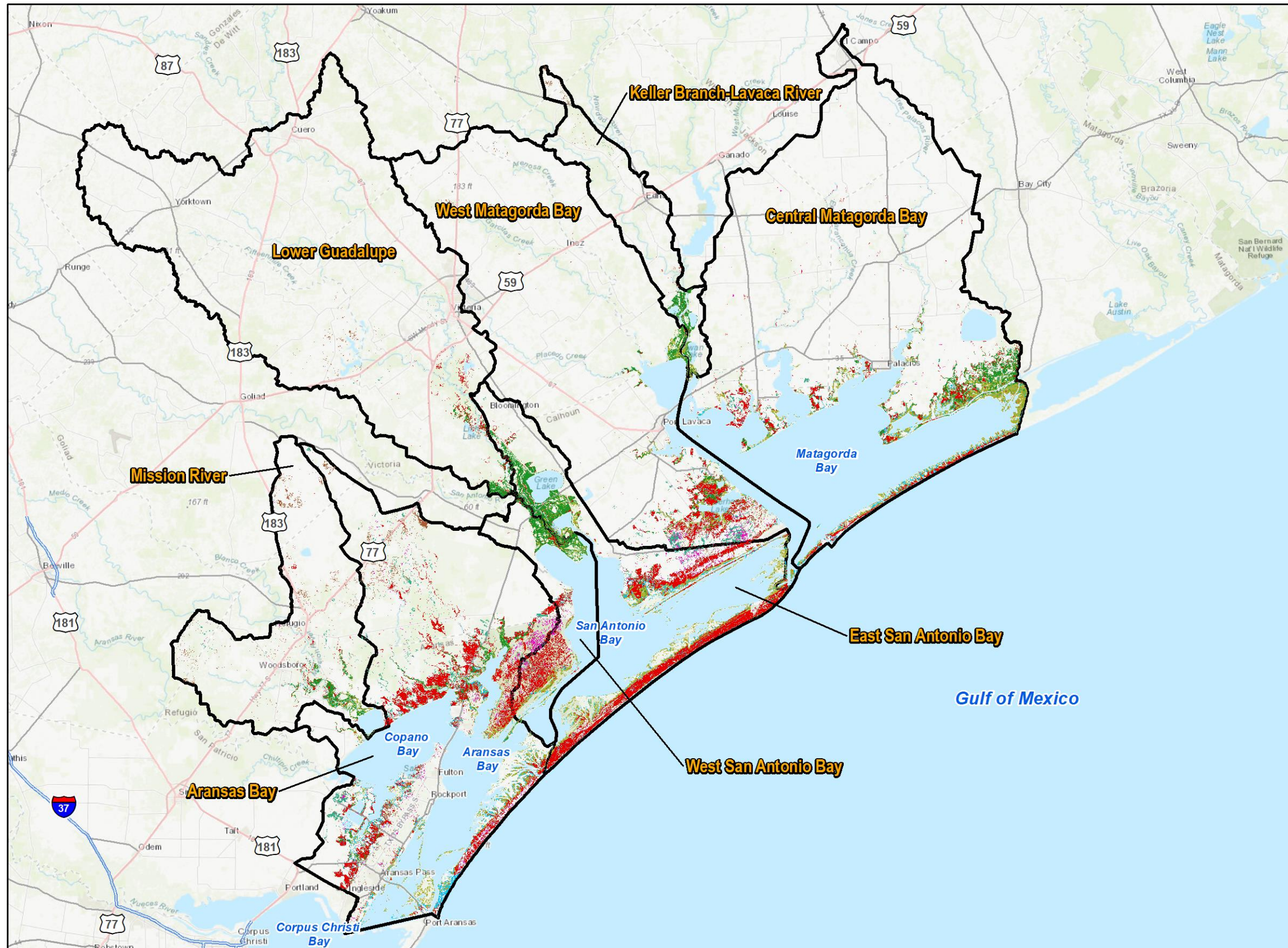
- 1 NRCS WRP 6674421000YQK CE
- 2 Runnels Family Mad Island Marsh Preserve
- 3 Johnson Ranch CE
- 4 Aransas First 105 ac
- 5 TOS Magic Ridge (approximate)
- 6 Welder Wildlife Foundation Park



1:750,000







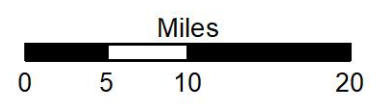
**Figure 8**  
 Guadalupe-Blanco River Authority  
 Comprehensive Land and  
 Conservation Easement Mapping Plan  
 Marshland and Prairie Habitats  
 in the Coastal Subbasins

-  Study Area Subbasins
-  Southeastern Coastal Plain Interdunal Wetland
-  Texas Coast Fresh and Oligohaline Tidal Marsh
-  Texas Coast Fresh and Oligohaline Tidal Marsh Shrubland
-  Texas Coast Salt and Brackish Tidal Marsh
-  Texas Coast Salt and Brackish Tidal Marsh Shrubland
-  Texas Saline Coastal Prairie
-  Texas-Louisiana Coastal Prairie
-  Texas-Louisiana Coastal Prairie Pondshore

Source: LANDFIRE 2020 and NatureServe 2009



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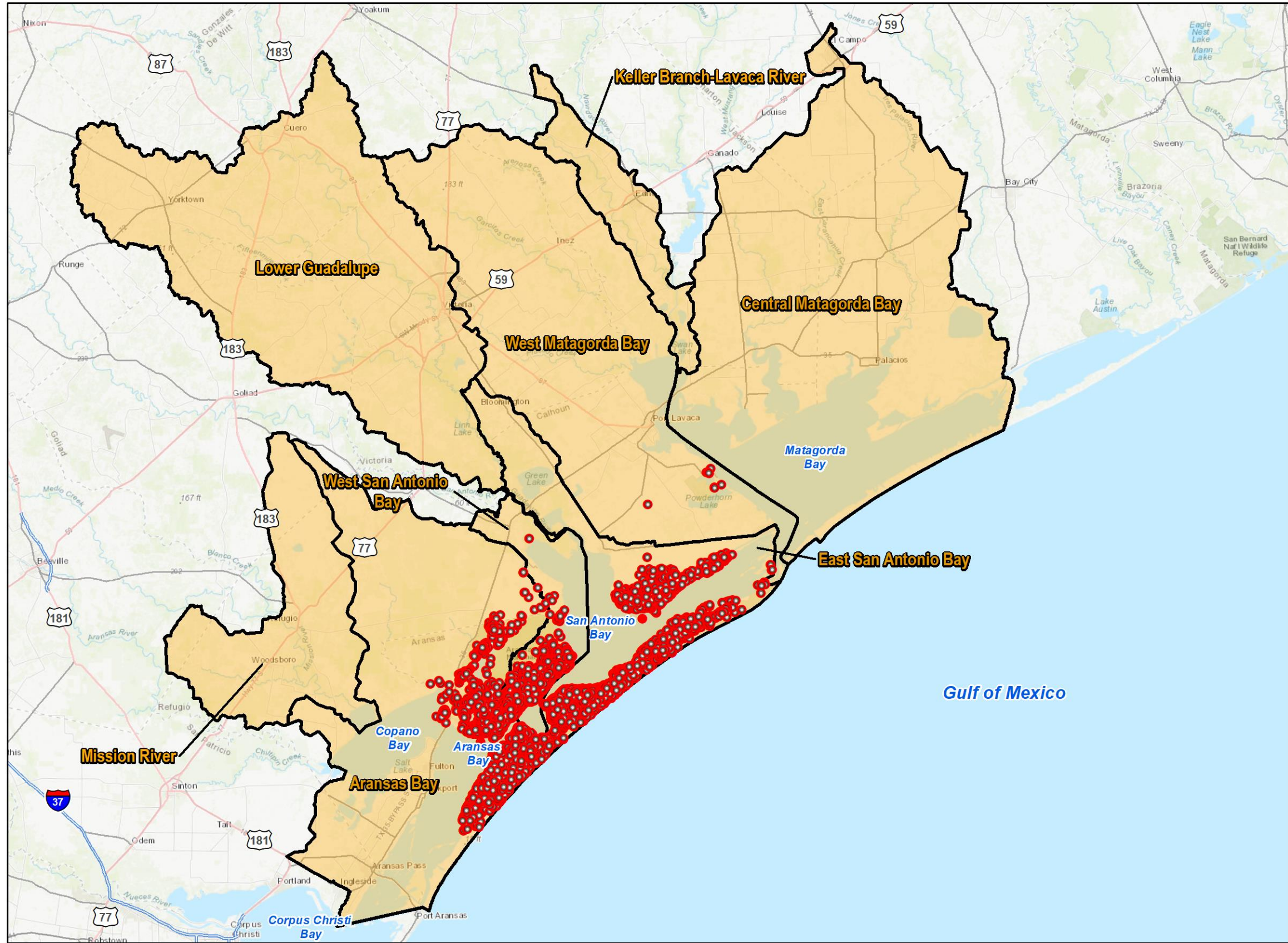


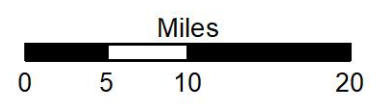
Figure 9  
 Guadalupe-Blanco River Authority  
 Comprehensive Land and  
 Conservation Easement Mapping Plan  
 Whooping Crane Sightings  
 1950-2011

- Study Area Subbasins
- Whooping Crane Sightings  
1950-2011

Source: Taylor et al. 2015



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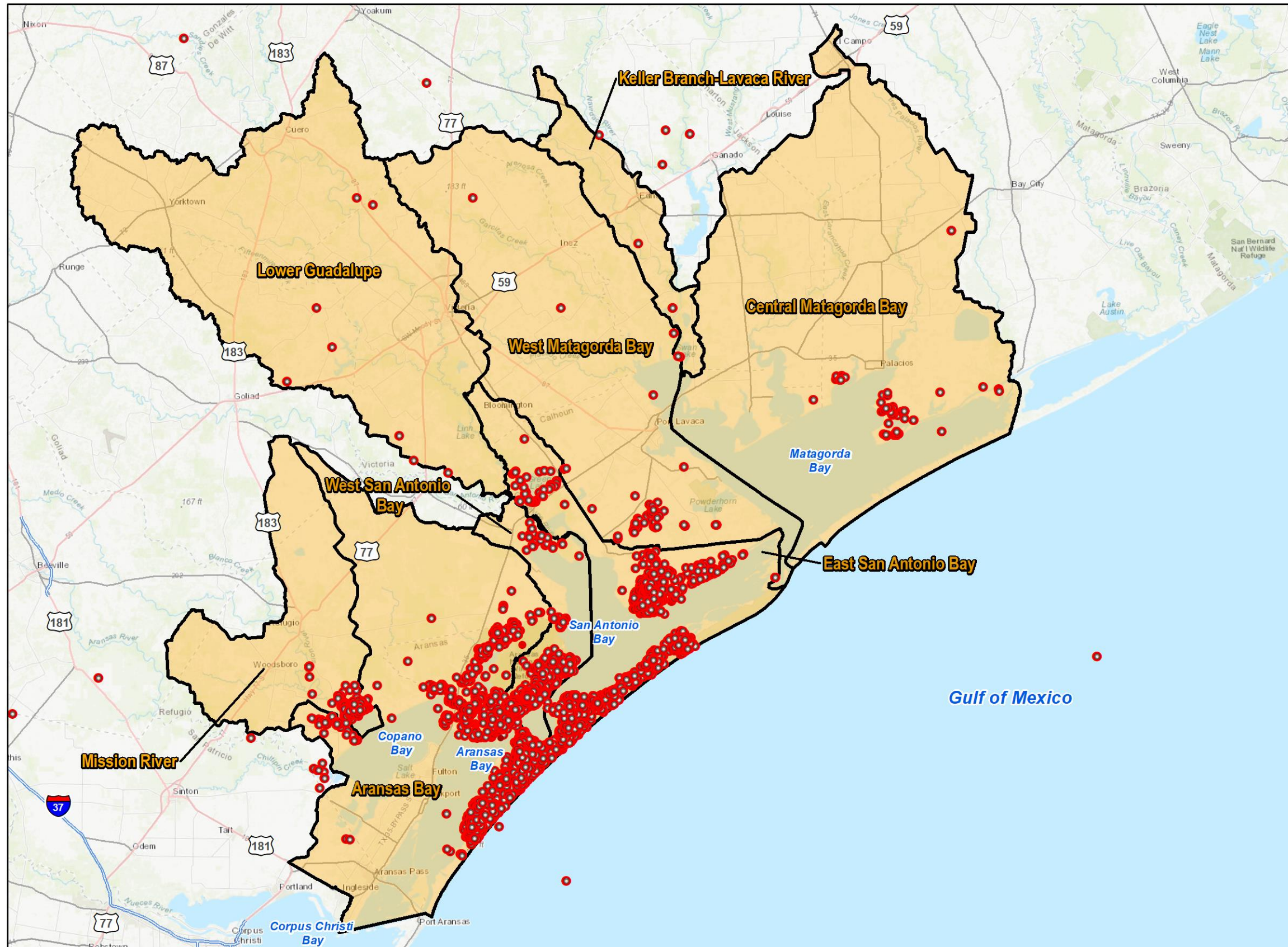


Figure 10  
 Guadalupe-Blanco River Authority  
 Comprehensive Land and  
 Conservation Easement Mapping Plan  
 Whooping Crane Telemetry Data  
 2009-2018

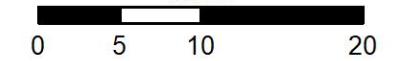
- Study Area Subbasins
- Whooping Crane Telemetry Data 2009-2018

Source: Pearse et al. 2020



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Miles





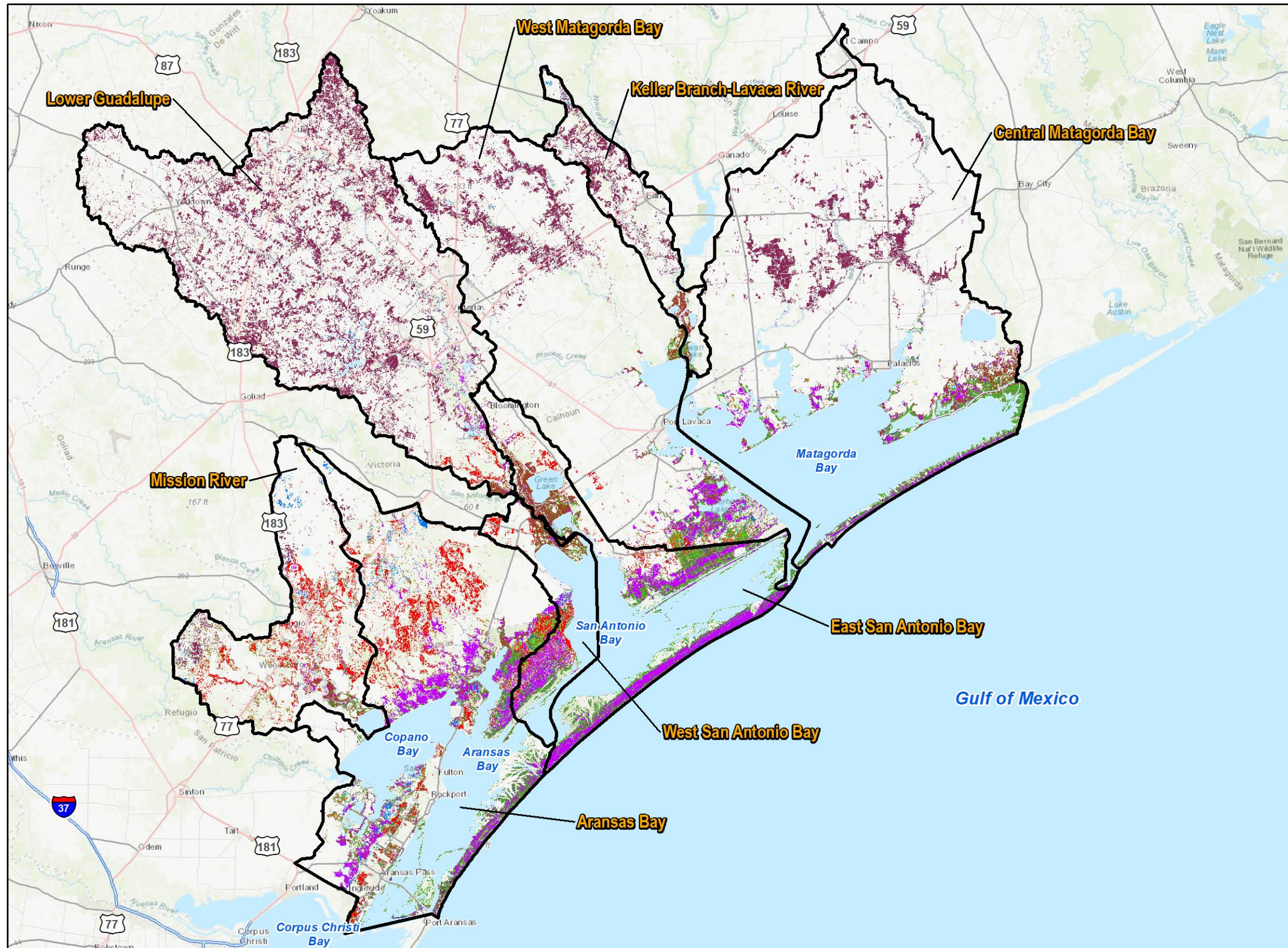


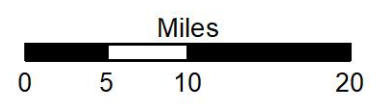
Figure 11  
 Guadalupe-Blanco River Authority  
 Comprehensive Land and  
 Conservation Easement Mapping Plan  
 Priority Habitats of the Gulf Coast  
 Prairies and Marshes Ecoregion  
 in the Coastal Subbasins

- Study Area Subbasins
- Central and South Texas Coastal Fringe Forest and Woodland
- East-Central Texas Plains Post Oak Savanna and Woodland
- Southeastern Coastal Plain Interdunal Wetland
- Tamaulipan Mixed Deciduous Thornscrub
- Texas Coast Beach
- Texas Coast Dune and Coastal Grassland
- Texas Coast Fresh and Oligohaline Tidal Marsh
- Texas Coast Fresh and Oligohaline Tidal Marsh Shrubland
- Texas Coast Salt and Brackish Tidal Marsh
- Texas Coast Salt and Brackish Tidal Marsh Shrubland
- Texas Saline Coastal Prairie
- Texas-Louisiana Coastal Prairie
- Texas-Louisiana Coastal Prairie Pondshore

Source: TCAP 2012a, 2012b, NatureServe 2009a, 2009b, and LANDFIRE 2020



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## **Appendix B**

### Evaluation Forms and Spreadsheets for the Coastal Subbasins

# Guadalupe-Blanco River Authority

## Land Conservation Criteria for the Coastal Subbasins

### A. Property Identification

Name of property:

Owner:

Address:

Telephone:

E-mail:

Type of ownership:

- Individual(s)
- Partnership/Corporate Entity
- Trust/Other

Size of property:

County:

Location:

Appraisal District parcel number(s):

Geographic coordinates:

Named streams within or bordering the property:

Property is under consideration for:

- Purchase (fee simple acquisition)
- Conservation easement (purchase of development rights, or PDR)

### B. Mapped Criteria

Evaluation of the following criteria is based on mapped data from the identified sources, as described in **Section 4.1.1**.

1. Property is in one of the following GBRA Coastal Subbasins conservation planning areas.

- Lower Guadalupe (Hydrologic Unit Code [HUC] 12100204) (12100401) (Priority 2)
- Central Matagorda Bay (HUC 12100401) (Priority 2)
- West Matagorda Bay (HUC 12100402) (Priority 1)
- East San Antonio Bay (HUC 12100403) (Priority 1)
- West San Antonio Bay (HUC 12100404) (Priority 1)
- Aransas Bay (HUC 12100405) (Priority 1)
- Mission River (HUC 1210040603) (Priority 2)
- Keller Branch-Lavaca River (HUC 1210010104) (Priority 2)

2. Estimated current carrying capacity of whooping cranes, as determined by habitat modeling method developed for the Texas Coastal Bend Landscape Conservation Design (Metzger et al. 2020).
  - High: Greater than 1.00 whooping cranes per square kilometer (WHCR/sq km)
  - Medium-High: 0.75 to 1.00 WHCR/sq km
  - Medium: 0.50 to 0.75 WHCR/sq km
  - Low: 0.02 to 0.50 WHCR/sq km
3. Estimated future 2100 carrying capacity of whooping cranes, assuming 1 meter sea level rise and with urbanization (model LC1), as determined by method described by Metzger et al. (2020).
  - High: Greater than 1.00 whooping cranes per square kilometer (WHCR/sq km)
  - Medium-High: 0.75 to 1.00 WHCR/sq km
  - Medium: 0.50 to 0.75 WHCR/sq km
  - Low: 0.02 to 0.50 WHCR/sq km
4. Existing vegetation type of the subject property includes coastal prairie and marsh habitat, as identified by LANDFIRE Existing Vegetation Type (LF-EVT).
  - High quality (67 percent or more of property meets requirement)
  - Moderate quality (33 to 67 percent of property meets requirement)
  - Low quality (less than 33 percent of property meets requirement)
5. Subject property is known to be occupied by the whooping crane.
  - Yes. List and describe numbers and years \_\_\_\_\_
  - No
  - Unknown (If unknown, have biological surveys been conducted  Yes  No. Provide additional details \_\_\_\_\_
6. Subject property contains Priority Habitat identified in the Texas Conservation Action Plan Gulf Coast Prairies and Marshes Ecoregion Handbook (TCAP 2012).
  - Yes; describe \_\_\_\_\_
  - No

**C. Property-specific Criteria**

Evaluation of the following criteria requires evaluation of site-specific property information, as described in **Section 4.1.2**.

1. Subject property is known to be occupied by other Priority Species as identified for the subbasin.
  - Yes, occupied in at least one year in the last five. List and describe numbers and years \_\_\_\_\_
  - No, but habitat is suitable and bordering, adjacent or neighboring habitat is occupied.
  - No, not known to be occupied, and habitat is not currently suitable.



Unknown (If unknown, have biological surveys been conducted  Yes  No. Provide additional details \_\_\_\_\_)

2. Subject property is enrolled in the Coastal Prairie Coalition Grazing Lands Conservation Initiative (GLCI) Programmatic Safe Harbor Agreement (Aransas, Calhoun, Goliad, Refugio, Victoria counties).

Yes

No

3. Subject property is bordering, adjacent to, or neighboring another protected property (either fee simple protection or conservation easement).

Bordering: The subject property is bordering existing protected lands with a shared boundary for a substantial length of at least one side.

Adjacent: The subject property is close to existing protected land, but does not share any boundary.

Neighboring: The subject property is not bordering or adjacent, but is sufficiently close to other protected land to provide some degree of added habitat for Priority Species, if there is no substantive current or future threat from degrading land use in the intervening land, and it makes a substantive contribution to total protected area in the vicinity (generally less than one mile separation).

Isolated: Not Bordering, Adjacent, or Neighboring.

4. Total area of subject property within 100 meters of the edge, when calculated with bordering protected lands.

High quality: less than 10 percent of subject property within 100 meters of the edge

Medium quality: 10 to 20 percent

Low quality: Greater than 20 percent

5. Subject property is minimally affected by invasive species.

Yes

No

Comments \_\_\_\_\_

#### **D. Additional Considerations for Conservation Easements**

1. Public Access. Inclusion of provisions in conservation easement to allow opportunities for compatible public access.

No Public Access (most common): Landowner reserves the right to allow or disallow members of the general public onto the property.

Open Access (uncommon): Landowner will allow certain public access to the property.

Comments \_\_\_\_\_

2. Conservation Values. The Internal Revenue Code 170(h)(4)(A) requires that a donated easement must be made exclusively for one of the following conservation purposes to be qualified as a charitable contribution.

- Preservation of land areas for outdoor recreation by, or the education of, the general public.
- Protection of a relatively natural habitat for fish, wildlife, or plants, or a similar ecosystem.
- Preservation of open space for the scenic enjoyment of the general public, or pursuant to a Federal, State, or local governmental conservation policy.
- Preservation of historically important land area or certified historic buildings.

Comments \_\_\_\_\_

3. Endowment. Landowner will provide an endowment for donated easement sufficient to monitor the subject property in perpetuity and uphold all other terms of the easement.

- Yes
- No

Comments \_\_\_\_\_

4. Known Title Issues

- Conflicting easements on property
- Easement required to access property
- Mortgages
- Mineral leases
- Severed mineral rights
- Tax liens
- Disputed boundaries/boundary encroachment
- Water rights issues
- Other
- None

Comments \_\_\_\_\_

5. Possible Adverse Conditions on Property

- Recognized Environmental Condition (REC) identified in Phase I Environmental Site Assessment.
- Dump or trash pit
- Gravel or mining operations
- Other reserved rights to potentially incompatible use.
- Oil/gas well or pipeline
- Adjacent commercial or residential development
- Other
- None

Comments \_\_\_\_\_

CRITERIA FOR COASTAL SUBBASINS	WEIGHT	SELECTION	SCORE
	100	(Choose from dropdown menus in this column)	100
<b>B. MAPPED CRITERIA (Section 4.1.1)</b>			
B1. Property is in one of the following GBRA Coastal Subbasins conservation planning areas.	10	East San Antonio Bay (HUC 12100403) (Priority 1)	10
B2. Estimated current carrying capacity of whooping cranes, as determined by habitat modeling method developed for the Texas Coastal Bend Landscape Conservation Design (Metzger et al. 2020).	16	High: Greater than 1.00 whooping cranes per square kilometer (WHCR/sq km)	16
B3. Estimated future 2100 carrying capacity of whooping cranes, assuming 1 meter sea level rise and with urbanization (projected by the LC1 model), as determined by method described by Metzger et al. (2020).	16	High: Greater than 1.00 whooping cranes per square kilometer (WHCR/sq km)	16
B4. Existing vegetation type of the subject property includes coastal prairie and marsh habitat, as identified by LANDFIRE Existing Vegetation Type (LF-EVT).	9	High quality (67 percent or more of property meets requirement)	9
B5. Subject property is known to be occupied by the whooping crane.	10	Yes	10
B6. Subject property contains Priority Habitat identified in the Texas Conservation Action Plan (TCAP) Gulf Coast Prairies and Marshes Ecoregion Handbook.	6	Yes	6
<b>Mapped Criteria Subtotal</b>	<b>67</b>		<b>67</b>
<b>C. PROPERTY-SPECIFIC CRITERIA (Section 4.1.2)</b>			
C1. Subject property is known to be occupied by other Priority Species as identified for the subbasin.	8	Yes, occupied in at least one year in the last five	8
C2. Subject property is enrolled in the Coastal Prairie Coalition Grazing Lands Conservation Initiative (GLCI) Programmatic Safe Harbor Agreement (Aransas, Calhoun, Goliad, Refugio, Victoria counties).	4	Yes	4
C3. Subject property is bordering, adjacent to, or neighboring another protected property (either fee simple protection or conservation easement).	8	Bordering: The subject property is bordering existing protected lands with a shared boundary for a substantial length of at least one side.	8
C4. Total area of subject property within 100 meters of the edge, when calculated with bordering protected lands.	7	High quality: less than 10 percent of subject property within 100 meters of the edge	7
C5. Subject property is minimally affected by invasive species.	6	Yes	6
<b>Property-Specific Criteria Subtotal</b>	<b>33</b>		<b>33</b>
<b>D. Additional Considerations for Conservation Easements</b>			
D1. Public Access. Inclusion of provisions in conservation easement to allow opportunities for compatible public access.			
D2. Conservation Values. The Internal Revenue Code 170(h)(4)(A) requires that a donated easement must be made exclusively for one of the following conservation purposes to be qualified as a charitable contribution.			
D3. Endowment. Landowner will provide an endowment for donated easement sufficient to monitor the subject property in perpetuity and uphold all other terms of the easement.			
D4. Known Title Issues			
Conflicting easements on property			

CRITERIA FOR COASTAL SUBBASINS	WEIGHT	SELECTION	SCORE
	100	(Choose from dropdown menus in this column)	100
Easement required to access property			
Mortgages			
Mineral leases			
Severed mineral rights			
Tax liens			
Disputed boundaries/boundary encroachment			
Water rights issues			
Other			
None			
<b>D5. Possible Adverse Conditions on Property</b>			
Recognized Environmental Condition (REC) identified in Phase I Environmental Site Assessment.			
Dump or trash pit			
Gravel or mining operations			
Other reserved rights to potentially incompatible use.			
Oil/gas well or pipeline			
Adjacent commercial or residential development			
Other			
None			

CRITERIA FOR COASTAL SUBBASINS	WEIGHT	SCORE
	100	
<b>B. MAPPED CRITERIA (Section 4.1.1)</b>		
<b>B1. Property is in one of the following GBRA Coastal Subbasins conservation planning areas.</b>	10	
Lower Guadalupe (HUC 12100204) (Priority 2)		8
Central Matagorda Bay (HUC 12100401) (Priority 2)		8
West Matagorda Bay (HUC 12100402) (Priority 1)		10
East San Antonio Bay (HUC 12100403) (Priority 1)		10
West San Antonio Bay (HUC 12100404) (Priority 1)		10
Aransas Bay (HUC 12100405) (Priority 1)		10
Mission River (HUC 1210040603) (Priority 2)		8
Keller Branch-Lavaca River (HUC 1210010104) (Priority 2)		8
(blank)		(blank)
<b>B2. Estimated current carrying capacity of whooping cranes, as determined by habitat modeling method developed for the Texas Coastal Bend Landscape Conservation Design (Metzger et al. 2020).</b>	16	
High: Greater than 1.00 whooping cranes per square kilometer (WHCR/sq km)		16
Medium-High: 0.75 to 1.00 WHCR/sq km		12
Medium: 0.50 to 0.75 WHCR/sq km		8
Low: 0.02 to 0.50 WHCR/sq km		4
(blank)		(blank)
<b>B3. Estimated future 2100 carrying capacity of whooping cranes, assuming 1 meter sea level rise and with urbanization (projected by the LC1 model), as determined by method described by Metzger et al. (2020).</b>	16	
High: Greater than 1.00 whooping cranes per square kilometer (WHCR/sq km)		16
Medium-High: 0.75 to 1.00 WHCR/sq km		12
Medium: 0.50 to 0.75 WHCR/sq km		8
Low: 0.02 to 0.50 WHCR/sq km		4
(blank)		(blank)
<b>B4. Existing vegetation type of the subject property includes coastal prairie and marsh habitat, as identified by LANDFIRE Existing Vegetation Type (LF-EVT).</b>	9	
High quality (67 percent or more of property meets requirement)		9
Moderate quality (33 to 67 percent of property meets requirement)		6
Low quality (less than 33 percent of property meets requirement)		3
(blank)		(blank)
<b>B5. Subject property is known to be occupied by the whooping crane.</b>	10	
Yes		10
No		5
(blank)		(blank)
<b>B6. Subject property contains Priority Habitat identified in the Texas Conservation Action Plan (TCAP) Gulf Coast Prairies and Marshes Ecoregion Handbook.</b>	6	
Yes		6
No		0
(blank)		(blank)
<b>Mapped Criteria Subtotal</b>	67	
<b>C. PROPERTY-SPECIFIC CRITERIA (Section 4.1.2)</b>		
<b>C1. Subject property is known to be occupied by other Priority Species as identified for the subbasin.</b>	8	
Yes, occupied in at least one year in the last five		8

CRITERIA FOR COASTAL SUBBASINS	WEIGHT	SCORE
	100	
No, but habitat is suitable and bordering, adjacent or neighboring habitat is occupied.		4
No, not known to be occupied, and habitat is not currently suitable		0
(blank)		(blank)
<b>C2. Subject property is enrolled in the Coastal Prairie Coalition Grazing Lands Conservation Initiative (GLCI) Programmatic Safe Harbor Agreement (Aransas, Calhoun, Goliad, Refugio, Victoria counties).</b>	4	
Yes		4
No		0
(blank)		(blank)
<b>C3. Subject property is bordering, adjacent to, or neighboring another protected property (either fee simple protection or conservation easement).</b>	8	
Bordering: The subject property is bordering existing protected lands with a shared boundary for a substantial length of at least one side.		8
Adjacent: The subject property is close to existing protected land, but does not share any boundary.		6
Neighboring: The subject property is not bordering or adjacent, but is sufficiently close to other protected land to provide some degree of added habitat for Priority Species, if there is no substantive current or future threat (see text for more info).		4
Isolated: Not Bordering, Adjacent, or Neighboring.		2
(blank)		(blank)
<b>C4. Total area of subject property within 100 meters of the edge, when calculated with bordering protected lands.</b>	7	
High quality: less than 10 percent of subject property within 100 meters of the edge		7
Medium quality: 10 to 20 percent		5
Low quality: Greater than 20 percent		2
(blank)		(blank)
<b>C5. Subject property is minimally affected by invasive species.</b>	6	
Yes		6
No		0
(blank)		(blank)
<b>Property-specific Criteria Subtotal</b>	33	
<b><u>D. Additional Considerations for Conservation Easements</u></b>		
<b>D1. Public Access. Inclusion of provisions in conservation easement to allow opportunities for compatible public access.</b>		
No Public Access (most common): Landowner reserves the right to allow or disallow members of the general public onto the property.		
Open Access (uncommon): Landowner will allow certain public access to the property.		
<b>D2. Conservation Values. The Internal Revenue Code 170(h)(4)(A) requires that a donated easement must be made exclusively for one of the following conservation purposes to be qualified as a charitable contribution.</b>		
Preservation of land areas for outdoor recreation by, or the education of, the general public.		
Protection of a relatively natural habitat for fish, wildlife, or plants, or a similar ecosystem.		
Preservation of open space for the scenic enjoyment of the general public, or pursuant to a Federal, State, or local governmental conservation policy.		
Preservation of historically important land area or certified historic buildings.		

CRITERIA FOR COASTAL SUBBASINS	WEIGHT	SCORE
	100	
<b>D3. Endowment. Landowner will provide an endowment for donated easement sufficient to monitor the subject property in perpetuity and uphold all other terms of the easement.</b>		
Yes		
No		
<b>D4. Known Title Issues</b>		
Conflicting easements on property		
Easement required to access property		
Mortgages		
Mineral leases		
Severed mineral rights		
Tax liens		
Disputed boundaries/boundary encroachment		
Water rights issues		
Other		
None		
<b>D5. Possible Adverse Conditions on Property</b>		
Recognized Environmental Condition (REC) identified in Phase I Environmental Site Assessment.		
Dump or trash pit		
Gravel or mining operations		
Other reserved rights to potentially incompatible use.		
Oil/gas well or pipeline		
Adjacent commercial or residential development		
Other		
None		