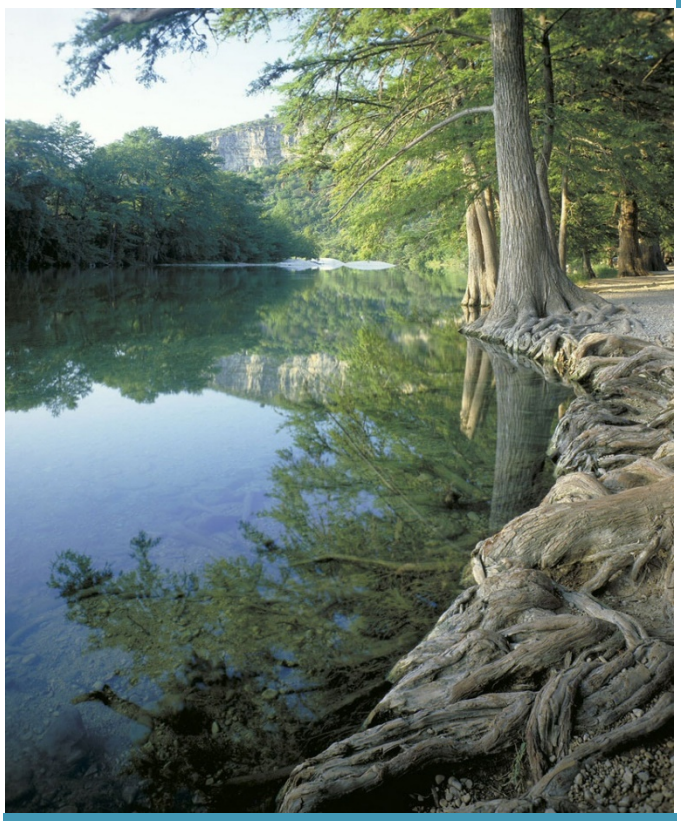

Chapter 1 – Planning Area Description

31 TAC § 361.30, 361.31, and 361.32

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1 Planning Area Description

The 31-county Nueces Region (Region 13) has an area of 24,094 square miles (15,420,000 acres), approximately 9.0% of the state's land area (Figure 1-1). The region is bound to the north by the Texas Water Development Board (TWDB) Flood Planning Region 12 (San Antonio), and to the south by TWDB Flood Planning Region 15 (Lower Rio Grande). In 2020, this region had a population of approximately 1,140,000.

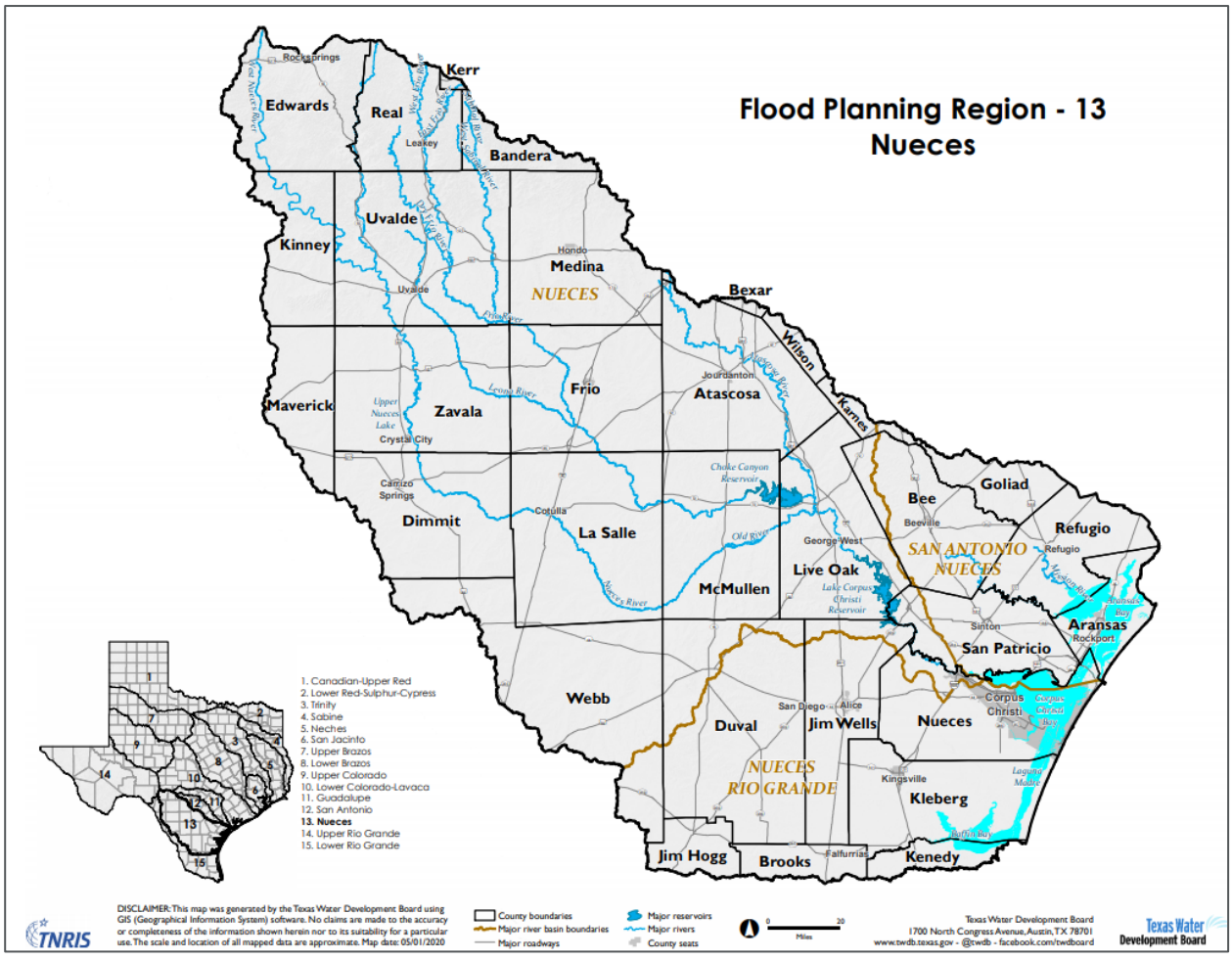

Figure 1-1. Nueces (Region 13) Flood Planning Region

1.1 Background

In 2019, the Texas Legislature and Governor Abbott adopted changes to Texas Water Code §16.061 that established a regional and state flood planning process and identified 15 flood planning regions across the state to coincide with major river basins. Information from each of the 15 regional flood plans (RFPs) will be compiled in the *2024 State Flood Plan*. The TWDB was charged with overseeing the development of each regional plan and compiling the state flood plan. The TWDB was also charged with

providing funding for investments in flood science and mapping efforts to support plan development.

This investment and planning efforts represent an important step in flood planning in Texas, because

- flood risks, impacts, and mitigation costs have never been assessed at a statewide level for Texas;
- flood risks pose a serious threat to lives and livelihoods across the state; and
- much of the flood risk in Texas is unmapped or based on out-of-date maps.

RFPs must be based on the best available science, data, models, and flood risk mapping. When complete, the plans will focus both on reducing existing risk to life and property and on enhancing floodplain management to avoid increasing flood risk in the future. The first RFP must be submitted to the TWDB by January 10, 2023. The TWDB will then compile these regional plans into a single statewide flood plan and will present it to the Legislature in 2024. An updated version of the state flood plan will be due every five years thereafter.

The TWDB has appointed a regional flood planning group (RFPG) for each region and has provided them with funding to prepare their plans. The TWDB administers the regional flood planning process through a contract with the planning group's sponsor selected by the RFPG. The Nueces Flood Planning Region (NFPR) sponsor is the Nueces River Authority. The Texas Legislature also allocated funding to be distributed by the TWDB for procuring technical assistance to develop the RFPs. HDR Engineering (HDR) was selected through a competitive process to serve as the technical consultant for the NFPR flood planning effort.

Stakeholders residing in and representing various interest categories were appointed for each region to provide representation and lead a bottom-up approach to developing the 2023 RFP. The RFPG's responsibilities include directing the work of the technical consultant; soliciting and considering public input; identifying specific flood risks; and identifying and recommending flood management evaluations, strategies, and projects to reduce risk in their regions. To ensure diverse perspectives are included, members represent a wide variety of stakeholders potentially affected by flooding. The following interest categories are included.

1. Public
2. Counties
3. Municipalities
4. Industries
5. Agriculture
6. Environment
7. Small Business

8. Electric-generating utilities
9. River authorities
10. Water districts
11. Water utilities
12. Flood districts

The members of the Nueces RFPG (NRFPG) for the first flood planning cycle are listed in Table 1-1 and Table 1-2.

Table 1-1. NRFPG Voting Membership

Member Name	Interest Category	Organization
LJ Francis (Chairman)	Municipalities	Consultant
Larry Dovalina (Vice-Chairman)	Water Utilities	City of Cotulla
Shanna Owens (Secretary)	Counties	San Patricio County DEMS
Julie Lewey	River Authorities	Nueces River Authority
Debra Barrett	Agricultural	Barrett Ag
Lauren Williams	Environmental	The Nature Conservancy
Jeffery Pollack (resigned)	Industries	Port of Corpus Christi
Robert Williams	Public	Mayor, Jourdanton
Andrew Rooke	Small Business	F.B Rooke & Sons
JR Ramirez	Water Utilities	Wintergarden GCD
David Baker	Electric Generating Utilities	City of Hondo
Larry Thomas	Flood Districts	Bandera County River Authority

Table 1-2. NRFPG Non-Voting Membership

Member Name	Agency
Tressa Olsen	Texas Water Development Board
Jim Tolan	Texas Parks and Wildlife Department
Brian Hurtuk	Texas Division of Emergency Management
Nelda Barrera	Texas Department of Agriculture
Kendria Ray	Texas State Soil and Water Conservation Board
Simone Sanders	General Land Office
Joel Anderson	Texas Commission on Environmental Quality
Patrick McGinn	Liaison to San Antonio RFPG and Rio Grande RFPG
Dave Mauk	Liaison from the San Antonio RFPG

1.2 Goal and Purpose of the 2023 Nueces (Region 13) Regional Flood Plan

All regional flood plans are to be developed according to 39 guiding principles (see 31 Texas Administrative Code [TAC] 362.3). The 2023 Nueces (Region 13) RFP focuses on identifying both existing and future condition flood risks within the Nueces basin; evaluating flood hazard exposure to life and property; identifying and evaluating potentially feasible flood management strategies and flood mitigation projects; presents recommended strategies and projects that minimize residual flood risk; and provides effective and economical management of flood risk to people, properties, and communities, and associated environmental benefits amongst other information.

1.3 Nueces Flood Planning Region Overview

1.3.1 Government Entities within Nueces Flood Planning Region

The following 31 counties were considered in the development of the Nueces RFP.

- Aransas County
- Atascosa County
- Bandera County
- Bee County
- Bexar County
- Brooks County
- Dimmit County
- Duval County
- Edwards County
- Frio County
- Goliad County
- Jim Hogg County
- Jim Wells County
- Karnes County
- Kenedy County
- Kerr County
- Kinney County
- Kleberg County
- La Salle County
- Live Oak County
- Maverick County
- McMullen County
- Medina County
- Nueces County
- Real County
- Refugio County
- San Patricio County
- Uvalde County
- Webb County
- Wilson County
- Zavala County

The following 57 municipalities were considered in the development of the Nueces RFP.

- Agua Dulce
- Alice
- Aransas Pass
- Asherton
- Bayside
- Beeville
- Benavides
- Big Wells
- Bishop
- Camp Wood
- Carrizo Springs
- Charlotte
- Christine
- Crystal City
- Devine
- Dilley
- Driscoll
- Encinal
- Falfurrias
- Freer
- Fulton
- George West
- Gregory
- Hondo
- Ingleside
- Ingleside on the Bay
- Lake City
- Lakeside
- Leakey
- Lytle
- Mathis
- Natalia
- Odem
- Orange Grove
- Pearsall
- Petronila
- Pleasanton
- Port Aransas
- Portland
- Refugio
- Robstown
- Rockport
- Rocksprings
- Sabinal
- San Diego
- San Patricio
- Sinton
- Taft
- Three Rivers
- Uvalde
- Woodsboro

- Corpus Christi
- Cotulla
- Jourdanton
- Kingsville
- Poteet
- Premont

The following 50 other government entities were considered by the Nueces RFPG in the development of the Nueces RFP.

- Guadalupe-Blanco River Authority
- Lower Colorado River Authority
- Nueces River Authority
- San Antonio River Authority
- Upper Guadalupe River Authority
- Bexar-Medina-Atascosa Counties Water Control and Improvement District (WCID) 1
- Alamo Area Council of Governments
- Alice Water Authority
- Aransas County Municipal Utility District (MUD 1)
- Aransas County Navigation District
- Aransas County WCID 1
- Bandera County River Authority
- Beeville Water Supply District
- Canyon Regional Water Authority
- Coastal Bend Council of Governments
- Corpus Christi Downtown Management District
- Duval County Conservation & Reclamation District
- Escondido Watershed District
- Freer WCID
- Golden Crescent Regional Planning Commission
- Hondo Creek Watershed Improvement District
- Jim Hogg County WCID 2
- Jim Wells County Fresh Water Supply District (FWSD) 1
- Lamar Improvement District
- Medina County WCID 2
- Middle Rio Grande Development Council
- Nueces County Bishop Driscoll Drainage District 3
- Nueces County Drainage & Conservation District 2
- Nueces County WCID 3
- Nueces County WCID 4
- Nueces County WCID 5
- Padre Island Gateway Municipal Management District
- Pettus MUD
- Port of Corpus Christi Authority
- Refugio County Drainage District 1
- Refugio County Navigation District
- Refugio County WCID 2
- Rio Grande Regional Water Authority
- Riviera WCID
- San Diego MUD 1
- San Patricio County Drainage District
- San Patricio County MUD 1
- San Patricio County Navigation District 1
- San Patricio MWD
- South Texas Development Council
- South Texas Water Authority
- Three Rivers Water District
- Zavala County WCID 1

- Maverick County WCID 1
- McMullen County WCID 1

1.3.2 Nueces Flood Planning Region Subregions

The NFPR is sub-divided into four subregions, as shown in Figure 1-2, to facilitate stakeholder engagement amongst the basin's varying geographic areas.

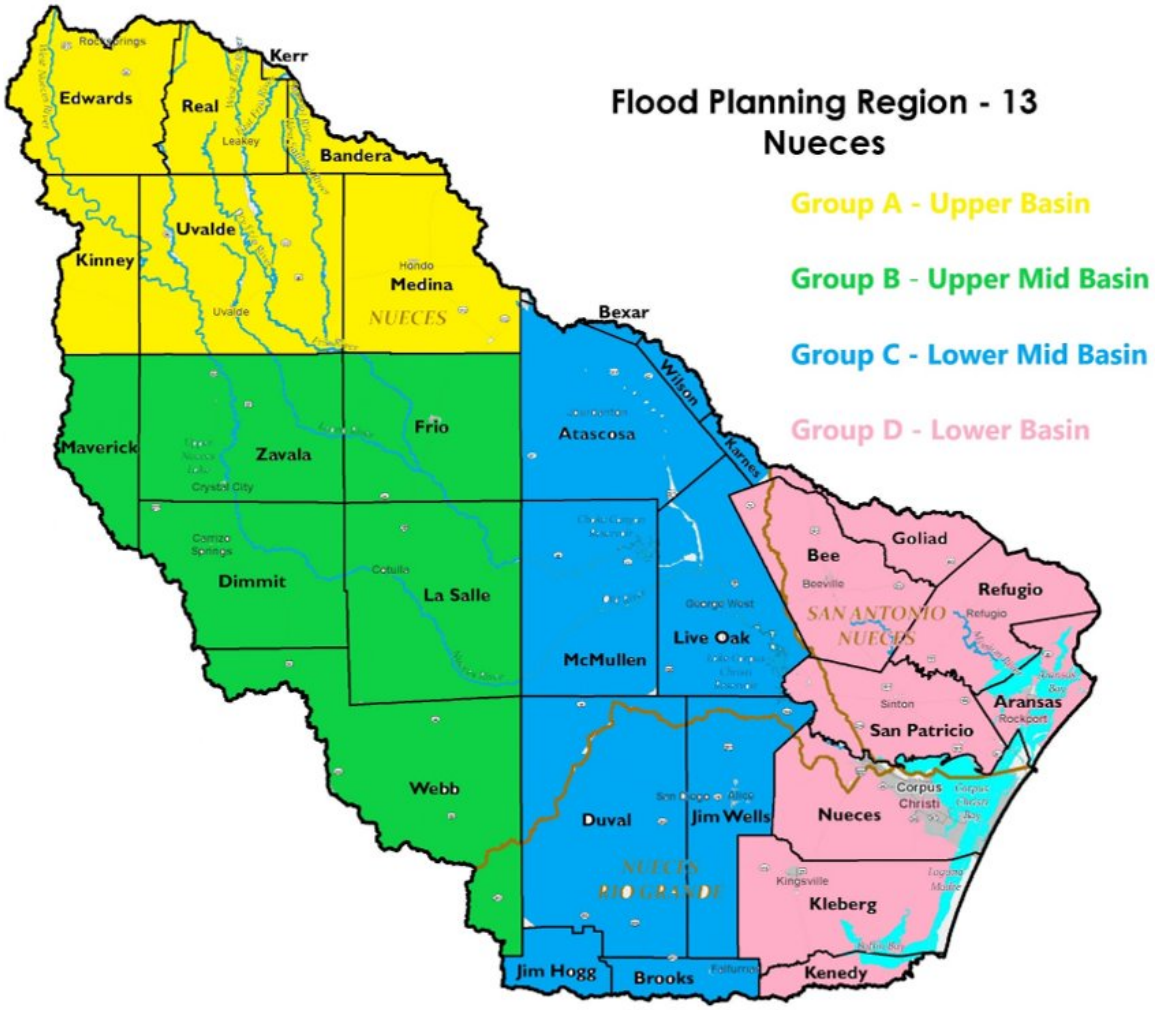

Figure 1-2. Nueces Flood Planning Area and Sub-Regions

1.3.3 Major Water Bodies

The NFPR includes an area that drains to Nueces River and associated tributaries. Nueces River rises in two forks in Edwards and Real counties and flows 315 miles to Nueces Bay on the Gulf near Corpus Christi. Principal tributaries of the Nueces are the Frio and Atascosa rivers. Nueces River feeds the Nueces Estuary, which includes Corpus Christi Bay and its western and southern extensions in Nueces Bay and Oso Bay. The Nueces Estuary spans 106,990 acres and is separated from the Gulf of

Mexico by Mustang Island. The Nueces Estuary also receives freshwater from Oso Creek via Oso Bay.

The NFPR also includes coastal areas north and south of the Nueces River basin. This includes the area that drains to the Mission River, which is formed by the confluence of Blanco and Medio creeks and runs southeast for 24 miles to its mouth at Mission Bay, an inlet of Copano Bay and subsequently Aransas Bay. And the NFPR includes the area that drains to the upper Laguna Madre Estuary. San Fernando Creek provides freshwater inflow into this estuary through Baffin Bay.

The NFPR contains the following major reservoirs.

- **Choke Canyon Reservoir** – This reservoir is located along Frio River four miles west of Three Rivers in Live Oak County. The Bureau of Reclamation built the reservoir in 1982 and the City of Corpus Christi and the Nueces River Authority own and operate it for municipal water supply and recreational purposes. According to a TWDB 2012 survey, Choke Canyon has a storage capacity of 662,821 acre-feet with a drainage area above the dam of 4,667 square miles. (TWDB, 2022)
- **Lake Corpus Christi (Live Oak)** – This reservoir is located along Nueces River four miles west of Mathis at the intersection of Live Oak, San Patricio, and Jim Wells County lines. The reservoir was originally built in 1929 and reconstructed in 1955. The City of Corpus Christi owns and operates the dam for municipal water supply and recreational purposes. According to a TWDB 2012 survey the reservoir has a capacity of 254,732 acre-feet with a drainage area above the dam of 16,656 square miles. (TWDB, 2022)
- **Upper Nueces Lake** – This reservoir is also known as the Upper Dam and is located along Nueces River six miles north of Crystal City in Zavala County. The reservoir was originally built in 1926 and was reconstructed in 1948. Zavala and Dimmit counties' Water Improvement District No.1 own and operate the dam for irrigational, recreational, and water supply purposes. The current storage capacity is estimated at 5,200 acre-feet with a drainage area above the dam of 2,160 square miles. (TWDB, 2022)

1.3.4 Major Ecosystems

The NFPR includes five of the 10 ecosystems identified by Texas Parks and Wildlife Department (TPWD) (Figure 1-3). NFPR ecoregions primarily consist of the Gulf Prairies and Marshes, South Texas Plains, and Edwards Plateau with slivers of the Post Oak Savanah and Blackland Prairie.

1.3.4.1 Gulf Coast Prairie

The Gulf Coast Prairies and Marshes region is a near-level, slowly drained plain less than 150 feet in elevation, dissected by streams and rivers flowing into the Gulf of Mexico. The region includes barrier islands along the coast, salt grass marshes surrounding bays and estuaries, remnant tallgrass prairies, oak parklands and oak mottes scattered along the coast, and tall woodlands in the river bottomlands. Average annual rainfall varies from 30 to 50 inches per year distributed fairly uniformly throughout the year. The growing season is usually more than 300 days, with high humidity and warm temperatures. Soils are acidic sands and sandy loams, with clays occurring primarily in the river bottoms. Native vegetation consists of tallgrass prairies and live oak woodlands. Brush species such as mesquite and acacias are more common now than in the past. Although much of the native habitat has been lost to agriculture and urbanization, the region still provides important habitat for migratory birds and spawning areas for fish and shrimp. (TPWD, 2022)

1.3.4.2 South Texas Plains

The South Texas Brush Country is characterized by plains of thorny shrubs and trees and scattered patches of palms and subtropical woodlands in the Rio Grande Valley. The plains were once covered with open grasslands and a scattering of trees, and the valley woodlands were once more extensive. Today, the primary vegetation consists of thorny brush such as mesquite, acacia, and prickly pear mixed with areas of grassland. The average annual rainfall of 20 to 32 inches increases from west to east. Average monthly rainfall is lowest during winter, and highest during spring (May or June) and fall (September). Summer temperatures are high, with very high evaporation rates. Soils of the region are alkaline to slightly acidic clays and clay loams. The deeper soils support taller brush, such as mesquite and spiny hackberry, whereas short, dense brush characterizes the shallow caliche soils. Although many land changes have occurred in this region, the brush country remains rich in wildlife and a haven for many rare species of plants and animals. It is home for semi-tropical species that occur in Mexico, grassland species that range northward, and desert species commonly found in the Trans-Pecos. Livestock grazing and crop production are the principal agricultural land uses. (TWDB, 2022)

1.3.4.3 Edwards Plateau

The Edwards Plateau region comprises an area of central Texas commonly known as the Texas Hill Country. It is a land of many springs, stony hills, and steep canyons. The region is home to a whole host of rare plants and animals found nowhere else on earth. Average annual rainfall ranges from 15 to 34 inches. Rainfall is highest in May or June and September. Soils of the Edwards Plateau are usually shallow with a variety of surface textures. They are underlain by limestone. Elevations range from slightly less than 100 feet to over 3,000 feet above sea level. Several river systems dissect the

surface, creating a rough and well-drained landscape. The limestone of the Edward's Plateau is honeycombed with thousands of caves. Beneath the eastern edge of the Plateau lies a hidden world of underground lakes known as the Edwards Aquifer. This precious water resource also is home to a number of curious creatures, such as the blind salamander. Today, the Edwards Plateau is characterized by grasslands, juniper/oak woodlands, and plateau live oak or mesquite savannah. Open grasslands and savannahs were more common in pre-settlement times than they are today. Ranching is the primary agricultural industry in the region. (TPWD, 2022)

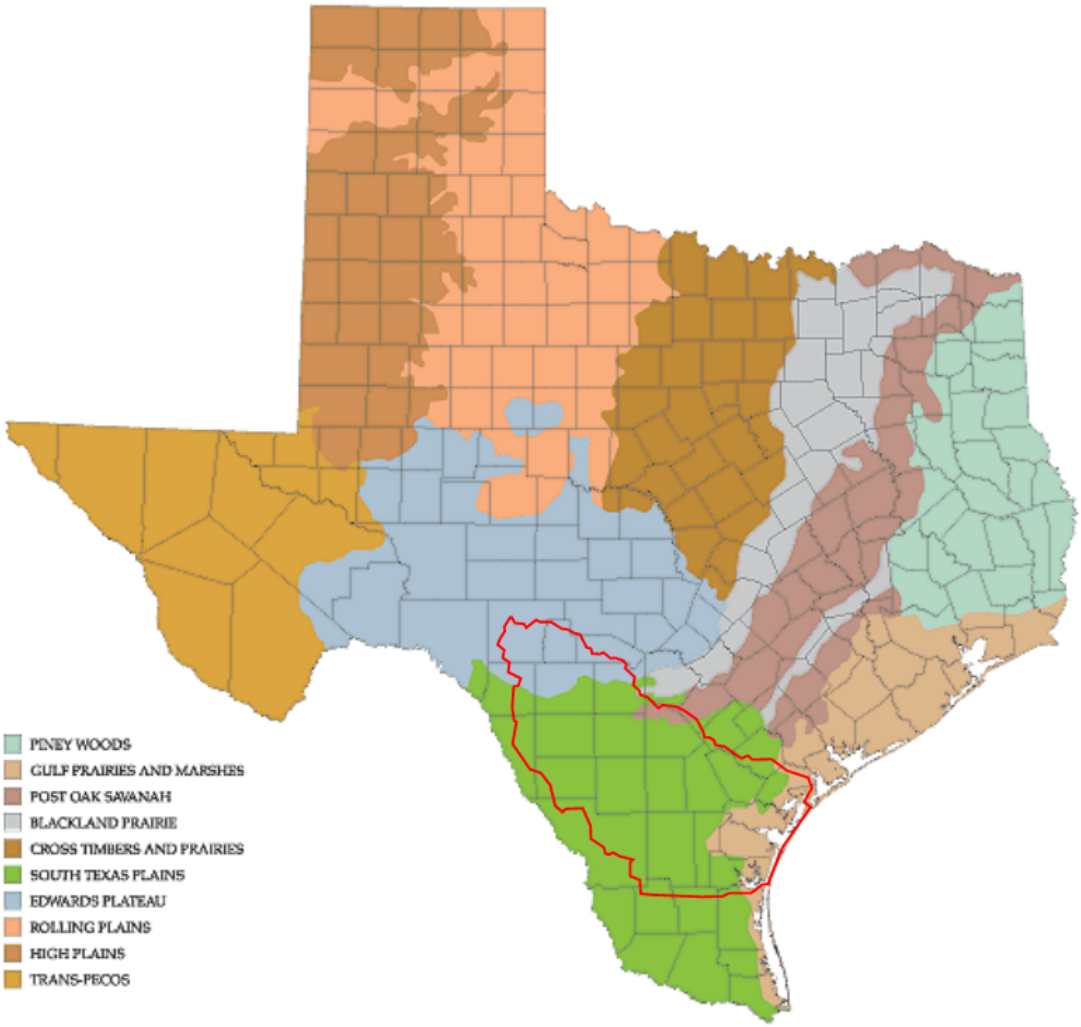

Figure 1-3. Region 13 Ecoregions (Source: Gould)

1.3.5 Land Use and Vegetative Cover

The NFPR is predominately rural with large areas of low to medium development intensity limited to the Corpus Christi metropolitan area. Pastures and cultivated crops are the predominant use of working lands across the NFPR. The land and vegetative cover align closely with the various ecoregions within the NFPR as shown in Figure 1-4 and Figure 1-5.

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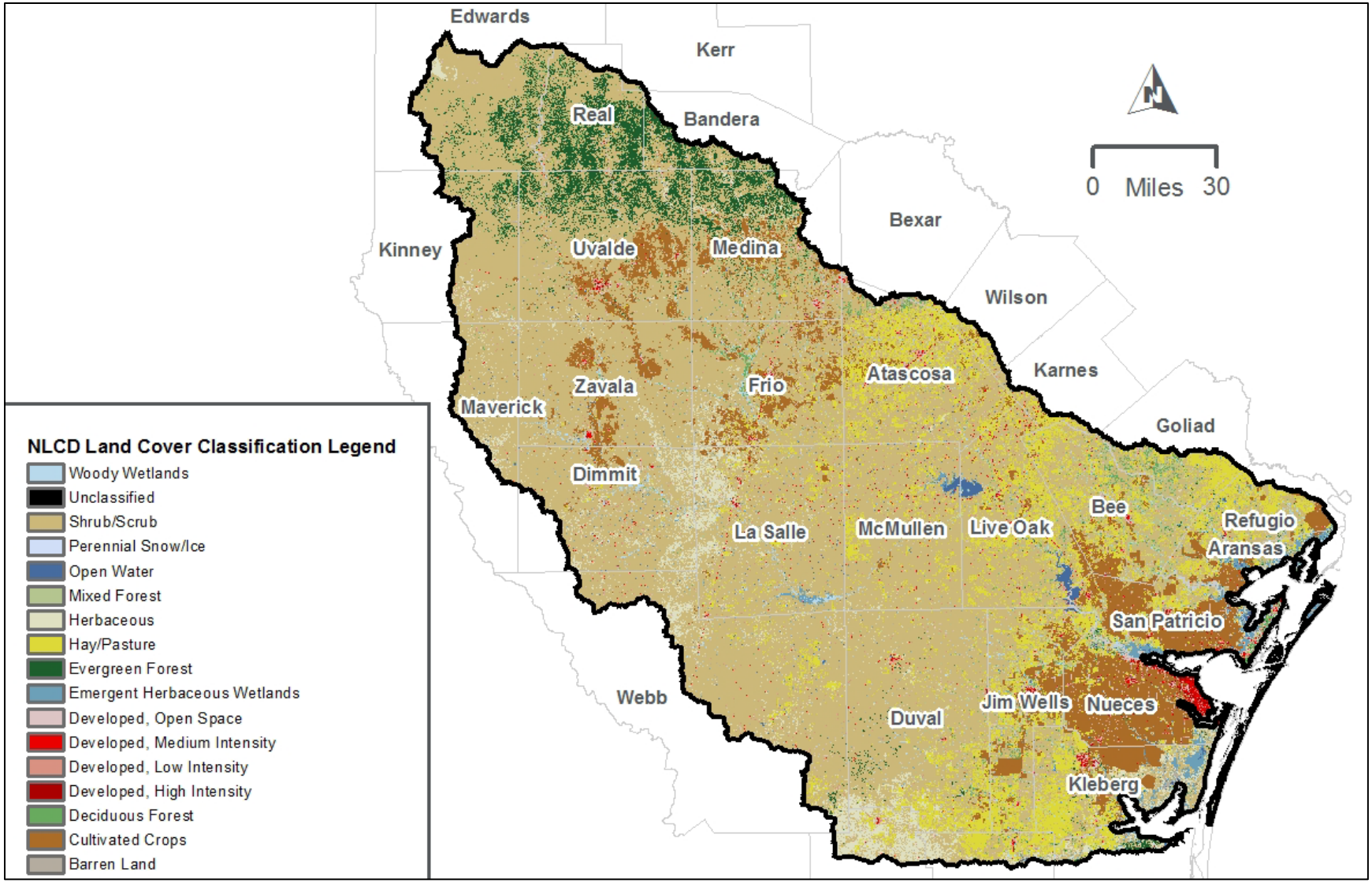

Figure 1-4. Land Cover (NLCD)

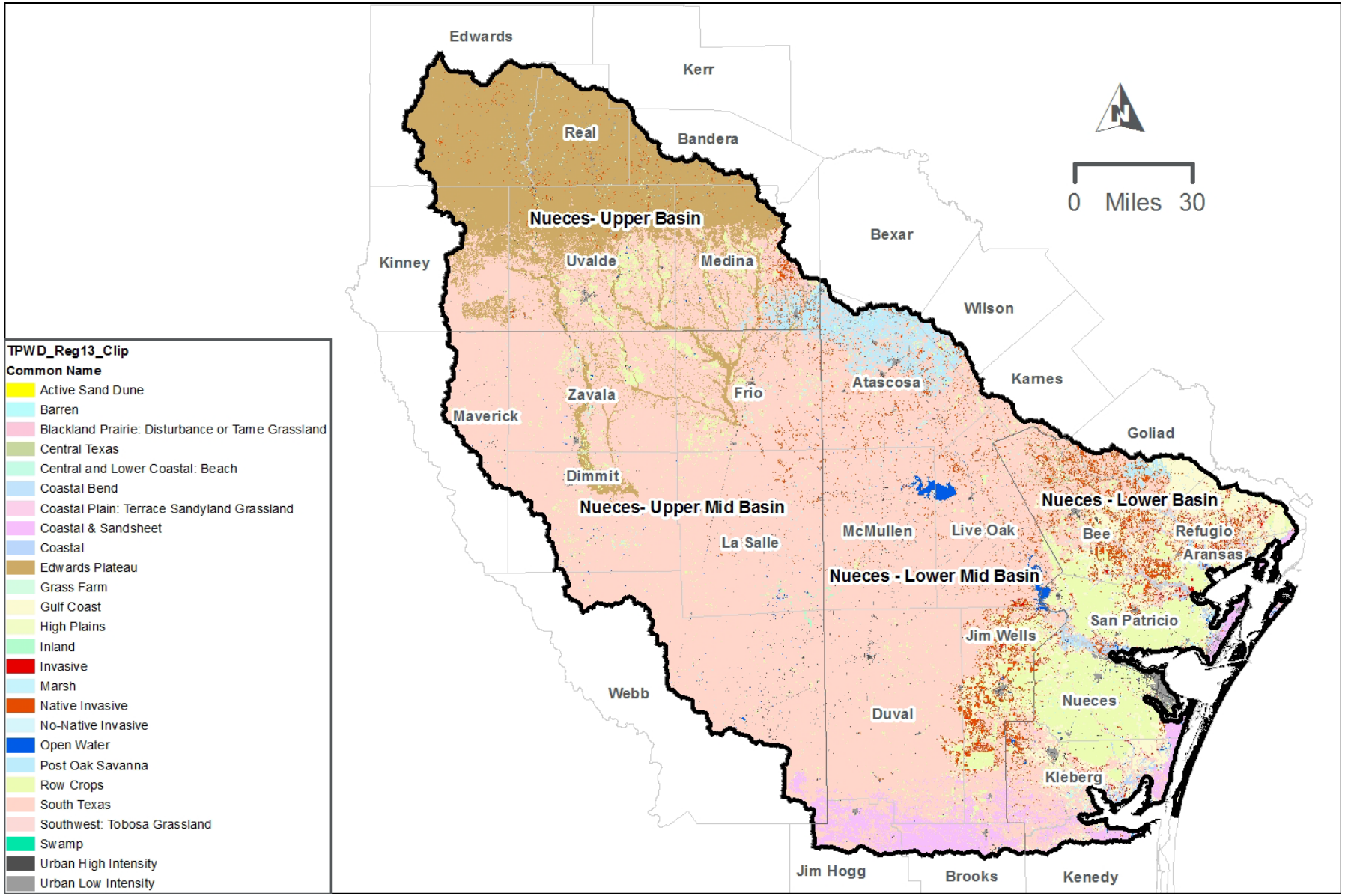

Figure 1-5. Vegetation Cover (TPWD)

1.3.6 Conservation Lands

The NFPR contains Conservation Lands to enable landowners to protect natural resources for future generations while maintaining private ownership. Conservation Lands in the NFPR are predominately located in the Edwards Plateau region as shown in Figure 1-6.

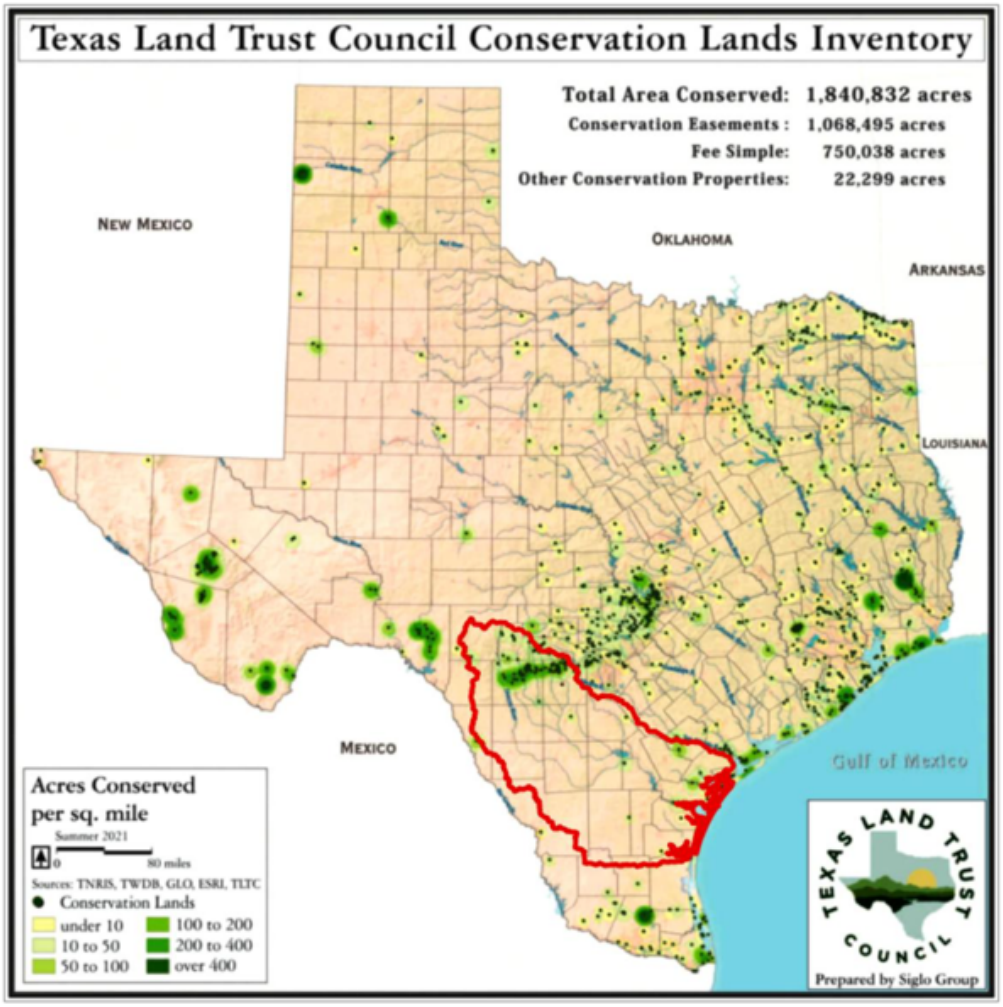

Figure 1-6. Conservation Lands Inventory (Texas Land Trust Council, 2021)

1.4 Social and Economic Character

1.4.1 Population Most at Risk of Flood Impacts

Population data for 2020 and 2050 was obtained from a query of the 2021 Regional Water Plan Data. The population in the NRPR was estimated at 1,140,000 in 2020. The basin is largely rural in nature with the City of Corpus Christi being the only major population center within the basin. The City of Corpus Christi had a population of roughly 325,000 in 2020 or roughly 30% of the total basin population. Most of the population resides in the lower basin as shown in Table 1-3. Other highly populated areas of the basin are near the population centers of Laredo (Webb County) and San

Antonio (Medina, Atascosa, Wilson, and Bexar counties) which are included in the Lower Rio Grande (Region 15) and San Antonio (Region 12) regions respectively. Future growth near these major cities will impact the population in the basin.

Overall, the region is expected to grow by 33% between 2020 and 2050 to a population of about 1,516,000. Most of this growth is expected to occur within areas of redevelopment or new development in or near cities (Figure 1-7).

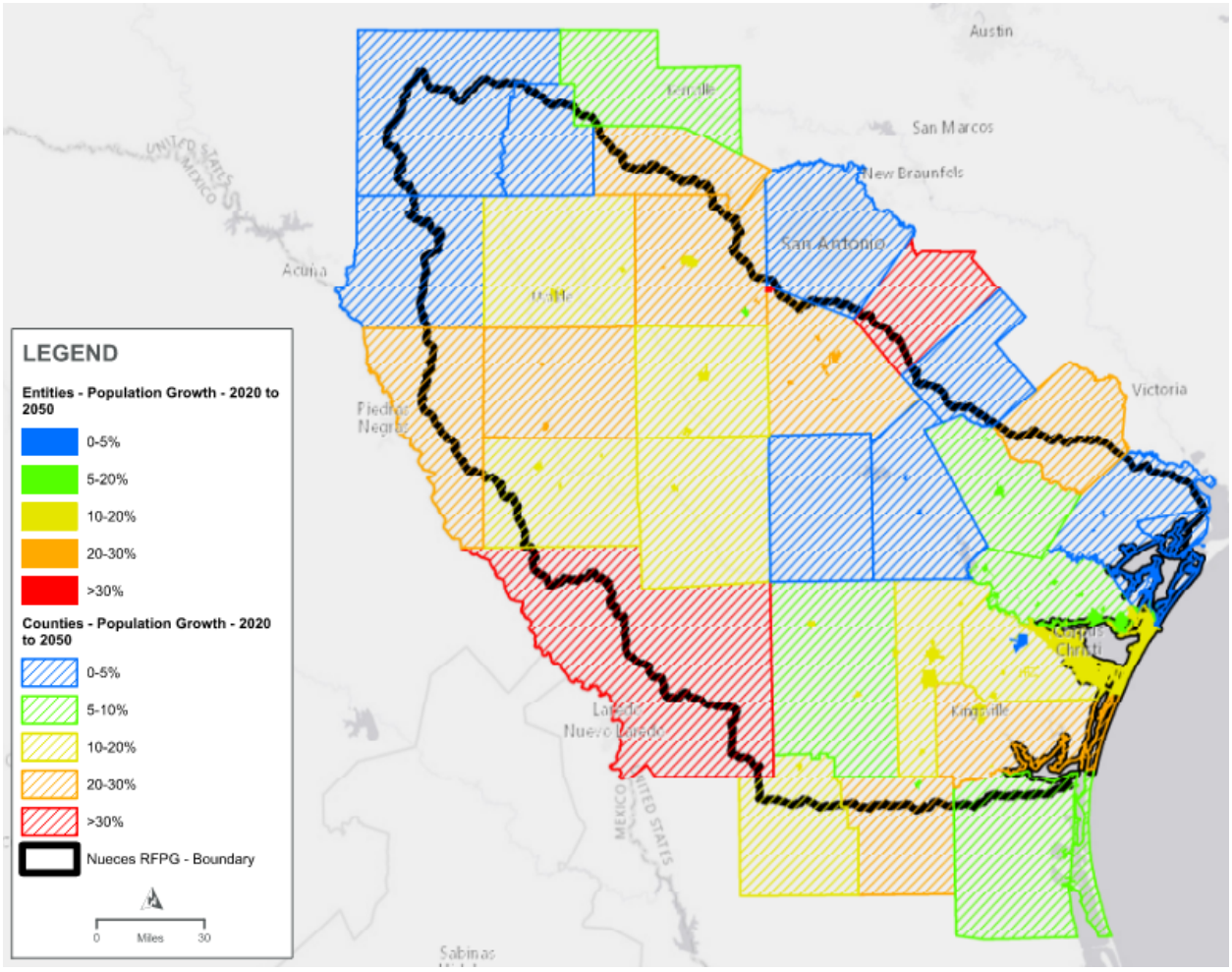

Figure 1-7. Projected Population Growth (2020 to 2050)

There are five cities projected to grow by at least 20% between 2020 and 2050 (See Table 1-3).

Table 1-3. Cities with highest projected growth rate, 2020-2050

Cities	2020	2050	% Growth
Lytle	4,150	5,532	33%
Jourdanton	4,829	6,626	37%
Poteet	3,871	5,022	30%
Pleasanton	11,142	14,454	30%
Crystal City	8,063	9,880	23%

There are three counties projected to grow by at least 30% between 2020 and 2050 (See Table 1-4).

Table 1-4. Counties with highest projected growth rate, 2020-2050

Counties	2020	2050	% Growth
Webb	318,028	464,960	46%
Wilson	54,266	79,044	46%
Atascosa	52,574	68,210	30%

The upper mid-basin represents the youngest population with the lowest median household income, lowest percent of higher education, and highest percent of population living below the poverty line (See Table 1-5).

Table 1-5. Demographics of the Various Nueces Sub-Regions

Demographic Category	Upper Basin	Upper Mid Basin	Lower Mid Basin	Lower Basin
Population (percent of entire basin)	9%	7%	17%	67%
Median Age	39	33	38	37
Median Household Income	$51,000	$36,000	$48,000	$53,000
Education – Bachelors+	17%	11%	14%	21%
Lives Below Poverty Line	15%	27%	20%	18%

The greatest risk of flood impacts is for areas experiencing population growth and for areas with limited resiliency due to limited resources. Without proper flood ordinances, population growth and associated developments are more likely to increase flood risks to life and property.

1.4.2 Economic Activity and Sectors Most at Risk of Flood Impacts

Economic activity and sectors most at risk of flooding include the following.

- **Real Estate** – Buildings located in areas susceptible to flood inundation are at risk of flood damage. The Nueces basin has roughly 61,000 buildings located within the existing 1% annual chance (100-year) floodplain.
- **Transportation** - Floods can cause roadways and bridges to be temporarily impassible for extended periods and can potentially cause long-term closures from wash outs and structural failures. The Nueces basin has roughly 3,200 miles of roadway segments and 5,400 roadway crossings located in the existing 1% annual chance floodplain.
- **Tourism** – The coastal waters and pristine waters of the upper basin support a robust tourism industry. Storm surges along the coast or flash flooding in the upper basin have caused the loss of housing and businesses that support the tourism industry.
- **Agriculture** – Agriculture by its nature is often located near waterways and thus susceptible to flood impacts. Agriculture development in proximity to deep, fast moving, and/or long-standing flood inundation areas are highly susceptible to flood impacts. The Nueces basin has roughly 390 square miles of agriculture areas within the existing 1% annual chance floodplain.

1.4.3 Development Most at Risk of Flood Impacts

Development most at risk of flood impacts include the following.

- **Development in low-lying gulf prairie and marsh lands located along the coast.** These areas are very flat and are inundated for long periods of time during and after flood events. Large portions of Nueces and San Patricio counties, as well as other areas along the coastline are within high growth areas and within these gulf prairie and marsh lands.
- **Unregulated development can potentially put existing and new buildings in harm's way.** Several high growth areas within the basin lack floodplain management practices and enforcement of regulations to mitigate future flooding events.
- **Roadway crossings of waterways are susceptible to damage from stormwater debris, erosion, and hydraulic forces.** There are roughly 5,400 roadway crossings of floodplains in the Nueces basin. Of these, 576 roadway crossings are considered low water crossings. Most of the low water crossings and many more other crossings are at high risk of flood impacts. Refer to Section 2.1.1.1 for further information on low water crossings.

1.5 Flood Prone Areas and Types of Major Flood Risks

Flood prone areas in the region generally include the following types of major flood risks.

- **Riverine Flooding** - Areas at risk of flooding when rivers and creeks come out of their banks. These areas are often included in 1% and 0.2% annual chance floodplains. Of particular high risk are existing and future development and populations located along the major rivers such as the Nueces, Frio, and Atascosa.
- **Coastal Flooding** - Areas at risk of flooding when sea water surges inland from tropical storm events. These areas are often included in 1% and 0.2% annual chance floodplains along coastlines. Of particular high risk are existing and future developments located within the low-lying areas of the gulf prairies and marshes.
- **Pluvial Flooding** – Areas at risk of flooding when extreme rainfall creates a flood independent of an overflowing water body. Pluvial flooding is caused when the ground is over saturated and/or drainage systems are overflowed and the excess water (surface water) cannot be absorbed or drained away.
    - **Urban Flooding** – A form of pluvial flooding that includes areas where local storm drain infrastructure is inadequate and flooding frequently occurs. These areas are often identified by residents as known frequent flood problem areas. Of particular high risk are existing and future developments planned and built without proper consideration of local drainage patterns.
- **Flash Flooding** – A form of riverine or pluvial flooding is particularly dangerous in the upper basin where flash flooding of low water crossings and low-lying areas can occur with little warning. Of particular high risk are campgrounds located in low-lying, frequently-flooded areas, and frequently traveled low water crossings.

Flood-prone areas in the region are identified in the flood plan by the following.

- **Areas within the 1% and 0.2% annual chance flood inundation boundaries.** These boundaries were defined for all waterways for both existing and future conditions with contributing drainage areas larger than one square mile for the entire basin.
- **Known low water crossings.** Low water crossings are considered potential flood-prone areas due to their inherent life-loss risk during flood conditions. Low water crossings are defined where a creek crosses a road that is low enough to be subject to frequent flooding during storm events or during a 50% annual chance (2-year) storm event.

- **Areas where residents and officials have reported past flooding.** Subregional meetings, interviews with officials, and an on-line public comment map were used to obtain information on known flood prone areas.
- **Areas where past flood damages, injuries, and deaths were recorded.** Historical flood data information was obtained and reviewed from the National Weather Service (NWS), the Federal Emergency Management Agency (FEMA), and the U.S. Geological Survey (USGS).

The flood prone areas are best identified by referring to the flood hazard, exposure, and vulnerability maps. These maps are fully described in Chapter 2 of the flood plan.

1.6 Key Historical Flood Events

Historical flood data is compiled from news reports of historical flood events, USGS gage records, NWS flood data, and FEMA flood damages. Table 1-6 summarizes the major historical flood events in the NFPR. A detailed summary of all key historical flood events and data obtained is included in Appendix C1 – Historic Flood Event Data.

Table 1-6. Major Historical Flood Events

Flood Event	Short Description
2017 Hurricane Harvey	64 injuries and 2 fatalities, $4.28 billion in damages in the Nueces Basin
2003 Flash Floods	Flash floods in northwestern counties of the Nueces Basin
2002 Frio River Flood	Record stages for middle basin parts near Tilden
1998 Flash Flood Real County	2 fatalities in Real County
1997 Flash Flood in Medina, Bandera, and Goliad Counties	4 fatalities across Medina, Bandera, and Goliad Counties.
1996 Nueces Flood	Record peak stage of the Nueces River near Uvalde
1971 Hurricane Edith and Fern	Historic flooding in the lower counties of the Nueces Basin
1967 Hurricane Beulah	41 fatalities, $1 billion of damage, and thousands of people lost their homes
1935 Nueces and West Nueces Flood	The earliest documented major flood in the Nueces River Basin
1932 Frio and Nueces Flood	The highest peak stage in the Frio River at Concan and the second highest recorded peak stage in the Nueces River near Uvalde.

1.7 Engagement of Political Subdivisions with Flood-Related Authority

The NRFPG compiled a list of existing political subdivisions within the NFPR that have flood-related authorities or responsibilities and identified a point of contact for each entity based on the FEMA Community Contact Report (dated February 12, 2021), and additional information provided by the Nueces River Authority. HDR developed a floodplain management survey about existing practices and sent it to the identified contacts. Survey results and follow-up correspondence confirmed that 13 of 31 counties and 12 of 57 cities with flood-related authority have floodplain management regulations. Of these, 11 counties and 11 cities have moderate/strong floodplain management practices and moderate/high levels of enforcement on these regulations. Additionally, eight counties and nine cities have been identified to have adopted higher floodplain management standards. These actively engaged counties and cities tend to be located near the high population and growth centers of Corpus Christi, San Antonio, and Laredo. For detailed information refer to Chapter 3, which fully describes floodplain management practices for the basin.

1.8 Extent of Local Regulation and Development Codes

Using policies and regulations to reduce the exposure of people and properties to flood risk are forms of non-structural flood control. By encouraging or requiring communities to avoid developing in flood-prone areas altogether, or to take precautions such as increasing building elevation, preserving overflow areas through buffering, and avoiding sensitive natural areas such as wetlands, communities can reduce the likelihood and extent of damages to existing and new development. Local regulations and development codes pertaining to flooding include the following.

- **Floodplain Ordinances** – Floodplain ordinances regulate development and the impact new development has on a community's floodplain. Community regulations are typically based on FEMA-provided flood hazard information but can be based on other local sources of data as well. Participation in the NFIP requires a community to have adopted a floodplain ordinance with minimum requirements established by FEMA.
- **Building Standards** – Building standards may include considerations for structures located within a floodplain, including minimum finish floor elevations and flood proofing requirements. NFIP requirements also set standards for property owners seeking to renovate structures in a floodplain, including those that experience repetitive or severe flood losses.
- **Drainage Design Standards** – Adopted drainage design standards set the minimum standards for stormwater management that must be met prior to the

approval of construction plans. Drainage criteria in the region are typically adopted by municipalities but are also used by counties.

- **Zoning and Land Use Policies** – Planning and zoning ordinances regulate acceptable types of land uses within a community to promote appropriate development, safety, and general welfare. Some communities use zoning and land use ordinances to establish open space requirements, conservation easements, and minimum setbacks from creeks and wetlands to preserve floodplain function and promote sustainable and resilient development.
- **Local and Regional Flood Plans** – Local and regional flood plans analyze a community's flood risk and present how that entity will improve its resiliency. Drainage master plans describe a community's physical and institutional planning environment and establish interjurisdictional roles and responsibilities when many drainage entities are present. Capital improvement plans (CIPs) identify capital project alternatives for an entity, provide economic analysis for alternatives, and often rank alternatives based on feasibility.
- **NFIP's Community Rating System (CRS)** - Credits community efforts beyond meeting minimum NFIP standards. The CRS provides 19 public information and floodplain management activities. Of which, a community must conduct elevation certificates and conduct floodplain management planning if in a designated repetitive loss community. All other activities are optional for participation in CRS. However, the program awards points and assigns a rating class on a scale of 1 to 10 based on participation in the various activities. Then the CRS assigns the percent discount for a community based on the determined rate class (i.e., a rate class of 7 correlates with a discount of 15% for property owners in a Special Flood Hazard Area).

As described in Section 1.7, local regulations related to flood management are strongest near major population centers and generally lacking for the remainder of the basin, which is rural in nature. The exposure analysis performed in this regional plan indicates that approximately 61,000 and 78,000 structures are in the existing and future 1% annual chance floodplains, respectively. However, this does not include the possibility of additional structures being built in the floodplain over the next 30 years. Thus, improving floodplain mapping and strengthening local regulations and development codes is key to reducing the future flood risk. One of the most effective regulations to reduce flood risk is to enact freeboard requirements on new structures. The NRFPG is strongly encouraging cities and counties in the Nueces Basin to actively consider requiring minimum finished floor elevations be set two feet above base flood elevations or above local ordinances, whichever is higher, in the basin. Extent of local regulations and development codes are presented in further detail in Chapter 3.

1.9 Agricultural and Natural Resources Impacted by Flooding

In the Nueces basin, cultivated crops are widespread within the coastal prairie and marsh area and pasture/hay land use is also widespread in the lower basin and in Atascosa County (see Figure 1-4 and Figure 1-5).

Flooding or excess precipitation can delay and reduce crop harvest, and erosion of sediment and nutrients downstream result in complete or partial crop loss. The impact that flooding has on farming depends on factors, including crop type, stage of the growing or harvesting season when the flood event occurs, and the magnitude of flooding. The numerous crop types grown in the Nueces basin region have varying degrees of resiliency to excess precipitation and prolonged standing water. Permanent crops, such as trees, tend to be more resilient to excess precipitation and standing water than row crops, such as corn or cotton. Heavy rain before planting can delay planting or prevent planting for the season. In addition, flooding damages can occur after a crop, like cotton or hay, has been harvested but not bailed or processed. But floods can also have a positive impact on farming as floods contribute to the fertility of agricultural lands.

Ranching activities in the region are also impacted by flooding. Livestock can be swept away, drowned, or injured by flash floods. After a flood, livestock can be particularly susceptible to certain types of parasites and diseases. Excessive rain may cause an increase in vectors, including flies and mosquitos, and cases of foot rot, which is a foot disease of cattle, sheep, and goats. Flood events can cause delays in building back livestock herds. Flood damages to livestock silage can reduce livestock head counts.

The Nueces region contains numerous natural resources that can be impacted by flood events. As with livestock, wildlife can be injured or killed by flash floods. Severe flood conditions can degrade stream health and impact ecosystems in the region.

In some ways, flooding can be a benefit for fields, wetlands, riparian areas if limited in depth, duration, and velocity. However, typically, in this region where flash floods are common, flooding causes erosion of sediment and nutrients, which can cause nutrient overgrowth and algal blooms in water bodies and nutrient deficiencies in agricultural producing lands.

1.10 Existing Local and Regional Flood Plans

A list of previous flood studies considered by the NRFPG to be relevant to the development of the RFP are fully described in Appendix C2 – List of Previous Flood Studies. Table 1-7 lists the names and publication years of these plans.

Table 1-7. List of Previous and Relevant Studies

Previous and Relevant Studies	Year
Coastal Texas Protection and Restoration Feasibility Study	2021
Lower Nueces River Watershed Protection Plan	2020
Atascosa-McMullen Multi-Jurisdictional Hazard Mitigation Action Plan	2020
Coastal Resiliency Master Plan	2019
Bandera County River Authority and Groundwater District Flood Plan	2019
The City of Alice & Jim Wells County Multi-Hazard Mitigation Plan	2018
San Patricio County Hazard Mitigation Action Plan	2018
Aransas County Multi-Jurisdictional Floodplain Management Plan	2017
Aransas County Texas Multi-Jurisdictional Hazard Mitigation Action Plan	2017
Nueces County Multi-Jurisdictional Hazard Mitigation Action Plan	2017
Hazard Identification, Risk Assessment (HIRA) and Consequence Analysis	2014
A Joint Erosion Response Plan for Nueces County and the City of Corpus Christi	2012
Coastal Bend Mitigation Action Plan	2012
Potential for Bed-Material Entrainment in selected Streams of the Edwards Plateau	2008

1.11 Existing Infrastructure

Background knowledge of the NFPR's existing natural and structural flood infrastructure provides context in identifying strategies and flood planning recommendations throughout the planning process. This section details the major natural flood mitigation features and constructed flood infrastructure in the NRFP area.

The general location, description, level of service, functionality, deficiency, and owning/operating entities for each identified natural flood mitigation features and constructed major flood infrastructure are summarized at length in Appendix A1 – TWDB Table 1 – Existing Flood Infrastructure Table and the GIS geodatabase. Features and infrastructure included, as applicable, are summarized in Table 1-8.

Additional information about significant or deficient/non-functioned features or infrastructure are detailed in subsequent sections as necessary.

- **Functional** infrastructure is defined as serving its intended design level of service.

- **Non-functional** infrastructure is defined as not providing its intended or design level of service.
- **Deficient** infrastructure is defined as constructed or natural features in poor structural or non-structural condition in need of replacement, restoration, or rehabilitation.

Table 1-8. List of Natural Features and Constructed Major Infrastructure

Flood Infrastructure	Definition	Description	Non-Functional / Deficient
Natural Features			
Rivers, Tributaries	Rivers are large natural waterways that carry water to an ocean or inland sea. Tributaries are natural waterways that flow into larger rivers or other bodies of water.	Added from National Hydrography Dataset (NHD)	Functional
Functioning Floodplains	A functioning floodplain are areas adjacent to rivers, ponds, lakes, and oceans that are periodically flooded at different points in time.	Added floodplains from the Texas Water Development Board (TWDB) compiled 'flood quilt', and other detailed studies.	Functional
Wetlands	A wetland is an area of land that is either covered by water or saturated with water.	Added from National Wetland Inventory	Functional
Sinkholes	A sinkhole is a cavity in the ground, especially in limestone bedrock, caused by water erosion and providing a route for surface water to disappear underground.	Added 23 from NHD and HDR Engineering, Inc. (HDR), many others not defined	Functional
Alluvial Fans	An alluvial fan is a fan-shaped mass of alluvium deposited as the flow of a river decreases in velocity.	None identified.	Not applicable

Flood Infrastructure	Definition	Description	Non-Functional / Deficient
Playa Lakes	A playa lake are often round hollows in the ground that only contains water occasionally.	None identified.	Not applicable
Vegetated Dunes	Vegetated dunes are sand dunes that are somewhat stabilized by plants roots.	Undefined – Geospatial dataset unavailable for dunes in Texas	Not applicable
Constructed Major Infrastructure			
Levees	A levee is an embankment built to contain, control, or divert the flow of water to provide protection from temporary flooding.	Added 8 levees from the National Levee Database. The following major levees are included: City of Three Rivers Levee; City of San Diego Levee; City of Alice Levee; City of Corpus Christi Levee – located west of Port of Corpus Christi Southside; City of Bishop Levee; Levee northwest of Aransas Pass, and south of State Highway 188; City of Aransas Pass Levee – Located on both sides of Port Aransas Causeway, along Redfish Bay; and Aransas National Wildlife Refuge Levee – Located on east side of St. Charles Bay.	Unknown
Sea Barriers, Walls, and Revetments	Sea barriers, walls, and revetments provide an erected structure to prevent the sea from encroaching on or eroding an area of land.	City of Corpus Christi has 2 noted sea walls – one protecting downtown, and another on Padre Island south of Packery Channel.	Functional

Flood Infrastructure	Definition	Description	Non-Functional / Deficient
Tidal Barrier and Gates	A tidal barrier typically spans an estuary, bay, river, or other sea inlet and contains gates that can open and close.	City of Corpus Christi and City of Aransas Pass have tidal barriers or gates that are put in place when tidal surges are expected due to tropical storms.	Functional
Stormwater Tunnels	A stormwater tunnel is a long pipe or box culvert that is typically installed deep underground.	None known	Unknown
Stormwater Canals	A stormwater canal is an artificial constructed above ground waterway used to convey water for irrigation.	A total of 362 miles of stormwater canals were identified within the Nueces Flood Planning Region (NFPR) according to the National Hydrography Dataset (NHD) by USGS.	Unknown
Dams that provide Flood Protection	A flood protection dam is defined as any barrier designed to runoff which has a height greater than six feet. This does not include railroad or roadway embankments.	A total of 501 dams were identified within the Nueces Flood Planning Region (NFPR) according to the National Inventory of Dams. Of this total, 23 flood control dams were constructed and are operated by the Natural Resources Conservation Service (NRCS), and 116 dams are regulated by the Texas Commission on Environmental Quality's (TCEQ) Dam Safety Program.	Of the TCEQ regulated dams, 14 are hydraulically inadequate or non-functional and 22 are in poor condition or deficient. Data from TCEQ and NRCS

Flood Infrastructure	Definition	Description	Non-Functional / Deficient
Detention and Retention Ponds	A detention pond is a man-made basin which holds runoff temporarily to attenuate peak flood flows. A retention pond serves a similar function but typically holds water all year round.	City of Ingleside has a regional detention pond (Whitney Lake Marsh Wildlife Refuge)	Functional
Storm Drain Systems	A storm drain system is a collection of inlets and pipes or box culverts that collect and convey runoff to a nearby waterway. Only major storm drain systems are to be identified in plan, not individual storm drains and inlets.	Major systems included for the City of Corpus Christi and the City of Ingleside	Unknown
Weirs	A weir is a control structure set to raise the level of water upstream or to regulate its flow.	None known	Unknown
Low water Crossings	Low water crossings (LWCs) are defined where a creek crosses a road that is low enough to be subject to frequent flooding during storm events or during a 50% annual chance (2-year) storm event.	548 LWCs were identified from TWDB HUB low water crossing data dated May 2021 22 LWCs were identified from available TxDOT data to be subject to frequent flooding. 6 LWCs were identified from the City of Beeville to be subject to frequent flooding. No other LWCs were identified during this first planning cycle.	Unknown

Flood Infrastructure	Definition	Description	Non-Functional / Deficient
Bridges	A bridge is a roadway structure that spans a waterway and includes all bridges and culverts spanning over 20'.	Added 2,706 bridges and culverts over 20' wide on public roads from National Bridge Inventory databased maintained by the Federal Highway Administration (FHWA).	Unknown
Stormwater Pump Stations	A stormwater pump station provides pump(s) to lift collected stormwater runoff from a sump to a higher discharge point.	City of Corpus Christi has 2 pump stations in the downtown area, and the City of Aransas Pass noted 1 pump station.	Corpus Christi – Functional; Aransas Pass – Non-Functional due to inability to handle flood flows and prevent flooding

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1.12 Proposed or Ongoing Flood Mitigation Projects

See Appendix A2 – TWDB Table 2 – Summary of Proposed or Ongoing Flood Mitigation Projects. This list includes 93 projects currently under construction, being implemented, or with dedicated funding to construction, the source of funding, and expected year of completion. The list includes numerous drainage improvement studies and projects for various cities and counties and includes multiple Texas Department of Transportation (TxDOT) bridge replacement and drainage projects, as identified from TxDOT's Project Tracker (txdot.gov). Figure 1-8 below depicts major proposed or ongoing flood mitigation projects.

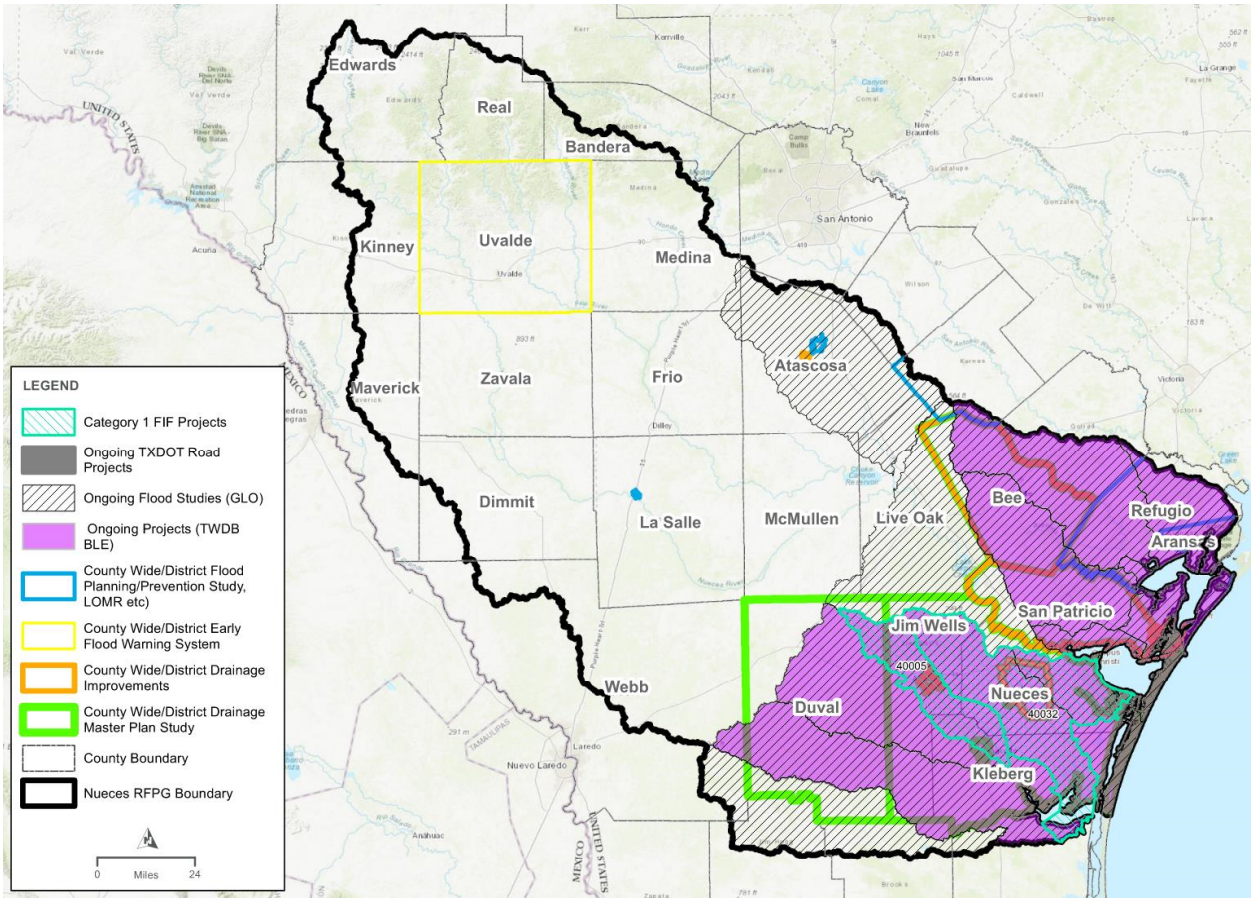

Figure 1-8. Major Flood Studies and On-Going Flood Studies/Projects (Map 2)

Major flood studies and on-going projects relevant to the NFPR include the following:

- General Land Office Regional Flood Study for the Nueces-San Antonio-Guadalupe-Lavaca-Colorado Study Basin
- Various County Drainage Master Plans, County-wide Drainage Improvement Projects, Early Flood Warning Systems, and Flood Prevention Studies (Duval, San Patricio, Nueces, Jim Wells, Kleberg, and Bee Counties)
- TWDB Base Level Engineering (BLE) Projects

- TWDB FIF funded on-going projects, as listed in Table 1-9. The various FIF categories represent the following:
    - Category 1 - flood protection planning grants for watersheds no smaller than HUC-10
    - Category 2 - planning, acquisition, design, construction, and rehabilitation type projects
    - Category 3 – federal award matching funds
    - Category 4 – measures immediately effective in protecting life and property
- Potential TWDB FIF funded projects, as listed in Table 1-10.

Table 1-9. TWDB FIF Funded On-Going Projects

TWDB Project #/ Category	Authority	Project Name	Project Description
40005 Cat-1	Alice	Master Drainage Study	H&H Modeling, conceptual engineering design, cost/benefit analysis, and plan for flood early warning system
40011 Cat-1	Karnes County	Flood Protection Planning Study	Study to update floodplain models and maps for high priority streams, flood problem areas, and to develop mitigation alternatives.
40030 Cat-2	Jourdanton	Main Street Drainage Project	Proposed improvements to improve roadside ditches and construct new channels in City's downtown area
40032 Cat-1	Nueces County	Regional Drainage Master Plan Study	Prepare basin-wide hydrologic models and limited-detailed hydraulic models in the Baffin Bay and South Corpus Christi watersheds, develop flood mitigation solutions for drainage problem areas, and conduct benefit/cost analysis.

40052 Cat-2	Nueces County DCD#2	Casa Blanca Drainage Improvements	Project includes drainage improvements to the existing Ruben Chavez S. Ditch and other downstream ditch improvements to mitigate potential flooding along the ditch and in the Casa Blanca subdivision.
40064 Cat-4	Uvalde County	Self-Supporting Tower for Early Warning System	The installation of the tower will provide sustainability to the Uvalde County Flood Early Warning System
40071 Cat-4	Nueces County DCD#2	Flood Early Warning System (FEWS)	Install 12-15 FEWS Stations in locations known to have repeated flooding.
40084 Cat-2	Cotulla	Flood Planning Study for LOMR	Defined AE flood hazard zone and floodway for the City of Cotulla.
40092 Cat-2	Nueces County DCD#2	Bosquez Rd. / Avenue J Drainage Improvements	Drainage improvements to improve drainage conditions at Robstown High School, Bluebonnet Subdivision, Hwy 44, and further downstream.
40093 Cat-2	Nueces County DCD#2	Ditch “A” and Bluebonnet Drainage Improvements	Drainage improvements at Ditch “A” and the Bluebonnet subdivision.
40117 Cat-2	Nueces River Authority	Green Lake Outfall System and Gregory Diversion Ditch	Project to address flooding issues in the Green Lake Drainage Basin and includes Green Lake dam and channel improvements, Gregory flood relief channel improvements, and Portland drainage improvements.
40135 Cat-2	Kingsville	Drainage Master Plan – Location 7 Improvements	Drainage improvements in the Location 7 drainage basin to relieve flooding along Pasadena Drive and in

			the Glover Park Subdivision in the southwest side of the City.
40142 Cat-2	Kingsville	Drainage Master Plan – Location 1	Drainage improvements in the Location 1 drainage basin to relieve flooding in Fairview Heights and San Jose Estates subdivisions in the northeast side of the city.
40143 Cat-2	Kingsville	Drainage Master Plan – Location 3	Drainage improvements in the Location 3 drainage basin to relieve flooding in Forest Park 2 subdivision on the east side of the city.
40144 Cat-2	Kingsville	Drainage Master Plan – Location 4	Drainage improvements in the Location 4 drainage basin to relieve flooding in Sarita Park 4/5, and Southmore Acres subdivision on the south-central side of the city.
40192 Cat-2	Kingsville	Drainage Master Plan – Location 8	Drainage improvements on Paulson Falls Drive to improve surface water drainage.

Table 1-10. Potential TWDB FIF Funded Projects

Abridged App #	Entity Name	Project Name
13606	Bee County	Medio Creek Flood Control Improvements
13605	Bee County	Master Drainage Planning Study
13819	Nueces County DCD#2	Flood Early Warning System
13818	Nueces County DCD#2	Master Drainage Planning Study
13558	Pleasanton	Atascosa Flood Prevention Project
13533	Kingsville	Location 2
13536	Kingsville	Location 5

Abridged App #	Entity Name	Project Name
13537	Kingsville	Location 6
13540	Kingsville	Location 9
13639	Aransas Pass	Stormwater Pump Station #3 (Euclid)
13627	Alice	Pintas Creek at Sunset Dr. & Virginia St. Drainage Improvements
13653	Alice	Master Drainage Planning Study
13608	Driscoll	Master Drainage Planning Study

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