CHAMBERS COUNTY

2024 Hazard Mitigation Plan Update

JUNE 4, 2024

Including Participating Jurisdictions: Anahuac, Beach City, CLCND, Cove, Mont Belvieu, and Old River-Winfree

Table of Contents

List of Figures

List of Tables

Section 1. Introduction and Adoption

Introduction

THIS PLAN IS AN UPDATE

Over twenty years ago, Congress recognized the need to support a new kind of planning that would help local communities understand and reduce their vulnerability to natural hazards by preparing a local hazard mitigation plan. Congress passed the Disaster Mitigation Act (DMA) of 2000 which amended the Robert T. Stafford Disaster and Emergency Act (Staffard Act). The Code of Federal Regulation (CFR) provides the regulatory requirements outlined in the DMA. 44 CFR § 201.6(d)(3) stipulates that a local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within 5 years in order to continue to be eligible for mitigation project grant funding.

Chambers County completed its original Hazard Mitigation Plan which was adopted in 2006 and updated in 2011 as part of a seven-county Regional Hazard Mitigation Plan (RHMP). For the 2016 update, new regulation and planning recommendations required that the Chambers County update be a new countywide multi-jurisdictional Hazard Mitigation Plan (HMAP). Chambers County partnered with the Houston-Galveston Area Council (H-GAC) to prepare that update which was adopted in 2017. For the current update, Chambers County hired a mitigation plan consultant to assist the County.

The Chambers County 2024 Plan is a multi-jurisdiction Plan representing the following jurisdictions:

- Unincorporated Chambers County
- Anahuac
- Beach City
- Cove
- Mont Belvieu
- Old-River-Winfree
- Chambers-Liberty Counties Navigation District

An important step in the lengthy process of improving resistance to hazards is the development of a hazard mitigation plan. The Chambers County (and participating jurisdictions) Hazard Mitigation Plan Update was prepared in accordance with the guidelines provided by FEMA and the Texas Division of Emergency Management (TDEM). The original plan set the stage for long-term disaster resistance through identification of actions that will, over time, reduce the exposure of people and property to hazards. Completion of the original Plan, and adoption by the County Commissioners Court and the City Councils, was a significant step toward identifying potential hazards that threaten the planning area, assessing risk, and implementing mitigation actions that will reduce property damages, injuries, and loss of life from hazards. Approval of the

original Plan and each subsequent update reviewed and approved by TDEM and FEMA also establish eligibility for certain mitigation grant funds. This plan update continues the County's efforts to build a safe and resilient community and to be eligible for FEMA mitigation grants.

Each iteration of the County's update, following FEMA's updated guidance and training, is more inclusive with actionable strategies, striving to integrate elements of mitigation planning with other plans in the community. In April 2022, FEMA released a Local Mitigation Planning Guide, FEMA's official policy on, and interpretation of, local hazard mitigation planning requirements. In May 2023, FEMA released the Local Mitigation Planning handbook to guide local governments as they update a hazard mitigation plan. The handbook emphasizes the shift to community resilience with a whole community approach that ensures vulnerable populations are represented. **Community Resilience** is a community's ability to prepare for anticipated hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. Activities such as disaster preparedness (which includes prevention, protection, mitigation, response, and recovery) and reducing community stressors (the underlying social, economic, and environmental conditions that can weaken a community) are key steps to resilience.

The intent of the current updated plan, while incorporating much of the past plans relevant data is to:

- Include any newly identified hazards or remove hazards that are no longer deemed a hazard
- Update the hazard/risk data with increased attention to community resiliency to changing conditions
- Update development data
- Review, update or revise as necessary the goals and actions from the last Plan
- Update the demographic information based on current information
- Improve outreach to the whole Chambers County and participating jurisdictions' communities and stakeholders during the planning process
- Review and update plans or reports for inclusion in this update of the Plan

While much of the information in the plan has been updated, the purpose of the plan is the same - to reduce the loss of life and property within the County and lessen the negative impacts of natural disasters. Vulnerability to several natural hazards has been identified through research, analysis, and public input. These hazards threaten the safety of residents and have the potential to damage or destroy both public and private property, disrupt the local economy, and impact the overall quality of life of individuals who live, work, and enjoy recreation in the County. While natural hazards cannot be eliminated, the effective reduction of a hazard's impact can be accomplished through thoughtful planning and action. One of the most effective tools a community can use to reduce hazard vulnerability is developing, adopting, and updating a hazard mitigation plan.

Summary

There are five sections of this Plan as well as annexes for each participating jurisdiction and appendices. Each section provides updates from the last six years (2018-2023) to the natural hazards that threaten the County and participating jurisdictions, the people and property exposed to those hazards, the planning process, and the maintenance process as well as status of the actions from the last plan and providing new mitigation action items. As in past years, when considering the magnitude of past events, the number of people and properties affected, and the severity of damage, flood hazards clearly are the most significant natural hazard to threaten the County. Sections one through five (the Introduction and Community Profile, the Planning Process, the Hazard Identification and Risk Assessment, the Mitigation Strategy, and the Plan Maintenance) and the appendices include all federally required elements of a disaster mitigation plan that apply to the entire planning area. Each of the participating jurisdictions has an annex which includes all federally required jurisdiction-specific elements.

The Plan is called Chambers County however, unless specified, it encompasses Chambers County and the participating jurisdictions. In preparing this update, Chambers County has again partnered with local jurisdictions. One of the benefits of such multi-jurisdictional planning is the ability to pool resources and eliminate redundant activities within a planning area that has uniform risk exposure and vulnerabilities. The Federal Emergency Management Agency (FEMA) encourages multi-jurisdictional planning under its guidance for the DMA. Elements and strategies in the plan were selected because they meet a program requirement and because they best meet the needs of all the participating jurisdictions and their citizens.

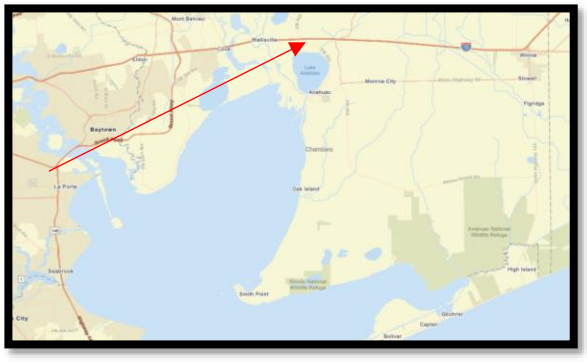
Adoption

Once the MPC received notice from FEMA/TDEM that this Plan was Approved Pending Adoption (APA), which indicated there are no more changes required by FEMA to the Plan, a recommendation to adopt was presented to Commissioners Court and the Jurisdiction Councils. Each jurisdiction's formal resolution is included as a part of their annex.

Community Profile

Planning Area – Location

Chambers County is in Southeast Texas and is a coastal county east of Houston. It is bordered by Harris County, Galveston County, Jefferson County, and Liberty County. It is bound by Cedar Bayou to the west, Trinity Bay to the south and west, Galveston Bay and Bolivar Peninsula to the south. Interstate 10 crosses the northern end of the County. Other major highways



include State Highways 61, 65, 99, and 146. It encompasses 597.1 square miles. Figure 1 is the State of Texas County Boundary Map with Chambers County in the red circle.

Figure 1 - Texas County Boundary Map

(District and County Map 2023 (txdot.gov)

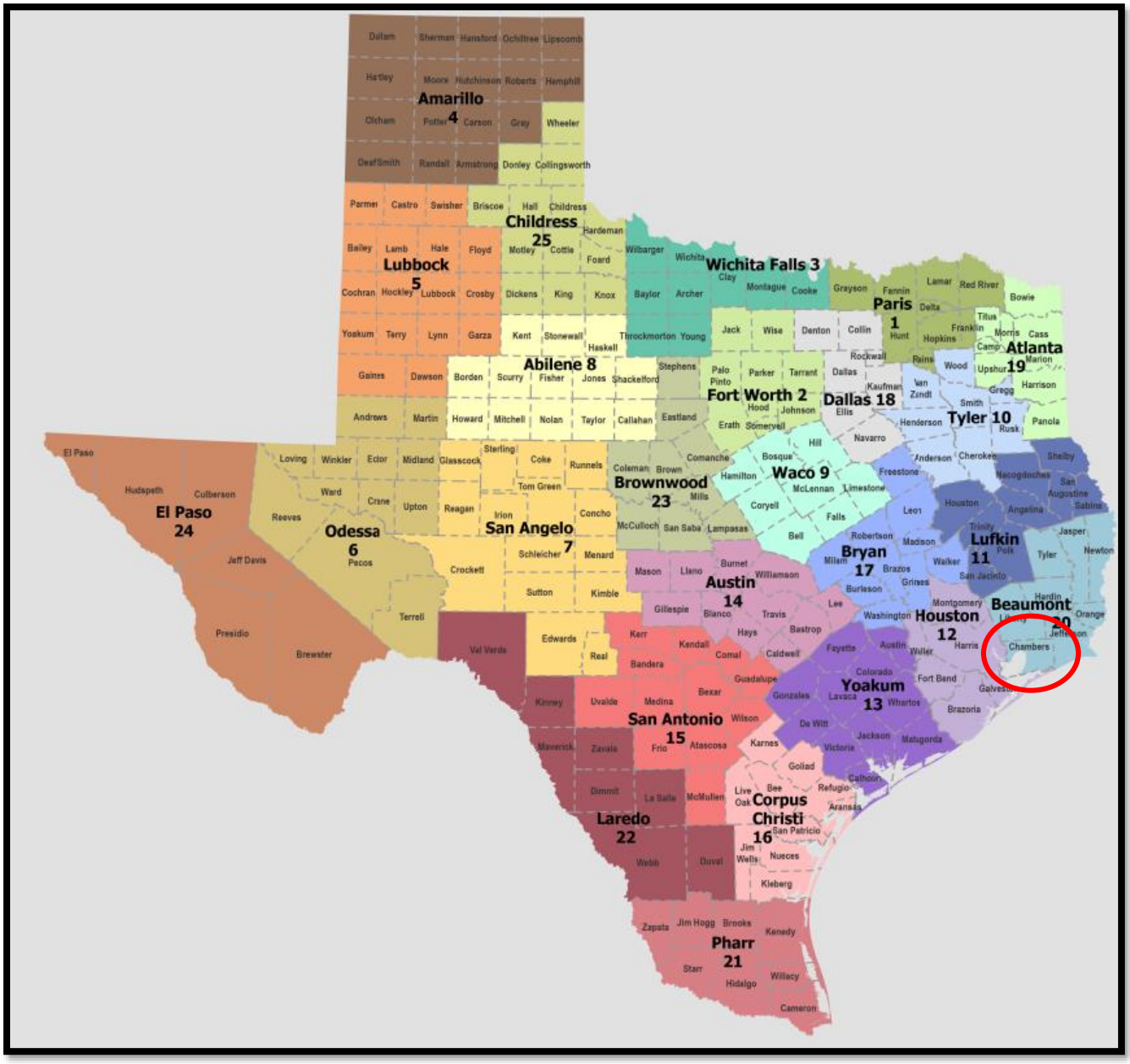
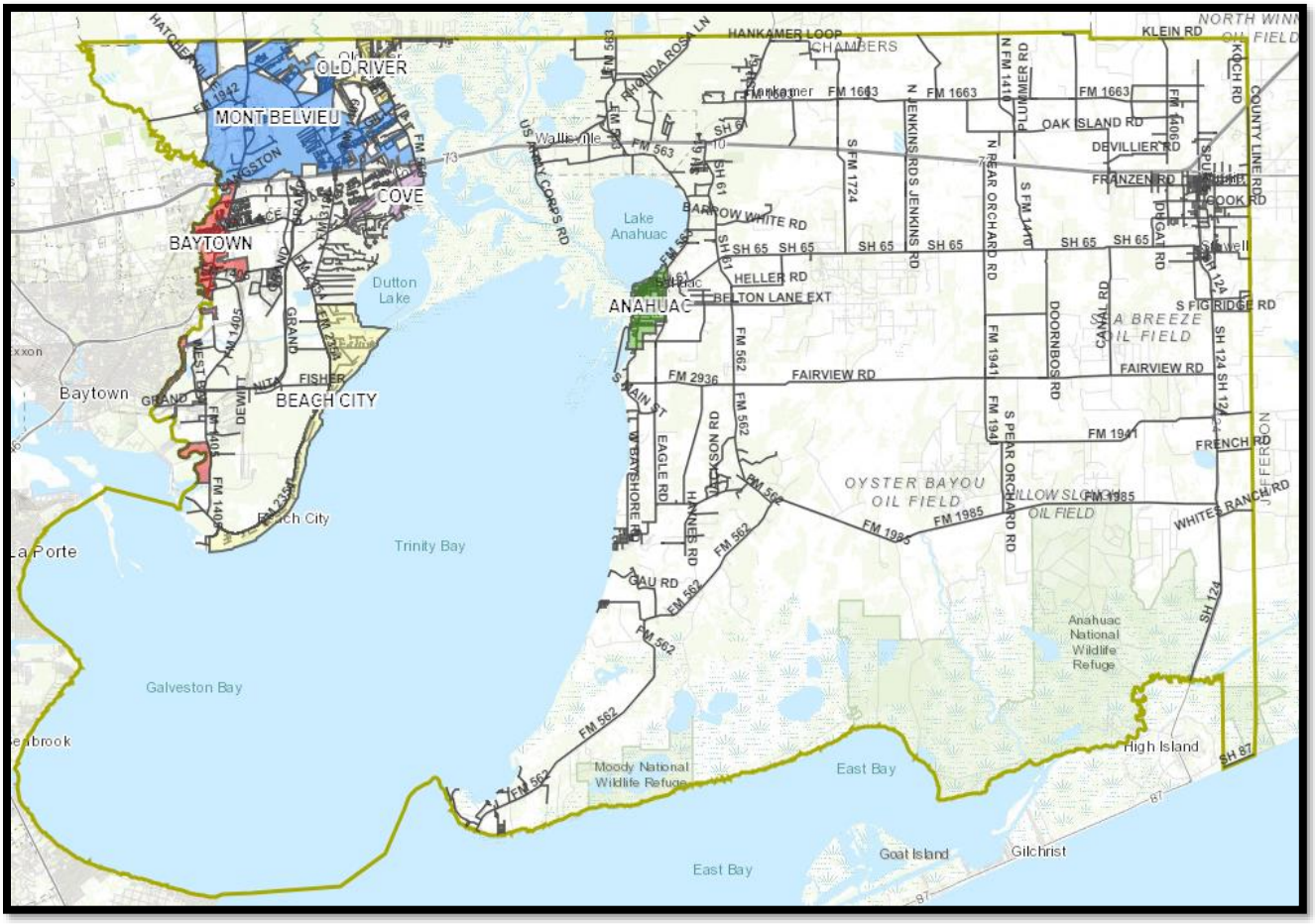


Figure 2 is a map of Chambers County and Cities boundaries.

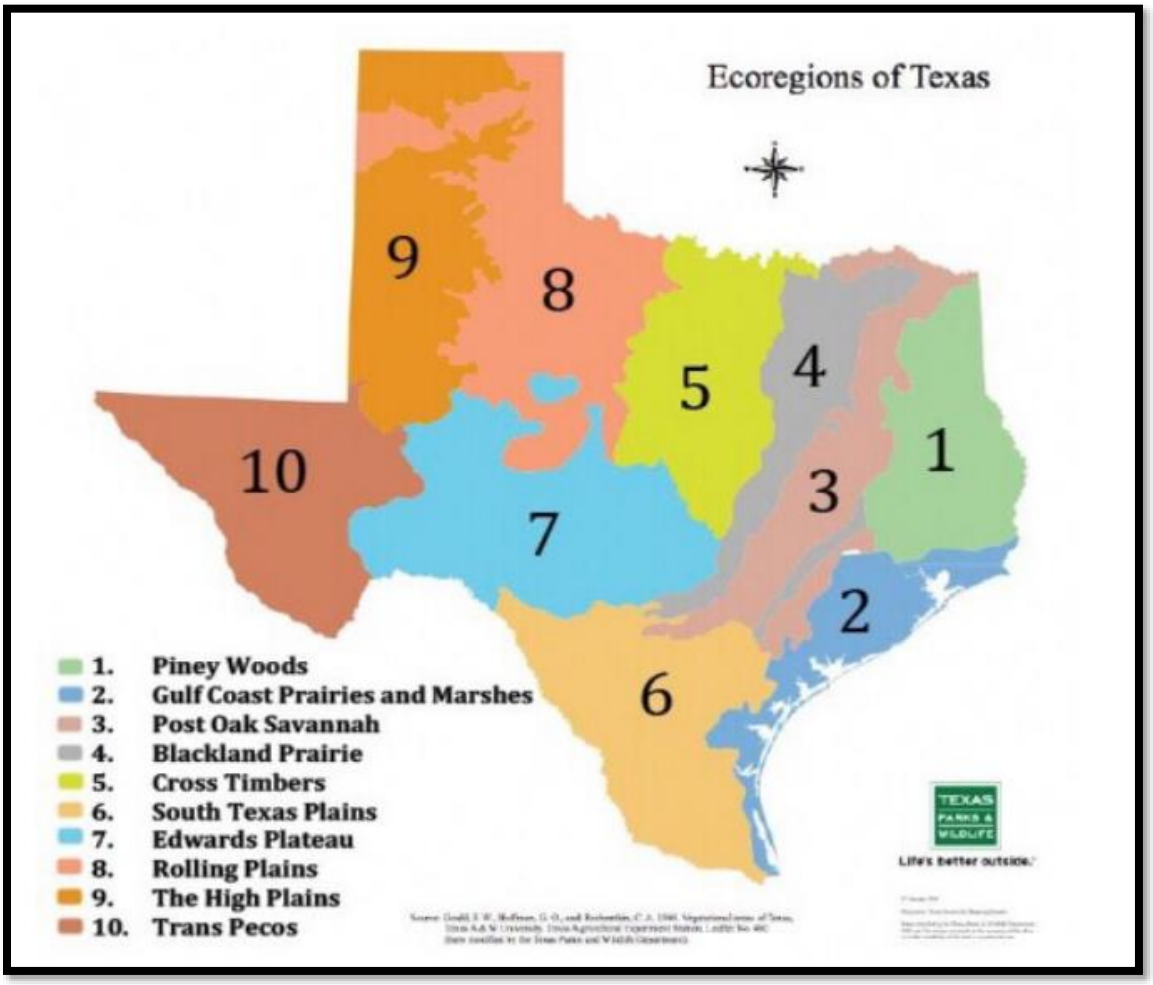
Figure 2 - Chambers County and Cities Boundary Map



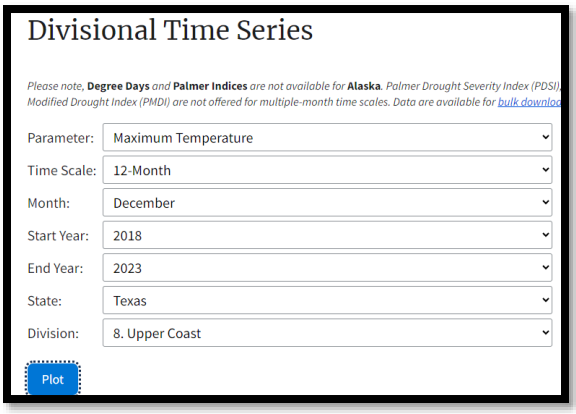
Physical Geography

Texas has ten distinct eco-regions, see Figure 3. Chambers County is part of the Gulf Coast Prairies and Marshes ecoregion (2) which is defined as nearly level, slowly drained plain, less than 150 feet in elevation, dissected by streams and rivers that flow 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.

Figure 3 - Eco-regions of Texas (https://tpwd.texas.gov/education/hunter-education/online-course/wildlife-conservation/texas-ecoregions)



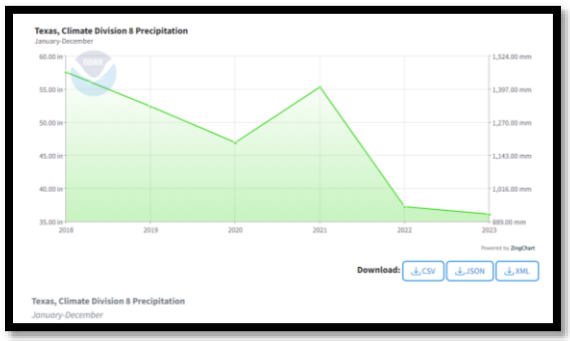
Climate



Chambers County climate is classified as a humid subtropical climate, with tropical influences. August normally ranks as the warmest month at a range of 90.25-95.63 °F and January the coldest month at a range of 41.06-46.44 °F. The National Oceanic and Atmospheric Administration (NOAA) has divided the contiguous U.S (CONUS) into 344 climate divisions. For the state of Texas there are eight divisions. For each division, monthly station temperature and precipitation values are computed from daily observations. Chambers County is in the Texas Climate Division 8 – Upper Coast. Using a 12-

month time scale from January-December for the last six years in the Upper Coast (8) Division, the maximum temperature, minimum temperature, average temperature and precipitation can be plotted or shown in a table (see Figure 4). The average temperature over the last six years is 71.1 degrees. The maximum average temperature for the same period is 80.6 degrees, the minimum average temperature is 61.5 degrees, and the average precipitation is 47.64 inches.

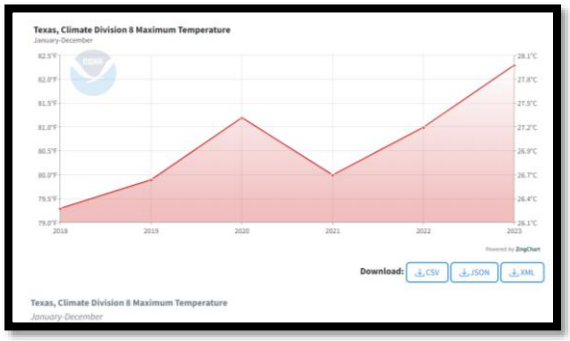
Figure 4 - Climate Division 8 Maximum, Minimum and Average Temperature and Precipitation

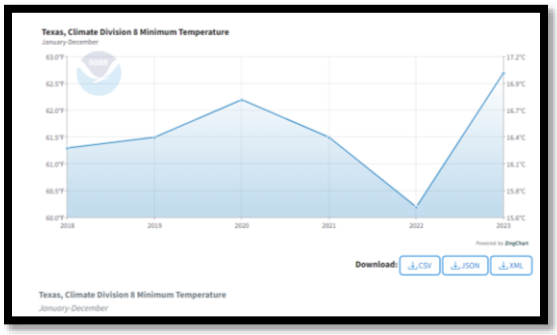


Texas, Climate Division 8 Average Temperature
January-December

Period	Average Temperature	Rank (out of 6)
January -December 2023	72.5°F	6
January -December 2022	70.6°F	2
January -December 2021	70.8°F	4
January -December 2020	71.7°F	5
January -December 2019	70.7°F	3
January -December 2018	70.3°F	1

NOAA National Centers for Environmental information, Climate at a Glance: Divisional Time Series, published January





2024, retrieved on February 6, 2024 from https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/divisional/time-series

Land Cover

Land use refers to the way land is developed or left in an undeveloped state. Having an accurate picture of an area's landscape and understanding how that landscape is changing is important information for any planning effort. Recognizing this importance, several government agencies formed the Multi Resolution Land Characteristics Consortium (MRLC) to produce the National Landcover Database (NLCD), a nationally standardized land cover and land change information product for the United States. Multiple dates of satellite imagery are used to document changes in various types of land cover.

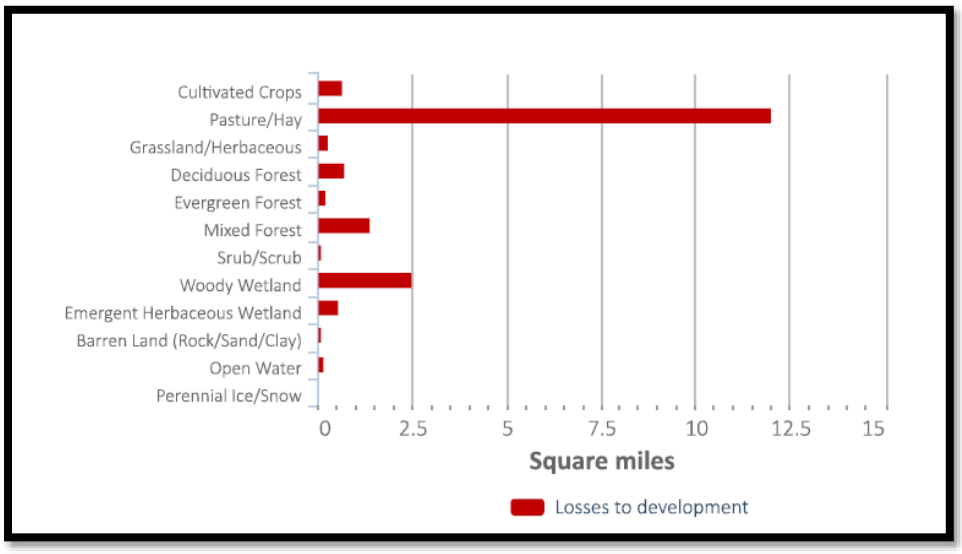
Chambers County has seen 7.02% or 61.21 square miles change from 2001 to 2021. While still considered rural, it is important to understand how the landscape is changing. Looking closer at that change, 6.98% of Chambers County is developed and of that percentage, 2.55% is impervious. Impervious surfaces can cause a greater risk for increased flooding and decreased water supply. While most of the land is not developed, between 2001 and 2021, 18.82 square miles of development and 9.79 square miles of impervious surfaces were gained. Figure 5 shows by land cover class, the net difference from 2001 to 2021.

Figure 5 - MRLC Chambers County, Texas Land Cover Report
(https://www.mrlc.gov/publications, report run on 12-14-23)

Land Cover Categories	Area 2001	Area Lost	Area Gained	Area 2021	Net Change	Percent Change
Developed, High Intensity	2.76	0.00	4.62	7.37	4.62	167.39%
Developed, Medium Intensity	5.86	-0.07	7.61	13.40	7.54	128.57%
Developed, Low Intensity	18.02	-0.91	5.41	22.52	4.50	24.95%
Developed, Open Space	15.38	-1.94	4.11	17.55	2.17	14.11%
Cultivated Crops	60.55	-1.44	11.78	70.88	10.34	17.07%
Pasture/Hay	258.11	-27.96	0.46	230.61	-27.50	-10.65%
Grassland	1.95	-0.75	3.25	4.46	2.51	128.55%
Deciduous Forest	1.73	-1.12	0.07	0.67	-1.05	-61.02%
Evergreen Forest	3.33	-0.57	0.47	3.22	-0.11	-3.16%
Mixed Forest	11.13	-2.34	0.55	9.33	-1.79	-16.10%
Scrub/Shrub	0.69	-0.30	0.97	1.37	0.67	97.34%
Woody Wetland	59.07	-8.76	5.71	56.03	-3.05	-5.16%
Emergent Herbaceous Wetland	152.14	-10.53	7.74	149.35	-2.79	-1.83%
Barren Land	2.48	-0.66	2.57	4.39	1.90	76.67%
Open Water	278.67	-3.83	5.88	280.71	2.05	0.73%
Perennial Snow/Ice	0.00	0.00	0.00	0.00	0.00	0.00%

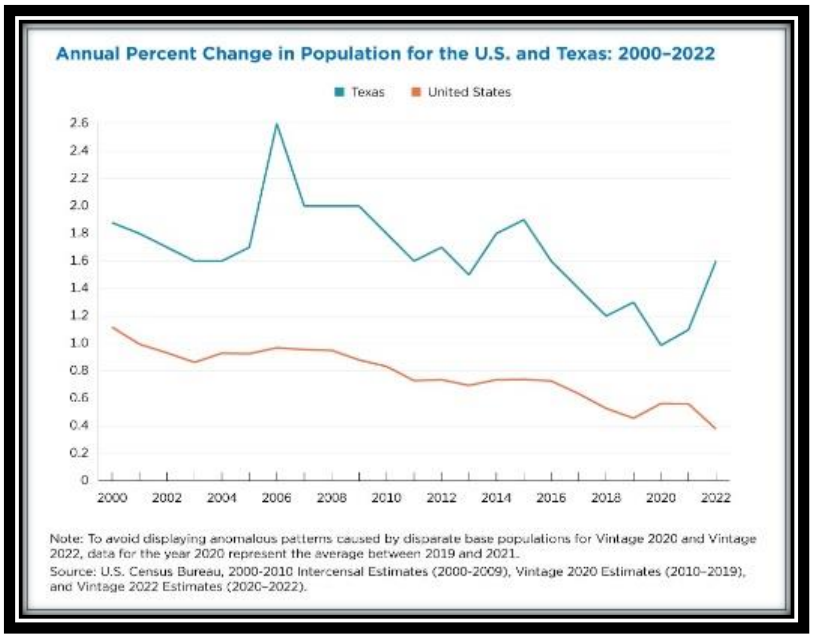
How the land is being lost is also important as land lost to development tends to be permanent. Figure 6 illustrates by natural land categories what is being lost by development, in this case the largest loss to development is pasture/hay land masses.

Figure 6 - Losses to Development in Chambers County (2001 to 2021)



Population and Demographics

The entire State of Texas continues to have significant population growth. As reported in the United States Census America Counts Stories, "The population of Texas, the largest in land area among the Lower 48 states, increased by 470,708 in 2022, continuing a steady uptick. From 2000 to 2022, the state gained 9,085,073 residents, more than any other state". [Texas Population Passes the 30-Million Mark in 2022 (census.gov)]



The Houston Metropolitan Statistical Area (MSA) area grew 18%, adding more than 1.1 million new residents (increased from 6.2 million in the 2012 estimate to 7.3 million in the 2022 estimate). Since the last plan (2017) Chambers County also grew as shown in Table 1.

Table 1 - Comparison of Population Data from 2017 HMP and 2024 HMP

	2017 Population	2023 Population	Difference
Chambers County	39,899.00	51,288.00	29%
Anahuac	2,339.00	1,967.00	-16%
Beach City	2,614.00	3,229.00	24%
Cove	510.00	528.00	4%
Mont Belvieu	5,584.00	8,547.00	53%
Old River-Winfree	1,190.00	1,359.00	14%

A review of the last six years (see Table 1) also shows that Chambers County and most of the participating jurisdictions' population continues to increase but at a slightly slower pace. Mont Belvieu is still the most populated City within the participating jurisdictions and only Anahuac's population has declined. The population trend information is used to estimate future shifts that could significantly change the character of the area. Population trends can provide a basis for making decisions on the type of mitigation approaches to be considered and the locations in which these approaches could be applied.

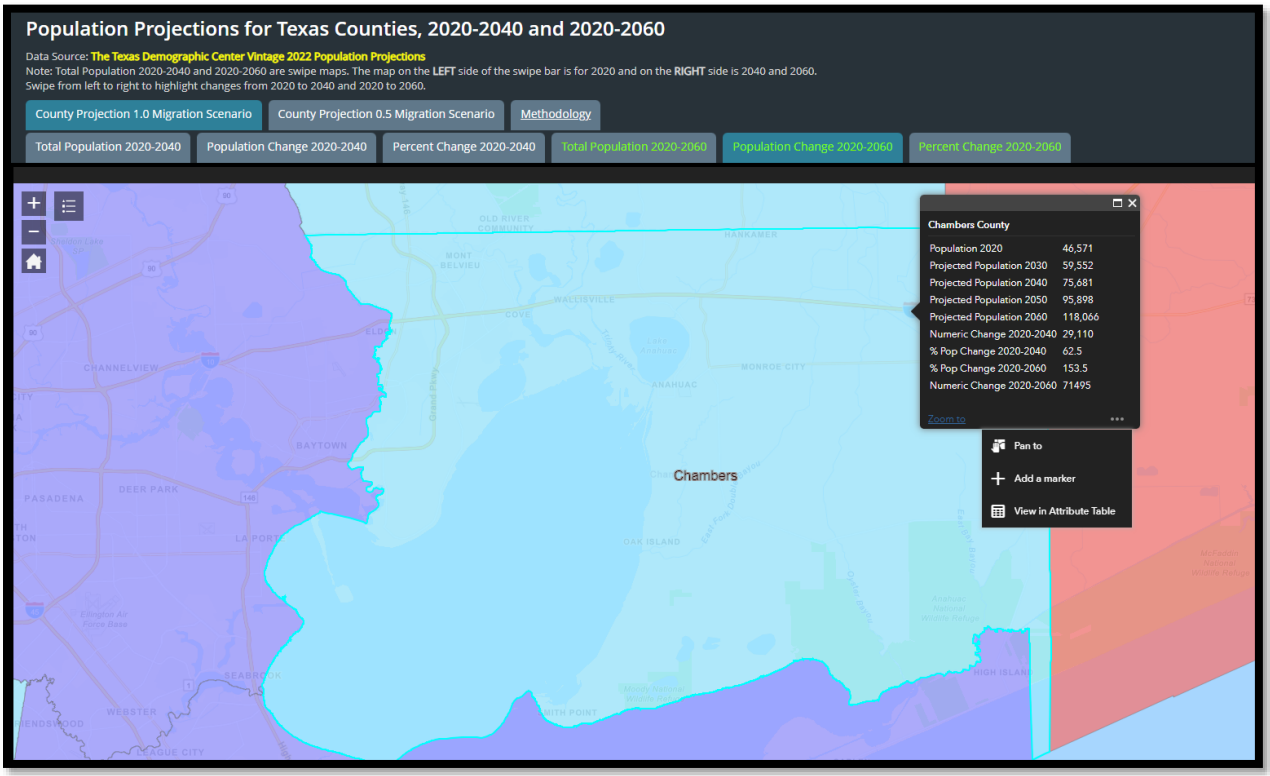
Table 2 - Comparison of Population Data from 2020 - 2022

	2020 Population	2022 Population	Percent change
Chambers County	46,571.00	51,288.00	10.10
Anahuac	1,980.00	1,967.00	(0.90)
Beach City	3,221.00	3,229.00	0.20
Cove	525.00	528.00	0.60
Mont Belvieu	7,654.00	8,547.00	11.70
Old River-Winfree	1,315.00	1,359.00	3.30

The Texas Demographic Center produces population projections for 40 years beyond the most recent Census to help planners and policymakers anticipate future demand for services and pressures on infrastructure. For Chambers County, by 2040, the population is expected to increase to 75,681 (62.5% population change) and by 2060 increase to 118,060, see Figure 7.

Figure 7 - Population Projection for Chambers County 2020 – 2040 and 2020-2060

https://demographics.texas.gov/Data/TPEPP/Projections

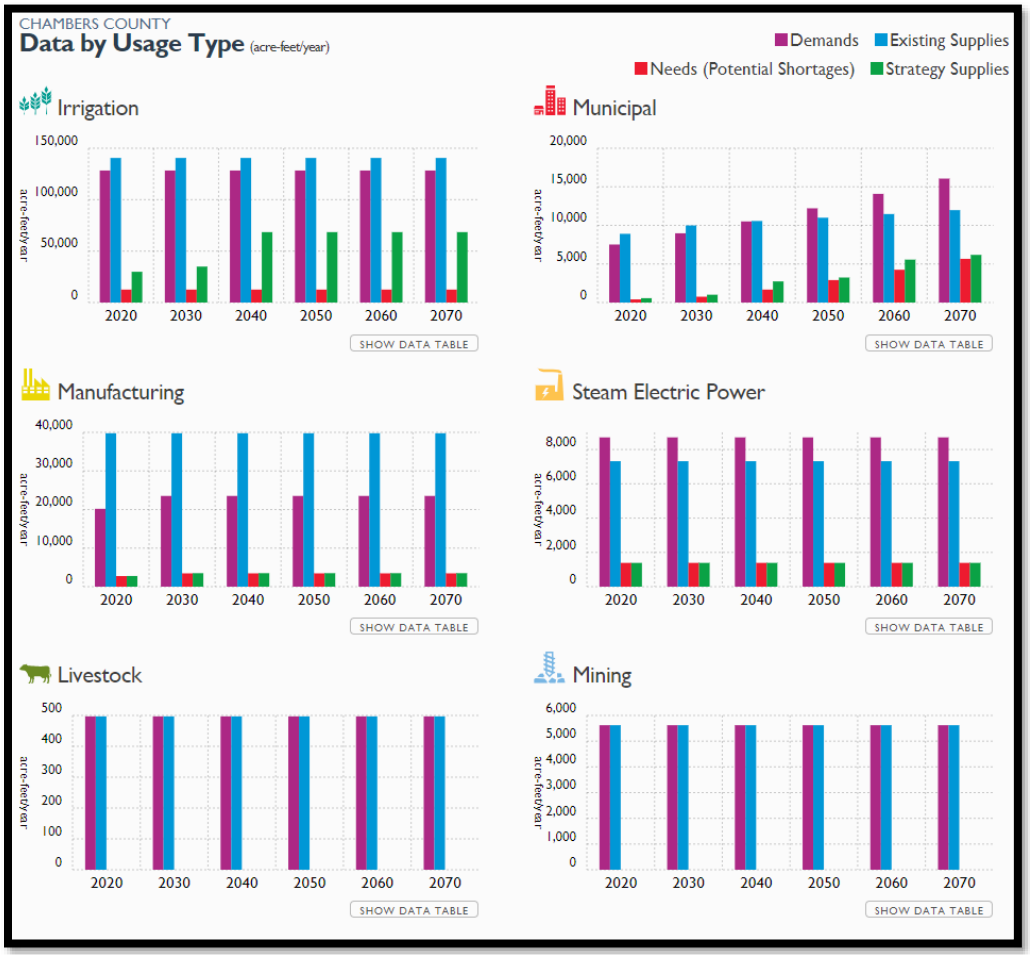


In addition to the population projection increase, so will the demands on resources like water. The Texas Water Development Board State Water Plan for 2022 projects the following demands by usage type as shown in Figure 8 for the County.

The Chambers-Liberty Counties Navigation District (CLCND), a participating district in the plan, helps to maintain the waterways and water supply that agriculture, local industry, and local municipalities depend on; their planning area are various water waterways throughout Chambers and Liberty County including the Trinity River Channel, Anahuac Channel, Cedar Bayou Channel, Double Bayou Channel, Trinity River Channel at Smith Point, and Lake Anahuac. Assets are a main pump plant, a main canal system, and the Upper Texas Coast Water-Borne Education Center. All three of these assets are in Anahuac. The plant has a pumping capacity of 240,000 gallons per minute utilizing four pumps. CLCND, using TWDB data, projects usage increases based on acre-feet from 2020-2030 by 58% with industrial use projected to increase. (CLCND Water Conservation and Drought Contingency Plan, revised 2019).

Figure 8 - Chambers County Data by Usage Type

(TWDB State Water Plan for 2022 [Chambers County | 2022 Texas State Water Plan])



Population density allows for broad comparison of settlement intensity across geographic areas. In the U.S., population density is typically expressed as the number of people per square mile of land area. Population size and density are both important for describing and predicting the status of the population. The US Census shows the 2020 County population per square mile (78) in comparison to the 2010 population per square mile (58.8) using the same land area in square miles (597).

The number indicates with the population growth, land area is being used to support that growth. To understand where in the County that growth/density is increasing, US Census Tract data can help communities on a census tract level see if the population is shifting to different parts of the County or just increasing from development. For population density, the higher the number, the more densely populated per acre.

Table 3 shows how, by census tracts in Chambers County, the population per square mile and the land area in square mile is growing. A summary review of the information indicates that the overall increase in population density is on the western side of the County (tracts 7101 and 7102.01 and 7102.02).

Table 3 - Chambers County Population Density by Census Tract

2020 Census Demographic Data Map Viewer

Jurisdictions 2020 Census	**Census Tract**	**Pop Density**	**Total Pop**	**Land Area**
Old River and Mont Belvieu	7101	231.4	10,655.00	46
Unincorporated Chambers County (Baytown)	7102.01	636.5	10,707.00	16.8
Beach City and Cove and near Baytown	7102.02	217.8	12,163.00	55.9
Unincorporated Chambers County	7103	37.7	3,057.00	81.2
Unincorporated Chambers County	7104.01	42.7	6,247.00	146.2
Unincorporated Chambers County (Anahuac, Winnie and Stowell)	7105	15	3,742.00	248.8
Unincorporated Chambers County	7106	0	-	2.1
		TOTAL	46,571.00	597

The 2020 Census Demographic Data Map Viewer (2020 Census Demographic Data Map Viewer), can provide a map of the date discussed in Table 3 and Figure 9 is a map of the census tract

7101 which includes the jurisdictions of Old River and Mont Belvieu. Just looking at Mont Belvieu, the 2010 data for Mont Belvieu lists the population density of 255.6 and in 2020 that number increased to 452.3.

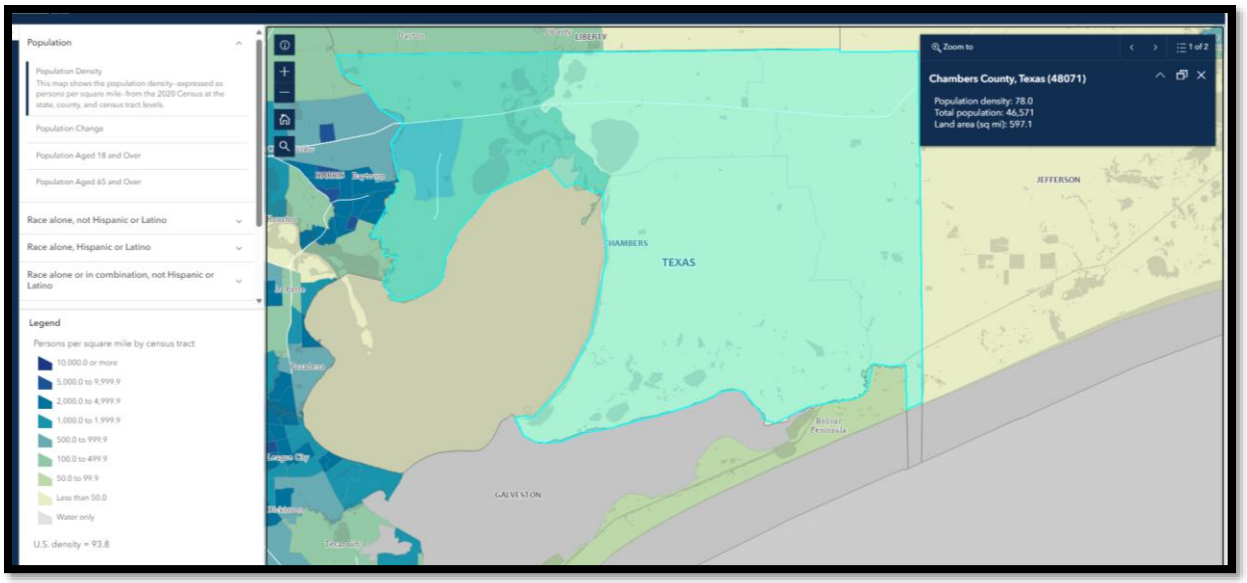


Figure 9 - Chambers County Census Tract ending in 7101 Population Map

2020 Census Demographic Data Map Viewer

Population Characteristics

Knowledge of the composition of the population is needed to help make informed decisions about the future. Information about the population is a critical part of hazard mitigation planning because it provides useful information to understand who and how the population could be at risk from a natural hazard as well as understand what segments of the population are more vulnerable during and after a natural event impacts and area.

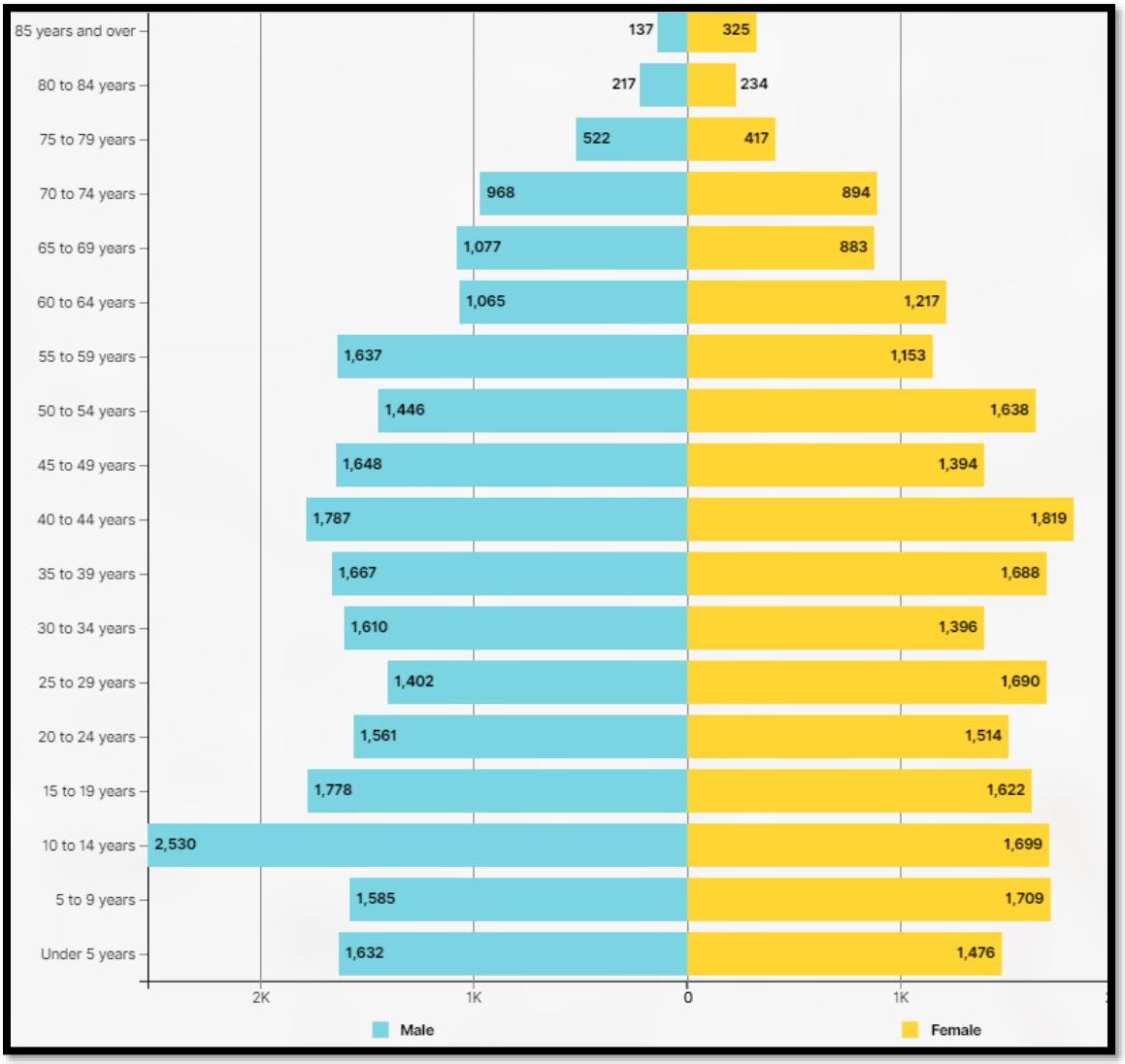
Taken from the 2020 Decennial Census data and using the total Chambers County 2020 population of 46,571, Figure X represents how the population is broken down in Chambers County by age and by sex. The median age for the County is 35.4 with approximately 12.1% of the population 65 years or older and approximately 6.7% of the population is under 5 years old.

Race and Hispanic Origin	
White alone, percent	86.8%
Black or African American alone, percent (a)	8.7%
American Indian and Alaska Native alone, percent (a)	1.2%
Asian alone, percent (a)	1.5%
Native Hawaiian and Other Pacific Islander alone, percent (a)	0.2%
Two or More Races, percent	1.7%
Hispanic or Latino, percent (b)	27.4%
White alone, not Hispanic or Latino, percent	61.6%

There are approximately 49.4% female and 50.6% male. Some other information provided regarding the population shows there are approximately 8.4% veterans in the County. Approximately 79.4% report that English is the type of language spoken at home with Spanish 19.1%, Asian and Pacific Islander, 1% Other Indo-European .4%. Approximately 8% of the population was born outside of the US. According to the 2020 Decennial Census, the racial composition is shown below.

Figure 10 - Chambers County Population and People

Chambers County, Texas - Census Bureau Profile



Households and Homeownership

There are 16,933 housing units as reported in the US Census 2020 Decennia for all Chambers County (including jurisdictions). There is an average of 2.97 people per household. The homeownership rate was 83.7% and the median value of owner-occupied homes was $279,200

and 86.7% were living in the same house one year ago. 96.3% of households had a computer and 89.5% had a broadband Internet subscription.

Education

In 2020, 74.2% were enrolled in kindergarten through 12th grade, 18.4% were enrolled in college and 3.8% were enrolled in graduate or professional school.

89.2% of the population graduated high school and 22.8% of the population attained a bachelor's degree.

Income

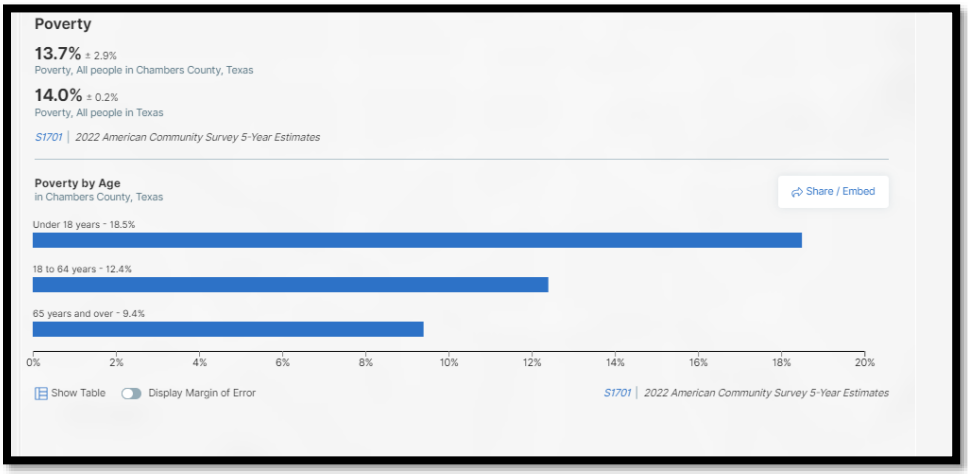
The median household income was $106,103 and the per capita income was $42,628. Figure 11 shows the breakdown by type of household and income which indicates that married-couple families tend to have a higher overall income than families and non-family households.

Figure 11 - Income By type of Household in Chambers County

	Chambers County, Texas							
	Households		Families		Married-couple families		Nonfamily households	
	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error
Total	15,744	±439	12,454	±506	9,889	±678	3,290	±562
Less than $10,000	3.3%	±1.6	5.3%	±2.3	1.2%	±1.2	4.5%	±3.7
$10,000 to $14,999	4.1%	±2.0	1.9%	±1.1	0.6%	±0.7	15.6%	±8.1
$15,000 to $24,999	6.4%	±2.0	5.1%	±1.9	4.9%	±2.3	7.8%	±3.9
$25,000 to $34,999	4.0%	±1.3	2.6%	±1.2	2.4%	±1.5	8.6%	±4.6
$35,000 to $49,999	7.5%	±2.7	5.6%	±2.8	5.2%	±3.2	14.3%	±6.9
$50,000 to $74,999	11.8%	±2.3	8.5%	±2.2	8.9%	±2.4	21.2%	±7.9
$75,000 to $99,999	9.9%	±3.1	11.2%	±3.7	10.5%	±3.8	8.9%	±4.5
$100,000 to $149,999	20.7%	±3.5	23.7%	±4.0	26.1%	±4.4	9.4%	±4.2
$150,000 to $199,999	16.4%	±3.0	19.0%	±3.7	21.1%	±4.1	6.3%	±4.8
$200,000 or more	15.8%	±3.1	16.9%	±3.4	19.1%	±3.6	3.5%	±3.2
Median income (dollars)	106,103	±8,787	130,195	±8,858	134,707	±6,339	47,348	±9,544
Mean income (dollars)	123,951	±8,898	131,431	±8,347	N	N	68,660	±16,516

The U.S. Census Bureau identifies households (2021) with two adults and two children with an annual household income below $26,246 per year as low income and individuals less than $13,171 as low income. For Chambers County, there were 13.7% of persons in poverty. A closer review of the statistics shows that most under poverty were children and the elderly as represented in Figure 12.

Figure 12 - Poverty by Age in Chambers County



Economy

The 2021 Economic Surveys Business Patterns reports that there are 737 employer establishments in Chambers County. The U.S. Census Bureau's Economic Census provides sub-national economic data by industry including the number of establishments, called the County Business Pattern (CBP) on a county level. Figure 14 is a list of industry types and the number of businesses in Chambers County.

Chambers County is economically divided between the communities and petrochemical complexes west of the Trinity River that are part of the Houston metropolitan region and the largely rural areas east of the Trinity River. Liquefied petroleum gas production and ancillary businesses are one of the primary economic drivers for the County. While most of these companies are in Harris County, the economic cluster extends into Chambers County. The Cedar Crossing Industrial Park, the fifth largest industrial park in the world, is the largest master-planned, rail-and-barge-served industrial park in the U.S. and spans approximately 15,000 acres of land. It is home to large distribution centers for retailers including Walmart and Home Depot. The economy in the eastern portion of the county is largely agricultural, along with a regionally significant fishery. Figure 13 shows Cedar Cross Industrial Park and other Land Use projections from the Chambers County Watershed Plan.

Figure 13 - Cedar Cross Industrial Park and other Land Use projections

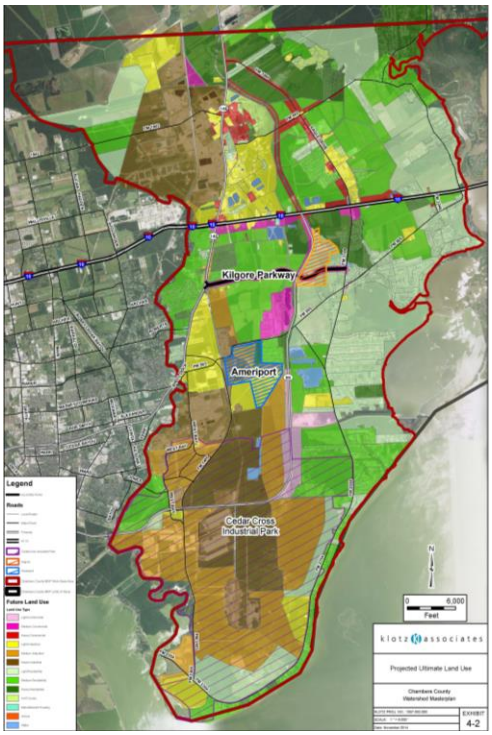
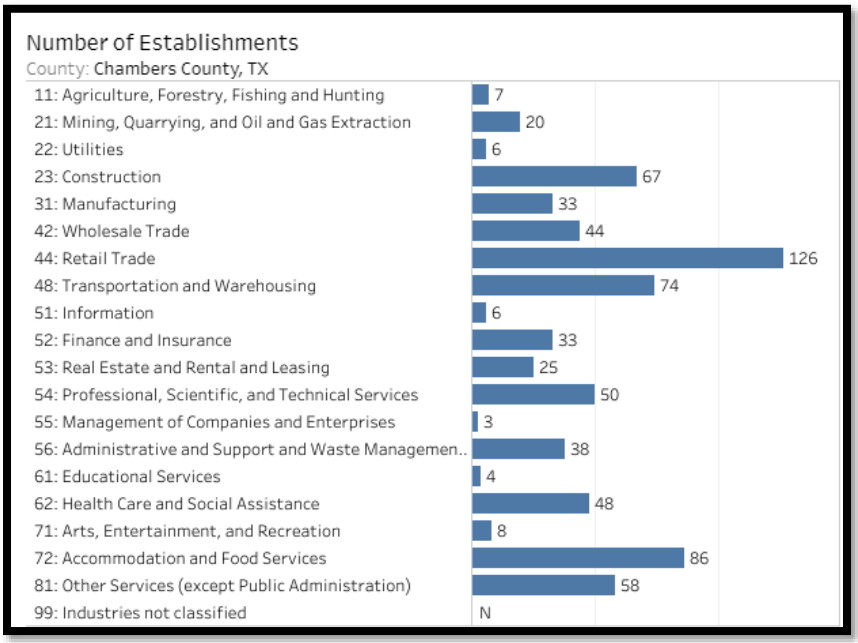


Figure 14 - Chambers County Number of Establishment for Selected Industries



Texas Workforce Commission (TWC) is the state agency charged with overseeing and providing workforce development services to employers and job seekers of Texas. Workforce Solutions

(WFS) under the direction of TWC is one of the 28 local workforce development boards throughout the State. WFS provides economic profiles and quarterly reports by County.

The 4th quarter 2023 report on the labor market information indicated that the rate of unemployment for Chambers County fell seven-tenths of a percentage point to 4.8 percent in October. While slightly higher than the State and national rates, they continue to fall annually, which is a positive sign for the economy. The County added 1,633 jobs over the year, up 8.4% from the 2nd quarter 2022 with the largest gains in Trade, Transportation, and Utilities. (https://www.wrksolutions.com/documents/Employer/LMI/Quarterly/ChambersQuarterly.pdf)/ Figure 15 provides a table from the report regarding employment and unemployment rates as compared to the State and Nation.

Figure 15 - Comparative Review of the Employment Rate for Chambers County
(Chambers Quarterly Profile (wrksolutions.com))

	OCT 2023	SEP 2023	OCT 2022
Civilian Labor Force	21,654	21,750	21,070
Total Employment	20,604	20,552	20,078
Unemployed	1,050	1,198	992
Unemployment Rate	4.8%	5.5%	4.7%
Comparative Actual Rates			
Texas	3.8%	4.1%	3.7%
U.S.	3.6%	3.6%	3.4%

Business, Workforce and Community

The TWC Chambers County Profile lists the major employers shown in Figure 16.

Figure 16 - Major Employers in Chambers County as reported by WFS
https://www.wrksolutions.com/documents/Employer/LMI/profiles/Chambersprofile.pdf

MAJOR EMPLOYERS
Anahuac ISD
Barbers Hill ISD
Bayer Corporation
CED Staffing Services
County of Chambers
Cryogenic Vessel Alternatives
East Chambers ISD
Exxon Mobile Corporation
Jindal United Steel
Saw Pipes USA Inc.

The largest industries in Chambers County are manufacturing, construction, and education services as reported by DATAUSA and the highest paying industries are utilities, real estate and rental and leasing, and Agriculture, Forest, Fishing and Hunting. The site has two charts for 2021, one for workforce and one for wages that illustrate this information, see Figures 17 and 18.

Figure 17 - Chambers County Workforce Occupations - 2021

(([Chambers County, TX | Data USA](#) [Chambers County, TX | Data USA](#))

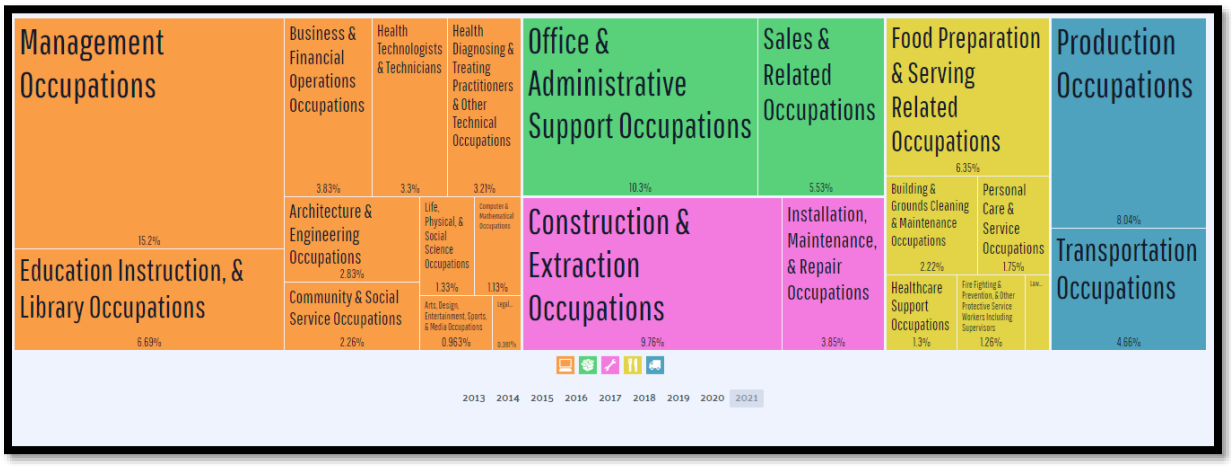
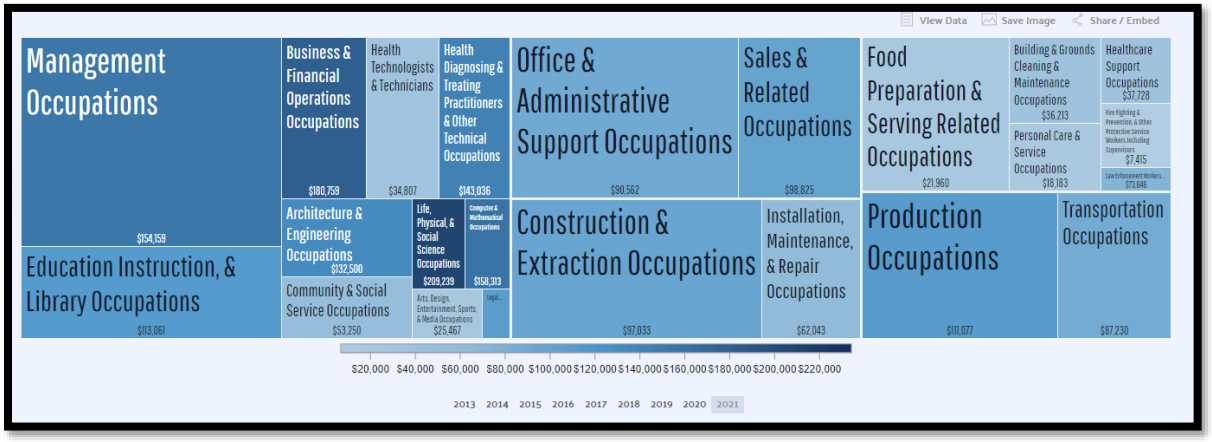


Figure 18 - Chambers County Average Wage by Occupation - 2021

[Chambers County, TX | Data USA](#)



Commute

The Census Bureau ACS 5-year Estimate reports that for 2021, the civilian labor force total was 66.7%. Of that percentage, 87.5% report driving alone to work. The average commute time is 30.4 minutes, and the average car ownership is two cars per household.

Vulnerable Populations

While age and income have been traditional indicators of vulnerable populations, these categories are not always inclusive of all the socially vulnerable populations. Social vulnerability is a concept that describes the condition of groups or communities that are more likely to suffer negative effects from external stressors such as natural hazards or disasters.

Census data provides helpful information to the percentage of populations in Chambers County that are socially vulnerable from natural hazard events. NOAA's National Centers for Environmental Information has released a mapping tool that provides county-level information on natural disasters and expands upon FEMA's National Risk Index to provide a view of a location's social vulnerability. The picture, risk and vulnerability provide the weather risk percentage and the vulnerable populations risk:

Risk and Vulnerability

Data Type	Chambers County	Texas	U.S.
Weather and Climate Risk			
Drought Risk	4.31	14.32	11.61
Flooding Risk	6.17	12.97	9.13
Freeze Risk	4.14	13.09	15.72
Severe Storm Risk	6.91	20.58	16.99
Tropical Cyclone Risk	8.76	6.41	4.36
Wildfire Risk	5.03	11.28	6.30
Winter Storm Risk	4.26	15.99	13.71
Socioeconomic Vulnerability			
Age < 18	28.00%	24.35%	22.36%
Age 65+	10.90%	17.53%	18.37%
All Vulnerabilities (%)	14.26%	17.24%	13.96%
Disabled Population	11.00%	16.08%	15.92%

Age 65+: Research has shown that older adults — those age 65 and up — are especially vulnerable to natural disasters. A disproportionate number of deaths and injuries from disasters occur in this population. In the United States, most older adults are unprepared for an emergency, and many are socially isolated. Older adults are also more likely to have chronic health problems and functional limitations that hamper their ability to prepare for and respond to a disaster. Many need help evacuating during an emergency. Almost 11% of Chambers County population falls in this category.

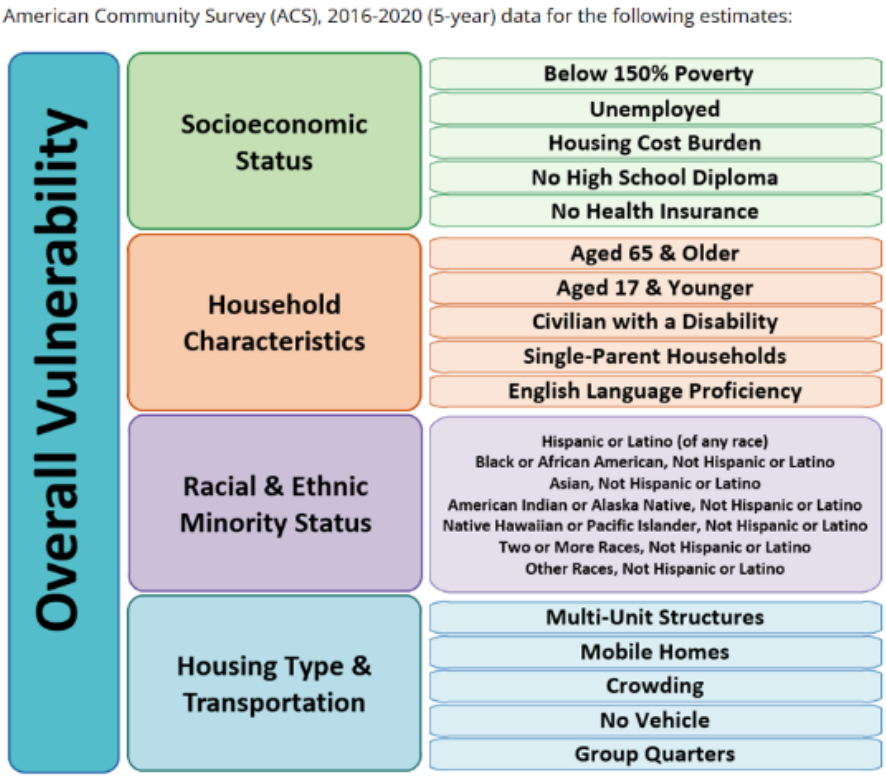
Age <18: Children under the age of 18 years are a particularly vulnerable population when exposed to natural disasters. Compared to adults, children suffer more severe physical effects. Disasters also can harm children indirectly. When a disaster affects parents and other adults (such as teachers), children's care, protection, and support systems are eroded. 28% of Chambers County population falls in this category.

Disabled population: Vulnerable populations such as those with disabilities, poor health and chronic disease are at an increased risk of adverse health and safety outcomes from natural disasters. Almost 11% of Chambers County population falls in this category.

All Vulnerabilities: This category includes Low income (Poor communities have higher deaths due to disasters, higher property damages, and, in their wake, disasters often increase poverty), Non-English Speaking (Non-English Speaking in Chambers County, Texas, 2.0% (+/- 1.0%) of households have limited English speaking status). Lack of transportation (Lack of transportation in Chambers County, Texas, approximate 357 (+/- 179) households that do not have access to a vehicle, which is 2.4% (+/- 1.20%) of households) (Disability Status, Non-English Speaking and lack of Transportation of the Civilian Noninstitutionalized Population 2017-2021 - COUNTIES | Emergency Management (census.gov).

To assist community preparation and response to hazardous events like natural disasters, The Center for Disease Control (CDC) Agency for Toxic Substances and Disease Registry (ATSDR) has created a database to help identify and map socially vulnerable populations called the Social Vulnerability Index (SVI). The CDC/ATSDR SVI uses U.S. Census data to determine the social vulnerability by census tract. The SVI ranks each tract on 16 factors, including poverty, lack of vehicle access, and crowded housing, and groups them into four related themes, socioeconomic status, housing characteristics, racial and minority status, and housing type/transportation (CDC/ATSDR SVI Fact Sheet | Place and Health | ATSDR). Figure 19 illustrates the four themes and illustrates 16 factors.

Figure 19 - CDC SVI Four themes and 16 Factors



A percentile ranking represents the proportion of tracts (or counties) that are equal to or lower than a tract (or county) of interest in terms of social vulnerability. For example, a CDC/ATSDR SVI ranking of 0.85 signifies that 85% of tracts (or counties) in the state or nation are less vulnerable than the tract (or county) of interest and that 15% of tracts (or counties) in the state or nation are more vulnerable. (CDC/ATSDR SVI Frequently Asked Questions (FAQ) | Place and Health | ATSDR). Possible scores range from 0 (lowest vulnerability) to 1 (highest vulnerability), so the higher the score, the more vulnerable the county or census tract is by theme or overall.

For Chambers County, there is a medium level of vulnerability, see Figure 20. However, the color coding suggests that some areas have a lower vulnerability (yellow) and some have a higher vulnerability (blue). Table 4 is census tract data and shows that census tract 7105.00 there is a high level of vulnerability overall. A closer look by theme indicates there is a high vulnerability in housing characteristics as well as housing type and transportation and socioeconomic. This information can be helpful as a community prepares and responds to natural hazard events.

Figure 20 - Chambers County CDC/ATSDR Social Vulnerability - 2021

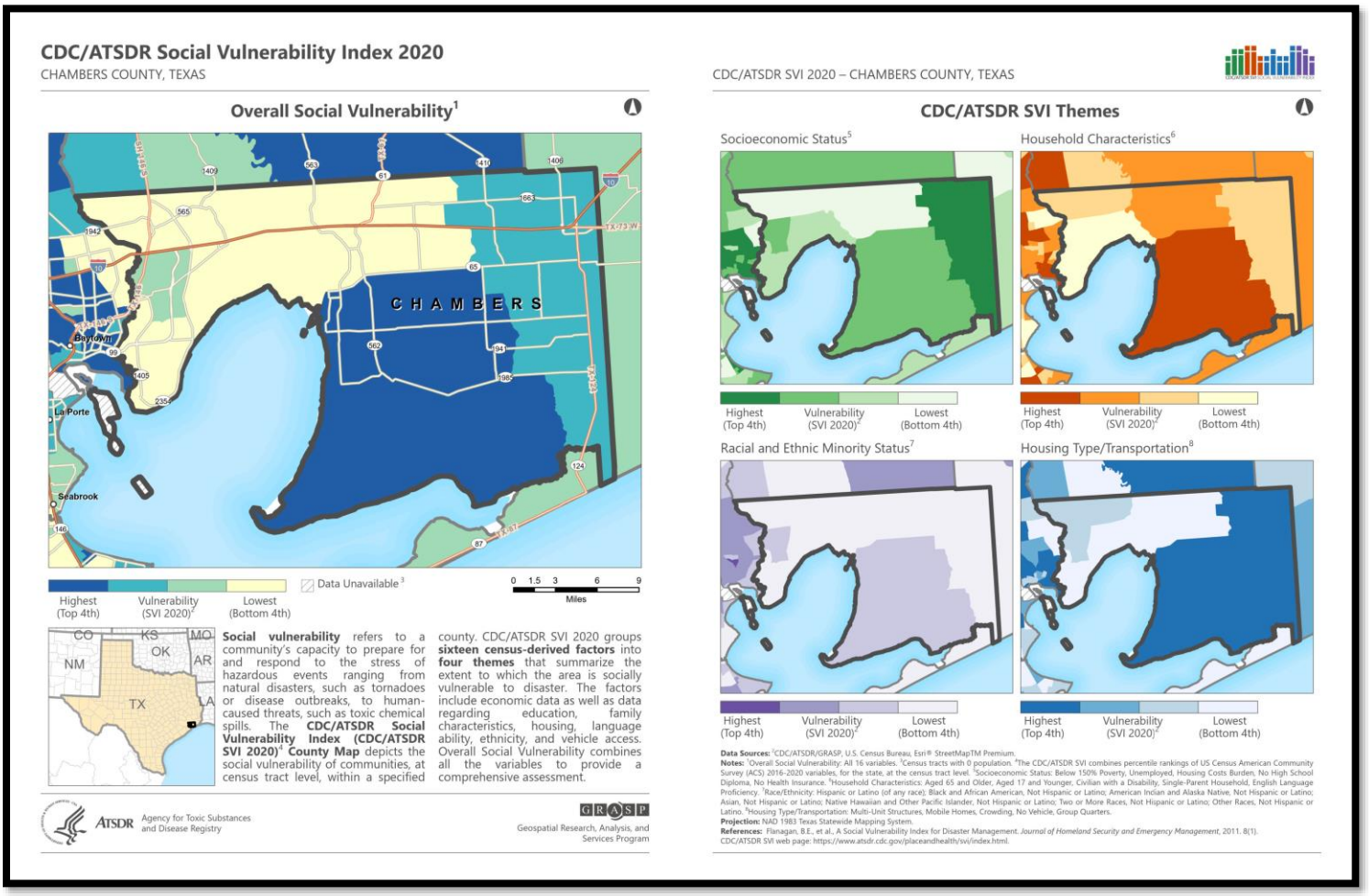


Table 4 - Chambers Census Tract Data, CDC/ATSDR Social Vulnerability - 2021

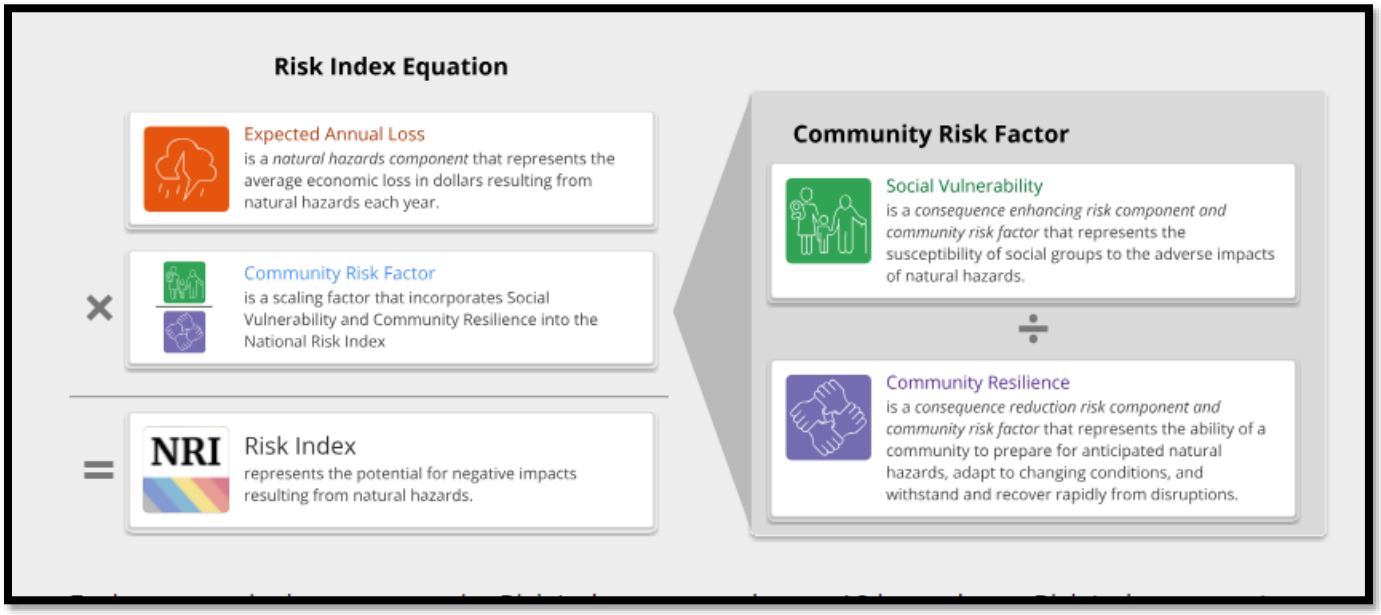
YEAR	ST	COUNTY	FIPS	Socio Economic	Housing Characteristics	Racial and Ethnic Minority Status	Housing Type and Transportation	Overall Track Summary Ranking
2020	TX	Chambers County	48071710100	0.2876	0.2915	0.1314	0.4642	0.2924
2020	TX	Chambers County	48071710201	0.6004	0.1457	0.4927	0.3278	0.3756

YEAR	ST	COUNTY	FIPS	Socio Economic	Housing Characteristics	Racial and Ethnic Minority Status	Housing Type and Transportation	Overall Track Summary Ranking
2020	TX	Chambers County	48071710202	0.4449	0.1784	0.1862	0.2478	0.2544
2020	TX	Chambers County	48071710300	0.1684	0.6424	0.0901	0.2232	0.2338
2020	TX	Chambers County	48071710401	0.8322	0.4391	0.123	0.8979	0.7362
2020	TX	Chambers County	48071710500	0.7345	0.9482	0.3922	0.8484	0.8598

FEMA has created a website dedicated to helping communities determine risk so it can determine measures to mitigate risk. The National Risk Index (https://hazards.fema.gov/nri), "is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards. The Risk Index leverages available source data for natural hazard and community risk factors to develop a baseline risk measurement for each United States county and Census tract." (https://hazards.fema.gov/nri/learn-more). Figure 21 shows the Risk Index Equation that is used to produce the risk index.

Figure 21 - FEMA's Risk Index Equation

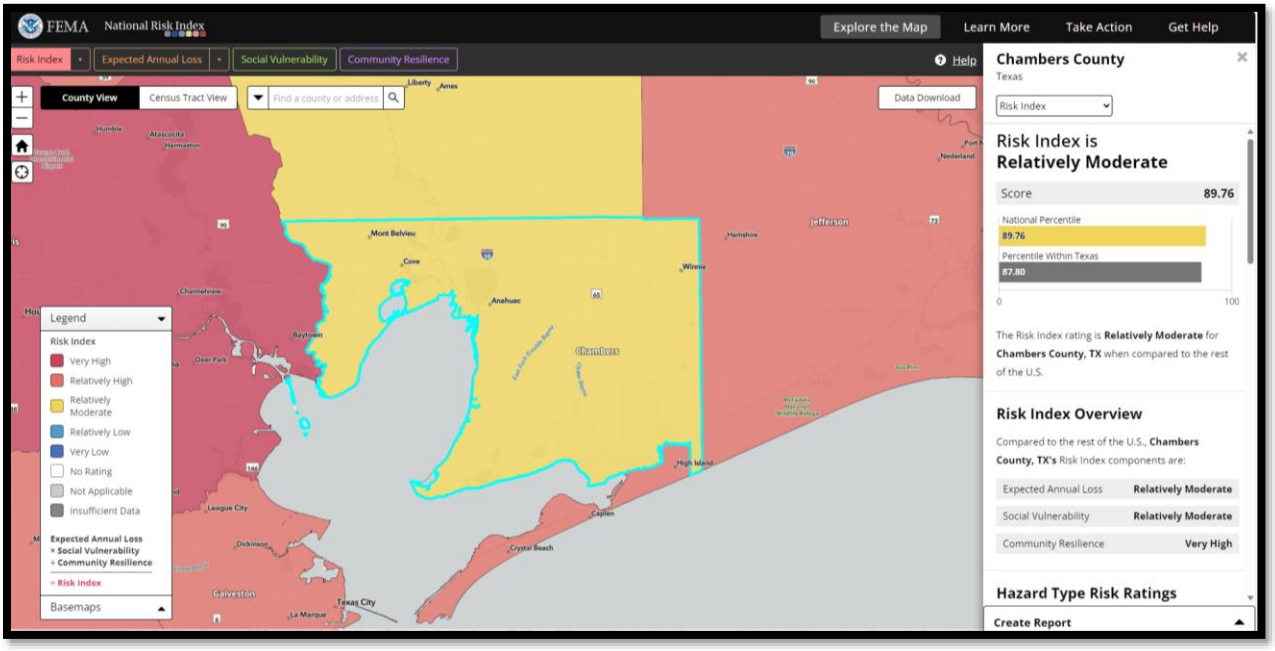
(Determining Risk | National Risk Index (fema.gov))



The community receives a score, which is represented by its percentile ranking among all other communities as the same level of risk. Chambers County received a score of 89.76. Communities also receive a rating which is a qualitative rating that describes the community compared to all

other communities at the same level. Chambers County received a "Relatively Moderate" rating, as shown in Figure 22. In the Risk Assessment section of the plan, each hazard will look at expected annual loss and community resilience scoring and rating for the planning area.

Figure 22 - FEMA's Risk Index for Chambers County



Building Stock

Using the 2022 Chambers County Appraisal District's Annual Report there are approximately 16,808 residential housing properties (single and multi-family homes), 1,650 commercial and industrial properties with a 2022 appraised market value of approximately $4,840,839,130.00. Table 5 provides for the full appraisal district report including additional taxed items such as vacant land and personal property, mobile homes as examples with total 2022 appraised value of $26,293,473,642.00 and total inventory of 47,038.00. There are also 27 public buildings that are listed as critical buildings by the County.

Table 5 - Appraisal District for Chambers County
(GetDocument (chamberscad.org)

Total Parcels	**47,038.00**
Appraised market value	$ 26,293,473,642.00
Single Family Residential (CAT A)	16,771.00
Multi-Family (CAT B)	37.00
Vacant Lots (CAT C)	5,544.00
Acreage and AG-use (CAT D)	5,716.00

Total Parcels	47,038.00
Farm and Ranch Improvements (CAT E)	5,501.00
Commercial and Industrial (CAT F)	1,650.00
Category G	3,584.00
Utilities (CAT J)	1,024.00
Personal Property (CAT L)	2,887.00
Mobile Homes (CAT M)	1,170.00
Inventory (CAT O)	561.00
Special Inventory (CAT S)	18.00
Exempt properties	3,600.00

Community Critical Facilities and Lifelines

Critical facilities are those that provide essential community services and emergency functions like continuity of government, emergency services, health, and educational facilities. Critical infrastructure can include utilities that provide water, electricity, transit, and communication services to the community (e.g. transportation systems, utilities, and water control systems). For hazard mitigation planning purposes, the following are the categories of assets:

Government Facilities. Buildings and facilities owned or leased by local governments, political subdivisions, and special purpose districts such as general-use office buildings and other structures that may house critical equipment, networks, or provide essential government services.

Emergency Services—Facilities used by first responder and public safety agencies that provide law enforcement, fire response, emergency medical services, incident response, and emergency management.

Education Facilities. Pre-kindergarten through 12th grade schools, school support facilities, and institutions of higher education.

Health and Medical Facilities. Health and medical services facilities provide direct patient care, public health services, healthcare delivery, and mass fatality services.

Transportation Systems. Transportation modes used to move people and goods through the county, state, country and overseas.

Utility Systems. Lifeline systems that support and sustain all other facilities and infrastructure such as water, wastewater, solid waste, electrical, and telecommunications.

Water Control Systems—Irrigation systems, drainage and pumping systems, levees, dams, and flood control channels.

Table 6 - Critical Facilities in Chambers County and Participating Jurisdictions

TYPE	NAME
Educational Facilities	Anahuac Elementary
Educational Facilities	Anahuac High School
Educational Facilities	Anahuac Middle School
Educational Facilities	Barber Hill High School
Educational Facilities	Barbers Hill Elementary School North
Educational Facilities	Barbers Hill Elementary School South
Educational Facilities	Barbers Hill Kindergarten
Educational Facilities	Barbers Hill Middle School
Educational Facilities	Barbers Hill Middle School North
Educational Facilities	Barbers Hill Primary School
Emergency Services	Anahuac VFD
Emergency Services	Anahuac Volunteer Emergency Medical Services
Emergency Services	Barbers Hill Fire Department
Emergency Services	Bayside Community High School
Emergency Services	Beach City VFD
Emergency Services	Chambers County Constable Precinct 2
Emergency Services	Chambers County EOC
Emergency Services	Chambers County Task Force
Emergency Services	County Sheriff
Emergency Services	Cove Fire & Rescue
Emergency Services	Hankamer VFD
Emergency Services	ISD Police Department
Emergency Services	Mont Belvieu Fire Department
Emergency Services	Mont Belvieu Police Dept
Emergency Services	Oak Island - Double Bayou VFD
Emergency Services	Police Department
Emergency Services	Smith Point VFD
Emergency Services	Smith Point Volunteer Fire Department and Emergency Services
Utility	Chambers County Landfill
Utility	Gulf West Landfill

Community lifelines are the most fundamental services in the community that, when stabilized, enable all other aspects of society. The National Response Framework (NFR) 4th Edition Toolkit 2.1 (interim product) identifies eight lifelines as critical for maintaining public health, safety, and economic viability and include:

- Safety and Security
- Food, Hydration, Shelter

- Health and Medical
- Energy (Power and Fuel)
- Communications
- Transportation
- Hazardous Materials
- Water Systems

Hazardous materials are included in the lifeline construct because hazardous materials and hazardous materials facilities present a serious risk to the communities in which they are located if these materials and facilities are destabilized. Hazardous materials are not addressed in this plan, however, because they do not constitute a natural hazard, which is the focus of this plan. The County has other plans that support that lifeline.

For community lifelines, each lifeline was reviewed.

Safety and Security: Components of this lifeline category include law enforcement/security, fire services, search and rescue services, government services and community safety. Table 7 summarizes the total number of each facility.

Table 7 - Chambers County Lifeline: Safety and Security

Police	EOC	Fire Stations	Govt Bldgs.	Schools
5	1	7	7	10

Food, Hydration, and Shelter: Food, Water, and Shelter lifelines include facilities pertaining to food supply (distribution facilities, programs, and supply chain, food banks), hydration (bottled water distribution, commercial water supply chain), shelter (housing and hotels), and agriculture (animals and agriculture). Table 8 summarizes the total of the lifelines.

Table 8 - Chambers County Lifeline: Food, Hydration, Shelter

Hydration	Foodbanks	Shelters	Agriculture
1	1	6	

Health and Medical: This lifeline includes medical care (e.g., hospitals, nursing homes, long-term care, and assisted living facilities) and patient movement (e.g., EMS). Table 9 summarizes the total number for each facility.

Table 9 - Chambers County Lifeline: Health and Medical

Hospitals	Nursing Homes	Long-term care facilities	EMS
2	2	1	5

Energy (Power and Fuel): Energy (power and fuel) lifelines include power grid and fuel facilities. Table 10 summarizes the fuel lifelines.

Table 10 - Chambers County Lifeline: Energy

Electric Substation	Power Plants	**Fuel**
26	5	Gas stations

Communications: Communication lifelines include infrastructure, alerts/warnings/messages, 911 and dispatch, and first responder communications. Table 11 summarizes the total number by category.

Table 11 - Chambers County Lifeline: Communications

Alert messages	**911 PSAP**
1	1

Transportation: Transportation lifelines include highways/roadways, mass transit, railway, aviation, and maritime. Several major highways pass through Chambers County including I-10, Highways 124, 61, 65, 146, 99. Table 12 summarizes the total number by category.

Table 12 - Chambers County Lifeline: Transportation

Airport	**Bus Facilities**	**Intermodal facilities**	**Rail Facilities**	**Maritime**
2 (regional)	0	0	0	

Water Systems: Water systems include potable water infrastructure (e.g., intake, treatment, storage, and distribution) and wastewater management (e.g., collection, storage, treatment, and discharge). Table 13 summarizes the total number by category.

Table 13 - Chambers County Lifeline: Water Systems

Potable Water Infrastructure	**Wastewater Management**
0	2

Figure 23 - Map of Hazard Mitigation Critical Facilities in Chambers County

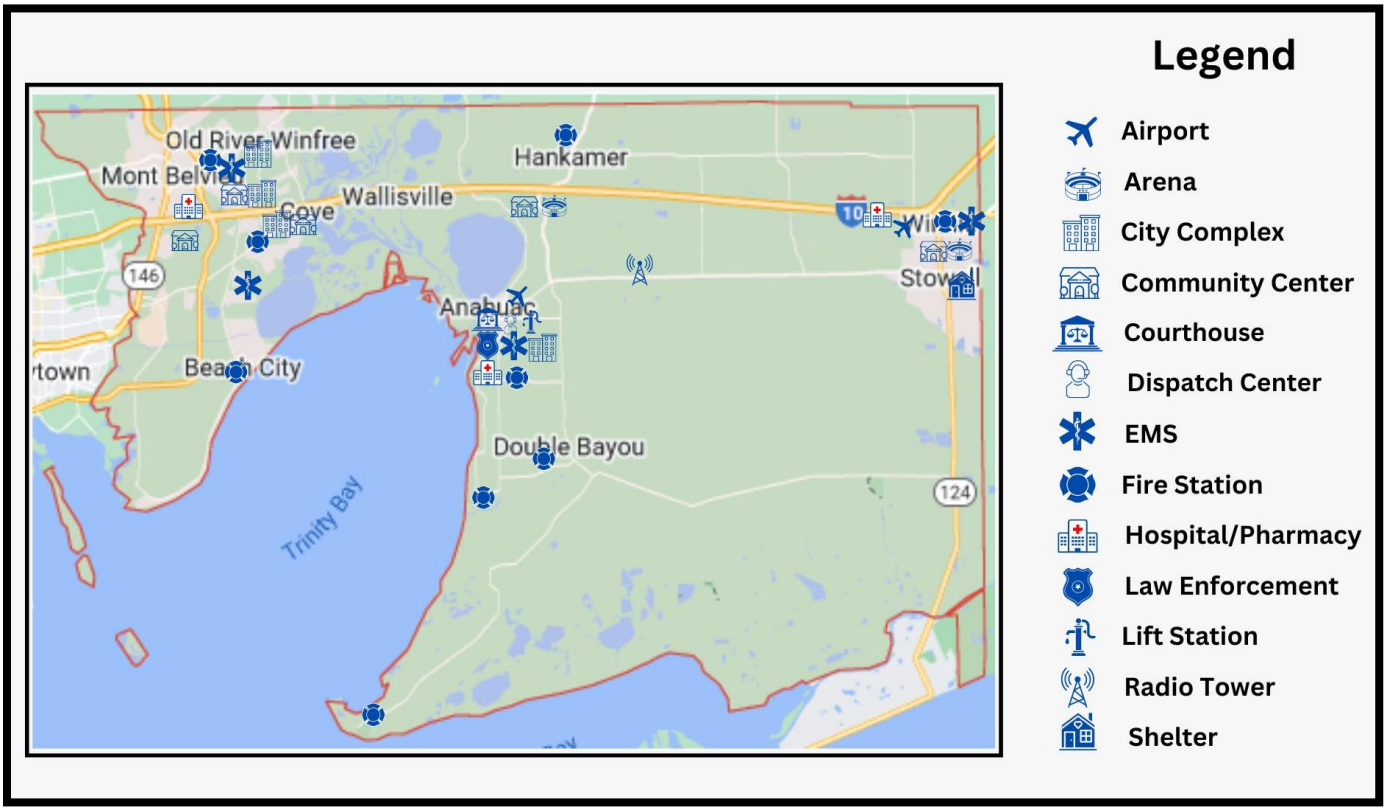
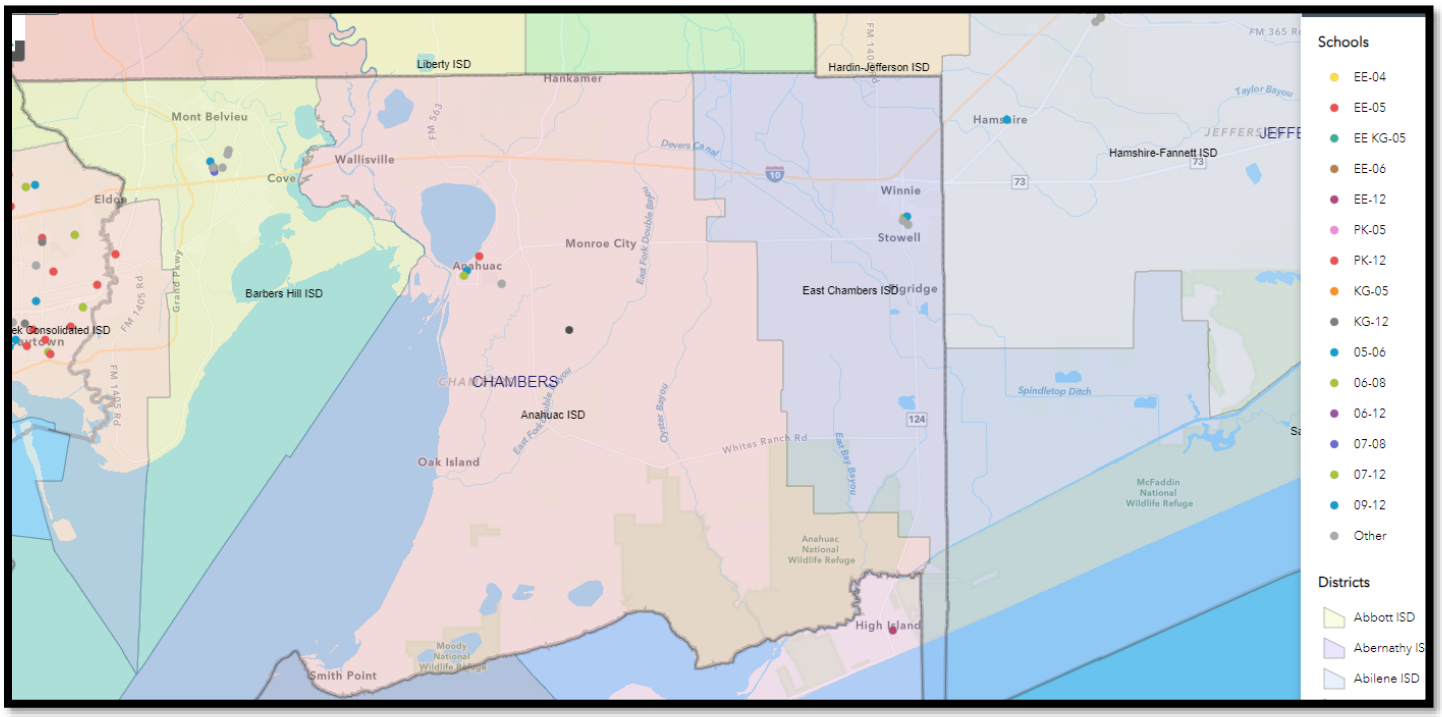


Figure 24 - Map of Independent School Districts (ISDs) in Chambers County
(TEA School District Locator School District Locator (arcgis.com)**)**



Changes in Development in hazard-prone areas

The County does not have building permit authority, that rests with the jurisdictions. The jurisdictions protect new development through hazard resistant building code requirements. However, older homes may suffer as some were built before these building codes were in place. Also, as impervious surfaces replace undeveloped lands, the jurisdictions, and the County, have to continue to enforce subdivision rules written to protect areas from causing additional negative impact.

While the County and the participating jurisdictions have floodplain protection policies in place, there can be pressure to allow for building in these areas, so the communities need to continue to balance new development without impacting hazard-prone areas. As areas grow, each community must review its development practices to ensure the safety and well-being for the whole community.

Section 2. The Planning Process

Changes from the Last Plan

Since the last iteration of the plan, the County made extensive efforts for outreach to the stakeholders and the public. The MPC requested stakeholder participation and then set a schedule for the stakeholders to learn about the process, complete a survey, understand how they can help, and proactively review and comment on the draft plan. In addition to stakeholder outreach, the public outreach also increased through surveys, notification through social media platforms as well as traditional platforms (website, newspaper notification) and meetings at times suitable to multiple audiences. This outreach helped increase participation and input to the plan from these groups.

The Purpose of the Plan

Over twenty years ago, Congress recognized the need to support a new kind of planning that would help local communities understand and reduce their vulnerability to natural hazards by preparing a local hazard mitigation plan. Congress passed the Disaster Mitigation Act (DMA) of 2000 which amended the Robert T. Stafford Disaster and Emergency Act (Stafford Act). The Code of Federal Regulation (CFR) provides the regulatory requirements outlined in the DMA. 44 CFR § 201.6(d)(3) stipulates that a local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within 5 years to continue to be eligible for mitigation project grant funding.

The Act intended to assist communities in reducing their risk from natural hazards by identifying resources, information, and strategies for risk reduction, and through careful planning and collaboration among public agencies, stakeholders, and the public, prepare and regularly update mitigation plans. To implement the DMA 2000 planning requirements, in April 2022 FEMA released a Local Mitigation Planning Guide, FEMA's official policy on, and interpretation of, local hazard mitigation planning requirements. In May 2023 FEMA released the Local Mitigation Planning handbook to guide local governments as they update a hazard mitigation plan. The handbook emphasizes the shift to community resilience and a whole community approach ensuring vulnerable populations are represented.

The purpose of Chambers County's Hazard Mitigation Plan is to reduce the loss of life and property within the county and lessen the negative impacts of natural disasters. Vulnerability to several natural hazards has been identified through research, analysis, and public input. These hazards threaten the safety of residents and have the potential to damage or destroy both public and private property, disrupt the local economy, and impact the overall quality of life of individuals who live, work, and enjoy recreation in the county. While natural hazards cannot be

eliminated, the effective reduction of a hazard's impact can be accomplished through thoughtful planning and action.

The concept and practice of reducing risks to people and property from known hazards is generally referred to as hazard mitigation. One of the most effective tools a community can use to reduce hazard vulnerability is developing, adopting, and updating a hazard mitigation plan as needed. A hazard mitigation plan establishes the broad community vision and guiding principles for reducing hazard risk, including the development of specific mitigation actions designed to eliminate or reduce identified vulnerabilities. While the goal of the plan was to have a unified approach to the planning, hazard profile and ranking, risk assessments, mitigation goals, actions, prioritization and implementation, and maintenance with all jurisdictions equally providing support to the overall plan, there are few sections that are unique to the jurisdictions, so annexes for each jurisdiction are provided to provide that information.

The Plan Participating Jurisdictions

The Update includes the following jurisdictions:

- Unincorporated Chambers County
- Anahuac
- Beach City
- Cove
- Mont Belvieu
- Old-River-Winfree
- Chambers-Liberty Counties Navigation District

The Planning Process

This section includes a description of the planning process used for the 2024 Chambers Hazard Mitigation Plan, including how it was prepared, who was involved in the process, and how the public was involved. The County followed a well-established planning process to update its Hazard Mitigation Plan (HMP). The process followed the FEMA Local Hazard Mitigation Plan regulations set forth in 44 Code of Federal Regulations (CFR) Part 201.6 and is FEMA's official source for defining the requirements for original and updated local hazard mitigation plans. In addition, the FEMA Local Mitigation Planning Handbook (May 2023) was used as a practical guide to ensure all requirements were satisfied. The Local Mitigation Planning Handbook suggests organizing the plan around four steps as illustrated in Figure 25.

Figure 25 - Steps to Prepare a Plan

(FEMA Local Mitigation Planning Handbook, May,2023 p. 2)

The HMP is a multi-jurisdictional plan for Chambers County and the participating jurisdictions which make up the planning area. The HMP includes all federal required elements for a hazard mitigation plan that apply to the entire planning area including:

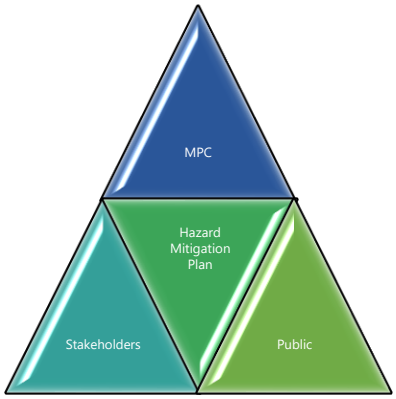
- Planning process
- Stakeholder and public outreach strategy
- Hazard risk assessment and ranking
- Previous actions status
- Mitigation strategy – goals, actions, prioritization, and implementation
- Integration with other planning initiatives
- Plan maintenance

Each participating jurisdiction has its own annex that provides for specific information unique for that jurisdiction including:

- Jurisdiction profile
- Jurisdiction Capabilities assessment
- Jurisdiction Hazard risk assessment
- Jurisdiction Resolution adopting the plan

The plan followed the recommended resource organization utilizing the support from three key groups:

- The Mitigation Planning Committee
- The Stakeholders
- The Public



Mitigation Planning Committee

The Mitigation Planning Committee (MPC) consists of County employees, jurisdiction employees or officials, and the plan consultant. The MPC leads the drafting of the plan as well as the annual review of the plan. Members are responsible for:

- Providing guidance and overseeing the planning process
- Attending and participating in meetings
- Establishing a timeline for completion of the plan update
- Assisting with the development and completion of certain planning elements, including:
  - Determining the planning process and schedule
  - Identifying and profiling the hazards of concern and preparing the risk assessment for each hazard
  - Developing a public and stakeholder outreach program
  - Assuring the data and information used in the plan process is the best available
  - Providing a capability assessment of the County and participating jurisdictions considering authorities, policies, programs, and resources available
  - Determining the hazard mitigation strategy and goals
  - Identifying, screening and prioritization of mitigation actions and implementation
  - Determining the maintenance process for the plan
  - Reviewing plan documents prior to submission to TDEM and FEMA
  - Ensuring that the plan meets the requirements of DMA 2000 as well as the Local Mitigation Planning Policy Guide (FP 206-21-0002) released April 19, 2022, Effective April 19, 2023 and 2023 Local Planning Handbook Updates.

During the first meeting, the team confirmed the composition of the Mitigation Planning Committee (MPC) and their respective positions. Roles and responsibilities were determined. The MPC undertook a detailed review of every section of the existing plan. The MPC identified all the subject areas where specific updates were required. For example, census figures, the numbers, and locations of critical buildings, infrastructure, and assets, and impacts of recent

hazard events, as some examples. The second purpose of the review was to ensure that the updated plan is fully compliant and responsive to all the FEMA requirements including understanding better the future climate change impacts and ensuring the mitigation strategy benefits all residents.

The review indicated that there were changes and updates with the new FEMA guidance that would require some research, revision, and more diligent outreach. Table 14 lists the MPC members for this plan. Minutes were prepared for each meeting to document the process and keep the plan on task. Those minutes can be found at the end of the plan in Appendix A.

Table 14 - Chambers County and Participating Jurisdictions

Name	Title	Organization	Role/Responsibility
Ryan Holzaepfel	**Emergency Management Coordinator/Fire Marshal**	**Chambers County**	**Data collection, analysis of hazards, identify actions, mitigation strategy, outreach strategy, map support, and draft review**
Robert Hall	**County Engineer**	**Chambers County**	**Data collection, analysis of hazards, identify actions, mitigation strategy, outreach strategy, map support, and draft review**
Brad Wilber	**Floodplain Administrator**	**Chambers County**	**Data collection, analysis of hazards, identify actions, mitigation strategy, outreach strategy, map support, and draft review**
Darla Branch	**Director, Environmental Health and Permitting**	**Chambers County**	**Data collection, analysis of hazards, identify actions, mitigation strategy, outreach strategy, map support, and draft review**
Samantha Humphrey	**Director, Economic Development**	**Chambers County**	**Data collection, analysis of hazards, identify actions, mitigation strategy, outreach strategy, map support, and draft review**
Robbie King	**Deputy Director, Economic Development**	**Chambers County**	**Data collection, analysis of hazards, identify actions, mitigation strategy, outreach strategy, map support, and draft review**

Name	Title	Organization	Role/Responsibility
Kenny Kathan	City Manager	Anahuac	Data collection, analysis of hazards, identify actions, mitigation strategy, outreach strategy, map support, and draft review
Ken Pantin	Mayor	Beach City	Data collection, analysis of hazards, identify actions, mitigation strategy, outreach strategy, map support, and draft review
Leroy Stevens	Mayor	Cove	Data collection, analysis of hazards, identify actions, mitigation strategy, outreach strategy, map support, and draft review
Misty Ford	City Secretary	Cove	Data collection, analysis of hazards, identify actions, mitigation strategy, outreach strategy, map support, and draft review
Lee Atchison	Emergency Management Coordinator /Fire Marshal	Mont Belvieu	Data collection, analysis of hazards, identify actions, mitigation strategy, outreach strategy, map support, and draft review
Brent Hahn	Fire Marshal	Mont Belvieu	Data collection, analysis of hazards, identify actions, mitigation strategy, outreach strategy, map support, and draft review
Francisco Carillo	Interim Director of Engineering	Mont Belvieu	Data collection, analysis of hazards, identify actions, mitigation strategy, outreach strategy, map support, and draft review
Claudia Sandoval	General Manager	Chambers-Liberty Navigation District	Data collection, analysis of hazards, identify actions, mitigation strategy, outreach strategy, map support, and draft review

Name	Title	Organization	Role/Responsibility
Joe Landry	**Mayor**	**Old River-Winfree**	**Data collection, analysis of hazards, identify actions, mitigation strategy, outreach strategy, map support, and draft review**
Kristen Thatcher	**Plan Consultant**	**JSWA**	**Drafting plan based on data and analysis from MPC, reports and plans, ensuring requirements are met for plan, and incorporating Stakeholders and Public comments**
Jeff Ward	**Plan Consultant**	**JSWA**	**Drafting plan based on data and analysis from MPC, reports and plans, ensuring requirements are met for plan, and incorporating Stakeholders and Public comments**
Chase Ward	**Plan Consultant**	**JSWA**	**Drafting plan based on data and analysis from MPC, reports and plans, ensuring requirements are met for plan, and incorporating Stakeholders and Public comments**

The MPC met seven times during the planning process and will be briefly summarized as the minutes are attached to the plan in Appendix A.

July 20, 2023 - The purpose of the meeting was to begin the planning process, finalize the MPC membership, identify potential stakeholders, to make certain decisions about contents of the plan, and to assign specific tasks to each member. Most of the tasks were related to updating information and maps as well as identifying which areas (of each section) required updates. Each section of the current plan was then reviewed and analyzed to determine which areas required update. The 2017 hazards were reviewed, the goal was reintroduced, and the team discussed plans, studies and reports that were completed since 2017 for review. The team also discussed an outreach strategy. Lastly, a schedule was put in place, see Figure 26

August 15, 2023 - The MPC reviewed the hazards from the 2017 plan. The team also reviewed the mitigation actions from that plan so status could be provided and a decision if the action was completed, ongoing, or no longer a priority. The stakeholder list was finalized, and the capabilities assessment commenced. There was discussion on development in the last five years

as well as updating the critical facilities. The outreach plan was formulated starting with a public survey and a draft letter inviting stakeholders to participate.

The MPC identified hazards that impact the planning area and hazards that could be omitted. The team further refined the outreach strategy and began the review of local capabilities.

September 25, 2023 - The MPC, using the hazard profile information and vulnerability analysis, began to classify and rank the hazards. The MPC was provided with the draft survey, flyer and factsheet to be placed on the County's website, advertised on the County and jurisdiction's social media platforms, and placed on TV monitors and digital displays that are in the jurisdiction's' buildings.

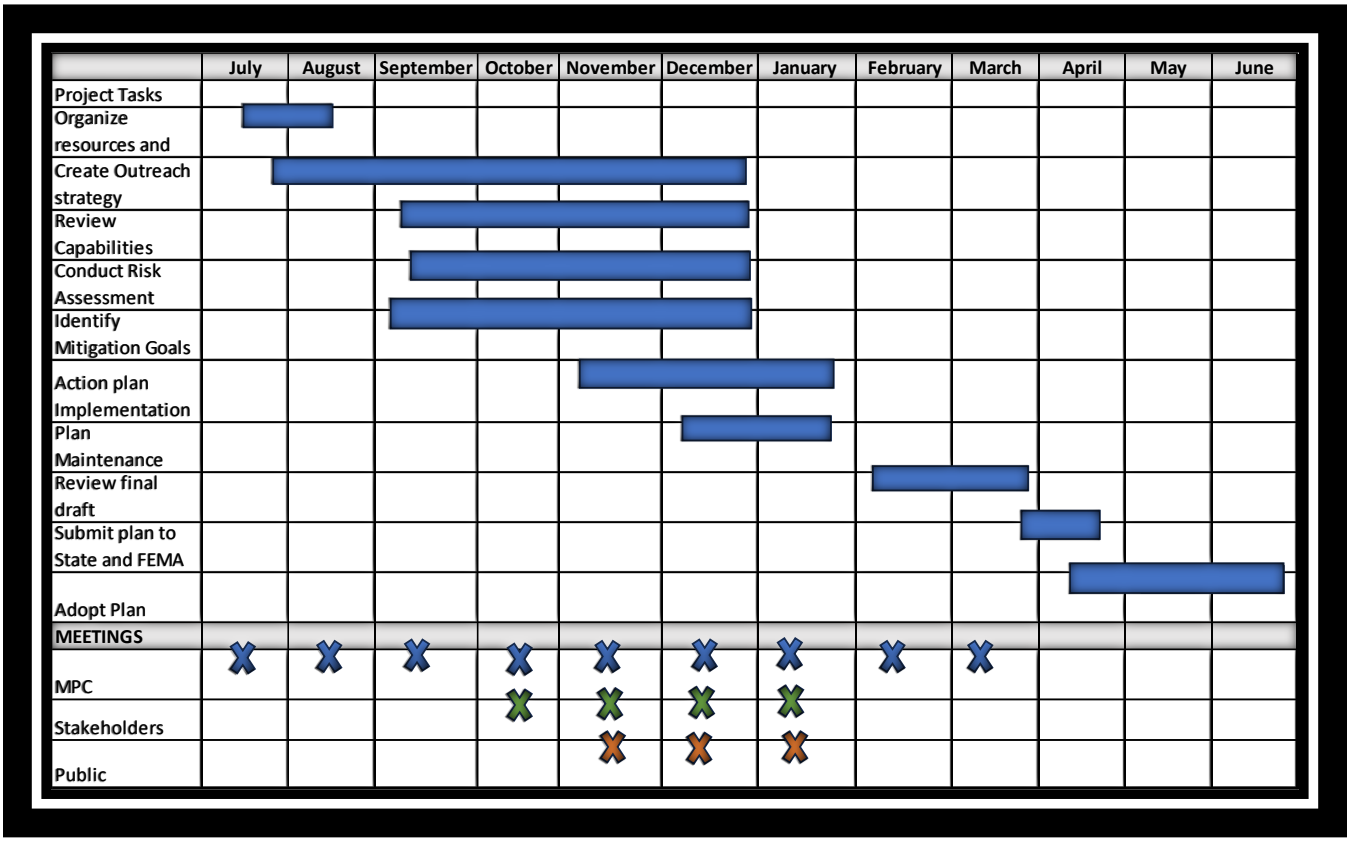
October 12, 2023 – The mitigation strategy and goals were reviewed and reaffirmed. The team began work on the mitigation actions reviewing problem statements by hazard. The mitigation strategy and goal were updated and finalized. The letter to the stakeholders was finalized for distribution along with a survey request.

October 26, 2023 –The team finalized the details of the actions and then prioritized the actions. Discussion regarding the maintenance process took place. Throughout December, the team would focus on the outreach to the stakeholders and the public on the draft update and work on the first draft ready for public review in March.

May 15, 2024 - Input received from the stakeholders was provided and the MPC reviewed the input and prepared the final draft for public review and input. The final draft date was set, and the second public meeting and outreach meetings were set.

July 5, 2024 - The MPC received comments from the 30-day public comment period. After reviewing, the team incorporated comments received in preparation to submit the final plan for TDEM to review.

Figure 26 - Tentative Schedule



Stakeholders

Stakeholders are individuals and organizations that may be affected by mitigation actions and policies and who can provide specific information on topics or provide input from a different perspective in the community including:

- Local and regional agencies involved in hazard mitigation activities
- Agencies that have the authority to regulate development
- Neighboring communities
- Representatives of businesses, academia, and other private organizations
- Representatives of nonprofit organizations, including community-based organizations, that work directly with and/or provide support to underserved communities and socially vulnerable populations, among others.

The MPC identified stakeholders and sent an invitation to participate in the plan process (by mail and email) to the stakeholders on November 3, 2023 and an example of the letter can be found in Appendix B. The stakeholders for this plan are listed in Table 15.

Stakeholder outreach was performed early on, and continually throughout the planning process. There were two formal presentations and one request for input on the first draft of the plan. The

stakeholders were also invited to the public meetings. Input was received throughout the drafting process. A brief description for the three stakeholder meetings is below.

December 5, 2023 – The MPC explained the importance of mitigation planning, the plan process, information and data on the plan draft, and how the stakeholders could help and provide input to the drafting process.

April 9, 2024 – The MPC summarized the draft of the plan and solicited review and input from the stakeholders.

May 15, 2024 –Stakeholders reviewed the draft and provided comments back for incorporation of the final draft to be submitted for public review on June 4th.

Table 15 - Chambers County 2024 Stakeholders

Surname	Name	Title	Organization
The Honorable	Lina Hidalgo	County Judge	Harris County
The Honorable	Jeff Branick	County Judge	Jefferson County
The Honorable	Mark Henry	County Judge	Galveston County
The Honorable	Jay Knight	County Judge	Liberty County
Mr.	Jason Reynolds	City Manager	City of Baytown
Mr.	David Alamia	Emergency Management Coordinator	City of Baytown
Mr.	Jerry Shadden	General Manager	Trinity Bay Conservation District
Mr.	Doug Canant	General Manager	Jefferson County Drainage District 6
Ms.	Cheryl Mergo	Senior Manager	Houston Galveston Area Council (H-GAC)
Ms.	Darcy Whatley	President and CEO	Mont Belvieu Rehabilitation and Healthcare Center

Surname	Name	Title	Organization
Ms.	Kayla Kiker	Administrator	Arboretum Nursing and Rehabilitation Center Of Winnie
Mr.	Tahir Javed	President/CEO	Riceland Medical Center
Ms.	Elizabeth Royer Kemp	Chairwoman	Anahuac Area Chamber of Commerce
Mrs.	Katelynn Smith	Executive Director	Anahuac Area Chamber of Commerce
Mr.	Brady Zieschang	President	Winnie Area Chamber of Commerce
Mrs.	Debbie Breaux	Executive Director	Winnie Area Chamber of Commerce
Ms.	Macie Schubert	President/CEO	Mont Belvieu Chamber of Commerce
Mr.	Steve Ahlenius	President/CEO	Greater Beaumont Chamber of Commerce
Dr.	Cody Abshier	Interim Superintendent	Anahuac ISD
Mr.	Scott Campbell	Superintendent	East Chambers ISD
Dr.	Greg Poole	Superintendent	Barbers Hill ISD
Dr.	Randal O'Brien	Superintendent	Goose Creek CISD
Mr.	Mark Sloan	Emergency Management Coordinator	Harris County Office of Emergency Management
Mr.	Michael White	Emergency Management Coordinator	Jefferson County Office of Emergency Management
Mr.	Bill Hergemueller	Emergency Management Coordinator	Liberty County Office of Emergency Management

Surname	Name	Title	Organization
Mr.	Scott Tafuri	Emergency Management Coordinator	Galveston County Office of Emergency Management
Chief	Kenneth Dobson	Fire Chief	Baytown Fire Department
Mr.	Scott Neal	Senior Pastor	Eagle Heights Fellowship
Mr. and Mrs.	Don and Jonna Gibson	Pastors	Mercy Gates Church
Mr.	Philip Tran	Reverand	St. Louis Catholic Church
Mr.	Brian Johnson	Pastor	First Baptist Church Winnie
Ms.	Melody Galland	Director of Maintenance	Texas Department of Transportation - Houston

Documentation of the Planning Process

It is important to document the planning process to inform the public and other readers about the overall approach to drafting the plan and to document who participated and how decisions were reached. To facilitate this documentation:

- Minutes were maintained for the MPC meetings.
- A letter was forwarded to the stakeholders to describe their role in the plan and planning effort and specify the means to provide that input. An example is attached to the plan in Appendix B. Additional virtual meetings were also held with the stakeholders who were invited by email and asked to complete a survey. Appendix C includes the presentations.
- An online hazard mitigation public survey was developed and made accessible through the County's website.
- Outreach material was created and disseminated through the County's website, social media platforms, and use of the Jurisdiction's digital display. Print material was prepared for each public meeting.
- Two public meetings were held. The draft plan was posted to the County's website and was mailed to interested parties upon request. The public was informed how to provide input during a 30-day comment period.
- Once comments were received, the MPC finalized the draft and submitted it to TDEM for review and FEMA approval.

Community Participation

Consistent with the County's standard practice of informing, engaging, and involving citizens, and to fulfill public participation requirements of the mitigation planning programs, the MPC developed an outreach plan that publicized the initiative and the survey, invited residents to review the draft plan, and solicited public comment.

The goals of the outreach strategy included:

- Public Awareness of the importance of hazard mitigation planning through surveys, presentations and educational materials using various media to inform the public (website, Facebook, digital display, and printed) as well as public gatherings and one-on one meetings
- Public Awareness of the County's Hazard Mitigation Plan update, process and tentative timeline
- Public input on the Plan

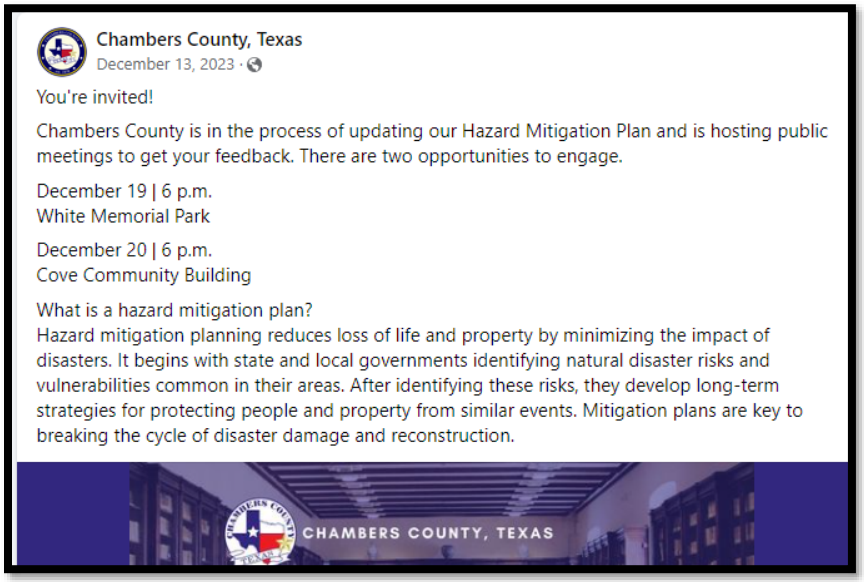
This strategy was implemented as follows:

A hazard mitigation plan public survey was created to gauge:

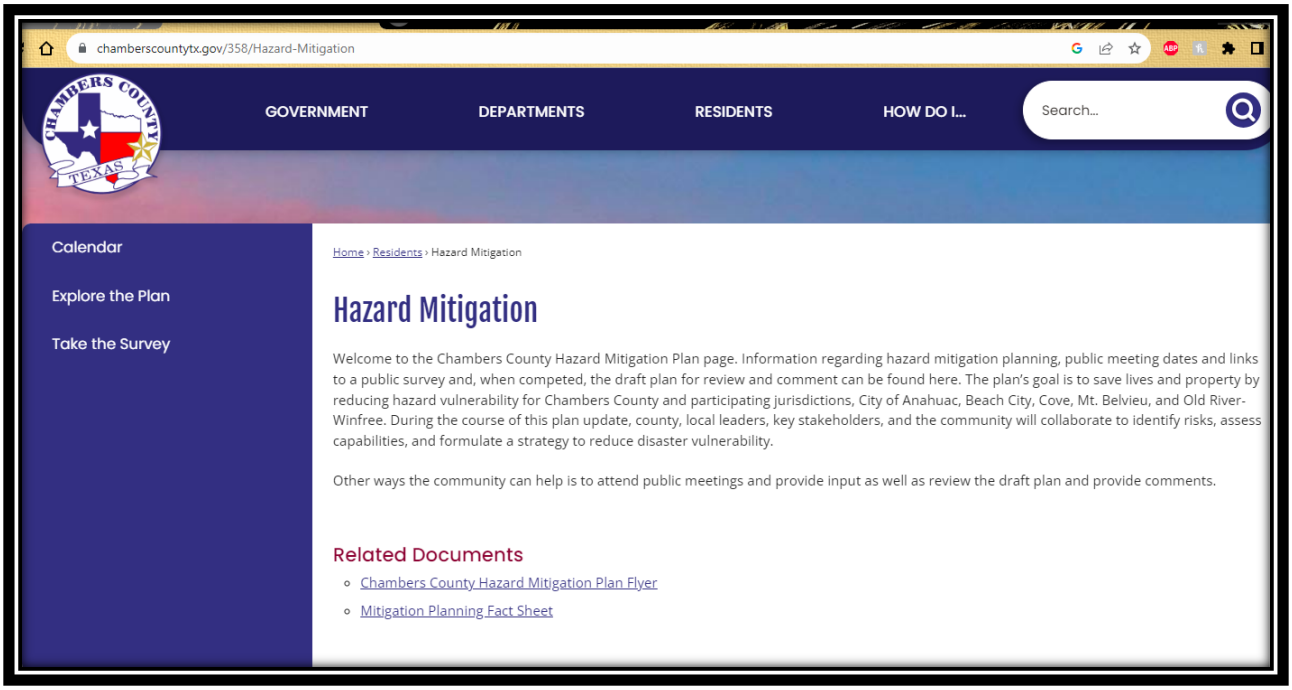
  - Resident's experience with hazards
  - Resident's perception of risks from hazards
  - Knowledge of importance of Mitigation Planning
  - Support of community programs that support Mitigation
- The survey was available on the County's website throughout the planning process.
- The Public was made aware of the survey through the County's social media platforms, website, Commissioners Court, and digital display. Figure 27 are a few visual examples.

Figure 27 - Examples of Public Outreach

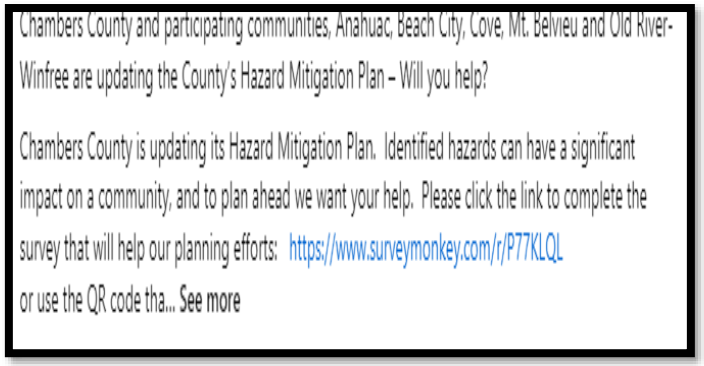
Facebook

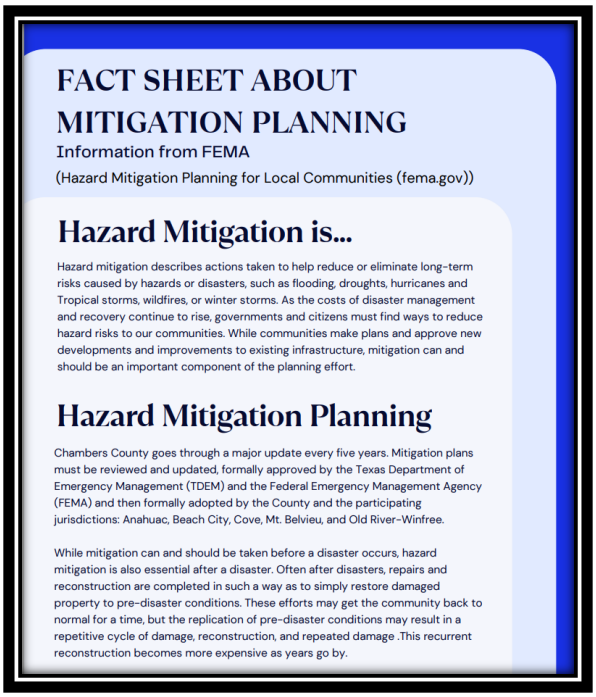


Website



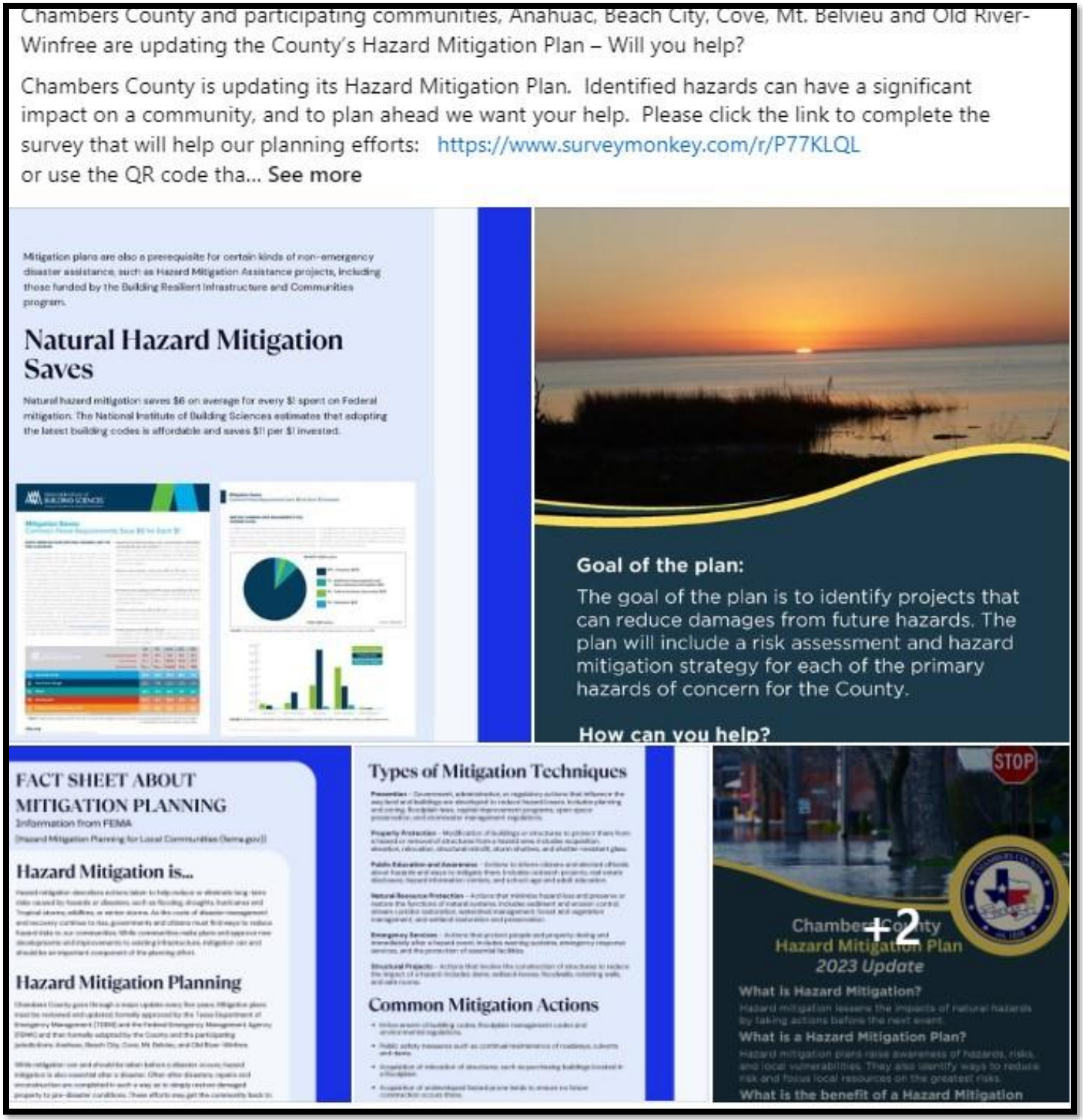
Social Media and Print



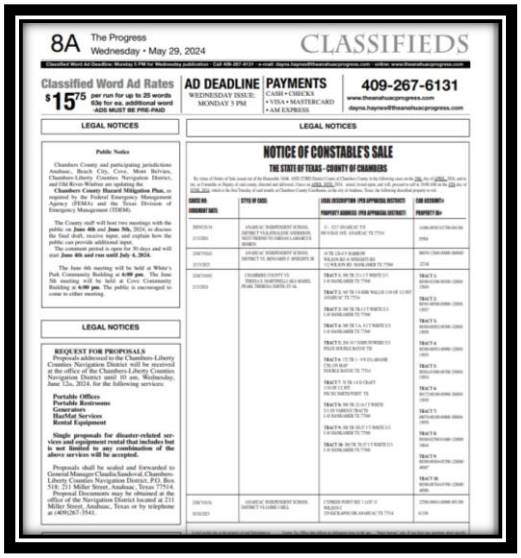


Digital Display

Flyers (Digital and Print) and Notice Sent to Newspapers



Digital, Print, and Social Media Public Notices of meetings


8A The Progress Wednesday • May 29, 2024 CLASSIFIEDS

Classified Word Ad Rates $15.75 per run for up to 25 words 63¢ for ea. additional word ADS MUST BE PRE-PAID

AD DEADLINE WEDNESDAY ISSUE: MONDAY 5 PM

PAYMENTS CASH • CHECKS • VISA • MASTERCARD • AM EXPRESS

409-267-6131

LEGAL NOTICES

NOTICE OF CONSTABLE'S SALE

THE STATE OF TEXAS - COUNTY OF CHAMBERS

LEGAL NOTICES

REQUEST FOR PROPOSALS

Individual meetings

Local Capabilities Assessment and Integration

The Texas Municipal League in its 2022 Handbook for Mayors and Councilmembers, explains that "Counties in Texas are known as "general purpose" governments due to the many different functions they perform. Counties serve the dual purpose of providing governmental services for the benefits of their residents and administrative services on behalf of the State. Major governmental services include road construction and maintenance, jails and courts, welfare, health, and law enforcement." (Texas Municipal League, 2022 Handbook for Mayors and Councilmembers, p. 7). The participating jurisdictions are either Home Rule (Mont Belvieu) or General Law Type A or B (Anahuac, Beach City, Cove and Old River-Winfree) government which will be explained in each annex. For Chambers-Liberty Counties Navigation District, it is governed by the Texas Water Code

Chambers County is governed by a five-member Commissioner's Court, consisting of the County Judge and four County Commissioners. The County Judge is elected to four-year terms in a county-wide election and is the executive officer of Chambers County. Commissioners are elected to four-year terms from single member districts. Commissioners Court is responsible for approving the County's annual budget, setting the property tax rate, establishing, and enforcing County policies, ordinances and regulations including making decisions related to land use, zoning, and other County regulations. It oversees the administration of the County employees, resources, and efficient operations. It is responsible for overseeing and funding major infrastructure projects including the construction and maintenance of County roads and bridges. Figure 28 are the 35 County Departments that execute the County policies, ordinances, regulations, projects, and maintenance.

Figure 28 - Chambers County Departments

The Capability Assessment describes the tools in the County's toolbox for implementing mitigation actions to reduce disaster losses and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs, or projects. These tools can be grouped into the following categories (see Figure 29):

Figure 29 - Categories for Capabilities Assessment

The MPC reviewed existing County and participating jurisdictions' capabilities, considering authorities, policies, programs, and resources available. The assessment of the mitigation goals, programs, and capabilities included grouping them into the four categories described in Figure 29.

Administrative and Technical Resources

Chambers County has a highly trained and effective staff that support mitigation planning for the County and participating jurisdictions including:

- Engineering
- GIS and Survey Support
- Economic Development and Grant Support
- Emergency Management
- Environmental Health and Permitting
- Fire Marshal
- Floodplain Administrator
- Permitting
- Legal Staff
- Stormwater Management

Administrative and technical resources - refers to the community's staff and their tools and skills that can be used for mitigation planning and to implement specific mitigation actions. It also refers to the ability to access and coordinate these resources effectively.

The MPC used FEMA's Worksheet 4: Capability assessment to list which capabilities each participating jurisdiction has authority to administer. It is important to note that the County supports the general law participating jurisdictions in many areas including Emergency Management, economic development, floodplain administration, grant support, and Fire Marshal. The participating jurisdictions responsibilities are based on whether they are a general law (GL) or home rule jurisdiction which is important for understanding why certain capabilities are found in the County which supports the jurisdictions. For the CLCND, since it is a navigation district with a very specific function, a discussion of its capabilities assessment is found in its annex.

Administrative/Tech Capabilities	Chambers County	Anahuac	Beach City	Cove	Mont Belvieu	Old River-Winfree
Planner/engineer with knowledge of land development/land management practices	Yes	Yes, contracted	No	No	Yes	Yes, contracted
Engineer/professional trained in Construction	Yes	Yes, contracted	No	No	Yes	

Administrative/Tech Capabilities	Chambers County	Anahuac	Beach City	Cove	Mont Belvieu	Old River-Winfree
practices related to buildings and/or infrastructure						
Planner/engineer/ scientist with an understanding of natural hazards	Yes	Yes, contracted			Yes	
Transportation Planner	Yes – County supports GL jurisdictions				Yes	
Resiliency Planner	Yes	No			Yes	
Personnel skilled in GIS	Yes	No			Yes	
Full-time building official	Jurisdiction responsible	Yes, contracted			Yes	
Floodplain Manager	Yes – County supports GL jurisdictions	Yes	Yes	Yes	Yes	Yes
Emergency Manager	Yes – County supports GL jurisdictions	Yes	Yes	Yes	Yes	
Grant Writer	Yes – County supports GL jurisdictions				Yes	
GIS Data **Hazard areas** **Critical facilities** **Building footprints** **Land use**	Yes	No			Yes	

Administrative/Tech Capabilities	Chambers County	Anahuac	Beach City	Cove	Mont Belvieu	Old River-Winfree
Assessor data						
Warning systems						
Other						

Administrative and Technical Review Recommendation to build upon the County's Mitigation Efforts: Ongoing training and software upgrades are important but can be costly. While the County provides training opportunities and software upgrades, additional training is always a benefit when time and funding are available.

Regulatory and Planning

The 2017 plan focused on the existing plans that many of the jurisdictions had including:

- FMP: Floodplain Management Plan
- EOP: Emergency Operations Plan
- COOP: Continuity of Operations Plan
- SO: Subdivision Regulation
- SARA: SARA Title III Emergency Response Plan

This iteration reaffirmed that the jurisdictions have those plans and focused on ordinance and other types of plans that could support or provide information for mitigation planning efforts. Using FEMA Worksheet #4 below is a summary by jurisdiction. For the CLCND, since it is a navigation district with a very specific function, a discussion of its capabilities assessment is found in its annex.

Regulatory and Planning – implementation of ordinances, polices, local laws and state statutes, and plans and programs that relate to the management and governance of growth and development to include:

- Local ordinances, zoning and building codes
- On-going plans or projects

Regulatory Tool	Chambers	Anahuac	Beach City	Cove	Mont Belvieu	Old-River-Winfree	More Information
Comprehensive Plan	No	Yes	No	No	Yes	No	Mont Belvieu: Plan 2035

Regulatory Tool	Chambers	Anahuac	Beach City	Cove	Mont Belvieu	Old-River-Winfree	More Information
Zoning Ordinance	No	No	No	No	Yes	No	Mont Belvieu: Muni-code Ch. 42
Subdivision Ordinance/ regulations	Yes		No County	No	Yes	Yes	Mont Belvieu: Muni-code Ch. 32
Site plan review requirements	Yes	Yes	Yes		Yes	No	
Growth management Ordinance	No	No	No	No	No	No	Anahuac: The compre-hensive Plan has statistical infor-mation on growth
Floodplain Management Plan and Floodplain Ordinance	Yes	Yes	Yes	Yes, to FMP	Yes	Yes	Mont Belvieu: Muni-code Ch. 10

Regulatory Tool	Chambers	Anahuac	Beach City	Cove	Mont Belvieu	Old-River-Winfree	More Information
Other special purpose ordinance (stormwater, steep slope, wildfire)	No	No	No	No	Yes	No	Mont Belvieu: Muni-code Ch. 32
BCEGS Rating	No	No	No	No	Yes	No	
Building Code	No	Yes	Yes	No	Yes	No	
Fire Department ISO rating	Yes		Yes 8B		Yes ISO 2	Yes	
Erosion or sediment control program	No	No	No	No	Yes	No	Mt. Belvieu: SWPPP BMP
Stormwater Management program	Yes			No	Yes		Chambers and Mont Belvieu: Stormwater MS4 permit covers the urbanized area (Map on County website) Drainage Criteria Manual

Regulatory Tool	Chambers	Anahuac	Beach City	Cove	Mont Belvieu	Old-River-Winfree	More Information
Capital Improvements plan	Yes	Yes	Yes	No	Yes		Anahuac: As part of the Compre-hensive plan
Economic Development plan	Yes	Yes	No	No	Yes		
Local Emergency Operation plan	Yes	Yes	Yes	Yes	Yes		Anahuac, Beach City, Cove, and Old River: Part of Chambers County Plan Mont Belvieu: City EOC
Participate in the NFIP	Yes CID: 480119B	Yes CID: 480120B	Yes CID: 480121B	Yes CID: 481510B	Yes CID: 480122B	Yes 481637B	
Elevation Certificates	Yes*				Yes		*Note: In Floodplain only

Regulatory Tool	Chambers	Anahuac	Beach City	Cove	Mont Belvieu	Old-River-Winfree	More Information
Participate in CRS	No	No	No	No	No	No	
Other plans	MDP				No		
Flood Insurance study or other engineering study for streams	Yes - FIS	Yes - FIS	Yes - FIS	Yes - FIS	Yes - FIS	Yes - FIS	Chambers County, Texas and incorp-orated areas FIS revised 1-19-18

Regulatory Recommendation to build upon the County's Mitigation Efforts: The County can research the requirements for CRS to determine feasibility for the County and the jurisdictions to pursue.

Financial Resources

The County and the participating jurisdictions have taxing authority, based on the type of government. Counties can levy a property or ad valorum tax, fees, and fines. City revenues come from many sources including utility fees (e.g. sewer rate fees), sales taxes, property taxes and user fees and rental. All types of government can and do try to levy potential state and federal grant funding as financial resources. Using FEMA Worksheet No. 4, the communities determined what financial tools are at their disposal.

Financial Resources – Financial capabilities - the resources that a jurisdiction has access to or is eligible to use to fund mitigation actions.

For the CLCND, since it is a navigation district with a very specific function, a discussion of its capabilities assessment is found in its annex.

Financial Tool	Chambers	Anahuac	Beach City	Cove	Mont Belvieu	Old-River-Winfree	More Information
Grants (e.g.: FEMA, DOT, CDBG)	Yes	Yes	Yes	Yes	Yes	Yes	
Capital Improvement Project Funding	Yes				Yes		
Authority to levy taxes for specific purposes	No				Yes		
Fees for water, sewer, gas, or electric services	No	Yes (W/S)	Yes		Yes (W/S)		
Impact fees for new development	Yes	Yes			Yes		
Incur Debt through general obligation bonds	Yes	Yes			Yes		
Incur Debt through special tax bonds	No	No			Yes		
Incur debt through private activities	No	No			No		
Withhold spending in hazard-prone areas	No				No		
Stormwater Service fees	Yes	No			No		

Insured Property and Equipment

The County maintains approximately $172 million in property insurance coverage, to protect the County from damage due to structural fire, wind, lightning and flooding. It also carries approximately $8.9 million in coverage for mobile equipment.

Financial Resources Recommendation to support Mitigation Efforts: Similar to administrative recommendation, training dedicated to finding and understanding all types of grant funds (federal and state) could be helpful for the County and participating jurisdictions to fund mitigation projects through means other than taxes and fees.

Education and Outreach

Education and Outreach –refers to education and outreach programs and methods already in place that could be used to implement mitigation activities and communicate hazard-related information.

Chambers County actively communicates with its residents using a variety of media, each of which has been used to convey information, including content about hazards. The County recently updated its website to make it a more user-friendly site to find out information important to its residents. While multiple departments provide education and awareness campaigns in support of hazard mitigation (e.g., Fire, Police, Economic Development, Road and Bridge and Engineering, Environmental Health and Permitting), the Emergency Management Department has a section on its site for Chambers County Risk, planning, preparedness, response, and safety and communication and public information. It actively communicates with its residents using a variety of media, each of which have been used to convey information, including content about hazards including:

- Announcements - News releases announcing County events and issues of public interest can be found on the website and are sent to local media to help publicize information to the public.
- Website - The County's official website provides information, applications, forms, and other important information.
- County Text and Email list –Called *Notify Me*, notifications are sent to individuals who have signed up to receive them by text or email.
- Chambers County's Mass Notification & Warning System - ChambersWarns is a state-of-the-art mass notification and warning system designed to warn residents about emergencies and other important community news in jurisdictions throughout Chambers County, Texas. It is a partnership between the Chambers County Office of Emergency Management (OEM) and the Chambers County Public Health Department.
- Social Media Platforms – The County has a Facebook page to relay information to the public.
- Reference links to additional flood control resources and water conservation sources are provided on the website, e.g. TXDOT).

For the CLCND, since it is a navigation district with a very specific function, a discussion of its capabilities assessment is found in its annex.

Education and Awareness Tools	Chambers	Anahuac	Beach City	Cove	Mont Belvieu	Comments
Program/Organization	Yes	Yes			Yes	Mont Belvieu: Department for

Education and Awareness Tools	Chambers	Anahuac	Beach City	Cove	Mont Belvieu	Comments
						Communications and Marketing
Community Newsletters	Chamber of Commerce	No			Yes	Mont Belvieu: MBTX Extra
Hazard awareness campaigns (such as Firewise, Storm Ready, Severe Weather Awareness Week, school programs, public events)	Hurricane Conference Storm Ready Fire Prevention weeks				Yes	Mont Belvieu: Storm Center and INFORCE
Local news	Yes	Yes	Yes	Yes	Yes	
Organizations that represent/advocate for/interact with underserved and vulnerable communities	Flyers posting publicly and private organizations					
Social media	Yes	Yes	Yes		Yes	
Other						

Education and Awareness Recommendation to support District Mitigation Efforts – The County can work with the State and FEMA for hazard awareness campaign support as staff is limited in this area as are funds for materials. Grants or City/County financial assistance for updated relevant materials and distribution would be helpful.

Participation in the National Flood Insurance Program (NFIP)

Floods are the most common and costly natural disaster in the U.S. Created by Congress in 1968, the NFIP is a federal program that aims to reduce the impact of flooding across the country. It does so by providing flood insurance to property owners who live in communities that adopt and enforce floodplain management standards – NFIP communities. The (NFIP) is a voluntary program that communities undertake on behalf of their constituents. It reduces the socio-economic impacts of flooding on communities through risk reduction via flood insurance and reduces the physical impacts of flooding through beneficial floodplain regulation. There are currently 3,903 active NFIP-backed flood insurance policies for the planning area (policies in force) that have a total coverage of $1,285,450,000. Table 16 shows by community, the number of policies and Total coverage as reported by the NFIP. For the CLCND, since it is a navigation district with a very specific function, it does not participate in the NFIP like the Cities and Counties.

Table 16 - Chambers County Policy Information

| Flood Insurance Data and Analytics (floodsmart.gov)

County	Community	Policies in Force	Total Coverage	Total Written Premium and FPF
CHAMBERS COUNTY	ANAHUAC, CITY OF (480120)	108	$31,455,000	$93,207
CHAMBERS COUNTY	BEACH CITY, CITY OF (480121)	331	$113,798,000	$226,278
CHAMBERS COUNTY	CHAMBERS COUNTY * (480119)	2,868	$934,631,000	$2,180,185
CHAMBERS COUNTY	COVE, CITY OF (481510)	23	$7,490,000	$13,858
CHAMBERS COUNTY	MONT BELVIEU, CITY OF (480122)	562	$195,348,000	$402,341
CHAMBERS COUNTY	OLD RIVER-WINFREE, CITY OF (481637)	11	$2,728,000	$6,443

Each of the participating jurisdiction's function under the regulatory umbrella of Chambers County. Chambers County employs a floodplain administrator who acts to oversee communities throughout the county. All jurisdictions in the plan currently participate in the NFIP.

The County adopted a Floodplain Management Ordinance on March 10, 2015. To remain NFIP compliant, the Floodplain Administrator's office conducts jurisdiction wide permitting of new development, permit review, engineering review, flood code enforcement, document development and flood zones using GIS, educate the public, and provide public assistance. To improve flood mitigation efforts and enhance their NFIP program, the participating jurisdictions

will adopt and enforce stronger floodplain management regulations for new construction in Special Flood Hazard Areas (SFHAs).

Type	Definition
Repetitive Loss Properties	A structure covered by an NFIP flood insurance policy that: ▪ Has had flood-related damage on two occasions, with the average cost of repair at or over 25% of the value of the structure at that time; and ▪ When the second flood-related damage took place, the policy had Increased Cost of Compliance coverage.
Severe Repetitive Loss Properties	A structure covered by an NFIP flood insurance policy that has had flood-related damage: ▪ For which four or more separate claims payments for flood-related damage have been made. The amount of each claim (including building and contents payments) exceeded $5,000, and the cumulative amount of the claims payments exceeded $20,000; or ▪ For which at least two flood insurance claims payments (building payments only) have been made, with a cumulative claims total that exceeds the market value of the insured structure.

Repetitive Loss and Severe Repetitive loss structures. Based on the number and amount of flood claims, the NFIP places properties into certain categories such as Repetitive Loss and Severe Repetitive Loss. The plan must address repetitively flooded, NFIP-insured structures including both repetitive and severe repetitive loss properties. The definition for each of these classifications is in the text box. FEMA provides aggregate data for the community to better understand the estimated numbers and types (residential or commercial) of these types of properties. Total RL Record is for properties that have been designated as repetitive loss. Of those, some are NFIP insured and some either are privately insured or not insured. Of the RL Record, some meet the further definition of FMA SRL or FMA RL regardless of insurance. The last column shows of the FMA RL or FMA SRL properties how many are insured. Table 17 provides the summary of data for residential properties and Table 18 is for commercial properties.

Table 17 - Summary of RL/SRL Residential Properties for Chambers County and Participating Jurisdictions

Jurisdiction	Total Repetitive Loss Record	NFIP Insured	FMA SRL	FMA RL	RL/SRL Insured
Unincorporated Chambers County	111	90	24	35	RL: 33 SRL: 22
Anahuac	27	14	2	7	RL: 3 SRL: 2
Beach City	1	0	0	0	RL: 0 SRL: 0
Cove	1	0	0	0	RL: 0 SRL: 0
Mont Belvieu	1	0	0	0	RL: 0 SRL: 0
Old River-Winfree	0	0	0	0	RL: 0 SRL: 0
Total	140	104	26	40	RL: 36 SRL: 24

Table 18 - Summary of RL/SRL Commercial Properties for Chambers County and Participating Jurisdictions

Jurisdiction	Total Repetitive Loss Record	NFIP Insured	FMA SRL	FMA RL	RL/SRL Insured
Unincorporated Chambers County	6	6	1	1	RL: 1 SRL: 1
Anahuac	2	0	0	0	RL: 0 SRL: 0
Beach City	0	0	0	0	RL: 0 SRL: 0
Cove	0	0	0	0	RL: 0 SRL: 0
Mont Belvieu	1	0	0	0	RL: 0 SRL: 0
Old River-Winfree	0	0	0	0	RL: 0 SRL: 0
Total	9	6	1	1	RL: 1 SRL: 1

Section 3. Hazard Identification and Risk Assessment

Changes from the Last Plan

As part of the update process, the MPC reviewed the hazards included in the most current plan and determined that three additional hazards would be added see Table 19. The MPC also reviewed if climate change further impacts the hazard and during the vulnerability analysis added a socially vulnerable populations segment. Numerous changes from the current plan were incorporated, including updated maps and tables displaying the event history from the National Center for Environmental Information (NCEI) for various hazards, community profile information, as well as many other less significant modifications.

Finally, while Chambers County and the participating jurisdictions worked very closely to create a comprehensive plan that encompasses the whole Chambers County community including one unified set of goals and actions, there is some information unique to each jurisdiction, so an annex has been added for each jurisdiction to provide the information and data unique to that jurisdiction as well as a place for the jurisdiction adoption of this plan update.

Table 19 - 2017 and 2024 Hazards

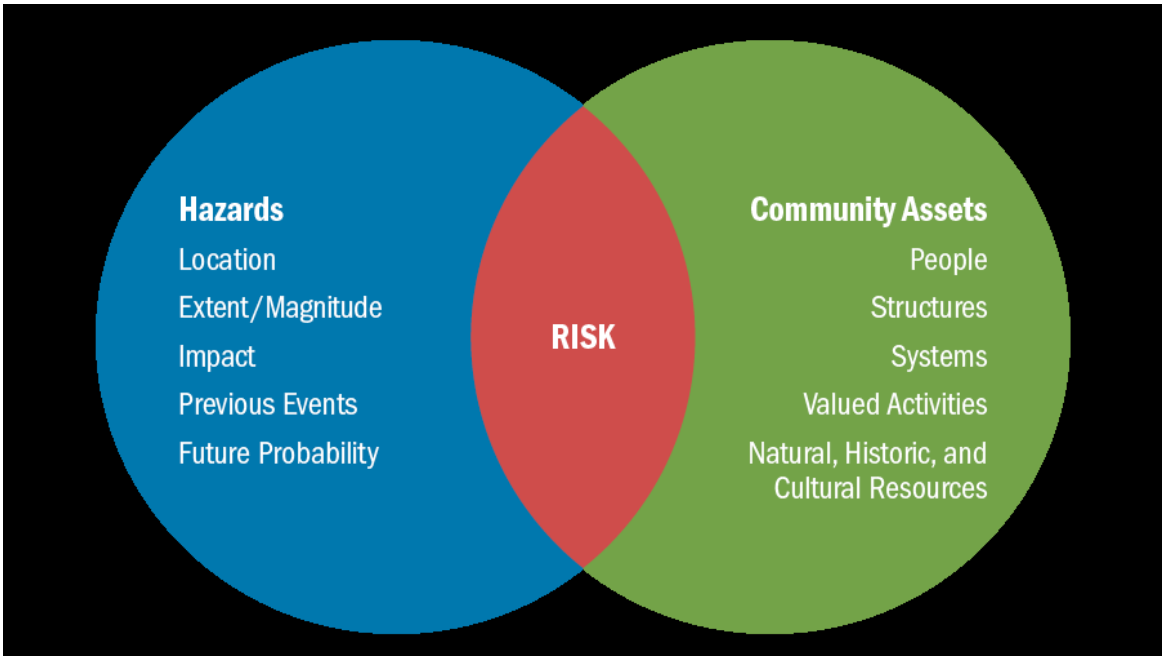
Hazards from 2017 Plan	Hazards for 2024 Plan
Flood	**Flood – Riverine and Coastal**
Hurricanes and Tropical Storms	**Hurricanes and Tropical Storms**
Tornado	**Tornado**
Drought	**Drought**
Heat Events	**Extreme Heat**
Expansive Soils	**Expansive Soils**
Lightning	**Lightning**
Coastal Erosion	**Coastal Erosion**
Hail	**Hail**
	Thunderstorms/severe winds
	Extreme Cold
	Winter Storm
	Wildfire
	Mont Belvieu – Salt dome

Introduction

Risk assessments are conducted to determine the potential impacts of specified hazards on human safety, the economy, and both the developed and natural environments of the community. Risk, as viewed from a hazard mitigation perspective, is the potential for loss of life, personal injury, property damage, loss or other impacts created by the interaction of natural hazards with local citizens and community assets.

FEMA has provided a diagram (Figure 30) that illustrates the concept of risk as the overlap between hazards and community assets – the smaller the overlap, the lower the risk. Each hazard includes a description of the hazard, location, extent, previous occurrence, probability of future events based on historical analysis, and if climate change can affect the probability of the hazard. Hazards are then evaluated based on potential impact on the community, the worst-case scenario for the community, the community's overall vulnerability with a subset of analysis on socially vulnerable populations.

Figure 30 - FEMA Concept of Risk Diagram



Identifying Hazards

The Hazard Summary Table (Table 21) provides an overview of the likelihood of occurrence and the estimated impact on public health, safety, and property for the hazards included in this plan. The definitions in Table 20 were reviewed for each hazard profiled and summarized. Each hazard received an overall significance classification of Low, Medium, or High.

Table 20 - Classifications and Definitions for Hazards

Location (Geographic Area Affected)
Negligible: Less than 10 percent of planning area or isolated single-point occurrences.
Limited: 10 to 25 percent of the planning area or limited single-point occurrences.
Significant: 25 to 75 percent of planning area or frequent single-point occurrences.
Extensive: 75 to 100 percent of planning area or consistent single-point occurrences.
Probability of Future Events
Unlikely: Less than 1% probability of occurrence in the next year or a recurrence interval of > every 100 years.
Occasional: 1 to 10%probability of occurrence in the next year or a recurrence interval of 11 to 100 years.
Likely: 10 to 90% probability of occurrence in the next year or a recurrence interval of 1 to 10 years.
Highly Likely: 90 to 100 percent probability of occurrence in the next year or a recurrence interval of < than 1 year.
Maximum Probable Extent (Magnitude based on historic events or future probability)
Weak: Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage.
Moderate: Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days.
Severe: Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months.
Extreme: Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions.
Overall Significance
Low: Two or more criteria fall in lower classifications, or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
Medium: The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating.
High: The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The MPC also compared the State of Texas 2023 Plan which identified eleven hazards (see Figure 31) for the region that includes Chambers County. The result was there were no hazards identified by the State that were not identified by the County.

Table 21 - Hazard Summary Table for Chambers County

Natural Hazard	Location (N, L, S, E)	Maximum Extent (W, M, S, E)	Likelihood of Occurrence (U, O, L, H)	Overall Significance (L, M, H)
Coastal Erosion	Significant	Moderate	Likely	Medium
Drought	Extensive	Severe	Likely	High
Extreme Cold/Freezes	Extensive	Severe	Likely	High
Expansive Soils	Extensive	Moderate	Likely	High
Extreme Heat	Extensive	Severe	Highly Likely	High
Flooding – Riverine/Coastal	Limited-R Significant-C	Moderate-R Extreme-C	Occasional	High
Hail	Extensive	Weak	Occasional	Low
Hurricanes and Tropical Storms	Extensive	Severe	Highly Likely	High
Lightning	Extensive	Weak	Highly Likely	Low
Salt Dome – Mont Belvieu	Limited	Extreme	Likely	High
Thunderstorms/ damaging winds	Extensive	Moderate	Highly Likely	Medium
Tornados	Extensive	Moderate	Likely	Medium

Natural Hazard	Location (N, L, S, E)	Maximum Extent (W, M, S, E)	Likelihood of Occurrence (U, O, L, H)	Overall Significance (L, M, H)
Wildfire	Significant	Moderate	Likely	Medium
Winter storms	Extensive	Moderate	Occasional	Medium

Figure 31 is from the State of Texas 2023 Hazard Mitigation Plan for Region 4 (which includes Chambers County). The hazards listed are consistent with the County's hazards in Table 21.

Figure 31 - Region 4 Summary of Hazards by Total Damage Amount

TDEM Website Files - State of Texas HMAP Update - 10.27.23.pdf (sharepoint.com)

Region 4 Hazard Rankings by Total Damages		
Hazard	**Hazard Ranking**	**Total Damages**
Hurricane	1	$4,084,033,024
Flood	2	$1,546,670,341
Severe Coastal Flood	3	$413,978,834
Drought	4	$171,229,891
Severe Wind	5	$79,397,008
Hailstorm	6	$65,439,927
Tornado	7	$61,350,962
Severe Winter Weather	8	$45,338,067
Lightning	9	$4,612,221
Extreme Heat	10	$0
Wildfire	11	$0
Grand Total		**$6,472,050,275**

Hazards Omitted

The County focused on hazards that occur within the planning area that historically have had enough impact (e.g., damage to property, infrastructure, injury, or death) that mitigation of that hazard is necessary for the welfare of the community. Certain hazards have no history of impact in the planning area; therefore, the County decided to omit these hazards. Important to note, while the County believes these hazards are negligible, each year it will review the hazard during its annual review to determine if the impact has changed and if so, will update the Plan accordingly. None of these hazards were included in the 2017 Plan either.

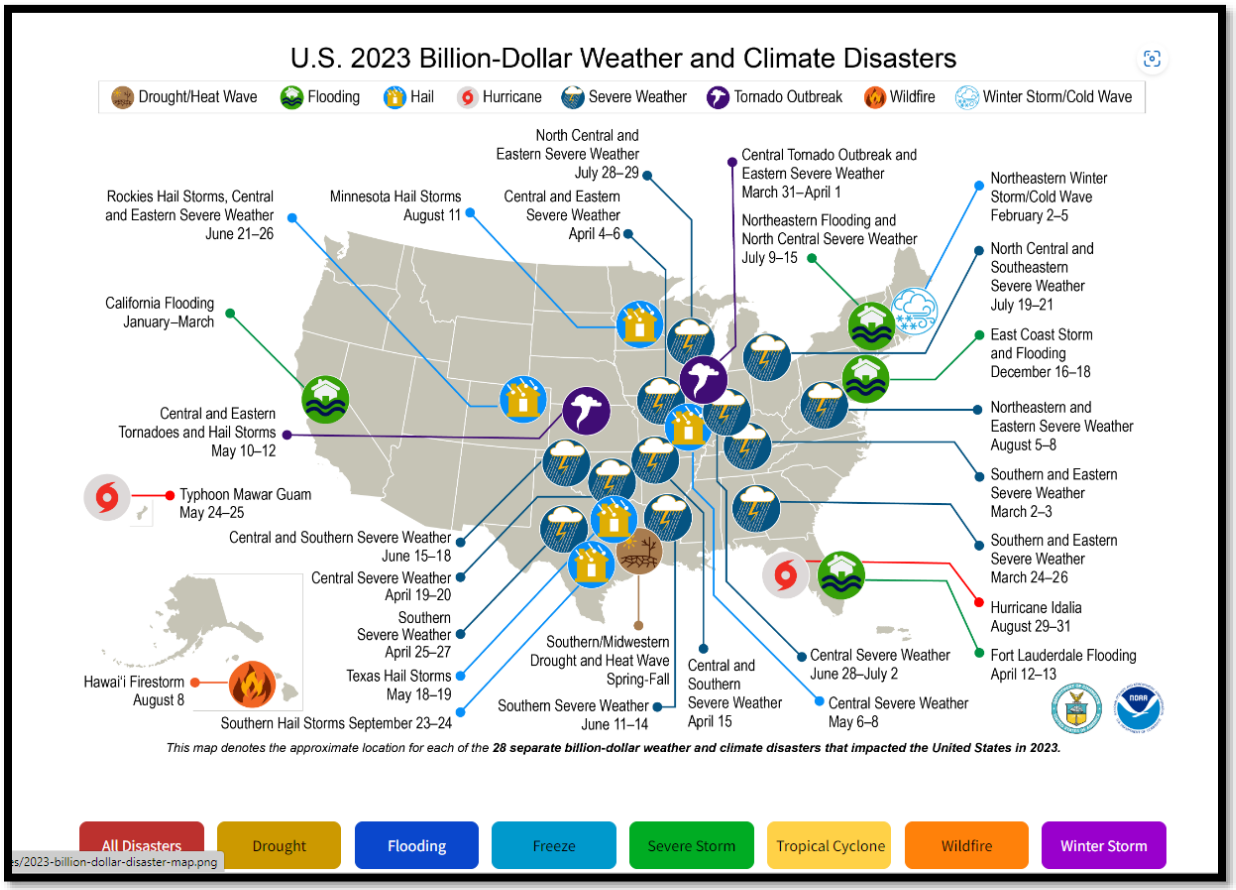
Table 22 - Hazards Omitted

Natural Hazard	Review	Reason for Omission
Dam/levee failure	Omit	While dams exist in Chambers County, none of the dams close to the planning area would have any effect on the planning area in the event of a failure.
Earthquake	Omit	The state plan indicates that earthquake occurrence is very rare and there is no history of impact to Chambers County.
Subsidence	Omit	Subsidence has not been a risk to Chambers County based on very little reliance on groundwater pumping.

Hazard Damage Summary Information

According to the NOAA NCEI Climate Monitoring website, The U.S. has sustained 376 weather and climate disasters since 1980 where overall damages/costs reached or exceeded $1 billion (https://www.ncei.noaa.gov/access/billions/). Although there is not one list of all private and public losses from natural disasters for the planning area, NOAA provides an annual review of disasters and costs nationwide. For 2023, the total cost of the 28 weather/climate disaster events to affect the United States was $92.9 billion. The events included 1 drought event, 4 flooding events, 19 severe storm events, 2 tropical cyclone events, 1 wildfire event, and 1 winter storm event. Figure 32 depicts the timing and location of these disasters.

Figure 32 - 2023 Disasters and Locations



Numerous federal agencies maintain a variety of records regarding losses associated with natural hazards. Unfortunately, no single source is considered to offer a definitive accounting of all losses. FEMA maintains records on federal expenditures associated with declared major disasters. The U.S. Army Corps of Engineers (USACE) and the Natural Resources Conservation Service (NRCS) collect data on losses during some of their ongoing projects and studies. As mentioned earlier in this Section, NOAA's National Center for Environmental Information database is another source where data statistics such as injuries, deaths, and damage estimates are maintained for a variety of natural hazards. The data is maintained at the county level, with more recent entries listing the specific location within the county. This county-wide hazard data from the NCEI is often the best available resource for documenting historical events.

Two sources used to help provide important data are the NCEI database and FEMA's declared disaster database. The State of Texas's 2023 Hazard Mitigation Plan summarizes damages by hazards by County from data from the NCEI database. The MPC summarized the State's findings for Chambers County as shown in Table 23.

Table 23 - Summary of Chambers County Damages by Hazards (TDEM Hazard Mitigation Plan, 2023)

County	Drought	Extreme Heat	Flood	Hailstorm	Hurricanes/TS	Lightning	Severe Wind	Winter storms	Tornado	Wildfire
Hazard Ranking	115	25	22	149	34	78	131	205	105	158
Number of Events	2	5	31	14	12	4	26	2	9	0
Property Damages	0	0	$ 90,636,412.00	$225,127.00	$14,671,113.00	$ 59,542.00	$1,075,572.00	$ -	$851,324.00	$ -
Crop Damages	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 15,285.00	$ -
Fatalities	0	1	0	0	0	2	0	0	0	0
Injuries	0	0	0	0	0	1	0	0	5	0
Annualized Losses	$ -	$ -	$ 4,119,836.91	$ 10,233.00	$ 666,869.00	$ 2,706.00	$ 48,890.00	$ -	$ 39,391.00	$ -
Average Annual Frequency	0.09	0.23	1.41	0.6	0.55	0.18	1.18	0.09	0.41	0
Average Annual Event 2000-2016	0.12	0.3	1.06	0.8	0.5	0.18	1.35	0.12	0.35	0
Annual Average Frequency Change	29%	32%	24.90%	2940%	8.30%	0.01%	14.50%	29.40%	13.70%	0.00%
Probability	Unlikely	Likely	Highly likely	Highly likely	Highly likely	Likely	Highly Likely	Unlikely	Likely	Unlikely

Both the number of events and damages to property are highest for flood events, followed by severe wind and tornadoes. Looking at another source, the MPC reviewed FEMA's declaration database.

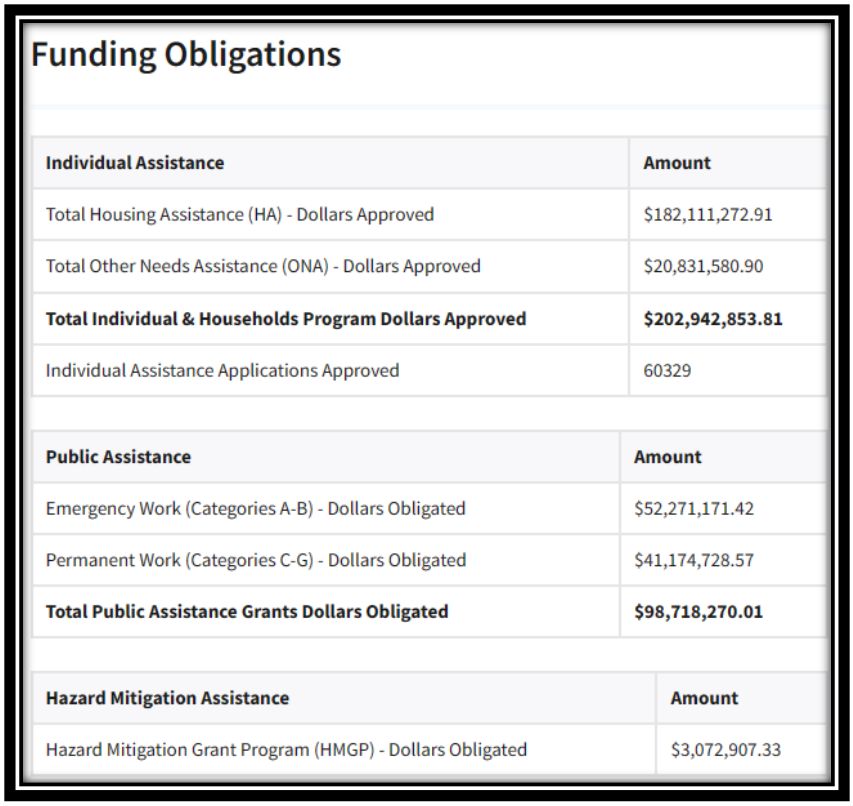
Losses Due to Major Disasters

In most declared major disasters, the federal government reimburses at least 75% of the eligible costs of cleanup and recovery and possibly more depending on the severity of the disaster. The remaining percentage is covered by the state and affected local jurisdictions. These costs, which do not include costs incurred by other federal agencies or by state and local agencies, include those associated with:

- Public assistance for debris removal, emergency services, roads and bridges, flood control facilities, public buildings and equipment, public utilities, and parks and recreational facilities.
- Financial assistance disbursed for individual and household grants, emergency food and shelter, and other assistance to individuals.
- Grant funds are set aside to support hazard mitigation.

An example is Texas Severe Winter Storms (4586-DR-TX). On February 18, 2021, Governor Abbott requested a major disaster declaration due to severe winter storms beginning on February 11, 2021, and continuing for several days. The Governor requested a declaration for Individual Assistance; all categories of public assistance, including snow assistance; and Hazard Mitigation for all 254 Texas counties. This event was of the severity and magnitude that the need for supplemental Federal assistance was determined to be necessary prior to the completion of joint Federal, State, and local government Preliminary Damage Assessments (PDAs). Per 44 C.F.R.§ 206.33(d) and § 206.36(d), the requirement for a joint PDA may be waived for those incidents of such unusual severity and magnitude that formal field damage assessments are not required to establish the need for supplemental Federal assistance under the Stafford Act. On February 19, 2021, President Biden declared that a major disaster exists in the State of Texas. The funding obligations were as follows on Figure 33.

Figure 33 - Funding Obligations by FEMA Disaster Category



Funding Obligations

Individual Assistance	Amount
Total Housing Assistance (HA) - Dollars Approved	$182,111,272.91
Total Other Needs Assistance (ONA) - Dollars Approved	$20,831,580.90
Total Individual & Households Program Dollars Approved	**$202,942,853.81**
Individual Assistance Applications Approved	60329

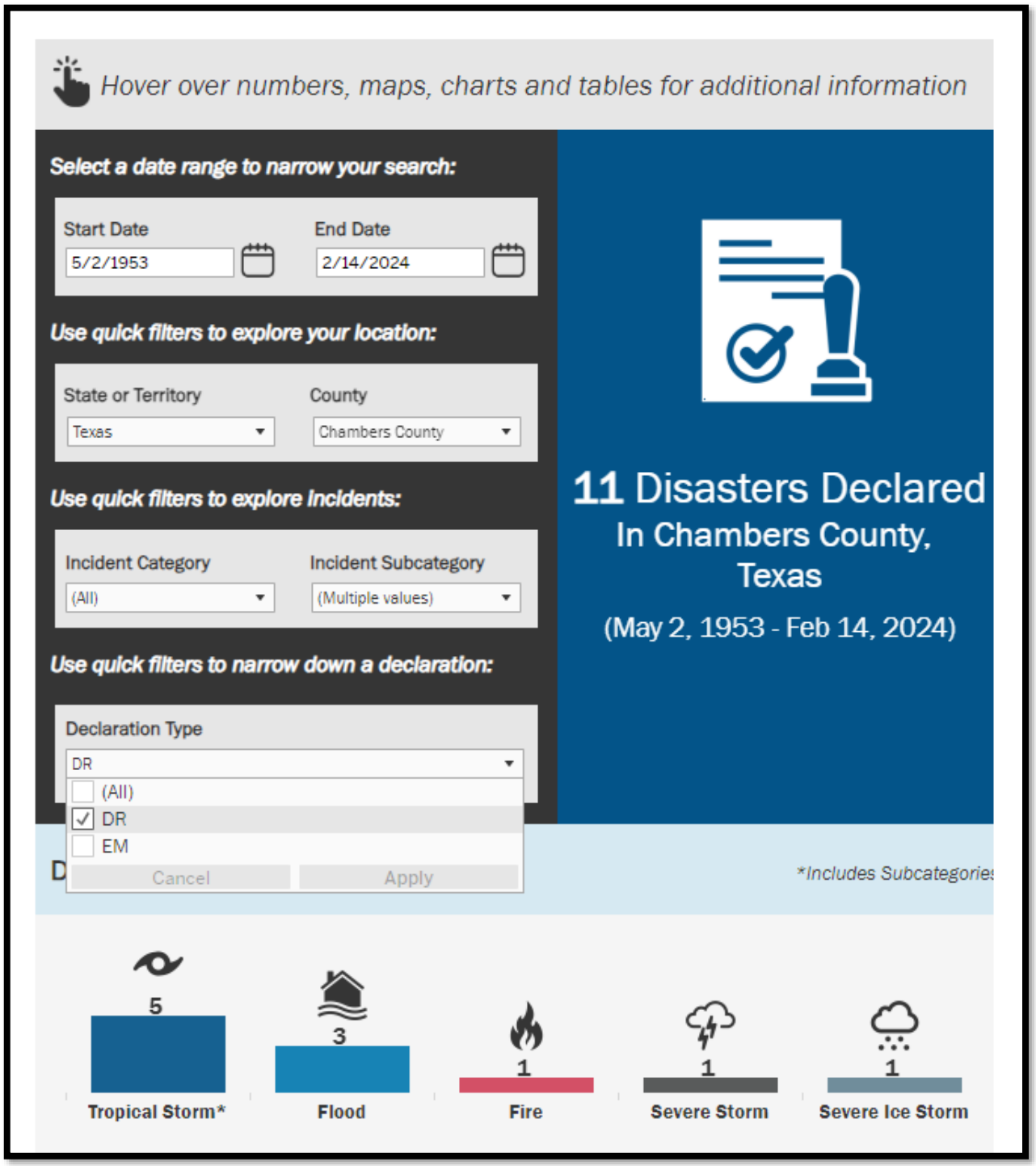
Public Assistance	Amount
Emergency Work (Categories A-B) - Dollars Obligated	$52,271,171.42
Permanent Work (Categories C-G) - Dollars Obligated	$41,174,728.57
Total Public Assistance Grants Dollars Obligated	**$98,718,270.01**

Hazard Mitigation Assistance	Amount
Hazard Mitigation Grant Program (HMGP) - Dollars Obligated	$3,072,907.33

Data on Presidential Disaster Declarations characterize some natural disasters that have affected the area. In 1965, the federal government began to maintain records of events determined to be significant enough to warrant declaration of a major disaster by the President of the United States. Presidential Disaster Declarations (DRs) are made at the county level and are not specific to any one city.

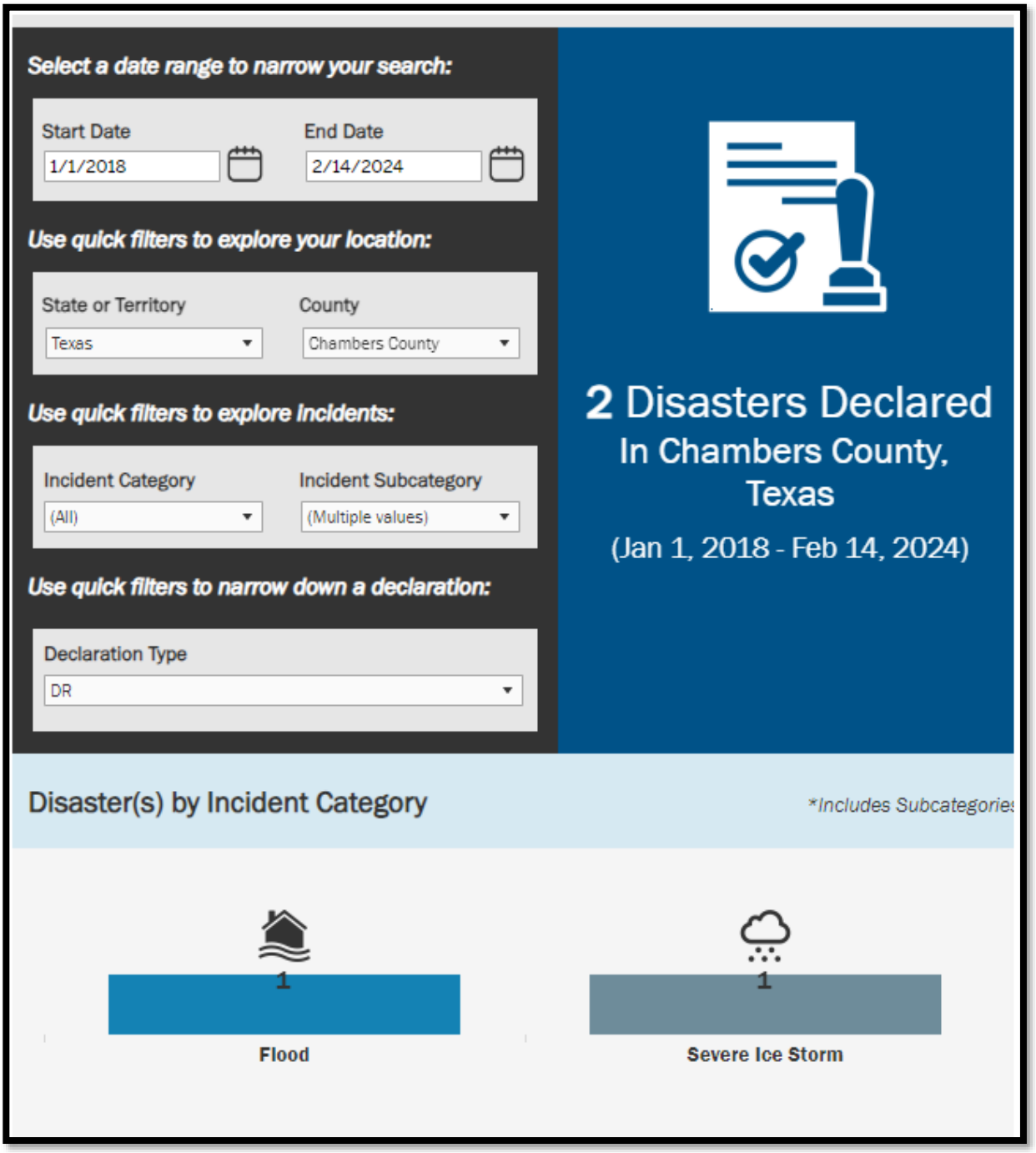
FEMA's website on Disaster Declaration for States and Counties (Disaster Declarations for States and Counties | FEMA.gov_) provides a summary illustration for Chambers County, Texas from 1953-2024 of Disaster Declarations as shown in Figure 34. A total of 11 natural disaster declarations have been made for Chambers County since 1953. By hazard, tropical storms top the list with five, followed by flood with three, and fire, severe ice storms and severe storms with one.

Figure 34 - Visual Summary of Disaster Declarations for Chambers County, Texas 1953-2024



Since 2018, there have been two Presidentially Declared disasters - flooding and severe ice storm, for Chambers County as represented in Figure 35.

Figure 35 - Visual Summary of Presidential Disaster Declarations for Chambers County. 2018-2024



Chambers County has persevered through many natural disasters. Table 24 is from the 2017 Plan and shows the Presidential Declared Disasters and Emergency Declarations that the County experienced from 1953 until 2017. Table 25 provides the same information from 2018-2024. Each disaster is costly and challenging. The goal of this plan is mitigation and to reduce the impact of future disasters like these mentioned below.

Table 24 - Chambers County Presidential and Emergency Declarations, 1953-2017

Declaration type	Declaration Date	Disaster Number	Type	Title
Presidential Disaster Declaration	7/28/1979	595	Flood	Storms& Flash Floods
Presidential Disaster Declaration	8/19/1983	689	Hurricane	Hurricane Allison
Presidential Disaster Declaration	10/18/1994	1041	Flood	Storms and Flash floods
Presidential Disaster Declaration	8/26/1998	1239	Severe Storm	Tropical Storm Charlie
Emergency Declaration	9/1/1999	3142	Fire	Extreme Fire Hazards
Presidential Disaster Declaration	6/9/2001	1379	Coastal Storm	Tropical Storm Allison
Emergency Declaration	2/1/2003	3171	Other	Loss of the Space Shuttle Columbia
Emergency Declaration	9/2/2005	3216	Hurricane	Hurricane Katrina Evacuation
Emergency Declaration	9/21/2005	3261	Hurricane	Hurricane Rita
Presidential Disaster Declaration	9/24/2005	1606	Hurricane	Hurricane Rita
Presidential Disaster Declaration	1/11/2006	1624	Fire	Extreme Wildfire Threat
Emergency Declaration	8/18/2007	3277	Hurricane	Hurricane Dean

Declaration type	Declaration Date	Disaster Number	Type	Title
Emergency Declaration	8/29/2008	3290	Hurricane	Hurricane Gustav
Emergency Declaration	9/10/2008	3294	Hurricane	Hurricane Ike
Presidential Disaster Declaration	9/13/2008	1791	Hurricane	Hurricane Ike
Presidential Disaster Declaration	8/25/2017	4332	Hurricane	Texas Hurricane Harvey

Table 25 - Chambers County Presidential and Emergency Declarations, 2018-2024

Declaration type	Declaration Date	Disaster Number	Type	Title
Presidential Disaster Declaration	**10/04/2019**	**4466**	**Flood**	**Tropical Storm Imeda**
Emergency Declaration	**08/24/2020**	**3540**	**Hurricane**	**Texas Tropical Storms Marco and Laura**
Emergency Declaration	**02/14/2021**	**3554**	**Severe Ice Storm**	**Severe Winter Storm**
Presidential Disaster Declaration	**02/19/2021**	**4586**	**Severe Ice Storm**	**Severe Winter Storm**

This information is helpful as it also shows that flooding is one of the most damaging hazards along with hurricanes and tropical Storms and severe winter storms/ice storms.

As mentioned earlier, the MPC reviewed the State of Texas Hazard Mitigation Plan (2023). In addition, The MPC reviewed the National Oceanic and Atmospheric Administration's National Centers for Environmental Information (NOAA, NCEI) hazard database, FEMA's Disaster

Declarations, Risk Index, neighboring counties and special districts (Harris, Jefferson, Liberty and Galveston , Trinity Bay Conservation District, HCFCD, and JCDD6) Hazard Mitigation Plans, Texas A&M Forest Service, Texas Wildfire Risk Assessment (TX WRAP), USDA Drought Disasters for Chambers County, General Land Office regional plan, TWDB 2022 State of Water Report, US Census Bureau data, Region 5 Neches Regional Flood Plan, and the CDC's Social Vulnerability Index. These reports were used in this plan as follows:

- State of Texas Hazard Mitigation Plan (2023): Plan's goals, actions and hazards were reviewed to gather data for this plan for mitigation strategy, goals, actions, and hazard data.
- National Oceanic and Atmospheric Administration's National Centers for Environmental Information (NOAA, NCEI): Information used to gather hazard data.
- FEMA Disaster Declarations and Risk Index: Information was used for historical information and for hazard data.
- Harris County Flood Control District's and Jefferson County Drainage District No. 6's Flood Warning System Databases: Databases were queried to provide historical and real time hazard data.
- Harris, Jefferson, Liberty and Galveston, Trinity Bay Conservation District, HCFCD, and JCDD6 Hazard Mitigation Plans Updates: Plan's goals, actions and hazards were reviewed to gather data for this plan.
- Texas A&M Forest Service Texas Wildfire Assessment: Report was reviewed to gather hazard data.
- CDC Social Vulnerability database was used for information on risk for vulnerable population.
- GLO Texas Coastal Resiliency Master Plan for Region One for projects and projections.
- US Census Data was used for information on population, density, housing, education, workforce and other community profile information.
- Region 5 Neches Regional Flood Plan provides data from a regional perspective on flooding for Chambers County.
- TWDB 2022 State of Water Report reviewed demands by usage type for the County.
- CLCND 2019 Water Conservation and Drought Contingency Plan reviewed demands on water supply and conservation efforts.

The next part of this section focuses on hazard identification, the potential impact of these hazards, and the community's vulnerability from each hazard.

Coastal Erosion

Update from last plan

- Events and maps since 2017 were updated and described.

Hazard Description

Coastal erosion is the gradual deterioration of shorelines and displacement caused by both physical and chemical forces. Some examples are water movements, wind, and meteorological conditions. Coastal erosion is quantified by assessing the loss of shoreline over time. The Texas General Land Office (GLO) reports that 'sixty-four percent of the Texas coast is eroding at an average rate of about six feet per year. FEMA estimates that every dollar spent on erosion control and mitigation to preserve wetlands and other natural ecosystems will provide a return on average of four dollars in cost-savings in the future." (Coastal Erosion (texas.gov))

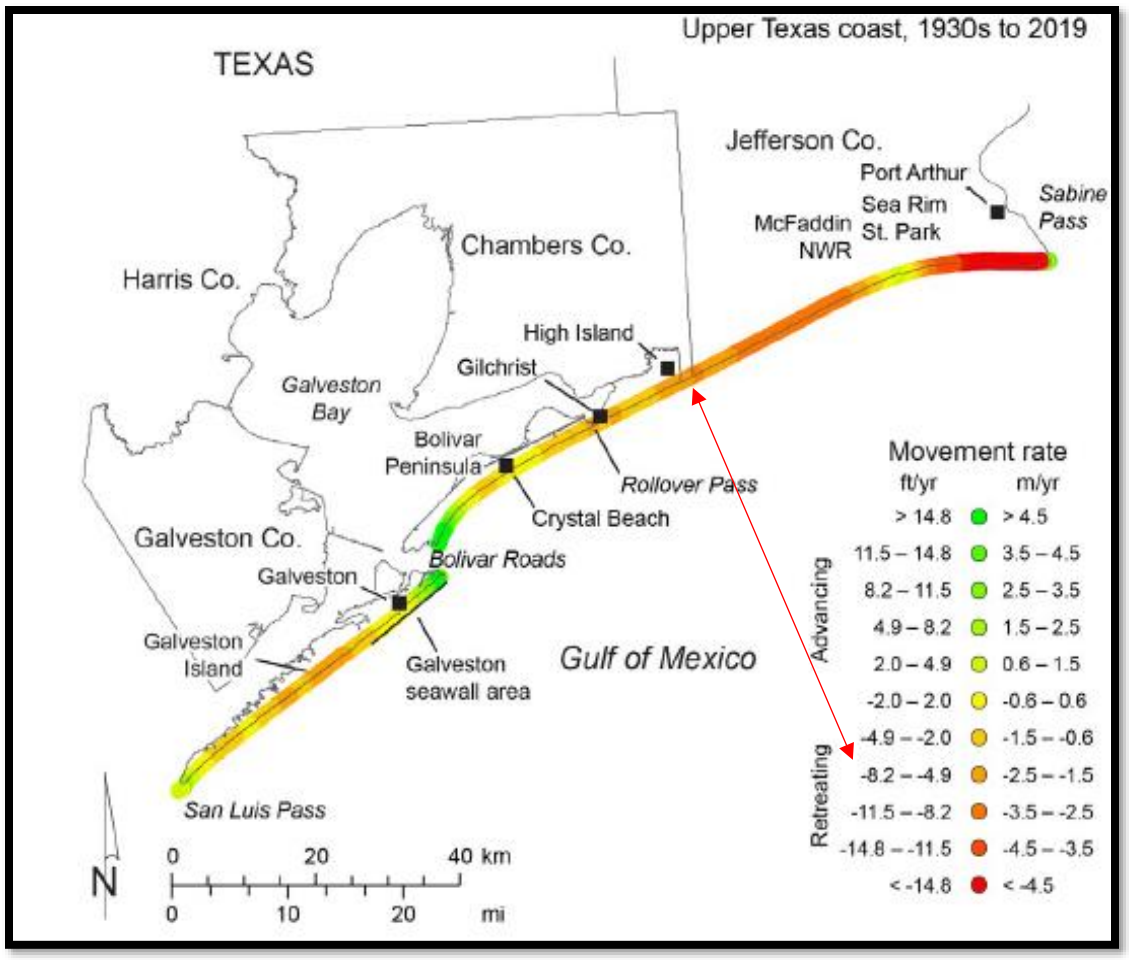
Location

The coastline and bay shoreline of Chambers County are susceptible to coastal erosion. Unincorporated Chambers County, Anahuac, Beach City, and Cove are the most likely jurisdictions to be affected by coastal erosion, see Figure 36.

Figure 36 - Coastal erosion areas in Chambers County

The Upper Texas coast retreat which includes Chambers County, was calculated at 5.5 feet per year from 2000-2019 as reported in the U.S.A.C.E. Coast Texas Protection and Restoration Feasibility Study Final Report. Figure 37 depicts shoreline change between 1930s to 2019. (Source within the Study: Bureau of Economic Geology)

Figure 37 - Gulf Shoreline erosion rates, 1930s-2019



Previous Occurrences

No historical damage values could be identified for losses due to erosion within the planning area. Coastal erosion damage can be difficult to quantify as there are typically not single events of coastal erosion, but gradual erosion over time. However, there are often coastal erosion effects during and after large storms or hurricanes due to the high winds and surge of water onto the coasts.

Future Occurrences

If reviewing the hazard based on number of events, there will not likely be any future occurrences of coastal erosion events in the planning area during the 5-year period of this plan. However, if reviewing the hazard based on annual erosion per year, it is anticipated that the planning area will continue to lose approximately 5.5 feet per year. However, climate change could increase that loss per year.

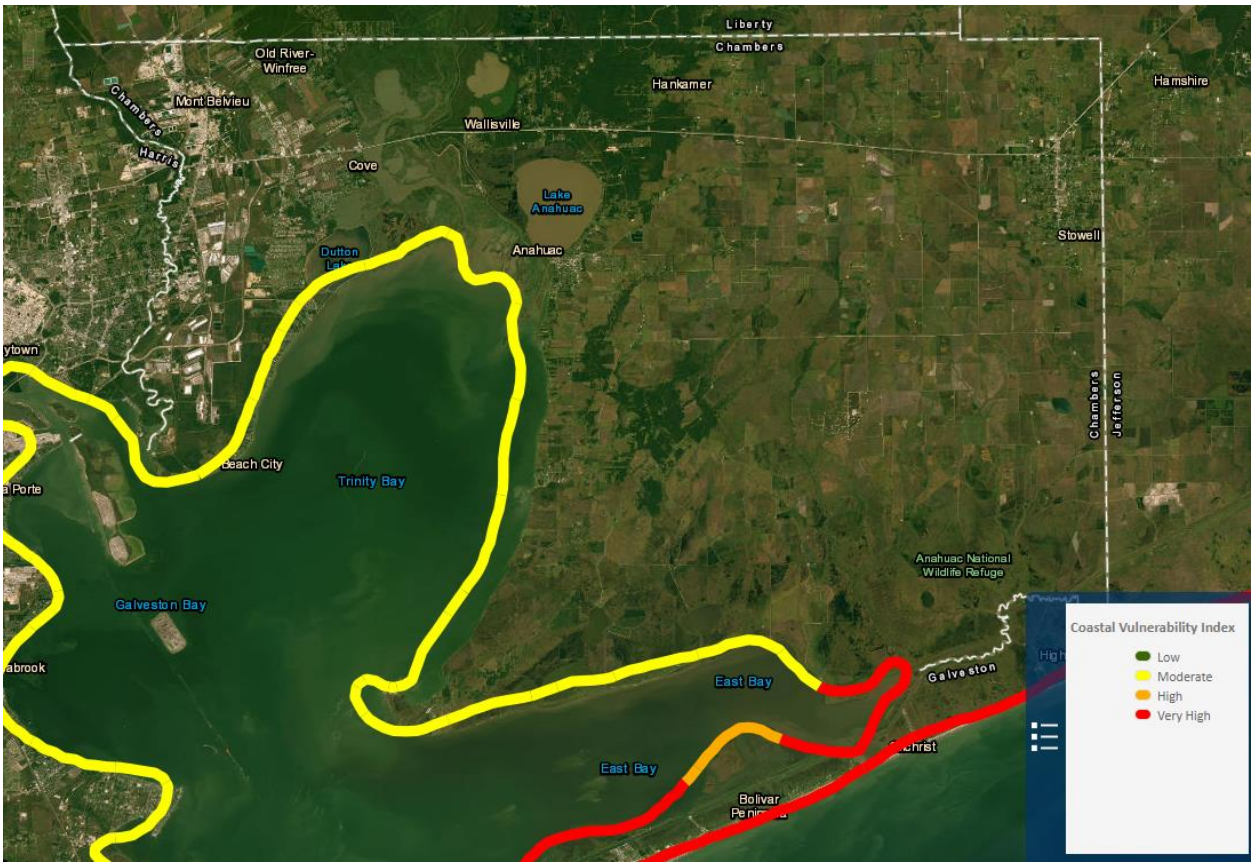
Extent

Coastal erosion is measured through feet (or meters) lost per year on the shoreline. The USGS Coastal Vulnerability Index is a tool that classifies based on following variables: geomorphology, regional coastal slope, tide range, wave height, relative sea-level rise and shoreline erosion and accretion rates. The combination of these variables and the association of these variables with each other furnishes a broad overview of regions where physical changes are likely to occur due to sea-level rise.

Figure 38 indicates that the vast majority of Chambers County is "moderate" on the Coastal Vulnerability Index.

Figure 38 - USGS Coastal Vulnerability Index

(U.S. Geological Survey, National Assessment of Coastal Vulnerability to Sea-Level Rise: Preliminary Results for the U.S. Gulf of Mexico Coast, Open File Report 00-179, Figure 1 (usgs.gov))



The State of Texas 2023 Hazard Mitigation Plan provides the maximum erosion rate in feet for Chambers County as -8.6 ranking it 8thin risk out the gulf coast counites. (2023 Texas State Hazard Mitigation Plan, Page, 51.)

Impact

The most likely impact from coastal erosion would be a reduction in wildlife refuge area, financial cost of beach replenishment, and potential damage to residential homes on the coast.

Effect of Climate Change on Coastal Erosion

Climate change could cause more frequent and extreme hurricanes and tropical storms. This in turn could cause more coastal erosion in the planning area.

Social Vulnerability

Social vulnerability is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

There is not significant difference in vulnerability between social groups regarding coastal erosion. This is mainly due to coastal erosion being a slow process over time. In addition, typically people that live near the coastline are often in higher income brackets that have the monetary capabilities to recover from any damage to their property due to coastal erosion.

Overall Vulnerability

Coastal erosion is a factor that affects certain portions of the planning area including, unincorporated Chambers County, Cove, Beach City, and Anahuac. There are typically not specific coastal erosion events, but rather a slow reduction in coastlines over time.

Typically, there is not a large amount of monetary damages that the County incurs for coastal erosion as most of the damage is in wildlife refuge area. There may be some cost for the County including:

- Financial cost of beach replenishment
- Potential loss of revenue from tourism
- Loss of natural habitat and wildlife along the coast

Potential or projected development could cause stress to the ecosystems and watershed which could weaken the areas that are used to help protect the shorelines. Similarly, populations also bring infrastructure which also could add stress to the ecosystems and watersheds. For instance, an increase in population, brings more stress on groundwater discharge and wastewater systems. Less visible hazards such as toxins, pathogens, saltwater intrusion, and wastewater discharge threaten coastal ecosystems and wildlife as well as the people who live, work, and play along the coasts. These contaminants can enter the coastal waterways through seepage, spills, runoff, or through groundwater discharge.

Drought

Update from last plan

- Events since 2017 were updated and described.

Hazard Description

Drought is a weather condition characterized by prolonged dryness that causes a significant decrease in soil moisture and water availability, making it challenging for plants, animals, and humans to thrive. In Texas, drought is specifically described in two main categories: agricultural drought and hydrologic drought:

- Agricultural drought refers to a dry period that lasts long enough and is intense enough to significantly impact crop and animal farming. It hampers agricultural productivity and can have adverse effects on the livelihoods of farmers and the availability of food resources.
- Hydrologic drought, on the other hand, is a more prolonged state of abnormally dry weather, leading to depletion of both surface and groundwater sources. This condition results in reduced water flow in rivers, streams, and springs, which can have far-reaching consequences on water supplies for various uses.

Texas is geographically diverse, divided into ten climatic divisions, ranging from areas with heavy precipitation to semi-arid and arid regions. As a result, different parts of the State are susceptible to periodic droughts of varying degrees of severity. This susceptibility is partly influenced by Texas' proximity to the Great American Desert in the southwestern United States. Throughout recorded history, Texas has experienced droughts in each decade, some of which have been particularly severe and had significant impacts on the State and its communities.

Location

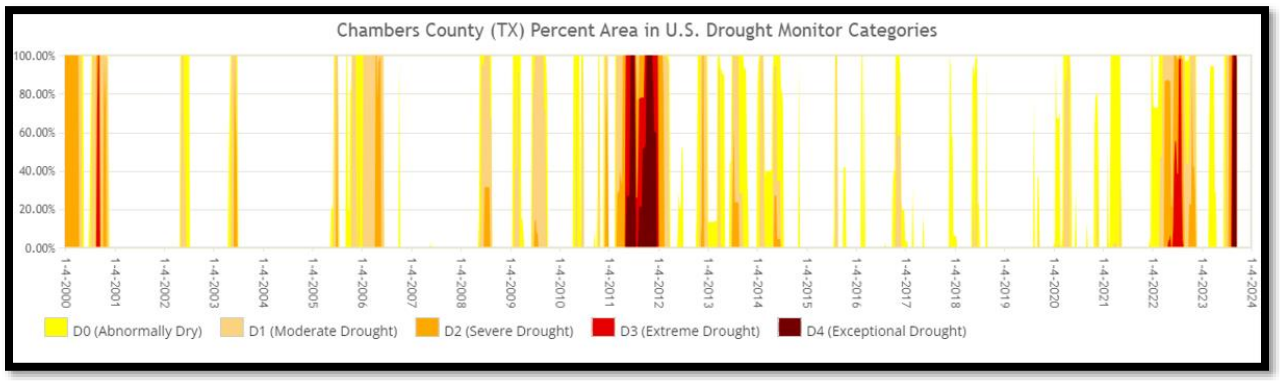
Chambers County is susceptible to all ranges of drought as defined by the Palmer Drought Severity Index (see magnitude/extent section) and since drought occurs on regional scale, all the planning area is equally at risk.

Previous Occurrences

Drought.gov data recorded 9 years with drought conditions of at least severe drought for Chambers County since the year 2000. There have been 2 years (2022, 2023) with severe drought events since the previous plan was completed in 2017.

Figure 39 shows the extent of all recorded droughts in the County since 2000. Data shows that there have been multiple cases of D3 and D4 drought in the County (extreme and exceptional drought conditions).

Figure 39 - U.S. Drought Monitor – Drought.gov



Future Occurrences

Based on 9 years (2000, 2003, 2006, 2011, 2012, 2013, 2014, 2022, and 2023) of drought events within 23 years, a drought occurs approximately once every 2.5 years on average in Chambers County and since droughts occur at a regional level, Chambers County can expect a drought event at about ~39% chance annually.

Extent

In 1965, W.C. Palmer developed an index to measure the departure of the moisture supply, called the Palmer Drought Severity Index (PDSI). The PDSI indicates the prolonged and abnormal moisture deficiency or excess and general conditions, not local variations caused by isolated rain. The PDSI is an important climatological tool for evaluating the scope, severity, and frequency of prolonged periods of abnormally dry or wet weather.

The equation for the PDSI was empirically derived from the monthly temperature and precipitation scenarios of 13 instances of extreme drought in western Kansas and central Iowa and by assigning an index value of -4 for these cases. Conversely, a +4 represents extremely wet conditions. From these values, seven categories of wet and dry conditions can be defined. Table 26 identifies the values used to define the PDSI. During the 2011 event the PDSI was -4.0 and again in 2023.

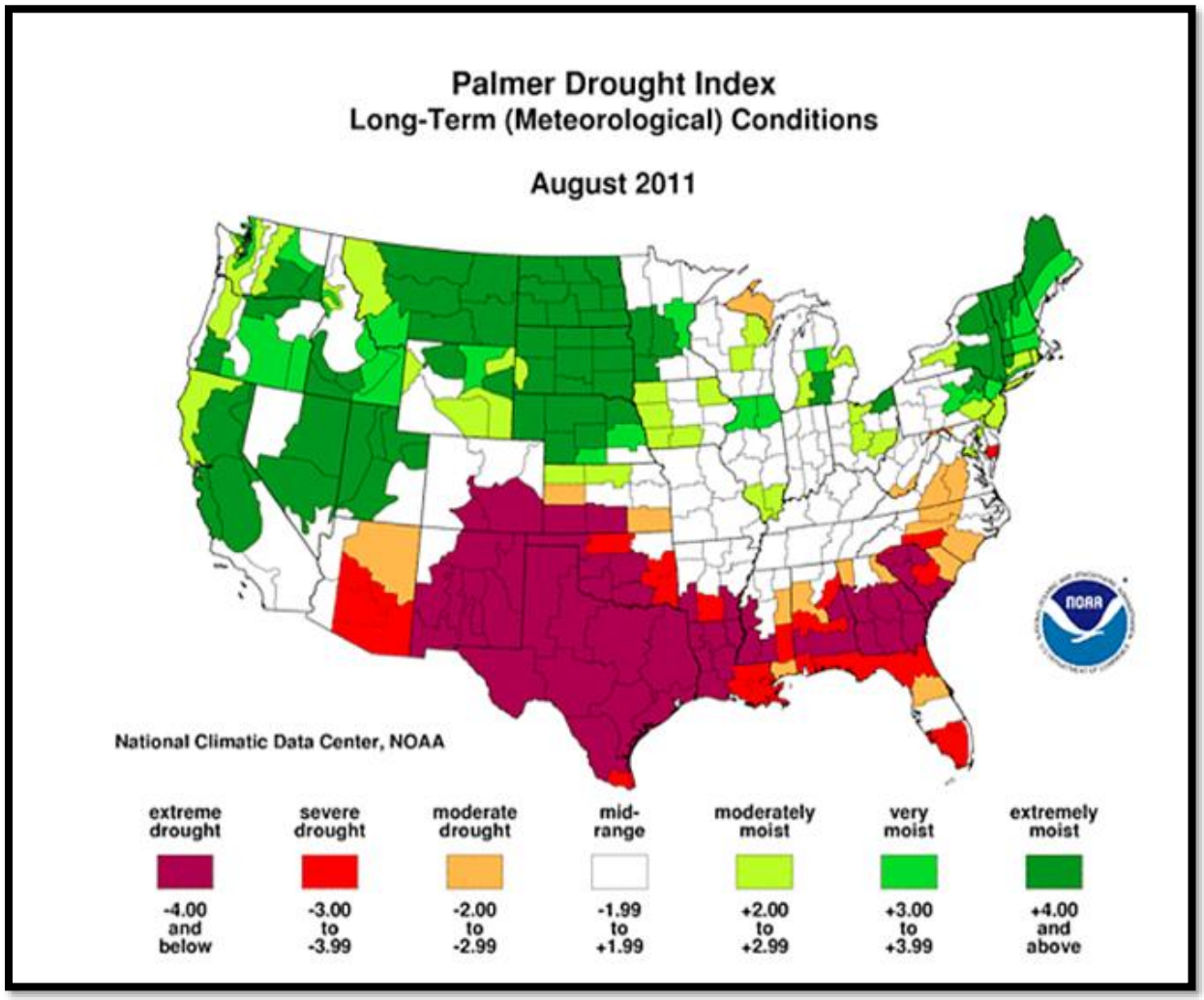
Table 26 - Palmer Drought Severity Index

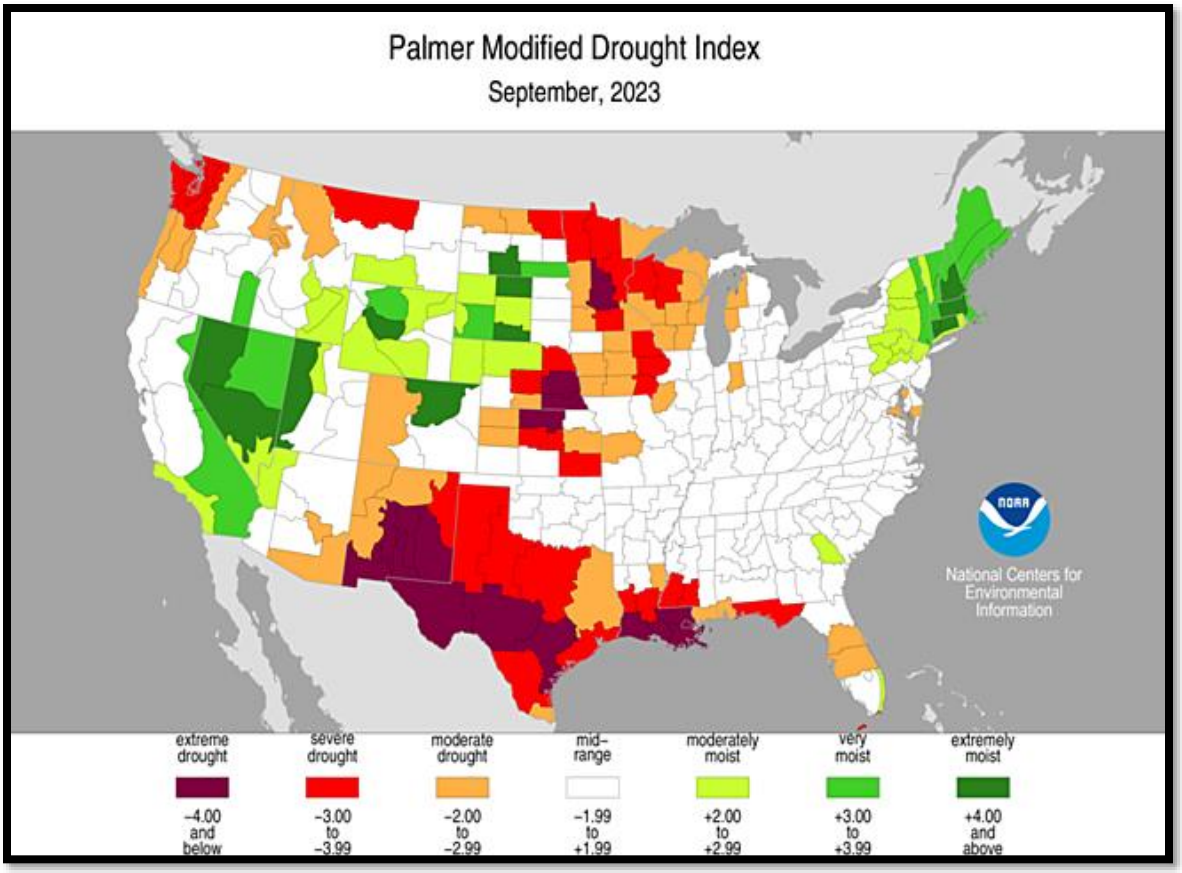
(Source: NOAA, National Weather Service - Climate Prediction Center)

Palmer Drought Severity Index
-4.0 or less (Extreme Drought)
-3.0 or -3.9 (Severe Drought)
-2.0 or -2.9 (Moderate Drought)

Palmer Drought Severity Index
-1.9 to +1.9 (Near Normal)
+2.0 or +2.9 (Unusual Moist Spell)
+3.0 or +3.9 (Very Moist Spell)
+4.0 or above (Extremely Moist)

Figure 40 - Palmer Drought Index (Source NCEI/NOAA)





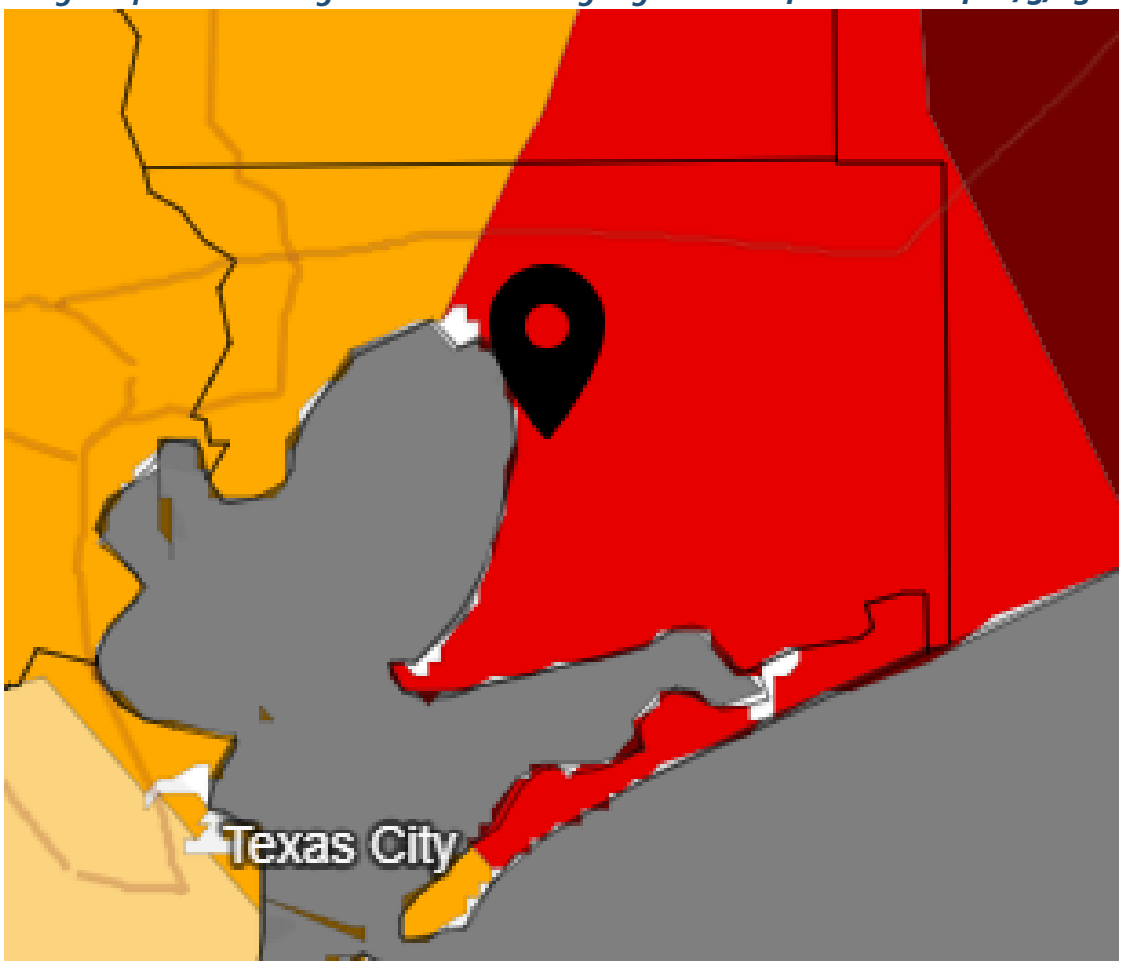
The U.S. Drought Monitor Drought Intensity Scale classifies drought by 5 categories, D0 through D4, with D4 being the most extreme drought conditions. Figure 41 below provides the description and impact for each category.

Figure 41 - Drought Classification (US Drought Monitor)

Category	Description	Possible Impacts
D0	Abnormally Dry	Going into drought: • short-term dryness slowing planting, growth of crops or pastures Coming out of drought: • some lingering water deficits • pastures or crops not fully recovered
D1	Moderate Drought	• Some damage to crops, pastures • Streams, reservoirs, or wells low, some water shortages developing or imminent • Voluntary water-use restrictions requested
D2	Severe Drought	• Crop or pasture losses likely • Water shortages common • Water restrictions imposed
D3	Extreme Drought	• Major crop/pasture losses • Widespread water shortages or restrictions
D4	Exceptional Drought	• Exceptional and widespread crop/pasture losses • Shortages of water in reservoirs, streams, and wells creating water emergencies

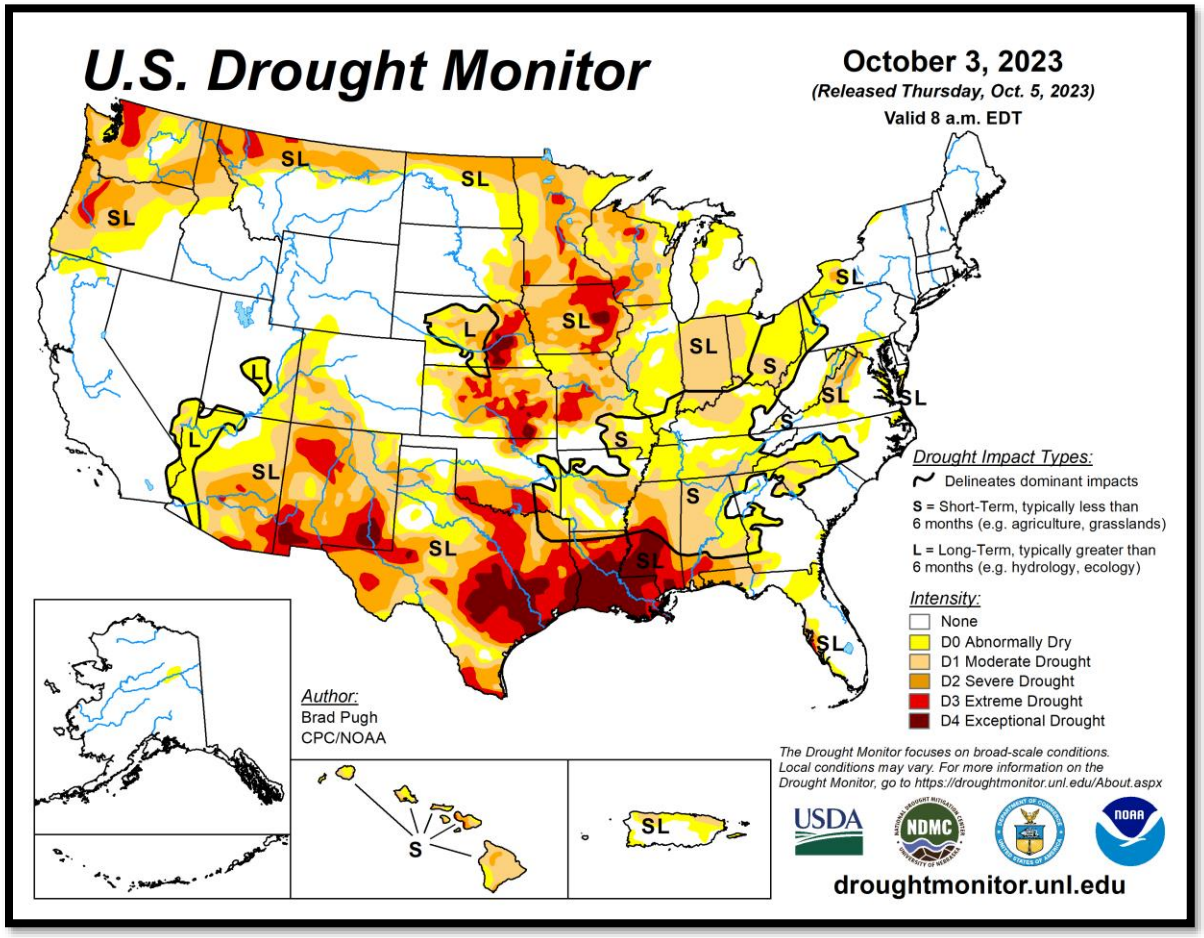
The maximum drought extent experienced in Chambers County is a Category D4 (exceptional drought) that was reported by the U.S Drought Monitor in 2011 and again in 2023 (Figure 42).

Figure 42 - U.S. Drought Monitor – Drought.gov - Data from Week of 10/3/23



Drought & Dryness Categories	% of Chambers County
D0 - Abnormally Dry	0%
D1 – Moderate Drought	0%
D2 – Severe Drought	22.21%
D3 – Extreme Drought	77.79%
D4 – Exceptional Drought	0%
Total Area in Drought (D1–D4)	100.00%

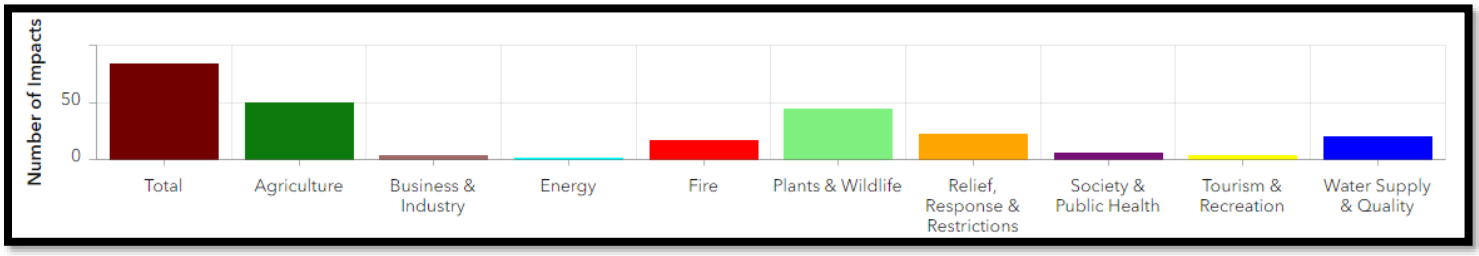
Current (week of 10/3/23) conditions show that most of the County is in extreme drought conditions.



Impact

The Drought Impact Reporter (DIR) is the nation's first comprehensive database of drought impacts. The database contains information from multiple federal agencies including the U.S. Department of Agriculture Risk Management Agency, the National Oceanic and Atmospheric Administration TRACS program, and Sectoral Applications Research Program. Figure 43 describes the number of impacts reported by category with plants, wildlife, and agriculture being reported with the greatest frequency. This data from the DIR started being reported in July 2005.

Figure 43 - Drought Impact Report for Chambers County Texas – July 2005 to July 2023



USDA National Agriculture Statistics Service collects data on US farms and ranches called the Census of Agricultures. In the 2022 report, Chambers County has 491 farms (down from 562 farms in 2017) with 199,088 acres in agricultural production. The market value of agricultural products sold is $53,224 (up from $19,252) with crops totaling $39,530 and livestock $13,694.

Apart from the impacts already mentioned in the Disaster Impact Report (DIR), drought had its most significant effects in 2023, leading to the implementation of several months long water conservation and reduction measures. As previously discussed, in 2011 the Southeast Texas region experienced an extended drought, causing record-breaking damages. Many crops were completely lost, and numerous animals had to be sold due to insufficient grazing resources. The extent of the damage in this entire region was significant, with property damage estimated at $10 million and agricultural losses amounting to approximately $100 million. There is not a quantifiable amount for the 2022/2023 droughts yet, however, costs are anticipated to be similar to the 2011 events.

Effect of Climate Change on Drought

Due to climate change, the probability of a drought event and its duration may increase in the future. This is due to the possibility of warming trends in the climate as well as fluctuations in the rainfall patterns. The Center for Climate and Energy Solutions reports that "Risk of drought is expected to grow due to reduced precipitation and higher temperatures caused by climate change. Droughts can have far-reaching impacts including degraded water quality, low river flows with ecological implications, saltwater intrusion in tidal river areas and land subsidence" (Resilience Strategies for Drought, 2018 resilience-strategies-for-drought.pdf (c2es.org)). With an extended and warmer climate, droughts can become longer, more frequent, and more severe for the County.

Social Vulnerability

Social vulnerability is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

In drought conditions, there are often water supply and quality issues. This adversely impacts socially vulnerable communities such as the elderly, children, low-income families, as well as those with professions such as farmers. Low-income families may live in areas that rely on poorly maintained water systems that put them at increased risk of health problems due to contaminated drinking water or being forced to reduce consumption during drought events. These same issues could affect the elderly community that may live in care facilities. Farmers could be negatively affected by reduced crop yield during drought events which could drastically lower income potential.

Overall Vulnerability

Drought risks to people and property within the County cannot be distinguished by area. All people and assets are considered to have the same degree of exposure.

The drought hazard affects all residential and commercial building types about equally within the planning area. Vulnerable assets may include residential, commercial, and critical facility buildings, crops, farms, landscaping, and common assets such as drinking water. Water distribution, water transmission lines, and water wells are affected by drought as well.

The National Risk Index shows drought is relatively moderate risk (86.3 national percentile) and relatively moderate (84.2 national percentile) in expected annual loss. This index estimates a 329 thousand dollar expected annual loss for the County.

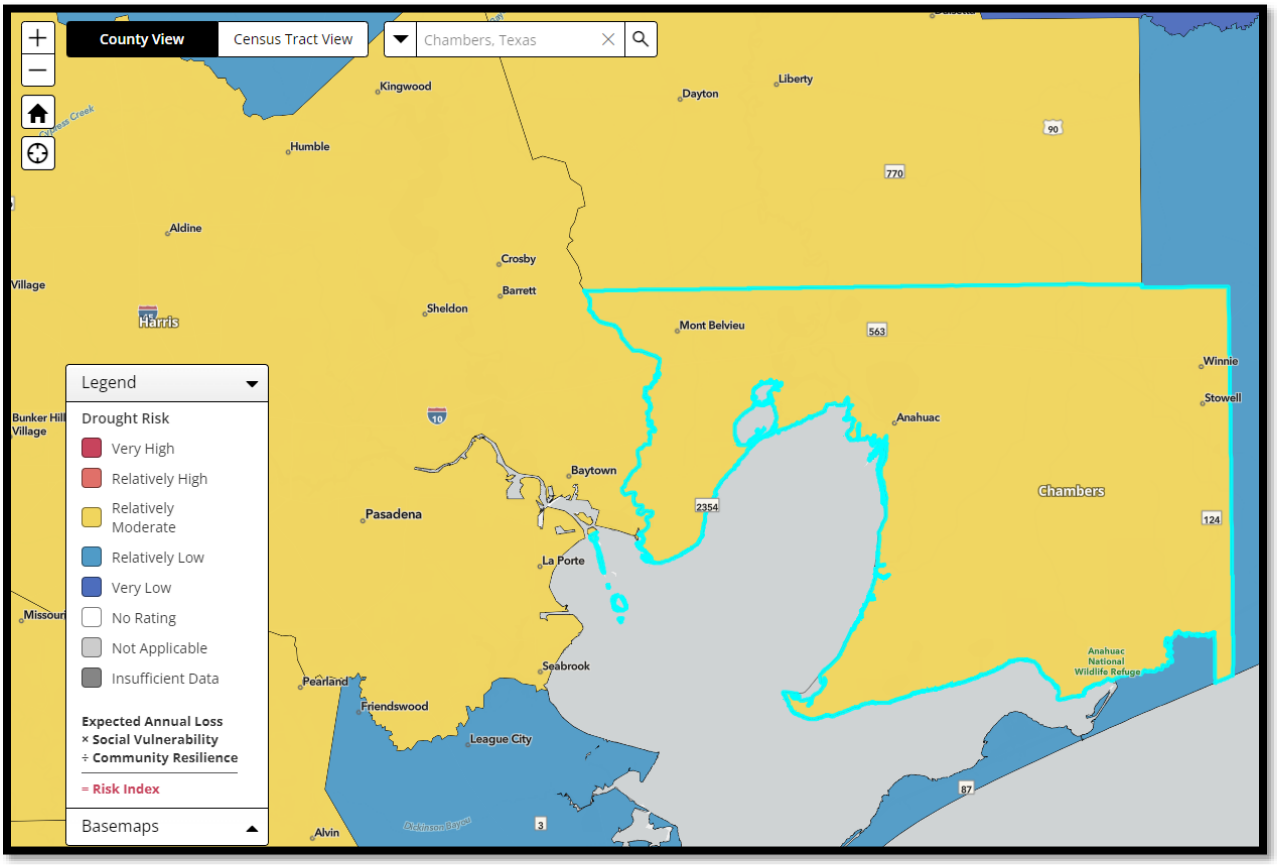
Future Changes that May Impact Vulnerability

Understanding future changes that affect vulnerability in the Planning Area can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development - Any areas of growth could be potentially impacted by the drought hazard because the entire County is exposed and vulnerable to droughts. Future growth and development could impact the amount of potable water available due to a drain on the available water resources. An increased drain on water resources would not only impact the County's population, but it would also exacerbate impacts to other areas of the County, as discussed above, including agriculture and recreational facilities.

- Projected changes in population - The County has experienced an increase in population shown between the 2010 and 2022 American Community Survey population estimates. The population of the County is expected to continue to increase. With an increase in population, the demand for water supply will increase. During a drought, the amount of water needed might not be available. This might require reallocation of water resources to meet demands

during a drought. If needed, the County can pass special ordinances regulating the amount of water consumed and used during periods of drought to conserve water.



Expansive Soil

Update from last plan

- Events since 2017 were updated and described.

Hazard Description

Expansive soil is caused by absorption of water from different minerals in the soil such as clay. When the soil absorbs water, it increases in volume. As the soil absorbs more water, the increase in volume can cause enough force on a building or structure to cause damage. Drought conditions can cause soil to contract in response to a loss of soil moisture, causing them to lose volume and shrink as they dry. A reduction in soil volume can affect the support to buildings or other structures, and result in damaging the foundation.

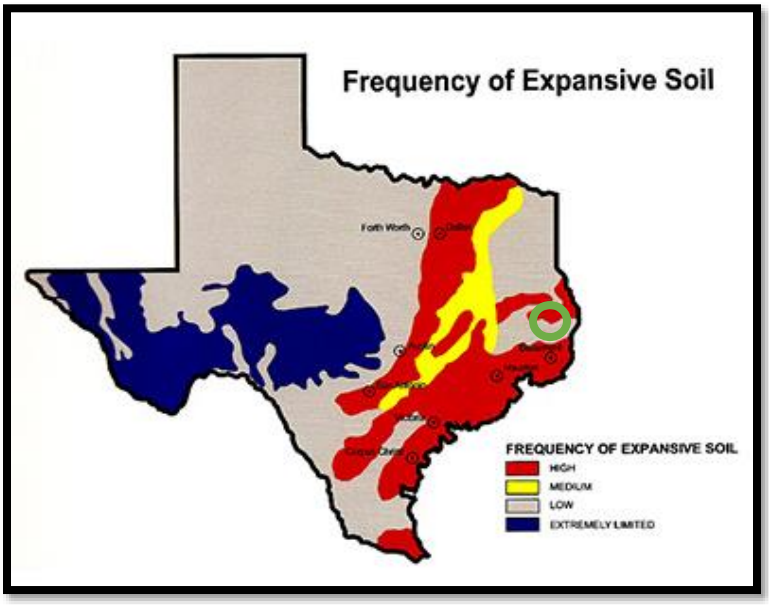
Many soils are not susceptible to expansion due to their contents. Typically clay minerals are more common to have issues with expansion. According to Geology.com, the majority of Texas, particularly the Southeast part of Texas, can be highly susceptible to expansive soils due to areas having a higher clay mineral content.

Location

As stated in the previous section, expansive soil is a prominent area of having clay minerals that cause a high swelling potential. It is hard to distinguish exactly what parts of Chambers County have the highest swelling potential soil, but it can be assumed an even distribution of risk throughout all jurisdictions. Figure 44 below shows expansive soil frequency throughout Texas. Chambers County is in the green circle.

Figure 44 - Expansive Soil Frequency in Texas

Source: Tellafirm.com



Previous Occurrences

Historically, there has been no reported damage in the NCEI database over the last 20 years. It is important to note that in some cases the damage is not reported. However, it is known that expansive soil is an issue that affects Chambers County. The main reason why events are not recorded is because the damage is largely very slow and cannot be contributed to a specific event. Many times, expansive soil damage is misconceived as poor construction or normal wear and tear on a building.

Future Occurrences

Due to no reported cases with damage in national databases over the last 20 years, an assumption is made that there may be no or negligible events for this hazard. However, damage to foundations has been reported to the County, therefore, as previously stated, it can still be likely that expansive soil will continue in the planning area due to the mineral content in much of the soil.

Extent

Expansive soil is calculated with the Linear Extensibility Percent (LEP) and the Coefficient of Linear Extent (COLE). COLE is a test frequently used to characterize expansive soils. COLE is a measure expressed as a fraction of the change in a soil sample dimension from the moist to dry state. The LEP is a measure expressed as a percentage of the change in a soil sample dimension from the moist to dry state. These two calculations will help classify an area by its Shrink-Swell Class. Table 27 below details the four different Shrink-Swell Classes. In general, if an area has a moderate to very high class, the soil has the potential to expand and contract, causing damage to foundation and pipes, among other issues. The planning area is considered in the high-very high class of this scale.

Table 27 - Shrink-Swell Classification

(https:/www.nrcs.usda.gov)

Shrink-Swell Class	Linear Extensibility Percent (LEP)	Coefficient of Linear Extent (COLE)
Low	3	0.
Moderate	3 to 6	.03-.06
High	6 to 9	.06-.09
Very High	Greater than or equal to 9	Greater than or equal to 0.09

Impact

According to the American Society of Civil Engineers, ¼ of all homes in the United States have some damage caused by expansive soils. Expansive soil has often contributed to a greater

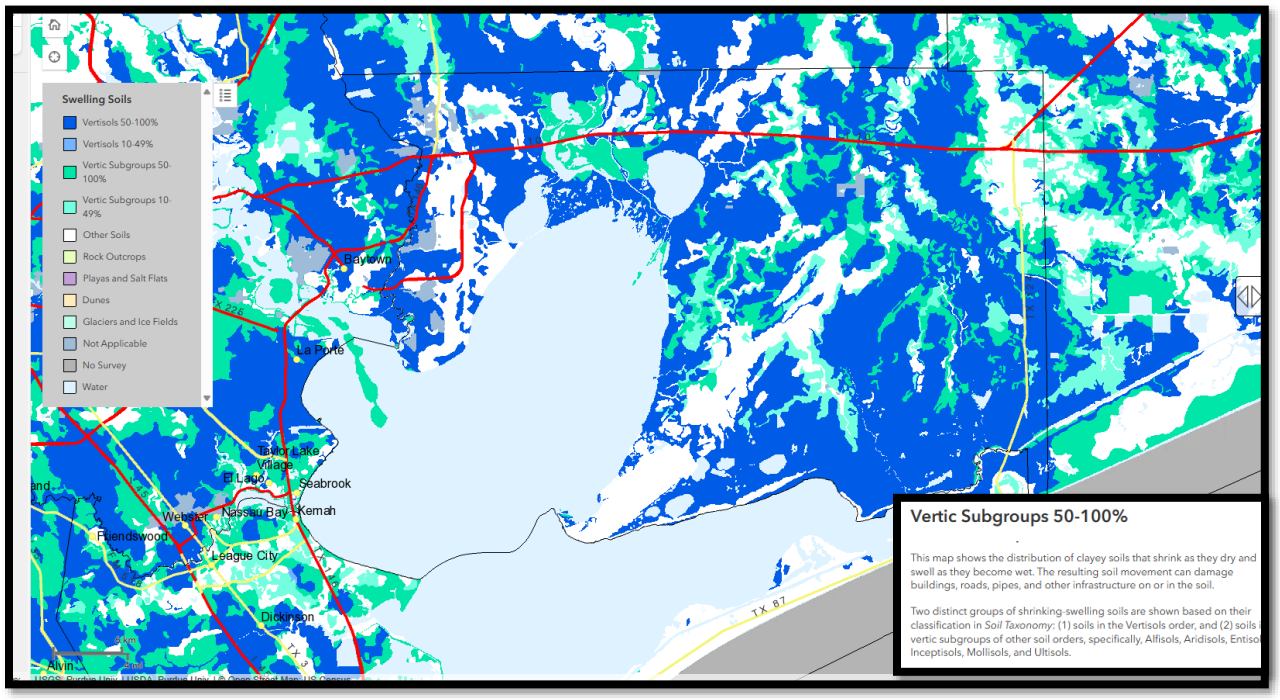
financial loss to property owners than natural disasters such as earthquakes, floods, hurricanes, and tornadoes.

Expansive soil causes the greatest impact when there is a moisture content change. Typically, if water content in the soil is constant then the cracks will not occur. The most likely damage from expansive soil are buildings (particularly foundation), roads, and crops.

USDA NRCS has interactive tools that access NRCS soils information. For swelling soils, Chambers County is primarily Vertic Subgroups 50-100% - Soils that shrink and swell make up 50-100% of this land area and vertic subgroups of Alfisols, Aridisols, Entisols, Inceptisols, Mollisols, or Ultisols are more abundant than Vertisols. This type and percentage indicate it has a high content of shrinking/swelling clay materials.

Figure 45 - Chambers County Swelling Soil Map

Soil Explorer Soil Apps Tools | Natural Resources Conservation Service (usda.gov)



The previous plan provided expansive soil data by Jurisdiction as shown in Table 28.

Table 28 - Expansive Soil Data by Jurisdiction

Jurisdiction	Low Swelling Potential	Moderate Swelling Potential	High Swelling Potential
Unincorporated Chambers County (includes CLCND)	25%	15%	60%
Anahuac	10%	20%	70%

Jurisdiction	Low Swelling Potential	Moderate Swelling Potential	High Swelling Potential
Beach City	10%	10%	80%
Cove	10%	10%	80%
Mont Belvieu	10%	10%	80%
Old River-Winfree	10%	45%	45%

Effect of Climate Change on Expansive Soil

Climate change may influence expansive soil. This is because there could be more prominent fluctuations in soil moisture, due to more extended drought events followed by heavy storms.

Social Vulnerability

Social vulnerability is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

In Chambers County there is likely no increase in susceptibility of social groups to expansive soil. If there is future damage from expansive soil, there would be an equal chance of occurrence for all people and parts of the County as there is no specific area that is significantly more prone than another.

Overall Vulnerability

As stated in the other sections, expansive soil is a high risk to Chambers County. This is due to the composition of the soil as well as fluctuations in soil moisture. This can gradually wear down foundation, roads, and kill crops. In most cases, expansive soil is not the reported cause of the damage since the effects occur very slowly. Problems with foundations, roadways, sidewalks and other structures and infrastructure like septic tanks are vulnerable. Older structures will be impacted with greater frequency due to the soil testing and stabilization requirements for newer structures (2005 State law).

Future Changes that May Impact Vulnerability

Understanding future changes that affect vulnerability in the Planning Area can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development - Any areas of growth's infrastructure (roads, sidewalks) could be potentially impacted by the expansive soil hazard. However, new homes should be better protected due to a 2005 soil test required by the Texas Department of Licensing and Regulation for all new builds.

- Projected changes in population - The County has experienced an increase in population between the 2010 American Community 2022 American Community Survey population. The population of the County is expected to increase over the next few years. With an increase in population, the need for increased infrastructure like homes with foundations, roads, sewer, and water lines also increase and with that the potential for infrastructure vulnerability.

Extreme Heat

Update from last plan

- Events since 2017 were updated and described.

Hazard Description

The 2018 Texas HMP Update provides a definition of extreme heat, describing it as a combination of very high temperatures and exceptionally humid conditions. When this combination persists over an extended period, it is referred to as a heat wave. Extreme heat poses a significant threat to human life by pushing the body beyond its normal limits. Under usual circumstances, the body's internal thermostat triggers perspiration, which evaporates to cool the body down. However, in extreme heat and high humidity, evaporation slows down, and the body must work harder to maintain a normal temperature.

Extreme heat is characterized by temperatures that are 10 degrees or more above the average high temperature for the region and last for several weeks. Humid or muggy conditions exacerbate the discomfort of high temperatures, occurring when a "dome" of high atmospheric pressure traps hazy and damp air near the ground. Excessively dry and hot conditions often precede dust storms.

Heat-related illnesses typically occur when individuals have been exposed to excessive heat or have exerted themselves beyond their capacity, considering factors like age and physical condition. Additionally, stagnant atmospheric conditions and poor air quality can contribute to and worsen heat-related health problems. It is crucial to be aware of the risks associated with extreme heat and take appropriate precautions to protect oneself during such conditions.

Location

Extreme heat occurs on a regional scale, so all of Chambers County is equally at risk. The climate in the region often bodes itself to having hot and humid summers with prolonged heat waves.

Previous Occurrences

The NOAA Storm Events Database documents 7 extreme heat events for Chambers County since the year 2000. These events are summarized in Table 29. The NOAA database showed that during those 7 heat events there was 1 recorded death. Since 2017 when the previous plan was completed, there have been just two recorded extreme heat events according to the NCEI database (June 2023, and July 2023).

Table 29 - Heat Events in Chambers County, 2000 – 2023

(Source: NOAA/NCEI)

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								1	0	0.00K	0.00K
CHAMBERS (ZONE)	CHAMBERS (ZONE)	TX	07/06/2000	06:00	CST	Heat		0	0	0.00K	0.00K
CHAMBERS (ZONE)	CHAMBERS (ZONE)	TX	08/29/2000	06:00	CST	Heat		0	0	0.00K	0.00K
CHAMBERS (ZONE)	CHAMBERS (ZONE)	TX	09/01/2000	00:00	CST	Heat		0	0	0.00K	0.00K
CHAMBERS (ZONE)	CHAMBERS (ZONE)	TX	09/22/2005	15:00	CST	Heat		1	0	0.00K	0.00K
CHAMBERS (ZONE)	CHAMBERS (ZONE)	TX	06/24/2009	15:05	CST-6	Heat		0	0	0.00K	0.00K
CHAMBERS (ZONE)	CHAMBERS (ZONE)	TX	06/16/2023	00:00	CST-6	Excessive Heat		0	0	0.00K	0.00K
CHAMBERS (ZONE)	CHAMBERS (ZONE)	TX	07/12/2023	02:52	CST-6	Excessive Heat		0	0	0.00K	0.00K
Totals:								1	0	0.00K	0.00K

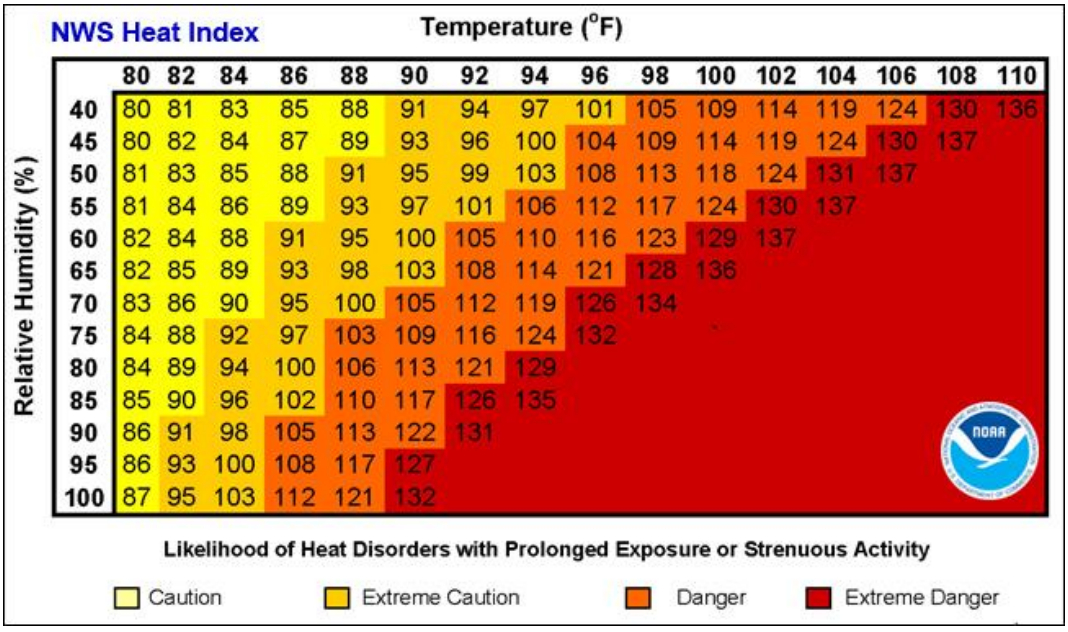
Future Occurrences

Based on 7 heat events over the last 23 years, an extreme heat event occurs approximately every 3.3 years and has an approximately 30% chance annually in Chambers County.

Extent

The National Weather Service (NWS) released a Heat Index (Figure 46) which helps describe how perceived heat changes as relative humidity and temperature changes. This index also color codes the likelihood of heat disorders at different perceived heat temperatures when people have prolonged exposure or are completing strenuous activities. The maximum probable extent the County can expect is considered severe/extreme which corresponds to the NWS classifications of "Danger" and "Extreme Danger" as shown on Figure X, however that will likely increase as the effects of climate change worsen, causing higher temperatures more frequently and for longer periods of time.

Figure 46 - NWS Heat Index



Impact

The NWS also tracks the impact of extreme heat with prolonged exposure or when completing strenuous activities. Figure 47 shows effects on the body at different heat index levels.

Figure 47 - Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Classification	Heat Index	Effect on the body
Caution	80°F - 89°F	Fatigue possible with prolonged exposure and/or physical activity
Extreme Caution	90°F - 102°F	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity
Danger	103°F - 124°F	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity
Extreme Danger	125°F or higher	Heat stroke highly likely

In Chambers County, the risk of extreme heat affects all people and properties uniformly across the entire area.

Certain populations, such as older adults and those with lower incomes, may be more vulnerable to the effects of very high temperatures. This vulnerability can be attributed to their reduced physical capacity to tolerate extreme heat or their lack of access to air conditioning, or in some cases, both. These factors make them more susceptible to heat-related health issues and discomfort during prolonged periods of extreme heat.

Moreover, excessive heat also puts a strain on the electrical power system. The high demand for cooling and air conditioning during extreme heat can lead to increased energy usage, potentially causing power outages. Areas experiencing power outages are directly impacted, and vulnerable populations, such as the elderly, young children, and economically disadvantaged individuals, could be particularly affected by these disruptions.

Overall, extreme heat poses a significant concern for Chambers County, as it affects everyone and places additional stress on both human health and the infrastructure, particularly the electrical grid. Understanding these risks is crucial for implementing appropriate measures to protect vulnerable populations and ensure the overall well-being of residents during extreme heat events.

Effect of Climate Change on Extreme Heat

Due to climate change, the probability of an extreme heat event and its duration may increase in the future. This is due to the possibility of warming trends in the climate. There will also likely be more severe cases of extreme heat events based on these trends. The Massachusetts Institute of Technology (MIT) created a Climate Portal to provide scientifically supported information regarding climate change to the public. It states:

Climate change has led to about 1.8° F (1° C) of average global warming so far. We emphasize the word "average" because this slight rise in average temperatures can cause a much steeper rise in record highs and very hot days. In recent years, weather stations around the world are recording a growing number of extreme heat events and record-high temperatures.

Climate change is also making the world more humid on average. Hot, humid days don't just feel muggier than dry days—they are also more dangerous. The human body cools itself by sweating, and if the air is too humid, sweat cannot evaporate, and the body will keep getting hotter. This condition can quickly lead to fatal heat stroke for people who cannot get to a cooler place. (Source: Extreme Heat | MIT Climate Portal)

Social Vulnerability

Social vulnerability is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Certain populations, such as older adults and those with lower incomes, may be more vulnerable to the effects of very high temperatures. This vulnerability can be attributed to their reduced physical capacity to tolerate extreme heat or their lack of access to air conditioning, or in some cases, both. These factors make them more susceptible to heat-related health issues and discomfort during prolonged periods of extreme heat.

Overall Vulnerability

Extreme heat risks to property within the County cannot be distinguished by area; the hazard is reasonably predicted to have uniform probability of occurrence across the entire planning area. After reviewing the NCEI database, there is no recorded property damage from extreme heat events. The chance of future damage to property is then considered negligible. As stated in the previous section, the disadvantaged population is most at most risk of injury or death from future extreme heat events.

The National Risk Index shows extreme heat is relatively low risk (43.0 national percentile) and relatively low (44.9 national percentile) in expected annual loss. This index estimates a $48 thousand dollar expected annual loss.

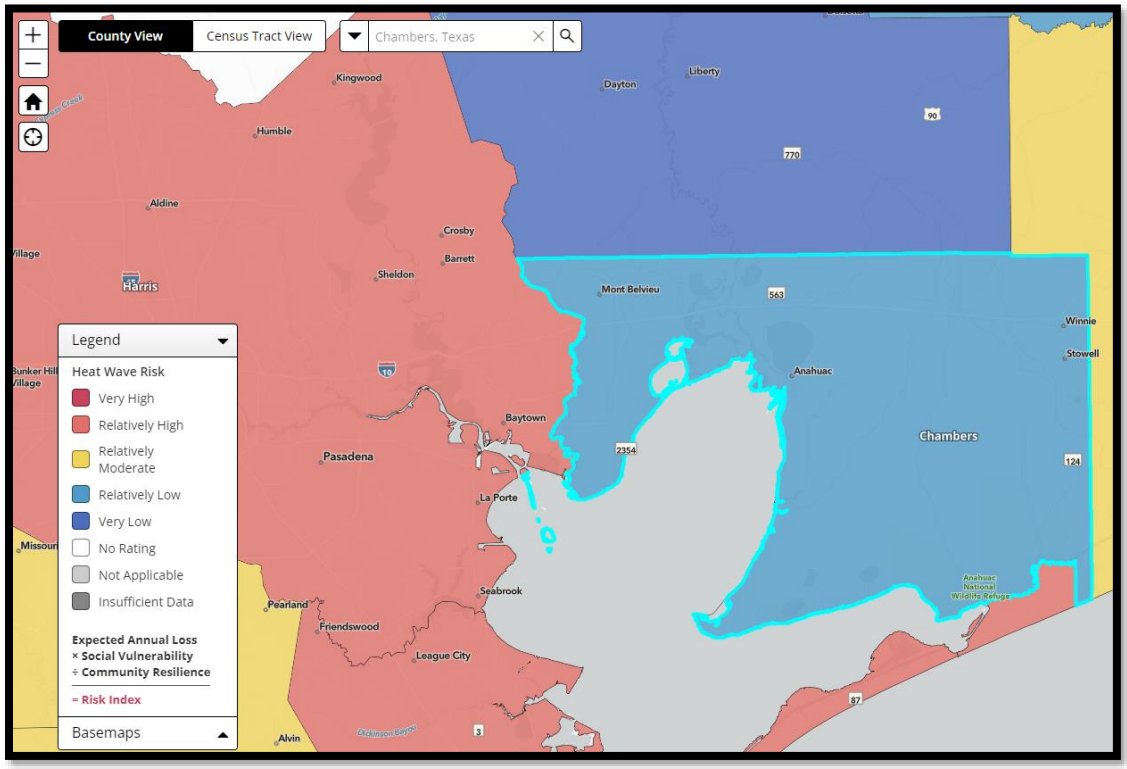
Future Changes that May Impact Vulnerability

Understanding future changes that affect vulnerability in the Planning Area can assist in planning for future development and ensure establishment of appropriate mitigation, planning,

and preparedness measures. The Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

Potential or projected development - Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. Areas targeted for potential future growth and development could be potentially impacted by extreme temperatures since the entire County is exposed. However, due to increased standards and codes, new developments can be less vulnerable to extreme temperatures in comparison with the aging building stock.

Projected changes in population - The County has experienced an increase in population between the 2010 American Community 2022 American Community Survey population. The population of the County is expected to increase over the next few years. With an increase in population, it will expose more people to the hazards mentioned earlier from extreme heat.



Flood

Update from last plan

- Events since 2017 were updated and described.

Hazard Description

The NOAA National Severe Storms Laboratory describes a flood as an overflow of water onto land that is typically dry. Floods can happen during heavy rains, when ocean waves come on shore, when snow melts quickly, or when dams or levees break. Damaging flooding may happen with only a few inches of water, or it may cover a house to the rooftop. Floods can occur within minutes or over a long period, and may last days, weeks, or longer. Floods are the most common and widespread of all weather-related natural disasters. Records show that up to 90 percent of the State of Texas's reported damage from natural disasters comes from flooding. (Severe Weather 101: Flood Basics (noaa.gov)). There are three types of floods that impact Chambers County - Riverine, flash, and coastal.

- River flooding primarily results from an extended precipitation event that occurs at, or upstream from, the affected area. River flooding can also occur when traditional flood-control structures, such as levees and dikes, are overtopped. Significant river flooding events in many coastal areas are often the result of tropical cyclones, such as Hurricane Floyd (1999) or Hurricane Harvey (2017).
- Flash flooding is a specific type of flood that occurs when there is heavy rainfall that is greater than what the ground can absorb. This is the most dangerous type of flood because it can happen very suddenly and there is often not much time to warn citizens of the danger.
- Coastal flooding occurs in areas directly adjacent to coastal waters. There are several distinct causes:
    - High-tide flooding occurs in low-lying coastal areas during extreme high tides (also known as perigean or king tides). These tides occur a few times per year when the sun, moon, and earth align. By definition, a coastal storm is not necessary for high-tide flooding to occur. However, even relatively weak onshore winds can increase the level of flooding.
    - Storm surge results from more severe storms such as tropical cyclones (hurricanes and typhoons) and nor'easters, as strong winds drive water onshore. For example, Hurricane Hugo (1989) and Hurricane Ike (2008) generated extensive storm surge. Communities do not have to be directly in or next to the path of a large storm to experience surge effects. Wave setup, an increase in water levels caused by breaking waves offshore (while the storm is approaching the coast), increases the height of storm surges.

Location

Chambers County is on the Gulf Coast and has several rivers and tributaries. While the coastal flooding is primarily located where Chambers County meets the Gulf of Mexico and around Galveston Bay (see map with red arrows), riverine flooding occurs throughout the County. Numerous canals, rivers, bayous, reservoirs, lakes, and stock ponds exist in Chambers County. These are used for water supply, drainage outlets, shipping facilities, fishing, wildlife, and recreation. The major streams within the County are the Cedar Bayou, Double Bayou, Trinity River, and Turtle Bayou. Figure 48 shows where the rivers and tributaries are located throughout the County

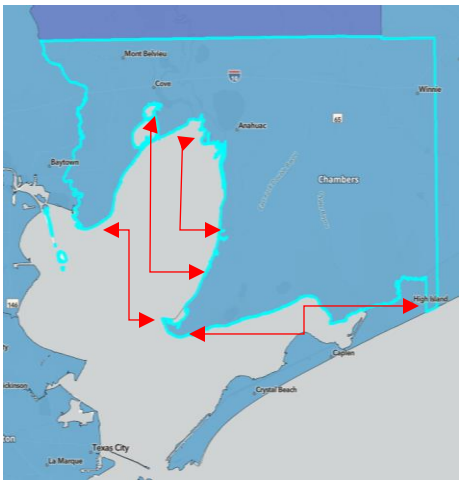
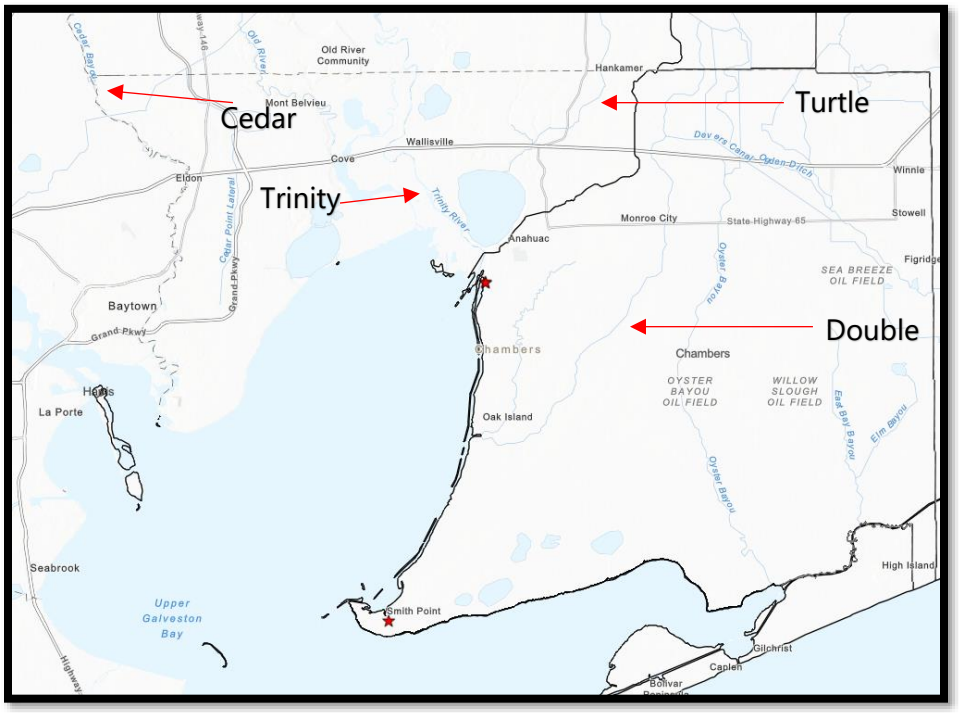


Figure 48 - Major Streams in Chambers County



Floodplains are the primary tool used by FEMA to determine areas at risk of flooding. The periodic flooding of lands adjacent to rivers, streams, and shorelines is a natural and inevitable occurrence that can be expected based upon established recurrence intervals. The recurrence interval of a flood is the average time interval, in years, that can be anticipated between flood events of a certain magnitude. Using the recurrence interval with land and precipitation modeling, forecasters can estimate the probability and likely location of flooding. These are expressed as floodplains.

The most used floodplain measurements are the 100-year floodplain and the 500-yearfloodplain. The 100-year floodplain has a 1 in 100 chance of flooding each year. The 500-year floodplain is estimated to have a 1 in 500 chance of occurring each year. Flood maps show areas subjected to the 1% chance flood and may include additional flood events such as 0.2% chance flood. Any place with a 1% chance or higher of experiencing a flood each year is mapped in a Special Flood Hazard Area (SFHA) and is considered to have a high risk. Those areas have at least a one-in-four chance of flooding during a 30-year mortgage. Homes and businesses in high-risk flood areas (1% annual chance) with government-backed mortgages are required to purchase and maintain flood insurance. In its 2023 Regional Flood Plan, Region 5 Neches Flood Planning Region, which includes Chambers County, reviewed the total land at risk (Annual Chance exceedance – ACE) by County for the 100 year (1%) and 500 year (.2%) as well as the future risk. While the document is under interim review and not to be used for construction, bidding or permit purposes, the information is helpful for planning purposes. Table 30 shows that the 1% area includes 203.33 acres that could flood from riverine flooding and 61.30 acres could flood from coastal flooding today. A review of future risk shows the same 1% now includes 310.09 acres could flood from riverine flooding and 61.16 acres from coastal flooding.

Table 30 - Total Land Area of Existing 1% ACE Flood Risk Type for Chambers County

(2023 Neches Regional Flood Plan, 05_RFP_Amend_Plan_Vol_1.pdf (dst.tx.us)_

County	Existing% (1% ACE or .2% ACE)	Total Riverine Flood Risk Area (sqmi)	Total Coastal Flood Risk Area (sqmi)	Total Local/Urban Flood Risk Area (sqmi)	Total Other Flood
Chambers	1%	203.33	61.30	0	0
Chambers	0.2%	310.09	61.30	0	0

Table 31 - Total Land Area of Future 1% ACE Flood Risk Type for Chambers County

05_RFP_Amend_Plan_Vol_1.pdf (dst.tx.us) Region 5 Neches RFPG

County	Future % (1% ACE or .2% ACE)	Total Riverine Flood Risk Area (sqmi)	Total Coastal Flood Risk Area (sqmi)	Total Local/Urban Flood Risk Area (sqmi)	Total Other Flood
Chambers	1%	310.09	61.16	0	0
Chambers	0.2%	339.97	61.16	0	0

The same report looked at structures located in the 100- and 500-year areas as well as flood prone areas. The following text box explains the map for Chambers County from the report in Figure 49. The 100-year area is colored blue, 500 is colored red and flood prone area is colored pink. Within the colors are dots that represent structures. There are three critical facilities located in these flood prone areas, 306 road crossings, and 409 roadway impacts.
There are over 2.5k residential and commercial structures. A further breakdown shows that 911 of those structures are in the 500 year, 1,200 are in the 100 year and 405 are in flood prone. The blue dots indicate structures have a social vulnerability less than.75 means lesser vulnerability and red is greater than .75 means greater vulnerability.

Figure 49 - 100- and 500-year Structure Locations

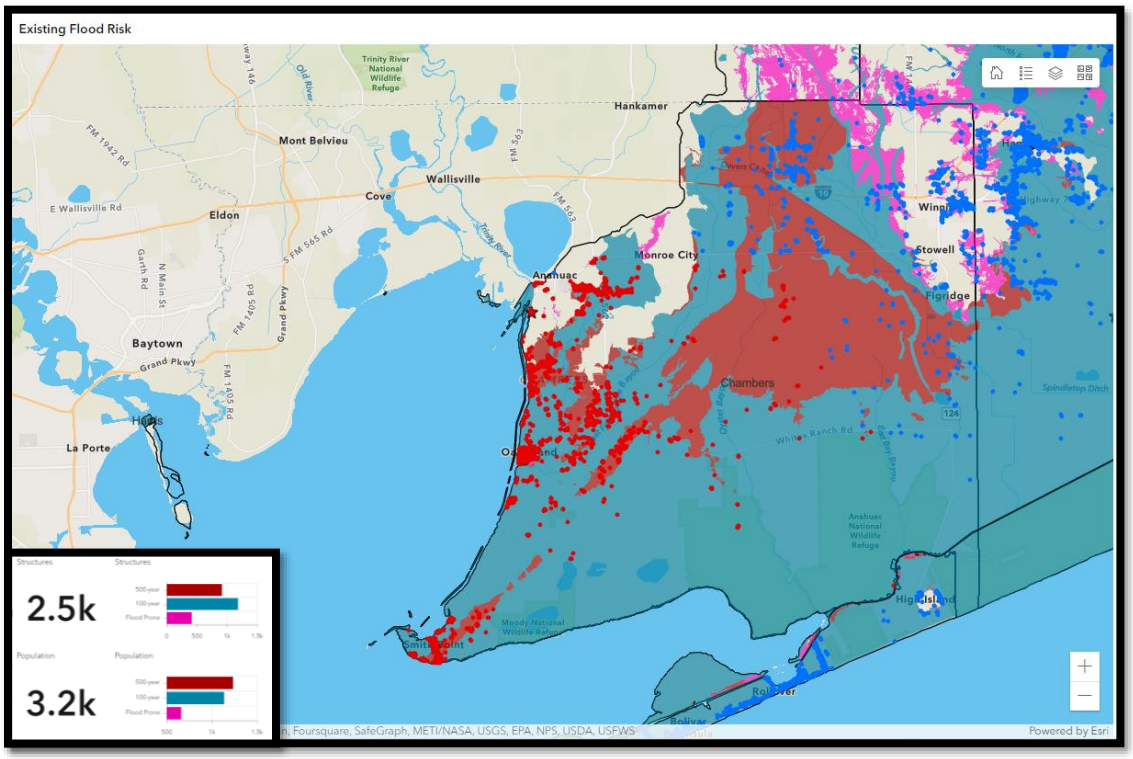
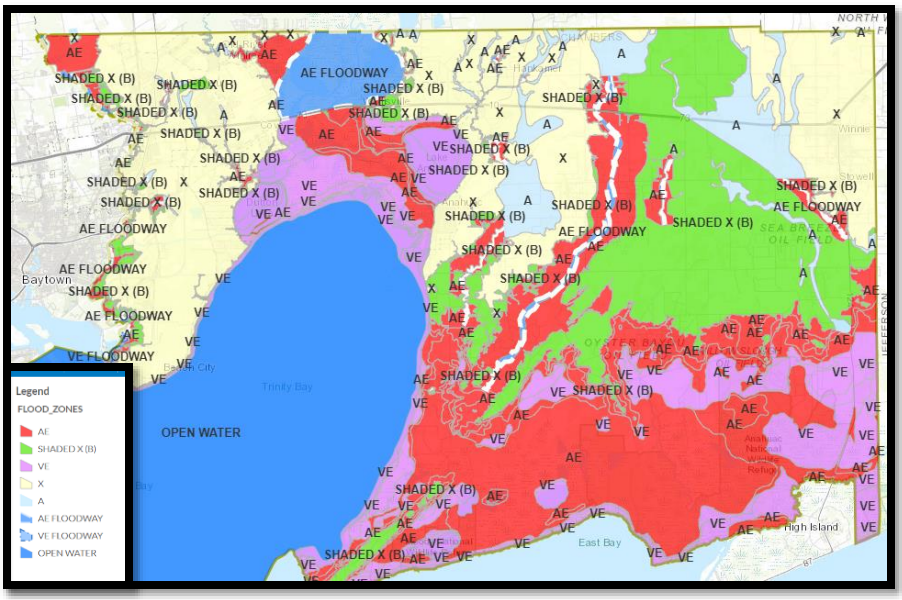


Figure 50 below shows the location of the different flood zones in Chambers County. Moderate to low-risk areas are in Zones B, C and X (shaded and unshaded). High risk non-coastal areas are in Zones A1-30, A, AE, AH, AO, AR and A99. High risk coastal areas are in Zones V, VE, V1-30. Undefined areas are Zone D. The State Hazard Mitigation Plan estimates approximately 25% of structures are in flood zones in Chambers County and approximately 10% of the population, see figures X and X.

Figure 50 - Chambers County Flood Zones

(CHAMBERS COUNTY PUBLIC INFORMATION 2021 (arcgis.com))



There are 3,903 policies in force throughout the County insuring structure and contents at a value of $1,285,450,000.00 with approximately 25% of the structures in the special flood hazard area (SFHA).

Figure 51 - Population in SFHA by County (Chambers County in red circle)

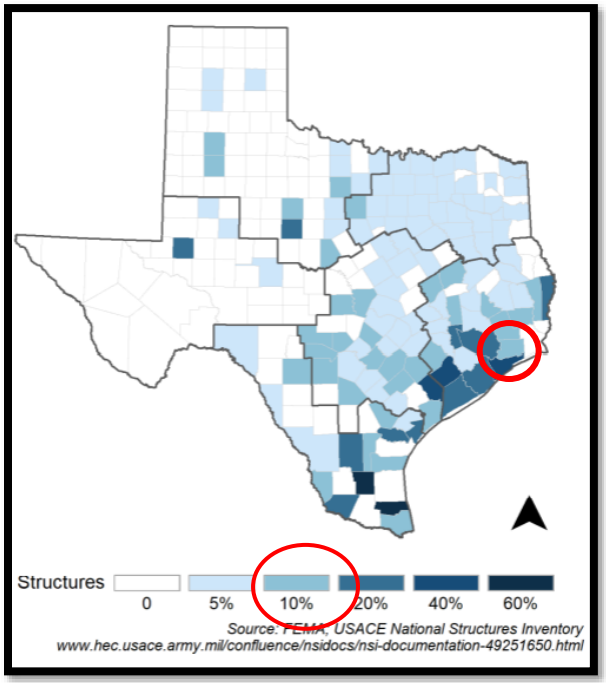
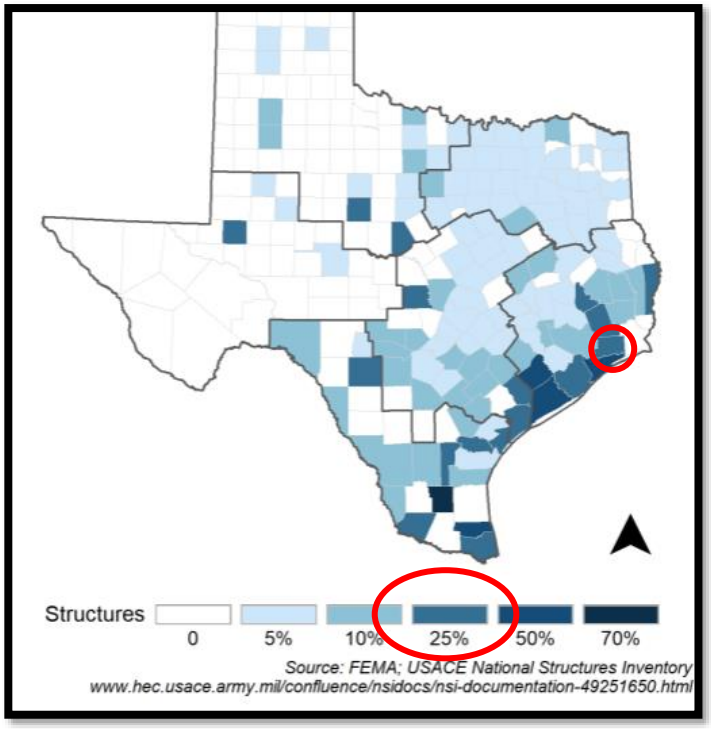


Figure 52 - Structures in SFHA by County (Chambers County in red circle)



Previous Occurrences

The NCEI Storm Events Database lists 31 flood events since 2000 in Chambers County. Table 32 summarizes those events and the reported damage. It appears that NCEI database is not accurately documenting all damage from flooding as almost all the over 80 million in damage since 2000 has come from a single event in 2019. The database had no recorded events for "flooding" hazard but had 31 for flash flood. For coastal storms it only had one, but under storm surge there also was one. The aforementioned were before 2010. Since 2017 when the previous plan was completed, only the Hurricane Imelda event in 2019 caused reported flood damage in Chambers County.

Table 32 - Floods in Chambers County from 1/1/2000 to 10/31/2023

(Coastal and Storm Surge)

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	125.00K	0.00K
COAST	CHAMBERS CO.	TX	10/05/1996	01:00	CST	Coastal Flood		0	0	0.00K	0.00K
COAST	CHAMBERS (ZONE)	TX	11/16/1996	14:00	CST	Coastal Flood		0	0	100.00K	0.00K
CHAMBERS (ZONE)	CHAMBERS (ZONE)	TX	04/25/1997	12:47	CST	Coastal Flood		0	0	25.00K	0.00K
CHAMBERS (ZONE)	CHAMBERS (ZONE)	TX	10/16/2006	06:00	CST-6	Coastal Flood		0	0	0.00K	0.00K
Totals:								0	0	125.00K	0.00K

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	300.000M	0.00K
CHAMBERS (ZONE)	CHAMBERS (ZONE)	TX	09/12/2008	08:00	CST-6	Storm Surge/tide		0	0	300.000M	0.00K
Totals:								0	0	300.000M	0.00K

Table 33 - Floods in Chambers County from 1/1/2000 to 10/31/2023

(Source: NCEI Database)

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	80.312M	0.00K
WEST CENTRAL PORTION	CHAMBERS CO.	TX	05/20/2000	02:30	CST	Flash Flood		0	0	50.00K	0.00K
NORTH PORTION	CHAMBERS CO.	TX	06/08/2001	04:30	CST	Flash Flood		0	0	0.00K	0.00K
NORTH PORTION	CHAMBERS CO.	TX	06/09/2001	12:30	CST	Flash Flood		0	0	0.00K	0.00K
COUNTYWIDE	CHAMBERS CO.	TX	11/05/2002	01:30	CST	Flash Flood		0	0	25.00K	0.00K
EAST PORTION	CHAMBERS CO.	TX	12/04/2002	06:50	CST	Flash Flood		0	0	9.00K	0.00K
MONT BELVIEU	CHAMBERS CO.	TX	03/13/2003	12:50	CST	Flash Flood		0	0	5.00K	0.00K
WINNIE	CHAMBERS CO.	TX	08/31/2003	11:55	CST	Flash Flood		0	0	3.00K	0.00K
SMITH PT	CHAMBERS CO.	TX	08/31/2003	11:55	CST	Flash Flood		0	0	3.00K	0.00K
EAST PORTION	CHAMBERS CO.	TX	09/01/2003	07:15	CST	Flash Flood		0	0	3.00K	0.00K
MONT BELVIEU	CHAMBERS CO.	TX	06/23/2004	20:40	CST	Flash Flood		0	0	25.00K	0.00K
WINNIE	CHAMBERS CO.	TX	06/25/2004	06:15	CST	Flash Flood		0	0	10.00K	0.00K
WINNIE	CHAMBERS CO.	TX	05/29/2006	03:00	CST	Flash Flood		0	0	50.00K	0.00K
STOWELL	CHAMBERS CO.	TX	07/06/2007	10:50	CST-6	Flash Flood		0	0	40.00K	0.00K
HANKAMER	CHAMBERS CO.	TX	08/05/2008	07:30	CST-6	Flash Flood		0	0	5.00K	0.00K
WALLISVILLE	CHAMBERS CO.	TX	04/24/2009	22:00	CST-6	Flash Flood		0	0	1.00K	0.00K
WINNIE	CHAMBERS CO.	TX	03/21/2015	16:30	CST-6	Flash Flood		0	0	15.00K	0.00K
MONT BELVIEU	CHAMBERS CO.	TX	06/04/2016	15:00	CST-6	Flash Flood		0	0	10.00K	0.00K
WINNIE	CHAMBERS CO.	TX	12/03/2016	13:00	CST-6	Flash Flood		0	0	5.00K	0.00K
MONT BELVIEU	CHAMBERS CO.	TX	03/29/2017	14:15	CST-6	Flash Flood		0	0	0.00K	0.00K
STOWELL	CHAMBERS CO.	TX	06/04/2017	08:50	CST-6	Flash Flood		0	0	3.00K	0.00K
BEACH CITY	CHAMBERS CO.	TX	08/27/2017	03:45	CST-6	Flash Flood		0	0	0.00K	0.00K
MONT BELVIEU	CHAMBERS CO.	TX	08/27/2017	13:00	CST-6	Flash Flood		0	0	0.00K	0.00K
MONT BELVIEU	CHAMBERS CO.	TX	08/28/2017	00:30	CST-6	Flash Flood		0	0	0.00K	0.00K
HANKAMER	CHAMBERS CO.	TX	08/28/2017	10:45	CST-6	Flash Flood		0	0	0.00K	0.00K
ANAHUAC	CHAMBERS CO.	TX	08/28/2017	12:15	CST-6	Flash Flood		0	0	0.00K	0.00K
HANKAMER	CHAMBERS CO.	TX	08/29/2017	14:25	CST-6	Flash Flood		0	0	0.00K	0.00K
MONROE CITY	CHAMBERS CO.	TX	08/29/2017	17:14	CST-6	Flash Flood		0	0	0.00K	0.00K
HANKAMER	CHAMBERS CO.	TX	09/18/2019	18:24	CST-6	Flash Flood		0	0	0.00K	0.00K
WINNIE	CHAMBERS CO.	TX	09/18/2019	22:45	CST-6	Flash Flood		0	0	50.00K	0.00K
LAKE ANAHUAC	CHAMBERS CO.	TX	09/19/2019	01:00	CST-6	Flash Flood		0	0	80.000M	0.00K
WINNIE	CHAMBERS CO.	TX	09/19/2019	01:42	CST-6	Flash Flood		0	0	0.00K	0.00K
Totals:								0	0	80.312M	0.00K

Future Occurrences

Based on the NCEI Storm Events Database, there were 31 flash flood events in Chambers County over the last 23 years. That equals about 1.35 events per year. For Coastal flooding, there were five events in the last 30 years which equates to 1 event every 6 years.

Category	Description
Minor Flooding	Minimal or no property damage, but possibly some public threat or inconvenience
Moderate Flooding	Some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary.
Major Flooding	Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.
Record Flooding	Flooding which equals or exceeds the highest stage or discharge observed at a given site during the period of record.

Extent

Flooding causes widespread and varying degrees of damage. The severity of a flood event is determined by a combination of stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and the degree of vegetative clearing. The principal factors affecting flood damage are flood depth and velocity. The deeper and faster flood flows become, the more damage they can cause.
Shallow flooding with high velocities can cause as much damage as deep flooding with slow. For Chambers County, floods are and continue to be the most frequent, destructive, and costly natural hazard facing the planning area. Once a river reaches flood stage (an established gauge height for a specific location, when the water surface level rises above the height it begins to create a hazard to lives, property, or commerce), the National Weather Service utilizes flood categories in describing the severity of a flood event in the corresponding river reach. The categories shown in the 2023 Texas Hazard Mitigation Plan are shown here. Flood severity is unique to each stream or river reach and is influenced by several conditions including, but not limited to, levels of precipitation, topography, ground saturation, duration of events and upstream conditions.

These conditions are monitored by rain gauges which measure rainfall amounts and monitor water levels in major streams and bayous on a real-time basis. Chambers County is monitored by rain gauges run by Harris County Flood Control District (HCFCD) for the northern and western part of the County, Trinity Bay Conservation District (TBCD) for central and eastern part of the County and Jefferson County Drainage District No. 6 (JCDD6) for the easternmost part of the County. Rain gauges are monitored for water levels, inundation levels and rainfall totals. TBCD rain gauges are in the following map shown in Figure 53. The severity of a flood depends not only on the amount of water that accumulates in a period but also the ability of the land to manage the water. Therefore, a worst-case scenario for Chambers County is a storm that releases a historic level of rainfall, causing the streams to be designated as record flooding by the NWS.

Figure 53 - TBCD Rain Gages

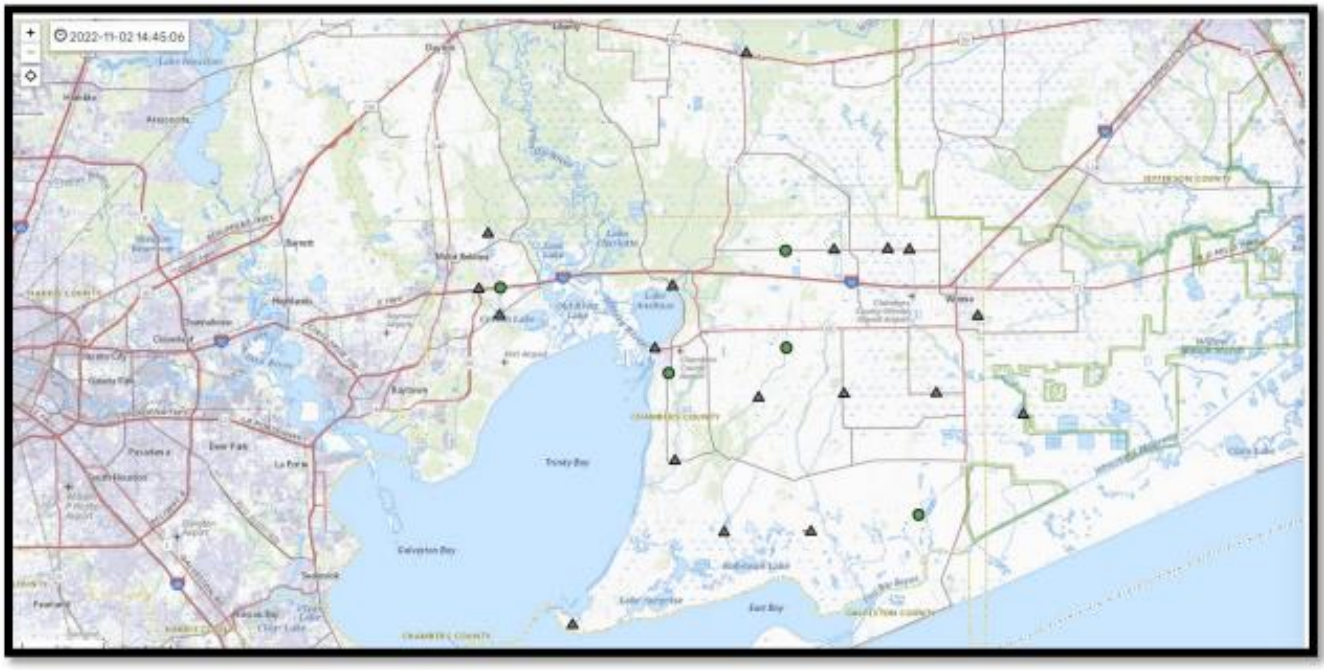


Figure 54 from the HCFCD Alert System describes the type of data/maps that can be derived to help community officials and the public understand rainfall over a specified timeframe, inundation, and flood risk in a particular area, a city or even at street-level detail. It can show inundation at various levels (e.g. gauge location, street, City) and, as described previously, residents can register for alerts if flooding is likely or possible as well as water level and rainfall for one or more-gauge locations.

Figure 54 - HCFCD 100 Clear Lake @SH 146 Elevation Data

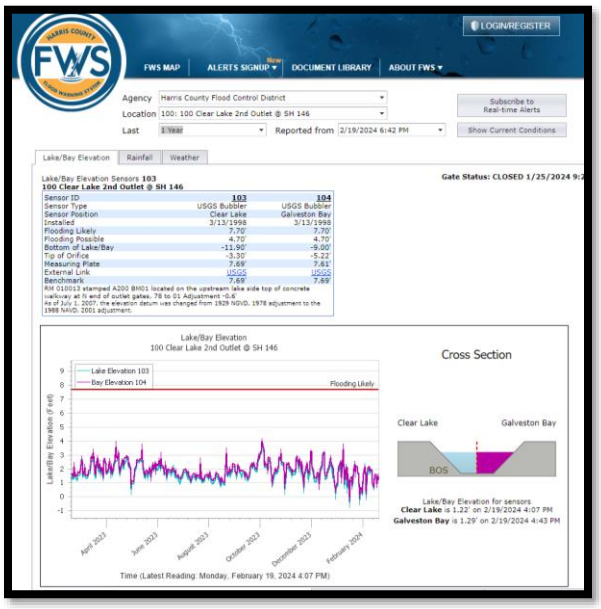
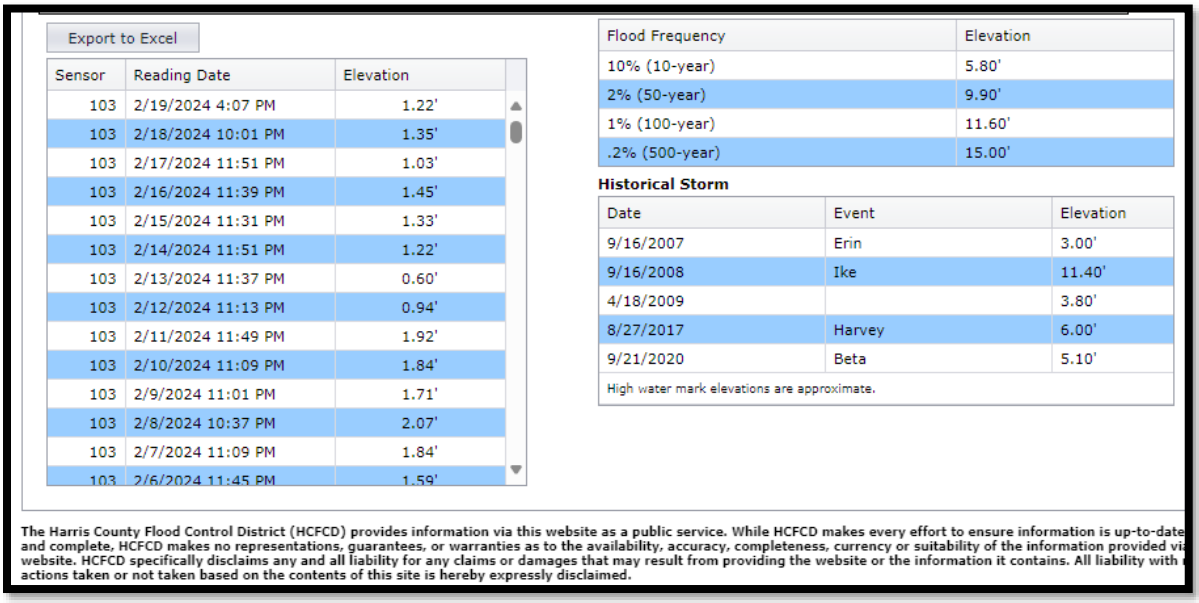


Figure 55 - HCFCD 100 Clear Lake @SH 146 Elevation Data



Export to Excel

Sensor	Reading Date	Elevation
103	2/19/2024 4:07 PM	1.22'
103	2/18/2024 10:01 PM	1.35'
103	2/17/2024 11:51 PM	1.03'
103	2/16/2024 11:39 PM	1.45'
103	2/15/2024 11:31 PM	1.33'
103	2/14/2024 11:51 PM	1.22'
103	2/13/2024 11:37 PM	0.60'
103	2/12/2024 11:13 PM	0.94'
103	2/11/2024 11:49 PM	1.92'
103	2/10/2024 11:09 PM	1.84'
103	2/9/2024 11:01 PM	1.71'
103	2/8/2024 10:37 PM	2.07'
103	2/7/2024 11:09 PM	1.84'
103	2/6/2024 11:45 PM	1.59'

Flood Frequency	Elevation
10% (10-year)	5.80'
2% (50-year)	9.90'
1% (100-year)	11.60'
.2% (500-year)	15.00'

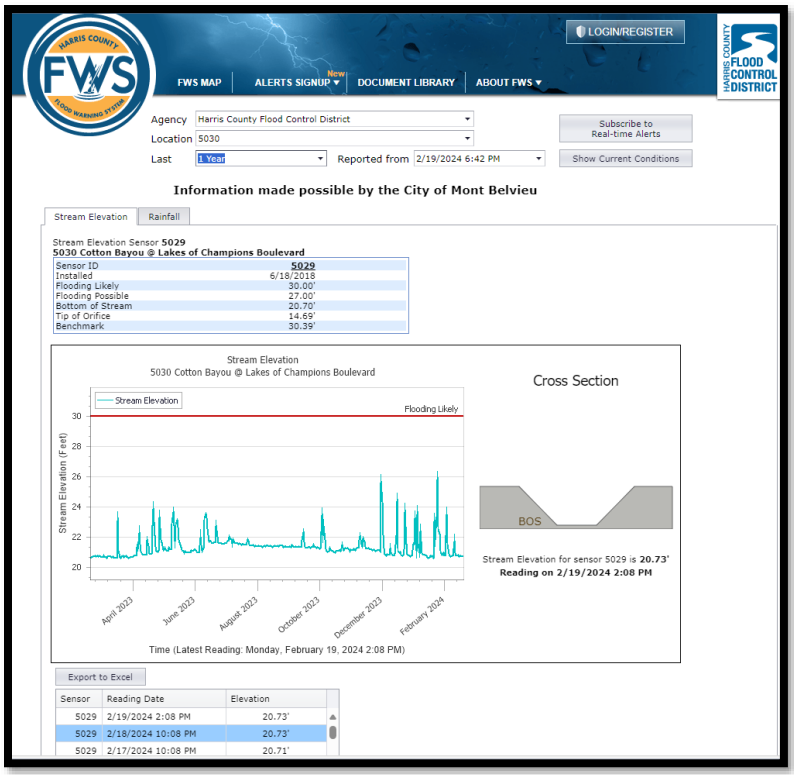
Historical Storm

Date	Event	Elevation
9/16/2007	Erin	3.00'
9/16/2008	Ike	11.40'
4/18/2009		3.80'
8/27/2017	Harvey	6.00'
9/21/2020	Beta	5.10'

High water mark elevations are approximate.

The Harris County Flood Control District (HCFCD) provides information via this website as a public service. While HCFCD makes every effort to ensure information is up-to-date and complete, HCFCD makes no representations, guarantees, or warranties as to the availability, accuracy, completeness, currency or suitability of the information provided via website. HCFCD specifically disclaims any and all liability for any claims or damages that may result from providing the website or the information it contains. All liability with actions taken or not taken based on the contents of this site is hereby expressly disclaimed.

Figure 56 - HCFCD 100 Clear Lake @SH 146 Elevation Data



Impact

Flooding impacts people, property, and infrastructure. Coastal flooding impact includes but are not limited to temporary and permanent displacement of residents and businesses, loss of life, widespread power outages, long-term limited mobility for residents and responders, and long-term closure or limited functionality of critical infrastructure facilities including hospitals and industrial facilities. Impacts on the planning area due to riverine flooding include but are not limited to temporary and permanent displacement of residents and businesses, limited mobility for residents and responders, loss of life, utility and power outages, and temporary closure of critical infrastructure facilities. Environmental impacts also occur due to chemicals and other hazardous materials contaminating water bodies.

People

While flooding can impact the entire County, the areas at greatest risk are the ones located within the Special Flood Hazard Areas (SHFA) of the County. The 2023 State of Texas Hazard Mitigation Plan indicated that 10% of the population in Chambers County are in a SHFA area. Therefore, according to the US Census Estimate of 51,288 total population, approximately 5,128 people are at greatest risk. Table 34 provides the breakdown by community.

Table 34 - Percent of Population within a SHFA in Chambers County

	2022 Population	10% Population SHFA
Chambers County	51,288.00	5,128.80
Anahuac	1,967.00	196.70
Beach City	3,229.00	322.90
Cove	528.00	52.80
Mont Belvieu	8,547.00	854.70
Old River-Winfree	1,359.00	135.90

Property

The following tables quantify residential and commercial buildings in Chambers County.

Table 35 - Residential Units within Chambers County

(2022 Chambers County Appraisal District Annual Report)

Type	Number of Structures
Total Housing Units (Cat A and B parcels)	16,808

Type	Number of Structures
Mobile/Manufactured Homes (Cat M parcels)	1,170
Occupied Housing Unit rate (US Census 2018-2022 Quick facts)	83.7%

Table 36 - Commercial and Public Units within Chambers County
(2022 Chambers County Appraisal District Annual Report)

Type	Number of Structures
Commercial and Industrial (Cat E) parcels	1,650
Public Buildings	27

There are two groups of properties at greatest risk of flooding in Chambers County: structures located in the SHFA, and structures designated as Repetitive Loss (RL) and Severe Repetitive Loss (SRL) properties. The 2023 State of Texas Hazard Mitigation Plan indicated that 25% of the structures in Chambers County are in a SHFA area. Using the building information from Tables 35 and 36 total 19,628 parcels of which 25% is 4,907 within the SFHA area.

Data provided by FEMA NFIP Data and Analytics indicates that for Chambers County as of 2022, 3,903 federal flood insurance policies were in-force, with 1,157 paid claims since 1979 at a value of $68,221,183.00. These insurance policies are administered by the National Flood Insurance Program (NFIP). Flood insurance policies and claims information can be used to identify buildings in mapped floodplains (where lenders require insurance) and where flooding has occurred (where owners are sufficiently concerned that they purchase flood insurance even if not required).

Appendix B of the State of Texas 2023 Hazard Mitigation Plan contains data for Repetitive Loss (RL) and Severe Repetitive Loss (SRL) properties by County, including the total payments, number of losses and number of properties as shown in Table 37. It shows that there are 198 RL properties and 40 SRL properties.

Table 37 - SRL and RL Properties as of October 2022 (Texas Water Development Board)

County	No. of RL Proper-ties	No. of Total RL Losses	Total RL Payments	No. of SRL Proper-ties	No. of Total SRL Losses	Total SRL Payments
Chambers	**198**	**490**	**$ 33,893,960.00**	**40**	**117**	**$ 11,370,412.00**

Looking at the detailed data though, several of the RL and SRL properties were for Baytown. Also looking only at FMA SRL and RL properties reduces that number as well. Removing those

properties, Chambers County has 40 RL properties and 24 SRL properties. Table 38 shows the aggregate by jurisdiction and included NFIP Insured policies (not an FMA RL or FMA SRL but may have had a claim) and non-insured numbers.

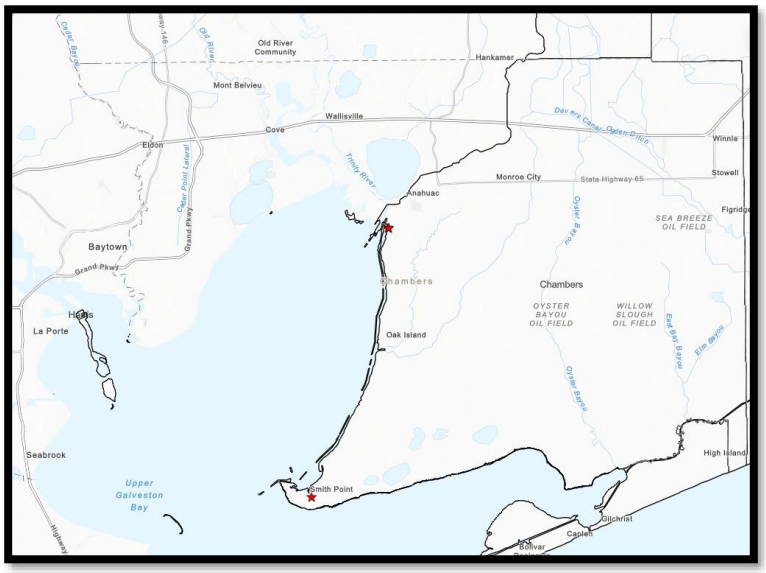
Table 38 - SRL and RL Properties as of October 2023 Aggregate Data

Jurisdiction	Total Repetitive Loss Record	NFIP Insured	FMA SRL	FMA RL	Non-Insured
Unincorporated Chambers County	111	90	22	33	2
Anahuac	27	14	2	7	4
Beach City	1	0	0	0	1
Cove	1	0	0	0	1
Mont Belvieu	0	0	0	0	1
Old River-Winfree	0	0	0	0	0
Total	140	104	24	40	9

The 2023 Neches Regional Flood Plan also aggregated critical facilities that are in SHFA area. Figure 57 indicates that Chambers County has one emergency building and two buildings that are medical and are depicted by the red star. Structures under the "Medical" category include hospitals in addition to assisted care facilities and nursing homes.

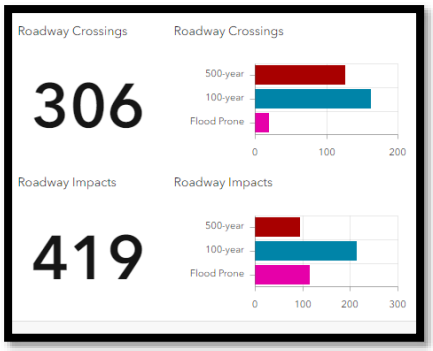
Figure 57 - Summary of Critical Facility Exposure for Chambers County and Map

County	Emergency	Infrastructure	Medical	School	Total
Anderson	0	0	1	0	**1**
Angelina	2	0	3	17	**22**
Chambers	1	0	2	0	**3**



Infrastructure

Roads. The 2023 Neches Regional Flood Study also looked at infrastructure like roads and utilities to understand the impact from flooding. TxDOT roadway data was provided so that exposure analysis could be completed. The number of stream crossings were analyzed with the total length of the roadway in miles inundated during a flood event. All points of intersection between streams and roads exposed to the 100 year and 500 were considered exposure points. For Chambers County, there were 161 roadway crossings in the 100 year and 126 in the 500 year. 19 were in the flood prone area.



Some of the most immediate and significant impacts of flooding are related to transportation and emergency services. Inundated roadways block the flow of people seeking to evacuate a flooded area; depending on flood severity, high water levels can render traditional methods of transportation such as automobiles and buses infeasible due to risk of drowning. Flooding can also delay or entirely prevent emergency services from reaching people in need of help. Depending on the severity of conditions, this can lead to further loss of life.

Water and Wastewater Treatment. Water and wastewater treatment plants can be impacted by flood events as these facilities are often located along water courses for discharging treated water. If these facilities are not protected from flood events, the impact on nearby communities' water supply and water quality can be devastating. The lives of nearby residents can be disrupted as they receive notices to limit water usage, and the potential of people being exposed to raw sewage overflows can cause illnesses and a significant amount of time and resources to eliminate the contamination.

Utilities. Flood events can damage power lines and other electricity distribution infrastructure. Roadway inundation often hinders the swift repair of damaged equipment, and a prolonged lack of electricity in a community will significantly magnify all the impacts previously discussed. Energy generation in the Neches River Basin is an important part of both the local, state, and national economy. Historical flood events in the basin and along the Gulf Coast have been shown to have significant impacts on oil and gas production and distribution. Potential failure of power generation plants due to flooding can cause direct losses including having to replace damaged equipment in addition to surrounding facilities losing power. For example, cities and counties may depend on local refineries to provide fuel necessary to operate emergency vehicles and stormwater pumps.

Agriculture. The US Environmental Protection Agency (EPA) writes, "Because agriculture relies on the weather, climate, and water availability to thrive, it is easily impacted by natural events…including contamination of water bodies, loss of harvest or livestock, increased

susceptibility to disease, and destruction of irrigation systems and other agricultural infrastructure." (Agriculture and Natural Events and Disasters | US EPA)

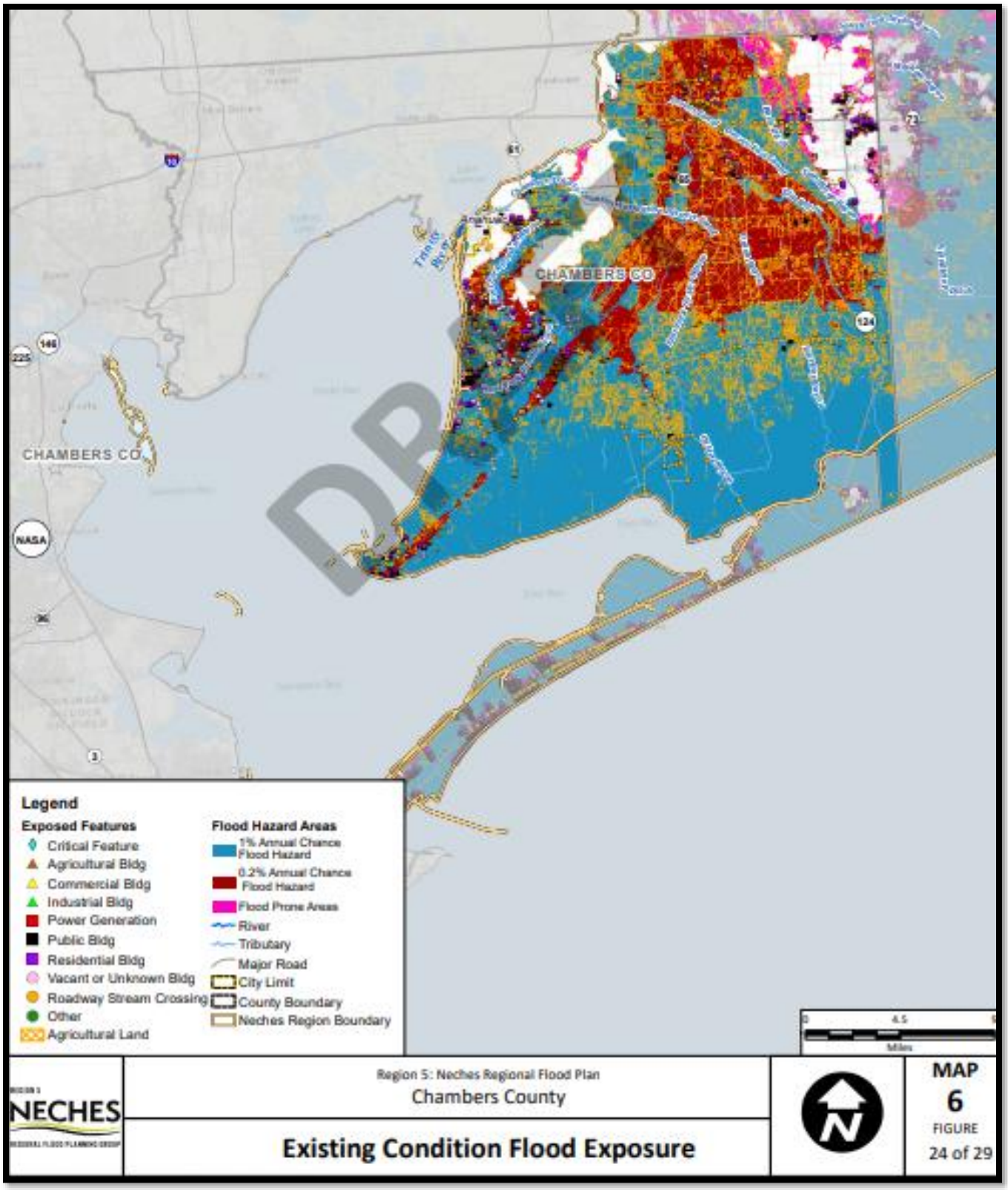
The Region 5 Neches 2023 Regional Flood Plan (Region 5 RFP) provided the total crop damage by County as Figure 58 shows from that plan, multiple years of losses were very costly to Chambers County.

Figure 58 - Total Crop Damage Value for Chambers County
(2023 Neches Regional Flood Plan)

County	Years of Loss	Indemnity Amount
Anderson	2011, 2015	$28,873.03
Chambers	2003, 2005, 2007, 2008, 2017, 2018, 2019, 2020	$7,733,789.79
Galveston	2005, 2017, 2018	$162,921.00

The Region 5 RFP also prepared a map that shows exposed features in the flood hazard areas and is provided in Figure 59.

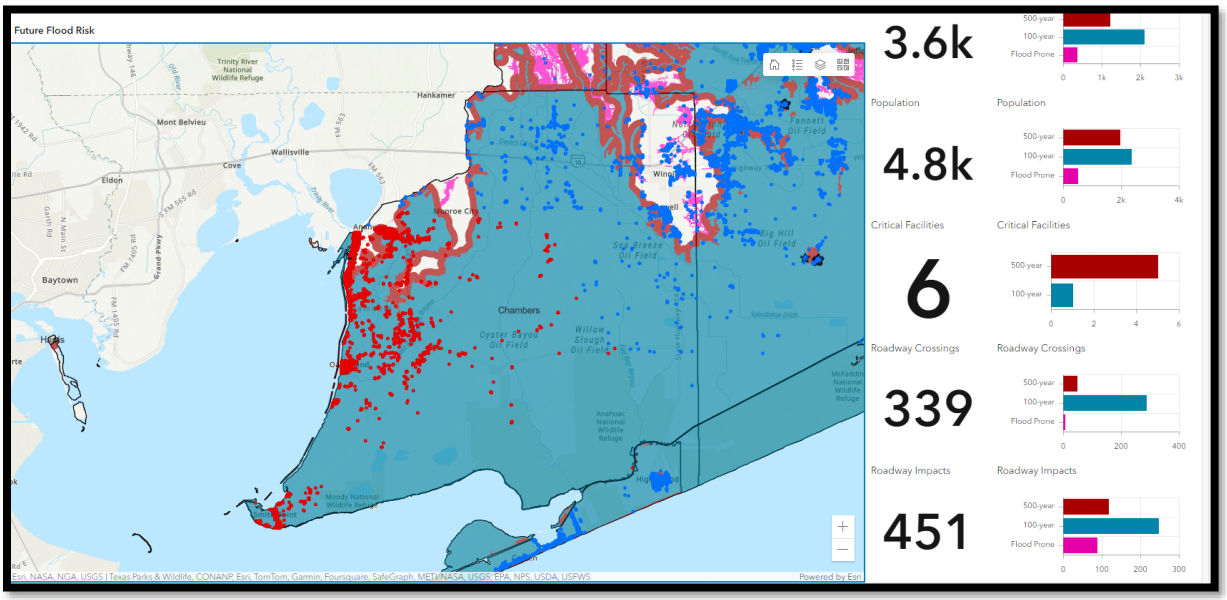
Figure 59 - Existing Conditions Flood Exposure for Chambers County
(2023 Neches Regional Flood Plan)



Effect of Climate Change on Flooding

The risk of flooding may intensify because of climate change. As the temperature of water rises, it often heightens the likelihood of hurricanes. Frequently, hurricane events coincide with the most severe flooding incidents. The Neches Regional Flood Plan also analyzed future condition flood hazard analysis. The analysis, shown in Figure 60 suggests future flooding will increase the risk for people, structures and infrastructure.

Figure 6o - Existing Conditions Flood Exposure for Chambers County
(2023 Neches Regional Flood Plan)



Social Vulnerability

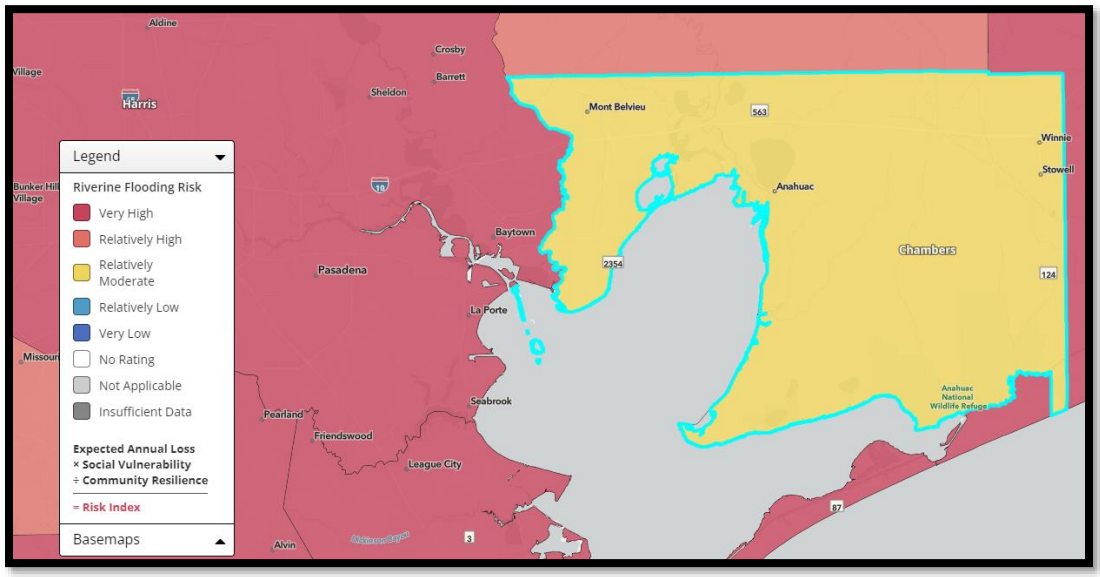
Social vulnerability is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

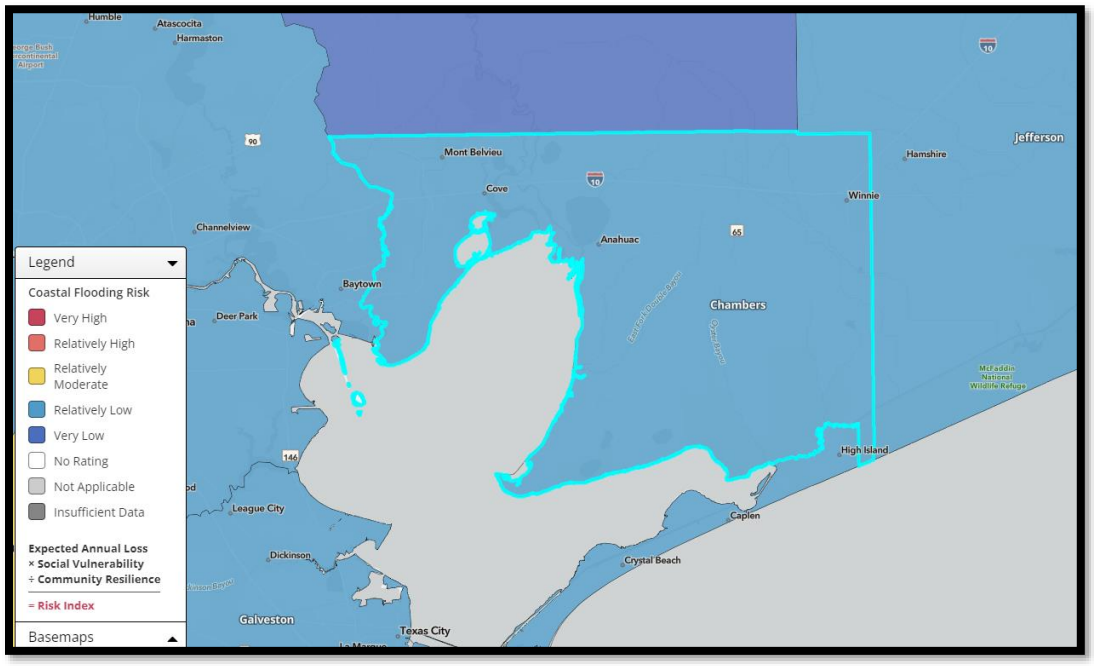
Flood events can be particularly dangerous to vulnerable groups such as the elderly, low-income individuals, individuals with health issues, and the homeless. In many cases, these individuals may reside in areas that are more susceptible to flooding as well as potentially live in a less reinforced home like a mobile home. These groups also are more likely to need extra time to evacuate or need assistance to evacuate during a flood.

Overall Vulnerability

Structures that are identified as Repetitive Loss or Severe Repetitive Loss are at the highest risk of damage from flooding. These structures are documented to have been impacted by multiple

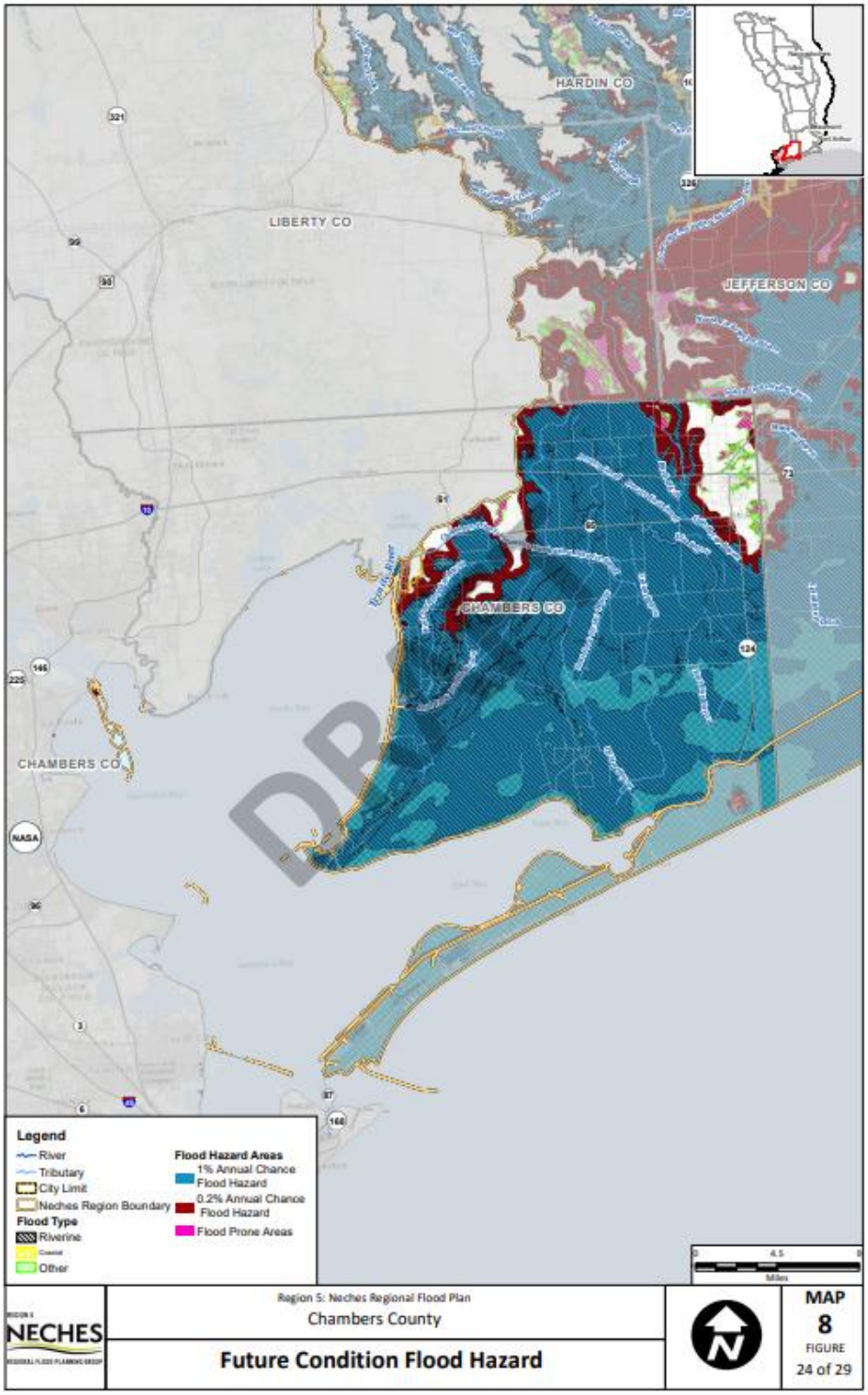
flood events. Homeowners that live in these structures are also highly vulnerable to injury or death during a flood event. In the planning area, assets such as wastewater treatment plant, lift stations, water tower, administrative offices, and parks are all also vulnerable to damage from flooding. The National Risk Index shows flood – riverine as a relatively moderate risk (93.8 national percentile) and relatively moderate (92.8 national percentile) in expected annual loss. This index estimates a 4.6 million dollar expected annual loss. It shows flood – coastal as relatively low (60.4 national percentile) and relatively low (59.7 national percentile) in expected loss with a $240,000 in expected annual loss.





The Neches Regional Flood Plan also analyzed future condition flood hazard analysis.

Figure 61 - Future Conditions Flood Exposure for Chambers County
(2023 Neches Regional Flood Plan)



Freezes/Extreme Cold

Update from last plan

- Freezes and extreme cold were not profiled in the previous plan.

Hazard Description

According to the National Weather Services, extreme cold/freezing in the Southern United States is considered any temperature below 32 degrees Fahrenheit. Wind chill plays a part in extreme cold as well. Wind chill is used to describe how the rate of heat loss in the body results from a combination of low temperature and the wind. The more wind there is the quicker heat is carried away from the body. This causes the effects of the extreme cold to become more severe.

Location

Due to the nature of extreme cold/freezing the entire planning area will be affected at the same rate.

Previous Occurrences

According to the NOAA NCEI database, extreme cold and windchill are reported on a county basis. The NCEI database reports 0 extreme cold events in the last 20 years.

Future Occurrences

Since there were no reported extreme cold events in the last 20 years, the MPC reviewed how many occurrences Chambers County's temperature was at or below 32 degrees. Extreme Weather watch tracks that data and the closest city near the planning are that it tracks is Houston. Figure 62 shows how many days a year since the last plan, Houston was less than 32-degree F. For the last seven years, the average number of days below 32 degrees is 3.86 days.

Figure 62 - Number of Days Below 32°F in Houston by Year

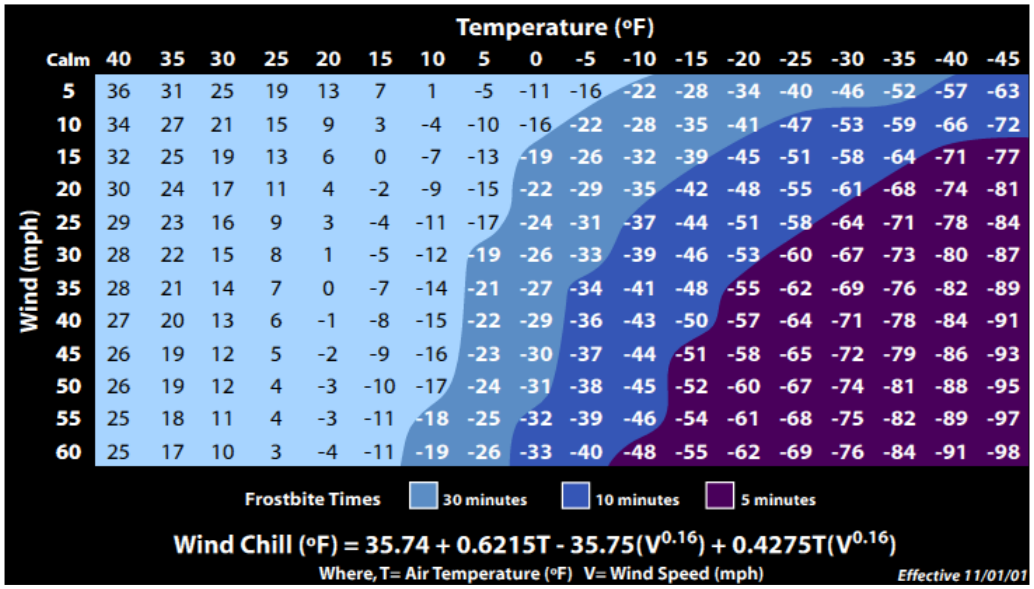
Number of Days Below 32 °F in Houston by Year (extremeweatherwatch.com)

Year	Rank	Days < 32 °F
2024	97	3
2023	127	0
2022	31	10
2021	69	6
2020	127	0
2019	109	1
2018	56	7

Extent

The National Weather Service has created a chart to document temperature and wind speed. Ultimately this creates a wind chill value based on the two. The NWS was able to calculate how long it would take a person to be frostbitten based on the wind chill.

Figure 63 - Wind Chill Chart from the NWS



Impact

Extreme cold events and ultimately severe wind chill can cause frostbite to people. Frostbite causes damage to body tissue and can cause loss of feeling in extremities. The NWS suggests getting inside to a warm area if a person starts to feel these symptoms during an extreme cold event.

Extreme cold events can also cause hypothermia, which is when the body temperature drops below 95 degrees Fahrenheit. Hypothermia is extremely serious and can be deadly. If a person survives, they can still have lasting damage to their internal organs. Typical signs of hypothermia include exhaustion, slurred speech, shivering, and memory loss.

Effect of Climate Change on Freezes/Extreme Cold

The probability of freezing and extreme cold events in the planning area might be impacted by a changing climate. Some evidence suggests that while climate change leads to warmer and longer summers, it could also result in more severe cold during winter months. Being ready for the effects of freeze events in Chambers County is crucial, particularly as most residents are unaccustomed to dealing with such temperatures.

Social Vulnerability

Social vulnerability is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

The groups most susceptible to negative effects of freezes and extreme cold are the homeless as well as those that are low-income. These groups may not have the ability to stay warm during these freezing temperatures which can cause effects such as frostbite or hypothermia.

Overall Vulnerability

The overall vulnerability of extreme cold and freezes is relatively low. This is mainly due to the climate in Chambers County having a low chance of extended freezing temperatures. Typically, when there are sub-freezing temperatures, they last for a short period of time.

The National Risk Index shows freezes and extreme cold are relatively moderate risk (64.2 national percentile) and relatively moderate (65.0 national percentile) in expected annual loss. This index $139 thousand dollar expected annual loss.

Future Changes that May Impact Vulnerability

Understanding future changes that affect vulnerability in the Planning Area can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

• Potential or projected development - Increased new development should not be impacted as much as older buildings as building codes and standards help mitigate that risk.

• Projected changes in population - An increase in the population does expose more people to extreme cold/freezes.

Hail

Update from last plan

Events since 2017 were updated and described.

Hazard Description

Hailstorms are a type of severe thunderstorm that can cause significant damage. During the formation of a hailstorm, ice crystals begin to develop within a low-pressure front as warm air rises rapidly into the upper atmosphere and cools down. These frozen droplets gradually gather and accumulate into ice crystals until they become precipitation. Hailstones are typically round or irregularly shaped masses of ice that are greater than 0.75 inches in diameter. The size of the hailstones is directly influenced by the size and intensity of the storm itself. According to the NOAA National Severe Storms Laboratory, the fall speed of hailstones can range from 9-25 mph for small hailstones, up to 100 mph for large hailstones (4 inches or greater). In more severe and larger storms, hailstones can grow, posing greater risks to property, crops, and people.

Location

Hailstorms affect the entire planning area equally. All parts of the planning area have been affected by hailstorms at some point in the past.

Previous Occurrences

According to the National Centers for Environmental Information (NCEI) Storm Events database, there have been 14 hail events in the last 23 years totaling an estimated $143,000.00 in property damage (Table 39). It is important to note that NCEI database will typically only record cases with damage when it comes to hail events. However, there are likely many more events with hail in the area that go unreported. Since the 2017 plan was completed, there were no cases of hail damage reported to the NCEI database in Chambers County.

Table 39 - Hail events in Chambers County (1/1/2000 to 10/31/2023)

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	143.00K	0.00K
OAK ISLAND	CHAMBERS CO.	TX	04/02/2000	13:50	CST	Hail	0.75 in.	0	0	10.00K	0.00K
WINNIE	CHAMBERS CO.	TX	04/02/2000	14:00	CST	Hail	1.00 in.	0	0	10.00K	0.00K
WALLISVILLE	CHAMBERS CO.	TX	04/03/2000	02:44	CST	Hail	1.75 in.	0	0	15.00K	0.00K
WINNIE	CHAMBERS CO.	TX	04/16/2001	13:05	CST	Hail	1.00 in.	0	0	15.00K	0.00K
WINNIE	CHAMBERS CO.	TX	04/16/2001	13:20	CST	Hail	1.75 in.	0	0	20.00K	0.00K
MONT BELVIEU	CHAMBERS CO.	TX	04/16/2001	13:45	CST	Hail	0.75 in.	0	0	10.00K	0.00K
MONT BELVIEU	CHAMBERS CO.	TX	04/07/2003	12:05	CST	Hail	1.75 in.	0	0	7.00K	0.00K
ANAHUAC	CHAMBERS CO.	TX	04/10/2004	19:45	CST	Hail	0.75 in.	0	0	10.00K	0.00K
MONT BELVIEU	CHAMBERS CO.	TX	04/10/2004	20:00	CST	Hail	1.00 in.	0	0	15.00K	0.00K
WINNIE	CHAMBERS CO.	TX	04/24/2006	23:30	CST	Hail	1.75 in.	0	0	15.00K	0.00K
WINNIE	CHAMBERS CO.	TX	04/25/2006	23:30	CST	Hail	1.75 in.	0	0	15.00K	0.00K
ANAHUAC	CHAMBERS CO.	TX	02/12/2008	12:50	CST-6	Hail	0.75 in.	0	0	0.00K	0.00K
WINNIE	CHAMBERS CO.	TX	05/26/2011	00:18	CST-6	Hail	1.75 in.	0	0	1.00K	0.00K
WALLISVILLE	CHAMBERS CO.	TX	04/19/2015	18:48	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
Totals:								0	0	143.00K	0.00K

Future Occurrences

Based on historical frequency of hail events that have been reported in Chambers County, it would be expected that there would be 61% chance per year for a hail event.

Extent

Hailstorm intensity is measured by the size of the hail and the damage it may cause. NCEI database uses the TORRO Hailstorm Intensity Scale (Table 40). Using the data from Table 39 above, the intensity category for Chambers County would range from H0-H5 during the last 23 years. Many of the reported events were in the H3 to H5 category.

Table 40 - TORRO Hailstorm Intensity Scale

	Intensity category	Size (inches diameter)	Descriptive Category	Typical damage impacts
H0	Hard hail	Up to 0.33	Pea	No damage
H1	Potentially damaging	0.33 – 0.60	Marble	Slight general damage to plants, crops
H2	Significant	0.60 - 0.80	Dime	Significant damage to fruit, crops, vegetation
H3	Severe	0.80 – 1.20	Nickel	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	1.2 – 1.6	Quarter	Widespread glass damage, vehicle bodywork damage
H5	Destructive	1.6 – 2.0	Half Dollar	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	2.0 – 2.4	Ping Pong Ball	Bodywork of grounded aircraft dented; brick walls pitted

	Intensity category	Size (inches diameter)	Descriptive Category	Typical damage impacts
H7	Destructive	2.4 – 3.0	Golf Ball	Severe roof damage, risk of serious injuries
H8	Destructive	3.0 – 3.5	Hen Egg	(Severest recorded in the British Isles) Severe damage to aircraft bodywork
H9	Super Hailstorms	3.5 – 4.0	Tennis Bal	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	4.0+	Baseball	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Impact

Based on historical records from the NCEI database, the largest potential impact of hailstorms in the planning area would cause damage to glass and bodywork on vehicles. There is also a low chance of damage to buildings.

Effect of Climate Change on Hail

Climate change could cause future hailstorms to be more extensive and at a higher category level. It will be important to monitor the effects of hail in the planning area over the coming years to determine if a larger amount of resources need to be allocated in future plans to help mitigate losses from event.

Social Vulnerability

Social vulnerability is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Social vulnerability to hail could likely affect low-income individuals as well as those that rely on farming for their income more than other groups. For low-income individuals this is because they are more prone to not have a home without covered parking or a garage. Hailstorms in this

area are more likely to cause bodywork damage to vehicles. Farmers can be heavily affected by hailstorms as they could destroy their crop yields and in turn their income.

Overall Vulnerability

Due to the size of the hail that has occurred previously in the planning area, people are not highly vulnerable to hail events. As stated in the previous sections, most hailstorms in the County were only strong enough to cause damage to crops, and minor damage to weak structures.

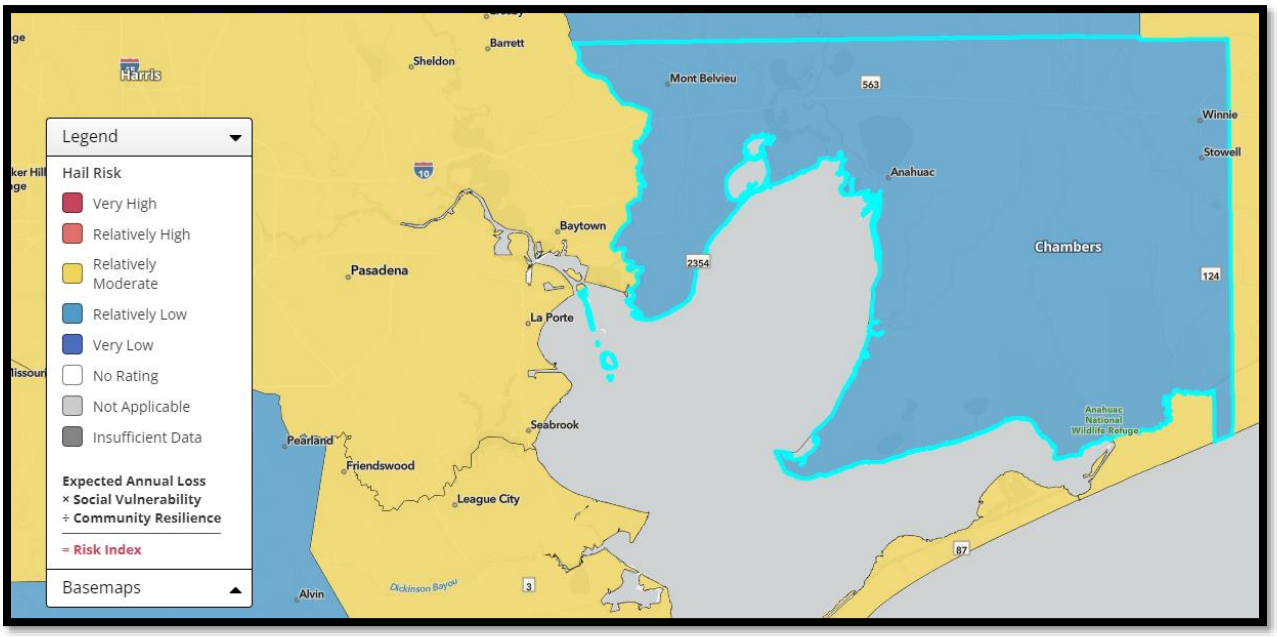
The National Risk Index shows hailstorms are relatively low risk (61.0 national percentile) and relatively low (62.9 national percentile) in expected annual loss. This index estimates a $158 thousand dollar expected annual loss.

Future Changes that May Impact Vulnerability

Understanding future changes that affect vulnerability in the Planning Area can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

• Potential or projected development - While building codes help mitigate hail damages, wood and masonry buildings tend to have more damage from hail than concrete or steel buildings. Manufactured homes are vulnerable as well, so the type of construction is important for development.

• Projected changes in population – Increase to the population also will expose more people to hailstorm events.



Hurricanes and Tropical Storms

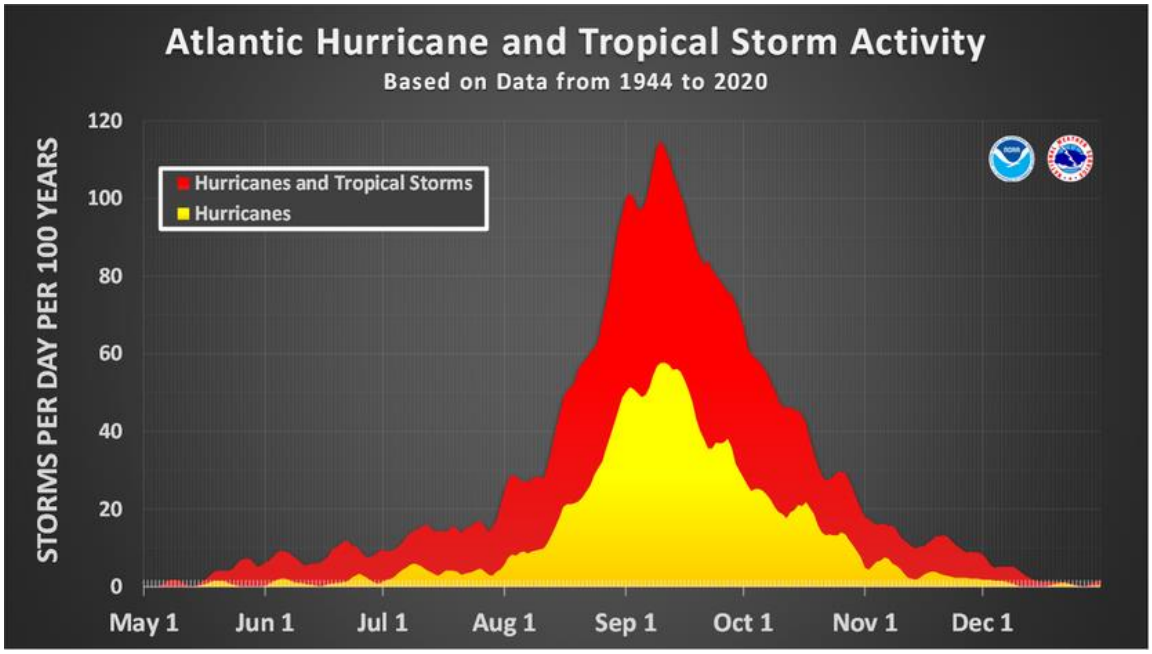
Update from last plan

Events since 2017 were updated and described.

Hazard Description

According to the National Hurricane Center, a tropical cyclone is a rotating, organized system of clouds and thunderstorms that originate over tropical or subtropical waters. There are 4 classifications: tropical depression, tropical storm, hurricane, major hurricane. These will be quantified in the extent section of this assessment.

Chambers County planning area is most susceptible to hurricane/tropical storms in the months of June to November, with August-October historically having the most activity.



Location

Due to Chambers County being located near the Gulf of Mexico, there is an immediate risk for hurricane/tropical storms in the entire planning area.

Previous Occurrences

According to the NOAA Historical Hurricane Tracks database, from 2003-2023 there have been 13 hurricane/tropical storms within a 75-mile radius of Chambers County as shown in Figure 64. The previous plan identified two other storms prior to 2003 (7/30/1989 Hurricane and 6/5/2001 Tropical Storm). The search area was set to 75-mile radius as even though the center of the

storm does not go over the planning area, the effects of the storm can often still be felt strongly. A perfect example is Hurricane Harvey in 2017. The NOAA Hurricane Tracks show that Harvey was barely in the 75-mile radius, however, that storm caused significant damage to the entire County. Since 2017 when the previous plan was completed, there have been 5 storms that affected Chambers County (Imelda 2019, Laura 2020, Beta 2020, Delta 2020, Nicholas 2021).

Figure 64 - Hurricane/Tropical Storm Tracks 2003-2023
(Source: NOAA Historical Hurricane Tracks)

Table 41 - Hurricane/Tropical Storms that Impacted Chambers County from 2003-2023

Storm Name	Date Range	Max Wind Speed (MPH)	Minimum Pressure (mb)	Category Max
Nicholas 2021	9/12/21 to 9/17/21	75	988	H1
Delta 2020	10/4/20 to 10/11/20	120	953	H4
Beta 2020	9/17/20 to 9/25/20	63	993	TS
Laura 2020	8/20/20 to 8/29/20	130	937	H4
Imelda 2019	9/17/19 to 9/19/19	46	1003	TS
Harvey 2017	8/16/17 to 9/2/17	132	937	H4
Cindy 2017	6/19/17 to 6/24/17	57	991	TS
Ike 2008	9/1/08 to 9/15/08	144	935	H4
Edouard 2008	8/3/08 to 8/6/08	63	996	TS
Humberto 2007	9/12/07 to 9/17/07	92	985	H1
Rita 2005	9/18/05 to 9/26/05	178	895	H5
Ivan 2004	9/2/04 to 9/24/04	166	910	H5
Grace 2003	8/30/03 to 9/2/03	40	1007	TS

It is important to note that the values in the above table are when each storm was at full strength and not necessarily the strength the storm was at point of causing impact to the planning area. Typically, the storm is at its greatest strength over the Gulf of Mexico and may quickly weaken once it reaches land.

Future Occurrences

Since there were 13 hurricane/tropical storms recorded by the NOAA Hurricane Track in the last 20 years, it could be expected that a hurricane/tropical storm would occur every 1.54 years on

average within a 75-mile radius of Chambers County. Therefore, there is a 65% chance of a hurricane/tropical storm event occurring with 75-miles of the planning area in any given year.

Extent

Table 42 overviews the Saffir/Simpson Hurricane Scale which is widely used to classify hurricanes by categories 1-5. The scale considers winds and the amount of damage that could be sustained by the storm. Category 1 is the lowest category of storm, while Category 5 is the strongest level storm. The entire planning area of Chambers County has potential to experience storm effects of all categories with 5 being the worst-case scenario.

Table 42 - Saffir/Simpson Hurricane Scale

Category	Pressure	Sustained Winds	Damage
1	> 980 mbar	74 - 95 mph	**Minimal**
2	965 – 979 mbar	96 - 110 mph	**Moderate**
3	945 – 964 mbar	111 – 130 mph	**Extensive**
4	920 – 944 mbar	131 – 155 mph	**Extreme**
5	< 920 mbar	> 155 mph	**Catastrophic**

Table 43 - Tropical Cyclone Classifications

Tropical Depression	**Maximum sustained wind speed is <39 mph**
Tropical Storm	**Maximum sustained wind speed ranges 39 - <74 mph**
Hurricane	**Maximum sustained surface wind speed 74 mph+**

Impact

The types of impacts that can be expected from hurricanes include but are not limited to: driving rain into buildings, resulting in water damage, downed trees, debris blocking roads, disrupted power lines, and damage to roofs and mobile homes. Hurricanes and tropical storms also bring heavy rains, causing nearby creeks to surpass their capacity and flood the surrounding area.

Effect of Climate Change on Hurricanes and Tropical Storms

Climate change may cause more frequent and powerful hurricanes. This is partly because hurricanes thrive on higher gulf temperatures. If the climate trends to being warmer in the future, there would likely be longer hurricane seasons and more severe hurricanes. As stated in the Texas 2023 Hazard Mitigation Plan:

The current climate assessment report for Texas indicates an expected increase in the intensity of very strong hurricanes, despite an expected lack of increase, or even a decrease, in hurricane frequency overall. Different research studies have produced some conflicting results. While some recent research has pointed to an apparent trend for U.S. tropical cyclones to move more slowly at landfall, much like Hurricane Harvey, other research suggests that Texas may be spared from such a slowdown. At this point, the enhanced risk is difficult to quantify, but substantial scientific progress on this topic is likely as climate models become better able to simulate the observed spatial distribution, frequency, and intensity of hurricanes.

(2023 Texas Hazard Mitigation Plan, page 131)

Social Vulnerability

Social vulnerability is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Vulnerable populations include, elderly, low income, people with health issues, the homeless, and residents that may struggle to evacuate. They may require extra time to evacuate or need assistance to evacuate and are more likely to seek or need medical attention or do not have the means and transportation support to evacuate. In addition, some of these groups are statistically more likely to have a home like a mobile home that are less reinforced to handle the effects of a hurricane.

Overall Vulnerability

Hurricanes in the planning area can be devastating, causing destruction of buildings and potential injury or death to individuals. The entire planning area is equally at risk for hurricanes. High winds can tear down powerlines, trees, barns, fences, and multitude of other debris can be blown into roadways and homes during the event.

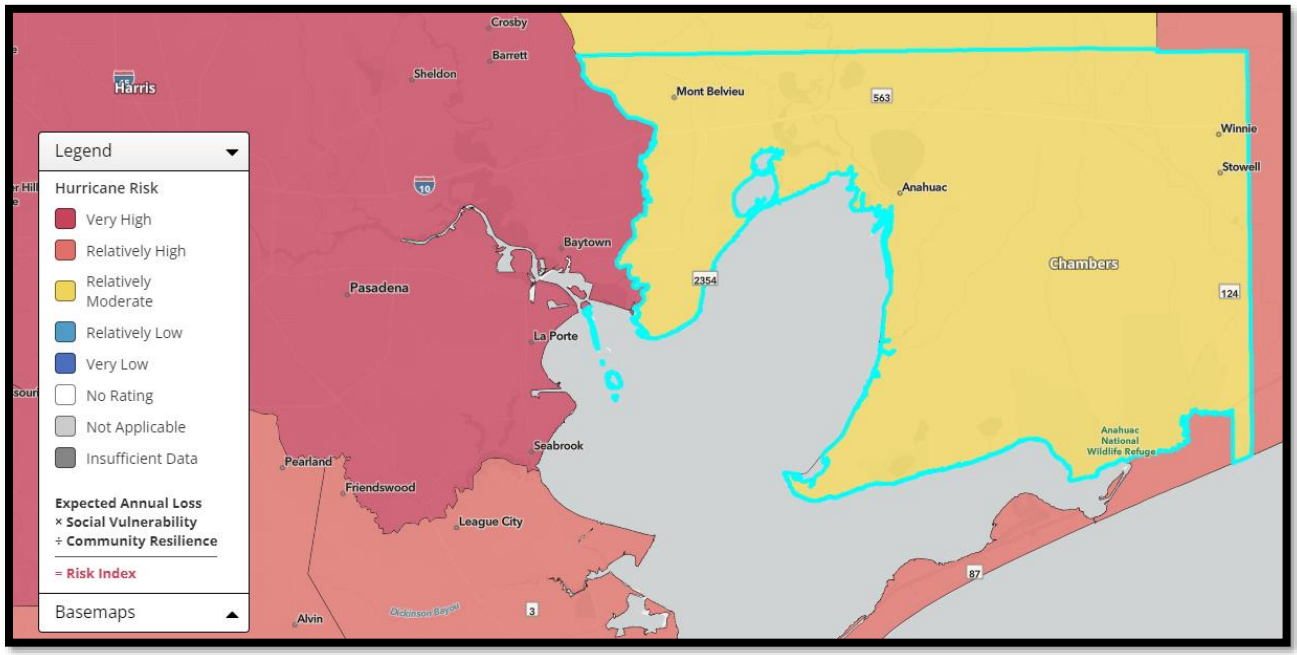
Additionally, residences and commercial buildings could be damaged or destroyed due to events; older residential neighborhoods and structures without a permanent foundation were identified as one of the main vulnerabilities throughout the county. While current building codes address the vulnerability of wind damage to structures, older buildings (particularly residential buildings) were built when less stringent building codes were in place; therefore, older residential building and residences could suffer greater damages.

The National Risk Index shows hurricane and tropical storms are relatively moderate risk (92.9 national percentile) and relatively moderate (92.5 national percentile) in expected annual loss. This index estimates a $24 million dollar expected annual loss.

Future Changes that May Impact Vulnerability

Understanding future changes that affect vulnerability in the Planning Area can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development - Any areas of growth could be potentially impacted by the hurricane and tropical storm hazard because the entire Planning Area is exposed and vulnerable; however, due to increased standards and codes, new development can be less vulnerable to the hazard compared with the aging building stock in the Planning Area.
- Projected changes in population - Increased population will expose more people to the risk to hurricane and tropical storm events.



Lightning

Update from last plan

Events since 2017 were updated and described.

Hazard Description

Lightning is a massive electrical spark that occurs in the atmosphere, connecting clouds, the air, or the ground. In its initial stages of development, the air acts as an insulator, keeping the positive and negative charges in the clouds and between the clouds and the ground separate. However, as the opposite charges accumulate and intensify, the insulating capacity of the air breaks down, leading to a rapid discharge of electricity known as lightning. This lightning flash temporarily equalizes the charged regions in the atmosphere until the opposite charges begin to accumulate once more, setting the stage for potential future lightning strikes.

Energy from a lightning channel can heat the air up to 50,000 degrees Fahrenheit. Thunder is the sound heard from a lightning strike and can be heard up to 25 miles away according to the NOAA National Severe Storms Laboratory. Light travels faster than sound does, so the distance of the lightning away from a location can be estimated by counting the time delay between the lightning strike and when the sound is heard and then dividing by 5. This will provide the miles away that the lightning is estimated.

Location

Lightning can strike any location in Chambers County.

Previous Occurrences

According to the NCEI database, since the start of 2000 there have been 4 reported lightning events in Chambers County. This totals 2 deaths, 1 injury, and $50 thousand in property damage. However, since lightning occurs every year, it can be assumed that those 4 reported events are just those events that were significant (either caused property damage, deaths, or injury). Table 44 below shows the cases of reported lightning events in the NCEI database. Since 2017 when the previous plan was completed there have been no reported lightning events causing damage in Chambers County according to the NCEI database.

Table 44 - NCEI Data for Lightning – 1/1/2000 to 10/31/2023

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								2	1	50.00K	0.00K
HANKAMER	CHAMBERS CO.	TX	08/24/2000	13:00	CST	Lightning		1	0	0.00K	0.00K
WHITES RANCH	CHAMBERS CO.	TX	06/24/2010	08:30	CST-6	Lightning		1	1	0.00K	0.00K
WINNIE	CHAMBERS CO.	TX	04/13/2016	02:10	CST-6	Lightning		0	0	30.00K	0.00K
BEACH CITY	CHAMBERS CO.	TX	05/12/2017	02:15	CST-6	Lightning		0	0	20.00K	0.00K
Totals:								2	1	50.00K	0.00K

Future Occurrences

Using the NCEI data in the previous section the probability of a reported lightning event in Chambers County is about 0.17 events per year or an event every 5.75 years. However, if using the calculation that an event occurs every year, there is a probability of more than one event occurring in any given year. Similarly, the probability of future occurrence is considered highly likely, though a damaging event is considered likely.

Extent

According to NOAA, the average number of clouds to ground flashes for the State of Texas between 2009 and 2018 was 11.0 flashes per square mile. Vaisala, a company that monitors total lightning across the United States providing reliable and accurate lightning information, suggests that Chambers County has 72 lightning events per square kilometer per year which is roughly 44.75 events per square mile per year from 2018 to 2023.

In addition to flashes, NOAA measures the number of lightning strikes in an interval of time which is quantified in a scale called the Lightning Activity Levels (LALs). Table 45 below further describes this scale.

Table 45 - LAL Scale (NOAA)

LAL	Cloud & Storm Development	Lightning Strikes/15 min
1	No thunderstorms.	-
2	Cumulus clouds are common but only a few reach the towering cumulus stage. A single thunderstorm must be confirmed in the	1-8

LAL	Cloud & Storm Development	Lightning Strikes/15 min
	observation area. The clouds produce mainly virga, but light rain will occasionally reach the ground. Lightning is very infrequent.	
3	Towering cumulus covers less than two-tenths of the sky. Thunderstorms are few, but two to three must occur within the observation area. Light to moderate rain will reach the ground, and lightning is infrequent.	9-15
4	Towering cumulus covers two to three-tenths of the sky. Thunderstorms are scattered and more than three must occur within the observation area. Moderate rain is common and lightning is frequent.	16-25
5	Towering cumulus and thunderstorms are numerous. They cover more than three-tenths and occasionally obscure the sky. Rain is moderate to heavy and lightning is frequent and intense.	>25
6	Similar to LAL 3 except thunderstorms are dry.	

The maximum extent the County can expect to experience is considered weak.

Impact

As described in the previous occurrences section, lightning events can cause injury, death, and property damage. The risk is still relatively low as there were only 2 reported deaths by the NCEI database for all of Chambers County over the last 23 years. The NCEI database does not quantify the LAL for reported events, it is difficult to quantify the most severe lightning events.

Therefore to determine the extent of the lightning strike, the yearly average range of estimated number of lightning strikes within the planning area and a cloud to ground flashes of six to twelve per square mile (further broken down to flashes per year) divided by the number of events that occur annually, the planning area should expect an average range of eleven to twenty-two lighting strikes within 15 minutes indicating lightning strikes have an average LAL range of 2-4. The maximum probable extent the County can expect to see is considered weak due to events typically causing little to no damage.

Effect of Climate Change on Lightning

Climate change may cause more severe storms which as a result could cause more frequent lightning strikes and thus a higher LAL.

Social Vulnerability

Social vulnerability is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Lightning poses the risk of power outages, which can be life-threatening for individuals dependent on electricity for life support. Generally, those without adequate shelter during a lightning storm and those relying on continuous power sources for survival are the most vulnerable populations.

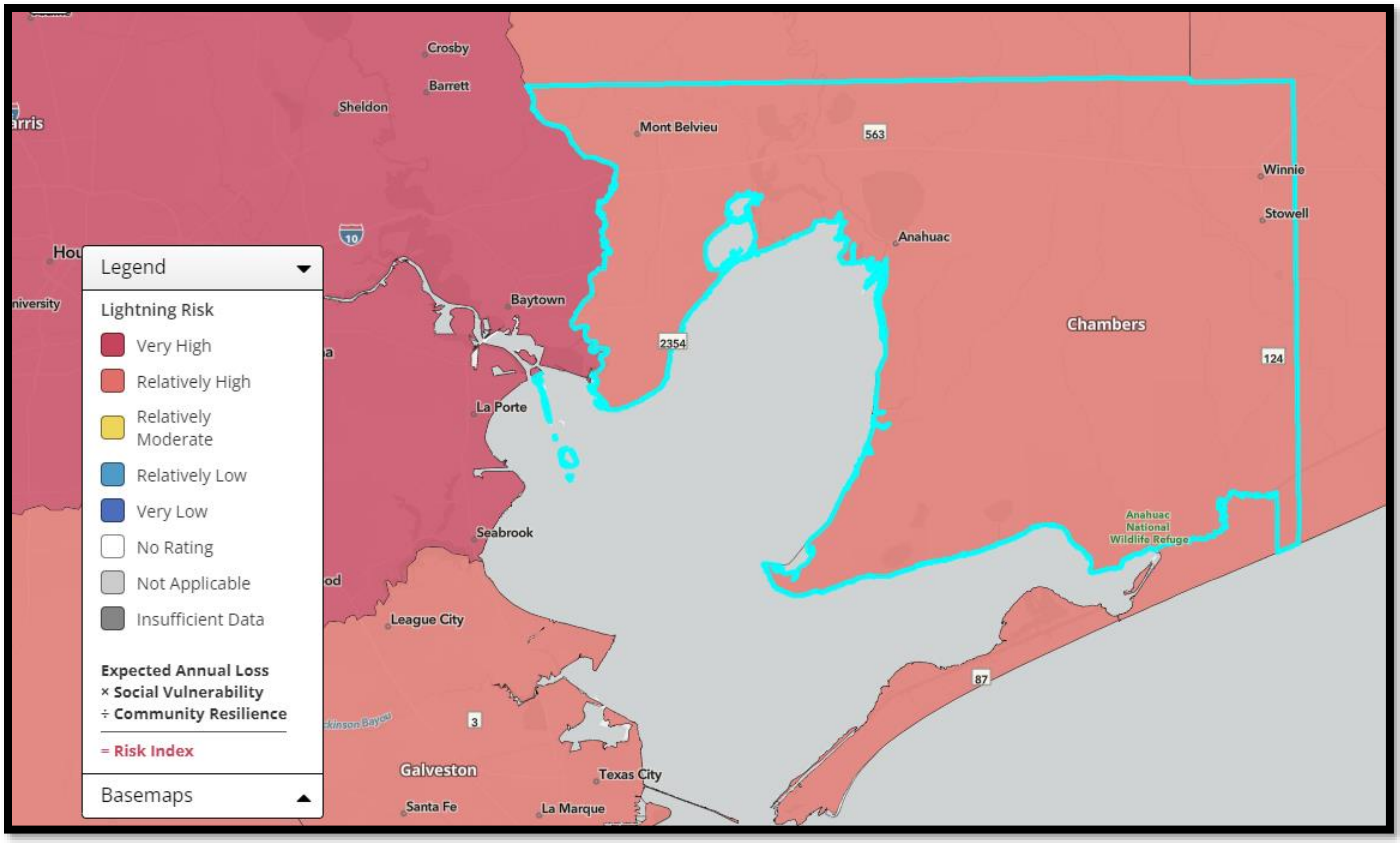
Overall Vulnerability

For the planning area, the major vulnerability to assets include damage to radio equipment, buildings, and potential power outages. It is important to have early warning capabilities to alert residents of potential incoming lightning. The National Weather Service (NWS) is a great resource for emergency management personnel as well as residents to use to keep updated. The National Risk Index shows that lightning is relatively high risk (95.8 national percentile) and relatively high (95.5 national percentile) in expected annual loss. This index estimates a $1.1 million dollar expected annual loss.

Future Changes that May Impact Vulnerability

Understanding future changes that affect vulnerability in the Planning Area can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development – Future development could be impacted by lightning storms. However, new development due to increased building codes and standards may help lessen the vulnerability of new buildings.
- Projected changes in population – An increase in population will expose more people to lightning hazards.


Crosby
Barrett
Sheldon
Mont Belvieu
563
Winnie
Stowell
Anahuac
10
Baytown
2354
Chambers
124
La Porte
Seabrook
Anahuac National Wildlife Refuge
League City
87
3
Galveston
Texas City
Santa Fe
La Marque
Legend
Lightning Risk
Very High
Relatively High
Relatively Moderate
Relatively Low
Very Low
No Rating
Not Applicable
Insufficient Data
Expected Annual Loss
× Social Vulnerability
÷ Community Resilience
= Risk Index
Basemaps

Salt Dome

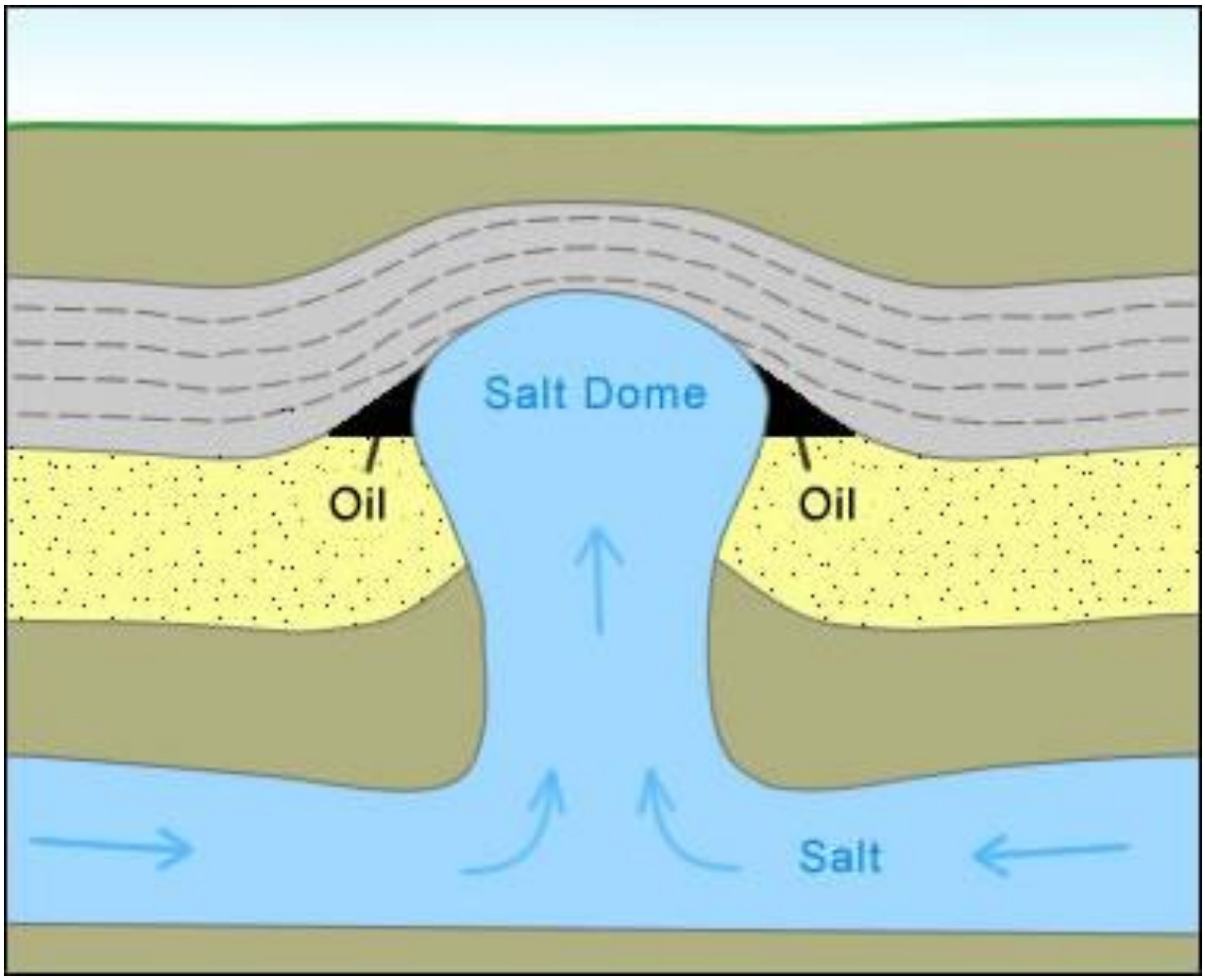
Update from last plan

Salt dome was not profiled in the previous plan.

Hazard Description

According to Ggeology.com, a salt dome is a mound or column of salt that has intruded upwards into overlying sediments. Salt domes can form in a sedimentary basin where a thick layer of salt is overlain by younger sediments of significant thickness. Where conditions allow, salt domes can rise thousands of feet above the layer of salt from which they began growing.

The development of salt domes can deform rock units into traps that hold oil and natural gas. They are often mined as sources of salt and sulfur. The impermeable nature of the salt can make them important sites for underground storage or underground disposal of hazardous waste.



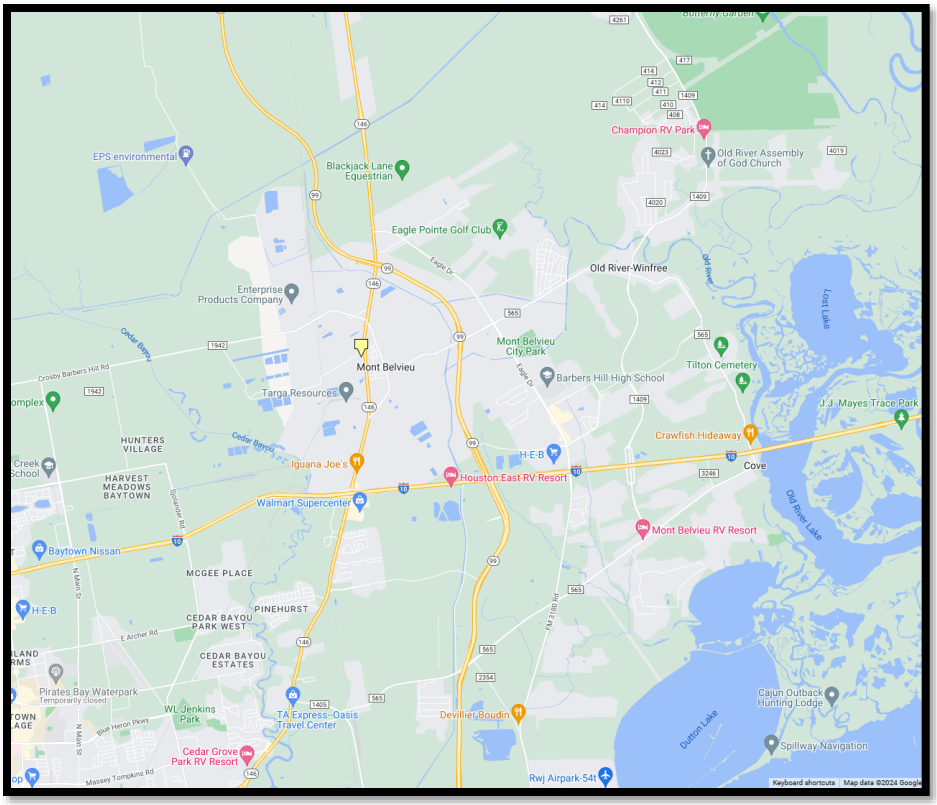
According to a 2013 research article published in Science Direct, most risks associated with salt domes consist of: oil and gas leakage, ground subsidence, and cavern failure. https://www.sciencedirect.com/science/article/abs/pii/S0951832013000069

Location

The salt dome being profiled in this plan is in Mont Belvieu. This salt dome is considered one of the most developed salt domes in the country, consisting of over 100 caverns according to the Center for Land Use Interpretation. It is located west of HWY 146 in Mont Belvieu, see Figure 65.

Photo of Mont Belvieu Salt Dome (source clui.org)

Figure 65 - Location of Mont Belvieu Salt Dome (yellow marker)



Previous Occurrences

Due to the nature of the work completed at the salt dome, the most common risks include oil and gas leakage, that can cause explosions. Over the last 38 years (since 1985) there have been at least six reported cases of explosions/fires at the Mont Belvieu salt dome. These cases occurred in 1985, 1988, 1992, 2011, 2016, and 2020. The residences that once were found in this area have since been moved away over the past few decades due to the large risks from these potential events.

Future Occurrences

Based on the 6 previous reported cases since 1985, a salt dome explosion/fire could be expected to occur once every 6.2 years. However, Texas has continued to try to increase their regulations to try to limit these sorts of events from occurring. After a large explosion in 1992, Texas now requires emergency shutoff valves and inspections for leaks every five years according to Houston Public Media (houstonpublicmedia.org).

Extent

The most severe Mont Belvieu salt dome explosion that was reported was in 1992. This explosion was due to a natural gas leakage. The large blast killed three people, injuring 21, and causing at least $9 million damage to homes and farms.

Impact

The largest potential impact of a salt dome explosion would be damage to the facility and risk of injury or death to people working in the area.

Effect of Climate Change on Salt Domes in Mont Belvieu

It is difficult to determine if climate change will have any effect on the chance of a salt dome explosion/fire in Mont Belvieu. There is no research that was found that would show any correlation.

Social Vulnerability

Social vulnerability is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Due to the nature of the salt dome in Mont Belvieu, the main group that could be vulnerable to the effects of an event would be those that work there.

Overall Vulnerability

In summary, the overall vulnerability of the salt domes in Mont Belvieu has reduced significantly with the increased regulatory requirements that Texas has enacted over the last two decades. They require additional inspections and emergency shutoff valves in the domes. However, there is still risk for future explosions/fires as the more recent occurrences show. Since there is little to no residences located around the salt domes, the main impact of an event would be damage to the facility as well as potential injury or death to those working in the area.

Future Changes that May Impact Vulnerability

- Potential or projected development - While there will be future development, ensuring that residences will not be located around the salt dome will be critical.
- Projected changes in population – While there will be population increase, ensuring population remains at a safe distance from the plant will be critical.

Severe Thunderstorms – High Wind

Update from last plan

Severe thunderstorms and high winds were not profiled in the previous plan.

Hazard Description

The NOAA National Severe Storms Laboratory (NSSL) describes a severe thunderstorm as any event that contains one or more of the following: hail one inch or greater, winds gusting more than 50 knots (57.5 mph), or a tornado.

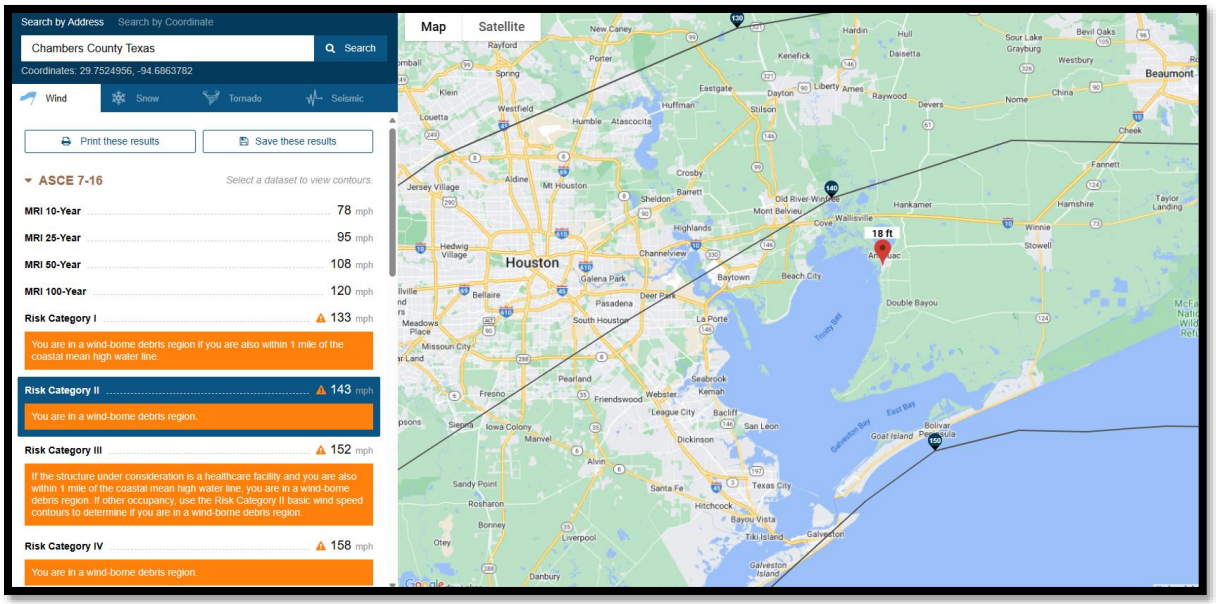
Most thunderstorms occur in the spring and summer months and typically in the afternoon or evening hours. However, they can happen at any time of year and any time of day. The NOAA NSSL lists Texas as an area with some of the highest risk of severe thunderstorms.

Location

Chambers County is listed as a Designated Catastrophe Area by the Texas Department of Insurance. The map below from the Texas Department of Insurance according to the 2018 IBC shows where Chambers County falls. This map is used to design buildings to withstand reasonably anticipated winds to minimize property damage. Most of the County sits within the 140 – 150 and the geographic area affected is considered extensive, with only Mont Belvieu and Old-River Winfree falling in the 130 – 140 band.

Figure 66 - Designated Catastrophe Area Map – Chambers County

(Source: ATC Hazards by Location, TDI, Adopted Building Codes (texas.gov))



Previous Occurrences

The NCEI Storm Event Database has reported 26 events of Thunderstorm Wind since 2000 in Chambers County.

Table 46 - Thunderstorm Wind Events 1/1/2000 to 10/31/2023

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	673.75K	0.00K
MONROE CITY	CHAMBERS CO.	TX	07/23/2000	14:55	CST	Thunderstorm Wind	69 kts. E	0	0	15.00K	0.00K
COUNTYWIDE	CHAMBERS CO.	TX	07/23/2000	16:15	CST	Thunderstorm Wind		0	0	25.00K	0.00K
WINNIE	CHAMBERS CO.	TX	08/11/2000	16:44	CST	Thunderstorm Wind	52 kts. M	0	0	15.00K	0.00K
HANKAMER	CHAMBERS CO.	TX	09/02/2000	19:05	CST	Thunderstorm Wind		0	0	100.00K	0.00K
HANKAMER	CHAMBERS CO.	TX	09/02/2000	19:13	CST	Thunderstorm Wind		0	0	25.00K	0.00K
ANAHUAC	CHAMBERS CO.	TX	09/02/2000	19:25	CST	Thunderstorm Wind		0	0	150.00K	0.00K
SMITH PT	CHAMBERS CO.	TX	09/02/2000	19:40	CST	Thunderstorm Wind	62 kts. M	0	0	0.00K	0.00K
HANKAMER	CHAMBERS CO.	TX	09/03/2000	18:20	CST	Thunderstorm Wind		0	0	100.00K	0.00K
ANAHUAC	CHAMBERS CO.	TX	09/03/2000	18:30	CST	Thunderstorm Wind		0	0	25.00K	0.00K
ANAHUAC	CHAMBERS CO.	TX	09/05/2000	15:15	CST	Thunderstorm Wind		0	0	15.00K	0.00K
ANAHUAC	CHAMBERS CO.	TX	08/04/2002	16:20	CST	Thunderstorm Wind	52 kts. E	0	0	0.00K	0.00K
WINNIE	CHAMBERS CO.	TX	08/26/2002	19:15	CST	Thunderstorm Wind		0	0	25.00K	0.00K
MONT BELVIEU	CHAMBERS CO.	TX	12/23/2002	22:32	CST	Thunderstorm Wind	52 kts. EG	0	0	20.00K	0.00K
MONT BELVIEU	CHAMBERS CO.	TX	06/02/2003	17:05	CST	Thunderstorm Wind	65 kts. EG	0	0	7.00K	0.00K
ANAHUAC	CHAMBERS CO.	TX	11/23/2004	23:15	CST	Thunderstorm Wind	60 kts. EG	0	0	35.00K	0.00K
WINNIE	CHAMBERS CO.	TX	11/23/2004	23:20	CST	Thunderstorm Wind	55 kts. EG	0	0	20.00K	0.00K
WINNIE	CHAMBERS CO.	TX	04/29/2006	11:25	CST	Thunderstorm Wind	55 kts. EG	0	0	35.00K	0.00K
HANKAMER	CHAMBERS CO.	TX	08/03/2008	17:55	CST-6	Thunderstorm Wind	52 kts. EG	0	0	8.00K	0.00K
WINNIE	CHAMBERS CO.	TX	06/06/2011	15:40	CST-6	Thunderstorm Wind	52 kts. EG	0	0	0.00K	0.00K
ANAHUAC	CHAMBERS CO.	TX	05/22/2013	04:30	CST-6	Thunderstorm Wind	65 kts. EG	0	0	4.00K	0.00K
WINNIE	CHAMBERS CO.	TX	05/22/2013	04:30	CST-6	Thunderstorm Wind	65 kts. EG	0	0	4.00K	0.00K
WALLISVILLE	CHAMBERS CO.	TX	05/22/2013	04:30	CST-6	Thunderstorm Wind	65 kts. EG	0	0	2.75K	0.00K
STOWELL	CHAMBERS CO.	TX	05/22/2013	04:44	CST-6	Thunderstorm Wind	68 kts. MG	0	0	0.00K	0.00K
WINNIE	CHAMBERS CO.	TX	05/26/2018	18:30	CST-6	Thunderstorm Wind	55 kts. EG	0	0	25.00K	0.00K
COVE	CHAMBERS CO.	TX	10/31/2018	21:00	CST-6	Thunderstorm Wind	55 kts. EG	0	0	0.00K	0.00K
MONT BELVIEU	CHAMBERS CO.	TX	10/27/2021	08:45	CST-6	Thunderstorm Wind	50 kts. EG	0	0	18.00K	0.00K
Totals:								0	0	673.75K	0.00K

Future Occurrences

The chance of a Thunderstorm and High Wind event would be about 1.13 events per year based on previous reported events.

Extent

The NOAA uses the Beaufort Wind Scale to quantify the wind effects that may occur during a severe thunderstorm event. According to the scale, Chambers County could expect to have events from 0 up to 12 in this scale with the worst-case scenario being 12.

Table 47 - Beaufort Wind Scale (Source: NOAA)

Force	Wind (Knots)	WMO Classification	Appearance of Wind Effects		
			On the Water	On Land	
0	Less than 1	Calm	Sea surface smooth and mirror-like	Calm, smoke rises vertically	

Force	Wind (Knots)	WMO Classification	Appearance of Wind Effects		
			On the Water	On Land	
1	1-3	Light Air	Scaly ripples, no foam crests	Smoke drift indicates wind direction, still wind vanes	
2	4-6	Light Breeze	Small wavelets, crests glassy, no breaking	Wind felt on face, leaves rustle, vanes begin to move	
3	7-10	Gentle Breeze	Large wavelets, crests begin to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended	
4	11-16	Moderate Breeze	Small waves 1-4 ft. becoming longer, numerous whitecaps	Dust, leaves, and loose paper lifted; small tree branches move	
5	17-21	Fresh Breeze	Moderate waves 4-8 ft. taking longer form, many whitecaps, some spray	Small trees in leaf begin to sway	
6	22-27	Strong Breeze	Larger waves 8-13 ft., whitecaps common, more spray	Larger tree branches moving, whistling in wires	
7	28-33	Near Gale	Sea heaps up, waves 13-19 ft., white foam streaks off breakers	Whole trees moving, resistance felt walking against wind	
8	34-40	Gale	Moderately high (18-25 ft.) waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks	Twigs breaking off trees, generally impedes progress	
9	41-47	Strong Gale	High waves (23-32 ft.), sea begins to roll, dense streaks of foam, spray may reduce visibility	Slight structural damage occurs, slate blows off roofs	
10	48-55	Storm	Very high waves (29-41 ft.) with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"	

Force	Wind (Knots)	WMO Classification	Appearance of Wind Effects		
			On the Water	On Land	
11	56-63	Violent Storm	Exceptionally high (37-52 ft.) waves, foam patches cover sea, visibility more reduced		
12	64+	Hurricane	Air filled with foam, waves over 45 ft., sea completely white with driving spray, visibility greatly reduced		

Impact

Most events that were reported in Chambers County mostly caused damage to vegetation and trees. At the upper level of the winds that the planning area has seen there may be some damage to structures and it may cause downed trees. There may also be damage to powerlines which may cause power outages in the area. The County has experienced severe thunderstorms and high winds up to 68 Knots. The type of impacts that can be expected are associated with the magnitudes from the Beaufort Wind Scale, which indicate storms as severe as a "Hurricane force wind" extent, involving trees being broken or uprooted along with considerable structural damage.

Effect of Climate Change on Severe Thunderstorms and High Wind

Climate change may cause more severe thunderstorms due to possible changes in moisture in the air as well as higher than average temperatures in the air. NASA's website, Global Climate Chane Vital Signs of the Planet reports, "Severe thunderstorms are defined as having sustained winds above 93 kilometers (58 miles) per hour or unusually large hail, and there are two key factors that fuel their formation: convective available potential energy (CAPE) and strong wind shear. CAPE is a measure of how much raw energy is available for storms; it relates to how warm, moist, and buoyant air is in a given area. Wind shear is a measure of how the speed and direction of winds change with altitude. Future conditions that are more intense and more frequent could cause the future probability to increase over what is the known probability based on historical data.

"CAPE can provide storms with the raw fuel to produce rain and hail, and vertical wind shear can pull and twist weak storms into strong, windy ones," explained Harold Brooks, a meteorologist at NOAA's National Severe Storms Laboratory.

Scientists have evidence that global warming should increase CAPE by warming the surface and putting more moisture in the air through evaporation. On the other hand, disproportionate warming in the Arctic should lead to less wind shear in mid-latitude areas prone to severe

thunderstorms. So one factor makes severe storms more likely, while the other makes them less so." Severe thunderstorms and climate change – Climate Change: Vital Signs of the Planet (nasa.gov)

Social Vulnerability

Social vulnerability is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Severe thunderstorms pose the risk of power outages, which can be life-threatening for individuals dependent on electricity for life support. Generally, those without adequate shelter during a severe thunderstorm and those relying on continuous power sources for survival are the most vulnerable populations.

Overall Vulnerability

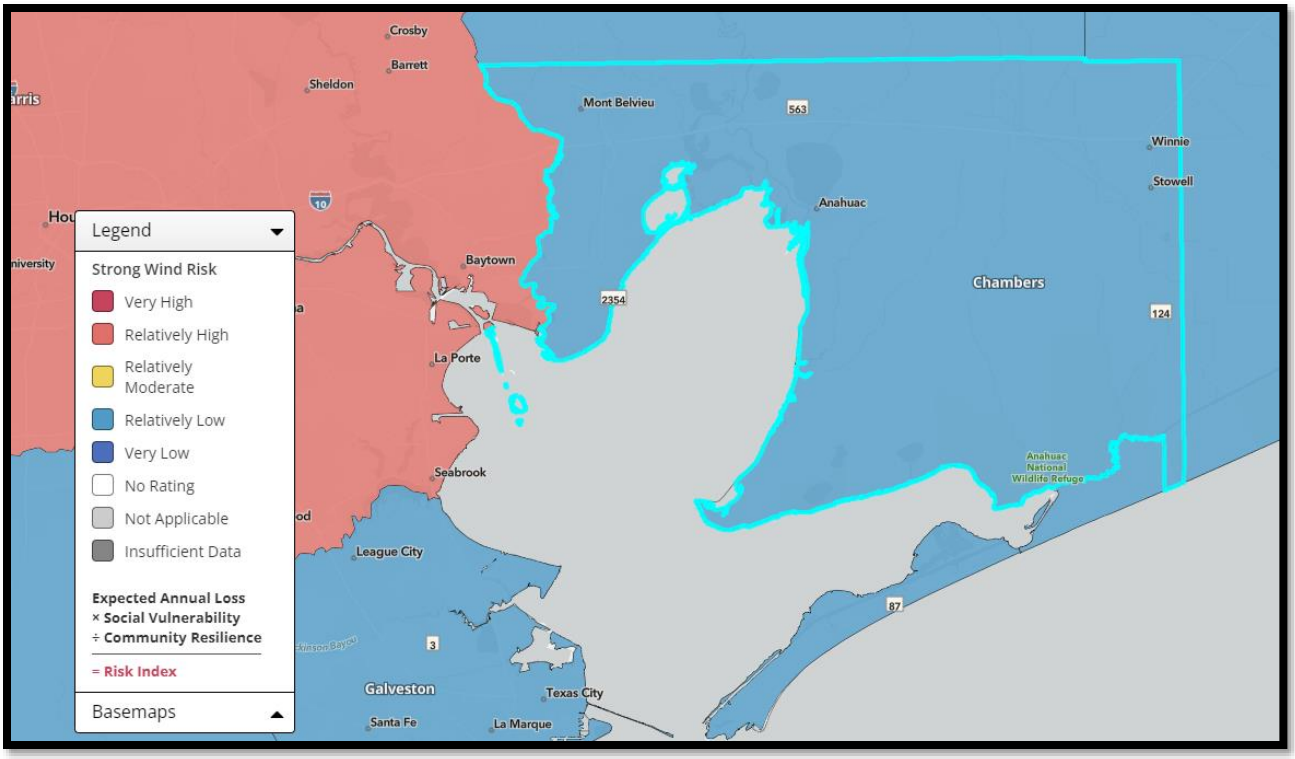
Similar to lightning events, for Chambers County, homes and County buildings are at highest vulnerability from severe thunderstorms and high wind. High winds could cause some damage to roofs as well as risk of downed trees hitting buildings or vehicles. Power outages can commonly occur from these events and could be an issue for at risk communities that may be more susceptible to these outages or those without access to generators. However, there are not many prevention or warning measures for thunderstorm and high wind events. In most cases, all that can be done is using weather forecasting to alert residents and county staff of possible thunderstorms in the area.

The National Risk Index shows severe thunderstorms and high winds are relatively low risk (55.6 national percentile) and relatively moderate (58.2 national percentile) in expected annual loss. This index estimates a 404 thousand dollar expected annual loss.

Future Changes that May Impact Vulnerability

Understanding future changes that affect vulnerability in the Planning Area can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development – Any new development should be protected due to improved building codes and standards.
- Projected changes in population – Increase in population exposes more people to thunderstorms and severe winds.


Crosby
Barrett
Sheldon
Mont Belvieu
563
Winnie
Stowell
Anahuac
Baytown
Chambers
2354
124
La Porte
Seabrook
Anahuac National Wildlife Refuge
League City
87
3
Galveston
Texas City
Santa Fe
La Marque
Legend
Strong Wind Risk
Very High
Relatively High
Relatively Moderate
Relatively Low
Very Low
No Rating
Not Applicable
Insufficient Data
Expected Annual Loss
× Social Vulnerability
÷ Community Resilience
= Risk Index
Basemaps

Tornadoes

Update from last plan

Events since 2017 were updated and described.

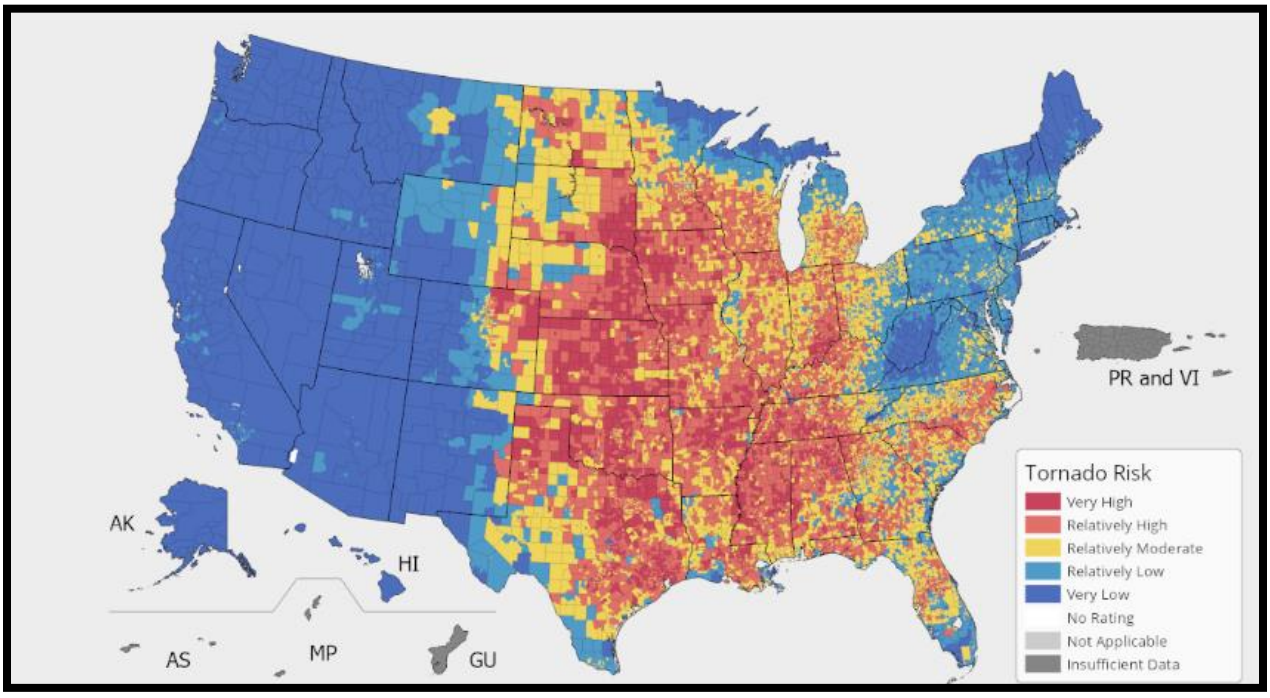
Hazard Description

According to the NOAA, a tornado is a narrow, violently rotating column of air that extends from a thunderstorm to the ground. Because wind is invisible, it is hard to see a tornado unless it forms a condensation funnel made up of water droplets, dust, and debris. The National Weather Service says that the greatest tornado activity occurs in Spring and Summer from around March to August. However, tornadoes can happen at any time of year.

Location

Tornados can happen anywhere at any time; however, Texas is known as one of the tornado capitals of the Country. As previously stated, the late Spring and early Summer have the highest density of tornado activity according to the NOAA National Severe Storms Laboratory. In addition, the most likely time for a tornado is between 4-9 p.m. According to Figure 66 below from FEMA, it shows much of Southeast Texas including Chambers County in the "Very High" risk of tornados.

Figure 67 - FEMA's National Risk Index for Tornados



Previous Occurrences

According to the NOAA NCEI database there have been 10 reported tornado events in Chambers County between 1/1/2000 and 10/31/2023. The reported damage includes 0 deaths, 5 injuries, and 550,000 dollars in property damage. Since 2017 when the previous plan was completed, there have been two tornado events, (2018 and 2023) both reported in Cove.

Figure 68 - Tornado Events (1/1/2000-10/30/2023)

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	5	550.00K	13.00K
ANAHUAC	CHAMBERS CO.	TX	04/03/2000	03:04	CST	Tornado	F1	0	0	100.00K	0.00K
MONROE CITY	CHAMBERS CO.	TX	08/31/2001	12:56	CST	Tornado	F0	0	0	0.00K	0.00K
BEACH CITY	CHAMBERS CO.	TX	11/17/2003	16:50	CST	Tornado	F0	0	0	0.00K	0.00K
WALLISVILLE	CHAMBERS CO.	TX	11/17/2003	17:30	CST	Tornado	F1	0	5	100.00K	0.00K
OAK ISLAND	CHAMBERS CO.	TX	11/17/2003	23:35	CST	Tornado	F1	0	0	300.00K	0.00K
SEA BREEZE	CHAMBERS CO.	TX	07/08/2006	09:25	CST	Tornado	F0	0	0	0.00K	0.00K
BEACH CITY	CHAMBERS CO.	TX	08/21/2012	16:50	CST-6	Tornado	EF0	0	0	0.00K	0.00K
COVE	CHAMBERS CO.	TX	03/29/2017	14:35	CST-6	Tornado	EF0	0	0	0.00K	13.00K
COVE	CHAMBERS CO.	TX	10/31/2018	20:57	CST-6	Tornado	EF1	0	0	50.00K	0.00K
COVE	CHAMBERS CO.	TX	01/24/2023	14:58	CST-6	Tornado	EF0	0	0	0.00K	0.00K
Totals:								0	5	550.00K	13.00K

Future Occurrences

Based on previous occurrences, there could be expected to be a 43% chance of a tornado event each year, or an event every 2.3 years.

Extent

Tornado damage severity is assessed using the Enhanced Fujita Tornado Scale (EF-Scale). This scale assigns numerical values to tornadoes based on their wind speed and categorizes them from zero to five, representing increasing levels of damage. Tornadoes typically form within larger vortex formations and are commonly associated with convective cells like thunderstorms or can occur in the right forward quadrant of a hurricane or tropical storm, far from the hurricane's eye.

Table 48 provides details about the categories in the Enhanced Fujita Tornado Scale. For the planning area, it is important to be prepared for the possibility of experiencing tornadoes ranging from EF0 to EF5, each with varying degrees of damage potential. However, according to the data collected from the NCEI database over the last 20 years, most tornadoes have been EF0 which have winds of 65-85 mph. A worst-case scenario would be EF5.

Table 48 - Enhanced Fujita (EF) scale

Enhanced Fujita Category	Wind Speed (mph)	Potential Damage
EF0	65-85	**Light damage.** Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF1	86-110	**Moderate damage.** Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	**Considerable damage.** Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136-165	**Severe damage**. Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	**Devastating damage**. Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF5	>200	**Incredible damage**. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (109 yd.); high-rise buildings have significant structural deformation; incredible phenomena will occur.

Impact

Tornado events can cause a devasting impact to the planning area. Most historical tornadoes in Chambers County have been EF0 or EF1 according to the NCEI database. EF0 tornadoes cause

impacts such as peeling surface off some roofs, some damage to gutters or siding, branches being broken off trees, and shallow-rooted trees being pushed over.

Effect of Climate Change on Tornadoes

Climate change could have a similar impact on tornadoes as was documented in this plan for severe thunderstorms. This is because tornadoes occur during a thunderstorm when there is an updraft of warm air causing a vortex in the center of the storm. This vortex swells with water vapor, which creates a funnel cloud that spirals, thus starting a tornado. Therefore, if climate change may cause a higher likelihood of a severe thunderstorm, there may also be a higher likelihood of tornadoes in the planning area.

National Geographic published an Article, Tornadoes and Climate Change. The article suggests "Predicting whether climate change will influence the frequency and power of tornadoes is a challenge. For all their destructive fury, tornadoes are relatively small when compared to some other extreme weather events. Hurricanes, for example, can span hundreds of miles, whereas the biggest tornado ever recorded measured 4.2 kilometers (2.6 miles) wide. They are also very short lived, lasting from a few seconds to a few hours as opposed to days or weeks at a time. This makes it very difficult to model in the climate simulations that scientists use to project the effects of climate change. Instead, scientists must attempt to predict how climate change might affect the individual weather "ingredients" that support the development of supercell thunderstorms (the type that produce tornadoes). These weather ingredients are: warm, moist air; an unstable atmosphere; and wind at different levels moving in different directions at different speeds, a phenomenon known as wind shear."

https://education.nationalgeographic.org/resource/tornadoes-and-climate-change/

Based on these studies, the data indicates climate change could cause more frequent and intense tornado events within the County.

Social Vulnerability

Social vulnerability is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Tornadoes pose the risk of power outages, which can be life-threatening for individuals dependent on electricity for life support. Populations that live in mobile homes are also more at risk due to the home being less prepared for dealing with the effects of a tornado. Low-income households may also be at further risk if they are less likely to be able to afford wind insurance.

Overall Vulnerability

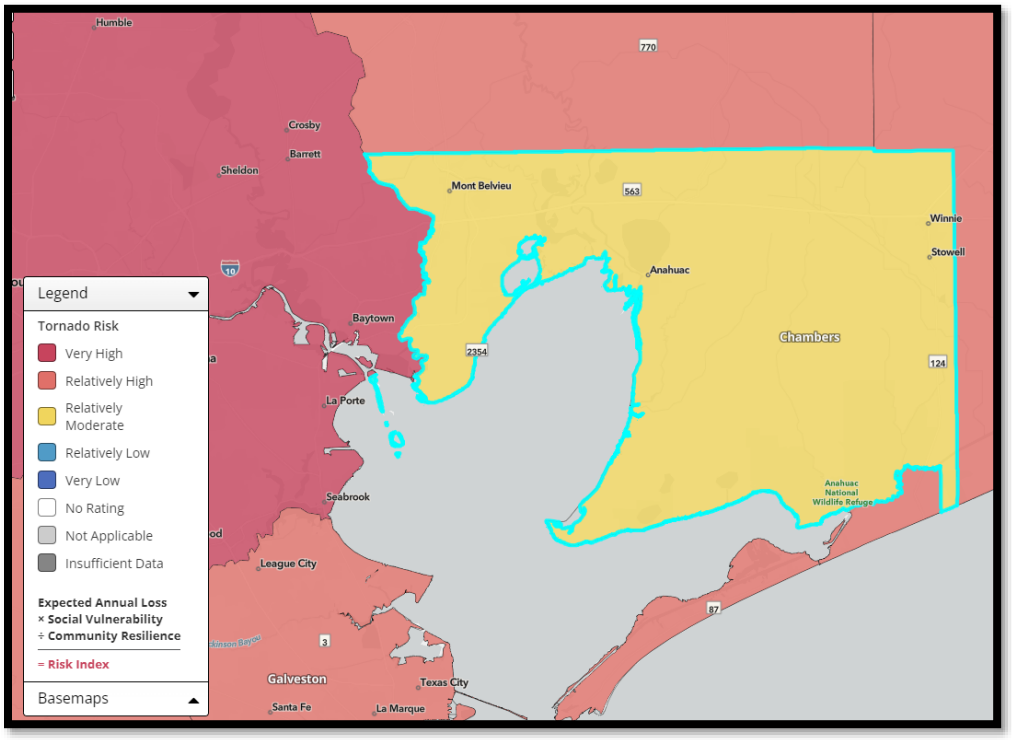
All assets in Chambers County are potentially vulnerable to damage from tornadoes. To help prevent against injury or death from tornadoes, it is important for officials to have early warning capabilities from services such as the National Weather Service (NWS). These officials then need to have the ability to broadcast the warning to anyone that is in their jurisdiction.

The National Risk Index shows tornadoes are relatively moderate risk (86.9 national percentile) and relatively moderate (87.3 national percentile) in expected annual loss. This index estimates a 5 million dollar expected annual loss.

Future Changes that May Impact Vulnerability

Understanding future changes that affect vulnerability in the Planning Area can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development - Any areas of growth could be potentially impacted by the tornado hazard because the entire County is exposed and vulnerable. Residential development, specifically manufactured homes, may be considered more vulnerable to tornadoes. In general, any development that has weak building and/or construction materials that could be impacted by high winds would be highly impacted by tornadoes.
- Projected changes in population – An increase in population will expose more people to tornadoes.



Wildfires

Update from last plan

Wildfire was not profiled in the previous plan.

Hazard Description

Wildfires are uncontrolled fires that frequently occur in wildland areas, and if left unchecked, they can engulf houses or agricultural resources. The interface between wildlands and human development, known as the wildfires/urban interface (WUI), is a critical zone where structures and human-made developments blend with undeveloped wilderness.

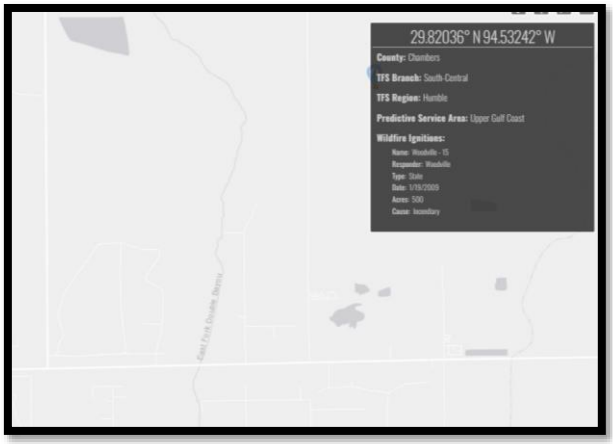
These fires often start unnoticed, but once ignited, they spread rapidly, fueled by dry vegetation and strong winds. Dense smoke from the wildfires can cover vast areas, sometimes stretching for miles around, serving as a signal of their presence. Wildfires can be initiated by human activities, such as arson or poorly managed campfires, or they can be triggered naturally, like when lightning strikes.

According to the Northwest Fire Science Consortium, there are three types of wildfires:

- Ground fire – these burn mostly in decayed roots below the ground. These often can go undetected for a long time because there is little smoke and does not spread quickly.
- Surface fire – these burn mostly moss, vegetation, shrubs, small trees, and loose needles on the surface of the ground. They can consume the forest canopy and are the most common type of wildfire.
- Crown fire – these are typically ignited by a surface fire and can get into the canopy of trees. These often spread rapidly with the aid of wind.

Location

Wildfires can be most dangerous in the Wildland Urban Interface (WUI). As described in the hazard description section, the WUI is described as a transition zone between the land that is developed by humans and the undeveloped land or wilderness. As more population growth occurs in the WUI there is more risk for damage from wildfire.



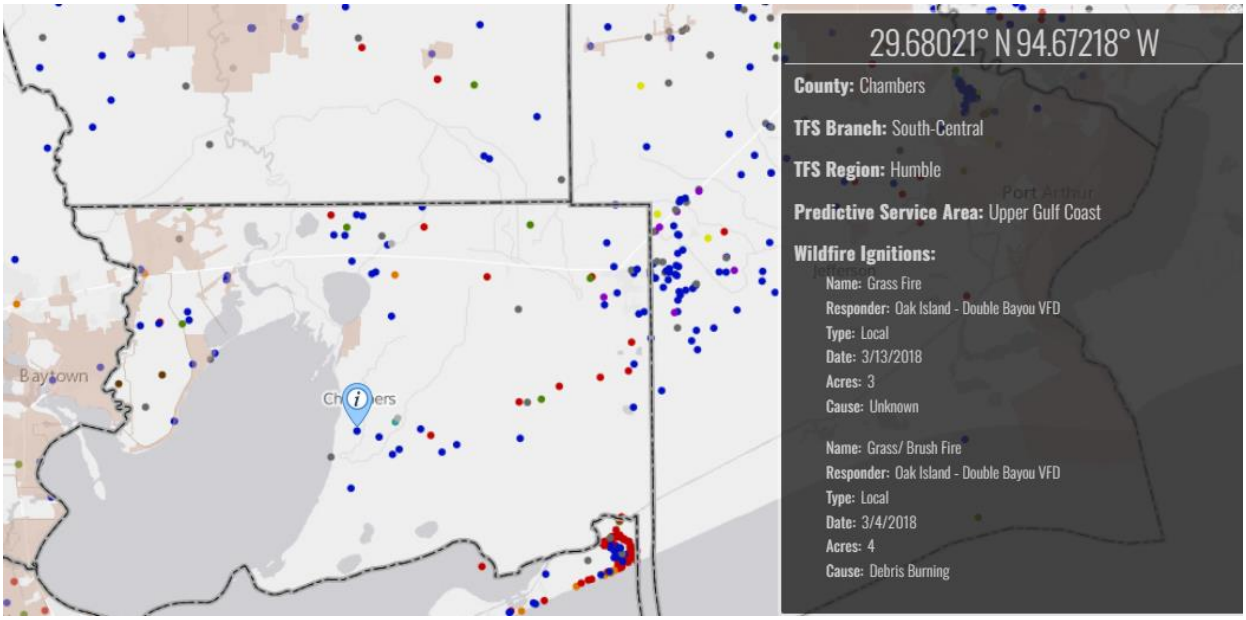
Previous Occurrences

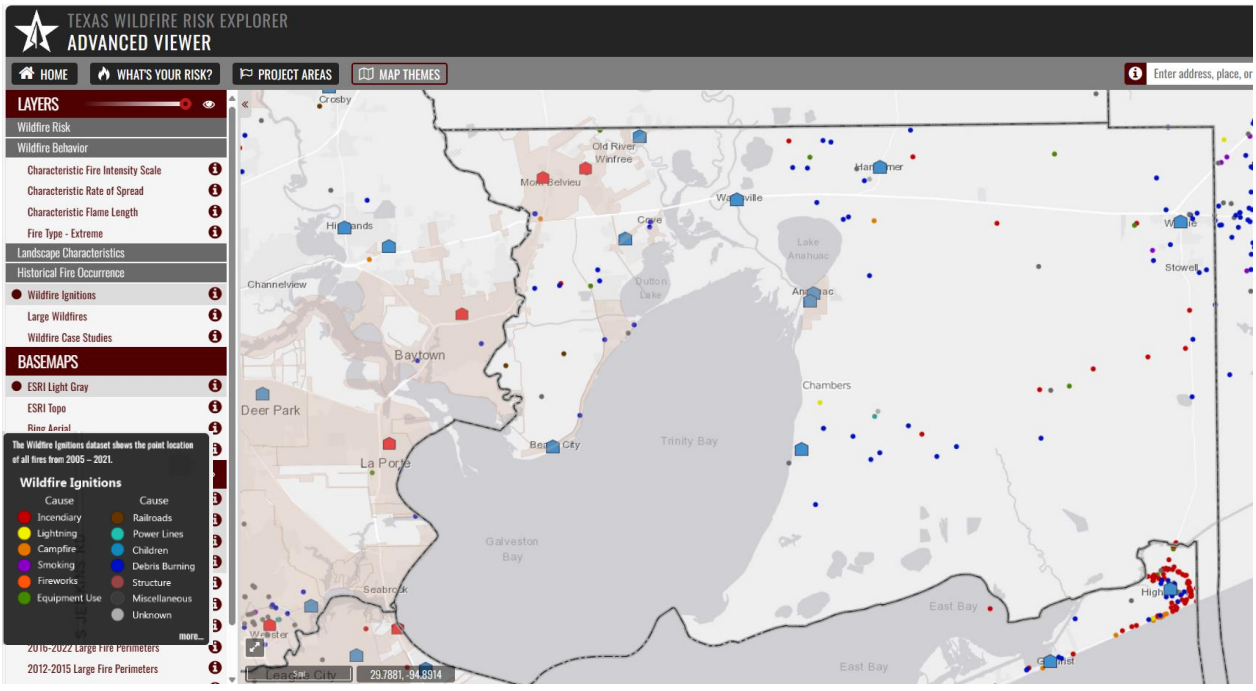
Neither the NCEI nor the National Climatic Data Center (NCDC) show any history of wildfire within all of Chambers County since 2000. A review of the Texas Wildfire Risk Explorer shows

there was one large wildfire in 2009 that burned over five hundred acres near I-10 and S. Jenkins Road. There have been several wildfire ignitions as marked by colored dots in Figure 69. When a dot is clicked on, information about the ignition is shown.

Figure 69 - Wildfire Ignitions in Chamber County (colored dots represent cause)

TEXAS WRAP - Advanced Viewer (texaswildfirerisk.com)





Future Occurrences

While there is no database to determine the quantity and year of the wildfire ignitions, they have and do happen in the County, therefore the future probability is likely.

Extent

The Fire Intensity Scale (FIS) is used by the Texas Wildfire Risk Assessment Portal (TxWRAP). TxWRAP is the primary mechanism for Texas A&M Forest Service (TFS) to deploy wildfire risk information and create awareness about wildfire issues across the state. The FIS categorizes fire intensity on a scale of Class 1 to 5. Figure 70 below details each of the categories.

Figure 70 - Fire Intensity Scale (FIS)

Class 1 Very Low	Very small, discontinuous flames, usually less than one foot in length; very low rate of spread; no spotting. Fires are typically easy to suppress by firefighters with basic training and non-specialized equipment.
Class 2 Low	Small flames, usually less than two feet long; small amount of very short range spotting possible. Fires are easy to suppress by trained firefighters with protective equipment and specialized tools.
Class 3 Moderate	Flames up to 8 feet in length; short-range spotting is possible. Trained firefighters will find these fires difficult to suppress without support from aircraft or engines, but dozer and plows are generally effective. Increasing potential for harm or damage to life and property.
Class 4 High	Large flames, up to 30 feet in length; short-range spotting common; medium range spotting possible. Direct attack by trained firefighters, engines, and dozers is generally ineffective, indirect attack may be effective. Significant potential for harm or damage to life and property.
Class 5 Very High	Very large flames up to 150 feet in length; profuse short-range spotting, frequent long-range spotting; strong fire-induced winds. Indirect attack marginally effective at the head of the fire. Great potential for harm or damage to life and property.

For Chambers County, the FIS is between Class 1 and 4 (very low to high). This is shown in Figure 71. This data was collected from the Texas Wildfire Risk Explorer.

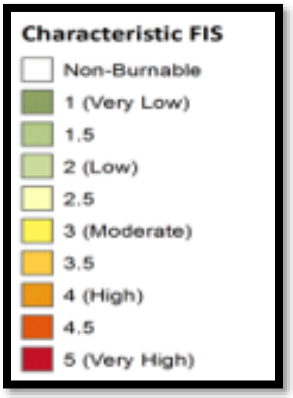
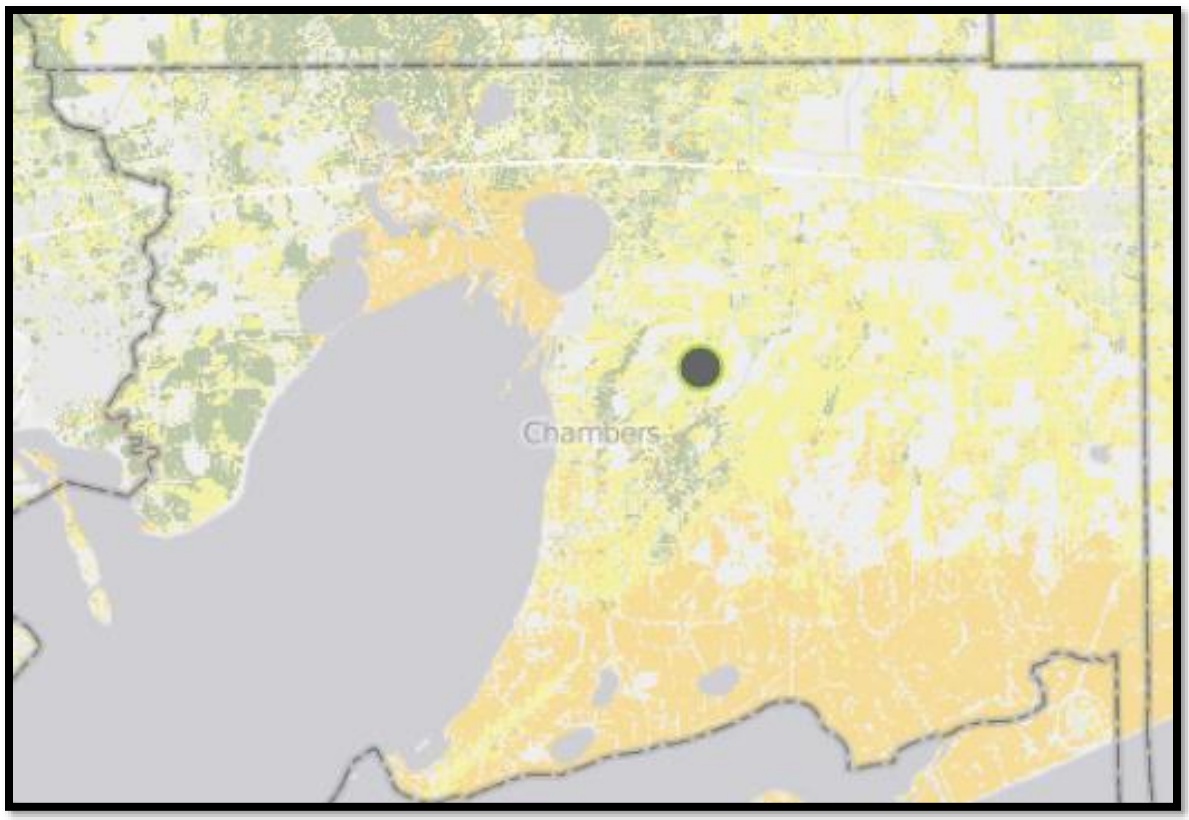
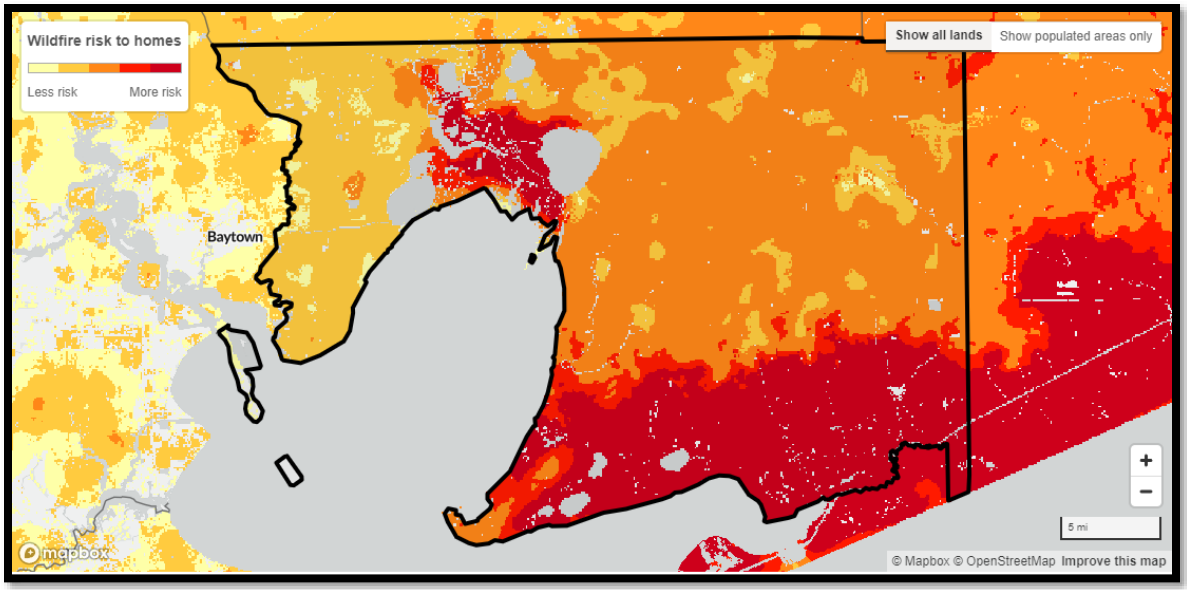


Figure 71 - Chambers County FIS



Another resource that qualitatively measures the risk of wildfires is wildfirerisk.org. Figure 72 below shows the risk of homes to wildfires in the planning area. The southern border of the county along with the area closest to Anahuac and to the north along Lake Anahuac are most susceptible to home damage.

Figure 72 - Wildfire Risk to Homes (Source: wildfirerisk.org)



Impact

Wildfire can spread and impact homes, crops, and other structures close to the WUI. Loss of life can also be a high risk with wildfires, especially in areas with inadequate housing that may cause a delay in ability to evacuate during an event.

Effect of Climate Change on Wildfire

Climate change could play a role in the likelihood of wildfires and their intensity. However, the United States Geological Survey finds that there is not a direct relationship with wildfire and climate change. However, their researchers did find a correlation between years with wildfires and years with warmer temperatures in the summer. This leads to a conclusion that indirectly a warmer climate may lead to more wildfires.

USGS reports, "There isn't a direct relationship between climate change and fire, but researchers have found strong correlations between warm summer temperatures and large fire years, so there is consensus that fire occurrence will increase with climate change." (https://www.usgs.gov/faqs/will-global-warming-produce-more-frequent-and-more-intense-wildfires)

Social Vulnerability

Social vulnerability is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Wildfire effects are most pronounced in groups such as the elderly, children, and those with health concerns such as with their respiratory system. This is largely due to the air pollution from the smoke of wildfire.

Overall Vulnerability

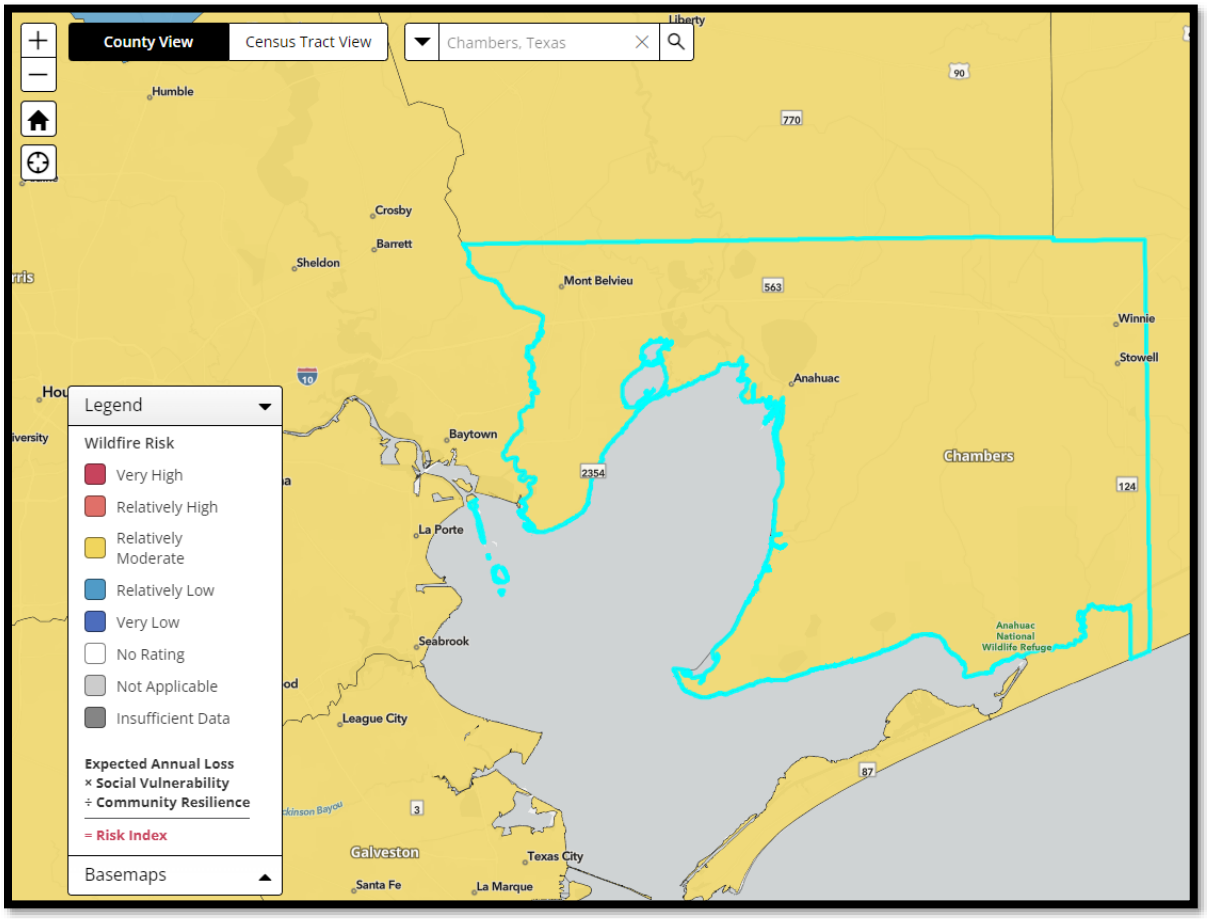
There are large portions of Chambers County with high risk of wildfires. As previously stated, those areas are largely the southern border, along with areas closer to the north end of Chambers County near Anahuac. This is due to higher vegetative areas such as wildlife refuges. However, in large portions of these high wildfire risk areas, there is little population residing. This reduces the overall vulnerability of damage to property or loss of life due to wildfire.

The National Risk Index shows wildfires are relatively moderate risk (91.9 national percentile) and relatively moderate (90.7 national percentile) in expected annual loss. This index estimates a 1.6 million dollar expected annual loss.

Future Changes that May Impact Vulnerability

Understanding future changes that affect vulnerability in the Planning Area can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development - The expansion of development toward wildfire hazard areas can be managed with strong land use and building codes. The International Building Code includes minimum standards related to the design and construction of buildings in fire hazard zones. The planning area is well equipped with these tools, and this planning process has assessed capabilities regarding the tools. As the planning area experiences future growth, it is anticipated that the exposure to this hazard will remain as assessed or even decrease over time due to these capabilities
- Projected changes in population – An increase in population will expose more people to wildfire hazard.



Winter Storm

Update from last plan

Winter storms were not profiled in the previous plan.

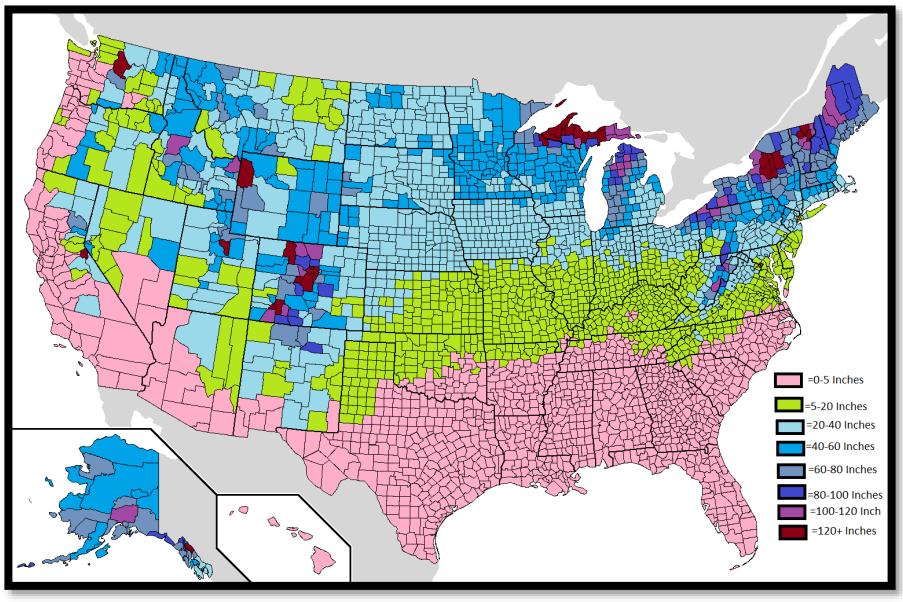
Hazard Description

According to the National Weather Service, a winter storm event (heavy sleet, heavy snow, ice storm, heavy snow and blowing snow or a combination of events) is categorized as 7 inches or more of snow in 12 hours or less; or 9 inches or more in 24 hours covering at least 50 percent of the zone or encompassing most of the population. Some of the largest risks of damage from winter storms are traffic accidents from icy roads, hypothermia from prolonged exposure to cold, and downed trees and powerlines.

Location

Although winter storms in Texas occur less frequently than they do further north, they occur often enough to be considered a viable, seasonal threat. Texans are most familiar with four types of winter storms: snowstorms, blizzards, cold waves, and ice storms. Due to the nature of winter storms, all people and assets in Chambers County have equal degree of exposure to a winter storm. The main types of events that occur in Chambers County are snowstorms, cold waves, and ice storms. Blizzards are not common in the planning area. The typical winter storm season is from November to middle of March but can extend just outside those time periods. Figure 73 shows the average annual snowfall totals for the United States. The map shows southeastern Texas receives between 0-5 inches of snow per year. The geographic area affected is considered Extensive.

Figure 73 - Average Snowfall per year



Previous Occurrences

According to the NCEI database there have been no recorded winter storm events that caused damage in Chambers County since the year 2000.

While not captured in the database, a Presidential Declaration occurred in February 2021 (DR-4586) after Winter Storm Uri dumped record amounts of snow on Texas, with the frigid temperatures and severe weather impacting all 254 counties in the state in February 2021. Millions of Texans lost power. Snow and ice paired with ultra-low temperatures caused widespread road closures and dangerous travel conditions. State emergency management leaders activated warming centers in communities across Texas and numerous personnel were deployed to assist stranded motorists and conduct welfare checks. The Texas Comptroller reported that Winter Storm Uri knocked out power for nearly 70 percent of Texans and disrupted water utilities, leaving many Texans without heat or running water for extended periods in the frigid cold. It resulted in between $80 billion and $130 billion in financial losses to the state economy, and what's more, claimed at least 210 lives.

A record freeze brought challenges for our state's power generation and delivery systems (ERCOT). Mainline power interruptions challenged our generators which affected our Water Production and Wastewater systems and caused a series of cascading events including a Boil Water Notice.

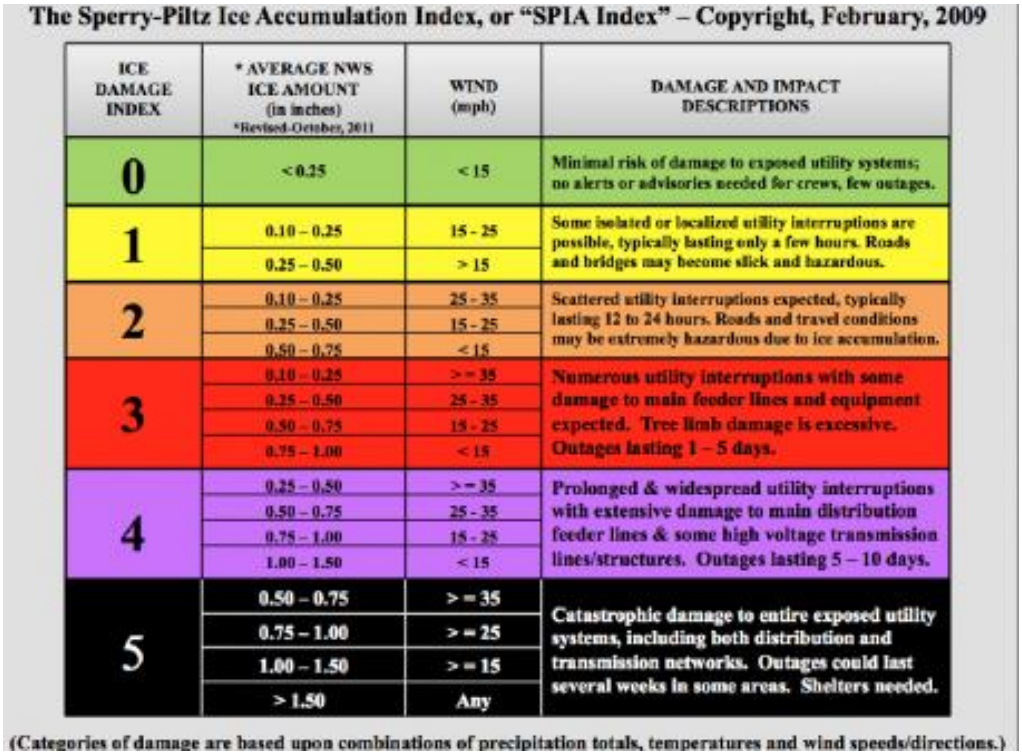
Future Occurrences

Since there have been no recorded winter storm events since 2000, there is limited risk of an event in the future. However, it is important to be prepared for a possible winter storm as when a storm does come, it can be devastating. This is largely because residents are not accustomed to dealing with the effects of the storms. Recent examples in parts of Texas are Winter Storm Uri in 2021 and Winter Storm Mara in 2023.

Extent

Due to Chambers County being in a subtropical climate there is not frequently snow accumulation that would cause significant damage. The Sperry-Piltz Ice Accumulation Index (SPIA) predicts potential damage from approaching ice storms. This index uses National Weather Service forecast data to help make its prediction. Figure 74 below quantifies the damage 0-5 based on ice amount and wind predictions.

Figure 74 - Sperry Piltz Ice Accumulation Index (SPIA)



The Sperry-Piltz Ice Accumulation Index, or "SPIA Index" – Copyright, February, 2009

ICE DAMAGE INDEX	* AVERAGE NWS ICE AMOUNT (in inches) *Revised-October, 2011	WIND (mph)	DAMAGE AND IMPACT DESCRIPTIONS
0	< 0.25	< 15	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	0.10 – 0.25	15 - 25	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
	0.25 – 0.50	> 15	
2	0.10 – 0.25	25 - 35	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
	0.25 – 0.50	15 - 25	
	0.50 – 0.75	< 15	
3	0.10 – 0.25	> = 35	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
	0.25 – 0.50	25 - 35	
	0.50 – 0.75	15 - 25	
	0.75 – 1.00	< 15	
4	0.25 – 0.50	> = 35	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
	0.50 – 0.75	25 - 35	
	0.75 – 1.00	15 - 25	
	1.00 – 1.50	< 15	
5	0.50 – 0.75	> = 35	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.
	0.75 – 1.00	> = 25	
	1.00 – 1.50	> = 15	
	> 1.50	Any	

(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Impact

Some of the largest impacts of winter storms in the planning area are to infrastructure like the power grid and pipes. Due to the lack of winter storms that the area receives, in many cases the communities are ill prepared to deal with the impacts. This was shown in Winter Storm Uri in 2021 that left large parts of the state without power and some without water for a time. In addition, motorists are not used to the icy roads which can cause significantly more accidents.

Effect of Climate Change on Winter Storm

The Environmental Protection Agency (EPA) tracks climate change indicators – one being heavy precipitation. On the website it states, "Climate change can affect the intensity and frequency of precipitation. Warmer oceans increase the amount of water that evaporates into the air. When more moisture-laden air moves over land or converges into a storm system, it can produce more intense precipitation—for example, heavier rain and snowstorms. The potential impacts of heavy precipitation include crop damage, soil erosion, and an increase in flood risk due to heavy rains (see the River Flooding indicator)—which in turn can lead to injuries, drownings, and other flooding-related effects on health." (https://www.epa.gov/climate-indicators/climate-change-indicators-heavy-precipitation)

As a result of heavier rain and snowstorms due to climate change, the probability of more hazardous winter storm within the County may increase.

Social Vulnerability

Social vulnerability is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

The groups that are most at risk during winter storm events are the homeless, the elderly, and those with health issues that limit them physically. The homeless due to lack of shelter, and the elderly due to limitations from being able to clear snow in driveway to leave home as well as increased risk of injury from falling on icy grounds.

Overall Vulnerability

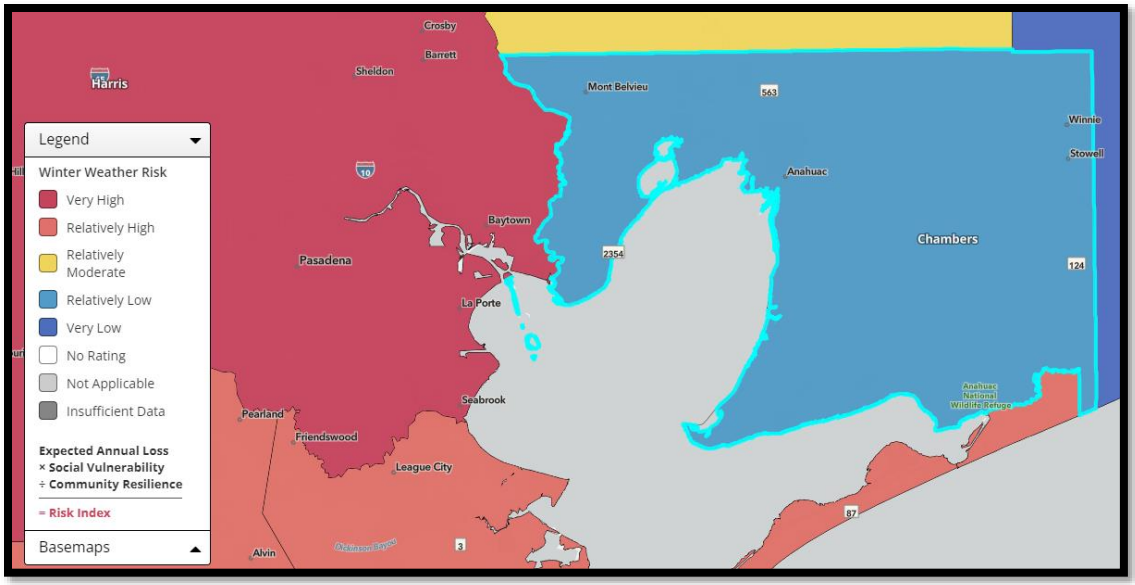
The overall vulnerability of Chambers County assets to winter storms is relatively low. The main assets at risk are pipes, crops, and infrastructure. Many assets would not likely be affected by the severity of winter storms that have historically occurred in the parts of Texas.

The National Risk Index shows wildfires are relatively low (52.9 national percentile) and relatively moderate (55.0 national percentile) in expected annual loss. This index estimates a 59 thousand dollar expected annual loss.

Future Changes that May Impact Vulnerability

Understanding future changes that affect vulnerability in the Planning Area can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development – the ability of new development to withstand winter weather impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction.
- Projected changes in population - With an increase in population, more people will be exposed to winter weather events. Additionally, the age of the population, changes in their geography, and how climate change could alter the winter weather received (rain versus snow) will be important to continue to assess future changes in vulnerability.


Legend
Winter Weather Risk
Very High
Relatively High
Relatively Moderate
Relatively Low
Very Low
No Rating
Not Applicable
Insufficient Data
Expected Annual Loss
× Social Vulnerability
÷ Community Resilience
= Risk Index
Basemaps
Harris
Crosby
Barrett
Sheldon
Mont Belvieu
563
Winnie
Stowell
Anahuac
Chambers
Baytown
Pasadena
2354
124
La Porte
Seabrook
Pearland
Friendswood
League City
Alvin
87
3

Community Assets

There are four main categories of assets that are to be considered: People, Economy, Built Environment, and Natural Environment. Although all assets found in the plan area may have some vulnerability to natural hazards discussed in this plan, the assets described below only encompass those that have jurisdictional authority over.

People: The health, safety, security, and general well-being of the citizens within the is of paramount importance to focused on areas of its responsibility - water and sanitary sewer for the entire community including dense population, access and functional need populations, children, populations that are dependent on assistance during emergencies and visiting populations.

Economy: A thriving economy is also important. focused on areas of its responsibility - water and sanitary sewer for the entire community including business and industry within its planning area.

Natural Environment: s Park must be prepared for disaster or reduce the magnitude of an event and areas that need protection in the event of disaster.

Built Environment: building and infrastructure as well as residents, industry and businesses located in the planning area. Specifically, for 's buildings and infrastructure.

The map on page __ shows the community assets considered critical as well at the County and Jurisdiction owned buildings. In addition to the building, all infrastructure (wastewater treatment plants, lift stations as examples) are also considered critical. In each annex, a high-level summary of assets at risk was also included by each hazard.

Analyze Risk

Once establishment of the hazard areas, extent, impact, and probability are complete and community assets identified, analysis can be conducted to identify where community specific vulnerabilities and problem areas exist. In addition to this information, community assets were also reviewed. Throughout this process, the city updated its critical infrastructure list to better assess what exactly, is at risk. Using this information and the most recent experiences from 2019-2023, the city ranked the hazards and developed actions to mitigate those hazards.

Hazard rankings were based on the impact to assets and hazard analysis. Hazards were ranked using a high, medium, or low ranking, defined as follows:

Low	**Unlikely to occur in area and impact is negligible.**
Medium	**Likely to occur in area, with moderate impact.**
High	**Highly likely to occur in area and impact could cause significant damage including fatalities.**

Summarize Vulnerability

The County focused on hazards that occur within the planning area that historically have had enough impact (e.g., damage to property, infrastructure, injury, or death) that mitigation of that hazard is necessary for the welfare of the community. Certain hazards have no history of impact in the planning area; therefore, the County decided to omit these hazards (earthquake, dam failure and subsidence). Once establishment of the hazard areas, extent, impact, and probability are complete and community assets identified, analysis can be conducted to identify where community specific vulnerabilities and problem areas exist. Using this information and the most recent experience of Hurricane Harvey, the city ranked the hazards and developed actions to help mitigate those hazards. The ranking list is in Table 49. While all hazards have actions, the hazards deemed medium and high were given higher priority than those ranked low.

Table 49 - Hazard Ranking

Hazard	Rank (HIGH MEDIUM LOW)
Coastal Erosion	Medium
Drought	High
Expansive Soils	High
Extreme Heat	High
Extreme Cold/Freezes	High
Flood	High
Hail	Low
Hurricane and Tropical Storm	High
Lightning	Low
Salt Domes	High
Severe Thunderstorm and High Wind	Medium
Tornado	Medium
Wildfire	Medium
Winter Storm	Medium

Section 4. Mitigation Strategy

Update from Last Plan

- Separated the status of the existing actions into completed or removed tables. The on-going actions were placed into the current hazard mitigation table, status provided and rank reassessed.
- For each action, discussed future conditions and vulnerable populations

Introduction

The planning process, hazard analysis, and vulnerability assessment serve as a foundation for a meaningful hazard mitigation strategy. The mitigation strategy provides an outline for how the County and the participating jurisdictions aim to address and reduce the risks associated with the natural hazards identified in the plan and reduce the potential impact on residents and structures identified through the risk assessment. The mitigation strategy is divided into three sections: mission statement, mitigation goal, and the mitigation action plan. The mission statement and mitigation goals provide the overall purpose of the mitigation strategy for the HMP. The mitigation action plan details specific mitigation actions, or projects, programs, and policies the County aims to meet these goals and objectives.

While developing new mitigation actions, the MPC carefully considered preventative activities (planning and zoning and hazard mapping), property protection (acquisitions, critical facility improvements), natural resource protection (floodplain protection), structural projects (storm sewer, roads and buildings), emergency services (warning systems, training) and public information and awareness (outreach, education and training).

The first step of the mitigation strategy involved review of the current plan's mission statement and mitigation goal, to assess whether it remains reflective of the current mitigation strategy. The review reaffirmed that the mission statement and goal have not changed.

Mission Statement

The HMP aims to implement new policies, programs, and projects to reduce the risks and impacts associated with natural hazards, including public education and partnerships between local officials and residents.

Mitigation Goal

Mitigation Goal A

Reduce the loss of life and serious injury due to natural hazards

Mitigation Goal B

Reduce the loss of personal and public property due to natural hazards

Status of Actions from Last Plan

The MPC went through each action from the 2017 plan to provide a status of the action and to determine if the action was completed, ongoing, no longer a priority so will be removed or changed. If the project was ongoing, it was moved to the new actions to be re-prioritized. Table 50 provides the status of the 2017 mitigation actions.

Table 50 - Status of 2017 Mitigation Actions

No.	Title	Jurisdiction	Description	Status Update as of 2024 and recommendation
A-1	Educating public on mitigation techniques	All Participating Jurisdictions	Implement an outreach and education campaign to educate the public on mitigation techniques for all hazards to reduce loss of life and property.	**Status Update:** There has been some public education. Grant funding would be helpful. The County hosts a hurricane conference which includes the stakeholders to provide guidance during a disaster. **Issues/Comment:** The County has purchased Burn Bans signs. However, purchasing more signs would be beneficial. City of Anahuac puts notices on the digital sign outside of City Hall. **Recommendation: ONGOING.** Will also include hazards wildfire and winter storm.
A-1.1	Educating public on mitigation techniques	All Participating Jurisdictions	Implement an outreach and education campaign to educate the public on mitigation techniques for erosion to reduce loss of life and property.	**Status Update:** There have been some public education. In a drought situation, the Communities will prepare a public awareness campaign to inform homeowners with slab on grade foundations to water the permitters to mitigate from cracking foundation. **Issues/Comment:** None **Recommendation: ONGOING.**
A-1.2	Educating public on mitigation techniques	All Participating Jurisdictions	Implement an outreach and education campaign to educate the public on mitigation techniques for Coastal Erosion to reduce loss of life and property.	**Status Update:** There have been some public education. Grant funding would be helpful to help distribute information from the GLO report and USFWS information. **Issues/Comment:** East Bay (boundary line between Chambers and Galveston) (Smith Point west to Hwy 124). USFWS working in the area to reduce the erosion to help mitigate for storm surge. **Recommendation: ONGOING.** Will look at possibilities through the County website and social media.

No.	Title	Jurisdiction	Description	Status Update as of 2024 and recommendation
A-2	Retrofitting structures for hail and wind protection	All Participating Jurisdictions	All participating jurisdictions will retrofit City and County owned structures with roofs that can withstand hail and high wind damage	**Status Update:** **Issues/Comment:** (2006 IBC IRC Inland 1 is 120 mph 3 second gust wind speed). Insurance providers are the main drivers for meeting wind and hail codes. Anahuac requires windstorm be built IBC 2018/2021. Mont Belvieu also has adopted building codes. General law not usually home rule City have IBC. There is not an ordinance for residential. For commercial, there is a Fire Code. The State does not allow Counties to adopt building codes **Recommendation: REMOVE**
A-3	Installing misting stations	All Participating Jurisdictions	The county and partnering cities will install misting stations throughout city and county owned parks and property to help prevent heat related illness or loss of life	**Status Update**: County is always on standby to open cooling centers when necessary. Anahuac has a splash pad (County) in Fort Anahuac Park that was built in 2022. Publicized from the digital sign. Winnie Stowell (County) and Mont Belvieu also have splash pads**.** **Issues/Comment:** Include libraries as cooling stations – 3 placed throughout the County **Recommendation: COMPLETE, CAN REMOVE**
A-4	Adopting ordinance for drought tolerant plants	All Participating Jurisdictions	All participating jurisdictions will develop an ordinance to require incorporating drought tolerant landscape design into all new county and city owned properties.	**Status Update:** Anahuac has a drought contingency plan. TBCD has a drought contingency plan. The County uses the Emergency Operations Plan annex that provides planning in the event of a drought which is also utilized in Beach City, Cove, and Old River-Winfree. Mont Belvieu has a drought contingency plan.

No.	Title	Jurisdiction	Description	Status Update as of 2024 and recommendation
				Issues/Comment: The County has purchased Burn Bans sign. However, purchasing more signs would be beneficial. City of Anahuac puts notices on the digital sign outside of City Hall. **Recommendation: REMOVE**
A-5	Rebate program for lightning rods	All Participating Jurisdictions	All participating jurisdictions will work to develop a program that offers reduced price lightning rods and technical assistance for homeowners throughout the county.	**Status Update:** Not a lightning rod program currently. The County Courthouse and cell towers have lightning protection and all new building have lightning protection. Anahuac's City buildings all have lightning protection **Issues/Comment:** **Recommendation: ONGOING.**
A-6	Drip irrigation	All Participating Jurisdictions	Jurisdictions will install drip irrigation around critical facilities' foundations throughout the county. This action mitigates the damage that shrinking and expanding soils cause on foundations and pipes.	**Status Update:** While there have not been any applications submitted yet for drip irrigations around public buildings, it is still of interest to the community's pending funding and time. **Issues/Comment:** **Recommendation: ONGOING.**
A-7	Updating Maps	All Participating Jurisdictions	All participating jurisdictions will work to update dam and levee failure inundation maps, and update floodway maps throughout the county. The updated floodway maps will also be made available to the public.	**Status Update:** There is a County-wide master drainage study that is currently underway that will look floodway information. There are no dams that impact the area. **Recommendation: REMOVE**

No.	Title	Jurisdiction	Description	Status Update as of 2024 and recommendation
A-8	Property Protection	All Participating Jurisdictions	Project will clear obstacles, widen, and reshape ditches, and upgrade culverts to restore adequate drainage to mitigate flooding throughout all participating jurisdictions	**Status Update:** Portions have been in CIP budgets but need to continue to have on future CIP budgets. **Issues/Comment:** Budget. **Recommendation: ONGOING.**
A-9	Creating Maps	All Participating Jurisdictions	Jurisdictions will work to create maps depicting coastal erosion in the county. The updated maps will also be made available to the public. These maps will be created in order to make up for the data deficiency identified in the last plan.	**Status Update:** The master drainage study is reviewing coastal erosion which may result in mapping. **Issues/Comment:** **Recommendation: ONGOING.**
B-1	Anahuac, North of Canal Drainage	Chambers County	In the City limits of Anahuac, the area north of the Chambers Liberty Counties Navigation District canal generally along N. Main Street, Texas Avenue, and Work Street.	**Status Update:** **Issues/Comment:** **Recommendation: REMOVE**
B-2	Hydroaxing Hackberry Gully and Cotton Bayou	Chambers County	Hydroaxing the entire length of Hackberry Gully and Cotton Bayou from South of I-10 to Cotton Lake. Clearing out invasive species as well as other vegetation that are	**Status Update:** Some of this work has been completed (Hackberry). **Issues/Comment:** Continued work needs to be done to complete both bayous south of S FM 565.

No.	Title	Jurisdiction	Description	Status Update as of 2024 and recommendation
			currently restricting the flow of storm water. Phases 1 and 2 have been completed, the requested funds will have completed phases 3 through 6, completing the project. The requested funds will also pay for acquisition of permanent easements on both sides of the complete length of the project area.	**Recommendation: ONGOING.**
B-3	Widen Mc Adams Ditch	Chambers County	Widen Mc Adams Ditch that crosses FM 3180 South	**Status Update:** Mc Adams Ditch was completed. **Issues/Comment:** **Recommendation: COMPLETED.**
B-4	Bridge on Rhonda Rosa Lane	Chambers County	Construct bridge on Rhonda Rosa Lane in Ranches on Turtle Bayou to replace box culverts	**Status Update:** Working with Trinity Bay Conservation District. **Issues/Comment:** **Recommendation: ONGOING.**
B-5	Harden and Expand Ambulance Service	Chambers County	Harden and expand the office and facilities for the Winnie area.	**Status Update:** Completed **Issues/Comment:** **Recommendation: COMPLETED.**

No.	Title	Jurisdiction	Description	Status Update as of 2024 and recommendation
B-6	Low Power Broadcast Radio	Chambers County	3 remote power FM broadcast radio sites with one control site for public information and warning. Could also disseminate information before, during, and after an event.	**Status Update:** Need to change. Remove. Public Notification system mentioned is outdated. **Issues/Comment:** County would place a warning siren as each fire station. Currently the County has approximately six sirens primarily at industrial areas. **Recommendation: ONGOING BUT CHANGED**
B-7	West Bay Road and Bridge	Raise West Bay Road- replace and raise bridge	Residents and structures near bridge, city, county, and regional residents traveling on West Bay Road	**Status Update:** Working with TxDOT to replace the bridge. **Issues/Comment:** **Recommendation: ONGOING.**
B-8	Desnagging, clearing, and grubbing of Turtle Bayou	Chambers County	Desnagging, clearing, and grubbing of Turtle Bayou from mouth to north of IH 10 and beyond.	**Status Update:** Working with Trinity Bay Conservation District. **Issues/Comment:** **Recommendation: ONGOING.**
B-9	Dredging Cedar Bayou	Chambers County	Dredging Cedar Bayou in West Chambers County	**Status Update: Working with USACE** **Issues/Comment:** **Recommendation: ONGOING.**
B-10	Dredging West Fork- Double Bayou	Chambers County	Dredge West Fork- Double Bayou from mouth to FM 562 bridge	**Status Update:** Working with Trinity Bay Conservation District. **Issues/Comment:** **Recommendation: ONGOING.**

No.	Title	Jurisdiction	Description	Status Update as of 2024 and recommendation
B-11	Enlarge ditches and create retention-Spindletop Bayou	Chambers County	Increase IH10 crossings, enlarge ditches and create retention along the Spindletop Bayou in east Chamber County	**Status Update:** Working with Trinity Bay Conservation District. **Issues/Comment:** **Recommendation: ONGOING.**
B-12	Shelving of Hackberry Gully and Cotton Bayou	Chambers County	Shelving the entire length of Hackberry Gully and Cotton Bayou from South of I-10 to Cotton Lake; thereby increasing the capacity of both in regard to the amount of water that they will hold during a flood event.	**Status Update:** **Issues/Comment:** **Recommendation: REMOVE**
B-13	Mobile Generators for Critical Facilities	Chambers County	(5) Mobile/portable generators to assist in keeping critical infrastructure online.	**Status Update:** **Issues/Comment:** Funding **Recommendation: ONGOING**
B-14	Storage building for generators and emergency supplies	Chambers County	Storage building to house and keep safe generators used to mitigate potential power losses, as well as emergency supplies and rescue equipment such as high water vehicles.	**Status Update:** **Issues/Comment:** Funding. **Recommendation: ONGOING.**
B-15	Road and Bridge Main	Chambers County	Stationary generator to power main Road and Bridge facility, which includes refueling stations.	**Status Update:** Completed **Recommendation: COMPLETED, no further action needed.**

No.	Title	Jurisdiction	Description	Status Update as of 2024 and recommendation
	Facility Generator			
B-16	Generator for White's Park Community Building/ Post-Storm Shelter (stationary)	Chambers County	Stationary generator to power large post-storm shelter for residents displaced after a disaster	**Status Update: Completed** **Recommendation: COMPLETED, no further action needed.**
B-17	Westside Community Building/Shelter	Chambers County	Stationary generator to power large post-storm shelter for residents displaced after a disaster	**Status Update:** Completed **Recommendation: COMPLETED, no further action needed.**
B-18	Shelter Generators	Chambers County	(3) stationary generators to power post-storm shelters for residents displaced after a disaster	**Status Update:** Completed **Recommendation: COMPLETED, no further action needed.**
B-19	Westside Road and Bridge Facility Generator	Chambers County	Stationary generator to power to Westside Road and Bridge facility, which includes refueling stations.	**Status Update:** Completed **Recommendation: COMPLETED, no further action needed.**
B-20	Westside Box Site	Chambers County	Stationary generator to power citizen collection station for debris collection	**Status Update:** Completed **Recommendation: COMPLETED, no further action needed.**

No.	Title	Jurisdiction	Description	Status Update as of 2024 and recommendation
C-1	North Anahuac Drainage	Anahuac	Clean and enlarge road ditches and culverts. Channelized the drainage outfall for the area north of the Lonestar Canal	**Status Update:** Ongoing, need to see if project is in the MDP. **Issues/Comment:** **Recommendation: ONGOING.** Will also include hazards wildfire and winter storm. CDBG-DR grant for drainage work in this area
C-2	Raw water pond armoring	Anahuac	Erosion proofing of the water treatment plant raw water pond	**Status Update:** Change. Not erosion proofing. Need to expand the size of the water pond. **Issues/Comment:** **Recommendation: ONGOING.** Change. Not erosion proofing. Need to expand the size of the water pond.
C-3	Southwest Anahuac Ditch	Anahuac	Channelization and crossing upgrades from Main Street to Bay	**Status Update:** A grant is needed. TxDOT grant. **Issues/Comment:** **Recommendation: ONGOING.**
C-4	Southeast Drainage Ditch	Anahuac	Channelization and crossing upgrades from Boliver Avenue to FM 563	**Status Update:** Complete, received a grant. **Issues/Comment:** **Recommendation: Complete.**

No.	Title	Jurisdiction	Description	Status Update as of 2024 and recommendation
C-5	Lift Station Reha-bilitation	Anahuac	Rehabilitation of 3 sanitary sewer lift stations to alleviate flooding of pumps.	**Status Update:** Completed. TWDB low interest loan including new water lines, new sewer lines and new wastewater treatment plant. **Issues/Comment:** **Recommendation: COMPLETE.**
D-1	Extend Langston Road	Mont Belvieu	Extend Langston Road to IH 10 Feed allowing 2 access points to McLeod Park Shelter	**Status Update:** City is still working on a plan to provide second access to McLeaod Park. **Issues/Comment:** ROW access and funding for the new road **Recommendation: ONGOING.** Pursue to get second access to Langston by possibly moving the connector road from I-10 frontage road to connect from SH99

New Actions

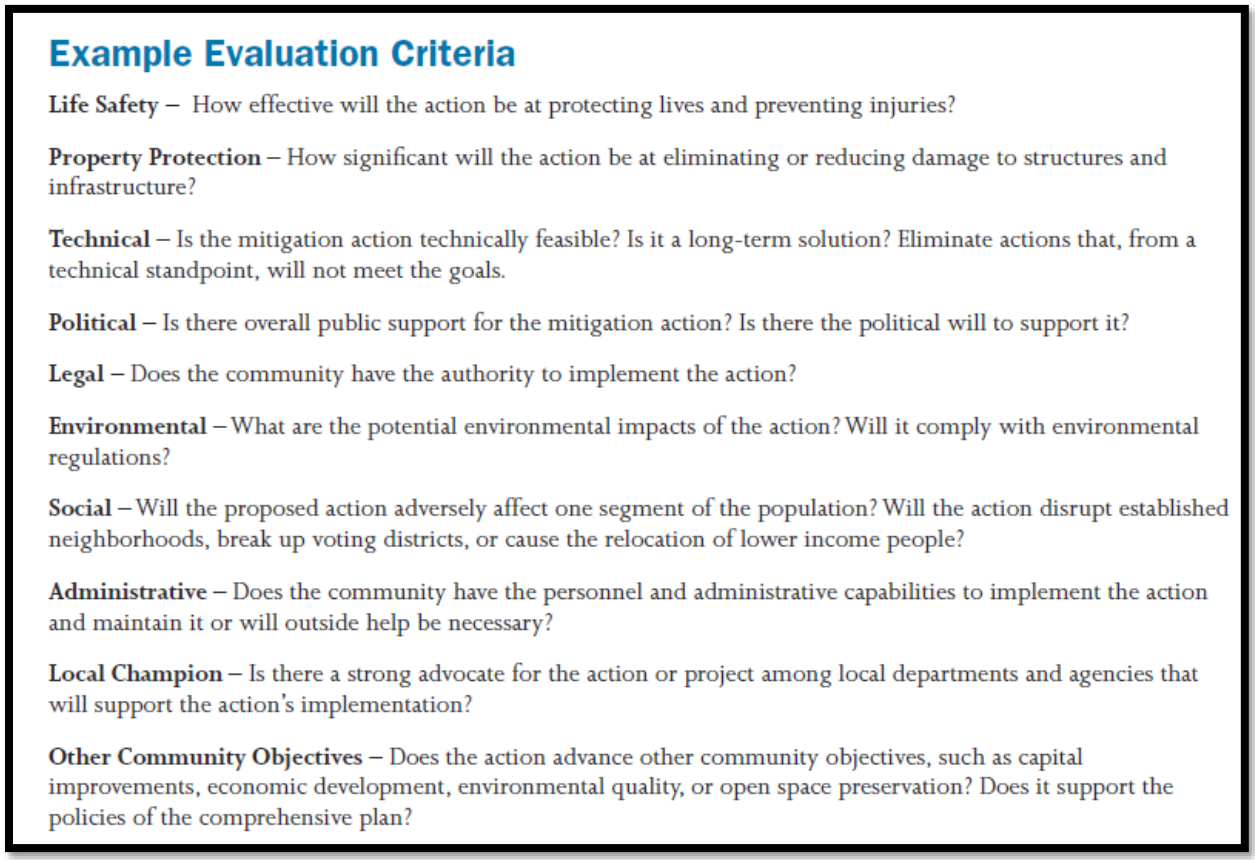
After a review of the actions in the current plan, the MPC began a process to identify new actions. The MPC utilized a version of FEMA's Mitigation Implementation Action Summary Worksheet to help describe important information about the action. In addition, the MPC tried to determine impacts from climate adaptation and on socially vulnerable populations.

After the actions were prioritized (discussed next section), the Actions Summary Worksheets were converted into the Mitigation Action Table.

Evaluate and Prioritize

To evaluate feasibility and analyze prioritization of actions, all new and existing actions were reviewed by the MPC. The process utilized the Mitigation Action Implementation Tool. The MPC was asked to consider the feasibility of identified mitigation actions as high, medium, or low and using the Mitigation Action Evaluation Tool (Life Safety, Property Protection, Technical, Political, Legal, Environmental, Social, Administration, Local Champion, and Other Community Objectives) rank the category 1-10 with 1 being a low priority for the category and 10 being a high for the category. Descriptions of the criteria are in Figure 75

Figure 75 - Description of Evaluation Criteria for Mitigation Prioritization



Example Evaluation Criteria

Life Safety – How effective will the action be at protecting lives and preventing injuries?

Property Protection – How significant will the action be at eliminating or reducing damage to structures and infrastructure?

Technical – Is the mitigation action technically feasible? Is it a long-term solution? Eliminate actions that, from a technical standpoint, will not meet the goals.

Political – Is there overall public support for the mitigation action? Is there the political will to support it?

Legal – Does the community have the authority to implement the action?

Environmental – What are the potential environmental impacts of the action? Will it comply with environmental regulations?

Social – Will the proposed action adversely affect one segment of the population? Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?

Administrative – Does the community have the personnel and administrative capabilities to implement the action and maintain it or will outside help be necessary?

Local Champion – Is there a strong advocate for the action or project among local departments and agencies that will support the action's implementation?

Other Community Objectives – Does the action advance other community objectives, such as capital improvements, economic development, environmental quality, or open space preservation? Does it support the policies of the comprehensive plan?

Low is defined as 1-50; Medium is defined as 51-75; and High is defined as 76-100. The results are shown in Table 51. The addressed hazards were also provided.

Table 51 - Ranking of Actions to Determine Priority Level

Action No.	Action (no.) Moved from 2017-2018 actions to current actions	MITIGATION ACTION SUMMARY OF PRIORITIZATION TOTAL SCORE BETWEEN 1-50 HAZARD IS LOW PRIORITY (L) TOTAL SCORE BETWEEN 51-75 HAZARD IS MEDIUM PRIORITY (M) TOTAL SCORE BETWEEN 76-100 HAZARD IS HIGH PRIORITY (H)	Total	Priority	Addressed Hazard CE: Coastal Erosion D: Drought EC/F: Extreme Cold/Freeze ES Expansive Soils EH: Extreme Heat F: Flood H: Hail H/TS: Hurricane/Tropical Storm L: Lightning SD: Salt Dome T/HW: Severe Thunderstorm/ High Wind T: Tornado WF: Wildfire W: Winter storm
32		Air Monitoring System Around the Salt Dome Area	88	H	SD
33		Seismic Activity System to detect ground disturbance around the Salt Dome Area	87	H	SD
34	A-8	Property Protection	83	H	F, H/TS, T/HW
34		Teacherville Drainage Improvement	82	H	F, H/TS, T/HW
1	A-1 and A-1.1	Educating public on mitigation techniques	82	H	D, EC/F, ES, EH, F, H, H/TS, L, T, WF, W
13	C-1	North Anahuac Drainage	77	H	F, H/, T/HW
10	B-9	Dredging Cedar Bayou	71	M	F, H/, T/HW
12	B-11	Enlarge ditches and create retention- Spindletop Bayou	70	M	F, H/, T/HW
11	B-10	Dredging West Fork- Double Bayou	70	M	F, H/, T/HW
6	B-2	Hydroaxing Hackberry Gully and Cotton Bayou	70	M	F, H/TS, T/HW
27		Generators at the lift stations in Anahuac	68	M	CE, F, H/TS, T/HW
5	A-9	Creating Maps	67	M	CE, F, H/TS
29		West Bay Living Shorelines at Sweetwater Preserve and Maggie's Cove	66	M	CE, F, H/TS, T/HW
24		Harden the emergency management stations (12) throughout the County	66	M	CE, F, H/TS, T/HW
35		Anahuac Main Pump Station	65	M	F, T/HW, ES, L, D
36		Lake Anahuac Pump Station	65	M	F, H/TS, T/HW, ES, L, D
17		Old River Cove Restoration	64	M	CE, F, H/TS, T/HW
14	C-3	Southwest Anahuac Ditch	64	M	F, H/, T/HW
37		Hog Bayou/Lake Anahuac Gate Structure	64	M	F, T/HW, ES, L, D
38		New Generator for CLCND Pump	64	M	F, T/HW, ES, L, D
21		Southeast Texas Flood Coordination Study - Regional Flood Sensor System	63	M	CE, F, H/TS, T/HW
23		Moody NWR Conservation and Restoration	62	M	CE, F, H/TS, T/HW
7	B-4	Bridge on Rhonda Rosa Lane	61	M	F, H/TS
39		Safe Room/Community Center in Mont Belvieu	61	M	EH, FL, H, H/TS, L, SD, T/HW, T, WF, W
2	A-5	Rebate program for lightning rods	61	M	L
22		East and West Galveston Bay Watershed, Wetland, and Habitat Conservation	60	M	CE, F, H/TS, T/HW
19		East Bay Living Shorelines and Wetland Restoration	60	M	CE, F, H/TS, T/HW
18		Anahuac National Wildlife Refuge East Unit Beneficial Use	60	M	CE, F, H/TS, T/HW
16		Anahuac National Wildlife Refuge Conservation and Restoration	59	M	CE, F, H/TS, T/HW
20		Pierce Marsh Wetland Restoration and Shoreline Protection	56	M	CE, F, H/TS, T/HW
8	B-7	West Bay Road and Bridge	55	M	F, H/TS
9	B-8	Desnagging, clearing, and grubbing of Turtle Bayou	53	M	F, H/, T/HW
30	B-13	5 mobile/portable generators to assist in keeping critical infrastructure online	52	M	CE, F, H/TS, EH, EC/F, T
31	B-14	Storage building for generators and emergency supplies	50	L	CE, F, H/TS, EH, EC/F, T
28		Generators at Emergency Services Stations (12)	50	L	CE, F, H/TS, EH, EC/F, T
25		Warning Sirens	50	L	CE, F, H/TS, T/HW, T, H, WF
26		Expansion of Raw Water Pond	47	L	CE, F, H/TS, T/HW, T, H, WF
15	D-1	Extend Langston Road to allow 2 Access Points to McLeod Park Shelter	40	L	F, H/TS, T, EH, H
3	A-6	Drip Irrigation	37	L	ES

Table 52 provides a list of each action by its action number. The Table also shows if the action is one that moved from the 2017/2018 plan and its priority level.

Table 52 - Mitigation Actions (2017 Plan)

Action No.	Former Action No.	Title	Priority
1	A-1 and A-1.1	Educating public on mitigation techniques	H
2	A-5	Rebate program for lightning rods	M
3	A-6	Drip Irrigation	L
4	A-8	Property Protection	H
5	A-9	Creating Maps	M
6	B-2	Hydroaxing Hackberry Gully and Cotton Bayou	M
7	B-4	Bridge on Rhonda Rosa Lane	M
8	B-7	West Bay Road and Bridge	M
9	B-8	Desnagging, clearing, and grubbing of Turtle Bayou	M
10	B-9	Dredging Cedar Bayou	M
11	B-10	Dredging West Fork- Double Bayou	M
12	B-11	Enlarge ditches and create retention- Spindletop Bayou	M
13	C-1	North Anahuac Drainage	H
14	C-3	Southwest Anahuac Ditch	M
15	D-1	Extend Langston Road to allow 2 Access Points to McLeod Park Shelter	L
16		Anahuac National Wildlife Refuge Conservation and Restoration	M
17		Old River Cove Restoration	M
18		Anahuac National Wildlife Refuge East Unit Beneficial Use	M
19		East Bay Living Shorelines and Wetland Restoration	M
20		Pierce Marsh Wetland Restoration and Shoreline Protection	M
21		Southeast Texas Flood Coordination Study - Regional Flood Sensor System	M
22		East and West Galveston Bay Watershed, Wetland, and Habitat Conservation	M
23		Moody NWR Conservation and Restoration	M
24		Harden the emergency management stations (12) throughout the County	M
25		Warning Sirens	L
26		Expansion of Raw Water Pond	L
27		Generators at the lift stations (Anahuac and Mont Belvieu), wastewater plants and wells in Mont Belvieu	M
28		Generators at Emergency Services Stations (12)	L
29		West Bay Living Shorelines at Sweetwater Preserve and Maggie's Cove	M
30	B-13	5 mobile/portable generators to assist in keeping critical infrastructure online	M
31	B-14	Storage building for generators and emergency supplies	L
32		Air Monitoring System Around the Salt Dome Area	H

Action No.	Former Action No.	Title	Priority
33		Seismic Activity System to detect ground disturbance around the Salt Dome Area	H
34		Teacherville Drainage Improvement	H
35		Anahuac Main Pump Station	M
36		Lake Anahuac Pump Station	M
37		Hog Bayou/Lake Anahuac Gate Structure	M
38		Generator for CLCND Pump	M
39		Safe Room/Community Center in Mont Belvieu	M

The Mitigation Action Table for 2024 can be found in Table 53.

Table 53 - The Mitigation Actions

<table>
<tr><th colspan="5">ACTION NO. 1
(moved from current plan (no. A-1 and A-1.1) into new actions)</th></tr>
<tr><td colspan="5">Title: Educating public on mitigation techniques</td></tr>
<tr><td colspan="5">JURISDICTION(S): Chambers County, Anahuac, Beach City, Cove, Mt. Belvieu, Old River-Winfree, and CLCND</td></tr>
<tr><th>Hazard(s) Addressed</th><th colspan="3">Description of Action</th><th>Implementing Department</th></tr>
<tr><td>Drought
Extreme Cold/Freezes
Expansive Soils
Extreme Heat
Flood
Hail
Hurricanes and Tropical Storms
Lightning
Tornadoes
Wildfire
Winter Storm</td><td colspan="3">Implement an outreach and education campaign to educate the public on mitigation techniques for all hazards to reduce loss of life and property.</td><td>Chambers County - Emergency Management Department
Anahuac - City Manager
Beach City - Mayor and City Council
Cove - Mayor and City Council
Mt. Belvieu - Emergency Services Department
Old River-Winfree- Mayor and City Council
CLCND – General Manager</td></tr>
<tr><th>Potential Funding Sources</th><th>Cost Estimate</th><th>Priority</th><th>Time Frame</th><th>Reduces Risk to:</th></tr>
<tr><td>Local budget and salary, HMPG, Fire Prevention and Safety Grants</td><td>$7,000</td><td>H</td><td>3-5 years</td><td>1. Existing Building and Infrastructure</td></tr>
<tr><th>Cost Benefit (avoided losses)</th><th colspan="3">Future Conditions Consideration (e.g.: climate change, population change)</th><th>Risk Addressed with note on benefit to vulnerable populations</th></tr>
<tr><td>Public education and Awareness</td><td colspan="3">Awareness and education about the growing threat from increased and more intense storms will help the public prepare for disasters.</td><td>As part of the analysis, the County reviews the impacts to the whole community.</td></tr>
</table>

ACTION NO. 2 (moved from current plan (no. A-5 into new actions)				
Title: Rebate program for lightning rods				
JURISDICTION(S): Chambers County, Anahuac, Beach City, Cove, Mt. Belvieu, Old River-Winfree, and CLCND				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Lightning	All participating jurisdictions will work to develop a program that offers reduced price lightning rods and technical assistance for homeowners throughout the County			Chambers County - Emergency Management Department Anahuac - City Manager Beach City - Mayor and City Council Cove - Mayor and City Council Mt. Belvieu - Emergency Services Department Old River-Winfree- Mayor and City Council CLCND – General Manager
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
HMPG, Fire Prevention and Safety Grants	$150,000	M	1-3 years	1. Existing Building and Infrastructure
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Homes and residents who could be affected by lightning.	Lightening may surge under climate change, but studies are limited.			As part of the analysis, the County reviews the impacts to the whole community.

ACTION NO. 3 (moved from current plan (no. A-6 into new actions)				
Title: Drip Irrigation				
JURISDICTION(S): Chambers County, Anahuac, Beach City, Cove, Mt. Belvieu, Old River-Winfree, and CNCLD				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Expansive Soils	Jurisdictions will install drip irrigation around critical facilities' foundations throughout the county. This action mitigates the damage that shrinking and expanding soils cause on foundations and pipes			Chambers County - Emergency Management Department and Engineering Department Anahuac - City Manager Beach City - Mayor and City Council Cove - Mayor and City Council Mt. Belvieu - Emergency Services Department and Engineering Dept. Old River-Winfree- Mayor and City Council CLCND – General Manager
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
HMPG, Fire Prevention and Safety Grants	$250,000	L	1-3 years	1. Existing Building and Infrastructure
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Cost of Repair to critical foundations, water, and sewer lines	Extreme weather may surge under climate change, but studies are limited.			This is to protect County assets.

ACTION NO. 4 (moved from current plan (no. A-8 into new actions)			
Title: Property Protection			
JURISDICTION(S): Chambers County, Anahuac, Beach City, Cove, Mt. Belvieu, Old River-Winfree, and CLCND			
Hazard(s) Addressed	**Description of Action**		**Implementing Department**
Floods Hurricanes/Tropical Storms Thunderstorms/High Winds	Project will clear obstacles, widen, and reshape ditches, and upgrade culverts to restore adequate drainage to mitigate flooding throughout all participating jurisdictions		Chambers County - Emergency Management Department and Engineering Department Anahuac - City Manager Beach City - Mayor and City Council Cove - Mayor and City Council Mt. Belvieu - Emergency Services Department and Engineering Dept. Old River-Winfree- Mayor and City Council CLCND – General Manager
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
FEMA Grants (HMGP, FMA, BRIC), CDBG DR Grants, TxDOT, USACE and GLO	$550,000	H	1-3 years	1. Existing Building and Infrastructure 2. New Building
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Homes, businesses, and public facilities	Design will take into account climate adaption and resilience using best available data.			Design will take into account vulnerable populations.

ACTION NO. 5 (moved from current plan (no. A-9 into new actions)				
Title: Creating Maps				
JURISDICTION(S): Chambers County, Anahuac, Beach City, Cove, Mt. Belvieu, Old River-Winfree, and CLCND				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Coastal Erosion Flooding Hurricane/Tropical Storms	Jurisdictions will work to create maps depicting coastal erosion in the County. The updated maps will also be made available to the public.			Chambers County - Emergency Management Department and Engineering Department Anahuac - City Manager Beach City - Mayor and City Council Cove - Mayor and City Council Mt. Belvieu - Emergency Services Department and Engineering Dept. Old River-Winfree- Mayor and City Council CLCND – General Manager
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
FEMA Grants (HMGP, FMA, BRIC), CDBG DR Grants, TxDOT, USACE and GLO	$550,000	M	1-3 years	1. Existing Building and Infrastructure 2. New Building
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Homes and property	Continued and growing threats to the critical infrastructure and natural systems requires the need to protect these assets.			Protecting community assets and natural systems and resources through mapping can identify vulnerabilities so projects can be developed.

ACTION NO. 6 (moved from current plan (no. B-2 into new actions)				
Title: Hydroaxing Hackberry Gully and Cotton Bayou				
JURISDICTION(S): Chambers County				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Flooding Hurricane/Tropical Storms Severe Thunderstorm/High Wind	Hydroaxing the entire length of Hackberry Gully and Cotton Bayou from South of I-10 to Cotton Lake. Clearing out invasive species as well as other vegetation that are currently restricting the flow of storm water. The project is broken into six phases. Phases 1 and 2 have been completed. However grant funds are needed to complete phases 3 through 6. Grant funds would also pay for acquisition of permanent easements on both sides of the complete length of the project area.			Chambers County - Emergency Management Department, Economic Development Department, and Engineering Department
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
FEMA Grants (HMGP, FMA, BRIC)	$2,500,000	M	3-5 years	1. Existing Building and Infrastructure 2. New Building
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
This area has been prone to flooding in the resent heavy rain events. Water filling the streets and coming near and/or entering homes. This is unincorporated area south of I-10 and East of 99 in the flood plains for Hackberry Gully and Cotton Bayou.	Design will take into account climate adaption and resilience using best available data.			Design will take into account vulnerable populations.

ACTION NO. 7 (moved from current plan (no. B-4 into new actions)				
Title: Bridge on Rhonda Rosa Lane				
JURISDICTION(S): Chambers County				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Flooding Hurricane/Tropical Storms Severe Thunderstorm/High Wind	Construct bridge on Rhonda Rosa Lane in Ranches on Turtle Bayou to replace box culverts			Chambers County - Emergency Management Department, Economic Development Department, and Engineering Department Working with Trinity Bay Conservation District
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
FEMA Grants (HMGP, FMA, BRIC), Rebuild Texas Project	$500,000	M	1-3 years	1. Existing Building and Infrastructure 2. New Building
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Residents and structures near Turtle Bayou.	Design will take into account climate adaption and resilience using best available data.			It is the only access/egress road to this area and hazards like flooding could be cut off from emergency support.

ACTION NO. 8 (moved from current plan (no. B-7 into new actions)				
Title: West Bay Road and Bridge				
JURISDICTION(S): Chambers County				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Flooding Hurricane/Tropical Storms Severe Thunderstorm/High Wind	Raise West Bay Road- replace and raise bridge.			Chambers County - County Judge, Emergency Management Department, Economic Development Department, and Engineering Department Working with TxDOT
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
Rebuild Texas Project, TXDOT Safe Pathways Program	$1,500,000	M	3-5 years	1. Existing Building and Infrastructure 2. New Building
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Residents and structures near bridge, city, county, and regional residents traveling on West Bay Road	Design will take into account climate adaption and resilience using best available data.			Design will take into account vulnerable populations.

ACTION NO. 9 (moved from current plan (no. B-8 into new actions)				
Title: Desnagging, clearing, and grubbing of Turtle Bayou				
JURISDICTION(S): Chambers County				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Flooding Hurricane/Tropical Storms Severe Thunderstorm/High Wind	Desnagging, clearing, and grubbing of Turtle Bayou from mouth to north of IH 10 and beyond.			Chambers County - County Judge, Emergency Management Department, Economic Development Department, and Engineering Department Working with Trinity Bay Conservation District
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
Rebuild Texas Project	$10,000,000	M	2-5 years	1. Existing Building and Infrastructure 2. New Building
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Residents and structures along Turtle Bayou	Design will take into account climate adaption and resilience using best available data.			Design will take into account vulnerable populations.

ACTION NO. 10 (moved from current plan (no. B-9 into new actions)				
Title: Dredging Cedar Bayou				
JURISDICTION(S): Chambers County, Mont Belvieu, Beach City, and CLCND				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Flooding Hurricane/Tropical Storms Severe Thunderstorm/High Wind	Dredging Cedar Bayou in West Chambers County			Chambers County - County Judge, Emergency Management Department, Economic Development Department, and Engineering Department Working with USACE Beach City – Mayor and City Council Mont Belvieu – Engineering Department CLCND – General Manager
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
USACE	$250,000,000	M	3-5 years	1. Existing Building and Infrastructure 2. New Building
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Residents and structures along Cedar Bayou	Design will take into account climate adaption and resilience using best available data.			Design will take into account vulnerable populations.

ACTION NO. 11 (moved from current plan (no. B-10 into new actions)			
Title: Dredging West Fork- Double Bayou			
JURISDICTION(S): Chambers County, Anahuac			
Hazard(s) Addressed	**Description of Action**		**Implementing Department**
Flooding Hurricane/Tropical Storms Severe Thunderstorm/High Wind	Dredge West Fork- Double Bayou from mouth to FM 562 bridge		Chambers County - County Judge, Emergency Management Department, Economic Development Department, and Engineering Department Working with USACE and Trinity Bay Conservation District Anahuac – City Administrator
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**
USACE, GLO CDBG-DR, TWDB	$5,500,000	M	3-5 years
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**		**Risk Addressed with note on benefit to vulnerable populations**
Residents and structures along Double Bayou	Design will take into account climate adaption and resilience using best available data.		Design will take into account vulnerable populations.

ACTION NO. 12 (moved from current plan (no. B-11 into new actions)			
Title: Enlarge ditches and create retention- Spindletop Bayou			
JURISDICTION(S): Chambers County			
Hazard(s) Addressed	**Description of Action**		**Implementing Department**
Flooding Hurricane/Tropical Storms Severe Thunderstorm/High Wind	Increase IH10 crossings, enlarge ditches and create retention along the Spindletop Bayou in east Chambers County		Chambers County - County Judge, Emergency Management Department, Economic Development Department, and Engineering Department Working with TxDot and Trinity Bay Conservation District
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
USACE, GLO - CDBG-DR	$5,500,000	M	3-5 years	1. Existing Building and Infrastructure 2. New Building
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Residents and structures along the Spindletop Bayou in Chambers County.	Design will take into account climate adaption and resilience using best available data.			Design will take into account vulnerable populations.

ACTION NO. 13 (moved from current plan (no. C-1 into new actions)			
Title: North Anahuac Drainage			
JURISDICTION(S): City of Anahuac			
Hazard(s) Addressed	**Description of Action**		**Implementing Department**
Flooding Hurricane/Tropical Storms Severe Thunderstorm/High Wind	Clean and enlarge road ditches and culverts. Channelized the drainage outfall for the area north of the Lonestar Canal (runs behind City Hall). Chambers County has received a grant from CDBG-DR for drainage work in the area.		Anahuac City Council and City Manager
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
CDBG-DR - MIT	$14,000,000	H	3-5 years	1. Existing Building and Infrastructure 2. New Building
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Flooding of homes and City's water plant	Design will take into account climate adaption and resilience using best available data.			Critical infrastructure is being protected. LMI area is also being protected.

ACTION NO. 14 (moved from current plan (no. C-3 into new actions)			
Title: Southwest Anahuac Ditch			
JURISDICTION(S): City of Anahuac			
Hazard(s) Addressed	**Description of Action**		**Implementing Department**
Flooding Hurricane/Tropical Storms Severe Thunderstorm/High Wind	Channelization and crossing upgrades from Main Street to Bay		Anahuac City Council and City Manager
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
CDBG-DR, FEMA FMA, HMGP, and BRIC, TxDOT grants	$500,000	M	3-5 years	1. Existing Building and Infrastructure 2. New Building
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**		**Risk Addressed with note on benefit to vulnerable populations**
Residents and structures from Main Street to Bay	Design will take into account climate adaption and resilience using best available data.		

ACTION NO. 15 (moved from current plan (no. D-1) into new actions)			
Title: Extend Langston Road			
JURISDICTION(S): City of Mont Belvieu			
Hazard(s) Addressed	**Description of Action**		**Implementing Department**
Flooding Hurricane/Tropical Storms Tornado Extreme Heat Hail	Extend Langston Road (one way road). It is easy for residents to be trapped. These new access points would allow an alternative to evacuate that is currently not present. City is still working on a plan to provide second access to McLeod Park. ROW access and funding is needed for the new road. Pursue funding to get second access to Langston by possibly moving the connector road from I-10 frontage road to connect from SH99.		Mont Belvieu City Engineer
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
CDBG-DR, FEMA FMA, HMGP, and BRIC, TxDOT grants	$9,000,000	L	3-5 years	1. Existing Building and Infrastructure
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**		**Risk Addressed with note on benefit to vulnerable populations**
Helping residents to evacuate.	Design will take into account climate adaption and resilience using best available data.		Mt. Belvieu and West Chambers residents are left with limited evacuation routes.

ACTION NO. 16				
Title: Anahuac National Wildlife Refuge Conservation and Restoration				
JURISDICTION(S): Chambers County, Anahuac				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Coastal Erosion Flood Hurricane/TS Thunderstorms/HW	The Texas Chenier Plain Refuge Complex supports a collection of National Wildlife Refuges (NWRs), including Anahuac, McFaddin, Texas Point, and Moody. This project would involve the acquisition of 65,000 acres of additional riverine, subtidal, freshwater, and marine habitats to include in the Texas Chenier Plain Refuge Complex and subsequent restoration and/or management of the land to a more natural and resilient state. This land spans across Chambers, Jefferson, and Galveston counties and acquisition efforts have added several thousand acres to Anahuac NWR.			Chambers County Engineering/Capital Projects Public Works Department
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
Federal Grants, Capital Projects Budget, GOMESA Fund	$25M	M	3-5 years	1. Existing Building and Infrastructure 2. New Development
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Avoided future flood risk Protects 8 critical facilities Protect 1 critical habitat, 12 endangered species and 36 migratory bird species.	The diverse coastal wetland habitats within the Texas Chenier Plain Refuge Complex are experiencing rates of decline along the Texas coast due to changing hydrologic conditions. These complexes are some of the largest along the coast but are also some of the most vulnerable with significant subsidence likely along the Chenier Plain			

ACTION NO. 17				
Title: Old River and Cove Restoration				
JURISDICTION(S): Chambers County, Old River-Winfree, Cove				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Coastal Erosion Flood Hurricane/TS Thunderstorms/HW	Construct approximately 7000 LF of breakwaters in addition to BUDM placement for living shoreline to protect wetlands.			Chambers County, Engineering Department working with State agencies Cove – Mayor and City Council Old River-Winfree – Mayor and City Council
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
Federal Grants, GLO, TWDB Grants	$9.2M	M	3-5 years	1. Existing Building and Infrastructure 2. New Development
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Avoided future flood risk Protects 8 critical facilities Protect 1 critical habitat, 12 endangered species and 36 migratory bird species.	The diverse coastal wetland habitats within the Texas Chenier Plain Refuge Complex are experiencing rates of decline along the Texas coast due to changing hydrologic conditions. These complexes are some of the largest along the coast but are also some of the most vulnerable with significant subsidence likely along the Chenier Plain			

ACTION NO. 18				
Title: Anahuac National Wildlife Refuge East Unit Beneficial Use				
JURISDICTION(S): Chambers County, Anahuac				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Coastal Erosion Flood Hurricane/TS Thunderstorms/HW	This project consists of restoring and enhancing the deteriorated marsh and open water areas within the heavily degraded Roberts Mueller habitat management unit on Anahuac National Wildlife Refuge (NWR). The tract is located on the north side of the Gulf Intracoastal Waterway (GIWW), just inland of its confluence with East Galveston Bay. Four beneficial use of dredged material (BUDM) cells are proposed, totaling 552 acres and requiring over 620,000 cubic yards of BUDM. This project is a high priority candidate in the Ducks Unlimited Beneficial Use Master Plan currently in progress. Preliminary engineering and 60% design have been completed on the four proposed restoration cells; this project would allow final engineering and design, permitting, and construction to be completed.			Chambers Engineering/Capital Projects Public Works Departments Anahuac – City Manager and Council
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
Federal Grants, GLO, TWDB Grants. Multi-County effort	$16M	M	3-5 years	1. Existing Building and Infrastructure 2. New Development
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed**
10,150 existing wetland carbon sequestion (tons C) Protects 8 critical facilities Protect 2 wetlands 12 endangered species and 24 migratory bird species.	Texas is losing coastal wetlands at a rate of more than 5,700 acres annually, and major causes of this loss include insufficient sediment supply, sea-level rise, subsidence, and coastal erosion. This project will regenerate previously healthy marsh on the Roberts Mueller tract of the East Unit of Anahuac NWR. From 1953 to 2018 the amount of open water has increased from less than 1% to over 68% due to the loss of emergent marsh vegetation. BUDM, using material from the GIWW, can be used to restore marsh elevations on the project site to restore emergent marsh. A major barrier to implementing BUDM projects is a lack of coordination between dredging schedules, permitting, and other logistics, demonstrating a need for a coordinated planning effort.			

ACTION NO. 19				
Title: East Bay Living Shorelines and Wetland Restoration				
JURISDICTION(S): Chambers County, Anahuac				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Coastal Erosion Flood Hurricane/TS Thunderstorms/HW	The project proposes wetland restoration & maintenance and shoreline protection near Smith Point and Rollover Pass to stabilize shorelines that experienced losses of wetland habitat. Living shorelines designed to include creation or enhancement of wetlands and oyster reefs would provide feeding and nesting sites for coastal birds.4 miles breakwaters.			Chambers Engineering/Capital Projects Public Works Departments Anahuac – City Manager and Council
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
Federal Grants, GLO, TWDB Grants. Multi-County effort	$26.9M	M	3-5 years	1. Existing Building and Infrastructure 2. New Development
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed**
The shorelines near Smith Point and Rollover Pass, as well as the other lands noted above, are experiencing losses of shoreline, estuarine wetland, and oyster reef habitat. Wetlands are important habitat for the area, as they provide water filtration and serve as a habitat for fish and other wildlife. This project would provide restoration efforts for the estuarine wetland habitats near Smith Point and adjacent shorelines. This project is supported by several private landowners owning lands between the shoreline protection projects at Anahuac NWR and Candy Abshier WMA. This project would connect these individual proposals and extend protection for all wetlands.				

ACTION NO. 20				
Title: Pierce Marsh Wetland Restoration and Shoreline Protection				
JURISDICTION(S): Chambers County, Anahuac				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Coastal Erosion Flood Hurricane/TS Thunderstorms/HW	This project would implement 8000LF of breakwaters to protect up to 100 acres of marsh restoration			Chambers Engineering/Capital Projects Public Works Departments with State agencies Anahuac – City Manager and Council
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
Federal Grants, GLO, TWDB Grants. Multi-County effort	$6.5M	M	3-5 years	1. Existing Building and Infrastructure 2. New Development
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Avoided future flood risk Protects 8 critical facilities Protect 1 critical habitat, 12 endangered species and 36 migratory bird species.	The diverse coastal wetland habitats within the Texas Chenier Plain Refuge Complex are experiencing rates of decline along the Texas coast due to changing hydrologic conditions. These complexes are some of the largest along the coast but are also some of the most vulnerable with significant subsidence likely along the Chenier Plain.			

ACTION NO. 21				
Title: Southeast Texas Flood Coordination Study - Regional Flood Sensor System				
JURISDICTION(S): Chambers County, Anahuac				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Coastal Erosion Flood Hurricane/TS Thunderstorms/HW	The Southeast Texas Flood Coordination Study (SETxFCS) is an ongoing, multifaceted project focused on activities to improve the resilience of the region to flood events. Project tasks include asset management, technical support, mapping elevations near sensor locations, aiding with sensor installation, and developing installation strategies that limit sensor sediment/biological interference to reduce data timeouts and site visits. Additional needs beyond the DHS S&T network are assessing regional coverage gaps and installing additional flood level sensors and rain gauges, development of long-term interagency system maintenance strategy, and development of guidance/workshops for similar deployments.			Chambers Engineering/Capital Projects Public Works Departments with State agencies Anahuac – City Manager and Council
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
Federal Grants, GLO, TWDB Grants. Multi-County effort	$900K	M	3-5 years	1. Existing Building and Infrastructure 2. New Development
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with**
Addresses data gaps. Support education and outreach. Updated, accessible flood sensing data would help stakeholders better respond to, recover from, plan for, and manage stormwater flooding. Improved data availability from the regional flood sensor system would help stakeholders in Southeast Texas—to plan for, predict, and respond to floods.				

ACTION NO. 23				
Title: Moody NWR Conservation and Restoration				
JURISDICTION(S): Chambers County, Anahuac				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Coastal Erosion Flood Hurricane/TS Thunderstorms/HW	This project would acquire additional properties to expand the Moody National Wildlife Refuge (NWR) and conduct restoration for existing wetlands in the Refuge. A future restoration phase for the lands conserved as part of this effort would be a living shoreline stabilization project to protect the shoreline from erosion. A 270-acre tract was purchased in the target area, and the U.S. Fish and Wildlife Service is working with multiple landowners on appraisals in the project area. The project would allow the first public access to the Refuge and within better reach local disadvantaged communities at Smith Point and Oak Island. This area was heavily impacted by Hurricane Ike, and the project will prevent development in acquired areas to avoid increasing losses on the coastal plain.			Chambers Engineering/Capital Projects Public Works Departments with State agencies Anahuac – City Manager and Council
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
Federal Grants, GLO, TWDB Grants. Multi-County effort	$10M	M	3-5 years	1. Existing Building and Infrastructure 2. New Development
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
49.21M Building Replacement Value Public Access Improvements Protects 140 Homes Protect 1 wetland, 85.7k existing wetland carbon sequestion	The Chambers County Green print for Growth and Conservation identifies critical areas for preservation, including several properties adjacent to the Moody NWR that are considered moderate to high conservation priorities. The conservation goals for Chambers County laid out in their Greenprint plan encompass preserving natural habitat, targeting restorable habitats, protecting water quality, protecting and restoring natural drainage, maintaining the rural character of the region, and creating more public access for nature-based restoration.			

ACTION NO. 24				
Title: Harden the emergency management stations (12) throughout the County				
JURISDICTION(S): Chambers County				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Coastal Erosion Flood Hurricane/TS Thunderstorms/HW Tornado Hail Wildfire	Harden each of the 12 Emergency Services Stations to withstand hazards.			County Emergency Management Department, Economic Development Department, Engineering Department
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
Federal Grants, EMPG grants, HMGP	$12M	M	5-10 years	1. Existing Building and Infrastructure
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Residents and Visitors who are affected by a natural disaster	Continued and growing threats to the critical infrastructure requires the need to protect these assets.			Protecting critical infrastructure provides for the health and safety of the population

ACTION NO. 25				
Title: Warning Sirens				
JURISDICTION(S): Chambers County				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Coastal Erosion Flood Hurricane/TS Thunderstorms/HW Tornado Hail Wildfire	Place warning siren at each 12 Emergency Services Stations.			County Emergency Management Department, Economic Development Department, Engineering Department
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
Federal Grants, EMPG grants	$50,000 each	L	2-10 years	1. Existing Building and Infrastructure
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Residents and Visitors who are affected by a natural disaster				

ACTION NO. 26				
Title: Expansion of Raw Water Pond				
JURISDICTION(S): City of Anahuac				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Coastal Erosion Flood Hurricane/TS Thunderstorms/HW	Expand the size of the raw water pond			County Emergency Management Department, Economic Development Department, Engineering Department
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
Federal Grants, EMPG grants	$10M	L	5-10 years	1. Existing Building and Infrastructure
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Degradation of raw water pond; economic loss for residents depending on the pond				

ACTION NO. 27				
Title: Generators at the lift stations. wastewater treatment plants, and City wells, and Public Works facility (Mon Belvieu) in Anahuac and Mont Belvieu				
JURISDICTION(S): City of Anahuac and Mont Belvieu				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Coastal Erosion Flood Hurricane/TS Thunderstorms/HW Extreme Heat Extreme Cold/Freeze Tornado	In the event of power loss/outage, a generator will be installed at each lift station and wastewater treatment plans, and City wells. and Public Works facility (Mon Belvieu).			Anahuac – City Manager and Council Mont Belvieu Engineering Department and Public Works Departments
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
FEMA FMA, BRIC, HMGP, State Grants for generators, TCEQ or GLO grants	$450,000 each	M	5-10 years	1. Existing Building and Infrastructure
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
	Continued and growing threats to the critical infrastructure requires the need to protect these assets.			Protecting critical infrastructure provides for the health and safety of the population

ACTION NO. 28				
Title: Generators at Emergency Services Stations (12)				
JURISDICTION(S): Chambers County				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Coastal Erosion Flood Hurricane/TS Thunderstorms/HW Extreme Heat Extreme Cold/Freeze Tornado	In the event of power loss/outage, a generator will be installed at each of the Emergency Services Stations			County Emergency Management Department, Economic Development Department, Engineering Department
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
FEMA FMA, BRIC, HMGP, State Grants for generators, TCEQ or GLO grants	$150,000 each	L	5-10 years	1. Existing Building and Infrastructure
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Avoided loss of life, property and continuity of service.	Continued and growing threats to the critical infrastructure requires the need to protect these assets.			Protecting critical infrastructure provides for the health and safety of the population

ACTION NO. 29				
Title: West Bay Living Shorelines at Sweetwater Preserve and Maggie's Cove				
JURISDICTION(S): Chambers County, Anahuac				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Coastal Erosion Flood Hurricane/TS Thunderstorms/HW	To expand upon more than 20 years of habitat restoration efforts in West Galveston Bay, the Galveston Bay Foundation (GBF) proposes to protect, enhance, and/or restore up to 145 acres of estuarine habitat. The proposed restoration activities are located at Sweetwater Preserve and will involve the construction of offshore wave barrier(s) to reduce erosion, stabilize the shoreline, and establish or enhance estuarine habitat. Pending the results of surveys and design plans, GBF and the project team will determine the best approach to establish a living shoreline or other stabilization structure at each location. Nature based shoreline protection techniques will be considered.			Chambers Engineering/Capital Projects Public Works Departments Anahuac – City Manager and Council
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
Federal Grants, GLO, Texas Parks and Wildlife Grants. Multi-County effort	$6.1M	M	3-5 years	1. Existing Building and Infrastructure 2. New Development
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Avoided future flood risk Protect 1wetland, 12 endangered species and 10 migratory bird species, creates and oyster habitat protected. It is anticipated the project will allow for the establishment of up to 130 acres of estuarine habitat in Maggie's Cove and up to 15 acres of intertidal marsh along the Sweetwater Preserve shoreline. The project will provide protection for up to 8,000 linear feet (approximately 1.5 miles) of shoreline.	The diverse coastal wetland habitats within the Texas Chenier Plain Refuge Complex are experiencing rates of decline along the Texas coast due to changing hydrologic conditions. These complexes are some of the largest along the coast but are also some of the most vulnerable with significant subsidence likely along the Chenier Plain.			As part of the analysis, the City reviews the impacts to the whole Pearland community.

ACTION NO. 30 (moved from current plan (no. B-13 into new actions)				
Title: Mobile Generators for Critical Facilities				
JURISDICTION(S): Chambers County				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Coastal Erosion Flood Hurricane/TS Thunderstorms/HW Extreme Heat Extreme Cold/Freeze Tornado	(5) Mobile/portable generators to assist in keeping critical infrastructure online.			Chambers County - County Judge, Emergency Management Department, Economic Development Department, and Engineering Department Working with TxDOT
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
FEMA FMA, BRIC, HMGP, State Grants for generators, TCEQ or GLO grants	$250,000	M	3-5 years	1. Existing Building and Infrastructure 2. New Building
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Network and phone system outages, loss of continuity of government	Continued and growing threats to the critical infrastructure requires the need to protect these assets.			Protecting critical infrastructure provides for the health and safety of the population

ACTION NO. 31 (moved from current plan (no. B-14 into new actions)				
Title: Storage building for generators and emergency supplies				
JURISDICTION(S): Chambers County				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Coastal Erosion Flood Hurricane/TS Thunderstorms/HW Extreme Heat Extreme Cold/Freeze Tornado	Storage building to house and keep safe generators used to mitigate potential power losses, as well as emergency supplies and rescue equipment such as high water vehicles.			Chambers County - County Judge, Emergency Management Department, Economic Development Department, and Engineering Department Working with TxDOT
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
FEMA FMA, BRIC, HMGP, State Grants for generators, TCEQ or GLO grants	$1,000,000	L	3-10 years	1. Existing Building and Infrastructure
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Chambers County public infrastructure protected	This will allow for rapid response of future climatic hazard events.			Ensuring continuity of service after a climatic event provides for the health and safety of the population.

ACTION NO. 32				
Title: Air Monitoring System Around the Salt Dome Area				
JURISDICTION(S): Chambers County and Mont Belvieu				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Salt Domes	Drilling sites may affect local air quality in several ways. Any related combustion process can release toxic chemicals into the air. For example, the burning off, or flaring, of excess natural gas; the operation of heavy equipment at the well site; and the use of diesel trucks to transport materials to and from a site may all contribute to air pollution. In addition, the chemicals and sand used in the hydraulic fracturing process, as well as other chemicals that surface with the natural gas, have potential to affect air quality. Placing an air quality monitoring system can allow the LEPC to issue alerts when air is unhealthy.			Local Emergency Planning Committee (which includes emergency managers from Chambers County and Mont Belvieu)
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
EPA, FEMA, and DOE grants. State grants	$300,000	H	3-10 years	1. Existing Building and Infrastructure
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Chambers County and Mont Belvieu public protected and public infrastructure protected				Elderly, very young, persons with respiratory issues or compromised health.

ACTION NO. 33				
Title: Seismic Activity System to detect ground disturbance around the Salt Dome Area				
JURISDICTION(S): Chambers County and Mont Belvieu				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Coastal Erosion Flood Hurricane/TS Thunderstorms/HW Extreme Heat Extreme Cold/Freeze Tornado	An explosion at the salt dome could cause ground disturbance from seismic activity that could damage structures, damage water pipes and disrupt wells which is the main source of water supply for the City of Mont Belvieu. A seismic activity system around the complex would give advance data to the LEPC to protect and/or shut off pipes and water to avoid contamination or damage to infrastructure.			Local Emergency Planning Committee (which includes emergency mangers from Chambers County and Mont Belvieu)
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
FEMA FMA, BRIC, HMGP, State Grants for generators, TCEQ or GLO grants	$1,000,000	H	3-10 years	1. Existing Building and Infrastructure
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Chambers County and Mont Belvieu public protected and public infrastructure protected				

ACTION NO. 34				
Title: Teacherville Drainage Improvements				
JURISDICTION(S): Chambers County				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Flood Hurricane/TS Thunderstorms/HW	There is an existing ditch which begins near the southwest corner of the IH-10/FM 1406 intersection, which flows from east to west along the northern border of the identified project area before turning to flow south along Dugat Street towards Franzen Road. In the existing condition, this ditch does not have adequate capacity to convey the 100-year rainfall event. This results in flow overtopping the channel banks and continuing as overland sheet flow through the project area. Additionally, overland sheet flow from the east overtops FM 1406 and continues west through the project area.			County Emergency Management Department, Economic Development Department Engineering Department
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
FEMA FMA, BRIC, HMGP, State Grants for generators, TCEQ or GLO grants	$9,555,000	H	3-10 years	1. Existing Building and Infrastructure
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Infrastructure, Homes and Property	Next generation modeling will help show increased depth of rainfall which will help with the H&H data used for the design to meet the risk.			Design will take into account any potential negative impacts to the area.

ACTION NO. 35				
Title: Anahuac Main Pump Station				
JURISDICTION(S): Chambers-Liberty Counties Navigation District				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Flood Hurricane/TS Thunderstorms/HW Expansive Soil Lightning	Purchase and install a new Pump Station including a new elevated pump building, pump, piping, modifications, pumping equipment, control center, perform electrical work, provide other associated appurtenances, and perform site work associated with construction. This pump provided water to two water treatment facilities: Trinity Bay Conservation District's West Water Plant and the City of Anahuac. Additionally, the pump station provides water to most of the farmlands in Chambers County east of the Trinity River. The pump station is currently located below the 100 year flood plain and experiences outages on a regular basis putting both potable water at risk and crops.			Chambers-Liberty Counties Navigation District
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
FEMA FMA, BRIC, HMGP, State Grants, TCEQ, TWDB or GLO grants	$8,500,000	M	5-10 years	1. Existing Building and Infrastructure
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Infrastructure, Provide water to Municipalities and farming industry	Continued and growing threats to the critical infrastructure requires the need to protect these assets.			Protecting critical infrastructure provides for the health and safety of the population

ACTION NO. 36				
Title: Lake Anahuac Pump Station				
JURISDICTION(S): Chambers-Liberty Counties Navigation District				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Flood Hurricane/TS Thunderstorms/HW Expansive Soil Lightning Drought	Purchase and install a new Pump Station including a new elevated pump building, pump, piping, modifications, pumping equipment, control center, perform electrical work, provide other associated appurtenances, and perform site work associated with construction. The purpose of this pump station is to lift fresh water approximately 15 feet from Hog Bayou into Lake Anahuac. It is essential that these pumps are in dependable condition so the District can provide fresh water to the Municipalities and the farmlands in Chambers County east of the Trinity River in case of a drought. The pump station is currently experiencing outages on a regular basis, putting potable water at risk and crops during drought years. In case of a flood this pump station also drains the surrounding area such as the north marsh but also Wallisville (north of I-10).			Chambers-Liberty Counties Navigation District
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
FEMA FMA, BRIC, HMGP, State Grants, TCEQ, TWDB or GLO grants	$6,000,000	M	5-10 years	Existing and new buildings
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Infrastructure, Provide water to Municipalities and farming industry	Continued and growing threats to the critical infrastructure requires the need to protect these assets.			Protecting critical infrastructure provides for the health and safety of the population

ACTION NO. 37				
Title: Hog Bayou/Lake Anahuac Gate Structure				
JURISDICTION(S): Chambers-Liberty Counties Navigation District				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Flood Hurricane/TS Thunderstorms/HW / Expansive Soil Lightning / Drought	In the event of a drought or loss of power at the Lake Anahuac Pump Station, the gate structure between Hog Bayou and Lake Anahuac will facilitate the flow of water from Hog Bayou into Lake Anahuac. It is the District's responsibility to provide fresh water to municipalities and farmlands in Chambers County east of the Trinity River. This gate structure would facilitate the release of water into Lake Anahuac during a drought or power outage, as well as during a flood.			Chambers-Liberty Counties Navigation District
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
FEMA FMA, BRIC, HMGP, State Grants, TCEQ, TWDB or GLO grants	$2,000,000	M	5 years	Existing and new buildings
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Infrastructure, Provide water to Municipalities and farming industry	Continued and growing threats to the critical infrastructure requires the need to protect these assets.			Protecting critical infrastructure provides for the health and safety of the population

ACTION NO. 38				
Title: Generator				
JURISDICTION(S): Chambers-Liberty Counties Navigation District				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
Flood Hurricane/TS Thunderstorms/HW / Expansive Soil Lightning / Drought	Purchase and install a new generator capable of sustaining a pump of 600 horsepower. This pump provides water to two water treatment facilities: Trinity Bay Conservation District's West Water Plant and the City of Anahuac. Additionally, the pump station provides water to most of the farmlands in Chambers County east of the Trinity River.			Chambers-Liberty Counties Navigation District
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
FEMA FMA, BRIC, HMGP, State Grants, TCEQ, TWDB or GLO grants	$1,000,000	M	5 years	Existing builidngs
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Infrastructure, Provide water to Municipalities and farming industry	Continued and growing threats to the critical infrastructure requires the need to protect these assets.			Protecting critical infrastructure provides for the health and safety of the population

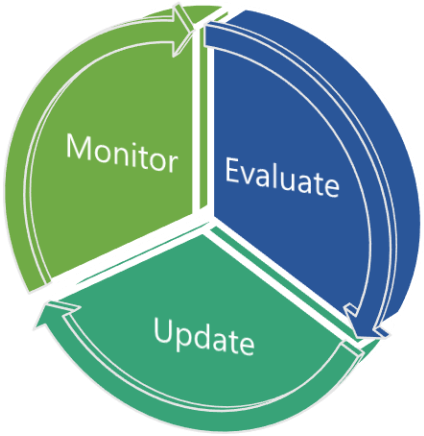
ACTION NO. 39				
Title: Community Safe Room				
JURISDICTION(S): Mont Belvieu				
Hazard(s) Addressed	**Description of Action**			**Implementing Department**
All Hazards	The City of Mont Belvieu proposes to construct a 15,000 square-foot hardened facility community safe to ensure first responders and essential employees have a safe, secure location during hazard events. The centralized, elevated location will allow personnel to carry out response, operation, and recovery tasks identified in the County's Emergency Management Plan. It will also ensure that these individuals are able to access the tools, equipment, and vehicles necessary to begin these activities. The building will be built to FEMA minimum building code requirements (FEMA P-361 & ICC 500) at a site currently owned by the City.			Mont Belvieu Fire Chief, Police Chief, Administration Engineering Departments
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
FEMA, TDEM	$10,836,000	M	2-5 years	1. New Building
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed**
Providing a hardened facility to shelter first responders and essential employees is critical to the City's ability to carry out all aspects of its emergency management plans. Additionally, utility systems can be managed from the site, ensuring the continuation of vital services after a natural disaster. The ability to provide quick and effective response and recovery immediately after a storm has passed will benefit all residents of the City.	The facility with vehicle and equipment storage beneath will be constructed at Langston Boulevard. The building will be built to FEMA specifications at a site currently owned by the City. Some concrete paving will be necessary to stabilize the pilings and provide parking. Environmental impacts have been considered.			

Section 5. Plan Maintenance Process

Plan updates provide the opportunity to consider how well the procedures established in the previously approved plan worked and revise as needed. The team reviewed the maintenance process and determined that the process is effective and should not change as it allows for monitoring, evaluating, and updating. The process includes a schedule for monitoring and evaluating the plan annually or procedures to follow a significant event (e.g., following a declared disaster), and producing an updated plan every five years.

Introduction

To remain an effective tool, the plan will undergo continuous review and updates. This practice is known as plan maintenance and requires the following:



Monitoring: Tracking implementation of the plan over time.

Evaluating: Assessing how well the plan meets its stated purpose and goals.

Updating: Reviewing and revising the plan at least once every five years.

To accomplish this, a Plan Maintenance Team (PMT) has been determined and is comprised of representatives from each of the County's participating jurisdictions, see Figure 76

Figure 76 - Chambers County PMT

Plan Maintenance Team (PMT)	
Plan Maintenance Team Leader	Chambers County Emergency Management Coordinator
Jurisdiction	**Responsible Entity**
Unincorporated Chambers County	Chambers County OEM, Economic Development, and County Judge
Cove	Mayor
Beach City	Mayor
Mont Belvieu	City Engineer
Old River-Winfree	Mayor
Anahuac	City Manager
Chambers-Liberty Counties Navigation District	General Manager

Monitoring, Evaluation and Updating the Plan

Procedures to monitor and evaluate the plan were outlined in the 2017 plan and continue for this plan update. The procedures ensure that the mitigation strategy including the mission statement, goals, and mitigation actions, are regularly examined for feasibility and that the plan remains a relevant and adaptive tool. The PMT will meet annually and hold its first meeting within one year after the plan's approval date. Eighteen months before this plan is set to expire, the PM will meet to develop a timeline and strategy for the five-year update. Table 54 are the methods and procedures for monitoring and evaluating the plan including a schedule and responsible entity.

Table 54 - Chambers County Plan Maintenance: Evaluation & Monitoring Procedures

Method and Procedures	Schedule	Responsible Entity
The PMT Leader will advertise all annual meetings in local newspapers, post invitations on the County social media pages, and post fliers at city and county buildings 30 days prior to the meetings.	30 days prior to annual meetings	Plan Maintenance Team Leader
The PMT Leader is responsible for evaluating the entire plan prior to the meeting. Each PMT member will be asked to identify and discuss any deficiencies in the plan as it relates to their jurisdiction. Each PMT member will discuss their findings followed by public input and comments.	Annually	PMT Leader, PMT member for each participating jurisdiction, and Public
Emerging hazards, risks, and vulnerabilities will be identified and discussed. ➢ PMT members are responsible for monitoring each natural hazard in their jurisdiction and providing a written and/or verbal update on any new occurrences and emerging risks. ➢ The PMT Leader will seek input from participants and the public at the annual meetings by opening the meeting for public comment. ➢ Newly identified hazards, risks, and vulnerabilities will be assigned to a PMT member to research and monitor.	Annually	Public and all participating jurisdictions

Method and Procedures	Schedule	Responsible Entity
The PMT will evaluate the entirety of the planning process and written plan to ensure the HMP remains relevant and the strategy continues to be effective. ➢ PMT members will identify new projects and/or re-prioritize existing strategies based on changes in their jurisdiction, emerging hazards, and shifting priorities. ➢ Mitigation strategies for the newly identified hazards, risks, and vulnerabilities will be proposed and discussed. ➢ Funding sources and multijurisdictional cooperation for new initiatives will be determined. ➢ The Plan Maintenance Team Leader will report on any suggestions for changing the whole written plan, planning, maintenance, or implementation process for the plan received by PMT members throughout the year. The PMT members will discuss which revisions/ suggestions they would like to implement.	Annually	PMT member for each participating jurisdiction
Each participating jurisdiction will evaluate their progress implementing the mitigation strategy. ➢ Representatives will publicly discuss progress and submit written progress reports to the team leader. ➢ Completed and ongoing mitigation actions will be discussed by responsible entity. ➢ Unaddressed mitigation actions will be evaluated for relevancy and/or amended to increase feasibility. ➢ Feasibility of the mitigation strategy will be evaluated, and any necessary revisions will be proposed. ➢ The team leader will seek comment from the public after each participating jurisdiction's presentation.	Annually	PMT, the responsible department identified in the mitigation action up for discussion, and the public.
The PMT will develop a timeline and strategy to update the plan 18 months before it expires. The update strategy will include: ➢ Establish entities responsible for drafting and submitting the update to TDEM ➢ Send appropriate representatives to G-318 training. ➢ Determine funding needs and funding sources for plan update.	Every 5 years	PMT

Integration into Existing Plans, Procedures, and Programs

Chambers County and the participating jurisdictions continue to improve their inter and intra-jurisdiction/department coordination, education and outreach on the importance of mitigation. Consistency across plans is a pathway to implementing equitable measures and

creating policy opportunities to address vulnerabilities. There are some obstacles – siloed departments/agencies, variations in planning processing and a great deal of plans and limited number of staff, however, each jurisdiction continues to make improvements to those challenges. There are several existing plans and programs that review and reference the hazard mitigation plan during their review and update. Some plans have not been updated, (e.g. Chambers County Master Drainage Plan – 2014), but when the County plans the update, the hazard mitigation plan will be reviewed. Not every community has a comprehensive plan or Capital improvement budget, however, those that do, review the hazard mitigation plan. The following are a list of plans or budget (in the case of CIP) by jurisdiction.

For the CLCND, since it is a navigation district with a very specific function, a discussion of its capabilities assessment is found in its annex.

CIP: Capital Improvement Program
CP: Comprehensive Plan
DCM: Drainage Criteria Manual
FMP: Floodplain Management Plan
EOP: Emergency Operations Plan
COOP: Continuity of Operations Plan
MDP: Master Drainage Plan
RFP: Regional Flood Plan
SO: Subdivision Ordinance or Regulation
SARA: Superfund Amendments and Reauthorization Act (SARA Title III), Local Emergency Planning Committee

Jurisdiction	CIP	CP	DCM	FMP	EOP	COOP	MDP	RFP	SO	SARA
Unincorporated Chambers County			X	X	X		X		X	X
Anahuac	X	X		X	X					X
Beach City				X	X				X	X
Mont Belvieu	X	X	X	X	X	X			X	X
Cove				X	X					X
Old-River Winfree				X	X				X	X
CLCND										

Some action items do not need to be implemented through regulation. Instead, these items can be implemented through the creation of new educational programs, continued interagency coordination, or improved public participation. During the annual plan evaluation process, the Planning Partnership representatives will identify additional policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions and include these findings and recommendations in the Annual HMP Progress Report.

Several existing plans and programs that require integration have been identified in Table 55. As each participating jurisdiction develops or approves new planning mechanisms, the mechanism's name and the integrations will be collected and reported in the annual review by the Plan Maintenance Team (PMT).

Table 55 - Planning Mechanism and Integration Method

Planning Mechanism	Jurisdictions	Integration Method
Flood Management Plan	Chambers County Anahuac Beach City Cove Mont Belvieu Old River-Winfree	Adoption of codes that support mitigation strategy and mitigation activities.
Stormwater Management Plan	Chambers County Anahuac Beach City Cove Mont Belvieu Old River-Winfree	Any Stormwater Management Plan updates will refer to, incorporate, and/or complement the HMP.
Emergency Operations Plan	Chambers County Anahuac Beach City Cove Mont Belvieu Old River-Winfree	Any Emergency Operations Plan updates will refer to, incorporate, and/or complement the HMP.
Subdivision Ordinance or Manual	Chambers County Anahuac Beach City Cove Mont Belvieu Old River-Winfree	The manual and/or ordinance will refer to, incorporate and/complements the HMP
Master Drainage Plan	Chambers County Anahuac Beach City Cove Mont Belvieu Old River-Winfree	Any Emergency Operations Plan updates will refer to, incorporate, and/or complement the HMP.
Drought Contingency Plan	Chambers County Anahuac Mont Belvieu CLCND	The plan will refer to, incorporate and/complements the HMP

To help institutionalize the integration process, each participating jurisdiction will continue to follow the process established in the previous plans:

- Propose a policy, strategy, or regulatory amendment to the proper governing body.
- Advertise the amendment 15 days prior to meeting where it will be discussed.
- Provide the public, elected officials, and governing bodies the opportunity to discuss and comment upon proposed change(s).
- If the proposal is accepted, the change is implemented by the appropriate governing authority.

Continued Public Involvement

Continued stakeholder and public involvement will remain a vital component of this Plan. The plan will be hosted on the County website, and public input can be submitted at any time. The PMT is responsible for documenting public feedback and presenting the comments for discussion at each annual Plan Maintenance Meeting.

The PMT Leader will also conduct outreach and invite the public to annual Plan Maintenance meetings. The PMT Leader will advertise all annual meetings in local newspapers, post invitations on the County social media pages, and post fliers at city and county buildings 30 days prior to the meetings.

In addition, each participating jurisdiction will seek input from the public on the status of existing hazards, emerging vulnerabilities, and evaluate the entirety of the planning process and written plan with the public. During each meeting, the PMT will provide an open comment forum for interactive discussion with the public. The development of new goals and strategies will be a joint effort between the PMT and public participants.

Annexes

Anahuac

Anahuac was incorporated by decree on October 30, 1948. It is a General Law City governed by a board of alderman and includes six members – a mayor and five aldermen, all who are elected at-large and are referred as the City's Council. General law cities are smaller cities, most of which are less than 5,000 in population. All general law cities operate according to specific state statutes prescribing their powers and duties, under the State's Local Government Code. General law cities are limited to doing what the state authorizes or permits them to do. If state law does not grant general law cities the express or implied power to initiate a particular action, none may be taken.

Anahuac has a City Administrator who manages the City's daily operations and a City Secretary who maintains records management, elections and public information for the City. The City also has several departments including Building and Planning, Code Compliance, Municipal Court, Public Works, and Animal Care and Control. It has one volunteer fire department (Anahuac VFD) that is supported by the City and the County and one EMS. Emergency Management is supported by the County. Its ordinances can be found on the City's website as well as information pertaining to permit applications.

Permits are required for new construction, new OSSFs, improvements, utility construction, reconnection of electricity, pipeline, and outdoor sign. The City operates a wastewater plant which can treat a maximum of 400,000 gallons per day; a water distribution system with installation and maintenance of all waterlines, sewer lines, meters and fire hydrants in the City; and manages the garbage collection through use of a contractor for the City. It is the County seat where many of the County's agencies are located.

Jurisdiction Profile

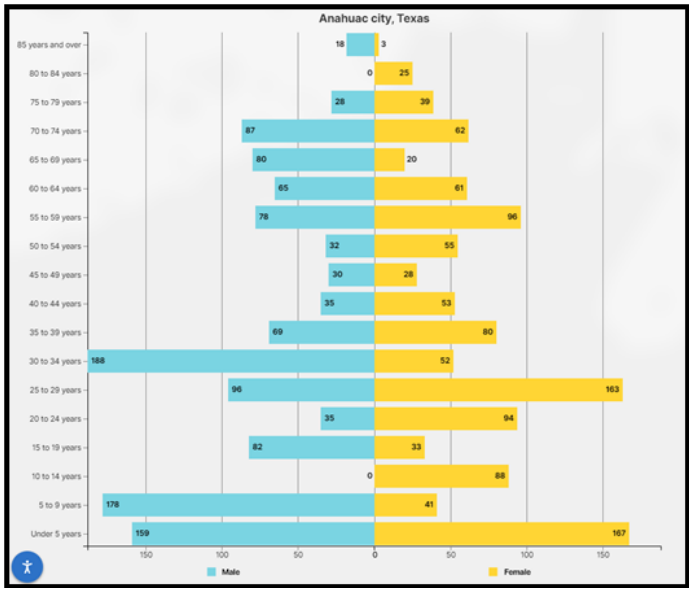
Anahuac is a city in the central part of Chambers County that is on the coast of Trinity Bay. Anahuac is about 2.1 square miles in total area. It is bordered by Lake Anahuac to its north, Chambers County airport to its east, Trinity Bay to its south and Trinity River to its west.

Figure 77 - Map of Anahuac

Population and demographics - Anahuac's estimated population is 1,967 according to 2022 U.S. Census Data, a 16% decrease from the 2017 plan estimate of 2,339. In addition, about 15% of the population is over the age of 65, and about 13% under the age of 5 and the median age is 31.4. Figure 78 shows the breakdown by gender and age for the City.

Figure 78 - Population Pyramid for Anahuac, Texas

(Anahuac - Census Bureau Profile)



5.7% of the population are veterans and 17.1% of the population fall under the poverty level. 63.6% of the population speaks English at home. 16.8% of the population are foreign born.

Education. 64.7% of the school enrolled population are enrolled in kindergarten to 12th grade and 6.7% have received a bachelor's degree or higher.

Housing. The rate of homeownership is 72.3%. There are approximately 790 housing units with over 10% over $300,000 in housing value. The average family size is 3.38 and 48.8% are married-couple family household. 20% are female household, no spouse present and 21.3% is male household, no spouse present.

Work. There is 55.9% employment rate with 96.3% driving to work on an average travel time of 22.3 minutes. The three largest industries employing Anahuac's residents are Construction (17.1%) followed by Manufacturing (16.0%), and Educational services, and health care and social assistance (15.7%). The median household income is $69,742.

Jurisdiction Capabilities Assessment

The below table assesses the degree of capability based on the area (limited, moderate, high) and a comment on the assessment. A full list of all capabilities is found the main body of the plan in "Section 2. The Planning Process".

Capability	Degree of Capability	Comment
Administrative/Tech Capabilities	Limited	The City has a very small staff and relies on the County for support in many of the hazard areas.
Regulatory Tools	Moderate	The City has ordinances to help mitigate damages from hazards in its floodplain, stormwater, subdivision, and building code requirements.
Financial Tools	Moderate	The City has a property tax, sales and use tax, utility tax, permit fees, court fees and fines, grant funds, and utility franchise fees.
Education and Awareness Tools	Moderate	The City's website provides information on hurricane preparedness and evacuation. It provides code of ordinances and permitting information and forms. It also provides links to important sites for hazard information. The City has a Facebook page in addition to the website to disseminate information to the public. It also has a municipal development district to help develop economic tourism and support, promote and aid projects for the growth of the City.

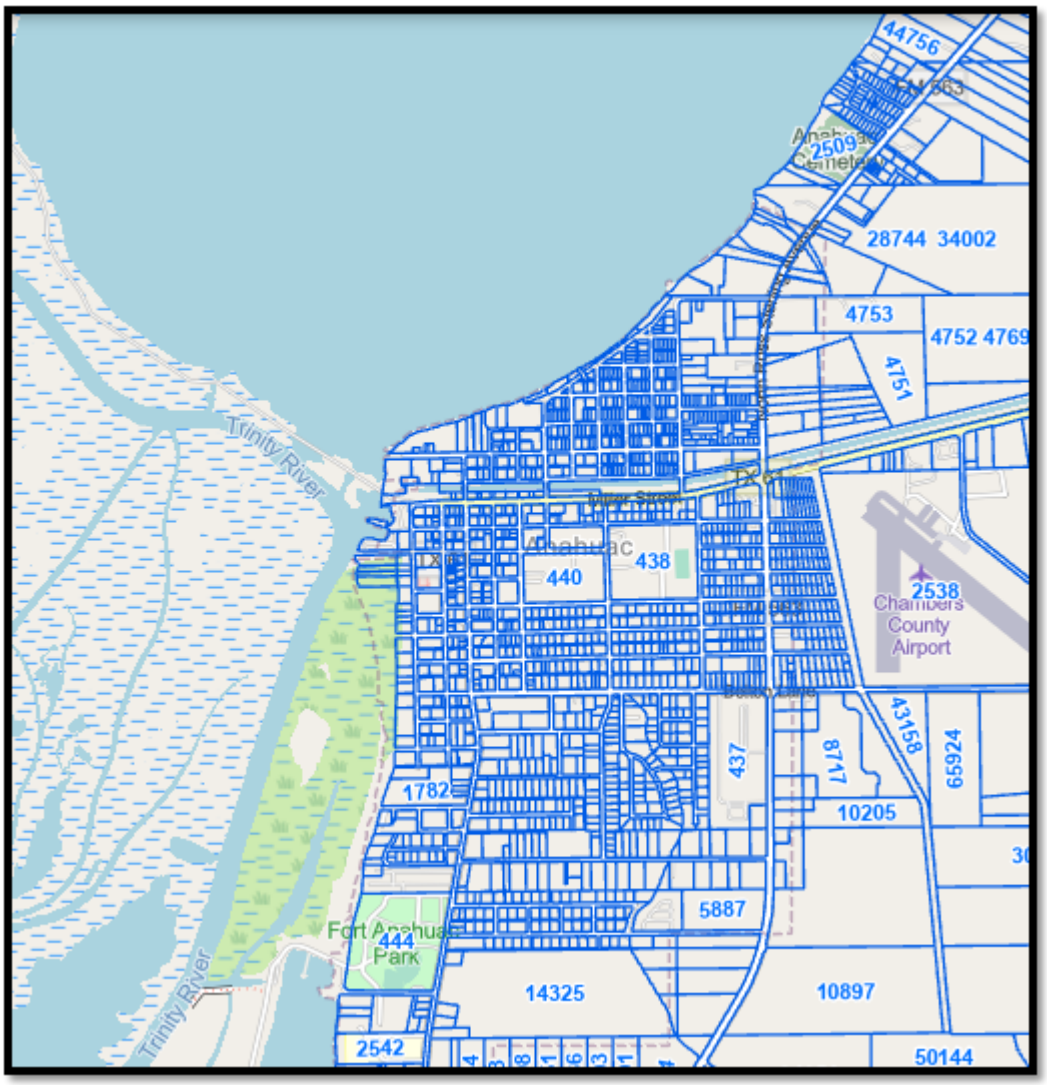
NFIP Summary

Anahuac participates in the National Flood Insurance Program (NFIP). The following summarizes the NFIP statistics.

Jurisdiction	Policies in Force	Amount of Paid Claims	Total RL Record	No. of RL Properties	No. of SRL Properties	Non-Insured
Anahuac	108	$31,455,000	27	3	2	13

Development Trends - While much of Anahuac is developed (2.1 square miles and 790 housing units), there is still room for growth. As previously noted, the population has declined by around 16% according to census data from 2017 to 2024. However, the area is projected to grow both in population and economic growth.

Figure 79 - Anahuac Parcel Map (Chambers County Appraisal District)



Jurisdiction Hazard Risk Assessment

The following hazard risk assessment details the hazards that most directly affect the jurisdiction. More information on each hazard can be found in "Section 3. Hazard Identification and Risk Assessment" section of the plan.

Coastal Erosion			
Approx. Size (Sq miles):	2.1	**Area Affected by Hazard**	Significant (25 to 75%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10 to 90% yearly)
Extent: According to the coastal vulnerability index, risk of erosion is moderate.			
Potential Impact of Event: Cost to replenish beach; damage to residential or commercial property on coast; and natural habitat loss along coastline.			
Overall Vulnerability/Significance: *Moderate*. Since coastal erosion is typically gradual, there are often no single events that are reported as damage from coastal erosion. Events such as hurricanes and other large storms typically cause the largest amount of erosion due to high winds and surge of water onto coasts.			

Drought			
Approx. Size (Sq miles):	2.1	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	2	**Probability of Event**	Likely (10 to 90% yearly)
Extent: The Palmer Drought Severity Index shows exception drought (D4) can occur in this area. This has occurred most recently in 2011 and 2023.			
Potential Impact of Event: Drought events can cause major economic damage to farmers that live in the area; Water supply and water quality can be negatively affected during droughts; Dry conditions can lead to higher risk of fires.			
Overall Vulnerability/Significance: *High*. Chamber's County economy relies heavily on farming such as for soybeans, rice, and cattle. In times of drought, this can severely damage crop yields and limit livestock grazing capabilities, which in turn negatively affects revenue.			

Expansive Soil			
Approx. Size (Sq miles):	2.1	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10 to 90% yearly)
Extent: According to the expansive soil map provided in the *Section 3* part of this plan, the entire planning area is in high risk for expansive soil.			
Potential Impact of Event: Cracks in foundation of residential and commercial buildings; Breaks in water pipes, particularly in critical facilities, could lead to temporary loss of service.			
Overall Vulnerability/Significance: *High*. While there are no recorded expansive soil events as the damage is typically gradual, the effects can be devasting. Older buildings tend to be most at risk due to less mitigation efforts made in the past during construction as well as the wear and tear damage over time. Structures at risk include ~377 high risk (built before 1980) residential buildings as well as critical facilities such as schools, fire stations, hospitals, police stations, shelters, emergency medical services, water treatment plan, and solid waste landfill.			

Extreme Heat			
Approx. Size (Sq miles):	2.1	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	2	**Probability of Event**	Highly Likely (90 to 100% yearly)
Extent: The jurisdiction can expect extreme heat events up to the "extreme danger" level of the NWS Heat Index chart found in *Section 3* of this plan			
Potential Impact of Event: Strain on the electrical power grid due to increased use of air conditioning; All citizens, particularly the vulnerable population, are at risk of heat stroke, that could potentially lead to injury or death.			
Overall Vulnerability/Significance: *High*. There is a high likelihood of extreme heat events in the jurisdiction. Vulnerable populations such as the elderly, young children, and economically disadvantaged individuals are at highest risk. Census data shows that ~26% of the population in this jurisdiction are younger than 18 and ~8% of the population is over 65.			

Flood			
Approx. Size (Sq miles):	2.1	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	1	**Probability of Event**	Occasional (1-10% yearly)
Extent: According to the National Risk Index show plan area is relatively moderate risk with 93.8 national percentile risk.			
Potential Impact of Event: Damage to resident's property as well as economic loss; Vulnerable populations at risk of injury or death due to difficulty in evacuation for upcoming potential events.			
Overall Vulnerability/Significance: *High*. Flood events are especially dangerous to vulnerable populations as they often live in more flood prone areas. In addition, these individuals may have more difficulty in evacuating due to physical limitations. In addition, critical facilities such as schools, hospitals, police stations, water treatment plants, fire station, EMS are at risk for damage.			

Freeze/Extreme Cold			
Approx. Size (Sq miles):	2.1	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10 to 90% yearly)
Extent: According to the National Risk Index the plan area is relatively moderate risk with 64.2 national percentile risk. While temperatures in the jurisdiction don't typically reach freezing levels, the residents are often unaccustomed to dealing with freezing temperatures when they do occur.			
Potential Impact of Event: Frostbite to residents in the jurisdiction, particularly those vulnerable population; Damage to infrastructure such as pipes, which may lead to interruptions in service during these events; Dangerous driving on roads during freezing conditions			
Overall Vulnerability/Significance: *High*. Freezing events are especially dangerous to vulnerable populations as they often do not have the means to deal with the low temperatures. While these events do not occur often in this area, when there is a freezing event there often can be severe effects.			

Hail			
Approx. Size (Sq miles):	2.1	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Occasional (1 to 10% yearly)
Extent: Hailstorms are measured using the TORRO Hailstorm Intensity Scale. H0-H5 level hail has occurred since 2000 in the jurisdiction.			
Potential Impact of Event: Vehicles in the jurisdiction could be damaged. This could cause economic loss to the owners; Hail could cause damage to weaker infrastructure			
Overall Vulnerability/Significance: *Low*. Hailstorms are relatively low risk to this jurisdiction. There is not a significant number of recorded events that caused damage in this jurisdiction. The monetary loss from the events that did cause damage are minimal when they do occur.			

Hurricane/Tropical Storm			
Approx. Size (Sq miles):	2.1	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	5	**Probability of Event**	Highly Likely (90 to 100% yearly)
Extent: The Saffir/Simpson Hurricane Scale has shown up to Category 5 hurricanes affecting the jurisdiction in the past.			
Potential Impact of Event: Damage to infrastructure such as downed power lines could affect availability for power and other utilities during a storm; Damage to critical facilities could delay response after a storm; Damage to homes and commercial buildings could cause economic hardship to residents.			
Overall Vulnerability/Significance: *High*. Hurricanes and Tropical Storms are highly dangerous to this jurisdiction. Category 5 hurricanes can affect this area which can cause devasting damage to structures and risk of injury or death to residents. In this jurisdiction, almost 80 percent of all homes were either built before 1980 or are mobile homes. These categories of homes are more susceptible to damage from hurricane force winds.			

Lightning			
Approx. Size (Sq miles):	2.1	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0 (none reported)	**Probability of Event**	Highly Likely (90 to 100% yearly)
Extent: The Lightning Activity Levels (LALs) scale is used by the NOAA to quantify the number of lightning strikes in an interval of time. While there have been no reported lightning events since the start of 2018, lightning strikes occur in the area during most thunderstorms. Typically, these events only get recorded if there is injury, death, or property damage.			
Potential Impact of Event: Potential loss of power if lightning strikes critical facilities or infrastructure such as power lines. This could prohibit the use of some utilities for a period of time; Potential death if resident is struck by lightning; Damage to homes and commercial buildings could cause economic hardship to residents.			
Overall Vulnerability/Significance: *Low*. While lightning occurs frequently in the jurisdiction, typically the strikes do not hit anything that causes significant damage. Over the last 20 years, there have been only a few events that the NCEI database shows caused property damage or injury/death in all of Chambers County. Critical facilities such as schools, fire stations, EMS, hospitals, police stations, and shelters could all lose power or be damaged from a lightning event.			

Severe Thunderstorms/High Wind			
Approx. Size (Sq miles):	2.1	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	3	**Probability of Event**	Highly Likely (90 to 100% yearly)
Extent: The Beaufort Wind Scale categorizes the wind effects that an area could feel during a severe thunderstorm event. This scale is rated 0-12. This jurisdiction could expect to have an event on the full 0-12 scale.			
Potential Impact of Event: Damage to infrastructure such as downed power lines could affect availability for power and other utilities during a severe thunderstorm; Damage to critical facilities could delay response after a storm; Damage to homes and commercial buildings could cause economic hardship to residents.			
Overall Vulnerability/Significance: *Medium*. Severe thunderstorms are dangerous to this jurisdiction. Higher category winds on the Beaufort scale can affect this area by causing significant damage to structures and risk of injury to residents. There is also a risk of destruction of homes in a severe thunderstorm event, however, these wind effects are typically on a lower scale than received during a hurricane event.			

Tornado			
Approx. Size (Sq miles):	2.1	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	2	**Probability of Event**	Likely (10-90% yearly)
Extent: The Enhanced Fujita (EF) scale categories tornadoes on the scale of EF0-EF5 based on wind speed of the tornado. Most tornadoes in the past in this area have been EF0 or EF1. The extent of damage with this category of tornado is light to moderate damage on roofs and downing of small trees.			
Potential Impact of Event: Moderate damage to roofs, windows, and doors; Damage to less reinforced homes like mobile homes; Knocked over trees which may cause damage to structures or loss of utilities like power.			
Overall Vulnerability/Significance: *Medium*. Tornadoes in this area are not typically the most severe based on previous occurrences, however, there is potential for higher impact tornadoes which could be devasting. This jurisdiction has about 80 percent of the housing as either mobile homes or built before 1980. These types of homes are typically at a higher risk for damage from a tornado.			

Wildfire			
Approx. Size (Sq miles):	2.1	**Area Affected by Hazard**	Significant (25-75%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10-90% yearly)
Extent: The Fire Intensity Scale (FIS) is used by the Texas Wildfire Risk assessment Portal to provide wildfire risk information. This scale goes from 1-5 with 5 being the most severe fire intensity. Data shows this jurisdiction as risk 3-5 on the scale.			
Potential Impact of Event: Damage to homes and other structures in the jurisdiction; Destruction of crop yields which could negatively affect farmers; Potential loss of life if resident is unable to evacuate during an event			
Overall Vulnerability/Significance: *Medium*. While there are no recorded events of wildfires according to the NCEI database, this jurisdiction is still at risk in certain areas of an event in the future. In some portions to the west of Lake Anahuac show level 5 on the FIS scale. If a wildfire were to occur, it could cause devasting damage to parts of the jurisdiction.			

Winter Storm			
Approx. Size (Sq miles):	2.1	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Occasional (1-10% yearly)
Extent: The Sperry-Piltz Ice Accumulation Index (SPIA) predicts potential damage from ice storms. The scale goes from 0-5, with 5 being the most severe. There are no recorded events in this jurisdiction according to NCEI, but if an event were to occur it would likely fall into one of the lower categories.			
Potential Impact of Event: Damage to infrastructure and potential loss of power and other utilities; Injury or death due to the adverse temperatures and conditions that residents in this area are not accustomed to; Loss of crops that could lead to negative economic conditions for farmers.			
Overall Vulnerability/Significance: *Medium*. While there are no recorded events of winter storms according to the NCEI database, this jurisdiction is still at risk in of an event in the future. An event likely would not be severe, but due to residents not being accustomed to these sorts of conditions, it could cause more dramatic issues as seen in parts of Texas during Winter Storm Uri in 2021.			

Jurisdiction Resolution Adoption the Plan

Beach City

Beach City was incorporated by decree on April 11, 1966. It is a General Law City governed by a board of alderman and includes six members – a mayor and five alderman, all who are elected at-large and are referred as the City's Council. General law cities are smaller cities, most of which are less than 5,000 in population. All general law cities operate according to specific state statutes prescribing their powers and duties, under the State's Local Government Code. General law cities are limited to doing what the state authorizes or permits them to do. If state law does not grant general law cities the express or implied power to initiate a particular action, none may be taken.

Beach City has a City Secretary who manages the City's daily operations. It has one volunteer fire department (Beach City VFD) that is supported by the City and the County. Emergency Management is supported by the County. Its ordinances can be found on the City's website as well as information pertaining to permit applications. Permits are required for new construction, new OSSFs, improvements, utility construction, reconnection of electricity, pipeline and outdoor sign. It does not have any utilities e.g. water or wastewater, instead it uses private wells, neighborhood privately owned water systems, private septic systems (aerobic systems).

Jurisdiction Profile

Beach City is found on the Western part of Chambers County and on the coast of Trinity Bay. It sits on a broad peninsula that is bordered on the east by Trinity Bay and on the west by the San Jacinto River. The southern tip of that peninsula is called Cedar Point. Beach City is about 4.5 square miles in total area.

Population and demographics. Beach City's estimated population is 3,229 according to 2022 U.S. Census Data, a 24% increase from the 2017 plan estimate of 2,614. In addition, about 17% of the population is over the age of 65, and about 2% under the age of 5 and the median age is 45.1. Figure 80 shows the breakdown by Gender and age for the City.

Figure 8o - Population Pyramid for Beach City, Texas

(Beach City - Census Bureau Profile)

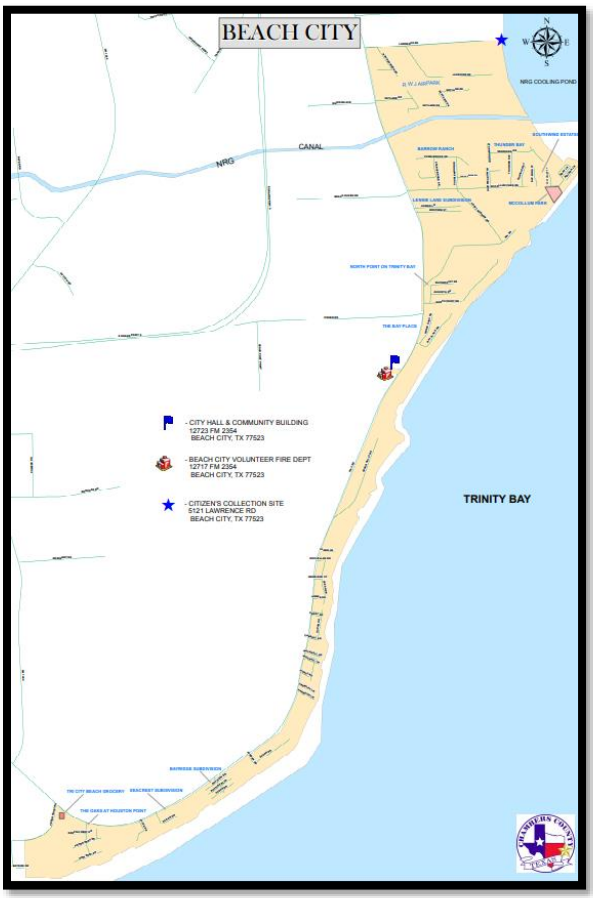
6.8% of the population are veterans and 4.6% of the population fall under the poverty level. 7.9% are disabled. 91% of the populations speaks English at home. 8.1% of the population are foreign born.

Education. 54.8% of the population are enrolled in kindergarten to 12th grade and 37.3% have received a bachelor's degree or higher.

Housing. The rate of homeownership is 93.5%. There are approximately 1,271 housing units with over 70% over $300,000 in housing value. The have family size is 2.84 and 73.5% are married-couple family household. 5.7% are female household, no spouse present and 13.4 is mail household, no spouse present. 8.5% are without health coverage

Work. There is 68.7 Employment rate with 88% drive to work on an average travel time of 28.8 minutes. The three largest industries employing Beach City residents are Education services, and health care and social assistance (19.7%) followed by Professional, scientific and management, administrative and waste management services (18.3%), and manufacturing (15%). The median household income is $169,570.

Figure 81 - Map of Beach City



Jurisdiction Capabilities Assessment

Table 56 assesses the degree of capability based on the area (limited, moderate, high) and a comment on the assessment. A full list of all capabilities in Chambers County is found in "Section 2. The Planning Process".

Table 56 - Beach City Jurisdiction Capabilities

Capability	Degree of Capability	Comment
Administrative/Tech Capabilities	Limited	The City has a very small staff and relies on the County for support in many of the hazard areas.
Regulatory Tools	Moderate	The City has ordinances to help mitigate damages from hazards in its floodplain, stormwater, subdivision, and building code requirements.
Financial Tools	Moderate	The City has a sales and use tax, utility tax, permit fees, court fees and fines, grant funds, and utility franchise fees.
Education and Awareness Tools	Moderate	The City's website provides information on hurricane preparedness and evacuation. It provides code of ordinances and permitting information and forms. It also provides links to important sites for hazard information. The City has a Facebook page in addition to the website to disseminate information to the public.

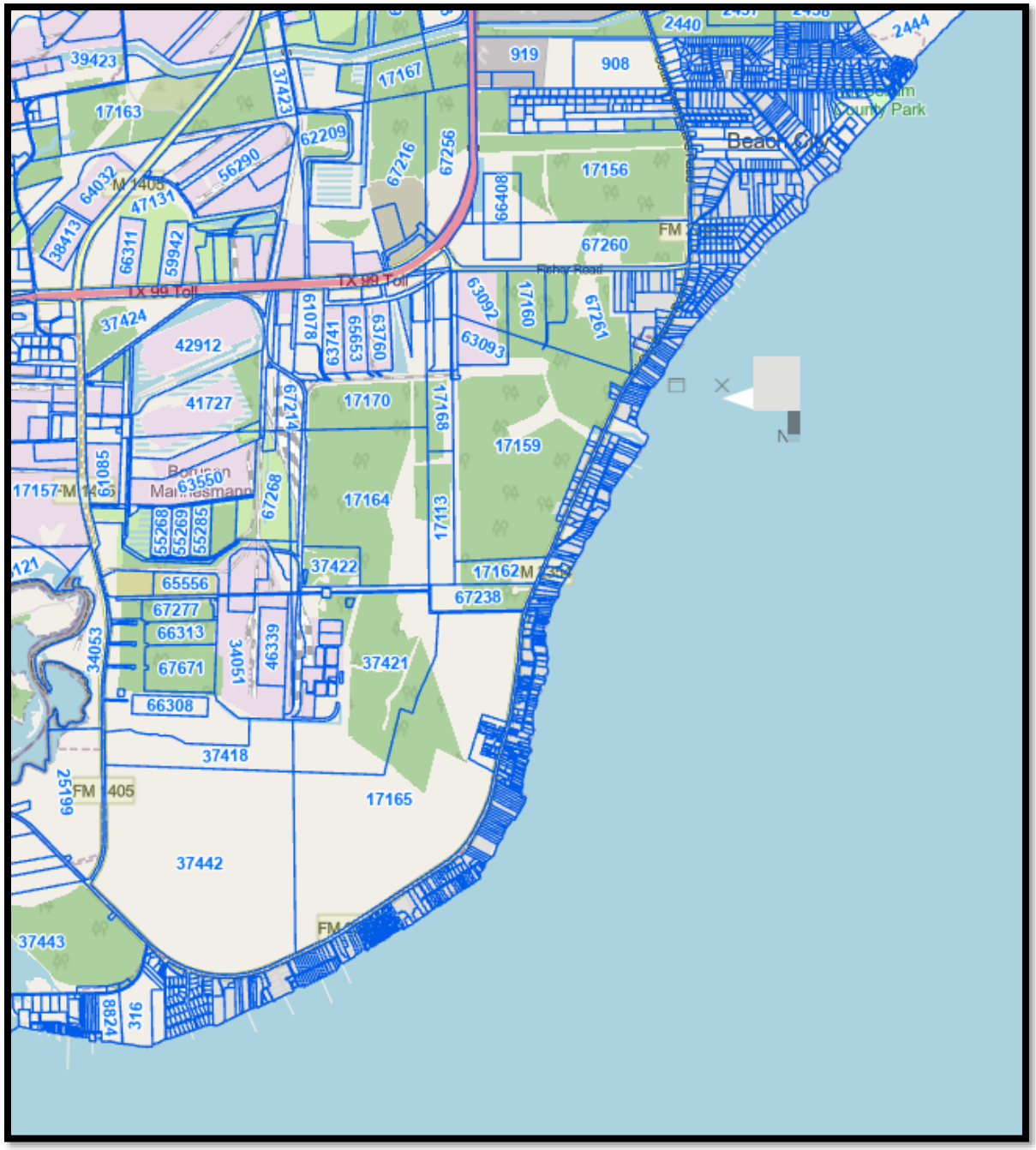
NFIP Summary

Beach City participates in the National Flood Insurance Program (NFIP). The following summarizes the NFIP statistics for Beach City.

Jurisdiction	Policies in Force	Amount of Paid Claims	Total RL Record	No. of RL Properties	No. of SRL Properties	Non-Insured
Beach City	331	$113,798.00	1	0	0	1

Development Trends. While much of Beach City is developing (4.5 square miles and 1,271 housing units), there is still room for growth. As previously noted, the population has increased by around 24% according to census data from 2017 to 2024 and yet the median year homes were built is 2000. While there is growth, it is relatively slow compared to other parts of the County.

Figure 82 - Beach City Parcel Map (Chambers County Appraisal District)



Jurisdiction Hazard Risk Assessment

The following hazard risk assessment details the hazards that most directly affect the jurisdiction. More information on each hazard can be found in "Section 3. Hazard Identification and Risk Assessment" section of the plan.

Coastal Erosion			
Approx. Size (Sq miles):	4.5	**Area Affected by Hazard**	Significant (25 to 75%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10 to 90% yearly)
Extent: According to the coastal vulnerability index, the risk of erosion is moderate.			
Potential Impact of Event: Cost to replenish beach; Damage to residential or commercial property on coast; Natural habitat loss along coastline			
Overall Vulnerability/Significance: *Moderate*. Since coastal erosion is typically gradual, there are often no single events that are reported as damage from coastal erosion. Events such as hurricanes and other large storms typically cause the largest amount of erosion due to high winds and surge of water onto coasts.			

Drought			
Approx. Size (Sq miles):	4.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	2	**Probability of Event**	Likely (10 to 90% yearly)
Extent: The PDSI shows exception drought (D4) can occur in this area. This has occurred most recently in 2011 and 2023.			
Potential Impact of Event: Drought events can cause major economic damage to farmers in the area; Water supply and water quality can be negatively affected during droughts; Dry conditions can lead to higher risk of fires			
Overall Vulnerability/Significance: *High*. Chamber's County economy relies heavily on farming such as for soybeans, rice, and cattle. In times of drought, this can severely damage crop yields and limit livestock grazing capabilities, which in turn negatively affects revenue.			

Expansive Soil			
Approx. Size (Sq miles):	4.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10 to 90% yearly)
Extent: According to the expansive soil map provided in the *Section 3* part of this plan, the entire planning area is in high risk for expansive soil			
Potential Impact of Event: Cracks in foundation of residential and commercial buildings; Breaks in water pipes, particularly in critical facilities, could lead to temporary loss of service			

Expansive Soil
Overall Vulnerability/Significance: *High*. While there are no recorded expansive soil events as the damage is typically gradual, the effects can be devasting. Older buildings tend to be most at risk due to less mitigation efforts made in the past during construction as well as the wear and tear damage over time. Structures at risk include ~196 high risk (built before 1980) residential buildings and at least 1 fire station.

Extreme Heat			
Approx. Size (Sq miles):	4.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	2	**Probability of Event**	Highly Likely (90 to 100% yearly)
Extent: The jurisdiction can expect extreme heat events up to the "extreme danger" level of the NWS Heat Index chart found in *Section 3* of this plan			
Potential Impact of Event: Strain on the electrical power grid due to increased use of air conditioning; All citizens, particularly the vulnerable population, are at risk of heat stroke, that could potentially lead to injury or death.			
Overall Vulnerability/Significance: *High*. There is a high likelihood of extreme heat events in the jurisdiction. Vulnerable populations such as the elderly, young children, and economically disadvantaged individuals are at highest risk. Census data shows that ~28% of the population in this jurisdiction are younger than 18 and ~16% of the population is over 65.			

Flood			
Approx. Size (Sq miles):	4.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	1	**Probability of Event**	Occasional (1-10% yearly)
Extent: According to the National Risk Index show plan area as relatively moderate risk with 93.8 national percentile risk.			
Potential Impact of Event: Damage to resident's property as well as economic loss; Vulnerable populations at risk of injury or death due to difficulty in evacuation for upcoming potential events.			
Overall Vulnerability/Significance: *High*. Flood events are especially dangerous to vulnerable populations as they often live in more flood prone areas. In addition, these individuals may have more difficulty in evacuating due to physical limitations. In addition, critical facilities such as fire station are at risk for damage.			

Freeze/Extreme Cold			
Approx. Size (Sq miles):	4.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10 to 90% yearly)
Extent: According to the National Risk Index the plan area is relatively moderate risk with 64.2 national percentile risk. While temperatures in the jurisdiction don't typically reach freezing levels, the residents are often unaccustomed to dealing with freezing temperatures when they do occur.			
Potential Impact of Event: Frostbite to residents in the jurisdiction, particularly those vulnerable population; Damage to infrastructure such as pipes, which may lead to interruptions in service during these events; Dangerous driving on roads during freezing conditions			
Overall Vulnerability/Significance: *High*. Freezing events are especially dangerous to vulnerable populations as they often do not have the means to deal with the low temperatures. While these events do not occur often in this area, when there is a freezing event there often can be severe effects.			

Hail			
Approx. Size (Sq miles):	4.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Occasional (1 to 10% yearly)
Extent: Hailstorms are measured using the TORRO Hailstorm Intensity Scale. H0-H5 level hail has occurred since 2000 in the jurisdiction.			
Potential Impact of Event: Vehicles in the jurisdiction could be damaged. This could cause economic loss to the owners; Hail could cause damage to weaker infrastructure			
Overall Vulnerability/Significance: *Low*. Hailstorms are relatively low risk to this jurisdiction. There is not a significant number of recorded events that caused damage in this jurisdiction. The monetary loss from the events that did cause damage are minimal when they do occur.			

Hurricane/Tropical Storm			
Approx. Size (Sq miles):	4.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	5	**Probability of Event**	Highly Likely (90 to 100% yearly)
Extent: The Saffir/Simpson Hurricane Scale has shown up to Category 5 hurricanes affecting the jurisdiction in the past.			

Hurricane/Tropical Storm

Potential Impact of Event: Damage to infrastructure such as downed power lines could affect availability for power and other utilities during a storm; Damage to critical facilities could delay response after a storm; Damage to homes and commercial buildings could cause economic hardship to residents.

Overall Vulnerability/Significance: *High*. Hurricanes and Tropical Storms are highly dangerous to this jurisdiction. Category 5 hurricanes can affect this area which can cause devasting damage to structures and risk of injury or death to residents. In this jurisdiction, almost 50 percent of all homes were either built before 1980 or are mobile homes. These categories of homes are more susceptible to damage from hurricane force winds.

Lightning

Approx. Size (Sq miles):	4.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0 (none reported)	**Probability of Event**	Highly Likely (90 to 100% yearly)

Extent: The Lightning Activity Levels (LALs) scale is used by the NOAA to quantify the number of lightning strikes in an interval of time. While there have been no reported lightning events since the start of 2018, lightning strikes occur in the area during most thunderstorms. Typically, these events only get recorded if there is injury, death, or property damage.

Potential Impact of Event: Potential loss of power if lightning strikes critical facilities or infrastructure such as power lines. This could prohibit the use of some utilities for a period of time; Potential death if resident is struck by lightning; Damage to homes and commercial buildings could cause economic hardship to residents.

Overall Vulnerability/Significance: *Low*. While lightning occurs frequently in the jurisdiction, typically the strikes do not hit anything that causes significant damage. Over the last 20 years, there have been only a few events that the NCEI database shows caused property damage or injury/death in all of Chambers County. In addition, the fire station could be damaged or lose power which could potentially slow down first responders.

Severe Thunderstorms/High Wind

Approx. Size (Sq miles):	4.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	3	**Probability of Event**	Highly Likely (90 to 100% yearly)

Extent: The Beaufort Wind Scale categorizes the wind effects that an area could feel during a severe thunderstorm event. This scale is rated 0-12. This jurisdiction could expect to have an event on the full 0-12 scale.

Severe Thunderstorms/High Wind

Potential Impact of Event: Damage to infrastructure such as downed power lines could affect availability for power and other utilities during a severe thunderstorm; Damage to critical facilities could delay response after a storm; Damage to homes and commercial buildings could cause economic hardship to residents.

Overall Vulnerability/Significance: *Medium*. Severe thunderstorms are dangerous to this jurisdiction. Higher category winds on the Beaufort scale can affect this area by causing significant damage to structures and risk of injury to residents. There is also a risk of destruction of homes in a severe thunderstorm event, however, these wind effects are typically on a lower scale than received during a hurricane event.

Tornado

Approx. Size (Sq miles):	4.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	2	**Probability of Event**	Likely (10-90% yearly)

Extent: The Enhanced Fujita (EF) scale categories tornadoes on the scale of EF0-EF5 based on wind speed of the tornado. Most tornadoes in the past in this area have been EF0 or EF1. The extent of damage with this category of tornado is light to moderate damage on roofs and downing of small trees.

Potential Impact of Event: Moderate damage to roofs, windows, and doors; Damage to less reinforced homes like mobile homes; Knocked over trees which may cause damage to structures or loss of utilities like power.

Overall Vulnerability/Significance: *Medium*. Tornadoes in this area are not typically the most severe based on previous occurrences, however, there is potential for higher impact tornadoes which could be devasting. This jurisdiction has about 50 percent of the housing as either mobile homes or built before 1980. These types of homes are typically at a higher risk for damage from a tornado.

Wildfire

Approx. Size (Sq miles):	4.5	**Area Affected by Hazard**	Significant (25-75%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10-90% yearly)

Extent: The Fire Intensity Scale (FIS) is used by the Texas Wildfire Risk assessment Portal to provide wildfire risk information. This scale goes from 1-5 with 5 being the most severe fire intensity. Data shows this jurisdiction as risk 2.5 to 3.5 on the scale.

Wildfire
Potential Impact of Event: Damage to homes and other structures in the jurisdiction; Destruction of crop yields which could negatively affect farmers; Potential loss of life if resident is unable to evacuate during an event
Overall Vulnerability/Significance: *Medium*. While there are no recorded events of wildfires according to the NCEI database, this jurisdiction is still at risk in certain areas of an event in the future. If a wildfire were to occur, there could be damage to homes and infrastructure in the area.

Winter Storm			
Approx. Size (Sq miles):	4.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Occasional (1-10% yearly)
Extent: The Sperry-Piltz Ice Accumulation Index (SPIA) predicts potential damage from ice storms. The scale goes from 0-5, with 5 being the most severe. There are no recorded events in this jurisdiction according to NCEI, but if an event were to occur it would likely fall into one of the lower categories.			
Potential Impact of Event: Damage to infrastructure and potential loss of power and other utilities; Injury or death due to the adverse temperatures and conditions that residents in this area are not accustomed to; Loss of crops that could lead to negative economic conditions for farmers			
Overall Vulnerability/Significance: *Medium*. While there are no recorded events of winter storms according to the NCEI database, this jurisdiction is still at risk in of an event in the future. An event likely would not be severe, but due to residents not being accustomed to these sorts of conditions, it could cause more dramatic issues as seen in parts of Texas during Winter Storm Uri in 2021.			

Jurisdiction Resolution Adoption the Plan

Cove

The City of Cove was incorporated by decree on May 23, 1973. It is a General Law City governed by a board of alderman and includes six members – a mayor and five alderman, all whom are elected at-large and are referred as the City's Council. General law cities are smaller cities, most of which are less than 5,000 in population. All general law cities operate according to specific state statutes prescribing their powers and duties, under the State's Local Government Code. General law cities are limited to doing what the state authorizes or permits them to do. If state law does not grant general law cities the express or implied power to initiate a particular action, none may be taken.

The City of Cove has a City Secretary who manages the City's daily operations. It has one volunteer fire department (Cove Fire and Rescue) that is supported by the City and the County. Emergency Management is supported by the County. Its ordinances can be found on the City Hall, 7911 Cove Loop Cove, TX 7523. It relies on the County for permit support regarding new construction, new OSSFs, improvements, utility construction, reconnection of electricity, pipeline and outdoor sign. It does not have any utilities e.g. water or wastewater, instead it uses private wells, neighborhood privately owned water systems, private septic systems (aerobic systems).

Jurisdiction Profile

Cove is a city in the Northwestern part of Chambers County. Cove is about 1.2 square miles in total area. It is bordered by Old River Lake on its west, Interstate 10 to its north and Cotton Lake to its east and Cotton Bayou runs through the City.

Population and demographics. Coves's estimated population is 528 according to 2022 U.S. Census Data, a 4% increase from the 2017 plan estimate of 510. In addition, about 24% of the population is over the age of 65, and about 2% under the age of 5 and the median age is 41.2. Figure 83 shows the breakdown by Gender and age for the City. 7.0% of the population are veterans and 15.3% of the population fall under the poverty level. 85.5% of the populations speaks English at home. 3.3% of the population are foreign born.

Education. 54.7% of the school enrolled population are enrolled in kindergarten to 12th grade and 8.1% have received a bachelor's degree or higher.

Housing. The rate of homeownership is 67.8%. There are approximately 223 housing units with over 60.6% over $300,000 in housing value. The have family size is 3.23 and 61.0% are married-couple family household. 26.0% are female household, no spouse present and 11.0% is male household, no spouse present.

Work. There is 53.1% employment rate with 97.8% driving to work on an average travel time of 17.7 minutes. The three largest industries employing Cove's residents are Retail trade (25.1%) followed by Professional, scientific, and management, and administrative and waste management services (13.9%), and Educational services, and health care and social assistance (8.0%). The median household income is $81,429.

Figure 83 - Population Pyramid for Cove, Texas

(Cove - Census Bureau Profile)

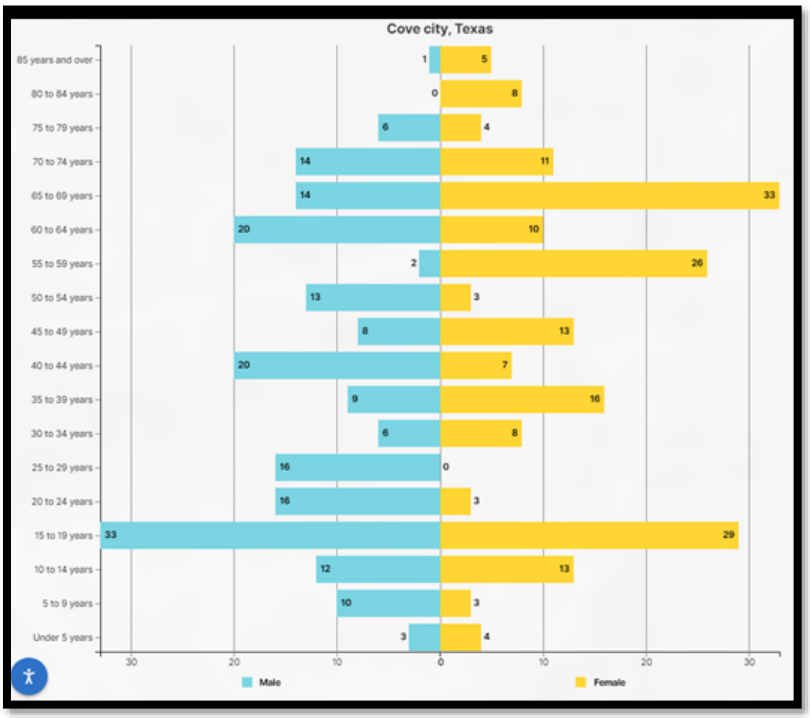


Figure 84 - Map of Cove

Jurisdiction Capabilities Assessment

The below table assesses the degree of capability based on the area (limited, moderate, high) and a comment on the assessment. A full list of all capabilities in Chambers County is found in "Section 2. The Planning Process".

Capability	Degree of Capability	Comment
Administrative/Tech Capabilities	Limited	The City has a very small staff and relies on the County for support in many of the hazard areas.
Regulatory Tools	Limited	The City has ordinances to help mitigate damages from hazards in its floodplain.
Financial Tools	Limited	The City has a sales and use tax and use of grant funds.
Education and Awareness Tools	Limited	The City does not use social media or have a website to keep up to date on community news. Most awareness would come from local news.

NFIP Summary

Cove participates in the National Flood Insurance Program (NFIP). The following summarizes the NFIP statistics.

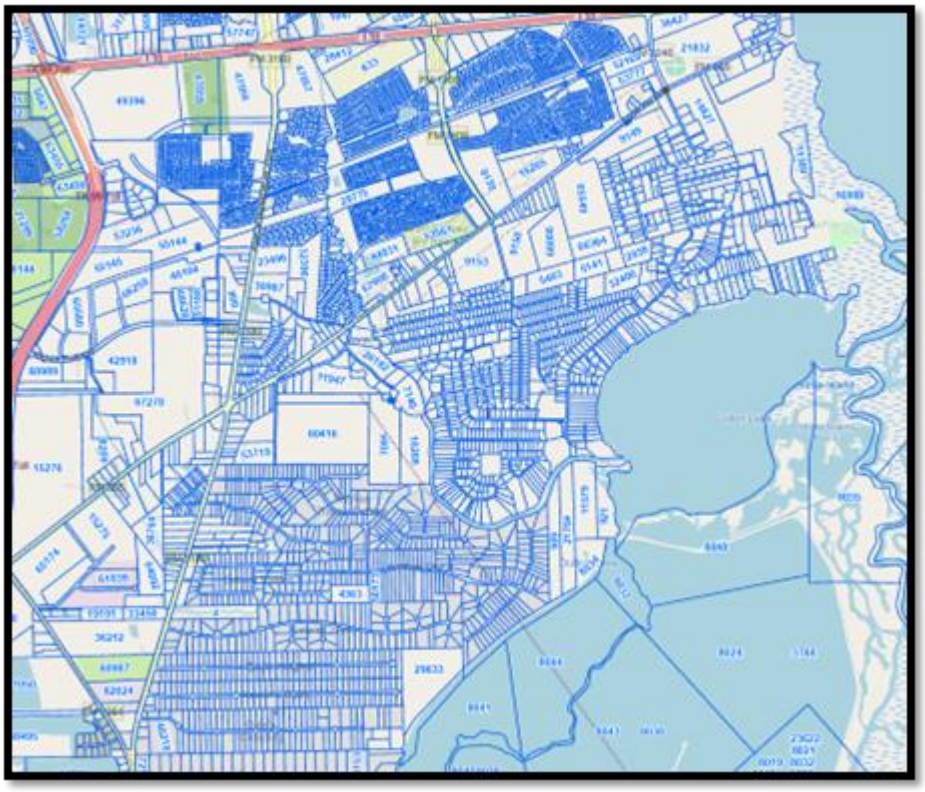
Jurisdiction	Policies in Force	Amount of Paid Claims	Total RL Record	No. of RL Properties	No. of SRL Properties	Non-Insured
Cove	23	$7,490,000	1	0	0	1

Development Trends - While much of Cove is developed (1.2 square miles, approximately 233 housing units), there is still room for growth. As previously noted, the population has increased by around 4% according to census data from 2017 to 2024 and homes built between 2010-2019 are about 3.8% as US Census Data shows below. While there is growth, it is relatively slow compared to other parts of the County.

Table 57 - Year and Percentage of Structures Built in Cove, Texas

YEAR STRUCTURE BUILT	Percent
Built 2020 or later	0.0%
Built 2010 to 2019	3.8%
Built 2000 to 2009	21.6%
Built 1990 to 1999	27.6%
Built 1980 to 1989	13.0%
Built 1970 to 1979	10.3%
Built 1960 to 1969	1.6%
Built 1950 to 1959	14.1%
Built 1940 to 1949	3.8%
Built 1939 or earlier	4.3%

Figure 85 - Cove Parcel Map (Chambers County Appraisal District)



Jurisdiction Hazard Risk Assessment

The following hazard risk assessment details the hazards that most directly affect the jurisdiction. More information on each hazard can be found in "Section 3. Hazard Identification and Risk Assessment" section of the plan.

Coastal Erosion			
Approx. Size (Sq miles):	1.2	**Area Affected by Hazard**	Significant (25 to 75%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10 to 90% yearly)
Extent: According to the coastal vulnerability index, the risk of erosion is moderate.			
Potential Impact of Event: Cost to replenish beach; Damage to residential or commercial property on coast; Natural habitat loss along coastline			
Overall Vulnerability/Significance: *Moderate*. Since coastal erosion is typically gradual, there are often no single events that are reported as damage from coastal erosion. Events such as hurricanes and other large storms typically cause the largest amount of erosion due to high winds and surge of water onto coasts.			

Drought			
Approx. Size (Sq miles):	1.2	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	2	**Probability of Event**	Likely (10 to 90% yearly)
Extent: The Palmer Drought Severity Index shows exception drought (D4) can occur in this area. This has occurred most recently in 2011 and 2023.			
Potential Impact of Event: Drought events can cause major economic damage to farmers that live in the area; Water supply and water quality can be negatively affected during droughts; Dry conditions can lead to higher risk of fires			
Overall Vulnerability/Significance: *High*. Chamber's County economy relies heavily on farming such as for soybeans, rice, and cattle. In times of drought, this can severely damage crop yields and limit livestock grazing capabilities, which in turn negatively affects revenue.			

Expansive Soil			
Approx. Size (Sq miles):	1.2	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10 to 90% yearly)
Extent: According to the expansive soil map provided in the *Section 3* part of this plan, the entire planning area is in high risk for expansive soil			
Potential Impact of Event: Cracks in foundation of residential and commercial buildings; Breaks in water pipes, particularly in critical facilities, could lead to temporary loss of service			
Overall Vulnerability/Significance: *High*. While there are no recorded expansive soil events as the damage is typically gradual, the effects can be devasting. Older buildings tend to be most at risk due to less mitigation efforts made in the past during construction as well as the wear and tear damage over time. Structures at risk include ~39 high risk (built before 1980) residential buildings and at least 1 fire station and 1 EMS.			

Extreme Heat			
Approx. Size (Sq miles):	1.2	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	2	**Probability of Event**	Highly Likely (90 to 100% yearly)
Extent: The jurisdiction can expect extreme heat events up to the "extreme danger" level of the NWS Heat Index chart found in *Section 3* of this plan			
Potential Impact of Event: Strain on the electrical power grid due to increased use of air conditioning; All citizens, particularly the vulnerable population, are at risk of heat stroke, that could potentially lead to injury or death.			

Extreme Heat

Overall Vulnerability/Significance: *High*. There is a high likelihood of extreme heat events in the jurisdiction. Vulnerable populations such as the elderly, young children, and economically disadvantaged individuals are at highest risk. Census data shows that ~19% of the population in this jurisdiction are younger than 18 and ~20% of the population is over 65.

Flood

Approx. Size (Sq miles):	1.2	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	1	**Probability of Event**	Occasional (1-10% yearly)

Extent: According to the National Risk Index show plan area as relatively moderate risk with 93.8 national percentile risk.

Potential Impact of Event: Damage to resident's property as well as economic loss; Vulnerable populations at risk of injury or death due to difficulty in evacuation for upcoming potential events.

Overall Vulnerability/Significance: *High*. Flood events are especially dangerous to vulnerable populations as they often live in more flood prone areas. In addition, these individuals may have more difficulty in evacuating due to physical limitations. In addition, critical facilities such as fire station and EMS are at risk for damage.

Freeze/Extreme Cold

Approx. Size (Sq miles):	1.2	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10 to 90% yearly)

Extent: According to the National Risk Index the plan area is relatively moderate risk with 64.2 national percentile risk. While temperatures in the jurisdiction don't typically reach freezing levels, the residents are often unaccustomed to dealing with freezing temperatures when they do occur.

Potential Impact of Event: Frostbite to residents in the jurisdiction, particularly those vulnerable population; Damage to infrastructure such as pipes, which may lead to interruptions in service during these events; Dangerous driving on roads during freezing conditions

Overall Vulnerability/Significance: *High*. Freezing events are especially dangerous to vulnerable populations as they often do not have the means to deal with the low temperatures. While these events do not occur often in this area, when there is a freezing event there often can be severe effects.

Hail			
Approx. Size (Sq miles):	1.2	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Occasional (1 to 10% yearly)
Extent: Hailstorms are measured using the TORRO Hailstorm Intensity Scale. H0-H5 level hail have occurred since 2000 in the jurisdiction.			
Potential Impact of Event: Vehicles in the jurisdiction could be damaged. This could cause economic loss to the owners; Hail could cause damage to weaker infrastructure			
Overall Vulnerability/Significance: *Low*. Hailstorms are relatively low risk to this jurisdiction. There is not a significant number of recorded events that caused damage in this jurisdiction. The monetary loss from the events that did cause damage are minimal when they do occur.			

Hurricane/Tropical Storm			
Approx. Size (Sq miles):	1.2	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	5	**Probability of Event**	Highly Likely (90 to 100% yearly)
Extent: The Saffir/Simpson Hurricane Scale has shown up to Category 5 hurricanes affecting the jurisdiction in the past.			
Potential Impact of Event: Damage to infrastructure such as downed power lines could affect availability for power and other utilities during a storm; Damage to critical facilities could delay response after a storm; Damage to homes and commercial buildings could cause economic hardship to residents			
Overall Vulnerability/Significance: *High*. Hurricanes and Tropical Storms are highly dangerous to this jurisdiction. Category 5 hurricanes can affect this area which can cause devasting damage to structures and risk of injury or death to residents. In this jurisdiction, almost 70 percent of all homes were either built before 1980 or are mobile homes. These categories of homes are more susceptible to damage from hurricane force winds.			

Lightning			
Approx. Size (Sq miles):	1.2	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0 (none reported)	**Probability of Event**	Highly Likely (90 to 100% yearly)
Extent: The Lightning Activity Levels (LALs) scale is used by the NOAA to quantify the number of lightning strikes in an interval of time. While there have been no reported			

Lightning			
lightning events since the start of 2018, lightning strikes occur in the area during most thunderstorms. Typically, these events only get recorded if there is injury, death, or property damage.			
Potential Impact of Event: Potential loss of power if lightning strikes critical facilities or infrastructure such as power lines. This could prohibit the use of some utilities for a period of time; Potential death if resident is struck by lightning; Damage to homes and commercial buildings could cause economic hardship to residents.			
Overall Vulnerability/Significance: *Low*. While lightning occurs frequently in the jurisdiction, typically the strikes do not hit anything that causes significant damage. Over the last 20 years, there have been only a few events that the NCEI database shows caused property damage or injury/death in all of Chambers County. In addition, the fire station and EMS could be damaged or lose power which could potentially slow down first responders.			

Severe Thunderstorms/High Wind			
Approx. Size (Sq miles):	1.2	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	3	**Probability of Event**	Highly Likely (90 to 100% yearly)
Extent: The Beaufort Wind Scale categorizes the wind effects that an area could feel during a severe thunderstorm event. This scale is rated 0-12. This jurisdiction could expect to have an event on the full 0-12 scale.			
Potential Impact of Event: Damage to infrastructure such as downed power lines could affect availability for power and other utilities during a severe thunderstorm; Damage to critical facilities could delay response after a storm; Damage to homes and commercial buildings could cause economic hardship to residents.			
Overall Vulnerability/Significance: *Medium*. Severe thunderstorms are dangerous to this jurisdiction. Higher category winds on the Beaufort scale can affect this area by causing significant damage to structures and risk of injury to residents. There is also a risk of destruction of homes in a severe thunderstorm event, however, these wind effects are typically on a lower scale than received during a hurricane event.			

Tornado			
Approx. Size (Sq miles):	1.2	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	2	**Probability of Event**	Likely (10-90% yearly)
Extent: The Enhanced Fujita (EF) scale categories tornadoes on the scale of EF0-EF5 based on wind speed of the tornado. Most tornadoes in the past in this area have been EF0 or EF1.			

Tornado
The extent of damage with this category of tornado is light to moderate damage on roofs and downing of small trees.
Potential Impact of Event: Moderate damage to roofs, windows, and doors; Damage to less reinforced homes like mobile homes; Knocked over trees which may cause damage to structures or loss of utilities like power.
Overall Vulnerability/Significance: *Medium*. Tornadoes in this area are not typically the most severe based on previous occurrences, however, there is potential for higher impact tornadoes which could be devasting. This jurisdiction has about 70 percent of the housing as either mobile homes or built before 1980. These types of homes are typically at a higher risk for damage from a tornado.

Wildfire			
Approx. Size (Sq miles):	1.2	**Area Affected by Hazard**	Significant (25-75%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10-90% yearly)
Extent: The Fire Intensity Scale (FIS) is used by the Texas Wildfire Risk assessment Portal to provide wildfire risk information. This scale goes from 1-5 with 5 being the most severe fire intensity. Data shows this jurisdiction as risk 3.5 to 5 on the scale.			
Potential Impact of Event: Damage to homes and other structures in the jurisdiction; Destruction of crop yields which could negatively affect farmers; Potential loss of life if resident is unable to evacuate during an event			
Overall Vulnerability/Significance: *Medium*. While there are no recorded events of wildfires according to the NCEI database, this jurisdiction is still at risk in certain areas of an event in the future. Since portions of this jurisdiction are in the risk 5 on the FIS, if a wildfire were to occur it could cause devasting damage.			

Winter Storm			
Approx. Size (Sq miles):	1.2	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Occasional (1-10% yearly)
Extent: The Sperry-Piltz Ice Accumulation Index (SPIA) predicts potential damage from ice storms. The scale goes from 0-5, with 5 being the most severe. There are no recorded events in this jurisdiction according to NCEI, but if an event were to occur it would likely fall into one of the lower categories.			
Potential Impact of Event: Damage to infrastructure and potential loss of power and other utilities; Injury or death due to the adverse temperatures and conditions that residents in this area are not accustomed to; Loss of crops that could lead to negative economic conditions for farmers.			

Winter Storm

Overall Vulnerability/Significance: *Medium*. While there are no recorded events of winter storms according to the NCEI database, this jurisdiction is still at risk in of an event in the future. An event likely would not be severe, but due to residents not being accustomed to these sorts of conditions, it could cause more dramatic issues as seen in parts of Texas during Winter Storm Uri in 2021.

Jurisdiction Resolution Adoption the Plan

Mont Belvieu

Jurisdiction Profile

Mont Belvieu was incorporated as a Home Rule Charter on November 11, 2013. As a home rule city, it operates under a council-manager form of government. The City Council is comprised of the Mayor and six Council Members elected by the residents of the City. The City Council appoints the City Manager, City Attorney, and Municipal Judge.

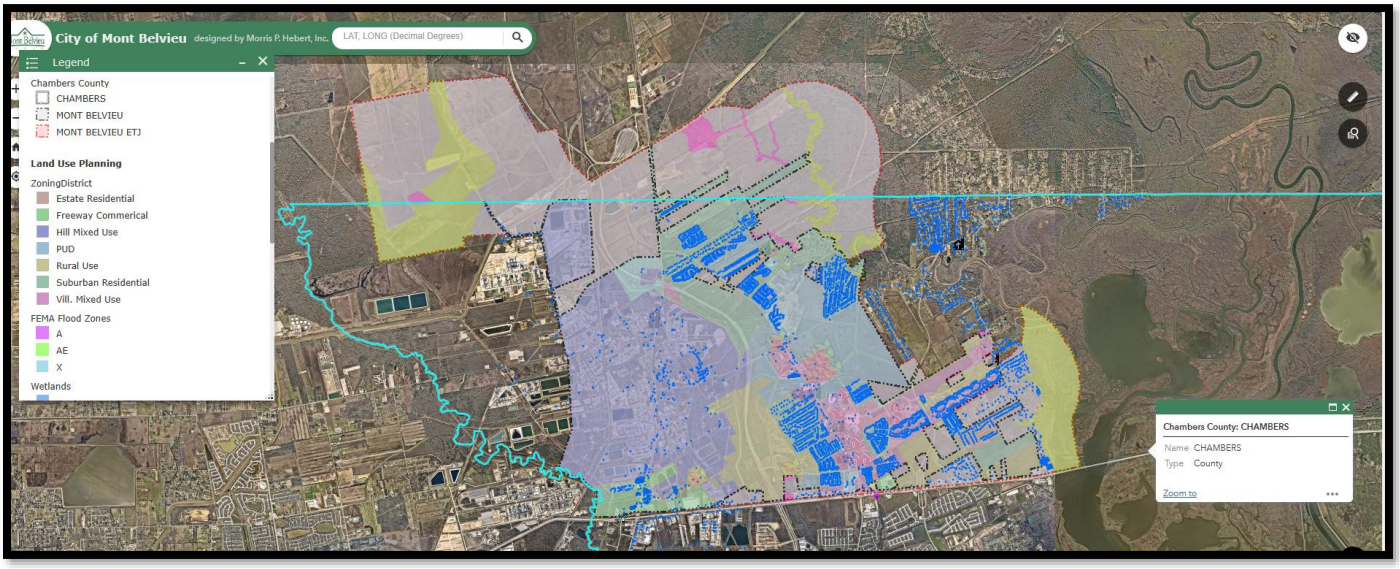
The City of Mont Belvieu is a full-service city. City departments include Administration, Communications and Marketing, Economic Development, Emergency Services, Engineering, Finance, Hurman Resources, Municipal Court, Parks & Recreation, Planning & Development, Police, and Public Works. Its Code of Ordinance can be found on its website as well as information for permits, and public utilities include water, wastewater, solid waste, and fiber network (MB Link).

Jurisdiction Profile

Mont Belvieu is found in the Northwestern part of Chambers County with a small portion located in Liberty County. Mont Belvieu is about 17 square miles in total area. It is north of Interstate 10 along State Highway 146 and approximately 30 miles east of Houston. It is west of Old River-Winfree. The City's GIS Department has extensive mapping capabilities and has City facility maps, CIP maps, new development maps, flood zone maps as examples. Figure 86 is a US Census Map of Mont Belvieu and Figure 87 is a map created by Mont Belvieu to show the flood prone areas, land use and wetlands map.

Figure 86 - Map of Mont Belvieu

Figure 87 - Mont Belvieu Land Use, Flood Zone, and Wetlands Map

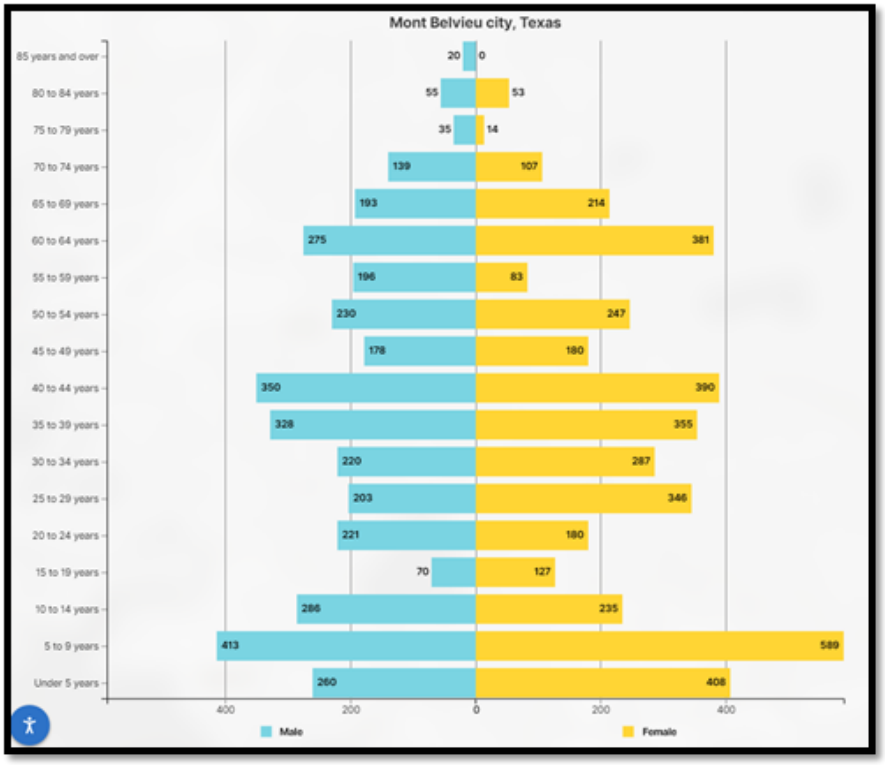


Population and demographics

Mont Belvieu's estimated population is 8,547 according to 2022 U.S. Census Data, a 53% increase from the 2017 plan estimate of 5,584. In addition, about 10% of the population is over the age of 65, and about 8% under the age of 5 and the median age is 36.0. Figure 88 shows the breakdown by Gender and age for the City.

Figure 88 - Population Pyramid for Mont Belvieu, Texas

([Mont Belvieu - Census Bureau Profile])



7.3% of the population are veterans and 10.9% of the population fall under the poverty level. 85.3% of the populations speaks English at home. 2.9% of the population are foreign born.

Education. 69.9% of the school enrolled population are enrolled in kindergarten to 12th grade and 35.9% have received a bachelor's degree or higher.

Housing. The rate of homeownership is 83.9%. There are approximately 2,629 housing units with over 69.6% over $300,000 in housing value. The have family size is 3.06 and 67.6% are married-couple family household. 13.5% are female household, no spouse present and 12.6 is male household, no spouse present.

Work. There is 69.4% Employment rate with 91.4% driving to work on an average travel time of 28.9 minutes. The three largest industries employing Mont Belvieu residents are Education services, and health care and social assistance (20.9%) followed by Manufacturing (18.4%), and Retail trade (11.6%). The median household income is $132,010.

Jurisdiction Capabilities Assessment

The below table assesses the degree of capability based on the area (limited, moderate, high) and a comment on the assessment. A full list of all capabilities in Chambers County is found in "Section 2. The Planning Process".

Capability	Degree of Capability	Comment
Administrative/Tech Capabilities	Moderate/High	The City has larger staff than many parts of the County. Staff include administrative, engineering, transportation, parks and recreation, emergency management, public works, marketing, police, finance, municipal court.
Regulatory Tools	Moderate/High	The City has ordinances to help mitigate damages from hazards in its floodplain, stormwater, subdivision, zoning, and building code requirements.
Financial Tools	Moderate/High	The City has property tax, sales and use tax, utility tax, permit fees, court fees and fines, grant funds, capital improvement funding, and utility franchise fees.
Education and Awareness Tools	Moderate/High	The City's website provides information on hurricane preparedness and evacuation. It provides code of ordinances and permitting information and forms. It also provides links to important sites for hazard information. The City has a Facebook page in addition to the website to disseminate information to the public. The City also use hazard awareness campaigns to further educate it's residents.

NFIP Summary

Mont Belvieu participates in the National Flood Insurance Program (NFIP). The following summarizes the NFIP statistics for Mont Belvieu.

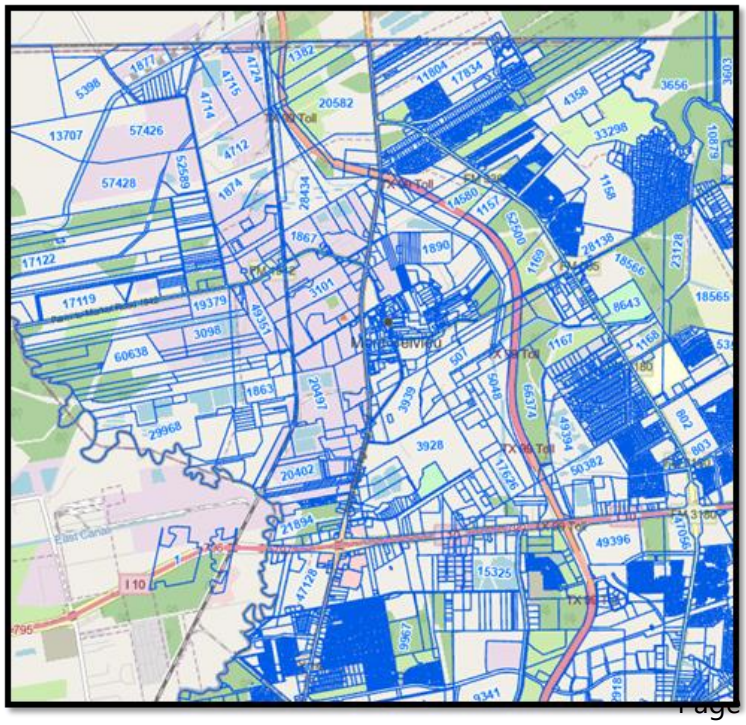
Jurisdiction	Policies in Force	Amount of Paid Claims	Total RL Record	No. of RL Properties	No. of SRL Properties	Non-Insured
Mont Belvieu	562	$195,348,000	2	0	0	2

Development Trends - While much of Mont Belvieu is developing (17 square miles and 2,629 housing units), there is still room for growth. As previously noted, the population has increased by around 53% according to census data from 2017 to 2024. Housing units also have increased, however, with a comprehensive plan, ordinances to regulate development and current building codes and standards, much of the housing is built to withstand the impacts of many of the hazards.

Table 58 - Year and Percentage of Structures Built in Cove, Texas

YEAR STRUCTURE BUILT	Percent
2020 or later	10.5%
2010 to 2019	39.9%
2000 to 2009	21.4%
1980 to 1999	17.2%
1960 to 1979	6.4%
1940 to 1959	2.6%
1939 or earlier	1.9%

Figure 89 - Mont Belvieu Parcel Map (Chambers County Appraisal District)



Jurisdiction Hazard Risk Assessment

The following hazard risk assessment details the hazards that most directly affect the jurisdiction. More information on each hazard can be found in "Section 3. Hazard Identification and Risk Assessment" section of the plan.

Drought			
Approx. Size (Sq miles):	15.3	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	2	**Probability of Event**	Likely (10 to 90% yearly)
Extent: The Palmer Drought Severity Index shows exception drought (D4) can occur in this area. This has occurred most recently in 2011 and 2023			
Potential Impact of Event: Drought events can cause major economic damage to farmers that live in the area; Water supply and water quality can be negatively affected during droughts; Dry conditions can lead to higher risk of fires			
Overall Vulnerability/Significance: *High*. Chamber's County economy relies heavily on farming such as for soybeans, rice, and cattle. In times of drought, this can severely damage crop yields and limit livestock grazing capabilities, which in turn negatively affects revenue.			

Expansive Soil			
Approx. Size (Sq miles):	15.3	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10 to 90% yearly)
Extent: According to the expansive soil map provided in the *Section 3* part of this plan, the entire planning area is in high risk for expansive soil			
Potential Impact of Event: Cracks in foundation of residential and commercial buildings; Breaks in water pipes, particularly in critical facilities, could lead to temporary loss of service			
Overall Vulnerability/Significance: *High*. While there are no recorded expansive soil events as the damage is typically gradual, the effects can be devasting. Older buildings tend to be most at risk due to less mitigation efforts made in the past during construction as well as the wear and tear damage over time. Structures at risk include ~312 high risk (built before 1980) residential buildings and critical facilities such as fire station, schools, EMS, police stations, shelters, and toxic release sites.			

Extreme Heat			
Approx. Size (Sq miles):	15.3	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	2	**Probability of Event**	Highly Likely (90 to 100% yearly)
Extent: The jurisdiction can expect extreme heat events up to the "extreme danger" level of the NWS Heat Index chart found in *Section 3* of this plan			
Potential Impact of Event: Strain on the electrical power grid due to increased use of air conditioning; All citizens, particularly the vulnerable population, are at risk of heat stroke, that could potentially lead to injury or death.			

Overall Vulnerability/Significance: *High*. There is a high likelihood of extreme heat events in the jurisdiction. Vulnerable populations such as the elderly, young children, and economically disadvantaged individuals are at highest risk. Census data shows that ~26% of the population in this jurisdiction are younger than 18 and ~11% of the population is over 65.

Flood			
Approx. Size (Sq miles):	15.3	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	1	**Probability of Event**	Occasional (1-10% yearly)
Extent: According to the National Risk Index show plan area as relatively moderate risk with 93.8 national percentile risk.			
Potential Impact of Event: Damage to resident's property as well as economic loss; Vulnerable populations at risk of injury or death due to difficulty in evacuation for upcoming potential events.			
Overall Vulnerability/Significance: *High*. Flood events are especially dangerous to vulnerable populations as they often live in more flood prone areas. In addition, these individuals may have more difficulty in evacuating due to physical limitations. In addition, critical facilities such as fire stations, EMS, schools, police stations, toxic release sites are at risk for damage.			

Freeze/Extreme Cold			
Approx. Size (Sq miles):	15.3	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10 to 90% yearly)
Extent: According to the National Risk Index the plan area is relatively moderate risk with 64.2 national percentile risk. While temperatures in the jurisdiction don't typically reach freezing levels, the residents are often unaccustomed to dealing with freezing temperatures when they do occur.			
Potential Impact of Event: Frostbite to residents in the jurisdiction, particularly those vulnerable population; Damage to infrastructure such as pipes, which may lead to interruptions in service during these events; Dangerous driving on roads during freezing conditions			
Overall Vulnerability/Significance: *High*. Freezing events are especially dangerous to vulnerable populations as they often do not have the means to deal with the low temperatures. While these events do not occur often in this area, when there is a freezing event there often can be severe effects.			

Hail			
Approx. Size (Sq miles):	15.3	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Occasional (1 to 10% yearly)
Extent: Hailstorms are measured using the TORRO Hailstorm Intensity Scale. H0-H5 level hail has occurred since 2000 in the jurisdiction.			
Potential Impact of Event: Vehicles in the jurisdiction could be damaged. This could cause economic loss to the owners; Hail could cause damage to weaker infrastructure			
Overall Vulnerability/Significance: *Low*. Hailstorms are relatively low risk to this jurisdiction. There is not a significant number of recorded events that caused damage in this jurisdiction. The monetary loss from the events that did cause damage are minimal when they do occur.			

Hurricane/Tropical Storm			
Approx. Size (Sq miles):	15.3	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	5	**Probability of Event**	Highly Likely (90 to 100% yearly)
Extent: The Saffir/Simpson Hurricane Scale has shown up to Category 5 hurricanes affecting the jurisdiction in the past.			
Potential Impact of Event: Damage to infrastructure such as downed power lines could affect availability for power and other utilities during a storm; Damage to critical facilities could delay response after a storm; Damage to homes and commercial buildings could cause economic hardship to residents.			
Overall Vulnerability/Significance: *High*. Hurricanes and Tropical Storms are highly dangerous to this jurisdiction. Category 5 hurricanes can affect this area which can cause devasting damage to structures and risk of injury or death to residents. In this jurisdiction, almost 40 percent of all homes were either built before 1980 or are mobile homes. These categories of homes are more susceptible to damage from hurricane force winds.			

Lightning			
Approx. Size (Sq miles):	15.3	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0 (none reported)	**Probability of Event**	Highly Likely (90 to 100% yearly)
Extent: The Lightning Activity Levels (LALs) scale is used by the NOAA to quantify the number of lightning strikes in an interval of time. While there have been no reported lightning events since the start of 2018, lightning strikes occur in the area during most			

Lightning
thunderstorms. Typically, these events only get recorded if there is injury, death, or property damage.
Potential Impact of Event: Potential loss of power if lightning strikes critical facilities or infrastructure such as power lines. This could prohibit the use of some utilities for a period; Potential death if resident is struck by lightning; Damage to homes and commercial buildings could cause economic hardship to residents.
Overall Vulnerability/Significance: *Low*. While lightning occurs frequently in the jurisdiction, typically the strikes do not hit anything that causes significant damage. Over the last 20 years, there have been only a few events that the NCEI database shows caused property damage or injury/death in all of Chambers County. Critical facilities such as schools, fire stations, EMS, police stations, and shelters could all lose power or be damaged from a lightning event.

Salt Dome			
Approx. Size (Sq miles):	15.3	**Area Affected by Hazard**	Limited (10-25%)
Events Since Start of 2018	1	**Probability of Event**	Likely (10 to 90% yearly)
Extent: Mont Belvieu salt dome explosions can be devasting, causing injury and death. In 1992 there was an explosion due to a natural gas leak. This ultimately killed three people and injured 21 more. This also caused over 9 million in damage to homes and farms in the area.			
Potential Impact of Event: Dome explosions can cause economic hardship in the area as many workers rely on this industry for their livelihood. After an explosion, parts of the dome may be shut down for a period of time; Potential injury/death to workers near explosion.			
Overall Vulnerability/Significance: *High*. While the number of salt dome fires/explosions have reduced since the increase in regulation requirements, an explosion can be highly destructive and put the workers at risk for injury and death.			

Severe Thunderstorms/High Wind			
Approx. Size (Sq miles):	15.3	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	3	**Probability of Event**	Highly Likely (90 to 100% yearly)
Extent: The Beaufort Wind Scale categorizes the wind effects that an area could feel during a severe thunderstorm event. This scale is rated 0-12. This jurisdiction could expect to have an event on the full 0-12 scale.			
Potential Impact of Event: Damage to infrastructure such as downed power lines could affect availability for power and other utilities during a severe thunderstorm; Damage to			

Severe Thunderstorms/High Wind
critical facilities could delay response after a storm; Damage to homes and commercial buildings could cause economic hardship to residents.
Overall Vulnerability/Significance: *Medium*. Severe thunderstorms are dangerous to this jurisdiction. Higher category winds on the Beaufort scale can affect this area by causing significant damage to structures and risk of injury to residents. There is also a risk of destruction of homes in a severe thunderstorm event, however, these wind effects are typically on a lower scale than received during a hurricane event.

Tornado			
Approx. Size (Sq miles):	15.3	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	2	**Probability of Event**	Likely (10-90% yearly)
Extent: The Enhanced Fujita (EF) scale categories tornadoes on the scale of EF0-EF5 based on wind speed of the tornado. Most tornadoes in the past in this area have been EF0 or EF1. The extent of damage with this category of tornado is light to moderate damage on roofs and downing of small trees.			
Potential Impact of Event: Moderate damage to roofs, windows, and doors; Damage to less reinforced homes like mobile homes; Knocked over trees which may cause damage to structures or loss of utilities like power.			
Overall Vulnerability/Significance: *Medium*. Tornadoes in this area are not typically the most severe based on previous occurrences, however, there is potential for higher impact tornadoes which could be devasting. This jurisdiction has about 38 percent of the housing as either mobile homes or built before 1980. These types of homes are typically higher risk for damage from a tornado.			

Wildfire			
Approx. Size (Sq miles):	15.3	**Area Affected by Hazard**	Significant (25-75%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10-90% yearly)
Extent: The Fire Intensity Scale (FIS) is used by the Texas Wildfire Risk assessment Portal to provide wildfire risk information. This scale goes from 1-5 with 5 being the most severe fire intensity. Data shows this jurisdiction as risk 2.5 to 3.5 on the scale.			
Potential Impact of Event: Damage to homes and other structures in the jurisdiction; Destruction of crop yields which could negatively affect farmers; Potential loss of life if resident is unable to evacuate during an event			
Overall Vulnerability/Significance: *Medium*. While there are no recorded events of wildfires according to the NCEI database, this jurisdiction is still at risk in certain areas of an			

event in the future. If a wildfire were to occur in this jurisdiction, it could cause damage to homes and infrastructure.

Winter Storm			
Approx. Size (Sq miles):	15.3	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Occasional (1-10% yearly)
Extent: The Sperry-Piltz Ice Accumulation Index (SPIA) predicts potential damage from ice storms. The scale goes from 0-5, with 5 being the most severe. There are no recorded events in this jurisdiction according to NCEI, but if an event were to occur it would likely fall into one of the lower categories.			
Potential Impact of Event: Damage to infrastructure and potential loss of power and other utilities; Injury or death due to the adverse temperatures and conditions that residents in this area are not accustomed to; Loss of crops that could lead to negative economic conditions for farmers.			
Overall Vulnerability/Significance: *Medium*. While there are no recorded events of winter storms according to the NCEI database, this jurisdiction is still at risk in of an event in the future. An event likely would not be severe, but due to residents not being accustomed to these sorts of conditions, it could cause more dramatic issues as seen in parts of Texas during Winter Storm Uri in 2021.			

Jurisdiction Resolution Adoption the Plan

Old River-Winfree

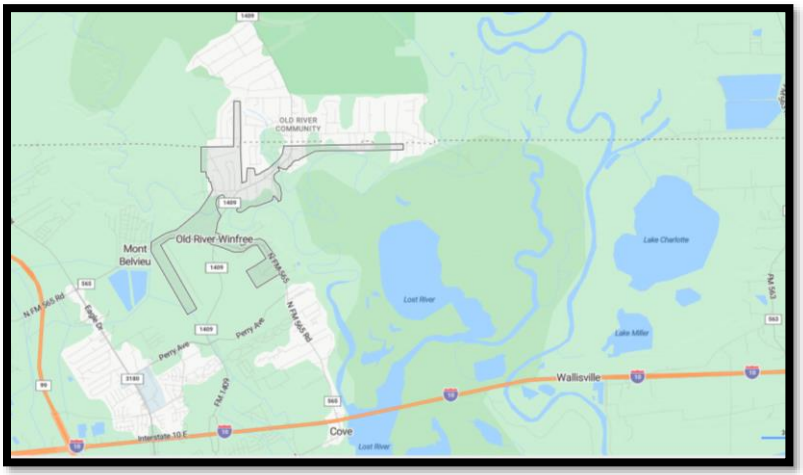
Old River-Winfree was incorporated by decree in July of 1979. It is a General Law City governed by a board of alderman and includes six members – a mayor and five aldermen, all who are elected at-large and are referred as the City's Council. General law cities are smaller cities, most of which are less than 5,000 in population. All general law cities operate according to specific state statutes prescribing their powers and duties, under the State's Local Government Code. General law cities are limited to doing what the state authorizes or permits them to do. If state law does not grant general law cities the express or implied power to initiate a particular action, none may be taken.

Old River-Winfree has a City Secretary who manages the City's daily operations. The City has contracted with Mont Belvieu to support it as a Fire Department. Emergency Management is supported by the County. Its ordinances can be found on the City's website including its floodplain ordinance. The website also has information pertaining to permit applications. Permits are required for new construction, new OSSFs, improvements, utility construction, reconnection of electricity, pipeline, and outdoor sign. It does not have any utilities e.g. water or wastewater, instead it uses private wells, neighborhood privately owned water systems, private septic systems (aerobic systems).

Jurisdiction Profile

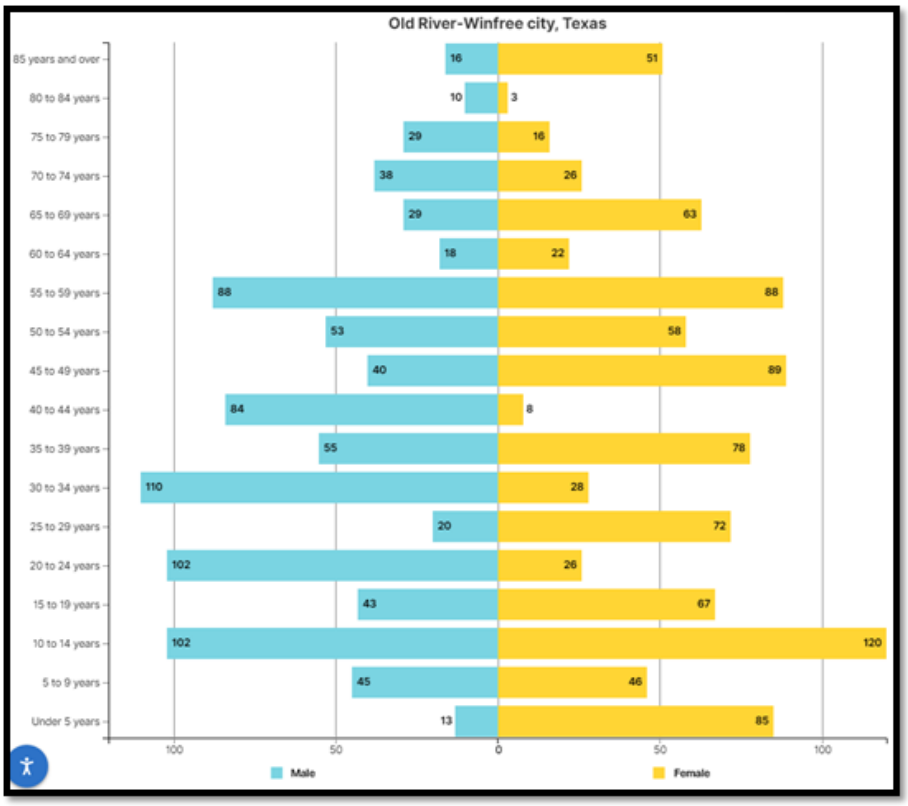
Old River-Winfree is found on the Northwestern part of Chambers County. Old River-Winfree is about 1.5 square miles in total area. It is bordered by Lost River to its east, Interstate 10 to its south, Mont Belvieu to its west and Liberty County to its north of which a very small portion of the City resides. In addition to its Community Building, it has an emergency shelter facility.

Figure 90 - Map of Old River-Winfree



Population and demographics. Old River-Winfree's estimated population is 1,359 according to 2022 U.S. Census Data, a 14% increase from the 2017 plan estimate of 1,190. In addition, about 15% of the population is over the age of 65, and about 5% under the age of 5 and the median age is 33.4. Figure 91 shows the breakdown by gender and age for the City.

Figure 91 - Population Pyramid for Old River-Winfree, Texas



(Old River-Winfree - Census Bureau Profile)

8.8% of the population are veterans and 21.0% of the population falls under the poverty level. 73.9% of the populations speaks English at home. 9.6% of the population are foreign born.

Education – 94.1% of the school enroll population are enrolled in kindergarten to 12th grade and 7.8% have received a bachelor's degree or higher.

Housing - The rate of homeownership is 86.5%. There are approximately 495 housing units with over 13.2% over $300,000 in housing value. The have family size is 4.07 and 57.1% are married-couple family household. 21.4% are female household, no spouse present and 11.8 is male household, no spouse present.

Work - There is 56.4% Employment rate with 95.9% driving to work on an average travel time of 32 minutes. The three largest industries employing Old River-Winfree residents are Construction

(29.4%) followed by Manufacturing (15.6%), and Retail trade (11.6%). The median household income is $77,813.

Jurisdiction Capabilities Assessment
The below table assesses the degree of capability based on the area (limited, moderate, high) and a comment on the assessment. A full list of all capabilities in Chambers County is found in "Section 2. The Planning Process".

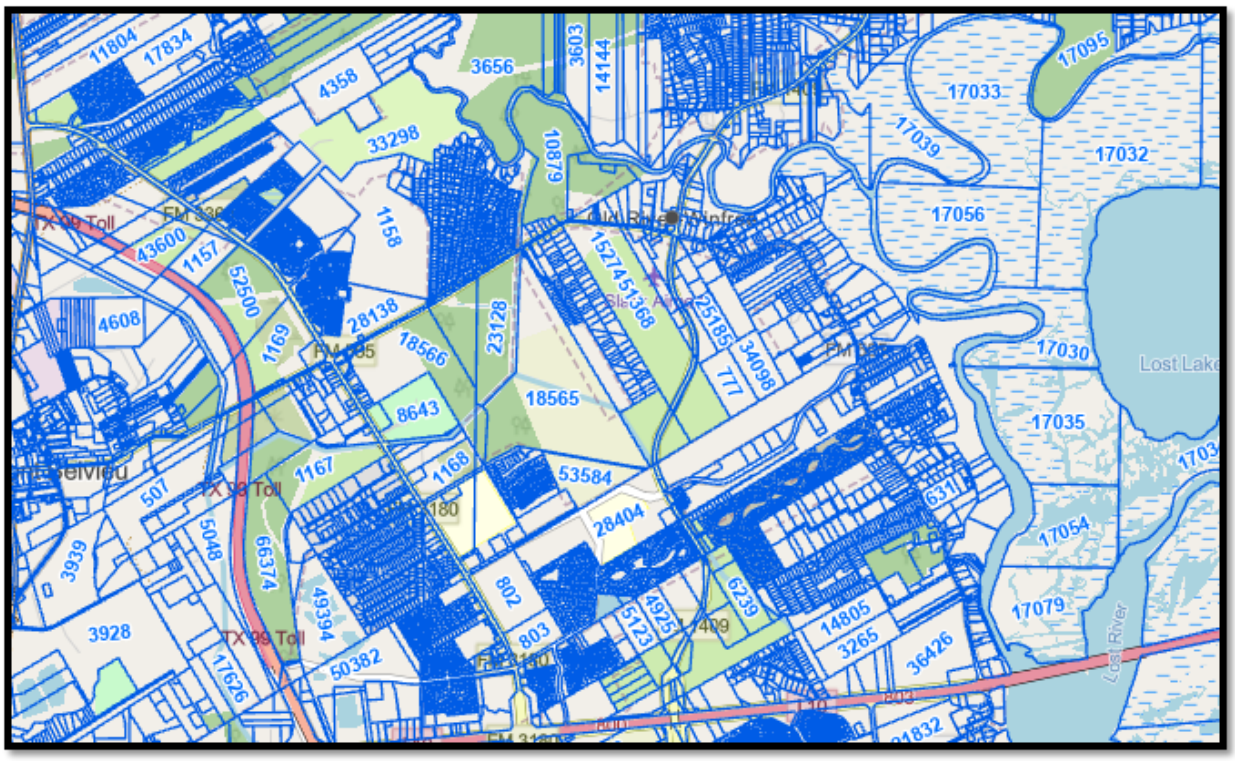
Capability	Degree of Capability	Comment
Administrative/Tech Capabilities	Limited	The City has a very small staff and relies on the County and Mont Belvieu for support in many of the hazard areas.
Regulatory Tools	Moderate	The City has ordinances to help mitigate damages from hazards in its floodplain, stormwater, and subdivision
Financial Tools	Limited	The City has a sales and use tax and use of grant funds
Education and Awareness Tools	Moderate	The City's website provides information on hurricane preparedness and evacuation. It provides code of ordinances and permitting information and forms. It also provides links to important sites for hazard information. The City has a Facebook page in addition to the website to disseminate information to the public.

NFIP Summary
Old River-Winfree participates in the National Flood Insurance Program (NFIP). The following summarizes the NFIP statistics for Old River-Winfree.

Jurisdiction	Policies in Force	Amount of Paid Claims	Total RL Record	No. of RL Properties	No. of SRL Properties	Non-Insured
Old River-Winfree	11	$2,728,000	0	0	0	0

Development Trends - While much of Old River-Winfree is developing (1.5 square miles and 495 housing units), there is still room for growth. As previously noted, the population has increased by around 14% according to census data from 2017 to 2024. The City has also held a public hearing recently to annex land (December 2023). Development may be slower than Mont Belvieu but there are indications of future growth in both population and buildings.

Figure 92 - Old River-Winfree Parcel Map (Chambers County Appraisal District)



Jurisdiction Hazard Risk Assessment

The following hazard risk assessment details the hazards that most directly affect the jurisdiction. More information on each hazard can be found in "Section 3. Hazard Identification and Risk Assessment" section of the plan.

Drought			
Approx. Size (Sq miles):	1.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	2	**Probability of Event**	Likely (10 to 90% yearly)
Extent: The Palmer Drought Severity Index shows exception drought (D4) can occur in this area. This has occurred most recently in 2011 and 2023.			
Potential Impact of Event: Drought events can cause major economic damage to farmers that live in the area; Water supply and water quality can be negatively affected during droughts; Dry conditions can lead to higher risk of fires			
Overall Vulnerability/Significance: *High*. Chamber's County economy relies heavily on farming such as for soybeans, rice, and cattle. In times of drought, this can severely damage crop yields and limit livestock grazing capabilities, which in turn negatively affects revenue.			

Expansive Soil			
Approx. Size (Sq miles):	1.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10 to 90% yearly)
Extent: According to the expansive soil map provided in the *Section 3* part of this plan, the entire planning area is in high risk for expansive soil			
Potential Impact of Event: Cracks in foundation of residential and commercial buildings; Breaks in water pipes, particularly in critical facilities, could lead to temporary loss of service			
Overall Vulnerability/Significance: *High*. While there are no recorded expansive soil events as the damage is typically gradual, the effects can be devasting. Older buildings tend to be most at risk due to less mitigation efforts made in the past during construction as well as the wear and tear damage over time. Structures at risk include ~217 high risk (built before 1980) residential buildings and critical facilities such as fire stations, schools, EMS, police stations, shelters, and toxic release sites.			

Extreme Heat			
Approx. Size (Sq miles):	1.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	2	**Probability of Event**	Highly Likely (90 to 100% yearly)
Extent: The jurisdiction can expect extreme heat events up to the "extreme danger" level of the NWS Heat Index chart found in *Section 3* of this plan			
Potential Impact of Event: Strain on the electrical power grid due to increased use of air conditioning; All citizens, particularly the vulnerable population, are at risk of heat stroke, that could potentially lead to injury or death.			
Overall Vulnerability/Significance: *High*. There is a high likelihood of extreme heat events in the jurisdiction. Vulnerable populations such as the elderly, young children, and economically disadvantaged individuals are at highest risk. Census data shows that ~31% of the population in this jurisdiction are younger than 18 and ~7% of the population is over 65.			

Flood			
Approx. Size (Sq miles):	1.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	1	**Probability of Event**	Occasional (1-10% yearly)
Extent: According to the National Risk Index show plan area as relatively moderate risk with 93.8 national percentile risk.			

Flood
Potential Impact of Event: Damage to resident's property as well as economic loss; Vulnerable populations at risk of injury or death due to difficulty in evacuation for upcoming potential events.
Overall Vulnerability/Significance: *High*. Flood events are especially dangerous to vulnerable populations as they often live in more flood prone areas. In addition, these individuals may have more difficulty in evacuating due to physical limitations. In addition, critical facilities such as fire stations, EMS, schools, police stations, toxic release sites are at risk for damage.

Freeze/Extreme Cold			
Approx. Size (Sq miles):	1.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10 to 90% yearly)
Extent: According to the National Risk Index the plan area is relatively moderate risk with 64.2 national percentile risk. While temperatures in the jurisdiction don't typically reach freezing levels, the residents are often unaccustomed to dealing with freezing temperatures when they do occur.			
Potential Impact of Event: Frostbite to residents in the jurisdiction, particularly those vulnerable population; Damage to infrastructure such as pipes, which may lead to interruptions in service during these events; Dangerous driving on roads during freezing conditions			
Overall Vulnerability/Significance: *High*. Freezing events are especially dangerous to vulnerable populations as they often do not have the means to deal with the low temperatures. While these events do not occur often in this area, when there is a freezing event there often can be severe effects.			

Hail			
Approx. Size (Sq miles):	1.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Occasional (1 to 10% yearly)
Extent: Hailstorms are measured using the TORRO Hailstorm Intensity Scale. H0-H5 level hail has occurred since 2000 in the jurisdiction.			
Potential Impact of Event: Vehicles in the jurisdiction could be damaged. This could cause economic loss to the owners; Hail could cause damage to weaker infrastructure			
Overall Vulnerability/Significance: *Low*. Hailstorms are relatively low risk to this jurisdiction. There is not a significant number of recorded events that caused damage in this			

Hail
jurisdiction. The monetary loss from the events that did cause damage are minimal when they do occur.

Hurricane/Tropical Storm			
Approx. Size (Sq miles):	1.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	5	**Probability of Event**	Highly Likely (90 to 100% yearly)
Extent: The Saffir/Simpson Hurricane Scale has shown up to Category 5 hurricanes affecting the jurisdiction in the past.			
Potential Impact of Event: Damage to infrastructure such as downed power lines could affect availability for power and other utilities during a storm; Damage to critical facilities could delay response after a storm; Damage to homes and commercial buildings could cause economic hardship to residents.			
Overall Vulnerability/Significance: *High*. Hurricanes and Tropical Storms are highly dangerous to this jurisdiction. Category 5 hurricanes can affect this area which can cause devasting damage to structures and risk of injury or death to residents. In this jurisdiction, almost 98 percent of all homes were either built before 1980 or are mobile homes. These categories of homes are more susceptible to damage from hurricane force winds.			

Lightning			
Approx. Size (Sq miles):	1.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0 (none reported)	**Probability of Event**	Highly Likely (90 to 100% yearly)
Extent: The Lightning Activity Levels (LALs) scale is used by the NOAA to quantify the number of lightning strikes in an interval of time. While there have been no reported lightning events since the start of 2018, lightning strikes occur in the area during most thunderstorms. Typically, these events only get recorded if there is injury, death, or property damage.			
Potential Impact of Event: Potential loss of power if lightning strikes critical facilities or infrastructure such as power lines. This could prohibit the use of some utilities for a period of time; Potential death if resident is struck by lightning; Damage to homes and commercial buildings could cause economic hardship to residents.			
Overall Vulnerability/Significance: *Low*. While lightning occurs frequently in the jurisdiction, typically the strikes do not hit anything that causes significant damage. Over the last 20 years, there have been only a few events that the NCEI database shows caused property damage or injury/death in all of Chambers County. Critical facilities such as schools,			

Lightning

fire stations, EMS, police stations, and shelters could all lose power or be damaged from a lightning event.

Severe Thunderstorms/High Wind

Approx. Size (Sq miles):	1.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	3	**Probability of Event**	Highly Likely (90 to 100% yearly)

Extent: The Beaufort Wind Scale categorizes the wind effects that an area could feel during a severe thunderstorm event. This scale is rated 0-12. This jurisdiction could expect to have an event on the full 0-12 scale.

Potential Impact of Event: Damage to infrastructure such as downed power lines could affect availability for power and other utilities during a severe thunderstorm; Damage to critical facilities could delay response after a storm; Damage to homes and commercial buildings could cause economic hardship to residents.

Overall Vulnerability/Significance: *Medium*. Severe thunderstorms are dangerous to this jurisdiction. Higher category winds on the Beaufort scale can affect this area by causing significant damage to structures and risk of injury to residents. There is also a risk of destruction of homes in a severe thunderstorm event, however, these wind effects are typically on a lower scale than received during a hurricane event.

Tornado

Approx. Size (Sq miles):	1.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	2	**Probability of Event**	Likely (10-90% yearly)

Extent: The Enhanced Fujita (EF) scale categories tornadoes on the scale of EF0-EF5 based on wind speed of the tornado. Most tornadoes in the past in this area have been EF0 or EF1. The extent of damage with this category of tornado is light to moderate damage on roofs and downing of small trees.

Potential Impact of Event: Moderate damage to roofs, windows, and doors; Damage to less reinforced homes like mobile homes; Knocked over trees which may cause damage to structures or loss of utilities like power.

Overall Vulnerability/Significance: *Medium*. Tornadoes in this area are not typically the most severe based on previous occurrences, however, there is potential for higher impact tornadoes which could be devasting. This jurisdiction has about 98 percent of the housing as either mobile homes or built before 1980. These types of homes are typically higher risk for damage from a tornado.

Wildfire			
Approx. Size (Sq miles):	1.5	**Area Affected by Hazard**	Significant (25-75%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10-90% yearly)
Extent: The Fire Intensity Scale (FIS) is used by the Texas Wildfire Risk assessment Portal to provide wildfire risk information. This scale goes from 1-5 with 5 being the most severe fire intensity. Data shows this jurisdiction as risk 3.5 to 4.5 on the scale.			
Potential Impact of Event: Damage to homes and other structures in the jurisdiction; Destruction of crop yields which could negatively affect farmers; Potential loss of life if resident is unable to evacuate during an event			
Overall Vulnerability/Significance: *Medium*. While there are no recorded events of wildfires according to the NCEI database, this jurisdiction is still at risk in certain areas of an event in the future. Since portions of this jurisdiction are in the risk 4.5 on the FIS, if a wildfire were to occur it could cause devasting damage.			

Winter Storm			
Approx. Size (Sq miles):	1.5	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Occasional (1-10% yearly)
Extent: The Sperry-Piltz Ice Accumulation Index (SPIA) predicts potential damage from ice storms. The scale goes from 0-5, with 5 being the most severe. There are no recorded events in this jurisdiction according to NCEI, but if an event were to occur it would likely fall into one of the lower categories.			
Potential Impact of Event: Damage to infrastructure and potential loss of power and other utilities; Injury or death due to the adverse temperatures and conditions that residents in this area are not accustomed to; Loss of crops that could lead to negative economic conditions for farmers.			
Overall Vulnerability/Significance: *Medium*. While there are no recorded events of winter storms according to the NCEI database, this jurisdiction is still at risk in of an event in the future. An event likely would not be severe, but due to residents not being accustomed to these sorts of conditions, it could cause more dramatic issues as seen in parts of Texas during Winter Storm Uri in 2021.			

Jurisdiction Resolution Adoption the Plan

Chambers-Liberty Counties Navigation District (CLCND)

The State of Texas Constitution gives communities the ability to create a political subdivision district for a specific purpose. It serves as an administrative division within a larger jurisdiction and has specific responsibilities. Chambers-Liberty Counties Navigation District (CLCND) was initiated by petition to the Chambers County Commissioners Court on April 10, 1944. The petition was signed by citizens of both Chambers and Liberty Counties and was accepted by the court for public hearing on June 5th, 1944. An election to confirm the creation was held and the creation of the District was authorized under Article XVI of the Constitution of the State of Texas, and it currently operates under Chapters 60, 62 and 63 of the Texas Water Code. The District is governed by the Board of Navigation and Canal Commissioners, which is appointed by the Commissioners Courts of both Chambers and Liberty Counties. Two members are appointed by each Court, with the fifth member being appointed jointly by both Courts and the term of each is four years.

Jurisdiction Profile

Unlike the other jurisdictions, CLCND is responsible for maintaining water ways and raw water. For raw water, it services 128,559 acres, all in Chambers County. The canal system services customers that use the waste for agricultural irrigation predominately. This water is used for municipal raw water, crops (rice is the leading crop), crawfish production and wildlife enhancement. In addition, the District owns submerged lands in the Trinity and Galveston Bays, comprising approximately 30,000 acres adjacent to the various authorized navigation channels within the District. The District acts as the Local Sponsor with the U.S. Army Corp of Engineers for maintenance of the channels. These channels are as follows:

- Trinity River Channel to Liberty
- Anahuac Channel
- Cedar Bayou Channel
- Double Bayou Channel
- Trinity River Channel at Smith Point

The District stretches from the northern boundary of Liberty County to the southern boundary of Chambers County and vary from five to ten miles in width following the Trinity River of approximately 440 acres. It comprises 255,649 acres in Chambers County and 185,375 acres in Liberty County. For the hazard review, the Chambers County acreage will be used. The original purpose of the District was to provide navigation, as it was intended to be the first leg of a barge channel to Dallas. The channel to Dallas never became a reality but the District now performs two major functions, navigation and raw water supply. In 1968, the District began supplying raw water for municipal purposes and now supplies the City of Anahuac Treatment Plant as well as two different treatment facilities owned by the Trinity Bay Conservation District. Normal municipal consumption utilizes some 800-acre feet per year or 260 million gallons.

Figure 93 - Map of CLCND Main Location

Figure 94 - Map of CLCND Navigation Service Boundaries

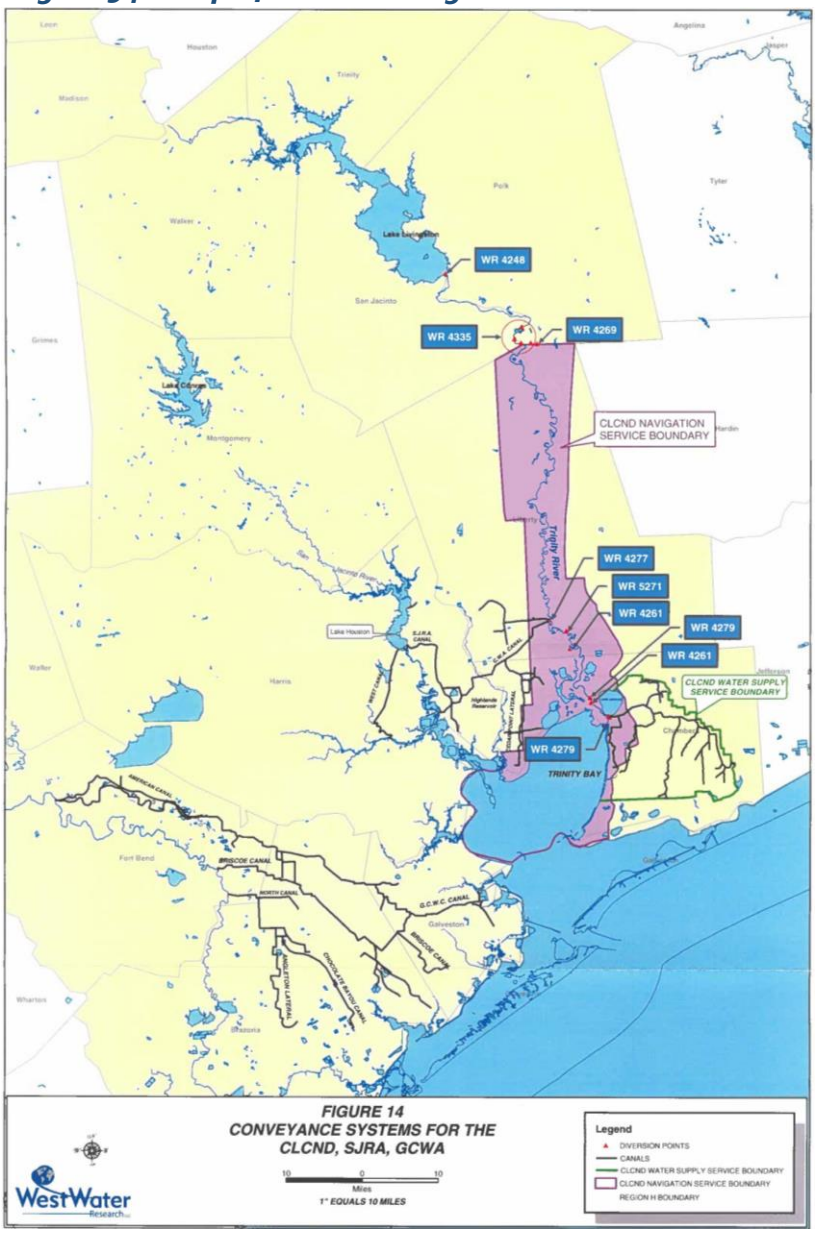
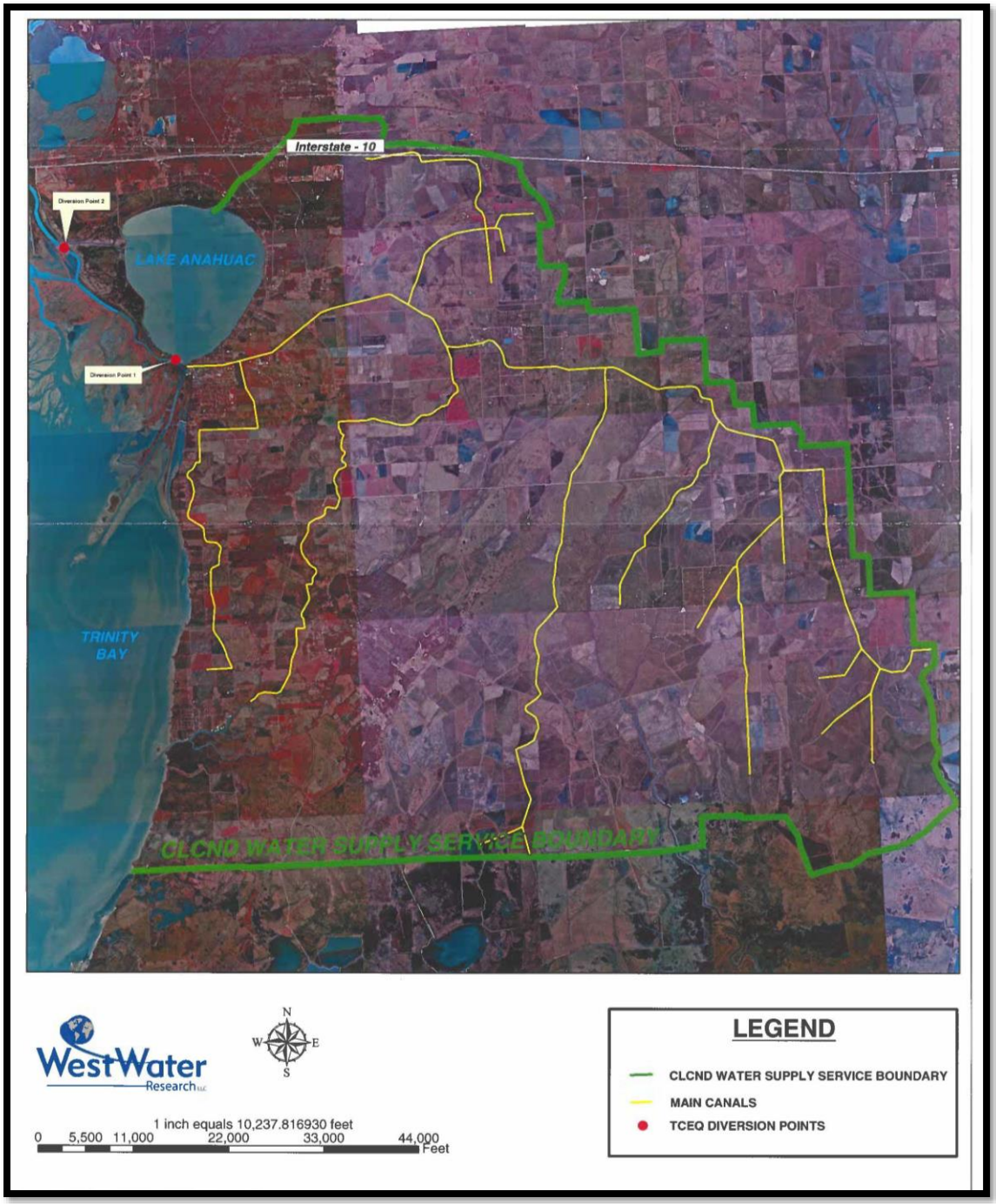


Figure 95 - Map of CLCND Water Supply Service Area and Diversion Points



Population and demographics. According to the CLCND Water Conservation and Drought Contingency Plan, the District uses TWDB 2021 population projects and usage projections. Figure 96 is from that plan.

Figure 96 - Population Projections, Chambers County, 2020-2070 (TWDB, 2021)

(CHAMBERS-LIBERTY COUNTIES NAVIGATION DISTRICT (clcnd.org))

	2020	2030	2040	2050	2060	2070
ANAHUAC	2390	2422	2456	2492	2531	2572
BAYTOWN	4857	5746	6664	7653	8711	9822
CC MUD 1	3194	3832	4489	5197	5954	6748
COUNTY-OTHER	13729	16483	19333	22398	25675	29118
MONT BELVIEU	6194	7920	9704	11627	13682	15841
TRINITY BAY CONSERVATION DISTRICT	11795	14140	16564	19174	21966	24898
TOTAL	42162	50543	59210	68541	78519	88999

Figure 97 depicts the water demand projections.

Figure 97 - Water Demand Projections, Chambers County, 2020-2070 (TWDB, 2021)

(CHAMBERS-LIBERTY COUNTIES NAVIGATION DISTRICT (clcnd.org))

	2020	2030	2040	2050	2060	2070
IRRIGATION	128320	128320	128320	128320	128320	128320
LIVESTOCK	497	497	497	497	497	497
MANUFACTURING	20182	23519	23519	23519	23519	23519
MINING	5,621	5,621	5,621	5,621	5,621	6,521
MUNICIPAL	7520	8974	10510	12210	14083	16063
STEAM ELECTRIC	8706	8706	8706	8706	8706	8706

The CLCND facilities consists of two main pump plants and one re-lift pump station. The Lake Plant, located at the northwest corner of Lake Anahuac, has two pumps, each with a rated capacity of 60,000 gallons per minute (GPM). These pumps diver water from the Trinity River through Big Hog Bayou and discharge it into Lake Anahuac. The main Anahuac Plant is in the city of Anahuac. It is equipped with four pumps, two each rated at 80,000 GPM and two each rated at 40,000 GPM that can divert water from the Trinity River or directly from Lake Anahuac and lift the water about 15 feet into the main canal. The re-lift pump station is located approximately six miles from each of the main Anahuac plant and list the water an additional ten feet from the main canal. It is equipped with one pump rated at 40,000 GPM and discharges into a lateral to flow by gravity to the service area north of the main canal.

CLCND owns Lake Anahuac, which provides storage capacity of approximately 35,000 acre-fee, comprised of 5,000 surface acres. The lake is fed by the Turtle Bayou watershed as well as by

water diverted from the Trinity River by the Lake plant. Water pumped into the main canal system at Anahuac gravity flows through approximately 75 miles of main canal and 125 miles of laterals.

Jurisdiction Capabilities Assessment
The below table assesses the degree of capability based on the area (limited, moderate, high) and a comment on the assessment. CLCND utilizes canal system regulations which include provisions for the method of supplying water to customers, uses and distribution of the water, and the procedures for applying for purchasing water.

In addition to the regulations, CLCND has an application process that potential customers must submit with a contract and UCC-1 lien form. Upon approval, the customer will obtain irrigation water. Rates for irrigation water are set by the CLCND Board prior to the beginning of each irrigation season (mid-March through mid-October). Rates are based upon acreage and location within the canal system service area.

Capability	Degree of Capability	Comment
Administrative/Tech Capabilities	Limited	The District has a very small staff and has very limited scope.
Regulatory Tools	Moderate	The District has canal system regulations, follows the Texas Water Code and TCEQ regulations.
Financial Tools	Limited	CLCND Canal/Water Supply is funded by the sale of water to the municipalities, agricultural industry for the irrigation of rice, crawfish, forage production and wildlife habitat enhancement. This function receives no funding from the property assessments. The Navigation functions are funded by property assessments on the properties located within the boundaries of the District.
Education and Awareness Tools	Limited	The District's website provides information on the history and function of the District, the Board meetings, some resources, and contact information.

NFIP Summary
As mentioned in the NFIP section of the plan, CLCND does not participate in the NFIP, however, the jurisdictions it supports do participate. While not an NFIP participant, CLCND does have flood insurance for some of the structures including the re-lift pump stations, office, main pump station, and lake pump station.

Development Trends - As previously noted, the population for the County has increased by around 14% according to census data from 2017 to 2024. For CLCND, future growth is expected

around 18% in this decade, and by approximately 111% in the planning horizon. Municipal use is expected to increase as well.

Jurisdiction Hazard Risk Assessment

The following hazard risk assessment details the hazards that most directly affect the jurisdiction. More information on each hazard can be found in "Section 3. Hazard Identification and Risk Assessment" section of the plan.

Drought			
Approx. Size (Sq miles):	255,649 Acres	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	2	**Probability of Event**	Likely (10 to 90% yearly)
Extent: The Palmer Drought Severity Index shows exception drought (D4) can occur in this area. This has occurred most recently in 2011 and 2023.			
Potential Impact of Event: Drought events can cause major economic damage to farmers that live in the area; Water supply and water quality can be negatively affected during droughts; Dry conditions can lead to higher risk of fires. Livestock and agricultural production; approximately 253,743 acres of agricultural land and $8.3 million in agricultural losses are estimated long-term losses due to one year of extreme drought.			
Overall Vulnerability/Significance: *High*. Chamber's County economy relies heavily on farming such as for soybeans, rice, and cattle, forage, and oyster and aquaculture enterprises are a significant part of the County's economy with over 734 farms throughout the County. . In times of drought, this can severely damage crop yields and limit livestock grazing capabilities, which in turn negatively affects revenue. Climate-induced changes in oysters can lead to increased disease outbreaks and reduced survival in the industry, impacting production and profitability.			

Expansive Soil			
Approx. Size (Sq miles):	255,649 Acres	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10 to 90% yearly)
Extent: According to the expansive soil map provided in the *Section 3* part of this plan, the entire planning area is in high risk for expansive soil			
Potential Impact of Event: Cracks in foundation of residential and commercial buildings; Breaks in water pipes, particularly in critical facilities, could lead to temporary loss of service. If CLCND infrastructure- pump or canal systems- are damaged due to pump plant's foundation or the concrete of the canal system cracking this could impede quantity of water throughout the District and lead to agriculture loss and financial loss for the County. Financial			

Expansive Soil
loss for farmers who depend on District's water supply. A lack of water may lead to serious injury or loss of life throughout the County. Economic loss for the County and local businesses that depend on the navigation channels maintained by the District and loss of revue from tourism f the Turtle Bayou Nature Preserve.
Overall Vulnerability/Significance: *High*. While there are no recorded expansive soil events as the damage is typically gradual, the effects can be devasting. Older buildings tend to be most at risk due to less mitigation efforts made in the past during construction as well as the wear and tear damage over time. Infrastructures at risk include pump plants, canal system and lift stations. Navigation channels and levee systems throughout the County.

Extreme Heat			
Approx. Size (Sq miles):	255,649 Acres	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	2	**Probability of Event**	Highly Likely (90 to 100% yearly)
Extent: The jurisdiction can expect extreme heat events up to the "extreme danger" level of the NWS Heat Index chart found in *Section 3* of this plan			
Potential Impact of Event: Strain on the electrical power grid due to increased use of air conditioning; All citizens, particularly the vulnerable population, are at risk of heat stroke, that could potentially lead to injury or death. Any visitors or residents or maintenance staff who are visiting the trails or working outside to maintain the canal, pump system, or manage any of the levee or navigation channels throughout the district may sustain serious injury or loss of life due to extreme heat.			
Overall Vulnerability/Significance: *High*. There is a high likelihood of extreme heat events in the jurisdiction. Vulnerable populations such as the elderly, young children, and economically disadvantaged individuals are at highest risk. Census data shows that ~31% of the population in this jurisdiction are younger than 18 and ~7% of the population is over 65. Visitors, staff, and residents working on or utilizing the Great Texas Coastal Birding Trail or at the Turtle Bayou Nature Preserve, or main pump plant or canal system			

Flood			
Approx. Size (Sq miles):	255,649 Acres	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	1	**Probability of Event**	Occasional (1-10% yearly)
Extent: According to the National Risk Index show plan area as relatively moderate risk with 93.8 national percentile risk.			

Flood
Potential Impact of Event: If CLCND infrastructure is damaged due to flooding this could impede quantity of water throughout the District and lead to agriculture loss and financial loss for the County; financial loss for farmers who depend on District's water supply; lack of a water may lead to serious injury or loss of life throughout the County; damage to the pumps due to flooding may lead to an increase in flooding in the County; economic loss for County and local businesses that depend on the navigation channels maintained by the District and as w ell as loss of revenue from tourism at Turtle Bayou Natre Preserve and trails.
Overall Vulnerability/Significance: *High*. Flood events are especially dangerous to vulnerable populations as they often live in more flood prone areas. In addition, these individuals may have more difficulty in evacuating due to physical limitations. In addition, critical facilities such as fire stations, EMS, schools, police stations, toxic release sites are at risk for damage. District supplies agriculture and local municipalities throughout the County with raw water; Navigation channels and levee systems throughout the County; Lake Anahuac and Main Pump plant on Miller Street; Turtle Bayou Nature Preserve.

Freeze/Extreme Cold			
Approx. Size (Sq miles):	255,649 Acres	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10 to 90% yearly)
Extent: According to the National Risk Index the plan area is relatively moderate risk with 64.2 national percentile risk. While temperatures in the jurisdiction don't typically reach freezing levels, the residents are often unaccustomed to dealing with freezing temperatures when they do occur.			
Potential Impact of Event: Frostbite to residents in the jurisdiction, particularly those vulnerable population; Damage to infrastructure such as pipes, which may lead to interruptions in service during these events; Dangerous driving on roads during freezing conditions			
Overall Vulnerability/Significance: *High*. Freezing events are especially dangerous to vulnerable populations as they often do not have the means to deal with the low temperatures. While these events do not occur often in this area, when there is a freezing event there often can be severe effects.			

Hail			
Approx. Size (Sq miles):	255,649 Acres	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Occasional (1 to 10% yearly)

Hail

Extent: Hailstorms are measured using the TORRO Hailstorm Intensity Scale. H0-H5 level hail has occurred since 2000 in the jurisdiction.

Potential Impact of Event: Vehicles could be damaged. This could lead to economic loss to the owners. If the District's infrastructure is damaged- pump and canal systems- due to hail this could impede quantity of water throughout the district and lead to agriculture loss and financial loss for the County. Financial loss for farmers who depend on District's water supply. A lack of water may lead to serious injury or loss of life throughout the County. Pumps or canals damaged due to hail may lead to an increase in flooding throughout the County. Economic loss for County and local businesses that depend on the navigation channels maintained by the District and as well as a loss of revenue from tourism at Turtle Bayou Nature Preserve.

Overall Vulnerability/Significance: *Low*. Hailstorms are relatively low risk to this jurisdiction. There is not a significant number of recorded events that caused damage in this jurisdiction. The monetary loss from the events that did cause damage are minimal when they do occur. If CLCND infrastructure is damaged- pump and canal systems- due to hail this could impede quantity of water throughout the district and lead to agriculture loss and financial loss for the County.

Hurricane/Tropical Storm

Approx. Size (Sq miles):	255,649 Acres	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	5	**Probability of Event**	Highly Likely (90 to 100% yearly)

Extent: The Saffir/Simpson Hurricane Scale has shown up to Category 5 hurricanes affecting the jurisdiction in the past.

Potential Impact of Event: Damage to infrastructure such as downed power lines could affect availability for power and other utilities during a storm; Damage to critical facilities could delay response after a storm; Damage to homes and commercial buildings could cause economic hardship to residents. If CLCND infrastructure is damaged due to wind damage this could impede quantity of water throughout the District and lead to agriculture loss and financial loss for the County; financial loss for farmers who depend on District's water supply if wind damages main pump plant; lack of a water may lead to serious injury or loss of life throughout the County; Damage to the levee or pumps may lead to increase in flooding throughout the County; Economic loss for County and local businesses that depend on the navigation channels maintained by the District as well as a and loss of revenue from tourism at Turtle Bayou Nature Preserve and trails.

Overall Vulnerability/Significance: *High*. Hurricanes and Tropical Storms are highly dangerous to this jurisdiction. Category 5 hurricanes can affect this area which can cause devasting damage to structures and risk of injury or death to residents. In this jurisdiction,

Hurricane/Tropical Storm
almost 98 percent of all homes were either built before 1980 or are mobile homes. These categories of homes are more susceptible to damage from hurricane force winds. CLCND supplies agriculture and local municipalities throughout the County with raw water; Navigation channels and levee systems throughout the County; Lake Anahuac and Main Pump plant on Miller Street; Turtle Bayou Nature Preserve.

Lightning			
Approx. Size (Sq miles):	255,649 Acres	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0 (none reported)	**Probability of Event**	Highly Likely (90 to 100% yearly)
Extent: The Lightning Activity Levels (LALs) scale is used by the NOAA to quantify the number of lightning strikes in an interval of time. While there have been no reported lightning events since the start of 2018, lightning strikes occur in the area during most thunderstorms. Typically, these events only get recorded if there is injury, death, or property damage.			
Potential Impact of Event: Potential loss of power if lightning strikes critical facilities or infrastructure such as power lines. This could prohibit the use of some utilities for a period of time; Injury or potential death if resident is struck by lightning; Damage to homes and commercial buildings could cause economic hardship to residents. If CLCND infrastructure- pump plant and canal system- is struck by lightning and damaged this could impede quantity of water throughout the district and lead to agriculture loss and financial loss for the County. Financial loss for farmers who depend on District's water supply. A lack of water may lead to severe hardship.			
Overall Vulnerability/Significance: *Low*. While lightning occurs frequently in the jurisdiction, typically the strikes do not hit anything that causes significant damage. Over the last 20 years, there have been only a few events that the NCEI database shows caused property damage or injury/death in all of Chambers County. Critical facilities such as schools, fire stations, EMS, police stations, shelters and pumps could all lose power or be damaged from a lightning event. A loss of power or damage to the pumps can have devastating consequences. Inoperable pumps would make it difficult to deliver water to the municipalities.			

Severe Thunderstorms/High Wind			
Approx. Size (Sq miles):	255,649 Acres	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	3	**Probability of Event**	Highly Likely (90 to 100% yearly)

Severe Thunderstorms/High Wind

Extent: The Beaufort Wind Scale categorizes the wind effects that an area could feel during a severe thunderstorm event. This scale is rated 0-12. This jurisdiction could expect to have an event on the full 0-12 scale.

Potential Impact of Event: Damage to infrastructure such as downed power lines could affect availability for power and other utilities during a severe thunderstorm; Damage to critical facilities could delay response after a storm; Damage to homes and commercial buildings could cause economic hardship to residents. If CLCND infrastructure is damaged due to wind damage- canal or pump system- this could impede quantity of water throughout the district and lead to agriculture loss. A lack of water may lead to serious injury or hardship.

Overall Vulnerability/Significance: *Medium*. Severe thunderstorms are dangerous to this jurisdiction. Higher category winds on the Beaufort scale can affect this area by causing significant damage to structures and risk of injury to residents. There is also a risk of destruction of homes in a severe thunderstorm event, however, these wind effects are typically on a lower scale than received during a hurricane event.

Tornado

Approx. Size (Sq miles):	255,649 Acres	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	2	**Probability of Event**	Likely (10-90% yearly)

Extent: The Enhanced Fujita (EF) scale categories tornadoes on the scale of EF0-EF5 based on wind speed of the tornado. Most tornadoes in the past in this area have been EF0 or EF1. The extent of damage with this category of tornado is light to moderate damage on roofs and downing of small trees.

Potential Impact of Event: Moderate damage to roofs, windows, and doors; Damage to less reinforced homes like mobile homes; Knocked over trees which may cause damage to structures or loss of utilities like power. If CLCND infrastructure is damaged due to wind damage- canal or pump system- this could impede quantity of water throughout the district and lead to agriculture loss. A lack of water may lead to serious injury or loss of life throughout the county. Damage to the levee or pumps by wind may lead to an increase in flooding throughout the county. Economic loss for county and local businesses that depend on the navigation channels maintained by the district and as well as a loss of revenue from tourism at Turtle Bayou Nature Preserve and trails due to wind damage.

Overall Vulnerability/Significance: *Medium*. Tornadoes in this area are not typically the most severe based on previous occurrences, however, there is potential for higher impact tornadoes which could be devasting. This jurisdiction has about 98 percent of the housing as either mobile homes or built before 1980. These types of homes are typically higher risk for damage from a tornado.

Wildfire			
Approx. Size (Sq miles):	255,649 Acres	**Area Affected by Hazard**	Significant (25-75%)
Events Since Start of 2018	0	**Probability of Event**	Likely (10-90% yearly)
Extent: The Fire Intensity Scale (FIS) is used by the Texas Wildfire Risk assessment Portal to provide wildfire risk information. This scale goes from 1-5 with 5 being the most severe fire intensity. Data shows this jurisdiction as risk 3.5 to 4.5 on the scale.			
Potential Impact of Event: Damage to homes and other structures in the jurisdiction; Destruction of crop yields which could negatively affect farmers; Potential loss of life if resident is unable to evacuate during an event			
Overall Vulnerability/Significance: *Medium*. While there are no recorded events of wildfires according to the NCEI database, this jurisdiction is still at risk in certain areas of an event in the future. Since portions of this jurisdiction are in the risk 4.5 on the FIS, if a wildfire were to occur it could cause devasting damage.			

Winter Storm			
Approx. Size (Sq miles):	255,649 Acres	**Area Affected by Hazard**	Extensive (75-100%)
Events Since Start of 2018	0	**Probability of Event**	Occasional (1-10% yearly)
Extent: The Sperry-Piltz Ice Accumulation Index (SPIA) predicts potential damage from ice storms. The scale goes from 0-5, with 5 being the most severe. There are no recorded events in this jurisdiction according to NCEI, but if an event were to occur it would likely fall into one of the lower categories.			
Potential Impact of Event: Damage to infrastructure and potential loss of power and other utilities; Injury or death due to the adverse temperatures and conditions that residents in this area are not accustomed to; Loss of crops that could lead to negative economic conditions for farmers.			
Overall Vulnerability/Significance: *Medium*. While there are no recorded events of winter storms according to the NCEI database, this jurisdiction is still at risk in of an event in the future. An event likely would not be severe, but due to residents not being accustomed to these sorts of conditions, it could cause more dramatic issues as seen in parts of Texas during Winter Storm Uri in 2021.			

Jurisdiction Resolution Adoption the Plan

Appendices

Appendix A – Minutes from MPC Meetings

Chambers County
Hazard Mitigation Plan Update
Thursday, July 20, 2023
Meeting Minutes

Attendees	Title and Organization
Robbie King	**Deputy Director Economic Development, Chambers County**
Brittany Theiler	**Generalist, Economic Development, Chambers County**
Ryan Holzaepfel	**Emergency Management Coordinator, Chambers County**
Darla Branch	**Environmental Health, Chambers County**
Bill Vola	**Deputy Emergency Management Coordinator, Chambers County**
Brent Hahn	**Fire Marshal, Mont Belvieu**
Brad Wilber	**Floodplain Administrator, Chambers County**
Kenny Kathan	**City Manager, City of Anahuac**
Lee Atchison	**Emergency Management Coordinator, Mont Belvieu**
Kristen Thatcher	**Plan Consultant, JSWA**
Chase Ward	**Plan Consultant, JSWA**

Identify and finalize Mitigation Planning Committee (MPC)

The MPC is a core group of employees from the County and participating jurisdictions responsible for developing and reviewing the plan update. These employees, representing emergency management, economic development, fire and safety, land use and permitting, floodplain administration, zoning and subdivision regulations, capital projects and engineering, have expertise and responsibility in mitigation efforts for the communities in the plan.

Members of the initially identified MPC discussed expanding the team to ensure the County and participating jurisdictions are included. An email requesting their participation will be sent to those identified.

Discussion of FEMA's updated Local Mitigation Policy Guide (effective April, 2023) and Handbook (effective May 2023)

The Committee was briefed on the recent FEMA Local Mitigation Policy Guide Updates, effective April 19, 2023, so the team could better understand what requirements would be needed for inclusion in this iteration of the plan update. Updates include planning and adapting to more intense changes to climate as a future condition and how it will impact people, land-use, and response. The guide also emphasized increased effort on inclusion of underserved communities and socially vulnerable populations (i.e., unhoused, elderly, mobility challenged) in the planning process, assessments of risk, and mitigation actions. Also discussed were the updates to the high hazard potential Dam program planning requirements, although there are no dams in the County.

Identify Stakeholders

Another important group in the planning process are the stakeholders. The MPC reviewed a list of organizations from the last plan and suggestions for this iteration, including adjacent counties and cities, hospitals, nursing homes, school districts, businesses, and community lifeline organizations (fire, EOC, and shelters and churches).

Review 2018 Hazards

The MPC reviewed the hazards profiled in the last iteration of the plan and hazards that have impacted the County since that plan was approved. In addition to the 2018 hazards, the team determined that the following hazards should also be profiled, and a risk assessment completed: extreme cold and or winter storm and wildfire. The team discussed dam failure and more research will be done to determine if any upstream dams have the potential to inundate and cause flooding to the County. A decision will be made after that research is completed.

The team also discussed non-natural hazards and decided to keep the plan largely natural hazards with the exception for the Mont Belvieu section. In Mont Belvieu, salt dome will be risk assessed.

2018 Hazards in Plan	2024 Hazards
Flood	**Flood** ❖ **Riverine** ❖ **Coastal**
Hurricanes and Tropical Storms	**Hurricanes and Tropical Storms**
Tornado	**Tornado**
Drought	**Drought**
Heat Events	**Heat Events – Extreme heat**
Expansive Soils	**Expansive Soils - subsidence**
Lightning	**Lightning**
Coastal Erosion	**Coastal Erosion**
Hail	**Hail**
	HAZARDS TO CONSIDER
	Winter Storm and/or extreme cold
	Wildfire
	Dam/levee failure
	Mont Belvieu – Salt dome profile

Mitigation Strategy

Members were provided the mitigation strategy and goal statement from the current plan, see below. The team was reminded that the plan must include general hazard mitigation goals that represent what the jurisdictions seek to accomplish through mitigation plan implementation and determine if change is needed due to current conditions and priorities or reaffirm.

Mission Statement

The HMAP aims to implement new policies, programs, and projects to reduce the risks and impacts associated with natural hazards, including public education and partnerships between local officials and residents.

Mitigation Goal A

Reduce the loss of life and serious injury due to natural hazards.

Mitigation Goal B

Reduce the loss of personal and public property due to natural hazards.

Outreach Strategy

The Local Mitigation Policy Guide places increased emphasis on continuing to improve the engagement of the public directly or through community-based organizations that represent potentially at-risk populations to ensure the plan establishes equitable outcomes for the whole community. The MPC strategized ways to engage all members of the community including use of:

- Social Media
- Flyers
- Surveys
- Websites
- Fact sheets and Q&A sheets
- Meetings

The team also identified what it wants to achieve through outreach efforts including:

- Educating the public on hazard mitigation and the importance of a hazard mitigation plan
- Hazard awareness and readiness campaigns
- Public input sessions on hazard vulnerability and mitigation actions

Existing plans, studies, reports, and technical information that can support planning efforts:

The team provided examples of studies to review:

- County-wide Drainage study
- City Comprehensive Plans
- City Drainage Plans
- EOP, specifically Annex M

Documents/Data/Map requests

The Committee discussed obtaining updated information to help with the update and analysis including NFIP data, building inventory, and permit information.

Schedule

A tentative scheduled was provided to the team. The next meeting will be August 15, 2023 at 2:00 pm.

Actions from meeting

Action Item	Assigned
Prepare minutes and distribute to MPC	KT
Email request to provide new member's reach information	KT
Update stakeholder list and distribute for review	KT
Work with Chambers on NFIP data needs	BW and KT
Provide studies and reports	MPC
Dam failure research	RH and BV

Chambers County
Hazard Mitigation Plan Update
Tuesday, August 15, 2023
Meeting Minutes

Attendees	Title and Organization
Robbie King	**Deputy Director Economic Development, Chambers County**
Brittany Theiler	**Generalist, Economic Development, Chambers County**
Ryan Holzaepfel	**Emergency Management Coordinator, Chambers County**
Darla Branch	**Environmental Health, Chambers County**
Bobby Hall	**County Engineer, Chambers County**
Samantha Humphrey	**Director, Economic Development, Chambers County**
Kenny Kathan	**City Manager, City of Anahuac**
Francisco Carillo	**Interim Director of Engineering, Mt. Belvieu**
Kristen Thatcher	**Plan Consultant, JSWA**
Chase Ward	**Plan Consultant, JSWA**

Review minutes and status of actions from 7-20-23 meeting
The MPC reviewed and approved the minutes from the 7-20-23 meeting. The team also reviewed the actions from the last meeting removing those that were completed and discussed ongoing work.

Finalize Stakeholders
The Committee reviewed the list, made a few adjustments, and then finalized the list of stakeholders and contact information.

Update hazards from current plan
Using the template of actions from the 2018 plan, the team went through each action to provide a status and to determine the outcome of the status (complete, ongoing, changed, remove). For those actions where additional information was needed an action was taken by a member of the MPC.

Local Capabilities Review
Local mitigation capabilities are existing authorities, policies, programs, and resources that reduce hazard impacts or could help to carry out hazard mitigation activities. The team was provided with a table of capabilities broken down by the four key types of capabilities: planning and regulatory, administrative, and technical, financial, and education and outreach by participating jurisdiction and went through populating the table. An action was taken to reach out to any participating jurisdictions who were not able to be at this meeting to request their input.

Outreach Strategy

The MPC reviewed the draft outreach strategy and concurred on the strategy. A draft survey will be prepared for the next meeting as well as a draft flyers and FAQ sheet to be used on the website.

Schedule

A tentative schedule was provided to the team. The next meeting will be September 25th, 2023 at 2:00 pm.

Actions from meeting

Action Item	Assigned
Prepare minutes and distribute to MPC	KT
Email request to provide status to current actions	KT
Email request to provide jurisdiction's responses to local capabilities table	KT
Draft survey, FAQ sheet and Flyer	KT and CW
Populate information needed for current actions and local capabilities	Members of the MPC

Chambers County
Hazard Mitigation Plan Update
Monday, September 25, 2023
Meeting Minutes

Attendees	Title and Organization
Robbie King	**Deputy Director Economic Development, Chambers County**
Brittany Theiler	**Generalist, Economic Development, Chambers County**
Ryan Holzaepfel	**Emergency Management Coordinator, Chambers County**
Bobby Hall	**County Engineer, Chambers County**
Samantha Humphrey	**Director, Economic Development, Chambers County**
Lee Atchison	**Fire Chief, Mt. Belvieu**
Francisco Carillo	**Interim Director of Engineering, Mt. Belvieu**
Kristen Thatcher	**Plan Consultant, JSWA**
Chase Ward	**Plan Consultant, JSWA**

Review minutes and status of actions from 8-15-23 meeting
The MPC reviewed and approved the minutes from the 8-15-23 meeting. The team also reviewed the actions from the last meeting removing those items that were completed and discussed ongoing work.

Review actions from last meeting
The Committee reviewed the actions from the last meeting and provided a status.

Review draft hazard profiles
Each hazard profile was reviewed by the team that provided data for:

- Where hazard might happen in the planning area (location).
- How minor or severe the hazard may be (extent).
- How often and where the hazard has happened in the past (previous occurrences).
- How likely is the hazard to occur and how it may change (frequency, intensity, etc.) in the future (probability).
- Which assets are at risk from the hazard (vulnerability).

Hazard classification and ranking using hazard profile data
Using FEMA provided definitions, the MPC classified each hazard's location, extent, future occurrence, and overall significance. In addition, the team listed the assets that are at risk from the hazard helping to shape the vulnerability analysis. RH and KT will reach out to the engineering team for a more in-depth discussion on dams and inundation scenarios as well as confirm that subsidence is not hazard for the County, just expansive soils and will provide an update at the next meeting.

Outreach Strategy
The MPC was provided a draft survey, flyer, and fact sheet to be used on the website. The team will review and provide comments/changes on or before October 10th. Once finalized, the team will work the IT department to have the documents uploaded to the website. The Economic Development Team will work through social media platforms to inform the public of the survey. The survey will be on the site for participants to take for approximately 4-6 weeks.

Schedule
The next meeting will be October 12th, 2023, at 2:00 pm.

Actions from meeting

Action Item	Assigned
Prepare minutes and distribute to MPC	KT
Work with Engineering Department on dams and subsidence discussion	KT and RH
Review and provide comments/changes on or before October 10th to the Draft survey, Fact sheet and Flyer	KT and CW

Chambers County
Hazard Mitigation Plan Update
Thursday October 12, 2023
Meeting Minutes

Attendees	Title and Organization
Robbie King	**Deputy Director Economic Development, Chambers County**
Ryan Holzaepfel	**Emergency Management Coordinator, Chambers County**
Samantha Humphrey	**Director, Economic Development, Chambers County**
Darla Branch	**Environmental Health, Chambers County**
Kenny Kathan	**City Manager, City of Anahuac**
Francisco Carillo	**Interim Director of Engineering, Mt. Belvieu**
Kristen Thatcher	**Plan Consultant, JSWA**
Chase Ward	**Plan Consultant, JSWA**

Review minutes and status of actions from 9-25-23 meeting
The MPC reviewed and approved the minutes from the 9-25-23 meeting. The team also reviewed the actions from the last meeting removing those items that were completed and discussed ongoing work.

Review Goal Statement from 2018 Plan
The MPC was provided with the 2018 HMP strategy, statement, and goals. The team also was provided with the State of Texas's 2018 HMP Goals and some other goal examples. After review and discussion, the MPC determined that the current HMP strategy, statement, and goals have not changed and will be used for this iteration of the plan update.

New Actions Discussion
The team discussed the four categories for mitigation: local plans and regulations; structure and infrastructure projects; natural systems protection and nature-based solutions; and education and awareness programs and examples of each to help facilitate the identification and discussion of new actions. The team work on either problem statements and or provided actions by looking at the hazard and discussion thee impacts or vulnerabilities faced from that hazard. Some hazards may not have many impacts, or the impacts may already be mitigated. In this case, fewer actions may be identified than for a hazard causing more frequent or severe impacts.

Identified 2023/2024 Hazards in Plan Update	PROBLEM STATEMENT AND/OR ACTIONS
Coastal Erosion	**Areas at risk: South of SH 99 and commercial areas that are closer to the Bayou area. Projects in the 2023 Texas Coastal Resiliency Master Plan for Chambers and participating jurisdictions:** • **Anahuac NWR Conservation and Restoration - $25M**

Identified 2023/2024 Hazards in Plan Update	PROBLEM STATEMENT AND/OR ACTIONS
	• **Anahuac NWR East Unit Beneficial Use - $16M** • **East and West Galveston Bay Watershed, Wetland, and Habitat Conservation - $15.6 M** • **East Bay Living Shorelines and Wetland Restoration - $26.9M** • **Moody NWR Conservation and Restoration - $10M** • **Old River Cove Restoration - $9.2M** • **Pierce Marsh Wetland Restoration and Shoreline Protection - $6.5M** • **SETX Flood Coordination Study Regional Flood Sensor System - $900K**
Drought	**Areas at Risk: Whole County impacted when there is a drought.** • **Mt. Belvieu instituted Drought Contingency Plan (DCP) in 2021 and in 2023 updated each stage with clearer guidance and definitions of the stages. Looking forward, the water infrastructure CIP is being pushed to earlier than the five-year plan.** • **City of Anahuac has a DCP as required by TCEQ. GLO funded a complete update of water and sewer infrastructure.**
Extreme Cold/ Freezes	**Areas at Risk: Whole County impacted when there is extreme cold/freeze.** • **Awareness campaigns before significant freeze event.** • **Mt. Belvieu reviewed water/wastewater infrastructure due to the loss of power, so generators have become a priority as well as weather-proofing piping at wastewater lift stations.**
Expansive Soil	**Areas at Risk: All areas of the County could experience expansive soil.** • **Awareness campaign letting public understand what expansive soil is and what an individual can do to help (e.g., gutter system to keep water away from foundation).** • **Septic system requirements call for stabilized sand backfill around the tanks to help mitigate cracks or leaks that would have been caused from expansive soils as well as underground pipes must have stabilized sand to help protect the pipes.** • **Permits are required for slab/foundation work which requires engineering work.** • **Feasibility study on the impacts of the current building code standards, CIP standards, to determine effectiveness or need to update.**
Extreme Heat	**Areas at Risk: Whole County impacted when there is extreme heat.** • **City of Anahuac and the Chamber County have a splash center. Study to see if there is another area that could support a splash center. Determine if there is public support for a fourth splash center.**
Flood	**Areas at Risk: Whole County impacted from floods.**

Identified 2023/2024 Hazards in Plan Update	PROBLEM STATEMENT AND/OR ACTIONS
	• **Belton Lane had flooding issues during main rain events. Three box culverts were installed to mitigate flooding. (Anahuac this project is complete).** • **Justice Center being built in Anahuac will upgrade current storm drains and add additional drainage. This new build is a good time to review any other storm drain issues for the area for potential upgrade.** • **Master Drainage plan will have projects identified that will need to have funding secured to implement that project.**
Hail	**Areas at Risk: Hail could impact any area of the County.** • **As many of the jurisdictions do not have a covered central area to pull equipment and vehicles under in the event of a hailstorm.** • **Funds to help build or upgrade covered parking for these assets (similar to the County's Road and Bridge covered parking to keep vehicles and equipment safe.**
Hurricanes and Tropical Storms	**Areas at Risk: Whole County impacted Hurricanes and Tropical Storms** • **Building additional hardened shelters.** • **Generators for critical facilities or critical infrastructure (e.g., there are nine fire stations, and the County would like to have them all have this back up power source).** • **City of Anahuac would like to have a generator at each of the three lift stations for wastewater treatment.**
Lightning	**Areas at Risk: Lightning could impact any area of the County.** • **Much has already been mitigated, there may not be any additional actions.** • **If there are any facilities that do not have lightning protection (surge protection and lightning rods where practicable), add these protections.**
Salt Dome – Mont Belvieu	**Areas at Risk: Mt. Belvieu** • **Fire protection including equipment, personnel, infrastructure, response plan *(FC and LA will discuss and prepare more detailed actions)*.**
Severe Thunder-storms – High Winds	**Areas at Risk: Severe Thunderstorms/high winds could impact any area of the County.** • **Much has already been mitigated, there may not be any additional actions.** • **Hardening facilities and evaluation of existing buildings to determine if they are safe to shelter in place.**
Tornadoes	**Areas at Risk: Tornadoes could impact any area of the County.** • **Hardening facilities and evaluation of existing buildings to determine if they are safe to shelter in place.** • **Upgrade the warning systems (sirens). Study to determine where best to place new warning systems.**

Identified 2023/2024 Hazards in Plan Update	PROBLEM STATEMENT AND/OR ACTIONS
Wildfire	**Areas at Risk: While wildfire could impact any area of the County, areas where there is interface (WUI) between structures and grasslands are most at risk.** • **Addressing water supply and personnel support.** • **Study to determine best sources to place water supply and then funding to obtain water supply area.** • **Equipment (off road as example for difficult to access Wildfires)**
Winter Storm	**Areas at Risk: Winter storm could impact any area of the County.** • **Awareness campaigns before significant freeze event.** • **Mt. Belvieu reviewed water/wastewater infrastructure due to the loss of power, so generators have become a priority as well as weather-proofing piping at wastewater lift stations.**

Outreach Strategy

The MPC approved the draft survey, flyer, and fact sheet to be used on the website. The Economic Development Team will work through social media platforms to inform the public of the survey. The survey will be on the site for participants to take for approximately 4-6 weeks.

The team also discussed reaching out to the stakeholders to request their participation and to explain their role and support they can provide to the plan update. The team reviewed a draft letter and will determine who from the County will sign the letter. KT and CW will mail and email the letters out once finalized.

Schedule

The next meeting will be October 26th, 2023, at 2:00 pm.

Actions from meeting

Action Item	Assigned
Prepare minutes and distribute to MPC	KT
Provide survey, fact sheet and flyer to the Economic Development Department	KT and CW
Provide a copy of the Anahuac comprehensive plan	KK
Work with Mt. Belvieu departments for salt dome actions	FC

Chambers County
Hazard Mitigation Plan Update
Thursday October 26, 2023
Meeting Minutes

Attendees	Title and Organization
Ryan Holzaepfel	**Emergency Management Coordinator, Chambers County**
Samantha Humphrey	**Director, Economic Development, Chambers County**
Darla Branch	**Environmental Health, Chambers County**
Brent Hahn	**Fire Marshal, Mont Belvieu**
Kenny Kathan	**City Manager, City of Anahuac**
Lee Atchison	**Emergency Management Coordinator, Mont Belvieu**
Kristen Thatcher	**Plan Consultant, JSWA**
Chase Ward	**Plan Consultant, JSWA**

Review minutes and status of actions from 10-12-23 meeting
The MPC reviewed and approved the minutes from the 9-26-23 meeting. The team also reviewed the actions from the last meeting removing those items that were completed and discussed ongoing work.

Discussion of action details
The MPC was provided each action identified to review the details needed for each action including the jurisdictions that the action will impact, the hazards addressed, a description of the action, the implementing departments, the potential funding sources, a cost estimate, timeframe, if the action reduces risk to existing building and infrastructure and/or new building, the cost benefit (or avoided losses). In addition the team discussed any future conditions that could impact the action and identified what risk the action addressed with attention paid to vulnerable populations.

Prioritization of actions
The team was given ten evaluation criteria to rank each action for each criteria. The minimum score per criteria is one and the maximum score per criteria is 10. If the total score was between 1-50 the action receives a low priority. If the total score is between 51-75 the action receives a medium priority and if the total score is between 76-100 the action receives a high priority. The results are in the table on page 2 of the minutes. If additional actions are added, the actions will be prioritized using the same process and then incorporated.

Plan Maintenance Process
Plan updates provide the opportunity to consider how well the procedures established in previously approved plan worked and revise as needed. The team reviewed the maintenance process and determined that the process is effective and should not change as it allows for monitoring, evaluating, and updating.

Stakeholder outreach

The team discussed continued outreach and determined that a letter of invitation will be sent to the stakeholders by mail and email. SH and KT will work on the letter and the mailings.

Action No.	Action (no.) Moved from 2018 actions to current actions	MITIGATION ACTION SUMMARY OF PRIORITIZATION TOTAL SCORE BETWEEN 1-50 HAZARD IS LOW PRIORITY (L) TOTAL SCORE BETWEEN 51-75 HAZARD IS MEDIUM PRIORITY (M) TOTAL SCORE BETWEEN 76-100 HAZARD IS HIGH PRIORITY (H)	Total	Priority	Addressed Hazard CE: Coastal Erosion D: Drought EC/F: Extreme Cold/Freeze ES Expansive Soils EH: Extreme Heat F: Flood H: Hail H/TS: Hurricane/Tropical Storm L: Lightning SD: Salt Dome T/HW: Severe Thunderstorm/ High Wind T: Tornado WF: Wildfire W: Winter storm
4	A-8	Property Protection	83	H	F, H/TS, T/HW
1	A-1 and A-1.1	Educating public on mitigation techniques	82	H	D, EC/F, ES, EH, F, H, H/TS, L, T, WF, W
13	C-1	North Anahuac Drainage	77	H	F, H/, T/HW
10	B-9	Dredging Cedar Bayou	71	M	F, H/, T/HW
12	B-11	Enlarge ditches and create retention- Spindletop Bayou	70	M	F, H/, T/HW
11	B-10	Dredging West Fork- Double Bayou	70	M	F, H/, T/HW
6	B-2	Hydroaxing Hackberry Gully and Cotton Bayou	70	M	F, H/TS, T/HW
27		Generators at the lift stations in Anahuac	68	M	CE, F, H/TS, T/HW
5	A-9	Creating Maps	67	M	CE, F, H/TS
29		West Bay Living Shorelines at Sweetwater Preserve and Maggie's Cove	66	M	CE, F, H/TS, T/HW
24		Harden the emergency management stations (12) throughout the County	66	M	CE, F, H/TS, T/HW
17		Old River Cove Restoration	64	M	CE, F, H/TS, T/HW
14	C-3	Southwest Anahuac Ditch	64	M	F, H/, T/HW
21		Southeast Texas Flood Coordination Study - Regional Flood Sensor System	63	M	CE, F, H/TS, T/HW
23		Moody NWR Conservation and Restoration	62	M	CE, F, H/TS, T/HW
7	B-4	Bridge on Rhonda Rosa Lane	61	M	F, H/TS
2	A-5	Rebate program for lightning rods	61	M	L
22		East and West Galveston Bay Watershed, Wetland, and Habitat Conservation	60	M	CE, F, H/TS, T/HW
19		East Bay Living Shorelines and Wetland Restoration	60	M	CE, F, H/TS, T/HW
18		Anahuac National Wildlife Refuge East Unit Beneficial Use	60	M	CE, F, H/TS, T/HW
16		Anahuac National Wildlife Refuge Conservation and Restoration	59	M	CE, F, H/TS, T/HW
20		Pierce Marsh Wetland Restoration and Shoreline Protection	56	M	CE, F, H/TS, T/HW
8	B-7	West Bay Road and Bridge	55	M	F, H/TS
9	B-8	Desnagging, clearing, and grubbing of Turtle Bayou	53	M	F, H/, T/HW
28		Generators at Emergency Services Stations (12)	50	L	CE, F, H/TS, EH, EC/F, T
25		Warning Sirens	50	L	CE, F, H/TS, T/HW, T, H, WF
26		Expansion of Raw Water Pond	47	L	CE, F, H/TS, T/HW, T, H, WF
15	D-1	Extend Langston Road to allow 2 Access Points to McLeod Park Shelter	40	L	F, H/TS, T, EH, H
3	A-6	Drip Irrigation	37	L	ES

Actions from meeting

Action Item	Assigned
Prepare minutes and distribute to MPC	KT
Provide information to actions	MPC
Prepare stakeholder letters have mailed and emailed on or before 11-3-23	SH and KT
Work with Mont Belvieu departments for salt dome actions	FC

Appendix B – Stakeholder Letter

the office of
THE COUNTY JUDGE
JIMMY SYLVIA

THE COUNTY OF CHAMBERS
ANAHUAC, TEXAS 77514

POST OFFICE BOX 939
TELEPHONE:
409/267-2440
FAX: 409/267-4453

November 3, 2023

The Honorable Jeff Branick
County Judge
Jefferson County
1149 Pearl Street
Beaumont, Texas 77701

RE: Request to Participate as a Stakeholder for the Chambers County and Participating Jurisdictions (City of Anahuac, Beach City, City of Cove, CLCND, Mt. Belvieu and Old River-Winfree), Texas, Local Hazard Mitigation Plan Update
Dear Judge Branick:

Chambers County, Texas is in the process of updating its 2019 Hazard Mitigation Plan (HMP) as FEMA requires local jurisdictions update their plans every five years. While the plan is drafted by a Mitigation Planning Committee (MPC) comprised of members of the County Departments and the Participating Jurisdictions' Departments, The MPC recognizes the importance of receiving input and expertise from the community throughout the plan update.

The planning process is an opportunity to bring together a wide range of community-based partners representing the interests of the whole community. The MPC has identified individuals and organizations that may be affected by mitigation actions and policies and who can provide specific information on topics or provide input from a different point of view in the community including:

- Local and regional agencies involved in hazard mitigation activities
- Agencies that have the authority to regulate development
- Neighboring communities
- Representatives of businesses, academia, and other private organizations
- Representatives of nonprofit organizations, including community-based organizations, that work directly with and/or provide support to underserved communities and socially vulnerable populations, among others.

This is a great opportunity for your organization to be involved in the planning process and the MPC would like to cordially invite you as a member of the stakeholder group. Participation includes providing information or input to inform the plan's content and reviewing the plan from your experience and perspective to ensure it is representative of all of Chambers County. It will not require any in person meetings. We will have conference call to provide background on the plan and how stakeholders can help and a second call outlining the plan's draft and will email you a link to review the plan as well as invite you to attend the public meetings.

Thank you very much for considering this request. It is important that stakeholders and the public have an opportunity to review and comment on this critical plan update.

Sincerely,

Jimmy Sylvia
Chambers County Judge

Appendix C – Public Notices

Chambers County and participating communities, Anahuac, Beach City, Cove, Mt. Belvieu and Old River-Winfree are updating the County's Hazard Mitigation Plan – Will you help?

Chambers County is updating its Hazard Mitigation Plan. Identified hazards can have a significant impact on a community, and to plan ahead we want your help. Please click the link to complete the survey that will help our planning efforts: https://www.surveymonkey.com/r/P77KLQL or use the QR code tha... See more

Appendix D – Presentations to Stakeholders and Public

Chambers County Mitigation Plan 2023 Update

Public Presentation

December 19 and 20, 2023

Hazard Mitigation

- One of the four components to disaster preparedness.
- Reduces impacts from natural hazards through plans, projects and services.
- There are several steps a community can take to help mitigate hazards - developing a Hazard Mitigation Plan (HMP) is one of them.

What is a Hazard Mitigation Plan?

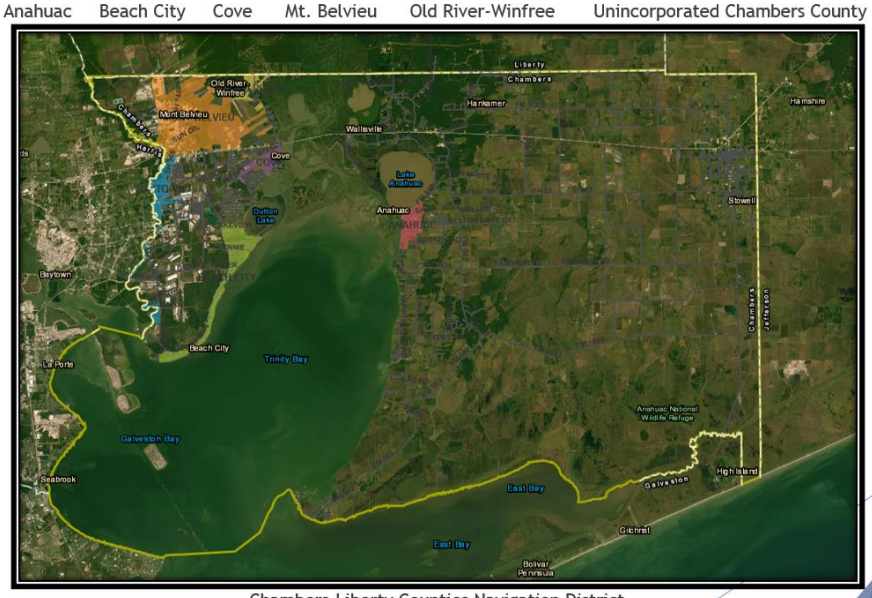
- Mitigation is most effective when it is based on a comprehensive, long-term plan that is developed BEFORE a disaster occurs.
- A Hazard Mitigation Plan (HMP) is used to identify policies and actions that can be implemented to reduce risk and future losses from hazards and disasters.
- It is a community-driven, living document that encourages communities to integrate mitigation into their day-to-day operations and decisions.

Why Update the Current Plan?

- Every five years, FEMA requires the County's HMP be updated (201.6 (d)(3))
- The mitigation plan update will:
  - Review and re-analyze risk based on changes in the last five years
  - Review the County mitigation priorities, strategy, goals, and actions to reduce risk
  - Gives the opportunity to advance the previous and ongoing mitigation efforts
  - Engage the whole community
  - Continue to allow the County to be eligible for pre- and post-disaster mitigation funding
  - Integrate plan with other community planning initiatives (comprehensive plan, CRS as examples)

Requirements for the plan

Anahuac Beach City Cove Mt. Belvieu Old River-Winfree Unincorporated Chambers County



Chambers-Liberty Counties Navigation District

PLANNING PROCESS

County and City Staff

Mitigation Planning Committee (MPC) - The core group responsible for making decisions, guiding the planning process, and agreeing upon the final contents of the plan. These are often leaders from the local communities that will adopt the plan (mayors, town administrators, county commissioners, etc.).

Stakeholders

Stakeholders - Individuals or groups that affect or can be affected by a mitigation action or policy.

Public

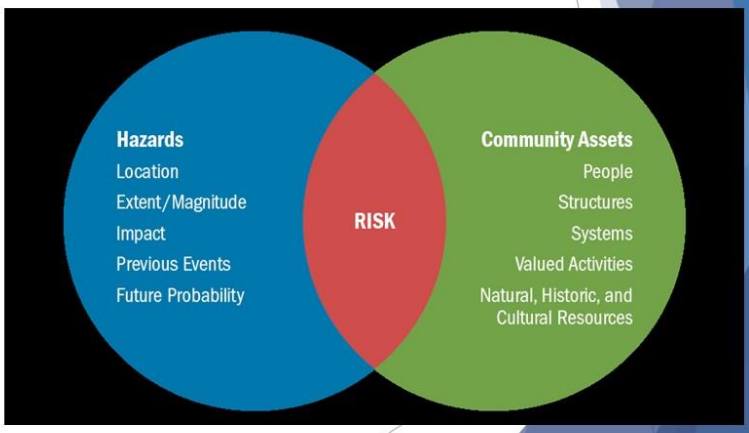
Public Engagement - Input from community members can strengthen the content and outcomes of the mitigation plan.

Community input and public participation are key to a successful mitigation plan

Risk Assessment

- Identify hazards
- Describe each hazard
- Profile each hazard
  - Location - where it might happen in the planning area
  - Extent - how minor or severe it may be
  - Previous Events - how often and where it has happened in the past
  - Future Probability - how likely it is to occur and how it may change (frequency/intensity) in the future

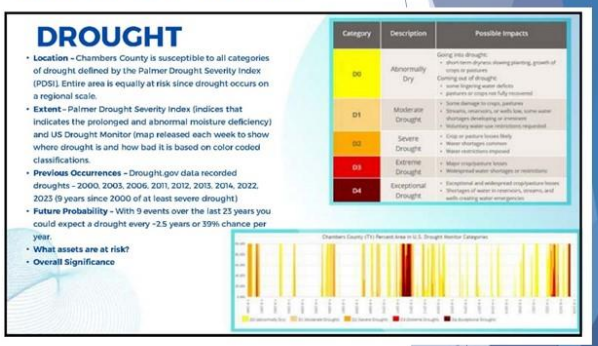
- Identify community assets
- Analyze impacts - the effects on assets
- Summarize vulnerability - which assets are at risk



Identified Hazards

2018 Hazards in Plan	2024 Hazards
Flood	Flood ❖ Riverine ❖ Coastal
Hurricanes and Tropical Storms	Hurricanes and Tropical Storms
Tornado	Tornado
Drought	Drought
Heat Events	Heat Events - Extreme heat
Expansive Soils	Expansive Soils
Lightning	Lightning
Coastal Erosion	Coastal Erosion
Hail	Hail
	HAZARDS INCLUDED FOR 2024 PLAN
	Winter Storm and/or extreme cold
	Wildfire
	Mont Belvieu - Salt domes

Hazard Profile



Assets

People | Structures | Systems | Resources | Activities

Chambers County Mitigation Strategy

Includes: Mission statement, Mitigation Goals, and Mitigation Action Plan that set the framework to identify, prioritize, and act to reduce risk.

➢ Mission Statement

The Hazard Mitigation Plan aims to implement new policies, programs, and projects to reduce the risks associated with natural hazards, including public education and partnerships between local officials and residents.

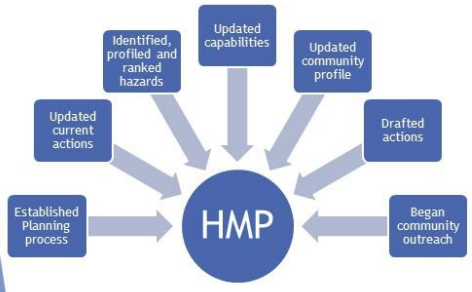
➢ Goals

- Reduce the loss of life and serious injury due to natural hazards
- Reduce the loss personal and public property due to natural hazards

➢ Mitigation Action Plan

Details specific mitigation actions, prioritizes the actions and provides a blueprint for implementation.

What has the Mitigation Planning Committee been up to?

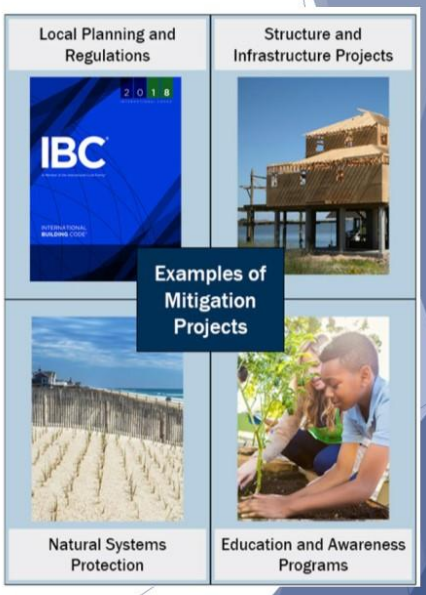


Hazards are risk assessed and actions identified by hazard

2023 Hazard profiled and ranked by significance (LOW/MEDIUM/HIGH) (H/M/L)	Mitigation Actions (A measure, project, plan or activity proposed to reduce or eliminate current and future vulnerabilities)
Flood (Riverine) H Flood (Coastal) H	• Drainage Projects • Buyouts/Elevations
Hurricane/Tropical Storm - H	• Property Protection • Dredging Cedar Bayou
Drought- H	• Alternative Water Supplies
Expansive Soils - H	• Drip irrigation
Extreme Cold - H	• Generators
Extreme Heat - H	• Extend Langston Road 2 Access Points to McLeod Park Shelter
Salt Dome - H	• Emergency equipment and personnel • Infrastructure resiliency
Coastal Erosion - M	• Watershed and habitat conservation • Shoreline Protection
Thunderstorm/High wind - M	• Generators
Winter Storm - M	• Generators
Wildfire - M	• Desnagging and clearing areas • Create CWPP
Lightning - L	• Rebate program for lightning rods
Tornado - L	• Warning sirens
Hail - L	• Hardening critical infrastructure

Actions to Mitigate Hazards

- For each hazard, two mitigation actions are needed
- Mitigation Actions primarily fall into four categories:
  - Local Planning and regulations include government authorities, policies or codes that influence the way land and buildings are developed and built.
  - Structure and Infrastructure involve modifying existing structures and infrastructures to protect them from a hazard or remove them from a hazard area. This could apply to public or private as well as critical infrastructure.
  - Natural Systems Protections can include green infrastructure and low impact development, nature-based solutions. Engineering with nature, and bioengineering to incorporate natural features or processes into the built environment.
  - Education and Awareness actions keep residents informed about potential natural disasters.



Actions Being Considered

Educating public on mitigation techniques	H
Rebate program for lightning rods	M
Drip Irrigation	L
Property Protection	H
Creating Maps	M
Hydroaxing Hackberry Gully and Cotton Bayou	M
Bridge on Rhonda Rosa Lane	M
West Bay Road and Bridge	M
Desnagging, clearing, and grubbing of Turtle Bayou	M
Dredging Cedar Bayou	M
Dredging West Fork- Double Bayou	M
Enlarge ditches and create retention- Spindletop Bayou	M
North Anahuac Drainage	H
Southwest Anahuac Ditch	M
Extend Langston Road to allow 2 Access Points to McLeod Park Shelter	L
Anahuac National Wildlife Refuge Conservation and Restoration	M
Old River Cove Restoration	M
Anahuac National Wildlife Refuge East Unit Beneficial Use	M
East Bay Living Shorelines and Wetland Restoration	M
Pierce Marsh Wetland Restoration and Shoreline Protection	M
Southeast Texas Flood Coordination Study - Regional Flood Sensor System	M
East and West Galveston Bay Watershed, Wetland, and Habitat Conservation	M
Moody NWR Conservation and Restoration	M
Harden the emergency management stations (12) throughout the County	M
Warning Sirens	L
Expansion of Raw Water Pond	L
Generators at the lift stations in Anahuac	M
Generators at Emergency Services Stations (12)	L
West Bay Living Shorelines at Sweetwater Preserve and Maggie's Cove	M
5 mobile/portable generators to assist in keeping critical infrastructure online	M
Storage building for generators and emergency supplies	L

Plan Maintenance

MONITORING THE PLAN
The County will monitor the mitigation actions to ensure that they are going to plan.

EVALUATING THE PLAN
The County will meet regularly, and after major natural hazard events, to evaluate how well the plan is working.

UPDATING THE PLAN
The County will continue to update the Plan every 5 years.

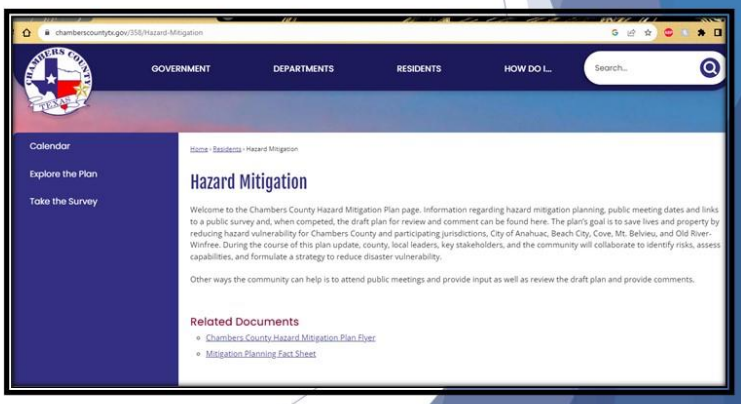
INTEGRATING THE PLAN
The County will integrate data, information, and actions from the HMP into other City plans and initiatives.

PUBLIC PARTICIPATION THROUGHOUT PLAN MAINTENANCE
The County is committed to public participation. Public engagement activities will align with the evaluation, monitoring, and plan update meetings as well as with large natural hazard events.

How can the Public Help?

- ❑ Have we accurately captured the natural hazards affecting our area and their consequences (e.g., damage and disruption of services?
- ❑ Are we missing important hazards and risks you would like to see addressed?
- ❑ Do the mitigation strategies and goals adequately respond to the hazards?
- ❑ Do you think most residents are well informed about the hazards affecting Chambers County?
- ❑ Are there additional ways the County and participating jurisdictions can inform residents about the risks?
- ❑ Are there actions you would like to added to the Update?

Please provide feedback Through the Chambers County Hazard Mitigation Plan Update Survey:

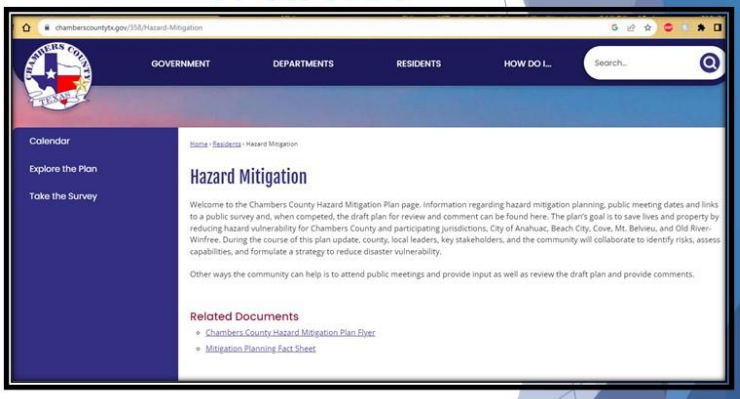


LOOK FOR OUTREACH INFORMATION

Print

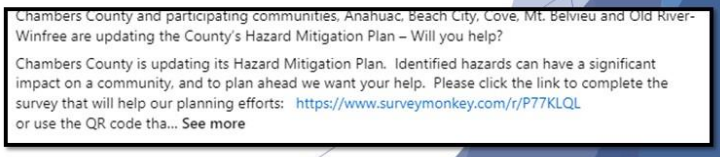

FACT SHEET ABOUT MITIGATION PLANNING
Information from FEMA
(Hazard Mitigation Planning for Local Communities (fema.gov))
Hazard Mitigation is...
Hazard Mitigation Planning

Website



Public Monitors

Social Media


Chambers County and participating communities, Anahuac, Beach City, Cove, Mt. Belvieu and Old River-Winfree are updating the County's Hazard Mitigation Plan – Will you help?
Chambers County is updating its Hazard Mitigation Plan. Identified hazards can have a significant impact on a community, and to plan ahead we want your help. Please click the link to complete the survey that will help our planning efforts: https://www.surveymonkey.com/r/P77KLQL
or use the QR code tha... See more

Chambers County Mitigation Plan 2023 Update

Stakeholder Presentation

December 5, 2023

What is Hazard Mitigation?

- Hazard mitigation describes actions taken to help reduce or eliminate long-term risks caused by hazards or disasters.
- There are several steps a community can take to help mitigate hazards - developing a Hazard Mitigation Plan (HMP) is one of them.

What is a Hazard Mitigation Plan?

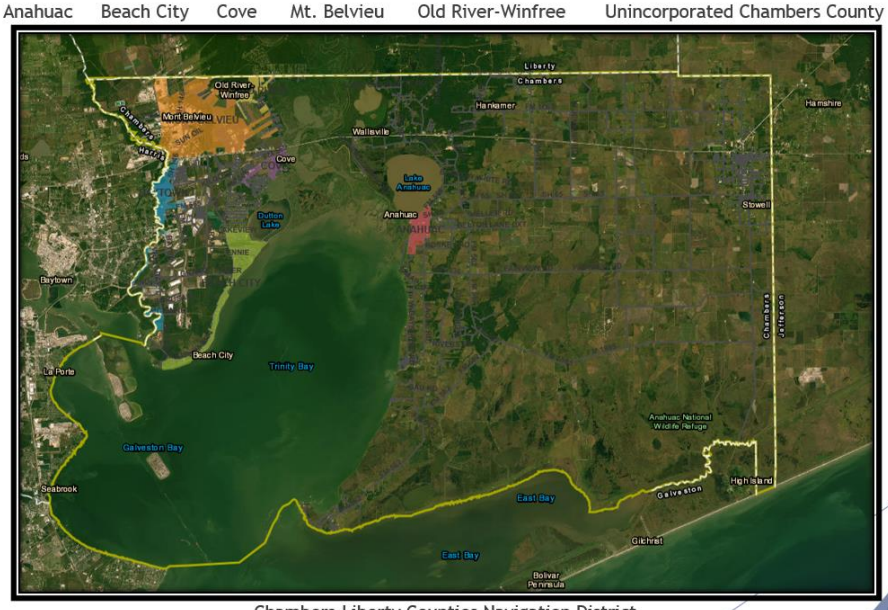
- Mitigation is most effective when it is based on a comprehensive, long-term plan that is developed BEFORE a disaster occurs.
- A Hazard Mitigation Plan (HMP) is used to identify policies and actions that can be implemented to reduce risk and future losses from hazards and disasters.
- It is a community-driven, living document that encourages communities to integrate mitigation into their day-to-day operations and decisions.

Why Update the Current Plan?

- Every five years, FEMA requires the County's HMP be updated.
- The mitigation plan update will:
  - Review and re-analyze risk based on changes in the last five years
  - Review the County mitigation priorities, strategy, goals, and actions to reduce risk
  - Gives the opportunity to advance the previous and ongoing mitigation efforts
  - Engage the whole community
  - Continue to allow the County to be eligible for pre- and post-disaster mitigation funding
  - Integrate plan with other community planning initiatives (comprehensive plan, CRS as examples)

Chambers County is a multi-jurisdiction plan including the following Participating Jurisdictions:

Anahuac Beach City Cove Mt. Belvieu Old River-Winfree Unincorporated Chambers County



Chambers-Liberty Counties Navigation District

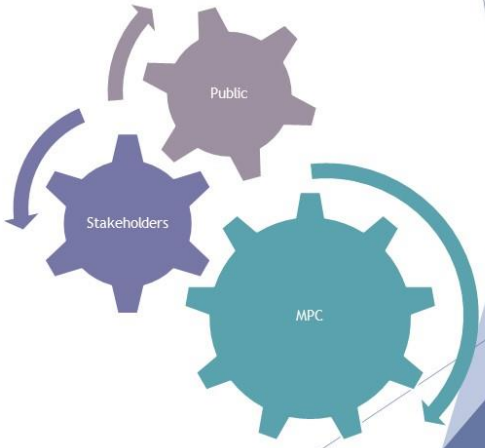
BUILDING THE PLANNING TEAM

Mitigation Planning Committee (MPC) - The core group responsible for making decisions, guiding the planning process, and agreeing upon the final contents of the plan. These are often leaders from the local communities that will adopt the plan (mayors, town administrators, county commissioners, etc.).

Stakeholders - Individuals or groups that affect or can be affected by a mitigation action or policy.

Public - Input from community members can strengthen the content and outcomes of the mitigation plan.

Community input and public participation are key to a successful mitigation plan



Building the Planning Team – Planning Partners

Mitigation Planning Committee

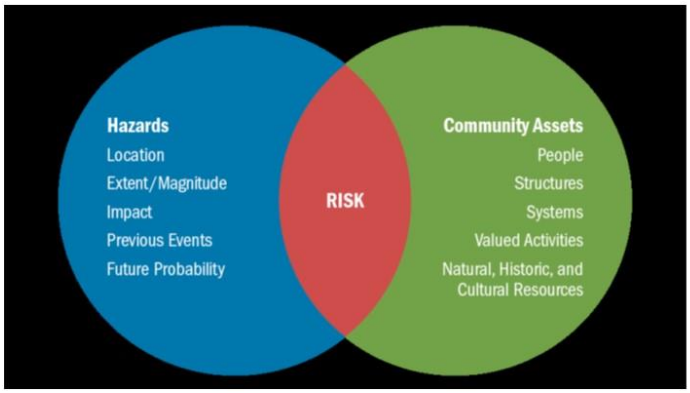
- Chambers County
  - Economic Development
  - Engineering Department
  - Health Department
  - Emergency Management Department
- Anahuac City Manager
- Beach City Mayor
- Cove Mayor
- Chambers-Liberty Counties Navigation District General Manager
- Mont Belvieu
  - Engineering Department
  - Emergency Management
- Old River-Winfree Mayor

Stakeholders

- Neighboring Counties
- Neighboring Cities
- Drainage Districts
- Academia
- Business Organizations
- Non-profit Organizations
- Hospitals
- Fire Departments

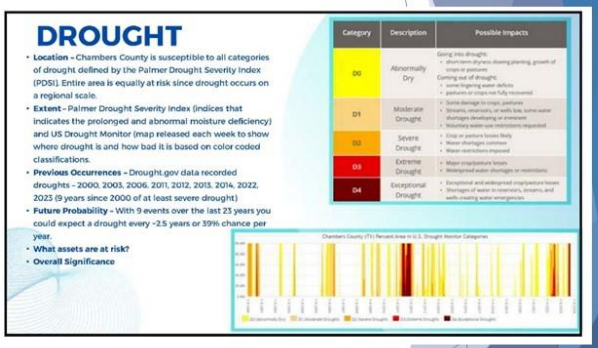
FIVE STEPS OF RISK ASSESSMENT

1. Identify hazards
2. Describe hazards
3. Identify community assets
4. Analyze impacts
5. Summarize vulnerability



Identified Hazards

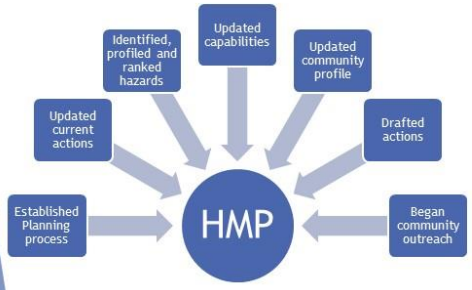
2018 Hazards in Plan	2024 Hazards
Flood	Flood ❖ Riverine ❖ Coastal
Hurricanes and Tropical Storms	Hurricanes and Tropical Storms
Tornado	Tornado
Drought	Drought
Heat Events	Heat Events - Extreme heat
Expansive Soils	Expansive Soils
Lightning	Lightning
Coastal Erosion	Coastal Erosion
Hail	Hail
	HAZARDS INCLUDED FOR 2024 PLAN
	Winter Storm and/or extreme cold
	Wildfire
	Mont Belvieu - Salt domes



RISK INFORMED

- Do you have data/information to help further analyze a hazard?
- Are there hazards that you believe impact the area not listed?
- Are there areas that are impacted that you want the MPC to be made aware?
- Are there populations that need to reached?
- Are there assets that need to be identified for protection?
- Are there reports/studies/assessments that you can provide for more detailed analysis?
- Can this plan be incorporated or reviewed in support of the plans/reports?

What has the Mitigation Planning Committee been up to?



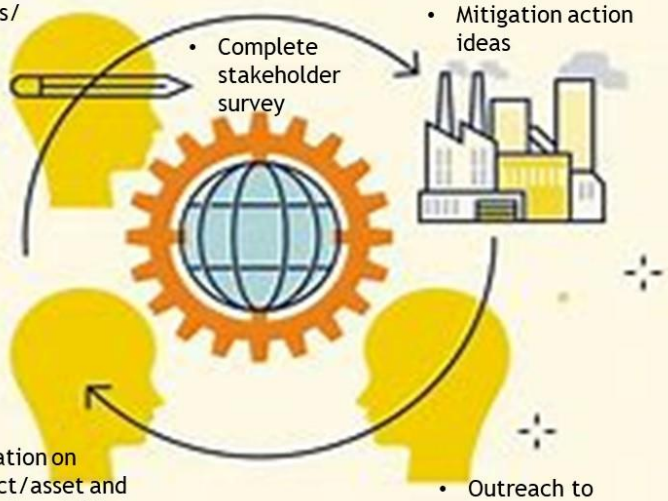
Hazards are risk assessed and actions identified by hazard

2023 Hazard profiled and ranked by significance (LOW/MEDIUM/HIGH) (H/M/L)	Mitigation Actions (A measure, project, plan or activity proposed to reduce or eliminate current and future vulnerabilities)
Flood (Riverine) H Flood (Coastal) H	• Drainage Projects • Buyouts/Elevations
Hurricane/Tropical Storm - H	• Property Protection • Dredging Cedar Bayou
Drought- H	• Alternative Water Supplies
Expansive Soils - H	• Drip irrigation
Extreme Cold - H	• Generators
Extreme Heat - H	• Extend Langston Road 2 Access Points to McLeod Park Shelter
Salt Dome - H	• Emergency equipment and personnel • Infrastructure resiliency
Coastal Erosion - M	• Watershed and habitat conservation • Shoreline Protection
Thunderstorm/High wind - M	• Generators
Winter Storm - M	• Generators
Wildfire - M	• Desnagging and clearing areas • Create CWPP
Lightning - L	• Rebate program for lightning rods
Tornado - L	• Warning sirens
Hail - L	• Hardening critical infrastructure

How can Stakeholders Help?

Each of you has a unique expertise, experience, and community perspective

- Reports/Studies/ Assessments
- Complete stakeholder survey
- Mitigation action ideas

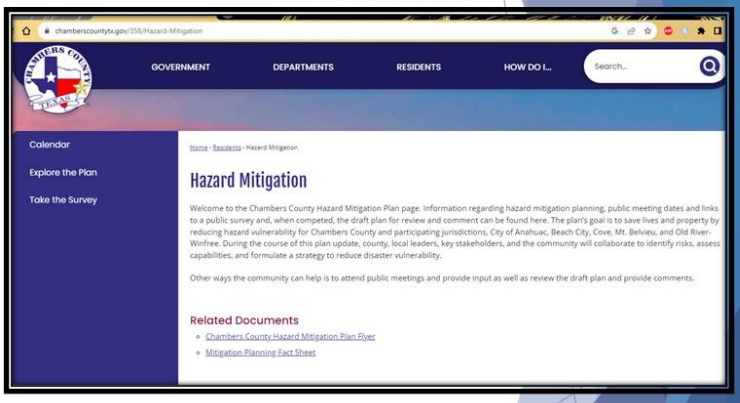


- Data/information on hazard/impact/asset and community vulnerability
- Outreach to larger community

REACHING THE WHOLE PEARLAND COMMUNITY

- Let community know about survey
- Let community know about importance of plan
- Get community involved in plan

Website



Public

Print

Monitors

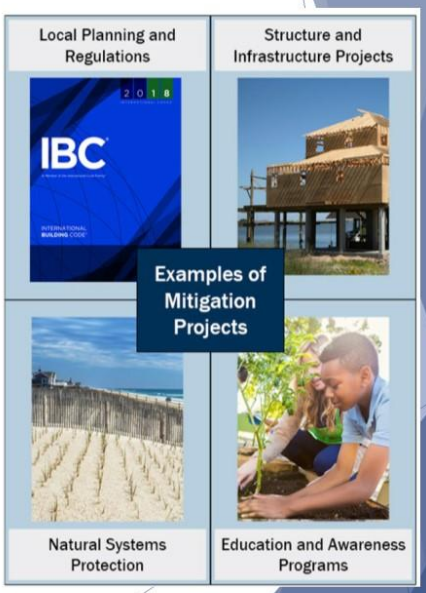
Social Media

Chambers County and participating communities, Anahuac, Beach City, Cove, Mt. Belvieu and Old River-Winfree are updating the County's Hazard Mitigation Plan – Will you help?

Chambers County is updating its Hazard Mitigation Plan. Identified hazards can have a significant impact on a community, and to plan ahead we want your help. Please click the link to complete the survey that will help our planning efforts: https://www.surveymonkey.com/r/P77KLQL or use the QR code tha... **See more**

Actions to Mitigate Hazards

- For each hazard, two mitigation actions are needed
- Mitigation Actions primarily fall into four categories:
  - Local Planning and regulations include government authorities, policies or codes that influence the way land and buildings are developed and built.
  - Structure and Infrastructure involve modifying existing structures and infrastructures to protect them from a hazard or remove them from a hazard area. This could apply to public or private as well as critical infrastructure.
  - Natural Systems Protections can include green infrastructure and low impact development, nature-based solutions. Engineering with nature, and bioengineering to incorporate natural features or processes into the built environment.
  - Education and Awareness actions keep residents informed about potential natural disasters.



Chambers County Mitigation Plan 2024 Update

Stakeholder Presentation

April 9, 2024

1

First Draft of The Hazard Mitigation Plan Update is Complete

- Some notes as you review:
  - There are no table numbers or figure numbers until the final draft.
  - As it is a first draft, there is some data the MPC is still trying to obtain or analyze.
  - The formatting is not finalized.
  - Not all of the appendices are included at this time.

2

Chambers County is a multi-jurisdiction plan including the following Participating Jurisdictions:

Anahuac Beach City Cove Mont Belvieu Old River-Winfree Unincorporated Chambers County

Chambers-Liberty Counties Navigation District

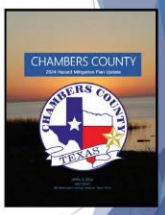
3

HMP Consists of:

- Five Sections
  - Introduction and Adoption
  - The Planning Process
  - Hazard Identification and Risk Assessment
  - Mitigation Strategy
  - Plan Maintenance
- Each Jurisdiction has a separate annex for specific information relating to that Jurisdiction

There are several appendices at the end

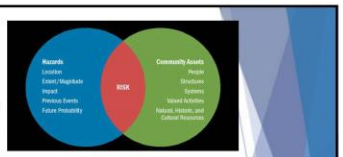
- Minutes from MPC Meetings
- Stakeholder letter example
- Stakeholder and Public Presentations from first meetings
- Public Notice
- Survey Results
- FEMA National Risk Index



4

Risk Assessment

- Identify hazards
- Describe each hazard
- Profile each hazard
  - Location - where it might happen in the planning area
  - Extent - how minor or severe it may be
  - Previous Events - how often and where it has happened in the past
  - Future Probability - how likely it is to occur and how it may change (frequency/ intensity) in the future
- Identify community assets
- Analyze Impacts - the effects on assets
- Summarize vulnerability - which assets are at risk



Socially Vulnerable Populations:

- Essential to include impacts to socially vulnerable populations
- The most at risk members in a community tend to suffer the greatest losses from disasters

Impacts of Climate Change

- Essential to include impacts to socially vulnerable populations
- The most at risk members in a community tend to suffer the greatest losses from disasters

Stakeholders: How can we do better outreach?

5

MPC Identified Hazards

2024 Hazards	Ranking
Coastal Erosion	Medium
Drought	High
Expansive Soil	High
Extreme Heat	High
Extreme Cold/Freeze	High
Flood	High
Hail	Low
Hurricane and Tropical Storm	High
Lightning	Low
Soil Slump	High
Severe Thunderstorm and High Wind	Medium
Tornado	Medium
Wildfire	Medium
Winter Storm	Medium
Omitted from consideration: dam/levee failure, earthquake, and subsidence	

Survey Says:

How concerned are you about the following hazards?	Extremely Concerned %
Flooding – streets/yard	42%
Hurricane/TS	36%
Flooding – home or business	27%
Drought	18%
Coastal Erosion	9%
Extreme Temperatures**	18%
Severe Weather*	9%
Wildfire	9%
Tornado	9%
Climate change	9%
Severe Winter Storms	9%
Geologic (earthquakes, sinkholes, subsidence)	0.00%

*Lightning, high winds, and hail were included in the same line as Severe Weather.
**Extreme Temperatures included extreme heat and extreme cold/freeze.

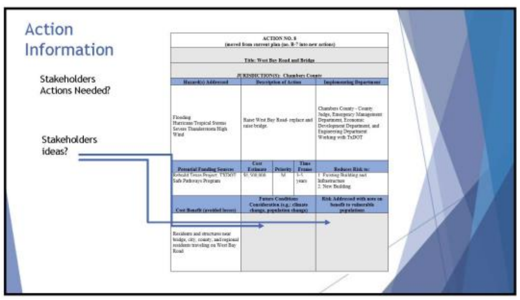
Assets

People Structures Systems Resources Activities

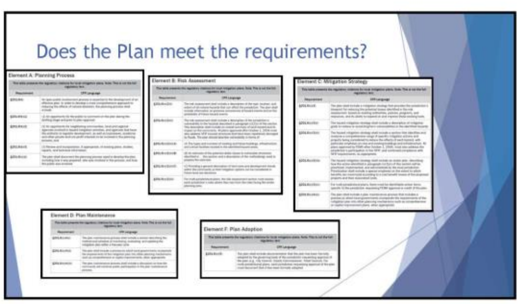
6


Chambers County Mitigation Strategy
MISSION STATEMENT
The HMP aims to implement new policies, programs, and projects to reduce the risks and impacts associated with natural hazards, including public education and partnerships between local officials and residents.
GOALS
Reduce the loss of life and serious injury due to natural hazards
Reduce the loss of personal and public property due to natural hazards
Mitigation Action Plan
Details specific mitigation actions, prioritizes the actions and provides a blueprint for implementation.

7


Action Information
Stakeholders Actions Needed?
Stakeholders ideas?
ACTION NO. 8
Title: West Bay Road and Bridge
Hazard(s) Addressed
Description of Action
Implementing Department
Flooding
Hurricane Tropical Storms
Severe Thunderstorm High Wind
Raise West Bay Road- replace and raise bridge.
Chambers County - County Judge, Emergency Management Department, Economic Development Department, and Engineering Department Working with TxDOT
Potential Funding Sources
Cost Estimate
Priority
Time Frame
Reduces Risk to:
Safe Pathways Program
M
years
1. Existing Building and Infrastructure
2. New Building
Future Conditions Consideration (e.g.: climate change, population change)
Residents and structures near bridge, city, county, and regional residents traveling on West Bay Road

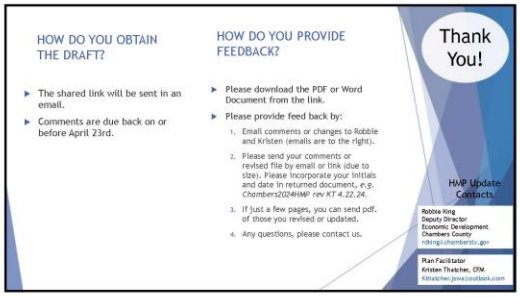
8


Does the Plan meet the requirements?
Element A: Planning Process
Element B: Risk Assessment
Element C: Mitigation Strategy
Element D: Plan Maintenance
Element F: Plan Adoption

9


How can Stakeholders Help?
Please review the draft, add comments, provide updated information, and ask questions
REVIEW
COMMENT
HMP
UPDATE

10


HOW DO YOU OBTAIN THE DRAFT?
The shared link will be sent in an email.
Comments are due back on or before April 23rd.
HOW DO YOU PROVIDE FEEDBACK?
Please download the PDF or Word Document from the link.
Please provide feed back by:
1. Email comments or changes to Robbie and Kristen (emails are to the right).
2. Please send your comments or revised file by email or link (due to size). Please incorporate your initials and date in returned document, e.g. Chambers2024HMP rev KT 4.22.24.
3. If just a few pages, you can send pdf. of those you revised or updated.
4. Any questions, please contact us.
Thank You!
HMP Update Contacts
Robbie King
Deputy Director
Economic Development
Chambers County
rking@chamberstx.gov
Plan Facilitator
Kristen Thatcher, CFM
kthatcher.hmp@outlook.com

11

Chambers County Mitigation Plan 2024 Update

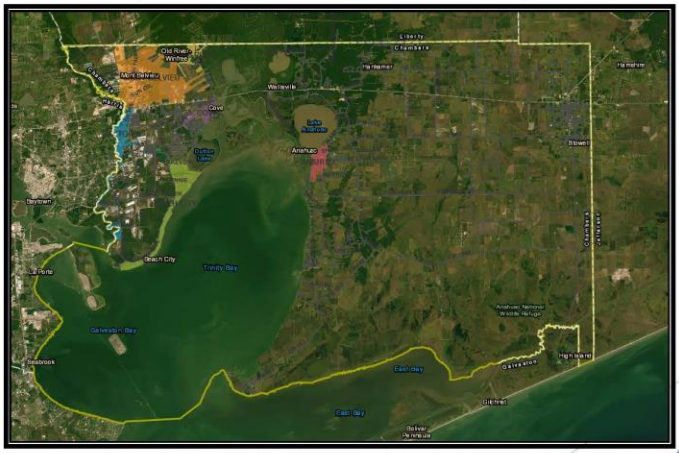
Public Presentations

June 4 and 5, 2024

1

Chambers County is a multi-jurisdiction plan including the following Participating Jurisdictions:

Anahuac Beach City Cove Mont Belvieu Old River-Winfree Unincorporated Chambers County

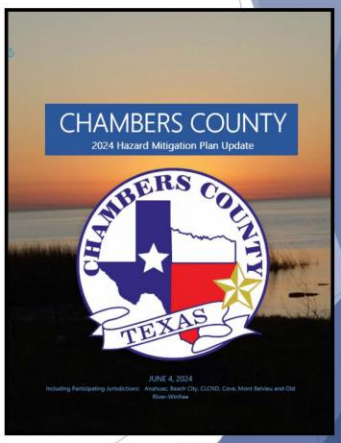


Chambers-Liberty Counties Navigation District

2

Draft of The Hazard Mitigation Plan Update is Complete

- Mitigation Planning Committee (MPC) drafted
- Stakeholders and Public are encouraged to review and provide input



- There are five sections of the Update, Annexes for each participating jurisdictions, and Appendices

3

HMP Consists of

- Five Sections
  - Introduction and Adoption
  - The Planning Process
  - Hazard Identification and Risk Assessment
  - Mitigation Strategy
  - Plan Maintenance
- Each Jurisdiction has a separate annex with specific Jurisdiction information

There are several appendices attached as well

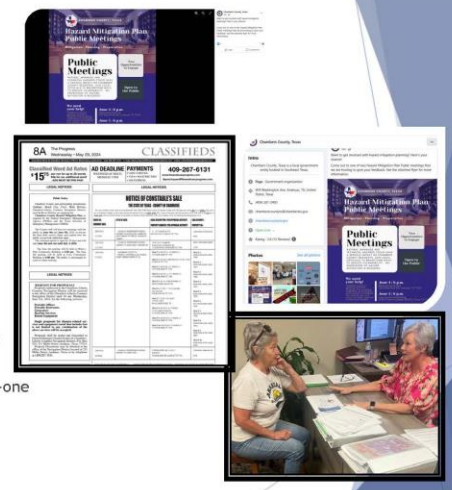
4

Planning

- Survey results indicated Social Media and local newspapers are how Chambers County residents are best notified
- County and Jurisdictions' used websites, Facebook, Print, and Signage to inform public

Outreach

- Public Meetings were held for input at various locations throughout the County
- Utilization of existing shows, exhibits, one-on-one meetings and public gatherings were used to discuss the plan update and solicit input



5

MPC Identified Hazards

2024 Hazards	Ranking
Coastal Erosion	Medium
Drought	High
Expansive Soil	High
Extreme Heat	High
Extreme Cold/Freeze	High
Flood	High
Hail	Low
Hurricane and Tropical Storm	High
Lightning	Low
Salt Dome	High
Severe Thunderstorm and High Wind	Medium
Tornado	Medium
Wildfire	Medium
Winter storm	Medium
Omitted from consideration: dam/levee failure, earthquake, and subsidence	

Survey Says:

How concerned are you about the following hazards?	Extremely Concerned %
Flooding – street/land	45%
Hurricane/TS	36%
Flooding – home or business	27%
Drought	18%
Coastal Erosion	9%
Extreme Temperatures**	18%
Severe Weather*	9%
Wildfire	9%
Tornado	9%
Climate change	9%
Severe Winter Storms	9%
Geologic (landslides, sinkholes, subsidence)	0.00%

*Lightning, high winds, and hail were included in the same line as Severe weather.
**Extreme Temperatures included extreme heat and extreme cold/freezes.

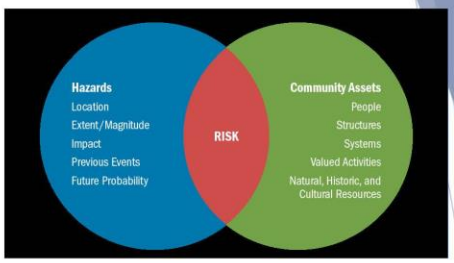
Assets

People | Structures | Systems | Resources | Activities

6

Risk Assessment

- Identify hazards
- Describe each hazard
- Profile each hazard
  - Location - where it might happen in the planning area
  - Extent - how minor or severe it may be
  - Previous Events - how often and where it has happened in the past
  - Future Probability - how likely it is to occur and how it may change (frequency/intensity) in the future
- Identify community assets
- Analyze impacts - the effects on assets
- Summarize vulnerability - which assets are at risk



Socially Vulnerable Populations

- Essential to include impacts to socially vulnerable populations
- The most at risk members in a community tend to suffer the greatest losses from disasters

How can we do better outreach?

Impacts of Climate Change

- Essential to include impacts to socially vulnerable populations
- The most at risk members in a community tend to suffer the greatest losses from disasters

7

Chambers County Mitigation Strategy

MISSION STATEMENT

The HMP aims to implement new policies, programs, and projects to reduce the risks and impacts associated with natural hazards, including public education and partnerships between local officials and residents.

GOALS

Reduce the loss of life and serious injury due to natural hazards

Reduce the loss of personal and public property due to natural hazards

Mitigation Action Plan

Details specific mitigation actions, prioritizes the actions and provides a blueprint for implementation.

8

39 Actions Identified

Action No.	Former Action No.	Title	Priority
1	A-1 and A-1.1	Educating public on mitigation techniques	H
2	A-5	Rebate program for lightning rods	M
3	A-6	Drip Irrigation	L
4	A-8	Property Protection	H
5	A-9	Creating Maps	M
6	B-2	Hydroaxing Hackberry Gully and Cotton Bayou	M
7	B-4	Bridge on Rhonda Ross Lane	M
8	B-7	West Bay Road and Bridge	M
9	B-8	Desnagging, clearing, and grubbing of Turtle Bayou	M
10	B-9	Dredging Cedar Bayou	M
11	B-10	Dredging West Fork- Double Bayou	M
12	B-11	Enlarge ditches and create retention- Spindletop Bayou	M
13	C-1	North Anahuac Drainage	H
14	C-3	Southwest Anahuac Ditch	M
15	D-1	Extend Langston Road to allow 2 Access Points to McLeod Park Shelter	L
16		Anahuac National Wildlife Refuge Conservation and Restoration	M
17		Old River Cove Restoration	M
18		Anahuac National Wildlife Refuge East Unit Beneficial Use	M
19		East Bay Living Shorelines and Wetland Restoration	M
20		Pierce Marsh Wetland Restoration and Shoreline Protection	M
21		Southeast Texas Flood Coordination Study - Regional Flood Sensor System	M
22		East and West Galveston Bay Watershed, Wetland, and Habitat Conservation	M
23		Moody NWR Conservation and Restoration	M
24		Harden the emergency management stations (12) throughout the County	M
25		Warning Sirens	L
26		Expansion of Raw Water Pond	L
27		Generators at the lift stations in Anahuac	M
28		Generators at Emergency Services Stations (12)	L
29		West Bay Living Shorelines at Sweetwater Preserve and Maggie's Cove	M
30	B-13	5 mobile/portable generators to assist in keeping critical infrastructure online	M
31	B-14	Storage building for generators and emergency supplies	L
32		Air Monitorine System Around the Salt Dome Area	H
33		Seismic Activity System to detect ground disturbance around the Salt Dome Area	H
34		Teacherville Drainage Improvement	H
35		Anahuac Main Pump Station	M
36		Lake Anahuac Pump Station	M
37		Hog Bayou/Lake Anahuac Gate Structure	M
38		Generator for CLCND Pump	M
39		Safe Room/Community Center in Mont Belvieu	M

Action Details

ACTION NO. 8
(moved from current plan (no. B-7 into new actions))

Title: West Bay Road and Bridge

JURISDICTION(S): Chambers County

Hazard(s) Addressed	Description of Action			Implementing Department
Flooding Hurricane/Tropical Storms Severe Thunderstorm/High Wind	Raise West Bay Road- replace and raise bridge.			Chambers County - County Judge, Emergency Management Department, Economic Development Department, and Engineering Department Working with TxDOT
Potential Funding Sources	**Cost Estimate**	**Priority**	**Time Frame**	**Reduces Risk to:**
Rebuild Texas Project, TXDOT Safe Pathways Program	$1,500,000	M	3-5 years	1. Existing Building and Infrastructure 2. New Building
Cost Benefit (avoided losses)	**Future Conditions Consideration (e.g.: climate change, population change)**			**Risk Addressed with note on benefit to vulnerable populations**
Residents and structures near bridge, city, county, and regional residents traveling on West Bay Road	Design will take into account climate adaption and resilience using best available data.			Design will take into account vulnerable populations.

Would the public recommend any actions not identified?

9

Does the Plan meet the requirements?

Element A: Planning Process

This table presents the regulatory citations for local mitigation plans. Note: This is not the full regulatory text.

Requirement	CFR Language
§201.6(b)	An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:
§201.6(b)(1)	(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
§201.6(b)(2)	(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and
§201.6(b)(3)	(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.
§201.6(c)(1)	The plan shall document the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

Element B: Risk Assessment

This table presents the regulatory citations for local mitigation plans. Note: This is not the full regulatory text.

Requirement	CFR Language
§201.6(c)(2)(i)	The risk assessment shall include a description of the type, location, and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
§201.6(c)(2)(ii)	The risk assessment shall include a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. All plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods. The plan should describe vulnerability in terms of:
§201.6(c)(2)(ii)(A)	(A) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas;
§201.6(c)(2)(ii)(B)	(B) An estimate of the potential dollar losses to vulnerable structures identified in … this section and a description of the methodology used to prepare the estimate.
§201.6(c)(2)(ii)(C)	(C) Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.
§201.6(c)(2)(iii)	For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

Element C: Mitigation Strategy

This table presents the regulatory citations for local mitigation plans. Note: This is not the full regulatory text.

Requirement	CFR Language
§201.6(c)(3)	The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve these existing tools.
§201.6(c)(3)(i)	The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.
§201.6(c)(3)(ii)	The hazard mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure. All plans approved by FEMA after October 1, 2006, must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.
§201.6(c)(3)(iii)	The hazard mitigation strategy shall include an action plan, describing how the actions identified in paragraph (c)(3)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.
§201.6(c)(3)(iv)	For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.
§201.6(c)(4)(ii)	The plan shall include a plan maintenance process that includes a process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

Element D: Plan Maintenance

This table presents the regulatory citations for local mitigation plans. Note: This is not the full regulatory text.

Requirement	CFR Language
§201.6(c)(4)(i)	The plan maintenance process shall include a section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.
§201.6(c)(4)(ii)	The plan shall include a process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvements, when appropriate.
§201.6(c)(4)(iii)	The plan maintenance process shall include a discussion on how the community will continue public participation in the plan maintenance process.

Element F: Plan Adoption

This table presents the regulatory citations for local mitigation plans. Note: This is not the full regulatory text.

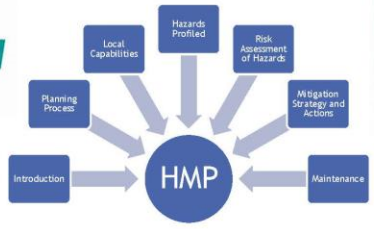
Requirement	CFR Language
§201.6(c)(5)	The plan shall include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council). For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.

All Jurisdictions will adopt plan after TDEM and FEMA approve pending adoption

10

How can the Public Help?

Please review the draft, add comments, provide updated information, improve outreach, and ask questions



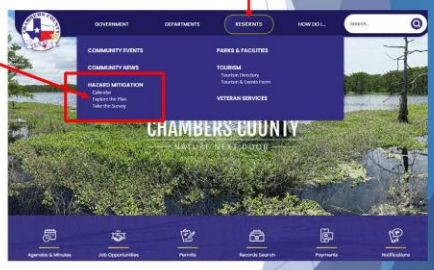
11

HOW DO YOU OBTAIN THE DRAFT?

- ✓ Go to the County's Website(chamberscountytx.gov)
- ✓ Click on RESIDENT in Top Headline
- ✓ Click on the Hazard Mitigation from the sidebar
  https: //chamberscountytx.gov/358/Hazard-Mitigation
- ✓ Click on Explore the Plan from the sidebar
  https://chamberscountytx.gov/361/Explore-the-Plan
- ✓ Download and Review
- ✓ There will be a 30-day comment period
- ✓ Please provide comments back on or before
  July 5, 2024

July 2024

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			



12

Appendix E – FEMA National Risk Index

National Risk Index

February 24, 2024

Chambers County, Texas

Summary

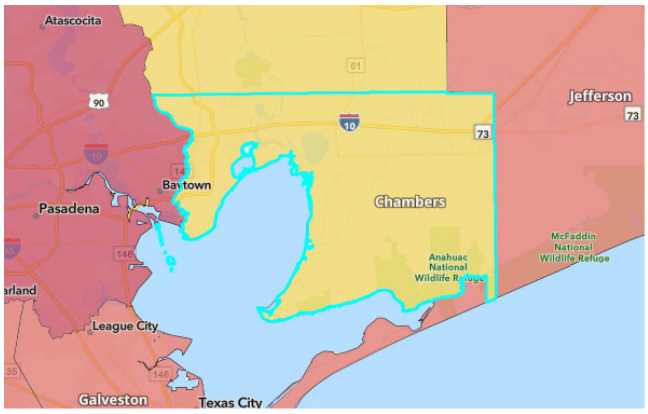
Risk Index is **Relatively Moderate**	Score **89.8** (0 – 100)
Expected Annual Loss is **Relatively Moderate**	Score **89.7** (0 – 100)
Social Vulnerability is **Relatively Moderate**	Score **47.4** (0 – 100)
Community Resilience is **Very High**	Score **91.9** (0 – 100)

While reviewing this report, keep in mind that low risk is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience.

For more information about the National Risk Index, its data, and how to interpret the information it provides, please review the **About the National Risk Index** and **How to Take Action** sections at the end of this report. Or, visit the National Risk Index website at **hazards.fema.gov/nri/learn-more** to access supporting documentation and links.

Risk Index

The Risk Index rating is **Relatively Moderate** for **Chambers County, TX** when compared to the rest of the U.S.



Score	89.76
National Percentile	89.76
Percentile Within Texas	57.80

0 – 100

90% of U.S. counties have a lower Risk Index

88% of counties in Texas have a lower Risk Index

Risk Index Legend

Very High | Relatively High | Relatively Moderate | Relatively Low | Very Low

No Rating | Not Applicable | Insufficient Data

Hazard Type Risk Index

Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's Expected Annual Loss value, community risk factors, and the adjustment factor used to calculate the risk value.

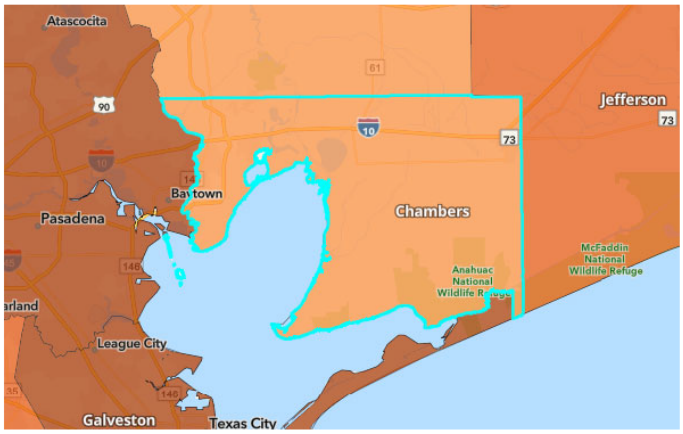
Hazard Type	Risk Index Rating	Risk Index Score	National Percentile
Avalanche	Not Applicable	–	
Coastal Flooding	Relatively Low	60.4	0 100
Cold Wave	Relatively Moderate	64.2	0 100
Drought	Relatively Moderate	86.3	0 100
Earthquake	Very Low	33.5	0 100
Hail	Relatively Low	61	0 100
Heat Wave	Relatively Low	43	0 100
Hurricane	Relatively Moderate	92.9	0 100
Ice Storm	Relatively Moderate	61.4	0 100
Landslide	Relatively Low	30.4	0 100
Lightning	Relatively High	95.8	0 100
Riverine Flooding	Relatively Moderate	93.8	0 100
Strong Wind	Relatively Low	55.6	0 100
Tornado	Relatively Moderate	86.9	0 100
Tsunami	Insufficient Data	–	
Volcanic Activity	Not Applicable	–	
Wildfire	Relatively Moderate	91.9	0 100
Winter Weather	Relatively Low	52.9	0 100

Risk Factor Breakdown

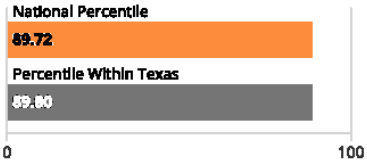
Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
Hurricane	$23,624,998	Relatively Moderate	Very High	1.16	$26,488,323	92.9
Riverine Flooding	$4,565,203	Relatively Moderate	Very High	1.16	$5,949,648	93.8
Tornado	$4,974,958	Relatively Moderate	Very High	1.16	$5,649,515	86.9
Wildfire	$1,634,269	Relatively Moderate	Very High	1.16	$2,262,465	91.9
Lightning	$1,053,641	Relatively Moderate	Very High	1.16	$1,205,356	95.8
Drought	$329,026	Relatively Moderate	Very High	1.16	$468,827	86.3
Strong Wind	$404,188	Relatively Moderate	Very High	1.16	$455,111	55.6
Coastal Flooding	$239,641	Relatively Moderate	Very High	1.16	$307,719	60.4
Hail	$158,201	Relatively Moderate	Very High	1.16	$178,211	61
Cold Wave	$138,972	Relatively Moderate	Very High	1.16	$162,324	64.2
Ice Storm	$103,154	Relatively Moderate	Very High	1.16	$116,803	61.4
Winter Weather	$58,530	Relatively Moderate	Very High	1.16	$67,350	52.9
Heat Wave	$48,361	Relatively Moderate	Very High	1.16	$55,636	43
Earthquake	$43,962	Relatively Moderate	Very High	1.16	$51,063	33.5
Landslide	$21,900	Relatively Moderate	Very High	1.16	$22,815	30.4
Avalanche	--	Relatively Moderate	Very High	1.16	--	--
Tsunami	--	Relatively Moderate	Very High	1.16	--	--
Volcanic Activity	--	Relatively Moderate	Very High	1.16	--	--

Expected Annual Loss

In **Chambers County, TX**, expected loss each year due to natural hazards is **Relatively Moderate** when compared to the rest of the U.S.



Score	89.72



90% of U.S. counties have a lower Expected Annual Loss

90% of counties in Texas have a lower Expected Annual Loss

Expected Annual Loss Legend

Very High | Relatively High | Relatively Moderate | Relatively Low | Very Low

No Expected Annual Losses | Not Applicable | Insufficient Data

Composite Expected Annual Loss	**$37,399,002.56**
Composite Expected Annual Loss Rate National Percentile	**94.3**

Building EAL	**$29,730,493.23**	Population EAL	**0.62** fatalities
Building EAL Rate	**$1 per $404.24 of building value**	Population EAL Rate	**1 per 75.40K people**
Agriculture EAL	**$513,970.01**	Population Equivalence EAL	**$7,154,539.32**
Agriculture EAL Rate	**$1 per $43.00 of agriculture value**		

Expected Annual Loss for Hazard Types

Expected Annual Loss scores for hazard types are calculated using data for only a single hazard type, and reflect a community's relative expected annual loss for only that hazard type.

15 of 18 hazard types contribute to the expected annual loss for **Chambers County, TX.**

Hurricane	Relatively Moderate	$23,624,998	92.5
Tornado	Relatively Moderate	$4,974,958	87.3

Hazard Type	Expected Annual Loss Rating	EAL Value	Score
Riverine Flooding	Relatively Moderate	$4,565,203	92.8
Wildfire	Relatively Moderate	$1,634,269	90.7
Lightning	Relatively High	$1,053,641	95.5
Strong Wind	Relatively Moderate	$404,188	58.2
Drought	Relatively Moderate	$329,026	84.2
Coastal Flooding	Relatively Low	$239,641	59.7
Hail	Relatively Low	$158,201	62.9
Cold Wave	Relatively Moderate	$138,972	65.0
Ice Storm	Relatively Moderate	$103,154	61.8
Winter Weather	Relatively Moderate	$58,530	55.0
Heat Wave	Relatively Low	$48,361	44.9
Earthquake	Very Low	$43,962	33.3
Landslide	Relatively Low	$21,900	60.4
Avalanche	Not Applicable	--	--
Tsunami	Insufficient Data	--	--
Volcanic Activity	Not Applicable	--	--

Expected Annual Loss Values

Hazard Type	Total	Building Value	Population Equivalence	Population	Agriculture Value
Avalanche	--	--	--	--	--
Coastal Flooding	$239,641	$232,660	$6,981	0.00	n/a
Cold Wave	$138,972	$2,083	$127,626	0.01	$9,262
Drought	$329,026	n/a	n/a	n/a	$329,026
Earthquake	$43,962	$35,989	$7,973	0.00	n/a
Hail	$158,201	$108,843	$43,958	0.00	$5,399
Heat Wave	$48,361	$22	$48,338	0.00	$1
Hurricane	$23,624,998	$22,572,006	$980,788	0.08	$72,204
Ice Storm	$103,154	$8,254	$94,900	0.01	n/a
Landslide	$21,900	$4,500	$17,400	0.00	n/a
Lightning	$1,053,641	$8,203	$1,045,438	0.09	n/a
Riverine Flooding	$4,565,203	$3,303,096	$1,171,883	0.10	$90,224

Hazard Type	Total	Building Value	Population Equivalence	Population	Agriculture Value
Strong Wind	$404,188	$178,062	$220,828	0.02	$5,299
Tornado	$4,974,958	$1,750,701	$3,223,697	0.28	$560
Tsunami	n/a	n/a	n/a	n/a	n/a
Volcanic Activity	--	--	--	--	--
Wildfire	$1,634,269	$1,523,930	$108,626	0.01	$1,713
Winter Weather	$58,530	$2,143	$56,105	0.00	$282

Exposure Values

Hazard Type	Total	Building Value	Population Equivalence	Population	Agriculture Value
Avalanche	--	--	--	--	--
Coastal Flooding	$57,386,014,416	$1,341,064,314	$56,044,950,101	4,831.46	n/a
Cold Wave	$551,521,503,580	$12,018,202,537	$539,481,200,000	46,507.00	$22,101,043
Drought	$11,282,138	n/a	n/a	n/a	$11,282,138
Earthquake	$552,241,724,000	$12,018,124,000	$540,223,600,000	46,571.00	n/a
Hail	$551,521,503,665	$12,018,202,537	$539,481,200,000	46,507.00	$22,101,128
Heat Wave	$551,521,503,580	$12,018,202,537	$539,481,200,000	46,507.00	$22,101,043
Hurricane	$551,521,431,669	$12,018,202,537	$539,481,200,000	46,507.00	$22,029,132
Ice Storm	$551,499,402,537	$12,018,202,537	$539,481,200,000	46,507.00	n/a
Landslide	$9,634,672,133	$136,447,844	$9,498,224,289	818.81	n/a
Lightning	$551,499,402,537	$12,018,202,537	$539,481,200,000	46,507.00	n/a
Riverine Flooding	$25,387,642,547	$560,213,125	$24,817,357,870	2,139.43	$10,071,552
Strong Wind	$551,521,503,665	$12,018,202,537	$539,481,200,000	46,507.00	$22,101,128
Tornado	$551,521,503,665	$12,018,202,537	$539,481,200,000	46,507.00	$22,101,128
Tsunami	n/a	n/a	n/a	n/a	n/a
Volcanic Activity	--	--	--	--	--
Wildfire	$38,008,583,062	$763,899,207	$37,237,425,794	3,210.12	$7,258,061
Winter Weather	$551,521,503,580	$12,018,202,537	$539,481,200,000	46,507.00	$22,101,043

Annualized Frequency Values

Hazard Type	Annualized Frequency	Events on Record	Period of Record
Avalanche	--	--	--

Hazard Type	Annualized Frequency	Events on Record	Period of Record
Coastal Flooding	3.8 events per year	n/a	Various (see documentation)
Cold Wave	0.1 events per year	1	2005-2021 (16 years)
Drought	12.3 events per year	308	2000-2021 (22 years)
Earthquake	0.044% chance per year	n/a	2021 dataset
Hail	2.8 events per year	69	1986-2021 (34 years)
Heat Wave	0.1 events per year	1	2005-2021 (16 years)
Hurricane	0.3 events per year	38	East 1851-2021 (171 years) / West 1949-2021 (73 years)
Ice Storm	1 event per year	49	1946-2014 (67 years)
Landslide	0 events per year	0	2010-2021 (12 years)
Lightning	138.3 events per year	2,191	1991-2012 (22 years)
Riverine Flooding	1.4 events per year	33	1996-2019 (24 years)
Strong Wind	1.6 events per year	39	1986-2021 (34 years)
Tornado	0.5 events per year	22	1950-2021 (72 years)
Tsunami	n/a	n/a	1800-2021 (222 years)
Volcanic Activity	--	--	--
Wildfire	0.738% chance per year	n/a	2021 dataset
Winter Weather	0.4 events per year	5	2005-2021 (16 years)

Historic Loss Ratios

Hazard Type	Overall Rating
Avalanche	--
Coastal Flooding	Very Low
Cold Wave	Very Low
Drought	Relatively High
Earthquake	Very Low
Hail	Relatively Low
Heat Wave	Relatively Low
Hurricane	Very High
Ice Storm	Relatively Low
Landslide	Relatively Moderate
Lightning	Relatively Moderate

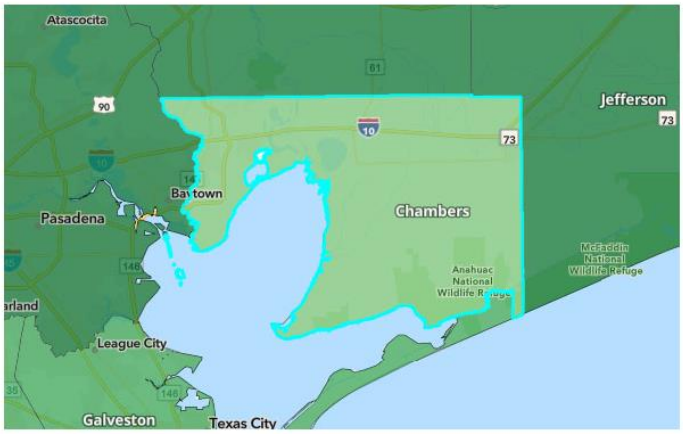
Hazard Type	Overall Rating
Riverine Flooding	Relatively Low
Strong Wind	Relatively Low
Tornado	Relatively Moderate
Tsunami	Insufficient Data
Volcanic Activity	--
Wildfire	Relatively Low
Winter Weather	Relatively Moderate

Expected Annual Loss Rate

Hazard Type	Building EAL Rate (per building value)	Population EAL Rate (per population)	Agriculture EAL Rate (per agriculture value)
Avalanche	--	--	--
Coastal Flooding	$1 per $51.66K	1 per 77.28M	--
Cold Wave	$1 per $5.77M	1 per 4.23M	$1 per $2.39K
Drought	--	--	$1 per $67.17
Earthquake	$1 per $333.94K	1 per 67.67M	--
Hail	$1 per $110.42K	1 per 12.27M	$1 per $4.09K
Heat Wave	$1 per $542.08M	1 per 11.16M	$1 per $17.81M
Hurricane	$1 per $532.44	1 per 550.05K	$1 per $306.09
Ice Storm	$1 per $1.46M	1 per 5.68M	--
Landslide	$1 per $2.67M	1 per 31.00M	--
Lightning	$1 per $1.47M	1 per 516.03K	--
Riverine Flooding	$1 per $3.64K	1 per 460.35K	$1 per $244.96
Strong Wind	$1 per $67.49K	1 per 2.44M	$1 per $4.17K
Tornado	$1 per $6.86K	1 per 167.35K	$1 per $39.49K
Tsunami	--	--	--
Volcanic Activity	--	--	--
Wildfire	$1 per $7.89K	1 per 4.97M	$1 per $12.90K
Winter Weather	$1 per $5.61M	1 per 9.62M	$1 per $78.37K

Social Vulnerability

Social groups in **Chambers County, TX** have a **Relatively Moderate** susceptibility to the adverse impacts of natural hazards when compared to the rest of the U.S.



Score	47.42

National Percentile
47.42

Percentile Within Texas
16.10

0 100

47% of U.S. counties have a lower Social Vulnerability

16% of counties in Texas have a lower Social Vulnerability

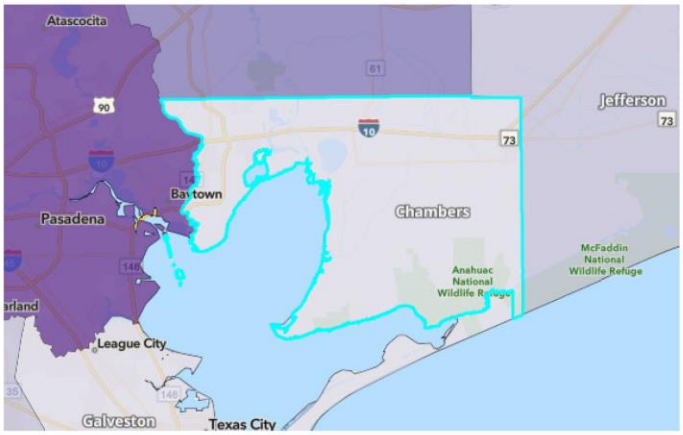
Social Vulnerability Legend

Very High | Relatively High | Relatively Moderate | Relatively Low | Very Low

Data Unavailable

Community Resilience

Communities in **Chambers County, TX** have a **Very High** ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to the rest of the U.S.



Score **91.88**

National Percentile

91.88

Percentile Within Texas

100.00

0 100

8% of U.S. counties have a higher Community Resilience

0% of counties in Texas have a higher Community Resilience

Community Resilience Legend

Very High | Relatively High | Relatively Moderate | Relatively Low | Very Low | Data Unavailable

About the National Risk Index

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.

The National Risk Index leverages available source data for Expected Annual Loss due to these 18 hazard types, Social Vulnerability, and Community Resilience to develop a baseline relative risk measurement for each United States county and Census tract. These measurements are calculated using average past conditions, but they cannot be used to predict future outcomes for a community. The National Risk Index is intended to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

Explore the National Risk Index Map at **hazards.fema.gov/nri/map**.

Visit the National Risk Index website at **hazards.fema.gov/nri/learn-more** to access supporting documentation and links.

Calculating the Risk Index

Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:

Risk Index = Expected Annual Loss × Social Vulnerability ÷ Community Resilience

Risk Index scores are presented as a composite score for all 18 hazard types, as well as individual scores for each hazard type.

For more information, visit **hazards.fema.gov/nri/determining-risk**.

Calculating Expected Annual Loss

Expected Annual Loss scores are calculated using an equation that combines values for exposure, annualized frequency, and historic loss ratios for 18 hazard types:

Expected Annual Loss = Exposure × Annualized Frequency × Historic Loss Ratio

Expected Annual Loss scores are presented as a composite score for all 18 hazard types, as well as individual scores for each hazard type.

For more information, visit **hazards.fema.gov/nri/expected-annual-loss**.

Calculating Social Vulnerability

Social Vulnerability is measured using the Social Vulnerability Index (SVI) published by the Centers for Disease Control and Prevention (CDC).

For more information, visit **hazards.fema.gov/nri/social-vulnerability**.

Calculating Community Resilience

Community Resilience is measured at the County level using the Baseline Resilience Indicators for Communities (HVRI BRIC) published by the University of South Carolina's Hazards and Vulnerability Research Institute (HVRI).

For more information, visit **hazards.fema.gov/nri/community-resilience**.

How to Take Action

There are many ways to reduce natural hazard risk through mitigation. Communities with high National Risk Index scores can take action to reduce risk by decreasing Expected Annual Loss due to natural hazards, decreasing Social Vulnerability, and increasing Community Resilience.

For information about how to take action and reduce your risk, visit **hazards.fema.gov/nri/take-action**.

Disclaimer

The National Risk Index (the Risk Index or the Index) and its associated data are meant for planning purposes only. This tool was created for broad nationwide comparisons and is not a substitute for localized risk assessment analysis. Nationwide datasets used as inputs for the National Risk Index are, in many cases, not as accurate as available local data. Users with access to local data for each National Risk Index risk factor should consider substituting

the Risk Index data with local data to recalculate a more accurate risk index. If you decide to download the National Risk Index data and substitute it with local data, you assume responsibility for the accuracy of the data and any resulting data index. Please visit the **Contact Us** page if you would like to discuss this process further.

The methodology used by the National Risk Index has been reviewed by subject matter experts in the fields of natural hazard risk research, risk analysis, mitigation planning, and emergency management. The processing methods used to create the National Risk Index have produced results similar to those from other natural hazard risk analyses conducted on a smaller scale. The breadth and combination of geographic information systems (GIS) and data processing techniques leveraged by the National Risk Index enable it to incorporate multiple hazard types and risk factors, manage its nationwide scope, and capture what might have been missed using other methods.

The National Risk Index does not consider the intricate economic and physical interdependencies that exist across geographic regions. Keep in mind that hazard impacts in surrounding counties or Census tracts can cause indirect losses in your community regardless of your community's risk profile.

Nationwide data available for some risk factors are rudimentary at this time. The National Risk Index will be continuously updated as new data become available and improved methodologies are identified.

The National Risk Index Contact Us page is available at **hazards.fema.gov/nri/contact-us**.

Appendix F – Results from Public Survey

Question 1:

Which jurisdiction in Chambers County are you located?

ANSWER CHOICES	RESPONSES	
Anahuac	10.00%	1
Beach City	20.00%	2
Mont Belvieu	10.00%	1
Cove	20.00%	2
Old River - Winfree	20.00%	2
Unincorporated Chambers County	20.00%	2
TOTAL		10

Question 2:

In the past five years, which of the following hazard events have you experienced in Chambers County? (Check all that apply)

ANSWER CHOICES		RESPONSES	
Climate Change		27.27%	3
Coastal Erosion		9.09%	1
Drought		81.82%	9
Extreme Temperatures (heat and cold)		72.73%	8
Flooding (Street/Land)		54.55%	6
Flooding (in a home or business)		9.09%	1
Geologic (Landslide, sinkholes, subsidence)		0.00%	0
Hurricane/Tropical Storms		54.55%	6
Tornado		0.00%	0
Severe Weather (high winds, lightning, hail)		63.64%	7
Severe Winter Storms (blizzard, heavy snow, ice)		18.18%	2
Wildfire		9.09%	1
Other (please specify)	Responses	9.09%	1
Total Respondents: 11			

Question 3:

How concerned are you about the following hazards in Chambers County? Please checkone for each hazard.

	NOT CONCERNED	SOMEWHAT CONCERNED	CONCERNED	VERY CONCERNED	EXTREMELY CONCERNED	TOTAL	WEIGHTED AVERAGE
Flooding - Street/Land	9.09% 1	9.09% 1	27.27% 3	9.09% 1	45.45% 5	11	3.73
Hurricane/Tropical Storm	9.09% 1	18.18% 2	18.18% 2	18.18% 2	36.36% 4	11	3.55
Flooding - in a home or business	9.09% 1	18.18% 2	27.27% 3	18.18% 2	27.27% 3	11	3.36
Drought	9.09% 1	18.18% 2	27.27% 3	27.27% 3	18.18% 2	11	3.27
Coastal Erosion	0.00% 0	27.27% 3	45.45% 5	18.18% 2	9.09% 1	11	3.09
Extreme Temperatures (heat and cold)	18.18% 2	36.36% 4	9.09% 1	18.18% 2	18.18% 2	11	2.82
Severe Weather (High winds, lightning, hail)	27.27% 3	9.09% 1	45.45% 5	9.09% 1	9.09% 1	11	2.64
Wildfire	18.18% 2	45.45% 5	18.18% 2	9.09% 1	9.09% 1	11	2.45
Tornado	45.45% 5	9.09% 1	18.18% 2	18.18% 2	9.09% 1	11	2.36
Climate Change	45.45% 5	27.27% 3	9.09% 1	9.09% 1	9.09% 1	11	2.09
Severe Winter Storms (blizzard, heavy snow, ice)	45.45% 5	36.36% 4	9.09% 1	0.00% 0	9.09% 1	11	1.91
Geologic (landslide, sinkholes, subsidence)	45.45% 5	27.27% 3	27.27% 3	0.00% 0	0.00% 0	11	1.82

Question 4:

Please check which hazard(s) have damaged your home. (Check all that apply)

ANSWER CHOICES		RESPONSES	
Climate Change		12.50%	1
Drought		62.50%	5
Extreme Temperatures (heat and cold)		37.50%	3
Flooding (Street/Land)		37.50%	3
Flooding (in a home or business)		25.00%	2
Geologic (Landslide, sinkholes, subsidence)		0.00%	0
Hurricane/Tropical Storm		62.50%	5
Tornado		12.50%	1
Severe Weather (high winds, lightning, hail)		50.00%	4
Severe Winter Storms (blizzard, heavy snow, ice)		37.50%	3
Wildfire		0.00%	0
If yes, please specify the damage sustained and or the event that caused the damage	Responses	12.50%	1
Total Respondents: 8			

Question 5:

How effective do you think the following methods are for providing hazard and disaster information?

	VERY EFFECTIVE	SOMEWHAT EFFECTIVE	NOT EFFECTIVE	UNSURE	TOTAL	WEIGHTED AVERAGE
Mass Notification System	81.82% 9	18.18% 2	0.00% 0	0.00% 0	11	1.18
Internet	63.64% 7	27.27% 3	9.09% 1	0.00% 0	11	1.45
TV	54.55% 6	27.27% 3	18.18% 2	0.00% 0	11	1.64
Social Media	54.55% 6	36.36% 4	0.00% 0	9.09% 1	11	1.64
City Website	27.27% 3	54.55% 6	18.18% 2	0.00% 0	11	1.91
County Website	27.27% 3	45.45% 5	27.27% 3	0.00% 0	11	2.00
Telephone	36.36% 4	27.27% 3	27.27% 3	9.09% 1	11	2.09
Radio	18.18% 2	45.45% 5	27.27% 3	9.09% 1	11	2.27
Schools	0.00% 0	72.73% 8	18.18% 2	9.09% 1	11	2.36
Public Meetings or Awareness Events	18.18% 2	27.27% 3	45.45% 5	9.09% 1	11	2.45
Outdoor Advertisement	18.18% 2	27.27% 3	45.45% 5	9.09% 1	11	2.45
Newspaper	0.00% 0	27.27% 3	63.64% 7	9.09% 1	11	2.82
Public Library	0.00% 0	36.36% 4	45.45% 5	18.18% 2	11	2.82

Question 6:

A number of activities can reduce your community's risk from natural hazards. These activities can be both regulatory and non-regulatory. Please check the box that best represents your opinion on the following strategies to reduce the risk and loss associated with natural hazards in Chambers County (in the Jurisdictions of Anahuac, Beach City, Cove, Mont Belvieu, and Old River-Winfree).

	STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE	NOT SURE	TOTAL	WEIGHTED AVERAGE
Making local water, wastewater infrastructure, and other public facilities more disaster resilient	90.91% 10	9.09% 1	0.00% 0	0.00% 0	0.00% 0	0.00% 0	11	1.09
Making your home more disaster resilient	72.73% 8	18.18% 2	9.09% 1	0.00% 0	0.00% 0	0.00% 0	11	1.36
Protect historical and cultural assets	63.64% 7	27.27% 3	9.09% 1	0.00% 0	0.00% 0	0.00% 0	11	1.45
Enforce the disclosure of natural hazard risks during real estate transactions	63.64% 7	27.27% 3	9.09% 1	0.00% 0	0.00% 0	0.00% 0	11	1.45
Policies that prohibit development in areas subject to natural hazards	54.55% 6	36.36% 4	0.00% 0	0.00% 0	9.09% 1	0.00% 0	11	1.73
Improve disaster preparedness of local schools	54.55% 6	27.27% 3	9.09% 1	0.00% 0	9.09% 1	0.00% 0	11	1.82
Regulatory approach to reducing risk (e.g. Zoning, Building Codes, Ordinances)	36.36% 4	36.36% 4	18.18% 2	9.09% 1	0.00% 0	0.00% 0	11	2.00
Combination of regulatory (policies and standards) as well as nonregulatory (education and awareness) approaches to reducing risk	36.36% 4	45.45% 5	9.09% 1	0.00% 0	9.09% 1	0.00% 0	11	2.00
Develop local inventory of at-risk buildings and infrastructure	36.36% 4	36.36% 4	18.18% 2	0.00% 0	9.09% 1	0.00% 0	11	2.09

Question 7:

Natural hazards can have a significant impact on a community, but planning for these events can help lessen the impacts. The following statements will help us determine the priorities of our residents regarding planning for natural hazards in Chambers County. Please tell us how important each one is to you.

	VERY IMPORTANT	SOMEWHAT IMPORTANT	NEUTRAL	NOT VERY IMPORTANT	NOT IMPORTANT	TOTAL	WEIGHTED AVERAGE
Protecting and reducing damages to utilities	100.00% 11	0.00% 0	0.00% 0	0.00% 0	0.00% 0	11	1.00
Protecting private property	90.91% 10	0.00% 0	9.09% 1	0.00% 0	0.00% 0	11	1.18
Protecting critical facilities and essential community services	81.82% 9	9.09% 1	9.09% 1	0.00% 0	0.00% 0	11	1.27
Promoting cooperation among public agencies, residents, non-profit organizations, and local businesses	81.82% 9	9.09% 1	9.09% 1	0.00% 0	0.00% 0	11	1.27
Strengthening emergency services (e.g., police, fire, EMS)	72.73% 8	18.18% 2	9.09% 1	0.00% 0	0.00% 0	11	1.36
Disclosing natural hazard risks during real estate transactions	72.73% 8	18.18% 2	9.09% 1	0.00% 0	0.00% 0	11	1.36
Preventing development in hazard areas (e.g., restrict building in the floodplain)	63.64% 7	18.18% 2	18.18% 2	0.00% 0	0.00% 0	11	1.55
Enhance the functions of natural features (e.g., streams, wetlands)	63.64% 7	18.18% 2	18.18% 2	0.00% 0	0.00% 0	11	1.55
Expand emergency management and preparedness programs	45.45% 5	36.36% 4	9.09% 1	9.09% 1	0.00% 0	11	1.82
Protecting historical and cultural landmarks	36.36% 4	27.27% 3	36.36% 4	0.00% 0	0.00% 0	11	2.00

Question 8:

In the following list, please check those activities that you have done in your home, plan to do in the near future, have not done, or are unable to do. Please check one answer for each activity that you or someone in your household have done.

	HAVE DONE	PLAN TO DO	NOT DONE	UNABLE TO DO	TOTAL
Developed an emergency plan for your home and family in order to decide what everyone will do in the event of a disaster or emergency	81.82% 9	18.18% 2	0.00% 0	0.00% 0	11
Talked with members in your home about what to do in case of a natural disaster or emergency	72.73% 8	18.18% 2	9.09% 1	0.00% 0	11
Reviewed the National Weather Service's Hurricane and Severe Weather Guide	72.73% 8	0.00% 0	27.27% 3	0.00% 0	11
Become trained in first aid and/or CPR	63.64% 7	9.09% 1	27.27% 3	0.00% 0	11
Attend meetings or received information on natural disasters or emergency preparedness	54.55% 6	0.00% 0	45.45% 5	0.00% 0	11
Discussed or created a utility shutoff procedure in the event of a natural disaster	45.45% 5	9.09% 1	45.45% 5	0.00% 0	11
Prepared a disaster supply kit with extra food, water, batteries, etc.	36.36% 4	36.36% 4	27.27% 3	0.00% 0	11
Searched the County's website for disaster preparedness information	36.36% 4	9.09% 1	54.55% 6	0.00% 0	11
Reviewed FEMA's "Ready" website (helping the public prepare for, respond to, and mitigate emergencies) located on the Chambers County OEM Website.	18.18% 2	27.27% 3	54.55% 6	0.00% 0	11

Question 9:

Is your home located in a FEMA-designated floodplain?

ANSWER CHOICES	RESPONSES	
Yes	18.18%	2
No	45.45%	5
Unsure	36.36%	4
TOTAL		11

Question 10:

Do you have flood insurance and have you ever had problems obtaining flood insurance?

	YES	NO	NOT SURE	TOTAL	WEIGHTED AVERAGE
Do you have flood insurance?	45.45% 5	54.55% 6	0.00% 0	11	1.55
Have you ever had problems obtaining flood insurance?	0.00% 0	63.64% 7	36.36% 4	11	2.36

Question 11:

What types of projects do you believe the County should be doing in order to reduce damage and disruption from hazard events within Chambers County? Please rank each option as high, medium or low priority.

	HIGH	MEDIUM	LOW	TOTAL	WEIGHTED AVERAGE
Capital projects such as lift stations, elevate critical facilities, drainage improvements and bank stabilization projects	81.82% 9	9.09% 1	9.09% 1	11	1.27
Retrofit infrastructure such as roads, bridges, drainage facilities, water supply, waste water and power supply facilities	81.82% 9	9.09% 1	9.09% 1	11	1.27
Perform projects that restore the natural environments capacity to absorb the impacts from natural hazards	63.64% 7	36.36% 4	0.00% 0	11	1.36
Retrofit and strengthen essential facilities such as police, fire, schools and hospitals	72.73% 8	18.18% 2	9.09% 1	11	1.36
Strengthen codes and regulations to include higher regulatory standards in hazard area	45.45% 5	45.45% 5	9.09% 1	11	1.64
Provide better public information about risk, and the exposure to hazards within the City	45.45% 5	36.36% 4	18.18% 2	11	1.73
Acquire vulnerable properties and maintain as open space	45.45% 5	36.36% 4	18.18% 2	11	1.73
Perform projects that mitigate the potential impacts from climate change	30.00% 3	60.00% 6	10.00% 1	10	1.80
Assist vulnerable property owners with securing funding for mitigation	36.36% 4	45.45% 5	18.18% 2	11	1.82