Refugio County

Multi-Hazard Mitigation Plan

2022

"Under the Federal Disaster Mitigation Act of 2000 (DMA 2000 or "the Act"), Refugio County (County) is required to have a Federal Emergency Management Agency ("FEMA") - approved Local Hazard Mitigation Plan ("the Plan") in order to be eligible for certain pre- and post-disaster mitigation funds. Adoption of this Plan by the County and approval by FEMA will serve the dual objectives of providing direction and guidance on implementing hazard mitigation in the County, and qualify the County to obtain federal assistance for hazard mitigation. Solely to help achieve these objectives, the Plan attempts to systematically identify and address hazards that can affect the County. Nothing in this Plan is intended to be an admission, either expressed or implied, by or on behalf of the County, of any County obligation, responsibility, duty, fault or liability for any particular hazard or hazardous condition, and no such County obligation, responsibility, duty, fault or liability should be inferred or implied from the Plan, except where expressly stated."

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1. Introduction and Background

1) Participating Jurisdictions

The Refugio County Multi-Hazard Mitigation plan includes seven participating jurisdictions: Refugio County, the Town of Bayside, the Town of Refugio, the Town of Woodsboro, Austwell-Tivoli Independent School District, Refugio Independent School District, Woodsboro Independent School District, and the Refugio County Water Control and Improvement District #1.

This plan is an update of the County's current plan that expires in January 2022. That plan, the Refugio County Mitigation Action Plan, also included the Town of Refugio, the Town of Woodsboro, Refugio Independent School District, Woodsboro Independent School District. The Town of Bayside, Austwell-Tivoli Independent School District, and the Refugio County Water Control and Improvement District #1 are new participants. The City of Austwell chose not to participate in the plan.

2) Hazards to be Addressed

The current plan addresses the following natural hazards: floods, hurricanes / tropical storms, wildfire, tornados, drought, extreme heat, hailstorms, winter weather, severe winds, lightning, and coastal erosion. The current plant will also address a new hazard: expansive soils.

For the update each participating jurisdiction will address the following natural hazards identified as threats throughout Texas in the State's 2018 hazard mitigation plan:

Hazard	Jurisdiction							
	Refugio County	Town of Bayside	Town of Refugio	Town of Woodsboro	Austwell-Tivoli ISD	Refugio ISD	Woodsboro ISD	WCID #1
Hurricanes, Tropical Storms and Depressions	x	x	x	x	x	x	x	x
Drought	x	x	x	x	x	x	x	x
Hailstorm	x	x	x	x	x	x	x	x
Severe Coastal Flooding	x	x	x	x				
Riverine Flooding	x	x	x	x	x	x	x	x
Tornados	x	x	x	x	x	x	x	x
Severe Winds	x	x	x	x	x	x	x	x
Wildfire	x	x	x	x	x	x	x	x
Winter Weather	x	x	x	x	x	x	x	x
Lightning	x	x	x	x	x	x	x	x
Extreme Cold	x	x	x	x	x	x	x	x
Extreme Heat	x	x	x	x	x	x	x	x
Additional Optional Hazards								
Coastal Erosion	x	x						
Inland Erosion								
Land Subsidence / Sinkhole								
Earthquakes								
Expansive Soils	x	x	x	x	x	x	x	x

Dam / Levee Failure								

Omission Statements

Refugio County will not be addressing the following hazards: Inland Erosion, Land Subsidence/Sinkhole, Earthquakes, or Dam/Levee Failure. The history of impacts for all the omitted hazards have been negligible (or non-existent), therefore the County expects that future impacts will be negligible as well, nor does the County anticipate submitting an application for grant funding to address any of them.

The Town of Bayside will not be addressing the following hazards: Inland Erosion, Land Subsidence/Sinkhole, Earthquakes, or Dam/Levee Failure. The history of impacts for all the omitted hazards have been negligible (or non-existent), therefore the Town expects that future impacts will be negligible as well, nor does the Town anticipate submitting an application for grant funding to address any of them.

The Town of Refugio will not be addressing the following hazards: Coastal Erosion, Inland Erosion, Land Subsidence/Sinkhole, Earthquakes, or Dam/Levee Failure. The history of impacts for all the omitted hazards have been negligible (or non-existent), therefore the Town expects that future impacts will be negligible as well, nor does the Town anticipate submitting an application for grant funding to address any of them.

The Town of Woodsboro will not be addressing the following hazards: Coastal Erosion, Inland Erosion, Land Subsidence/Sinkhole, Earthquakes, or Dam/Levee Failure. The history of impacts for all the omitted hazards have been negligible (or non-existent), therefore the Town expects that future impacts will be negligible as well, nor does the Town anticipate submitting an application for grant funding to address any of them.

Austwell-Tivoli ISD will not be addressing the following hazards: Severe Coastal Flooding, Coastal Erosion, Inland Erosion, Land Subsidence/Sinkhole, Earthquakes, or Dam/Levee Failure. The history of impacts for all the omitted hazards have been negligible (or non-existent), therefore the ISD expects that future impacts will be negligible as well, nor does the ISD anticipate submitting an application for grant funding to address any of them.

Refugio ISD will not be addressing the following hazards: Severe Coastal Flooding, Coastal Erosion, Inland Erosion, Land Subsidence/Sinkhole, Earthquakes, or Dam/Levee Failure. The history of impacts for all the omitted hazards have been negligible (or non-existent), therefore the ISD expects that future impacts will be negligible as well, nor does the ISD anticipate submitting an application for grant funding to address any of them.

Woodsboro ISD will not be addressing the following hazards: Severe Coastal Flooding, Coastal Erosion, Inland Erosion, Land Subsidence/Sinkhole, Earthquakes, or Dam/Levee Failure. The history of impacts for all the omitted hazards have been negligible (or non-existent), therefore the ISD expects that future impacts will be negligible as well, nor does the ISD anticipate submitting an application for grant funding to address any of them.

Refugio County WCID #1 will not be addressing the following hazards: Severe Coastal Flooding, Coastal Erosion, Inland Erosion, Land Subsidence/Sinkhole, Earthquakes, or Dam/Levee Failure. The history of impacts for all the omitted hazards have been negligible (or non-existent), therefore the ISD expects that future impacts will be negligible as well, nor does the ISD anticipate submitting an application for grant funding to address any of them.

2. Planning Process

The Refugio County Multi-Hazard Mitigation Plan is a multi-jurisdiction plan. Representatives to the local planning team were selected by each jurisdiction. Planning team members represented the following offices and departments:

Table 1: Local Planning Team Representatives

Title	Jurisdiction
Emergency Management Coordinator	Refugio County
County Judge	Refugio County
Mayor	Town of Bayside
Superintendent	Refugio ISD
Mayor	Town of Refugio
Office Manager	Refugio Co WCID #1
Superintendent	Woodsboro ISD
Mayor	Town of Woodsboro
Superintendent	Austwell-Tivoli ISD

Once the planning team was established, members developed a schedule with specific goals and proposed meeting dates over the planning period.

Table 2: Plan Schedule

	Timeline												
Planning Tasks	2021												Completed
	January	February	March	April	May	June	July	August	Sept	Oct	Nov	Dec	
Organize Resources and Identify Planning Team													
Create Outreach Strategy													
Review Community Capabilities													
Conduct Risk Assessment													
Identify Mitigation Goals and Actions													
Develop Action Plan for Implementation													
Identify Plan Maintenance Procedures													
Review Plan Draft													
Submit Plan to State and FEMA													12/09/2021
Adopt Plan													5/24/2022
	Meetings												
Planning Team			3/4/2021		5/18/2021			8/5/2021					
Public Outreach – Online Surveys													
Stakeholder Outreach													

1) Existing Plans, Reports, Ordinances, and Technical Information Sources

Each planning team member worked to collect and provide the input and information necessary to develop the hazard mitigation strategy. Research was coordinated and conducted by local planning team members. The local planning team reviewed the following documents during the planning process:

Table 3: Planning Team Data Sources

Data Source	Data Incorporation	Purpose
Federal Emergency Management Agency (FEMA) Flood Zones	Flood zone maps	GIS mapping of flood zones
National Centers for Environmental Information (NCEI)	Hazard occurrences	Previous event occurrences, damage dollars, and mapping for all hazards
National Inventory of Dams	Dam information	High-hazard dam list
National Oceanic and Atmospheric Administration (NOAA)	Historic Weather Data	Previous event occurrences, damage dollars, and mapping for all hazards
National Severe Storms Laboratory (NSSL)	Historic Weather Data	Previous event occurrences, damage dollars, and mapping for all severe storms
National Weather Service (NWS), Shreveport, LA Office	Historic Weather Data	Previous event occurrences, damage dollars, and mapping for all hazards
Region C 2016 Water Plan	Determining changing drought impacts	Review expected changes in type / volume of local water demands
Refugio County 2018 CHAMPS Report	Natural hazard data	Review previously compiled natural hazard histories.
Refugio County Appraisal District Data	Property values and parcel counts	Population counts, parcel data, and land use data
Refugio County Hazard Mitigation Plan, 2017-2022	Previous planning approach, hazards addressed, and mitigation actions	Previous planning team representatives, plan maintenance, hazard histories, and mitigation actions
State of Texas Hazard Mitigation Plan 2018 Update	Hazard Descriptions	Official descriptions of hazards and their potential impacts

Additional information sources included: USDA Census of Agriculture, United States Geological Survey, Vaisala, and specific details about previous natural hazard events from planning team participants, the Emergency Management Coordinator in particular. Sources are noted throughout the document. Report titles and links to the most recently accessed websites hosting the related information are also noted, where appropriate.

Area stakeholders contacted to participate in the planning process included the following offices and departments within the participating jurisdictions and neighboring jurisdictions:

Table 4: Local Stakeholders Contacted

Title	Agency or Department	Participated
Emergency Management Coordinator	San Patricio County	N
Emergency Management Coordinator	Victoria County	Y
Fire Chief	Bayside Volunteer Fire Department	N
County Judge	Aransas County	Y

Area stakeholders were contacted by email. In an effort to increase participation, each stakeholder was contacted at least twice. Area stakeholders who chose to participate provided important supplemental input and information that helped shape mitigation strategies for each hazard, in particular by making the planning team aware of hazard areas that had not been previously identified.

2) Project Meetings

The planning team met virtually on three separate occasions. Additional communication was regularly carried out via email and over the phone.

The first planning team meeting was held virtually on March 4th, 2020. During this meeting, the planning team decided which hazards needed to be addressed in the mitigation plan and which were not relevant. To make these decisions, a hazard handout was produced to show previous occurrences of each hazard, associated deaths and injuries, and total dollar damages.

The team agreed to use the collected hazard data, as the foundation for its hazard risk assessment and ongoing research into hazard extent, impact, and vulnerability.

The planning team also identified area stakeholders to be contacted in the time between the second and third meeting.

At the end of the meeting, Planning team members agreed to compile relevant data, including city ordinances, and begin identifying critical facilities.

The second planning team meeting was held virtually on May 18th, 2021. Prior to the meeting, planning team members were provided with information about the meeting's scope based on the information the team had gathered between meetings.

To stay on schedule, the planning team needed to meet four objectives: Review and tentatively approve the critical facilities list; review previous mitigation actions and determine whether or not they were implemented and successful; and start identifying future mitigation actions appropriate to the natural hazards identified in the first planning team meeting.

The planning team met its objectives.

The final planning team meeting was held virtually on August 5th, 2021. The planning team discussed and identified new mitigation actions, discussed final changes to the plan drafts, and agreed to work on completing all deliverables for the plan. Additional work was done over email in preparation for submitting the plan for official review on December 9th, 2021.

3) Public Input

Members of the public were invited to participate in two public comment periods to provide input and feedback during the planning process. Due to the COVID-19 pandemic, the public comment periods were held virtually. The first public comment period took place in June and July 2021. A Google Form survey was posted to the County website for a period of two weeks for members of the public to fill out. No responses were received for the survey.

The second public comment period took place in November and December 2021. A copy of the in-progress plan draft was posted to the County website for two weeks for the public to review and comment on. This public comment period was advertised in the newspaper and shared on social media. No responses were received for the survey.

4) Plan Maintenance

The hazard mitigation plan is not a static document. As conditions change and mitigation actions are implemented, the plan will need to be updated to reflect new and changing conditions in each jurisdiction.

The planning team has identified specific departments to oversee action implementation in each jurisdiction. The planning team has also identified potential funding sources and an implementation timeframe for each mitigation action. The expected timeframes will be an important component in determining whether or not actions are implemented efficiently. The departments or persons identified for each jurisdiction include but are not limited to:

Table 5: Maintenance Responsibility

Title	Jurisdiction
Emergency Management Coordinator	Refugio County
County Judge	Refugio County
Mayor	Town of Bayside
Superintendent	Refugio ISD
Mayor	Town of Refugio
Office Manager	Refugio Co WCID #1
Superintendent	Woodsboro ISD
Mayor	Town of Woodsboro
Superintendent	Austwell-Tivoli ISD

Within one year of adoption of this plan, each department or agency will review and, as appropriate, integrate implementation of their respective mitigation actions with their existing internal plans and policies relating to capital improvements, land use, design and construction, and emergency management.

On a biannual basis, representatives from each jurisdiction serving as the planning team will evaluate progress on implementing the plan's mitigation actions. The planning team will review departmental / agency findings, public input, and future development plans to evaluate the effectiveness and appropriateness of the plan.

In light of changing funding sources, hazard vulnerability, and local mitigation priorities, the planning team will identify changes to plan goals and priorities for their respective jurisdictions, and they will report their findings to the rest of the planning team. It will be the planning team's responsibility to identify relevant reasons for delay or obstacles to completing the plan's mitigation actions, along with recommended strategies to overcome any deficiencies.

Any significant change to the plan, including but not limited to changing mitigation actions, abandoning mitigation actions, or pursuing new mitigation actions, will require the County and participating jurisdictions to provide opportunities for the public to make its views and concerns known. Refugio County and the participating jurisdictions will provide notice to the public through announcements in the local paper, fliers posted at city hall or other government buildings, and on the jurisdictions' website.

5) Plan Monitoring

The Refugio County Emergency Management Coordinator (EMC) will be responsible for the overall continued coordination and monitoring of the mitigation plan in its entirety, including but not limited to the planning process, risk assessment, strategy, and the actions assigned for each hazard. The agency or department identified above in Table 5 shall serve as the responsible party for each respective jurisdiction. The plan monitoring worksheet outlined below will serve as the basis for revision of the plan.

At a minimum, the mitigation plan will be reviewed by the EMC and planning team representatives from each jurisdiction quarterly, during budget workshops, and as other plans are being developed or revised including comprehensive plans, capital improvement project plans, and emergency plans.

To execute the monitoring requirement, the EMC will produce a plan monitoring worksheet to be completed by each jurisdiction's representative. The worksheet will identify and track the following for each mitigation action: the expected implementation schedule, setbacks or delays, changes to the local risk assessment, changes in jurisdictional capabilities, and current and future opportunities for integration with other local plans.

Regularly monitoring the plan implementation process in each participating jurisdiction will ensure that every component of the plan gets reviewed for potential amendments.

After adoption of this plan, it will be posted to each participating jurisdiction's website or Facebook page, and a printed copy will be available for review in the Office of Emergency Management. The goal is to create the opportunity for constant and continued feedback from local officials, stakeholders, and the general public.

6) Plan Evaluation

Proper evaluation will measure the progress and effectiveness of the mitigation actions identified in the plan. On a bi-annual basis the Emergency Management Coordinator along with the planning team representatives from each jurisdiction will use the following criteria, along with additional metrics as necessary, to assess the effectiveness of the plan in its entirety, including but not limited to the planning process, risk assessment, strategy, and the actions:

- Do the specified goals and objectives still address current and expected conditions?
- Has the nature, magnitude, and/or risk of any hazard changed?
- Have there been changes in land development that the plan needs to address?
- Are available resources suitable for implementing the plan?
- Is funding budgeted or available to successfully implement prioritized mitigation actions?

- Are there opportunities in the local budgeting process or local, state, and national grant funding cycles to increase funding to implement mitigation actions?

Other steps will include site visits to completed mitigation projects in each jurisdiction to measure and ensure their success. In the event that a mitigation project fails to meet its goal, the planning team will evaluate the causes of the shortcoming. The planning team will use their assessment to amend the project and related projects in other jurisdictions, allocate additional resources to achieve the desired outcome for the project and related projects in other jurisdictions, or replace the project and similar projects in other jurisdictions with better projects.

The EMC and planning team members will also work to implement any additional revisions required to ensure that the plan and their respective jurisdiction is in full compliance with federal regulations and state statutes.

7) Plan Update

The plan is designed to address a five-year period. In accordance with 44CFR Section 201.6, it will be updated every five years to maintain compliance with State and Federal regulations. However, at least every two years from the date of approval, and quarterly on the fifth and final year of the plan, the EMC and planning team representatives from each participating jurisdiction will thoroughly review any significant changes in their respective jurisdictions that might impact the plan update.

During the update process, planning team representatives will do the following for their respective jurisdictions: collect data on recent occurrences of each natural hazard identified in the plan, record how each natural hazard impacted their jurisdiction during the preceding years, determine whether or not implemented mitigation actions produced the desired outcomes in their jurisdiction, and determine whether or not to modify their jurisdiction's list of hazards to be addressed in the update.

Additional considerations to address on a jurisdictional level include but are not limited to: changes in local development, changes in exposure to natural hazards, the development of new mitigation capabilities or techniques, and revisions to state or federal legislation.

The update process will provide continued opportunity for the public and elected officials to determine which actions succeeded, failed, or are no longer relevant. It is also an opportunity for each jurisdiction to identify recent losses due to natural hazards and to consider whether or not any of those losses could have been avoided.

3. Determining Risk

1) Risk Assessment

Throughout the plan, each hazard addressed will consider its history, likelihood of future occurrence, extent, jurisdictional vulnerability, location and impact.

Likelihood of Future Occurrence is measured based on a hazard's expected frequency of occurrence based on its previous frequency. Each hazard's likelihood of occurrence will be considered using the following standardized parameters:

- Highly likely – event probable in the next year
- Likely – event probable in the next three years
- Occasional – event possible in the next five years
- Unlikely – event possible in the next 10 years

Given this plan's five-year duration, hazards likely to occur during that period will be given priority when selecting and prioritizing mitigation actions.

2) Distribution of Property by Housing Units, Density, and Median Value

Category	Refugio County	Town of Bayside	Town of Refugio	Town of Woodsboro
Total Housing Units[1]	3,732	283	1,354	655
Housing Unit Density (per sq. mile)	4.6 units/sq mi	259.7/sq mi	862.4/sq mi	655/sq mi
Median Housing Value[2]	$85,600	$89,700	$78,300	$76,000
Estimated Value of Housing Units[3]	$319,459,200	$25,385,100	$106,018,200	$49,780,000

[1] Table B25001 2015-2019 ACS Estimates
[2] Table B25077 2015-2019 ACS Estimates
[3] Total value of housing units derived from median value multiplied by number of units

3) Distribution of Vulnerable Populations

The planning team identified a set of indicators it could use to identify each jurisdiction's vulnerable population. The indicators include demographic data like age and income, as well as geographic data including the location of low income or subsidized housing units, concentrations of manufactured and mobile homes, and concentrations of homes in substandard condition.

Age, Disability, and Income

The populations of each jurisdiction were broken down into four categories: young residents, elderly residents, disabled residents, and low-income residents. Residents falling into these categories were deemed most likely to suffer disproportionate losses due to natural hazards because of their potentially limited means to prepare for and recover from a hazard event.

Demographic Category	Refugio County	Town of Bayside	Town of Refugio	Town of Woodsboro	Texas	U.S.
Population Under Age 5[4]	5.9%	3.3%	6.8%	5.0%	7.1%	6.1%
Population Over Age 65[5]	21.6%	27%	18.7%	22.8%	12.3%	15.6%
Disability Status[6]	21.6%	24.6%	23.7%	21.2%	11.5%	12.7%
Individuals Below Poverty Level[7]	16.5%	26.1%	21.2%	18.0%	14.7%	12.3%

Distribution of Vulnerable Populations

The vulnerable populations map is based on a social vulnerability index created specifically for the planning area. The index considers six relevant Census Block Group-level factors: poverty rate, population of residents 65 years old and older, population of residents younger than 18, the population of residents without a high school diploma or GED, the population of residents with a low English proficiency, and the number of homes constructed before 1980.

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[4] Table S0101, Age and Sex, 2015-2019 ACS 5-Year Estimates
[5] Table S0101, Age and Sex, 2015-2019 ACS 5-Year Estimates
[6] Table S1810, Disability Characteristics, 2019 ACS 5-Year Estimates
The U.S. Census defines a person as having a work disability if one or more of the following conditions are met:
1. Persons with a health problem or disability which prevents them from working or which limits the kind or amount of work they can do
2. Persons who have retired or left a job for health reasons
3. Persons currently not in the labor force because of a disability.
4. Persons who did not work at all in the previous year because of illness or disability
5. Under 65 years old and covered by Medicare in previous year.
6. Under 65 years old and received Supplemental Security Income (SSI) in previous year.
7. Received VA disability income in previous year.
[7] Table DP03, Selected Economic Characteristics, 2019 ACS 5-Year Estimates Data Profiles

To create the index, each factor is re-scaled by assigning the largest population in each category a score of 1. The remaining population counts for each category are then given a score based the ratio of the relevant population to the largest population. Once each factor has a re-scaled score, the scores for each factor are totaled to create an overall index number for each Census Block Group. The vulnerable populations map is representative of each Census Block Group's overall vulnerability, based on the six factors outlined above, relative to the other Census Block Groups in the planning area.

Vulnerability Maps

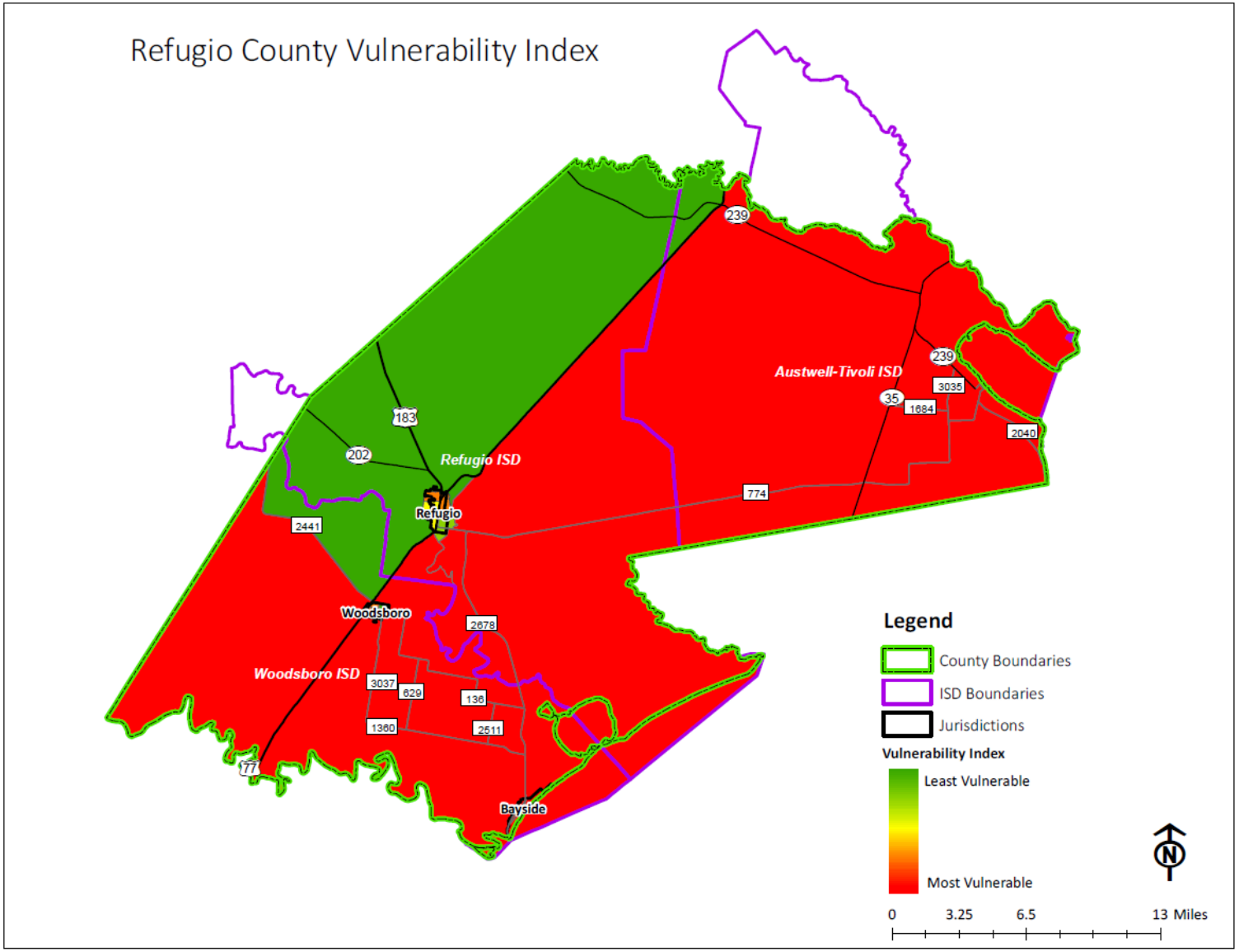

Figure 1: Refugio County and Jurisdictions Vulnerability Index

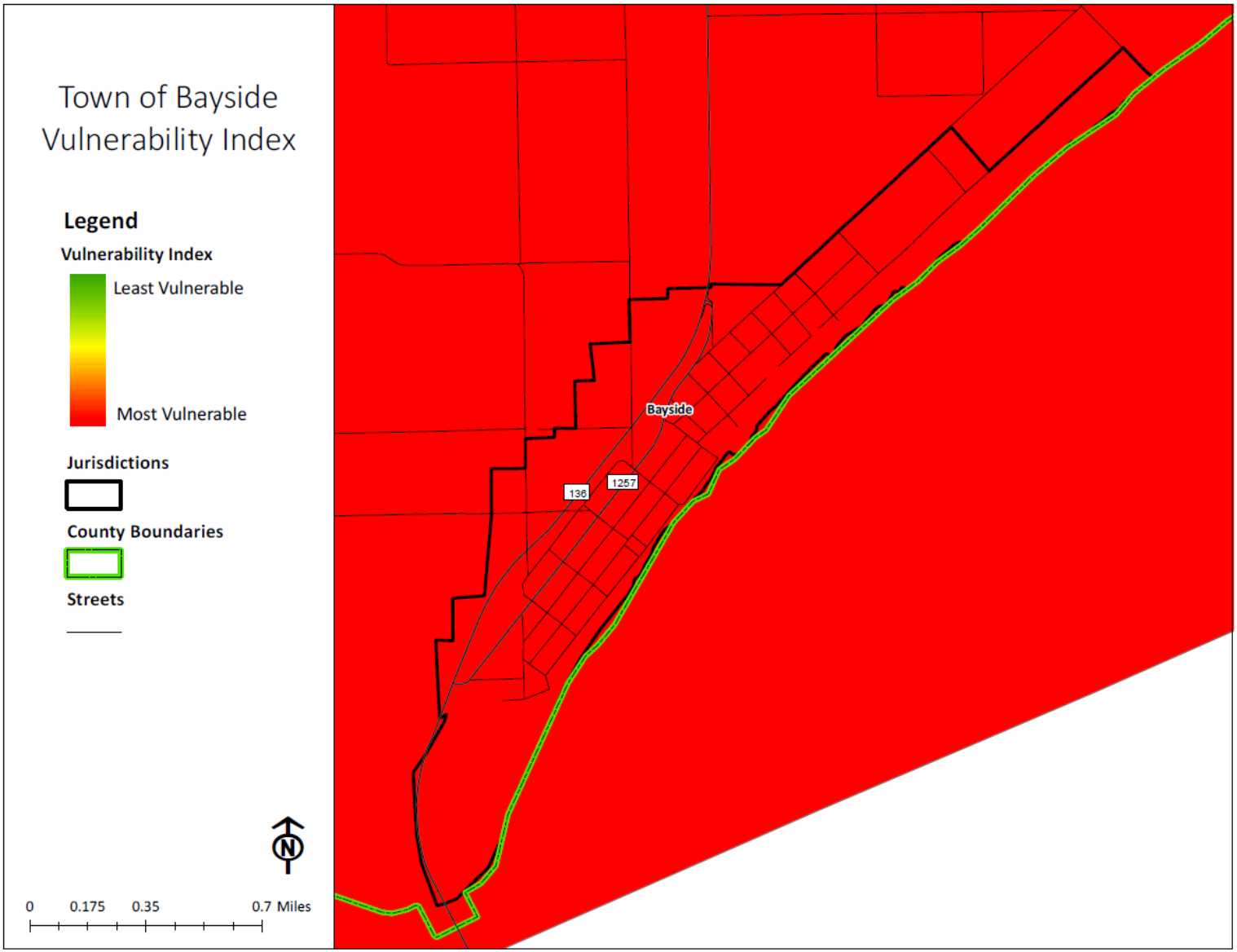

Figure 2: Town of Bayside Vulnerability Index

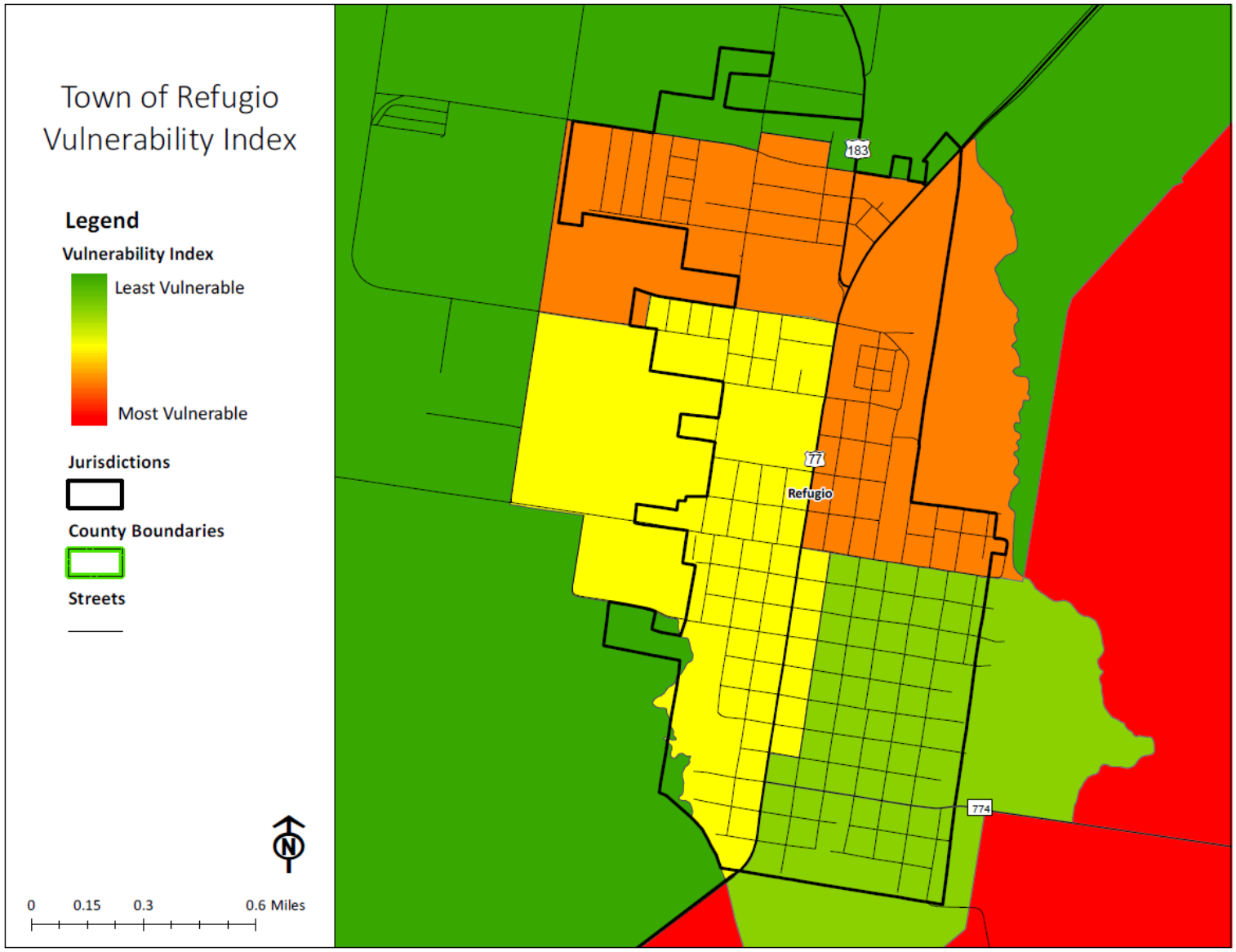

Figure 3: Town of Refugio Vulnerability Index

Figure 4: Town of Woodsboro Vulnerability Index

4. Hurricanes / Tropical Storms

Once a tropical depression has intensified to the point where its maximum sustained winds are between 35-64 knots (39 – 73 mph), it becomes a tropical storm. At these wind speeds the storm becomes more organized and begins to become more circular in shape – resembling a hurricane. The rotation of a tropical storm is more recognizable than for a tropical depression. Tropical storms can cause many problems without becoming a hurricane. However, most of the problems a tropical storm causes stem from heavy rainfall and high winds.

According to National Oceanic and Atmospheric Administration (NOAA), a hurricane is an intense tropical weather system of strong thunderstorms with a well-defined surface circulation and maximum sustained winds of 74 mph or higher. Hurricanes are categorized according to the strength of their winds using the Saffir-Simpson Hurricane Scale. A Category 1 storm has the lowest wind speeds, while a Category 5 hurricane has the highest. These are relative terms, because lower category storms can sometimes inflict greater damage than higher category storms, depending on where they strike and the specific hazards they can cause. In fact, tropical storms can also produce significant damage and loss of life, mainly due to flooding.

The ingredients for a hurricane include a pre-existing weather disturbance, warm tropical oceans, moisture, and relatively light winds aloft. If the right conditions persist long enough, they can combine to produce the violent winds, incredible waves, torrential rains, and floods associated with this phenomenon.

According to the 2018 Texas State Hazard Mitigation Plan, the pattern of increasing average hurricane intensity and changes in average sea level will contribute to the annual increase in expected damages from hurricanes. Increasing levels of atmospheric moisture will cause increasing damage impacts from the total amount of rainfall that occurs during tropical storms/hurricanes.

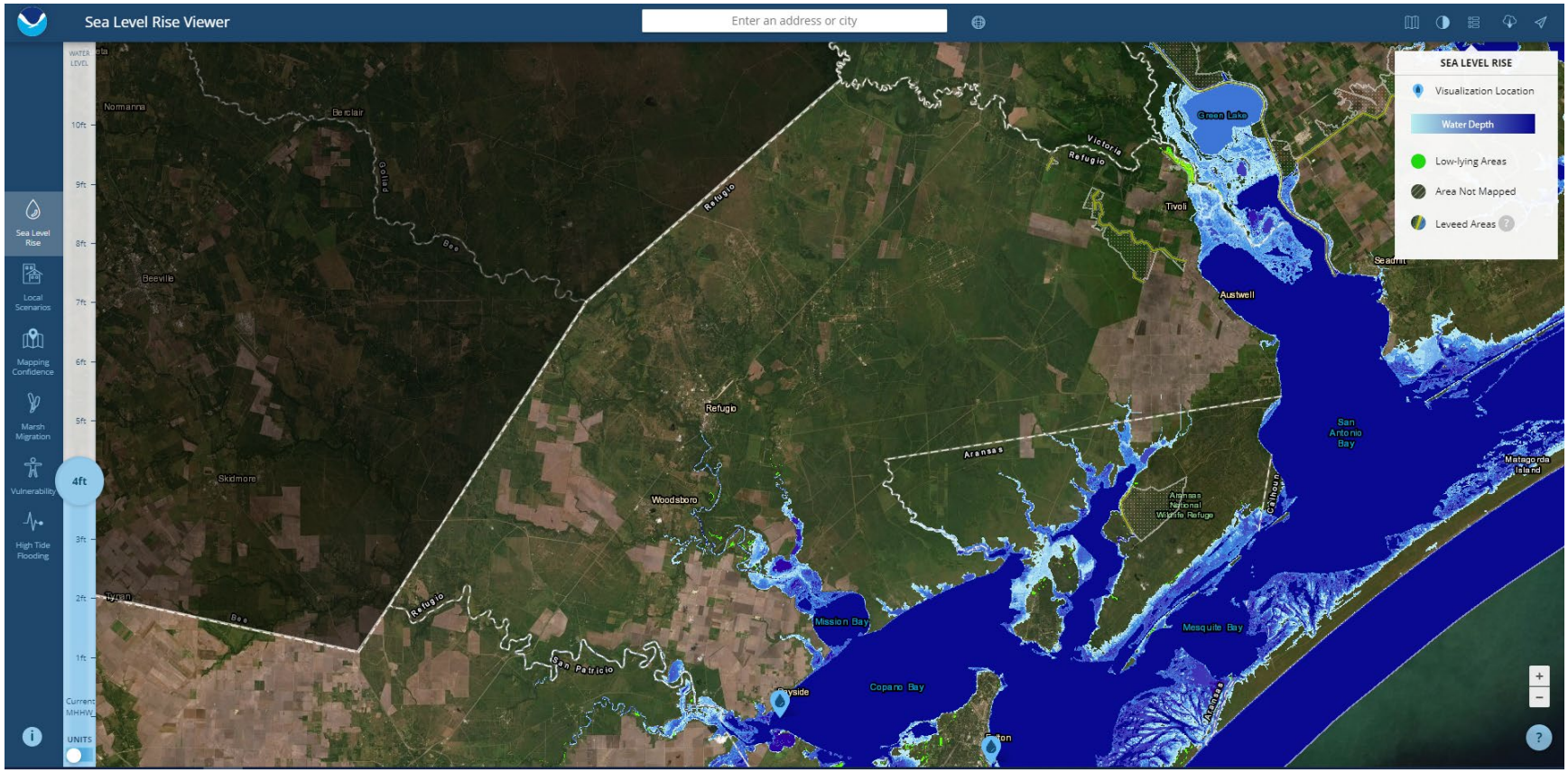

Figure 5: Estimated Impact on Refugio County from a 4 Ft Sea Level Rise[8]

[8] https://coast.noaa.gov/slr/

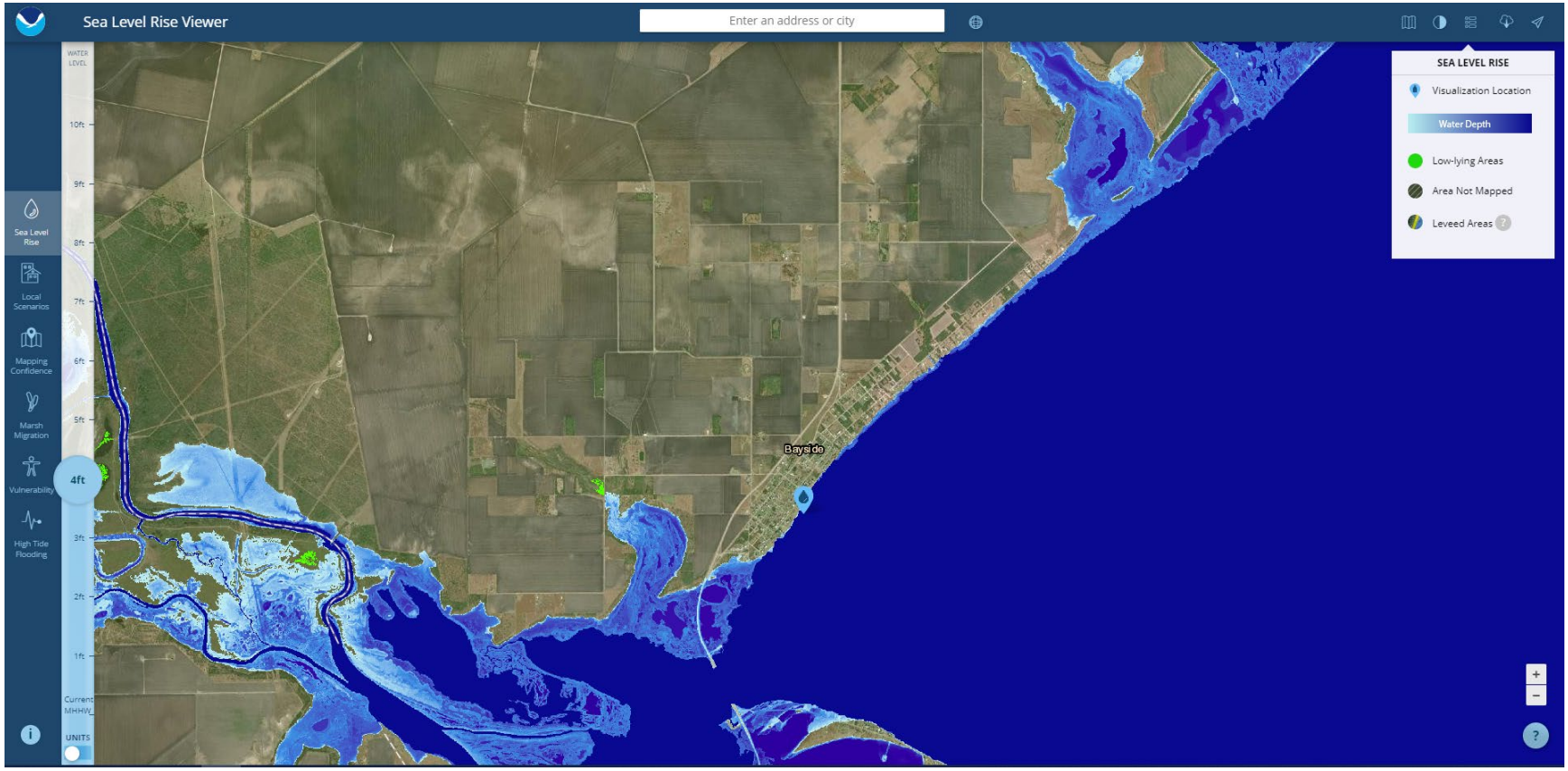

Figure 6: Expected Impact from a 4 Ft Sea Level Rise in the Town of Bayside[9]

[9] https://coast.noaa.gov/slr/

1) Hurricanes / Tropical Storms History

The planning team relied on data from the National Centers for Environmental Information (NCEI) to develop a flood history for the County and each participating jurisdiction.

According to Refugio County's 2017 plan, neither the County nor the participating jurisdictions had experienced a hurricane or tropical storm since 2007.

Since the 2017 plan, three hurricanes/tropical storms have affected Refugio County and the participating jurisdictions: Tropical Storm Bill in 2015; Hurricane Harvey in 2017; and Hurricane Hanna in 2020.

Location	Date Range	Number of Hurricane & Tropical Storm Events	Hurricane & Tropical Storm Category Range	Maximum Wind Speed Range (MPH)	Local Fatalities	Local Injuries	Local Property Damage $2021	Local Crop Damage $2021
Countywide	6/16/2015 - 7/25/2020	3	Tropical Storm – Category 4	54 – 129	0	0	$544,741,351.17	$21,789,654.05

Hurricane Harvey made landfall as a Category 4 hurricane on August 25th, 2017. The National Centers for Environmental Information (NCEI) lists the impact on Refugio County and the participating jurisdictions:

> Widespread moderate structural damage with pockets of major structural damage occurred in Refugio. Most homes and businesses had roof damage, broken windows, and damaged garage doors. Two motels received significant damage to their roofs. Gas station canopies and many signs were destroyed. A few brick structures experienced moderate damage. Numerous trees and power poles were blown down. Roof damage occurred to several churches and every school building in the district except for the athletic facility. The school gymnasiums and auditorium lost portion of their roofs. Several trailer homes and storage buildings were destroyed. There was widespread tree damage with a few very large trees completely uprooted. Widespread moderate structural damage occurred in Bayside, Austwell, and Tivoli. Numerous trees and power poles were blown down including some high tension power poles. In Woodsboro, widespread minor to moderate damage occurred with a few poorly constructed homes with major damage. The elementary gymnasium and auditorium roofs were blown off. Numerous trees and a few power poles were blown down. The Bayside Richardson Coop Gin near Woodsboro sustained major damage and 30 thousand bales of cotton in storage modules were damaged. A sensor deployed by Texas Tech measured sustained winds of 106 mph with gusts to 125 mph just west of Mission Bay before the sensor was hit by

debris. Another sensor showed wind speed of 102 mph with gusts to 129 mph north of the intersection of Highway 35 and Farm to Market Road 774 in eastern Refugio County. Around 440 homes were destroyed, around 1050 homes experienced major damage, and 66 businesses suffered major damage. Around 750 homes had minor damage with another 310 homes affected.

In addition to the impacts listed above, Hurricane Harvey also dropped an estimated 15 to 25 inches of rain on Refugio County and the participating jurisdictions over 72 hours, causing major flooding on Copano Creek near Refugio[10]. Copano Creek rose to 16.84 ft on August 29th, 2017[11].

2) Likelihood of Future Events

Hurricanes occur in seasonal patterns between June 1 and November 30. Based on historical frequency of significant hurricane events in Refugio County and the participating jurisdictions outlined above, the probability of a future event affecting any of the participating jurisdictions is likely, meaning a hurricane is possible in the next three years.

3) Extent

The Saffir-Simpson Scale categorizes hurricane intensity linearly based upon maximum sustained winds, barometric pressure, and storm surge potential. Wind, pressure, and surge are combined to estimate potential damage. Categories 3, 4 and 5 are classified as "major" hurricanes. Major hurricanes comprise only 20 percent of total tropical cyclone landfalls but they account for over 70 percent of the damage in the United States. Damage from hurricanes can result from spawned tornados, coastal flooding from storm surge, and inland flooding from heavy rainfall.

Table 6: Saffir-Simpson Scale

Category	Maximum Sustained Wind Speed (MPH)	Minimum Surface Pressure (Millibars)	Storm Surge (Feet)
1	74-95	Greater than 980	3-5
2	96-110	979-965	6-8
3	111-130	964-945	9-12
4	131-155	944-920	13-18
5	155+	Less than 920	19+

Table 7 below profiles the potential wind speeds in miles per hour (mph) that each participating jurisdiction might expect during a hurricane event for various return periods. In the case of a 10-year event, the wind speeds are projected to fall below the minimum sustained winds necessary

[10] https://www.weather.gov/crp/hurricane_harvey
[11] https://water.weather.gov/ahps2/hydrograph.php?wfo=crp&gage=rcct2

to be classified as a Category 1 hurricane. Instead, these wind speeds fall at the upper end of the tropical storm wind range, 39 – 73 mph.

Table 7: Average Hurricane Wind Speed by Jurisdiction[12]

Jurisdiction	Wind Speed (MPH) Per Return Period						
	10-year	20-year	50-year	100-year	200-year	500-year	1,000-year
Refugio County	60	78	101	116	127	138	145
Town of Refugio	59	77	100	115	125	136	144
Town of Bayside	59	77	100	116	126	137	144
Refugio ISD	59	77	100	115	125	136	144
Town of Woodsboro	59	77	100	116	126	137	144
Woodsboro ISD	59	77	100	116	126	137	144

The worst hurricanes known to have affected Refugio County and the participating jurisdictions have been as intense as Category 5 with wind gusts up to 175 mph; storm surge as high as 10'; and dropped up to 25" in rainfall. According to the best information available, the worst hurricanes and tropical storms in all participating jurisdictions inflicted damages of over $500 Million adjusted for inflation to $2021. Future storms may meet previous worst-case Category 5 storms in terms of strength, rainfall, flooding, damage dollars, injuries, and deaths.

4) Location and Impact

A) Location

Location is often referred to in terms of Tier I and II counties, designated by the Texas Department of Insurance (TDI) for windstorm insurance purposes, to represent differing levels of loss exposure to coastal counties and adjacent counties. Tier I are those counties adjacent to the Gulf of Mexico and Tier II are those counties adjacent to Tier I counties. Refugio County is a Tier I county.

As a Tier 1 county, all of Refugio County and its participating jurisdictions are in direct threat of tropical storms and hurricanes, including associated flooding, high winds, and storm surge. The effects of tropical storms and hurricanes begin to diminish as they move inland. However, the winds alone from Hurricane Harvey reached as far as 140 miles from the eye of the storm.

[12] Section 6: Hurricane, p. 3 – *Guadalupe-Brazos River Authority Plan*

Tropical storms and hurricanes vary tremendously in terms of size, location, intensity and duration. According to the Refugio County 2018 CHAMPS Report, Refugio County's proximity to the coast places it among the top 20% of all Texas counties in terms of recorded hurricane and tropical storm impacts including damage dollars, injuries, and deaths.

B) Impact

The planning team determined that Refugio County is uniformly exposed to tropical storms and hurricanes.

Impacts from a Hurricane or Tropical Storm in Refugio County and the participating jurisdictions may include but are not limited to loss of power due to downed lines caused by flying debris or fallen trees, flooding, flooding due to storm surge, flooding due to damaged or destroyed roofs, damaged or broken windows, damage due to flying debris, wind damage, crop damage or destruction, and even death.

5) Vulnerability

A) Population

As described in Section 3 of Chapter 3 above, Refugio County and the participating jurisdictions are home to many vulnerable residents. Increased vulnerability may be due to many factors including but not limited to: age, physical ability, financial means, housing type, and housing condition. Many of these vulnerabilities often overlap.

The participating jurisdictions recognize that vulnerable populations may need additional help preparing for and recovering from a hurricane or tropical storm.

Residents of mobile / manufactured housing are of particular concern. These structures are never considered safe during a hurricane, and depending on tie-down methods, may also be unsafe during strong tropical storms.

Residents of sub-standard structures are also of particular concern. Structures in sub-standard condition ahead of a tropical storm or hurricane, whether due to structural damages, missing windows or doors, holes in exterior walls or the roof, may be less safe during a hurricane or tropical storm than structures in standard condition. Existing structural weaknesses may mean increased damages, injuries, or loss of life

B) Critical Infrastructure

United States Highway 77, United States Highway 183, State Highway 35, State Highway 239 are TxDOT-designated major hurricane evacuation routes for Refugio County from the coast.

Flooding along any of these routes during a hurricane evacuation could strand motorists trying to escape the storm. These drivers may need to be rescued and could be injured or killed.

C) Critical Facilities

Critical facilities are critical because of their special function, size, service area, or unique role. Moreover, damage to critical facilities brings increased negative impact to the community beyond the importance of the critical facility itself. The planning team identified 119 critical facilities spread across the County and participating jurisdictions. Because of Refugio County's status as a Tier 1 County, all critical facilities, identified in Table 8 below, no matter their jurisdictional location, are equally vulnerable to a tropical storm / hurricane event.

Table 8: Critical Facilities Vulnerable to Tropical Storms and Hurricanes and Potential Impacts

Refugio County	Potential Hurricane / Tropical Storm Impacts										
	Loss of Power	Flying Debris	Falling Trees	Flooding	Storm Surge	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Aransas River Boat Ramp		x		x	x					x	x
Aransas River Bridge		x		x						x	x
Blanco Creek Bridge				x						x	x
Bonnie View Community Center	x	x	x	x		x	x	x	x	x	x
Copano Bay Boat Ramp				x						x	x
Elevated Storage Tank	x	x		x					x	x	x
Ground Storage Tank				x						x	x
Hynes Bay Boat Ramp				x						x	x
Lift Stations	x	x	x	x				x	x	x	x
Mary Rhodes Pipeline				x						x	x
Mission River Bridge				x						x	x
Padilla Hall	x	x	x	x		x	x	x	x	x	x
Pressure Tank				x						x	x
Pump Stations				x						x	x
Radio Towers	x	x		x				x	x	x	x
Refugio County Airport (Rooke Field)				x						x	x
Refugio County Community Center	x	x	x	x		x	x	x	x	x	x
Refugio County Courthouse	x	x	x	x		x	x	x	x	x	x
Refugio County Expo Center	x	x	x	x		x	x	x	x	x	x
Refugio County Fairgrounds	x	x	x	x		x	x	x	x	x	x
Refugio County Jail	x	x	x	x		x	x	x	x	x	x
Refugio County Precinct Building, Precinct 1	x	x	x	x		x	x	x	x	x	x
Refugio County Precinct Building, Precinct 2	x	x	x	x		x	x	x	x	x	x

Refugio County Precinct Building, Precinct 3	x	x	x	x		x	x	x	x	x	x
Refugio County Precinct Building, Precinct 4	x	x	x	x		x	x	x	x	x	x
Southcross Energy GP	x	x		x		x	x	x	x	x	x
State Highway 35		x	x	x						x	x
Union Pacific Railroad		x	x	x						x	x
United States Highway 77		x	x	x						x	x
United States Highway 77A / 183		x	x	x						x	x
Wastewater Treatment Plant	x	x	x	x	x	x	x	x	x	x	x
Water Treatment Plant	x	x		x	x	x	x	x	x	x	x
Water Wells	x	x	x	x			x	x	x	x	x

City of Austwell	**Potential Hurricane / Tropical Storm Impacts**										
	Loss of Power	Flying Debris	Falling Trees	Flooding	Storm Surge	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Austwell Volunteer Fire Department	x	x	x	x	x	x	x	x	x	x	x
Elevated Storage Tank	x	x		x	x				x	x	x
Wastewater Treatment Plant	x	x	x	x	x	x	x	x	x	x	x
Water Treatment Plant	x	x		x	x	x	x	x	x	x	x

Town of Bayside	**Potential Hurricane / Tropical Storm Impacts**										
	Loss of Power	Flying Debris	Falling Trees	Flooding	Storm Surge	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Town of Bayside City Hall and Community Center	x	x	x	x	x	x	x	x	x	x	x
Town of Bayside Volunteer Fire Department	x	x	x	x	x	x	x	x	x	x	x
Wastewater Treatment Plant	x	x		x	x	x			x	x	x
Water Plant	x	x	x	x	x	x	x	x	x	x	x

Lift Stations	x	x	x	x	x			x	x	x	x
Water Wells	x	x	x	x	x	x	x	x	x	x	x
Pump Stations	x	x	x	x	x	x	x	x	x	x	x
Reverse Osmosis Units	x	x	x	x	x	x	x	x	x	x	x

Town of Refugio	Potential Hurricane / Tropical Storm Impacts										
	Loss of Power	Flying Debris	Falling Trees	Flooding	Storm Surge	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
City Hall	x	x		x		x	x	x	x	x	x
Elevated Storage Tank		x		x		x			x	x	x
Elevated Storage Tank		x		x		x			x	x	x
HEB & HEB Pharmacy	x	x		x		x	x	x	x	x	x
Parker Lumber	x	x		x		x	x	x	x	x	x
Refugio County Memorial Hospital and Helipad	x	x	x	x		x	x	x	x	x	x
Town of Refugio Fire Department	x	x	x	x		x	x	x	x	x	x
Town of Refugio Police Department	x	x		x		x	x	x	x	x	x
Vantage Bank	x	x	x	x		x	x	x	x	x	x
Village Pharmacy	x	x		x		x	x	x	x	x	x
Wastewater Treatment Plant	x	x		x		x	x	x	x	x	x
Water Plant #1	x	x		x		x	x	x	x	x	x
Water Plant #2	x	x	x	x		x	x	x	x	x	x
Water Plant #3	x	x		x		x	x	x	x	x	x
Refugio Rural Health Clinic	x	x	x	x		x	x	x	x	x	x
Refugio Specialty Clinic	x	x	x	x		x	x	x	x	x	x
Refugio Manor Nursing and Rehabilitation Center	x	x	x	x		x	x	x	x	x	x
Mission Ridge Nursing and Rehabilitation Center	x	x	x	x		x	x	x	x	x	x
Gulf South Pipeline Co.	x	x		x		x	x	x	x	x	x

Valiant Petroleum	x	x		x		x	x	x	x	x	x
EOG Resources	x	x		x		x	x	x	x	x	x
Lift Stations	x	x	x	x		x	x	x	x	x	x
Pump Stations	x	x	x	x		x	x	x	x	x	x
Town of Refugio Police Department Annex	x	x		x		x	x	x	x	x	x
RV Park	x	x	x	x		x	x	x	x	x	x
Woodforest National Bank	x	x	x	x		x	x	x	x	x	x

Town of Woodsboro	Potential Hurricane / Tropical Storm Impacts										
	Loss of Power	Flying Debris	Falling Trees	Flooding	Storm Surge	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
200k Gallon Ground Tanks	x	x	x	x					x	x	x
Ballfield Concession	x	x	x	x		x	x	x	x	x	x
Chlorine Storage	x	x	x	x		x	x	x	x	x	x
City Building	x	x	x	x		x	x	x	x	x	x
Elevated Storage Tank	x	x		x					x	x	x
Equipment Storage	x	x	x	x		x	x	x	x	x	x
Fast Break	x	x		x		x	x	x	x	x	x
Filtration Control Building	x	x	x	x		x	x	x	x	x	x
Filtration Tanks	x	x	x	x		x	x	x	x	x	x
First National Bank	x	x	x	x		x	x	x	x	x	x
Gazebo		x	x	x					x	x	x
Haertig, Inc.	x	x		x		x	x	x	x	x	x
Office Building	x	x	x	x		x	x	x	x	x	x
Parts Barn	x	x	x	x		x	x	x	x	x	x
SCADA / Electrical System	x	x	x	x		x	x	x	x	x	x
Storage / Rental Building	x	x	x	x		x	x	x	x	x	x

Town of Woodsboro Volunteer Fire Department	x	x	x	x		x	x	x	x	x	x
Tractor Storage	x	x	x	x		x	x	x	x	x	x
Tuttle's Grocery Market	x	x	x	x		x	x	x	x	x	x
Wastewater Treatment Plant	x	x		x		x	x	x	x	x	x
Water Plant	x	x	x	x		x	x	x	x	x	x
Well #3	x	x	x	x		x			x	x	x
Well #4	x	x	x	x		x			x	x	x
Woodsboro City Hall	x	x	x	x		x	x	x	x	x	x
Woodsboro Family Center	x	x	x	x		x	x	x	x	x	x
Woodsboro Farmers COOP	x	x	x	x		x	x	x	x	x	x
Wranosky Wran Lift Station	x	x	x	x	x			x	x	x	x

Tivoli	**Potential Hurricane / Tropical Storm Impacts**										
	Loss of Power	Flying Debris	Falling Trees	Flooding	Storm Surge	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Elevated Storage Tank		x		x					x	x	x
Tivoli Volunteer Fire Department	x	x	x	x		x	x	x	x	x	x
Wastewater Treatment Plant	x	x		x	x		x	x	x	x	x
Water Plant	x	x	x	x		x	x	x	x	x	x

Austwell-Tivoli ISD	**Potential Hurricane / Tropical Storm Impacts**										
	Loss of Power	Flying Debris	Falling Trees	Flooding	Storm Surge	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Austwell-Tivoli High School	x	x	x	x	x	x	x	x	x	x	x
Austwell-Tivoli Elementary	x	x	x	x	x	x	x	x	x	x	x
Austwell-Tivoli Administration Building	x	x	x	x	x	x	x	x	x	x	x

Austwell-TIvoli Maintenance Building	x	x	x	x	x	x	x	x	x	x	x

Refugio ISD	Potential Hurricane / Tropical Storm Impacts										
	Loss of Power	Flying Debris	Falling Trees	Flooding	Storm Surge	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Refugio ISD Elementary School (Primary School)	x	x	x	x		x	x	x	x	x	x
Refugio High School/Refugio ISD Administration Building	x	x	x	x		x	x	x	x	x	x
Refugio ISD Junior High School (7th & 8th Grade Building)	x	x	x	x		x	x	x	x	x	x
Jack Sportsman Bobcat Stadium/Athletic Facility/Maintenance Building	x	x		x		x	x	x	x	x	x

Woodsboro ISD	Potential Hurricane / Tropical Storm Impacts										
	Loss of Power	Flying Debris	Falling Trees	Flooding	Storm Surge	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Eagle Dome	x	x				x				x	x
Woodsboro ISD Administration Office	x	x	x			x	x	x	x	x	x
Woodsboro ISD Elementary School	x	x	x	x		x	x	x	x	x	x
Woodsboro ISD Junior and Senior High School	x	x	x	x		x	x	x	x	x	x

Refugio Water Control and Improvement District #1	Potential Hurricane / Tropical Storm Impacts										
	Loss of Power	Flying Debris	Falling Trees	Flooding	Storm Surge	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Water Treatment Plant	x	x		x	x	x	x	x	x	x	x
Wastewater Plant	x	x		x		x	x	x	x	x	x
Elevated Storage Tank		x		x					x	x	x

Water Wells	x	x	x	x		x	x	x	x	x	x
Lift Station	x	x	x	x	x			x	x	x	x

5. Drought

Drought is defined as the consequence of a natural reduction in the amount of precipitation expected over an extended period of time, usually a season or more in length.

Droughts are one of the most complex natural hazards to identify because it is difficult to determine their precise beginning or end. In addition, droughts can lead to other hazards such as extreme heat and wildfires. Their impact on wildlife and area farming is enormous, often killing crops, grazing land, edible plants and even in severe cases, trees. A secondary hazard to drought is wildfire because dying vegetation serves as a prime ignition source. Therefore, a heat wave combined with a drought is a very dangerous situation.

Table 9: Drought Classifications

Meteorological Drought	The degree of dryness or departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales.
Hydrologic Drought	The effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels.
Agricultural Drought	Soil moisture deficiencies relative to water demands of plant life, usually crops.
Socioeconomic Drought	The effect of demands for water exceeding the supply as a result of a weather-related supply shortfall.

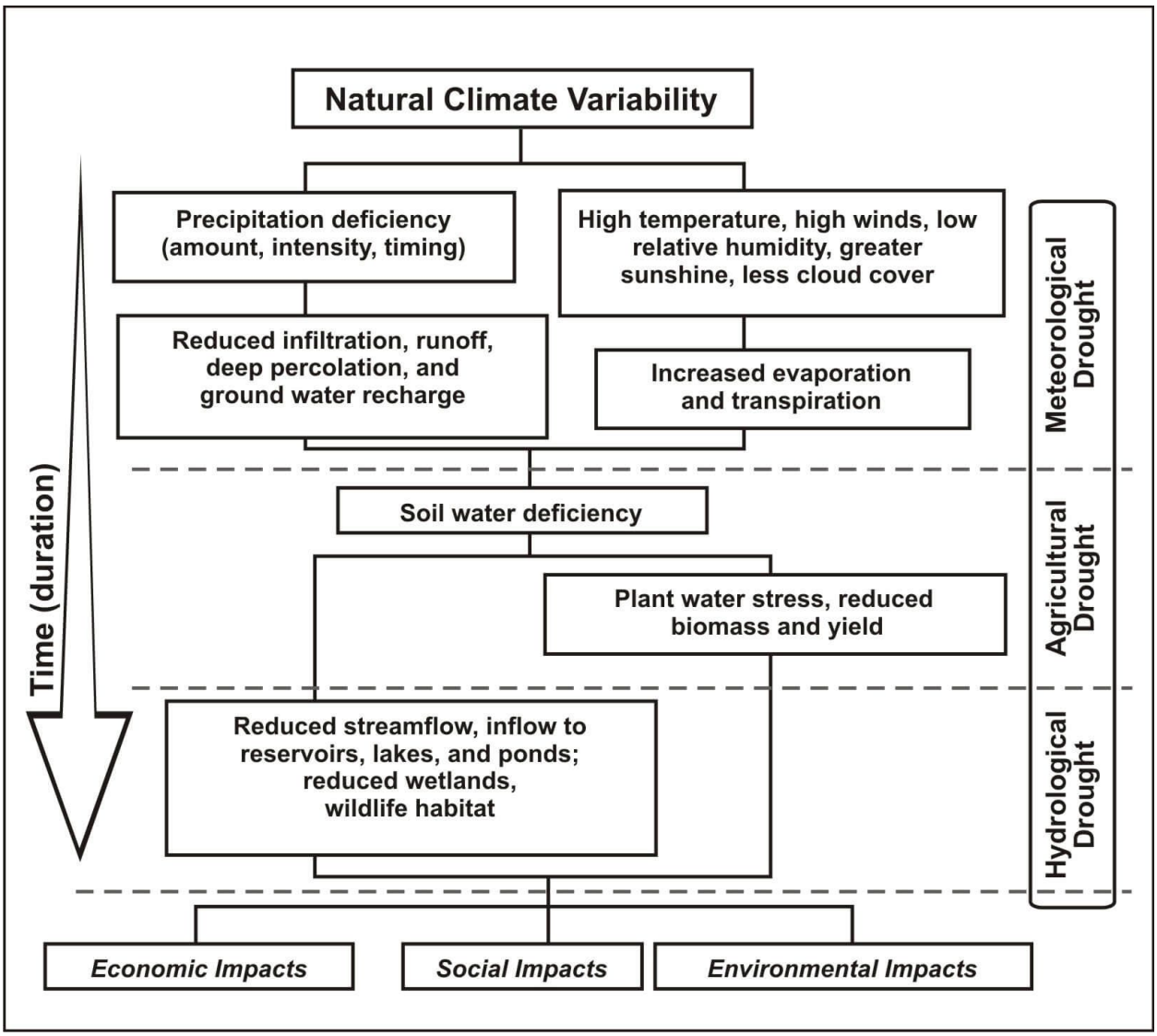

Figure 7: Sequence of Drought Occurrence and Impacts for Commonly Accepted Drought Types[13]

[13] Source: National Drought Mitigation Center, University of Nebraska-Lincoln, https://drought.unl.edu/Education/DroughtIn-depth/TypesofDrought.aspx

1) Drought History

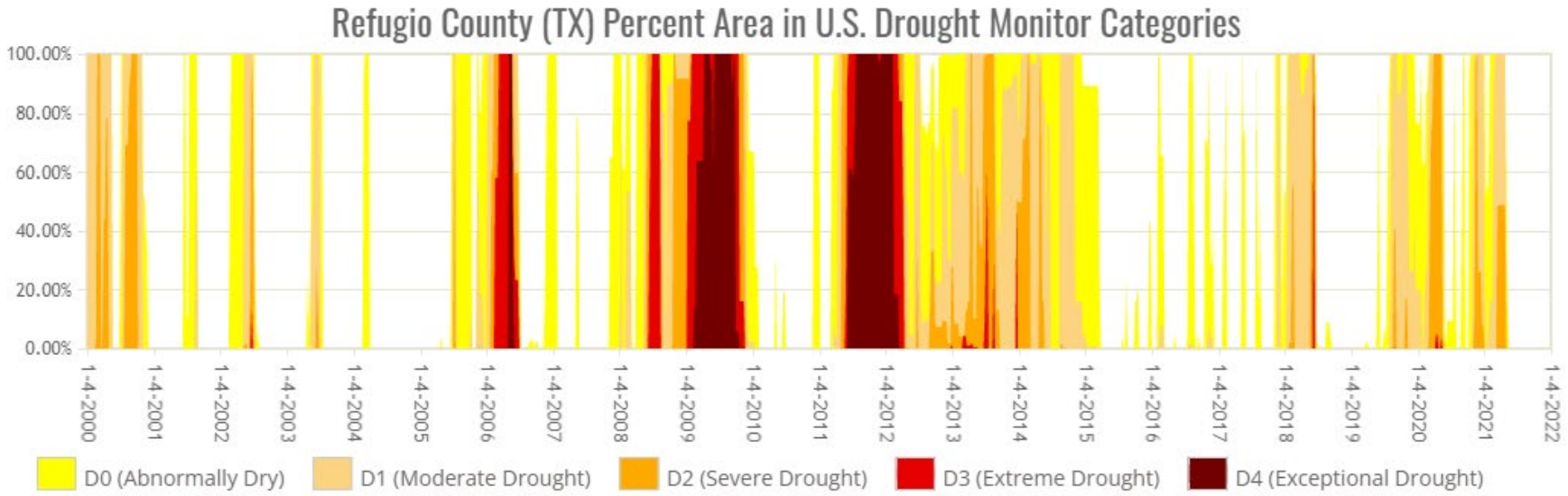

Figure 8: Refugio County Drought History[14]

[14] www.droughtmonitor.unl.edu

Drought history is recorded at the county level. However, the data is measured by the percentage of the county affected by drought. Although no specific data regarding drought's occurrences in the other participating jurisdictions is available, it's possible to use the data in Figure 8 to infer when the participating jurisdictions previously experienced drought conditions due to the fact that the conditions impacted 100% of the county. According to the data, Refugio County and the participating jurisdictions have experienced drought conditions on a nearly annual basis since 2000.

According to data from the NCEI, Refugio County and the participating jurisdictions have experienced the following drought events and damages since the 2017 plan:

Location	Date Range	Number of Drought Events	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Countywide	1/1/2014-5/1/2020	21	0	0	$0	$0

There were no recorded injuries or deaths due to drought in Refugio County or the participating jurisdictions.

2) Likelihood of Future Events

Based on historical drought in Texas and Refugio County, the probability of future drought affecting Refugio County and the participating jurisdictions is likely, meaning an event affecting any or all of the participating jurisdictions probable in the next three years, and a major drought every 20 years.

3) Extent

Over the last 15 years, Refugio County has regularly experienced county-wide droughts classified as periods ranging from abnormal dryness to exceptional drought. At multiple times, the entire County, including all participating jurisdictions, has been in exceptional drought, the most severe drought category.

The Palmer Drought Index is used to measure the extent of drought by measuring the duration and intensity of long-term drought-inducing circulation patterns. Long-term drought is cumulative, with the intensity of drought during the current month dependent upon the current weather patterns plus the cumulative patterns of previous months. The hydrological impacts of drought (e.g., reservoir levels, groundwater levels, etc.) take longer to develop.

Table 10: Palmer Drought Index

Drought Index	Drought Conditions Classifications						
	Extreme	Severe	Moderate	Normal	Mostly Moist	Very Moist	Extremely Moist
Z Index	-2.75 and below	-2.00 to -2.74	-1.25 to -1.99	-1.24 to +.99	+1.00 to +2.49	+2.50 to +3.49	n/a
Meteorological	-4.00 and below	-3.00 to -3.99	-2.00 to -2.99	-1.99 to +1.99	+2.00 to +2.00	+3.00 to +3.00	+4.00 and above
Hydrological	-4.00 and below	-3.00 to -3.99	-2.00 to -2.99	-1.99 to +1.99	+2.00 to +2.00	+3.00 to +3.00	+4.00 and above

Table 11: Palmer Drought Category Descriptions[15]

Category	Description	Possible Impacts	Palmer Drought Index
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures; fire risk above average. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.	-1.0 to -1.9
D1	Moderate Drought	Some damage to crops, pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing or imminent, voluntary water use restrictions requested.	-2.0 to -2.9
D2	Severe Drought	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed.	-3.0 to -3.9
D3	Extreme Drought	Major crop/pasture losses; extreme fire danger; widespread water shortages or restrictions.	-4.0 to -4.9
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells, creating water emergencies.	-5.0 or less

Drought is monitored nationwide by the National Drought Mitigation Center (NDMC). Indicators are used to describe broad scale drought conditions across the U.S. Indicators correspond to the intensity of drought.

[15] www.droughtmonitor.unl.edu

Based on the historical occurrences of drought, Refugio County and all participating jurisdictions should anticipate experiencing droughts ranging from abnormally dry to exceptional drought or D0 to D4 based on the Palmer Drought Category. Given varying conditions, droughts may start on the low end of the Palmer Drought Category but will intensify with duration and an ongoing lack of precipitation.

Future drought events may be as bad as D4 on the Palmer Drought Index.

4) Location and Impact

A) Location

Drought has no distinct geographic boundary. Drought can occur across all participating jurisdictions.

B) Impact

General impacts may include water shortage, risk to public safety due to wildfire risk increases, respiratory impacts to the public due to affected air quality, and degradation of fish and wildlife habitat.

Economic impacts may include increased prices for food, unemployment for farm workers and ranch hands, livestock mortality from limited grazing availability, and reduced tax revenues because of reduced supplies of agriculture products and livestock that are dependent on rainfall.

The Town of Refugio adopted its current Drought Contingency Plan in 2000. The plan describes three stages of water restrictions ranging from alternating day usage of water for outdoor purposes to directly limiting citizens' water usage.

The Town of Woodsboro adopted its current Drought Contingency Plan in 2000. The plan includes sections ranging from the Criteria for Initiation and Termination of Drought Response Stages to Conservation Strategies, Triggers, and Responses corresponding to three stages of drought.

None of the other participating jurisdictions have a drought contingency plan.

5) Vulnerability

Because drought has the potential to impact every jurisdiction equally, all improved property and the entire population is exposed to this hazard. General impacts may include water shortage, risk to public safety due to wildfire risk increases, respiratory impacts to the public due to affected air quality, and degradation of fish and wildlife habitat.

Economic impacts may include increased prices for food, unemployment for farm workers and ranch hands, livestock mortality from limited grazing availability, and reduced tax revenues because of reduced supplies of agriculture products and livestock that are dependent on rainfall.

Lower income populations who may not have the resources to buy large quantities of bottled water in the event of a shortage may be more vulnerable than other populations.

A) Population

As described in Section 3 of Chapter 3 above, Refugio County and the participating jurisdictions are home to many vulnerable residents. Increased vulnerability may be due to many factors including but not limited to age, physical ability, financial means, housing type, and housing condition. Many of these vulnerabilities often overlap.

The jurisdictions recognize that vulnerable populations may need additional help preparing for and recovering from a drought. Lower income populations who may not have the resources to buy large quantities of bottled water in the event of a shortage may be more vulnerable than other populations.

B) Critical Facilities

In addition to triggering various components of participating jurisdictions' Drought Contingency plans, drought conditions may affect local critical facilities. Area fire departments may see increased demand for controlling wildland fire due to dry conditions. Drought is likely to require increased output from the local power companies in order to keep up with electrical demand. Depending on factors like time of year, temperature, and duration, increased electrical demand may cause brownouts that would impact critical facilities.

Table 12: Critical Facilities Vulnerable to Drought and Potential Impacts

Refugio County	Potential Drought Impacts	
	Increased Demand for Services	Economic Damages
Aransas River Boat Ramp		x
Aransas River Bridge		
Blanco Creek Bridge		
Bonnie View Community Center	x	
Copano Bay Boat Ramp		x
Elevated Storage Tank	x	x
Ground Storage Tank	x	x
Hynes Bay Boat Ramp		x
Lift Stations	x	x
Mary Rhodes Pipeline	x	x
Mission River Bridge		
Padilla Hall	x	
Pressure Tank	x	x
Pump Stations	x	x
Radio Towers		
Refugio County Airport (Rooke Field)		x
Refugio County Community Center	x	
Refugio County Courthouse		
Refugio County Expo Center	x	
Refugio County Fairgrounds		
Refugio County Jail		
Refugio County Precinct Building, Precinct 1		
Refugio County Precinct Building, Precinct 2		
Refugio County Precinct Building, Precinct 3		
Refugio County Precinct Building, Precinct 4		
Southcross Energy GP		x
State Highway 35		

Union Pacific Railroad		
United States Highway 77		
United States Highway 77A / 183		
Wastewater Treatment Plant	x	x
Water Treatment Plant	x	x
Water Wells	x	x

City of Austwell	Potential Drought Impacts	
	Increased Demand for Services	Economic Damages
Austwell Volunteer Fire Department	x	
Elevated Storage Tank	x	
Wastewater Treatment Plant	x	x
Water Treatment Plant	x	x

Town of Bayside	Potential Drought Impacts	
	Increased Demand for Services	Economic Damages
Town of Bayside City Hall and Community Center	x	
Town of Bayside Volunteer Fire Department	x	
Wastewater Treatment Plant	x	x
Water Plant	x	x
Lift Stations	x	x
Water Wells	x	x
Pump Stations	x	x
Reverse Osmosis Units	x	x

Town of Refugio	Potential Drought Impacts	
	Increased Demand for Services	Economic Damages
City Hall	x	x
Elevated Storage Tank	x	

Elevated Storage Tank	x	
EOG Resources		x
Gulf South Pipeline Co.		x
HEB & HEB Pharmacy	x	x
Lift Stations	X	x
Mission Ridge Nursing and Rehabilitation Center	x	
Parker Lumber		x
Pump Stations	X	X
Refugio County Memorial Hospital and Helipad	x	
Refugio Manor Nursing and Rehabilitation Center	x	
Refugio Rural Health Clinic	x	
Refugio Specialty Clinic	x	
RV Park		
Town of Refugio Fire Department	x	
Town of Refugio Police Department		
Town of Refugio Police Department Annex		
Valiant Petroleum		x
Vantage Bank		
Village Pharmacy	x	x
Wastewater Treatment Plant	x	
Water Plant #1	x	
Water Plant #2	x	
Water Plant #3	x	
Woodforest National Bank		

Town of Woodsboro	Potential Drought Impacts	
	Increased Demand for Services	Economic Damages
200k Gallon Ground Tanks	x	x
Ballfield Concession	x	
Chlorine Storage	x	x

City Building		
Elevated Storage Tank	x	
Equipment Storage		
Fast Break		x
Filtration Control Building	x	x
Filtration Tanks	x	x
First National Bank		
Gazebo		
Haertig, Inc.		
Office Building		
Parts Barn		
SCADA / Electrical System		
Storage / Rental Building		
Town of Woodsboro Volunteer Fire Department	x	
Tractor Storage		
Tuttle's Grocery Market		x
Wastewater Treatment Plant	x	
Water Plant	x	
Well #3	x	x
Well #4	x	x
Woodsboro City Hall	x	
Woodsboro Family Center	x	
Woodsboro Farmers COOP		x
Wranosky Wran Lift Station	x	x

Tivoli	**Potential Drought Impacts**	
	Increased Demand for Services	Economic Damages
Elevated Storage Tank	x	
Tivoli Volunteer Fire Department	x	
Wastewater Treatment Plant	x	x

Water Plant	x	x

Austwell-Tivoli ISD	Potential Drought Impacts	
	Increased Demand for Services	Economic Damages
Austwell-Tivoli High School	x	
Austwell-Tivoli Elementary	x	
Austwell-Tivoli Administration Building	x	
Austwell-TIvoli Maintenance Building	x	

Refugio ISD	Potential Drought Impacts	
	Increased Demand for Services	Economic Damages
Refugio ISD Elementary School (Primary School)	x	
Refugio ISD High School	x	
Refugio ISD Junior High School (7th & 8th Grade Building)	x	
Jack Sportsman Bobcat Stadium/Athletic Facility/Maintenance Building	x	

Woodsboro ISD	Potential Drought Impacts	
	Increased Demand for Services	Economic Damages
Woodsboro ISD Administration Office	x	
Woodsboro ISD Elementary School	x	
Woodsboro ISD FEMA Dome	x	
Woodsboro ISD Junior and Senior High School	x	

Refugio Water Control and Improvement District #1	Potential Drought Impacts	
	Increased Demand for Services	Economic Damages
Water Treatment Plant	x	x

Wastewater Plant	x	x
Elevated Storage Tank	x	x
Water Wells	x	x
Lift Station	x	x

C) Vulnerable Structures and Infrastructure

Given drought's geographic reach, all structures within the participating jurisdictions are equally vulnerable to the hazard. However, given the limited structural damage inflicted by previous droughts, future structural damages are expected to be similarly limited.

Table 13: Structures Vulnerable to Drought

Jurisdiction	Parcel Count[16]	Estimated Potential Damage Value
Refugio County	11,162	$2,477,921,463
Town of Bayside	1,341	$91,827,960
Town of Refugio	2,156	$120,602,883
Town of Woodsboro	1,620	$68,833,140
Austwell-Tivoli ISD	11	$225,820
Refugio ISD	11	$268,080
Woodsboro ISD	14	$1,107,240
Refugio County WCID #1	4	$16,530

[16] County Parcel Count Includes All Parcels in Refugio County

I. Agricultural Production

According to the USDA 2017 Census of Agriculture[17], the total market value of agricultural products sold, including direct sales, in Refugio County was $35,912,000. Between 1995 and 2018[18], $54,599,404 in indemnities was paid to farmers in Refugio County. That is roughly $2,373,887 per year. Although the proportion of indemnities paid to cover losses due to drought isn't identifiable, given Refugio County's recent drought history, it is likely that at least some of the dollars paid were related to drought-caused damages.

Given agriculture's role in the County, drought-caused losses will have impacts beyond any individual and may lead to contraction in the wider economy. However, because the data is recorded at the county level, there is no specific information regarding agricultural losses to due drought for the individual participating jurisdictions.

[17]https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_County_Level/Texas/st48_2_0002_0002.pdf

[18] https://farm.ewg.org/cropinsurance.php?fips=48391&summpage=SUMMARY

6. Hailstorm

Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and subsequent cooling of the air mass. Frozen droplets gradually accumulate into ice crystals until they fall as precipitation that is round or irregularly shaped masses of ice. The size[19] of hailstones is a direct result of the size and severity of the storm.

High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a byproduct of heating on the Earth's surface. Higher temperature gradients above Earth's surface result in increased suspension time and hailstone size.

Texas officials estimate that up to 40 percent of all homeowners' insurance claims in the state result from hail damage.

1) Hailstorm History

In the 2017 plan, Refugio County and the participating jurisdictions noted that between 1993 and 2012, the last year a hailstorm was recorded, there were 26 hailstorms in Refugio County and the participating jurisdictions with hail ranging in size from ¾" in diameter up to 2 ¾" in diameter. No injuries, deaths, or damages were recorded for any of the hailstorms in the previous plan.

The following tables identify the most comprehensive list available of hailstorm events and associated damages in Refugio County and the participating jurisdictions. No participating jurisdiction has recorded a hailstorm more recently than 2020.

Table 14: Refugio County Hailstorm History

Location	Date Range	Number of Hailstorms	Hail Diameter in inches	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Countywide	4/13/2015-5/28/2020	6	0.88-2.5	0	0	$357,754.41	$0

Table 15: Town of Refugio Hailstorm History

Location	Date Range	Number of Hailstorms	Hail Diameter in inches	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Refugio	4/16/2015 – 6/5/2017	2	1.5-1.75	0	0	$55,182.12	$0

[19] As of January 5, 2010, the national minimum size for severe hail increased from ¾" to 1".

Table 16: Town of Woodsboro Hailstorm History

Location	Date Range	Number of Hailstorms	Hail Diameter in inches	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Woodsboro	4/29/2017	1	1.75	0	0	$10,671.59	$0

2) Likelihood of Future Events

Based on the past history for the participating jurisdictions, hail events are likely, meaning that an event is probable in every jurisdiction within the next three years.

3) Extent

The severity of hail events ranges based on the size of the hail, wind speed, and the number and types of structures in the path of the hailstorm. Storms that produce high winds in addition to hail are most damaging and can result in numerous broken windows and damaged siding.

When hail breaks windows, water damage from accompanying rains can also be significant. A major hailstorm can easily cause damage running into the millions of dollars. Nationwide hail is responsible for over $1 billion in property and crop damages per year. The scale showing intensity categories in Table 17 was developed by combining data from National Climatic Data Center (NCEI) and the Tornado and Storm Research Organization (TORRO).

Table 17: Hailstorm Intensity[20,21]

Size Code	Intensity Category	Size (Diameter in inches)	Descriptive Term	Typical Damage
H0	Hard Hail	Up to 0.33	Pea	No damage
H1	Potentially Damaging	0.33-.060	Mothball	Slight damage to plants and crops
H2	Significant	.060-.080	Penny	Significant damage to fruit, crops, and vegetation
H3	Severe[22]	0.80-1.20	Nickel – Half dollar	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored

[20] http://www1.NCEI.noaa.gov/pub/data/cmb/extremes/scec/reports/SCEC-Hail-Guide.pdf
[21] http://www.torro.org.uk/hscale.php
[22] Hail must be 1" or larger to be classified as severe

H4	Severe	1.2-1.6	Half dollar – Ping pong ball	Widespread glass damage and vehicle bodywork damage
H5	Destructive	1.6-2.0	Ping pong ball – hen egg	Wholesale destruction of glass, damage to tiled roofs, and significant risk of injuries
H6	Destructive	2.0-2.4	Hen egg – tennis ball	Bodywork of grounded aircraft dented and brick walls pitted
H7	Destructive	2.4-3.0	Tennis ball – Baseball	Severe roof damage and risk of serious injuries
H8	Destructive	3.0-3.5	Hockey puck	Severe damage to aircraft bodywork
H9	Super Hailstorms	3.5-4.0	Softball	Extensive structural damage could cause fatal injuries
H10	Super Hailstorms	4.0+	Greater than softball-sized	Extensive structural damage could cause fatal injuries

According to NCEI data, the worst hailstorms in Refugio County and the participating jurisdictions have produced hail up to 2 ¾" in diameter, H7 on the Hailstorm Intensity Scale, and have inflicted up to $423,608.12 in reported property damages.

Future hailstorms may meet previous H7 ones in terms of hailstone size, damage dollars inflicted, and the number of residents injured or killed.

4) Location and Impact

A) Location

Hailstorms vary in terms of size, location, intensity and duration but are considered frequent occurrences in the planning area. Each jurisdiction is uniformly exposed to hail events just as each is uniformly exposed to the thunderstorms that typically produce the hail events.

B) Impact

The severity of a hailstorm's impact is considered to be limited since they generally result in injuries treatable with first aid, shut down critical facilities and services for 24 hours or less, and less than ten percent of affected properties are destroyed or suffer major damage. All existing and future buildings, facilities, and populations are in the participating jurisdictions are considered to be exposed to this hazard and could potentially be impacted.

5) Vulnerability

A) Population

As described in Section 3 of Chapter 3 above, Refugio County and the participating jurisdictions are home to many vulnerable residents. Increased vulnerability may be due to many factors including but not limited to: age, physical ability, financial means, housing type, and housing condition. Many of these vulnerabilities often overlap.

Since hailstorms arise with little to no warning, the participating jurisdictions recognize that vulnerable populations may primarily need additional help recovering from a hailstorm.

Residents of sub-standard structures are of particular concern. Structures in sub-standard condition ahead of a hailstorm, whether due to structural damages, missing windows or doors, holes in exterior walls or the roof, may sustain more damages than structures in standard condition.

Existing weaknesses, especially those related to the condition of a structure's roof, due to housing type or existing damages, may lead to compounded damages, injuries, or loss of life.

B) Critical Facilities

Due to their flat roofs and the increased vulnerability a flat roof creates the following critical facilities were determined to be especially vulnerable to hailstorms:

Table 18: Critical Facilities Vulnerable to Hailstorms and Potential Impacts

Refugio County	Potential Hailstorm Impacts		
	Water damage due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows
Bonnie View Community Center	x	x	x
Lift Stations			x
Padilla Hall	x	x	x
Radio Towers			x
Refugio County Community Center	x	x	x
Refugio County Courthouse	x	x	x
Refugio County Expo Center	x	x	x
Refugio County Fairgrounds	x	x	x
Refugio County Jail	x	x	x
Refugio County Precinct Building, Precinct 1	x	x	x
Refugio County Precinct Building, Precinct 2	x	x	x
Refugio County Precinct Building, Precinct 3	x	x	x
Refugio County Precinct Building, Precinct 4	x	x	x

Southcross Energy GP	x	x	x
Wastewater Treatment Plant	x	x	x
Water Treatment Plant	x	x	x
Water Wells		x	x

City of Austwell	Potential Hailstorm Impacts		
	Water damage due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows
Austwell Volunteer Fire Department	x	x	x
Wastewater Treatment Plant	x	x	x
Water Treatment Plant	x	x	x

Town of Bayside	Potential Hailstorm Impacts		
	Water damage due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows
Town of Bayside City Hall and Community Center	x	x	x
Town of Bayside Volunteer Fire Department	x	x	x
Wastewater Treatment Plant	x		
Water Plant	x	x	x
Lift Stations			x
Water Wells	x	x	x
Pump Stations	x	x	x
Reverse Osmosis Units	x	x	x

Town of Refugio	Potential Hailstorm Impacts		
	Water damage due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows
City Hall	x	x	x
Elevated Storage Tank	x		
Elevated Storage Tank	x		
HEB & HEB Pharmacy	x	x	x
Parker Lumber	x	x	x
Refugio County Memorial Hospital and Helipad	x	x	x
Town of Refugio Fire Department	x	x	x
Town of Refugio Police Department	x	x	x

Vantage Bank	x	x	x
Village Pharmacy	x	x	x
Wastewater Treatment Plant	x	x	x
Water Plant #1	x	x	x
Water Plant #2	x	x	x
Water Plant #3	x	x	x
Refugio Rural Health Clinic	x	x	x
Refugio Specialty Clinic	x	x	x
Refugio Manor Nursing and Rehabilitation Center	x	x	x
Mission Ridge Nursing and Rehabilitation Center	x	x	x
Gulf South Pipeline Co.	x	x	x
Valiant Petroleum	x	x	x
EOG Resources	x	x	x
Lift Stations	x	x	x
Pump Stations	x	x	x
Town of Refugio Police Department Annex	x	x	x
RV Park	x	x	x
Woodforest National Bank	x	x	x

Town of Woodsboro	Potential Hailstorm Impacts		
	Water damage due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows
Ballfield Concession	x	x	x
Chlorine Storage	x	x	x
City Building	x	x	x
Equipment Storage	x	x	x
Fast Break	x	x	x
Filtration Control Building	x	x	x
Filtration Tanks	x	x	x
First National Bank	x	x	x
Haertig, Inc.	x	x	x
Office Building	x	x	x
Parts Barn	x	x	x
SCADA / Electrical System	x	x	x
Storage / Rental Building	x	x	x
Town of Woodsboro Volunteer Fire Department	x	x	x
Tractor Storage	x	x	x
Tuttle's Grocery Market	x	x	x

Wastewater Treatment Plant	x	x	x
Water Plant	x	x	x
Well #3	x		
Well #4	x		
Woodsboro City Hall	x	x	x
Woodsboro Family Center	x	x	x
Woodsboro Farmers COOP	x	x	x
Wranosky Wran Lift Station			x

Tivoli	**Potential Hailstorm Impacts**		
	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows
Tivoli Volunteer Fire Department	x	x	x
Wastewater Treatment Plant		x	x
Water Plant	x	x	x

Austwell-Tivoli ISD	**Potential Hailstorm Impacts**		
	Water damage due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows
Austwell-Tivoli High School	x	x	x
Austwell-Tivoli Elementary	x	x	x
Austwell-Tivoli Administration Building	x	x	x
Austwell-TIvoli Maintenance Building	x	x	x

Refugio ISD	**Potential Hailstorm Impacts**		
	Water damage due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows
Refugio ISD Elementary School (Primary School)	x	x	x
Refugio High School/Refugio ISD Administration Building	x	x	x
Refugio ISD Junior High School (7th & 8th Grade Building)	x	x	x
Jack Sportsman Bobcat Stadium/Athletic Facility/Maintenance Building	x	x	x

Woodsboro ISD	Potential Hailstorm Impacts		
	Water damage due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows
Eagle Dome	x		
Woodsboro ISD Administration Office	x	x	x
Woodsboro ISD Elementary School	x	x	x
Woodsboro ISD Junior and Senior High School	x	x	x

Refugio Water Control and Improvement District #1	Potential Hailstorm Impacts		
	Water damage due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows
Water Treatment Plant	x	x	x
Wastewater Plant	x	x	x
Water Wells	x	x	x
Lift Station			x

C) Vulnerable Structures

Every structure is vulnerable to damage from hail. However, commercial structures with flat roofs are especially vulnerable due to the increased exposure that flat roofs create.

Table 19: All Parcels Vulnerable to Hailstorms[23]

Jurisdiction	Parcel Count	Estimated Potential Damage Value
Refugio County	11,162	$2,477,921,463
Town of Bayside	1,341	$91,827,960
Town of Refugio	2,156	$120,602,883
Town of Woodsboro	1,620	$68,833,140
Austwell-Tivoli ISD	11	$225,820
Refugio ISD	11	$268,080
Woodsboro ISD	14	$1,107,240

[23] Estimated potential damage values based on Refugio CAD Data and Market Values of parcels

Refugio County WCID #1	4	$16,530

7. Severe Coastal Flooding

According to the Texas State Hazard Mitigation Plan, coastal flooding, also called storm surge, is caused by hurricane-level tropical cyclone events. The nature of the damage it produces, and the way to mitigate for it, are more comparable to riverine flooding than to Hurricanes/Tropical Storms/Depressions.

The counties along the Texas coast have been divided into five storm surge basins, which are used to estimate storm surge likelihood and extent. They are also the basis of hurricane evacuation plans. Refugio County is within the Matagorda Bay storm surge basin.

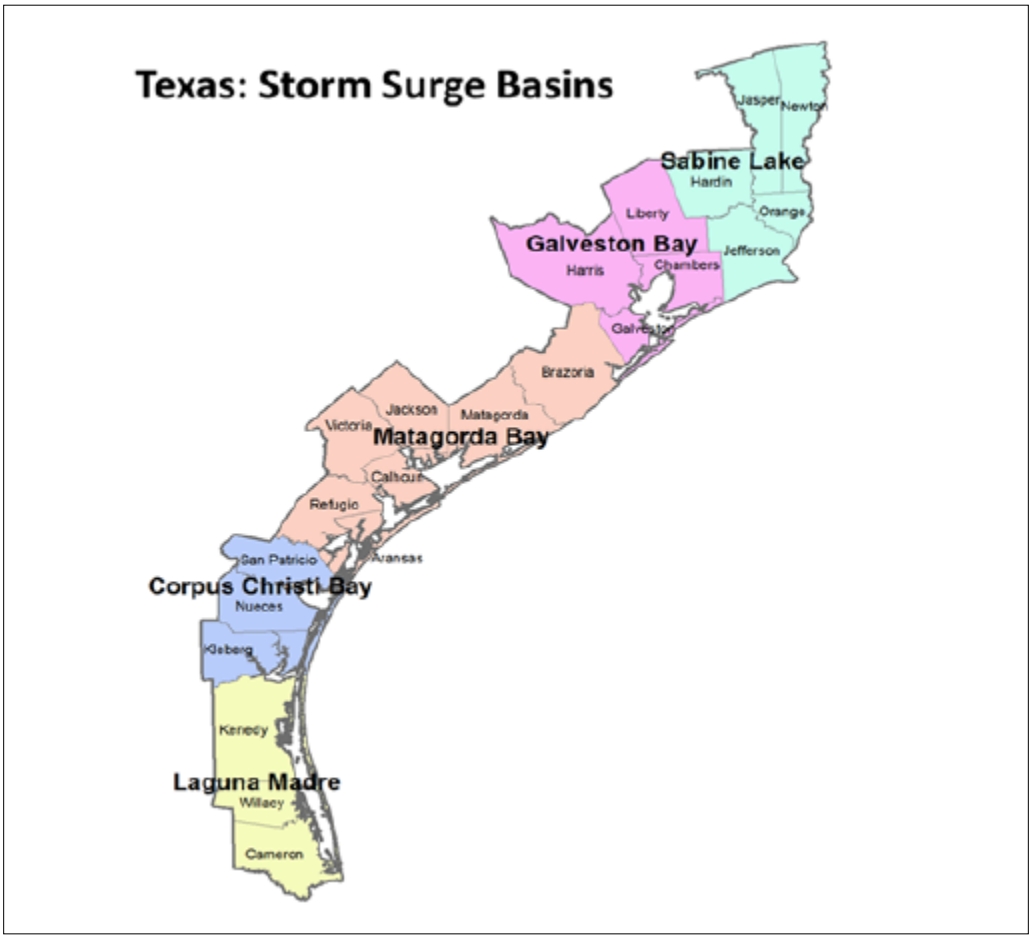

Figure 9: Texas Storm Surge Basins[24]

According to the 2018 Texas State Hazard Mitigation Plan, changes in sea level will contribute directly to increasing damage from storm surge on the Texas coastline. Texas currently has

[24] Texas State Hazard Mitigation Plan 2018

approximately 1,700 square miles that fall within the 100-Year coastal floodplain. By 2050, this area is projected to increase to nearly 2,500 square miles. Figure 10 and Figure 11 below show the estimated impact to Refugio County and the Town of Bayside from a four-foot increase in sea level.

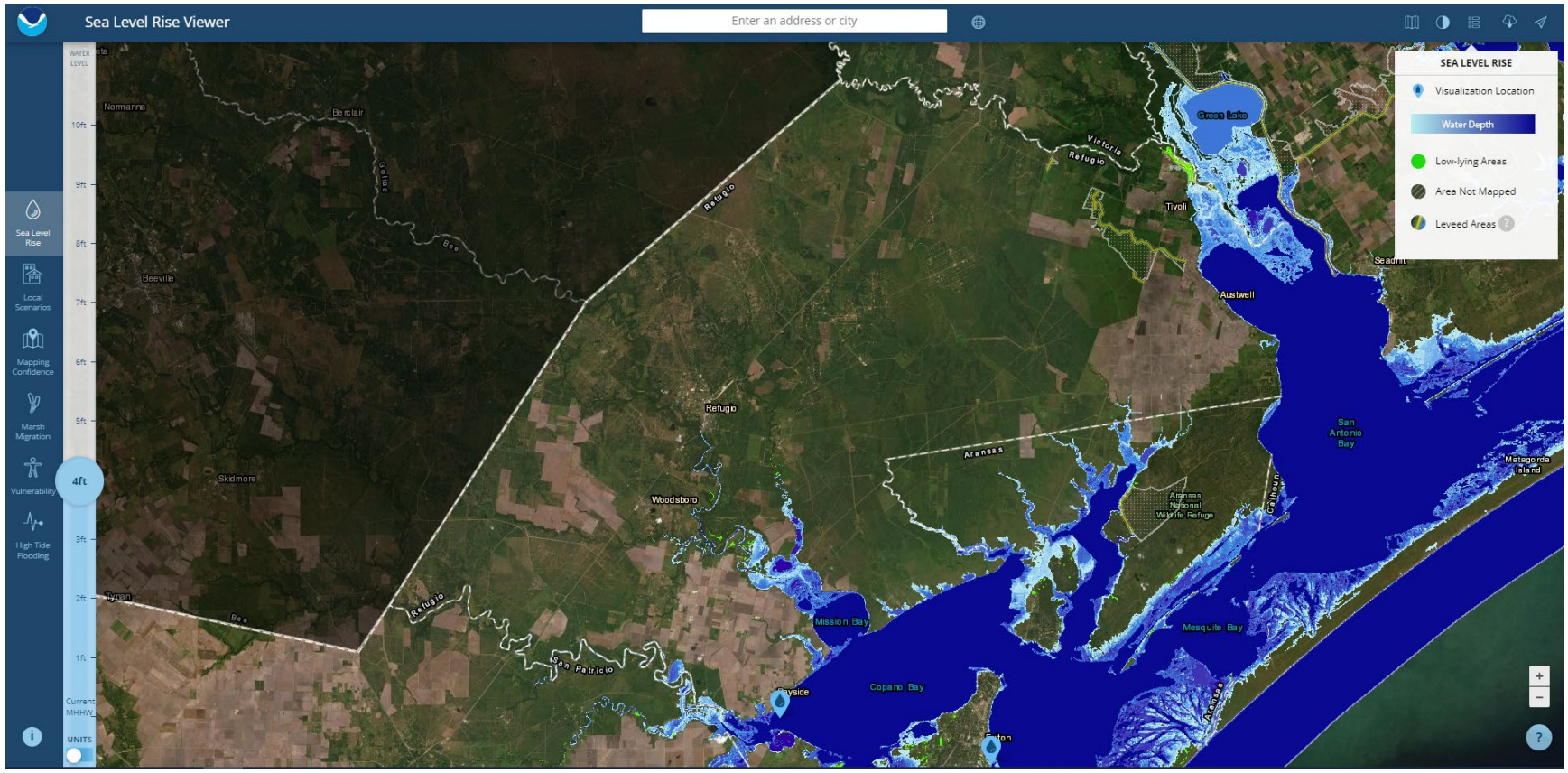

Figure 10: Estimated Impact on Refugio County from a 4 Ft Sea Level Rise[25]

[25] https://coast.noaa.gov/slr/

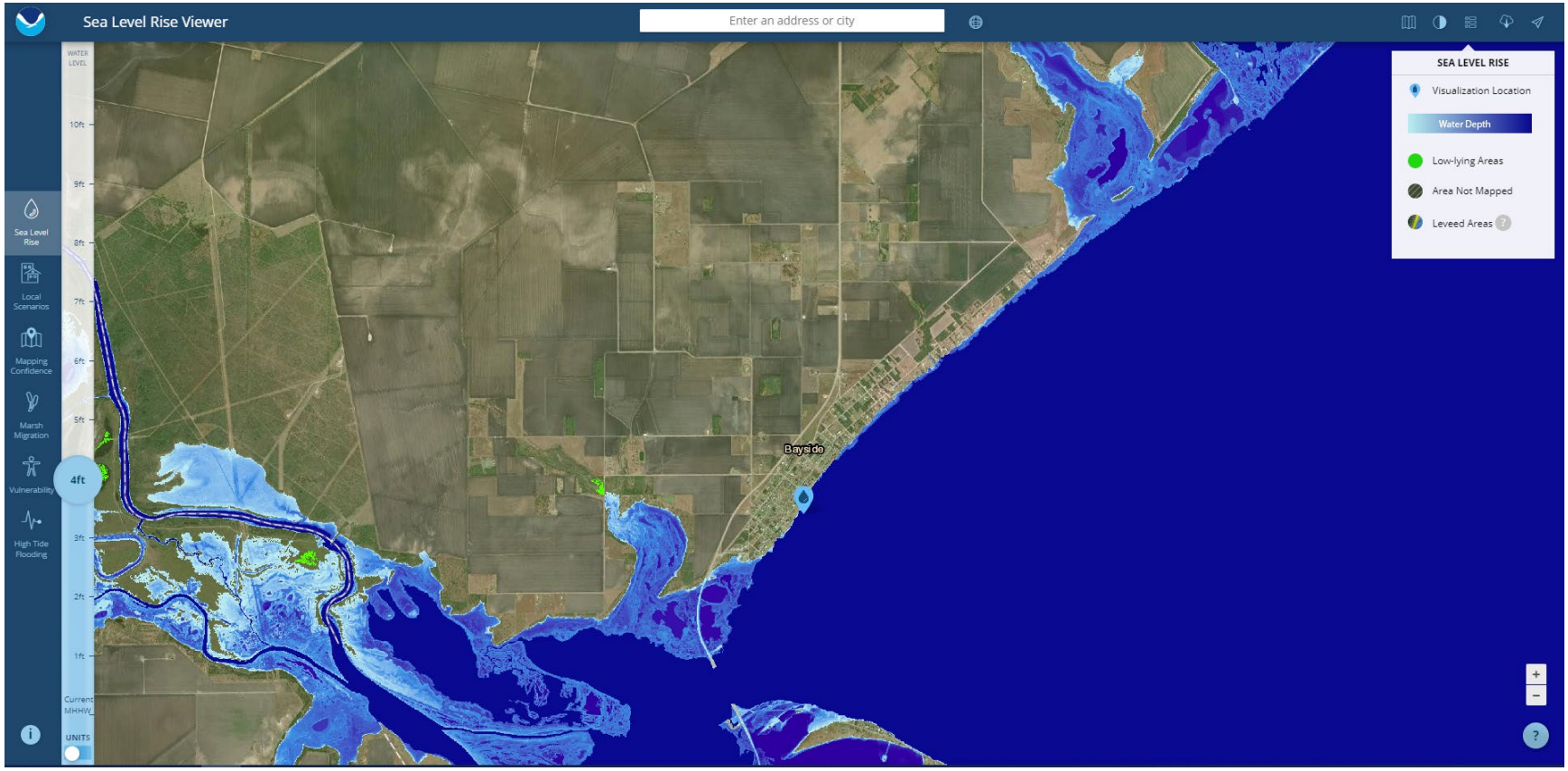

Figure 11: Expected Impact from a 4 Ft Sea Level Rise in the Town of Bayside[26]

[26] https://coast.noaa.gov/slr/

1) Severe Coastal Flooding History

Severe Coastal Flooding was covered under the Flood hazard in the previous plan. The planning team relied on data from the National Centers for Environmental Information (NCEI) to develop a coastal flood history for the County and each participating jurisdiction.

According to the NCEI, Refugio County has experienced six storm surge and one coastal flood events since 1950. There was no information on coastal flooding events in the individual jurisdictions.

Table 20: Refugio County Coastal Flooding History

Location	Date Range	Number of Flood Events	Flood Types	Local Fatalities	Local Injuries	Local Property Damage $2021	Local Crop Damage $2021
County	6/30/20210 - 10/8/2020	7	Storm Surge, Coastal Flood	0	0	$25,159.59	$0

Austwell-Tivoli ISD determined that the jurisdiction has no risk of inundation from Severe Coastal Flooding and the history of impacts of Severe Coastal Flooding have been negligible (or non-existent), therefore it is expected that future impacts will be negligible as well and isn't addressing the hazard.

Refugio ISD determined that the jurisdiction has no risk of inundation from Severe Coastal Flooding and the history of impacts of Severe Coastal Flooding have been negligible (or non-existent), therefore it is expected that future impacts will be negligible as well and isn't addressing the hazard.

Woodsboro ISD determined that the jurisdiction has no risk of inundation from Severe Coastal Flooding and the history of impacts of Severe Coastal Flooding have been negligible (or non-existent), therefore it is expected that future impacts will be negligible as well and isn't addressing the hazard.

Refugio County Water Control and Improvement District #1 determined that the jurisdiction has no risk of inundation from Severe Coastal Flooding and the history of impacts of Severe Coastal Flooding have been negligible (or non-existent), therefore it is expected that future impacts will be negligible as well and isn't addressing the hazard.

2) Likelihood of Future Events

Hurricanes occur in seasonal patterns between June 1 and November 30. Based on historical frequency of significant hurricane events in Refugio County and the participating jurisdictions,

the probability of a future storm surge/coastal flooding event affecting any of the participating jurisdictions is likely, meaning a coastal flooding event is possible in the next three years.

3) Extent

The worst coastal flooding events in Refugio County and the participating jurisdictions have produced storm tides/surges up to 10 feet higher than the average water level.[27] According to the best information available, the coastal flooding events in all participating jurisdictions inflicted damages of $22,381.69 adjusted for inflation to $2021. Future coastal flooding events may meet previous worst-case coastal flooding events in terms of storm surge level, damage dollars, injuries, and even deaths.

4) Location and Impact

Figure 12 profiles potential storm surge in Refugio County. Storm surge occurs when a storm's winds push sea water toward the shore. The advancing surge combines with normal tides to create a hurricane storm tide, raising the average water level 15 feet or more. Storm surge can be hugely destructive. Sand dunes can be washed out, buildings near the coast can be toppled, and the surge can push flooding miles inland through rivers and back bays.[28]

[27] Event date 8/25/2017, NCEI Data.

[28] https://www.floodsmart.gov/floodsmart/pages/coastal_flooding/major_coastal_hazards.jsp

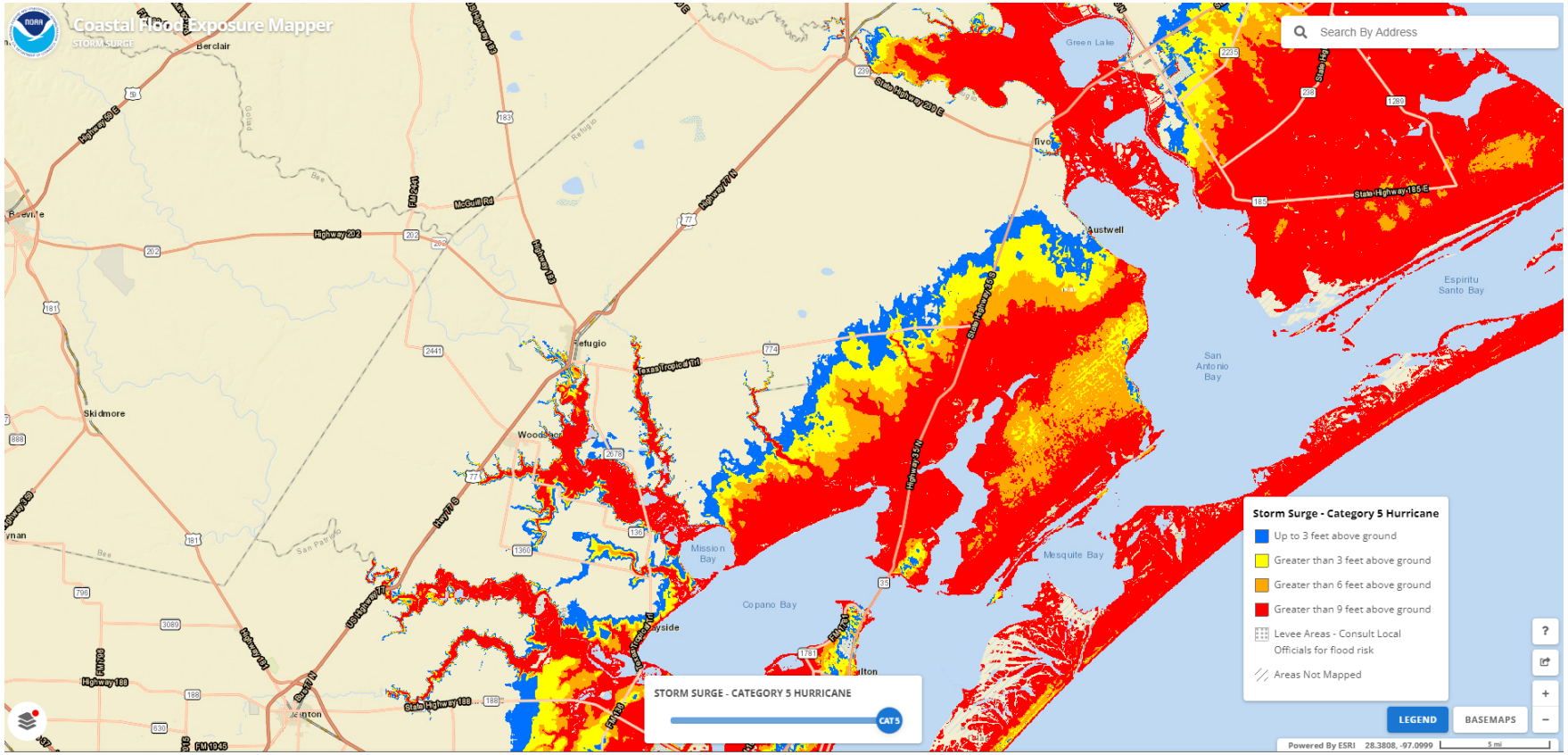

Figure 12: Refugio County Storm Surge[29]

[29] https://coast.noaa.gov/floodexposure/#-10808778,3284412,11z/eyJoIjoic3Rvcm1TdXJnZXwxfDUifQ==

5) Vulnerability

A) Population

As described in Section 3 of Chapter 3 above, Refugio County and the participating jurisdictions are home to many vulnerable residents. Increased vulnerability may be due to many factors including but not limited to: age, physical ability, financial means, housing type, and housing condition. Many of these vulnerabilities often overlap.

The participating jurisdictions recognize that vulnerable populations may need additional help preparing for and recovering from a coastal flooding event.

Residents of mobile / manufactured housing are of particular concern. These structures are never considered safe during a coastal flood, and depending on tie-down methods, may threaten surrounding structures.

Residents of sub-standard structures are also of particular concern. Structures in sub-standard condition ahead of a tropical storm or hurricane, whether due to structural damages, missing windows or doors, holes in exterior walls or the roof, may be less safe during a hurricane or tropical storm than structures in standard condition. Existing structural weaknesses may mean increased damages, injuries, or loss of life

B) Critical Infrastructure

United States Highway 77, United States Highway 183, State Highway 35, State Highway 239 are TxDOT-designated major hurricane evacuation routes for Refugio County from the coast.

Coastal flooding along any of these routes during a hurricane evacuation could strand motorists trying to escape the storm. These drivers may need to be rescued and could be injured or killed.

C) Critical Facilities

Critical facilities are critical because of their special function, size, service area, or unique role. Moreover, damage to critical facilities brings increased negative impact to the community beyond the importance of the critical facility itself. Critical facilities vulnerable to coastal flooding/storm surge were identified based on their location in the potential impact zone for a Category Five hurricane storm surge.

Table 21: Critical Facilities Vulnerable to Coastal Flooding

Refugio County
Aransas River Boat Ramp
Bonnie View Community Center
Copano Bay Boat Ramp
Elevated Storage Tank

Ground Storage Tank
Hynes Bay Boat Ramp
Lift Stations
Pressure Tank
Pump Stations
Refugio County Precinct Building, Precinct 2
Wastewater Treatment Plant
Water Treatment Plant
Water Wells

City of Austwell
Austwell Volunteer Fire Department
Elevated Storage Tank
Wastewater Treatment Plant
Water Treatment Plant

Town of Bayside
Town of Bayside City Hall and Community Center
Town of Bayside Volunteer Fire Department
Wastewater Treatment Plant
Water Plant
Lift Stations
Water Wells
Pump Stations
Reverse Osmosis Units

D) Vulnerable Parcels

Parcels vulnerable to flooding have been identified by their complete or partial location within an estimated Category Five hurricane storm surge zone.

Table 22: Parcels Vulnerable to Coastal Flooding

Jurisdiction	Parcel Count	Estimated Potential Damage Value
Refugio County	1,285	$277,705,950
Town of Bayside	318	$30,315,450

8. Riverine Flooding

According to the Texas State Hazard Mitigation Plan, Floods are defined as:

> [T]he accumulation of water within a water body and the overflow of excess water into adjacent floodplain lands.
>
> In hydrologic analysis, runoff is that portion of rainfall which, in combination with other factors, contributes to the stream flow of any surface drainage way. When runoff exceeds the carrying capacity of the stream or drainage, flooding occurs. Runoff is a product of two major groups of factors, climate and physiographic. Climatic factors may include precipitation, evaporation, transpiration and interception. Physiographic factors would include the characteristics of the watershed such as size, shape and slope of the basin's drainage area, the general land use within the basin. Average annual runoff decreases unevenly moving east to west across Texas, the localized variations based on these factors listed above.
>
> When surface water runoff enters into streams, rivers, or dry creek beds, riverine flooding conditions occur whenever the water carrying capacity of the water channel is compromised by excess runoff.
>
> If the local basin drainage area is relatively flat, shallow, slow-moving floodwater can last for days. In drainage areas with substantial slope, or the channel is narrow and confined, rapidly moving and extreme high-water conditions, called a flash flood, can occur.

1) Flood History

The planning team relied on data from the National Centers for Environmental Information (NCEI) to develop a flood history for the County and each participating jurisdiction.

According to Refugio County's 2017 plan, the County and jurisdictions addressing the hazard recorded 30 flood events between 1997 - 2014, none of which was reported to have caused any injuries, fatalities, or damages. Of the 30 events, one was related to rainfall associated with a tropical system. Twenty-eight were classified as Flash Floods. Eight of the events directly impacted the Town of Refugio and seven directly impacted the Town of Woodsboro.

Between 2014 – 2021, Refugio County and the participating jurisdictions recorded 10 additional riverine flood events.

Table 23: Refugio County Riverine Flood History

Location	Date Range	Number of Flood Events	Flood Types	Local Fatalities	Local Injuries	Local Property Damage $2021	Local Crop Damage $2021
Countywide	8/26/2017 – 9/15/2018	7	Flash Flood / Flood	0	0	$0	$0

Table 24: Town of Bayside Riverine Flood History

Location	Date Range	Number of Flood Events	Flood Types	Local Fatalities	Local Injuries	Local Property Damage $2021	Local Crop Damage $2021
Town of Bayside	9/15/2018	1	Flash Flood	0	0	$0	$0

Table 25: Town of Refugio Riverine Flood History

Location	Date Range	Number of Flood Events	Flood Types	Local Fatalities	Local Injuries	Local Property Damage $2021	Local Crop Damage $2021
Town of Refugio	6/25/2014	1	Flash Flood	0	0	$0	$0

Table 26: Town of Woodsboro Riverine Flood History

Location	Date Range	Number of Flood Events	Flood Types	Local Fatalities	Local Injuries	Local Property Damage $2021	Local Crop Damage $2021
Town of Woodsboro	3/9/2016	1	Flash Flood	0	0	$0	$0

A) National Flood Insurance Program

The National Flood Insurance Program (NFIP) is administered by FEMA to provide flood insurance coverage to the nation. All of the jurisdictions are listed as participating communities on the Community Status Book Report.

Refugio County, the Town of Bayside, Town of Refugio, and the Town of Woodsboro have adopted and enforce flood damage prevention ordinances in their respective jurisdictions. All four ordinances require the lowest level of new structures in the floodplain to meet or exceed

the base flood elevation. At this time, the County is considering updating its ordinance to require 18" of freeboard. In Refugio County, the Floodplain Administrator is empowered to administer and implement the provisions of the ordinance. The Town of Refugio's Flood Damage Prevention Ordinance designates the City Secretary as responsible for enforcing its floodplain management regulations and ensuring regulations meet or exceed the minimum NFIP requirements. The Town of Woodsboro's Flood Damage Prevention Ordinance designates the Town Secretary as the floodplain administrator responsible for enforcing its floodplain management regulations and ensuring regulations meet or exceed the minimum NFIP requirements. The Town of Bayside's Flood Damage Prevention Ordinance designates the Mayor as the floodplain administrator responsible for enforcing its floodplain management regulations and ensuring regulations meet or exceed the minimum NFIP requirements.

Each of these jurisdictions is responsible for the enforcement of floodplain management regulations and how these regulations will meet or exceed the minimum NFIP requirements. The existing ordinances and any future updates will guide each jurisdiction as it continues to comply with NFIP requirements through local permitting, inspection, and recordkeeping, especially for new and substantially redeveloped construction. Each jurisdiction will continue to encourage residents to purchase flood insurance to reduce their flood risk.

The current FIRM maps covering Refugio County and the participating jurisdictions became effective on September 26, 2014. A revalidation of existing LOMCs became effective on September 27, 2014, and a Letter of Map Amendment upholding the Zone A boundaries as drawn on the 9/26/14 FIRM maps became effective on February 3, 2015.

The flood mitigation actions outlined in Section 17 below were developed with flood mitigation and NFIP compliance in mind. Public awareness in particular will be an ongoing effort in each participating jurisdiction to reduce future losses due to flooding, and it will continue even after recommended corrective actions have been implemented.

As of April 2, 2021, there are 69 NFIP policies in force in unincorporated Refugio County and the City of Austwell. These policies cover property worth $19,097,000.

There are 21 NFIP policies in force in the Town of Bayside covering property worth $6,300,000.

There are 36 NFIP policies in force in the Town of Refugio covering property worth $7,192,000.

There are 15 NFIP policies in force in the Town of Woodsboro covering property worth $3,237,000.

As of April 2, 2021, there have been 103 paid NFIP claims totaling $1,572,643.

Table 27: NFIP Claims and Payments

Jurisdiction Name	Total Premiums	Total Closed Paid Losses	Total Payments
City of Austwell	$3,864	6	$39,960
Town of Bayside	$8,105	20	$245,796
Refugio County (Unincorporated)	$32,112	34	$638,451
Town of Refugio	$21,140	32	$400,514
Town of Woodsboro	$5,996	11	$247,922

A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling ten-year period, since 1978. According to the best information available, there are no repetitive loss properties in Refugio County or any of the participating jurisdictions.

A severe repetitive loss property is: "a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding $5,000 and with cumulative amount of such claims payments exceeding $20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property. According to the best information available, there are no severe repetitive loss properties in Refugio County or any of the participating jurisdictions.

2) Likelihood of Future Events

In the case of the FEMA 100-year floodplain, there's a 1% annual chance, and in the 500-year floodplain it's a 0.02% annual chance. The probability of a 100-year riverine flood event is therefore occasional. The probability of a 500-year flood event is therefore unlikely.

However, based on the frequency of previous flood events, every jurisdiction can expect to experience some type of riverine flooding that may or may not meet the definition of a 100-year or 500-year event on a more regular basis.

In the participating jurisdictions, previous flood history indicates that a future riverine flood event is likely, meaning that one is probable in the next three years.

3) Extent

Extent is the strength or magnitude of a hazard. The magnitude of a flood event is typically designated by its return period. For this analysis, the primary focus is the FEMA 100-year floodplain because it's the standard used by the NFIP.

The FEMA 100-year floodplain designates areas within Refugio County and the participating jurisdictions that have a 1% chance of a flood event with a magnitude expected to be equaled or exceeded once on average during any 100-year period. However, despite the name and its significance, areas within the FEMA 100-year floodplain may flood more or less frequently over any given time period.

The FEMA 500-year floodplain designates areas within Refugio County and the participating jurisdictions that have a 0.02% chance of a flood event with a magnitude expected to be equaled or exceeded once on average during any 500-year period. Like the FEMA 100-year floodplain, areas within the FEMA 500-year floodplain may flood more or less frequently over any given time period.

The worst flooding events in Refugio County and the participating jurisdictions have inflicted as high as $7,219,118.44[30]in property damages. Crop damages during the worst flooding in Refugio County and the participating jurisdictions have been as high as $4,599,283.20[31]. The worst flood events in Refugio County and the participating jurisdictions have caused at least two fatalities and one injury[32]. Flooding throughout the County and the participating jurisdictions has been as deep as 3'. Future flood events in Refugio County and the participating jurisdictions may meet previous worst-case events.

4) Location and Impact

A) Refugio County

Roughly 14% (70,568 acres out of 497,528) of Refugio County is in the FEMA 100-year floodplain. The rest of Refugio County, roughly 85% (426,960 acres out of 498,428), is in the FEMA 500-year floodplain.

[30] Incident date: 10/19/1984, Refugio County 2013 CHAMPS Report, Adjusted for inflation to $2021
[31] Incident date: 8/10/1980, Refugio County 2013 CHAMPS Report, Adjusted for inflation to $2021
[32] Refugio County CHAMPS Report

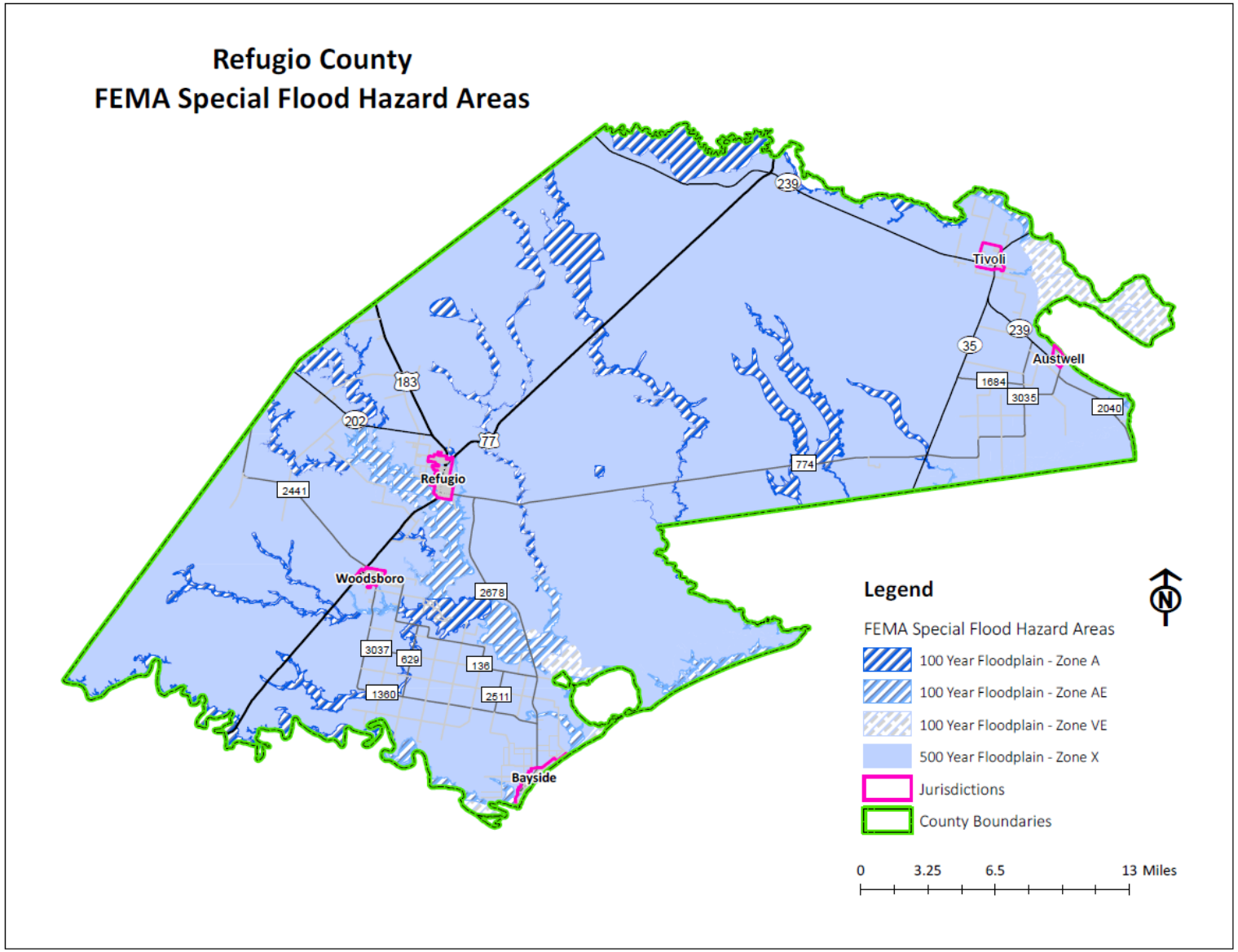

Figure 13: Refugio County FEMA Special Flood Hazard Areas

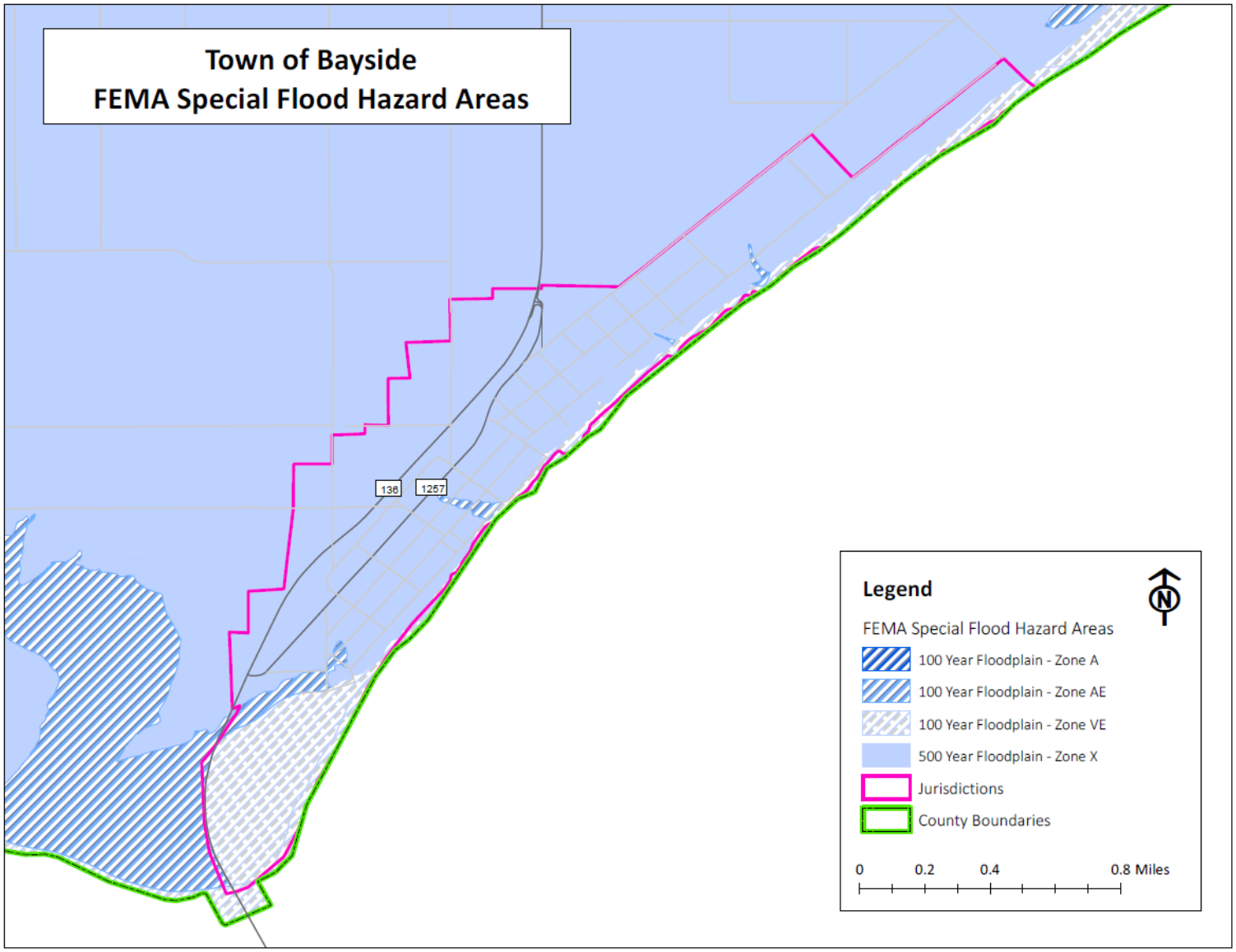

Figure 14: Town of Bayside FEMA Special Flood Hazard Areas

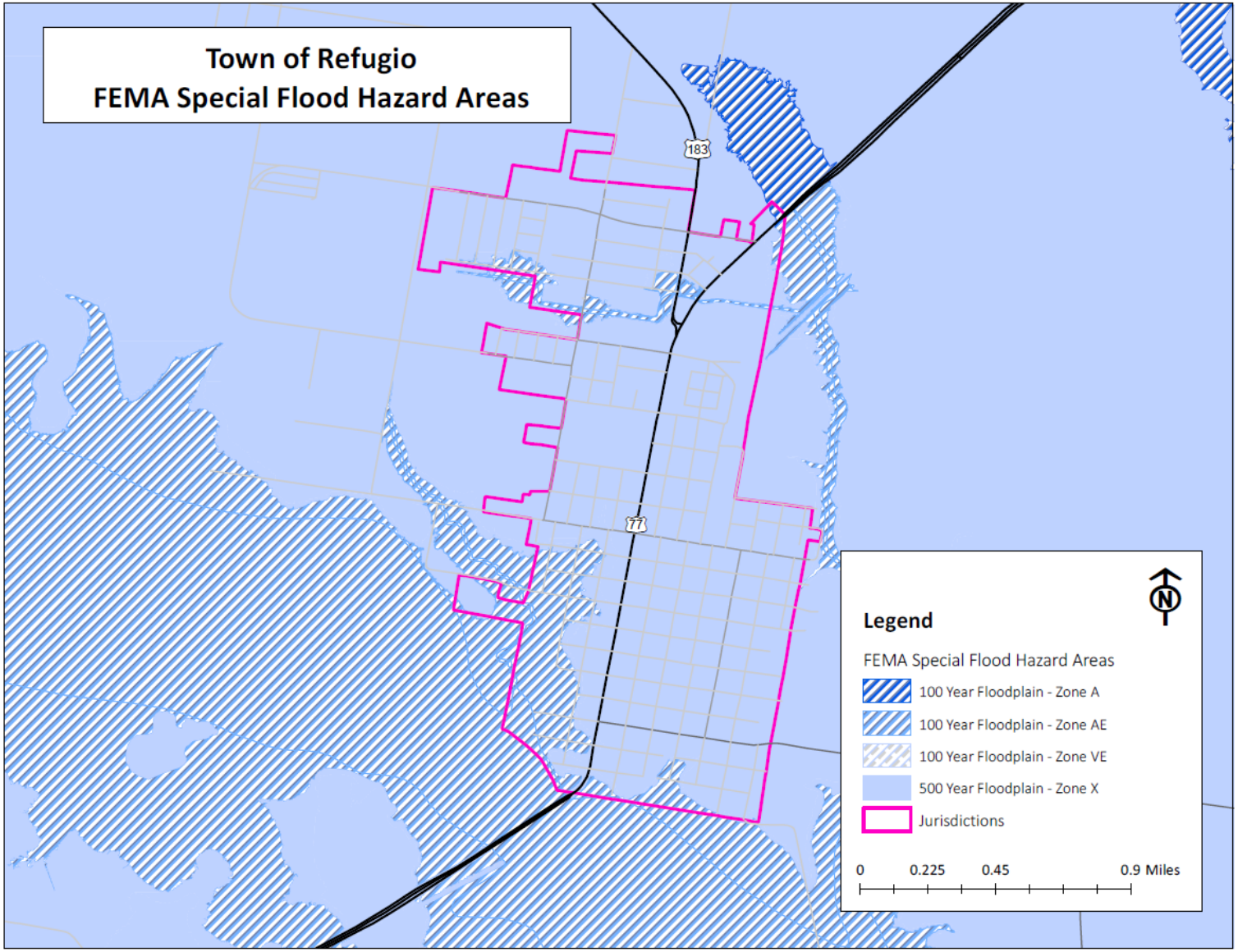

Figure 15: Town of Refugio FEMA Special Flood Hazard Areas

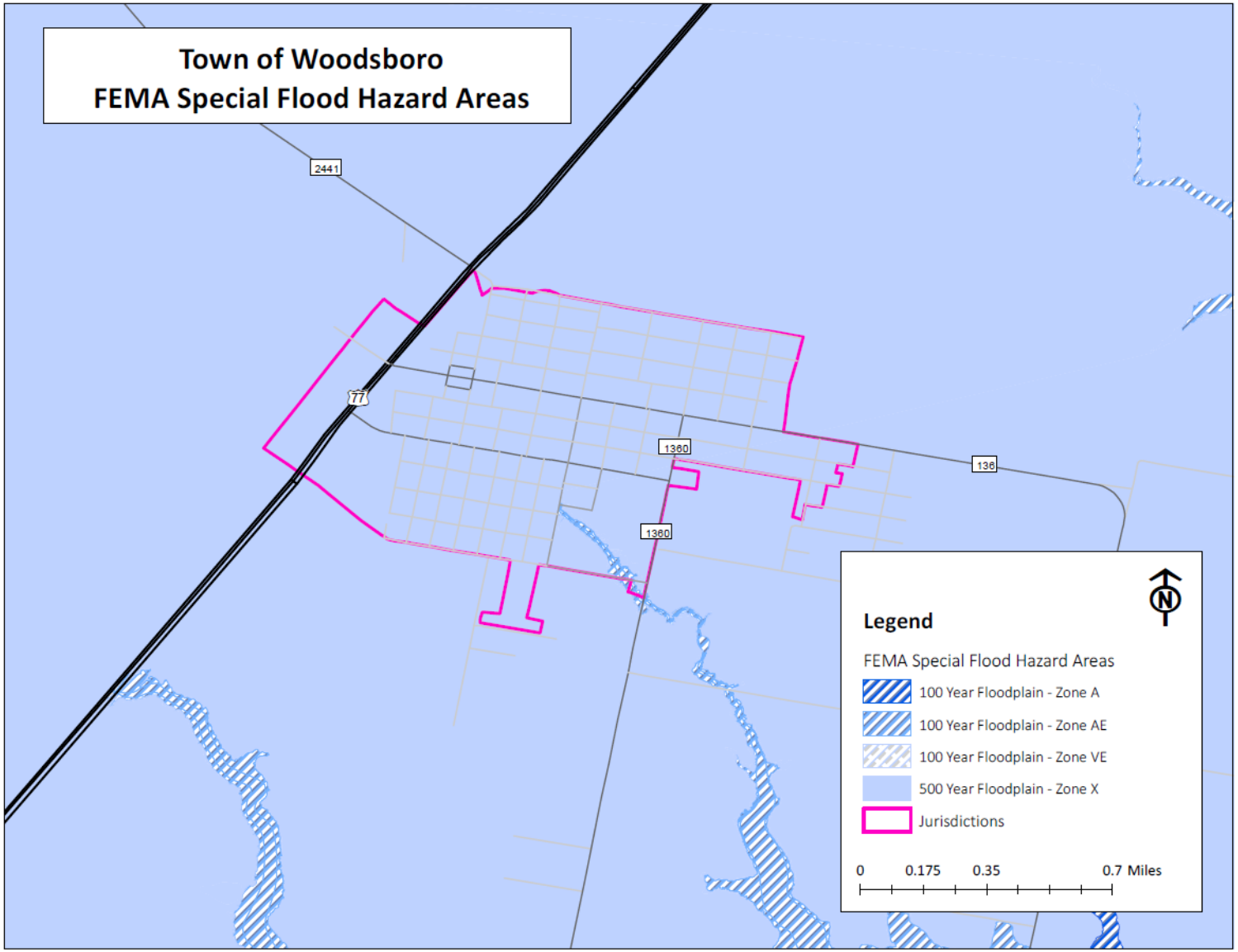

Figure 16: Town of Woodsboro FEMA Special Flood Hazard Areas

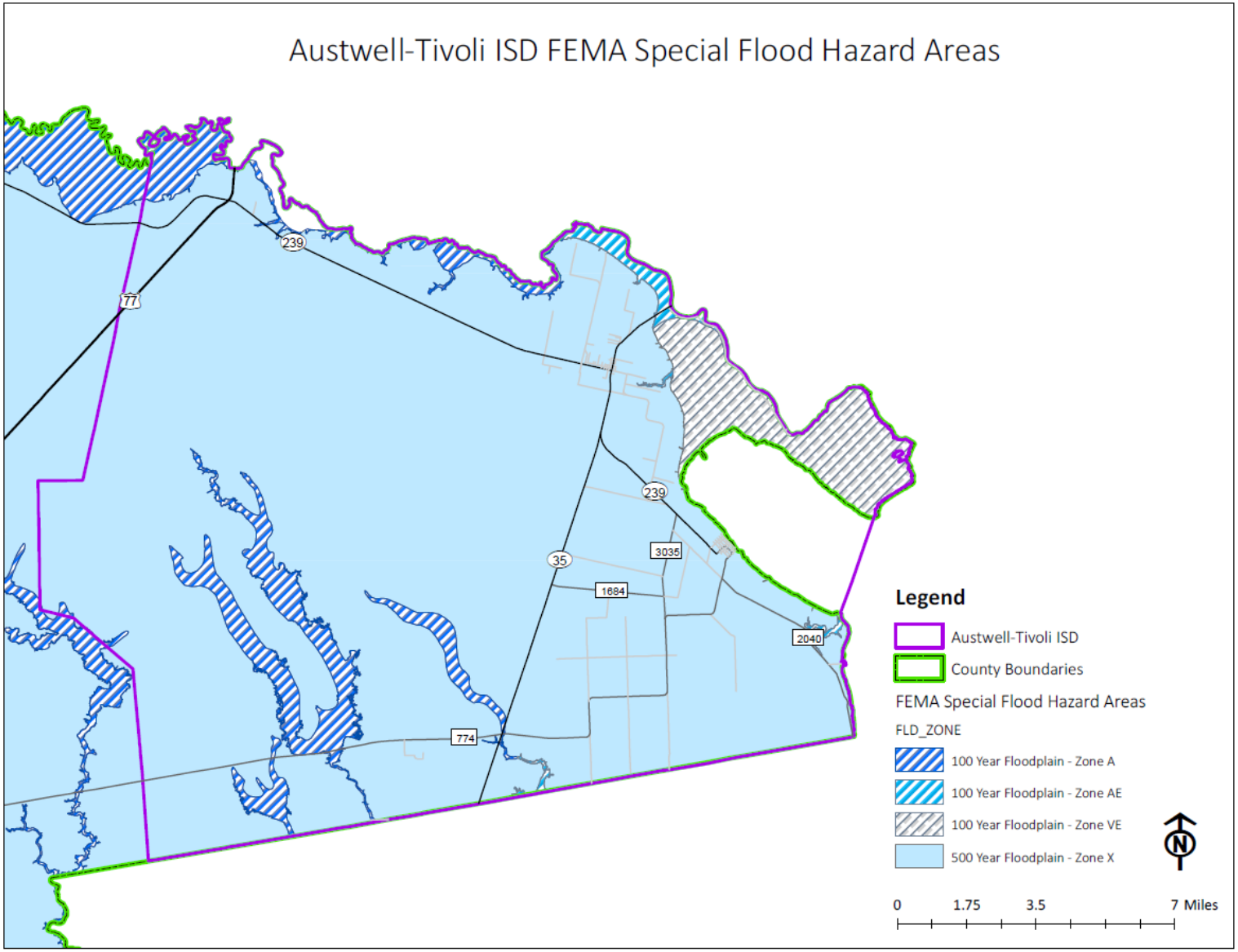

Figure 17: Austwell-Tivoli ISD FEMA Special Flood Hazard Areas

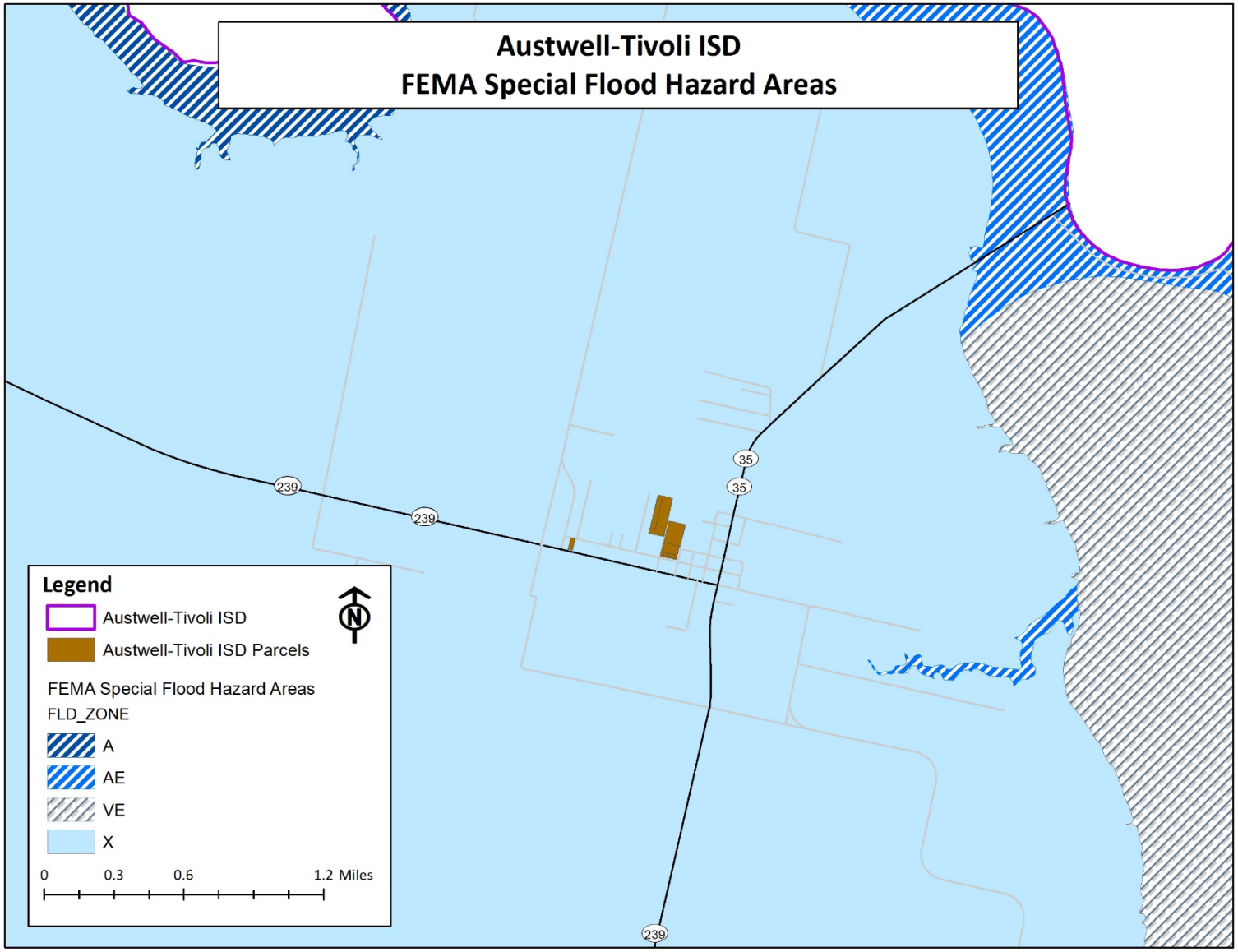

Figure 18: Austwell-Tivoli ISD Owned Parcels

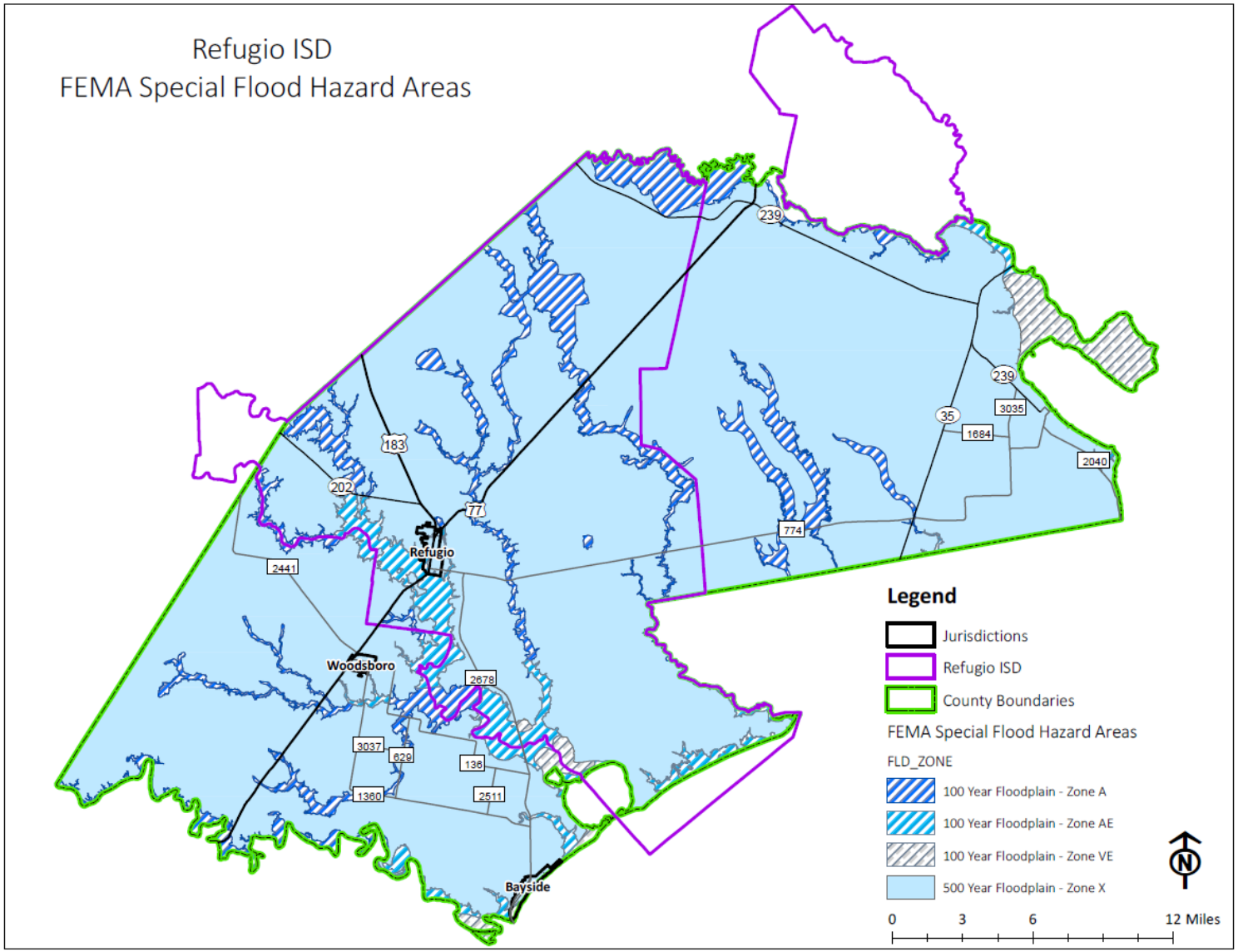

Figure 19: Refugio ISD FEMA Special Flood Hazard Areas

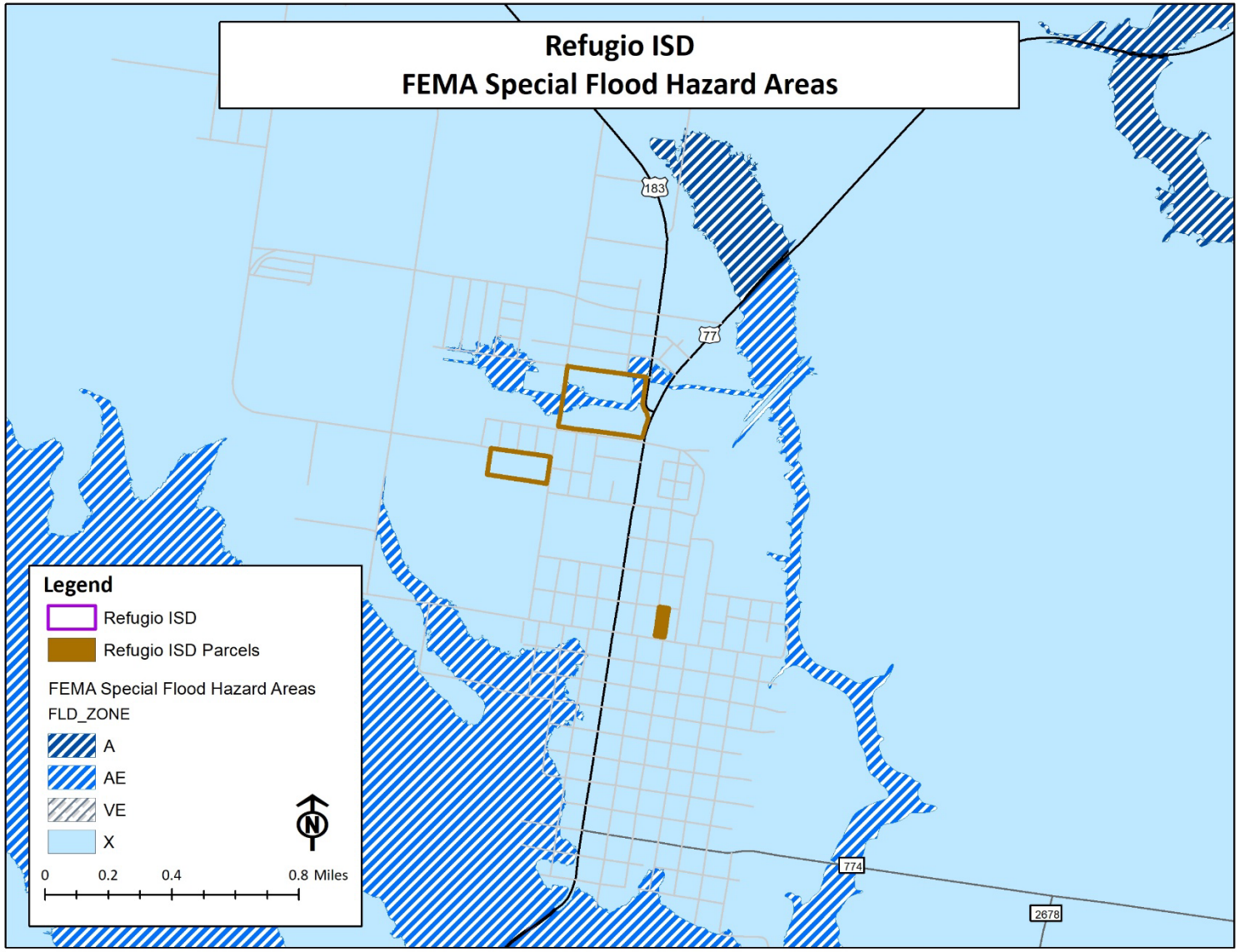

Figure 20: Refugio ISD Owned Parcels

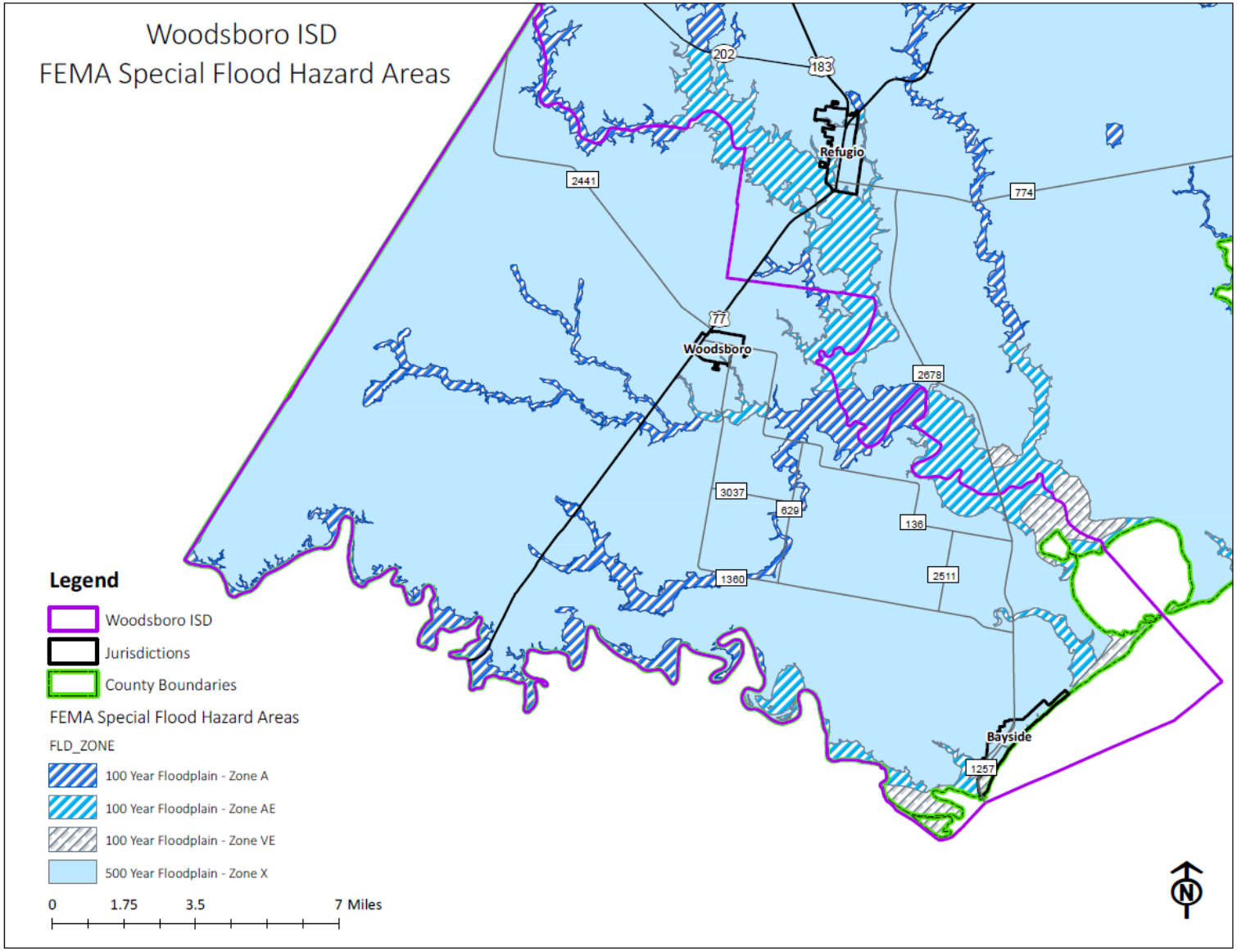

Figure 21: Woodsboro ISD FEMA Special Flood Hazard Areas

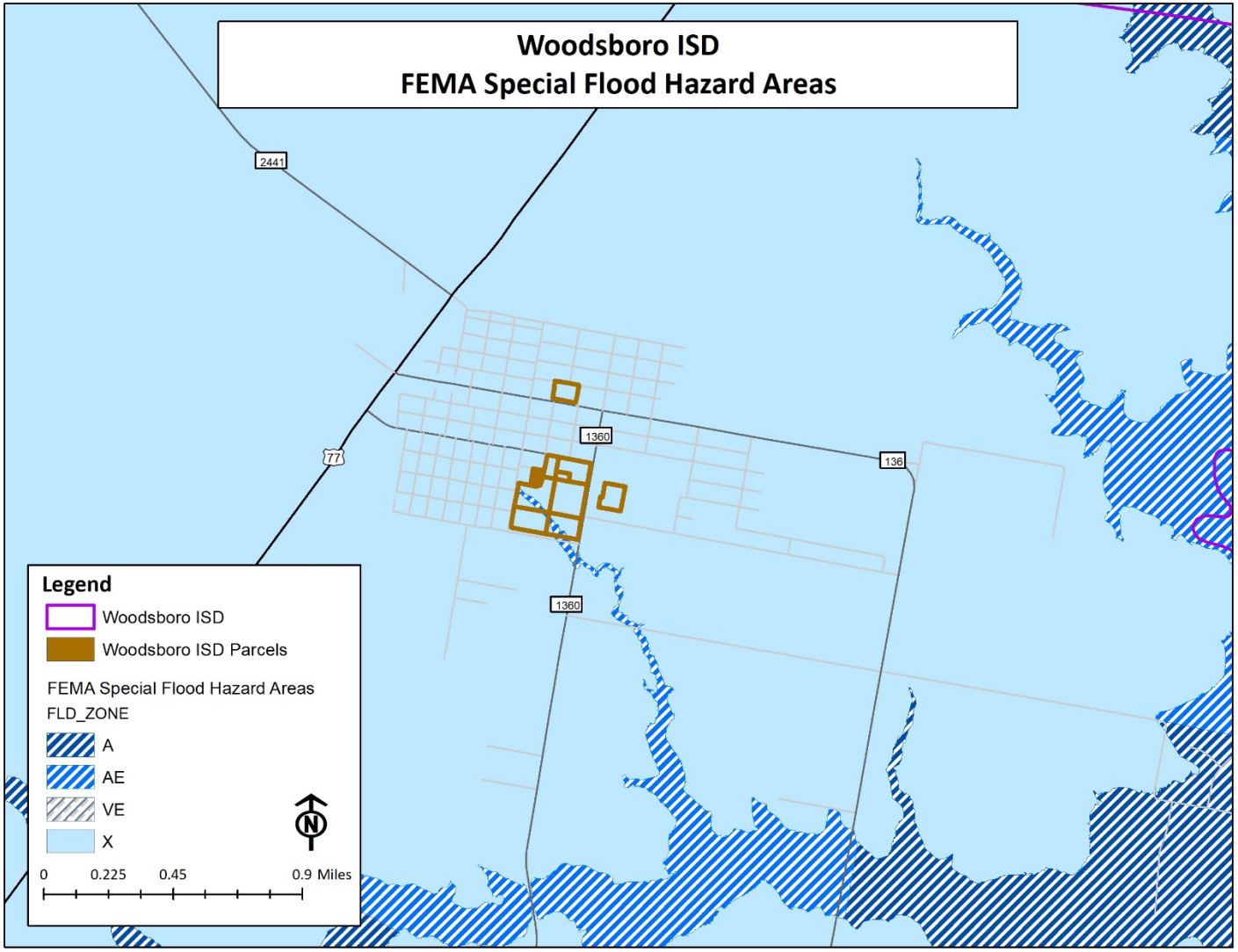

Figure 22: Woodsboro ISD Owned Parcels

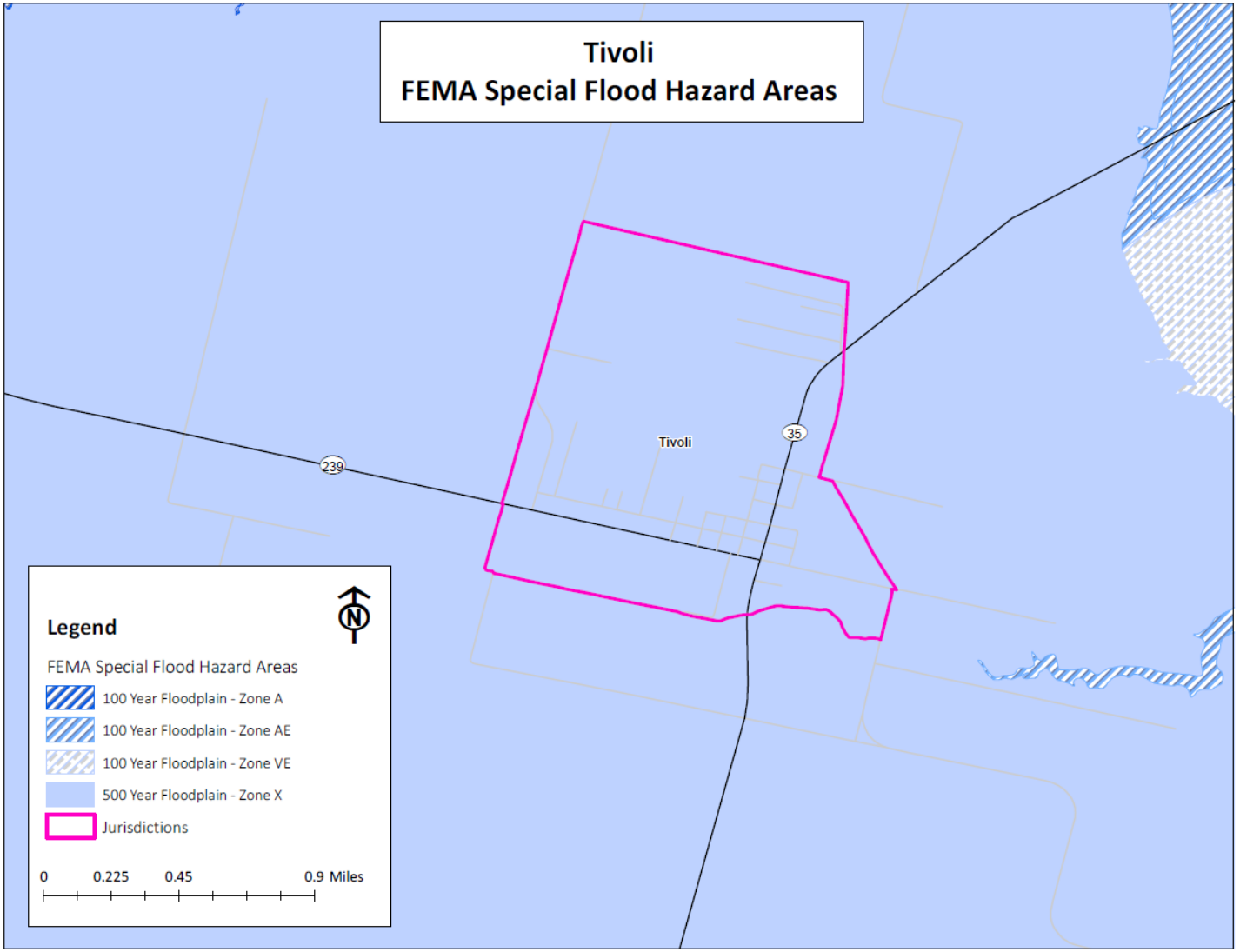

Figure 23: RCWCID #1 FEMA Special Flood Hazard Areas[33]

[33] All of the critical facilities for RCWCID #1 are located in the Census-Designated Place of Tivoli

B) Impact

Although the probability of a FEMA 100-year flood event remains occasional, 1% in any given year, the floodplain crosses all of Refugio County's major thoroughfares, potentially limiting travel across, within, and around the County.

The impact of a FEMA 100-year flood event will vary depending on the location, size of the affected area, and number of structures affected. County residents outside of the participating jurisdictions are concentrated in the City of Austwell, the Town of Bayside, and unincorporated areas like Tivoli and Bonnie View. Flooding in these areas will impact more residents than flooding in less developed parts of the County. Parts of the County may temporarily lose power due to downed power lines. Motorists and residents throughout the County may be left stranded and needing rescue. Affected structures may be flooded, damaged by floodborne contaminants, damaged by debris flow, damaged by wave action, or even completely washed away. Crops may be damaged or destroyed. Estimated damage totals to vulnerable structures and total structures affected during a 100-year flood event may meet the totals outlined in Table 13 above.

Despite the unlikely probability of a so-called 500-year flood, 0.02% in any given year, the danger isn't negligible. Moreover, the relatively limited information on the 500-year flood zone should not be interpreted to mean that a 500-year flood will only occur in the areas depicted in the 500-year flood zone on the County's NFIP maps. Parts of the County may temporarily lose power due to downed power lines. Motorists and residents may be left stranded and needing rescue. Affected structures may be flooded, damaged by floodborne contaminants, damaged by debris flow, damaged by wave action, or even completely washed away. Crops may be damaged or destroyed. A 500-year flood event is expected to affect a larger area and more structures than a 100-year flood. Estimated damage totals to vulnerable structures and total structures affected during a 500-year flood event may meet the totals outlined in Table 13 below.

5) Vulnerability

A) Population

As described in Section 3 of Chapter 3 above, Refugio County and the participating jurisdictions are home to many vulnerable residents. Increased vulnerability may be due to many factors including but not limited to: age, physical ability, financial means, housing type, and housing condition. Many of these vulnerabilities often overlap.

The participating jurisdictions recognize that vulnerable populations may need additional help preparing for and recovering from a flood.

Residents of mobile / manufactured housing are of particular concern. These structures are never considered safe during a flood, and depending on tie-down methods, may threaten surrounding structures.

Residents of sub-standard structures are also of particular concern. Structures in sub-standard condition ahead of a flood, whether due to structural damages, missing windows or doors, holes in exterior walls or the roof, may be less safe during a flood than structures in standard condition. Existing structural weaknesses may mean increased damages, injuries, or loss of life

B) Critical Facilities

Critical facilities are critical because of their special function, size, service area, or unique role. Moreover, damage to critical facilities brings increased negative impact to the community beyond the importance of the critical facility itself. The planning team identified 119 critical facilities spread across the County and participating jurisdictions. All are located in a known FEMA Special Flood Hazard Area.

Refugio County
Aransas River Boat Ramp
Aransas River Bridge
Blanco Creek Bridge
Bonnie View Community Center
Copano Bay Boat Ramp
Elevated Storage Tank
Ground Storage Tank
Hynes Bay Boat Ramp
Lift Stations
Mary Rhodes Pipeline
Mission River Bridge
Padilla Hall
Pressure Tank
Pump Stations
Radio Towers
Refugio County Airport (Rooke Field)
Refugio County Community Center
Refugio County Courthouse
Refugio County Expo Center
Refugio County Fairgrounds
Refugio County Jail
Refugio County Precinct Building, Precinct 1
Refugio County Precinct Building, Precinct 2

Refugio County Precinct Building, Precinct 3
Refugio County Precinct Building, Precinct 4
Southcross Energy GP
State Highway 35
Union Pacific Railroad
United States Highway 77
United States Highway 77A / 183
Wastewater Treatment Plant
Water Treatment Plant
Water Wells

City of Austwell
Austwell Volunteer Fire Department
Elevated Storage Tank
Wastewater Treatment Plant
Water Treatment Plant

Town of Bayside
Town of Bayside City Hall and Community Center
Town of Bayside Volunteer Fire Department
Wastewater Treatment Plant
Water Plant
Lift Stations
Water Wells
Pump Stations
Reverse Osmosis Units

Town of Refugio
City Hall
Elevated Storage Tank
Elevated Storage Tank
HEB & HEB Pharmacy
Parker Lumber
Refugio County Memorial Hospital and Helipad
Town of Refugio Fire Department
Town of Refugio Police Department
Vantage Bank

Village Pharmacy
Wastewater Treatment Plant
Water Plant #1
Water Plant #2
Water Plant #3
Refugio Rural Health Clinic
Refugio Specialty Clinic
Refugio Manor Nursing and Rehabilitation Center
Mission Ridge Nursing and Rehabilitation Center
Gulf South Pipeline Co.
Valiant Petroleum
EOG Resources
Lift Stations
Pump Stations
Town of Refugio Police Department Annex
RV Park
Woodforest National Bank

Town of Woodsboro
200k Gallon Ground Tanks
Ballfield Concession
Chlorine Storage
City Building
Elevated Storage Tank
Equipment Storage
Fast Break
Filtration Control Building
Filtration Tanks
First National Bank
Gazebo
Haertig, Inc.
Office Building
Parts Barn
SCADA / Electrical System
Storage / Rental Building
Town of Woodsboro Volunteer Fire Department
Tractor Storage
Tuttle's Grocery Market
Wastewater Treatment Plant

Water Plant
Well #3
Well #4
Woodsboro City Hall
Woodsboro Family Center
Woodsboro Farmers COOP
Wranosky Wran Lift Station

Tivoli
Elevated Storage Tank
Tivoli Volunteer Fire Department
Wastewater Treatment Plant
Water Plant

Austwell-Tivoli ISD
Austwell-Tivoli High School
Austwell-Tivoli Elementary
Austwell-Tivoli Administration Building
Austwell-TIvoli Maintenance Building

Refugio ISD
Refugio ISD Elementary School (Primary School)
Refugio High School/Refugio ISD Administration Building
Refugio ISD Junior High School (7th & 8th Grade Building)
Jack Sportsman Bobcat Stadium/Athletic Facility/Maintenance Building

Woodsboro ISD
Eagle Dome
Woodsboro ISD Administration Office
Woodsboro ISD Elementary School
Woodsboro ISD Junior and Senior High School

Refugio Water Control and Improvement District #1
Water Treatment Plant
Wastewater Plant
Elevated Storage Tank

Water Wells
Lift Station

C) Vulnerable Parcels

Parcels vulnerable to flooding have been identified by their complete or partial location within the FEMA 100-year floodplain and the FEMA 500-year floodplain.

Table 28: Vulnerable Parcels by Flood Zone in Refugio County

Jurisdiction	Total Parcels	Estimated Potential Damage Value
FEMA 100-Year Flood Zone A		
Refugio County	609	$72,773,430
FEMA 500-Year Flood Zone		
Refugio County	8,904	$1,444,041,487

Table 29: Vulnerable Parcels by Flood Zone in the Town of Bayside

Jurisdiction	Total Parcels	Estimated Potential Damage Value
FEMA 100-Year Flood Zone A		
Town of Bayside	17	$976,260
FEMA 500-Year Flood Zone		
Town of Bayside	1,061	$64,019,130

Table 30: Vulnerable Parcels by Flood Zone in the Town of Refugio

Jurisdiction	Total Parcels	Estimated Potential Damage Value
FEMA 100-Year Flood Zone A		
Town of Refugio	100	$1,784,300

FEMA 500-Year Flood Zone		
Town of Refugio	1,847	$105,990,738

Table 31: Vulnerable Parcels by Flood Zone in the Town of Woodsboro

Jurisdiction	Total Parcels	Estimated Potential Damage Value
FEMA 100-Year Flood Zone A		
Town of Woodsboro	4	$652,840
FEMA 500-Year Flood Zone		
Town of Woodsboro	1,541	$66,300,160

Table 32: Vulnerable Austwell-Tivoli ISD Parcels by Flood Zone

Jurisdiction	Total Parcels	Estimated Potential Damage Value
FEMA 500-Year Flood Zone		
Austwell-Tivoli ISD	11	$225,820

Table 33: Vulnerable Refugio ISD Parcels by Flood Zone

Jurisdiction	Total Parcels	Estimated Potential Damage Value
FEMA 100-Year Flood Zone A		
Refugio ISD	1	$122,240
FEMA 500-Year Flood Zone		
Refugio ISD	10	$145,840

Table 34: Vulnerable Woodsboro ISD Parcels by Flood Zone

Jurisdiction	Total Parcels	Estimated Potential Damage Value
FEMA 100-Year Flood Zone A		
Woodsboro ISD	3	$489,630
FEMA 500-Year Flood Zone		
Woodsboro ISD	11	$617,610

Table 35: Vulnerable RCWCID #1 Parcels by Flood Zone

Jurisdiction	Total Parcels	Estimated Potential Damage Value
FEMA 500-Year Flood Zone		
Refugio County WCID #1	3	$5,640

9. Tornado

A tornado is defined as a rapidly rotating vortex or funnel of air extending ground-ward from a cumulonimbus cloud. Most of the time, vortices remain suspended in the atmosphere and are visible as a funnel cloud. However, when the lower tip of a vortex touches the ground, the tornado becomes a force of destruction. Tornado strength is currently measured using the Enhanced Fujita (EF) Scale. Like the previously used Fujita scale, the EF Scale uses damage to estimate tornado wind speeds and assign a number between 0 and 5. A rating of EF0 represents minor to no damage whereas a rating of EF5 represents total destruction of buildings.

1) Tornado History

Refugio County previously reported 23 tornados between 1963 - 2015. The 2017 plan recorded $1,000 in property damages during that time. However, the damage total is considered to be low. The damaging event occurred in 2002, and the total wasn't adjusted to account for inflation. None of the tornados was reported to have caused any injuries, or fatalities.

Since the previous plan, six tornados have been reported in Refugio County and the participating jurisdictions.

Table 36: Refugio County Tornado History[34]

Location	Date Range	Number of Tornados	F / EF Magnitude Range	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Countywide	6/25/2014-7/25/2020	6	EF0, EFU	0	0	$170,455.57	$0

The Town of Refugio has one reported tornado on 6/25/2014 that caused $55,247.62 in damages. No injuries or deaths were recorded for that event. The Town of Woodsboro has one reported tornado on 3/28/2018 that caused $104,171.53 in damages. No injuries or deaths were recorded for that event. None of the other participating jurisdictions had any reported tornados.

2) Likelihood of Future Events

Based on the frequency of previous tornados in Refugio County and the participating jurisdictions, a future event that may impact any or all of them is likely, meaning one is probable in the next three years.

[34] https://www.NCEI.noaa.gov/stormevents/

3) Extent

Before 2007, the Fujita Scale was used for rating tornado strength. The Fujita Scale is based on damage intensity instead of wind speed, with estimated wind speed ranges based on the extent of observed damage.

Table 37: Fujita Scale

Fujita Scale			
Enhanced Fujita Category	Wind Speed (MPH)	Character	Potential Damage
Zero (F0)	40-72	Weak	Light Damage. Some damage to chimneys; branches broken off trees, shallow-rooted trees uprooted, sign boards damaged.
One (F1)	73-112	Weak	Moderate damage. Roof surfaces peeled off; mobile homes pushed foundations or overturned; moving autos pushed off road.
Two (F2)	113-157	Strong	Considerable damage. Roofs torn from frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light objects become projectiles.
Three (F3)	158-206	Strong	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.
Four (F4)	207-260	Violent	Devastating damage. Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
Five (F5)	260-318	Violent	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (109 yds.); high-rise buildings have significant structural deformation; incredible phenomena will occur.

Adopted after 2007, the Enhanced Fujita Scale, or EF Scale, is the scale for rating the strength of tornados via the damage they cause. Six categories from zero to five represent increasing degrees of damage. The scale considers how most structures are designed and is thought to be an accurate representation of the surface wind speeds in the most violent tornados.

Table 38: Enhanced Fujita Scale[35]

[35] Texas State Hazard Mitigation Plan, 2013 Update

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 yds.); high-rise buildings have significant structural deformation; incredible phenomena will occur.

Since the previous plan, only EF0 and EFU tornados have been recorded. The worst tornado occurred on 3/28/2018 in the Town of Woodsboro, causing $104,171.53 in property damages. No injuries or deaths have been reported since the previous plan. Future tornados may meet up to EF5 on the Enhanced-Fujita Scale.

4) Location and Impact

A) Location

Tornados are not constrained by any distinct geographic boundary. Tornados can occur across all participating jurisdictions and may freely cross from one jurisdiction into another.

B) Impact

Impacts from a tornado may include but are not limited to damaged or destroyed personal property including vehicles, damaged or destroyed agricultural, residential, commercial, and industrial buildings. Crops may be damaged or destroyed. Pets and livestock may be injured or killed by tornados or flying debris. Pets and livestock may escape due to damaged or destroyed structures and fences.

In the worst cases, tornados may cause injuries and/or be deadly.

5) Vulnerability

Tornados have the potential to impact the entire planning area. All existing and future buildings, critical facilities, critical infrastructure, improved property, and the population of the participating jurisdictions are considered vulnerable to this hazard.

A) Population

As described in Section 3 of Chapter 3 above, Refugio County and the participating jurisdictions are home to many vulnerable residents. Increased vulnerability may be due to many factors including but not limited to: age, physical ability, financial means, housing type, and housing condition. Many of these vulnerabilities often overlap.

The participating jurisdictions recognize that vulnerable populations may need additional help preparing for and recovering from a tornado.

Residents of mobile / manufactured homes are of particular concern. These structures are never considered safe during a tornado.

Residents of sub-standard structures are also of particular concern. Structures in sub-standard condition ahead of a tornado, whether due to structural damages, missing windows or doors, holes in exterior walls or the roof, may be less safe during a tornado than structures in standard condition.

Existing structural weaknesses, due to housing type or existing damages, may lead to compounded damages, injuries, or loss of life.

B) Critical Facilities and Infrastructure

Certain critical facilities and infrastructure in each jurisdiction may be particularly vulnerable to tornados. These facilities have been identified for reasons including: the number of people who use the facility or infrastructure, the facility's role in providing basic services to begin the cleanup process and get the jurisdictions running again, and the facility's ability to offer goods and materials residents will need to resume normalcy as quickly as possible. The selected critical facilities are built from a variety of materials with varying levels of resistance to tornadic damages. Additionally, their varying ages mean they weren't constructed to uniform building standards. Given tornados' violent nature, these facilities may experience increased levels of vulnerability to the hazards. Damage to any of these facilities may have a disproportionately negative impact on each jurisdiction's recovery from a tornado if that damage affects the facility's ability to reopen and resume normal business right away.

Table 39: Critical Facilities Vulnerable to Tornados and Potential Impacts

Refugio County	Potential Tornado Impacts								
	Loss of Power	Flying Debris	Uprooted Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Aransas River Boat Ramp		x						x	x
Aransas River Bridge		x						x	x
Blanco Creek Bridge								x	x
Bonnie View Community Center	x	x	x	x	x	x	x	x	x
Copano Bay Boat Ramp								x	x
Elevated Storage Tank	x	x					x	x	x
Ground Storage Tank								x	x
Hynes Bay Boat Ramp								x	x
Lift Stations	x	x	x			x	x	x	x
Mary Rhodes Pipeline								x	x
Mission River Bridge								x	x
Padilla Hall	x	x	x	x	x	x	x	x	x
Pressure Tank								x	x
Pump Stations								x	x
Radio Towers	x	x				x	x	x	x
Refugio County Airport (Rooke Field)								x	x
Refugio County Community Center	x	x	x	x	x	x	x	x	x
Refugio County Courthouse	x	x	x	x	x	x	x	x	x
Refugio County Expo Center	x	x	x	x	x	x	x	x	x
Refugio County Fairgrounds	x	x	x	x	x	x	x	x	x
Refugio County Jail	x	x	x	x	x	x	x	x	x
Refugio County Precinct Building, Precinct 1	x	x	x	x	x	x	x	x	x
Refugio County Precinct Building, Precinct 2	x	x	x	x	x	x	x	x	x

Refugio County Precinct Building, Precinct 3	x	x	x	x	x	x	x	x	x
Refugio County Precinct Building, Precinct 4	x	x	x	x	x	x	x	x	x
Southcross Energy GP	x	x		x	x	x	x	x	x
State Highway 35		x	x					x	x
Union Pacific Railroad		x	x					x	x
United States Highway 77		x	x					x	x
United States Highway 77A / 183		x	x					x	x
Wastewater Treatment Plant	x	x	x	x	x	x	x	x	x
Water Treatment Plant	x	x		x	x	x	x	x	x
Water Wells	x	x	x		x	x	x	x	x

City of Austwell	Potential Tornado Impacts								
	Loss of Power	Flying Debris	Uprooted Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Austwell Volunteer Fire Department	x	x	x	x	x	x	x	x	x
Elevated Storage Tank	x	x					x	x	x
Wastewater Treatment Plant	x	x	x	x	x	x	x	x	x
Water Treatment Plant	x	x		x	x	x	x	x	x

Town of Bayside	Potential Tornado Impacts								
	Loss of Power	Flying Debris	Uprooted Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Town of Bayside City Hall and Community Center	x	x	x	x	x	x	x	x	x
Town of Bayside Volunteer Fire Department	x	x	x	x	x	x	x	x	x
Wastewater Treatment Plant	x	x		x			x	x	x
Water Plant	x	x	x	x	x	x	x	x	x

Lift Stations	x	x	x			x	x	x	x
Water Wells	x	x	x	x	x	x	x	x	x
Pump Stations	x	x	x	x	x	x	x	x	x
Reverse Osmosis Units	x	x	x	x	x	x	x	x	x

Town of Refugio	Potential Tornado Impacts								
	Loss of Power	Flying Debris	Uprooted Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
City Hall	x	x		x	x	x	x	x	x
Elevated Storage Tank		x		x			x	x	x
Elevated Storage Tank		x		x			x	x	x
HEB & HEB Pharmacy	x	x		x	x	x	x	x	x
Parker Lumber	x	x		x	x	x	x	x	x
Refugio County Memorial Hospital and Helipad	x	x	x	x	x	x	x	x	x
Town of Refugio Fire Department	x	x	x	x	x	x	x	x	x
Town of Refugio Police Department	x	x		x	x	x	x	x	x
Vantage Bank	x	x	x	x	x	x	x	x	x
Village Pharmacy	x	x		x	x	x	x	x	x
Wastewater Treatment Plant	x	x		x	x	x	x	x	x
Water Plant #1	x	x		x	x	x	x	x	x
Water Plant #2	x	x	x	x	x	x	x	x	x
Water Plant #3	x	x		x	x	x	x	x	x
Refugio Rural Health Clinic	x	x	x	x	x	x	x	x	x
Refugio Specialty Clinic	x	x	x	x	x	x	x	x	x
Refugio Manor Nursing and Rehabilitation Center	x	x	x	x	x	x	x	x	x
Mission Ridge Nursing and Rehabilitation Center	x	x	x	x	x	x	x	x	x
Gulf South Pipeline Co.	x	x		x	x	x	x	x	x

Valiant Petroleum	x	x		x	x	x	x	x	x
EOG Resources	x	x		x	x	x	x	x	x
Lift Stations	x	x	x	x	x	x	x	x	x
Pump Stations	x	x	x	x	x	x	x	x	x
Town of Refugio Police Department Annex	x	x		x	x	x	x	x	x
RV Park	x	x	x	x	x	x	x	x	x
Woodforest National Bank	x	x	x	x	x	x	x	x	x

Town of Woodsboro	Potential Tornado Impacts								
	Loss of Power	Flying Debris	Uprooted Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
200k Gallon Ground Tanks	x	x	x				x	x	x
Ballfield Concession	x	x	x	x	x	x	x	x	x
Chlorine Storage	x	x	x	x	x	x	x	x	x
City Building	x	x	x	x	x	x	x	x	x
Elevated Storage Tank	x	x					x	x	x
Equipment Storage	x	x	x	x	x	x	x	x	x
Fast Break	x	x		x	x	x	x	x	x
Filtration Control Building	x	x	x	x	x	x	x	x	x
Filtration Tanks	x	x	x	x	x	x	x	x	x
First National Bank	x	x	x	x	x	x	x	x	x
Gazebo		x	x				x	x	x
Haertig, Inc.	x	x		x	x	x	x	x	x
Office Building	x	x	x	x	x	x	x	x	x
Parts Barn	x	x	x	x	x	x	x	x	x
SCADA / Electrical System	x	x	x	x	x	x	x	x	x
Storage / Rental Building	x	x	x	x	x	x	x	x	x

Town of Woodsboro Volunteer Fire Department	x	x	x	x	x	x	x	x	x
Tractor Storage	x	x	x	x	x	x	x	x	x
Tuttle's Grocery Market	x	x	x	x	x	x	x	x	x
Wastewater Treatment Plant	x	x		x	x	x	x	x	x
Water Plant	x	x	x	x	x	x	x	x	x
Well #3	x	x	x	x			x	x	x
Well #4	x	x	x	x			x	x	x
Woodsboro City Hall	x	x	x	x	x	x	x	x	x
Woodsboro Family Center	x	x	x	x	x	x	x	x	x
Woodsboro Farmers COOP	x	x	x	x	x	x	x	x	x
Wranosky Wran Lift Station	x	x	x			x	x	x	x

Tivoli	**Potential Tornado Impacts**								
	Loss of Power	Flying Debris	Uprooted Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Elevated Storage Tank		x					x	x	x
Tivoli Volunteer Fire Department	x	x	x	x	x	x	x	x	x
Wastewater Treatment Plant	x	x			x	x	x	x	x
Water Plant	x	x	x	x	x	x	x	x	x

Austwell-Tivoli ISD	**Potential Tornado Impacts**								
	Loss of Power	Flying Debris	Uprooted Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Austwell-Tivoli High School	x	x	x	x	x	x	x	x	x
Austwell-Tivoli Elementary	x	x	x	x	x	x	x	x	x
Austwell-Tivoli Administration Building	x	x	x	x	x	x	x	x	x

Austwell-TIvoli Maintenance Building	x	x	x	x	x	x	x	x	x

Refugio ISD	Potential Tornado Impacts								
	Loss of Power	Flying Debris	Uprooted Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Refugio ISD Elementary School (Primary School)	x	x	x	x	x	x	x	x	x
Refugio High School/Refugio ISD Administration Building	x	x	x	x	x	x	x	x	x
Refugio ISD Junior High School (7th & 8th Grade Building)	x	x	x	x	x	x	x	x	x
Jack Sportsman Bobcat Stadium/Athletic Facility/Maintenance Building	x	x		x	x	x	x	x	x

Woodsboro ISD	Potential Tornado Impacts								
	Loss of Power	Flying Debris	Uprooted Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Eagle Dome	x	x		x				x	x
Woodsboro ISD Administration Office	x	x	x	x	x	x	x	x	x
Woodsboro ISD Elementary School	x	x	x	x	x	x	x	x	x
Woodsboro ISD Junior and Senior High School	x	x	x	x	x	x	x	x	x

Refugio Water Control and Improvement District #1	Potential Tornado Impacts								
	Loss of Power	Flying Debris	Uprooted Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Water Treatment Plant	x	x		x	x	x	x	x	x
Wastewater Plant	x	x		x	x	x	x	x	x
Elevated Storage Tank		x					x	x	x

Water Wells	x	x	x	x	x	x	x	x	x
Lift Station	x	x	x			x	x	x	x

C) Vulnerable Parcels

Table 40: Parcels Vulnerable to Tornados

Jurisdiction	Parcel Count	Estimated Potential Damage Value
Refugio County	11,162	$2,477,921,463
Town of Bayside	1,341	$91,827,960
Town of Refugio	2,156	$120,602,883
Town of Woodsboro	1,620	$68,833,140
Austwell-Tivoli ISD	11	$225,820
Refugio ISD	11	$268,080
Woodsboro ISD	14	$1,107,240
Refugio County WCID #1	4	$16,530

10. Severe Winds

A windstorm[36] is classified as any wind that is strong enough to cause at least light damage to trees and buildings and may or may not be accompanied by precipitation. Wind speeds during a windstorm typically exceed 41 knots. Damage can be attributed to gusts or longer periods of sustained winds.

Severe Winds may last for just a few minutes when caused by downbursts from thunderstorms, or they may last for hours (and even several days) when they result from large-scale weather systems. A windstorm that travels in a straight line and is caused by the gust front (the boundary between descending cold air and warm air at the surface) of an approaching thunderstorm is called a derecho. Derechos are capable of causing widespread damage and landscape devastation.

1) Severe Wind History

In the 2017 plan, Refugio County and the participating jurisdictions recorded 20 instances of severe winds with gusts up to 61mph that caused at least $76,500 in damages.

The following tables identify the most comprehensive list available of severe wind events and associated damages in Refugio County and the participating jurisdictions. The Town of Refugio and Austwell-Tivoli ISD experienced more than half of the severe wind events. No participating jurisdiction has recorded a severe wind event more recently than 2019.

Table 41: Refugio County Severe Winds History

Location	Date Range	Windstorm Events	Windspeed Range Knots	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Countywide	5/24/2015 – 3/9/2016	2	Up to 61	0	0	$49,388.92	$0

Table 42: Town of Refugio Severe Winds History

Location	Date Range	Windstorm Events	Windspeed Range Knots	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Town of Refugio	5/15/2015 – 6/6/2019	4	Up to 56	0	0	$301,400.39	$0

[36] https://www.britannica.com/science/windstorm

Table 43: Austwell-Tivoli ISD Severe Wind History

Location	Date Range	Windstorm Events	Windspeed Range Knots	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Austwell	5/15/2015 – 6/6/2019	2	Up to 56	0	0	$220,728.48	$0

There was no specific information on severe winds occurring since the 2017 plan for the Town of Bayside, the Town of Woodsboro, or Woodsboro ISD. Refugio County WCID #1 is assumed to have the same history as Refugio County.

2) Likelihood of Future Events

Refugio County and the participating jurisdictions have experienced a damaging windstorm roughly once a year. Given the frequency of past events, the probability of a damaging windstorm in the future is likely, meaning that an event affecting any or all of the participating jurisdictions is probable in the next three years.

3) Extent

The generally accepted extent scale for wind events is the Beaufort Wind Scale. The following table lists categories, measurement, classification, and appearance descriptions.

Table 44: Beaufort Wind Scale[37]

Beaufort Wind Scale				
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
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 feet becoming longer, numerous whitecaps	Dust, leaves, and loose paper lifted, small tree branches move

[37] Source: www.spc.noaa.gov/faq/tornado/beaufort.html

5	17-21	Fresh Breeze	Moderate waves 4-8 feet taking longer form, many whitecaps, some spray	Small trees in leaf begin to sway
6	22-27	Strong Breeze	Larger waves 8-13 feet, whitecaps common, more spray	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	Sea heaps up, waves 13-20 feet, white foam streaks off breakers	Whole trees moving, resistance felt walking against wind
8	34-40	Gale	Moderately high (13-20 feet) waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks	Whole trees in motion, resistance felt walking against wind
9	41-47	Strong Gale	High waves (20 feet), 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 (20-30 feet) with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	56-63	Violent Storm	Exceptionally high (30-45 feet) waves, foam patches cover sea, visibility more reduced	
12	64+	Hurricane	Air filled with foam, waves over 45 feet, sea completely white with driving spray, visibility greatly reduced	

The worst Severe Winds in Refugio County and the participating jurisdictions have ranged from 1 to 11 on the Beaufort Wind Scale.

With winds up to 61 MPH, or an 11 on the Beaufort Wind Scale, the single most devastating wind event inflicted $100,000 in property damages in 2015. Adjusted for inflation to $2021, in 1994, Severe Winds inflicted $9,009.92 in agricultural damages, but no wind speed was recorded. Future Severe Winds may meet previous ones in terms of wind speed and damage dollars inflicted.

4) Location and Impact

A) Location

Severe winds are not constrained by any distinct geographic boundary. Severe winds can occur across all participating jurisdictions.

B) Impact

Impacts from a severe wind event may include but are not limited to damaged or destroyed personal property including vehicles, damaged or destroyed agricultural, residential, commercial, and industrial buildings. Crops may be damaged or destroyed. Pets and livestock may be injured or killed by flying debris. Pets and livestock may escape due to damaged or destroyed structures and fences.

In the worst cases, severe wind events may cause injuries and/or be deadly.

5) Vulnerability

Severe wind events have the potential to impact all participating jurisdictions. Therefore, each jurisdiction is equally exposed to the hazard. Improved property, critical facilities, critical infrastructure, and the entire population are considered vulnerable to Severe Winds.

Based on severe wind data collected for the participating jurisdictions, Severe Winds primarily damage physical structures. However, there is no uniformity with respect to the type of structures that have been damaged by Severe Winds in any of the participating jurisdictions. Windstorm damages can be directly caused by the wind itself, flying debris, and falling trees, or indirectly by damages like power outages.

A) Population

As described in Section 3 of Chapter 3 above, Refugio County and the participating jurisdictions are home to many vulnerable residents. Increased vulnerability may be due to many factors including but not limited to: age, physical ability, financial means, housing type, and housing condition. Many of these vulnerabilities often overlap.

The participating jurisdictions recognize that vulnerable populations may need additional help preparing for and recovering from a severe wind event.

Residents of mobile / manufactured homes are of particular concern. These structures may not be safe during severe winds.

Residents of sub-standard structures are also of particular concern. Structures in sub-standard condition ahead of a severe wind event, whether due to structural damages, missing windows or doors, holes in exterior walls or the roof, may be less safe during severe winds than structures in standard condition.

Existing structural weaknesses, due to housing type or existing damages, may lead to compounded damages, injuries, or loss of life.

B) Critical Facilities

Similar to hurricanes and tornados, certain critical facilities and infrastructure in each jurisdiction may be particularly vulnerable to Severe Winds. These facilities have been identified for reasons including: the number of people who use the facility or infrastructure, the facility's role in providing basic services to begin the cleanup process and get the jurisdictions running again, and the facility's ability to offer goods and materials residents will need to resume normalcy as quickly as possible. The selected critical facilities are built from a variety of materials with varying levels of resistance to wind damages. Additionally, their varying ages mean they weren't constructed to uniform building standards. Given wind's potentially violent nature, these facilities may experience increased levels of vulnerability to the hazards. Damage to any of these facilities may have a disproportionately negative impact on each jurisdiction's recovery from a windstorm if that damage affects the facility's ability to reopen and resume normal business right away.

Table 45: Critical Facilities Vulnerable to Severe Winds and Potential Impacts

Refugio County	Potential Severe Wind Impacts								
	Loss of Power	Flying Debris	Uprooted Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Aransas River Boat Ramp		x						x	x
Aransas River Bridge		x						x	x
Blanco Creek Bridge								x	x
Bonnie View Community Center	x	x	x	x	x	x	x	x	x
Copano Bay Boat Ramp								x	x
Elevated Storage Tank	x	x					x	x	x
Ground Storage Tank								x	x
Hynes Bay Boat Ramp								x	x
Lift Stations	x	x	x			x	x	x	x
Mary Rhodes Pipeline								x	x
Mission River Bridge								x	x
Padilla Hall	x	x	x	x	x	x	x	x	x
Pressure Tank								x	x
Pump Stations								x	x
Radio Towers	x	x				x	x	x	x
Refugio County Airport (Rooke Field)								x	x
Refugio County Community Center	x	x	x	x	x	x	x	x	x
Refugio County Courthouse	x	x	x	x	x	x	x	x	x
Refugio County Expo Center	x	x	x	x	x	x	x	x	x
Refugio County Fairgrounds	x	x	x	x	x	x	x	x	x
Refugio County Jail	x	x	x	x	x	x	x	x	x
Refugio County Precinct Building, Precinct 1	x	x	x	x	x	x	x	x	x
Refugio County Precinct Building, Precinct 2	x	x	x	x	x	x	x	x	x

Refugio County Precinct Building, Precinct 3	x	x	x	x	x	x	x	x	x
Refugio County Precinct Building, Precinct 4	x	x	x	x	x	x	x	x	x
Southcross Energy GP	x	x		x	x	x	x	x	x
State Highway 35		x	x					x	x
Union Pacific Railroad		x	x					x	x
United States Highway 77		x	x					x	x
United States Highway 77A / 183		x	x					x	x
Wastewater Treatment Plant	x	x	x	x	x	x	x	x	x
Water Treatment Plant	x	x		x	x	x	x	x	x
Water Wells	x	x	x		x	x	x	x	x

City of Austwell	Potential Severe Wind Impacts								
	Loss of Power	Flying Debris	Falling Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Austwell Volunteer Fire Department	x	x	x	x	x	x	x	x	x
Elevated Storage Tank	x	x					x	x	x
Wastewater Treatment Plant	x	x	x	x	x	x	x	x	x
Water Treatment Plant	x	x		x	x	x	x	x	x

Town of Bayside	Potential Severe Wind Impacts								
	Loss of Power	Flying Debris	Falling Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Town of Bayside City Hall and Community Center	x	x	x	x	x	x	x	x	x
Town of Bayside Volunteer Fire Department	x	x	x	x	x	x	x	x	x
Wastewater Treatment Plant	x	x		x			x	x	x
Water Plant	x	x	x	x	x	x	x	x	x

Lift Stations	x	x	x			x	x	x	x
Water Wells	x	x	x	x	x	x	x	x	x
Pump Stations	x	x	x	x	x	x	x	x	x
Reverse Osmosis Units	x	x	x	x	x	x	x	x	x

Town of Refugio	Potential Severe Wind Impacts								
	Loss of Power	Flying Debris	Falling Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
City Hall	x	x		x	x	x	x	x	x
Elevated Storage Tank		x		x			x	x	x
Elevated Storage Tank		x		x			x	x	x
HEB & HEB Pharmacy	x	x		x	x	x	x	x	x
Parker Lumber	x	x		x	x	x	x	x	x
Refugio County Memorial Hospital and Helipad	x	x	x	x	x	x	x	x	x
Town of Refugio Fire Department	x	x	x	x	x	x	x	x	x
Town of Refugio Police Department	x	x		x	x	x	x	x	x
Vantage Bank	x	x	x	x	x	x	x	x	x
Village Pharmacy	x	x		x	x	x	x	x	x
Wastewater Treatment Plant	x	x		x	x	x	x	x	x
Water Plant #1	x	x		x	x	x	x	x	x
Water Plant #2	x	x	x	x	x	x	x	x	x
Water Plant #3	x	x		x	x	x	x	x	x
Refugio Rural Health Clinic	x	x	x	x	x	x	x	x	x
Refugio Specialty Clinic	x	x	x	x	x	x	x	x	x
Refugio Manor Nursing and Rehabilitation Center	x	x	x	x	x	x	x	x	x
Mission Ridge Nursing and Rehabilitation Center	x	x	x	x	x	x	x	x	x
Gulf South Pipeline Co.	x	x		x	x	x	x	x	x

Valiant Petroleum	x	x		x	x	x	x	x	x
EOG Resources	x	x		x	x	x	x	x	x
Lift Stations	x	x	x	x	x	x	x	x	x
Pump Stations	x	x	x	x	x	x	x	x	x
Town of Refugio Police Department Annex	x	x		x	x	x	x	x	x
RV Park	x	x	x	x	x	x	x	x	x
Woodforest National Bank	x	x	x	x	x	x	x	x	x

Town of Woodsboro	Potential Severe Wind Impacts								
	Loss of Power	Flying Debris	Falling Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
200k Gallon Ground Tanks	x	x	x				x	x	x
Ballfield Concession	x	x	x	x	x	x	x	x	x
Chlorine Storage	x	x	x	x	x	x	x	x	x
City Building	x	x	x	x	x	x	x	x	x
Elevated Storage Tank	x	x					x	x	x
Equipment Storage	x	x	x	x	x	x	x	x	x
Fast Break	x	x		x	x	x	x	x	x
Filtration Control Building	x	x	x	x	x	x	x	x	x
Filtration Tanks	x	x	x	x	x	x	x	x	x
First National Bank	x	x	x	x	x	x	x	x	x
Gazebo		x	x				x	x	x
Haertig, Inc.	x	x		x	x	x	x	x	x
Office Building	x	x	x	x	x	x	x	x	x
Parts Barn	x	x	x	x	x	x	x	x	x
SCADA / Electrical System	x	x	x	x	x	x	x	x	x
Storage / Rental Building	x	x	x	x	x	x	x	x	x

Town of Woodsboro Volunteer Fire Department	x	x	x	x	x	x	x	x	x
Tractor Storage	x	x	x	x	x	x	x	x	x
Tuttle's Grocery Market	x	x	x	x	x	x	x	x	x
Wastewater Treatment Plant	x	x		x	x	x	x	x	x
Water Plant	x	x	x	x	x	x	x	x	x
Well #3	x	x	x	x			x	x	x
Well #4	x	x	x	x			x	x	x
Woodsboro City Hall	x	x	x	x	x	x	x	x	x
Woodsboro Family Center	x	x	x	x	x	x	x	x	x
Woodsboro Farmers COOP	x	x	x	x	x	x	x	x	x
Wranosky Wran Lift Station	x	x	x			x	x	x	x

Tivoli	**Potential Severe Wind Impacts**								
	Loss of Power	Flying Debris	Falling Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Elevated Storage Tank		x					x	x	x
Tivoli Volunteer Fire Department	x	x	x	x	x	x	x	x	x
Wastewater Treatment Plant	x	x			x	x	x	x	x
Water Plant	x	x	x	x	x	x	x	x	x

Austwell-Tivoli ISD	**Potential Severe Wind Impacts**								
	Loss of Power	Flying Debris	Falling Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Austwell-Tivoli High School	x	x	x	x	x	x	x	x	x
Austwell-Tivoli Elementary	x	x	x	x	x	x	x	x	x
Austwell-Tivoli Administration Building	x	x	x	x	x	x	x	x	x

Austwell-TIvoli Maintenance Building	x	x	x	x	x	x	x	x	x

Refugio ISD	**Potential Severe Wind Impacts**								
	Loss of Power	Flying Debris	Falling Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Refugio ISD Elementary School (Primary School)	x	x	x	x	x	x	x	x	x
Refugio High School/Refugio ISD Administration Building	x	x	x	x	x	x	x	x	x
Refugio ISD Junior High School (7th & 8th Grade Building)	x	x	x	x	x	x	x	x	x
Jack Sportsman Bobcat Stadium/Athletic Facility/Maintenance Building	x	x		x	x	x	x	x	x

Woodsboro ISD	**Potential Severe Wind Impacts**								
	Loss of Power	Flying Debris	Falling Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Eagle Dome	x	x		x				x	x
Woodsboro ISD Administration Office	x	x	x	x	x	x	x	x	x
Woodsboro ISD Elementary School	x	x	x	x	x	x	x	x	x
Woodsboro ISD Junior and Senior High School	x	x	x	x	x	x	x	x	x

Refugio Water Control and Improvement District #1	**Potential Severe Wind Impacts**								
	Loss of Power	Flying Debris	Falling Trees	Flooding Due to Physical Damages	Damaged or Destroyed Roofs	Damaged or Broken Windows	Wind Damage	Injuries	Death
Water Treatment Plant	x	x		x	x	x	x	x	x
Wastewater Plant	x	x		x	x	x	x	x	x
Elevated Storage Tank		x					x	x	x

Water Wells	x	x	x	x	x	x	x	x	x
Lift Station	x	x	x			x	x	x	x

C) Vulnerable Parcels

Table 46: Parcels Vulnerable to Severe Winds

Jurisdiction	Parcel Count	Estimated Potential Damage Value
Refugio County	11,162	$2,477,921,463
Town of Bayside	1,341	$91,827,960
Town of Refugio	2,156	$120,602,883
Town of Woodsboro	1,620	$68,833,140
Austwell-Tivoli ISD	11	$225,820
Refugio ISD	11	$268,080
Woodsboro ISD	14	$1,107,240
Refugio County WCID #1	4	$16,530

11. Wildfire

Wildfire is defined as a sweeping and destructive conflagration and can be further categorized as wildland, interface, or intermix fires.

Wildland fires are fueled almost exclusively by natural vegetation wildland/urban interface (WUI) fires include both vegetation and the built environment. The wildfire disaster cycle begins when homes are built adjacent to wildland areas. When what would have been rural wildfires occur, they advance through all available fuels, which can include homes and structures.

1) Wildfire History

The Texas A&M Forest Service Wildfire Risk Assessment Portal provides wildfire data on fires that occurred as recently as 2015. Additional data came from local planning team members.

In the 2017 plan, the County and participating jurisdictions looked at Texas A&M Forest Service Wildfire Risk Assessment Portal data from 2005 – 2009.

None of the participating jurisdictions have data available on fires past 2015.

According to NCEI data, there was one recorded wildfire in the County in 2019. The 2019 fire didn't cause any injuries or fatalities; there was no information on damages caused by the fire.

The following tables show the wildfire history of each participant as recorded by the Texas A&M Forest Service. Volunteer Fire Departments were used to account for individual jurisdictions. None of these events includes any information about damages, injuries, or fatalities.

Table 47: Refugio County Wildfire History 2010-2015

Location	Date Range	Number of Wildfire Events	Range of Acres Burned	Total Acres Burned
Countywide	1/1/2010 – 9/3/2012	28	0 – 1,350	2,675.25

Table 48: Town of Bayside Wildfire History 2010 - 2015

Location	Date Range	Number of Wildfire Events	Total Acres Burned
Town of Bayside	10/23/2011	1	4

Table 49: Town of Woodsboro Wildfire History 2010 - 2015

Location	Date Range	Number of Wildfire Events	Range of Acres Burned	Total Acres Burned
Town of Woodsboro	1/6/2011 – 7/16/2011	13	0.5 - 50	135

While Austwell-Tivoli ISD, Refugio ISD, Woodsboro ISD, and Refugio County WCID #1 do not have specific information about wildfire history, their histories are assumed to be the same as Refugio County and the participating cities.

Wildfire history isn't broken down beyond the city level. However, given the participating jurisdictions' locations within the planning area, and specifically the number of their facilities located in the wildfire hazard area, participating jurisdictions determined they're vulnerable to hazard despite lacking a specific history of previous wildfire events.

2) Likelihood of Future Events

Although the County and participating jurisdictions haven't recorded a wildfire since 2015, given the prior frequency of wildfire events, a wildfire event in any of the jurisdictions addressing the hazard is highly likely, meaning an event is probable within the next year

3) Extent

The Texas A&M Forest Service's Characteristic Fire Intensity Scale (FIS) specifically identifies areas where significant fuel hazards and associated dangerous fire behavior potential exist. The FIS is a fire behavior output, which is influenced by three environmental factors - fuels, weather, and topography. According to Texas A&M Forest Service data, Refugio County and the participating jurisdictions are rated between Class 1 and Class 4.

Table 50: Characteristic Fire Intensity Scale[38]

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.

[38] https://www.texaswildfirerisk.com

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.

The National Wildfire Coordinating Group (NWCG) provides an additional way to measure extent by accounting for fire size. Based on NWCG numbers, the largest fire in Refugio County and the participating jurisdictions was a Class F event. Based on Texas A&M Forest Service data, the average fire in Refugio County and the participating jurisdictions is a Class C event.

Table 51: National Wildfire Coordinating Group Size Class of Fire[39]

Class A	¼ acre or less
Class B	More than ¼ acre, but less than 10 acres
Class C	10 acres or more, but less than 100 acres
Class D	100 acres or more, but less than 300 acres
Class E	300 acres or more, but less than 1,000 acres
Class F	1,000 acres or more, but less than 5,000 acres
Class G	5,000 acres or more

Previous wildfires in Refugio County and the participating jurisdictions have ranged between Class 1 and Class 4 on the Characteristic Fire Intensity Scale, with flames up to 12' in length, and between Class A and Class F on the National Wildfire Coordinating Group Size Class of Fire scale. Most fires have been small and were contained quickly. However, the worst reported fire in Refugio County burned 1,350 acres.

Future fire events in Refugio County and the participating jurisdictions may meet the worst reported wildfires in terms of intensity, acreage burned, and inflicted damage.

4) Location and Impact

[39] http://www.nwcg.gov/term/glossary/size-class-of-fire

A) Location

Due to wildfire's ability to inflict damages to both structures and landscapes, wildfire risk and vulnerability, both full and partial, for the participating jurisdictions have been assessed based on TxWRAP's Wildland Urban Interface boundaries[40]. The Wildland Urban Interface is the area where people and their homes meet or mix with wildland vegetation. Many different types of land uses can be found within the WUI.

Because wildfires are dynamically unpredictable, the following maps and tables may not be representative of every jurisdiction at risk of wildfire. For the maps below, "No Data" means populated areas surrounded by sufficient non-burnable areas (i.e. interior urban areas) have been removed from the dataset, as these areas are not expected to be directly impacted by a wildfire, according to TxWRAP.

[40] https://texaswildfirerisk.com/the-wildland-urban-interface

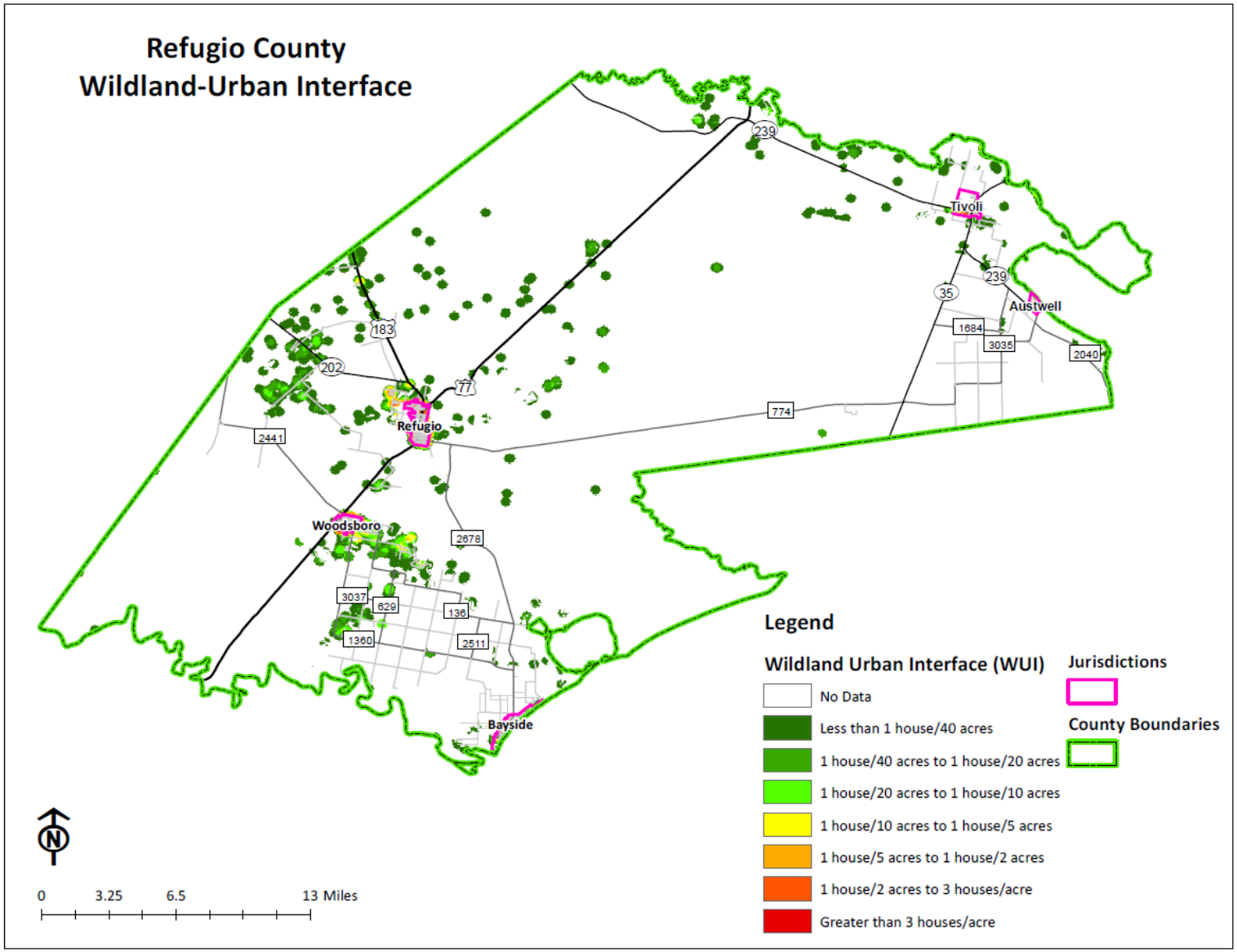

Figure 23: Refugio County Wildland-Urban Interface

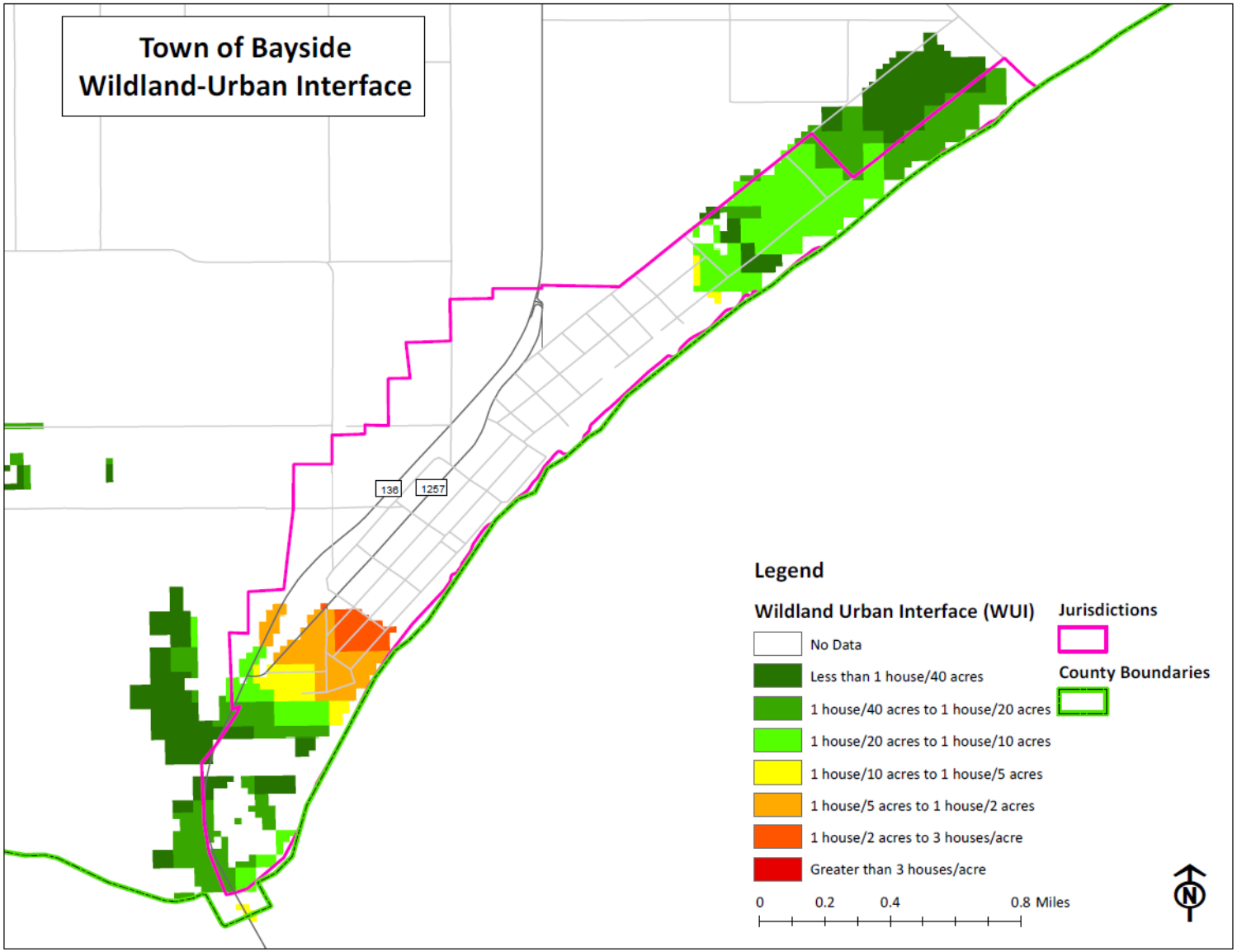

Figure 24: Town of Bayside Wildland-Urban Interface

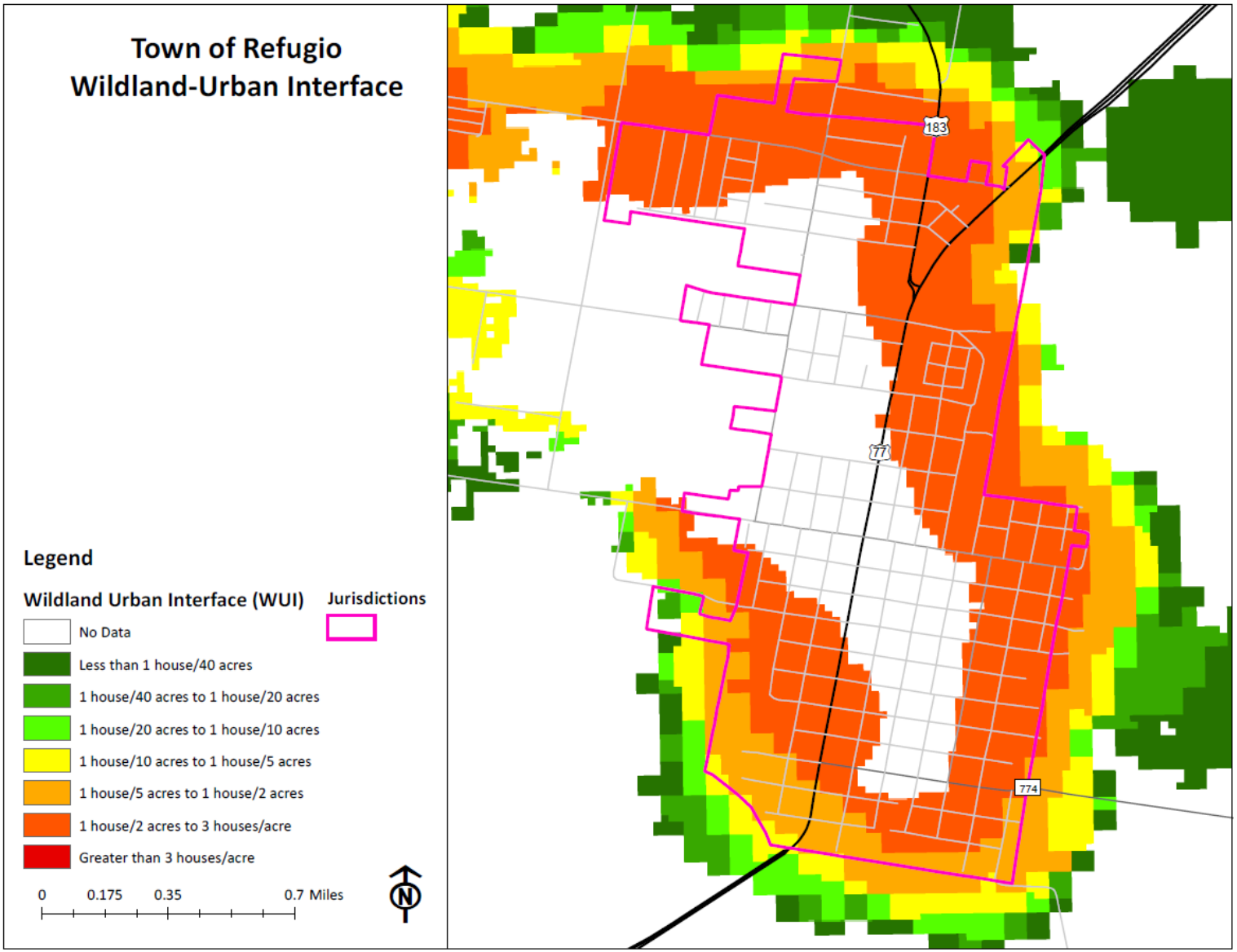

Figure 25: Town of Refugio Wildland-Urban Interface

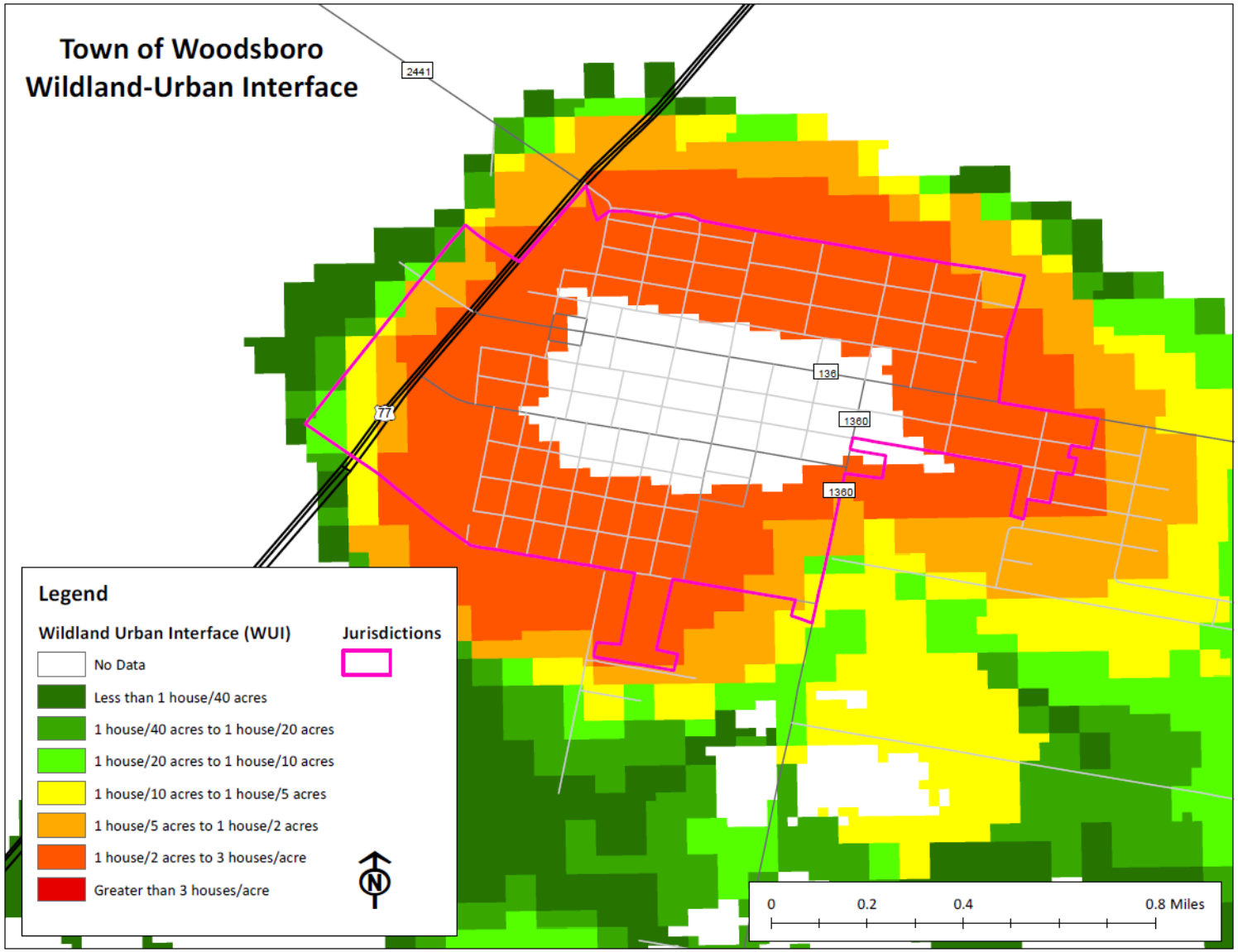

Figure 26: Town of Woodsboro Wildland-Urban Interface

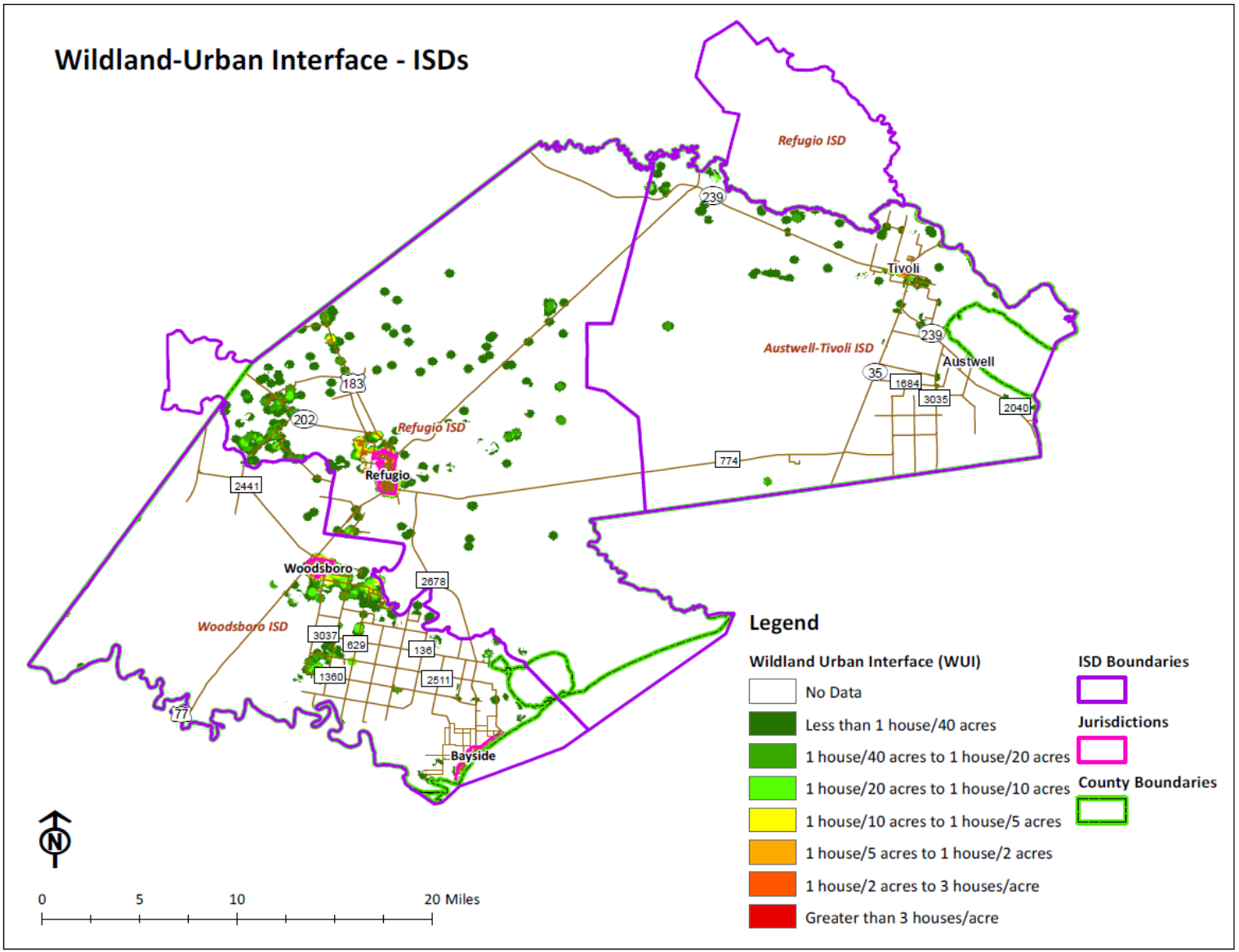

Figure 27: ISD Wildland-Urban Interface

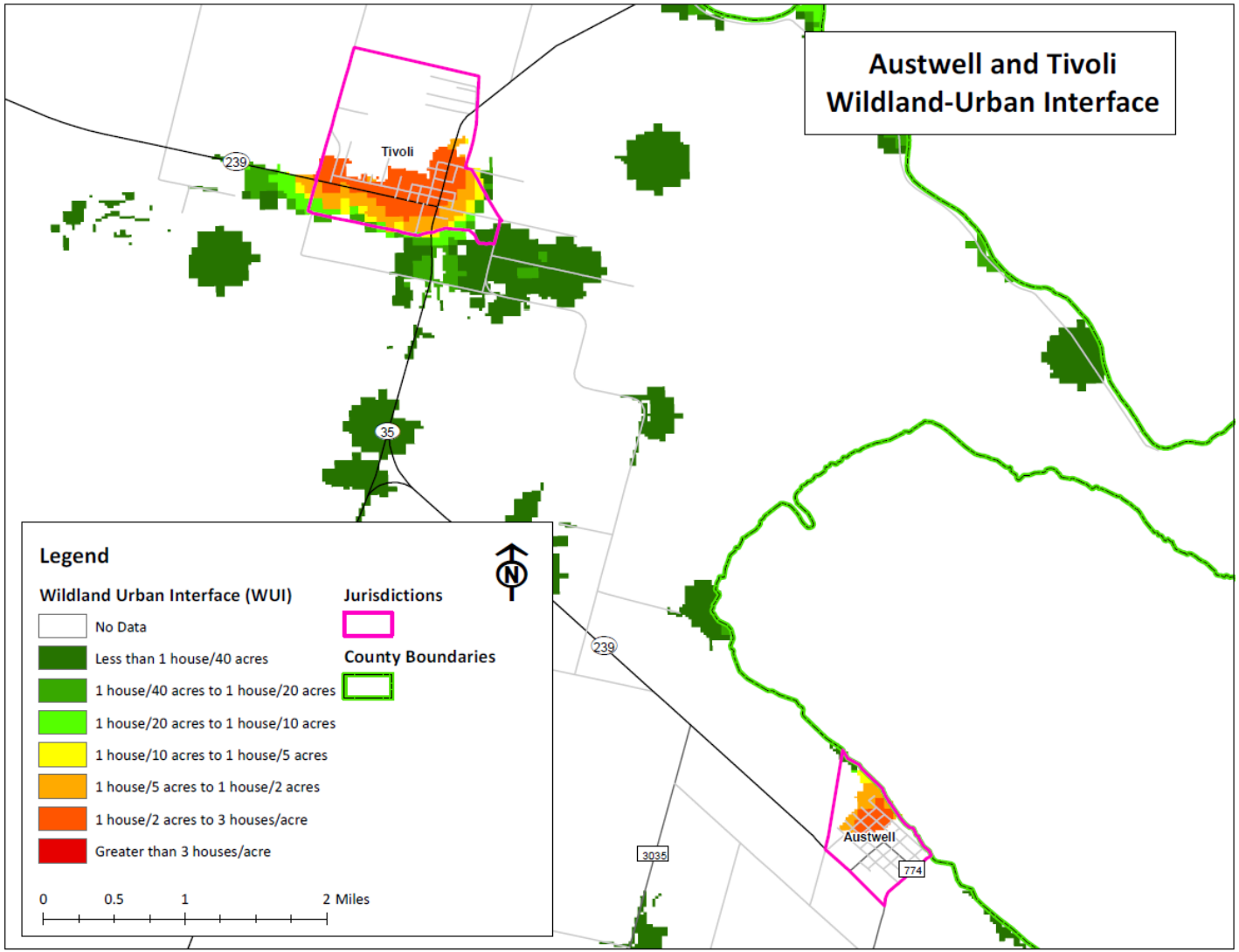

Figure 28: Austwell-Tivoli ISD and RCWCID #1 Wildland-Urban Interface[41]

[41] RCWCID #1's critical facilities are located in Tivoli.

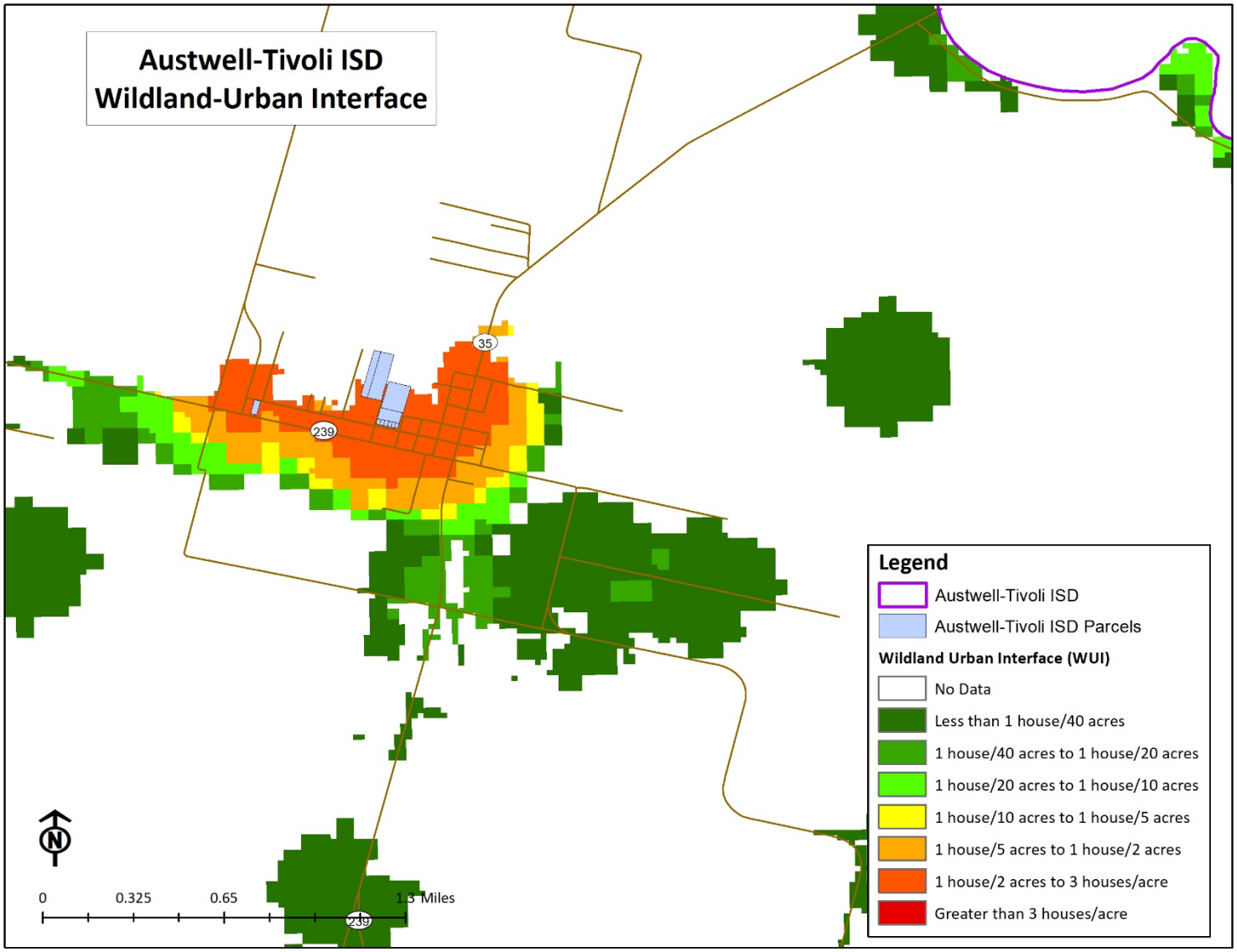

Figure 29: Autwell-Trivoli ISD Owned Parcels

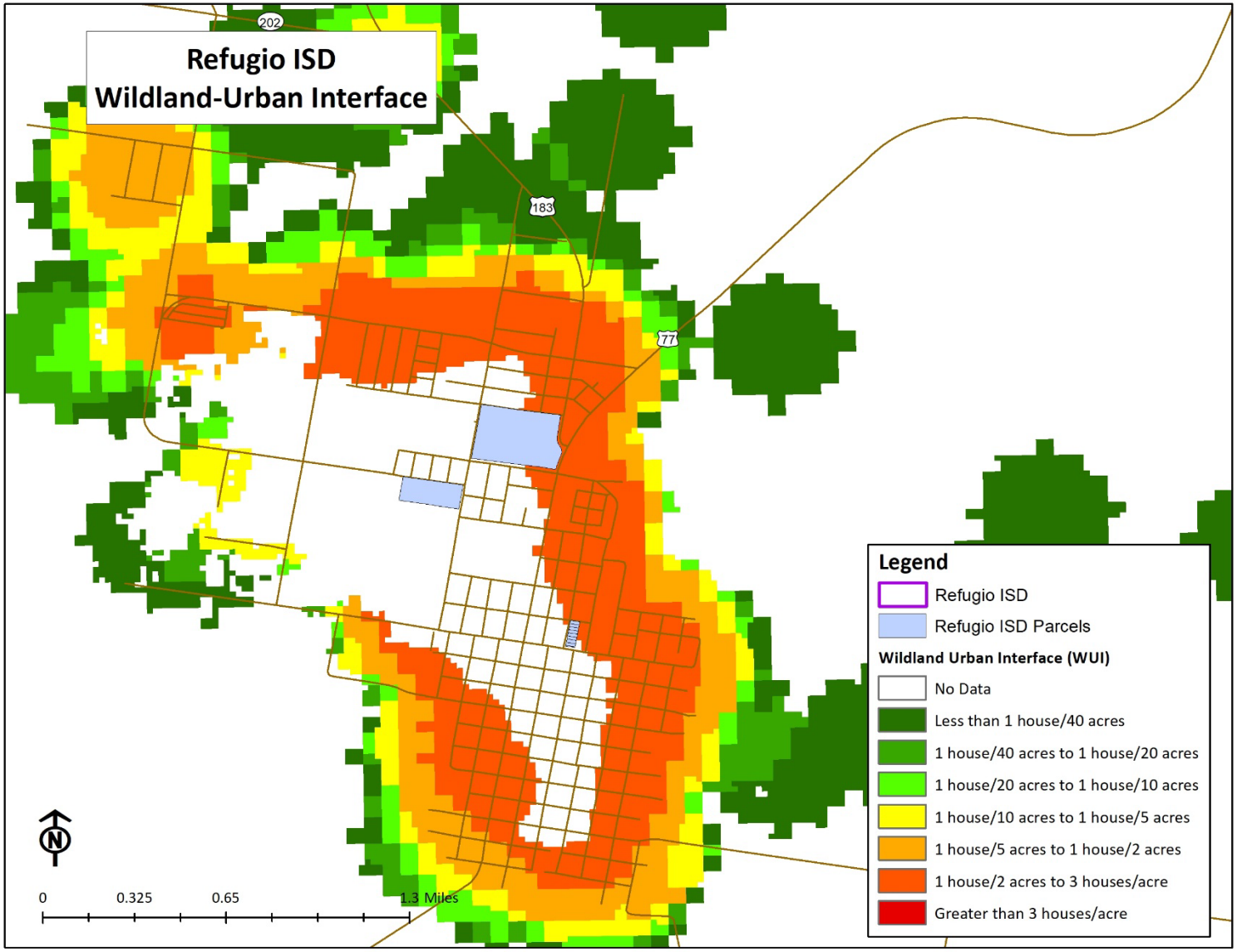

Figure 30: Refugio ISD Owned Parcels

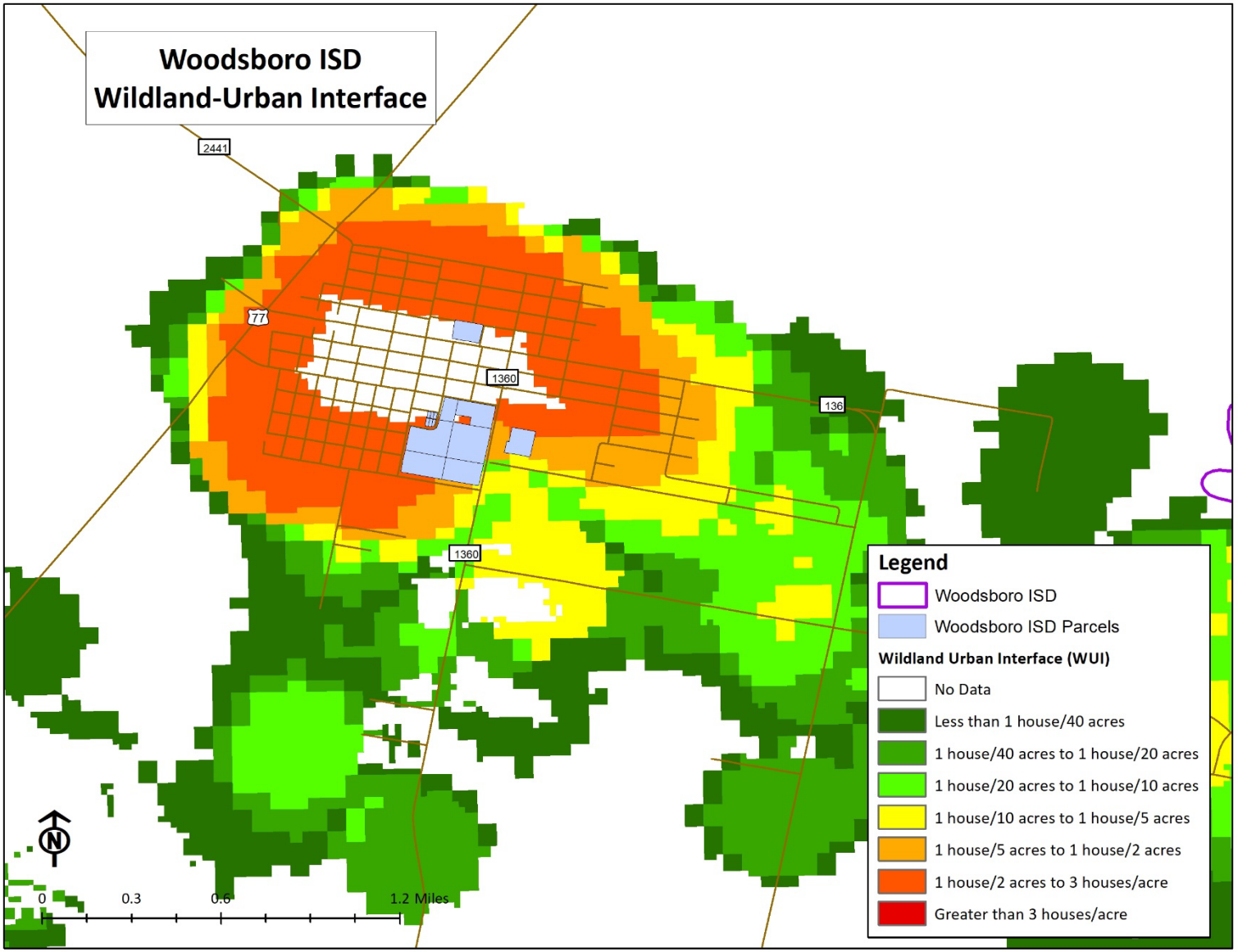

Figure 31: Woodsboro ISD Owned Parcels

B) Impact

Impacts from a wildfire in Refugio County and the participating jurisdictions may include but are not limited to: crop damage or destruction, damaged or destroyed agricultural, residential, commercial, and industrial buildings, escaped, lost, injured or killed livestock and pets. In the worst cases, residents may be injured or killed.

5) Vulnerability

A) Population

As described in Section 3 of Chapter 3 above, Refugio County and the participating jurisdictions are home to many vulnerable residents. Increased vulnerability may be due to many factors including but not limited to: age, physical ability, financial means, housing type, and housing condition. Many of these vulnerabilities often overlap.

The jurisdictions recognize that vulnerable populations may need additional help preparing for and recovering from a wildfire.

Residents of mobile homes, specifically those built before HUD's Manufactured Housing and Standards requirements were introduced in 1976, are of particular concern. These structures are more prone to fire and have a higher incidence of occupant death than modern manufactured homes.

Residents of sub-standard structures are also of particular concern. Structures in sub-standard condition ahead of a wildfire, whether due to structural damages, missing windows or doors, holes in exterior walls or the roof, may be less safe during a wildfire than structures in standard condition. Exterior damages may make the homes more prone to fire by more readily exposing flammable materials to flame. Missing windows and other exterior gaps may leave residents and structures prone to smoke inhalation and smoke damage.

All of these issues may increase damages and lead to injuries or loss of life.

B) Critical Facilities

There are 119 critical facilities located throughout the County and participating jurisdictions. 57 critical facilities are located in the wildland urban interface (WUI), as defined by the Texas A&M Forest Service. Because of their location in the WUI, the density of development, and proximity to wildland areas, these facilities are believed to be particularly susceptible to future wildfire threats.

Table 52: Critical Facilities Vulnerable to Wildfire and Potential Impacts

Refugio County	Potential Wildfire Impacts				
	Destruction	Partial Destruction	Heat Damage	Smoke Damage	Water Damage
Bonnie View Community Center	x	x	x	x	x
Copano Bay Boat Ramp	x	x			
Mission River Bridge	x	x	x		
Padilla Hall	x	x	x	x	x
Radio Tower 28°19'27.3"N 97°17'46.9"W	x	x	x		
Radio Tower 435 Jackson Rd. 28°19'27.3"N 97°17'46.9"W	x	x	x		
Radio Tower Shay Rd. 28°19'29.2"N 97°16'16.4"W	x	x	x		
Refugio County Expo Center	x	x	x	x	x
Refugio County Fairgrounds	x	x	x	x	x
Refugio County Precinct Building, Precinct 1	x	x	x	x	x
Refugio County Precinct Building, Precinct 2	x	x	x	x	x
Refugio County Precinct Building, Precinct 3	x	x	x	x	x
Refugio County Precinct Building, Precinct 4	x	x	x	x	x

City of Austwell	Potential Wildfire Impacts				
	Destruction	Partial Destruction	Heat Damage	Smoke Damage	Water Damage
Wastewater Treatment Plant	x	x	x	x	x
Water Treatment Plant	x	x	x	x	x

Town of Bayside	Potential Wildfire Impacts				
	Destruction	Partial Destruction	Heat Damage	Smoke Damage	Water Damage
Wastewater Treatment Plant	x	x		x	x
Lift Stations	x	x	x	x	x
Water Wells	x	x	x	x	x
Pump Stations	x	x	x	x	x

Town of Refugio	Potential Wildfire Impacts				
	Destruction	Partial Destruction	Heat Damage	Smoke Damage	Water Damage
City Hall	x	x	x	x	x
Elevated Storage Tank	x	x	x		
Gulf South Pipeline Co.	x	x	x	x	x
Parker Lumber	x	x	x	x	x
Refugio County Courthouse	x	x	x	x	x
Refugio County Jail	x	x	x	x	x
Town of Refugio Police Department	x	x	x	x	x
Valiant Petroleum	x	x	x	x	x
Vantage Bank	x	x	x	x	x
Water Plant #2	x	x	x		
Water Plant #3	x	x	x		
Woodforest National Bank	x	x	x	x	x

Town of Woodsboro	Potential Wildfire Impacts				
	Destruction	Partial Destruction	Heat Damage	Smoke Damage	Water Damage
Elevated Storage Tank	x	x	x		
First National Bank	x	x	x	x	x
Wastewater Treatment Plant	x	x	x	x	x
Woodsboro Family Center	x	x	x	x	x

Tivoli	Potential Wildfire Impacts				
	Destruction	Partial Destruction	Heat Damage	Smoke Damage	Water Damage
Elevated Storage Tank	x	x			
Tivoli Volunteer Fire Department	x	x	x	x	x
Wastewater Treatment Plant	x	x	x	x	x
Water Plant	x	x	x	x	x

Austwell-Tivoli ISD	Potential Wildfire Impacts				
	Destruction	Partial Destruction	Heat Damage	Smoke Damage	Water Damage
Austwell-Tivoli High School	x	x	x	x	x
Austwell-Tivoli Elementary	x	x	x	x	x
Austwell-Tivoli Administration Building	x	x	x	x	x
Austwell-TIvoli Maintenance Building	x	x	x	x	x

Refugio ISD	Potential Wildfire Impacts				
	Destruction	Partial Destruction	Heat Damage	Smoke Damage	Water Damage
Refugio High School/Refugio ISD Administration Building	x	x	x	x	x
Refugio ISD Junior High School (7th & 8th Grade Building)	x	x	x	x	x
Jack Sportsman Bobcat Stadium/Athletic Facility/Maintenance Building	x	x	x	x	x

Woodsboro ISD	Potential Wildfire Impacts				
	Destruction	Partial Destruction	Heat Damage	Smoke Damage	Water Damage
Woodsboro ISD Administration Office	x	x	x	x	x
Woodsboro ISD Elementary School	x	x	x	x	x
Woodsboro ISD FEMA Dome	x	x	x	x	x
Woodsboro ISD Junior and Senior High School	x	x	x	x	x

Refugio Water Control and Improvement District #1	Potential Wildfire Impacts				
	Destruction	Partial Destruction	Heat Damage	Smoke Damage	Water Damage
Water Treatment Plant	x	x	x	x	x
Wastewater Plant	x	x	x	x	x
Elevated Storage Tank	x	x			
Water Wells	x	x	x	x	x
Lift Station	x	x	x	x	x

C) Vulnerable Parcels

Table 53: Refugio County Parcels Vulnerable to Wildfire

Jurisdiction	Total	Estimated Potential Damage Value
Countywide	**5,454**	**$718,990,853**

Table 54: Town of Bayside Parcels Vulnerable to Wildfire

Jurisdiction	Total	Estimated Potential Damage Value
Town of Bayside	**441**	**$37,034,280**

Table 55: Town of Refugio Parcels Vulnerable to Wildfire

Jurisdiction	Total	Estimated Potential Damage Value
Town of Refugio	**1,278**	**$61,665,264**

Table 56: Town of Woodsboro Parcels Vulnerable to Wildfire

Jurisdiction	Total	Estimated Potential Damage Value
Town of Woodsboro	**979**	**$39,086,660**

Table 57: Austwell-Tivoli ISD Parcels Vulnerable to Wildfire

Jurisdiction	Total	Estimated Potential Damage Value
Austwell-Tivoli ISD	**11**	**$225,820**

Table 58: Refugio ISD Parcels Vulnerable to Wildfire

Jurisdiction	Total	Estimated Potential Damage Value
Refugio ISD	**7**	**$192,800**

Table 59: Woodsboro ISD Parcels Vulnerable to Wildfire

Jurisdiction	Total	Estimated Potential Damage Value
Woodsboro ISD	**13**	**$1,099,890**

Table 60: Refugio County WCID #1 Parcels Vulnerable to Wildfire

Jurisdiction	Total	Estimated Potential Damage Value
Refugio County WCID #1	**3**	**$5,640**

12. Winter Weather

A severe winter storm is defined by extreme cold and heavy concentrations of snowfall or ice. Texas is disrupted more severely by Winter Weather than are regions that experience severe winter weather more frequently.

The types of Winter Weather which Texans are most familiar with are snowstorms, blizzards, cold waves and ice storms.

Snowfall with an accumulation of four or more inches in a 12-hour period is considered a heavy snowfall. Snowfall of any amount is rare south of a line from Del Rio to Port Arthur, and it is this rarity of event, coupled with a lack of preparedness for such an event, that creates a severe weather condition.

Blizzards are the most perilous of all winter storms, characterized by low temperatures and strong winds in excess of 35 mph, bearing large amounts of blowing or drifting snow. Blizzards take a terrible toll on livestock and people caught in the open. In Texas, blizzards are most likely to occur in the Panhandle and South Plains Regions.

The passage of a winter cold front with a drastic drop in temperature heralds the arrival of a cold wave, usually referred to as a "blue north'er."

An ice storm occurs when rain falls out of the warm and moist upper layers of the atmosphere into a cold and dry layer near the ground. The rain freezes on contact with the cold ground and accumulates on exposed surfaces. If a half inch of rain freezes on trees and utility wires, damage can occur, especially if accompanied by high winds, thus half an inch is used as the criteria before an icing event is categorized as an "ice storm."

1) Severe Winter Weather History

In the 2017 plan, Refugio County covered the Severe Winter Storm hazard. This hazard has been broken up into a separate Winter Weather hazard and Extreme Cold hazard in this plan update.

In the 2017 plan, Refugio County and the participating jurisdictions reported five Winter Weather events between 2004 and 2011. None are reported to have caused any injuries, fatalities, or damages. Between 2015 and 2021, Refugio County and the participating jurisdictions have experienced five Winter Weather events, as shown below. The NCEI data did not report any injuries, fatalities, or damage costs.

Table 61: Refugio County Winter Weather History

Location	Date Range	Number of Winter Weather	Winter Storm Types	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Countywide	12/7/2017 – 2/16/2021	5	Heavy Snow, Ice Storm	0	0	$0	$0

The most recent winter weather event was Winter Storm Uri in February 2021 during which there was an eighth of an inch to a quarter inch of ice accumulation. No damages, injuries, or deaths were officially recorded in the NCEI data.

2) Likelihood of Future Events

Because it is likely that more winter storms have occurred than have been officially reported, the probability for winter storms occurring in Refugio County and the participating jurisdictions is occasional, meaning an event affecting any or all of the participating jurisdictions is possible in the next five years.

3) Extent

Table 62 below displays the magnitude of Winter Weather.

Table 62: Winter Weather Extent Scale[42]

Frost Advisory*	Issued when nighttime minimum temperatures are expected to range from 33°F to 36°F in the growing season.
Freeze Warning*	Issued when nighttime minimum temperatures are expected to reach 32°F or lower in the growing season. They are usually issued to highlight the first few freezes of the fall, or unusually late freezes in the spring. *A Freeze Watch is issued when these conditions may be met 12 to 48 hours in the future.*
Snow Advisory	Issued when accumulating snow of 2 to 4 inches is expected. An advisory may still be warranted if lesser accumulations will produce travel difficulties, especially early in the winter season.
Blowing Snow Advisory	Issued when blowing snow is expected to occasionally reduce visibilities to 1/4 mile or less with winds generally 25 to 34 mph. The event should last at least 3 hours.
Snow and Blowing Snow Advisory	Issued when winds of 25 to 34 mph are expected to be accompanied by falling snow and blowing snow, occasionally reducing the visibility to 1/4 mile or less. The event should last at least 3 hours

[42] Source: National Weather Service Weather Forecast Office; Norman, Oklahoma. http://www.srh.noaa.gov/oun/?n=spotter-wwa-definitions

Freezing Rain / Drizzle Advisory	Issued for freezing rain when ice accumulations are expected to cause travel problems, but not exceed 1/4".
Sleet Advisory	Issued for accumulating sleet of 1/4" to 1". Because sleet usually occurs with other precipitation types, a winter weather advisory will almost always be used in such cases.
Winter Weather Advisory	Issued for a winter weather event in which there is more than one hazard present, but all precipitation is expected to remain below warning criteria. For example, it would be issued if 2 inches of snow were expected with a small amount of sleet mixing in at times.
Wind Chill Advisory[43]	Issued when wind chill temperatures are expected to be a significant inconvenience to life with prolonged exposure, and, if caution is not exercised, could lead to hazardous exposure.
Wind Chill Warning[44]	Issued when wind chill temperatures are expected to be hazardous to life within several minutes of exposure.
Ice Storm Warning	Issued when a period of freezing rain is expected to produce ice accumulations of 1/4" or greater, or cause significant disruptions to travel or utilities.
Heavy Sleet Warning	Issued when a period of sleet is expected to produce ice accumulations of 1" or greater, or cause significant disruptions to travel or utilities.
Heavy Snow Warning	Issued when snow is expected to accumulate 4 inches or more in 12 hours, or 6 inches or more in 24 hours.
Winter Storm Warning	Issued for a winter weather event in which there is more than one hazard present, and one of the warning criteria listed above is expected to be met. For example, it would be issued if 5 inches of snow were expected in 12 hours, with some sleet mixing in at times. It is commonly issued for heavy snow with strong winds of 25-34 mph that will cause blowing and drifting of the snow. *A Winter Storm Watch is issued when these conditions may be met 12 to 48 hours in the future.*
Blizzard Warning	Issued for sustained wind or frequent gusts greater than or equal to 35 mph accompanied by falling and/or blowing snow, frequently reducing visibility to less than 1/4 mile for three hours or more. *A Blizzard Watch is issued when these conditions may be met 12 to 48 hours in the future.*

* - Non-precipitation watch / warning / advisory

According to the Refugio County 2013 CHAMPS Report, the worst winter weather events have inflicted up to $3,119,233[45] in property damages and up to $1,084,978[46] in crop damages in a

[43] https://www.osha.gov/dts/weather/winter_weather/windchill.html
[44] https://www.osha.gov/dts/weather/winter_weather/windchill.html
[45] Event date: 12/22/1989, damage dollars adjusted to $2016
[46] Event date: 1/8/1973, damage dollars adjusted to $2016

single event. Based on previous winter storm events, future storms in Refugio County and the participating jurisdictions may see snow accumulation of up to 4" and see ice accumulation of up to 1/4". Future winter storm events may meet previous ones in terms of intensity, duration, and the number of residents injured or worse.

4) Location and Impact

A) Location – All Jurisdictions

Severe winter weather has no distinct geographic boundary. Severe winter weather can occur across the entire planning area and uniformly affect all participating jurisdictions.

B) Impact – All Jurisdictions

The potential impact of a severe winter storm is normally minor, resulting in few, if any, injuries. Because of the rarity of winter storm events in Refugio County and the participating jurisdictions, drivers, especially those unfamiliar with or unable to drive in icy conditions, may be at the highest risk of crashing their vehicle and sustaining injuries.

Beyond accidents caused by icy conditions, severe winter weather has the potential to cause widespread power outages. Trees and other vegetation that grow along or near power lines and utility lines can become overburdened by ice and snow accumulation. Falling limbs or trees can easily take down power and utility lines. Neglected vegetation is especially at risk of failure due to increased weight loads. Power outages can create a cascading effect depending on residents' ability to heat their homes without electricity, especially for those young, elderly, and low-income residents as identified in Section 3 of Chapter 3 above. Power outages may also affect residents' ability to get water due to lift stations and water plants not having power. During Winter Storm Uri, high demand for electricity coupled with reduced power supply led to millions of Texans without power for several days. Although no deaths related to Winter Weather have been reported in the participating jurisdictions, in the worst cases, the hazard has the potential to be deadly.

Winter Weather will likely cause only minor property damage and minimal disruption to the quality of life in the participating jurisdictions. Depending on when the event happens, a severe winter storm may damage or destroy crops.

5) Vulnerability

A) Infrastructure

While all of the participating jurisdictions are exposed to extreme temperatures, existing buildings and infrastructure are not considered vulnerable to significant damage directly caused by severe winter storm events. This determination was made based on the expectation that

most roofs can support 20 lbs. / square foot of snow[47]. The worst snowstorm in any participating jurisdiction dropped 4". Although it's not impossible[48] for that much snow to cause structural damage, given that the snow weight is well below the threshold where damage is likely, structural damages are not expected. Additionally, 1" of ice is roughly equivalent in weight per square foot to 10" of snow. Considering the worst ice storms in the participating jurisdictions cause ice accumulations of 1/4", it's unlikely, but not impossible, that an ice storm causing structural ice accumulations of less than 4" will cause significant structural damages.

However, significant damages may be incurred indirectly. Examples include, but are not limited to, trees and limbs that fall after being overburdened with snow or ice, building strikes due to vehicles losing traction on snow or ice-covered roads, and power outages that affect building temperature regulation and allow pipes to freeze and burst.

B) Population

As described in Section 3 of Chapter 3 above, Refugio County and the participating jurisdictions are home to many vulnerable residents. Areas with concentrations of young, elderly, and low-income residents may feel greater impacts from severe winter weather due to those populations' limited ability to properly address the hazard. Deficiencies may include but aren't limited to: lack of heating in their homes or vehicles, lack of access to heated public spaces during the coldest part of the day or night, and frozen pipes that may jeopardize access to drinking water, and in the worst cases, lead to severe structural damage that can render a home unlivable. The consequences for these populations' exposure to severe winter weather can include but are not limited to: complications for those suffering from hypertension, hypothyroidism, and diabetes, as well as exhaustion, hypothermia, trench foot, or death.

C) Critical Facilities

Any shutdown of critical facilities due to severe winter weather is expected to be temporary. However, based on the proximity of trees and powerlines on their properties, the following 76 critical facilities may be at a higher risk of losing power due to falling limbs.

[47] https://disastersafety.org/freezing-weather/prevent-roof-collapse-homes/

[48] https://www.fema.gov/media-library-data/7d8c55d1c4f815edf3d7e7d1c120383f/FEMA957_Snowload_508.pdf - The weight of a foot a snow can vary widely based on how wet the snow is, between 3 and 21 lbs. per square foot. However, wet snow primarily affects the East Coast, Pacific Northwest, and southwestern Alaska.

Table 63: Critical Facilities Vulnerable to Winter Weather

Jurisdiction	Critical Facilities	Potential Winter Weather Impacts
		Falling Tree Limbs
Refugio County	Bonnie View Community Center	x
	Lift Stations	x
	Padilla Hall	x
	Refugio County Community Center	x
	Refugio County Courthouse	x
	Refugio County Expo Center	x
	Refugio County Fairgrounds	x
	Refugio County Jail	x
	Refugio County Precinct Building, Precinct 1	x
	Refugio County Precinct Building, Precinct 2	x
	Refugio County Precinct Building, Precinct 3	x
	Refugio County Precinct Building, Precinct 4	x
	State Highway 35	x
	Union Pacific Railroad	x
	United States Highway 77	x
	United States Highway 77A / 183	x
	Wastewater Treatment Plant	x
	Water Wells	x
City of Austwell	Austwell Volunteer Fire Department	x
	Wastewater Treatment Plant	x
Town of Bayside	Town of Bayside City Hall and Community Center	x
	Town of Bayside Volunteer Fire Department	x
	Water Plant	x
	Lift Stations	x
	Water Wells	x
	Pump Stations	x
	Reverse Osmosis Units	x
Town of Refugio	Refugio County Memorial Hospital and Helipad	x
	Town of Refugio Fire Department	x
	Vantage Bank	x
	Water Plant #2	x
	Refugio Rural Health Clinic	x
	Refugio Specialty Clinic	x
	Refugio Manor Nursing and Rehabilitation Center	x
	Mission Ridge Nursing and Rehabilitation Center	x

	Lift Stations	x
	Pump Stations	x
	RV Park	x
	Woodforest National Bank	x
Town of Woodsboro	200k Gallon Ground Tanks	x
	Ballfield Concession	x
	Chlorine Storage	x
	City Building	x
	Equipment Storage	x
	Filtration Control Building	x
	Filtration Tanks	x
	First National Bank	x
	Gazebo	x
	Office Building	x
	Parts Barn	x
	SCADA / Electrical System	x
	Storage / Rental Building	x
	Town of Woodsboro Volunteer Fire Department	x
	Tractor Storage	x
	Tuttle's Grocery Market	x
	Water Plant	x
	Well #3	x
	Well #4	x
	Woodsboro City Hall	x
	Woodsboro Family Center	x
	Woodsboro Farmers COOP	x
	Wranosky Wran Lift Station	x
Tivoli	Tivoli Volunteer Fire Department	x
	Water Plant	x
Austwell-Tivoli ISD	Austwell-Tivoli High School	x
	Austwell-Tivoli Elementary	x
	Austwell-Tivoli Administration Building	x
	Austwell-TIvoli Maintenance Building	x
Refugio ISD	Refugio ISD Elementary School (Primary School)	x
	Refugio High School/Refugio ISD Administration Building	x
	Refugio ISD Junior High School (7th & 8th Grade Building)	x
Woodsboro ISD	Woodsboro ISD Administration Office	x
	Woodsboro ISD Elementary School	x
	Woodsboro ISD Junior and Senior High School	x
RCWCID #1	Water Wells	x
	Lift Station	x

13. Lightning

Lightning is a massive electrostatic discharge between electrically charged regions within clouds, or between a cloud and the Earth's surface.

Lightning damage can result in electrocution of humans and animals; vaporization of materials along the path of the strike; fire caused by the high temperature produced by the strike; and sudden power surges that can damage electrical and electronic equipment. Millions of dollars of direct and indirect damages result from lightning strikes on electric utility substations and distribution lines. While property damage is the major hazard associated with lightning, it should be noted that lightning strikes kill nearly 50 people [49]each year in the United States.

1) Lightning History

In the 2017 plan, Refugio County and the participating jurisdictions reported three lightning events between 1984 and 2014. One of the lightning events caused $2,870,669 in damages and injured one person.

According to the NCEI, only one lightning event has been recorded in Refugio County and the participating jurisdictions since the 2017 plan. There is no data documenting a lightning event more recent than 2016. However, the planning team determined that lightning events occur multiple times annually.

Table 64: Refugio County Lightning History

Location	Date Range	Number of Lightning Events	Fatalities	Injuries	Property Damage $2021	Crop Damage $2021
Refugio	3/9/2016	1	0	0	$27,247.33	$0

2) Likelihood of Future Events

Lightning is especially associated with thunderstorms. Despite the lack of reported instances of lightning-caused damages, a lightning event is highly likely, meaning an event affecting any or all of the participating jurisdictions is probable in the next year.

According to information from VAISALA[50], most of Refugio County can expect between 6 to 12 lightning flashes per square mile per year. Some small parts of the County and participating jurisdictions can expect to see between 12 and 20 lightning flashes per square mile per year.

[49] http://www.lightningsafety.noaa.gov/victims.shtml
[50] http://www.vaisala.com/VaisalaImages/Lightning/avg_fd_2005-2014_CONUS_2mi_grid.png

3) Extent

The extent for lightning can be expressed in terms of the number of strikes within an interval. Given the lack of lightning history data, it is expected that Refugio County and all participating jurisdictions may experience lightning events between LAL 1 and LAL 5. Dry thunderstorms, LAL 6, are not expected.

Table 65: Lightning Activity Levels[51]

Lightning Activity Level (LAL)		
Activity levels are valuable guidance tools to aid in the preparation for possible fire initiation from cloud-to-ground lightning.		
LAL	Cloud and Storm Development	Lightning Strikes per 15 Minutes
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 observation area. The clouds produce mainly virga, but light rain will occasionally reach the ground. Lightning is very infrequent.	1-8
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 worst lightning events to affect Refugio County and the participating jurisdictions have inflicted up to $2,870,669 in damages and injured one person. Future events may meet previous intensity levels, damage dollars inflicted, and the number of residents injured or worse.

4) Location and Impact

A) Location

Lightning strikes have no distinct geographic boundary. Lightning can occur across each participating jurisdiction.

[51] Source: http://www.prh.noaa.gov/hnl/pages/LAL.php

B) Impact

Impacts from lightning in all jurisdictions may include but are not limited to loss of power due to electrical surges, damaged or destroyed personal property including computers and other electronics, damaged or destroyed agricultural, residential, commercial, and industrial buildings. Crops may be damaged or destroyed. Livestock may be injured or killed by lightning. In the worst cases, lightning may cause injuries or even loss of life.

5) Vulnerability

According to the Lightning Protection Institute, it is a myth[52] that lightning always strikes the tallest objects. Given lightning's indiscriminate nature, it is impossible to identify buildings that are at an increased risk of being struck by lightning. All existing and future buildings, critical facilities, critical infrastructure, improved property, and the population are exposed to this hazard. However, structures without adequate lightning protection and those with large concentrations of electronic equipment like computers, servers, and printers, are most vulnerable, as are locations that may have outside crowds during a lightning event.

A) Critical Facilities

Table 66: Critical Facilities Vulnerable to Lightning and Potential Impacts

Refugio County	Potential Lightning Impacts			
	Physical Damage	Electrical Damage	Data Damage or Loss	Fire
Bonnie View Community Center	x	x	x	x
Padilla Hall	x	x	x	x
Radio Tower	x	x	x	
Radio Tower	x	x	x	
Radio Tower	x	x	x	
Radio Tower	x	x	x	
Radio Tower	x	x	x	
Radio Tower	x	x	x	
Radio Tower	x	x	x	
Refugio County Airport (Rooke Field)	x	x	x	x
Refugio County Community Center	x	x	x	x
Refugio County Expo Center	x	x	x	x
Refugio County Fairgrounds	x	x	x	x
Refugio County Precinct Building, Precinct 2	x	x	x	x
Refugio County Precinct Building, Precinct 4	x	x	x	x
Refugio County Courthouse	x	x	x	x
Refugio County Jail	x	x	x	x

[52] http://lightning.org/wp-content/uploads/2015/06/LPI_lightning_infographic_2015.jpg

City of Austwell	Potential Lightning Impacts			
	Physical Damage	Electrical Damage	Data Damage or Loss	Fire
Austwell Volunteer Fire Department	x	x	x	x

Town of Bayside	Potential Lightning Impacts			
	Physical Damage	Electrical Damage	Data Damage or Loss	Fire
Town of Bayside City Hall and Community Center	x	x	x	x
Town of Bayside Volunteer Fire Department	x	x	x	x

Town of Refugio	Potential Lightning Impacts			
	Physical Damage	Electrical Damage	Data Damage or Loss	Fire
City Hall	x	x	x	x
Mission Ridge Nursing and Rehabilitation Center	x	x	x	x
Refugio County Memorial Hospital	x	x	x	x
Refugio County Memorial Hospital Helipad	x	x	x	x
Refugio Manor Nursing and Rehabilitation Center	x	x	x	x
Refugio Rural Health Clinic	x	x	x	x
Refugio Specialty Clinic	x	x	x	x
Town of Refugio Fire Department	x	x	x	x
Town of Refugio Police Department	x	x	x	x

Town of Woodsboro	Potential Lightning Impacts			
	Physical Damage	Electrical Damage	Data Damage or Loss	Fire
Town of Woodsboro Volunteer Fire Department	x	x	x	x
Woodsboro City Hall	x	x	x	x
Woodsboro Family Center	x	x	x	x

Tivoli	Potential Lightning Impacts			
	Physical Damage	Electrical Damage	Data Damage or Loss	Fire
Tivoli Volunteer Fire Department	x	x	x	x

Austwell-Tivoli ISD	Potential Lightning Impacts			
	Physical Damage	Electrical Damage	Data Damage or Loss	Fire
Austwell-Tivoli High School	x	x	x	x
Austwell-Tivoli Elementary	x	x	x	x
Austwell-Tivoli Administration Building	x	x	x	x
Austwell-TIvoli Maintenance Building	x	x	x	x

Refugio ISD	Potential Lightning Impacts			
	Physical Damage	Electrical Damage	Data Damage or Loss	Fire
Refugio ISD Elementary School (Primary School)	x	x	x	x
Refugio ISD High School	x	x	x	x
Refugio ISD Junior High School (7th & 8th Grade Building)	x	x	x	x

Woodsboro ISD	Potential Lightning Impacts			
	Physical Damage	Electrical Damage	Data Damage or Loss	Fire
Woodsboro ISD Administration Building	x	x	x	x
Woodsboro ISD Elementary School	x	x	x	x
Eagle Dome	x	x	x	x
Woodsboro ISD Junior and Senior High School	x	x	x	x

RCWCID #1	Potential Lightning Impacts			
	Physical Damage	Electrical Damage	Data Damage or Loss	Fire
Office Building	x	x	x	x

B) Vulnerable Parcels

Table 67: Parcels Vulnerable to Lightning

Jurisdiction	Parcel Count	Estimated Potential Damage Value
Refugio County	11,162	$2,477,921,463
Town of Bayside	1,341	$91,827,960
Town of Refugio	2,156	$120,602,883
Town of Woodsboro	1,620	$68,833,140
Austwell-Tivoli ISD	11	$225,820
Refugio ISD	11	$268,080
Woodsboro ISD	5	$261,790
Refugio County WCID #1	4	$16,530

14. Extreme Cold

Extreme cold can happen anywhere in the state, although its levels can range extensively. In the panhandle extreme cold means days below zero Fahrenheit while in the Rio Grande Valley it means reaching temperatures below freezing. Extreme cold is an issue any time winter temperatures drop significantly below normal and make staying warm and safe a challenge.

Extreme cold can accompany winter weather, but it can also be independent of those storms. For that reason, the impacts of extreme cold are presented here separately from the impacts of severe winter weather.

1) Extreme Cold History [53]

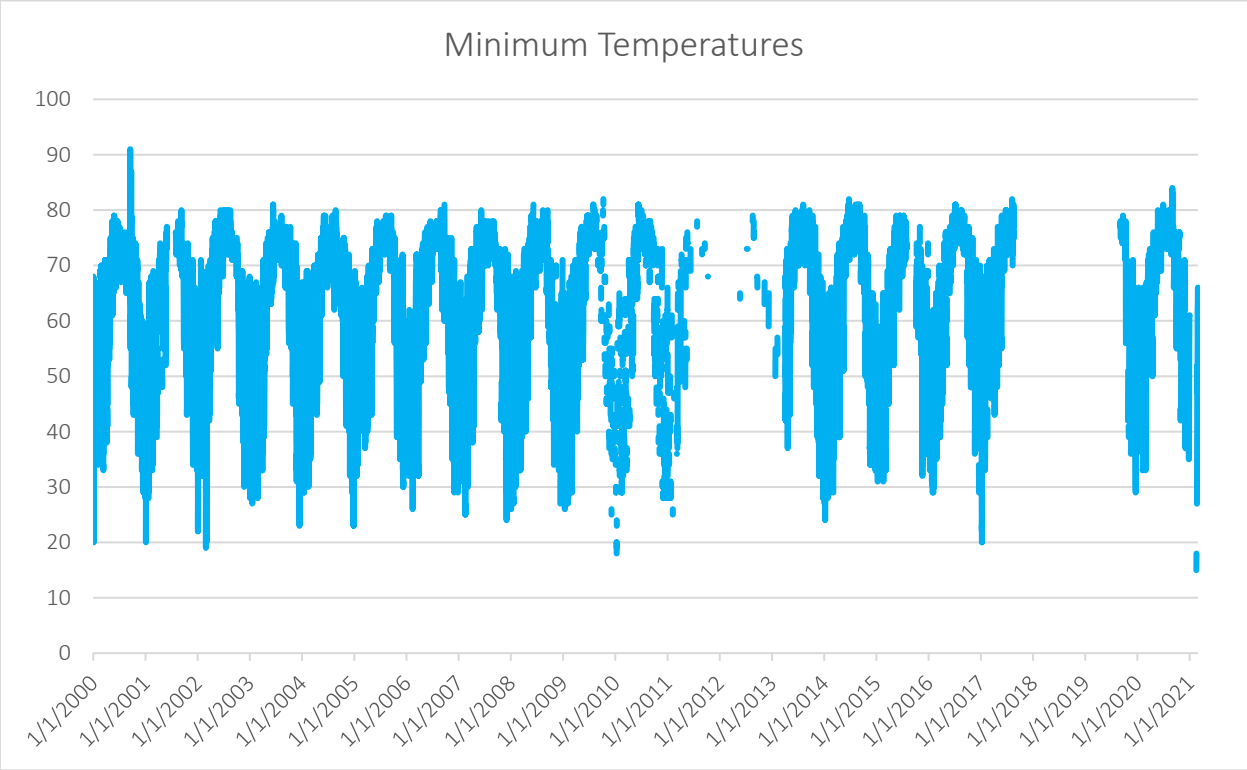

Figure 33: Minimum Recorded Daily Temperature 2000-Present[54]

Refugio County and the jurisdictions addressing the hazard have not previously included extreme cold in their mitigation plan as a standalone hazard. Prior to the 2018 update to the State of Texas mitigation plan, extreme cold was considered part of the severe winter storm hazard.

[53] Comprehensive temperature data for Refugio County isn't available. Instead, the planning team used data from neighboring Anderson County to estimate Refugio County's extreme cold history.

[54] Source: National Centers for Environmental Information, https://www.NCEI.noaa.gov/cdo-web/datasets

Between 2000 and 2021, Refugio County experienced 371 days with a minimum temperature of 32˚F or colder. At least 4 of those days had a maximum temperature of 32˚F or below. During Winter Storm Uri in February 2021, the maximum temperature was 25˚F.

During the same timeframe, the coldest temperature recorded was 15˚F on February 16, 2021.

Temperature data is recorded at the county level. However, given the nature of extreme cold and the proximity of all jurisdictions to each other, the jurisdictions addressing the hazard experienced the same extreme cold events.

No damage dollars for any extreme cold event have been recorded in any participating jurisdiction.

2) Likelihood of Future Occurrence

Based on historic weather data, extreme cold in Refugio County and the participating jurisdictions is occasional, meaning an event affecting any or all of the participating jurisdictions is possible in the next five years.

3) Extent

The magnitude or intensity of an extreme cold event is measured according to temperature in relation to wind speed. The relationship is referred to as the "Wind Chill," and is depicted in Figure 29.

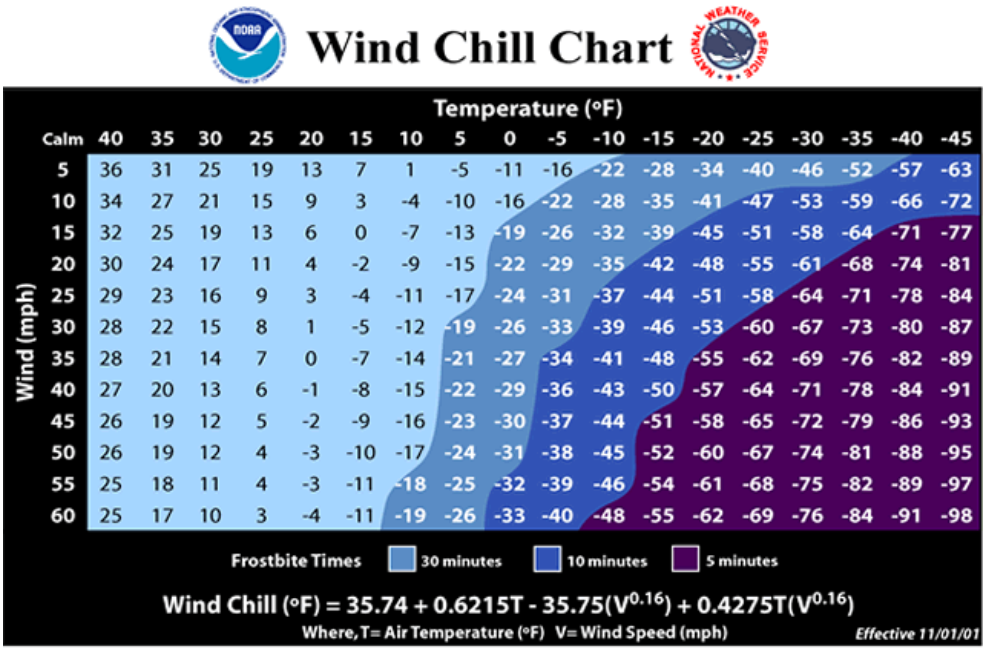

Figure 34: NOAA's NWS Wind Chill Index

As displayed in Figure 29, the wind chill temperature is a measurement of how cold the wind makes the air feel to the human body. Since wind can dramatically accelerate heat loss from the body, a 20° day could feel just as cold as a calm day with 0° temperatures. The Wind Chill Chart factors the wind chill; it is not applicable in calm winds or when the temperature is over 50°.

The coldest temperatures in Refugio County and the participating jurisdictions may meet the current record temperature of 15˚F. Future extreme cold events may be as intense, long-lasting, and dangerous as previous ones.

4) Location and Impact

A) Location – All Jurisdictions

Extreme cold has no distinct geographic boundary. Extreme cold can occur across the entire planning area and uniformly affect all participating jurisdictions.

B) Impact – All Jurisdictions

The potential impact of extreme cold is normally minor, resulting in few, if any, injuries. No property or crop damage specifically tied to extreme cold events has been recorded in any of the participating jurisdictions. No deaths related to extreme cold have ever been reported in the participating jurisdictions. However, based on the hazard's potential, in the worst cases, especially if combined with winter weather, the hazard may inflict property or crop damages, and it can even be deadly. Any shutdown of facilities due to extreme cold is expected to be temporary.

5) Vulnerability

A) Population

As described in Section 3 of Chapter 3 above, Refugio County and the participating jurisdictions are home to many vulnerable residents. Areas with concentrations of young, elderly, and low-income residents may feel greater impacts from extreme cold due to those populations' limited ability to properly address the hazard. Deficiencies may include but aren't limited to: lack of heating in their homes or vehicles, lack of access to heated public spaces during the coldest part of the day or night, and frozen pipes that may jeopardize access to drinking water, and in the worst cases, lead to severe structural damage that can render a home unlivable. The consequences for these populations' exposure to extreme cold may include but are not limited to: complications for those suffering from hypertension, hypothyroidism, and diabetes, as well as exhaustion, hypothermia, trench foot, or death.

B) Critical Facilities

While all of the jurisdictions are exposed to extreme temperatures, existing buildings, infrastructure, and critical facilities are not considered vulnerable to damages significant enough

to interrupt or stop normal operations. Therefore, any estimated property losses associated with the hazard are anticipated to be minimal across the area.

15. Extreme Heat

Extreme heat is defined as summertime temperatures that are substantially hotter and/or more humid than average for a given location at that time of year. Humid conditions, which add to the discomfort of high temperatures, occur when a "dome" of high atmospheric pressure traps hazy, damp air near the ground.

Although heat can damage buildings and facilities, it presents a more significant threat to the safety and welfare of citizens. The major human risks associated with severe summer heat include: heat cramps; sunburn; dehydration; fatigue; heat exhaustion; and heat stroke. The most vulnerable population to heat casualties are children and the elderly or infirm, who frequently live on low fixed incomes and cannot afford to run air-conditioning on a regular basis. This population is sometimes isolated, with no immediate family or friends to look out for their wellbeing.

Severe summer heat is an invisible killer. Although a heat wave does not happen with the spectacle of other hazards such as tornados and floods, the National Center for Environmental Health reports that extreme heat caused 7,415 heat-related deaths in the United States from 1999 to 2010[55]. Extreme heat kills more people than hurricanes, floods, tornados and lightning combined, according to the National Weather Service. In 2001, 300 deaths were caused by excessive heat exposure.

[55] http://www.bt.cdc.gov/disasters/extremeheat/heat_guide.asp

1) Extreme Heat History

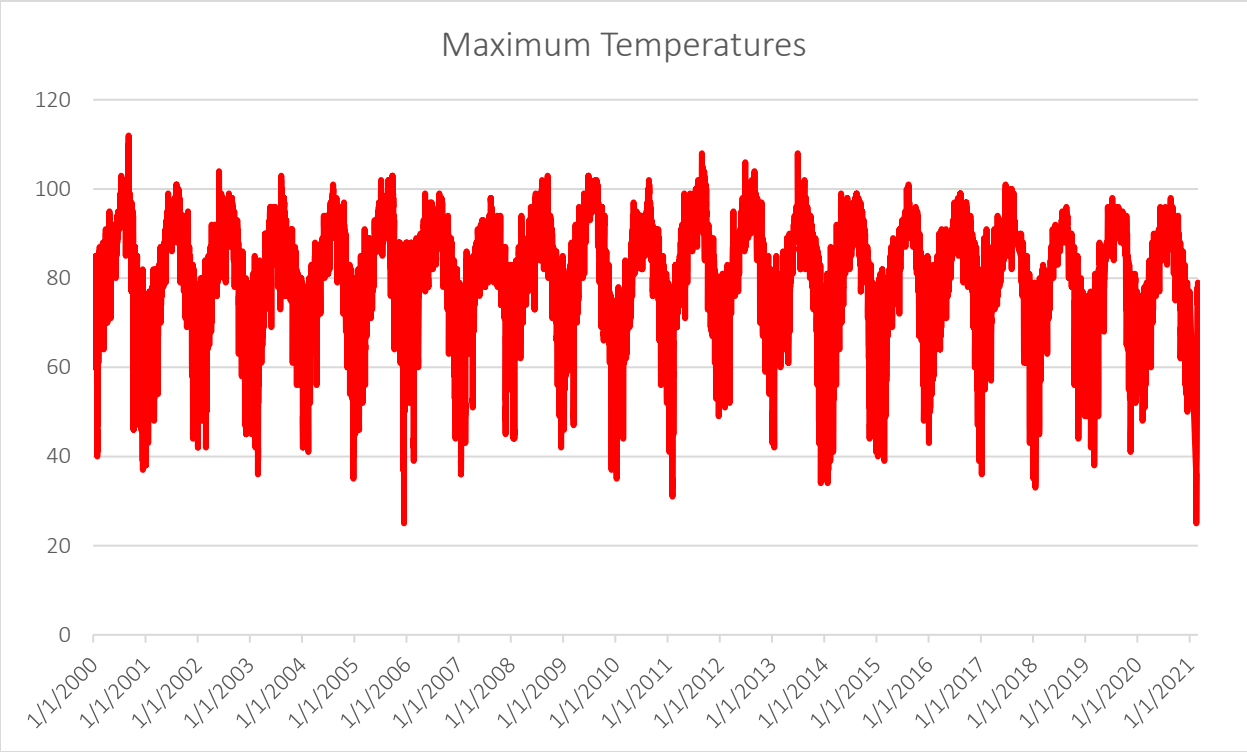

Figure 35: Maximum Recorded Daily Temperature 2000-2021[56]

Between January 2000 and February 2021, Refugio County and the participating jurisdictions experienced 165 days with a maximum temperature of 100˚F or hotter and over 1,100 days where the combination of humidity and moderate-to-high temperatures warranted a heat advisory, if not an extreme heat warning. There were 100 excessive heat warning days from January 2000 to February 2021.

Extreme heat data is recorded at the county level. However, given the nature of extreme heat and the proximity of all jurisdictions to each other, every jurisdiction experienced the same extreme heat events. No damage dollars for any extreme heat event have been recorded in any participating jurisdiction in over 15 years.

2) Likelihood of Future Events

Based on historic weather data, the probability of extreme heat in Refugio County and the participating jurisdictions is highly likely, meaning an event affecting any or all of the participating jurisdictions is probable in the next year.

[56] *Source: National Climatic Data Center, https://www.NCEI.noaa.gov/cdo-web/datasets*

3) Extent

The magnitude or intensity of an extreme heat event is measured according to temperature in relation to the percentage of humidity. According to the National Oceanic Atmospheric Administration (NOAA), this relationship is referred to as the "Heat Index," and is depicted in Figure 31. This index measures how hot it feels outside when humidity is combined with high temperatures.

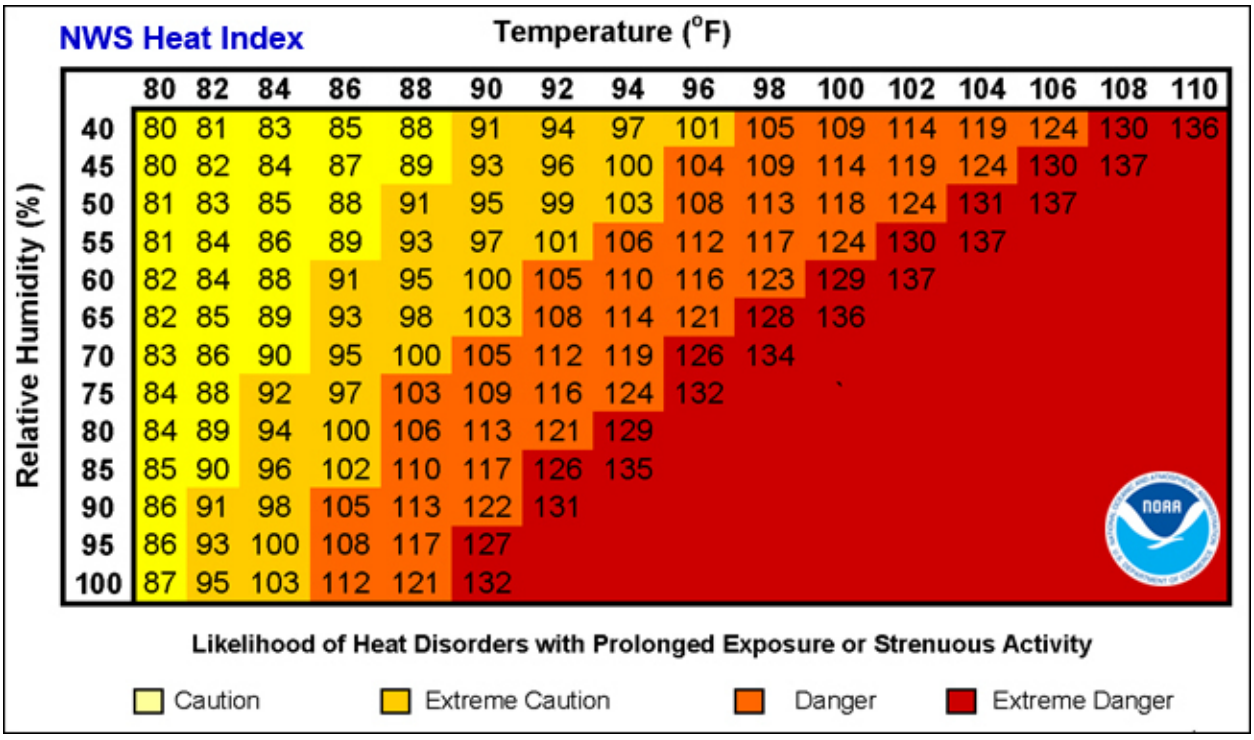

Figure 36: NOAA's NWS Heat Index Chart[57]

The extent scale in Figure 31 displays varying degrees of caution depending on the relative humidity combined with the temperature. For example, when the temperature is below 90˚F, caution should be exercised if the humidity level is at or above 40 percent.

The shaded zones on the chart indicate varying symptoms or disorders that could occur depending on the magnitude or intensity of the event. "Caution" is the first level of intensity where fatigue due to heat exposure is possible. "Extreme Caution" indicates that sunstroke, muscle cramps or heat exhaustion are possible, whereas a "Danger" level means that these symptoms are likely. "Extreme Danger" indicates that heat stroke is likely.

[57] http://www.nws.noaa.gov/om/heat/ht-images/heatindexchart.png

The National Weather Service (NWS) initiates alerts based on the Heat Index as shown in Table 68.

Table 68: Heat Intensity

Intensity	Description
Heat Advisory	Extreme heat index making it feel hot, typically between 105˚F to 110˚F for 3 hours or more during the day and at or above 75˚F at night.
Excessive Heat Warning	Extreme heat index making it feel very hot, typically above 105˚F for 3 hours or more during the day and at or above 80˚F at night.

Given an estimated daily average relative humidity level of 75%[58], highs as low as 89˚F can produce a heat index temperature of 106˚F. The combination of high humidity and moderate temperatures creates an environment that reaches the Danger Zone on NOAA's Heat Index Chart, and may trigger a Heat Advisory from the NWS.

Between 2000 and 2021, Refugio County and the participating jurisdictions experienced 1,138 days with highs of 89˚F or hotter and overnight lows of 75˚F or hotter. Based on the NWS descriptions in Table 68 above, and the average daily humidity level, these days likely warranted a heat advisory.

The hottest temperature recorded in Refugio County in the recent past, 112˚F, was reached on September 5, 2000. Based on the NWS descriptions in Table 68 above, at least 100 of the 1,138 heat advisory days warranted an excessive heat warning based on daytime highs, the average daily humidity level, and overnight lows not falling below 80˚F.

According to the Refugio County 2013 CHAMPS Report, the worst extreme heat events occurred in 1980 and 1995. The 1980 event resulted in one injury and $15,365 in crop damages and $1,536,425 in property damages adjusted to $2016. The 1995 event resulted in nine injuries and no crop or property damages. No extreme heat events have been reported since the previous plan.

Future extreme heat events may meet previous ones in terms of intensity, duration, and the number residents injured or worse.

[58] https://www.currentresults.com/Weather/Texas/humidity-annual.php

4) Location and Impact

A) Location – All Jurisdictions

Extreme heat has no distinct geographic boundary. Extreme heat can occur across the entire planning area and uniformly affect all participating jurisdictions.

B) Impact – All Jurisdictions

The potential impact of excessive summer heat is normally minor, resulting in few, if any, injuries. No property or crop damage specifically tied to extreme heat events has been recorded in any of the participating jurisdictions in over 15 years. No deaths related to extreme heat have ever been reported in the participating jurisdictions. However, based on the hazard's potential, in the worst cases, especially if combined with drought conditions, the hazard may inflict property or crop damages, and it can even be deadly. Any shutdown of facilities due to extreme heat is expected to be temporary.

5) Vulnerability

A) Population

As described in Section 3 of Chapter 3 above, Refugio County and the participating jurisdictions are home to many vulnerable residents. Vulnerable populations may feel greater impacts from extreme heat due to these populations' limited ability to properly address the hazard due to deficiencies including but not limited to: lack of air conditioning in their homes or vehicles, lack of access to air-conditioned public spaces during the hottest part of the day, insufficient numbers of box or ceiling fans, or lack of access to other means of cooling. The consequences for these populations' exposure to extreme heat can include but are not limited to: heat cramps, sunburn, dehydration, fatigue, heat exhaustion, heat stroke, or death.

B) Critical Facilities

While all of the jurisdictions are exposed to extreme temperatures, existing buildings, infrastructure, and critical facilities are not considered vulnerable to damages significant enough to interrupt or stop normal operations. Therefore, any estimated property losses associated with the hazard are anticipated to be minimal across the area.

16. Coastal Erosion – Refugio County and Town of Bayside Only

Coastal erosion is a hydrologic hazard defined as the wearing away of land and loss of beach, shoreline, or dune material because of natural coastal processes or manmade influences. Erosion along the Texas Gulf Coast is measured as an historical shoreline change rate, averaged over a 90-year period.

Texas has one of the longest coastlines in America coupled with some of the highest rates of coastal erosion in the nation.

Several processes contribute to chronic (long-term) or episodic (storm-induced) shoreline erosion of the Texas Gulf Coast. These processes include climate, tides, relative sea-level rise, subsidence, tropical storms, and the amount and rate of sediment supply. Coastal erosion affects both Gulf and bay shorelines, resulting in the loss of agricultural, industrial, residential land, critical infrastructure, and wetlands. Erosion is attributable to relative sea level rise and to the fact that sediment removal by wave energy exceeds that supplied to the beach by currents. Climatic changes (from wetter to drier) have decreased the volume of sediments carried to the Texas coast by rivers[59].

According to the 2018 Texas State Hazard Mitigation Plan, sea level rise paired with increasing intensity and frequency of hurricanes can directly impact future coastal erosion by increasing rates of soil loss.

1) Coastal Erosion History

According to the Refugio County 2018 CHAMPS Report, the majority of Refugio County's shoreline experiences coastal erosion rates of between 0.5' – 8.2' per year.

[59] Texas State Hazard Mitigation Plan, 2013 Update

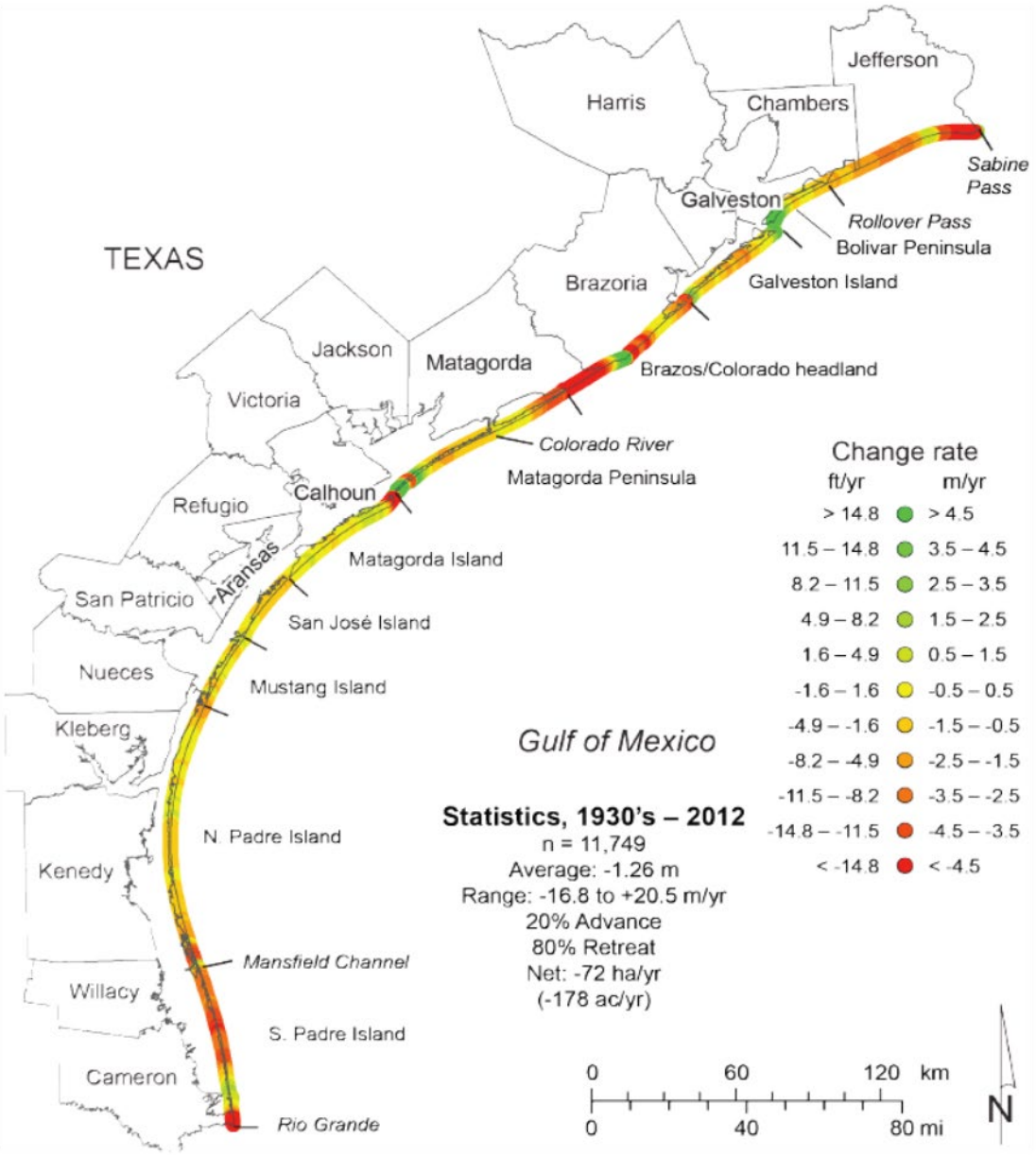

Figure 37: Texas Coastline Erosion Rates[60]

The planning team has determined that at least one coastal erosion event occurs annually in Refugio County.

The Town of Refugio determined that the jurisdiction has no risk of Coastal Erosion and the history of impacts of Coastal Erosion have been negligible (or non-existent), therefore it is expected that future impacts will be negligible as well and isn't addressing the hazard.

[60] Source: 2018 Refugio County CHAMPS Report

The Town of Woodsboro determined that the jurisdiction has no risk of Coastal Erosion and the history of impacts of Coastal Erosion have been negligible (or non-existent), therefore it is expected that future impacts will be negligible as well and isn't addressing the hazard.

Austwell-Tivoli ISD determined that the jurisdiction has no risk of Coastal Erosion and the history of impacts of Coastal Erosion have been negligible (or non-existent), therefore it is expected that future impacts will be negligible as well and isn't addressing the hazard.

Refugio ISD determined that the jurisdiction has no risk of Coastal Erosion and the history of impacts of Coastal Erosion have been negligible (or non-existent), therefore it is expected that future impacts will be negligible as well and isn't addressing the hazard.

Woodsboro ISD determined that the jurisdiction has no risk of Coastal Erosion and the history of impacts of Coastal Erosion have been negligible (or non-existent), therefore it is expected that future impacts will be negligible as well and isn't addressing the hazard.

Refugio County Water Control and Improvement District #1 determined that the jurisdiction has no risk of Coastal Erosion and the history of impacts of Coastal Erosion have been negligible (or non-existent), therefore it is expected that future impacts will be negligible as well and isn't addressing the hazard.

2) Likelihood of Future Events

Given the ongoing nature of coastal erosion, the probability of an event in Refugio County is highly likely, meaning ongoing coastal erosion is probable in the next year.

3) Extent

Texas has some of the highest coastal erosion rates in the country. Research shows that 64%[61] of the Texas Gulf Coast is eroding at an average rate of about 6' per year. As a whole the Texas coast is eroding at an average rate of 2.3' per year. In the worst cases, areas may lose 30' or more per year.

In 2004 Refugio County completed the Bayside Shoreline Erosion Control and Habitat Enhancement Project. The project cost $105,000. Its overall goal was to reduce erosion by providing a natural vegetative wave barrier to absorb wave energy, use bluff shaping and planting grasses to reduce impact of waves and bluff retreat, create/restore habitat for wildlife and marine life, improve water quality by creating a vegetative filter strip, educate the community on the benefits of using vegetation for shoreline erosion response, reduce and

[61] http://www.glo.texas.gov/coast/coastal-management/coastal-erosion/index.html

prevent the loss of property and public infrastructure due to chronic shoreline retreat, enhance property values and enhance the recreational value of shorelines[62].

Ongoing coastal erosion may meet previous rates of erosion and potentially inflict equal or greater damages.

4) Location and Impact

Refugio County has 61 miles of bay shoreline. Direct impacts from coastal erosion will be limited to areas along the shoreline depicted below:

Figure 38: Areas Subject to Coastal Erosion in Refugio County

The impacts of erosion may include but are not limited to decreasing property values, the partial or complete loss of structures adjacent to the coast, economic losses to agricultural operations, damage to local infrastructure including roads, bridges, and piers, and increased damage from tropical storms and hurricanes.

[62] http://www.glo.texas.gov/coastal-grants/projects/completed/03-026-shoreline-erosion-habitat-enhancement.html

5) Vulnerability

A) Critical Facilities

There are no critical facilities that are vulnerable to coastal erosion at this time.

B) Vulnerable Parcels

To determine vulnerability, all parcels in Refugio County and the Town of Bayside that are directly on or adjacent to the coast were selected. Ongoing coastal erosion is likely to continue to have a negative impact on the property and economic values of land that abuts the shoreline.

Table 69: Parcels Vulnerable to Coastal Erosion

Jurisdiction	Total	Estimated Potential Damage Value
Refugio County	**323**	**$49,110,390**

17. Expansive Soils

Expansive soils are defined as soils and soft rock that tend to swell or shrink due to changes in moisture content. Changes in soil volume present a hazard primarily to structures built on top of expansive soils.

Expansive soils (bentonite, smectite, or other reactive clays) expand when the soil particles attract water and can shrink when the clay dries. Expansive soil can grow to as much as 15 times its original size, thus causing severe damage. Sidewalks, roads, and residential and commercial buildings may be lifted causing cracks and distortion.

It is differential expansion that causes damage. If the entire area under a foundation or road maintained the same moisture content, the entire structure would rise uniformly, and there would be no damage. Residential construction generally has more problems than commercial, but both experience significant losses. The foundation type most prevalent in Texas, slab on grade, is also the most susceptible to damage from expansive clays.

1) Expansive Soils History

Neither Refugio County nor the participating jurisdictions have a documented history of damages caused by expansive soils.

The participating jurisdictions consider this to be a data deficiency.

To remedy the deficiency, the jurisdictions have proposed a mitigation action in Chapter 18 that will create a study to track instances of damages due to expansive soils and begin developing a comprehensive history of the hazard and its effects.

2) Likelihood of Future Events

Given the lack of an officially recorded hazard history in Refugio County and the participating jurisdictions, it's difficult to attempt to estimate the likelihood of future expansive soils hazards events.

However, in light of the jurisdictions' histories of heavy rainfalls and periods of drought, conditions that lead clay-filled soils to expand and contract respectively, it may be fair to say that a future expansive soils event is unlikely, meaning one is possible in the next 10 years.

As information on the hazard is gathered more closely moving forward, its likelihood will be revised accordingly.

3) Extent

According to the State of Texas Mitigation Plan Update 2013, determining the extent of the expansive soils hazard requires measuring a soil's swelling potential or volumetric swell. To test the soil for these properties, the State outlined the following procedure:

> Soil material is disaggregated and passed through the #4 sieve and then brought to approximately the optimum moisture content (as determined by American Society for Testing and Materials [ASTM-D-1557]). The optimum moisture content equates to approximately 80 to 85% of saturation. After setting for 6 to 30 hours, the moisture-conditioned soil is compacted into a 4-in diameter mold. The moisture content is then adjusted, if necessary, to bring the sample to 50% saturation. A 144 psf surcharge is applied and the sample is wetted and monitored for 24 hours, measuring the volumetric swell. The Expansion Index is calculated as follows:
>
> EI = 100 x Δh x F
>
> Where Δh = percent swell and F = fraction passing No. 4 sieve
>
> The following "ratings" can be accepted examples expected for "extent" when a risk is identified as Expansive Soils:

Table 70: ASTM D4729-11 Expansive Soils Index (in %)

0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
>130	Very High

The participating jurisdictions lack the information to create an Expansive Soils Index as shown in Table 70 and have instead decided to rely on the county-wide soil studies produced by the United States Department of Agriculture (USDA), Soil Conservation Service[63] as well as the USDA's Web Soil Survey[64] data. The Web Soil Survey in particular offers both soil maps and USDA guidance on soil suitability for various types of development.

For the purposes of this plan, the jurisdictions have decided to consider the ratings of Refugio County soils for the construction of both residential dwellings on concrete slab and small commercial buildings.

[63] https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/texas/TX325/0/Medina.pdf
[64] http://websoilsurvey.nrcs.usda.gov/app/

As shown in Figure 34 below, more than half (62.3%) of Refugio County contains soils that are "Very Limited" for the construction of dwellings on concrete slab, the State's most prevalent dwelling foundation. Additionally, a significant portion (32.3%) of the County's soils, most heavily concentrated in the western half of the County, are considered "Somewhat Limited" for the construction of dwellings on concrete slab.

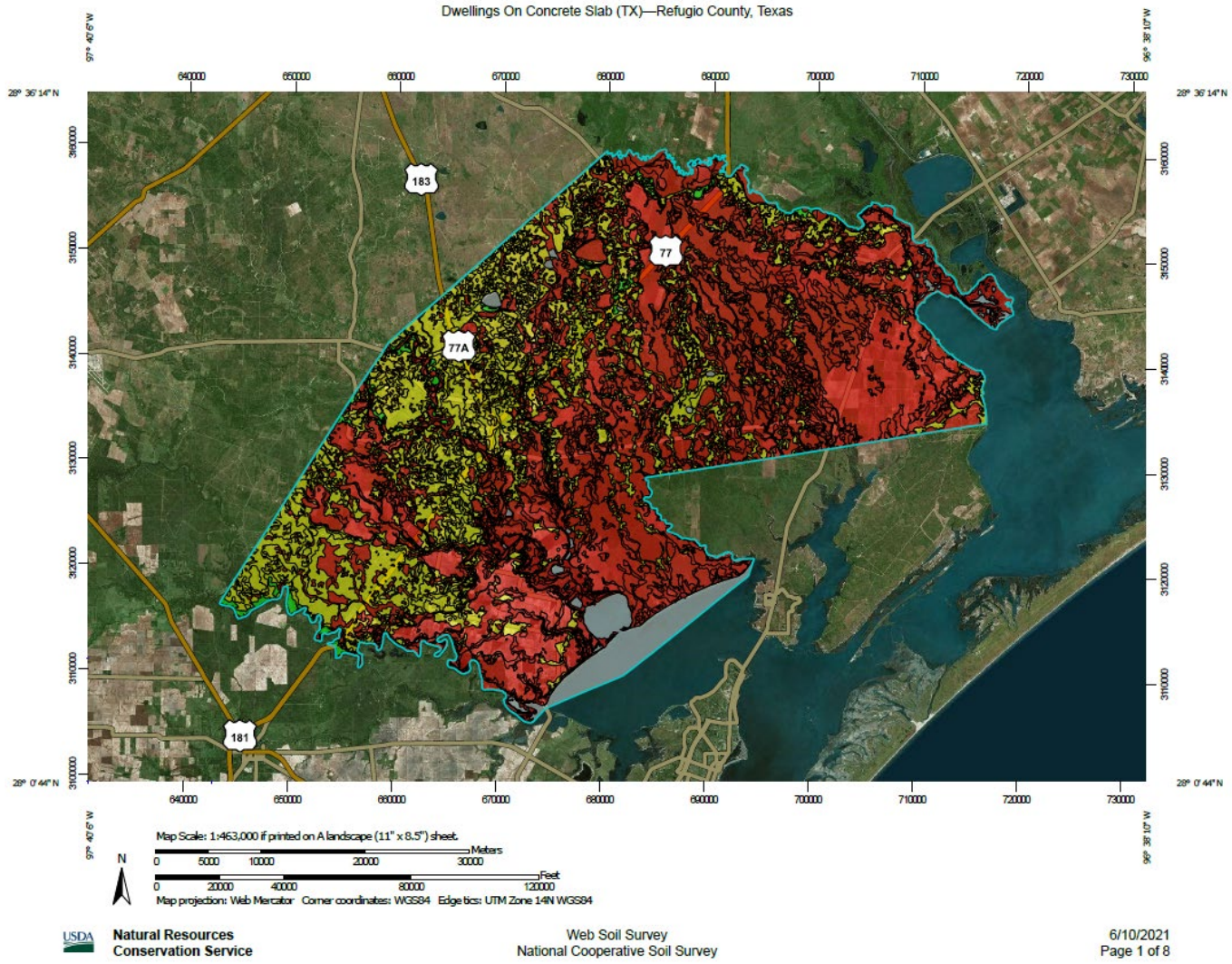

Figure 39: Refugio County Soil Ratings for the Construction of Dwellings on Concrete Slab[65]

[65] https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Background
- Aerial Photography

Soils

Soil Rating Polygons
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Lines
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Points
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Refugio County, Texas
Survey Area Data: Version 21, Jun 11, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jan 1, 1999—Dec 31, 2003

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

As shown in Figure 35 below, more than half of Refugio County and the participating jurisdictions are comprised of soils that are “Very Limited” (62.8% of the County) for the construction of small commercial buildings, defined as structures less than three stories high, without basements, and constructed on foundations consisting of spread footings or reinforced concrete built on undisturbed soil at a depth of 2’ or at the depth of maximum frost penetration, whichever is deeper.

The areas considered very limited for the construction of small commercial buildings are primarily concentrated in the southern half of Refugio County.

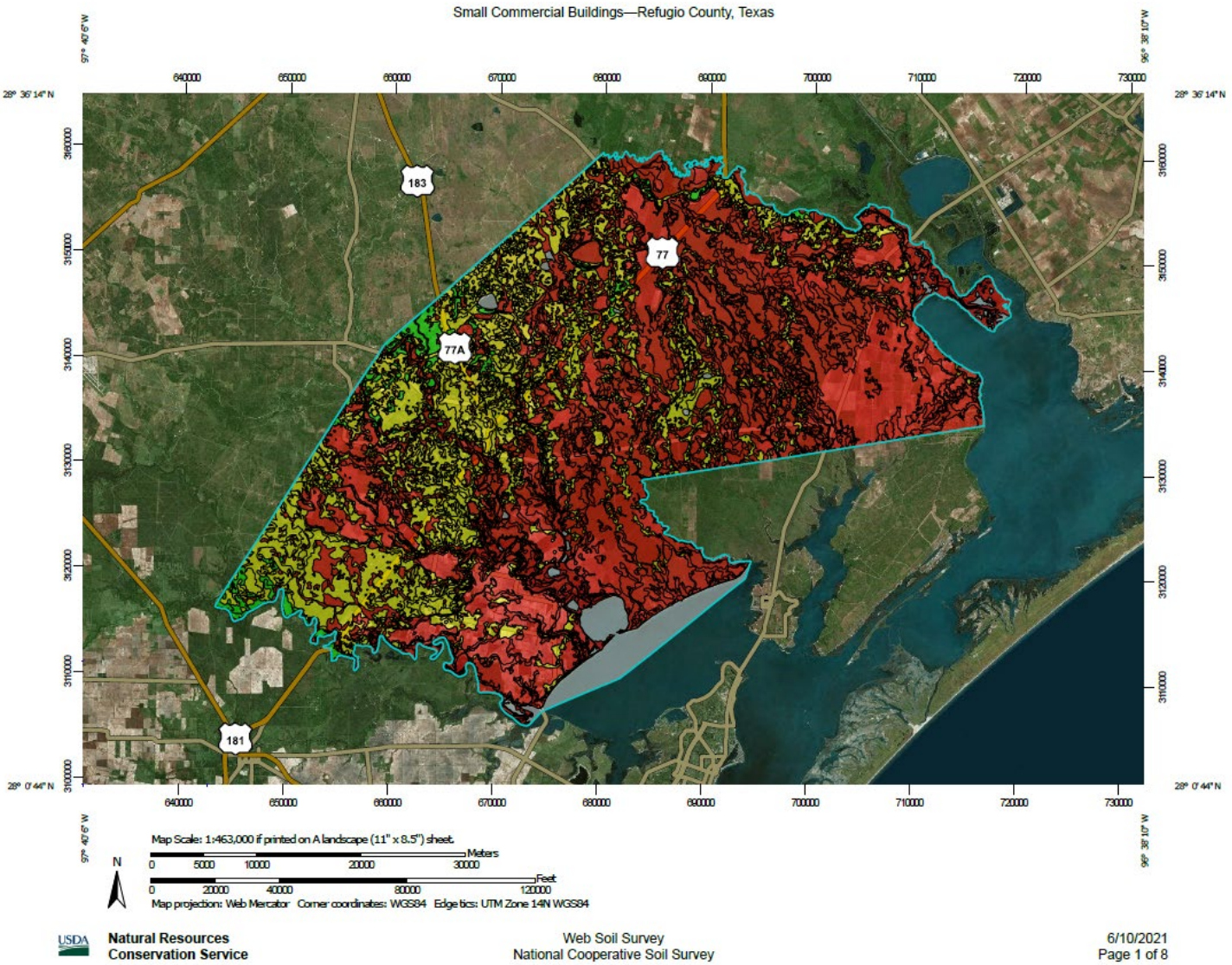

Figure 40: Refugio County Soil Ratings for the Construction of Small Commercial Buildings

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Lines
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Points
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Refugio County, Texas
Survey Area Data: Version 21, Jun 11, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jan 1, 1999—Dec 31, 2003

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

4) Location and Impact

A) Location – All Jurisdictions

As shown in the maps above, expansive soils exist across the County, and have the potential to affect all participating jurisdictions. Areas within each jurisdiction may be more affected by expansive soils depending on both building location and building type.

B) Impact – All Jurisdictions

The potential impact of expansive soils in the jurisdictions is unknown at this time. Future hazard events are expected to result in few, if any, injuries.

However, as outlined in the State of Texas Mitigation Plan Update 2018, the combination of expansive soils and Texas homebuilders' propensity for installing concrete slab foundations, often results in cracked foundations that can literally halve a home's value. In such cases, economic losses are not limited to those borne by the homeowner. Instead, halved property values result in lower property values, and therefore, lower property tax revenues.

Potential ripple effects make it difficult to estimate how wide-reaching expansive soils' impact could be. Under the right circumstances, expansive soils may wreak havoc on local economies by depleting homeowners' bank accounts and decimating municipal budgets. In the worst cases, building owners may choose to walk away, rather than make costly repairs, thus saddling local governments with abandoned properties and the incumbent challenges they pose.

5) Vulnerability

Refugio County and the participating jurisdictions are exposed to expansive soils to varying degrees based on both soil type and building type, as shown in Figure 34 and Figure 35 above. At this time, given the combination of the hazard's ability to inflict unpredictable damages, the lack of officially reported data, and the diversity of building ages, types, and foundations in each participating jurisdiction, it's unfeasible to identify which buildings, infrastructure, and critical facilities are vulnerable to damages significant enough to interrupt or stop normal operations. Therefore, all are considered equally vulnerable to the hazard.

A) Critical Facilities

Table 71: Refugio County Critical Facilities Vulnerable to Expansive Soils

Refugio County
Aransas River Boat Ramp
Aransas River Bridge
Blanco Creek Bridge
Bonnie View Community Center
Copano Bay Boat Ramp

Elevated Storage Tank
Ground Storage Tank
Hynes Bay Boat Ramp
Lift Stations
Mary Rhodes Pipeline
Mission River Bridge
Padilla Hall
Pressure Tank
Pump Stations
Radio Towers
Refugio County Airport (Rooke Field)
Refugio County Community Center
Refugio County Courthouse
Refugio County Expo Center
Refugio County Fairgrounds
Refugio County Jail
Refugio County Precinct Building, Precinct 1
Refugio County Precinct Building, Precinct 2
Refugio County Precinct Building, Precinct 3
Refugio County Precinct Building, Precinct 4
Southcross Energy GP
State Highway 35
Union Pacific Railroad
United States Highway 77
United States Highway 77A / 183
Wastewater Treatment Plant
Water Treatment Plant
Water Wells

City of Austwell
Austwell Volunteer Fire Department
Elevated Storage Tank
Wastewater Treatment Plant
Water Treatment Plant

Town of Bayside
Town of Bayside City Hall and Community Center
Town of Bayside Volunteer Fire Department

Wastewater Treatment Plant
Water Plant
Lift Stations
Water Wells
Pump Stations
Reverse Osmosis Units

Town of Refugio
City Hall
Elevated Storage Tank
Elevated Storage Tank
HEB & HEB Pharmacy
Parker Lumber
Refugio County Memorial Hospital and Helipad
Town of Refugio Fire Department
Town of Refugio Police Department
Vantage Bank
Village Pharmacy
Wastewater Treatment Plant
Water Plant #1
Water Plant #2
Water Plant #3
Refugio Rural Health Clinic
Refugio Specialty Clinic
Refugio Manor Nursing and Rehabilitation Center
Mission Ridge Nursing and Rehabilitation Center
Gulf South Pipeline Co.
Valiant Petroleum
EOG Resources
Lift Stations
Pump Stations
Town of Refugio Police Department Annex
RV Park
Woodforest National Bank

Town of Woodsboro
200k Gallon Ground Tanks
Ballfield Concession

Chlorine Storage
City Building
Elevated Storage Tank
Equipment Storage
Fast Break
Filtration Control Building
Filtration Tanks
First National Bank
Gazebo
Haertig, Inc.
Office Building
Parts Barn
SCADA / Electrical System
Storage / Rental Building
Town of Woodsboro Volunteer Fire Department
Tractor Storage
Tuttle's Grocery Market
Wastewater Treatment Plant
Water Plant
Well #3
Well #4
Woodsboro City Hall
Woodsboro Family Center
Woodsboro Farmers COOP
Wranosky Wran Lift Station

Tivoli
Elevated Storage Tank
Tivoli Volunteer Fire Department
Wastewater Treatment Plant
Water Plant

Austwell-Tivoli ISD
Austwell-Tivoli High School
Austwell-Tivoli Elementary
Austwell-Tivoli Administration Building
Austwell-TIvoli Maintenance Building

Refugio ISD
Refugio ISD Elementary School (Primary School)
Refugio High School/Refugio ISD Administration Building
Refugio ISD Junior High School (7th & 8th Grade Building)
Jack Sportsman Bobcat Stadium/Athletic Facility/Maintenance Building

Woodsboro ISD
Eagle Dome
Woodsboro ISD Administration Office
Woodsboro ISD Elementary School
Woodsboro ISD Junior and Senior High School

Refugio Water Control and Improvement District #1
Water Treatment Plant
Wastewater Plant
Elevated Storage Tank
Water Wells
Lift Station

B) Vulnerable Parcels

Table 72: Expansive Soils Vulnerability

Jurisdiction	Parcel Count	Estimated Potential Damage Value
Refugio County	11,162	$2,477,921,463
Town of Bayside	1,341	$91,827,960
Town of Refugio	2,156	$120,602,883
Town of Woodsboro	1,620	$68,833,140
Austwell-Tivoli ISD	11	$225,820
Refugio ISD	11	$268,080
Woodsboro ISD	14	$1,107,240
Refugio County WCID #1	4	$16,530

18. Mitigation Strategy

1) Capability Assessment

Refugio County and the participating jurisdictions have shown themselves to be highly capable, especially in terms of implementing hazard mitigation actions. All four jurisdictions participated in the 2017 plan. Each of these jurisdictions completed, or is in the process of completing, many of the actions recommended in the 2017 plan.

In addition to reviewing previous actions and the steps taken to implement them, the planning team reviewed existing regulatory capabilities and opportunities for establishing new capabilities and enhancing existing ones. At this time, all jurisdictions could improve their hazard mitigation capabilities through the following efforts: budgeting for mitigation actions and support, passing policies and procedures to implement mitigation actions, adopting and implementing stricter mitigation regulations, approving the hiring and training of staff for mitigation activities, and approving mitigation updates and additions to existing plans as new needs are recognized. The participating cities could further improve their capabilities by creating and adopting regularly updated comprehensive plans.

Table 73: Capability Assessment by Jurisdiction

Refugio County Administrative, Financial, Regulatory, and Technical Abilities
Floodplain Management
Emergency Management
Economic Development
Road and Bridge Management
Tax Collection
Grant Writing
General Budgeting
CIP Funding
CDBG Funding
State and Federal Grant Funding

Town of Bayside Administrative, Financial, Regulatory, and Technical Abilities
Floodplain management
Emergency Management

Subdivision
Zoning
Building Code Enforcement
Nuisance Abatement
Substandard Structures Abatement
Drought Contingency Planning
Comprehensive Planning
Economic Development
Tax Collection
Grant Writing
General Budgeting
CIP Funding
CDBG Funding
State and Federal Grant Funding

Town of Refugio Administrative, Financial, Regulatory, and Technical Abilities
Floodplain management
Emergency Management
Subdivision
Zoning - (if adopted)
Building Code Enforcement
Nuisance Abatement
Substandard Structures Abatement
Drought Contingency Planning
Comprehensive Planning
Economic Development
Tax Collection
Grant Writing
General Budgeting
CIP Funding
CDBG Funding
State and Federal Grant Funding

Town of Woodsboro Administrative, Financial, Regulatory, and Technical Abilities

Floodplain management
Emergency Management
Subdivision - (if adopted)
Zoning - (if adopted)
Building Code Enforcement
Substandard Structures Abatement
Drought Contingency Planning
Comprehensive Planning
Economic Development
Tax Collection
Grant Writing
General Budgeting
CIP Funding
CDBG Funding
State and Federal Grant Funding

Austwell-Tivoli ISD Administrative, Financial, Regulatory, and Technical Abilities
Emergency Planning
Facilities Management
Tax Collection
Grant Writing
General Budgeting
CIP Funding
CDBG Funding
State and Federal Grant Funding

Refugio ISD Administrative, Financial, Regulatory, and Technical Abilities
Emergency Planning
Facilities Management
Tax Collection
Grant Writing
General Budgeting
CIP Funding
CDBG Funding

State and Federal Grant Funding

Woodsboro ISD Administrative, Financial, Regulatory, and Technical Abilities
Emergency Planning
Facilities Management
Tax Collection
Grant Writing
General Budgeting
CIP Funding
CDBG Funding
State and Federal Grant Funding

Refugio County WCID #1 Administrative, Financial, Regulatory, and Technical Abilities
Emergency Planning
Facilities Management
Tax Collection
Grant Writing
General Budgeting
CIP Funding
CDBG Funding
State and Federal Grant Funding

2) Goals and Objectives Overview

The hazard analysis has shown that Refugio County and the participating jurisdictions are at risk of multiple natural hazards. The following goals and objectives take a broad approach to improving outcomes before, during, and after these anticipated natural hazard events.

The mitigation actions the County and participating jurisdictions have selected are designed to address specific hazard-related issues in support of achieving the desired goals and objectives. The overarching priorities of the communities are reflected in the goals and objectives outlined below. Community priorities have not changed since the last plan, they are seen as a direct continuation of the goals and objectives outlined in the 2017 plan.

3) Long-Term Vision

The hazard mitigation plan must strike a balance between identifying long-term goals and objectives and prioritized mitigation actions that may be addressed sooner, depending on funding availability and local priorities. The result is that certain goals and objectives don't have a corresponding mitigation action. Instead, by taking the long view, the local planning team has created a framework that can be developed as the plan is updated over time.

4) Goals

A) Goal 1: To reduce loss of life and injury to persons

Objective 1.1
Improve the delivery and effectiveness of warning messages

Objective 1.2
Preserve public and private emergency response capability (9-1-1, law enforcement, fire services, emergency medical services, hospitals).

Objective 1.3
Utilize available mitigation measures to prevent or reduce life-threatening impacts of natural hazards.

Objective 1.4
Reduce obstacles to timely and safe evacuation of flood hazard areas.

Objective 1.5
Reduce vulnerability of individuals living in mobile homes / manufactured housing.

Objective 1.6
Reduce life or health threatening impacts on individuals with special physical care requirements.

Objective 1.7
Reduce secondary impacts to health and safety from cascading effects.

B) Goal 2: To reduce disruptions to essential public services and infrastructure

Objective 2.1
Minimize disruption to and enhance rapid restoration of utilities.

Objective 2.2
Minimize disruption to and enhance rapid restoration of essential transportation infrastructure.

Objective 2.3
Minimize disruption to governmental, educational, and other institutions providing services to the public.

C) Goal 3: To reduce economic impacts to individuals, businesses, and area institutions

Objective 3.1
Increase home and business owner investment in available mitigation measures for private property.

Objective 3.2
Increase home and business owner participation in appropriate insurance programs.

Objective 3.3
Increase public and private sector development and use of operations continuity strategies.

Objective 3.4
Utilize available mitigation measures to prevent or reduce economic losses from natural hazards.

Objective 3.5
Reduce vulnerability of existing development by encouraging property owners to participate in buy-out or flood-proofing opportunities.

Objective 3.6
Reduce vulnerability of future development by utilizing available planning and structural standards.

D) Goal 4: To reduce losses to civic, cultural, and environmental resources

Objective 4.1
Protect public investment in community-owned facilities and infrastructure through appropriate structural, non-structural, and financial methods.

Objective 4.2
Reduce future losses to the non-profit sector through participation in available mitigation opportunities.

Objective 4.3
Reduce vulnerability of historically or culturally significant structures.

Objective 4.4
Minimize environmental impacts from cascading effects.

5) Mitigation Action Plan

A) Mitigation Action Prioritization

The planning team members have identified at least two mitigation actions per natural hazard. For this update, the planning team members chose to utilize the same prioritization criteria as the previous plan. The action items were identified and prioritized in consideration of the following criteria:

1) Life safety and property protection improvements
2) Cost effectiveness – do the action's future benefits exceed its implementation costs
3) Technical feasibility – is the action reasonable given its technical requirements
4) Political acceptability
5) Administrative capabilities and legal authorities for implementation
6) Funding availability
7) The action's environmental impacts
8) The action's social acceptability
9) The action's ability to reduce risk to more than one hazard
10) The ease of implementation
11) The availability of a local champion
12) The action's relationship to other community objectives

In addition to considering an action's cost effectiveness as described above, the planning team considered TDEM's Cost-Effectiveness, Environmental Soundness and Technical Feasibility requirements as they relate to construction projects. Mitigation actions relating to physical infrastructure will meet the State's standards as outlined below:

A) Any state government construction project, regardless of potential funding source, has to be cost effective, technically feasible and meet all of the appropriate federal, state, and local environmental laws and regulations before it is started.

B) State government projects funded by Federal Mitigation Grant Programs administered by TDEM have to meet specific criteria related to cost effectiveness, environmental

soundness and technical feasibility. These are outlined in the applicable FEMA grant program guidance for that particular funding program.

B) Incorporation and Integration of Existing Capabilities and Hazard Mitigation

As previously outlined, the planning team reviewed a range of codes, ordinances, and planning studies that have been adopted by the participating jurisdictions. The planning team's goal was to understand how these existing capabilities might affect mitigation actions in terms of implementation and enforcement.

Mitigation Action Status – 2017 plan

In addition to reviewing existing codes, ordinances, and planning studies, the planning team also examined the status of each mitigation action identified in the 2017 plan.

A slight increase in local development is not known to have affected local vulnerability to the natural hazards this plan addresses or to those addressed in the 2017 plan.

Mitigation actions marked as abandoned are no longer considered relevant as written to the participating jurisdictions.

Table 74: Previous Mitigation Action Incorporation with Existing Departments and Capabilities by Jurisdiction

Jurisdiction	Hazards Addressed	Mitigation Action	Multi-Hazard Action Item Description	Status
ALL	Flood, Hurricane / Tropical Storm, Wildfire, Tornado, Drought, Coastal Erosion, Extreme Heat, Hailstorms, Winter Weather, Severe Winds, Lightning	Educational Outreach	This action will create a program to educate the public about specific mitigation actions for all hazards, including but not limited to participation in NFIP, Wildfire Fuels Reduction, Structural Hardening, etc…	**Refugio County:** Completed (Social Media – Facebook). **Town of Woodsboro:** Deferred to Plan Update, need to budget for it. **Town of Refugio:** Completed **Refugio ISD:** Deferred to Plan Update **Woodsboro ISD:** Deferred to Plan Update
ALL	Flood, Hurricane / Tropical Storm, Wildfire, Tornado, Hailstorms, Winter Weather, Severe Winds	Implement a Tree Trimming Program	This action will develop and implement a tree trimming program to minimize the amount of debris generated during severe weather events.	**Refugio County:** Deferred to Plan Update. **Town of Refugio:** Deferred to Plan Update. **Town of Woodsboro:** Deferred to Plan Update, need to budget for it. **Refugio ISD:** Deferred to Plan Update **Woodsboro ISD:** Deferred to Plan Update
ALL	Flood, Hurricane / Tropical Storm, Extreme Heat, Hailstorm, Lightning	Purchase Back Up Power Generators	Installing generators at critical facilities will help ensure physical safety for facility occupants and maintain electronic systems functionality during power outages.	**Refugio County:** Completed (Generator/Transfer Switches). **Town of Refugio:** Completed **Town of Woodsboro:** Completed – at City Hall, WWTP, and WTP. **Refugio ISD:** Deferred to Plan Update **Woodsboro ISD:** Deferred to Plan Update
ALL	Hurricane / Tropical Storm, Hailstorm, Windstorm	Harden Facilities	This action proposes hardening facilities. Hardening will include but is not limited to reinforcing building foundations, elevating low-lying structures, upgrading and/or adding shatter-resistant films to all glazing, implementing window shutter program for coastal properties, building protective walls around exposed gas tanks and cylinders, shielding roof-mounted equipment, and adding bracing and tie-down clips to building roofs.	**Refugio County:** Deferred to Plan Update and In Progress. **Town of Refugio:** Deferred to Plan Update and In Progress. **Town of Woodsboro:** Completed at City Hall. In Progress at Fire Department. **Refugio ISD:** Deferred to Plan Update **Woodsboro ISD:** Abandoned
ALL	Flood, Hurricane / Tropical Storm	Construct Storm Drainage Infrastructure	This action proposes constructing new storm drainage infrastructure and / or improving existing	**Refugio County:** Deferred to Plan Update and In Progress.

			infrastructure to reduce the potential impacts of future flood events.	**Town of Refugio:** Deferred to Plan Update and In Progress. **Town of Woodsboro:** In Progress. **Refugio ISD:** Deferred to Plan Update **Woodsboro ISD:** Abandoned
ALL	**Hurricanes / Tropical Storms**	Construct Safe Rooms	The action's goal is to minimize vulnerability to hurricanes / tropical storms by constructing strategically located safe rooms.	**Refugio County:** Deferred to Plan Update and In Progress. **Town of Refugio:** Deferred to Plan Update and In Progress. **Town of Woodsboro:** Deferred to Plan Update, no funding. **Refugio ISD:** Abandoned **Woodsboro ISD:** Abandoned
Refugio County	**Flood**	Drainage Improvement at FM 629 and Boenig Rd.	Eliminating flooding at the intersection of FM 629 and Boenig Rd. Flooding in this area limits access to high water vehicles and other supplies stored at the Precinct 2 Yard that the County may need during or after a flood event.	*Completed*
Refugio County	**Flood**	Increase Freeboard Requirement to 18"	The Refugio County Office of Emergency Management determined that updating the County's flood ordinance to require 18" of freeboard could improve the County's resiliency and minimize damages to future construction.	*Deferred to Plan Update*
Refugio County	**Flood**	Install a Local Flood Warning System	Flooded roadways and low water crossings routinely create problems throughout Refugio County. In an effort to prevent loss of life and protect property, the County plans to install a Local Flood Warning System, including automatically-triggered flooded roadway and low water crossing warning signs at appropriate locations throughout the County.	*Abandoned*
Refugio County	**Flood**	Drainage Improvement along SH 35 just south of FM 774	State Highway 35 just south of FM 774 is known to flood due to heavy rains and tidal inundation. This particular segment of SH 35 is part of the TxDOT designated hurricane evacuation route network. Flooding during an evacuation could cause serious delays, injuries, or worse.	*Deferred to Plan Update*
Refugio County	**Hurricane / Tropical Storm**	Harden Storage Facilities to Protect Critical Equipment	This action proposes hardening precinct buildings where critical equipment is stored. Hardening will include but is not limited to replacing existing windows and doors with hurricane resistant ones,	*Deferred to Plan Update*

			building protective walls around gas and propane tanks, and adding bracing and tie-down clips to precinct building roofs.	
Refugio County	**Wildfire**	Wildfire Fuels Reduction	The action's goal is to reduce wildfire fuels on County-maintained land. Unchecked wildfire fuels increase the potential for a wildfire's ability to spread quickly, potentially resulting in higher damage dollar totals.	*Deferred to Plan Update*
Refugio County	**Tornado**	Install NOAA Weather Radios in County Facilities	An indoor warning system will help ensure everyone's safety ahead of a tornado. To that end, the County will install a NOAA weather radio in every county facility that is occupied on a full time basis.	*Abandoned*
Refugio County	**Drought**	Develop and Implement a New Drought Ordinance	The County will re-evaluate all existing drought control measures to identify strengths and weaknesses in order to develop and enforce a new drought ordinance.	*Completed*
Refugio County	**Drought**	Plant drought resistant vegetation on County properties to limit water consumption.	To limit water consumption at County-owned and maintained facilities, the County will adopt a policy of replanting landscaping with drought tolerant plant varieties. To the extent possible, landscaping will be replanted on an as-needed basis, as opposed to an immediate replanting of all landscaping.	*Completed*
Refugio County	**Coastal Erosion**	Shoreline Erosion Control and Habitat Enhancement	Coastal erosion is an ongoing hazard in Refugio County. Similar to the County's previous Coastal Erosion project, the overall goal of this action will be to reduce erosion by methods including but not limited to: vegetative wave barriers to absorb wave energy, bluff shaping and planting grasses to reduce wave impact and bluff retreat, wildlife and marine life habitat creation and restoration, and vegetative filter strips to improve water quality.	*Deferred to Plan Update*
Refugio County	**Extreme Heat**	Set up Cooling Centers in Existing County Facilities	The action's goal is to increase extreme heat resilience throughout Refugio County by limiting its vulnerable populations' exposure to extreme heat.	*Completed and In Progress.*
Refugio County	**Hailstorms**	Exposed Equipment and Utilities Hardening	Many of the County Courthouse's utilities are roof-mounted and are therefore more vulnerable to damage during a hailstorm than if they were shielded. Additionally, increasing the amount of covered parking at certain County facilities is likely to reduce hailstorm-related damages to County vehicles that might otherwise be parked in the open.	*Abandoned*

Refugio County	**Severe Winds**	Harden Storage Buildings to Protect Critical Equipment	This action proposes hardening precinct buildings where critical equipment is stored. Hardening will include but is not limited to replacing existing windows and doors with wind resistant ones, building protective walls around gas and propane tanks, and adding bracing and tie-down clips to precinct building roofs.	*Deferred to Plan Update*
Refugio County	**Lightning**	Install Surge Protection for all County-Owned Critical Electronic Devices	Electronic systems are particularly vulnerable to power outages and surges caused by lightning. As recordkeeping becomes fully digitized, protecting the electronic systems that maintain and provide access to digital data is critical. To protect these systems, the County will install surge protection on all critical computers and electronic devices.	*Deferred to Plan Update and In Progress*
Town of Refugio	**Flood**	Increase Freeboard Requirement to 18"	The Town of Refugio Mayor's Office determined that updating the Town's flood ordinance to require 18" of freeboard could improve the Town's resiliency and minimize damages to future construction.	*In Progress.*
Town of Refugio	**Flood**	Install a Local Flood Warning System	Flooded roadways and low water crossings routinely create problems throughout the Town of Refugio. In an effort to prevent loss of life and protect property, the Town plans to install a Local Flood Warning System, including automatically-triggered flooded roadway and low water crossing warning signs at appropriate locations throughout the Town.	*In Progress.*
Town of Refugio	**Hurricane / Tropical Storm**	Harden Storage Facilities to Protect Critical Equipment	This action proposes hardening City-owned buildings where critical equipment is stored. Hardening will include but is not limited to replacing existing windows and doors with hurricane resistant ones, building protective walls around gas and propane tanks, and adding bracing and tie-down clips to precinct building roofs.	*Completed.*
Town of Refugio	**Wildfire**	Wildfire Fuels Reduction	The action's goal is to reduce wildfire fuels on Town of Refugio-maintained land. Unchecked wildfire fuels increase the potential for a wildfire's ability to spread quickly, potentially resulting in higher damage dollar totals.	*Completed.*
Town of Refugio	**Tornado**	Install NOAA Weather Radios in Town of Refugio Facilities	An indoor warning system will help ensure everyone's safety ahead of a tornado. To that end, the Town will install a NOAA weather radio in every Town-owned facility that is occupied on a full time basis.	*Completed.*

Town of Refugio	Drought	Develop and Implement a New Drought Ordinance	The Town of Refugio will re-evaluate all existing drought control measures to identify strengths and weaknesses in order to develop and enforce a new drought ordinance.	*Completed.*
Town of Refugio	Drought	Plant drought resistant vegetation on Town of Refugio properties to limit water consumption.	To limit water consumption at Town-owned and maintained facilities, the Town of Refugio will adopt a policy of replanting landscaping with drought tolerant plant varieties. To the extent possible, landscaping will be replanted on an as-needed basis, as opposed to an immediate replanting of all landscaping.	*Completed.*
Town of Refugio	Extreme Heat	Set up Cooling Centers in Existing Town of Refugio Facilities	The action's goal is to increase extreme heat resilience throughout the Town of Refugio by limiting its vulnerable populations' exposure to extreme heat.	*Abandoned.*
Town of Refugio	Hailstorms	Exposed Equipment and Utilities Hardening	Many of the Town of Refugio's utilities are roof-mounted and are therefore more vulnerable to damage during a hailstorm than if they were shielded. Additionally, increasing the amount of covered parking at certain Town facilities is likely to reduce hailstorm-related damages to Town of Refugio vehicles that might otherwise be parked in the open.	*Completed.*
Town of Refugio	Severe Winds	Harden Storage Buildings to Protect Critical Equipment	This action proposes hardening Town of Refugio buildings where critical equipment is stored. Hardening will include but is not limited to replacing existing windows and doors with wind resistant ones, building protective walls around gas and propane tanks, and adding bracing and tie-down clips to precinct building roofs.	*Completed.*
Town of Refugio	Lightning	Install Surge Protection for all Town-Owned Critical Electronic Devices	Electronic systems are particularly vulnerable to power outages and surges caused by lightning. As recordkeeping becomes fully digitized, protecting the electronic systems that maintain and provide access to digital data is critical. To protect these systems, the Town of Refugio will install surge protection on all critical computers and electronic devices.	*Completed.*

Town of Woodsboro	Flood	Increase Freeboard Requirement to 18"	The Town of Woodsboro Mayor's Office determined that updating the Town's flood ordinance to require 18” of freeboard could improve the Town's resiliency and minimize damages to future construction.	*In Progress*
Town of Woodsboro	Flood	Install a Local Flood Warning System	Flooded roadways and low water crossings routinely create problems throughout the Town of Woodsboro. In an effort to prevent loss of life and protect property, the Town plans to install a Local Flood Warning System, including automatically-triggered flooded roadway and low water crossing warning signs at appropriate locations throughout the Town.	*Abandoned*
Town of Woodsboro	Hurricane / Tropical Storm	Harden Storage Facilities to Protect Critical Equipment	This action proposes hardening City-owned buildings where critical equipment is stored. Hardening will include but is not limited to replacing existing windows and doors with hurricane resistant ones, building protective walls around gas and propane tanks, and adding bracing and tie-down clips to precinct building roofs.	*In Progress.*
Town of Woodsboro	Wildfire	Wildfire Fuels Reduction	The action's goal is to reduce wildfire fuels on Town of Woodsboro-maintained land. Unchecked wildfire fuels increase the potential for a wildfire’s ability to spread quickly, potentially resulting in higher damage dollar totals.	*Deferred to Plan Update*
Town of Woodsboro	Tornado	Install NOAA Weather Radios in Town of Woodsboro Facilities	An indoor warning system will help ensure everyone’s safety ahead of a tornado. To that end, the Town will install a NOAA weather radio in every Town-owned facility that is occupied on a full time basis.	*Abandoned.*
Town of Woodsboro	Drought	Develop and Implement a New Drought Ordinance	The Town of Woodsboro will re-evaluate all existing drought control measures to identify strengths and weaknesses in order to develop and enforce a new drought ordinance.	*Deferred to Plan Update*
Town of Woodsboro	Drought	Plant drought resistant vegetation on Town of Woodsboro properties to limit water consumption.	To limit water consumption at Town-owned and maintained facilities, the Town of Woodsboro will adopt a policy of replanting landscaping with drought tolerant plant varieties. To the extent possible, landscaping will be replanted on an as-	*In Progress*

			needed basis, as opposed to an immediate replanting of all landscaping.	
Town of Woodsboro	Extreme Heat	Set up Cooling Centers in Existing Town of Woodsboro Facilities	The action's goal is to increase extreme heat resilience throughout the Town of Woodsboro by limiting its vulnerable populations' exposure to extreme heat.	*Deferred to Plan Update*
Town of Woodsboro	Hailstorms	Exposed Equipment and Utilities Hardening	Many of the Town of Woodsboro's utilities are roof-mounted and are therefore more vulnerable to damage during a hailstorm than if they were shielded. Additionally, increasing the amount of covered parking at certain Town facilities is likely to reduce hailstorm-related damages to Town of Woodsboro vehicles that might otherwise be parked in the open.	*In Progress*
Town of Woodsboro	Severe Winds	Harden Storage Buildings to Protect Critical Equipment	This action proposes hardening Town of Woodsboro buildings where critical equipment is stored. Hardening will include but is not limited to replacing existing windows and doors with wind resistant ones, building protective walls around gas and propane tanks, and adding bracing and tie-down clips to precinct building roofs.	*In Progress*
Town of Woodsboro	Lightning	Install Surge Protection for all Town-Owned Critical Electronic Devices	Electronic systems are particularly vulnerable to power outages and surges caused by lightning. As recordkeeping becomes fully digitized, protecting the electronic systems that maintain and provide access to digital data is critical. To protect these systems, the Town of Woodsboro will install surge protection on all critical computers and electronic devices.	*In Progress*
Refugio ISD	Flood	Install a Local Flood Warning System	This action's goal is to prevent loss of life and protect Refugio ISD property by working with the County to install a Local Flood Warning System, including automatically-triggered flooded roadway and low water crossing warning signs at appropriate locations throughout Refugio County, particularly along school bus routes.	*Abandoned.*
Refugio ISD	Hurricane / Tropical Storm	Harden Storage Facilities to Protect Critical Equipment	This action proposes hardening Refugio ISD buildings where critical equipment is stored. Hardening will include but is not limited to replacing existing windows and doors with hurricane resistant ones, building protective walls around gas and propane	*Deferred to Plan Update.*

			tanks, and adding bracing and tie-down clips to precinct building roofs.	
Refugio ISD	**Wildfire**	Wildfire Fuels Reduction	The action's goal is to reduce wildfire fuels on ISD-maintained land. Unchecked wildfire fuels increase the potential for a wildfire's ability to spread quickly, potentially resulting in higher damage dollar totals.	*Abandoned.*
Refugio ISD	**Tornado**	Install NOAA Weather Radios in ISD Facilities	An indoor warning system will help ensure everyone's safety ahead of a tornado. To that end, the Refugio ISD Superintendent's Office will install a NOAA weather radio in every ISD facility that is occupied on a full time basis.	*Abandoned.*
Refugio ISD	**Drought**	Water Use Reduction Policy	This action will reduce Refugio ISD's water usage during times of drought. The Refugio ISD Superintendent's Office will adopt a water use reduction policy that mirrors the Town of Refugio's Drought Contingency Plan. The ISD will enforce its policy in step with the Town of Refugio.	*Abandoned.*
Refugio ISD	**Drought**	Plant drought resistant vegetation on ISD properties to limit water consumption.	To limit water consumption at ISD-owned and maintained facilities, the Refugio ISD Superintendent's Office will adopt a policy of replanting ISD landscaping with drought tolerant plant varieties. To the extent possible, landscaping will be replanted on an as-needed basis, as opposed to an immediate replanting of all landscaping.	*Deferred to Plan Update*
Refugio ISD	**Extreme Heat**	Set up Cooling Centers in Existing ISD Facilities	The action's goal is to increase extreme heat resilience throughout the Refugio ISD Service Area by limiting its vulnerable populations' exposure to extreme heat.	*Abandoned.*
Refugio ISD	**Hailstorms**	Exposed Equipment and Utilities Hardening	Many Refugio ISD utilities are roof-mounted and are therefore more vulnerable to damage during a hailstorm than if they were shielded. Additionally, ISD vehicles and equipment would benefit from increased protection by experiencing less damage during a hailstorm if ISD facilities offered more covered parking and storage facilities.	*Deferred to Plan Update.*
Refugio ISD	**Severe Winds**	Harden Storage Buildings to Protect Critical Equipment	This action proposes hardening ISD buildings where critical equipment is stored. Hardening will include but is not limited to replacing existing windows and doors with wind resistant ones, building protective	*Deferred to Plan Update.*

			walls around gas and propane tanks, and adding bracing and tie-down clips to ISD building roofs.	
Refugio ISD	**Lightning**	Install Surge Protection for all ISD-Owned Critical Electronic Devices	Electronic systems are particularly vulnerable to power outages and surges caused by lightning. As recordkeeping becomes fully digitized, protecting the electronic systems that maintain and provide access to digital data is critical. To protect these systems, the ISD will install surge protection on all critical computers and electronic devices.	*Deferred to Plan Update.*
Woodsboro ISD	**Drought**	Water Use Reduction Policy	This action will reduce Woodsboro ISD's water usage during times of drought. The Woodsboro ISD Superintendent's Office will adopt a water use reduction policy that mirrors the Town of Woodsboro's Drought Contingency Plan. The ISD will enforce its policy in step with the Town of Woodsboro.	*Deferred to Plan Update.*
Woodsboro ISD	**Drought**	Plant drought resistant vegetation on ISD properties to limit water consumption.	To limit water consumption at ISD-owned and maintained facilities, the Woodsboro ISD Superintendent's Office will adopt a policy of replanting ISD landscaping with drought tolerant plant varieties. To the extent possible, landscaping will be replanted on an as-needed basis, as opposed to an immediate replanting of all landscaping.	*In Progress.*
Woodsboro ISD	**Hailstorms**	Exposed Equipment and Utilities Hardening	Many Woodsboro ISD utilities are roof-mounted and are therefore more vulnerable to damage during a hailstorm than if they were shielded. Additionally, ISD vehicles and equipment would benefit from increased protection by experiencing less damage during a hailstorm if ISD facilities offered more covered parking and storage facilities.	*Deferred to Plan Update* *In Progress.*
Woodsboro ISD	**Severe Winds**	Harden Storage Buildings to Protect Critical Equipment	This action proposes hardening ISD buildings where critical equipment is stored. Hardening will include but is not limited to replacing existing windows and doors with wind resistant ones, building protective walls around gas and propane tanks, and adding bracing and tie-down clips to ISD building roofs.	*Deferred to Plan Update* *In Progress.*
Woodsboro ISD	**Lightning**	Install Surge Protection for all ISD-Owned Critical Electronic Devices	Electronic systems are particularly vulnerable to power outages and surges caused by lightning. As recordkeeping becomes fully digitized, protecting the electronic systems that maintain and provide access to digital data is critical. To protect these	*In Progress.*

			systems, the ISD will install surge protection on all critical computers and electronic devices.	
Woodsboro ISD	Flood	Install a Local Flood Warning System	This action's goal is to prevent loss of life and protect Woodsboro ISD property by working with the County to install a Local Flood Warning System, including automatically-triggered flooded roadway and low water crossing warning signs at appropriate locations throughout Woodsboro County, particularly along school bus routes.	*Abandoned.*
Woodsboro ISD	Extreme Heat	Set up Cooling Centers in Existing ISD Facilities	The action's goal is to increase extreme heat resilience throughout the Woodsboro ISD Service Area by limiting its vulnerable populations' exposure to extreme heat.	*Deferred to Plan Update.*
Woodsboro ISD	Wildfire	Wildfire Fuels Reduction	The action's goal is to reduce wildfire fuels on ISD-maintained land. Unchecked wildfire fuels increase the potential for a wildfire's ability to spread quickly, potentially resulting in higher damage dollar totals.	*In Progress.*
Woodsboro ISD	Hurricane / Tropical Storm	Harden Storage Facilities to Protect Critical Equipment	This action proposes hardening Woodsboro ISD buildings where critical equipment is stored. Hardening will include but is not limited to replacing existing windows and doors with hurricane resistant ones, building protective walls around gas and propane tanks, and adding bracing and tie-down clips to precinct building roofs.	*Deferred to Plan Update.*
Woodsboro ISD	Tornado	Install NOAA Weather Radios in ISD Facilities	An indoor warning system will help ensure everyone's safety ahead of a tornado. To that end, the Woodsboro ISD Superintendent's Office will install a NOAA weather radio in every ISD facility that is occupied on a full time basis.	*Completed.*

Incorporation and Integration Opportunities and Processes

Each jurisdiction has its own established process for integrating new actions, codes, ordinances, plans, and studies into its existing capabilities.

None of the participating jurisdictions undertook any actions to formally incorporate the previous plan into their normal operations. Instead, they relied on the plan itself, and pursued projects as funding and other resources became available.

The planning team will ensure that each jurisdictions' various departments continue to integrate hazard mitigation actions into their day-to-day processes.

Table 75: Plan Integration

Department	All Departments	Commissioners' Court, Road and Bridge, Mayor's Office, Council, Public Works, Economic Development, Zoning, Schoolboard	Planning, Zoning, Economic Development, Public Works, Mayor's Office, Floodplain Manager	Office of Emergency Management, Mayor's Office, Chief of Fire Department, Superintendent's Office	Office of Emergency Management, Mayor's Office, Chief of Fire Department, Superintendent's Office	Office of Emergency Management, Mayor's Office, Superintendent's Office, Administrative Office	Floodplain Manager, Mayor's Office
Activity	Annual Budget	Capital Improvement Projects	Comprehensive Master Plan	Public Involvement	Emergency Operations	Grant Application	Floodplain Management
Time Frame	Quarterly/ Annual workshops	Bi-annually	Every 10 Years	As Needed	Annually	Annual Funding Cycles	Annually
Integration Process	Discuss integration of medium and high priority actions with Commissioners' Court, Council, or Schoolboard (as appropriate) concerning feasibility, potential funding sources, and a preliminary cost benefit review.	Discuss inclusion of mitigation actions with CIPs. Ensure CIPs are consistent with mitigation actions, NFIP compliance, and any new land use development.	Review existing floodplain and land use controls to ensure that long term goals are consistent with actions in the HMAP.	Utilize jurisdictional web sites, social media, and other forms of advertising to make announcements of any periodic review activities concerning potential amendments or updating of the HMAP	Review prevention and protection projects for continued relevance. Ensure appropriate actions and information are included in the Emergency Operation Plan.	Review and update mitigation actions as necessary based on funding opportunities available through FEMA BRIC, FEMA HMGP, and other grant funding sources.	Update and maintain floodplain information including but not limited to: maps, construction practices, permitting, and NFIP compliance.
Jurisdiction							
Refugio County	x	x	x	x	x	x	x
Town of Bayside	x	x	x	x	x	x	x
Town of Refugio	x	x	x	x	x	x	x
Town of Woodsboro	x	x	x	x	x	x	x
Austwell-Tivoli ISD	x	x		x	x	x	
Refugio ISD	x	x		x	x	x	
Woodsboro ISD	x	x		x	x	x	
Refugio County WCID #1	x	x				x	

Each new mitigation action below outlines the following requirements: the identified responsible department head or delegate will research all relevant information to confirm the action's feasibility and prioritization, will formulate a plan of action, and will confirm funding sources and identify any fiscal liabilities associated with the mitigation action.

As part of each jurisdiction's commitment to transparency, all relevant information, including but not limited to that described above and in each action's description, will be presented to the public before the action is formally adopted for implementation. After public notification, the adoption process will resemble the following for each jurisdiction:

Table 76: Integration Process

Jurisdiction	Integration Process
Refugio County	After considering integrating mitigation actions with the activities outlined in Table 75 above, mitigation actions will be presented, considered, and formally adopted by the County Commissioners' Court and County Judge. Refugio County will also use the Refugio County Hazard Mitigation Plan as a technical reference and data source for identified and future mitigation actions, as well as future planning processes.
Town of Bayside	After considering integrating mitigation actions with the activities outlined in Table 75 above, mitigation actions will be presented, considered, and formally adopted by the council and mayor. The Town of Bayside will also use the Refugio County Hazard Mitigation Plan as a technical reference and data source for identified and future mitigation actions, as well as future planning processes.
Town of Refugio	After considering integrating mitigation actions with the activities outlined Table 75 above, mitigation actions will be presented, considered, and formally adopted by the council and mayor. The Town of Refugio will also use the Refugio County Hazard Mitigation Plan as a technical reference and data source for identified and future mitigation actions, as well as future planning processes.
Town of Woodsboro	After considering integrating mitigation actions with the activities outlined in Table 75 above, mitigation actions will be presented, considered, and formally adopted by the council and mayor. The Town of Woodsboro will also use the Refugio County Hazard Mitigation Plan as a technical reference and data source for identified and future mitigation actions, as well as future planning processes.
Austwell-Tivoli ISD	After considering integrating mitigation actions with the activities outlined in Table 75 above, mitigation actions will be presented, considered, and formally adopted by the school board. Austwell-Tivoli ISD will also use the Refugio County Hazard Mitigation Plan as a technical reference and data source for identified and future mitigation actions, as well as future planning processes.
Refugio ISD	After considering integrating mitigation actions with the activities outlined in Table 75 above, mitigation actions will be presented, considered, and formally adopted by the school board. Refugio ISD will also use the Refugio County Hazard Mitigation Plan as a technical reference and data source for identified and future mitigation actions, as well as future planning processes.
Woodsboro ISD	After considering integrating mitigation actions with the activities outlined in Table 75 above, mitigation actions will be presented, considered, and formally adopted by the school board. Woodsboro ISD will also use the Refugio County Hazard Mitigation Plan as a technical reference and data source for identified and future mitigation actions, as well as future planning processes.
Refugio County WCID #1	After considering integrating mitigation actions with the activities outlined in Table 75 above, mitigation actions will be presented, considered, and formally adopted by the board. Refugio County WCID #1 will also use the Refugio County Hazard Mitigation Plan as a technical reference and data source for identified and future mitigation actions, as well as future planning processes.

6) Mitigation Actions by Jurisdiction and by Hazard

Each jurisdiction has selected actions that were identified as high or medium priority and that are in line with TDEM's recommended mitigation actions. However, many of the mitigation actions below are dependent upon outside grant funding for implementation. For all actions likely to require grant funding, potential sources have been identified. However, grant funding is awarded on a competitive basis, so applying for funding doesn't guarantee that funds will be received. Refugio County and the participating jurisdictions have a successful history of applying for and receiving grant funding to implement physical infrastructure actions. Budget constraints will remain the determining factor for how and when each action is implemented.

A) Refugio County

Multi-Hazard Actions

Mitigation Action	Educational Outreach
Objective	This action will create a program to educate the public about specific mitigation actions for all hazards, including but not limited to participation in NFIP, Wildfire Fuels Reduction, Structural Hardening, etc…
Hazard	Hurricanes/Tropical Storms/Depression, Drought, Hailstorm, Severe Coastal Flooding, Riverine Flooding, Tornados, Severe Winds, Wildfire, Winter Weather, Lightning, Extreme Cold, Extreme Heat, Coastal Erosion, Expansive Soils
Priority	Medium
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source(s)	County, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB
Responsible Department(s)	Office of Emergency Management
Implementation Schedule	Long Term 5-10 years+
Target	Existing and future population

Mitigation Action	Construct Community Safe Rooms
Objective	The action's goal is to minimize local population vulnerability to Hurricanes/Tropical Storms and Tornados by providing public safe rooms.
Hazard	Hurricane/Tropical Storm, Tornado
Priority	High
Estimated Cost	Greater than $100,000
Potential Funding Source (s)	County, FEMA BRIC, FEMA HMGP

Responsible Department	County Commissioners' Court, Office of Emergency Management
Implementation Schedule	Short Term: 1 - 2 Years
Target	Existing and future population and infrastructure

Mitigation Action	Document Hazard Occurrences
Objective	This action will document occurrences of hazards within the next five years to address deficiencies in the data.
Hazard	Expansive Soils, Coastal Erosion
Priority	Low
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source(s)	County, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB, TCEQ
Responsible Department(s)	Office of Emergency Management
Implementation Schedule	Long Term: 5 – 10+ Years
Target	Existing and future population and infrastructure

Mitigation Action	Implement a Tree Trimming Program
Objective	This action will develop and implement a tree trimming program to minimize the amount of debris generated during severe weather events.
Hazard	Hurricane / Tropical Storm, Wildfire, Tornado, Hailstorms, Winter Weather, Severe Winds
Priority	High
Estimated Cost	$10,000 - $100,0000
Potential Funding Source(s)	County, FEMA BRIC, FEMA HMGP
Responsible Department(s)	Office of Emergency Management
Implementation Schedule	Short Term - 1-5 Years
Target	Existing and future infrastructure

Mitigation Action	Create Drainage Master Plan
Objective	This action proposes creating a drainage master plan for the County, in conjunction with other jurisdictions, that will provide the County with a comprehensive planning document that provides basic information and necessary guidance for the county-wide drainage system, including but not limited to an H&H study.
Hazard	Severe Coastal Flooding, Riverine Flooding, Hurricanes/Tropical Storms

Priority	Medium
Estimated Cost	Less than $100,000
Potential Funding Source (s)	County, FEMA BRIC, FEMA FMA, FEMA HMGP, CDBG-MIT
Responsible Department	County Commissioners' Court
Implementation Schedule	5 Years
Target	Existing and future infrastructure

Mitigation Action	Harden Storage Facilities to Protect Critical Equipment
Objective	This action proposes hardening precinct buildings where critical equipment is stored. Hardening will include but is not limited to replacing existing windows and doors with hurricane resistant ones, building protective walls around gas and propane tanks, and adding bracing and tie-down clips to precinct building roofs.
Hazard	Hurricane / Tropical Storm, Severe Winds
Priority	High
Estimated Cost	Greater than $100,000
Potential Funding Source (s)	County, FEMA BRIC, FEMA FMA
Responsible Department	Office of Emergency Management
Implementation Schedule	Long Term - Greater than 5 Years
Target	Existing infrastructure

Mitigation Action	Construct Storm Drainage Infrastructure
Objective	This action proposes constructing new storm drainage infrastructure to reduce the potential impacts of future flood events.
Hazard	Severe Coastal Flooding, Riverine Flooding
Priority	High
Estimated Cost	More than $1,000,000
Potential Funding Source (s)	County, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB
Responsible Department	County Commissioners' Court
Implementation Schedule	Short Term: 0-2 Years
Target	Existing infrastructure

Mitigation Action	Set up Cooling and Warming Centers in Existing Facilities
Objective	The action's goal is to increase extreme heat and cold resilience by limiting vulnerable populations' exposure to extreme heat or extreme cold by creating new or setting up existing facilities as cooling centers or warming centers.
Hazard	Winter Weather, Extreme Cold, Extreme Heat
Priority	High
Estimated Cost	$10,000 - $100,000
Potential Funding Source(s)	County, FEMA BRIC, FEMA HMGP
Responsible Department(s)	County Commissioners' Court, Office of Emergency Management
Implementation Schedule	Short Term: 0-2 Years
Target	Existing and future population

Single Hazard Actions

Mitigation Action	Harden Storage Facilities to Protect Critical Equipment
Objective	This action proposes hardening precinct buildings where critical equipment is stored. Hardening will include but is not limited to replacing existing windows and doors with hurricane resistant ones, building protective walls around gas and propane tanks, and adding bracing and tie-down clips to precinct building roofs.
Hazard	Hurricane / Tropical Storm
Priority	High
Estimated Cost	Greater than $100,000
Potential Funding Source (s)	County, FEMA BRIC, FEMA FMA
Responsible Department	Office of Emergency Management
Implementation Schedule	Long Term - Greater than 5 Years
Target	Existing infrastructure

Mitigation Action	Increase Freeboard Requirement to 18"
Objective	The Refugio County Office of Emergency Management determined that updating the County's flood ordinance to require 18" of freeboard could improve the County's resiliency and minimize damages to future construction.

Hazard	Flood
Priority	High
Estimated Cost	Less than $10,000
Potential Funding Source (s)	County
Responsible Department	Office of Emergency Management
Implementation Schedule	Short Term - 1-5 Years
Target	Future development

Mitigation Action	Drainage Improvement along SH 35 just south of FM 774
Objective	State Highway 35 just south of FM 774 is known to flood due to heavy rains and tidal inundation. This particular segment of SH 35 is part of the TxDOT designated hurricane evacuation route network. Flooding during an evacuation could cause serious delays, injuries, or worse.
Hazard	Flood
Priority	High
Estimated Cost	Greater than $100,000
Potential Funding Source (s)	TxDOT, County, FEMA BRIC, FEMA FMA
Responsible Department	TxDOT, Office of Emergency Management
Implementation Schedule	Short Term - 1-5 Years
Target	Existing and future infrastructure

Mitigation Action	Wildfire Fuels Reduction
Objective	The action's goal is to reduce wildfire fuels on County-maintained land. Unchecked wildfire fuels increase the potential for a wildfire's ability to spread quickly, potentially resulting in higher damage dollar totals.
Hazard	Wildfire
Priority	High
Estimated Cost	$10,000 - $100,000
Potential Funding Source (s)	County, FEMA BRIC
Responsible Department	Office of Emergency Management
Implementation Schedule	Short Term - 1-5 Years
Target	Existing and future infrastructure

Mitigation Action	Shoreline Erosion Control and Habitat Enhancement
Objective	Coastal erosion is an ongoing hazard in Refugio County. Similar to the County's previous Coastal Erosion project, the overall goal of this action will be to reduce erosion by methods including but not limited to: vegetative wave barriers to absorb wave energy, bluff shaping and planting grasses to reduce wave impact and bluff retreat, wildlife and marine life habitat creation and restoration, and vegetative filter strips to improve water quality.
Hazard	Coastal Erosion
Priority	Medium
Estimated Cost	Greater than $100,000
Potential Funding Source (s)	County, Texas General Land Office, FEMA BRIC, FEMA HMGP
Responsible Department	Refugio County Office of Emergency Management, Copano Bay Soil and Water Conservation District, Texas General Land Office
Implementation Schedule	Long Term - Greater than 5 Years
Target	Existing and future development

Mitigation Action	Install Surge Protection for all County-Owned Critical Electronic Devices
Objective	Electronic systems are particularly vulnerable to power outages and surges caused by lightning. As recordkeeping becomes fully digitized, protecting the electronic systems that maintain and provide access to digital data is critical. To protect these systems, the County will install surge protection on all critical computers and electronic devices.
Hazard	Lightning
Priority	Medium
Estimated Cost	Less than $10,000
Potential Funding Source (s)	County, FEMA BRIC, FEMA HMGP
Responsible Department	Office of Emergency Management
Implementation Schedule	Short Term - 1-5 Years
Target	Existing and future County-owned electronic devices

Mitigation Action	Replace Current Landscaping with Drought Resistant Plant Varieties
Objective	This action's goal is to limit water consumption at County-owned and maintained facilities by replacing existing landscaping with more drought resistant types.
Hazard	Drought

Priority	High
Estimated Cost	Less than $10,000
Potential Funding Source (s)	County, FEMA BRIC, FEMA HMGP
Responsible Department	County Commissioners' Court
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and future infrastructure

B) Town of Bayside

Multi-Hazard Actions

Mitigation Action	Educational Outreach
Objective	This action will create a program to educate the public about specific mitigation actions for all hazards, including but not limited to participation in NFIP, Wildfire Fuels Reduction, Structural Hardening, etc…
Hazard	Hurricanes/Tropical Storms/Depression, Drought, Hailstorm, Severe Coastal Flooding, Riverine Flooding, Tornados, Severe Winds, Wildfire, Winter Weather, Lightning, Extreme Cold, Extreme Heat, Coastal Erosion, Expansive Soils
Priority	Medium
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source(s)	City, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB
Responsible Department(s)	Mayor and Council
Implementation Schedule	Long Term 5-10 years+
Target	Existing and future population

Mitigation Action	Purchase or Upgrade Back Up Power Generators
Objective	Installing or upgrading generators at critical facilities will help ensure physical safety for facility occupants and maintain electronic systems functionality during power outages. Portable generators will maintain additional systems functionality including but not limited to lift stations, pumps, and communications infrastructure.
Hazard	Hurricanes/Tropical Storms/Depression, Hailstorm, Riverine Flooding, Tornados, Severe Winds, Wildfire, Winter Weather, Lightning, Extreme Cold, Extreme Heat
Priority	High
Estimated Cost	More than $100,000 Each for Fixed Generators, Including Associated Engineering Costs. Less than $100,000 Each for Portable Generators

Potential Funding Source (s)	City, FEMA BRIC, FEMA HMGP
Responsible Department	Mayor and Council
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing infrastructure

Mitigation Action	Install and Expand Warning Systems/Weather Radio
Objective	Warning systems will help limit local vulnerability to tornados by giving residents an opportunity to take shelter before one occurs.
Hazard	Hurricanes/Tropical Storms/Depression, Drought, Hailstorm, Severe Coastal Flooding, Riverine Flooding, Tornados, Severe Winds, Wildfire, Winter Weather, Lightning, Extreme Cold, Extreme Heat, Coastal Erosion, Expansive Soils
Priority	High
Estimated Cost	$1,000 - $100,000 per device
Potential Funding Source (s)	City, FEMA PDM, FEMA HMGP
Responsible Department	Mayor and Council
Implementation Schedule	Short Term – 1 - 5 Years
Target	Existing and future population

Mitigation Action	Document Hazard Occurrences
Objective	This action will document occurrences of hazards within the next five years to address deficiencies in the data.
Hazard	Expansive Soils, Coastal Erosion
Priority	Low
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source(s)	City, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB, TCEQ
Responsible Department(s)	Public Works
Implementation Schedule	Long Term: 5 – 10+ Years
Target	Existing and future population and infrastructure

Mitigation Action	Create Drainage Master Plan

Objective	This action proposes creating a drainage master plan for the City, in conjunction with other jurisdictions, that will provide the City with a comprehensive planning document that provides basic information and necessary guidance for the county-wide drainage system, including but not limited to an H&H study.
Hazard	Severe Coastal Flooding, Riverine Flooding, Hurricanes/Tropical Storms
Priority	Medium
Estimated Cost	Less than $100,000
Potential Funding Source (s)	City, County, FEMA BRIC, FEMA FMA, FEMA HMGP, CDBG-MIT
Responsible Department	Mayor and Council, Public Works
Implementation Schedule	5 Years
Target	Existing and future infrastructure

Mitigation Action	Construct Storm Drainage Infrastructure
Objective	This action proposes constructing new storm drainage infrastructure to reduce the potential impacts of future flood events.
Hazard	Severe Coastal Flooding, Riverine Flooding
Priority	High
Estimated Cost	More than $1,000,000
Potential Funding Source (s)	City, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB
Responsible Department	Mayor and Council, Public Works
Implementation Schedule	Short Term: 0-2 Years
Target	Existing infrastructure

Mitigation Action	Set up Cooling and Warming Centers in Existing Facilities
Objective	The action's goal is to increase extreme heat and cold resilience by limiting vulnerable populations' exposure to extreme heat or extreme cold by creating new or using existing facilities as cooling centers or warming centers.
Hazard	Extreme Heat, Extreme Cold
Priority	High
Estimated Cost	$10,000 to $100,000
Potential Funding Source(s)	City FEMA BRIC, FEMA HMGP

Responsible Department(s)	Mayor and Council, Fire Department
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and future population

Mitigation Action	Increased Thermal Insulation
Objective	The action's goal is to increase extreme cold and heat resilience by increasing thermal insulation of critical facilities.
Hazard	Extreme Heat, Extreme Cold, Winter Weather
Priority	Medium
Estimated Cost	$10,000 to $100,000
Potential Funding Source(s)	City, FEMA BRIC, FEMA HMGP
Responsible Department(s)	Mayor and Council, Fire Department
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and future population

Mitigation Action	Document Hazard Occurrences
Objective	This action will document occurrences of hazards within the next five years to address deficiencies in the data.
Hazard	Expansive Soils, Coastal Erosion
Priority	Low
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source(s)	Town, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB, TCEQ
Responsible Department(s)	Mayor and Council, Public Works
Implementation Schedule	Long Term: 5 – 10+ Years
Target	Existing and future population and infrastructure

Single Hazard Actions

Mitigation Action	Install Check Valves

Objective	This action proposes installing check valves to prevent backflow and reduce the potential impacts of future flood events.
Hazard	Severe Coastal Flooding, Riverine Flooding
Priority	Medium
Estimated Cost	$10,000 to $100,000
Potential Funding Source (s)	City, FEMA FMA, FEMA BRIC, FEMA HMGP
Responsible Department	Mayor and Council, Public Works
Implementation Schedule	Medium Term: 3-5 Years
Target	Existing infrastructure

Mitigation Action	Purchase Portable or Permanent Pumps
Objective	This action proposes purchasing portable or permanent pumps that can be deployed as needed to reduce the potential impacts of future flood events.
Hazard	Severe Coastal Flooding, Riverine Flooding
Priority	High
Estimated Cost	$10,000 to $100,000
Potential Funding Source (s)	City, FEMA FMA, FEMA BRIC, FEMA HMGP
Responsible Department	Mayor and Council, Public Works
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing infrastructure

Mitigation Action	Shoreline Erosion Control and Habitat Enhancement
Objective	Coastal erosion is an ongoing hazard in Refugio County and the participating jurisdictions. Similar to the City's previous Coastal Erosion project, the overall goal of this action will be to reduce erosion by methods including but not limited to: vegetative wave barriers to absorb wave energy, bluff shaping and planting grasses to reduce wave impact and bluff retreat, wildlife and marine life habitat creation and restoration, and vegetative filter strips to improve water quality.
Hazard	Coastal Erosion
Priority	Medium
Estimated Cost	Greater than $100,000
Potential Funding Source (s)	City, County, Texas General Land Office, FEMA BRIC, FEMA HMGP

Responsible Department	Mayor and Council, Public Works
Implementation Schedule	Long Term: 5 -10+ Years
Target	Existing and future development

Mitigation Action	Replace Current Landscaping with Drought Resistant Plant Varieties
Objective	This action's goal is to limit water consumption at City-owned and maintained facilities by replacing existing landscaping with more drought resistant types.
Hazard	Drought
Priority	High
Estimated Cost	Less than $10,000
Potential Funding Source (s)	City, FEMA BRIC, FEMA HMGP
Responsible Department	Mayor and Council
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and future infrastructure

C) Town of Refugio

Multi-Hazard Actions

Mitigation Action	Educational Outreach
Objective	This action will create a program to educate the public about specific mitigation actions for all hazards, including but not limited to participation in NFIP, Wildfire Fuels Reduction, Structural Hardening, etc…
Hazard	Hurricanes/Tropical Storms/Depression, Drought, Hailstorm, Severe Coastal Flooding, Riverine Flooding, Tornados, Severe Winds, Wildfire, Winter Weather, Lightning, Extreme Cold, Extreme Heat, Expansive Soils
Priority	Medium
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source(s)	City, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB
Responsible Department(s)	Mayor and Council
Implementation Schedule	Long Term 5-10 years+
Target	Existing and future population

Mitigation Action	Purchase or Upgrade Back Up Power Generators
Objective	Installing or upgrading generators at critical facilities will help ensure physical safety for facility occupants and maintain electronic systems functionality during power outages. Portable generators will maintain additional systems functionality including but not limited to lift stations, pumps, and communications infrastructure.
Hazard	Hurricanes/Tropical Storms/Depression, Hailstorm, Severe Coastal Flooding, Riverine Flooding, Tornados, Severe Winds, Wildfire, Winter Weather, Lightning, Extreme Cold, Extreme Heat
Priority	High
Estimated Cost	More than $100,000 Each for Fixed Generators, Including Associated Engineering Costs. Less than $100,000 Each for Portable Generators
Potential Funding Source (s)	City, FEMA BRIC, FEMA HMGP
Responsible Department	Mayor and Council
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing infrastructure

Mitigation Action	Install and Expand Warning Systems/Weather Radio
Objective	Warning systems will help limit local vulnerability to tornados by giving residents an opportunity to take shelter before one occurs.
Hazard	Hurricanes/Tropical Storms/Depression, Drought, Hailstorm, Severe Coastal Flooding, Riverine Flooding, Tornados, Severe Winds, Wildfire, Winter Weather, Lightning, Extreme Cold, Extreme Heat, Expansive Soils
Priority	High
Estimated Cost	$1,000 - $100,000 per device
Potential Funding Source (s)	City, FEMA PDM, FEMA HMGP
Responsible Department	Mayor and Council
Implementation Schedule	Short Term – 1 - 5 Years
Target	Existing and future population

Mitigation Action	Create Drainage Master Plan
Objective	This action proposes creating a drainage master plan for the City, in conjunction with other jurisdictions, that will provide the City with a comprehensive planning document that provides basic information and necessary guidance for the county-wide drainage system, including but not limited to an H&H study.
Hazard	Severe Coastal Flooding, Riverine Flooding, Hurricanes/Tropical Storms
Priority	Medium
Estimated Cost	Less than $100,000
Potential Funding Source (s)	City, County, FEMA BRIC, FEMA FMA, FEMA HMGP, CDBG-MIT
Responsible Department	Mayor and Council, Public Works
Implementation Schedule	5 Years
Target	Existing and future infrastructure

Mitigation Action	Set up Cooling and Warming Centers in Existing Facilities
Objective	The action's goal is to increase extreme heat and cold resilience by limiting vulnerable populations' exposure to extreme heat or extreme cold by creating new or setting up existing facilities as cooling centers or warming centers.
Hazard	Extreme Heat, Extreme Cold, Winter Weather
Priority	High
Estimated Cost	$10,000 to $100,000
Potential Funding Source(s)	City, FEMA BRIC, FEMA HMGP
Responsible Department(s)	Mayor and Council, Fire Department
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and future population

Single Hazard Actions

Mitigation Action	Construct Storm Drainage Infrastructure
Objective	This action proposes constructing new storm drainage infrastructure to reduce the potential impacts of future flood events.
Hazard	Severe Coastal Flooding, Riverine Flooding

Priority	High
Estimated Cost	More than $1,000,000
Potential Funding Source (s)	City, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB
Responsible Department	Mayor and Council, Public Works
Implementation Schedule	Short Term: 0-2 Years
Target	Existing infrastructure

Mitigation Action	Install Check Valves
Objective	This action proposes installing check valves to prevent backflow and reduce the potential impacts of future flood events.
Hazard	Severe Coastal Flooding, Riverine Flooding
Priority	Medium
Estimated Cost	$10,000 to $100,000
Potential Funding Source (s)	City, FEMA FMA, FEMA BRIC, FEMA HMGP
Responsible Department	Mayor and Council, Public Works
Implementation Schedule	Medium Term: 3-5 Years
Target	Existing infrastructure

Mitigation Action	Purchase Portable or Permanent Pumps
Objective	This action proposes purchasing portable or permanent pumps that can be deployed as needed to reduce the potential impacts of future flood events.
Hazard	Severe Coastal Flooding, Riverine Flooding
Priority	High
Estimated Cost	$10,000 to $100,000
Potential Funding Source (s)	City, FEMA FMA, FEMA BRIC, FEMA HMGP
Responsible Department	Mayor and Council, Public Works
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing infrastructure

Mitigation Action	Document Hazard Occurrences

Objective	This action will document occurrences of hazards within the next five years to address deficiencies in the data.
Hazard	Expansive Soils
Priority	Low
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source(s)	City, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB, TCEQ
Responsible Department(s)	Public Works
Implementation Schedule	Long Term: 5 – 10+ Years
Target	Existing and future population and infrastructure

Mitigation Action	Replace Current Landscaping with Drought Resistant Plant Varieties
Objective	This action's goal is to limit water consumption at City-owned and maintained facilities by replacing existing landscaping with more drought resistant types.
Hazard	Drought
Priority	High
Estimated Cost	Less than $10,000
Potential Funding Source (s)	City, FEMA BRIC, FEMA HMGP
Responsible Department	Mayor and Council
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and future infrastructure

D) Austwell-Tivoli ISD

Multi-Hazard Actions

Mitigation Action	Purchase Back Up Power Generators
Objective	Installing generators at critical facilities will help ensure physical safety for facility occupants and maintain electronic systems functionality during power outages. Portable generators will maintain additional systems functionality including but not limited to lift stations, pumps, and communications infrastructure.
Hazard	Hurricanes/Tropical Storms/Depression, Hailstorm, Riverine Flooding, Tornados, Severe Winds, Wildfire, Winter Weather, Lightning, Extreme Cold, Extreme Heat
Priority	High
Estimated Cost	More than $100,000 Each for Fixed Generators, Including Associated Engineering Costs. Less than $100,000 Each for Portable Generators
Potential Funding Source (s)	ISD, FEMA BRIC, FEMA HMGP

Responsible Department	Superintendent, School Board
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing infrastructure

Mitigation Action	Educational Outreach
Objective	This action will create a program to educate the public about specific mitigation actions for all hazards, including but not limited to participation in NFIP, Wildfire Fuels Reduction, Structural Hardening, etc…
Hazard	Hurricanes/Tropical Storms/Depression, Drought, Hailstorm, Riverine Flooding, Tornados, Severe Winds, Wildfire, Winter Weather, Lightning, Extreme Cold, Extreme Heat, Expansive Soils
Priority	Medium
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source(s)	ISD, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB
Responsible Department(s)	Superintendent, School Board
Implementation Schedule	Long Term 5-10 years+
Target	Existing and future population

Mitigation Action	Create Drainage Master Plan
Objective	This action proposes creating a drainage master plan for the ISD, in conjunction with other jurisdictions, that will provide the ISD with a comprehensive planning document that provides basic information and necessary guidance for the county-wide drainage system, including but not limited to an H&H study.
Hazard	Riverine Flooding, Hurricanes/Tropical Storms
Priority	Medium
Estimated Cost	Less than $100,000
Potential Funding Source (s)	ISD, County, FEMA BRIC, FEMA FMA, FEMA HMGP, CDBG-MIT
Responsible Department	Superintendent, School Board
Implementation Schedule	5 Years
Target	Existing and future infrastructure

Mitigation Action	Implement a Tree Trimming Program
Objective	This action will develop and implement a tree trimming program to reduce wildfire fuels and minimize the amount of debris generated during natural hazard events. Projects may include but are not limited to trees along power lines within the jurisdiction that are connected to critical facilities and creating firebreaks.
Hazard	Hurricane/Tropical Storm, Wildfire, Tornado, Hailstorm, Winter Weather, Severe Winds
Priority	Medium
Estimated Cost	$10,000 - $500,0000
Potential Funding Source (s)	ISD, FEMA BRIC, FEMA HMGP
Responsible Department	Superintendent, School Board
Implementation Schedule	1 - 5 Years
Target	Existing and future infrastructure

Mitigation Action	Construct Community Safe Rooms
Objective	The action's goal is to minimize local population vulnerability to Hurricanes/Tropical Storms and Tornados by providing public safe rooms.
Hazard	Hurricane/Tropical Storm, Tornado
Priority	High
Estimated Cost	Greater than $100,000
Potential Funding Source (s)	ISD, FEMA BRIC, FEMA HMGP
Responsible Department	Superintendent, School Board
Implementation Schedule	Short Term: 1 - 2 Years
Target	Existing and future population and infrastructure

Mitigation Action	Install Impact and Wind-resistant Windows and Doors at Public Facilities
Objective	This action proposes hardening facilities. Hardening will include adding impact and wind-resistant doors and windows at public and critical facilities in the City.
Hazard	Hurricane / Tropical Storm, Hailstorm, Severe Winds
Priority	High
Estimated Cost	$10,000 to $100,000

Potential Funding Source (s)	ISD, FEMA BRIC, FEMA HMGP
Responsible Department	Superintendent, School Board
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing infrastructure

Mitigation Action	Set up Cooling and Warming Centers in Existing Facilities
Objective	The action's goal is to increase extreme heat and cold resilience by limiting vulnerable populations' exposure to extreme heat or extreme cold by creating new or using existing facilities as cooling centers or warming centers.
Hazard	Extreme Heat, Extreme Cold, Winter Weather
Priority	High
Estimated Cost	$10,000 to $100,000
Potential Funding Source(s)	ISD, FEMA BRIC, FEMA HMGP
Responsible Department(s)	Superintendent, School Board
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and future population

Single Hazard Actions

Mitigation Action	Replace Water Fixtures with Low Flow Units
Objective	This action's goal is to limit water consumption at ISD-owned and maintained facilities by replacing traditional water fixtures with low flow units.
Hazard	Drought
Priority	Low
Estimated Cost	$10,000 - $100,000
Potential Funding Source (s)	ISD, FEMA BRIC, FEMA HMGP
Responsible Department	Superintendent, School Board
Implementation Schedule	Medium Term: 3-5 Years
Target	Existing and Future infrastructure

Mitigation Action	Purchase Portable or Permanent Pumps

Objective	This action proposes purchasing portable or permanent pumps that can be deployed as needed to reduce the potential impacts of future flood events.
Hazard	Riverine Flooding
Priority	High
Estimated Cost	$10,000 to $100,000
Potential Funding Source (s)	ISD, FEMA FMA, FEMA BRIC, FEMA HMGP
Responsible Department	Superintendent, School Board
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing infrastructure

Mitigation Action	Install Protective Window Shutters on Public Facilities
Objective	This action proposes adding protective shutters to public facilities. Doing so will help limit exposure to hailstorm damages.
Hazard	Hailstorm
Priority	Medium
Estimated Cost	$10,000 to $100,000
Potential Funding Source (s)	ISD, FEMA BRIC, FEMA HMGP
Responsible Department	Superintendent, School Board
Implementation Schedule	Medium Term: 3 – 5 Years
Target	Existing infrastructure

Mitigation Action	Develop and Implement a New Tie-Down Ordinance for Manufactured / Mobile Homes, Temporary Buildings, and Unrestrained Advertisement Signs
Objective	The ISD will re-evaluate all existing tie-down measures to identify strengths and weaknesses in order to develop and enforce a new tie-down ordinance.
Hazard	Severe Winds
Priority	High
Estimated Cost	Less than $10,000
Potential Funding Source (s)	ISD
Responsible Department	Superintendent, School Board
Implementation Schedule	Short Term: 0 – 2 Years

Target	Existing and future population and infrastructure

Mitigation Action	Document Hazard Occurrences
Objective	This action will document occurrences of hazards within the next five years to address deficiencies in the data.
Hazard	Expansive Soils
Priority	Low
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source(s)	ISD, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB, TCEQ
Responsible Department(s)	Superintendent, School Board
Implementation Schedule	Long Term: 5 – 10+ Years
Target	Existing and future population and infrastructure

E) Refugio ISD

Multi-Hazard Actions

Mitigation Action	Educational Outreach
Objective	This action will create a program to educate the public about specific mitigation actions for all hazards, including but not limited to participation in NFIP, Wildfire Fuels Reduction, Structural Hardening, etc…
Hazard	Hurricanes/Tropical Storms/Depression, Drought, Hailstorm, Riverine Flooding, Tornados, Severe Winds, Wildfire, Winter Weather, Lightning, Extreme Cold, Extreme Heat, Expansive Soils
Priority	Medium
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source(s)	ISD, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB
Responsible Department(s)	Superintendent, School Board
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and future population

Mitigation Action	Purchase Back Up Power Generators
Objective	Installing generators at critical facilities will help ensure physical safety for facility occupants and maintain electronic systems functionality during power outages. Portable generators will maintain additional systems functionality including but not limited to lift stations, pumps, and communications infrastructure.

Hazard	Hurricanes/Tropical Storms/Depression, Hailstorm, Riverine Flooding, Tornados, Severe Winds, Wildfire, Winter Weather, Lightning, Extreme Cold, Extreme Heat
Priority	High
Estimated Cost	More than $100,000 Each for Fixed Generators, Including Associated Engineering Costs. Less than $100,000 Each for Portable Generators
Potential Funding Source (s)	ISD, FEMA BRIC, FEMA HMGP
Responsible Department	Superintendent, School Board
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing infrastructure

Mitigation Action	Create Drainage Master Plan
Objective	This action proposes creating a drainage master plan for the County, in conjunction with other jurisdictions, that will provide the County with a comprehensive planning document that provides basic information and necessary guidance for the county-wide drainage system, including but not limited to an H&H study.
Hazard	Riverine Flooding, Hurricanes/Tropical Storms
Priority	Medium
Estimated Cost	Less than $100,000
Potential Funding Source (s)	ISD, FEMA BRIC, FEMA FMA, FEMA HMGP, CDBG-MIT
Responsible Department	Superintendent, School Board
Implementation Schedule	5 Years
Target	Existing and future infrastructure

Mitigation Action	Implement a Tree Trimming Program
Objective	This action will develop and implement a tree trimming program to reduce wildfire fuels and minimize the amount of debris generated during natural hazard events. Projects may include but are not limited to trees along power lines within the jurisdiction that are connected to critical facilities and creating firebreaks.
Hazard	Hurricane/Tropical Storm, Wildfire, Tornado, Hailstorm, Winter Weather, Severe Winds
Priority	Medium
Estimated Cost	$10,000 - $500,0000
Potential Funding Source (s)	ISD, FEMA BRIC, FEMA HMGP

Responsible Department	Superintendent, School Board
Implementation Schedule	1 - 5 Years
Target	Existing and future infrastructure

Mitigation Action	Install Impact and Wind-resistant Windows and Doors at Public Facilities
Objective	This action proposes hardening facilities. Hardening will include adding impact and wind-resistant doors and windows at public and critical facilities in the City.
Hazard	Hurricane / Tropical Storm, Hailstorm, Windstorm
Priority	High
Estimated Cost	$10,000 to $100,000
Potential Funding Source (s)	ISD, FEMA BRIC, FEMA HMGP
Responsible Department	Superintendent, School Board
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing infrastructure

Mitigation Action	Harden Facilities
Objective	This action proposes hardening facilities. Hardening will include but is not limited to adding impact and wind-resistant doors, windows; reinforcing building foundations, elevating low-lying structures, upgrading and/or adding shatter-resistant films to all glazing, upgrading thermal insulation, building protective walls around exposed gas tanks and cylinders, shielding roof-mounted equipment, and adding bracing and tie-down clips to building roofs.
Hazard	Hurricanes/Tropical Storms, Hailstorms, Winter Weather, Extreme Cold, Riverine Flooding
Priority	High
Estimated Cost	Greater than $100,000
Potential Funding Source (s)	ISD, FEMA FMA, FEMA BRIC, FEMA HMGP, CDBG MIT
Responsible Department	Superintendent, School Board
Implementation Schedule	5 Years
Target	Existing infrastructure

Single Hazard Actions

Mitigation Action	Construct Storm Drainage Infrastructure
Objective	This action proposes constructing new storm drainage infrastructure to reduce the potential impacts of future flood events.
Hazard	Riverine Flooding
Priority	Medium
Estimated Cost	More than $100,000
Potential Funding Source (s)	ISD, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB
Responsible Department	Superintendent, School Board
Implementation Schedule	Medium Term: 3 – 5 Years
Target	Existing infrastructure

Mitigation Action	Replace Current Landscaping with Drought Resistant Plant Varieties
Objective	This action's goal is to limit water consumption at ISD-owned and maintained facilities by replacing existing landscaping with more drought resistant types.
Hazard	Drought
Priority	High
Estimated Cost	Less than $10,000
Potential Funding Source (s)	ISD, FEMA BRIC, FEMA HMGP
Responsible Department	Superintendent, School Board
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and future infrastructure

Mitigation Action	Replace Water Fixtures with Low Flow Units
Objective	This action's goal is to limit water consumption at ISD-owned and maintained facilities by replacing traditional water fixtures with low flow units.
Hazard	Drought
Priority	Low
Estimated Cost	$10,000 - $100,000
Potential Funding Source (s)	ISD, FEMA BRIC, FEMA HMGP
Responsible Department	Superintendent, School Board
Implementation Schedule	Medium Term: 3-5 Years

Target	Existing and Future infrastructure

Mitigation Action	Install Surge Protection to Protect Electronic Assets
Objective	This action will install surge protection at all ISD facilities to prevent damage to critical electronic devices including but not limited to: computers, servers, audio/visual equipment, laboratory equipment, and appliances.
Hazard	Lightning
Priority	High
Estimated Cost	$1,000 - $50,000
Potential Funding Source (s)	ISD, FEMA BRIC, FEMA HMGP
Responsible Department	Superintendent, School Board
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing infrastructure

Mitigation Action	Document Hazard Occurrences
Objective	This action will document occurrences of hazards within the next five years to address deficiencies in the data.
Hazard	Expansive Soils
Priority	Low
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source(s)	ISD, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB, TCEQ
Responsible Department(s)	Superintendent, School Board
Implementation Schedule	Long Term: 5 – 10+ Years
Target	Existing and future population and infrastructure

F) Town of Woodsboro

Multi-Hazard Actions

Mitigation Action	Educational Outreach
Objective	This action will create a program to educate the public about specific mitigation actions for all hazards, including but not limited to participation in NFIP, Wildfire Fuels Reduction, Structural Hardening, etc…
Hazard	Hurricanes/Tropical Storms/Depression, Drought, Hailstorm, Severe Coastal Flooding, Riverine Flooding, Tornados, Severe Winds, Wildfire, Winter Weather, Lightning, Extreme Cold, Extreme Heat, Expansive Soils

Priority	Medium
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source(s)	City, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB
Responsible Department(s)	Mayor and Council, Police Department, Fire Department, Emergency Management
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and future population

Mitigation Action	Purchase or Upgrade Back Up Power Generators
Objective	Installing or upgrading generators at critical facilities will help ensure physical safety for facility occupants and maintain electronic systems functionality during power outages. Portable generators will maintain additional systems functionality including but not limited to lift stations, pumps, and communications infrastructure.
Hazard	Hurricanes/Tropical Storms/Depression, Hailstorm, Severe Coastal Flooding, Riverine Flooding, Tornados, Severe Winds, Wildfire, Winter Weather, Lightning, Extreme Cold, Extreme Heat
Priority	High
Estimated Cost	More than $100,000 Each for Fixed Generators, Including Associated Engineering Costs. Less than $100,000 Each for Portable Generators
Potential Funding Source (s)	City, FEMA BRIC, FEMA HMGP
Responsible Department	Mayor and Council
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing infrastructure

Mitigation Action	Implement a Tree Trimming Program
Objective	This action will develop and implement a tree trimming program to reduce wildfire fuels and minimize the amount of debris generated during natural hazard events. Projects may include but are not limited to trees along power lines within the jurisdiction that are connected to critical facilities and creating firebreaks.
Hazard	Hurricane/Tropical Storm, Wildfire, Tornado, Hailstorm, Winter Weather, Severe Winds
Priority	Medium
Estimated Cost	$10,000 - $500,0000
Potential Funding Source (s)	City, FEMA BRIC, FEMA HMGP
Responsible Department	City Council

Implementation Schedule	1 - 5 Years
Target	Existing and future infrastructure

Mitigation Action	Construct Community Safe Rooms
Objective	The action's goal is to minimize local population vulnerability to Hurricanes/Tropical Storms and Tornados by providing public safe rooms.
Hazard	Hurricane/Tropical Storm, Tornado
Priority	High
Estimated Cost	Greater than $100,000
Potential Funding Source (s)	City, FEMA BRIC, FEMA HMGP
Responsible Department	Mayor and Council, Public Works, Emergency Management
Implementation Schedule	Short Term: 1 - 2 Years
Target	Existing and future population and infrastructure

Mitigation Action	Harden Facilities
Objective	This action proposes hardening facilities. Hardening will include but is not limited to increasing thermal insulation, upgrading and/or adding shatter-resistant films to all glazing, installing impact and wind-resistant windows and doors, installing shutters, building protective walls around exposed gas tanks and cylinders, designing water delivery systems to accommodate drought events; developing new or upgrading existing water delivery systems to eliminate breaks and leaks; shielding roof-mounted equipment.
Hazard	Hurricane/Tropical Storm, Tornado, Hailstorm, Windstorm, Drought
Priority	High
Estimated Cost	Greater than $100,000
Potential Funding Source (s)	City, FEMA BRIC, FEMA HMGP
Responsible Department	Mayor and Council, Public Works,
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing infrastructure

Mitigation Action	Install Impact and Wind-resistant Windows and Doors at Public Facilities

Objective	This action proposes hardening facilities. Hardening will include adding impact and wind-resistant doors and windows at public and critical facilities in the City.
Hazard	Hurricane / Tropical Storm, Hailstorm, Windstorm
Priority	High
Estimated Cost	$10,000 to $100,000
Potential Funding Source (s)	City, FEMA BRIC, FEMA HMGP
Responsible Department	Mayor and Council, Public Works
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing infrastructure

Mitigation Action	Set up Cooling and Warming Centers in Existing Facilities
Objective	The action's goal is to increase extreme heat and cold resilience by limiting vulnerable populations' exposure to extreme heat or extreme cold by creating new or using existing facilities as cooling centers or warming centers.
Hazard	Extreme Heat, Extreme Cold
Priority	Medium
Estimated Cost	Greater than $100,000
Potential Funding Source(s)	City, FEMA BRIC, FEMA HMGP
Responsible Department(s)	Mayor and Council, Police, Emergency Management
Implementation Schedule	Medium Term: 3 – 5 Years
Target	Existing and future population

Mitigation Action	Increased Thermal Insulation
Objective	The action's goal is to increase extreme cold and heat resilience by increasing thermal insulation of critical facilities.
Hazard	Extreme Heat, Extreme Cold, Winter Weather
Priority	Medium
Estimated Cost	$10,000 to $100,000
Potential Funding Source(s)	City, FEMA BRIC, FEMA HMGP

Responsible Department(s)	Mayor and Council, Public Works
Implementation Schedule	Medium Term: 3 – 5 Years
Target	Existing and future population

Single Hazard Actions

Mitigation Action	Document Hazard Occurrences
Objective	This action will document occurrences of hazards within the next five years to address deficiencies in the data.
Hazard	Expansive Soils
Priority	Low
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source(s)	City, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB, TCEQ
Responsible Department(s)	Mayor and Council
Implementation Schedule	Long Term: 5 – 10+ Years
Target	Existing and future population and infrastructure

Mitigation Action	Construct Storm Drainage Infrastructure
Objective	This action proposes constructing new storm drainage infrastructure to reduce the potential impacts of future flood events.
Hazard	Severe Coastal Flooding, Riverine Flooding
Priority	Medium
Estimated Cost	More than $100,000
Potential Funding Source (s)	City, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB
Responsible Department	Mayor and Council, Planning
Implementation Schedule	Medium Term: 3 – 5 Years
Target	Existing infrastructure

Mitigation Action	Upgrade Existing Drainage Pump Stations
Objective	This action proposes upgrading existing drainage pump stations to reduce the potential impacts of future flood events.

Hazard	Severe Coastal Flooding, Riverine Flooding
Priority	Medium
Estimated Cost	$10,000 to $100,000
Potential Funding Source (s)	City, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB
Responsible Department	Mayor and Council, Public Works
Implementation Schedule	Medium Term: 3 – 5 Years
Target	Existing infrastructure

Mitigation Action	Install Check Valves
Objective	This action proposes installing check valves to prevent backflow and reduce the potential impacts of future flood events.
Hazard	Severe Coastal Flooding, Riverine Flooding
Priority	Medium
Estimated Cost	$10,000 to $100,000
Potential Funding Source (s)	City, FEMA FMA, FEMA BRIC, FEMA HMGP
Responsible Department	Mayor and Council, Public Works
Implementation Schedule	Medium Term: 3-5 Years
Target	Existing infrastructure

Mitigation Action	Purchase Portable or Permanent Pumps
Objective	This action proposes purchasing portable or permanent pumps that can be deployed as needed to reduce the potential impacts of future flood events.
Hazard	Severe Coastal Flooding, Riverine Flooding
Priority	Medium
Estimated Cost	$10,000 to $100,000
Potential Funding Source (s)	City, FEMA FMA, FEMA BRIC, FEMA HMGP
Responsible Department	Mayor and Council, Public Works
Implementation Schedule	Medium Term: 3-5 Years
Target	Existing infrastructure

Mitigation Action	Wildfire Fuels Reduction

Objective	The action's goal is to reduce wildfire fuels on City-maintained land. Unchecked wildfire fuels increase the potential for a wildfire's ability to spread quickly, potentially resulting in higher damage dollar totals.
Hazard	Wildfire
Priority	Medium
Estimated Cost	Greater than $100,000
Potential Funding Source (s)	City, FEMA BRIC
Responsible Department	Mayor and Council, Police, Fire
Implementation Schedule	Medium Term: 3-5 Years
Target	Existing and future infrastructure

Mitigation Action	Develop and Implement a New Drought Contingency Plan
Objective	Re-evaluate all existing drought control measures to identify strengths and weaknesses in order to develop and enforce a new or updated drought contingency plan.
Hazard	Drought
Priority	High
Estimated Cost	$10,000 to $100,000
Potential Funding Source(s)	City, FEMA BRIC, FEMA HMGP
Responsible Department(s)	Mayor and Council
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and future population and infrastructure

Mitigation Action	Develop and Implement a New Water Conservation Ordinance
Objective	The City will re-evaluate all existing water conservation and reduction measures to identify strengths and weaknesses in order to develop and enforce a new water conservation ordinance.
Hazard	Drought
Priority	High
Estimated Cost	Less than $10,000
Potential Funding Source (s)	City, FEMA BRIC, FEMA HMGP

Responsible Department	Mayor and Council, Ordinance
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and future population and infrastructure

Mitigation Action	Replace Current Landscaping with Drought Resistant Plant Varieties
Objective	This action's goal is to limit water consumption at City-owned and maintained facilities by replacing existing landscaping with more drought resistant types.
Hazard	Drought
Priority	High
Estimated Cost	Less than $10,000
Potential Funding Source (s)	City, FEMA BRIC, FEMA HMGP
Responsible Department	Mayor and Council
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and future infrastructure

Mitigation Action	Replace Water Fixtures with Low Flow Units
Objective	This action's goal is to limit water consumption at City-owned and maintained facilities by replacing traditional water fixtures with low flow units.
Hazard	Drought
Priority	Low
Estimated Cost	$10,000 - $100,000
Potential Funding Source (s)	City, FEMA BRIC, FEMA HMGP
Responsible Department	Mayor and Council, Public Works
Implementation Schedule	Medium Term: 3-5 Years
Target	Existing and Future infrastructure

Mitigation Action	Develop and Implement a New Tie-Down Ordinance for Manufactured / Mobile Homes, Temporary Buildings, and Unrestrained Advertisement Signs
Objective	The City will re-evaluate all existing tie-down measures to identify strengths and weaknesses in order to develop and enforce a new tie-down ordinance.

Hazard	Severe Winds
Priority	High
Estimated Cost	Less than $10,000
Potential Funding Source (s)	City
Responsible Department	Mayor and Council, Public Works
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and future population and infrastructure

Mitigation Action	Install Protective Window Shutters on Public Facilities
Objective	This action proposes adding protective shutters to public facilities. Doing so will help limit exposure to hailstorm damages.
Hazard	Hailstorm
Priority	Medium
Estimated Cost	$10,000 to $100,000
Potential Funding Source (s)	City, FEMA BRIC, FEMA HMGP
Responsible Department	Mayor and Council, Public Works
Implementation Schedule	Medium Term: 3 – 5 Years
Target	Existing infrastructure

Mitigation Action	Install Grounding Systems to Protect Electronic Assets
Objective	This action will install grounding systems at all City facilities to prevent damage to critical electronic devices including but not limited to: computers, servers, audio/visual equipment, laboratory equipment, and appliances.
Hazard	Lightning
Priority	High
Estimated Cost	$1,000 - $50,000
Potential Funding Source (s)	City, FEMA BRIC, FEMA HMGP
Responsible Department	Mayor and Council, Public Works
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing infrastructure

Mitigation Action	Install Surge Protection and Grounding Systems to Protect Electronic Assets
Objective	This action will install surge protection at all City facilities to prevent damage to critical electronic devices including but not limited to: computers, servers, audio/visual equipment, laboratory equipment, and appliances.
Hazard	Lightning
Priority	High
Estimated Cost	$1,000 - $50,000
Potential Funding Source (s)	City, FEMA BRIC, FEMA HMGP
Responsible Department	Mayor and Council, Public Works
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing infrastructure

G) Woodsboro ISD

Multi-Hazard Actions

Mitigation Action	Educational Outreach
Objective	This action will create a program to educate the public about specific mitigation actions for all hazards, including but not limited to participation in NFIP, Wildfire Fuels Reduction, Structural Hardening, etc…
Hazard	Hurricanes/Tropical Storms/Depression, Drought, Hailstorm, Riverine Flooding, Tornados, Severe Winds, Wildfire, Winter Weather, Lightning, Extreme Cold, Extreme Heat, Expansive Soils
Priority	Medium
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source(s)	ISD, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB
Responsible Department(s)	Superintendent, School Board
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and future population

Mitigation Action	Purchase Back Up Power Generators
Objective	Installing generators at critical facilities will help ensure physical safety for facility occupants and maintain electronic systems functionality during power outages. Portable generators will maintain additional

	systems functionality including but not limited to lift stations, pumps, and communications infrastructure.
Hazard	Hurricanes/Tropical Storms/Depression, Hailstorm, Riverine Flooding, Tornados, Severe Winds, Wildfire, Winter Weather, Lightning, Extreme Cold, Extreme Heat
Priority	High
Estimated Cost	More than $100,000 Each for Fixed Generators, Including Associated Engineering Costs. Less than $100,000 Each for Portable Generators
Potential Funding Source (s)	ISD, FEMA BRIC, FEMA HMGP
Responsible Department	Superintendent, School Board
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing infrastructure

Mitigation Action	Create Drainage Master Plan
Objective	This action proposes creating a drainage master plan for the ISD, in conjunction with other jurisdictions, that will provide the ISD with a comprehensive planning document that provides basic information and necessary guidance for the county-wide drainage system, including but not limited to an H&H study.
Hazard	Riverine Flooding, Hurricanes/Tropical Storms
Priority	Medium
Estimated Cost	Less than $100,000
Potential Funding Source (s)	ISD, County, FEMA BRIC, FEMA FMA, FEMA HMGP, CDBG-MIT
Responsible Department	Superintendent, School Board
Implementation Schedule	5 Years
Target	Existing and future infrastructure

Mitigation Action	Implement a Tree Trimming Program
Objective	This action will develop and implement a tree trimming program to reduce wildfire fuels and minimize the amount of debris generated during natural hazard events. Projects may include but are not limited to trees along power lines within the jurisdiction that are connected to critical facilities and creating firebreaks.
Hazard	Hurricane/Tropical Storm, Wildfire, Tornado, Hailstorm, Winter Weather, Severe Winds
Priority	Medium

Estimated Cost	$10,000 - $500,0000
Potential Funding Source (s)	ISD, FEMA BRIC, FEMA HMGP
Responsible Department	Superintendent, School Board
Implementation Schedule	1 - 5 Years
Target	Existing and future infrastructure

Mitigation Action	Set up Cooling and Warming Centers in Existing Facilities
Objective	The action's goal is to increase extreme heat and cold resilience by limiting vulnerable populations' exposure to extreme heat or extreme cold by creating new or using existing facilities as cooling centers or warming centers.
Hazard	Extreme Heat, Extreme Cold, Winter Weather
Priority	High
Estimated Cost	$10,000 to $100,000
Potential Funding Source(s)	ISD, FEMA BRIC, FEMA HMGP
Responsible Department(s)	Superintendent, School Board
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and future population

Single-Hazard Actions

Mitigation Action	Replace Water Fixtures with Low Flow Units
Objective	This action's goal is to limit water consumption at ISD-owned and maintained facilities by replacing traditional water fixtures with low flow units.
Hazard	Drought
Priority	Low
Estimated Cost	$10,000 - $100,000
Potential Funding Source (s)	ISD, FEMA BRIC, FEMA HMGP
Responsible Department	Superintendent, School Board
Implementation Schedule	Medium Term: 3-5 Years
Target	Existing and Future infrastructure

Mitigation Action	Install Surge Protection to Protect Electronic Assets
Objective	This action will install surge protection at all ISD facilities to prevent damage to critical electronic devices including but not limited to: computers, servers, audio/visual equipment, laboratory equipment, and appliances.
Hazard	Lightning
Priority	High
Estimated Cost	$1,000 - $50,000
Potential Funding Source (s)	ISD, FEMA BRIC, FEMA HMGP
Responsible Department	Superintendent, School Board
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing infrastructure

Mitigation Action	Install Grounding Systems to Protect Electronic Assets
Objective	This action will install grounding systems at all ISD facilities to prevent damage to critical electronic devices including but not limited to: computers, servers, audio/visual equipment, laboratory equipment, and appliances.
Hazard	Lightning
Priority	High
Estimated Cost	$10,000 to $100,000
Potential Funding Source (s)	ISD, FEMA BRIC, FEMA HMGP
Responsible Department	Superintendent, School Board
Implementation Schedule	1 - 5 Years
Target	Existing infrastructure

Mitigation Action	Document Hazard Occurrences
Objective	This action will document occurrences of hazards within the next five years to address deficiencies in the data.
Hazard	Expansive Soils
Priority	Low
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source(s)	ISD, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB, TCEQ

Responsible Department(s)	Superintendent, School Board
Implementation Schedule	Long Term: 5 – 10+ Years
Target	Existing and future population and infrastructure

H) Refugio County WCID #1

Multi-Hazard Actions

Mitigation Action	Educational Outreach
Objective	This action will create a program to educate the public/customers about specific mitigation actions for all hazards, including but not limited to participation in NFIP, Wildfire Fuels Reduction, Structural Hardening, etc…
Hazard	Hurricanes/Tropical Storms/Depression, Drought, Hailstorm, Riverine Flooding, Tornados, Severe Winds, Wildfire, Winter Weather, Lightning, Extreme Cold, Extreme Heat, Expansive Soils
Priority	Medium
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source(s)	RCWCID #1, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB
Responsible Department(s)	RCWCID #1 Public Works
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and future population

Mitigation Action	Purchase Back Up Power Generators
Objective	Installing generators at critical facilities will help ensure physical safety for facility occupants and maintain electronic systems functionality during power outages. Portable generators will maintain additional systems functionality including but not limited to lift stations, pumps, and communications infrastructure.
Hazard	Hurricanes/Tropical Storms/Depression, Hailstorm, Riverine Flooding, Tornados, Severe Winds, Wildfire, Winter Weather, Lightning, Extreme Cold, Extreme Heat
Priority	High
Estimated Cost	More than $100,000 Each for Fixed Generators, Including Associated Engineering Costs. Less than $100,000 Each for Portable Generators
Potential Funding Source (s)	RCWCID #1, FEMA BRIC, FEMA HMGP

Responsible Department	RCWCID #1 Public Works
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing infrastructure

Mitigation Action	Set up Cooling and Warming Centers in Existing Facilities
Objective	The action's goal is to increase extreme heat and cold resilience by limiting vulnerable populations' exposure to extreme heat or extreme cold by creating new or setting up existing facilities as cooling centers or warming centers.
Hazard	Extreme Heat, Extreme Cold, Winter Weather
Priority	High
Estimated Cost	$10,000 to $100,000
Potential Funding Source(s)	RCWCID #1, FEMA BRIC, FEMA HMGP
Responsible Department(s)	RCWCID #1 Public Works
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and future population

Mitigation Action	Increased Thermal Insulation
Objective	The action's goal is to increase extreme cold and heat resilience by increasing thermal insulation of critical facilities.
Hazard	Extreme Heat, Extreme Cold, Winter Weather
Priority	Medium
Estimated Cost	$10,000 to $100,000
Potential Funding Source(s)	RCWCID #1, FEMA BRIC, FEMA HMGP
Responsible Department(s)	RCWCID #1 Public Works
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and future population

Single Hazard Actions

Mitigation Action	Install Check Valves

Objective	This action proposes installing check valves to prevent backflow and reduce the potential impacts of future flood events.
Hazard	Riverine Flooding
Priority	High
Estimated Cost	$10,000 to $100,000
Potential Funding Source (s)	RCWCID #1, FEMA FMA, FEMA BRIC, FEMA HMGP
Responsible Department	RCWCID #1 Public Works
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing infrastructure

Mitigation Action	Purchase Portable or Permanent Pumps
Objective	This action proposes purchasing portable or permanent pumps that can be deployed as needed to reduce the potential impacts of future flood events.
Hazard	Riverine Flooding
Priority	High
Estimated Cost	$10,000 to $100,000
Potential Funding Source (s)	RCWCID #1, FEMA FMA, FEMA BRIC, FEMA HMGP
Responsible Department	RCWCID #1 Public Works
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing infrastructure

Mitigation Action	Document Hazard Occurrences
Objective	This action will document occurrences of hazards within the next five years to address deficiencies in the data.
Hazard	Expansive Soils
Priority	Low
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source(s)	RCWCID #1, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB, TCEQ
Responsible Department(s)	RCWCID #1 Public Works
Implementation Schedule	Long Term: 5 – 10+ Years
Target	Existing and future population and infrastructure

Mitigation Action	Replace Water Fixtures with Low Flow Units
Objective	This action's goal is to limit water consumption at city-owned and maintained facilities by replacing traditional water fixtures with low flow units on an as-needed basis.
Hazard	Drought
Priority	High
Estimated Cost	$10,000 - $100,000
Potential Funding Source (s)	RCWCID #1, FEMA BRIC, FEMA HMGP
Responsible Department	RCWCID #1 Public Works
Implementation Schedule	Short Term: 0 – 2 Years
Target	Existing and Future infrastructure

Mitigation Action	Install Grounding Systems to Protect Electronic Assets
Objective	This action will install grounding systems at all RCWCID #1 facilities to prevent damage to critical electronic devices including but not limited to: computers, servers, audio/visual equipment, laboratory equipment, and appliances.
Hazard	Lightning
Priority	High
Estimated Cost	$10,000 to $100,000
Potential Funding Source (s)	RCWCID #1, FEMA BRIC, FEMA HMGP
Responsible Department	RCWCID #1 Public Works
Implementation Schedule	1 - 5 Years
Target	Existing infrastructure