HAZARD MITIGATION PLAN

2023 2028

Plan to be adopted by:

Sutton County
City of Sonora
Sutton County Hospital District
Sonora Independent School District

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Section I: Introduction

Purpose

The goal of all mitigation efforts is long-term reduction. The emphasis on sustained actions to reduce long-term risk differentiates mitigation from preparedness and response tasks that are required to survive a disaster and form recovery tasks, which are essentially the return to pre-disaster status. Mitigation actions follow a disaster focus on making the situation safer and better than before the incident occurred. Mitigation is an essential component of emergency management. Effective mitigation actions can decrease the impact, the requirements, and the expense of future hazard events. None of the communities in this plan have been designated for special consideration because of minority or economically disadvantaged populations.

Hazard mitigation planning is never ending. The primary purpose of this plan is to ensure that the residents, visitors, and businesses in Sutton County, Texas are safe and secure from natural hazards by reducing the risk and vulnerability before disasters happen, through federal, state, and local community communication, public education, research, and data analysis. This plan is intended to serve as a guide in coordinating and implementing hazard mitigation policies, programs, and projects.

The Sutton County Hazard Mitigation Plan has been developed, and the assessment level of planning preparedness is intermediate. The Hazard Mitigation Action Plan Update will only serve to enhance the County's already considerable capabilities in recognizing, planning for, responding to, and recovering from disaster. The County's history of careful development, monitoring, and integration of emergency management and hazard mitigation planning is testament to its standing commitment to make the jurisdictions as disaster resistant as possible.

The Plans, ordinances, maps, and codes were reviewed by the Hazard Mitigation Committee and staff before mitigation action items and implementation strategies were determined. Information gathered from the Plans, ordinances, maps, permits, and codes were considered and incorporated into this Hazard Mitigation Plan. The lack of various plans and codes were also considered. This was factored in when considering the various mitigation action items and implementation strategies.

We cannot control natural phenomena such as floods, tornadoes, winter storms, wildfires, and other hazardous events. Despite their destructiveness, these occurrences are part of the natural system.

While we cannot prevent natural hazards, we can reduce some of their adverse consequences. We can avoid the worst-case scenario when a hazard does occur by managing the known characteristics of the hazard.

The following objectives will be addressed in the plan:

- What hazards could occur
- Frequency of occurrence
- Hazards impact on community and severity of impact

- Vulnerability to each hazard
- Hazards with greatest risks
- Prioritized mitigation actions

Plan Organizational Structure

Organizational Structure

A Multi-Jurisdictional Hazard Mitigation Planning Team (HMPT) was formed consisting of representatives from local jurisdictions to work together in the plan update development. The team's primary duties were:

- Assign a lead planning staff member to provide technical assistance and necessary data to the Sutton County Hazard Mitigation Planning Team (HMPT).
- Schedule, coordinate and facilitate community meetings with the assistance of the planning team.
- Identify hazards and estimate potential losses from future hazard events.
- Develop and prioritize mitigation action to address identified risks.
- Work with the planning team to collect and analyze data and develop goals and implementation strategies.
- Prepare, based on community input and team direction, the first draft of the plan and provide technical writing assistance for review, editing and formatting.
- Coordinate with stakeholders within the cities and the unincorporated areas of County during plan development.
- Submit the final plan to the State of Texas and provide follow up technical assistance to the Sutton County Community Mitigation Planning Team to correct any noted deficiencies after the review of the plan by the State of Texas.
- Upon approval by the State of Texas, submit the updated plan to FEMA and provide follow up technical assistance to the Sutton County Community Mitigation Planning Team to address any noted deficiencies after the review of the plan by FEMA.
- Prepare for and attend City Council/Commissioners Court/public meetings during plan consideration and plan adoption process.
- Complete and acquire approval of all necessary forms associated with the application for Sutton County's Multi-Jurisdictional Hazard Mitigation Grant.
- Coordinate adoption and final approval process by all City and Town Councils and the Commissioners Court of the updated and approved FEMA plan.
- Submit a final plan, with adoption documentation and approval signatures, for all participating jurisdictions, to the State and FEMA and ensure plan is noted as complete and approved by both agencies.
- After the State of Texas and FEMA approval of the plan, assume responsibility for bringing the plan to life by ensuring it remains relevant by monitoring progress, through regular maintenance and implementation projects.

The Planning Process

Plan Preparation and Development

Mitigation planning involves bringing together multiple components and players to create more disaster-resistant communities. This section provides an overview of the planning process, highlighting key steps as well as providing a detailed description of how stakeholders and the public were involved.

Table 1: Planning Team Representatives

Title	Jurisdiction
Sutton County Judge	Sutton County
Sutton County/City EMC	City of Sonora
City of Sonora Mayor	Sonora ISD
LMH Hospital CEO	Sutton County Hospital District
LMH Hospital COO	Sutton County Hospital District
Sonora Fire Department	City of Sonora
Sutton County EMS	Sutton County
Sonora ISD Superintendent	Sonora ISD
Sonora ISD	Sonora ISD

Sutton County Economic Considerations

Sutton County and many of the jurisdictions have limited revenues and the population is rural. The county does not have a budget that allows for projects that can be completed without assistance on the state or federal levels. The jurisdictions do not have large local governments and the county is operated and maintained by dedicated workers.

The Sutton County Hazard Mitigation Plan Update consists of Sutton County, the City of Sonora, Sutton County Hospital District, and Sonora Independent School District. The HMPT assisted in developing plan goals and actions by using their knowledge and skill sets to create a comprehensive plan update.

Team meetings, telephone calls, and email communications played a role in the completion of the plan. The initial kick off meeting was held via teams on August 1, 2023. The initial meeting was attended by the local, county, and state representatives to discuss the planning process and set expectations. Additionally, meetings were held monthly to check the progress of the plan update and the Hospital District and ISD joined the planning process.

Public Participation

Public participation is a key component to a strategic planning process. Citizen participation offers citizens a chance to voice their opinions. In addition to the open public meetings, the Planning Team was able to solicit input from citizens and stakeholders using a public

participation survey. This survey was designed to obtain data and information from the residents of the planning area.

Planning Team member communities distributed surveys at public forums and posted the survey on their community websites. Opportunities were provided for public involvement and input via public surveys sent to the citizens of Sonora and Sutton County through the Everbridge Nixle system. The link for the survey was posted on their website and the link was sent via Everbridge with capability to respond on a mobile device. There were 10 responses to the survey from the public. Those responses and input were reviewed and provided valuable input to the plan update. A public meeting to obtain public feedback on the plan draft will be held after the final draft is approved by all planning team members. A summary of survey findings is in Appendix A.

Benefits of Mitigation Planning

1. Increases public awareness and understanding of vulnerabilities as well as support for specific actions to reduce losses from future natural disasters.
2. Builds partnerships with diverse stakeholders, increasing opportunities to leverage data and resources in reducing workloads as well as achieving shared community objectives.
3. Expands understanding of potential risk reduction measures to include structural and regulatory tools, where available, such as ordinances and building codes.
4. Informs development, prioritization, and implementation of mitigation projects. Benefits accrue over the life of the project as losses are avoided from each subsequent hazard event.

Overview of the Plan Creation

In developing the Plan, the Plan participants used the April 2023 "*Local Mitigation Planning Policy Guide*" and the *State and Local Mitigation Planning How-to Guides* (FEMA Publication Series 386) to create the Plan Update in accordance with the process outlined in the planning guide.

The Multi-Jurisdictional Planning Process

A multi-jurisdiction plan was chosen to best prepare the communities of Sutton County for Hazards. Mitigation plans need to be a living document and to ensure this the plan must be monitored, evaluated, and updated on a five-year or less cycle. This includes incorporating the mitigation plan into county and local comprehensive or capital improvement plans as they are developed.

Organize Resources

Effective planning efforts result in practical and useful plans, but written plans are only one element in the process. The planning process is as important as the plan itself. A successful planning process organizes resources by encouraging cooperation and bringing together a cross-section of government agencies, local entities, concerned citizens, and other stakeholders to reach consensus on how to achieve a desired outcome or resolve a community issue. Applying a

community wide approach and including multiple aspects adds validity to the plan. Those involved gain a better understanding of the problem and how solutions and actions were devised. The result is a common set of community values and widespread support for directing financial, technical, and human resources to an agreed upon action.

1. A comprehensive county approach was taken in developing the plan. An open public involvement process was established for the public, neighboring communities, regional agencies, businesses, academia, etc. to provide opportunities for everyone to become involved in the planning process and make their views heard. This was done by having public meetings that were advertised with notices in public places and by media press releases.
2. Each participant was explained the Hazard Mitigation Planning Process. These opportunities were also used to gather hazard information, develop mitigation strategies, and edit the plan during the writing process.
3. The review and incorporation of appropriate existing plans, studies, reports, technical information, and other research was included into the plan during its drafting process.
4. Support and information were obtained from other government agencies and programs such as the National Flood Insurance Program (NFIP), Natural Resources Conservation Service (NRCS), US Geological Survey (USGS), NOAA Weather, etc.

Risk and Vulnerability Assessment

The plan must be reactive to hazards that face the community. It is not sufficient to just identify the hazards. The potential consequences of these hazards must be assessed. This phase included identifying and profiling all hazards, including vulnerability and risk. Research into the history of Sutton County to document past disasters was required. National weather records, local documentation, and public feedback were used to assess the hazards incorporated into the plan.

- A general assessment included using residents, historical data, Texas State Mitigation Plan, Local or Regional Reports, Strategic Plans, Flood Studies, and the 2023 Concho Valley Threat and Hazard Identification and Risk Assessment (THIRA) to establish the following:
- The type, location, and extent of all hazards that can affect the jurisdiction, both historically and in the future.
- Past occurrences of hazard events in or near the community and the severity, duration, and the resulting influences on the area.
- Description of the jurisdictions vulnerability to those hazards including types and numbers of existing and future buildings, infrastructure, and critical facilities in identified hazard areas.
- Probability or likelihood of hazard occurrence.
- General description of land use and development trends for future land use decisions.

The development of a multi-jurisdictional hazard mitigation plan involves the use of many types of information including historical data on previous disasters, information on critical infrastructures, zoning and flood plain maps, records charts, etc. from many sources.

Review and Incorporation of Existing Plans

Review

A variety of existing studies, plans, reports, and technical information were reviewed as part of the planning process. Sources of the information included FEMA, the United States Army Corps of Engineers (USACE), the U.S. Fire Administration, National Oceanic and Atmospheric Administration (NOAA), the Texas Water Development Board (TWDB), the Texas Commission on Environmental Quality (TCEQ), the State Comptroller, the Texas State Data Center, Texas Forest Service, the Texas Division of Emergency Management (TDEM), and local hazard assessments and plans.

Incorporation of Existing Plans

Current projects and studies were utilized as a starting point for discussing mitigation actions amongst the planning team. Previous hazard events, occurrences and descriptions were identified through NOAA's National Climatic Data Center (NCDC). These studies were used as a starting point for suggesting grant and mitigation activities based on flood-related funding availability. Information from the Texas Forest Service was used to appropriately rank the wildfire hazard, and to help identify potential grant opportunities. The State of Texas Mitigation Plan, developed by TDEM, was discussed in the initial planning meeting to develop a specific group of hazards to address in the planning effort. The State Plan was also used as a guidance document, along with FEMA materials, in the development of the Plan.

Develop Mitigation Strategies

Written strategies were developed to demonstrate how Sutton County intends to reduce losses identified in the risk assessment. It includes goals and objectives to guide the selection of mitigation activities and reduce potential losses. This is a blueprint for reducing the potential losses identified in the risk assessment. The mitigation strategy also includes:

- A description of mitigation objectives meant to reduce long-term vulnerability. These objectives were identified by the planning team using hazard profiles, survey assessments, etc.
- Identification and a comprehensive analysis of a range of mitigation actions and projects.
- An Action Plan describing how the mitigation actions and projects were prioritized, and how they would be implemented and administered.

Table 2: Planning Team Data Sources

Data Source	Data Incorporation	Purpose
National Flood Insurance Program (NFIP)	Flood prevention requirements	Flood insurance program participation requirements
The US Geological Survey (USGS)	Historic weather data	Previous event occurrences, damage dollars, and mapping for all hazards
Natural Resources Conservation Service (NRCS)	Historic weather data	Previous event occurrences, damage dollars, and mapping for all hazards
State of Texas Hazard Mitigation Plan 2023	Hazard descriptions	Official descriptions of hazards and their potential impacts
Texas Wildfire Risk Assessment Portal (TXWRAP)	Hazard occurrences	Previous event occurrences, damage dollars, and mapping for all hazards
NOAA Weather	Historic weather data	Previous event occurrences, damage dollars, and mapping for all hazards
The US Census Bureau	Census information	Recent census information, building values, and other demographic information
National Centers for Environmental Information (NCEI)	Hazard occurrences	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 hazards
Federal Emergency Management Agency (FEMA) Flood Zones	Flood maps	GIS mapping of flood zones and firmettes

Plan Maintenance

This describes the system that Sutton County and the participating jurisdictions will monitor the plan, provide descriptions of how, when and by whom the plan actions will be evaluated, and presents criteria used to evaluate the plan, and how it will be maintained and updated.

As conditions change and mitigation actions are implemented, the plan will need to be updated to reflect changes in each jurisdiction. The planning team has identified the following positions as the responsible party for maintenance.

Maintenance Responsibility

Table 3:Maintenance Responsibility

Title	Jurisdiction
Sutton County Judge	Sutton County
Sutton County/City EMC	City of Sonora
City of Sonora Mayor	Sonora ISD
LMH Hospital CEO	Sutton County Hospital District
LMH Hospital COO	Sutton County Hospital District
Sonora Fire Department	City of Sonora
Sutton County EMS	Sutton County
Sonora ISD	Sonora ISD
Sonora ISD	Sonora ISD

Within one year of the plan adoption, each department or agency will review and update as appropriate. On a biannual basis, representatives from each jurisdiction serving on the planning team will evaluate progress on the mitigation action implementation. They will review agency findings, public input, and future development plans to evaluate the effectiveness of the plan.

Any significant change to the plan, including but not limited to changing or updating mitigation actions, abandoning mitigation actions, or pursuing new mitigation actions will be pursued through the appropriate channels.

Plan Monitoring

The City of Sonora Emergency Management Coordinator (EMC) will be responsible for the overall continued coordination and monitoring of the plan in its entirety. The agency or department listed in Table 3 will serve as the responsible party for each jurisdiction. At a minimum, the EMC and planning team will monitor the mitigation plan annually or as mitigation projects are implemented. Regularly monitoring the plan implementation process in each jurisdiction will ensure that every component of the plan is reviewed.

After the adoption of the plan, each jurisdiction will have a copy to display on their websites or have printed in their physical locations.

Plan Evaluation

Proper evaluation will measure progress and effectiveness of the mitigation actions. On an annual basis the EMC and the planning team will review the plan using the following criteria:

- Are the specific goals and objectives still current?
- Has the nature, magnitude, or risk of any hazard changed?
- Have there been any changes in land development that should be addressed?
- Are available resources available for implementation of mitigation actions?

- Are there other funding sources that increase mitigation actions?

Other steps will include monitoring the success of implemented mitigation projects. The team will evaluate this and assess for future amendments to mitigation actions and plan updates.

Plan Update

The plan is designed to address a five-year period. In accordance with the 44CFR Section 201.6, it will be updated every five years to maintain compliance with State and Federal regulations. However, at least two years from the date of the approval and annually the planning team will meet to review the plan.

During the update process, the planning team will provide the following from their jurisdiction:

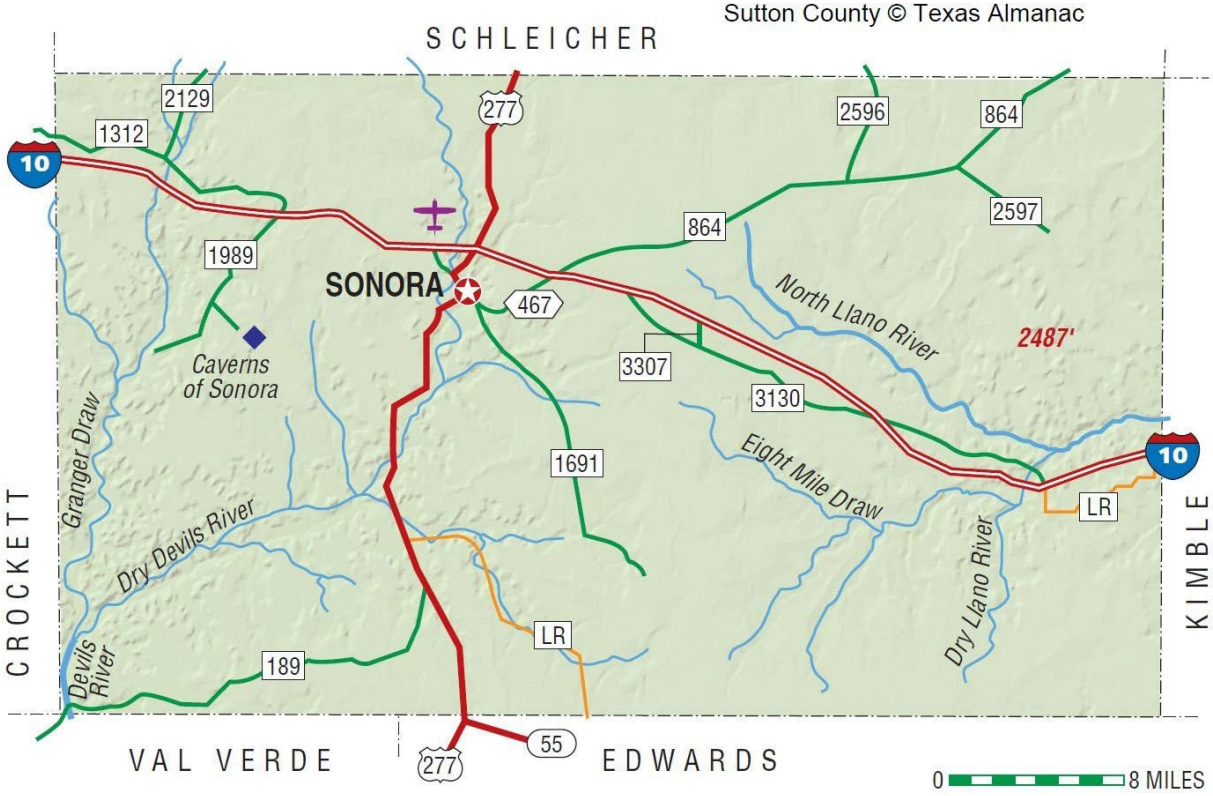
- Data for recent occurrences of the hazards identified in the plan.
- Determine whether mitigation measures were implemented and effective.
- Data for any losses due to the identified hazards.
- Determine if actions or hazards should be modified for their jurisdiction.

Additional changes to be considered during the update would be changes in local development, demographics, revision to state legislation, and hazard changes. The update process provides the community an opportunity to determine if the actions succeeded, failed, or are irrelevant. It is also an opportunity for each plan participant to identify gaps or success in their actions.

Plan Implementation

Once FEMA Region VI and the Hazard Mitigation Officer for the State of Texas reviews, indicates that the plan meets all Federal planning requirements, and is approvable, the plan will be submitted to local elected officials of each participating jurisdictions for adoption. Sutton County and the participating jurisdictions will be given thirty days to allow and receive public input from their citizens prior to approval. Once completed, copies of the resolutions will be included.

Sutton County © Texas Almanac



Section II: Regional Profile

Sutton County is in west central Texas. Its geographic center is at 30°31' north latitude and 100°38' west longitude, 135 miles northwest of San Antonio and seventy miles south of San Angelo. Sutton County covers 1,455 square miles on the western edge of the Edwards Plateau; elevations range from 1,900 to 2,300 feet. Soils are generally shallow and stony, though deep loams are found along watercourses and irregular outcrops of limestone. The most important of the county's natural resources are moderate-sized oil and gas reserves, which came into significant production in the late 1960s and 1970s. Though range grasses constitute the most common form of vegetation, the area is distinguished from a true grassland by the existence of isolated stands of shin oak, juniper, and mesquite. The region was originally home to a wide variety of game animals and predators, most significantly deer, quail, dove, wild turkey, plover, coyotes, timber wolves, and bobcats. Periodically herds of antelope and buffalo wandered onto the Edwards Plateau, though they were not native to the region. The single most significant factor in the development of Sutton County has been the scarcity of water. Precipitation averages just twenty inches annually, and severe droughts occur regularly. Meager rainfall is further depleted by rapid evaporation due to the plateau's constant, dry winds. Consequently, the county is completely dependent for its water supply upon deep wells that tap the Edwards Trinity Aquifer. Sutton County's climate is that of a subtropical steppe, characterized by wide daily temperature fluctuations. The January average low is 32° F, and the July average high is 96°. The growing season is 235 days long. Generally, the county receives about two inches of snow each year.

The Dry Devils River in Sonora, Texas, is an important waterway that requires careful monitoring and management to prevent flooding and ensure the safety of local infrastructure. The river's unique flow characteristics, particularly the funneling effect caused by the transition from a wider upstream channel to a narrower downstream portion, necessitate targeted mitigation strategies. This document outlines the importance of monitoring and evaluating the water flow in the Dry Devils River, focusing on the challenges posed by the funnel effect and the narrow passage under the US Highway 277 south bridge.

Lillian M. Hudspeth Memorial Hospital is located in Sutton County, it provides general medical care for inpatient, outpatient, and emergency room patients, and participates in the Medicare and Medicaid programs. Emergency room services are available on a 24-hour per day, seven-day per week basis. The hospital houses 12 critical access hospital beds, 11 beds with 5 overflow beds, depending on staffing. For 2023 the hospital numbers are as follows:

- 72 Full Time Employees (FTE)
- 8,134 clinic visits
- 1,450 ER visits
- 85,118 outpatient visits
- 82 inpatients

- 87 observation patients

Sutton County EMS is a partnership between the Sutton County Hospital District and Sutton County to provide pre-hospital care (911 and transfer services) to the citizens of Sonora and Sutton County. Sutton County EMS is a paid service licensed by the Texas Department of State Health Services as BLS with Mobile Intensive Care unit capabilities. The table below shows the number of EMS runs from 2021-2023.

Table 4: EMS Runs Table 2021-2023

Year	Number of runs
2021	661
2022	622
2023	591

The Sonora Independent School District is classified by UIL as a class AA school, with 650 students currently enrolled and 110 employees. The district consists of two campuses dedicated to instructional engagement and student success. Sonora Elementary school is committed to meeting the needs of today's changing society, providing quality, child-centered learning environment in which all students acquire knowledge and develop the skills and work habits to enable them to have happy, successful lives.

Sonora Secondary School has a strong history of success in its academic, vocational, and athletic programs. Their vision is: Sonora High School will be a place of compassion, commitment, integrity, happiness, order, and creativity. All students and teachers will be inspired to become partners in the quest for knowledge.

The Sonora Volunteer Fire Department provides Fire and Rescue services to the City of Sonora and Sutton County. The Fire department is staffed by approximately 20 volunteers. The table below shows the number of runs done by the fire department from 2021-2023.

Table 5: Fire Dept Runs Table 2021-2023

Year	Number of runs
2021	47
2022	104
2023	106

A list of critical facilities in the community is listed within Table 57.

Population and Demographics

Table 6: Sutton County Population Distribution (2022)

JURISDICTION	TOTAL 2022 POPULATION	ESTIMATED SPECIAL NEEDS POPULATIONS	
		Elderly (Over 65)	Low Income (</= $20,000)
Sutton County	**3,217**	**20.1%**	**13.9%**

Table 7: Ethnicity for Sutton County (2022)

JURISDICTION	HISPANIC ALONE	WHITE ALONE	AFRICAN AMERICAN ALONE	AMERICAN INDIAN & ALASKAN NATIVE ALONE	ASIAN ALONE	NATIVE HAWAIIAN/ PACIFIC ISLANDER ALONE	MULTI-RACIAL
Sutton County	**65.9%**	**32.5%**	**1.8%**	**1.8%**	**0.7%**	**0.0%**	**1.4%**

Distribution of Vulnerable Populations

The planning team identified a set of indicators to determine the vulnerable population. The indicators include demographic data such as age and income, CDC Social Vulnerability Index score, location of low income or subsidized housing units, and concentration of mobile homes.

Age, Disability, and Income

The population was broken down into four categories: young residents, elderly residents, disabled residents, and low-income residents. Residents falling into those categories were deemed most likely to suffer disproportionate losses due to natural hazards due to their potentially limited means to prepare for and recovery from a hazard event.

Table 8: Age, Disability, and Poverty Level Percentages

Demographic Category	Sutton County	City of Sonora	Texas	U.S.
Total Population	3,217	2,502	29,145,505	331,449,281
Population under age 65	83.14%	87.6%	86.6%	82.7%
Population over age 65	16.86%	12.4%	13.4%	17.3%
Disability Status	9.21%	6.9%	12.4%	13.4%
Individuals below poverty level	13.9%	19.3%	14%	12.6%

Social Vulnerability Index

Using the 2018 Social Vulnerability Index (SVI) from the CDC, Sutton County has an overall score of 0.60 on a 0-1 scale with 0 being lowest vulnerable to 1 being most vulnerable. A score of 0.60 indicates that Sutton County has a moderate to high vulnerability.

The CDC SVI describes areas and communities that are more socially vulnerable to disasters. There are 15 social factors considered for determining SVI with the most vulnerable listed on the table below for Sutton County. The factors below include poverty, lack of access to vehicles, crowded homes, and minority status.

Table 9: Sutton County SVI

Vulnerability	Percentage*
Socioeconomic	0.46
Household Composition	0.64
Minority Status/ Language	0.96
Housing/Transportation	0.31

- *The percentage scale is between 0-1. 0 is the least vulnerable and 1 is the most vulnerable.*

Low Income and Subsidized Housing

Low-income residents in Sutton County are served by the Sonora Housing Authority. There are several rural rental assistance programs offered through the housing authority to include:

- Section 515
- Section 521
- Low-income housing tax credits (LIHTC)
- Low-income housing tac credits (LIHTC) 40/60 set aside

There are two subsidized apartment complexes in the City of Sonora. One complex is reserved for seniors and has 32 units. The other complex does not have an age restriction; however, it is subsidized and has 32 units. In Sutton County there are a total of 64 subsidized units.

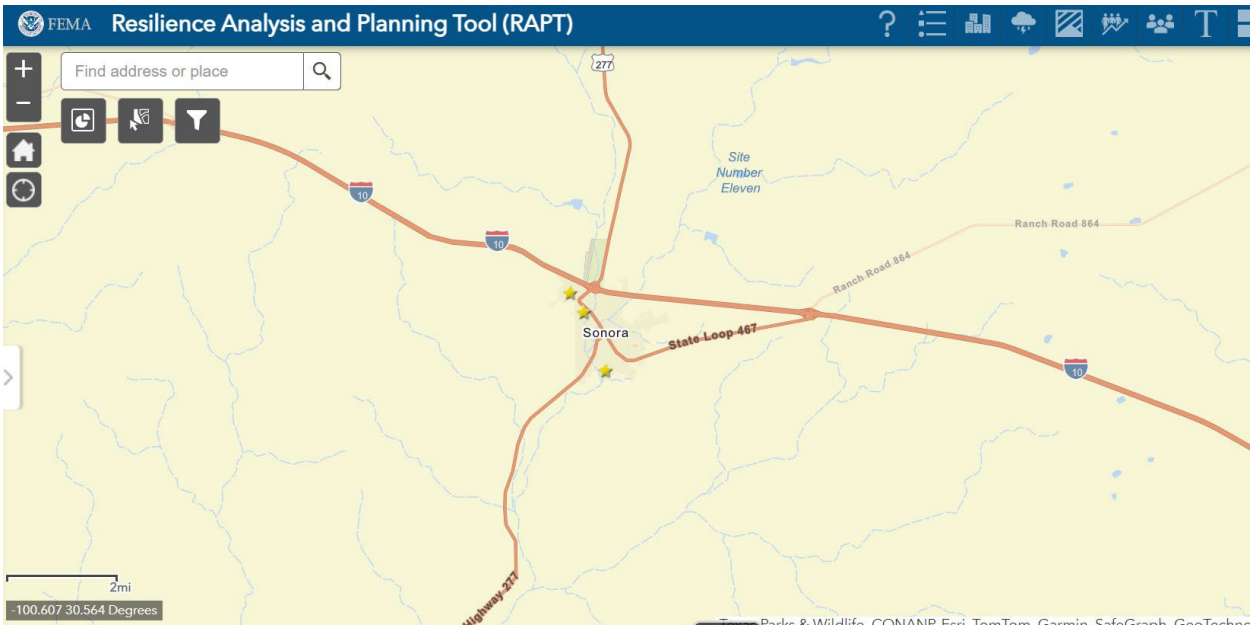
Residents of low-income and/or subsidized housing are expected to suffer disproportionate losses due to hazard events due to their potentially limited means to prepare for and recover for it.

Housing Type and Condition

Housing type is another area of vulnerability in many communities across Texas, Sutton County is no exception. Mobile/manufactured homes have been identified as being disproportionately vulnerable to certain hazards to include hurricanes, floods, tornados, severe weather events, and severe wind. Manufactured/Mobile Home parks can be found throughout Sutton County, with

several parks being in the City of Sonora. One of the parks has a combination of mobile homes and RV spaces for short or long-term rental. Among the parks identified it is estimated there are about 100 plus lots for mobile homes and RVs. When weather is severe these are the areas of the community that could suffer substantial losses and therefore are identified as vulnerable.

Figure 1: Mobile Home parks in Sutton County



Distribution of Property by Housing Density and Potential Damage Values

The table below represents the housing density in Sutton County and the potential losses to residents during a hazard event.

Table 10: Housing Density and Potential Damage Values

Category	Sutton County
Total Housing Units	1,878
Median Housing Value	$132,600
Housing Unit Density (per square mile)	1.3 unit per square miles
Median Housing Value	$70,600
Occupied	1359
Vacant	519

Major Disaster Declarations

The following table outlines all major declarations that have occurred in Sutton County since the 2018 HMP.

Table 11: Disaster Declarations in Sutton County

Sutton County Major Disaster Declarations		
Disaster	**Incident Period**	**Declaration Date**
DR-4586 Texas Severe Winter Storms	February 11 to February 21,2021	February 19, 2021
DR-4485 Texas COVID-19 Pandemic	January 20, 2020, to May 11, 2023	March 25, 2020
DR-4416 Texas Severe Storms and Flooding	September 10 to November 2, 2018	February 25, 2019

Section III: Risk Assessment

Extreme Weather and Climate Change

Currently there is a strong scientific consensus that the Earth is warming and that this warming is mainly caused by human activities. This consensus is supported by various studies of scientists' opinions and by position statements of scientific organizations, many of which explicitly agree with the Intergovernmental Panel on Climate Change (IPCC) synthesis reports.

Nearly all publishing climate scientists (97-98%) support the consensus on anthropogenic climate change, and the remaining 3% of contrarian studies either cannot be replicated or contain errors. One of the most visible consequences of a warming world is an increase in the intensity and frequency of extreme weather events. The National Climate Assessment finds that the number of heat waves, heavy downpours, and major hurricanes has increased in the United States, and the strength of these events has increased, too.

There are no national or major scientific institutions anywhere in the world that would dispute the theory of anthropogenic climate change that will increase the likelihood of unstable weather patterns.

Climate models have previously shown that Earth will see more heavy rainstorms as the atmosphere warms, but a new climate model developed by NASA researchers is the first to show the difference in strength between storms that occur over land and those over the ocean and how storms strengths will change in general.

These conclusions are particularly bad news for the storm-prone portions of the central and eastern United States, where strong winds are a major source of weather-related casualties. Also, according to NASA, Global warming will make severe thunderstorms and tornadoes a more common feature of U.S. weather.

The western United States will not catch a break either – while it is expected to get drier, the storms that so form are likely to have more lightning, which could then trigger more wildfires. No single weather event can be directly attributed to climate change. But as the globe warms up, Americans can expect more storms bearing done on much of the United States, scientist say. Even increased snowfall has a climate change connection. That is not because of the Feb. 1, 2011, storm can be linked to rising atmospheric carbon dioxide levels or increasing global temperature – again, such a connection is impossible to make – but, according to climatologists, an increased propensity for winter storms is exactly what you would expect in a warming climate.

Regardless of individual views regarding global warming, extreme weather patterns over the last ten years are self-evident. We can easily predict that continued extremes in weather, like those mentioned above, will occur in the foreseeable future.

Hazard Identification

This section begins the risk assessment, which also includes hazard profiles and vulnerability assessments found in Section IV. The purpose of this section is to provide background information for the hazard identification process, as well as descriptions for the natural, human, and technological hazards identified.

Hazard Assessment Elements

The Hazard Profiles, found in the following sections, were prepared for each identified natural hazard and assess the hazard per the following seven elements.

1. **Description:** Identification and description of hazards likely to affect the multi-jurisdictional area along with the sources used to identify these hazards.
2. **Location:** Describes the location or geographic area affected by each natural hazard along with a map of the area affected.
3. **Impact:** Describes the hazard's potential severity of impact that the hazard event is capable of inflicting upon the county and jurisdictions. Classification methods such as the Fujita Scale and Richter Scales are used to illustrate the extent.
4. **Previous Occurrences:** Describes the hazard in terms of what, when, and where past events have occurred and the extent of damage.
5. **Probability of Future Events**: Describes the probability that the hazard will occur within the county and jurisdictions.
6. **Vulnerability:** Describes how exposed or susceptible to damage the county is in terms of why and where the hazard can occur within the county and/or the other jurisdictions. The vulnerability is the risk of future occurrences. THMP and other local data were used to establish a base map and conduct risk assessments.

Likelihood of Future Events is measured based on a hazard's expected frequency of occurrence in terms of previous frequency. Each hazard's likelihood of future events 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. Vulnerability risk of each hazard has risen as population fluctuates in conjunction with new development and growth in the County. Furthermore, the effects of climate change have increased the frequency and intensity of hazard events: for example, Sutton County has experienced multiple ice storms and winter weather, and flooding. Climate change is expected to exacerbate hazard events in the future. New development and climate change continue to increase vulnerability to natural hazards in the

jurisdictions. While the Sutton County Hospital District and the Sonora ISD may not have officially recorded history of certain natural hazards, their location with the County and the City of Sonora presents valid assumptions of high risk and impacts as the area continues to grow.

Hazards to be Addressed

Previously, the expired 2018 plan identified ten (10) natural hazards facing the County: flooding, thunderstorms, hail, tornados, wildfire, dam failure, winter storms, extreme heat, drought, and hurricanes. As of now, all participating jurisdictions will address and profile the twelve (12) hazards identified on Table 12. The 2023 Sutton County Hazard Mitigation Plan update will address the following natural hazards identified in the State of Texas' 2023 Hazard Mitigation Plan as threats throughout the state.

Table 13 shows the hazards identified potential losses from the FEMA National Risk Index (NRI). This is anticipated losses based on historical losses and demographic information.

Table 12: List of Hazards Addressed

Hazard	Jurisdiction			
	Sutton County	Sonora	Sutton County Hosp District	Sonora ISD
Flooding	X	X	X	X
Hurricanes	X	X	X	X
Wildfire	X	X	X	X
Tornados	X	X	X	X
Drought	X	X	X	X
Extreme Cold	X	X	X	X
Extreme Heat	X	X	X	X
Hailstorm	X	X	X	X
Winter Weather	X	X	X	X
Severe Winds	X	X	X	X
Lightning & Thunderstorms	X	X	X	X
Additional Optional Hazards				
Coastal Erosion				
Severe Coastal Flood				
Land Subsidence				
Earthquakes				
Expansive Soils				
Dam/Levee Failure	X	X	X	X

Omission Statements

Sutton County and the participating jurisdictions will not be addressing the following hazards: Coastal/Inland Erosion and Dam/Levee Failure. The history of impacts for all the omitted

hazards have been negligible (or non-existent); therefore, the County and participating jurisdictions expects that future impacts will be negligible as well, nor do the County and participating jurisdictions anticipate applying for grant funding to address any of them.

Table 13: NRI Anticipated Loss

Hazard	Anticipated Annual Loss per National Risk Index (NRI)	NRI Expected Annual Loss Rating
Flooding	$1,368,425	Relatively Moderate
Hurricanes	$14,411	Very Low
Wildfire	$1,169,980	Relatively Moderate
Tornados	$74,388	Very Low
Drought	$3,772	Very Low
Extreme Cold	$14,437	Relatively Low
Extreme Heat	$20,420	Relatively Low
Hailstorm	$38,749	Very Low
Winter Weather	$42,532	Relatively Low
Severe Winds	$29,885	Very Low
Lightning	$48,141	Relatively Low
Earthquakes	$972	Very Low

Section IV: Hazard Descriptions

Floods

Hazard Description

Floods generally result from excessive precipitation and the severity of a flood event is typically determined by a combination of several major factors, including stream and river basin topography and physiography, precipitation and weather patterns, recent soil moisture conditions, and the degree of vegetative clearing and impervious surface. Generally, floods are events that may last for several days. The primary types of general flooding are inland and coastal flooding. Inland flooding is profiled in this section since coastal flooding is not applicable to the study area.

Inland or riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. It is natural and inevitable as it is the overbank flooding of rivers and streams, typically resulting from large-scale weather systems that generate prolonged rainfall over a wide geographic area. Some river floods occur seasonally when winter or spring rainfalls fill river basins with too much water, too quickly. Torrential rains from decaying hurricanes or tropical systems can also produce river flooding.

Location

The location of flood zones in the planning area are illustrated in Figures 2 and 3. All flood maps were obtained from the Texas Water Development Board Flood Planning Group for Region 10 & 14. Sutton County is a member of both regions due to the county being split. All flood zones mapped are the 100-year event probabilities or the base flood. The County and all participating jurisdictions are considered susceptible to direct and indirect impacts from flooding. The FEMA FIRM is included below, however there is no electronic version available. The FIRMs in the rural areas of Texas have not been updated. Flood groups with the TWDB are working on rectifying this issue by creating flood plans.

Flood Map from TWDB Region 10 showing the portion of the County they cover, the eastern half, Figure 2. As indicated on this map there is a need for flood management evaluation in Eastern Sutton County Figure 3. It was also recommended that there be a flood management evaluation for Western Sutton County as indicated in Figure 4.

Figure 2: Regional Flood Map Eastern Sutton County

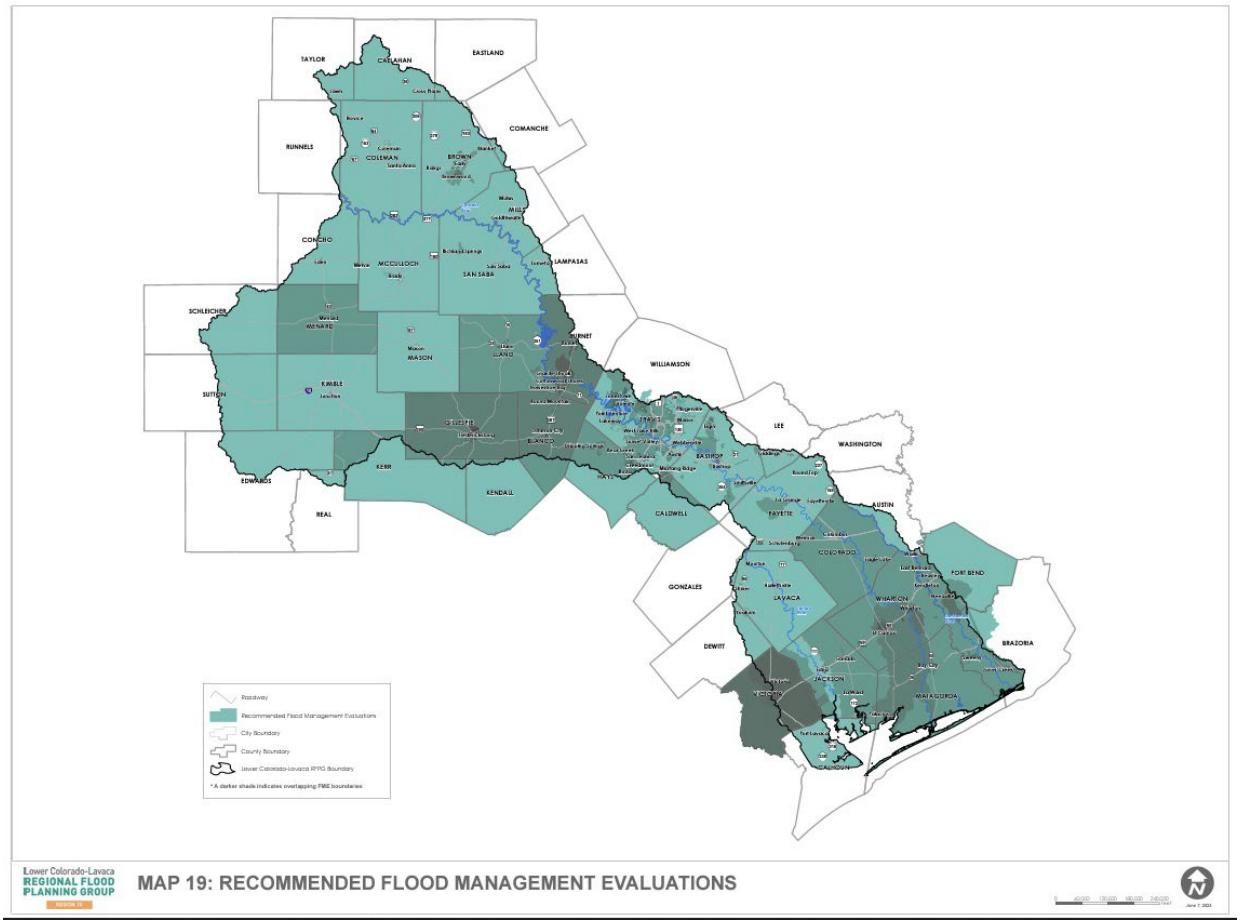


Figure 3: Regional Flood Map Western Sutton County

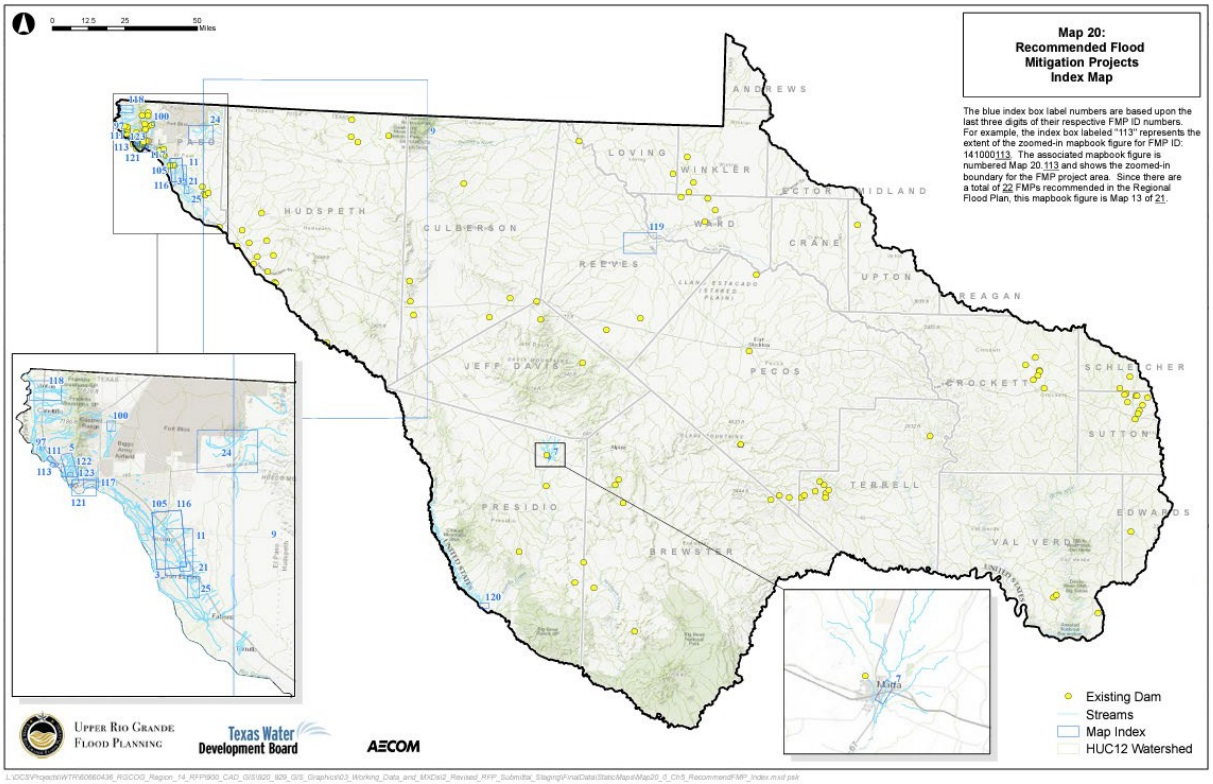
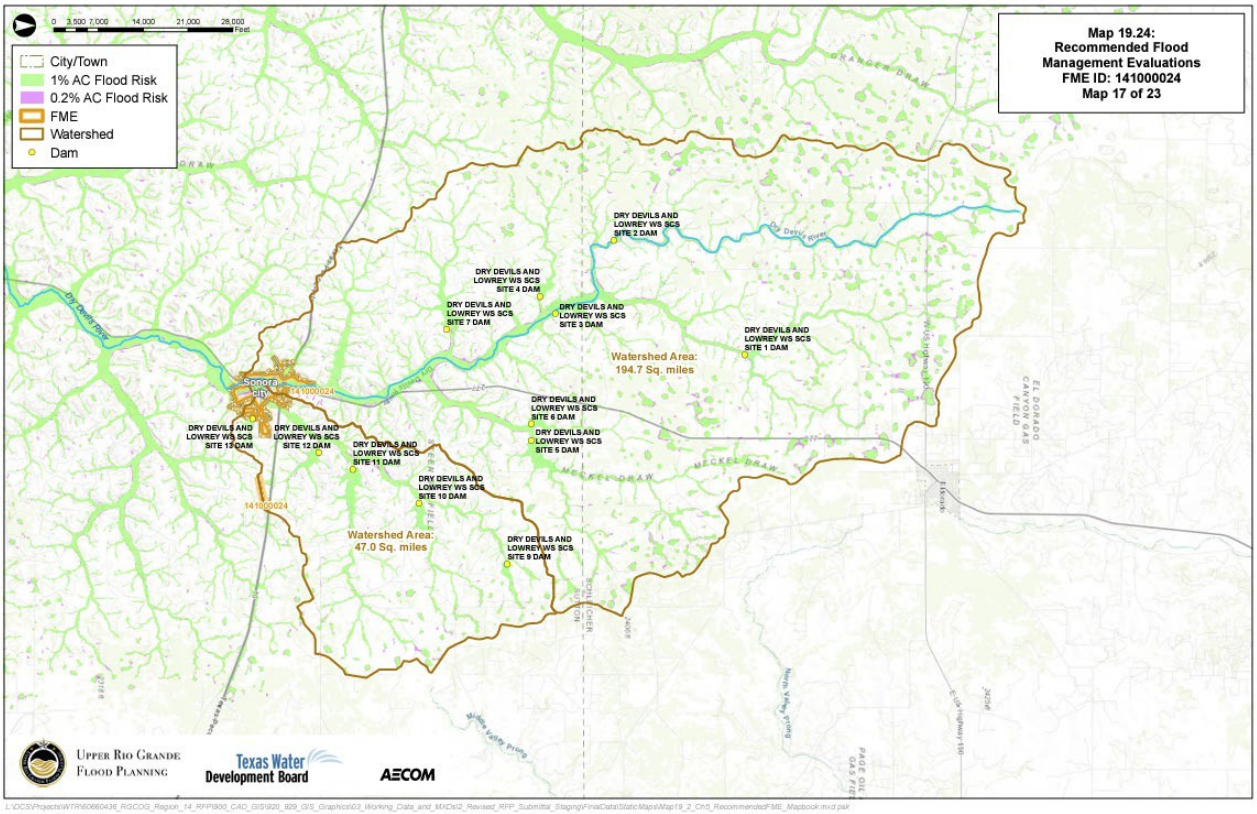


Figure 4: Western Sutton County Floodplain Risks



Impact and Extent

The severity of a flood event is typically determined by a combination of several factors including stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and degree of vegetative clearing and impervious surface. Generally, floods are events that may last for several days. Flooding would not affect the entire county in a similar manner; however, the entire county and all participating jurisdictions would be affected by a flood incident.

The flood impact to Sutton County and the surrounding communities would be major. The resulting illnesses or injuries may result in disability and more than 25% of property could be destroyed or damaged. Critical facilities in Sutton could be shut down for up to two weeks or more.

Determining the intensity and magnitude of a flood event is dependent upon the flood zone and location of the flood hazard area in addition to depths of flood waters. The extent of flood damage can be expected to be more damaging in the areas that will convey a base flood. FEMA categorizes areas on the terrain according to how the area will convey flood water. Flood zones are the categories that are mapped on Flood Insurance Rate Maps. Based on the FIRM, Figure 5, Sutton County is located in Zone A throughout the County and in the City of Sonora. Major thoroughfares are adjacent to Zone A, which indicates that they are more susceptible to flooding.

This is the most recent FIRM per the FEMA MSC. FEMA has not done electronic FIRMs for this area.

Figure 5: Sutton County FIRM

Zone A is interchangeably referred to as the 100-year flood, the one percent-annual chance flood, or the Special Flood Hazard Area (SFHA), or more commonly, the base flood. By any name, it is the area that will convey the base flood. This area constitutes a threat to the planning area, and it is the only threat; no other flood zones have been mapped in the Region according to available flood maps.

Structures built in the Special Flood Hazard Area are subject to damage by rising waters and floating debris. Moving flood water exerts pressure on everything in its path and causes erosion of soil and solid objects. Utility systems, such as heating, ventilation, air conditioning, fuel, electrical systems, sewage maintenance systems and water systems, if not elevated above base flood elevation, may also be damaged.

Extent is provided for each county and each participating community within that county in terms of depth of flood waters. Table 14 below describes the category of risk and potential magnitude of an event while Table 15 provides the range of intensity for Sutton County as the extent is universal for the participating communities within each county.

The water depths depicted in Table 14 are an approximation based on elevation data (above sea level rather than above ground) and stream gauge data provided by the National Weather Service. This level of risk is determined by the levels of area streams and rivers.

The severity of a flooding event varies depending on the relative risk to citizens and structures located within the planning area. Table 15 depicts the level of impact, which includes the level of impact for the participating stakeholders within each county.

Flood impact in Sutton County and the participating jurisdictions will vary depending on the location, size of the affected area, and number of structures affected. Although the likelihood of a FEMA 100-year flood event remains occasional, 1% in any given year, the floodplain crosses all of Sutton County's major thoroughfares, potentially limiting travel across, within, and around the County.

Residents in the participating jurisdictions 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 foodborne contaminants, damaged by debris flow, or even completely washed away. Crops may be damaged or destroyed. Estimated damage totals to vulnerable parcels affected during a 100-year flood event may meet the totals outlined in Table 14.

Despite the unlikely probability of a so-called 500-year flood, 0.02% in any given year, the danger is not 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 within the 500-year flood zones. Similar to 100-year flood events, 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 flood borne contaminants, damaged by debris flow, or even completely washed away; crops may be damaged or destroyed. Estimated damage totals to vulnerable parcels affected during a 500- year flood event may meet the totals outlined in Table 14.

In addition to flooding's direct effects, the participating jurisdictions may be subject to indirect effects. These may include but are not limited to loss of power, limited travel due to flooded and/or washed-out roads, and limited access to nearby emergency care centers.

Table 14: Extent Scale – Water Depth (Mean Sea level, MSL)

SEVERITY	MSL (IN FEET)	DESCRIPTION
BELOW FLOOD STAGE	0 to 15	Water begins to exceed low sections of banks and the lowest sections of the floodplain.
ACTION STAGE	16 to 23	Flow is well into the floodplain; minor lowland flooding reaches low areas of the floodplain. Livestock should be moved from low lying areas.
FLOOD STAGE	24 to 28	Homes are threatened and properties downstream of river flows or in low lying areas begin to flood.
MODERATE FLOOD STAGE	29 to 32	At this stage the lowest homes downstream flood. Roads and bridges in the floodplain flood severely and are dangerous to motorists.
MAJOR FLOOD STAGE	33 and above	Major flooding approaches homes in the floodplain. Primary and secondary roads and bridges are severely flooded and very dangerous. Major flooding extends well into the floodplain, destroying property, equipment and livestock.

Table 15: Extent for Sutton County

PARTICIPATING COUNTY	ESTIMATED SEVERITY PER FLOOD EVENT1	PEAK FLOOD EVENT2
Sutton	**Action Stage, 16 to 23 feet**	**Peak MSL is unavailable for Sutton County.**

Historical Occurrences

Historical evidence shows that areas within the region are susceptible to flooding, especially in the form of flash flooding. It is important to note that only flood events that have been reported have been factored into this risk assessment, and in most cases NCDC data is limited to flood events that have occurred since 1994. It is likely that additional flood occurrences have gone unreported before and during this recording period. In some instances, historical flood information, as provided by NCDC, shows flood activity across a multi-county forecast area for a particular event. In such instances, an appropriate percentage of the total property and crop damage reported for the entire forecast area has been allocated to each participating county impacted by the event. Table 16 shows historical incident information.

Flood data is generally recorded at the county or city level, there is no specific data regarding flood events for the Sutton County Hospital District or Sonora ISD. However, the hospital district and ISD have flood history that is known to be like the County and its surrounding areas given that it is located in the Sutton County, Texas boundaries. While flood impacts are not limited to jurisdictional boundaries, they can easily impact part or all the surrounding County.

Table 16: Historical Flood Events for Sutton County 2010-2023

Jurisdiction	Events	Deaths	Injuries
Sutton County	27	0	2

Table 17: Sutton County Property Damage Due to Flooding, 2010-2023

Location	Property Damage
Sutton County	$0
City of Sonora	$1,800,000.00
Sutton County Hospital District	$0
Sonora ISD	$0

Significant Events

2018

A devastating major flood event produced 11-17 inches of rain in 45-50 minutes in the Northern part of the county. At the County Court House 4.5 inches of rain accumulated. Two injuries were reported during this flood event. Initial damage assessments estimated about $5 million in damages for the County. City of Sonora equipment damages were estimated at about $1.8 million. Due to surrounding highways being flooded resources were not able to be deployed into the area.

Figure 6: 2018 Flood Event Areas

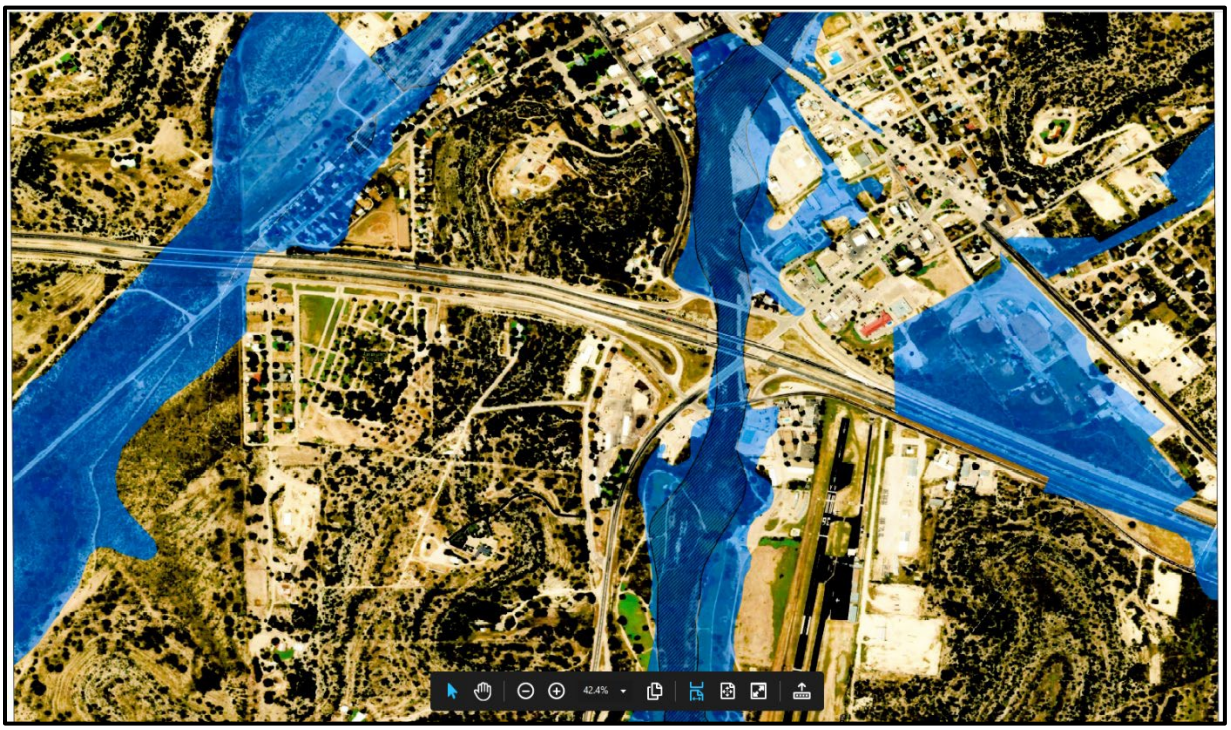


Figure 7: 2018 Flood Aerial View

Figure 8: 2018 Flood Event Aerial View #2

Figure 9: 2018 Flood Event Aerial View #3

Figure 10: 2018 Flood Event Aerial View #4

Probability and Likelihood of Future Events

Based on historical occurrences and extent, flooding is highly likely meaning an event is probable within the next year. This event could affect the entire planning area. The local planning team determined it is probable that Sutton County and the participating jurisdictions will experience a flood event in the next year, meaning an event is highly likely.

In the case of the FEMA 100-year floodplain there is a 1% annual chance, while in the 500-year floodplain there is a 0.02% annual chance. Thus, the likelihood of a 100-year flood event is occasional and the likelihood of a 500-year flood event is unlikely. However, based on the frequency of previous flood events, every jurisdiction can expect to experience some type of flooding that may or may not meet the definition of a 100-year or 500-year event on a more regular basis.

Vulnerability

As described in Section 2 above, Sutton 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.

All structures within the participating jurisdictions are equally vulnerable to flooding.
Given the devastating structural damage inflicted by previous events, future structural damages are expected to be similar but may increase depending on the flooding event.

Climate Change

Climate change is described as a significant change in either the average state of the climate or in its variability over an extended period. Climate change in and of itself is not necessarily a hazard, but it may increase the frequency and/or intensity of identified hazards over time. Climate change could affect communities in a variety of ways, but it is currently unclear what extent the impacts will have on the Planning Area. It is anticipated that hazard-causing events will fluctuate due to climate change over time. As new information and new models are developed, a climate change Risk Assessment may be enhanced to measure and assess these impacts more accurately.

“Climate change may cause river floods to become larger or more frequent than they used to be in some places yet become smaller and less frequent in other places. As warmer temperatures cause more water to evaporate from the land and oceans, changes in the size and frequency of heavy precipitation events may in turn affect the size and frequency of river flooding.”

NFIP

Flood insurance offered through the National Flood Insurance Program (NFIP) is the best way for home and business owners to protect themselves financially against the flood hazard. Sutton County and the City of Sonora are listed as participating NFIP communities in the FEMA Community Status Book Report.

The planning area has developed mitigation actions or analyzed previous actions that relate to either NFIP maintenance or compliance.

The overall priority of each action is reflected in the mitigation actions found in Section V for the local jurisdictions. In prioritizing actions, a community must consider many factors. Of primary consideration is targeting specific mitigation actions for implementation following a major disaster. Other factors that determine prioritization are, in part, ease of implementation by the community, cost of the project vs. perceived benefit, timeframe for implementing the action, and available personnel to oversee and implement the project.

Hurricanes

Hazard Description

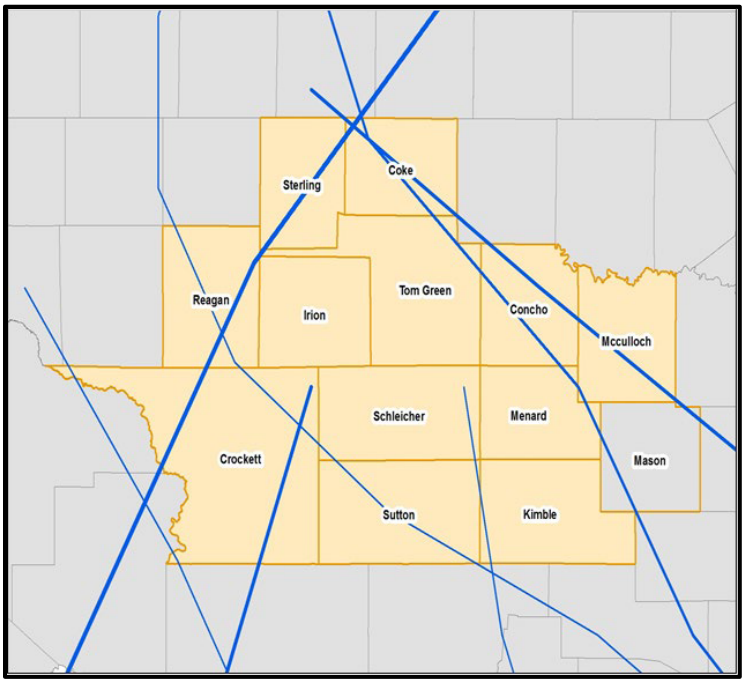
According to the National Oceanic and Atmospheric Administration (NOAA), a hurricane is an intense tropical weather system of strong thunderstorms with well-defined surface circulation and maximum sustained winds of 74 mph or higher. In the Northern Hemisphere circulation of winds near the Earth's surface is counterclockwise.

Hurricanes often begin as tropical depressions that intensify into tropical storms when maximum sustained winds increase to between 35-64 knots (39 – 73 mph). At these wind speeds, the storm becomes more organized and circular in shape and begins to resemble a hurricane. Once sustained winds reach or exceed 74 mph, the storm becomes a hurricane. The intensity of a land falling hurricane is expressed in categories relating wind speeds and potential damage. Tropical storm-force winds are strong enough to be dangerous to those caught in them.

Location

Although the planning area is located inland from the coast, they are still susceptible to the indirect threats of a hurricane, including high winds and flooding. The planning area is outside of the hurricane wind speed hazard areas and is approximately 100 miles northwest of San Antonio, which is the inland extremity of hurricane wind hazard zones. Due to the location outside of the hazard areas, the planning area has and could play host to coastal area residents who evacuate during hurricane events. The location of previous hurricane tracks is shown in Figure 11.

Figure 11: Historical Storm Tracks for Concho Valley



Although tropical storm and hurricane effects begin to diminish as they move inland, the winds Hurricane Harvey alone reached as far as 140 miles from the eye of the storm. The County and all participating jurisdictions are considered susceptible to indirect impacts from hurricanes and tropical storms including high winds and flooding.

Impact and Extent

Hurricanes are categorized according to the strength and intensity of their winds using the Saffir-Simpson Hurricane Scale (See Table 18). A Category 1 storm has the lowest wind speeds, while a Category 5 hurricane has the highest. This scale only ranks wind speed, but lower category storms can inflict greater damage than higher category storms depending on where they strike, the amount of storm surge, other weather they interact with and how slow they move.

Table 18: Saffir-Simpson Hurricane Scale

Category	Maximum Sustained Wind Speed (MPH)	Minimum Surface Pressure (Millibars)	Storme 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+

Based on the historical storm tracks for hurricanes and the location of the planning area outside of the hurricane wind hazard area, the average extent to be mitigated for is a Category 1 storm for the communities in the planning area.

Historical Occurrences

There are no historical occurrences of hurricanes that have impacted Sutton County and the planning jurisdiction, however due to the proximity of the county they are susceptible to the weather conditions such as rain and flooding that will sweep across Texas depending on the path of the hurricane once it has made landfall. As there are no historical occurrences, the County does not have any losses related to hurricanes.

Although hurricanes and tropical storms have made landfall at various categories around the planning area, the storms have usually weakened to tropical storms or depressions by that time, being near the end of their life cycle. With the storms having reduced winds, extreme rainfall is a hazard of concern. In Figure 11, hurricane track widths are reflective of their strength at their strongest magnitude at any location.

While Sutton County Hospital District and Sonora ISD do not have specific information about hurricane history, the histories are assumed to be the same as the City of Sonora and Sutton County. Given the participating jurisdictions locations within the planning area, and the number of facilities located in the hazard area, they are determined to be vulnerable to the hazard despite lacking a specific history of previous events.

Probability and likelihood of Future Events
Based on historical occurrences and the infrequency of significant hurricane wind events, the probability of future events is unlikely, with an event no more frequent than every 10 years. The County and all participating jurisdictions are considered susceptible to direct and indirect impacts from hurricanes.

Vulnerability
Hurricane-force winds can cause major damage to large areas; hence all existing buildings, facilities and populations are equally exposed and vulnerable to this hazard and could potentially be impacted. Warning time for hurricanes has lengthened due to modern and early warning technology. Hurricane-force winds can easily destroy poorly constructed buildings and mobile homes, as well as debris such as signs, roofing materials, and small items left outside which become extremely hazardous in hurricanes and tropical storms. Extensive damage to trees, towers, and underground utility lines (from uprooted trees) and fallen poles cause considerable civic disruption.

The potential severity of impact from a hurricane for the planning area is classified as limited; injuries would be treatable with first aid, critical facilities would not be shut down for more than 24 hours, and less than 10 percent of property would be destroyed.

Population
As described in Section 2 above, Sutton 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 related event.

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

All structures within the participating jurisdictions are equally vulnerable to hurricanes. However, given the lack of structural damage inflicted by previous events, future structural damages are expected to be similarly limited.

Climate Change
Climate change is described as a significant change in either the average state of the climate or in its variability over an extended period. Climate change in and of itself is not necessarily a hazard, but it may increase the frequency and/or intensity of identified hazards over time. Climate change could affect communities in a variety of ways, but it is currently unclear what extent the impacts will have on the Planning Area. It is anticipated that hazard-causing events will fluctuate due to climate change over time. As new information and new models are developed, a climate change Risk Assessment may be enhanced to measure and assess these impacts more accurately.

"Climate change is expected to affect tropical cyclones by increasing sea surface temperatures, a key factor that influences cyclone formation and behavior. The U.S. Global Change Research Program and the Intergovernmental Panel on Climate Change project that tropical cyclones will become more intense over the 21st century, with higher wind speeds and heavier rains."

Wildfire

Hazard Description
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.

Location
The County and all participating jurisdictions are considered susceptible to damage and impacts from wildfires.

Impact and Extent

The overall level of concern (LOC) for wildfire is located mostly along the perimeter of the jurisdiction where wildland and urban areas interface. It is one of the two primary outputs and is a measure of wildfire risk. The LOC can be used to: identify areas where mitigation options may be of value; allow agencies to work together and better define priorities; develop a refined analysis of a complex landscape and fire situations using GIS; and increase communication with residents to address community priorities and needs.

Areas along railroads and people with homes in wooded, rural areas have an increased risk of wildfire. The sparsely populated participating jurisdictions and rural areas of Sutton County can experience large sweeping fires, especially where areas of vegetation are not maintained. If a severe wildfire event were to occur, police stations, volunteer fire departments and schools would be at risk.

Wildfire risk is measured in terms of magnitude and intensity using the Keetch-Byram Drought Index (KBDI), a mathematical system for relating current and recent weather conditions to potential or expected wildfire behavior.

The KBDI determines forest fire potential and is based on a daily water balance, where a drought factor is balanced with precipitation and soil moisture (assumed to have a maximum storage capacity of eight inches) and is expressed in hundredths of an inch of soil moisture depletion. Figure 12 displays the KBDI for Texas 2023.

Each color on the map represents the drought index at that location. The drought index ranges from 0 to 800, where a drought index of 0 represents no moisture depletion, and an index of 800 represents absolutely dry conditions.

These numbers correlate with potential fire behavior as follows:

- 0 - 200 Soil and fuel moisture are high. Most fuels will not readily ignite or burn. However, with sufficient sunlight and wind, cured grasses and some light surface fuels will burn in spots and patches.
- 200 - 400 Fires more readily burn and will carry across an area with no gaps. Heavier fuels will still not readily ignite and burn. Expect smoldering and the resulting smoke to carry into and possibly through the night.

- 400 - 600 Fire intensity begins to significantly increase. Fires will readily burn in all directions exposing mineral soils in some locations. Larger fuels may burn or smolder for several days creating possible smoke and control problems.

- 600 - 800 Fires will burn to mineral soil. Stumps will burn to the end of underground roots and spotting will be a major problem. Fires will burn throughout the night and heavier fuels will actively burn and contribute to fire intensity.

The planning area currently falls mostly within a scale of 0-300, with some areas in the 500-600 range. Table 19 provides information on the average, maximum and minimum KBDI for the planning area. This table should be read in conjunction with the current KBDI index in determining the potential magnitude of a wildfire event. Because the KBDI is a measure of the current readiness of fuels for wildfire, caution should be exercised in dryer, hotter conditions, and the KBDI should be referenced as the area experiences changes in precipitation and soil moisture.

Table 19: Extent for Wildfire for Sutton County

County	Extent to be mitigated (KBDI Range)
Sutton	270-660

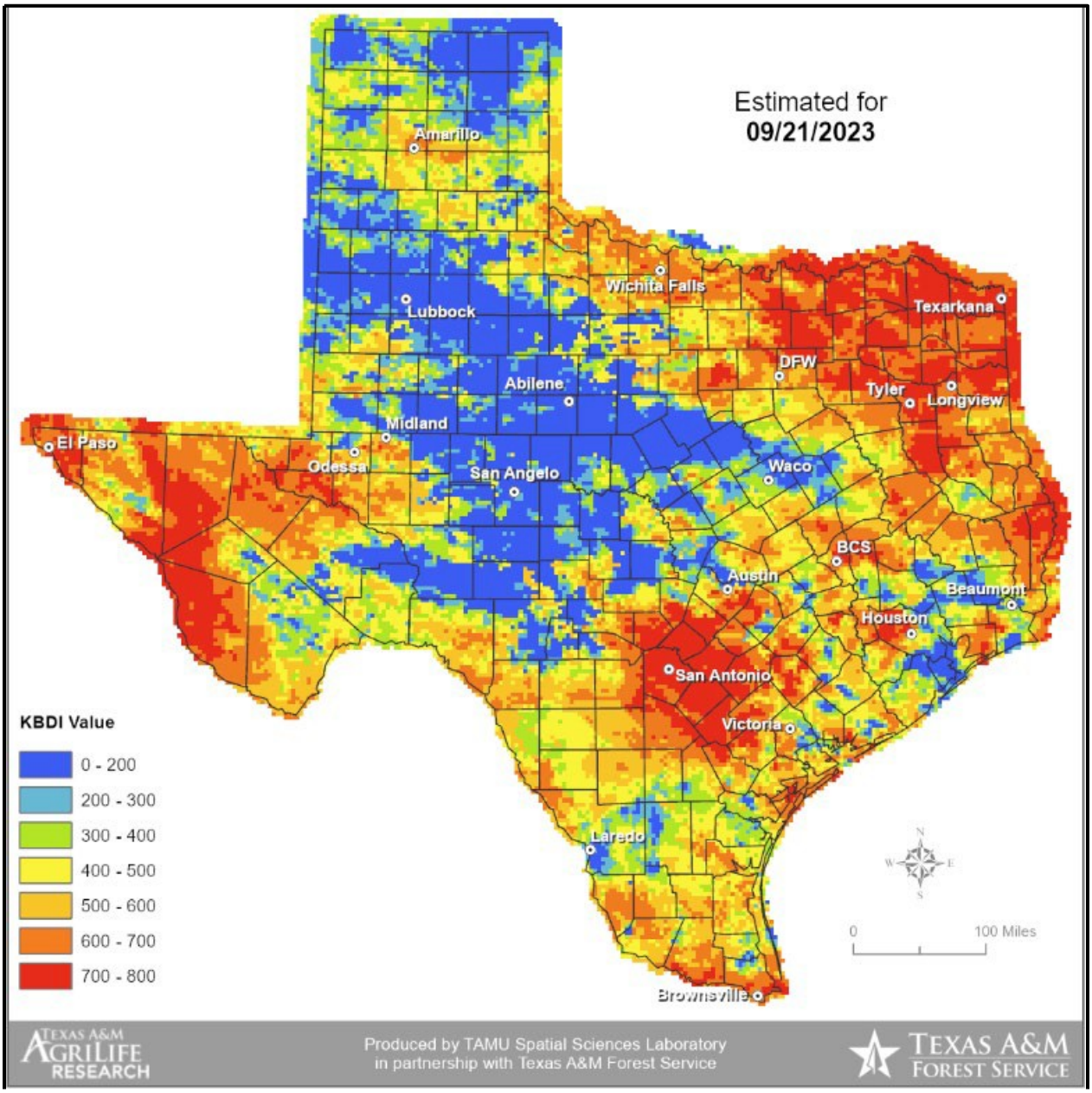


Figure 12: KDBI for Texas 2023

Below are Wildland Urban Interface (WUI)Wildfire Maps for Sutton County and the city of Sonora with their corresponding legend. The fire department is represented by a blue house icon. There is only one in the County, it is located in Sonora.

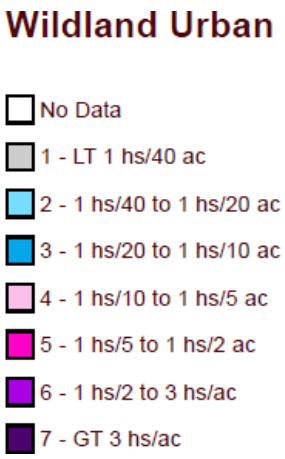


Figure 13: WUI Legend

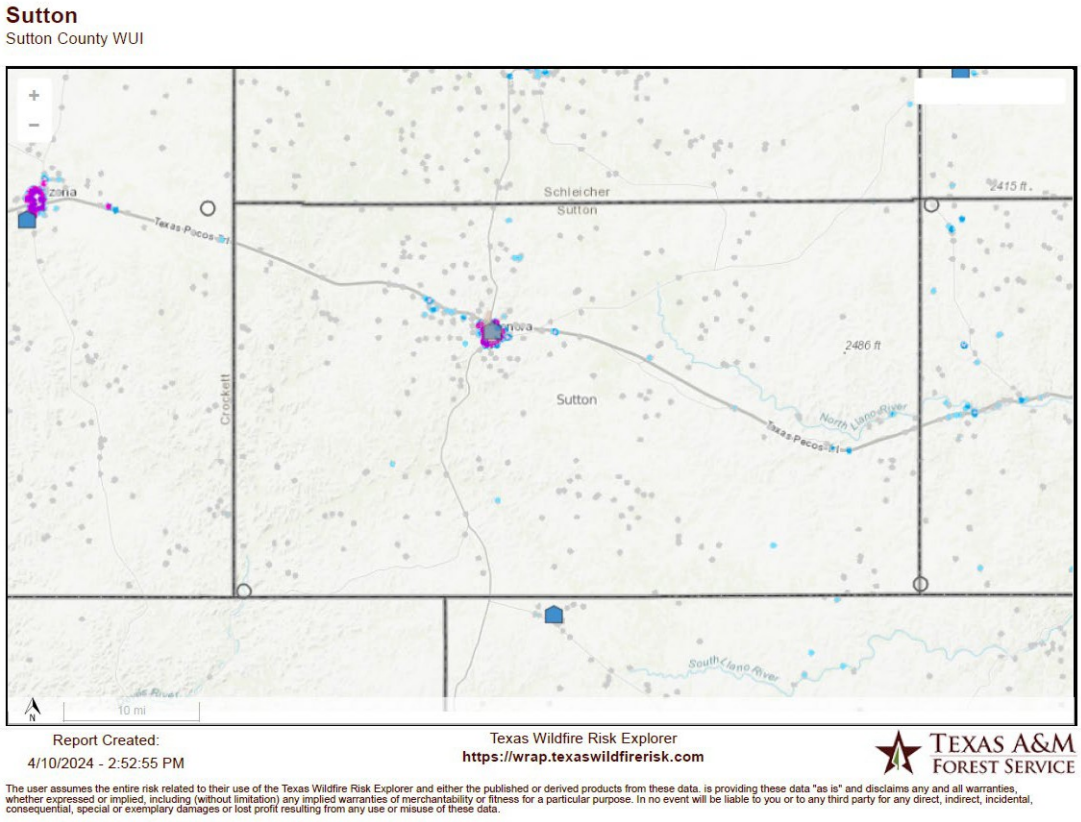


Figure 14: Sutton County WUI

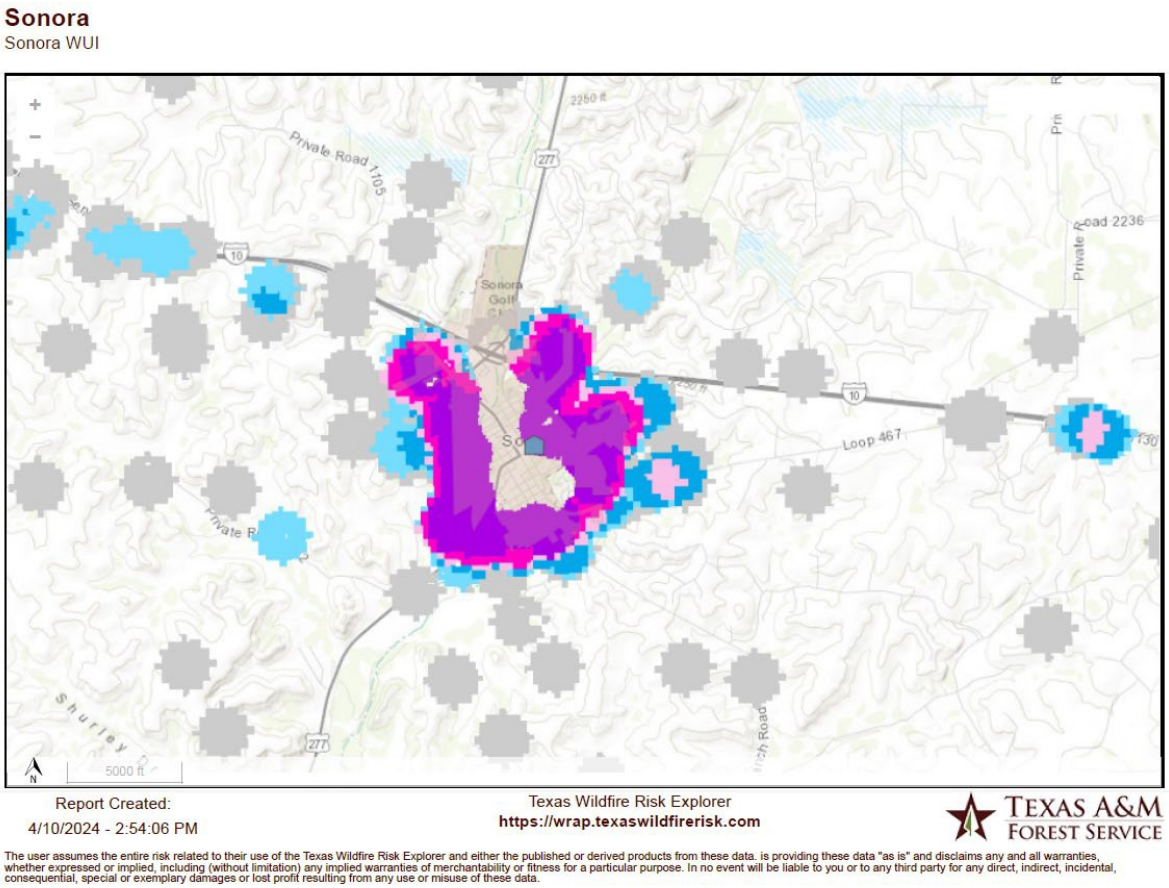


Figure 15: City of Sonora WUI

The wildfire threat of Sutton County is represented in the map below with the corresponding legend.

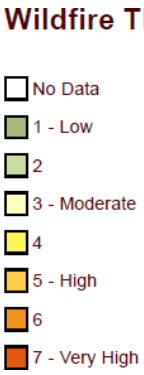


Figure 16: Wildfire Threat Legend

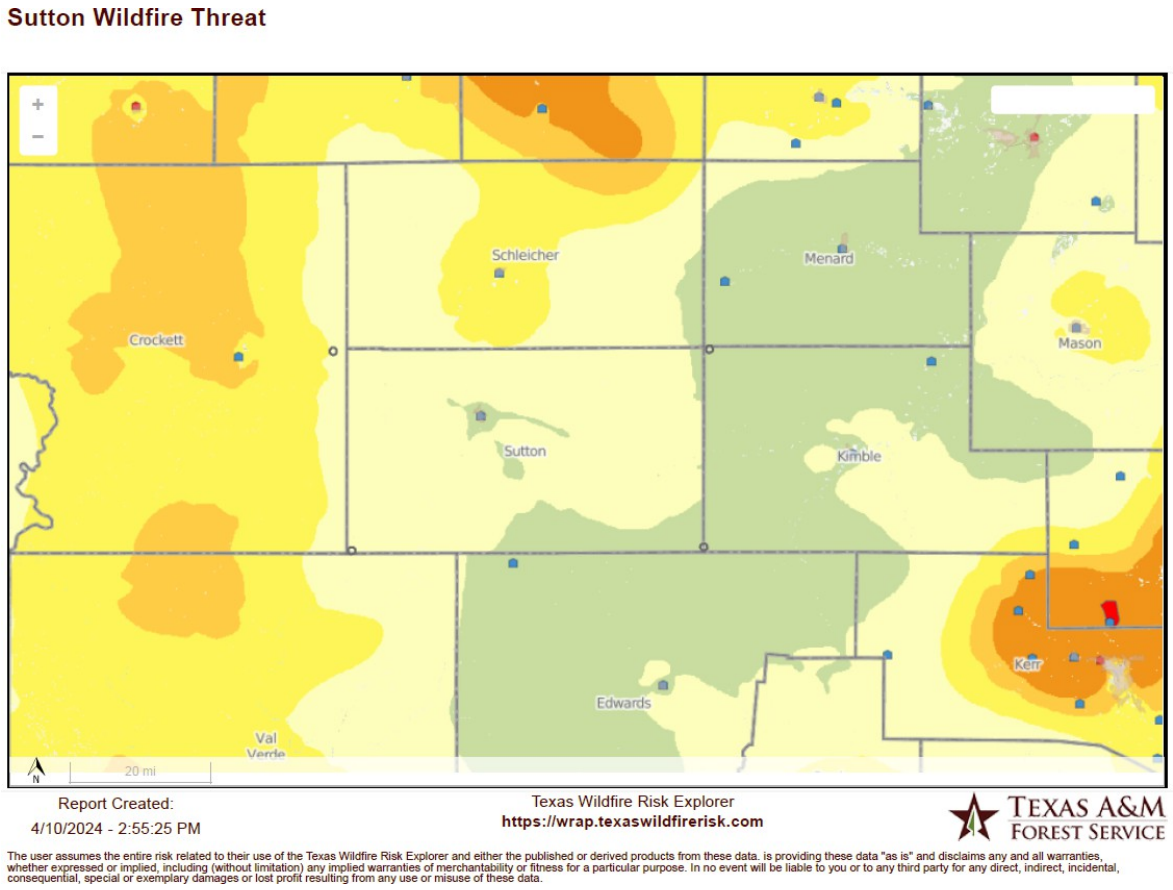


Figure 17: Sutton County Wildfire Threat

History

While Sutton County Hospital District and Sonora ISD do not have specific information about wildfire history, the histories are assumed to be the same as the City of Sonora and Sutton County. Wildfire history is not broken down beyond the city level. Therefore, given the participating jurisdictions locations within the planning area, and the number of facilities located in the wildfire hazard area, they are determined to be vulnerable to the hazard despite lacking a specific history of previous wildfire events.

Table 20: Wildfire events in Sutton County from 2010-2023

County	Years	Number of events
Sutton	2011, 2015, 2017, 2018, 2019, 2020	22

Table 21: Wildfire Events and Acres

Year	Number of Fires	Acres damaged
2011	5	7,494
2015	3	9,180
2017	1	700
2018	3	530
2019	7	6,220
2020	3	10,027

Table 22: Loss due to wildfire in Sutton County 2010-2023

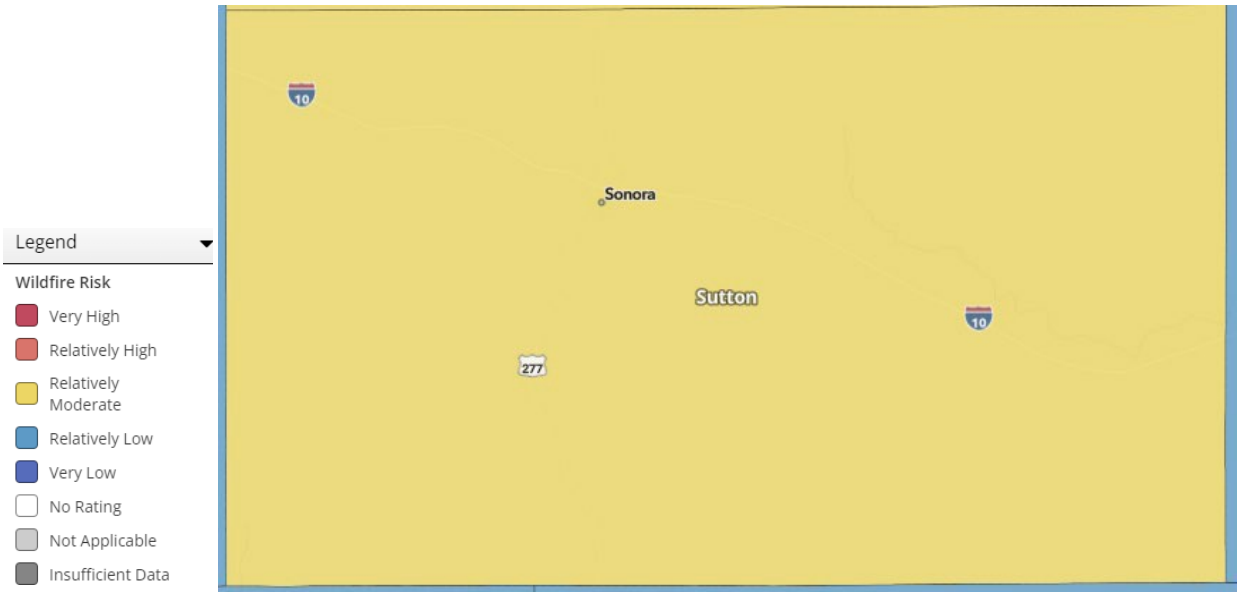
Location	Property Damage
Sutton County	$0
City of Sonora	$31,000.00
Sutton County Hospital District	$0
Sonora ISD	$0

Probability and Likelihood of Future Events

Wildfires can occur at any time of the year. Climatic conditions, such as severe freezes and drought can significantly increase the intensity of wildfires since these conditions kill vegetation, creating a prime fuel source for these types of fires. The intensity of fires and the rate at which they spread are directly related to wind speed, temperature, and relative humidity.

The FEMA National Risk Index has Sutton county listed as having a relatively moderate risk for wildfire.

Figure 18: NRI Wildfire Risk



Vulnerability

As described in Section 2 above, Sutton 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 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.

All structures within the participating jurisdictions are equally vulnerable to wildfire. However, given the minor structural damage inflicted by previous events, future structural damages are expected to be similarly limited.

Climate Change

Climate change is described as a significant change in either the average state of the climate or in its variability over an extended period. Climate change in and of itself is not necessarily a hazard, but it may increase the frequency and/or intensity of identified hazards over time. Climate change could affect communities in a variety of ways, but it is currently unclear what extent the impacts will have on the Planning Area. It is anticipated that hazard-causing events will fluctuate due to climate change over time. As new information and new models are

developed, a climate change Risk Assessment may be enhanced to measure and assess these impacts more accurately.

"Research shows that changes in climate create warmer, drier conditions, leading to longer and more active fire seasons. Increases in temperatures and the thirst of the atmosphere due to climate change has increased the aridity of forest fuels during the fire season. These drivers were found to be responsible for over half the observed decrease in the moisture content of fuels in western U.S. forests from 1979 to 2015, and the doubling of forest fire burned area over the period 1984 to 2015. For much of the U.S. West, projections show that an average annual 1 degree C temperature increase would increase the median burned area per year by as much as 600%."

Tornado

Hazard Description

Tornadoes are among the most violent storms on the planet. A tornado is a violently rotating column of air extending between, and in contact with, a cloud and the surface of the earth. The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 miles per hour or more. In extreme cases, winds may approach 300 miles per hour. Damage paths can be in excess of one mile wide and 50 miles long.

Seasonal patterns are relevant to tornadoes. Thunderstorms form when warm, moist air collides with cooler, drier air. Since these masses tend to come together during the transition from summer to winter, most thunderstorms and resulting tornadoes occur during the spring (April through June) and fall (October through December). Warning time for tornadoes is minimal and ranges from no warning time to 30 minutes.

The most powerful tornadoes are produced by "super-cell thunderstorms." These storms are affected by horizontal wind shears (winds moving in different directions at different altitudes) that begin to rotate the storm. This horizontal rotation can be tilted vertically by violent updrafts, and the rotation radius can shrink, forming a vertical column of very quickly swirling air. This rotating air can eventually reach the ground, forming a tornado.

Severe thunderstorms can produce tornadoes, high winds, and hail—any of which can cause extensive property damage and loss of life. Tornadoes occasionally accompany tropical storms and hurricanes that move over land. They are the most common to the right and front of the storm center path as it comes ashore. Tornadoes vary in terms of duration, wind speed and the toll that they take, as shown in Table 23.

Location

The locations of these incidents are completely random and unpredictable. Sutton County is located in FEMA Wind Zone III; one of the most severe (Figure 19). The County and all participating jurisdictions are considered susceptible to indirect impacts from tornados including high winds. The jurisdictions in the planning area experience a uniform range of intensity for a tornado as evidenced by the location and historical occurrences.

Impact and Extent

A tornado is given a Fujita rating of 0-5, based on the most intense damage along its path. Wind velocities necessary to produce center damage are often associated with the Fujita category, but that practice is often misleading. The Fujita wind estimates are intended to be based upon the expected damage to a well-built residential structure. Poorly built structures can suffer significant structural damage under lesser winds than the Fujita Scale might suggest. Commercial properties may or may not experience the same failures under high wind speeds as residential property. Thus, the Fujita scale is largely a residential scale, with much more care required in assessment after wind damage to a commercial structure. A wider range of construction techniques and

materials can be found in a building section classified as commercial. For example, a concrete/steel reinforced building is much more durable than a typical community convenience store, yet both may be considered commercial in city land use/appraisal data sets.

Since February 2007, the Fujita Scale has been replaced by the Enhanced Fujita Scale Table 23, which retains the same basic design as its predecessor with six strength categories. The newer scale reflects more refined assessments of tornado damage surveys, standardization, and damage consideration to a wider range of structures.

Table 23: Enhanced Fujita Scale for Tornados

Storm Category	3 Second Gust (MPH)	Damage Description
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**	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads; attached garages may be destroyed.
EF2	**111-135**	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
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.

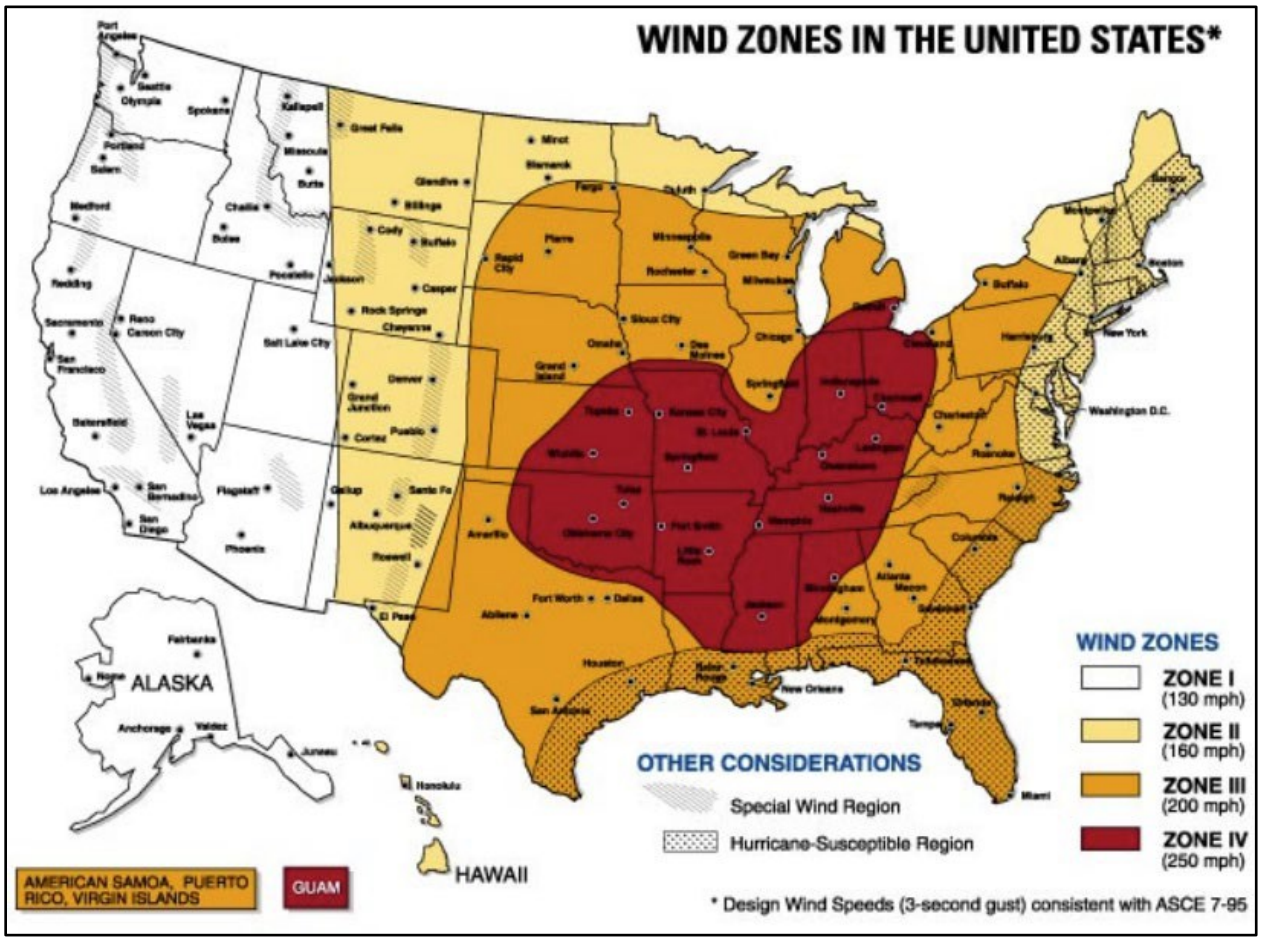


Figure 19: FEMA Wind Zones in the United States

Historical Occurrences

Sutton County has not had any tornadoes touchdown in the county. The table below represents the number of tornado warnings that the County has had. The County and all participating jurisdictions are considered susceptible to direct and indirect impacts from tornadoes. There are no financial losses related to tornado events.

Tornado data is generally recorded at the county or city level, there is no specific data regarding tornado events for the Sutton County Hospital District or Sonora ISD. However, the hospital district and ISD have history that is known to be like the County and its surrounding areas given that it is located in the Sutton County, Texas boundaries. While tornado impacts are not limited to jurisdictional boundaries, they can easily impact part or all the surrounding County.

Table 24: Tornado Warnings in Sutton County from 2010-2023

Jurisdiction	EVENTS
Sutton County	**8**

Significant Events

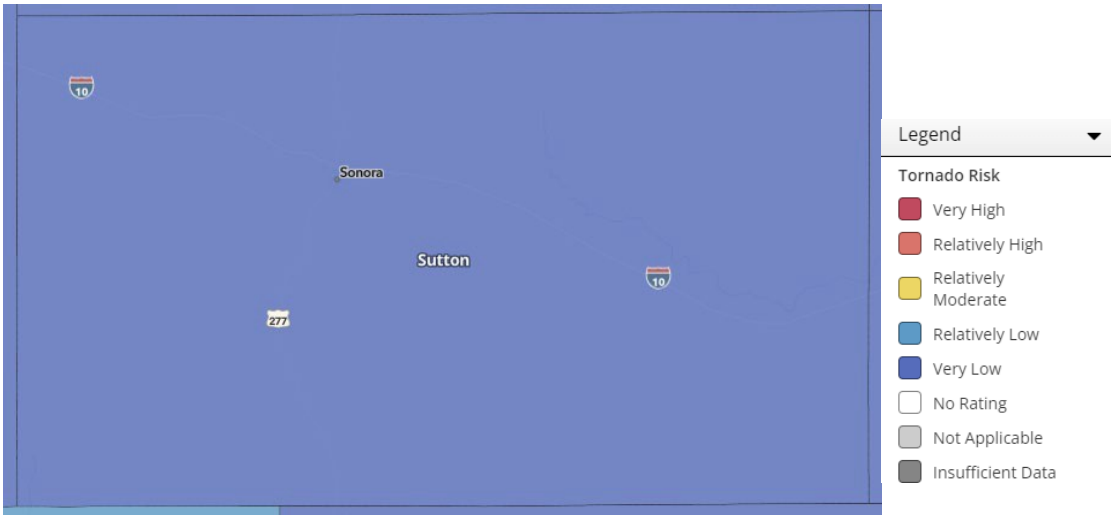
As previously stated, the County has not had any occurrences of tornadoes, however the possibility is there based on the number of warnings issued.

Probability and Likelihood of Future Events

The likelihood of future tornadoes will be determined in consideration of all tornadoes in Sutton County. Tornado events in Sutton County are considered a likely hazard given the frequency of previous warnings and weather conditions in the County and participating jurisdictions, meaning one is possible in the next three years.

The FEMA National Risk Index has Sutton county listed as having a very low risk for tornadoes, however if there were to be a disaster event they would have issues with resiliency due to the rural location and vulnerable communities.

Figure 20: NRI Tornado Risk



Vulnerability

Tornadoes 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.

As described in Section 2 above, Sutton 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.

All structures within the participating jurisdictions are equally vulnerable to tornadoes. However, given the minor structural damage inflicted by previous events, future structural damages are expected to be similarly limited.

Climate Change

Climate change is described as a significant change in either the average state of the climate or in its variability over an extended period. Climate change in and of itself is not necessarily a hazard, but it may increase the frequency and/or intensity of identified hazards over time. Climate change could affect communities in a variety of ways, but it is currently unclear what extent the impacts will have on the Planning Area. It is anticipated that hazard-causing events will fluctuate due to climate change over time. As new information and new models are developed, a climate change Risk Assessment may be enhanced to measure and assess these impacts more accurately.

"Scientists must attempt to predict how climate change might affect the individual weather 'ingredients' that support the development of supercell thunderstorms (the type that produce tornadoes).

These weather ingredients are:

- warm, moist air;
- an unstable atmosphere; and
- wind at different levels moving in different directions at different speeds, a phenomenon known as wind shear.

Some studies predict that climate change could provide the opportunity for more severe thunderstorms to form. However, this does not necessarily mean that more tornadoes will occur, especially in light of the fact that only about 20 percent of supercell thunderstorms produce tornadoes."

Drought

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

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 25: 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.

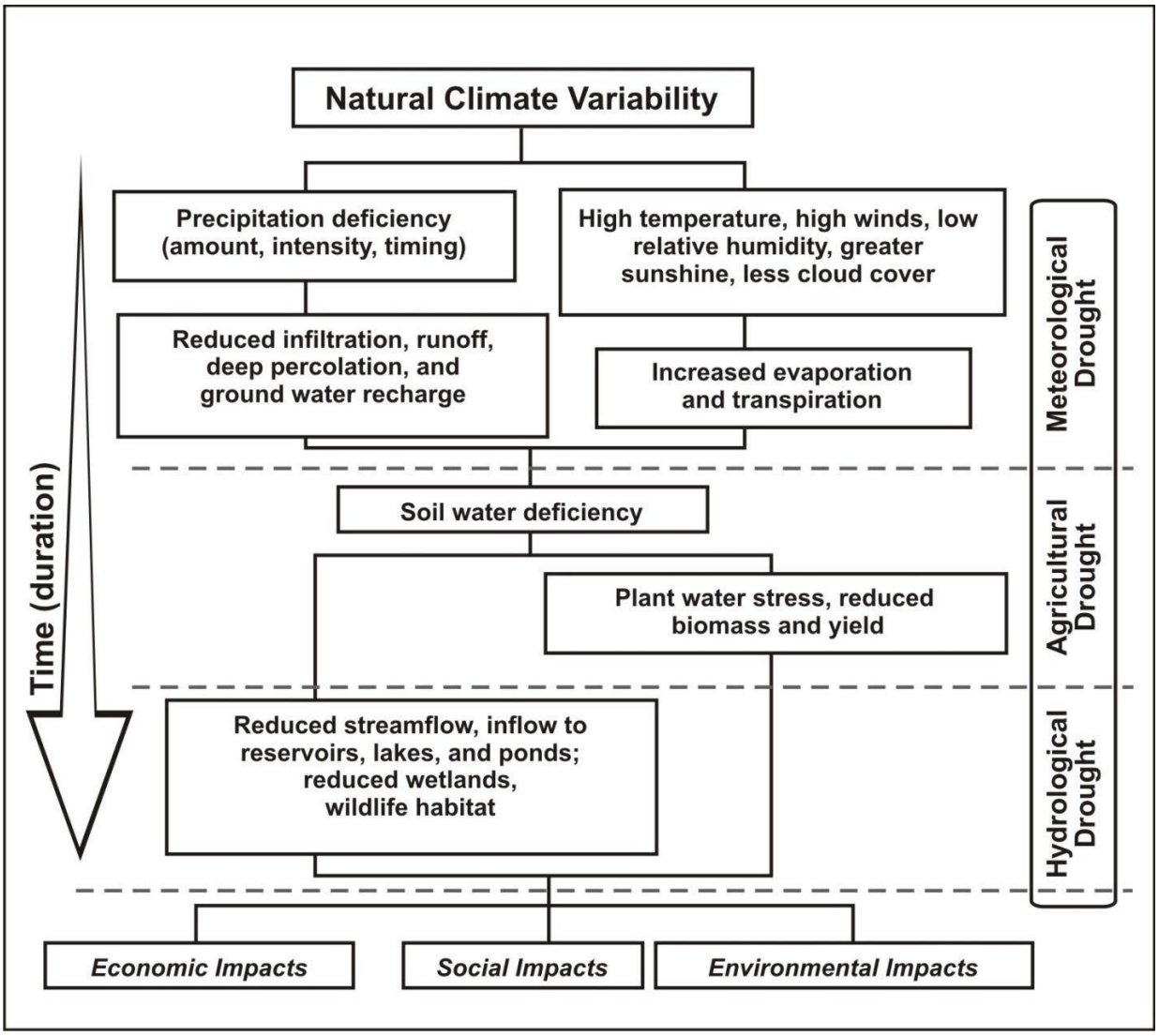


Figure 21: Climate Variability Drought Visual

Location
Drought has no distinct geographic boundary. Drought can occur across all participating jurisdictions. The County and all participating jurisdictions are considered susceptible to direct and indirect impacts from flooding.

Impact and Extent
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, along with other supply shortages.

Since 2000, Sutton County has regularly experienced county-wide droughts classified as periods ranging from abnormal dryness to exceptional drought. Between 2010 and 2013, the entire County, including all participating jurisdictions, was in a state of extreme or exceptional drought, the most severe drought categories.

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.

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

Based on the historical occurrences of drought, Sutton 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 Index but will intensify with duration and ongoing lack of precipitation. Future drought events may reach the intensity of D4 on the Palmer Drought Index.

Table 26: 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 +0.99	+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 27: Palmer Drought Category Descriptions

Category	Description	Possible Impact	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**

Historical Occurrences

Drought data is generally recorded at the county or city level, there is no specific data regarding drought events for the Sutton County Hospital District or Sonora ISD. However, the hospital district and ISD have drought history that is known to be like the County and its surrounding areas given that it is located in the Sutton County, Texas boundaries. While drought impacts are not limited to jurisdictional boundaries, they can easily impact part or all the surrounding County.

Due to the seasonal, long term, and widespread nature of the drought hazard, events occur over the course of one year and the same drought event will be reported by multiple counties in a region. One drought event will not occur repeatedly in a single year.

Table 28 below shows the drought event year and number of events reported during the period 2010 to 2023.

Table 28: Historical Drought events for Sutton County 2010-2023

County	Years	Total Number of Events
Sutton	2010, 2011, 2012, 2013, 2014, 2015, 2019	38

Table 29: Losses in Sutton County from 2010-2023

Location	Property Damage	Crop Damage
Sutton County	$0	$0
City of Sonora	$30,000.00	$0
Sutton County Hospital District	$0	$0
Sonora ISD	$0	$0

Significant Events

In 2011 and 2012 Sutton County had ten (10) events of drought on record. Some of the more extreme events are listed below.

February 1-31, 2011

Very little rainfall resulted in drought conditions returning to West Central Texas. Warm and windy days without rain continued to dry out soil. Burn bans remained in effect in most counties. Some hay fields were being tilled to aerate the soils, large amounts of damage to wheat and other small grain crops from the extremely cold temperatures and dry conditions became evident, very little pasture grass was greening up, livestock remained in fair condition with ongoing supplemental feeding. The Keetch-Byrum Drought Index was in the 500 TO 700 range. The 400 to 600 range is typical of late summer and early fall. In this range, lower litter and duff layers contribute to fire intensity and will burn actively. The 600 to 800 range is often associated with more severe drought with increased wildfire occurrence. Intense, deep burning fires with significant downwind spotting can be expected.

April 1-30, 2011

The U.S. Drought Monitor placed most of West Central Texas in an extreme drought for April. According to the Texas Crop Weather Report issued by the Texas A&M Agriculture Program, the following impacts were noted across West Central Texas: hot, dry and windy conditions persisted, range land and pastures were in poor condition, stock water tank levels were critically low, livestock producers had to provide supplemental feeding due to poor foliage quality, and

some producers sold livestock in order to decrease stocking rates. This extreme drought also resulted in an extremely high fire danger as soil was extremely dry.

February 1-29, 2012

The drought that began in October of 2010, continued to impact the northern Big Country, the Northwest Hill Country and western Crockett County. The drought eased across the remainder of West Central Texas because of cool, wet weather. Rainfall was near to above normal over most of the area except for the region north of Interstate 20.

According to the Texas Crop Report prepared by Texas A&M, pasture and rangeland conditions remained very poor across western Crockett County. The condition of livestock was still generally poor. Most producers were in the calving season and still had to provide supplemental feed. They still found it hard to find alfalfa. When they found it, the price was extremely high.

March 1-31, 2012

The drought continued to grip the Big Country, western Concho Valley, and the Northern Edwards Plateau. Exceptional drought continued to plague the region mainly north of Interstate 20 and west of U.S. Highway 283. The community of Robert Lee continues to build a pipeline that will bring water into the community from the Oak Creek Reservoir and nearby groundwater sources. Although some beneficial rains have fallen, many ranchers have not replenished their herds.

May 1-31, 2012

Although beneficial rains returned to a large part of West Central Texas, there were a few areas that did not receive rainfall. Severe to extreme drought continued to grip much of the Big Country or the region along and north of Interstate 20, and the western portions of the Northern Edwards Plateau (Crockett and western Sutton County). Exceptional drought continued to plague western Fisher County. The community of Robert Lee continues to build a pipeline that will bring water into the community from the Oak Creek Reservoir and nearby groundwater sources. Surface water supplies are still low across the region due to limited runoff from rainfall. The City of San Angelo has enacted drought level two water restriction because of a limited, 17-month water supply. Several other cities like Abilene and Brownwood have also enacted water restrictions because of the dwindling water supplies.

According to the Texas Crop Weather Report issued May 22 by the Texas A&M Agriculture Program, the wheat harvest was in full swing with good yields, much of the wheat was grazed out or baled for hay. Cotton farmers in many areas began planting. Rangeland and pastures were boosted by recent rains, but weeds continued to be a problem in all areas. Coastal Bermuda grass fields still had bare patches from 2011 but were improving. Stock Tanks were full in most areas. Livestock were in good condition. Sheep and goat producers were finishing working goats and shearing sheep. Ranchers became very optimistic and began restocking cattle, sheep and goat herds.

July 1-3, 2012

Severe to exceptional drought continued to grip much of the Big Country or the region north of Interstate 20. Severe drought returned to San Angelo, Eldorado, Sonora, Ozona and surrounding communities with the lack of beneficial rainfall and hot temperatures. Surface water supplies are still low across West Central Texas which includes the Big Country due to limited runoff from rainfall. The City of San Angelo has enacted drought level two water restriction because of a limited, 15-month water supply. Several other cities like Abilene and Brownwood have also enacted water restrictions because of the dwindling water supplies.

According to the Texas Crop Weather Report issued July 31, by the Texas A&M Agriculture Program for the Big Country Region, the dryland cotton crop was suffering from moisture stress and was not growing. Insurance adjusters were adjusting more dryland cotton acres. Pastures were in fair to poor condition. The extreme heat was another concern as cattle producers were seeing stock tanks drying up and well levels dropping. Fly and insect pressure was ongoing. Wildfires were becoming more of a concern.

Over the rest of West Central Texas, the hot, dry conditions continued. Soil-moisture levels continued to decline with high evaporation rates. Most row crops showed severe moisture stress. Although cotton was beginning to bloom, it was also moisture stressed. Irrigation continued where water was available. Producers were cutting and baling hay grazer. More rain was needed to make a second cutting. Grazing was very limited, and producers started feeding hay. Stock-tank water levels dropping. Livestock remained in good condition, though some producers were selling cattle due to high feed costs and very little access to hay.

September 1-30, 2012

The U.S. Drought Monitor issued through the National Drought Mitigation Center on September 25, depicts exceptional drought across Jones and Haskell Counties and shows extreme drought over the Big Country and Sutton County. Meanwhile, the rest of the region was under an extreme drought. The lack of rainfall and very hot conditions have caused the drought to expand across West Central Texas.

According to the Texas Crop Weather Report issued September 25, by the Texas A&M Agriculture Program for the northern Big Country Region, pastures, and rangeland of those counties with exceptional to extreme drought remained in poor condition and needed rain. Stock-water tanks remained low as did lake levels. Some of the dryland cotton was being claimed as a loss. The irrigated cotton will provide some yield.

Surface water supplies are still low across West Central Texas due to limited runoff from rainfall. The City of San Angelo has enacted drought level two water restriction because of a limited, 13-month water supply. Several other cities including Abilene, Ballinger and Brownwood have also enacted water restrictions because of the dwindling water supplies. Over the rest of West Central Texas, the hot, dry conditions continued. Soil-moisture levels continued to decline with high evaporation rates. Most row crops showed severe moisture stress. Stock-tank water levels dropping. Supplemental feeding of livestock continued

Probability and Likelihood of Future Events

Based on occurrence and frequency of past events, it can be expected that a drought event will impact somewhere in the planning area approximately every other year. Hence, the probability of a future drought occurrence is likely, with an event probable within three years.

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.

As described in Section 2 above, Sutton 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. 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.

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.

All structures within the participating jurisdictions are equally vulnerable to drought. However, given the minor structural damage inflicted by previous events, future structural damages are expected to be similarly limited.

Climate Change

Climate change is described as a significant change in either the average state of the climate or in its variability over an extended period. Climate change in and of itself is not necessarily a hazard, but it may increase the frequency and/or intensity of identified hazards over time. Climate change could affect communities in a variety of ways, but it is currently unclear what extent the impacts will have on the Planning Area. It is anticipated that hazard-causing events will fluctuate due to climate change over time. As new information and new models are developed, a climate change Risk Assessment may be enhanced to measure and assess these impacts more accurately.

"As average temperatures have risen because of climate change, the Earth's water cycle has sped up through an increase in the rate of evaporation from soil and transpiration from plants. An increase in evapotranspiration makes more water available in the air for precipitation, but contributes to drying over some land areas, leaving less moisture in the soil. As the climate continues to change, many historically wet areas are likely to experience increased precipitation and increased risk of flooding, while historically dry areas are likely to experience less precipitation and increased risk of drought."

Extreme Cold

Hazard Description

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 winter weather.

Location

Extreme cold has no distinct geographic boundary. Extreme cold can occur across the entire planning area and uniformly affect all participating jurisdictions. The County and all participating jurisdictions are considered susceptible to direct and indirect impacts from extreme cold.

Impact and Extent

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 damage, and it can even be deadly. Any shutdown of facilities due to extreme cold is expected to be temporary.

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 22.

As displayed in Figure 22, 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 Sutton County and the participating jurisdictions may meet the current record temperature of 11˚F. Future extreme cold events may be as intense, long-lasting, and dangerous as previous ones.

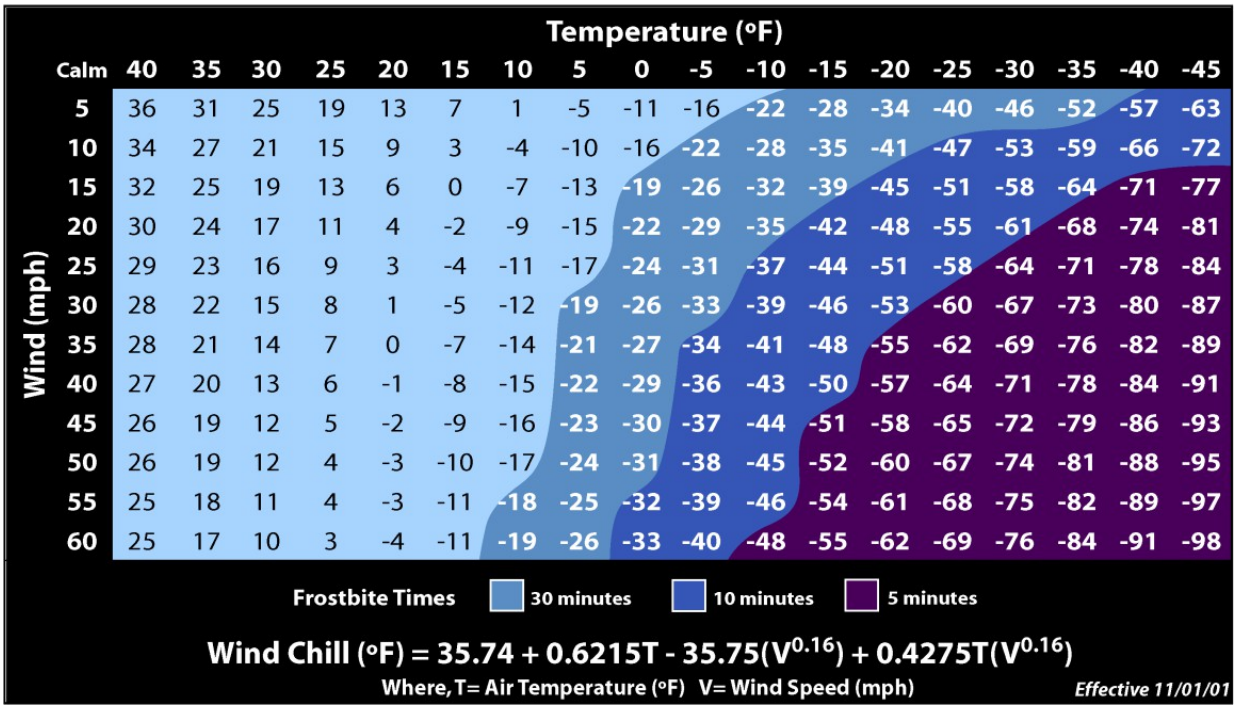


Figure 22: NOAA NWS Wind Chill Index

Historical Occurrence

Extreme cold data is generally recorded at the county or city level, there is no specific data regarding extreme cold events for the Sutton County Hospital District or Sonora ISD. However, the hospital district and ISD have history that is known to be like the County and its surrounding areas given that it is located in the Sutton County, Texas boundaries. While extreme cold impacts are not limited to jurisdictional boundaries, they can easily impact part or all the surrounding County.

Table 30: Sutton County Extreme Cold Historical Events 2010-2023

County	Years	Number of events
Sutton	2010, 2013, 2014, 2015, 2018, 2019, 2020, 2021, 2022, 2023	31

Table 31: Losses in Sutton County from 2010-2023

Location	Property Damage	Crop Damage
Sutton County	$0	$0
City of Sonora	$21,491.15	$0
Sutton County Hospital District	$0	$0
Sonora ISD	$0	$0

Significant Events

In 2021 Sutton County experienced six (6) events related to extreme cold. The most impactful are listed below.

February 2021
Much like the rest of the state of Texas, Sutton County suffered through the 2021 winter storm. This left most of the planning area without power for 4-5 days. There were two fatalities due to the extreme winter conditions. The County faced damage to their infrastructure from water lines to lift stations that were essential in maintaining the planning area safe. Freezing rain, snow, and sleet impacted the area with dangerously low wind chills affecting all the citizens and the critical infrastructure.

Probability and Likelihood of Future Events

A total of 31 unique events have impacted the planning area from 2010 to 2023. It is likely that the planning area will experience a winter storm event; an event is probable within the region within the next three years.

Vulnerability

As described in Section 2 above, Sutton 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 are not 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.

All structures within the participating jurisdictions are equally vulnerable to extreme cold. However, given the minor structural damage inflicted by previous events, future structural damages are expected to be similarly limited.

Climate Change

Climate change is described as a significant change in either the average state of the climate or in its variability over an extended period. Climate change in and of itself is not necessarily a hazard, but it may increase the frequency and/or intensity of identified hazards over time. Climate change could affect communities in a variety of ways, but it is currently unclear what extent the impacts will have on the Planning Area. It is anticipated that hazard-causing events will fluctuate due to climate change over time. As new information and new models are developed, a climate change Risk Assessment may be enhanced to measure and assess these impacts more accurately.

“Stretching of the Arctic polar vortex—a strong band of winds in the stratosphere surrounding the North Pole— has increased with Arctic amplification, and is linked with extreme cold across parts of Asia and North America. Climate change is favorable for increasing Arctic polar vortex stretching events. When the Arctic polar vortex is strong and stable, the polar air remains in place over the North Pole; when the polar vortex weakens or stretches, extremely cold air can dip south. Results show that stronger Arctic polar vortex conditions are decreasing in frequency, while weaker Arctic polar vortex conditions and stretching disruptions are increasing in frequency for October through February.”

Extreme Heat

Hazard Description

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 heat-related deaths in an increasing number over the past ten years. Extreme heat kills more people than hurricanes, floods, tornados, and lightning combined, according to the National Weather Service. In 2023, the EPA reported 1,300 deaths were caused by excessive heat exposure. The CDC reports that in 2022 there were 37 reported cases of heat related illness or injuries in Sutton County.

Location

Extreme heat has no distinct geographic boundary. Extreme heat can occur across the entire planning area and uniformly affect all participating jurisdictions. The County and all participating jurisdictions are considered susceptible to direct and indirect impacts from extreme heat.

Impact and Extent

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. 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 damage, and it can even be deadly. Any shutdown of facilities due to extreme heat is expected to be temporary.

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 23. This index measures how hot it feels outside when humidity is combined with high temperatures.

The extent scale in Figure 23 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.

The National Weather Service (NWS) initiates alerts based on the Heat Index as shown in Table 32.

Given an estimated daily average during the summer is 94˚F with a relative humidity of 55 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 an NWS Heat Advisory.

Between 2010 and 2023 Sutton County and the participating jurisdictions experienced 674 days with highs of 89˚F or hotter and overnight lows of 75˚F or hotter. Based on the NWS descriptions in Table 32, and the average daily humidity level, these days likely warranted a heat advisory.

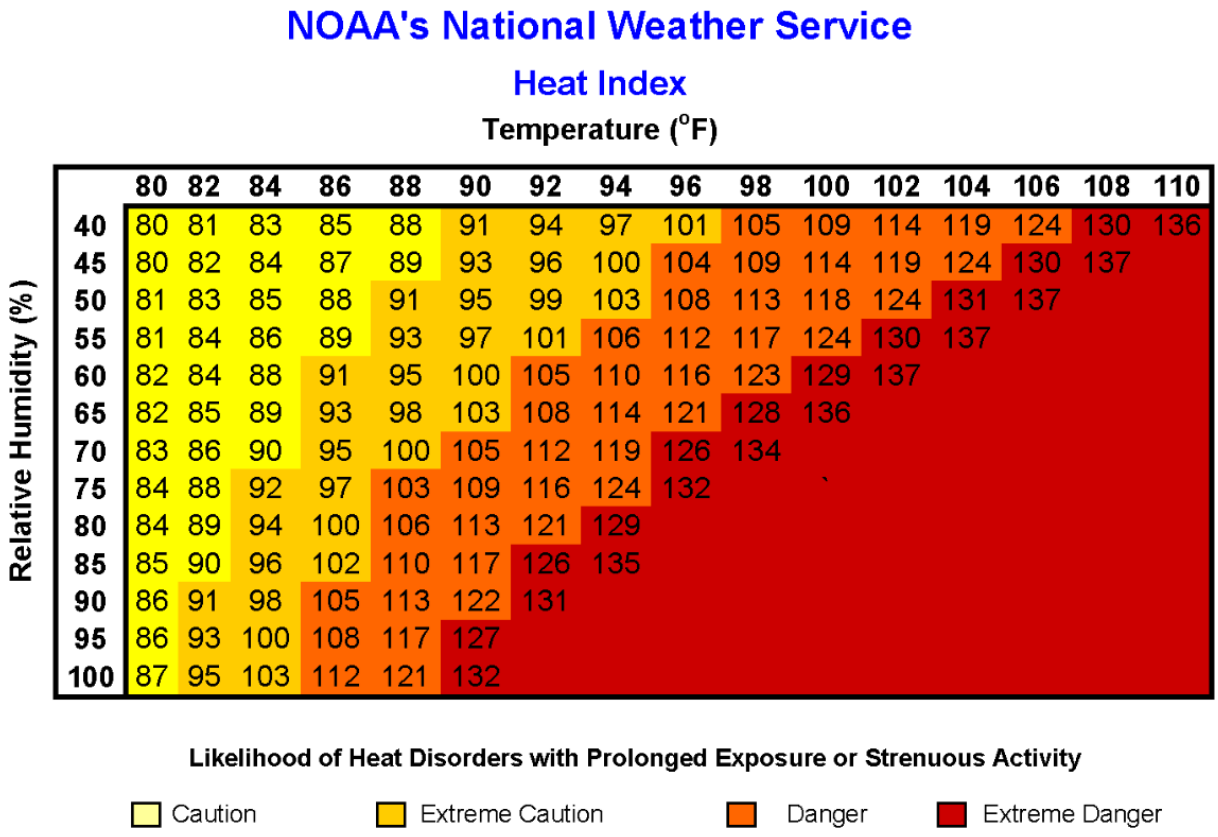


Figure 23: NWS Heat Index

Table 32: NWA Alerts

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.

Historical Occurrence

In the 2018 HMAP, Sutton County and the participating jurisdictions reported that it is highly likely the County will experience extreme heat. The hottest temperature recorded in Sutton County in the recent past, 103˚F, was reached in August 2019.

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. While extreme heat impacts are not limited to jurisdictional boundaries, they can easily impact part or all the surrounding County.

Table 33: Drought events are recorded separately from extreme heat events

County	Years	Number of Events
Sutton	2019	1

Table 34: Losses in Sutton County from 2010-2023

Location	Property Damage	Crop Damage
Sutton County	$0	$0
City of Sonora	$0	$0
Sutton County Hospital District	$80,000.00	$0
Sonora ISD	$0	$0

Probability and Likelihood of Future Events

Based on historic weather data, extreme heat in Sutton 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.

Vulnerability

As described in Section 2 above, Sutton 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.

All structures within the participating jurisdictions are equally vulnerable to extreme heat. However, given the minor structural damage inflicted by previous events, future structural damages are expected to be similarly limited.

Climate Change

Climate change is described as a significant change in either the average state of the climate or in its variability over an extended period. Climate change in and of itself is not necessarily a hazard, but it may increase the frequency and/or intensity of identified hazards over time. Climate change could affect communities in a variety of ways, but it is currently unclear what extent the impacts will have on the Planning Area. It is anticipated that hazard-causing events will fluctuate due to climate change over time. As new information and new models are developed, a climate change Risk Assessment may be enhanced to measure and assess these impacts more accurately.

“Record-setting daily temperatures, heat waves, and cold spells are a natural part of day-to-day variation in weather. As the Earth’s climate warms overall, however, heat waves are expected to become more frequent and more intense. Higher heat index values (which combine temperature and humidity to describe perceived temperature) are expected to increase discomfort and aggravate health issues.”

Hailstorm

Hazard Description

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 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.

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 hail events. The County and all participating jurisdictions are considered susceptible to direct and indirect impacts from hail.

Impact and Extent

The severity of a hailstorm's impact is considered 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 in the participating jurisdictions are considered exposed to this hazard and could potentially be impacted.

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 damage per year.

The scale showing intensity categories in Table 35 was developed by combining data from National Climatic Data Center (NCDC) and the Tornado and Storm Research Organization (TORRO).

Table 35: TORRO Scale for Hail

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	0.80-1.20	Nickel- half dollar	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
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 Hailstorm	3.5-4.0	Softball	Extensive structural damage could cause fatal injuries

According to NCEI data, the worst hailstorms in Sutton County and the participating jurisdictions have produced hail up to 2" in diameter, H5 on the Hailstorm Intensity Scale. Golf ball size hail was seen multiples times in Sutton County.

Future hailstorms may meet previous worst-case H6 storms in terms of strength, intensity, hailstone size, damage dollars inflicted, and the number of residents injured or killed.

Historical Occurrence

Hail data is generally recorded at the county or city level, there is no specific data regarding hail events for the Sutton County Hospital District or Sonora ISD. However, the hospital district and ISD have history that is known to be like the County and its surrounding areas given that it is located in the Sutton County, Texas boundaries. While hail impacts are not limited to jurisdictional boundaries, they can easily impact part or all the surrounding County.

Table 36: Historical Hail Events for Sutton County from 2010-2023

County	Years	Number of Events
Sutton	2010, 2012, 2014, 2015, 2016, 2018, 2019	11

Table 37: Losses in Sutton County from 2010-2023

Location	Property Damage	Crop Damage
Sutton County	$426,434.10	$0
City of Sonora	$0	$0
Sutton County Hospital District	$89,502.68	$0
Sonora ISD	$3,332,755.74	$0

Significant Events

March 19, 2012

Golf ball size hail was reported throughout the City of Sonora and Sutton County.

May 10, 2015

Golf ball size hail was reported among the Interstate and throughout Sutton County. This was reported over a period of three days.

April 2016

Windows were broken and damage was seen throughout the County. Sonora ISD reported severe hail damage to the roof.

Probability and Likelihood of Future Events

Based on the reported past history for the planning area, hail events are highly likely, meaning that an event is probable within the next year.

Vulnerability

As described in Section 2 above, Sutton 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, 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 damage, missing windows or doors, holes in exterior walls or the roof, may sustain more damage 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 damage, injuries, or loss of life.

All structures within the participating jurisdictions are equally vulnerable to hail. However, given the structural damage inflicted by previous events, future structural damages are expected to be similarly limited.

Climate Change

Climate change is described as a significant change in either the average state of the climate or in its variability over an extended period. Climate change in and of itself is not necessarily a hazard, but it may increase the frequency and/or intensity of identified hazards over time. Climate change could affect communities in a variety of ways, but it is currently unclear what extent the impacts will have on the Planning Area. It is anticipated that hazard-causing events will fluctuate due to climate change over time. As new information and new models are developed, a climate change Risk Assessment may be enhanced to measure and assess these impacts more accurately.

"As a result of anthropogenic warming, it is generally anticipated that low-level moisture and convective instability will increase, raising hailstorm likelihood and enabling the formation of larger hailstones; the melting height will rise, enhancing hail melt and increasing the average size of surviving hailstones."

Winter Weather

Hazard Description

Winter weather is defined by extreme cold and heavy concentrations of snowfall or ice. Due to low frequency, severe winter weather storms affect Texas more severely compared to other regions that experience severe winter weather more frequently. The types of severe winter storms 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.

Blizzards are the most perilous of all winter storms, characterized by low temperatures and strong winds of more than 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."

Location

Severe winter weather has no distinct geographic boundary. Severe winter weather can occur across the entire planning area and uniformly affect all participating jurisdictions. The County and all participating jurisdictions are considered susceptible to direct and indirect impacts from winter weather.

Impact and Extent

The potential impact of a severe winter storm is normally minor, resulting in few, if any, injuries. 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 2 above. Although no deaths related to severe winter storms have been reported in the participating jurisdictions, in the worst cases, the hazard has the potential to be deadly. Severe winter storms 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. The planning area's main access roads are I-10 and I-20 which in times of a winter storm may be heavily disrupted. This can lead to using County resources for vehicular accidents that occur in their area and can also lead to delays in transportation of needed resources to the area.

Table 38 below displays the magnitude of severe winter storms.

Based on previous winter storm events, future storms in Sutton County and the participating jurisdictions may see snow accumulation of up to 7" and see ice accumulation of up to .2".

Table 38: Winter Weather Extent Scale

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.
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	Issued when wind chill temperatures are expected to be significant inconvenience to life with prolonged exposure, and, if caution is not exercised, could lead to hazardous exposure.
Wind Chill Warning	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.*

Historical Occurrence

Winter weather data is generally recorded at the county or city level, there is no specific data regarding winter weather events for the Sutton County Hospital District or Sonora ISD. However, the hospital district and ISD have history that is known to be like the County and its surrounding areas given that it is located in the Sutton County, Texas boundaries. While winter weather impacts are not limited to jurisdictional boundaries, they can easily impact part or all the surrounding County.

Table 39: Historical Winter Weather Events in Sutton County 2010-2023

County	Years	Number of events
Sutton	2010, 2013, 2014, 2015, 2018, 2019, 2020, 2021, 2022, 2023	31

Table 40: Losses in Sutton County from 2010-2023

Location	Property Damage	Crop Damage
Sutton County	$0	$0
City of Sonora	$21,491.15	$0
Sutton County Hospital District	$0	$0
Sonora ISD	$0	$0

Probability and Likelihood of Future Events

Future winter storms in Sutton County and the participating jurisdictions are considered likely due to the significant impacts of the historic winter weather, meaning an event affecting any or all of the participating jurisdictions is probable in the next three years.

Vulnerability

While all of the participating jurisdictions are exposed to extreme temperatures, existing buildings, infrastructure, and critical facilities are not considered vulnerable to significant damage 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. The worst snowstorm in any participating jurisdiction dropped up to a maximum of 7". Although it is not impossible 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 1" of snow. Considering the worst ice storms in the participating jurisdictions cause ice accumulations of .2", it is 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.

As described in Section 2 above, Sutton 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.

Climate Change

Climate change is described as a significant change in either the average state of the climate or in its variability over an extended period. Climate change in and of itself is not necessarily a hazard, but it may increase the frequency and/or intensity of identified hazards over time. Climate change could affect communities in a variety of ways, but it is currently unclear what extent the impacts will have on the Planning Area. It is anticipated that hazard-causing events will fluctuate due to climate change over time. As new information and new models are developed, a climate change Risk Assessment may be enhanced to measure and assess these impacts more accurately.

"Warmer temperatures cause more water to evaporate from the land and oceans, which leads to more precipitation, larger storms, and more variation in precipitation in some areas. In general, a warmer climate causes more of this precipitation to fall in the form of rain instead of snow. Some places, however, could see more snowfall if temperatures rise but still remain below the freezing point, or if storm tracks change. Areas near large lakes might also experience more snowfall as

lakes remain unfrozen for longer periods, allowing more water to evaporate. In contrast, other areas might experience less snowfall as a result of wintertime droughts."

Severe Winds

Hazard Description

Severe Winds are classified as any wind that is strong enough to cause at least light damage to trees and buildings, which 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.

Windstorms 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.

Location

Severe winds are not constrained by any distinct geographic boundary. Windstorms can occur across all participating jurisdictions. The County and all participating jurisdictions are considered susceptible to direct and indirect impacts from severe wind.

Impact and Extent

Impacts from a windstorm 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, windstorms may cause injuries and/or be deadly.

The worst severe wind events in Sutton County and the participating jurisdictions have ranged up to 12 on the Beaufort Wind Scale. No recent severe wind events in any of the participating jurisdictions have caused any injuries or deaths. Future severe wind events may meet previous worst-case Force 12 events in terms of strength and intensity of wind speed.

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

Table 41: Beaufort Wind Scale

Beaufort Wind Scale				
Force	**Wind (Knots)**	**WMO Classification**	**Appearance of Wind Effects On Water**	**Appearance of Wind Effects On Land**
0	Less than 1	Calm	Sea surface smooth and mirrorlike	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
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	

Historical Occurrence

Extreme wind data is generally recorded at the county or city level, there is no specific data regarding wind events for the Sutton County Hospital District or Sonora ISD. However, the hospital district and ISD have history that is known to be like the County and its surrounding areas given that it is located in the Sutton County, Texas boundaries. While wind impacts are not limited to jurisdictional boundaries, they can easily impact part or all the surrounding County.

Table 42: Historical Wind Events for Sutton County 2010-2023

County	Year	Number of Events
Sutton	2019	1

Table 43: Losses in Sutton County from 2010-2023

Location	Property Damage	Crop Damage
Sutton County	$0	$0
City of Sonora	$40,000.00	$0
Sutton County Hospital District	$0	$0
Sonora ISD	$0	$0

Significant Events

May 20, 2019

Wind gusts were as high as 45 MPH. A wind advisory was issued due to the likelihood of high winds blowing down limbs, trees, and power lines.

Probability and Likelihood of Future Events

Given the frequency of past events in all jurisdictions, a damaging severe wind event in the future is highly likely, meaning that an event is probable in the next year.

Vulnerability

Windstorms 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 windstorms.

Based on windstorm data collected for the participating jurisdictions, windstorms primarily

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

As described in Section 2 above, Sutton 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 windstorm.

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

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

Climate Change

Climate change is described as a significant change in either the average state of the climate or in its variability over an extended period. Climate change in and of itself is not necessarily a hazard, but it may increase the frequency and/or intensity of identified hazards over time. Climate change could affect communities in a variety of ways, but it is currently unclear what extent the impacts will have on the Planning Area. It is anticipated that hazard-causing events will fluctuate due to climate change over time. As new information and new models are developed, a climate change Risk Assessment may be enhanced to measure and assess these impacts more accurately.

“The Arctic has warmed more than lower latitudes, and as a result the temperature difference between the mid-latitudes and the polar regions has become reduced, which has changed the path of the northern hemisphere jet stream so that it now moves north and south over a greater range of latitudes. As the atmosphere continues to warm, we expect to see much deeper north-south waves, which will cause a slowing down, or even blocking, of the jet stream. This could result in weather systems that persist for much longer than would be considered normal over any particular region.”

“Another recent study found that there will be regional and seasonal variability in winds in the United States as carbon dioxide levels increase by 2100, wind speeds will decrease over most of the western U.S. and the East Coast, but the central U.S. will see an increase.”

Lightning & Thunderstorms

Hazard Description

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 about 20 people each year in the United States.

Thunderstorms are generally considered a common occurrence in the Region. Typical thunderstorms are 15 miles in diameter and last an average of 30 minutes. Despite the short time span, thunderstorms can be extremely dangerous, as they are often strong and fast in their approach and can be accompanied by flash flooding, lightning, hail, tornadoes, and high winds.

Location

Lightning strikes have no distinct geographic boundary. Lightning can occur across each participating jurisdiction. The County and all participating jurisdictions are considered susceptible to direct and indirect impacts from lightning.

Impact and Extent

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. A thunderstorm is measured in terms of intensity based on the strength of the wind speeds or significant winds associated with the thunderstorm event.

A thunderstorm event is typically defined by the National Climatic Data Center (NCDC) based on the intensity and magnitude of wind events associated with the thunderstorm, which can affect the planning area randomly. Because the magnitude of a thunderstorm does not take into account wind speeds from a tornado, but specifically significant winds, the extent to which it can affect the planning area is a range from a Force 10 to a Force 12. Since the greatest wind speed recorded for the area is 80 knots, in preparation for a thunderstorm, the extent to be mitigated is a Force 12

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 Sutton County and all participating jurisdictions may experience lightning events between Lightning Activity Level (LAL) 1 and 5. Dry thunderstorms, LAL 6, are not expected. Activity levels are valuable guidance tools to aid in the preparation for possible fire initiation from cloud-to-ground lightning.

Table 44: Lightning Activity Levels Table

Lightning Activity Level (LAL)		
LAL	**Cloud and Storm Development**	**Lightning Strikes Per Minute**
1	No thunderstorms.	
2	Cumulus clouds are common but only a few reaches 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.	

Table 45: Beaufort Wind Scale

Beaufort Wind Scale				
Force	**Wind (Knots)**	**WMO Classification**	**Appearance of Wind Effects On Water**	**Appearance of Wind Effects On Land**
0	Less than 1	Calm	Sea surface smooth and mirrorlike	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

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	

Historical Occurrence

According to NCEI data, Sutton County and the participating jurisdictions have not experienced any lightning events since the 2018 HMAP. However, lightning events often go unreported, so it is likely that events have occurred since the last plan. There is no data documenting a lightning event more recent than 2009. Sutton County and the participating jurisdictions reported 3 lightning events from 1973 to 2009. There are no losses related to lightning events.

NECI storm events database has no lightning reports for Sutton county from 2010-2023.

Table 46: NECI lightning report for Sutton County 2010-2023

Search Results for Sutton County, Texas

Event Types: Lightning

0 events were reported between 01/01/2010 and 12/31/2023 (5113 days)

Summary Info:

Number of County/Zone areas affected:	0
Number of Days with Event:	0
Number of Days with Event and Death:	0
Number of Days with Event and Death or Injury:	0
Number of Days with Event and Property Damage:	0
Number of Days with Event and Crop Damage:	0
Number of Event Types reported:	0

Lightning data is generally recorded at the county or city level, there is no specific data regarding lightning events for the Sutton County Hospital District or Sonora ISD. However, the hospital district and ISD have history that is known to be like the County and its surrounding areas given that it is located in the Sutton County, Texas boundaries. While lightning impacts are not limited to jurisdictional boundaries, they can easily impact part or all the surrounding County.

While there were no reported lightning events, there have been lots of thunderstorms that could produce lightning and other disastrous weather events.

Table 47: Historical Occurrence of Thunderstorms in Sutton County 2010-2023

County	Year	Number of Events
Sutton	2019, 2020, 2021, 2022, 2023	42

Probability and Likelihood of Future Events

Lightning is especially associated with thunderstorms. Despite the lack of officially 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, most of Sutton County can expect about 8 to 10 lightning flashes per square miles per year.
Available data was evaluated to provide an expected frequency of thunderstorms, potential loss estimates, a description of vulnerability, and a statement of impact of thunderstorm events.

The probability of occurrence for future thunderstorms in the planning area is highly likely, meaning it is likely of a storm event occurring within the next year. According to the NCDC reported historical occurrences, counties within the planning Region experience a severe storm eight times a year. Given this regular frequency of occurrence, it can be expected that future thunderstorms will continue to threaten life and property throughout the planning area.

Vulnerability

According to the Lightning Protection Institute, it is a myth that lightning always strikes the tallest objects. Given lightning's indiscriminate nature, it is impossible to identify buildings or populations 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.

All structures within the participating jurisdictions are equally vulnerable to lightning. However, given the lack of structural damage inflicted by previous events, future structural damages are expected to be similarly limited.

Climate Change

Climate change is described as a significant change in either the average state of the climate or in its variability over an extended period. Climate change in and of itself is not necessarily a hazard, but it may increase the frequency and/or intensity of identified hazards over time. Climate change could affect communities in a variety of ways, but it is currently unclear what extent the impacts will have on the Planning Area. It is anticipated that hazard-causing events will fluctuate due to climate change over time. As new information and new models are developed, a climate change Risk Assessment may be enhanced to measure and assess these impacts more accurately.

"New research from the University of California, Berkeley, found warming conditions would result in 50% more lightning strikes by the end of the century. The scientists found lightning strikes would increase by about 12% for every 1C of warming."

Earthquake

Hazard Description

Earthquakes are defined as the shaking or trembling of the earth that is volcanic or tectonic in origin. A quake with magnitude 3 may do no more than startle people and rattle dishes within a one square mile region. However, a magnitude 7 would be felt by people over the entire State of Texas, and could do significant damage to buildings, bridges, and dams over a considerable region.

Location

Earthquakes have no distinct geographic boundary in Sutton County. Earthquakes can equally affect all jurisdictions addressing the hazard. Despite the lack of geographic boundary, damage is expected to be negligible in most participating jurisdictions. The County and all participating jurisdictions are considered susceptible to direct and indirect impacts from earthquakes.

Impact and Extent

Impacts may include structural damage to buildings of all types. Road networks that pass through the participating jurisdictions may be damaged to the point of failure as the ground shifts. Water and wastewater systems may fail due to cracks and breaks in underground tanks and pipe networks.

Earthquake strength is generally measured on the Richter Magnitude Scale. The Modified Mercalli Intensity Scale for Earthquakes provides an additional means of describing an earthquake's effects.

A future earthquake affecting Sutton County and the participating jurisdictions may meet or exceed previous events up to a 6.0 on the Richter Magnitude Scale or a VIII on the Modified Mercalli Intensity Scale.

Table 48: Richter Magnitude Scale

Richter Magnitude Scale		
Magnitude	**Earthquake Effects**	**Estimated Number Each Year**
2.5 or less	Usually not felt but can be recorded by seismograph	900,000
2.5 to 5.4	Often felt, but only causes minor damage	30,000
5.5 to 6.0	Slight damage to buildings and other structures	500
6.1 to 6.9	May cause a lot of damage in very populated areas	100
7.0 to 7.9	Major earthquake, serious damage	20
8.0 or greater	Great earthquake; can destroy communities near the epicenter	One every 5 to 10 years.

Table 49: Modified Mercalli Intensity Scale for Earthquakes

Modified Mercalli Intensity Scale			
Scale	**Intensity**	**Description of Effects**	**Corresponding Richter Scale Magnitude**
I	Instrumental	Detected only by seismographs	<4.2
II	Feeble	Some people feel it	<4.2
III	Slight	Felt by people resting, like a truck rumbling by	<4.2
IV	Moderate	Felt by people walking	<4.2
V	Slightly Strong	Sleepers awake; church bells ring	<4.8
VI	Strong	Trees sway, suspended objects swing, objects fall off shelves	<5.4
VII	Very Strong	Mild alarm; walls crack; plaster falls	<6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged	
IX	Ruinous	Some houses collapse; ground cracks; pipes break open	<6.9
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread	<7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes, and cables destroyed; general triggering of other hazards	<8.1
XII	Catastrophic	Total destruction: trees fall or ground rises and falls in waves	>8.1

Historical Occurrence

Earthquake data is generally recorded at the county or city level, there is no specific data regarding earthquake events for the Sutton County Hospital District or Sonora ISD. However, the hospital district and ISD have history that is known to be like the County and its surrounding areas given that it is located in the Sutton County, Texas boundaries. While earthquake impacts are not limited to jurisdictional boundaries, they can easily impact part or all the surrounding County. There are no financial losses related to earthquake events.

Table 50: Earthquakes in Sutton County from 2010-2023

County	Years	Number of Events
Sutton	2023	2

Significant Events

October 8, 2023

A magnitude 2.1 was felt in Northwest Sutton County. It was 5.01 km deep in the earth with an epicenter at 31.138, -101.197.

March 16, 2023

A magnitude 2.1 was felt in Northwest Sutton County. It was 2.03 km deep in the earth with an epicenter at 31.13433838, -101.2382098.

Probability and Likelihood of Future Events

Given the proximity but infrequency of earthquakes within the area, an earthquake that could affect any or all of the participating jurisdictions is unlikely, meaning that one is possible in the next 10 years.

Vulnerability

As described in Section 2 above, 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 an earthquake. Structures in substandard condition ahead of an earthquake may be more likely to suffer additional damages, including irreparable foundation or structural damages as the ground shifts. Depending on their means, these residents may require additional assistance recovering from earthquake-caused damage.

All structures within the participating jurisdictions are equally vulnerable to earthquakes. However, given the minor structural damage inflicted by previous events, future structural damages are expected to be similarly limited.

Climate Change

Climate change is described as a significant change in either the average state of the climate or in its variability over an extended period. Climate change in and of itself is not necessarily a hazard, but it may increase the frequency and/or intensity of identified hazards over time. Climate change could affect communities in a variety of ways, but it is currently unclear what extent the impacts will have on the Planning Area. It is anticipated that hazard-causing events will fluctuate due to climate change over time. As new information and new models are developed, a climate change Risk Assessment may be enhanced to measure and assess these impacts more accurately.

“The largest climate variable that could change fault stress loads is surface water in the form of rain and snow. As it turns out, changes in stress loads on Earth’s crust from periods of drought can, in fact, be significant. Research by JPL scientist Donald Argus and others in 2017 using data from a network of high-precision GPS stations in California, Oregon and Washington found that

alternating periods of drought and heavy precipitation in the Sierra Nevada between 2011 and 2017 actually caused the mountain range to rise by nearly an inch and then fall by half that amount, as the mountain rocks lost water during the drought and then regained it. The study did not specifically look at potential impacts on faults, but such stress changes could potentially be felt on faults in or near the range."

Dam Failure

Hazard Description

Dams are water storage, control or diversion structures that impound water upstream in reservoirs. Dam failure can take several forms, including a collapse of, or breach in, the structure. While most dams have storage volumes small enough that failures have few or no repercussions, dams storing large amounts can cause significant flooding downstream. Dam failures can result from anyone, or a combination, of the following causes:

- Prolonged periods of rainfall and flooding, which cause most failures.
- Inadequate spillway capacity, resulting in excess overtopping of the embankment.
- Internal erosion caused by embankment or foundation leakage or piping.
- Improper maintenance, including failure to remove trees, repair internal seepage problems, or maintain gates, valves, and other operational components.
- Improper design or use of improper construction materials.
- Failure of upstream dams in the same drainage basin.
- Landslides into reservoirs, which cause surges that result in overtopping.
- High winds, which can cause significant wave action and result in substantial erosion.
- Destructive acts of terrorists; and
- Earthquakes, which typically cause longitudinal cracks at the tops of the embankments, lead to structural failure.

Benefits provided by dams include water supplies for drinking, irrigation, and industrial uses; flood control; hydroelectric power; recreation; and navigation. At the same time, dams also represent a risk to public safety. Dams require ongoing maintenance, monitoring, safety inspections, and sometimes even rehabilitation to continue safe service.

In the event of a dam failure, the energy of the water stored behind the dam is capable of causing rapid and unexpected flooding downstream, resulting in loss of life and great property damage. A devastating effect on water supply and power generation could be expected as well. The terrorist attacks of September 11, 2001, generated increased focus on protecting the country's infrastructure, including ensuring the safety of dams.

One major issue with the safety of dams is their age and the average age of America's 80,000 dams is 51 years. More than 2,000 dams near population centers are in need of repair, according to statistics released in 2009 by the Association of State Dam Safety Officials. In addition to the continual aging of dams, there have not been significant increases in the number of safety inspectors resulting in haphazard maintenance and inspection.

The Association of State Dam Safety Officials estimate that $16 billion will be needed to fix all high-hazard dams, but the total for all state dam- safety budgets is less than $60 million. The current maintenance budget does not match the scale of America's long-term modifications of its watersheds. Worse still, more people are moving into risky areas. As the American population grows, dams that once could have failed without major repercussions are now upstream of cities and development.

Location

Dam failure can happen at any dam location in Sutton County. Dam failure can equally affect all jurisdictions addressing the hazard. Depending on the size and impact of the dam failure, damage is expected to be negligible in most participating jurisdictions.

The State of Texas has 7,413 dams, all regulated by the Texas Commission on Environmental Quality (TCEQ). Of these, 854 are considered "high-hazard," 779 are considered "significant-hazard," and 5,780 are considered "low-hazard." According to the American Society of Civil Engineers' "Report Card," the Association of State Dam Safety Officials reports that there are 403 unsafe dams in Texas. All dams in the planning area are listed in Table 51 with latitude and longitude information.

Table 51: Dam Locations and Storage Capacity for Sutton County

COUNTY	SITE NO.	LATITUDE	LONGITUDE	HEIGHT (Ft.)	STORAGE (Acre Feet)
Sutton	Dry Devils & Lowrey WS SCS Site 3	30.695	-100.68333	38	**10,643**
Sutton	Dry Devils & Lowrey WS SCS Site 4	30.68833	-100.69167	40	**2,755**
Sutton	Dry Devils & Lowrey WS SCS Site 6	30.685	-100.62833	43	**2,187**
Sutton	Dry Devils & Lowrey WS SCS Site 7	30.64833	-100.675	35	**5,560**
Sutton	Dry Devils & Lowrey WS SCS Site 5	30.685	-100.62	52	**9,610**
Sutton	Dry Devils & Lowrey WS SCS Site 9	30.675	-100.55833	34	**1,289**
Sutton	Dry Devils & Lowrey WS SCS Site 10	30.63667	-100.58833	48	**4,020**

Sutton	Dry Devils & Lowrey WS SCS Site 11	30.60833	-100.605	48	**9,756**
Sutton	Dry Devils & Lowrey WS SCS Site 12	30.59333	-100.61333	37	**2,076**
Sutton	Dry Devils & Lowrey WS SCS Site 13	30.565	-100.63	32	**659**
Sutton	Dry Devils & Lowrey WS SCS Site 8	30.6	-100.65	34	**3,981**
Sutton	Fort Terrett Ranch River Dam	30.47	-100.18333	10	**62**
Schleicher	Dry Devils and Lowrey WS SCS Site 2	30.719	-100.720	48	**9,232**

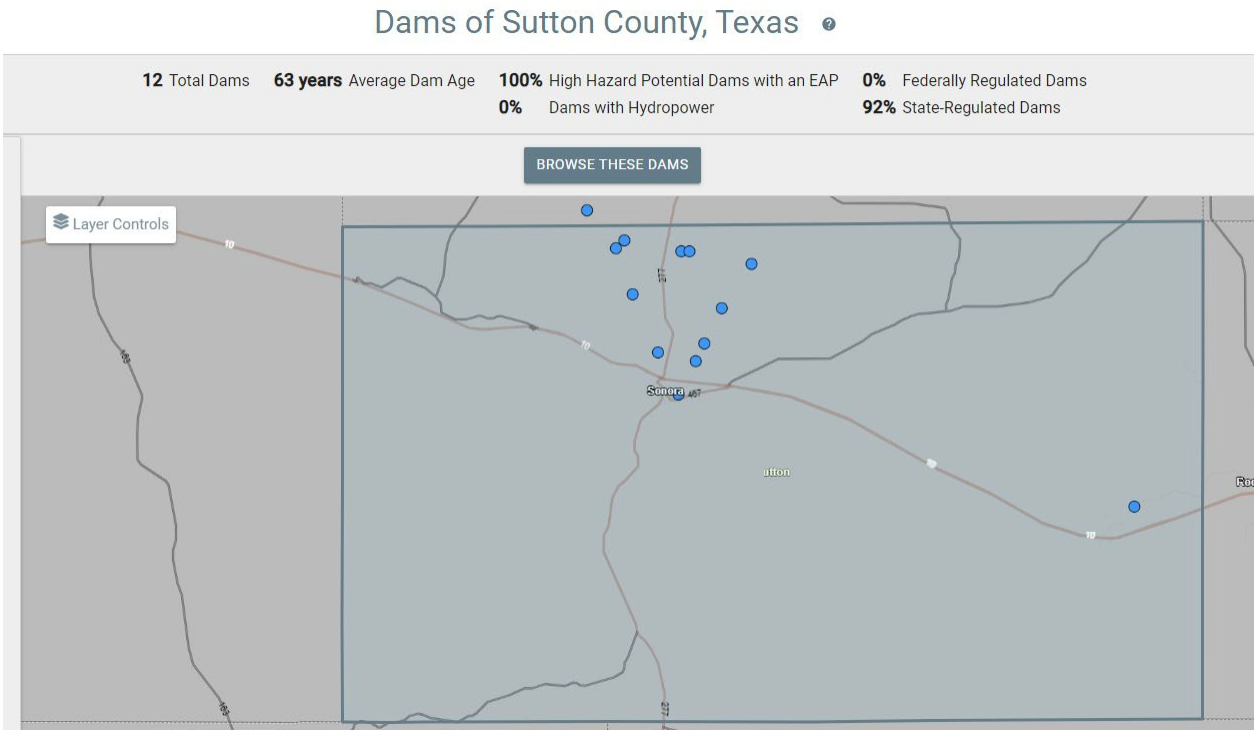


Figure 24: Sutton County Dams

Impact and Extent

Significant and high hazard dams are in both rural and populated areas in the planning area. Although low hazard dams are those at which failure or mis-operation probably would not result in loss of human life and would cause limited economic and/or environmental losses, damage to agriculture and housing is possible due to the amount of low hazard dams in each county.

If there were to be disruption to the Dry Devils and Lowrey WS SCS Site 2 located in Schleicher County there is a potential impact to the planning area, due to the proximity of this dam.

Flooding is the most prominent effect of dam failure. If the dam failure is severe enough, a large amount of water would enter the downstream waterways forcing them out of their banks.

The extent or magnitude of a dam failure event is described in terms of the classification of the damages that could result from a dam's failure, not the probability of failure. The National Interagency Committee on Dam Safety defines high hazard dams as those where failure or mis-operation will cause loss of human life. Prior to 2009, high hazard dams were defined as those at which failure or mis-operation would probably cause loss of human life. Dams classified as "significant" were those at which failure or mis-operation probably would not result in loss of human life but could cause economic loss, environmental damage, disruption of lifeline facilities, or other significant damage. Low hazard potential dams are those at which failure or mis-operation probably would not result in loss of human life but would cause limited economic and/or environmental losses. Losses would be limited mainly to the owner's property. Classifications for extent after 2009 are found in Table 52 below.

Table 52: Extent Classifications

Hazard Potential Classification	Loss Of Human Life	Dam Storage Capacity
Low	None Expected	Less than 10,000 acre-feet
Significant	Probable (1 to 6)	Between 10,000 and 100,000 acre-feet
High	Loss of Life Expected (7 or More)	100,000 acre-feet or more

The extent or average magnitude of a dam failure event that could be expected is shown in Table 53. The extent classification was determined by taking the average of dams in each jurisdiction and weighing low hazard dams as a 1, significant hazard dams as a 2, and high hazard dams as a 3 based on the potential severity, warning time, and duration.

Table 53: Extent by Jurisdiction

Jurisdiction	Dams & Classification	Extent Classification	Level Of Intensity To Mitigate
Sutton County	12 – Total 10 – High 2 – Low	High	The County has eleven high hazard dams, therefore in the event of a dam failure loss of life is expected.
Sonora	None	Low	There are no dams located within the city limits; however, there are two low hazard dams located right outside of the city limits.

Historical Occurrence

There has not been a recorded dam failure event in the planning area. There are no financial losses associated with dam failure.

Probability and Likelihood of Future Events

No historical events of dam failure have been recorded in the planning area, though the risk of dam failure is monitored closely. Due to the lack of historical occurrences, the probability of a future event is unlikely, meaning an event is possible within the next ten years.

Vulnerability

As described in Section 2 above, 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 dam failure event. Structures in substandard condition ahead of a dam failure event may be more likely to suffer additional damages, including irreparable foundation or structural damages as the ground shifts. Depending on their means, these residents may require additional assistance recovering from damage.

A dam breach could result in multiple deaths with facilities being shut down for 30 days or more, and more than 50 percent of property destroyed or damaged. For these reasons, creating mitigations actions to remove or protect people and structures from the path of destruction is necessary in order to minimize impact from dam failure.

All structures within the participating jurisdictions are equally vulnerable to dam failure. However, given the lack of previous events, future structural damage is expected to be limited.

Climate Change

Climate change can impact dam failure. Large dams as well as protective dikes and levees are critical infrastructures whose failure has high economic and social consequences. Dams can "weaponize" flooding events and turn water flows into a catastrophic disaster. Floods causing dams to crest can happen at any time, do not have to be forecast and the failure of a dam can happen in waves and depart faster than a tsunami. Dams as well as protective dikes and levees are critical infrastructures whose associated risk must be properly managed in a continuous and updated process. Usually, dam safety management has been carried out assuming stationary climatic and non-climatic conditions. However, the projected alterations due to climate change are likely to affect different factors driving dam risk.

Most risk assessments in the past assumed a stationary condition in the variability in climate phenomena, including the frequency and magnitude of extreme events. However, changes in climate factors such as variations in extreme temperatures or frequency of heavy precipitation events are likely to affect the different factors driving dam risks. The assumptions of stationary climatic baselines are no longer appropriate for long-term dam safety management. Researchers suggest performing an update of risk components (loads, system response, and consequences) to take into account the new climate change scenarios becomes imperative for adaptation and decision-making support under a more resilient approach.

Section V: Mitigation Strategy

Capability Assessment

Sutton County and the participating jurisdictions have shown themselves to be highly capable. The ISD and Hospital District were unable to participate in the previous plan but have been an active participant in the update and assessment of hazards that they face.

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.

Table 54: Capability Assessment by Jurisdiction

Sutton County
Floodplain Management
Emergency Management
Tax Collection
Economic Development
Grant Writing
State and Federal Grant Funding
Road and Bridge Management
General Budgeting

City of Sonora
Floodplain Management
Emergency Management
Zoning
Code Enforcement
Comprehensive Planning
Economic Development
Grant Writing
General Budgeting
State and Federal Grant Funding
Tax Collection

Sutton County Hospital District
Emergency Planning
Grant Writing
State and Federal Grant Funding
Facilities Management

Sonora Independent School District
Emergency Planning
Grant Writing
State and Federal Grant Funding
Facilities Management

Table 55: Building Codes per Jurisdiction

Jurisdiction	Codes	Description
Sutton County	ICC – International Building Codes	The County defers to the State of Texas, which recommends the International Building Codes. NFIP standards are always promoted during code inspection process for compliance. The County has no enforcement in place.
City of Sonora	ICC – International Building Codes	The City of Sonora has adopted the 2015 International Building Codes, including Residential Code, Plumbing Code, Mechanical Code, Fuel Gas Code, Energy Code, and Electrical Code. NFIP standards are always promoted during code inspection process for compliance.
Sutton County Hospital District	ICC – International Building Codes	Sutton County Hospital District defers to the City of Sonora and State of Texas, which recommends the 143 International Building Codes. They are compliant with NFIP standards. The Hospital District has no enforcement in place.
Sonora ISD	ICC – International Building Codes	Sonora ISD defers to the City of Sonora and State of Texas, which recommends the 143 International Building Codes. They are compliant with NFIP standards. The ISD has no enforcement in place.

Goals and Objectives

The hazard analysis has shown that Sutton 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 goals and objectives in this plan reflect the overarching priorities identified by the communities and are similar to the goals listed in the 2018 plan. They have been expanded to include public services, public infrastructure, economic impacts, civic resources, and cultural resources as priorities in addition to reducing loss of life, injury, property damage, and preservation of natural resources. 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.

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 do not 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.

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 owners' investment in available mitigation measures for private property.

Objective 3.2
Increase home and business owners' 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.

Mitigation Action Plan

A.) Mitigation Action Prioritization

The planning team members have identified at least two mitigation actions per natural hazard.

The previous plan had a prioritization process utilizing the STAPLEE criteria and benefit-cost review, their prioritization considered cost effectiveness; technical feasibility; and environmental soundness of each action; project implementation; and administrative barriers.
For this update, 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 – 2018 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 2018 plan.

Mitigation actions marked as abandoned are no action taken due to funding will be considered no longer considered relevant as written. Previous actions will be incorporated into new actions.

Table 56: Previous Mitigation Actions

Sutton County		
Hazards Addressed	**Mitigation Actions**	**Status**
Hazardous Material Incident	Purchase 6 chemical suits.	No action taken due to funding.
Multiple Hazards	Multi-hazard awareness program/education.	No action taken due to funding.
Hazardous Material Incident	Develop training program for response personnel.	No action taken due to funding.
Extreme Heat/Drought	Implement public education with newspaper and tv ads.	No action taken due to funding.
Multiple Hazards	Multi-hazard awareness program/education.	No action taken due to funding.
Flood	Purchase NOAA radios for critical facilities.	No action taken due to funding.
Flood	Purchase & install low water crossing signage.	No action taken due to funding.
Extreme Heat	Install quick connect generator hook-ups at critical facilities.	No action taken due to funding.

City of Sonora		
Hazards Addressed	**Mitigation Actions**	**Status**
Hazardous Material Incident	Purchase 6 chemical suits.	No action taken due to funding.
Hazardous Material Incident	Purchase site detox equipment.	No action taken due to funding.
Multiple Hazards	Purchase four hi-bank radios for VFD.	No action taken due to funding.
Hazardous Material Incident	Develop training program for response personnel.	No action taken due to funding.
Multiple Hazards	Install Reverse 911 system.	The City and County uses two types of public information systems. The City uses Nixle, and the County uses Code Red.
Wildfire	Develop volunteer fire fighting team.	No action taken due to funding.
Wildfire	Implement wildfire protection plan.	No action taken due to funding.
Flood	Flood awareness program/education.	No action taken due to funding.
Flood	Promote NFIP.	The inspectors promote NFIP compliance during all inspections.
Thunderstorm/Tornado	Retrofit traffic lights for high winds.	No action taken due to funding.

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.

C) 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, thus applying for funding does not guarantee that funds will be received. Budget constraints will remain the determining factor for how and when each action is implemented.

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 Wildfire Fuels Reduction, Tornado Saferooms, Structural Hardening, etc.
Hazard	All Hazards
Priority	High
Estimated Cost	Less than $10,000 per hazard
Potential Funding Source	County, FEMA BRIC, FEMA HMGP, FEMA FMA, TWDB, GLO
Responsible Department	Sutton County, Sonora ISD, City of Sonora, Sutton County Hospital District
Implementation Schedule	1-5 years
Target	Existing and future population

Mitigation Action	Implement a tree trimming program
Objective	This action will develop and implement a tree trimming program to reduce loose / dead tree limbs that may cause damage during a hazard event.
Hazard	Flood, Hurricanes, Wildfire, Tornado, Drought, Hailstorm, Winter Weather, Severe Winds, Lightning/Thunderstorms
Priority	High
Estimated Cost	$10,000 to $100,000
Potential Funding Source	County, Agency Budgets, FEMA PDM, FEMA HMGP
Jurisdiction	Sutton County, Sonora ISD, City of Sonora, Sutton County Hospital District

Implementation Schedule	1-5 years
Target	Existing and future population

Mitigation Action	**Set up heating and cooling centers.**
Objective	The action's goal is to increase resilience by limiting vulnerable populations' exposure to extreme weather by creating new or opening existing facilities as cooling centers or warming centers.
Hazard	Extreme Heat, Extreme Cold, Winter Weather
Priority	Medium
Estimated Cost	$10,000 to $100,000
Potential Funding Source	County, Agency Budgets, FEMA PDM, FEMA HMGP
Responsible Department	Sutton County, City of Sonora
Implementation Schedule	1-5 years
Target	Existing and future population, Community infrastructure

Mitigation Action	**Purchase and stall backup 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, hospital, clinics, schools, pumps, and communications infrastructure.
Hazard	All Hazards
Priority	High
Estimated Cost	More than $100,000 for fixed generators to include associated costs of engineering. Less than $100,000 for portable generators.
Potential Funding Source	County, Agency Budgets, FEMA BRIC, FEMA HMGP
Responsible Department	Sutton County, Sonora ISD, City of Sonora, Sutton County Hospital District
Implementation Schedule	1-5 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. In the classroom and hospital settings, it will provide advance warning for leadership to monitor and make appropriate decisions.
Hazard	All Hazards
Priority	Medium
Estimated Cost	$1,000 to $100,000 per device
Potential Funding Source	County, Agency Budgets, FEMA BRIC, FEMA HMGP
Responsible Department	Sutton County, Sonora ISD, City of Sonora, Sutton County Hospital District
Implementation Schedule	1-2 years

Target	Existing 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, shielding roof mounted equipment.
Hazard	All Hazards
Priority	Medium
Estimated Cost	$100,000 per hardening activity
Potential Funding Source	County, Agency Budgets, FEMA BRIC, FEMA HMGP
Responsible Department	Sutton County, Sonora ISD, City of Sonora, Sutton County Hospital District
Implementation Schedule	5 years
Target	Existing infrastructure

Mitigation Action	**Develop and implement flood damage prevention ordinance.**
Objective	This action proposes developing a flood damage prevention ordinance and appointing a floodplain manager in order to maintain compliance with NFIP.
Hazard	Flood
Priority	High
Estimated Cost	Less than $1,000
Potential Funding Source	County, Agency Budgets
Responsible Department	Sutton County, City of Sonora
Implementation Schedule	1-5 years
Target	Existing infrastructure and existing and future populations

Mitigation Action	**Upgrade existing drainage systems and pump stations.**
Objective	This action proposes upgrading existing drainage pump stations and drainage systems in the community to reduce the potential impacts of future flood events.
Hazard	Flood
Priority	Medium
Estimated Cost	$10,000 - $100,000
Potential Funding Source	County, Agency Budgets, FEMA BRIC, FEMA HMGP
Responsible Department	Sutton County, City of Sonora
Implementation Schedule	3-5 years
Target	Existing infrastructure and existing and future populations

Mitigation Action	**Wildfire fuels reduction.**
Objective	This action will develop and implement a program to identify and

	prioritize lands in the Wildland Urban Interface in need of fuels reduction and then reduce or remove wildfire fuels through various methods as appropriate.
Hazard	Wildfire
Priority	High
Estimated Cost	$10,000 - $100,000
Potential Funding Source	County, Agency Budgets, FEMA BRIC, FEMA HMGP, CDBG-MIT
Responsible Department	Sutton County, City of Sonora
Implementation Schedule	3-5 years
Target	Existing infrastructure and existing and future populations

Mitigation Action	**Install surge protection to protect electronic assets.**
Objective	This action will install surge protection at all County facilities to prevent damage to critical electronic devices including but not limited to computers, servers, audio/visual equipment, laboratory equipment, and appliances.
Hazard	Lightning/Thunderstorms, Tornado, Hurricanes, Wind
Priority	Medium
Estimated Cost	$1,000 - $5,000
Potential Funding Source	County, Agency Budgets, FEMA BRIC, FEMA HMGP
Responsible Department	Sutton County, Sonora ISD, City of Sonora, Sutton County Hospital District
Implementation Schedule	0-2 years
Target	Existing 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	Low
Estimated Cost	Less than $10,000
Potential Funding Source	County, Agency Budgets, FEMA BRIC, FEMA HMGP
Responsible Department	Sutton County, City of Sonora
Implementation Schedule	1-5 years
Target	Existing infrastructure, future and existing population

Mitigation Action	**Review and update dam inspection protocol.**
Objective	Evaluate existing dam inspection protocol and update as necessary.
Hazard	Dam Failure
Priority	Low
Estimated Cost	Less than $10,000

Potential Funding Source	County, Agency Budgets
Responsible Department	Sutton County, City of Sonora
Implementation Schedule	1-5 years
Target	Existing infrastructure, future and existing population

Mitigation Action	**Conduct studies to develop dam inundation maps.**
Objective	Conduct studies to develop dam inundation maps for all dams that affect the County. Data obtained from the studies will assist the county in developing the most appropriate mitigation actions to save lives and property.
Hazard	Dam Failure
Priority	Low
Estimated Cost	$100,000
Potential Funding Source	County, Agency Budgets, FEMA BRIC, FEMA HMGP
Responsible Department	Sutton County, City of Sonora
Implementation Schedule	1-5 years
Target	Existing infrastructure, future and existing population

Mitigation Action	**Using drought resistant landscaping**
Objective	Encourage and/or mandate the use of drought resistant landscaping as appropriate, through ordinance development and/or enforcement.
Hazard	Drought
Priority	Low
Estimated Cost	$30,000 plus
Potential Funding Source	County, Agency Budgets
Responsible Department	Sutton County, City of Sonora
Implementation Schedule	3-5 years
Target	Existing infrastructure

Mitigation Action	**Harden utilities for seismic activity.**
Objective	Meet with representatives of utility companies to require use of seismic piping when extending or providing new water, sewer, or natural gas service. Harden existing piping as indicated against seismic activity.
Hazard	Earthquake
Priority	Low
Estimated Cost	$30,000 plus
Potential Funding Source	County, Agency Budgets, FEMA BRIC, FEMA HMGP
Responsible Department	Sutton County, City of Sonora
Implementation Schedule	3-5 years
Target	Existing infrastructure

Mitigation Action	Conduct outreach campaigns in winter and fall.
Objective	Conduct an outreach campaign by running public service announcements informing the public regarding possible actions to take when temperatures fall below freezing (32°F) and where the blankets points of distribution are available for the public.
Hazard	Extreme cold, Winter Weather
Priority	Low
Estimated Cost	$5,000 plus
Potential Funding Source	County, Agency Budgets
Responsible Department	Sutton County, Sonora ISD, City of Sonora, Sutton County Hospital District
Implementation Schedule	3-5 years
Target	Existing infrastructure

Mitigation Action	Insulate agency owned properties against cold damage.
Objective	Insulate public buildings and replace damaged pipes and/or install insulation to prevent freezing.
Hazard	Extreme cold, Winter Weather
Priority	Medium
Estimated Cost	$5,000 plus
Potential Funding Source	County, Agency Budgets, FEMA BRIC, FEMA HMGP
Responsible Department	Sutton County, Sonora ISD, City of Sonora, Sutton County Hospital District
Implementation Schedule	3-5 years
Target	Existing infrastructure

Mitigation Action	Insulate agency owned properties against heat damage.
Objective	Install worn insulation on the roof to enhance energy efficiency (for cooling) and around pipes to prevent heat loss and reduce cost of cooling.
Hazard	Extreme heat, Drought
Priority	Low
Estimated Cost	$5,000 plus
Potential Funding Source	County, Agency Budgets, FEMA BRIC, FEMA HMGP
Responsible Department	Sutton County, Sonora ISD, City of Sonora, Sutton County Hospital District
Implementation Schedule	3-5 years
Target	Existing infrastructure

Mitigation Action	Educate community on residential and commercial flood prevention.
Objective	Educate the public on mitigation activities that can help protect properties in the event of a flood, such as elevating AC units, elevating structures, and use of freeboard.

Hazard	Flood, Dam Failure, Hurricanes, Thunderstorms
Priority	Low
Estimated Cost	$5,000 plus
Potential Funding Source	County, Agency Budgets, FEMA FMA, FEMA HMGP
Responsible Department	Sutton County, Sonora ISD, City of Sonora, Sutton County Hospital District
Implementation Schedule	3-5 years
Target	Existing infrastructure

Mitigation Action	**Improve water drainage system.**
Objective	This action proposes constructing new and/or widening storm drainage infrastructure to reduce the potential impacts of future flood events. Including but not limited to increasing capacity of ditches, culverts, detention ponds.
Hazard	Flood, Dam Failure, Hurricanes, Thunderstorms
Priority	Low
Estimated Cost	$5,000 plus
Potential Funding Source	County, Agency Budgets, FEMA BRIC, FEMA HMGP, FEMA HMA
Responsible Department	Sutton County, Sonora ISD, City of Sonora, Sutton County Hospital District
Implementation Schedule	3-5 years
Target	Existing infrastructure

Mitigation Action	**Insulate agency owned properties against cold damage.**
Objective	Inspect roof sheathing of public buildings and install deteriorated roofing to resist the impact of hail as needed. Place protective covers over existing windows and hail guards on AC units.
Hazard	Hail, Tornado, Hurricane, Thunderstorms
Priority	Low
Estimated Cost	$5,000 plus
Potential Funding Source	County, Agency Budgets, FEMA BRIC, FEMA HMGP, FEMA HMA
Responsible Department	Sutton County, Sonora ISD, City of Sonora, Sutton County Hospital District
Implementation Schedule	3-5 years
Target	Existing infrastructure

Mitigation Action	**Insulate agency owned properties against lightning damage.**
Objective	Install surge protectors and lightning rods on critical facilities where needed.
Hazard	Hail, Tornado, Hurricane, Thunderstorms
Priority	Low
Estimated Cost	$5,000 plus

Potential Funding Source	County, Agency Budgets, FEMA BRIC, FEMA HMGP, FEMA HMA
Responsible Department	Sutton County, Sonora ISD, City of Sonora, Sutton County Hospital District
Implementation Schedule	3-5 years
Target	Existing infrastructure

Mitigation Action	**Insulate agency owned properties against tornado damage.**
Objective	Strengthen existing buildings and residence by making them more resistant to damage from tornadoes.
Hazard	Tornado
Priority	Low
Estimated Cost	$5,000 plus
Potential Funding Source	County, Agency Budgets, FEMA BRIC, FEMA HMGP, FEMA HMA
Responsible Department	Sutton County, Sonora ISD, City of Sonora, Sutton County Hospital District
Implementation Schedule	3-5 years
Target	Existing infrastructure

Mitigation Action	**Insulate agency properties against wind damage.**
Objective	Retrofit governmental buildings and critical facilities (e.g., replace roofs; anchor HVAC equipment) as necessary.
Hazard	Tornado, Hurricane, Winds, Thunderstorms
Priority	Low
Estimated Cost	$5,000 plus
Potential Funding Source	County, Agency Budgets, FEMA BRIC, FEMA HMGP, FEMA HMA
Responsible Department	Sutton County, Sonora ISD, City of Sonora, Sutton County Hospital District
Implementation Schedule	3-5 years
Target	Existing infrastructure

Mitigation Action	**Implement interoperable communication among agencies.**
Objective	Develop and install new equipment for interoperable communications between all emergency response agencies.
Hazard	All hazards
Priority	Low
Estimated Cost	$1,500,000 plus
Potential Funding Source	County, Agency Budgets, FEMA BRIC, FEMA HMGP, FEMA HMA
Responsible Department	Sutton County, Sonora ISD, City of Sonora, Sutton County Hospital District
Implementation Schedule	3-5 years

Target	Existing infrastructure

Mitigation Action	**Create drainage master plan.**
Objective	This action proposes creating a drainage master plan for the City, in conjunction with the County, which 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	Flooding
Priority	High
Estimated Cost	$100,000
Potential Funding Source	County, Agency Budgets, FEMA BRIC, FEMA HMGP, FEMA HMA
Responsible Department	Sutton County, Sonora ISD, City of Sonora, Sutton County Hospital District
Implementation Schedule	3-5 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, Extreme Heat
Priority	Medium
Estimated Cost	$10,000 to $100,000
Potential Funding Source	County, Agency Budgets, FEMA BRIC, FEMA HMGP, FEMA HMA
Responsible Department	Sutton County, Sonora ISD, City of Sonora, Sutton County Hospital District
Implementation Schedule	3-5 years
Target	Existing and future infrastructure

Appendix A

Community Survey Results

The community survey consisted of the following 20 questions:

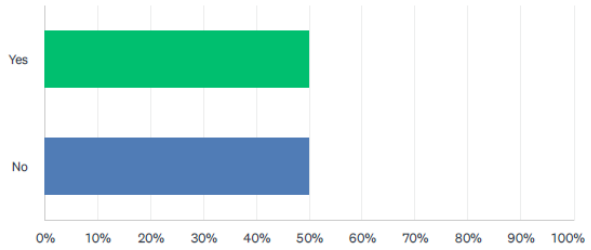
- Have you ever experienced or been impacted by a disaster?
- How concerned are you about the possibility of your community being affected by a disaster?
- Please select the one hazard you think is the highest threat to your community.
- Please select the one hazard you think is the second highest threat to your community.
- Please select the one hazard you think is the third highest threat to your community.
- Is your home located in a floodplain?
- Do you have flood insurance?
- If you do not have flood insurance, why not?
- Have you taken any actions to make your home or neighborhood more resistant to hazards?
- Are you interested in making your home or neighborhood more resistant to hazards?
- What is the most effective way to receive information about how to make your home and community more resistant to hazards?
- In your opinion, what are some steps your local government could take to reduce or eliminate the risk of future hazard damages to your community?
- Are there any other issues regarding the reduction of risk and loss associated with hazards or disasters in the community that you think are important?
- A number of community-wide activities can reduce our risk from hazards. In general, these activities fall into one of the following six broad categories. Please tell us how important you think each one is for your community to consider pursuing.
- Prevention - Actions that protect people and property during and immediately after a hazard event. Examples include warning systems, evacuation planning, emergency response training, and protection of critical facilities or systems.
- Natural Resource Protection - Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems. Examples include floodplain protection, habitat preservation, slope stabilization, riparian buffers, and forest management.
- Prevention / Local Plans & Regulations - Administrative or regulatory actions that influence the way land is developed and buildings are built. Examples include planning and zoning, building codes, open space preservation, and floodplain regulations.
- Property Protection - Actions that involve the modification of existing buildings to protect them from a hazard or removal from the hazard area. Examples include acquisition, relocation, elevation, structural retrofits, and storm shutters.
- Public Education and Awareness - Actions to inform citizens about hazards and techniques they can use to protect themselves and their property. Examples include outreach projects, school education programs, library materials, and demonstration events.

- Structural Projects - Actions intended to lessen the impact of a hazard by modifying the natural progression of the hazard. Examples include dams, levees, seawalls detention / retention basins, channel modification, retaining walls, and storm sewers.

The answers are represented below:

Q1 Have you ever experienced or been impacted by a disaster?

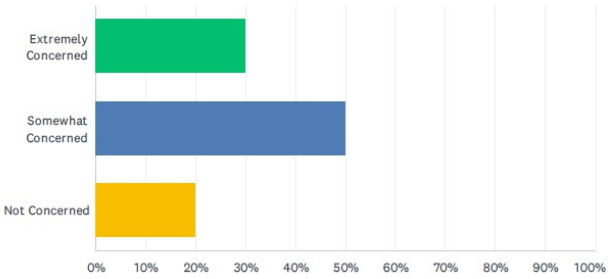
Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	50.00%	5
No	50.00%	5
TOTAL		10

Q2 How concerned are you about the possibility of your community being affected by a disaster?

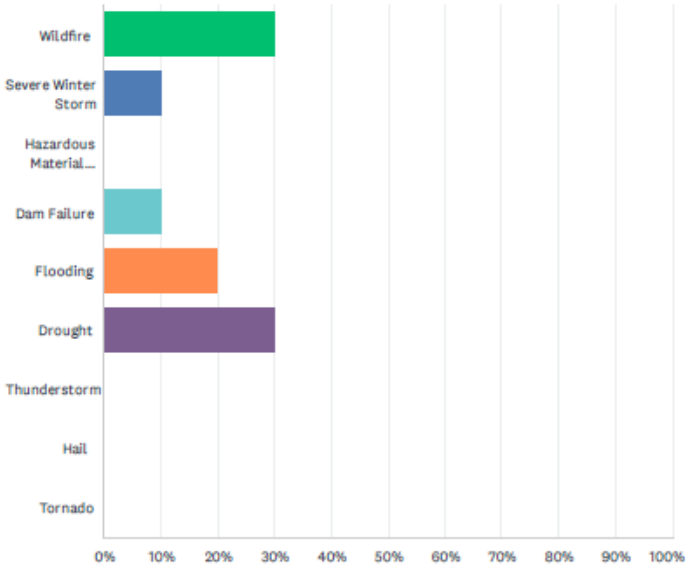
Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Extremely Concerned	30.00%	3
Somewhat Concerned	50.00%	5
Not Concerned	20.00%	2
TOTAL		10

Q3 Please select the one hazard you think is the highest threat to your community.

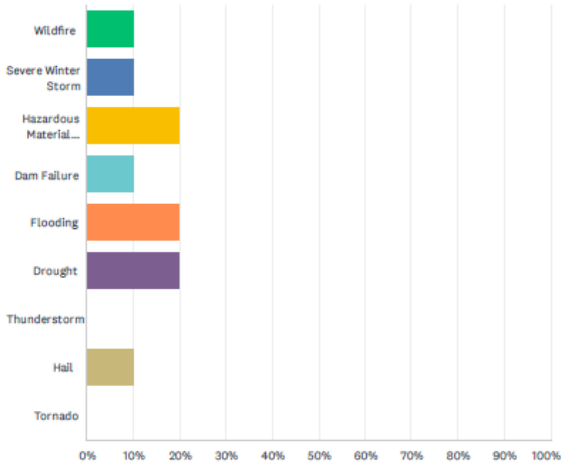
Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Wildfire	30.00%	3
Severe Winter Storm	10.00%	1
Hazardous Material Incident	0.00%	0
Dam Failure	10.00%	1
Flooding	20.00%	2
Drought	30.00%	3
Thunderstorm	0.00%	0
Hail	0.00%	0
Tornado	0.00%	0
TOTAL		10

Q4 Please select the one hazard you think is the second highest threat to your community.

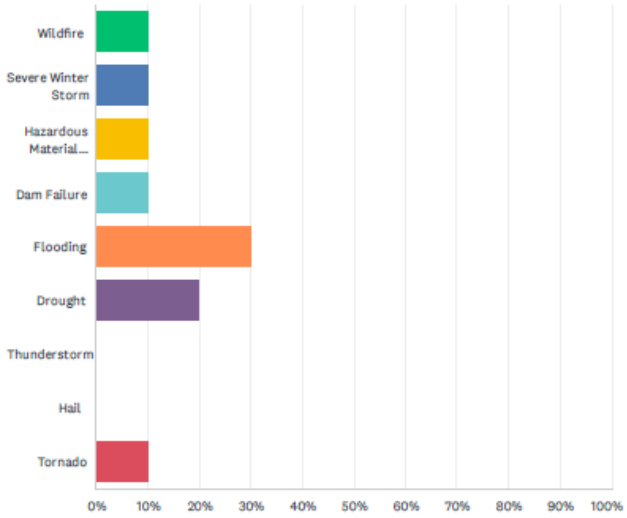
Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Wildfire	10.00%	1
Severe Winter Storm	10.00%	1
Hazardous Material Incident	20.00%	2
Dam Failure	10.00%	1
Flooding	20.00%	2
Drought	20.00%	2
Thunderstorm	0.00%	0
Hail	10.00%	1
Tornado	0.00%	0
TOTAL		10

Q5 Please select the one hazard you think is the third highest threat to your community.

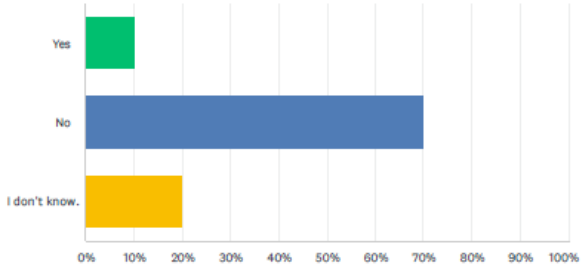
Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Wildfire	10.00%	1
Severe Winter Storm	10.00%	1
Hazardous Material Incident	10.00%	1
Dam Failure	10.00%	1
Flooding	30.00%	3
Drought	20.00%	2
Thunderstorm	0.00%	0
Hail	0.00%	0
Tornado	10.00%	1
TOTAL		10

Q6 Is your home located in a floodplain?

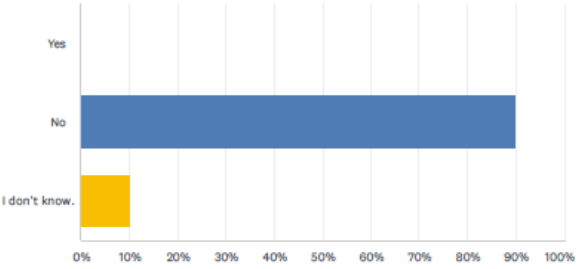
Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	10.00%	1
No	70.00%	7
I don't know.	20.00%	2
TOTAL		10

Q7 Do you have flood insurance?

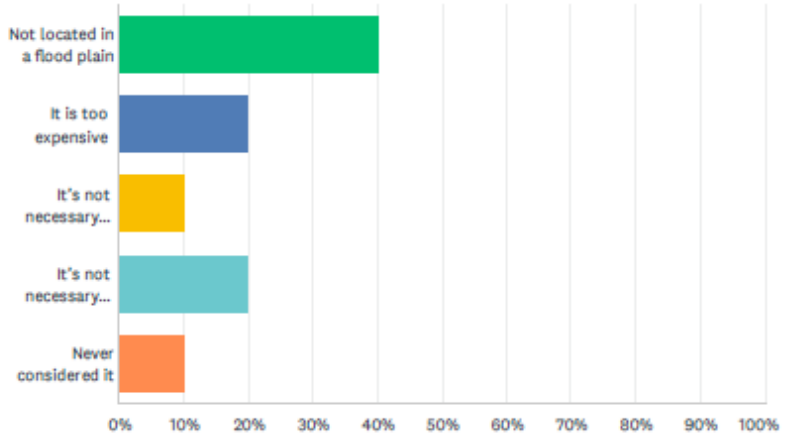
Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	90.00%	9
I don't know.	10.00%	1
TOTAL		10

Q8 If you do not have flood insurance, why not?

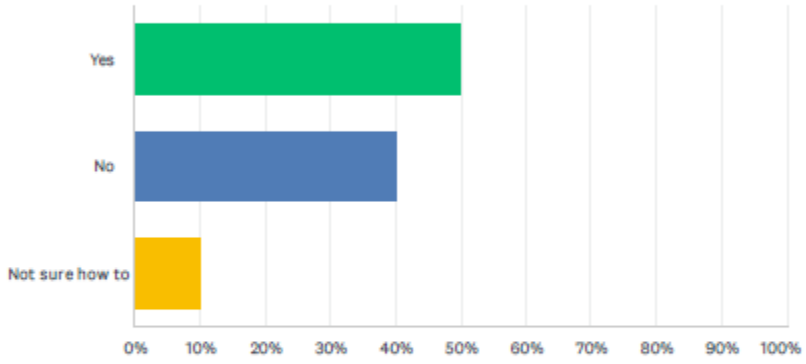
Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Not located in a flood plain	40.00%	4
It is too expensive	20.00%	2
It's not necessary because it never floods	10.00%	1
It's not necessary because my home is elevated or otherwise protected	20.00%	2
Never considered it	10.00%	1
TOTAL		10

Q9 Have you taken any actions to make your home or neighborhood more resistant to hazards?

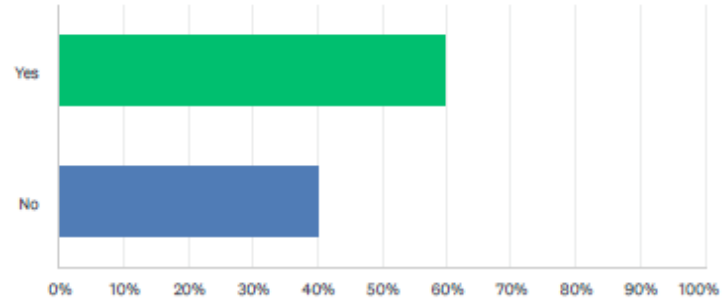
Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	50.00%	5
No	40.00%	4
Not sure how to	10.00%	1
TOTAL		10

Q10 Are you interested in making your home or neighborhood more resistant to hazards?

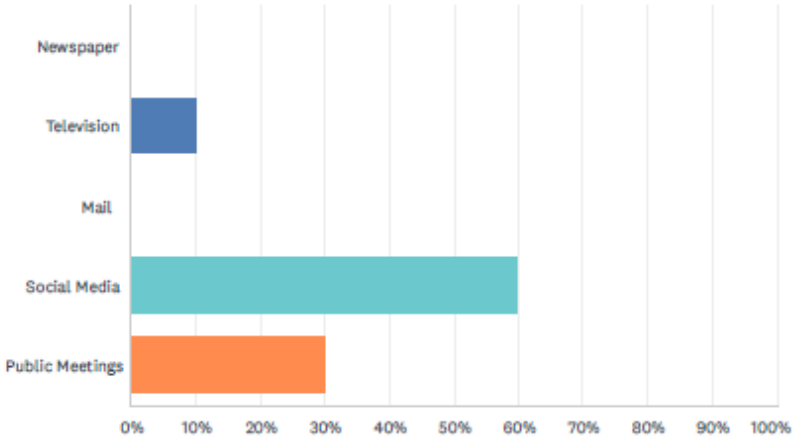
Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	60.00%	6
No	40.00%	4
TOTAL		10

Q11 What is the most effective way to receive information about how to make your home and community more resistant to hazards?

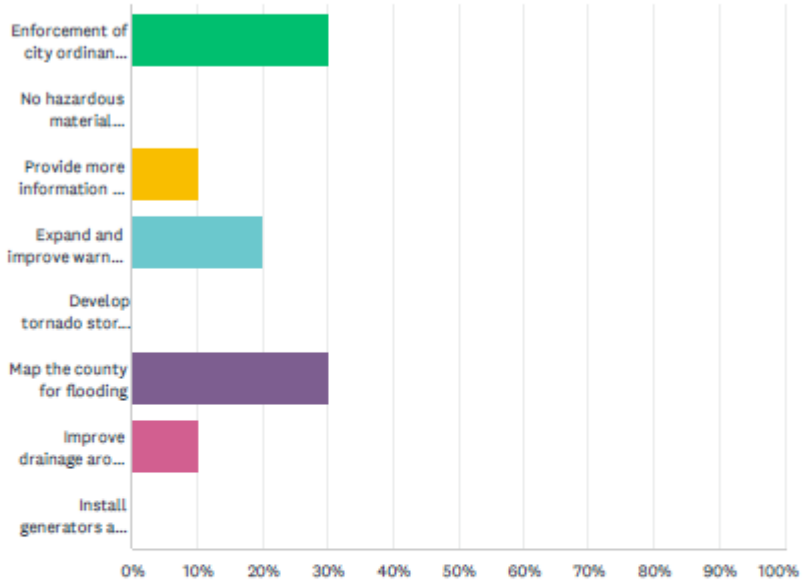
Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Newspaper	0.00%	0
Television	10.00%	1
Mail	0.00%	0
Social Media	60.00%	6
Public Meetings	30.00%	3
TOTAL		10

Q12 In your opinion, what are some steps your local government could take to reduce or eliminate the risk of future hazard damages to your community?

Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Enforcement of city ordinances for unmaintained property, brush control	30.00%	3
No hazardous material parking in city limits	0.00%	0
Provide more information to the public and have information readily available	10.00%	1
Expand and improve warning systems	20.00%	2
Develop tornado storm shelters	0.00%	0
Map the county for flooding	30.00%	3
Improve drainage around the County	10.00%	1
Install generators at critical facilities	0.00%	0
TOTAL		10

Q13 Are there any other issues regarding the reduction of risk and loss associated with hazards or disasters in the community that you think are important?

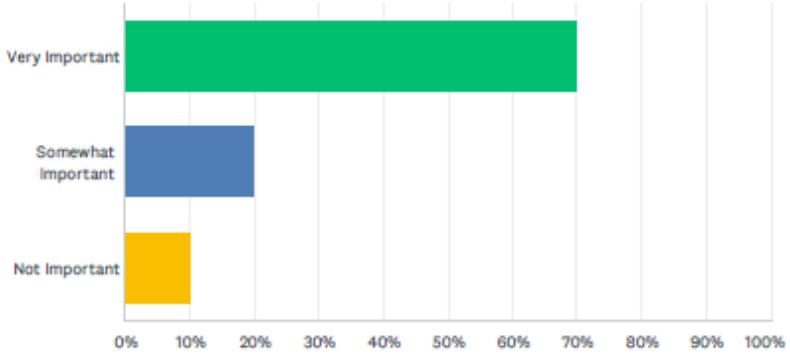
Answered: 8 Skipped: 2

Q14 A number of community-wide activities can reduce our risk from hazards. In general, these activities fall into one of the following six broad categories. Please tell us how important you think each one is for your community to consider pursuing.

Answered: 3 Skipped: 7

Q15 a. Prevention - Actions that protect people and property during and immediately after a hazard event. Examples include warning systems, evacuation planning, emergency response training, and protection of critical facilities or systems.

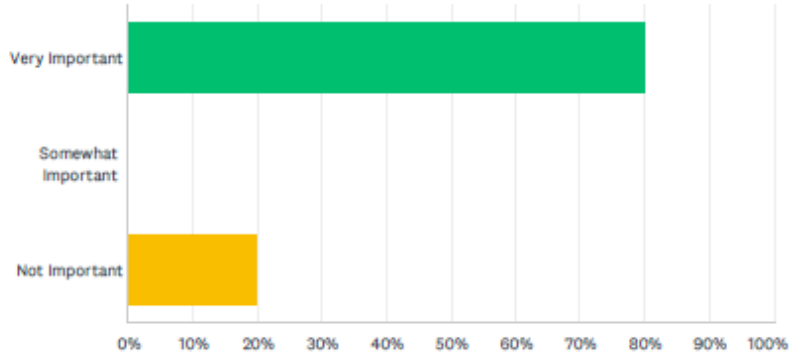
Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Very Important	70.00%	7
Somewhat Important	20.00%	2
Not Important	10.00%	1
TOTAL		10

Q16 b. Natural Resource Protection - Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems. Examples include floodplain protection, habitat preservation, slope stabilization, riparian buffers, and forest management.

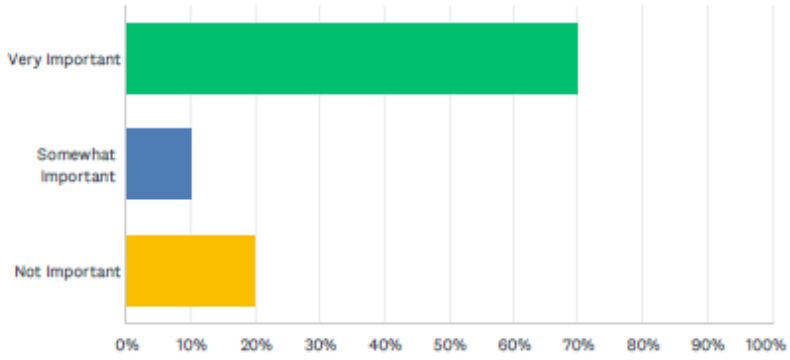
Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Very Important	80.00%	8
Somewhat Important	0.00%	0
Not Important	20.00%	2
TOTAL		10

Q17 c. Prevention / Local Plans & Regulations - Administrative or regulatory actions that influence the way land is developed and buildings are built. Examples include planning and zoning, building codes, open space preservation, and floodplain regulations.

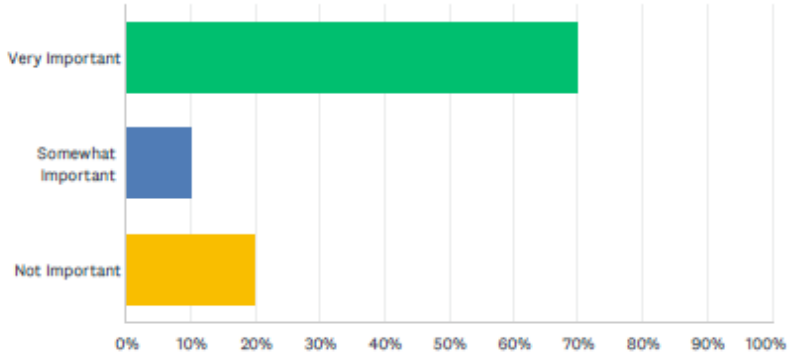
Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Very Important	70.00%	7
Somewhat Important	10.00%	1
Not Important	20.00%	2
TOTAL		10

Q18 d. Property Protection - Actions that involve the modification of existing buildings to protect them from a hazard or removal from the hazard area. Examples include acquisition, relocation, elevation, structural retrofits, and storm shutters.

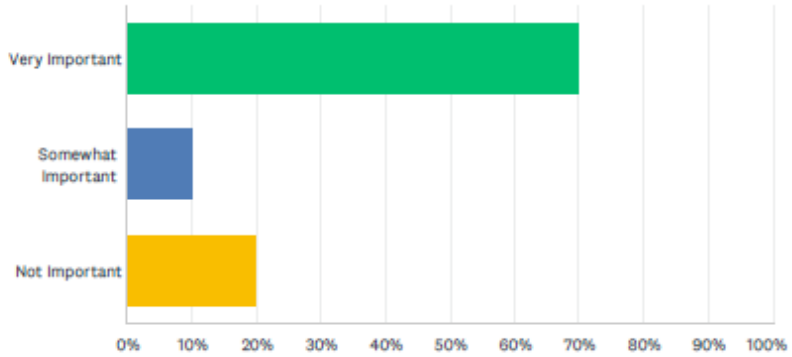
Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Very Important	70.00%	7
Somewhat Important	10.00%	1
Not Important	20.00%	2
TOTAL		10

Q19 e. Public Education and Awareness - Actions to inform citizens about hazards and techniques they can use to protect themselves and their property. Examples include outreach projects, school education programs, library materials, and demonstration events.

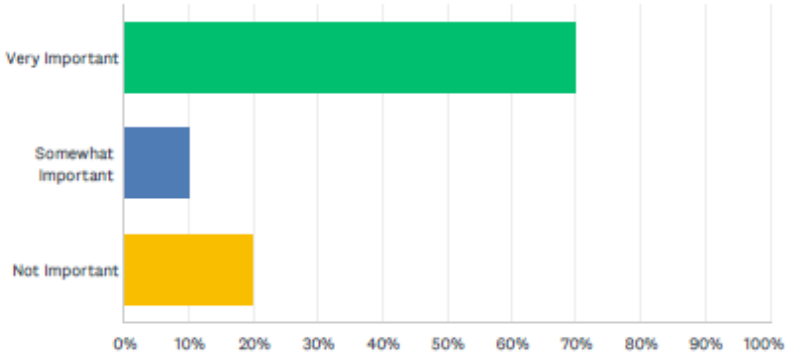
Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Very Important	70.00%	7
Somewhat Important	10.00%	1
Not Important	20.00%	2
TOTAL		10

Q20 f. Structural Projects - Actions intended to lessen the impact of a hazard by modifying the natural progression of the hazard. Examples include dams, levees, seawalls detention / retention basins, channel modification, retaining walls, and storm sewers.

Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Very Important	70.00%	7
Somewhat Important	10.00%	1
Not Important	20.00%	2
TOTAL		10

Survey links were sent to the participants via Nixle, and it was advertised on their website. The screenshots are listed below.

Figure 25: Nixle Screenshot

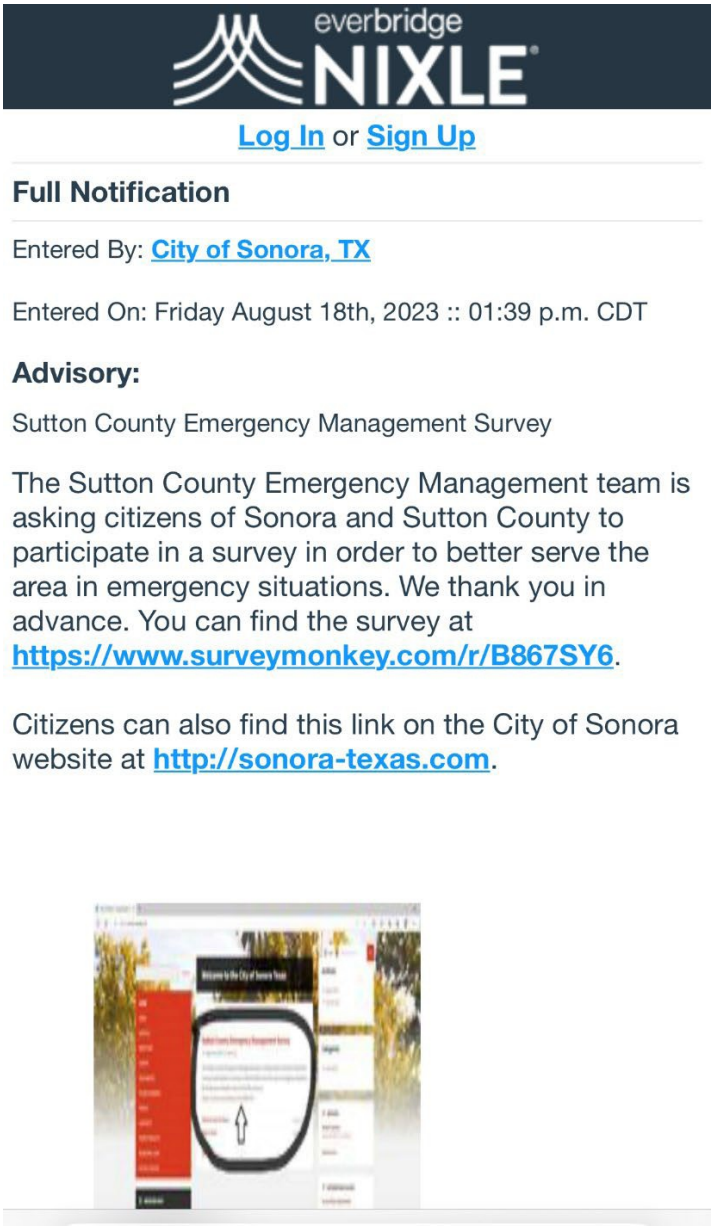
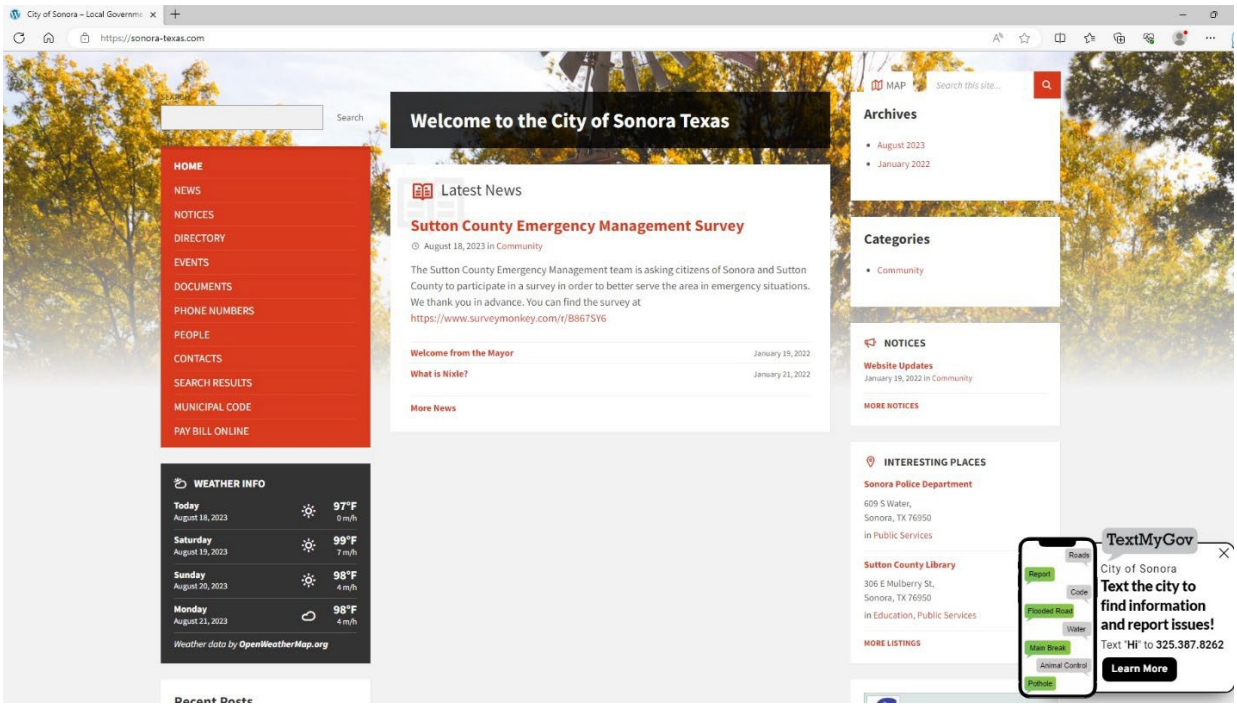


Figure 26: Screenshot of Survey on Website



Appendix B

HM Planning Meetings

Throughout the process there were virtual meetings held. The planning team met on XX occasions. Additional communication was regularly carried out via email and over the phone.

The initial meeting was held virtually on August 1, 2023. During this meeting, the planning team discussed the previous plan and the planning process. All team members were new to this process so it was decided that they would have several meetings over the next month to properly plan their approach to this plan and who would be on the planning team or what entities would be involved.

The second planning team meeting was held on August 17, 2023. They discussed the planning team and the jurisdictions that should be invited. They also discussed the previous plan.

The third planning team meeting was held on September 5, 2023. During this meeting all planning team members were identified and introduced to the process. The ISD and hospital district were new to the plan so there were discussions of how to approach this plan.

The fourth meeting was held on October 17, 2023. 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. At the end of the meeting, planning team members were tasked with compiling relevant data for the identified hazards.

Due to circumstances the planning team was unable to meet until February 8, 2024. During this meeting the team reevaluated what was already obtained from the previous meetings and opted for monthly meetings to ensure they stayed on task. All team members researched the hazards and any effects their jurisdiction would have on them. They also researched previous events and losses from those. They opted to do half the hazards now and the other half the next month to make the process less overwhelming.

On February 29, 2024, the team met to discuss the information they had and compiled it together. They also discussed the next steps in the planning process. The community survey results were provided to be compiled with the plan. The plan structure was determined, and all parties agreed on the last group of hazards that needed to be addressed.

On March 21, 2024, all parties met virtually to discuss the hazards identified and any losses that they had incurred from each. It was determined that the next meeting would be to speak about the actions. The previous actions and potential new actions would be compiled and sent via email for review prior to the April meeting.

During the April 18, 2024, meeting the team discussed the actions, what the status of the previous actions were and the next steps for community input. The survey was completed months before and the results were added to the draft. However, the community needs to review the plan and have an opportunity for input. The team will compile the d

During May 9, 2024, the meeting the team finalized the actions and agreed to compile the plan into a final draft with the appendices added. All parties will then review it prior to the June meeting. During this meeting the discussion of the community outreach was brought up and the adoption process. As a team they will decide before the next meeting if they will adopt it prior to submission or wait until the approval pending adoption letter is issued.

Table 57: Planning Meetings

Date	Platform
8/1/2023	Virtual
8/17/2023	Virtual
9/5/2023	Virtual
10/17/2023	Virtual
2/8/2024	Virtual
2/29/2024	Virtual
3/21/2024	Virtual
4/18/2024	Virtual
5/9/2024	Virtual

Appendix C: Toxic Sites And Critical Facilities

This Appendix is For Official Use Only (FOUO) and may be exempt from public release under the Freedom of Information Act (FOIA).

Toxic Sites

Table 58: Listing of Tier-2 Toxic Sites

COUNTY	JURISDICTION	FACILITY NAME
Sutton	Ft. McKavett	Wilson Lease
Sutton	Midland	Devon Energy – Sonora Field
Sutton	Sonora	Aldwell Ranch Field
Sutton	Sonora	Archer SWD
Sutton	Sonora	Askew & Glimp 42 # 1 SWD
Sutton	Sonora	Baker Petrolite – Sonora
Sutton	Sonora	Bart Booster
Sutton	Sonora	Basic Energy Services/Sonora
Sutton	Sonora	Bloodworth SWD
Sutton	Sonora	Bruce Babb Chemicals, Inc. (BB Chemicals)
Sutton	Sonora	Burns Compressor Station
Sutton	Sonora	Byrd/WTG Compressor-Byrd Operating Co.
Sutton	Sonora	Canyon Ranch 115 SWD
Sutton	Sonora	CEM Tank Battery
Sutton	Sonora	Center Point #2
Sutton	Sonora	Center Point #3
Sutton	Sonora	Center Point #4
Sutton	Sonora	Center Point #5
Sutton	Sonora	Center Point #6
Sutton	Sonora	Center Point #7
Sutton	Sonora	Center Point #8
Sutton	Sonora	Center Point #9
Sutton	Sonora	Center Point #11
Sutton	Sonora	Center Point #12
Sutton	Sonora	Center Point #13
Sutton	Sonora	Center Point #15
Sutton	Sonora	Center Point #16
Sutton	Sonora	Center Point #17
Sutton	Sonora	Center Point #20
Sutton	Sonora	Center Point #21
Sutton	Sonora	Center Point #23
Sutton	Sonora	Center Point #24
Sutton	Sonora	Center Point #28
Sutton	Sonora	Center Point #29

COUNTY	JURISDICTION	FACILITY NAME
Sutton	Sonora	Center Point #30
Sutton	Sonora	Center Point #40
Sutton	Sonora	Center Point #41
Sutton	Sonora	Center Point #42
Sutton	Sonora	Center Point #50
Sutton	Sonora	Center Point #61
Sutton	Sonora	Center Point 46
Sutton	Sonora	Dannheim Compressor Station
Sutton	Sonora	Davis Compressor Station
Sutton	Sonora	Duke Wilson Compressor Station
Sutton	Sonora	Dunbar #79 Water Station
Sutton	Sonora	East Ward Compressor Station
Sutton	Sonora	Epps Tank Battery
Sutton	Sonora	Espy Compressor Station
Sutton	Sonora	Fawcett Compressor Station
Sutton	Sonora	Fields 55 – 5 SWD
Sutton	Sonora	Florence-Hamill 26 – 2 – Byrd Operating Co.
Sutton	Sonora	Genini 39 #1 Tank Battery
Sutton	Sonora	Glasscock Compressor Station
Sutton	Sonora	Hideout
Sutton	Sonora	Hudspeth Compressor
Sutton	Sonora	Hudspeth Stonewater
Sutton	Sonora	Ingram – Sonora Plant
Sutton	Sonora	Jones Center Point
Sutton	Sonora	Jones R.157 – 1
Sutton	Sonora	Jones SWD 118 – 16
Sutton	Sonora	Juno Compressor Station
Sutton	Sonora	Kiser #02 – 2
Sutton	Sonora	Lively Compressor Station
Sutton	Sonora	M & B Battery
Sutton	Sonora	Mayer
Sutton	Sonora	Mayer Ranch 38 – 39 Tank Battery
Sutton	Sonora	Mayer Biff South Tank Battery
Sutton	Sonora	Mayer CK 12
Sutton	Sonora	Mayer CK Compressor Station
Sutton	Sonora	Mayer DC Compressor Station
Sutton	Sonora	Mayer GL JR Compressor Station
Sutton	Sonora	Mayer GL SR Compressor Station
Sutton	Sonora	Mayer Ranch Comp. Station
Sutton	Sonora	Mayfield Compressor Station
Sutton	Sonora	McMillian – Cusenbary Tank Battery
Sutton	Sonora	McMillian Tank Battery
Sutton	Sonora	Mitchell Tank Battery
Sutton	Sonora	Morriss Truck Station

Sutton	**Sonora**	**Nabors Well Services Ltd.**
Sutton	**Sonora**	**Nabors Well Services Ltd.**
Sutton	**Sonora**	**Nicks, Gerald #5**
Sutton	**Sonora**	**Nobles #04**
Sutton	**Sonora**	**Nobles #05**
Sutton	**Sonora**	**Nobles #06**
Sutton	**Sonora**	**Nobles #07**
Sutton	**Sonora**	**North Rich Compressor Station**
Sutton	**Sonora**	**Oasis Compressor Station**
Sutton	**Sonora**	**Pfluger 86 – 1 SWD**
Sutton	**Sonora**	**Richardson Center Point**
Sutton	**Sonora**	**Rip Ward Lease**
Sutton	**Sonora**	**Sawyer Canyon Area "Carta" -sold 10-30-09**
Sutton	**Sonora**	**Sawyer Canyon Area "E" -sold 10-30-09**
Sutton	**Sonora**	**Sawyer Canyon Area "F" -sold 10-30-09**
Sutton	**Sonora**	**Shurley South Compressor Station**
Sutton	**Sonora**	**Simmons Ranch 102**
Sutton	**Sonora**	**Simmons Ranch 103 Tank Battery**
Sutton	**Sonora**	**Simmons Ranch 28**
Sutton	**Sonora**	**Simons Petroleum – Sonora Bulk Plant**
Sutton	**Sonora**	**Sonora Area "B" -sold 10-30-09**
Sutton	**Sonora**	**Sonora Area "C"**
Sutton	**Sonora**	**Sonora Compressor Station**
Sutton	**Sonora**	**Sonora Compressor Station**
Sutton	**Sonora**	**Sonora Gas Plant**
Sutton	**Sonora**	**Sonora Plant 1**
Sutton	**Sonora**	**Sonora Yard Tank Battery**
Sutton	**Sonora**	**South Rich Compressor Station**
Sutton	**Sonora**	**Steen #58**
Sutton	**Sonora**	**Steen 47 Compressor Station**
Sutton	**Sonora**	**Stewart 2 – 4 SWD**
Sutton	**Sonora**	**Thompson**
Sutton	**Sonora**	**TxDOT – San Angelo – Sonora Maintenance Facility**
Sutton	**Sonora**	**United Fuel & Energy**
Sutton	**Sonora**	**Van Shoubrouck SWD Facility**
Sutton	**Sonora**	**VV Tank Battery**
Sutton	**Sonora**	**Ward 26 Compressor Station**
Sutton	**Sonora**	**West Fin Tex Yard**
Sutton	**Sonora**	**Whitehead Compressor Station**
Sutton	**Sonora**	**Wilson North Compressor Station**
Sutton	**Sonora**	**Wilson South Compressor Station**
Sutton	**Sonora**	**Canyon Ranch 82 – 8S SWD**
Sutton	**Sonora**	**Schlumberger Technology Corporation**

Critical Facilities

Table 59: Sutton County Critical Facilities

COUNTY	JURISDICTION	NAME	TYPE	COST (In Thousands)
Sutton	Sonora	Lillian M Hudspeth Memorial Hospital	Medical	$390
Sutton	Sonora	Sutton County Sheriff	Police Station	$267
Sutton	Sonora	Sonora Police Department	Police Station	$5,826

Appendix D: Pipeline Failure Considerations

Pipeline failure was considered a hazard in the previous plan. Due to the risks involved for all communities Sutton County Hazard Mitigation Planning Team opted to add the information as an appendix. All

Hazard Description
Fuel pipeline breach or pipeline failure addresses the rare, but serious hazard of an oil or natural gas pipeline. An estimated 2.2 million miles of pipelines in the United States carry hazardous materials. Natural gas pipelines transport natural gas. Oil or liquid petroleum pipelines transport crude oil and refined products from crude oils, such as gasoline, home heating oil, jet fuel and kerosene in addition to liquefied propane, ethylene, butane and some petrochemical products. Occasionally oil pipelines are also used to transport liquefied gases, such as carbon dioxide.

Pipeline failure is a rare occurrence but has the potential to cause extensive property damage and loss of life. Pipelines have caused fires and explosions that killed more than 200 people and injured more than 1,000 people nationwide and 50 people in Texas in the last decade.

Location and Extent
Figure 27 shows the locations of gas and oil pipelines throughout the planning area. It is important to note that due to scale, some pipelines cannot be seen on maps where one pipeline runs directly over another or where pipelines appear too close together to be visible on the map.

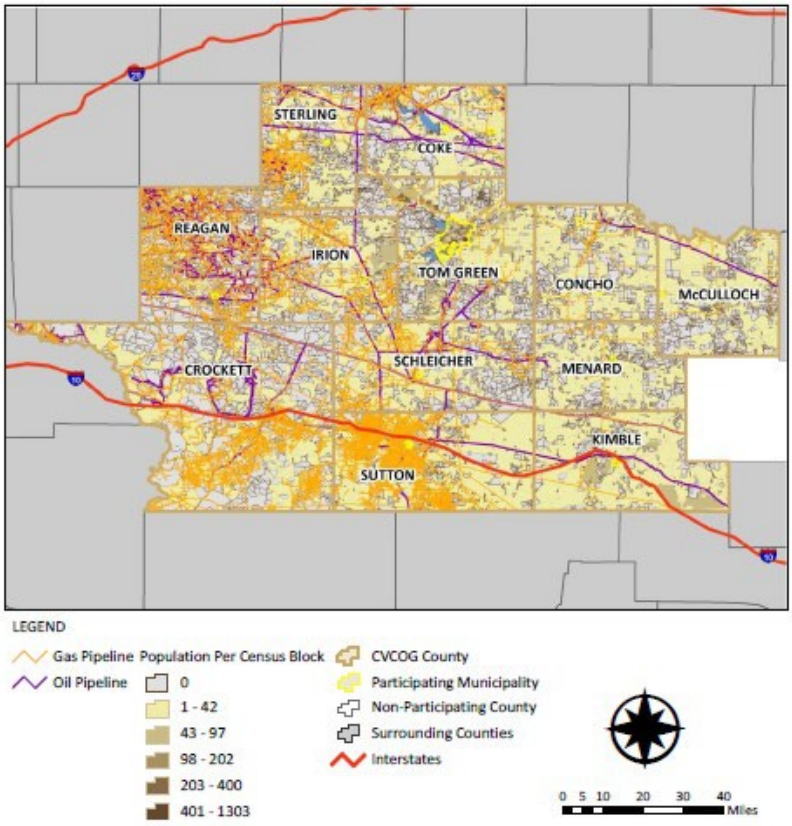


Figure 27: Gas and Oil Pipelines in the Concho Valley COG

If any of these energy pipelines, gas or oil, were to rupture, such an event could endanger property and lives in the immediate area (up to 500 meters for immediate [primary] impact and up to 2,500 meters for secondary impact).

Previous Occurrences

Railroad Commission of Texas records indicate there were 27 minor pipeline incidents reported between 2011 to 2023. There were no fatalities or injuries reported. The costs to repair the pipeline ranged from $0 to $25,000. The issues reported consisted of damage to the pipeline but nothing that caused massive evacuations or deaths.

Probability of Future Events

Although approximately 26,396 kilometers of pipeline exist in the study area, no major historic incidents have been recorded for Sutton County. Based on historic incident records, a pipeline incident for the planning area is unlikely.

Vulnerability and Impact

The total number of population and parcels potentially at risk from gas and oil pipeline failures, respectively, are shown in Tables 60 and 61 below. The analysis for gas pipelines consists of

natural gas and for oil pipelines, the analysis included natural gas liquids. The immediate (primary) area of impact for both types of pipeline accidents is a 500-meter buffer. The secondary area of impact for both types of pipeline accidents is a 2,500-meter buffer. Both types of impact can inflict substantial damage on the surrounding areas.

Oil and gas pipeline failure can have a substantial impact. Such events can cause multiple deaths, completely shut down facilities for thirty days or more, and cause more than fifty percent of affected properties to be destroyed or suffer major damage.

Table 60: Potential Impact Due to Gas Pipeline Failure

JURISDICTION	IMMEDIATE IMPACT (500 METERS)			SECONDARY IMPACT (2,500 METERS)		
	Number People Exposed	Number Buildings Exposed	Value of Buildings Exposed ($)	Number People Exposed	Number Buildings Exposed	Value Of Buildings Exposed ($)
Sutton County	1,389	826	$68,348,000	3,964	2,422	$245,559,000
Sonora	650	310	$27,815,000	2,891	1,613	$158,154,000
Uninc. Sutton County	739	516	$40,533,000	1,073	809	$87,405,000

Table 61: Potential Impact Due to Oil Pipeline Failure

JURISDICTION	IMMEDIATE IMPACT (500 METERS)			SECONDARY IMPACT (2,500 METERS)		
	Number People Exposed	Number Buildings Exposed	Value Of Buildings Exposed ($)	Number People Exposed	Number Buildings Exposed	Value Of Buildings Exposed ($)
Sutton County	5	9	$533,000	582	358	$44,290,000
Sonora	0	0	$0	352	174	$2,191,800
Uninc. Sutton County	5	9	$533,000	230	184	$42,098,200

Appendix E: Hazardous Material Incident (Fixed And Mobile)

Hazardous Material Incident (Fixed and Mobile) was considered as a hazard in the previous plan. Due to the risks involved for all communities Sutton County Hazard Mitigation Planning Team opted to add the information as an appendix.

Hazard Description
In a hazardous material incident, solid, liquid and/or gaseous contaminants are released from fixed or mobile containers. Weather conditions will directly affect how the hazard develops.

The Toxics Release Inventory (TRI) is a publicly available database from the federal Environmental Protection Agency (EPA) that contains information on toxic chemical releases and other waste management activities reported annually by certain covered industry groups, as well as federal facilities. This inventory was established under the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) and expanded by the Pollution Prevention Act of 1990. Each year, facilities that meet certain activity thresholds must report their releases and other waste management activities for listed toxic chemicals to EPA and to their state or tribal entity.

A facility must report if it meets the following three criteria:

- The facility falls within one of the following industrial categories: manufacturing; metal mining; coal mining; electric generating facilities that combust coal and/or oil; chemical wholesale distributors; petroleum terminals and bulk storage facilities; RCRA Subtitle C treatment, storage and disposal (TSD) facilities; and solvent recovery services.

- Have 10 or more full-time employee equivalents.

- Manufactures or processes more than 25,000 pounds or otherwise uses more than 10,000 pounds of any listed chemical during the calendar year. Persistent, bioaccumulative and toxic (PBT) chemicals are subject to different thresholds of 10 pounds, 100 pounds or 0.1 grams depending on the chemical.

Tier 2 data is a publicly available database from the Texas Department of State Health Services Tier 2 Chemical Reporting Program. Under the community right-to-know program laws upheld at the state and federal level, all facilities which store significant quantities of hazardous chemicals must share this information with state and local emergency responders and planners. Facilities in Texas share this information by filing annual hazardous chemical inventories with the state, with Local Emergency Planning Committees (LEPCs) and with local fire departments. The Texas Tier 2 Reports contain facility identification information and detailed chemical data about hazardous chemicals stored at the facility.

A facility must report if it meets the following criteria:

- Any company using chemicals that could present a physical or health hazard must report them, according to Tier 2 requirements.

- If an industry has an OSHA deemed hazardous chemical that exceeds the appropriate threshold at a certain point in time, then the chemical must be reported. These chemicals may be on the list of 356 Extremely Hazardous Substances (EHS) or could be one of the 650,000 reportable hazardous substances (not on the EHS list). This reporting format is for a "snapshot in time". EHS chemicals have to be reported if the quantity is either greater than 500 pounds, or if the Threshold Planning Quantity (TPQ) amount is less than 500 pounds.

Location
The locations of available georeferenced TRI and Tier 2 listed toxic sites in the planning area are shown below in Figure 28 For fixed site analysis, only toxic sites that have georeferenced data available were analyzed and the circle buffers, 500 and 2,500 meters are assumed in respect to the different levels of impact—immediate (primary) and secondary, are drawn around each hazardous material site.

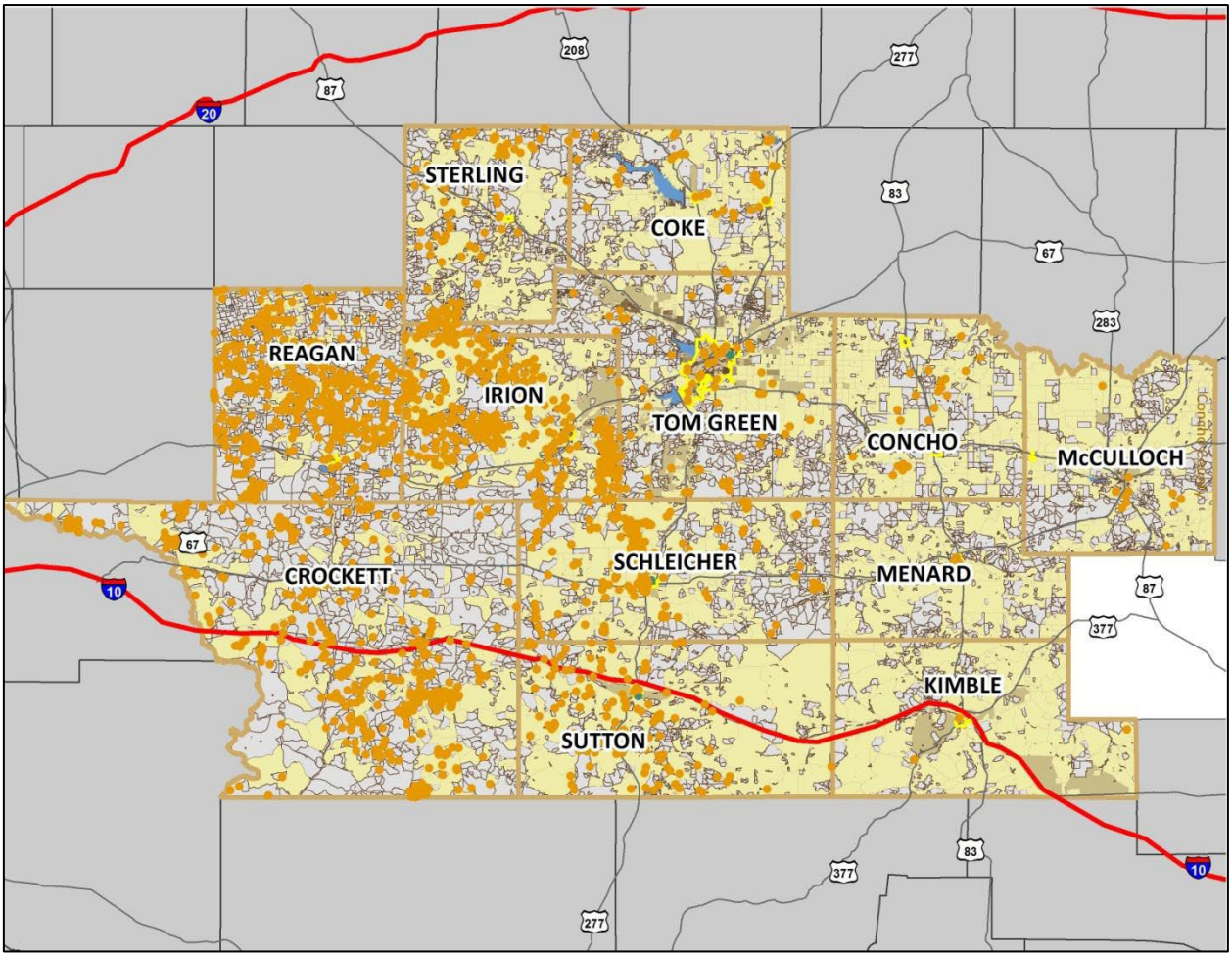


Figure 28: Fixed HAZMAT Analysis Locations and Buffers for the Concho Valley COG

For the mobile toxic release analysis, major roads consisting of Interstates, U.S. highways and State highways, along with railroads were chosen as the routes where hazardous materials are most likely to be transported. The analysis buffer along these selected infrastructure elements is the same as that used for fixed site analysis (500 meters and 2,500 meters). The 500-meter and 2,500-meter buffers for the two infrastructure elements that comprise the mobile toxic release hazard: highway and rail are illustrated in Figure 29. It is worth noting that all known city facilities fall within at least the 2,500-meter secondary impact buffer.

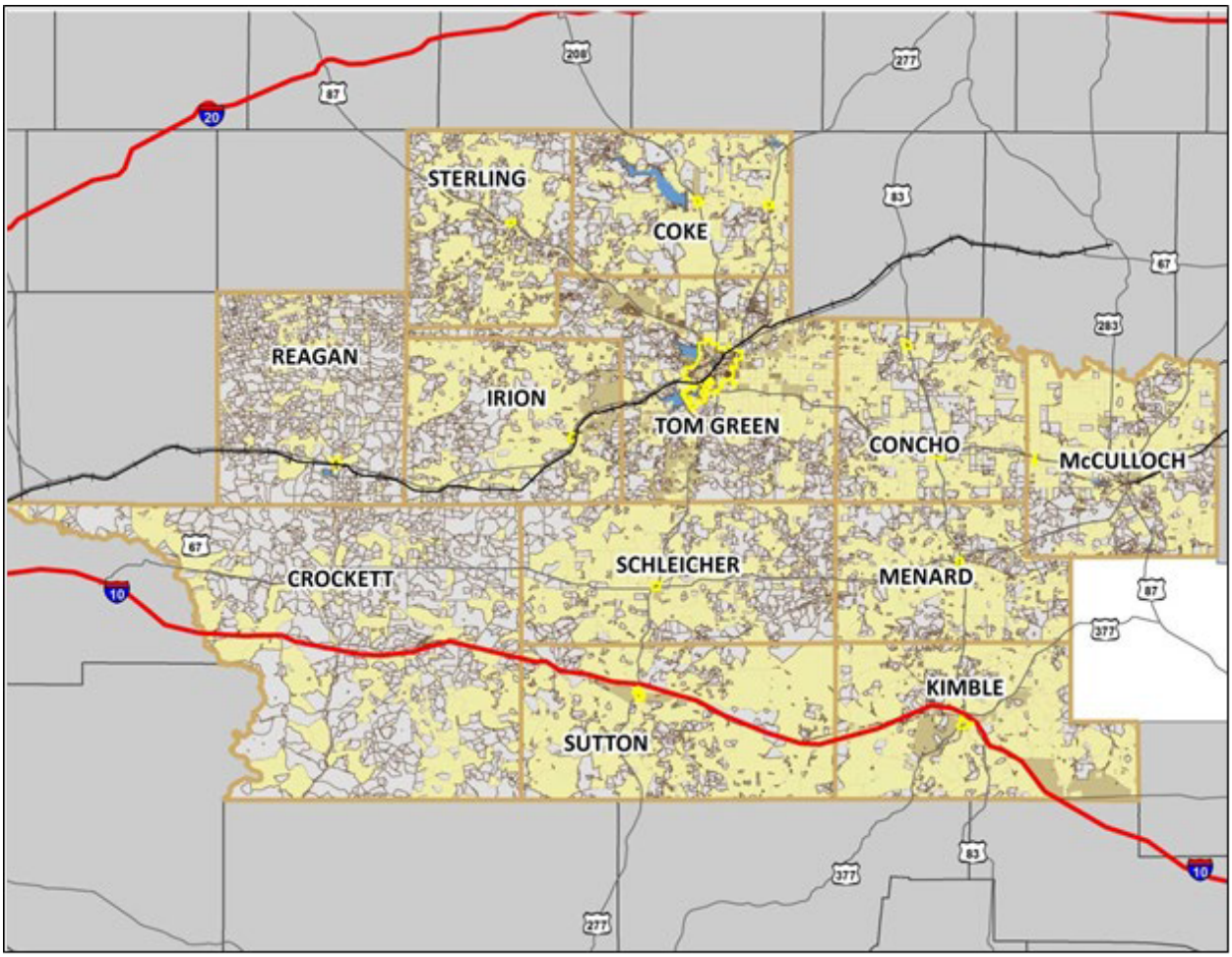


Figure 29: Mobile HAZMAT Analysis Corridors and Buffers

Extent

From a hazardous material incident, the micro-meteorological effects of the buildings and terrain can alter travel and duration of agents. Shielding in the form of sheltering-in-place can protect people and property from harmful effects. Non-compliance with fire and building codes, as well as failure to maintain existing fire and containment features can substantially increase the damage from a hazardous material incident. The duration of a hazardous material incident can range from hours to days. Warning time for hazardous material incidents is minimal to none.

Previous Occurrences

No historic incidents have been reported within the past 20 years. Approximately 2,037 hazardous materials facilities are required to report threshold incidents to the Toxic Release Inventory.

Probability of Future Events

Hazardous materials are transported through all counties within the planning area using major highways and thoroughfares. The risk of hazardous spills during transport exists and may

increase in areas with continued industrial development and major highways. Based on historical event information, the probability of future occurrences is unlikely, with an event possible within the next ten years.

Vulnerability and Impact

The estimated toxic release exposure of people and parcels by jurisdiction for fixed sites using census block data is shown in Table 62. Primary and secondary impact distances were selected based on guidance from FEMA 426, Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings and engineering judgment. Because many sites containing hazardous materials are located in densely populated areas, there is population and structures that could be susceptible to a release from more than one site.

Hazardous materials or toxic releases can have a substantial impact. Such events can cause multiple deaths, completely shut down facilities for thirty days or more, and cause more than fifty percent of affected properties to be destroyed or suffer major damage.

Table 62: Estimated Exposure of People and Parcels (Fixed Site Toxic Release)

JURISDICTION	IMMEDIATE IMPACT (500 METERS)			SECONDARY IMPACT (2,500 METERS)		
	Number People Exposed	Number Buildings Exposed	Value Of Buildings Exposed ($)	Number People Exposed	Number Buildings Exposed	Value Of Buildings Exposed ($)
Sutton County	**1,200**	**685**	**$62,916,000**	**6,924**	**3,921**	**$378,621,000**
Sonora	1,195	681	$62,740,000	5,663	3,161	**$308,062,000**
Uninc. Sutton County	**5**	**4**	**$176,000**	**1,261**	**760**	**$70,559,000**

Table 63: Estimated Exposure of People and Parcels (Mobile Toxic Release—Highway and Rail)

JURISDICTION	IMMEDIATE IMPACT (500 METERS)			SECONDARY IMPACT (2,500 METERS)		
	Number People Exposed	Number Buildings Exposed	Value Of Buildings Exposed ($)	Number People Exposed	Number Buildings Exposed	Value Of Buildings Exposed ($)
Sutton County	**2,047**	**1,165**	**$118,516,000**	**3,546**	**2,003**	**$199,398,000**
Sonora	**1,702**	**963**	**$96,355,000**	**2,891**	**1,613**	**$158,154,000**
Uninc. Sutton County	**345**	**202**	**$22,161,000**	**655**	**390**	**$41,244,000**

Appendix F: Special Projects & Considerations

Below are case studies submitted by the City of Sonora in relation to project ideas and considerations for identified hazards. These case studies could be considered as a baseline for future projects or informational purposes to support the need for hazard mitigation in the community.

Case Study One

Importance of Including Groundwater Production and Wastewater Treatment Facilities in the Hazard Mitigation Plan

Introduction

Groundwater production and wastewater treatment facilities are vital components of any urban infrastructure. Their inclusion in the Hazard Mitigation Plan (HMP) is essential for ensuring the resilience and functionality of essential services during and after disaster events. The city of Sonora provides a pertinent example of the significant impacts that natural disasters can have on such facilities, highlighting the need for proactive mitigation measures.

Case Study: 2018 Sonora Flood Event and 2021Winter Storm Uri

Impact of the 2018 Sonora Flood Event

During the Sonora flood event in 2018, several critical components of Sonora's wastewater management infrastructure were severely affected:

- Wastewater Treatment Plant: Located on the southern end of Sonora, downstream of the Dry Devils River, the plant's headworks were damaged. The fine screens, which are essential for initial wastewater treatment, required replacement at a cost of approximately $25,000.
- Lift Stations: The flood severely damaged one lift station located in the commercial district on the northwest side of Sonora, incurring an estimated repair cost of $1 million. The station's location within the floodplain was a significant factor in its failure.
- Aerial Sewer Lines: Damage to several aerial sewer lines required repairs costing around $20,000.

These incidents underscore the vulnerability of wastewater infrastructure to flooding, especially those situated in floodplains. Such damages disrupt service delivery and pose environmental and public health risks.

Impact of Winter Storm Uri (2021)

Winter Storm Uri further demonstrated the vulnerability of Sonora's water infrastructure:

- Water System: Several six-inch lines at the water processing centers froze and cracked, necessitating repairs costing approximately $6,000. This highlighted the susceptibility of water supply lines to extreme cold temperatures.
- Lift Station: The previously damaged lift station from the 2018 flood sustained additional damage. The trash pump froze due to a lack of electricity, causing the housing to crack and rendering the lift station non-functional. Necessary cost repairs approximately $14360.

Critical Need for Infrastructure Resilience

Ensuring Water Quality

Maintaining good quality drinking water during disaster events is critical. The following measures are necessary to achieve this:

- Backup Power Supplies: Ensuring continuous power supply to water processing and wastewater treatment facilities can prevent equipment failure during power outages.
- Adequate Insulation: Service lines need proper insulation to withstand extreme temperatures, preventing freezing and subsequent damage.
- Infrastructure Relocation and Rebuilding: Facilities located within the hundred-year floodplain should be relocated or rebuilt to higher standards to mitigate flood risks.

Conclusion

The experiences of Sonora during the 2015 Sonora flood and 2021 Winter Storm Uri event vividly illustrate the need to include groundwater production and wastewater treatment facilities in the Hazard Mitigation Plan. Such inclusion will facilitate proactive measures, ensuring that these critical infrastructures remain functional during disasters, thereby protecting public health, the environment, and the economic stability of the region. As Sonora works on relocating and rebuilding its vulnerable lift station, it serves as a testament to the importance of resilience planning in safeguarding essential services.

Case Study 2

Developing and Implementing a Flood Forecasting Program for Sonora, Texas

Introduction

During the devastating flood event of 2018, emergency responders in the City of Sonora and Sutton County struggled to estimate and forecast flood water levels accurately. This highlighted the critical need for a robust flood forecasting program. Such a program is essential to improve public safety, protect property, and ensure timely and effective emergency response. The leadership of these entities must prioritize the development and implementation of a flood forecasting system to mitigate future flood risks.

Key Components of a Flood Forecasting Program

The proposed flood forecasting program will consist of several key components to ensure its effectiveness. These components include:

1. Inundation Model
2. Real-Time Water Level Measurements
3. Elevation Map Creation
4. Hydraulic Modeling

Inundation Model

An inundation model predicts the areas that will be affected by flooding based on various inputs such as rainfall data, river flow rates, and topographical information. This model helps emergency responders and planners visualize potential flood scenarios and prepare accordingly.

Real-Time Water Level Measurements

Real-time water level measurements are crucial for an effective flood forecasting program. It is essential to develop a model that leverages artificial intelligence (AI) programming combined with real-time data from groundwater gauges. These gauges, deployed throughout the county, will provide hourly updates on water levels, allowing for accurate and timely information dissemination to relevant government agencies.

By continuously monitoring water levels in rivers and other bodies of water, the program can forecast potential hazard areas and provide early warnings to residents and emergency services.

Elevation Map Creation

Once water levels are known, having accurate terrain maps becomes critical. High-resolution elevation maps are invaluable for flood forecasting as they account for small terrain features that can significantly impact flooding. The mapping process involves:

- Collecting and aligning large sets of satellite images.
- Creating depth maps for each image and fusing them optimally to produce a comprehensive elevation map.

These maps enable precise modeling of water flow and potential flood impacts.

Hydraulic Modeling

With real-time water level data and accurate elevation maps, the next step is hydraulic modeling. This involves two main components:

<u>Physics-Based Hydraulic Model:</u>

This model updates the location and velocity of water over time based on physical laws. It is suitable for detailed and accurate simulations when provided with high-resolution inputs.

Machine Learning Integration:

To enhance efficiency, the hydraulic model can be optimized for network usage. Machine learning algorithms can be employed to extend traditional physics-based models, enabling the support of larger grids and covering more areas. This approach can simplify computational complexity while maintaining accuracy.

Anticipated Benefits

Implementing a comprehensive flood forecasting program offers numerous benefits:

Improved Public Safety:

Early warnings allow residents to evacuate or take protective measures, reducing the risk of injury or loss of life.

Property Protection:

Accurate forecasts enable better planning and response, minimizing property damage.

Efficient Emergency Response:

Real-time data and forecasts help emergency responders deploy resources more effectively and make informed decisions.

Community Preparedness:

Awareness and preparedness initiatives can be developed based on reliable flood forecasting data, enhancing community resilience.

Conclusion

The flood event of 2018 underscored the urgent need for a flood forecasting program in the City of Sonora and Sutton County. By developing and implementing a program that includes an inundation model, real-time water level measurements, elevation map creation, and advanced hydraulic modeling, local leadership can significantly improve the safety and well-being of their communities. Investing in this technology will provide timely and accurate information, helping to save lives and protect property in future flood events.

Case Study 3

Mitigating Flood Hazards in Sonora, Texas:

A Case for a Culvert Bridge on Chestnut Road

Introduction

In 2018, the city of Sonora, Texas, experienced a significant flood event that highlighted the vulnerability of certain residential areas. This document explores the challenges faced during the flood, particularly in the southeastern part of Sonora, and proposes the construction of a square culvert type bridge at the 300 block of Chestnut Road to mitigate these hazards. This bridge will provide essential ingress and egress routes for both emergency responders and residents during flood events.

Background

Sonora, Texas, like many areas prone to flooding, has regions where low water crossings serve as the only access points. During the 2018 flood, these crossings were submerged, isolating residential areas and complicating rescue efforts. The southeast part of Sonora was effectively turned into an island, making it nearly impossible for emergency responders to reach the stranded citizens.

The Problem

Isolation During Floods:

The low water crossings on the roads servicing the southeast part of Sonora were completely submerged during the flood event, cutting off access.

Emergency Response Issues:

Emergency responders struggled to reach the citizens, delaying critical assistance.

Resident Safety:

Residents were trapped without a safe way to evacuate, increasing the risk of harm.

Proposed Solution: Square Culvert Bridge

To address these challenges, the construction of a square culvert type bridge at the 300 block of Chestnut Road is proposed. This structure will ensure that the area remains accessible during flood events, providing a reliable route for both emergency responders and residents.

Benefits of the Culvert Bridge

Uninterrupted Access:

The bridge will remain above water levels during floods, ensuring continuous access.

Improved Safety:

Residents will have a secure evacuation route, reducing the risk of being stranded.

Enhanced Emergency Response:

Emergency services can reach affected areas more swiftly, improving response times and outcomes.

Implementation Plan

1. Site Assessment:

   Conduct a thorough assessment of the proposed site at the 300 block of Chestnut Road to determine the specific engineering requirements.

2. Design and Engineering:

   Develop detailed plans for the square culvert bridge, ensuring it meets all safety and regulatory standards.

3. Funding:

   Secure funding through local government budgets, state assistance, and federal grants. Possible sources include FEMA's Hazard Mitigation Grant Program and the Texas Department of Transportation.

4. Construction:

   Hire qualified contractors to build the bridge, with an emphasis on quality and durability to withstand future flood events.

5. Community Engagement:

   Inform and involve the local community throughout the planning and construction process to ensure support and address any concerns.

Conclusion

The construction of a square culvert bridge at the 300 block of Chestnut Road is a critical step in enhancing the flood resilience of Sonora, Texas. By ensuring reliable access for emergency responders and providing a safe evacuation route for residents, this infrastructure project will significantly mitigate the hazards posed by future flood events. The city of Sonora must prioritize this project, seeking necessary funding and engaging the community to protect its citizens from the dangers of flooding.

Next Steps

1. Research Funding Options:

   Identify and apply for grants at local, state, and federal levels.

2. Engage Stakeholders:

Hold meetings with local residents, emergency services, and city planners to gather input and support.

3. Initiate Design Phase:

   Commission engineers to begin detailed design work on the culvert bridge.

4. Begin Construction:

   Start the construction process with regular updates and milestones to keep the community informed.

By following these steps, Sonora can ensure that its southeastern residents are protected and accessible, even during severe weather events.

Sonora EOC Development

In recent years, the city of Sonora has experienced a range of emergencies and disasters, from devastating wildfires, floods, and winter storms to public health crises like pandemics and the ongoing border security challenges. These events have tested our resilience and underscored the critical need for a centralized approach to managing such crises. Despite the commendable efforts of our emergency responders and volunteers, the lack of a dedicated emergency operations center (EOC) has hindered our ability to effectively coordinate and manage resources during these critical times.

An emergency operations center would serve as a centralized command and control facility, bringing together representatives from local government, emergency services, healthcare providers, and community organizations. This hub would facilitate seamless collaboration, communication, and coordination among all stakeholders involved in emergency response. By having a unified location where key decision-makers can work together, the EOC would significantly enhance our community's ability to respond to and recover from disasters more efficiently and effectively.

The absence of an EOC in Sonora has led to challenges in managing emergencies, often resulting in delayed responses and inefficient use of resources. The establishment of an EOC would ensure that during emergencies, our city can provide a swift and coordinated response, ultimately leading to better outcomes for our residents. Unfortunately, both the city of Sonora and Sutton County currently lack the necessary resources to develop or build an EOC. Efforts are ongoing to secure funding through various grant applications aimed at either constructing a new facility or rehabilitating existing structures to serve as our EOC.

The creation of an EOC is not just a logistical improvement; it is a vital step toward safeguarding our community's future. By investing in this critical infrastructure, we can ensure that Sonora is

better prepared to handle whatever challenges come our way, protecting lives, property, and the well-being of our citizens.

Appendix G: Plan Adoption

All adoption resolutions will be placed here

Appendix H: FEMA Approval Letter