H2O PARTNERS

2026

City of San Angelo and Tom Green County

Hazard Mitigation Plan Update

Mitigating Risk for a Safe, Secure, Sustainable Future

For more information, visit our website at:

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Section 1
Introduction

SECTION 1: INTRODUCTION

BACKGROUND

Tom Green County is located in West-Central Texas. The largest city and county seat, San Angelo, is approximately 230 miles southwest of Fort Worth. Coke County is adjacent to the north, Runnels County to the northeast, Sterling County to the northwest, Concho County borders the eastern portion of the county, Irion County and Reagan County are to the west, and Menard County and Schleicher County are to the south.

Texas is prone to extremely heavy rains and flooding, with half of the world record rainfall rates (48 hours or less)[1] While flooding is a well-known risk, the City of San Angelo and Tom Green County are susceptible to a wide range of natural hazards, including but not limited to tornadoes, extreme heat, wildfire, and drought. These life-threatening hazards can destroy property, disrupt the economy, and lower the overall quality of life for individuals.

While it is impossible to prevent an event from occurring, the impacts to people and property can be minimized through effective mitigation. The Federal Emergency Management Agency (FEMA) defines mitigation as *sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects.*[2] Communities participate in hazard mitigation by developing hazard mitigation plans. The Texas Division of Emergency Management (TDEM) is required to review the plan, and FEMA has the authority to review and approve hazard mitigation plans through the Disaster Mitigation Act of 2000.

The Disaster Mitigation Act requires that hazard mitigation plans be reviewed and revised every five years to maintain eligibility for Hazard Mitigation Assistance (HMA) grant funding. In 2020, the City of San Angelo and Tom Green County developed their previous Hazard Mitigation Action Plan (HMAP) to be specific to the City of San Angelo and Tom Green County.

FEMA approved the previous Tom Green County / City of San Angelo Hazard Mitigation Action Plan in 2020, which then was set to expire in 2025. Therefore, the City and County began the process of developing a Hazard Mitigation Plan Update in order to maintain eligibility for grant funding. The HMAP Update planning process provided an opportunity for the City of San Angelo and Tom Green County to evaluate successful mitigation actions and explore opportunities to avoid future disaster loss.

The City of San Angelo and Tom Green County selected H2O Partners, Inc. to write and develop the 2026 Plan Update, hereinafter titled: “City of San Angelo and Tom Green County Hazard Mitigation Action Plan Update 2026: Maintaining a Safe, Secure, and Sustainable Community” (Plan Update). This is a multi-jurisdictional plan; the participating jurisdictions include:

[1] Source: http://www.floodsafety.com/texas/regional-info/san-antonio-flooding/
[2] Source: http://www.fema.gov/hazard-mitigation-planning-resources

- Tom Green County
- City of San Angelo
- San Angelo Independent School District (ISD)[3]

Hazard mitigation activities are an investment in a community's safety and sustainability. It is widely accepted that the most effective hazard mitigation measures are implemented at the local government level, where decisions on the regulation and control of development are ultimately made. A comprehensive review of a hazard mitigation plan addresses vulnerabilities to hazards that exist today and in the foreseeable future. Therefore, it is essential that a plan identify projected patterns of how future development will increase or decrease a community's overall hazard vulnerability.

SCOPE

The focus of the Plan is to identify activities to mitigate hazards classified as "high" or "moderate" risk, as determined through a detailed hazard risk assessment conducted for the City of San Angelo, Tom Green County, and the participating ISD. The hazard classification enables the participating jurisdictions to prioritize mitigation actions based on hazards that can present the greatest risk to lives and property in the geographic scope.

PURPOSE

The Plan Update was prepared by the City of San Angelo, Tom Green County, San Angelo ISD, and H2O Partners, Inc. The purpose of the Plan Update is to protect people and structures and to minimize the costs of disaster response and recovery. The goal of the Plan Update is to minimize or eliminate long-term risks to human life, property, operations, and the environment from known hazards by identifying risks and implementing cost-effective hazard mitigation actions. The planning process is an opportunity for participating jurisdictions within the City of San Angelo and Tom Green County, stakeholders, and the general public to evaluate and develop successful hazard mitigation actions to reduce future risk of loss of life and damage to property resulting from a disaster in the planning area.

The Mission Statement of the Plan Update is "*Maintaining a secure and sustainable future through the revision and development of targeted hazard mitigation actions to protect life and property."*

The City of San Angelo, Tom Green County, and San Angelo ISD identified eleven natural hazards to be addressed by the Plan Update. The specific goals of the Plan Update are to:

- Provide a comprehensive update to the 2020 HMAP;
- Minimize disruption to participating jurisdictions within the County following a disaster;
- Streamline disaster recovery by articulating actions to be taken before a disaster strikes to reduce or eliminate future damage;
- Demonstrate a firm local commitment to hazard mitigation principles;
- Serve as a basis for future funding that may become available through grants and technical assistance programs offered by the State or Federal government. The Plan will enable the City of San Angelo, Tom Green County, and the participating ISD to take advantage of rapidly developing mitigation grant opportunities as they arise; and

[3] This is a new Plan participant.

- Ensure that the City of San Angelo, Tom Green County, and San Angelo ISD maintain eligibility for the full range of future Federal disaster relief.

AUTHORITY

The Plan is tailored specifically for the City of San Angelo, Tom Green County, San Angelo ISD and plan participants including Planning Team members, stakeholders, and the general public who participated in the Plan Update development process. The Plan complies with all requirements promulgated by the Texas Division of Emergency Management (TDEM) and all applicable provisions of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Section 104 of the Disaster Mitigation Act of 2000 (DMA 2000) (P.L. 106-390), and the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004 (P.L. 108–264), which amended the National Flood Insurance Act (NFIA) of 1968 (42 U.S.C. 4001, et al). Additionally, the Plan complies with the Interim Final Rules for the Hazard Mitigation Planning and Hazard Mitigation Grant Program (44 CFR, Part 201), which specify the criteria for approval of mitigation plans required in Section 322 of the DMA 2000 and standards found in FEMA's "Local Mitigation Planning Policy Guide" (April 2025), and the "Local Mitigation Planning Handbook" (June 2025).

SUMMARY OF SECTIONS

Sections 1 and 2 of the Plan Update outline the Plan's purpose and development, including how Planning Team members, stakeholders, and members of the general public were involved in the planning process. Section 3 profiles the planning area's population and economy.

Sections 4 through 15 present a hazard overview and information on individual natural hazards in the planning area. For each hazard, the Plan Update presents a description of the hazard, a list of historical hazard events, and the results of the vulnerability and risk assessment process.

Section 16 presents hazard mitigation goals and objectives. Section 17 gives an analysis of the previous actions, and Section 18 presents hazard mitigation actions for the City of San Angelo, Tom Green County, and the participating ISD. Section 19 identifies Plan maintenance mechanisms.

Human-caused hazards are included in Appendix A The list of Planning Team members and stakeholders is located in Appendix B. Public survey results are presented in Appendix C. Appendix D contains a detailed list of critical facilities for the area. Appendix E contains information regarding dam locations within the City of San Angelo and Tom Green County. Appendix F contains information regarding workshops and meeting documentation. Capability Assessment results for the Plan participants are in Appendix G. Appendix H includes State and Federal Funding Opportunities. Resolutions denoting adoption of the Plan Update are located at the end of this document.[4]

[4] Information contained in some of these appendices is exempt from public release under the Freedom of Information Act (FOIA).

Section 2
Planning Process

SECTION 2: PLANNING PROCESS

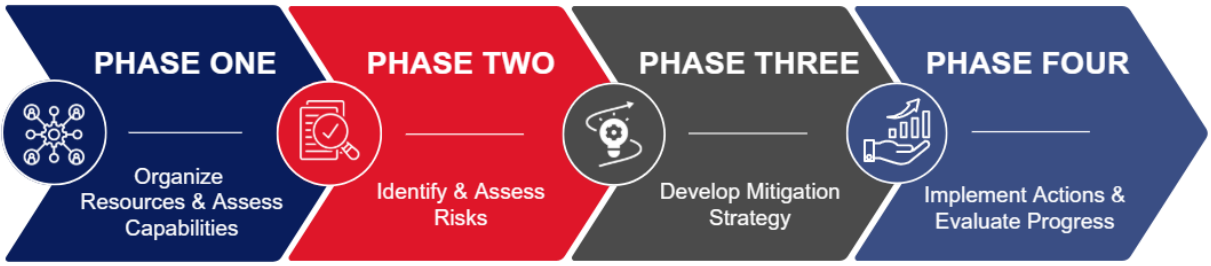
PLAN PREPARATION AND DEVELOPMENT

Hazard mitigation planning involves coordination with various constituents and stakeholders to develop a more disaster-resistant community. Section 2 provides an overview of the planning process, including the identification of key steps and a detailed description of how stakeholders and the public were involved.

OVERVIEW OF THE PLAN

The City of San Angelo and Tom Green County hired H2O Partners, Inc. (Consultant Team), to provide technical support and oversee the development of the City of San Angelo and Tom Green County Hazard Mitigation Action Plan Update 2026. The Consultant Team used the FEMA “Local Mitigation Planning Policy Guide” (April 2025), and the “Local Mitigation Planning Handbook” (June 2025) to develop the Plan Update. The overall planning process is shown in Figure 2-1 below.

Figure 2-1. Mitigation Planning Process



PLANNING TEAM

Key members of H2O Partners, Inc. developed the Plan Update in conjunction with the Planning Team. The Planning Team was established using a direct representation model. Some of the responsibilities of the Planning Team included completing Capability Assessment surveys, providing input regarding the identification of hazards, identifying mitigation goals, and developing mitigation strategies. An Executive Planning Team consisting of key personnel involved in hazard mitigation activities from the City of San Angelo, Tom Green County, and San Angelo ISD, shown in Table 2-1, was formed to coordinate planning efforts and request input and participation in the planning process. Table 2-2 reflects the Advisory Planning Team, consisting of additional representatives from additional and departments from the participating jurisdictions within Tom Green County that participated throughout the planning process. All Executive and Advisory Planning Team members are involved in hazard mitigation activities; those with the authority to regulate development are identified within Appendix B.

Table 2-1. Executive Planning Team

Organization / Department	Title
Tom Green County – Government	Commissioner Precinct 3
City of San Angelo – Emergency Management	Emergency Management Coordinator
City of San Angelo – Public Works	Grants Administrator
San Angelo ISD – Student Services and School Safety	Director

Table 2-2. Advisory Planning Team

Organization / Department	Title
Tom Green County – Environmental Health Services	Senior Environmental Specialist Designative Representative / Site Evaluator
Tom Green County – Financial Accounting and Grants	Grants Administrator
Tom Green County – Government	County Judge
City of San Angelo – Operations	Stormwater Program Administrator

Organization / Department	Title
City of San Angelo – Engineering	City Engineer
City of San Angelo – Finance	Assistant Director
City of San Angelo – Finance	Director
City of San Angelo – Fire	Assistant Fire Chief / Operations
City of San Angelo – Fire	Fire Chief
City of San Angelo – Government	Assistant City Attorney
City of San Angelo – Government	City Attorney
City of San Angelo – Government	City Manager
City of San Angelo – Information Technology	IT Lead
City of San Angelo – Operations	Assistant Director
City of San Angelo – Operations	Director
City of San Angelo – Planning and Development Services	Director
City of San Angelo – Water Utilities	Director
City of San Angelo – Public Works	Executive Director
San Angelo ISD – Administration	Superintendent
San Angelo ISD – Business and Support Services	Assistant Superintendent
San Angelo ISD – Purchasing	Director

PUBLIC AND STAKEHOLDER INVOLVEMENT

An important component of hazard mitigation planning is public participation and stakeholder involvement. Input from individual citizens and the community as a whole provides the Planning Team with a greater understanding of local concerns and increases the likelihood of successfully implementing hazard mitigation actions. When citizens and stakeholders, such as local businesses, nonprofits, hospitals, and schools are involved, they are more likely to gain a greater appreciation of the risks that hazards may present in their community and take steps to reduce or mitigate their impact.

Stakeholder involvement is essential because a diverse group of participants can provide insight from a wide range of perspectives and expertise. Throughout the planning process, members of community organizations, local businesses, schools, hospitals, and neighboring jurisdictions were invited to participate in the development of the Plan Update. The Stakeholder Group included representatives from both the public and private sectors and served as a key component of participating jurisdictions' outreach efforts. Their input directly influenced the Plan Update; for

example, concerns expressed at public meetings regarding potential wildfire incidents led the Planning Team to include a mitigation action to conduct vegetation and brush removal in residential areas to reduce the risks of wildfire.

A key goal of the Planning Team was to build equity into the planning process. Organizations that support underserved communities and socially vulnerable populations were intentionally invited to ensure equitable access to the planning process and meaningful participation by all residents. These organizations also helped ensure that the interests of vulnerable populations were accurately represented and served as valuable resources for sharing information with those communities. The Planning Team drew on longstanding partnerships and coordinated with new local agencies, organizations, and community leaders to support engagement efforts. These organizations were included in the planning process as stakeholders and were invited to participate in the planning process via email. These agencies were also encouraged to publicize and attend public meetings and solicit feedback through the public survey.

Overall, the public and stakeholders were involved in the development of the City of San Angelo and Tom Green County Hazard Mitigation Action Plan Update 2026 at different stages prior to official Plan approval and adoption. Public input was gathered through three methods: (1) open public meetings; (2) survey instruments; and (3) making the draft Plan Update available for public review on participating jurisdictions' websites.

The public and stakeholders were notified at the public meetings that the draft Plan Update would be available for review. The draft Plan Update was made available to the general public for review and comment on the participating jurisdictions' websites. While no feedback was received on the draft Plan Update itself, feedback provided through the public survey was incorporated into the Plan. Public input was used to identify hazards of greatest concern to residents and to help determine and prioritize mitigation actions.

Documentation of stakeholder meetings is included in Appendix F. A list of organizations invited to participate and those that engaged in the planning process is provided in Appendix B. Upon approval by FEMA, the final Plan Update will be posted on the participating jurisdictions' websites, and a copy will be maintained at the City of San Angelo Office of Emergency Management.

PUBLIC MEETINGS

Public meeting notices were posted on the participating jurisdictions' websites, social media platforms, and bulletin boards in public facilities to increase public participation in the Plan Update development process. A series of public meetings were held in the planning area to collect public and stakeholder input. Topics of discussion included the purpose of hazard mitigation, discussion of the planning process, and types of natural hazards. A sampling of these notices can be found in Appendix F, along with the documentation on the public meetings.

Public meetings were held on the following dates:

- October 22, 2025, at the City Hall building in the City of San Angelo
- December 3, 2025, at the City Hall building in the City of San Angelo

PUBLIC PARTICIPATION SURVEY

In addition to public meetings, the Planning and Consultant Teams developed a public survey designed to solicit public input during the planning process from citizens and stakeholders to obtain data regarding the identification of any potential hazard mitigation actions or problem areas. The survey was promoted by local officials and a link to the survey was posted on the

participating jurisdictions' websites. A total of 70 surveys were completed online. The survey results are presented in Appendix C. The Planning Team reviewed the input from the surveys and decided which information to incorporate into the Plan as hazard mitigation actions. For example, results indicate that drought and extreme heat are the hazards of highest concern for the public. Constructing, maintaining and retrofitting infrastructure, as well as protecting and improving the reliability of utilities were two main actions identified in survey responses that the local government should take to mitigate risk to these hazards. As a result, the Planning Team has included mitigation actions to upgrade critical facilities to include drought mitigation measures such as greywater reuse systems, drought tolerant landscaping, and installation of a sprinkler system, as well as installing generators at all fire stations and critical facilities throughout the planning area.

PLANNING PROCESS

The process used to prepare the Plan Update followed the four major steps included in Figure 2-1. After the Planning Team was organized, a capability assessment was developed and distributed at the Kickoff Workshop. A capability assessment is used to summarize and determine the extent of a jurisdiction's planning, regulatory, administrative, technical, fiscal, and political capacity.

Hazards identified by the Planning Team were assessed on the basis of historical occurrences and corresponding injuries, fatalities, and monetary damages. Results associated with each of the hazards were provided at the Risk Assessment Workshop. Based on the participating jurisdictions' and district's identified social and structural vulnerabilities, specific mitigation strategies were discussed and developed at the Mitigation Strategy Workshop.

During the Plan Update development process described herein, the following factors were taken into consideration:

- The nature and magnitude of risks currently affecting the communities;
- Current and anticipated conditions and financial resources;
- Feasibility issues that could affect implementation of the Plan Update;
- Anticipated outcomes; and
- How the City of San Angelo, Tom Green County, San Angelo ISD, agencies, and partners will participate in implementing the Plan Update.

Finally, Plan maintenance and implementation procedures are included in Section 19. Participation of Planning Team members, stakeholders, and the public at each of the workshops is documented in Appendix F.

KICKOFF WORKSHOP

The Kickoff Workshop was held on October 22, 2025 virtually via Microsoft Teams. The initial workshop informed participating officials and key department personnel about how the planning process pertained to their distinct roles and responsibilities and engaged stakeholder groups that focus on vulnerable populations and underserved communities including, but not limited to, public libraries, economic development agencies, local colleges, and surrounding communities. In addition to the kickoff presentation, participants received the following:

- Project overview regarding the planning process;
- Public survey access information;
- Hazard Ranking form; and

- Capability Assessment survey for completion.

At the Kickoff Workshop, the Planning Team identified and considered a range of natural hazards that affect the communities. Each participant ranked hazards in terms of the frequency of occurrence and impact. The results of the ranking sheets reflect differing perceptions of risk across the planning area based on individual experience, professional roles, and familiarity with local conditions. The assessments were also used to set priorities for hazard mitigation actions based on potential loss of lives and dollar losses.

HAZARD IDENTIFICATION

At the Kickoff Workshop, and through email and phone correspondence, the Planning Team conducted preliminary hazard identification. The Planning Team, in coordination with the Consultant Team, reviewed and considered a full range of natural hazards. Once identified, the teams narrowed the list to significant hazards by reviewing hazards affecting the area, the 2023 State of Texas Hazard Mitigation Plan, and initial study results from reputable sources such as federal and state agencies. Based on this initial analysis, the teams identified a total of 11 natural hazards which pose a significant threat to the planning area.

RISK ASSESSMENT

An initial risk assessment for the City of San Angelo, Tom Green County, and San Angelo ISD was completed in November 2025 and results were presented to Planning Team members at the Risk Assessment Workshop held on December 3, 2025, in conjunction with the Mitigation Strategy Workshop, virtually via Microsoft Teams. At the workshop, the characteristics and consequences of each hazard were evaluated to determine the extent to which the planning area would be affected in terms of potential danger to citizens and property.

Property and crop damages were estimated by gathering data from the National Centers for Environmental Information (NCEI) and the National Oceanic and Atmospheric Administration (NOAA). The assessment also examined the impact of various hazards on the built environment, including general building stock, critical facilities, lifelines, and infrastructure. The resulting risk assessment profiled hazard events, provided information on previous occurrences, estimated probability of future events, and detailed the spatial extent and magnitude of impacts on people and property. Following the Risk Assessment Workshop, historical event data from the NCEI was provided to the Planning Team for their review and assistance in identifying significant events. A hazard profile and vulnerability analysis for each of the hazards can be found in Sections 4 through 15.

MITIGATION STRATEGY DEVELOPMENT

Developing the mitigation strategy for the Plan Update involved identifying mitigation goals and new mitigation actions. A Mitigation Strategy Workshop was held on December 3, 2025, in conjunction with the Risk Assessment Workshop, virtually via Microsoft Teams. Regarding hazard mitigation action priorities, workshop participants emphasized the desire for flood projects. The Planning Team was proactive in identifying mitigation actions to lessen the risk of all the identified hazards included in the Plan Update.

The Consultant Team provided example hazard mitigation actions for profiled hazards to generate ideas about actions relevant to the Plan Update. Planning Team members then developed action plans identifying proposed actions, costs and benefits, the responsible organization(s), effects on new and existing buildings, implementation schedules, priorities, and potential funding sources.

Each mitigation action in Section 18 identifies a lead agency, funding source, and implementation timeframe to ensure accountability and timely progress.

Specifically, the process involved:

- Listing optional hazard mitigation actions based on information collected from previous plan reviews, studies, and interviews with federal, state, and local officials. Workshop participants reviewed the optional mitigation actions and selected actions that were most applicable to their area of responsibility, cost-effective in reducing risk, easily implemented, and likely to receive institutional and community support.

- Workshop participants inventoried federal and state funding sources that could assist in implementing the proposed hazard mitigation actions. Information was collected, including the program name, authority, purpose of the program, types of assistance and eligible projects, conditions on funding, types of hazards covered, matching requirements, application deadlines, and a point of contact.

- Planning Team members considered the benefits that would result from implementing the hazard mitigation actions compared to the cost of those projects. Although detailed cost-benefit analyses were beyond the scope of the Plan Update, Planning Team members utilized economic evaluation as a determining factor between hazard mitigation actions.

- Planning Team members then selected and prioritized mitigation actions based on FEMA's STAPLEE criteria and included social, technical, administrative, political, legal, economic, and environmental considerations. The overall priority of each action is reflected in the hazard mitigation actions identified in Section 18.

Hazard mitigation actions identified in the process were made available to the Planning Team for review. The draft Plan Update was maintained on file by the City of San Angelo, Tom Green County, and San Angelo ISD, and was made available to the general public for review.

REVIEW AND INCORPORATION OF EXISTING PLANS

REVIEW

Background information utilized during the planning process included various studies, plans, reports, and technical information from sources such as FEMA, the United States Army Corps of Engineers (USACE), the U.S. Fire Administration, the National Oceanic and Atmospheric Administration (NOAA), the Texas Water Development Board (TWDB), the Texas Commission on Environmental Quality (TCEQ), the Texas State Data Center, the Texas A&M Forest Service, the Texas Division of Emergency Management (TDEM), and local hazard assessments and plans. Section 4 and the hazard-specific sections of the Plan Update (Sections 5-15) summarize the relevant background information.

Specific background documents, including those from FEMA, provided information on hazard risk, hazard mitigation actions currently being implemented, and potential mitigation actions. Previous hazard events, occurrences, and descriptions were identified through NOAA's National Centers for Environmental Information (NCEI). Results of past hazard events were found through searching the NCEI Storm Events Database. The USACE studies were reviewed for their assessment of risk and potential projects in the region. Information from the State Demographer was reviewed for population and other projections and included in Section 3 of the Plan Update.

Data from the Texas A&M Forest Service was used to appropriately rank the wildfire hazard, and to help identify potential grant opportunities. Materials from FEMA and TDEM were reviewed for guidance on Plan Update development requirements.

INCORPORATION OF EXISTING PLANS INTO THE HMAP PROCESS

A Capability Assessment was completed by key departments from the City of San Angelo, Tom Green County, and San Angelo ISD, which provided information pertaining to existing plans, policies, ordinances, and regulations to be integrated into the goals and objectives of the Plan Update. The relevant information was included in a master Capability Assessment, Appendix G.

Existing projects and studies were utilized as a starting point for discussing hazard mitigation actions among Planning and Consultant Team members. For example, San Angelo ISD enhanced communication systems on all campuses. Subsequently, in order to build upon these efforts, the Planning Team included a mitigation action to reinforce community towers, masts, and antennas.

For a comprehensive list of actions from the previous Tom Green County / City of San Angelo Hazard Mitigation Action Plan, please refer to Section 17.

The current Flood Insurance Study (FIS) as well as the current effective Digital Flood Insurance Rate Maps (DFIRM) were used in the flood hazard risk assessment (Section 9). The FIRM panels for the City of San Angelo and Tom Green County (map ID 48451C, panels 25-1025) show the areas throughout the planning area at greater risk of flooding. The FIS report contains detailed flood elevation data in flood profiles and data tables and is utilized in determining extent.

Additionally, policies and ordinances were reviewed by the participating jurisdictions. Other plans were reviewed, such as Capital Improvement Plans and Emergency Operations Plans to identify any additional mitigation actions.

Finally, the 2023 State of Texas Hazard Mitigation Plan, developed by TDEM, was discussed in the initial planning meeting in order to develop a specific group of hazards to address in the planning effort. The 2023 State Plan was also used as a guidance document, along with FEMA materials, in the development of the City of San Angelo and Tom Green County Hazard Mitigation Action Plan Update 2026.

INCORPORATION OF THE HMAP INTO OTHER PLANNING MECHANISMS

Planning Team members will integrate implementation of the Plan Update with other planning mechanisms for the City of San Angelo, Tom Green County, and San Angelo ISD, such as the Emergency Operations Plan, ordinances, and related efforts. The capability assessment provides an overview of the Planning Team members' existing planning and regulatory capabilities. These existing capabilities provide the mechanisms to implement the mitigation strategy objectives. For example, the adoption of building codes and implementation of land use regulations have been demonstrated to help communities avoid losses from natural hazard events. Currently, the City of San Angelo has both building codes and land use regulations in place. Please refer to Appendix G for a complete inventory of each participating jurisdictions' capabilities.

Following adoption of the Plan Update, the Planning Team will coordinate periodic reviews of existing plans, planning mechanisms, and building codes to ensure hazard mitigation actions are integrated and implemented in accordance with the approved Plan. These reviews will evaluate

the need for revisions or updates and ensure that future long-term planning efforts contribute to reducing risk to life and property from identified moderate- and high-risk hazards.

It should be noted that the Hazard Mitigation Plan Update has been used as a reference when reviewing and updating all plans and ordinances for the entire planning area. The Emergency Management Action Plan developed for the City of San Angelo is updated every five years and incorporates goals, objectives and actions identified in the Plan Update.

OPPORTUNITIES FOR EXPANDING EXISTING CAPABILITIES

Based on the results of the completed Capability Assessments, the City of San Angelo, Tom Green County, and San Angelo ISD described methods for achieving future hazard mitigation measures by expanding existing capabilities. For example, each jurisdiction has an opportunity to identify opportunities for cross-training or increasing the technical expertise of staff by attending free training available through FEMA and the Texas Division of Emergency Management (TDEM) by monitoring classes and availability through the TDEM Training Division Learning Management Site.[1] In addition, each jurisdiction can identify Planning Team members with the authority to monitor the Plan and identify grant funding opportunities for expanding staff. Other options for improving capabilities for each jurisdiction are included in Table 2-3.

Table 2-3. Opportunities for Improving and Expanding Existing Capabilities

Jurisdiction	Opportunities
City of San Angelo	• Integrate risk information from HMAP into future updates to **Capital Improvement Plan**. • Integrate risk information from HMAP into future updates to **Comprehensive Plan**. • Develop a **Community Wildfire Protection Plan** based on information in the risk assessment and identified mitigation projects within the HMAP. • Review current **floodplain ordinances** for opportunities to increase resiliency such as modifying permitting or building codes. • Review current **building and land use ordinances** for opportunities to increase resiliency such as modifying permitting or building codes.
Tom Green County	• Integrate risk information from HMAP into future updates to **Capital Improvement Plan**. • Integrate risk information from HMAP into future updates to **Comprehensive Plan**. • Develop a **Community Wildfire Protection Plan** based on information in the risk assessment and identified mitigation projects within the HMAP. • Review current **floodplain ordinances** for opportunities to increase resiliency such as modifying permitting or building codes. • Develop **building and land use ordinances** that will require all new developments to conform to the highest mitigation standards.

[1] Texas Division of Emergency Management: https://tdem.texas.gov/preparedness/training

Jurisdiction	Opportunities
San Angelo ISD	• Integrate risk information from HMAP into future updates to **Capital Improvement Plan.** • Develop an **all-hazards outreach program** in coordination with the City of San Angelo and Tom Green County.

PLAN REVIEW AND PLAN UPDATE

As with the development of the Plan Update, the City of San Angelo and Tom Green County will oversee the review and update process for relevance and if necessary, make adjustments. At the beginning of each fiscal year, Planning Team members will meet to evaluate the Plan and review other planning mechanisms to ensure consistency with long-range planning efforts. In addition, planning participants will also meet once a year, by conference call or presentation, to re-evaluate prioritization of the hazard mitigation actions. The Plan may be amended to include additional hazard mitigation actions as they are developed.

TIMELINE FOR IMPLEMENTING MITIGATION ACTIONS

Both the Executive Planning Team (Table 2-1) and the Advisory Planning Team (Table 2-2) will engage in discussions regarding a timeframe for how and when to implement each hazard mitigation action. Considerations include when the action will be started, how existing planning mechanisms' timelines affect implementation, and when the action should be fully implemented. Timeframes may be general, and there will be short-, medium-, and long-term goals for implementation based on prioritization of each action, as identified on the hazard mitigation action tables included in the Plan Update for the City of San Angelo, Tom Green County, and San Angelo ISD.

Both the Executive and Advisory Planning Team will evaluate and prioritize the most suitable hazard mitigation actions for the community to implement. The timeline for implementation of actions will partially be directed by participating jurisdictions' comprehensive planning processes, budgetary constraints, and community needs. The City of San Angelo, Tom Green County, and San Angelo ISD are committed to addressing and implementing hazard mitigation actions that may be aligned with and integrated into the Plan Update.

Overall, the Planning Team is in agreement that goals and actions of the Plan Update shall be aligned with the timeframe for implementation of hazard mitigation actions with respect to annual review and updates of existing plans and policies.

Section 3
Planning Area Profile

SECTION 3: PLANNING AREA PROFILE

OVERVIEW

Tom Green County comprises 1,540.5 square miles in west central Texas. The "Concho Country," which included Tom Green County, was known to the Spanish 300 years before Texas became a republic. The native people in the area were the Jumanos. In 1629 and 1632, Father Juan de Salas visited and worked among the Jumanos on the Concho River. Captains Hernán Martín and Diego del Castillo who followed in 1650, recovered pearls from the Concho River. Early explorers noted the friendliness of the Jumanos, the abundance of pecan trees and mussel shells, and vast herds of buffalo. By the mid-eighteenth century, the Apache people had allied with and then absorbed the Jumanos. The Apache people were later forced west by the Comanches and their allies. The Comanche people remained in control of the Concho Country until they were overwhelmed by the westward expansion of settlers in the second half of the 19th century.

Following the annexation of Texas by the United States in 1845, a number of forts were built to restrain the Comanche attacks and protect the settlers moving to the region. A second series of forts was built, including Camp J. E. Johnston in northwest Tom Green County and Fort Chadbourne in the area of modern Coke County, thirty miles up Owl Creek from its confluence with the Colorado River. The Butterfield Overland Mail stage line followed in 1857, west through Carlsbad, across the headwaters of the Middle Concho River, on to Horsehead Crossing on the Pecos River, and El Paso. The stage line was abandoned, as was Fort Chadbourne, with the outbreak of the Civil War.

Following the Civil War, Ben Ficklin opened a stage station by the same name on the Concho River. The area attracted a few settlers, mostly migratory buffalo hunters. In the winter and spring, buffalo were plentiful and quickly became the major industry of the area. There were hostilities between the native groups and the hunters that escalated into a fight between people from the Kickapoo and a combination of Texas Rangers and Confederate troops at Dove Creek in January of 1865. Camp Hatch was established in 1867, renamed Camp Kelly in January of 1868, and finally Fort Concho in March. A small community was established at Fort Concho, consisting of a saloon and several gambling houses. The settlement was first called Over the River but later named Santa Angela. To obtain post office approval, the town was called San Angelo. The establishment of Fort Concho was the watershed event in the history of Tom Green County. The fort protected the stage and mail line, escorted cattle drives, and defended against attacks. By 1870, the population of the County was 1,000, with most people living near Fort Concho.

On March 13, 1874, the County was officially established by an act of the legislature and named in honor of Brigadier General Thomas Green. Because of the omission of a northern boundary, the County was a huge area of more than 60,000 square miles that included the land of 66 modern Texas counties. On August 21, 1876, the northern boundary was drawn from the northwest corner of Runnels County west to the New Mexico line. This cut off the area of 54 counties to the north. The remaining Tom Green County was still larger than Massachusetts and Connecticut combined and included the modern counties of Coke, Crane, Ector, Glasscock, Irion, Loving, Midland, Reagan, Sterling, Upton, and Ward. The county organization election was held on January 5, 1875, when the voters elected officials and chose Ben Ficklin, instead of the larger San Angelo, as the location for the county seat. The community of Ben Ficklin was completely destroyed by a flood in August 1882. This flood caused 65 deaths and the county seat to be moved to San Angelo. In 1884, the courthouse was built. Shortly after San Angelo became the County seat, the first sheep were brought from California by John Arden, and later they came from New England.

A major factor in the development of agriculture was the first rail connection completed in September 1888 by the Santa Fe Railroad. This provided direct access to the market for cattle, sheep, goats, wool, and other products. By the turn of the century, an estimated 3,500 to 5,000 railroad cars of cattle were shipped annually, making San Angelo the largest range cattle-shipping station in the United States. The County was not the leading sheep county in the region, but the railroad made it the market center. The first wool warehouse was built in the fall of 1888, and in the early years, over a million pounds of wool per year were shipped from San Angelo. A second rail connection was completed in 1908 by the Kansas City, Mexico, and Orient Railway. The decade of the 1880s ended with the incorporation of San Angelo as a city and the closing of Fort Concho in 1889. The first electric light plant was built in 1890, and the first sewer system was completed in 1895. The population increased gradually to 5,152 in 1890 and to 6,804 in 1900.

The population has increased every decade since organization, with the exception of the period 1910 to 1920, when a severe drought reduced the population by 15 percent from 17,882 people to 15,210 people. The area recovered, and the population increased to 36,033 in 1930 and 39,302 in 1940.

In the 20th century, the County continued to be dominated by agriculture, primarily cotton, beef cattle, and wool. Sheep and goats, grain sorghum, dairy cattle, pecans, and poultry also remained important. The City of San Angelo is now recognized as one of the nation's major market and processing center for sheep and wool, with Texas leading the U.S. in overall sheep and goat numbers, largely from the Edwards Plateau. Producers Livestock Auction is the largest sheep and goat auction in the country.[1,2]

Figure 3-1 shows the general location of City of San Angelo and Tom Green County.

[1] Texas State Historical Association: https://www.tshaonline.org/handbook/entries/tom-green-county
[2] Source: https://www.hmdb.org/m.asp?m=96063

Figure 3-1. Location of the City of San Angelo and Tom Green County

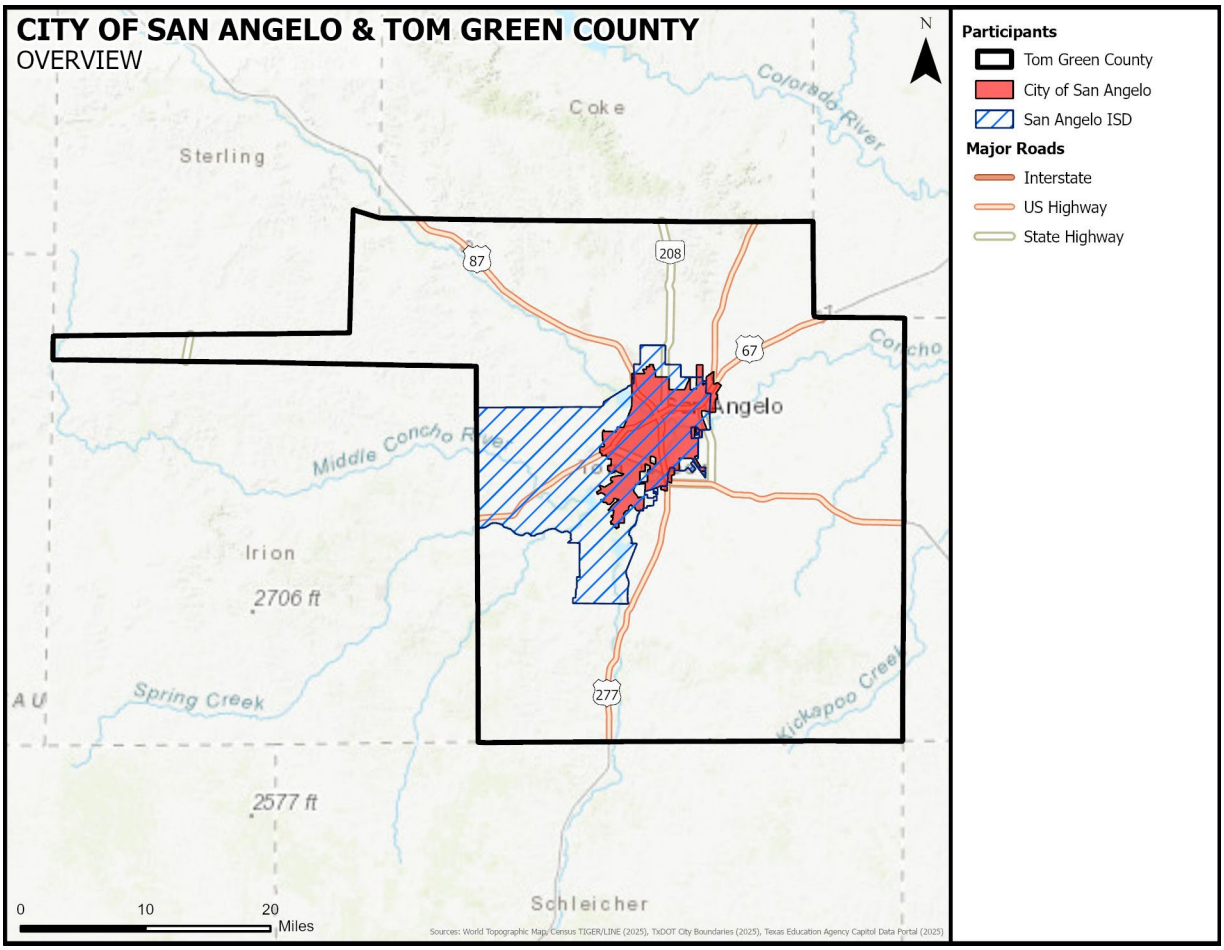
Table 3-1 below lists the jurisdictions and district that participated in the City of San Angelo and Tom Green County Hazard Mitigation Action Plan Update 2026.

Table 3-1. Participating Jurisdictions

Participating Jurisdictions
City of San Angelo
Tom Green County
San Angelo Independent School District (ISD)

Figure 3-2 shows the participating jurisdictions and district that are covered in the risk assessment analysis of the Plan Update.

Figure 3-2. City of San Angelo and Tom Green County Planning Area



POPULATION AND DEMOGRAPHICS

Table 3-2 shows the population distribution in the City of San Angelo and Tom Green County in 2010, 2020, and 2024 (2024 American Community Survey (ACS) five-year estimates).[3] According to the 2020 Census, the City of San Angelo has an official population of 99,893 residents, a 7 percent increase since the 2010 census; Tom Green County has an official population of 120,003, a 9 percent increase since the 2010 census.. County totals throughout this section include all areas within the county lines, including unincorporated areas and non-participating jurisdictions within the County. Table 3-3 summarizes select characteristics of vulnerable or sensitive populations in the City of San Angelo and Tom Green County using data from the U.S. Census Bureau 2024 ACS five-year estimates.

[3] ACS is simply an estimate, and many variables are involved in achieving an accurate estimation of the number of people living in a given area at a given time.

Table 3-2. Population Distribution by Jurisdiction[4,5]

Jurisdiction	2010 (Census)	2020 (Census)	2024 (ACS Estimates)	Population Change			
				2010-2020	Percent	2010-2024	Percent
City of San Angelo	93,200	99,893	99,674	6,693	7%	6,474	7%
Tom Green County	110,224	120,003	119,577	9,779	9%	9,353	8%

Table 3-3. Populations at Greater Risk by Jurisdiction[6]

Jurisdiction	Population				
	65 and Older	Under 5	With A Disability	Below Poverty Level	Limited English Speaking
City of San Angelo	16,795	5,905	14,943	10,964	5,245
Tom Green County	20,295	7,368	17,826	13,273	6,329

ISD POPULATION

As shown above, Figure 3-2 shows the participating Independent School District (ISD) within Tom Green County that is covered in the risk assessment analysis of the Plan Update.

The mission of San Angelo Independent School District is to engage all students in a relevant and inspiring education that produces future-ready graduates. San Angelo ISD comprises fourteen elementary schools, three middle schools, two high schools, and three alternative campuses. Table 3-4 summarizes the number of people employed, students enrolled, and vulnerable or sensitive populations as provided by the ISD.

Table 3-4. ISD Population

Independent School District	Employees	Students	Estimated Vulnerable or Sensitive Populations	
			Under 5	Staff Works Outdoors
San Angelo ISD	1,913	12,410	313	126

ECONOMIC IMPACT

Hazard events have the potential to disrupt employment, reduce household income, and limit the ability of residents to recover from impacts. Households with lower incomes or limited financial resources may face greater challenges in preparing for, responding to, and recovering from

[4] U.S. Census Bureau: https://www.census.gov
[5] U.S. Census Bureau: 2024 American Community Survey 5-Year Estimates Data Profiles.
[6] U.S. Census Bureau: 2024 American Community Survey 5-Year Estimates Data Profiles.

hazard events. The community's economic character therefore provides important context for understanding the potential impacts and recovery capacity following hazard events.

For Tom Green County the American Community Survey 2024 estimates, 59 percent of the population 16 years and over (94,362) is employed in the labor force. The per capita income is $35,866 and the median household income countywide is $68,370. Families with incomes below the poverty level in 2024 made up 7.6 percent of all families. Of families that have children under 18 years old, 10.9 percent are below the poverty level.

Tables 3-5 and 3-6 show the various occupations and industries within and Tom Green County, according to the U.S. Census Bureau 2024 ACS five-year estimates.

Table 3-5. Occupations of Employed Population in Tom Green County[7]

Occupation	Estimate	Percent
Civilian employed population 16 years and over	55,611	
Management, business, science, and arts occupations	19,532	35.1
Sales and office occupations	12,326	22.2
Service occupations	10,513	18.9
Production, transportation, and material moving occupations	7,458	13.4
Natural resources, construction, and maintenance occupations	5,782	10.4

Table 3-6. Industries of Employed Population in Tom Green County[8]

Industry	Estimate	Percent
Civilian employed population 16 years and over	55,611	
Educational services, health care, and social assistance	13,726	24.7
Retail trade	6,609	11.9
Arts, entertainment, recreation, accommodation and food services	5,317	9.6
Professional, scientific, and management, and administrative and waste management services	4,873	8.8
Construction	4,307	7.7
Public administration	4,132	7.4
Finance and insurance, and real estate and rental and leasing	3,727	6.7
Manufacturing	3,403	6.1

[7] U.S. Census Bureau: 2024 American Community Survey 5-Year Estimates Data Profiles.
[8] U.S. Census Bureau: 2024 American Community Survey 5-Year Estimates Data Profiles.

Industry	Estimate	Percent
Other services, except public administration	2,746	4.9
Agriculture, forestry, fishing and hunting, and mining	2,684	4.8
Transportation and warehousing, and utilities	2,513	4.5
Wholesale trade	852	1.5
Information	722	1.3

NATURAL, CULTURAL, AND HISTORIC RESOURCES

Tom Green County enjoys a lengthy 235-day growing season, with average temperatures ranging from a low of 32°F in January to a high of 97°F in July. Annual precipitation averages 18.2 inches, and elevations across the county vary from 1,717 to 2,480 feet.

The Concho River serves as the principal waterway, formed in San Angelo by the confluence of its three main branches: the North, Middle, and South Concho rivers. The North Concho and its tributaries, including Bald Eagle, Chalk, Dry, Grape, Little, Mulberry, and Walnut creeks, drain the northwestern section. The Middle Concho, along with tributaries such as Brushy, Dove, Dry Rocky, East Rocky, West Rocky, and Spring creeks, drains the west-central and southwestern areas. The South Concho and its tributaries, Burks and Pecan creeks, handle drainage in the south, while the main Concho River and tributaries like Catalan, Erica, Hog Marsh, Kickapoo, Lipan, and Snake creeks drain the southeast.

The county spans two distinct physiographic regions: the Osage Plains and the Edwards Plateau. In the central, eastern, and southeastern sections, vegetation reflects the Lower Osage Plains and High Plains, featuring buffalo, grama, wheat, and Indian grasses interspersed with mesquite and xerophytes. The northern, western, and extreme southwestern areas showcase short grasses and scattered timbers typical of the Edwards Plateau and Hill Country, including live, shinnery, and red oaks mixed with buffalo and mesquite grasses, plus shrubs and cacti such as algerita, cat's claw, chaparral, prickly pear, and yucca.

San Angelo remains the nation's largest processing and shipping center for the wool and mohair industry, a legacy of the region's historic ranching heritage. As of 1990, approximately 200,000 of the county's roughly one million acres were under cultivation, including 15,000 irrigated acres. Commercial minerals include caliche, limestone, and oil and gas deposits in the south-central and northwestern areas[9].

The City of San Angelo offers a delightful blend of history, culture, outdoor recreation, and unique local charm. Visitors can step back in time at Fort Concho National Historic Landmark, a beautifully preserved 19th-century frontier fort with original buildings, museums, and occasional reenactments. Fort Concho was established in 1867 and was active until 1889. The arts scene thrives at the San Angelo Museum of Fine Arts, which showcases contemporary and Texas

[9] Source: https://www.tshaonline.org/handbook/entries/tom-green-county

works, and the Chicken Farm Art Center, a community of artist studios, galleries, and shops, while downtown features colorful murals and independent galleries.

The Concho River is known for its three main branches, the North, Middle, and South Concho which then converge in San Angelo to form the main stream. It flows 58 miles through Tom Green and Concho Counties, then empties into the Colorado River. The river was named after the freshwater mussels, in particular the Tampico pearly mussel that produces pinkish-purple Concho pearls.

For outdoor enthusiasts, the scenic Concho River Walk provides miles of paved trails perfect for walking, biking, or simply enjoying the water, and San Angelo State Park offers hiking, mountain biking, horseback riding, camping, fishing, and views of bison and the official Texas Longhorn herd. The International Waterlily Collection at Civic League Park is a peaceful highlight with its stunning ponds, and nearby lakes like Nasworthy, O.C. Fisher, and Twin Buttes are ideal for boating, swimming, and picnicking. Other fun spots include the Railway Museum of San Angelo, family-friendly areas such as the Kids Kingdom playground, and seasonal events ranging from rodeos and art festivals to holiday light displays along the river.

San Angelo features dozens of colorful fiberglass sheep statues scattered throughout the city; this is a public art installation known as the "Sheeptacular" (or Sheep Spectacular) project. Launched in 2007 by Downtown San Angelo, Inc., this initiative pays tribute to the city's deep roots in the sheep and wool industry, which once earned San Angelo the title of "Wool Capital of the World." There are over 110 sheep statues throughout the City of San Angelo. Visitors can pick up a sheep tour map from the visitor center or online to hunt them all down.[10]

In addition, the City of San Angelo's and Tom Green County's designated historic buildings and sites preserve their rich history. There are 70 buildings and sites on the National Archives Catalog.[11] Historic buildings are vulnerable to natural hazards as their construction pre-dates modern building codes. There are also historic preservation considerations and requirements for historic structures when they are included in mitigation or recovery projects.

To further understand natural resources that may be vulnerable to a hazard event and those that need consideration when implementing mitigation activities, it is important to identify at-risk species (i.e., endangered species) in the planning area. According to the U.S. Fish and Wildlife Service, as of January 2026, there are four federally endangered, threatened, or candidate species in Tom Green County, listed in Table 3-7. Additionally, four species are listed as in recovery (Bald Eagle, Least Tern, Black-Capped Vireo, and Concho Water Snake). The report contains species that are known to or are believed to occur in this county, based on the species' current range, as defined by the USFWS. The definition of current range that the FWS uses is the general geographic area where we know or suspect that a species currently occurs.[12]

[10] Source: https://discoversanangelo.com/listing/san-angelo-visitor-center/
[11] National Archives Catalog: https://catalog.archives.gov
[12] U.S. Fish and Wildlife Service: https://ecos.fws.gov/ecp/report/species-listings-by-current-range-county?fips=48451

Table 3-7. Endangered Species in Tom Green County[13]

Type	Common Name	Scientific Name	Species Status
Clams	Texas Pimpleback	Cyclonaias petrina	Endangered
Clams	Texas Fatmucket	Lampsilis bracteate	Endangered
Birds	Rufa Red Knot	Calidris canutus rufa	Threatened
Insects	Monarch Butterfly	Danaus plexippus	Proposed Threatened

CHANGES IN VULNERABILITY

EXISTING LAND USE AND DEVELOPMENT TRENDS

A zoning ordinance sets forth regulations and standards related to the extent of land and structure uses that are allowed in certain areas. A zoning map shows the location of zoning districts and standards within a community, gives an overall picture of the types of developments, and is used as a tool to inform continued growth efforts and initiatives. The City of San Angelo has zoning ordinances in place.

A review of housing can also give a picture of the built environment and the changes in vulnerability to various hazards in a jurisdiction. Table 3-8 lists the total housing units for each jurisdiction, where data was available, between 2020 and 2024, utilizing 2020 Decennial Census data U.S. Census Bureau 2024 ACS five-year estimates. Between official U.S. Census counts, the estimates use a formula based on the applicable Decennial Census housing units count, new residential construction, new mobile homes, and housing unit loss. The census data "residential construction" category calculates building permits issued utilizing permitted construction counts as well as permit completion rates. Estimates of decreasing housing units are computed by applying an annual loss rate to the housing stock. The rate is then added to an estimate of the number of units lost due to natural disasters. Housing loss rates are derived from prior American Housing Survey (AHS) estimates at the regional level. A unit is counted as lost if a survey was completed in the AHS, but it was listed as a non-response (Type C, 30 - Demolished) in the subsequent survey, indicating a permanent loss to the housing stock.[14] It is simply an estimate, and many variables are involved in achieving an accurate estimation of the number of housing units in a given area at a given time.

Table 3-8. Total Housing Units by Jurisdiction, 2020- 2024[15]

Jurisdiction	Total Housing Units					Change 2020-2024	Percent of Change
	2020	2021	2022	2023	2024		
City of San Angelo	43,314	43,314	43,576	43,877	44,176	912	2%
Tom Green County	51,406	51,040	51,487	51,949	52,318	860	2%

[13] U.S. Fish and Wildlife Service: https://ecos.fws.gov/ecp/report/species-listings-by-current-range-county?fips=48451
[14] U.S. Census Bureau: https://www.census.gov/programs-surveys/popest/technical-documentation/methodology.html
[15] U.S. Census Bureau: https://www.census.gov

Certain types of housing found in the City of San Angelo and Tom Green County planning area are more vulnerable than typical site-built, newly constructed residential structures. For the City of San Angelo this includes mobile or manufactured homes, of which there are 1,154 (3 percent of total housing stock) in the planning area. In Tom Green County 2,670 (5 percent of total housing stock) manufactured or mobile homes are in the planning area. Additionally, single-family residences (SFR) built before 1980 are typically built to lower or less stringent construction standards than newer construction, making these homes more susceptible to damage during hazard events. These older homes comprise 52 percent (23,187 structures) of housing stock in the City of San Angelo and 50 percent (25,944 structures) of housing stock in Tom Green County overall. Table 3-9 includes housing inventory data for the participating jurisdictions and district per the 2024 American Community Survey five-year estimates.

Table 3-9. Housing Inventory and Vulnerable Structures by Jurisdiction[16]

Jurisdiction	Housing Units		
	Total	SFR Built Prior to 1980	Manufactured Homes
City of San Angelo	44,176	23,187	1,154
Tom Green County	52,318	25,944	2,670
San Angelo ISD	-	100	19

SUMMARY OF VULNERABILITY TRENDS

The City of San Angelo and Tom Green County planning area experienced an overall population increase of 9 percent between 2010 and 2020. The American Community Survey estimates the 2024 total housing units for the planning area to be 52,318, or a 2 percent increase from 2020. The overall population increase combined with the increase in housing units indicates an increase in vulnerability to all hazards in terms of populations and the built environment. Changes in vulnerability vary by jurisdiction based on each jurisdiction's trends in population and development (Table 3-10). Changes in vulnerability for the participating ISD is considered to similarly align with the jurisdiction in which it is located unless specifically noted otherwise.

Table 3-10. Changes in Vulnerability by Jurisdiction

Jurisdiction	Population Trend	Housing Trend	Changes in Vulnerability
City of San Angelo	Increase	Increase	Increase
Tom Green County	Increase	Increase	Increase

Changes in vulnerability are applicable to all natural hazards except when discussing dam failure, as vulnerability for this hazard is discussed in relation to changes in the estimated inundation areas for profiled dams. For the four dams profiled in Section 5, there is an increase in vulnerability in the estimated inundation areas. While flood and wildfire hazards feature geographical

[16] The Housing Inventory and Vulnerable Structures are based off the 2024 American Community Survey 5-Year Estimates Data Profiles. The participating district does not have housing units; however, they did provide buildings built prior to 1980 and mobile buildings.

boundaries, increases in population and building inventory can increase overall vulnerability for these hazards even when the trends occur outside of the known hazard boundary. Development decreases permeable surface areas and increases runoff, increasing flood risk. As population density increases, the Wildland Urban Interface (WUI) typically increases. WUI growth often results in more wildfire ignitions, which puts more lives and houses at risk.

FUTURE GROWTH AND DEVELOPMENT

To better understand how future growth and development in Tom Green County might affect hazard vulnerability, it is useful to consider population growth, occupied and vacant land, the potential for future development in hazard areas, and current planning and growth management efforts. Population projections from 2020 to 2060 are listed in Table 3-11, provided by the Office of the State Demographer, Texas State Data Center, and the Institute for Demographic and Socioeconomic Research. Projections are based on a mid-migration scenario, which assumes that the U.S. and Texas migration patterns remain similar to the past two decades. The total population growth rate accounts for natural increase (births minus deaths) as well as net migration. This information is only available at the county level; however, the projections reflect an increase in population density, which would indicate an increase in vulnerability for the County.

Table 3-11. Tom Green County Population Projections[17]

Land Area (square miles)	2020		2030		2040		2050		2060	
	Population									
	Total Number	Density	Total Number	Density	Total Number	Density	Total Number	Density	Total Number	Density
1,522	120,003	78.85	126,212	82.93	134,338	88.26	140,266	92.16	145,177	95.39

Comprehensive Plans are guiding documents in a community that set forth a vision, goals, policies, and guidelines to direct future physical, social, and economic development within a jurisdiction. They are part of a continuous process to provide a sustainable environment for citizens and consider the general desire of the community to conserve, preserve, and protect the natural environment of their jurisdiction. These plans present a future vision for each participating jurisdiction and district, outlining recommendations on growth, community character, infrastructure, land use, economic development, zoning, mobility, and public facilities, while guiding staff, decision-makers, and citizens to weigh choice with an eye toward the future. The City of San Angelo and Tom Green County have Comprehensive Plans in place. Refer to the Capability Assessment in Appendix F for a complete list of the plans, ordinances, and other resources for all participating jurisdictions and districts.

[17] Texas Demographic Center: https://demographics.texas.gov/Projections/

Section 4
Risk Overview

SECTION 4: RISK OVERVIEW

HAZARD DESCRIPTION

Section 4 is the first phase of the Risk Assessment, providing background information for the hazard identification process and descriptions of the hazards identified. The Risk Assessment continues with Sections 5 through 15 and Appendix A, which include hazard descriptions and vulnerability assessments.

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, the City of San Angelo, Tom Green County, and San Angelo ISD identified 11 natural hazards that are addressed in the Hazard Mitigation Plan Update, and were identified as significant, as shown in Table 4-1. The hazards were identified through input from Planning Team members and a review of the current 2023 State of Texas Hazard Mitigation Plan (State Plan). Readily available online information from reputable sources such as federal and state agencies was also evaluated and utilized to supplement information as needed.

In general, there are five categories of hazards: atmospheric, hydrologic, geologic, technological, and human-caused. Atmospheric hazards are events or incidents associated with weather-generated phenomena. The following have been identified as significant for the planning area: extreme heat, hail, lightning, thunderstorm wind, tornado, and winter storm (Table 4-1).

Hydrologic hazards are events or incidents associated with water-related damage and account for over 75 percent of federal disaster declarations in the United States. Hydrologic hazards identified as significant for the planning area include drought and flood.

Geologic hazards are events or incidents associated with the earth's crust. The geologic hazard identified as significant for the planning area is earthquake.

Technological hazards refer to the origins of incidents that can arise from human activities, such as the construction and maintenance of dams. They are distinct from natural hazards primarily because they originate from human activity. Human activity may increase or decrease the risks presented by natural hazards; however, they are not inherently human-induced. Therefore, dam failure is classified as a quasi-technological hazard and referred to as "technological" in Table 4-1 for description purposes.

For the Risk Assessment, wildfire is categorized as "other" since this hazard is not considered atmospheric, geologic, hydrologic, or technological.

Human-caused hazards are events or incidents caused by human intent, human error, or failed systems. They can be caused or exacerbated by accidental or intentional human actions that result in the loss of life or property. Appendix A includes the following human-caused hazards:

cyber-attack, hazardous materials, infectious disease, invasive species, terrorism, and water contamination.

Table 4-1. Hazard Descriptions

Hazard	Description
Atmospheric	
Extreme Heat	Extreme heat is the condition whereby temperatures hover ten degrees or more above the average high temperature in a region for an extended period of time.
Hail	Hailstorms are a potentially damaging outgrowth of severe thunderstorms. 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.
Lightning	Lightning is a sudden electrostatic discharge that occurs during an electrical storm. This discharge occurs between electrically charged regions of a cloud, between two clouds, or between a cloud and the ground.
Thunderstorm Wind	Thunderstorm winds, often referred to as straight-line winds, are produced by severe thunderstorms and can reach speeds exceeding 100 mph. These winds are often caused by downbursts or microbursts, which are powerful columns of air that descend from a storm and spread outward upon hitting the ground. They can cause damage patterns similar to tornadoes but occur without rotation, spreading out in a straight path. Contrastingly, high wind events can occur in the absence of other definable hazard conditions, developing from strong pressure systems or terrain effects and causing similar impacts, especially in exposed or rural areas.
Tornado	A tornado is a violently rotating column of air that has contact with the ground and is often visible as a funnel cloud. Its vortex rotates cyclonically with wind speeds ranging from as low as 40 mph to as high as 300 mph. The destruction caused by tornadoes ranges from light to catastrophic, depending on the location, intensity, size, and duration of the storm.
Winter Storm	Severe winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Blizzards, the most dangerous of all winter storms, combine low temperatures, heavy snowfall, and winds of at least 35 mph, reducing visibility to only a few yards. Ice storms occur when moisture falls and freezes immediately upon impact on trees, power lines, communication towers, structures, roads, and other hard surfaces. Winter storms and ice storms can down trees, cause widespread power outages, damage property, and cause fatalities and injuries to human life.

Hazard	Description
Geologic	
Earthquake	An earthquake is the sudden, rapid shaking of the earth, caused by the breaking and shifting of subterranean rock as it releases strain that has accumulated over a long time. Initial mild shaking may strengthen and become extremely violent within seconds.
Hydrologic	
Drought	A prolonged period of less than normal precipitation such that the lack of water causes a serious hydrologic imbalance. Common effects of drought include crop failure, water supply shortages, and fish and wildlife mortality.
Flood	The accumulation of water within a body of water, which results in the overflow of excess water onto adjacent lands, usually floodplains. The floodplain is the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that is susceptible to flooding. Most floods fall into the following three categories: riverine flooding, coastal flooding, and shallow flooding.
Other	
Wildfire	A wildfire is an uncontrolled fire burning in an area of vegetative fuels such as grasslands, brush, or woodlands. Heavier fuels with high continuity, steep slopes, high temperatures, low humidity, low rainfall, and high winds all work to increase the risk for people and property located within wildfire hazard areas or along the urban/wildland interface. Wildfires are part of the natural management of forest ecosystems, but most are caused by human factors.
Technological	
Dam Failure	Dam failure is the collapse, breach, or other failure of a dam structure resulting in downstream flooding. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and severe property damage if development exists downstream of the dam.

Hazards that were not considered significant and were not included in the Plan Update are located in Table 4-2, along with the evaluation process used for determining the significance of each of these hazards. Hazards not identified for inclusion at this time may be addressed during future evaluations and updates.

Table 4-2. Other Hazards Deferred

Hazard Considered	Reason for Determination
Coastal Erosion	The planning area is not located on the coast. Therefore, coastal erosion does not pose a risk.

Hazard Considered	Reason for Determination
Expansive Soils	The planning area has no historical expansive soil occurrences, and it is in an area where occurrences are considered rare. Expansive soils have not impacted critical structures, systems, populations, or other community assets or vital services in the past, and none is expected in the future.
Land Subsidence	The planning area has no historical land subsidence occurrences, and it is in an area where occurrences are considered rare. Land subsidence has not impacted critical structures, systems, populations, or other community assets or vital services in the past, and none is expected in the future.
Tropical Cyclone	The planning area has no historical hurricane / tropical storm occurrences, and it is in an area where occurrences are considered rare. Tropical cyclones have not impacted critical structures, systems, populations, or other community assets or vital services in the past, and none are expected in the future.

DISASTER DECLARATION HISTORY

One method of understanding hazards that pose a risk to Tom Green County is to identify past hazard events that triggered federal or state disaster declarations. Federal and state declarations may be granted when the severity and magnitude of an event surpass the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. Table 4-3 lists state and federal disaster declarations received by Tom Green County. Many of the disaster events were regional or statewide.

Between 1953 and February 2026, Tom Green County received 21 federal disaster declarations. The largest share was related to fires (6), followed by declarations for hurricanes (5), severe storms (4), biological (2), severe ice storms (2), flood (1) and drought (1).

Table 4-3. Disaster Declaration History of Tom Green County, 1953 – February 2026[1]

Year	Declaration Title	Hazard	Declaration Type	Disaster No.
1990	Severe Storms, Tornadoes, & Flooding	Severe Storm	DR	DR-863
1993	Extreme Fire Hazard	Drought	EM	EM-3113
1995	Severe Storms, Hail, Flooding and Tornadoes	Severe Storm	DR	DR-1056
1996	Extreme Fire Hazard	Fire	EM	EM-3117
1998	Tropical Storm Charley	Severe Storm	DR	DR-1239
1999	Extreme Fire Hazards	Fire	EM	EM-3142

[1] FEMA: https://www.fema.gov/openfema-data-page/disaster-declarations-summaries-v2

Year	Declaration Title	Hazard	Declaration Type	Disaster No.
2005	Hurricane Rita	Hurricane	EM	EM-3261
2005	Hurricane Katrina Evacuation	Hurricane	EM	EM-3216
2005	Hurricane Rita	Hurricane	DR	DR-1606
2006	Extreme Wildfire Threat	Fire	DR	DR-1624
2008	Wildfires	Fire	EM	EM-3284
2008	Hurricane Ike	Hurricane	EM	EM-3294
2008	Hurricane Gustav	Hurricane	EM	EM-3290
2011	Wildcat Fire	Fire	FM	FM-2892
2011	Wildfires	Fire	DR	DR-1999
2015	Severe Storms, Tornadoes, Straight-Lines Winds, and Flooding	Severe Storm	DR	DR-4223
2020	Covid-19 Pandemic	Biological	DR	DR-4485
2020	Covid-19	Biological	EM	EM-3458
2021	Severe Winter Storms	Severe Ice Storm	DR	DR-4586
2021	Severe Winter Storm	Severe Ice Storm	EM	EM-3554
2025	Severe Storms, Straight-Line Winds, and Flooding	Flood	DR	DR-4879

In addition to the 21 federally declared disasters, there have been 37 U.S. Department of Agriculture (USDA) Secretarial disaster designations between 2012 and 2025. The Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency loans available to producers suffering losses in those counties and in counties that are contiguous to a designated county.[2] Of the 37 USDA designations for Tom Green County, many listed multiple factors as having caused the disaster area designation. The leading cause was drought, which was included in 33 designations. Other factors listed include excessive heat (13 designations), high wind (12), fire / wildfire (10), insects (10), and frost / freeze (2).

NATURAL HAZARDS AND CLIMATE CHANGE

Climate change is defined as a long-term shift in temperature and weather patterns. These shifts can increase or decrease the risk of natural hazards. Global climate change is expected to exacerbate the risks of certain types of natural hazards impacted by rising sea levels, warmer ocean temperatures, higher humidity, the possibility of stronger storms, and an increase in wind and flood damage due to storm surges. Texas is considered one of the more vulnerable states in

[2] United States Department of Agriculture https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/emergency_disaster_designation_declaration_process-factsheet.pdf

the U.S. to both abrupt climate changes and the impact of gradual climate changes on the natural and built environments.

Climate change is expected to lead to an increase in average temperatures as well as an increase in the frequency, duration, and intensity of extreme heat events. With no reductions in emissions worldwide, the state of Texas is projected to experience an additional 30 to 60 days per year above 100°F than what is experienced now.[3]

The State Climatologist's *Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900-2036* identifies ongoing and likely future trends through 2036 based on analysis of historic observations of temperatures, precipitation, and extreme weather. Table 4-4 highlights future trends in extreme weather from the report.

Table 4-4. Future Trends in Extreme Weather in Texas[4,5]

Hazards	Expected Trends
Extreme Temperatures	• The average annual surface temperature in 2036 is expected to be 3.0°F warmer than the 1950-1999 average and 1.8°F warmer than the 1991-2020 average. • The number of 100°F days is projected to double by 2036, with urban areas experiencing a higher frequency due to the urban heat island effect. • Fewer cold extremes and warmer minimum temperatures are projected, suggesting a continued decrease in freezing conditions and frost days, as well as a warming trend for the coolest days of summer. • The number of heatwaves per year and number of days per year classified as heatwaves are expected to increase. • Data suggests a recent increase in both the severity and frequency of extreme heat, while extreme cold has decreased in both aspects.
Precipitation	• Precipitation has increased by 10 percent or more in eastern Texas, but no significant trends are evident in western Texas. • Natural variability will substantially influence precipitation trends through 2036. • Extreme precipitation has already intensified by about 7 percent from 1960 to 2020 and is projected to continue increasing statewide—by 6-10 percent in intensity relative to 1950–1999 (2-3 percent relative to 2001–2020), and by 30-50 percent in frequency compared to 1950–1999 (10-15 percent compared to 2001–2020).

[3] Kloesel, K., B. Bartush, J. Banner, D. Brown, J. Lemery, X. Lin, C. Loeffler, G. McManus, E. Mullens, J. Nielsen-Gammon, M. Shafer, C. Sorensen, S. Sperry, D. Wildcat, and J. Ziolkowska, 2018: Southern Great Plains. In Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 987–1035. doi: 10.7930/NCA4.2018.CH23. https://nca2018.globalchange.gov/chapter/23/

[4] Nielsen-Gammon, John, Holman, Sara, Buley, Austin and Jorgensen, Savannah. Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900-2036, 2021 Update. Texas A&M University Office of the Texas State Climatologist. October 7, 2021. https://climatexas.tamu.edu/files/ClimateReport-1900to2036-2021Update

Hazards	Expected Trends
Drought	• Projected increases in temperature, rainfall variability, and other factors—such as improved plant water use efficiency—collectively indicate a decrease in water availability; however, the extent of this impact varies significantly across regions and applications. • Sector-based variance in impact trends is expected, with agricultural areas potentially experiencing less impact than surface water supply.
Flood	• Observational data suggests no long-term trend in river flooding, and this remains consistent for current projections, barring areas with normally high rainfall or for the most extreme flood events. • Urban flooding is projected to increase due to both population growth and rising precipitation intensity, particularly in areas with fast-response drainage systems. • The climate-driven trend in urban flood frequency should be similar to the climate-driven trend in extreme precipitation frequency: 30-50 percent in 2036 relative to 1950-1999 and 10-15 percent relative to 2001-2020. • Areas already experiencing flooding are likely to see an increase in the frequency and magnitude of events.
Winter Weather	• As the climate warms, the likelihood of winter weather decreases. • Widespread snowfall events in Texas, such as the one in February 2021, remain extremely rare and have not shown an increase in frequency. However, with rising air temperatures, a decrease in both the frequency and intensity of such events is expected—reducing the overall snow hazard. • Extreme cold has become less frequent and less severe overall but is subject to more variation than other temperate extremes, thus, massively cold temperatures will continue to be possible.
Thunderstorms (Wind, Hail, Lightning)	• The evolution of reporting methods and magnitude scales, along with inconsistencies in observational data, has resulted in the absence of reliable, comprehensive records—limiting the ability to project trends and necessitating the use of indirect indicators. • Indirect evidence supports an increase in the number of days capable of producing severe thunderstorms and very large hail; however, a substantial basis to quantify these trends remains lacking.
Wildfire	• Reductions in precipitation, rising temperatures, increased surface dryness, stronger winds, lower humidity, and higher fuel loads are projected to vary in intensity across different regions of Texas, leading to non-uniform increases in wildfire risk. • The geographical boundaries of the area of the state commonly affected may expand.

OVERVIEW OF HAZARD ANALYSIS

The methodologies utilized to develop the Risk Assessment are a historical analysis and a statistical approach. Both methodologies provide an estimate of potential impact by using a common, systematic framework for evaluation.

Records for the City of San Angelo and Tom Green County were retrieved from the National Centers for Environmental Information (NCEI) and the National Oceanic and Atmospheric Administration (NOAA) databases. These records were analyzed to identify the occurrence of hazard events in the planning area and the maximum recorded magnitude of each event. Geographic information system (GIS) technology was also used to identify and assess risks and evaluate community assets and their spatial vulnerability to hazards.

The four general parameters that are described for each hazard in the Risk Assessment include frequency of return, approximate annualized losses, a description of general vulnerability, and a statement of the hazard's impact.

The frequency of return was calculated by dividing the number of events in the recorded time period for each hazard by the overall time period that the resource database was recording events. Frequency of return statements are defined in Table 4-5, and impact statements are defined in Table 4-6 below.

Table 4-5. Frequency of Return Statements

Probability	Description
Highly Likely	Event is probable in the next year.
Likely	Event is probable in the next three years.
Occasional	Event is probable in the next five years.
Unlikely	Event is probable in the next ten years.

Table 4-6. Impact Statements

Potential Severity	Description
Substantial	Multiple deaths. Complete shutdown of facilities for 30 days or more. More than 50 percent of property destroyed or with major damage.
Major	Injuries and illnesses resulting in permanent disability. Complete shutdown of critical facilities between one and four weeks. More than 25 percent of property destroyed or with major damage.
Minor	Injuries and illnesses do not result in permanent disability. Complete shutdown of critical facilities for up to one week. More than 10 percent of property destroyed or with major damage.
Limited	Injuries and illnesses are treatable with first aid. Shutdown of critical facilities and services for 24 hours or less. Less than 10 percent of property destroyed or with major damage.

Each of the hazard profiles includes a description of a general Vulnerability Assessment. Vulnerability refers to the total assets that are subject to damage from a hazard based on historic recorded damages. Assets in the region were inventoried and defined in hazard zones where

appropriate. The total amount of damage, including property and crop damages, for each hazard is divided by the total number of assets (building value totals) in that community to determine the percentage of damage that each hazard can cause to the community. Risk and consequences will be addressed and covered within each hazard profile under the Vulnerability and Impact section as well as under the Assessment of Impact sections, where applicable.

To better understand how future growth and development in the Tom Green County region might affect hazard vulnerability, it is useful to consider population growth, occupied and vacant land, the potential for future development in hazard areas, and current planning and growth management efforts. Hazard vulnerability for the City of San Angelo, Tom Green County, and San Angelo ISD was reviewed based on recent development changes that occurred throughout the planning area. The population of the Tom Green County has grown by 9 percent between 2010 and 2020, according to the U.S. Census Bureau. Therefore, the vulnerability to the population, infrastructure, and buildings has increased for hazards that do not have a geographical boundary. Once loss estimates and vulnerability were known, an impact statement was applied to relate the potential impact of the hazard on the assets within the area of impact.

HAZARD RANKING

During the 2025 planning process, the Planning Team conducted a risk ranking exercise to get input from the Planning Team and stakeholders. Table 4-7 portrays the results of the risk assessment analysis, including the frequency of occurrence, potential severity, and the Planning Team's self-assessment for hazard ranking based on local knowledge of past events and impacts for each identified hazard. The definitions for frequency of occurrence and potential severity can be found in Table 4-5 and Table 4-6.

Table 4-7. Hazard Risk Ranking

Hazard	Frequency of Occurrence	Potential Severity	Ranking
Drought	Highly Likely	Minor	High
Extreme Heat	Highly Likely	Limited	High
Flood	Highly Likely	Minor	High
Hail	Highly Likely	Limited	High
Lightning	Highly Likely	Limited	High
Thunderstorm Wind	Highly Likely	Minor	High
Tornado	Highly Likely	Substantial	High
Wildfire	Highly Likely	Limited	High
Winter Storm	Highly Likely	Substantial	High
Earthquake	Unlikely	Limited	Low

RISK ASSESSMENT RESOURCES AND DATA LIMITATIONS

The risk and vulnerability assessment relies heavily on the content of the National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database. This database covers weather-related hazards that affect the planning area and that are profiled in this Plan Update, including winter weather (extreme cold and winter storm), drought, hail, lightning, thunderstorm wind, flood, extreme heat, and tornado. Other hazards were analyzed using databases containing more comprehensive historical data specific to Texas, such as the Texas A&M Forest Service (TFS) for wildfires and the United States Geological Survey for earthquakes. Historical dam incidents, including failures, were researched through the Association of State Dam Safety Officials database.

The NCEI Storm Events Database is a rich centralized repository of nationwide weather-related hazard events. Among other things, it is the source used by NOAA to populate its monthly storm data publication. The database contains recorded weather events of significance based on a range of potential criteria including intensity, duration, damages, injuries, or other noteworthy events. The history of data available in the NCEI database allows the study of impacts of individual hazards over an extended period of time. This data contributes to the framework for understanding relative risks over time.

While the NCEI is considered one of the most comprehensive national historical event databases, it is not without limitations. Records of historical occurrences in the state shows significant variations in the number of events recorded from one county to the next. Further research shows that the variations are more attributable to under-reporting of events than variations in weather occurrences. Only the events that have been reported in the database are factored into the risk assessment when no other reliable resources are available. It is accurate to assume that additional natural hazard occurrences have gone unreported or have been underreported. The risk assessment in this Plan is considered the baseline for estimating potential future losses and frequency of events, which are assumed to be the minimum the planning area can anticipate. Additionally, significant events may be reported by both the county and local jurisdictions. This is due to reports from various locations impacted by a given event.

Finally, damages are not reported for the majority of events recorded in the NCEI, as property damage estimates are not always available. Natural hazard event damages are often covered by private insurance and statistical insurance data is not readily available in the public domain. The National Weather Service (NWS) regional forecast coordinators utilize the resources available to them to describe damages or impacts of events. However, local input is key to assigning damages to historical events.

ASSUMPTIONS

Event data is often reported at the county level only. This is primarily due to the nature of most natural hazards impacting areas larger than a single municipality. Winter storms or extreme heat, for example, impact large regions and are not confined to a single location. NWS regional coordinators typically gather event data from countywide or regional reporting and record it accordingly. Some exceptional events are captured by NWS regional coordinators when the impact of the event is severe or catastrophic. However, most events recorded at the municipality level are conveyed by local officials. Event data at the municipality level is often limited as a result. Due to the more robust reporting at the county level and limited reporting at the local level, summary vulnerability statements are formulated using both local and countywide event data.

These vulnerability assessments assume that events impacting the county similarly impact the jurisdictions within that county. Therefore, the countywide assessment is considered similar for all participating jurisdictions and districts unless stated otherwise. Future risk and vulnerability assessments at the local, county, and state levels will benefit significantly from increased, detailed event reporting.

Section 5
Dam Failure

SECTION 5: DAM FAILURE

Section 5 is **For Official Use Only (FOUO)** and may be exempt from public release under the Freedom of Information Act (FOIA).

Section 6
Drought

SECTION 6: DROUGHT

HAZARD DESCRIPTION

Drought is a period of unusually persistent dry weather that persists long enough to cause serious problems such as crop damage and/or water supply shortages. The severity of the drought depends upon the degree of moisture deficiency, the duration, and the size of the affected area. Drought is a normal part of virtually all climatic regions, including areas with high and low average rainfall. Droughts can be classified as meteorological, hydrologic, agricultural, and socioeconomic. Table 6-1 presents definitions for these different types of droughts.

Droughts are one of the most complex of all natural hazards as it is difficult to determine their precise beginning or end. In addition, droughts can create ideal conditions for 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 6-1. Drought Classification Definitions[1]

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.

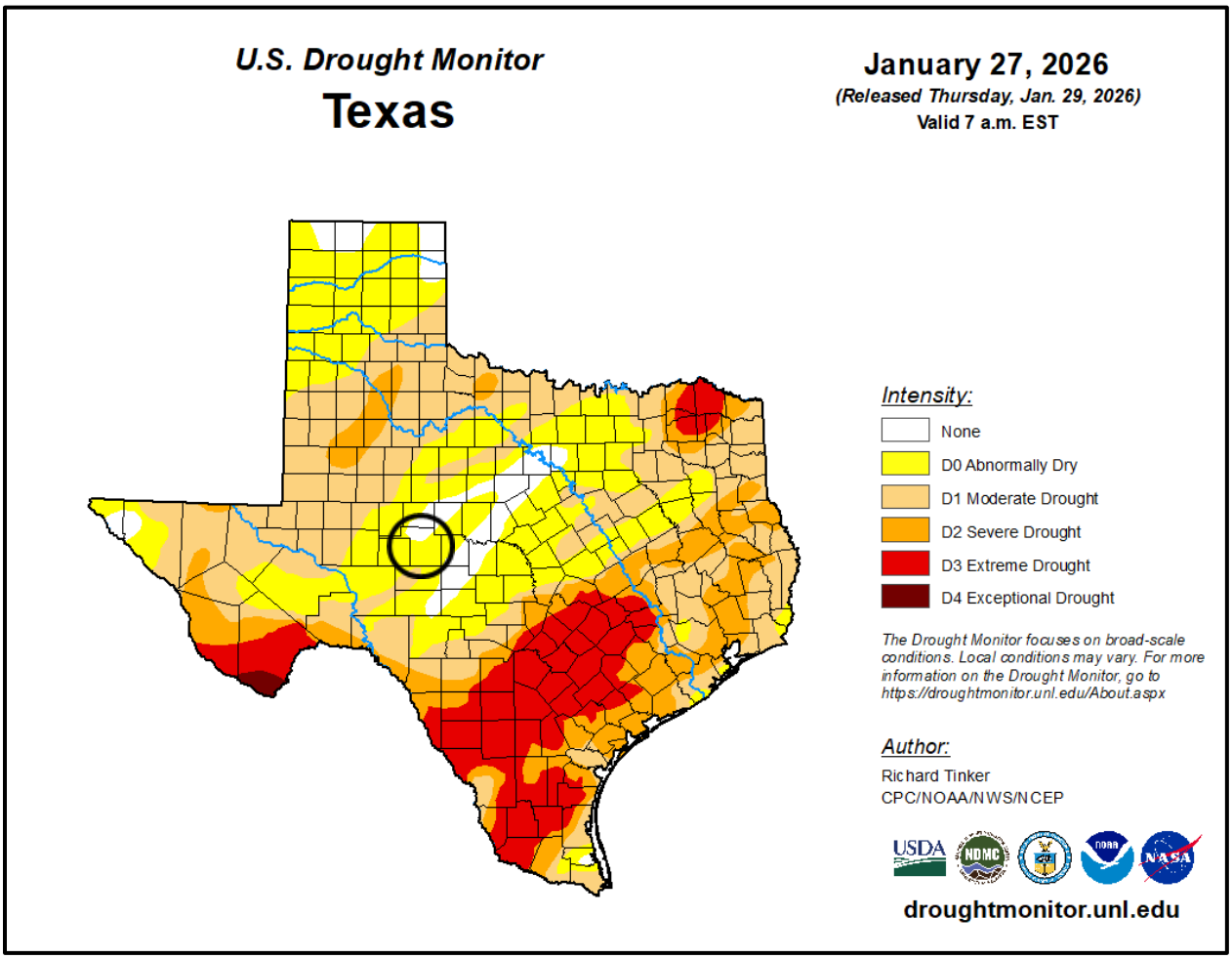
LOCATION

Droughts occur regularly throughout Texas including the City of San Angelo and Tom Green County planning area and are considered a normal condition. However, they can vary greatly in their intensity and duration. The U.S. Drought Monitor, produced through a partnership between the National Drought Mitigation Center at the University of Nebraska-Lincoln, U.S. Department of

[1] Source: Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy, FEMA

Agriculture and the National Oceanic and Atmospheric Administration, shows the planning area is currently experiencing none to abnormally dry drought conditions (Figure 6-1) but has experienced a range of conditions from normal (none) to exceptional drought conditions over the last decade (Figure 6-2). There is no distinct geographic boundary to drought; therefore, it can occur anywhere throughout the City of San Angelo and Tom Green County planning area.

Figure 6-1. U.S. Drought Monitor, January 2026



EXTENT

The Palmer Drought Index is used to measure the extent of drought by measuring the duration and intensity of long-term drought-inducing circulation patterns. Long-term drought is cumulative, with the intensity of drought during the current month dependent upon the current weather patterns plus the cumulative patterns of previous months. The hydrological impacts of drought (e.g., reservoir levels, groundwater levels, etc.) take longer to develop. Table 6-2 depicts magnitude of drought, while Table 6-3 describes the classification descriptions.

Table 6-2. Palmer Drought Index

Drought Index	Drought Condition Classifications						
	Extreme	Severe	Moderate	Normal	Moderately Moist	Very Moist	Extremely Moist
Z Index	-2.75 and below	-2.00 to -2.74	-1.25 to -1.99	-1.24 to +.99	+1.00 to +2.49	+2.50 to +3.49	N/A
Meteorological	-4.00 and below	-3.00 to -3.99	-2.00 to -2.99	-1.99 to +1.99	+2.00 to +2.99	+3.00 to +3.99	+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 +2.99	+3.00 to +3.99	+4.00 and above

Table 6-3. Palmer Drought Category Descriptions[2]

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

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

Based on the historical occurrences for drought and the location of the City of San Angelo and Tom Green County planning area, the area can anticipate the full range of drought from abnormally dry to exceptional drought, or D0 to D4, based on the Palmer Drought Category.

[2] Source: National Drought Mitigation Center

Exceptional drought (D4) is the highest level of drought severity and the most extreme drought conditions the planning area can anticipate in the future.

HISTORICAL OCCURRENCES

The City of San Angelo and Tom Green County planning area may experience an extreme drought in any given year. According to the U.S. Drought Monitor, between January 2000 and June 2025, the City of San Angelo and Tom Green County planning area spent 961 weeks (71%) in some level of drought as defined as Abnormally Dry (D0) or worse conditions. The longest drought during this period lasted for just over 5 years and 2 months. The City of San Angelo and Tom Green County has received 33 USDA disaster declarations for drought from 2012 through 2024.

Figure 6-2. City of San Angelo and Tom Green County Drought Intensity, January 2000 – June 2025[3]

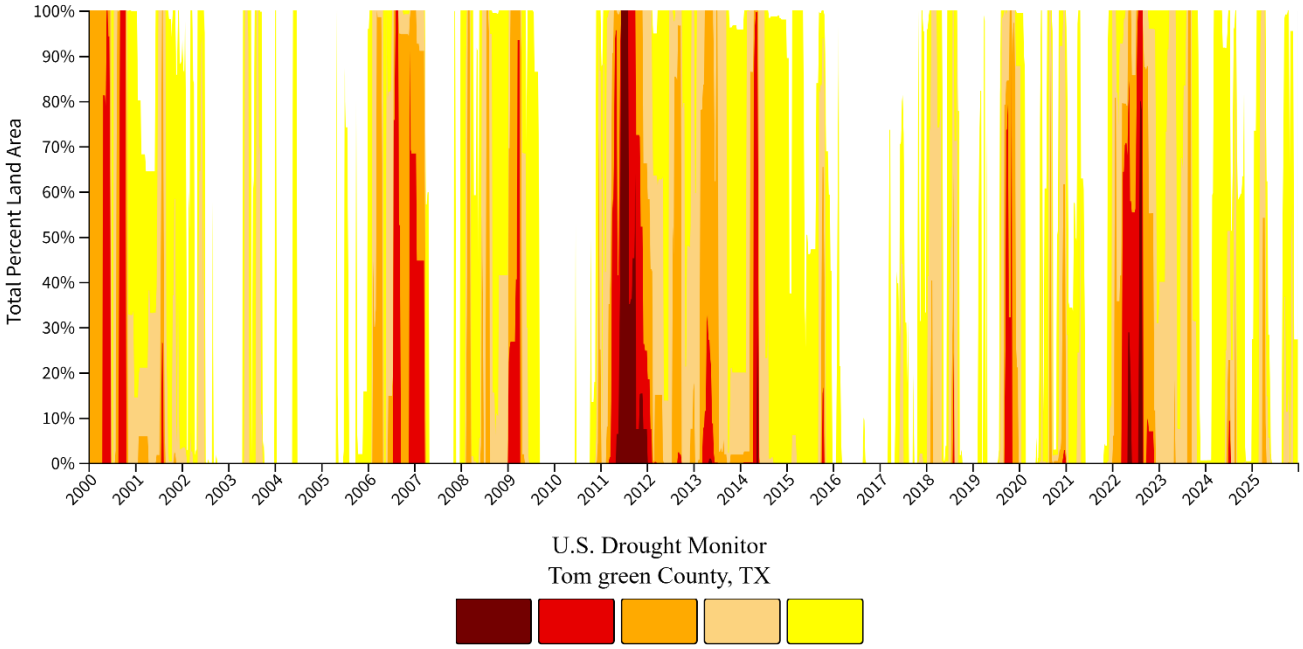


Table 6-4 lists historical damaging events that have occurred in the City of San Angelo and Tom Green County as reported in the National Centers for Environmental Information (NCEI) Storm Events Database. A total of 57 drought impacts were reported in the NCEI over the course of the 14 unique drought periods experienced in the City of San Angelo and Tom Green County from January 1998 through June 2025. Historical drought impacts reported in the NCEI database for the City of San Angelo and Tom Green County planning area over the 25.5-year reporting period have resulted in $183,967,300 (2026 dollars) in crop damages.

Historical drought information shows drought activity across a multi-county forecast area for each event, the appropriate percentage of the total property and crop damage reported for the entire forecast area has been allocated to each county impacted by the event. Historical drought data

[3] U.S. Drought Monitor

is provided on a county-wide basis per the NCEI Storm Events database. Only those events with reported damage are provided in Table 6-4. Historical drought data for San Angelo ISD is provided on a county-wide basis per the NCEI database. San Angelo ISD did not report damages separately or apart from the county-wide drought events. A summary of historical drought events is provided in Table 6-5.

Table 6-4. Historical Drought Events, January 1998 – June 2025[4]

Jurisdiction	Date	Injuries	Deaths	Property Damage	Crop Damage
Tom Green County	8/1/1998	0	0	$0	$23,396,100
Tom Green County	5/1/2000	0	0	$0	$160,571,200

Table 6-5. Historical Drought Events Summary, January 1998 – June 2025

Jurisdiction	Drought Impacts	Injuries	Deaths	Property Damage	Crop Damage
Tom Green County	57	0	0	$0	$183,967,300

Based on historical drought events for the City of San Angelo and Tom Green County planning area, including San Angelo ISD, 4 unique drought periods were reported since the 2020 plan.

SIGNIFICANT EVENTS

January 2000 – July 2002

Devastating drought conditions occurred across West Central Texas, with the entire planning area experiencing severe (D2) drought conditions. These conditions continued until the beginning of July, when the planning area was finally downgraded to abnormally dry (D0) drought conditions. However, those conditions didn't last long, because by September 2000, the planning area was experiencing extreme (D3) drought conditions. These extreme conditions continued until mid-December 2000, which was when most of the planning area was once again downgraded to abnormally dry conditions. 2001 was a much calmer year compared to 2000, with the planning area staying in abnormally dry (D0) to moderate (D1) drought conditions throughout the year. This drought caused an estimated $183,967,300 (2026 dollars) in crop damages.

October 2010 – December 2015

Drought conditions developed throughout the entire planning area, and by the end of December 2010, most of the planning area began to experience moderate (D1) drought conditions. These conditions continued until April 2011, which was when drought conditions really began to pick up. By this point, most of the planning area was experiencing extreme (D3) drought conditions. These conditions continued until end of June, which was when conditions were elevated to exceptional (D4) drought conditions. Exceptional drought conditions continued to linger until January 2012, and by this point the planning area experienced a wide range of conditions from moderation (D1) to exceptional (D4) drought conditions. At this time also, the planning area had also received some much-needed rain, which caused some of the planning area to get downgraded in the severity of their drought conditions. 2012 was a much calmer year compared to 2011, being that

[4] Only those events with reported injuries, fatalities, or damages were included in the table.

most of the planning area spent a majority of this year in only moderate (D1) or severe (D2) drought conditions. This trend continued throughout all of 2013 and into early 2014. By April 2014, most of the planning area was back to experiencing extreme (D3) drought conditions. A variety of drought conditions continued throughout the rest of 2015 and most of 2015. Drought conditions were finally alleviated in October 2015, when the planning area received some very much needed rainfall. This ended the over 5-year drought period, and the worst drought the State of Texas has experienced.

PROBABILITY OF FUTURE EVENTS

According to the U.S. Drought Monitor, 14 unique drought periods (ranging from five weeks to about 5 years and 2 months in duration) occurred over a 25.5-year reporting period, which provides a probability of approximately one event every year. This frequency supports a “Highly Likely” probability of future events for the City of San Angelo and Tom Green County planning area, including San Angelo ISD.

CLIMATE CHANGE CONSIDERATIONS

With the range of factors influencing drought conditions, it is impossible to make quantitative statewide projections of drought trends; however, many factors point toward increased drought severity. Drought will continue to be driven largely by precipitation variability over multiple decades, with long-term precipitation trends expected to be relatively small. Other factors affecting drought impacts, such as increased temperatures and improved plant water use efficiency, can affect water availability. These impacts could cause drought impact trends to be highly sector-specific, with the impacts possibly smaller for agriculture than for surface water supply.[5]

It is projected that future changes to the City of San Angelo and Tom Green County will include increased temperatures, which according to the U.S. Climate Explorer, the planning area may experience a 6°F increase in average extreme heat temperatures. Historically, extreme temperatures averaged 101°F in the City of San Angelo and Tom Green County, but between 2035 and 2064 the average will be 107°F, increasing the severity and frequency of drought events. Some projections show an even higher increase; however, the severity will be dependent on overall future emissions and is subject to change.

VULNERABILITY AND IMPACT

Loss estimates were based on 25.5 years of statistical data from the NCEI and the U.S. Drought Monitor. A drought event frequency-impact was then developed to determine an impact profile on agriculture products and estimate potential losses due to drought in the area. All existing and future buildings, facilities, and populations are exposed to this hazard and could potentially be impacted. However, drought impacts are mostly experienced in water shortages, or crop and livestock losses on agricultural lands and typically have minimal impact on buildings.

[5] Cleaveland, M. K., T. H. Votteler, D. K. Stahle, R. C. Casteel, and J. L. Banner, 2011: Extended Chronology of Drought in South Central, Southeastern and West Texas. Texas Water Journal, 2, 54-96, as cited in as cited in Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900-2036, Texas A&M University Office of the Texas State Climatologist, 2021 update.

The City of San Angelo and Tom Green County Planning Team identified the following critical facilities as assets that are considered the most important to the planning area and are susceptible to a range of impacts caused by drought events. For a comprehensive list by participating jurisdiction, please see Appendix D.

Table 6-6. Critical Facilities Vulnerable to Drought Events

Critical Facility Type	Potential Impacts
Emergency Response Services (EOC, Fire, Police, EMS, Hospitals)	• Increased law enforcement activities may be required to enforce water restrictions. • Firefighters may have limited water resources to aid in firefighting and suppression activities, increasing risk to lives and property. • Potential for increased number of emergency calls as drought events can lead to cascading hazard events such as wildfires and flash flooding.
Airport, Academic Institutions, Community Residential Facilities, Day Care Facilities, Evacuation Centers & Shelters, Governmental Facilities	• Strain on staff as drought may cause health problems related to low water flows and poor water quality. • Operations dependent on water supply may be adversely impacted.
Commercial Suppliers (food, gas, etc.)	• Operations dependent on water supply may be adversely impacted.
Utility Services and Infrastructure (electric, water, wastewater, communications)	• Potential for increased number of emergency calls as drought events can lead to cascading hazard events such as wildfires and flash flooding. • Operations dependent on water supply may be adversely impacted.

Even with the planning area relying on multiple water utility providers as well as local and private service, high demand can still deplete these resources during extreme drought conditions. As resources are depleted, potable water is in short supply and overall water quality can suffer, elevating health concerns for all residents but especially vulnerable populations – typically children, the elderly, and the ill. In addition, potable water is used for drinking, sanitation, patient care, sterilization, equipment, heating and cooling systems, and many other essential functions in medical facilities.

The average person will survive only a few days without potable water, and this timeframe can be drastically shortened for those people with more fragile health – typically children, the elderly, and people with disabilities. In addition, people who speak a language other than English may face increased vulnerability due to language barriers that limit their access to important information such as weather-related warnings and instructions regarding safety measures.

The population over 65 in the City of San Angelo and Tom Green County planning area is estimated at 17 percent of the total population and children under the age of 5 are estimated at 6 percent. The population with a disability is estimated at 15 percent of the total population. An

estimated 11 percent of the planning area population live below the poverty level and 5 percent of the populations speak English “less than very well” (Table 6-7).

Table 6-7. Populations at Greater Risk by Participating Jurisdiction

Jurisdiction	Population				
	65 and Older	Under 5	With a Disability	Below Poverty Level	Limited English Speaking
Tom Green County	20,295	7,368	17,826	13,273	6,329
City of San Angelo	16,795	5,905	14,943	10,964	5,245

Table 6-8. Populations at Greater Risk for Special Districts

Independent School District	Population
	Under 5
San Angelo ISD	313

The planning area is also vulnerable to food shortages when drought conditions exist, and potable water is in short supply. Potable water is used for drinking, sanitation, patient care, sterilization, equipment, heating and cooling systems, and many other essential functions in medical facilities. All residents in the City of San Angelo and Tom Green County planning area could be adversely affected by drought conditions, which could limit water supplies and present health threats.

The economic impact of droughts can be significant as they produce a complex web of impacts that spans many sectors of the economy and reach well beyond the area experiencing physical drought. This complexity exists because water is integral to our ability to produce goods and provide services. If droughts extend over several years, the direct and indirect economic impact can be significant.

The City of San Angelo and Tom Green County has a prominent agricultural sector and features 1,392 farms over 937,713 acres of land including grains, oilseeds, dry beans, dry peas, cattle and calves. The City of San Angelo and Tom Green County’s annual market value of agricultural products sold is over $101,976,000. An estimated 75 percent of sales are from livestock and poultry products and an estimated 25 percent of sales are from crops. Most of the county’s agriculture sales are cattle and calves.[6] A lactating dairy cow will consume 30 to 50 gallons of water a day. The average adult beef cow requires approximately 12 gallons of water a day. Drought can negatively affect nutrition sources, milk production, and future yields. Dry pastures lead to lower quality hay and increased fire danger. Decreases in feed availability can lead to overgrazing. Heat stress can decrease milk production in dairy cattle. Prolonged drought periods could have devastating impacts on the agricultural industry across the planning area.

Impacts of past droughts experienced in the City of San Angelo and Tom Green County planning area, including San Angelo ISD, have resulted in no reported fatalities, injuries, or property

[6] Census of Agriculture. Tom Green County, Texas County Profile. 2022.

damages. Historical crop losses due to drought are significant for the planning area over the 25.5 year reporting period, supporting a “Minor” severity of impact meaning crop losses between 10 and 25 percent of the annual yield during prolonged droughts. The annualized estimated losses due to drought over the 25.5-year reporting period in the City of San Angelo and Tom Green County planning area $6,689,700 (2026 dollars). Table 6-9 shows annualized exposure.

Table 6-9. Estimated Annualized Losses for City of San Angelo and Tom Green County

Jurisdiction	Total Property & Crop Loss (2026 dollars)	Annual Loss Estimates (2026 dollars)
Tom Green County	$183,967,300	$6,689,700

ASSESSMENT OF IMPACTS

The Drought Impact Reporter was developed in 2005 by the University of Nebraska-Lincoln to provide a national database of drought impacts. Droughts can have an impact on agriculture, business and industry; energy; fire; plants and wildlife; relief, response, and restrictions; society and public health; tourism and recreation; and water supply and quality. The reports are submitted from individuals to Federal, State, and local agencies, as well as the general public. Table 6-10 lists the drought impacts to the City of San Angelo and Tom Green County from January 2005 to June 2025 based on reports received by the Drought Impact Reporter.

Table 6-10. Drought Impacts, January 2005 – June 2025

Drought Impacts	
Agriculture	118
Business & Industry	2
Energy	0
Fire	26
Plants & Wildlife	80
Relief, Response & Restrictions	19
Society & Public Health	8
Tourism & Recreation	2
Water Supply & Quality	44

Drought has the potential to impact people in the City of San Angelo and Tom Green County planning area. While it is rare that drought, in and of itself, leads to a direct risk to the health and safety of people in the U.S., severe water shortages could result in inadequate supply for human needs. Based on historical population trends, the City of San Angelo and Tom Green County population is projected to increase. Future growth can cause concern for the current water infrastructure and demand for the planning area. Severe drought conditions can be frequently associated with a variety of impacts, including:

- The number of health-related low-flow issues (e.g., diminished sewage flows, increased pollution concentrations, reduced firefighting capacity, and cross-connection contamination) will increase as the drought intensifies.
- Public safety from forest/range/wildfires will increase as water availability and/or pressure decreases.
- Respiratory ailments may increase as the air quality decreases.
- There may be an increase in disease due to wildlife concentrations (e.g., rabies, Rocky Mountain spotted fever, Lyme disease).
- Residents may disagree with the County and City over water use/water rights, creating conflict.
- Political conflicts may increase between municipalities, counties, states, and regions.
- Water management conflicts may arise between competing interests.
- Increased law enforcement activities may be required to enforce water restrictions.
- Severe water shortages could result in inadequate supply for human needs as well as lower quality of water for consumption.
- Firefighters may have limited water resources to aid in firefighting and suppression activities, increasing risk to lives and property.
- During drought there is an increased risk for wildfires and dust storms.
- The community may need increased operational costs to enforce water restriction or rationing.
- Prolonged drought can lead to increases in illness and disease related to drought.
- Utility providers can see decreases in revenue as water supplies diminish.
- Utilities providers may cut back energy generation and service to their customers to prioritize critical service needs.
- Hydroelectric power generation facilities and infrastructure would have significantly diminished generation capability. Dams simply cannot produce as much electricity from low water levels as they can from high water levels.
- Fish and wildlife food and habitat will be reduced or degraded over time during a drought and disease will increase, especially for aquatic life.
- Wildlife will move to more sustainable locations creating higher concentrations of wildlife in smaller areas, increasing vulnerability, and further depleting limited natural resources.
- There are four federally endangered, threatened or candidate species in the City of San Angelo and Tom Green County. Severe and prolonged drought can result in the reduction of a species or cause the extinction of a species altogether.
- Plant life will suffer from long-term drought. Wind and erosion will also pose a threat to plant life as soil quality will decline. The urban tree canopy, including county and city parks, are vulnerable to the impacts of prolonged drought.
- Dry and dead vegetation will increase the risk of wildfire.
- Drought poses a significant risk to annual and perennial crop production and overall crop quality leading to higher food costs.
- Drought-related declines in production may lead to an increase in unemployment.
- Drought may limit livestock grazing resulting in decreased livestock weight, potential increased livestock mortality, and increased cost for feed.
- Negatively impacted water suppliers may face increased costs resulting from the transport water or developing supplemental water resources.
- Long term drought may negatively impact future economic development.

SECTION 6: DROUGHT

The overall extent of damage caused by periods of drought is dependent on its extent and duration. The level of preparedness and pre-event planning done by the community, local businesses, and citizens will contribute to the overall economic and financial conditions in the aftermath of a drought event.

Section 7
Earthquake

SECTION 7: EARTHQUAKE

HAZARD DESCRIPTION

An earthquake is the sudden movement of the Earth's surface caused by the release of stress accumulated within or along the edge of the Earth's tectonic plates, volcanic eruption, or by a manmade explosion. The majority of earthquakes occur along faults; however, earthquakes can occur within plate interiors. Over geologic time, plates move and plate boundaries change, pushing weakened boundary regions to the interior part of the plates. These areas of weakness within the continents can cause earthquakes in response to stresses that originate at the edges of the plate or in the deeper crust.

Earthquake locations are described by the focal depth and geographic position of the epicenter. The focal depth of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (the focus or hypocenter). The epicenter is the point on the Earth's surface directly above the hypocenter. Earthquakes usually occur without warning, with their effects impacting great distances away from the epicenter.

According to the U.S. Geological Society (USGS) Earthquake Hazards Program, an earthquake hazard is anything associated with an earthquake that may influence an individual's normal activities. Table 7-1 describes definition of examples.

Table 7-1. Definitions of Earthquake Hazards[1]

Hazard	Description
Surface Faulting	Displacement that reaches the earth's surface during slip along a fault. Commonly occurs with shallow earthquakes, those with an epicenter less than 20 kilometers.
Ground Motion (shaking)	The movement of the earth's surface from earthquakes or explosions. Ground motion or shaking is produced by waves that are generated by sudden slip on a fault or sudden pressure at the explosive source and travel through the earth and along its surface.
Landslide	A movement of surface material down a slope.
Liquefaction	A process by which water-saturated sediment temporarily loses strength and acts as a fluid, like when you wiggle your toes in the wet sand near the water at the beach. This effect can be caused by earthquake shaking.

[1] Source: USGS, 2012

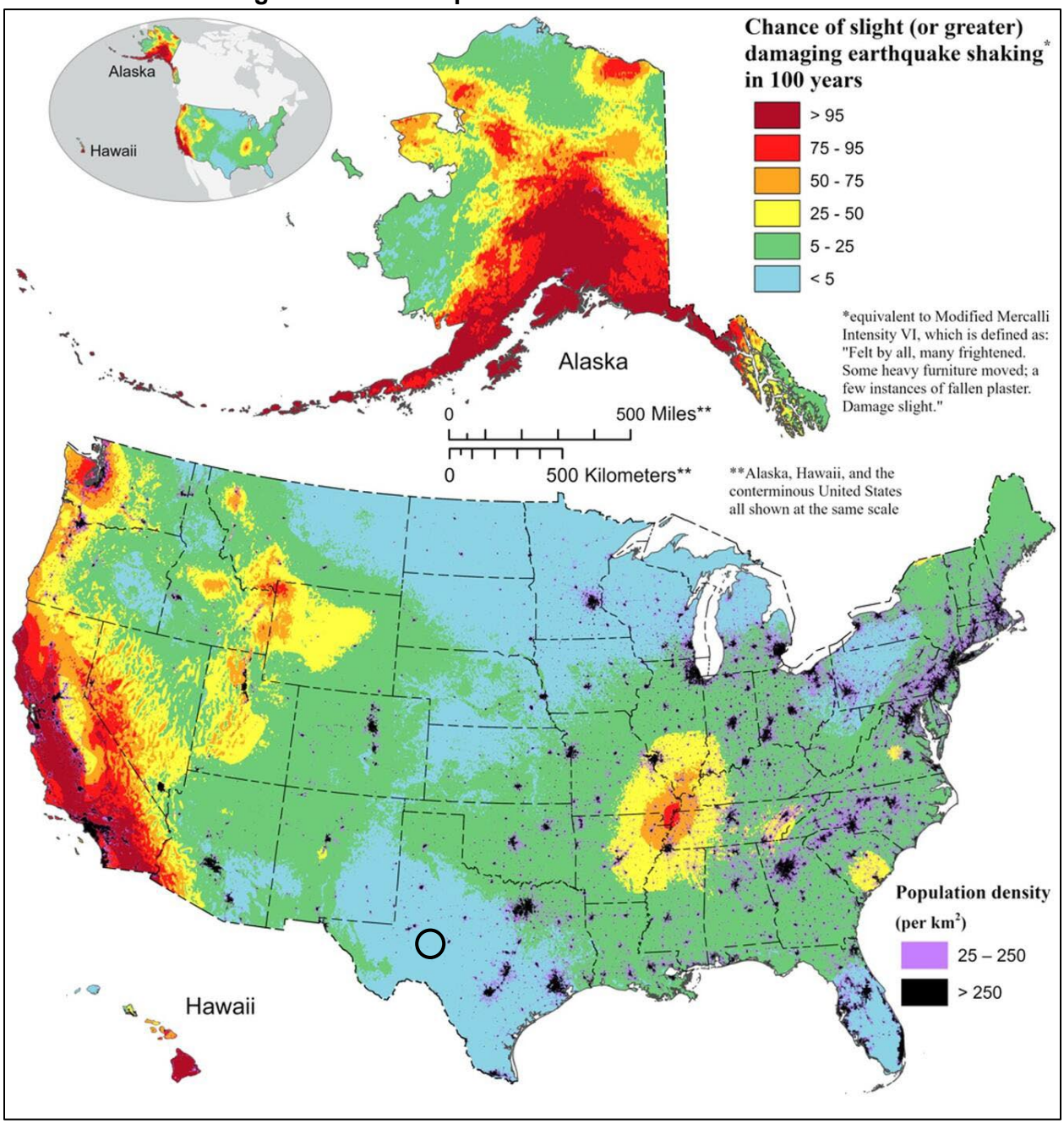
Hazard	Description
Tectonic Deformation	A change in the original shape of a material due to stress and strain.
Tsunami	A sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major submarine slides, or exploding volcanic islands.
Seiche	The sloshing of a closed body of water from earthquake shaking.

LOCATION

Earthquake hazard areas are mapped by the USGS's National Seismic Hazard Model (NSHM). Figure 7-1 shows the most recent 2023 iteration of this USGS model. The NSHM defines the potential for earthquake ground shaking for various probability levels across the United States. The 2023 NSHM is an update to the previous 2018 version, and compiles data and findings from a number of sources including earthquake catalogs, geodetic- and geologic-based fault and deformation models, and ground motion models (GMMs), among others.[2] The map shows the percent chance that a given area will experience a category VI (or stronger) earthquake in 100 years, as defined by the Modified Mercalli Intensity (MMI) Scale (Table 7-3). The likelihood of a significant earthquake event is signified by the color-coding on the map. Densely populated areas are also highlighted on the map (purple and black dotting) to indicate areas of elevated vulnerability in relation to higher seismic risk. The City of San Angelo and Tom Green County planning area, as identified in Figure 7-1, is located in a low hazard area, with a less than five percent chance of experiencing a strong earthquake every 100 years.

[2] Note: A comprehensive overview of the modelling process can be found at the USGS website, https://www.usgs.gov/programs/earthquake-hazards/science/2023-50-state-long-term-national-seismic-hazard-model-0#overview

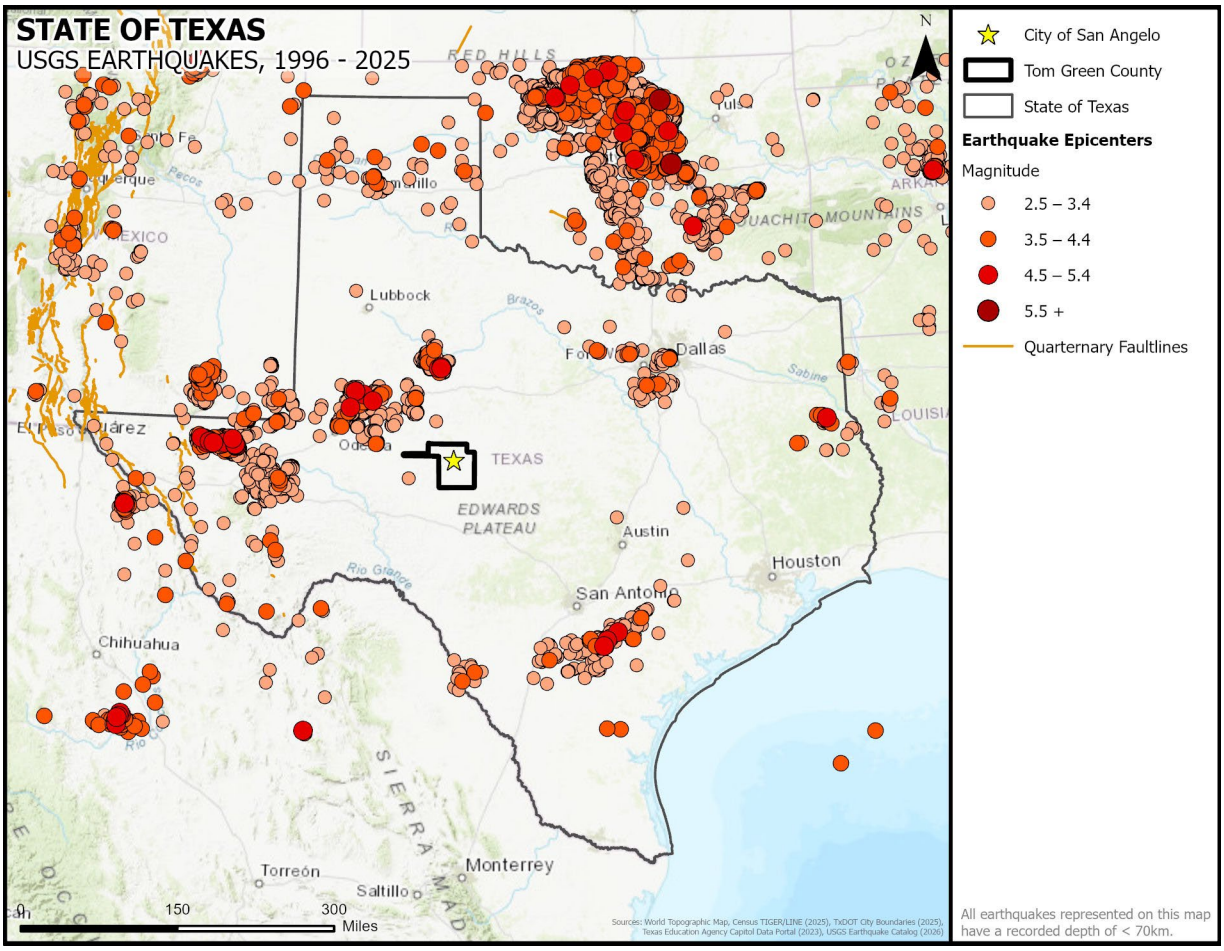
Figure 7-1. U.S. Map of Peak Ground Acceleration[3]



[3] Note: The City of San Angelo and Tom Green County planning area is indicated by the black circle.

Figure 7-2 maps historic earthquake epicenters across Texas between 1996 and 2025.

Figure 7-2. Historic Earthquake Epicenters in Texas, 1996-2025[4]



EXTENT

Earthquakes are measured in terms of magnitude and intensity. The prevalent magnitude measurement in use today is based on the Moment Magnitude Scale (MMS). MMS measures the movement of rock along the fault. It accurately measures larger earthquakes, which can last for minutes, affect a much larger area, and cause more damage. Magnitudes are based on a logarithmic scale (base 10), meaning that for each whole number you go up on the magnitude scale, the amplitude of the ground motion recorded by a seismograph goes up ten times. Using this scale, a magnitude 5 earthquake would result in ten times the level of ground shaking as a magnitude 4 earthquake (and about 32 times as much energy would be released).[5] The USGS reports earthquake magnitudes above 4.0 as “moment magnitude,” often described in the press

[4] Note: Tom Green County is indicated by the black polygon.

[5] Source: (n.d.). How Do We Measure Earthquake Magnitude? Michigan Tech. https://www.mtu.edu/geo/community/seismology/learn/earthquake-measure/#:~:text=The%20moment%20magnitude%20scale%20is,the%20earthquake%20at%20multiple%20stations

as "Richter" magnitude. Table 7-2 shows the magnitude levels for the current Richter / Moment Magnitude scale.

Table 7-2. Richter / Moment Magnitude Scale[6]

Magnitude	Category	Description of Effects	Events per Year
< 3.0	Micro	Usually not felt, but can be recorded by seismograph.	+100,000
3.0 – 3.9	Minor	Often felt, but causes no damage.	12,000 - 100,000
4.0 – 4.9	Light	Felt by all, minor breakage of objects.	2,000 - 12,000
5.0 – 5.9	Moderate	Some damage to weak structures.	200 – 2,000
6.0 – 6.9	Strong	Moderate damage in populated areas.	20 – 200
7.0 – 7.9	Major	Serious damage over large areas with loss of life expected.	3 – 20
> 7.9	Great	Severe destruction and loss of life over large areas.	Less than 3

Earthquake intensity measurement is an on-the-ground description. The measurement qualitatively explains the severity of earthquake shaking and its effects on people and their environment. Intensity measurements will differ depending on each location's proximity to the epicenter or point on the surface of the earth directly above the focus where the earthquake started. The intensity scale consists of a series of certain key responses such as people awakening, movement of furniture, damage to chimneys, and total destruction. There can be multiple intensity measurements associated with an earthquake as opposed to one magnitude measurement.[7] The Modified Mercalli Intensity value assigned to a specific site after an earthquake has a more meaningful measure of severity to the nonscientist than the magnitude because intensity refers to the effects actually experienced at a specific location. The scale provides the intensity of the earthquake in values ranging from I to X. Table 7-3 describes the typical effects and intensities associated with earthquakes of various magnitudes. The intensity and effects depend on multiple factors (earthquake depth, epicenter location, site geology, population density, to name a few) and can vary widely.

[6] Source: (n.d.). Earthquakes. Britannica. https://www.britannica.com/science/earthquake-geology
[7] Source: Wood, H. O., and Neumann, Frank (1931). Modified Mercalli Intensity Scale of 1931: Seismological Society of America Bulletin, v. 21, no. 4, p. 277-283

Table 7-3. Magnitude and Modified Mercalli Intensity (MMI) Scale[8]

Intensity	Category	Description of Effects	Corresponding Richter Magnitude
I	Not Felt	Not felt except by a very few under especially favorable conditions.	< 2.0
I	Not Felt	Felt only by a few persons at rest, especially on upper floors of buildings.	2.0 – 2.9
II – III	Weak	Felt quite noticeably by persons indoors, with shaking of indoor objects. Rarely causes damages.	3.0 – 3.9
IV – V	Light to Moderate	Noticeable shaking of indoor objects and rattling noises. Felt by most people in the affected area. Generally, no to minimal damage.	4.0 – 4.9
VI – VII	Strong to Very Strong	Significant damages to poorly constructed buildings. Limited to moderate damages to well-built structures.	5.0 – 5.9
VIII – IX	Severe to Violent	Damage slight in specially designed structures; considerable damage in ordinary buildings with partial collapse. Damage great in poorly built structures.	6.0 – 6.9
VIII +	Severe to Extreme	Damage considerable in specially designed structures. Damage substantial to most buildings, with partial or complete collapse. Felt across great distances with major damage mostly limited to 250 km from Epicenter.	7.0 – 7.9
VIII – IX	Severe to Violent	Major damage to buildings, structures likely to be destroyed; will cause moderate to heavy damage to sturdy or earthquake-resistant buildings; damaging in large areas; felt in extremely large regions.	8.0 – 8.9
VIII +	Severe to Extreme	At or near total destruction. Severe damage or collapse to all buildings; heavy damage and shaking extends to distant locations and permanent changes in ground topography.	9.0+

[8] Source: USGS

Taking into consideration the possible extent of an earthquake for the area, by reviewing Tables 7-2 and 7-3 in conjunction with no significant previous occurrences, as depicted in Figure 7-2, the City of San Angelo and Tom Green County planning area experiences on average less than 3.0 magnitude or Levels I (not felt) on the Modified Mercalli Intensity scale. This is the greatest extent the entire planning area can anticipate in the future, based on historic records.

HISTORICAL OCCURRENCES

According to USGS, and the National Geophysical Data Center (NGDC), there are no “significant” earthquakes on record for the State of Texas and the entire City of San Angelo and Tom Green County planning area from 2150 B.C. to present. A significant earthquake, as defined by NGDC, is one that has caused at least moderate damage (approximately $1 million or more), has resulted in 10 or more deaths, has registered as a magnitude 7.5 or greater, has registered as Modified Mercalli Intensity (MMI) Scale X or greater, or generated a tsunami. None of these criteria have been met by any seismic activity known to have impacted the planning area.

The USGS also has a database that tracks all earthquakes with a magnitude 2.5 or greater across the United States. According to the database, there were no earthquakes reported within the planning area between 1996 and 2025. During that same period, 66 earthquakes occurred within a 50-mile radius of the planning area and 604 earthquakes occurred within a 100-mile radius. Many of these occurred to the west of the Tom Green County planning area. The maximum magnitude recorded for earthquakes within the 50-mile radius was magnitude 3.8, considered a Level IV-V (weak) earthquake. In the 100-mile radius, the greatest recorded magnitude was 5.2, a Level VI-VII (strong to very strong) earthquake.

Another aspect of earthquakes tracked by the USGS is the depth at which they occur. Shallow earthquakes tend to be more damaging and cause more intense shaking than deeper earthquakes, however deep earthquakes are more likely to be felt over a wider area.

While it is possible for the planning area to feel stronger earthquakes that occur inside county boundaries, or within the 100-mile radius around the planning area, at this time, there are no known damages associated with these events for the City of San Angelo and Tom Green County planning area. Table 7-5 summarizes historical earthquake events that have occurred inside or near the planning area.

Figure 7-3. Historic Earthquake Events in or Near Tom Green County, 1996 – 2025

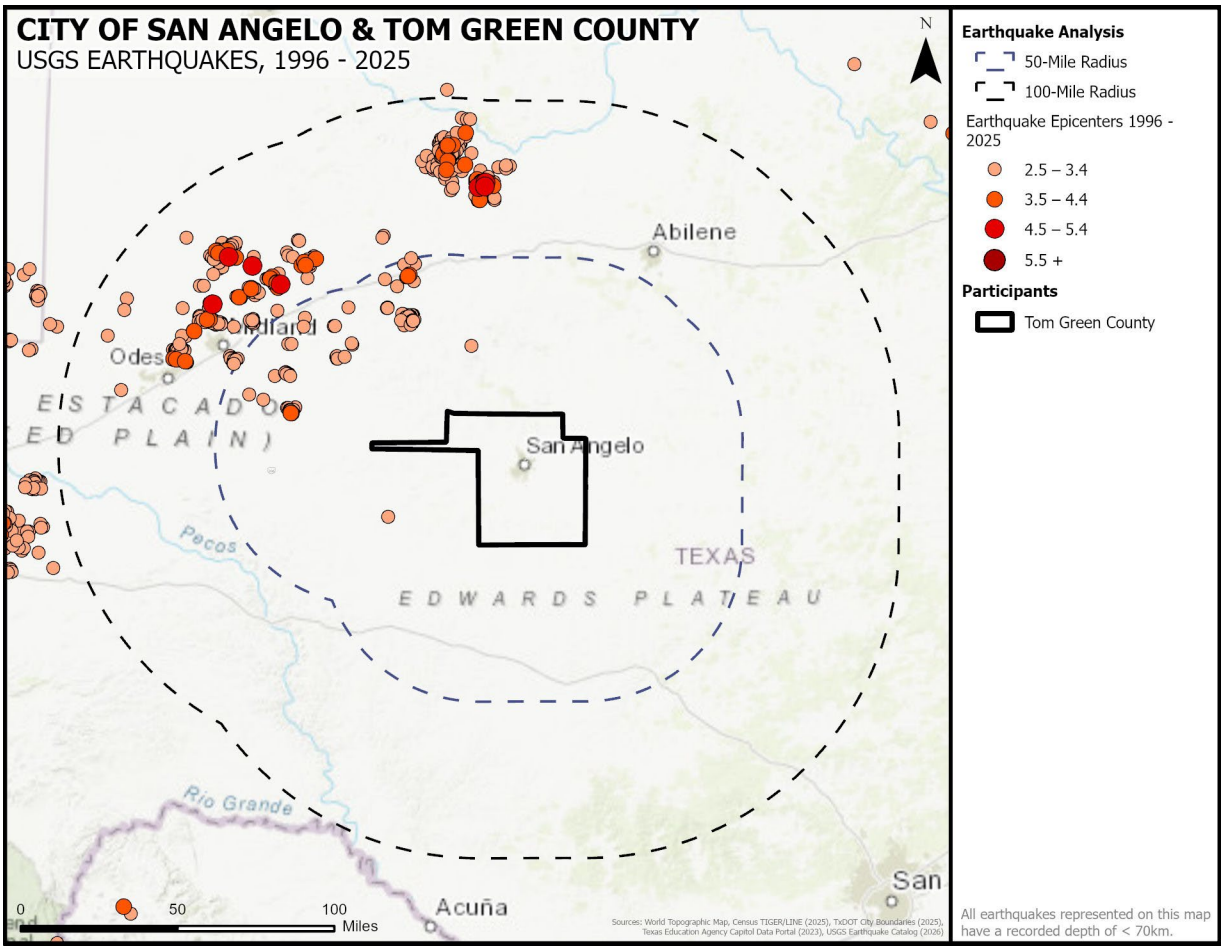


Table 7-4. Historical Earthquake Event Summary, 1996 – 2025[9]

Jurisdiction	Number of Events	Maximum Extent	Depth Range (km)	Injuries & Fatalities	Property & Crop Damage
Tom Green County	0	0	0	0	$0
50-Mile Radius	66	3.8	0.02-11.95	0	$0
100-Mile Radius	604	5.2	0.02 – 14.64	0	$0

PROBABILITY OF FUTURE EVENTS

Earthquake Hazard Maps show the distribution of earthquake shaking levels that have a certain probability of occurring over a given period. According to the USGS, the entire City of San Angelo and Tom Green County planning area has less than a five percent chance of a slightly damaging (or greater) earthquake within 100 years. Based on historical records, the probability of a

[9] Source: USGS

damaging earthquake affecting the planning area is “Unlikely,” meaning that an event is probable in the next 10 years.

CLIMATE CHANGE CONSIDERATIONS

Damaging earthquakes are rare within the State of Texas, including the City of San Angelo and Tom Green County planning area. Changing conditions of weather patterns and climate change has not been established as having a direct impact on earthquake intensity or frequency.

According to the USGS, statistically there is an approximately equal distribution of earthquakes in all cold weather, hot weather, rainy weather, etc. Very large low-pressure changes associated with major storm systems, like typhoons and hurricanes, are known to trigger episodes of fault slip or slow earthquakes in the Earth’s crust and may also play a role in triggering some damaging earthquakes. However, the numbers are small and are not statistically significant.[10]

The City of San Angelo and Tom Green County planning area is located outside of any known earthquake hazard areas. It sits in the Edwards Plateau, an area of relatively stable and flat terrain with no major tectonic faults. Climate change is assumed to have no impact on the probability or intensity of potential earthquakes in the planning area.

VULNERABILITY AND IMPACT

Little warning is usually associated with earthquakes and can impact areas a great distance away from the epicenter. The amount of damage depends on the density of population and buildings, and infrastructure construction in the affected area. Some places may be more vulnerable than others based on soil type, building age, and building codes in the City of San Angelo and Tom Green County planning area.

Earthquakes often exhibit signs that when detected, allow forewarning. While all citizens are at risk of the impacts of an earthquake, forced relocation and disaster recovery disproportionately impacts low-income residents who lack the financial means to evacuate, afford a long-term stay away from home, and to rebuild or repair their homes. The elderly, children, and people with a disability may have trouble evacuating due to mobility issues or a lack of awareness, making them more susceptible to injury or harm. In addition, people who speak a language other than English may face increased vulnerability due to language barriers that limit their access to important information such as warnings, evacuation routes and instructions regarding safety measures.

The population over 65 in the planning area is estimated at 17 percent of the total population and children under the age of 5 are estimated at 6 percent. The population with a disability is estimated at 15 percent of the total population. An estimated 11 percent of the planning area population live below the poverty level and 5 percent of the populations speak English ‘less than very well’ (Table 7-5).

[10] Source: (n.d.). *Natural Hazards*. United Stated Geological Survey. https://www.usgs.gov/faqs/there-earthquake-weather

Table 7-5. Populations at Greater Risk by Jurisdiction[11]

Jurisdiction	Population				
	65 and Older	Under 5	With a Disability	Below Poverty Level	Limited English Speaking
Tom Green County	20,295	7,368	17,826	13,273	6,329
City of San Angelo	16,795	5,905	14,943	10,964	5,245

The San Angelo ISD has vulnerable populations to consider including students with disabilities as well as younger students who may face higher risks regarding safety and evacuation. However, all Texas ISD's are required by state law to have a multi-hazard emergency operations plan (EOP) that includes specific procedures for students with disabilities, impairments, or other circumstances that may require additional safety considerations, mitigating the additional vulnerability.

The City of San Angelo and Tom Green County Planning Team identified the following critical facilities as assets that are considered the most important to the planning area and are susceptible to a range of impacts caused by earthquake events. For a comprehensive list by participating jurisdiction, please see Appendix D.

Table 7-6. Critical Facilities Vulnerable to an Earthquake

Critical Facility Type	Potential Impacts
Emergency Response Services (EOC, Fire, Police, EMS), Hospitals and Medical Centers	• Emergency operations and services may be significantly impacted due to power outages, damaged facilities, fires and/or loss of communications. Impact can impede emergency response vehicle access to areas. • Power outages could disrupt communications, delaying emergency response times. • Extended power outages may lead to possible looting, destruction of property, and theft, further burdening law enforcement resources.
Airport, Academic Institutions, Animal Shelter, Evacuation Centers and Shelters, Governmental Facilities, Residential/Assisted Living Facilities	• Power outages could disrupt critical care. • Backup power sources could be damaged. • Evacuations may be necessary due to extended power outages or other associated damages to facilities. • Economic disruption due to power outages negatively impact airport services as well as area businesses reliant on airport operations.

[11] US Census Bureau 2023 ACS data

Critical Facility Type	Potential Impacts
Commercial Supplier (food, fuel, etc.)	• Facilities, infrastructure, or critical equipment including communications may be damaged, destroyed or otherwise inoperable. • Essential supplies like medicines, water, food, and equipment deliveries may be delayed.
Utility Services and Infrastructure (electric, water, wastewater, communications)	• Emergency operations and critical services may be significantly impacted due to power outages, damaged facilities, and/or loss of communications. Impact can impede emergency service vehicle access to areas. • Power outages could disrupt communications, delaying emergency response times further straining the capacity and resources of emergency service personnel.

With no significant historical events recorded, neither annualized loss-estimates nor a breakdown of potential dollar losses of critical facilities and infrastructure from earthquakes are available. The potential severity of impact from an earthquake for the entire City of San Angelo and Tom Green County planning area is classified as “Limited,” meaning that less than 10 percent of infrastructure would be damaged with critical facilities being shut down for less than 24 hours.

Section 8
Extreme Heat

SECTION 8: EXTREME HEAT

HAZARD DESCRIPTION

Extreme heat is a prolonged period of excessively high temperatures and exceptionally humid conditions. Extreme heat during the summer months is a common occurrence throughout the State of Texas, and the City of San Angelo and Tom Green County planning area is no exception. The County typically experiences extended heat waves or an extended period of extreme heat and is often accompanied by high humidity.

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 extreme heat include heat cramps; sunburn; dehydration; fatigue; heat exhaustion; and even heat stroke. The most vulnerable population to heat casualties are children and the elderly or infirmed 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 well-being.

Critical infrastructure can also be damaged or impacted by extreme heat. High temperatures may cause a rise in electricity consumption as homes, schools, and businesses try to regulate the temperature. This may lead to energy shortages and possible blackouts.

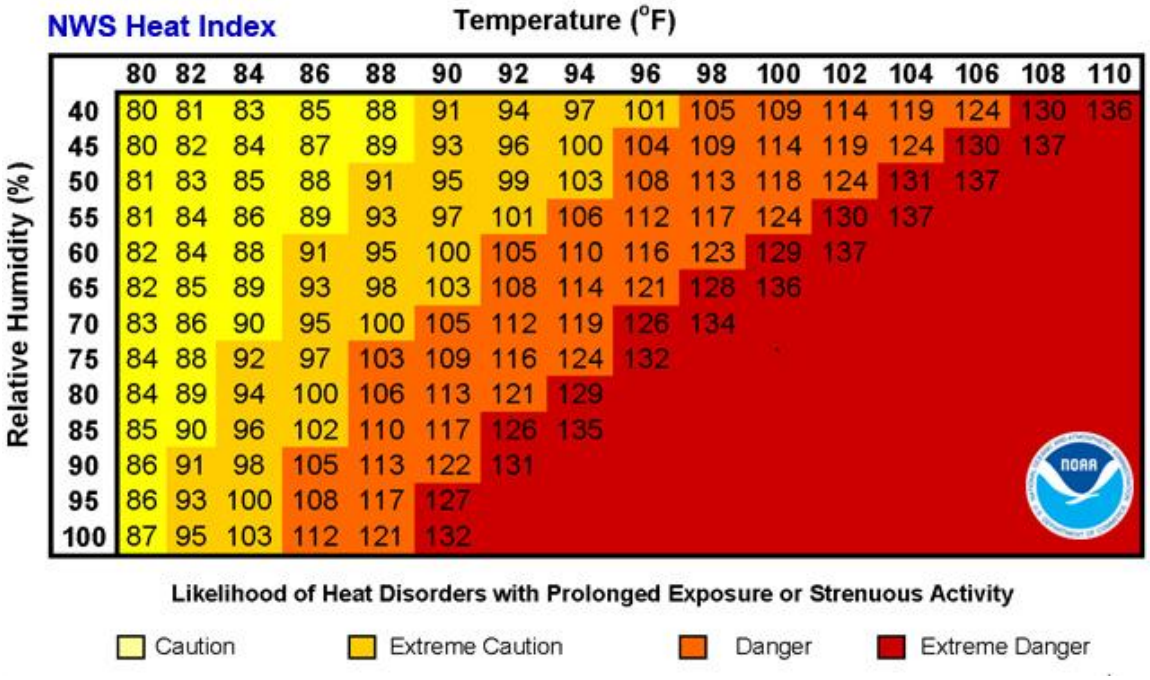
LOCATION

Extreme heat events can occur anywhere throughout the City of San Angelo and Tom Green County planning area.

EXTENT

The magnitude or intensity of an extreme heat event is measured according to temperature in relation to the percentage of humidity. According to the National Oceanic Atmospheric Administration (NOAA), this relationship is referred to as the “Heat Index” and is depicted in Figure 8-1. This index measures how hot it feels outside when humidity is combined with high temperatures.

Figure 8-1. Extent Scale for Extreme Heat[1]



The index in Figure 8-1 displays varying categories of caution depending on the relative humidity combined with the temperature. For example, when the temperature is at 90 degrees Fahrenheit (°F) or lower, 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. The National Weather Service (NWS) initiates alerts based on the Heat Index as shown in Table 8-1.

Table 8-1. Heat Index and Warnings

Category	Heat Index	Possible Heat Disorders	Warning Type
Extreme Danger	125°F and higher	Heat stroke or sun stroke likely.	An Excessive Heat Warning is issued if the Heat Index rises above 105°F at least 3 hours during the day or above 80°F at night.
Danger	103 – 124°F	Sunstroke, muscle cramps, and/or heat exhaustion are likely. Heatstroke possible with prolonged exposure and/or physical activity.	An Excessive Heat Warning is issued if the Heat Index rises above 105°F at least 3 hours during the day or above 80°F at night.

[1] Source: NOAA

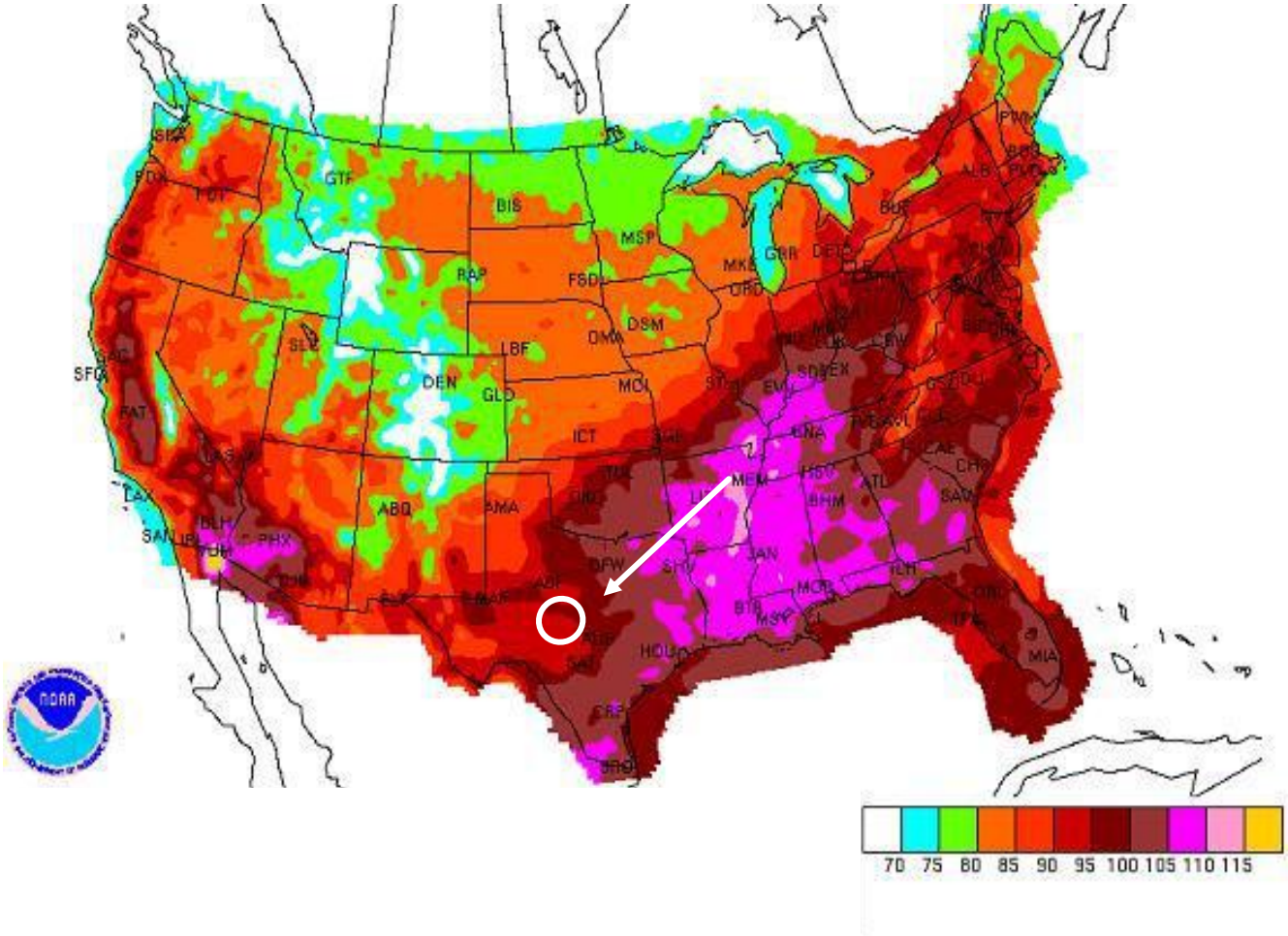
Category	Heat Index	Possible Heat Disorders	Warning Type
Extreme Caution	90 – 103°F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.	A Heat Advisory will be issued to warn that the Heat Index may exceed 105°F.
Caution	80 – 90°F	Fatigue is possible with prolonged exposure and/or physical activity.	A Heat Advisory will be issued to warn that the Heat Index may exceed 105°F.

Tom Green County's terrain is even to slightly hilly. It comprises 1,541 square miles in West Central Texas. The county has a 235-day growing season, an average temperature range of 32°F in January and 97°F in July, an average annual precipitation of 18.2 inches, and an elevation variation of 1,717 feet to 2,480 feet. The principal river in the county is the Concho, which is formed by the convergence of the North, Middle, and South Concho rivers.

Due to its geography and its semi-arid, hot, and subtropical climate, the City of San Angelo and Tom Green County planning area can expect an extreme heat event each summer. Citizens, especially children and the elderly, should exercise caution by staying out of the heat for prolonged periods when a heat advisory or excessive heat warning is issued. In addition, those working or remaining outdoors for extended periods of time are at greater risk.

Figure 8-2 displays the daily maximum heat index as derived from NOAA based on data compiled from 1838 to 2015. The white circle shows the City of San Angelo and Tom Green County planning area. The planning area is represented in a red color across the County. The red color indicates an average daily heat index of 90°F to 95°F. Therefore, City of San Angelo and Tom Green County could experience dangerous heat from 90°F to 95°F and should anticipate the extent of "Extreme Caution" which can include sunstroke, muscle cramps, and heat exhaustion. The planning area's record high temperature of 114°F was documented in the City of San Angelo on June 20, 2023. This is the maximum temperature the planning area can anticipate based on historical events.

Figure 8-2. Average Daily Maximum Heat Index Days[2]



HISTORICAL OCCURRENCES

The National Centers for Environmental Information (NCEI) Storm Events database is a national data source organized under the National Oceanic and Atmospheric Administration (NOAA). The NCEI is the largest archive available for historic storm events data. Previous occurrences for extreme heat are derived from the NCEI database, which identifies extreme heat events at the county level for each event. According to heat related incidents located within City of San Angelo and Tom Green County, there have been five extreme heat events on record for the planning area (Table 8-2) including one reported by San Angelo ISD. Historical extreme heat information, as provided by the NCEI, shows extreme heat activity across a multi-county forecast area for each event.

[2] NRDC and the white circle indicates the City of San Angelo and Tom Green County planning area.

Historical data for all participating jurisdictions is provided on a county-wide basis per the NCEI database from 1996 through 2025. No fatalities or damages were reported to the NCEI. The ISD reported one injury related to high temperatures in July 2023, when temperatures reached 110°F. No additional damages were reported for the ISD.

Only extreme heat events that have been reported have been factored into this Risk Assessment. It is highly likely additional extreme heat occurrences have gone unreported during the recording period. Due to the limited number of reported events, average high temperatures have been analyzed in order to determine the probability of future events.

Table 8-2. Historical Extreme Heat Events, 1996 – 2025[3]

Jurisdiction	Date	Deaths	Injuries	Property Damage	Crop Damage
Tom Green County	7/1/2022	0	0	$0	$0
Tom Green County	6/19/2023	0	0	$0	$0
Tom Green County /San Angelo ISD	7/18/2023	0	1	$0	$0
Tom Green County	8/5/2023	0	0	$0	$0
Tom Green County	8/21/2024	0	0	$0	$0
Totals	**5**	**0**	**1**	$0	$0

Table 8-3. Historical Extreme Heat Events Summary, 1996 – 2025

Jurisdiction	Number of Events	Deaths	Injuries	Property Damage	Crop Damage
Tom Green County	5	0	1	$0	$0

Based on the list of historical extreme heat events for the City of San Angelo and Tom Green County planning area, five events were recorded since the 2020 Plan.

SIGNIFICANT EVENTS

August 5, 2023

In August, the San Angelo Regional Airport shattered 12 daily record high temperatures, with 10 of those days reaching 108°F or higher, including two that hit 110°F or above on August 9th and 10th. On August 10th, the airport also tied the all-time August record high of 111°F. This intense heat wave across much of west central Texas resulted from a persistent, strong upper-level ridge of high pressure dominating the region throughout the month.

PROBABILITY OF FUTURE EVENTS

According to historical records, the City of San Angelo and Tom Green County planning area has experienced five events in a 29.5-year reporting period. Historical records in combination with an

[3] NOAA, NCEI Storm Events Database

analysis of maximum average temperatures provide a probability of at least one event every year. This frequency supports a “Highly Likely” probability of future events for the planning area.

CLIMATE CHANGE CONSIDERATIONS

Climate change is expected to lead to an increase in average temperatures as well as an increase in frequency, duration, and intensity of extreme heat events. With no reductions in emissions worldwide, the state of Texas is projected to experience an additional 30 to 60 days per year above 100°F than what is experienced now.[4]

In addition, it is projected that future changes to City of San Angelo and Tom Green County will include increased temperatures, which according to the U.S. Climate Explorer, the planning area may experience a 6°F increase in the average extreme heat temperatures. Historically, extreme temperatures averaged 101°F in City of San Angelo and Tom Green County, but between 2035 and 2064 the average will be 107°F, increasing the severity and frequency of extreme heat events. Some projections show an even higher increase; however, the severity will be dependent on overall future emissions and is subject to change.

VULNERABILITY AND IMPACT

While the City of San Angelo and Tom Green County planning area is exposed to extreme temperatures, existing buildings, infrastructure, and critical facilities are not likely to sustain significant damage from extreme heat events. Therefore, any estimated property losses associated with the extreme heat hazard are anticipated to be minimal across the area.

Every summer, the hazard of heat-related illness becomes a significant public health issue throughout much of the United States. Mortality rates increase during heat waves, and excessive heat is an important contributing factor to deaths from other causes, particularly among the elderly. Extreme temperatures present a significant threat to life and safety for the population of the County as a whole. Heat casualties, for example, are typically caused by a lack of adequate air conditioning or heat exhaustion. The most vulnerable population to heat casualties are the elderly or infirmed who frequently live on 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 well-being. Children may also be more vulnerable if left unattended in vehicles. Populations living below the poverty level are often unable to run air conditioning on a regular basis and are limited in their ability to seek medical treatment.

Vulnerable and underserved populations are disproportionately impacted by extreme heat events as they may be more susceptible to health risks. The population below the poverty level are less likely to be able to afford air conditioning during the hot summer months as well as less likely to have access to medical care. In addition, people who speak a language other than English may face increased vulnerability due to language barriers that limit their access to important information such as weather-related warnings and instructions regarding safety measures.

The population over 65 in the City of San Angelo and Tom Green County planning area is estimated at 17 percent of the total population and children under the age of 5 are estimated at 6

[4] Nielsen-Gammon, John, Holman, Sara, Buley, Austin and Jorgensen, Savannah. Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900-2036, 2021 Update. Texas A&M University Office of the Texas State Climatologist. October 7, 2021. https://climatexas.tamu.edu/files/ClimateReport-1900to2036-2021Update

percent. The population with a disability is estimated at 15 percent of the total population. An estimated 11 percent of the planning area population live below the poverty level and 5 percent of the populations speak English 'less than very well' (Table 8-4). The participating ISD has a combined total of 126 staff that work outdoors and may be exposed to extreme heat conditions (Table 8-5).

Table 8-4. Populations at Greater Risk by Participating Jurisdiction

Jurisdiction	Population				
	65 and Older	Under 5	With a Disability	Below Poverty Level	Limited English Speaking
City of San Angelo	16,795	5,905	14,943	10,964	5,245
Tom Green County	20,295	7,368	17,826	13,273	6,329

Table 8-5. Populations at Greater Risk for Special Districts

Independent School District	Population	
	Under 5	Works Outdoors
San Angelo ISD	313	126

Extremely high temperatures can have significant secondary impacts, leading to droughts, water shortages, increased fire danger, and prompt excessive demands for energy. Typically, more than 12 hours of warning time would be given before the onset of an extreme heat event. In terms of vulnerability to structures, the impact from extreme heat is considered negligible. No historical agricultural losses were recorded over the reporting period. With one injury and no reported damages or fatalities, the potential impact of excessive summer heat is considered "Limited", with any injuries being treatable with first aid, shutdown of critical facilities for 24 hours or less, and less than 10 percent of property being destroyed.

The City of San Angelo and Tom Green County Planning Team identified the following critical facilities as assets that are considered the most important to the planning area and are susceptible to a range of impacts caused by extreme heat events. The following critical facilities would be vulnerable to extreme heat events in the City of San Angelo and Tom Green County planning area. For a comprehensive list by participating jurisdiction, please see Appendix D.

Table 8-6. Critical Facilities Vulnerable to Extreme Heat Events

Critical Facility Type	Potential Impacts
Emergency Response Services (EOC, Fire, Police, EMS, Hospitals)	• Emergency operations, services and response times may be significantly impacted due to power outages, and/or loss of communications. • Exposure to heat can cause heat illnesses in first responders, especially for those in heavy equipment. • Roads may become impassable due to excessive heat causing asphalt roads to soften and concrete roads to shift or buckle impacting response times by emergency services.

Critical Facility Type	Potential Impacts
Airport, Academic Institutions, Community Residential Facilities, Day Care Facilities, Evacuation Centers & Shelters, Governmental Facilities	• Facilities, infrastructure, or critical equipment including communications may be damaged, destroyed or otherwise inoperable. • Power outages due to increased usage could disrupt critical care. • Backup power sources could be damaged. • Evacuations may be necessary due to extended power outages, breaks in water main lines or other associated damage to facilities. • Facilities, infrastructure, or critical equipment including communications may be damaged, destroyed or otherwise inoperable. • Economic disruption due to power outages negatively impact airport services as well as area businesses reliant on airport operations.
Commercial Suppliers (food, gas, etc.)	• Facilities, infrastructure, or critical equipment including communications may be damaged, destroyed or otherwise inoperable. • Essential supplies like medicines, water, food, and equipment deliveries may be delayed.
Utility Services and Infrastructure (electric, water, wastewater, communications)	• Emergency operations, services and response times may be significantly impacted due to power outages, and/or loss of communications. • Roads may become impassable due to excessive heat causing asphalt roads to soften and concrete roads to shift or buckle impacting response times by emergency services. • Breaks in water main lines or other associated damage to facilities.

ASSESSMENT OF IMPACTS

The greatest risk from extreme heat is to public health and safety. Extreme heat conditions can be frequently associated with a variety of impacts, including:

- In Tom Green County vulnerable populations, particularly the elderly (17 percent of total population), children under 5 (6 percent of total population), and those with a disability (15 percent of total population) can face serious or life-threatening health problems from exposure to extreme heat including hyperthermia, heat cramps, heat exhaustion, and heat stroke (or sunstroke).
- Response personnel, including utility workers, public works personnel, and any other professions where individuals are required to work outside, are more subject to extreme heat related illnesses since their exposure would typically be greater.
- High energy demand periods can outpace the supply of energy, potentially creating the need for rolling brownouts which would elevate the risk of illness to vulnerable residents.
- Highways and roads may be damaged by excessive heat causing asphalt roads to soften and concrete roads to shift or buckle.
- Vehicle engines and cooling systems typically run harder during extreme heat events resulting in increases in mechanical failures.

- Extreme heat events during times of drought can exacerbate the environmental impacts associated with drought, decreasing water and air quality and further degrading wildlife habitat.
- Extreme heat increases ground-level ozone (smog), increasing the risk of respiratory illnesses.
- Negatively impacted water suppliers may face increased costs resulting from the transport of water resources or development of supplemental water resources.
- Tourism and recreational activities at places may be negatively impacted during extreme heat events, reducing seasonal revenue.
- Outdoor activities may see an increase in school injury or illness during extreme heat events.

The economic and financial impacts of extreme heat on the community will depend on the duration of the event, demand for energy, drought associated with extreme heat, and many other factors. The level of preparedness and the amount of planning done by the community, local businesses, and citizens will impact the overall economic and financial conditions before, during, and after an extreme heat event.

Section 9
Flood

SECTION 9: FLOOD

HAZARD DESCRIPTION

Floods generally result from excessive precipitation. The severity of a flood event is 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 surfaces. Typically, floods are long-term events that may last for several days.

The primary types of general flooding are inland and coastal flooding. Due to City of San Angelo and Tom Green County's inland location, only inland flooding is profiled in this section. Inland or riverine flooding is a result of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. Inland or riverine flooding is overbank flooding of rivers and streams, typically resulting from large-scale weather systems that generate prolonged rainfall over a wide geographic area. Therefore, it is a naturally occurring and inevitable event. 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.

The City of San Angelo and Tom Green County planning area is subject to extreme rainfall events, often in short durations, leading to dangerous flash flooding events. Floods are a natural and recurrent event and take place every year, in all seasons.

LOCATION

The Flood Insurance Rate Maps (FIRMs) prepared by FEMA provide an overview of flood risk but can also be used to identify the areas of the planning area that are vulnerable to flooding. FIRMs are used to regulate new development and to control the substantial improvement and repair of substantially damaged buildings. Flood Insurance Studies (FIS) are often developed in conjunction with FIRMs. The FIS typically contains a narrative of the flood history of a community and discusses the engineering methods used to develop the FIRMs. The FIS also contains flood profiles for studying flooding sources and can be used to determine Base Flood Elevations (BFEs) for some areas.

The FIS for Tom Green County is dated June 19, 2012. This compiles all previous flood information including data collected on numerous waterways. This study indicates that the principal flooding problems are the recurring damage to physical property in the City of San Angelo and parts of Tom Green County, resulting from flooding along major stream corridors. Damages primarily includes modern, well-built residences, along with some older, more modest homes. Commercial and light industrial properties are also subject to flooding, especially near major roadway crossings. Flooding impacts are exacerbated by undersized bridges, low-water crossings, and small dams that restrict flood flows. The area has a long history of flooding associated with the Concho River and its primary tributaries, including the North, South, and Middle Concho Rivers.

The current effective Digital Flood Insurance Rate Map or DFIRM (map ID 48451C, panels 25-1025, dated June 19, 2012) data provided by FEMA for City of San Angelo and Tom Green County shows the following flood hazard areas:

- Zone A: Areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown. Mandatory flood insurance requirements and floodplain management standards apply.
- Zone AE: Areas subject to inundation by 1-percent-annual-chance shallow flooding. It is the base floodplain where BFEs are provided. AE zones are now used on new format FIRMs instead of A1-30 zones.
- Zone X: Moderate risk areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by a levee. No BFEs or base flood depths are shown within these zones.

Locations of flood zones in City of San Angelo and Tom Green County based on the Digital Flood Insurance Rate Map (DFIRM) from FEMA are illustrated in Figures 9-1 through 9-3.

Additionally, San Angelo ISD reports that Bradford Elementary School is particularly vulnerable to flooding.

Figure 9-1. Estimated Flood Zones in the City of San Angelo

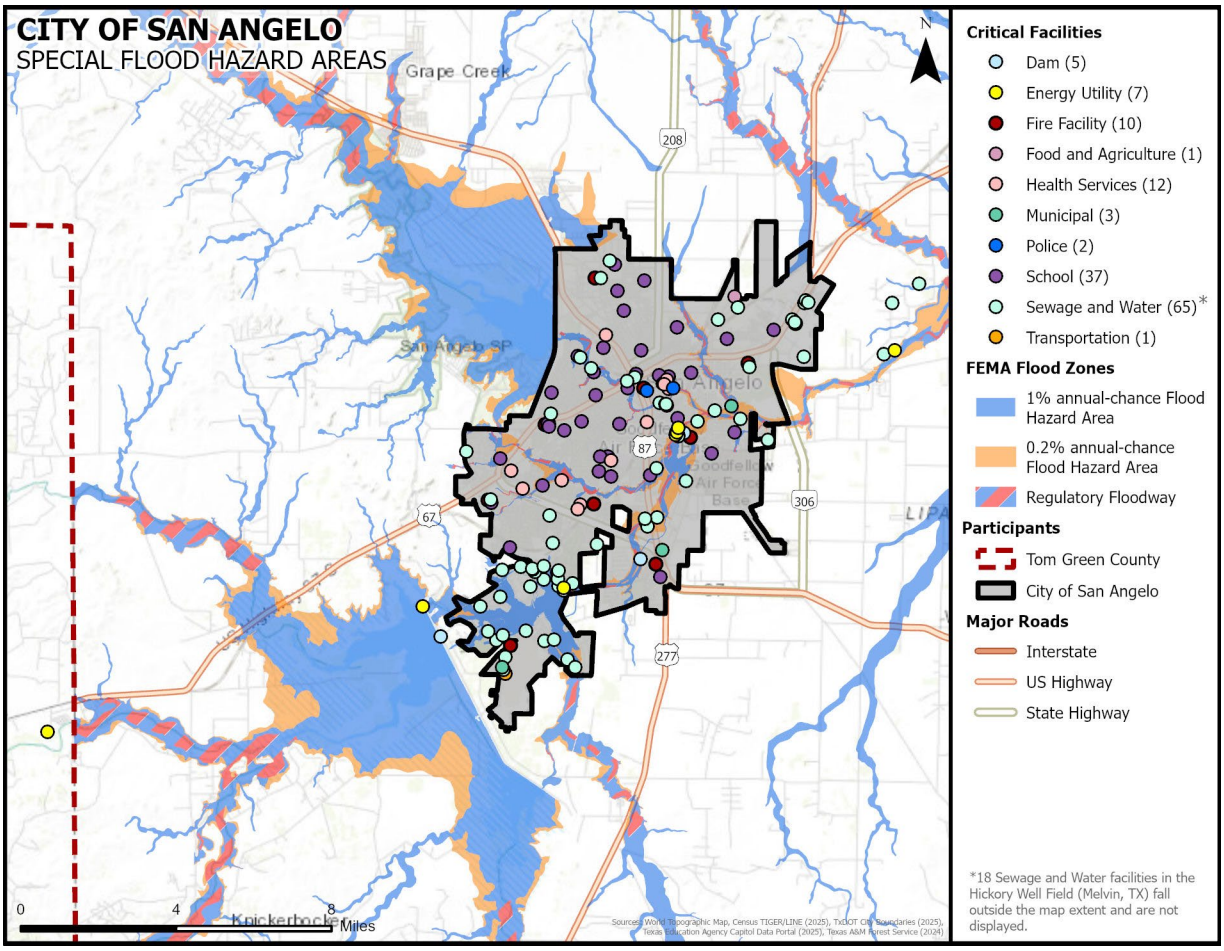


Figure 9-2. Estimated Flood Zones in Tom Green County

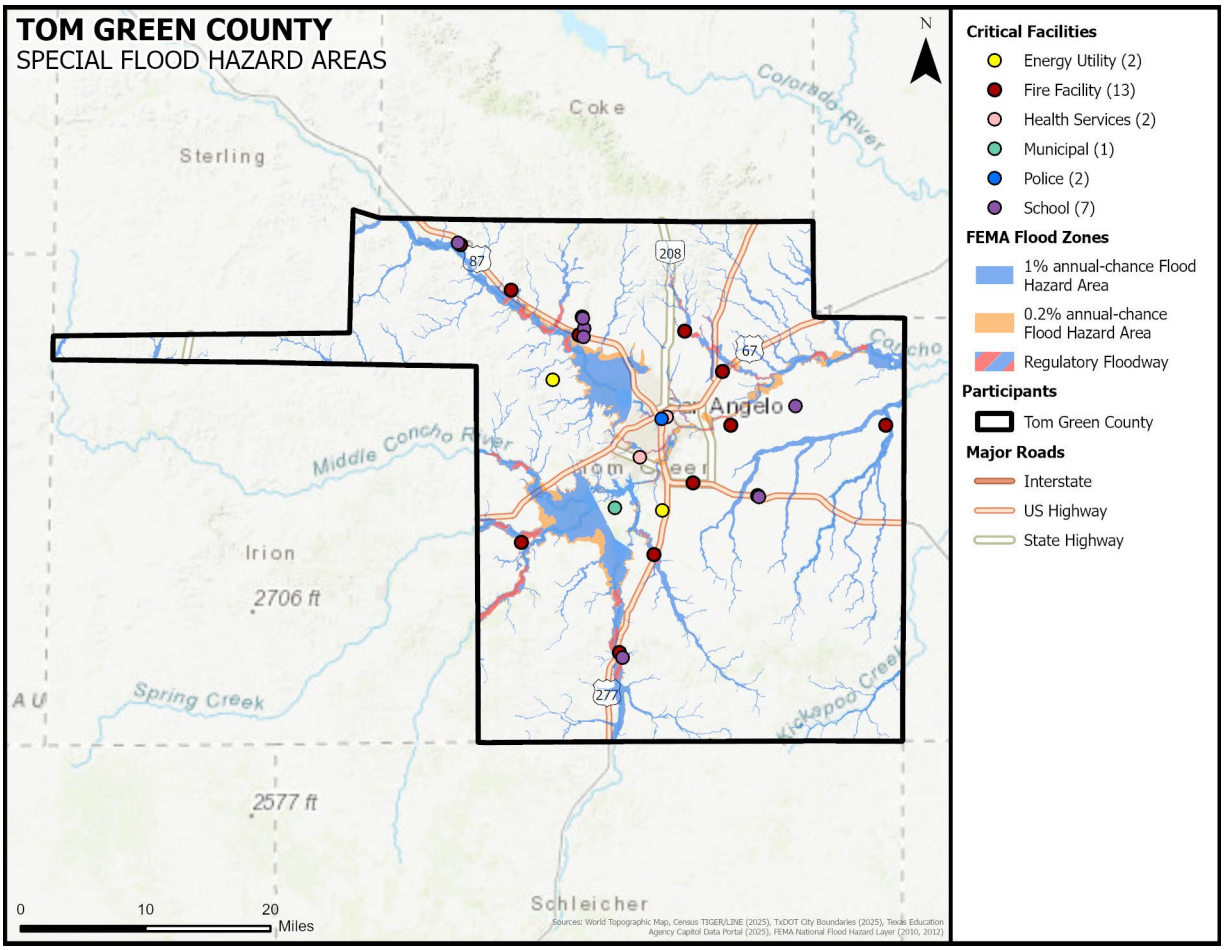
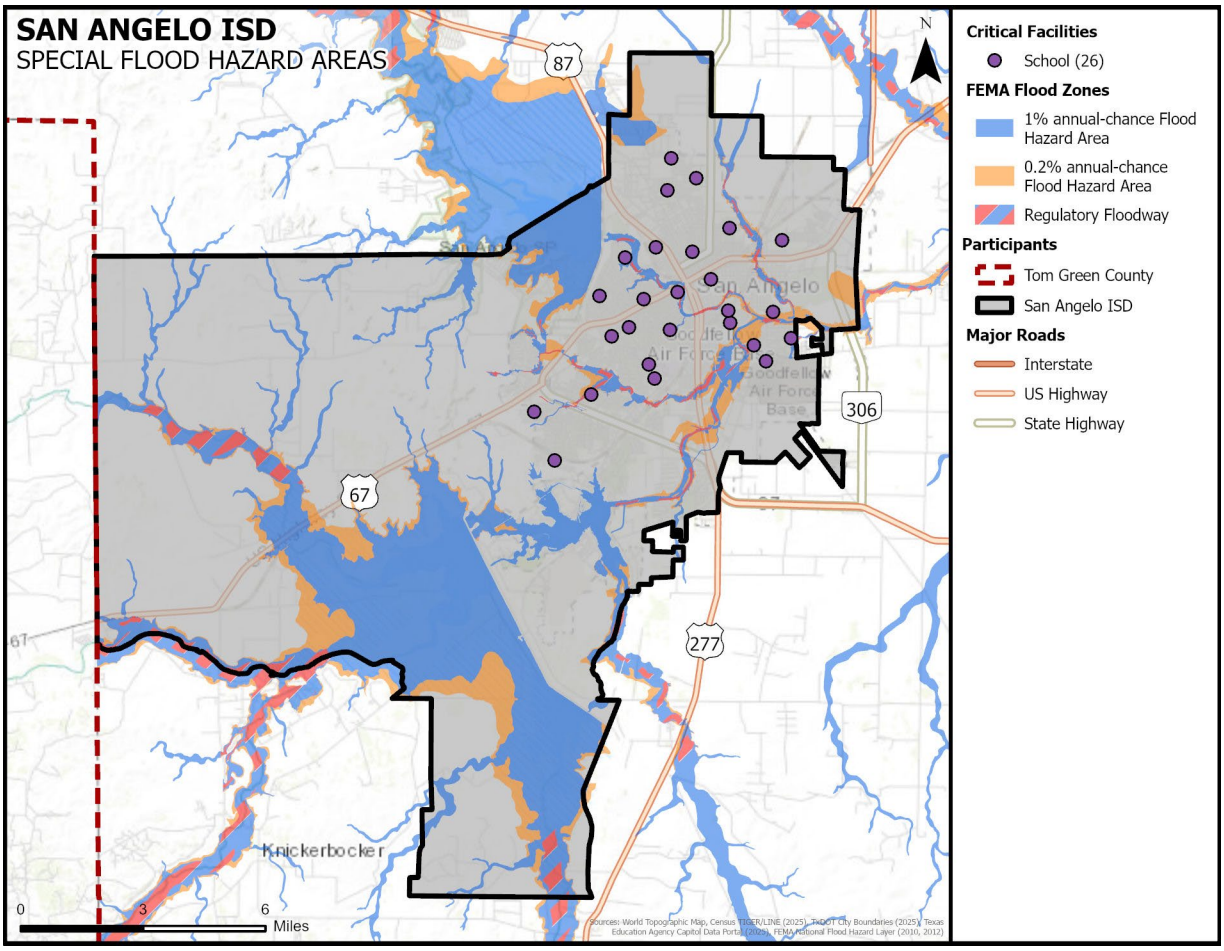


Figure 9-3. Estimated Flood Zones for the San Angelo ISD



EXTENT

The severity of a flood event is 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 surfaces. Typically, floods are long-term events that may last for several days.

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 the depths of flood waters. The extent of flood damages 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 FIRMs. Table 9-1 provides a description of FEMA flood zones and the flood impact in terms of severity or potential harm. Flood Zones A, AE, and X are the hazard areas mapped in the region. Figures 9-1 through 9-6 should be read in conjunction with the extent for flooding in Tables 9-1 to determine the intensity of a potential flood event.

Table 9-1. Flood Zones

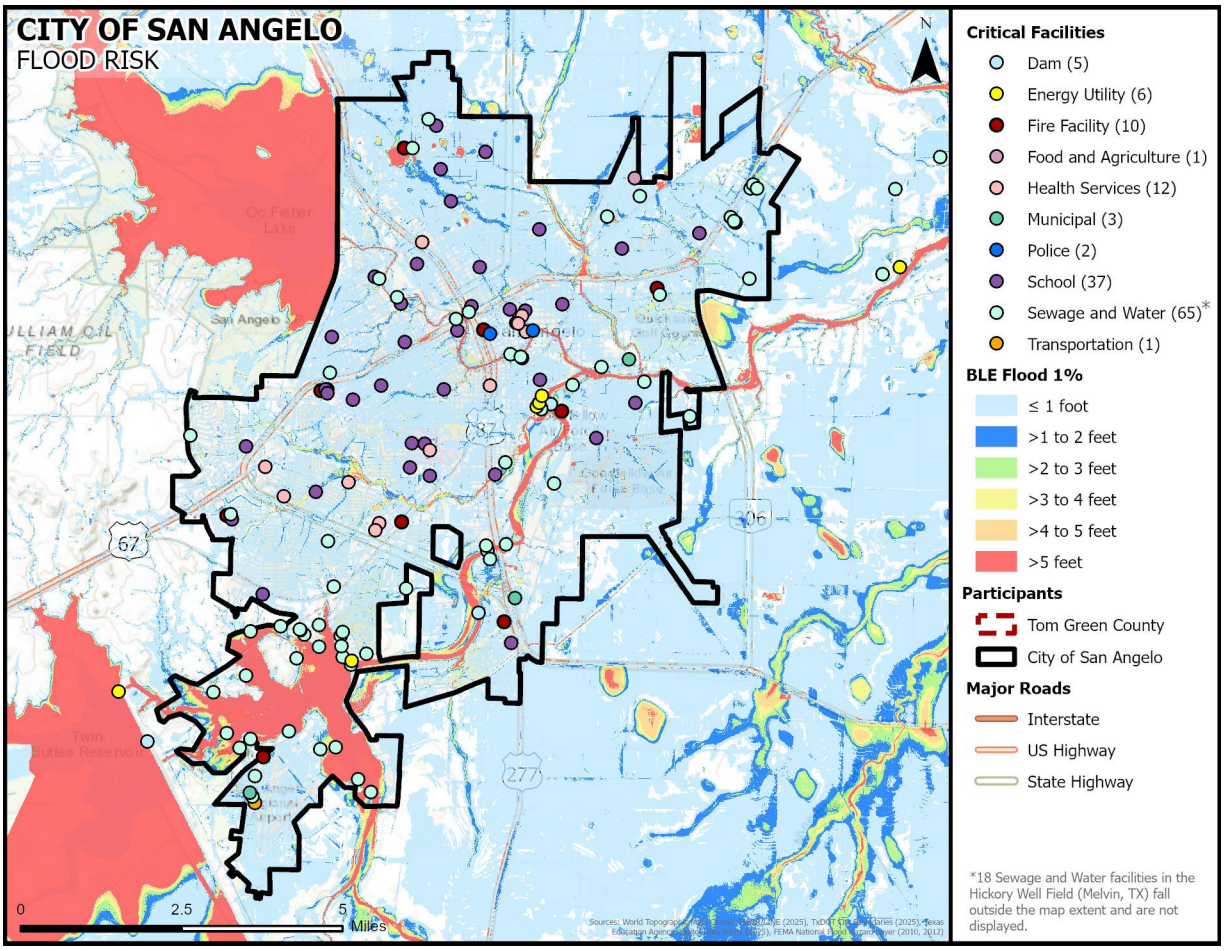
Intensity	Zone	Description
High	Zone A	Areas with a 1-percent-annual-chance of flooding and a 26 percent chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas, no depths or base flood elevations are shown within these zones.
	Zone A1-30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a Base Flood Elevation (BFE) (old format).
	Zone AE	The base floodplain where BFEs are provided. AE Zones are now used on the new format FIRMs instead of A1-A30 Zones.
	Zone AO	River or stream flood hazard areas and areas with a 1-percent-annual-chance or greater of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26 percent chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
	Zone AH	Areas with a 1-percent-annual-chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26 percent chance of flooding over the life of a 30-year mortgage. BFEs derived from detailed analyses are shown at selected intervals within these zones.
	Zone A99	Areas with a 1-percent-annual-chance of flooding that will be protected by a federal flood control system where construction has reached specified legal requirements. No depths or BFEs are shown within these zones.
	Zone AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
Moderate to Low	Zone X 500	An area inundated by 500-year flooding; an area inundated by 100-year flooding with average depths of less than 1 foot or with drainage areas less than 1 square mile; or an area protected by levees from 100-year flooding.

Zone A is interchangeably referred to as the 100-year flood, the 1-percent-annual-chance flood, the Special Flood Hazard Area (SFHA), or more commonly, the base flood. This is the area that will convey the base flood and constitutes a threat to the planning area. The impact from a flood event can be more damaging in areas that will convey a base flood.

Structures built in the SFHA 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. If not elevated above Base Flood Elevation, utility systems, such as heating, ventilation, air conditioning, fuel, electrical systems, sewage maintenance systems and water systems, may also be damaged.

The intensity and magnitude of a flood event is also determined by the depth of flood water. According to FEMA's Region 6 Estimated Base Flood Elevation Viewer, the planning area may experience flood depths of greater than 5 feet.[1] A map for the planning area with the Base Flood Elevation depth range is provided in Figures 9-4 through 9-6.

Figure 9-4. Estimated Base Flood Elevation Flood Depths for City of San Angelo



[1] U.S. Geological Survey. Estimated Base Flood Elevation (BFE) Viewer. https://webapps.usgs.gov/infrm/estBFE/.

Figure 9-5. Estimated Base Flood Elevation Flood Depths for Tom Green County

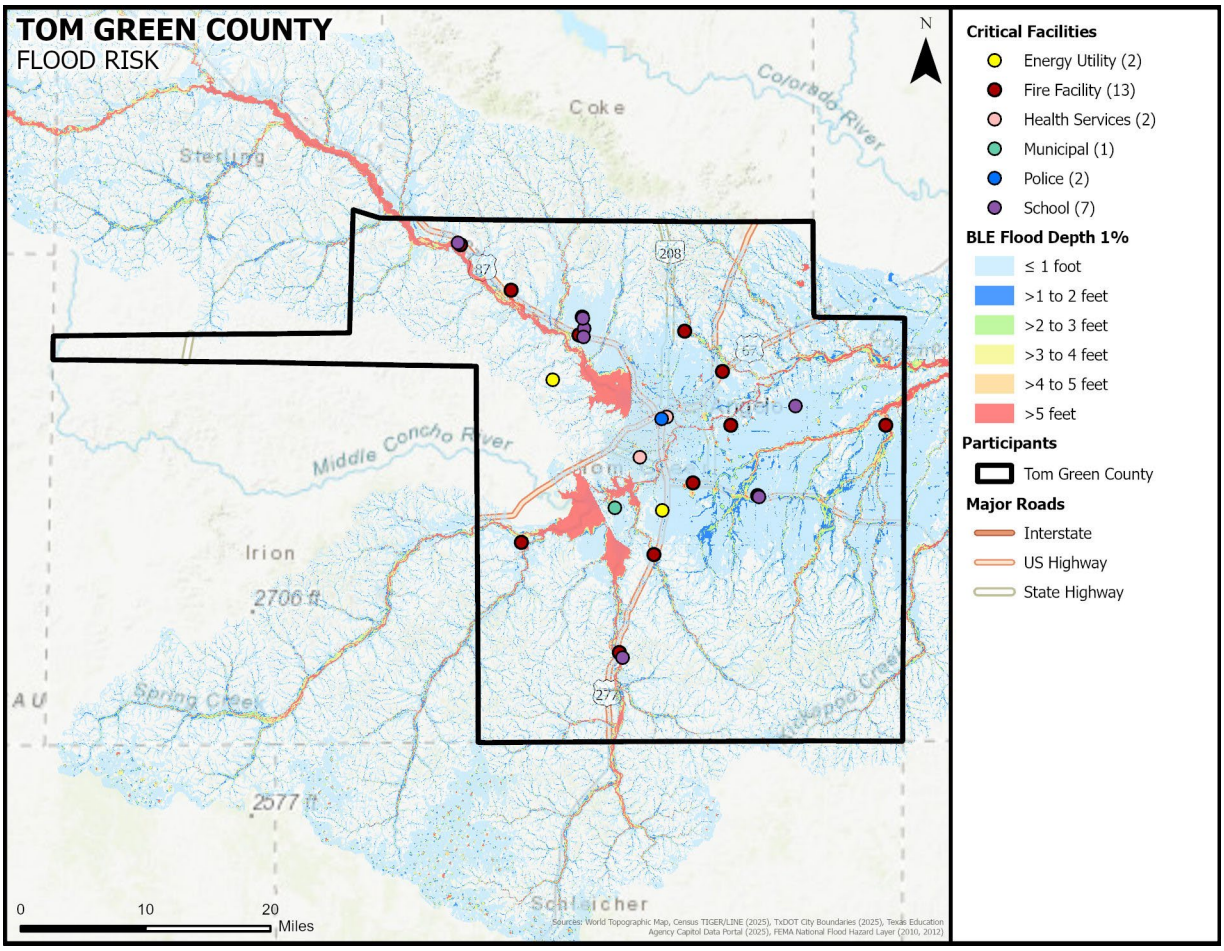
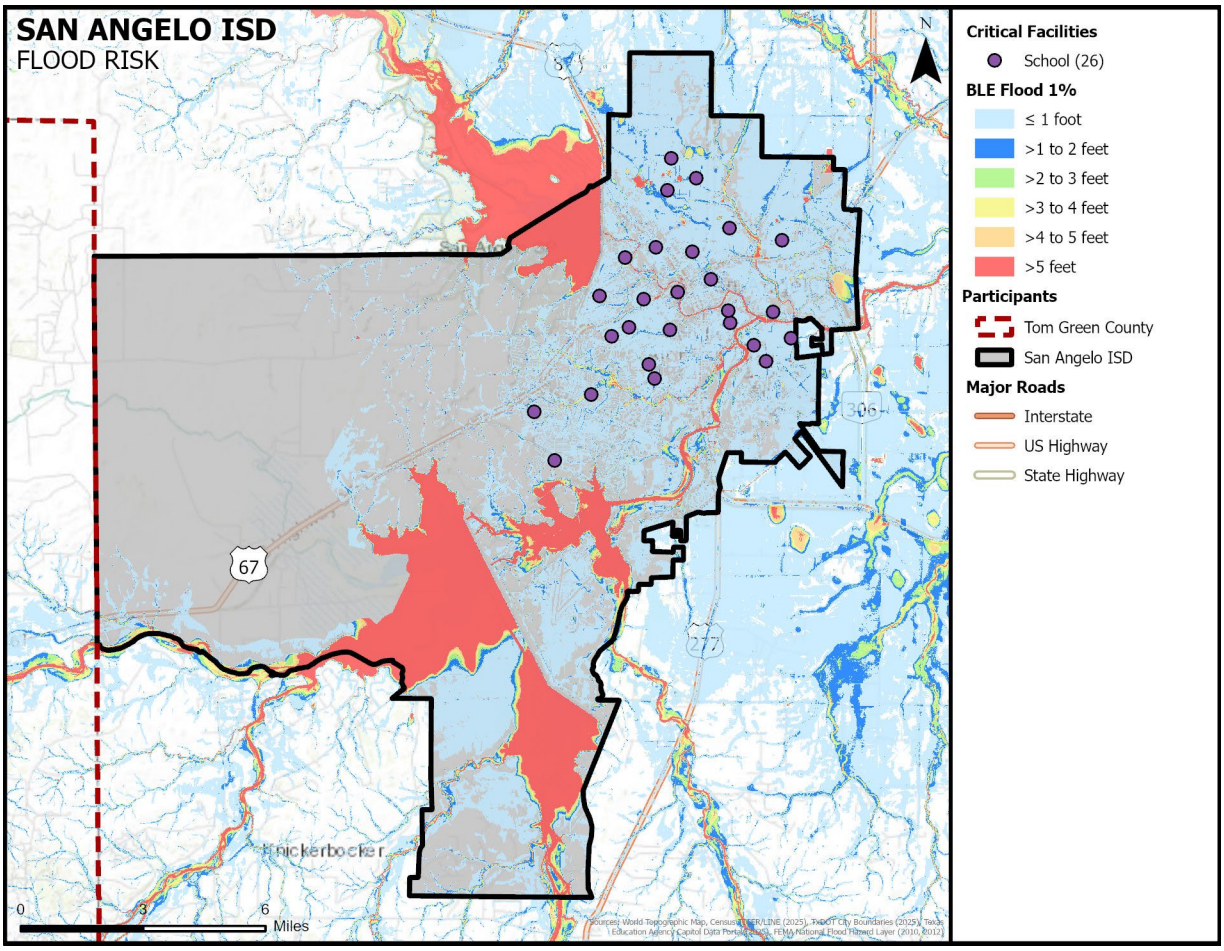


Figure 9-6. Estimated Base Flood Elevation Flood Depths for San Angelo ISD



The range of flood intensity that the planning area can experience is high, or Zone A. Based on historical occurrences, the planning area could expect to experience an average of 2 to 3 inches of rain within a 1-hour period, resulting in flash flooding.

The data described in Table 9-1, together with Figures 9-1 through 9-6, and historical occurrences for the area, provides an estimated potential magnitude and severity for the City of San Angelo and Tom Green County planning area.

HISTORICAL OCCURRENCES

Historical evidence indicates that areas within the planning area 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, therefore it is likely that additional flood occurrences have gone unreported before and during the recording period. Table 9-2 identifies historical flood events that resulted in damages, injuries, or fatalities within the City of San Angelo and Tom Green County planning area. Table 9-3 provides the historical flood event summary by jurisdiction. Historical data is provided by the Storm Prediction Center (NOAA), National Centers for Environmental Information (NCEI) database for City of San Angelo and Tom Green County. There have been 141 recorded flood events in the planning area.

Historical flood data events for the special districts are primarily provided in the NCEI database within the county or city in which the special district is located. San Angelo ISD has reported minor flood impacts associated with a flood event in July of 2025, however, no additional events, injuries, fatalities, or damages were reported separate and apart from the NCEI.

Table 9-2. Historical Flood Events, January 1996 – June 2025[2]

Jurisdiction	Date	Deaths	Injuries	Property Damage	Crop Damage
Tom Green County	8/28/1996	0	0	$103,000	$0
Tom Green County	8/29/1996	0	0	$412,000	$0
City of San Angelo	6/8/1997	0	0	$20,300	$0
City of San Angelo	6/14/1997	0	0	$50,600	$0
City of San Angelo	5/26/1998	0	0	$199,100	$0
City of San Angelo	5/26/1998	0	0	$298,600	$0
City of San Angelo	9/18/2001	0	1	$0	$0
City of San Angelo	3/19/2002	0	0	$18,200	$0
City of San Angelo	5/4/2002	0	0	$18,100	$0
City of San Angelo	5/15/2002	0	0	$23,500	$0
Tom Green County	7/6/2002	0	2	$179,900	$0
City of San Angelo	6/3/2003	0	0	$264,600	$0
Tom Green County	6/21/2004	0	0	$24,000	$0
Tom Green County	5/8/2007	0	0	$7,800	$0
City of San Angelo	6/3/2007	0	0	$15,600	$0
Tom Green County	6/24/2007	0	0	$3,200	$0
Tom Green County	5/18/2015	0	0	$681,200	$0
Tom Green County	5/19/2015	0	0	$681,200	$0
Totals		**0**	**3**	**$3,000,900**	**$0**

[2] Table only includes historical flood events that resulted in damages, injuries, or fatalities between January 1996 and June 2025 in the NCEI database. Values are in 2026 dollars.

Table 9-3. Summary of Historical Flood Events, January 1996 – June 2025[3]

Jurisdiction	Number of Events	Deaths	Injuries	Property Damage	Crop Damage
Tom Green County	58	0	2	$2,092,300	$0
City of San Angelo	83	0	1	$908,600	$0
San Angelo ISD	0	-	-	-	-
Totals	**141**	**0**	**3**	**$3,000,900**	

Based on the list of historical flood events for the City of San Angelo and Tom Green County planning area, 31 events have occurred since the 2020 Plan.

SIGNIFICANT EVENTS

Flash Flood on September 18, 2001

Scattered severe thunderstorms moved southeast across the Big Country, Concho Valley, and the Heartland, producing heavy rainfall and localized flooding. In the City of San Angelo, floodwaters trapped a man in his vehicle, resulting in minor injuries. He clung to a guide wire for approximately 20 minutes before police and fire personnel were able to wade through the high water and rescue him. Minor flood-related damage was also reported in San Angelo and near Lowake in Concho County.

Flash Flood on July 6, 2002

Thunderstorms produced four inches of rainfall in a short period of time. The intense rainfall caused several low-water crossings throughout the county to become flooded. A couple and their son were swept into Live Oak Creek while attempting to navigate a flooded roadway and remained trapped for approximately one and a half hours before rescue personnel were able to reach them. The couple sustained minor injuries and lost most of their belongings. In the City of San Angelo, widespread street flooding prompted numerous water rescues by emergency responders. This event resulted in $179,900 (2026 dollars) in property damages.

Flood on June 18-19, 2015

Flooding impacted Tom Green County and the City of San Angelo, flooding numerous homes, roads, and low-water crossings. On the 18th, Loop 306 at Knickerbocker Road and Jefferson Street was inundated, and U.S. Highway 87 was flooded for approximately one mile east of Wall. Over 4 inches of rain was measured in 90 minutes south-southwest of San Angelo. A woman was rescued from a vehicle swept away at the Southwest Boulevard low-water crossing. Flooding forced the closure of San Angelo Regional Airport, with flights diverted to Abilene.

On the 19th, rainfall totals of 4 to over 8 inches across the Concho River watershed caused flash flooding, swift-water rescues, and river flooding. The Concho River at Carlsbad reached major flood stage, cresting at 21 feet. Approximately 150 homes in Tom Green County, including San Angelo and parts of San Angelo State Park, were flooded. Flood events across these two days resulted in a total of $1,362,400 (2025 dollars) in property damages.

[3] Participating jurisdictions with no reported events show a "-" in table columns where damages, deaths or injuries would be otherwise reported.

PROBABILITY OF FUTURE EVENTS

Based on 141 recorded historical occurrences within a 29.5-year reporting period within the City of San Angelo and Tom Green County planning area, including San Angelo ISD, flooding is considered "Highly Likely," meaning an event is probable within the next year.

CLIMATE CHANGE CONSIDERATIONS

River flooding in Texas is projected to have no substantial change through 2036. This is in large part due to the construction of dams and reservoirs for flood management in the 20th century. There is a mixture of historical trends categorized by season, with no one clear trend to project. In addition, meteorological drivers of river flooding (increased rainfall intensity, decreased soil moisture) are projected to have competing influences. On balance, if an increasing trend is present in river flooding, it will be at the most extreme flood events or in the wettest parts of the state where there is so much rainfall that a decrease in soil moisture would have little mitigating impact.[4]

VULNERABILITY AND IMPACT

A property's vulnerability to a flood depends on its location and proximity to the floodplain. Structures that lie along banks of a waterway are the most vulnerable and are often repetitive loss structures. City of San Angelo and Tom Green County promote development outside of the floodplain. In terms of structure and infrastructure damages and service disruptions, the potential severity of impacts for flood events is considered limited, with the complete shutdown of critical facilities for 24-hours or less and less than 10 percent of property destroyed or with major damage. However, due to reported injuries, the impact of flooding in the City of San Angelo and Tom Green County planning area, including San Angelo ISD, is considered "Minor" with injuries and illnesses do not result in permanent disability, depending on the size and extent of the event.

Table 9-4 includes the comprehensive critical facilities identified in Appendix D that were considered the most important to the planning area that are subject to a range of impacts due to flood and are located in the regulatory floodplain. For a comprehensive list of identified critical facilities by participating jurisdiction, please see Appendix D.

Table 9-4. Critical Facilities in the Floodplain by Participating Jurisdiction

Critical Facility Type	Critical Facilities at Risk	Potential Impacts
Emergency Response Departments (EOC, Fire, Police, EMS), Hospitals	Tom Green County: 1 Fire Facility City of San Angelo: 1 Health Service Facility	• Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications. • Emergency vehicles can be damaged by rising flood waters. • Flood-related rescues may be necessary at swift and low water crossings or in flooded neighborhoods where roads have become impassable, placing first responders in harm's way.

[4] Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900-2036, Texas A&M University Office of the Texas State Climatologist, 2021 update.

Critical Facility Type	Critical Facilities at Risk	Potential Impacts
		• Evacuations may be required for entire neighborhoods because of rising floodwaters, further taxing limited response capabilities and increasing sheltering needs for displaced residents. • Power outages could disrupt communications, delaying emergency response times. • Critical staff may be injured or otherwise unable to report for duty, limiting response capabilities. • Washed out roads and bridges can impede emergency response vehicle access to areas. • Increased number of structure fires due to gas line ruptures and downed power lines, further straining the capacity and resources of emergency personnel. • First responders are exposed to downed power lines, contaminated and unusual debris, hazardous materials, and generally unsafe conditions.
Airport, Academic Institutions, Community Residential Facilities, Day Care Facilities, Evacuation Centers & Shelters, Governmental Facilities	City of San Angelo: 2 School Facilities	• Structures can be damaged by rising flood waters. • Power outages could disrupt critical care. • Backup power sources could be damaged, inundated or otherwise inoperable. • Critical staff may be impacted and unable to report for duty, limiting response capabilities. • Evacuations may be necessary due to extended power outages, gas line ruptures, or inundation of facilities. • Additional emergency responders and critical aid workers may not be able to reach the area for days. • Power outages and infrastructure damage may prevent larger airports from acting as temporary command centers for logistics, communications, and emergency operations. • Temporary break in operations may significantly inhibit post event evacuations. • Damaged or destroyed highway infrastructure may substantially increase the need for airport operations.
Commercial Suppliers (food, gas, etc.)	N/A	• Facilities or infrastructure may be damaged, destroyed or otherwise inaccessible. • Essential supplies like medicines, water, food, and equipment deliveries may be significantly delayed.
Utility Services and Infrastructure (electric, water, wastewater, communications)	City of San Angelo: 4 Dams, 2 Energy Utility, 27 Sewage and Water Facilities	• Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications. • Emergency service vehicles can be damaged by rising flood waters. • Flood-related rescues may be necessary at swift and low water crossings or in flooded neighborhoods where roads have become impassable, placing emergency service workers in harm's way.

Critical Facility Type	Critical Facilities at Risk	Potential Impacts
		• Increased number of structure fires due to gas line ruptures and downed power lines, further straining the capacity and resources of emergency personnel. • Service responders are exposed to downed power lines, contaminated and unusual debris, hazardous materials, and generally unsafe conditions.

Historic loss estimates due to flood are presented in Table 9-5 below. Considering 141 flood events over a 29.5-year period, frequency is approximately four to five events every year.

Table 9-5. Average Annualized Losses by Jurisdiction, January 1996 – June 2025

Jurisdiction	Total Property & Crop Loss	Average Annual Loss Estimates
Tom Green County	$2,092,300	$70,900
City of San Angelo	$908,600	$30,800
San Angelo ISD	$0	-
Totals	**$3,000,900**	**$101,700**

While all citizens are at risk of the impacts of a flood, forced relocation and disaster recovery disproportionately impacts low-income residents who lack the financial means to travel, afford a long-term stay away from home, and to rebuild or repair their homes. In addition, due to factors like limited mobility, communication difficulties, medical needs, reliance on support services, transportation challenges, housing accessibility issues, and possible shortages in emergency shelter accommodations, the elderly, children, and people with disabilities are also disproportionately affected by flooding events. People who speak a language other than English may face increased vulnerability due to language barriers that limit their access to important information such as weather-related warnings and instructions regarding safety measures.

The population over 65 in the City of San Angelo and Tom Green County planning area is estimated at 17 percent of the total population and children under the age of 5 are estimated at 6 percent. The population with a disability is estimated at 15 percent of the total population. An estimated 11 percent of the planning area population live below the poverty level and 5 percent of the populations speak English 'less than very well'.

Table 9-6. Populations at Greater Risk by Jurisdiction[5]

Jurisdiction	Population				
	65 and Older	Under 5	With a Disability	Below Poverty Level	Limited English Speaking
City of San Angelo	16,795	5,905	14,943	10,964	5,245

[5] U.S. Census Bureau Five-Year estimates

Jurisdiction	Population				
	65 and Older	Under 5	With a Disability	Below Poverty Level	Limited English Speaking
Tom Green County	20,295	7,368	17,826	13,273	6,329

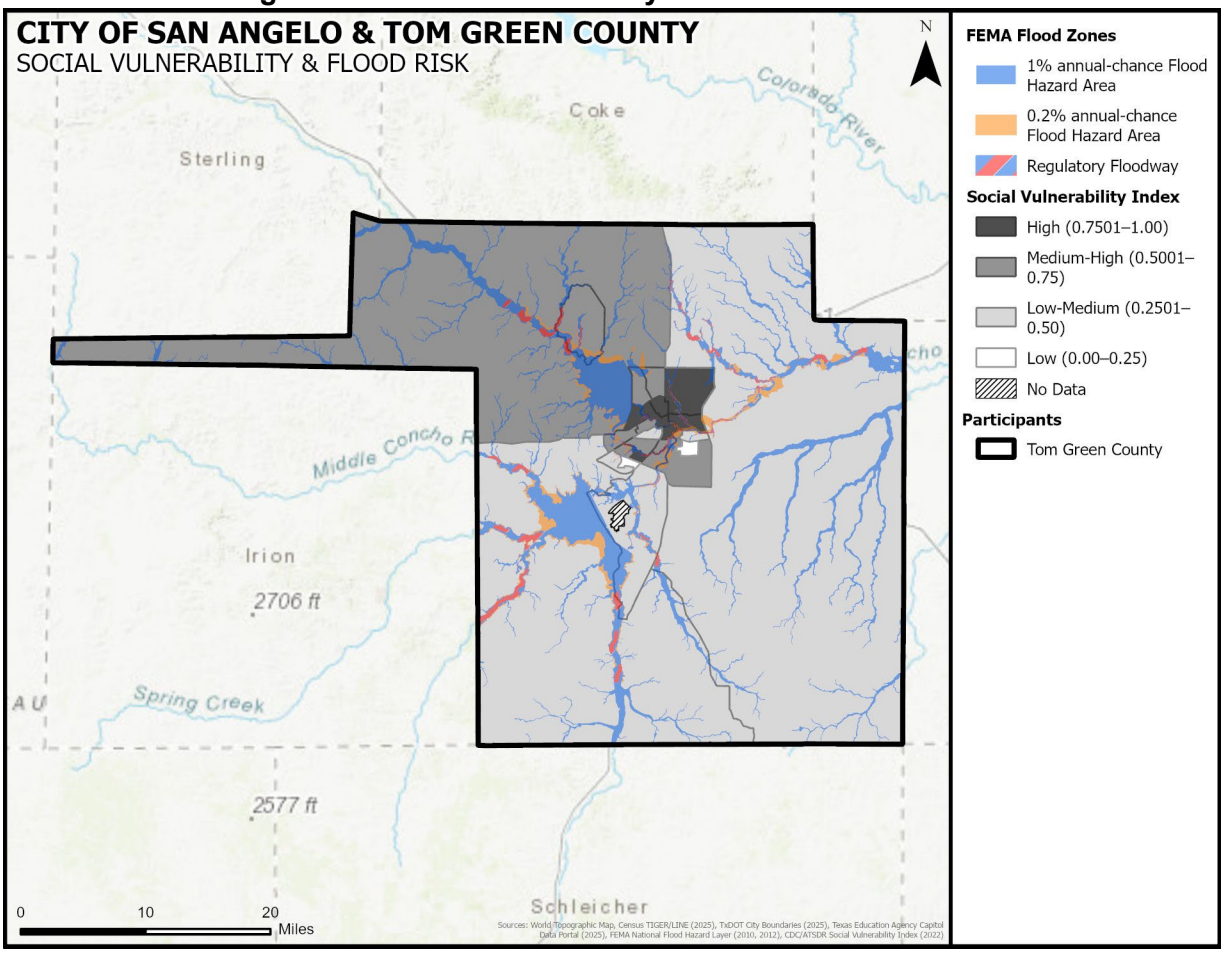
The ISD also has several employees that work outdoors such as maintenance, security, and others that may be subject to severe weather conditions, as well as children under the age of 5 that may be vulnerable to impacts (Table 9-8).

Table 9-7. Populations at Greater Risk for Special Districts

Independent School District	Population	
	Under 5	Works Outdoors
San Angelo ISD	313	126

The Center for Disease Control (CDC) created a Social Vulnerability Index (SVI) which includes a database and mapping application that identifies and quantifies communities experiencing social vulnerability. The current CDC SVI uses 16 U.S. census variables from the 5-year American Community Survey (ACS) to identify communities that may need support before, during, or after disasters. All 16 variables fall under four broad categories including socioeconomic status (population in poverty, unemployment, etc.), household characteristics (age, disability status, etc.), racial and ethnic minority status, and housing type and transportation (mobile homes, no vehicles, etc.). Populations experiencing social vulnerability may be adversely impacted by natural hazards, disasters, and other community-level stressors. Figure 9-7 identifies areas of social vulnerability using the CDC's SVI and where these areas overlap with the planning area's flood hazard areas.

Figure 9-7. Social Vulnerability and Flood Hazard Areas



ASSESSMENT OF IMPACTS

Flooding is the deadliest natural disaster that occurs in the U.S. each year, and it poses a constant and significant threat to the health and safety of the people in the City of San Angelo and Tom Green County planning area. Impacts to the planning area can include:

- Flood-related rescues may be necessary at swift water and low water crossings or in flooded neighborhoods where roads have become impassable, placing first responders in harm's way.
- Evacuations may be required for entire neighborhoods because of rising floodwaters, further taxing limited response capabilities and increasing sheltering needs for displaced residents.
- Health risks and threats to residents are elevated after the flood waters have receded due to contaminated flood waters (untreated sewage and hazardous chemicals) and mold growth typical in flooded buildings and homes.
- Significant flood events often result in widespread power outages, increasing the risk to more vulnerable portions of the population who rely on power for health and/or life safety.
- Extended power outages can result in an increase in structure fires and/or carbon monoxide poisoning, as individuals attempt to cook or heat their home with alternate, unsafe cooking or heating devices, such as grills.

- Floods can destroy or make residential structures uninhabitable, requiring shelter or relocation of residents in the aftermath of the event.
- First responders are exposed to downed power lines, contaminated and potentially unstable debris, hazardous materials, and generally unsafe conditions, elevating the risk of injury to first responders and potentially diminishing emergency response capabilities.
- Emergency operations and services may be significantly impacted due to damaged facilities.
- Significant flooding can result in the inability of emergency response vehicles to access areas of the community.
- Critical staff may suffer personal losses or otherwise be impacted by a flood event and be unable to report for duty, limiting response capabilities.
- City or County departments may be flooded, delaying response and recovery efforts for the entire community.
- Private sector entities that the planning area and its residents rely on, such as utility providers, financial institutions, and medical care providers, may not be fully operational and may require assistance from neighboring communities until full services can be restored.
- Damage to infrastructure may slow economic recovery since repairs may be extensive and lengthy.
- Some businesses not directly damaged by the flood may be negatively impacted while utilities are being restored or water recedes, further slowing economic recovery.
- When the community is affected by significant property damage it is anticipated that funding would be required for infrastructure repair and restoration, temporary services and facilities, overtime pay for responders, as well as normal day-to-day operating expenses.
- Displaced residents may not be able to immediately return to work, further slowing economic recovery.
- Residential structures substantially damaged by a flood may not be rebuilt for years and uninsured or underinsured residential structures may never be rebuilt, reducing the tax base for the community.
- Large floods may result in a dramatic population fluctuation, as people are unable to return to their homes or jobs and must seek shelter and/or work outside of the affected area.
- Businesses that are uninsured or underinsured may have difficulty reopening, which results in a net loss of jobs for the community and a potential increase in the unemployment rate.
- Recreation activities may be unavailable, and tourism can be unappealing for years following a large flood event, devastating directly related local businesses and negatively impacting economic recovery.
- Flooding may cause significant disruptions of clean water and sewer services, elevating health risks and delaying recovery efforts.
- The psychosocial effects on flood victims and their families can traumatize them for long periods of time, creating long term increases in medical treatment and services.
- Extensive or repetitive flooding can lead to decreases in property value for the affected community.

- Flood poses a potential catastrophic risk to annual and perennial crop production and overall crop quality, leading to higher food costs.
- Flood related declines in production may lead to an increase in unemployment.
- Large floods may result in loss of livestock, increased livestock mortality due to stress and waterborne disease, and increased cost for feed.

The overall extent of damage caused by floods is dependent on the extent, depth, and duration of flooding, in addition to the velocities of flows in the flooded areas. The level of preparedness and pre-event planning done by the community, local businesses, and citizens will contribute to the overall economic and financial conditions in the aftermath of a flood event.

NATIONAL FLOOD INSURANCE PROGRAM (NFIP) PARTICIPATION

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. City of San Angelo and Tom Green County participate in the NFIP and are in good standing. It is noted that special districts, like San Angelo ISD, are not eligible participants in the NFIP.

As an additional indicator of floodplain management responsibility, communities may choose to participate in FEMA's Community Rating System (CRS). This is an incentive-based program that allows communities to undertake flood mitigation activities that go beyond NFIP requirements. Currently, neither of the participating communities participate in the CRS. The City of San Angelo and Tom Green County may evaluate their capacity for CRS participation in the next planning cycle.

City of San Angelo and Tom Green County currently have in place minimum NFIP standards for new construction and substantial improvements of structures. Both jurisdictions are considering adopting additional higher regulatory NFIP standards to limit floodplain development.

The flood hazard areas throughout City of San Angelo and Tom Green County are subject to periodic inundation, which may adversely affect public safety, resulting in loss of life and property, health and safety hazards, disruption of commerce and governmental services, and extraordinary public expenditures for flood protection and relief. Flood losses are created by the cumulative effect of obstructions in floodplains which cause an increase in flood heights and velocities. In addition, occupancy in flood hazard areas creates an increase in vulnerabilities to flood hazards as they typically are inadequately elevated, flood-proofed, or otherwise protected from flood damage. Mitigation actions are included to address flood maintenance issues as well, including routinely clearing debris from roadside ditches and bridges, and expanding drainage culverts and storm water structures to convey flood water more adequately.

It is the purpose of City of San Angelo and Tom Green County to continue to promote public health, safety, and general welfare by minimizing public and private losses due to flood conditions in specific areas. Each of the NFIP participating jurisdictions in the Plan Update are guided by their local Flood Damage Prevention Ordinance. These communities will continue to comply with NFIP requirements through their local permitting, inspection, and record-keeping requirements for new and substantially developed construction. Further, the NFIP program promotes sound development in floodplain areas and includes provisions designed to:

- Protect human life and health;
- Minimize expenditure of public money for costly flood control projects;
- Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
- Minimize prolonged business interruptions;
- Minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets, and bridges located in floodplains;
- Help maintain a stable tax base by providing for the sound use and development of flood-prone areas in such a manner as to minimize future flood blight areas; and
- Ensure that potential buyers are notified that property is in a flood area.

In order to accomplish these tasks, City of San Angelo and Tom Green County seek to observe the following guidelines in order to achieve flood mitigation:

- Restrict or prohibit uses that are dangerous to health, safety, or property in times of flood, such as filling or dumping, that may cause excessive increases in flood heights or velocities;
- Require that uses vulnerable to floods, including facilities, which serve such uses, be protected against flood damage at the time of initial construction, as a method of reducing flood losses;
- Control the alteration of natural floodplains, stream channels, and natural protective barriers, which are involved in the accommodation of floodwaters;
- Control filling, grading, dredging, and other development, which may increase flood damage; and
- Prevent or regulate the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards to other lands.

NFIP COMPLIANCE AND MAINTENANCE

All NFIP participating jurisdictions have developed mitigation actions that relate to either NFIP maintenance or compliance. Compliance and maintenance actions can be found in Section 18.

Flooding was identified as a significant risk hazard during hazard ranking activities at the Risk Assessment Workshop by the majority of the planning team. As such, many of the mitigation actions were developed with flood mitigation in mind. A majority of these flood actions address compliance with the NFIP and implementing flood awareness programs. All participating jurisdictions recognize the need and are working towards adopting higher NFIP regulatory standards to further minimize flood risk in their community. In addition, each jurisdiction focuses on public flood awareness activities. This includes promoting the availability of flood insurance by placing promotional material in public libraries or public meeting places in participating jurisdictions.

Each NFIP participating jurisdiction in this planning process has a designated floodplain administrator. All floodplain administrators in the planning area will continue to maintain compliance with the NFIP, including continued floodplain administration, zoning ordinances, and development regulation. The floodplain ordinance adopted by each participating jurisdiction outlines the minimum requirements for development in Special Flood Hazard Areas.

All jurisdictions have a permitting process in place and each local floodplain administrator is responsible for coordinating inspections of damaged homes located in the floodplain. Following a flood event, local officials inspect damaged homes to make a substantial damage determination. Substantially damaged homes must be brought into compliance. Similarly, proposed improvements to homes located in the floodplain are reviewed by local building officials to determine if a substantial improvement is proposed. The floodplain administrator oversees permitted repairs and improvements to ensure compliance during the rebuilding or improvement process.

REPETITIVE LOSS

The Flood Mitigation Assistance (FMA) Grant Program under FEMA provides federal funding to assist states and communities in implementing mitigation measures to reduce or eliminate the long-term risk of flood damage to buildings that are insured under the National Flood Insurance Program. The Texas Water Development Board (TWDB) administers the FMA grant program for the State of Texas. One of the goals of the FMA program is to reduce the burden of repetitive loss and severe repetitive loss properties on the NFIP through mitigation activities that significantly reduce or eliminate the threat of future flood damages.

Repetitive Loss properties are defined as structures that are:

- Any insurable building for which 2 or more claims of more than $1,000 each, paid by the National Flood Insurance Program (NFIP) within any 9-year period, since 1978;
- May or may not be currently insured under the NFIP.

Severe Repetitive Loss properties are defined as structures that are:

- Covered under the NFIP and have at least 4 flood related damage claim payments (building and contents) over $5,000.00 each, and the cumulative amount of such claims payments exceed $20,000; or
- At least 2 separate claim payments (building payments only) have been made, with the cumulative amount of the building portion of such claims exceeding the market value of the building.

In either scenario, at least 2 of the referenced claims must have occurred within any 9-year period and must be greater than 10 days apart. Table 9-8 shows repetitive loss and severe repetitive loss properties for City of San Angelo and Tom Green County.

Table 9-8. Repetitive Loss and Severe Repetitive Loss Properties

Jurisdiction	Number of Structures	Number of Losses	Structure Type
Tom Green County	1	2	Single Family
City of San Angelo	7	16	Single Family
	1	2	2 to 4 Unit Residential

Section 10
Hail

SECTION 10: HAIL

HAZARD DESCRIPTION

Hailstorm events are a potentially damaging outgrowth of severe thunderstorms. During 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 the 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 typically greater than 0.75 inches in diameter. 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 by-product of heating on the Earth's surface. Higher temperature gradients above Earth's surface result in increased suspension time and hailstone size.

According to the National Insurance Crime Bureau (NICB), between 2018 and 2020 the State of Texas had the greatest number of hail loss claims in the U.S. with 605,866 loss claims (23 percent of total hail claims in the U.S.) due to hail events. In this two-year period Texas experienced a total of 584 severe hail days. Five of the top ten cities for hail loss claims between 2017 and 2019 were in Texas, three of which were in the Dallas-Fort Worth metropolitan area.[1]

In 2021, 6.8 million properties in the U.S. experienced one or more damaging hail events, resulting in a total of $16.5 billion in insured losses. Texas had the highest number of properties affected by hail with over 1.5 million properties or 17 percent of total properties in the state affected; an increase of 80,000 properties affected between 2020 and 2021. Texas hailstorms accounted for almost a quarter of total U.S. properties affected by hail in 2021.

LOCATION

Hailstorms are an extension of severe thunderstorms that could potentially cause severe damage. Hailstorms are not confined to any specific geographic location and can vary greatly in size, location, intensity, and duration. Therefore, the entire City of San Angelo and Tom Green County

[1] Manasek, Thomas, "2018-2020 United States Hail Loss Claims and Questionable Claims" (National Insurance Crime Bureau, March 15, 2021). http://www.rmiia.org/downloads/PUBLIC%202018%20-%202020%20Hail%20foreCAST-%20TJM.pdf

planning area is equally at risk to the hazard of hail. Refer to Figure 10-1 for the location of past hail events in the planning area.

EXTENT

The National Weather Service (NWS) classifies a storm as "severe" if there is hail three-quarters of an inch in diameter (approximately the size of a penny) or greater, based on radar intensity or as seen by observers. The intensity category of a hailstorm depends on hail size and the potential damage it could cause, as depicted in the National Centers for Environmental Information (NCEI) Intensity Scale in Table 10-1.

Table 10-1. Hail Intensity and Magnitude[2]

Size Code	Intensity Category	Size (diameter inches)	Descriptive Term	Typical Damage
H0	Hard Hail	Up to 0.33	Pea	No damage
H1	Potentially Damaging	0.33 – 0.60	Marble	Slight damage to plants and crops
H2	Potentially Damaging	0.60 – 0.80	Dime	Significant damage to plants and crops
H3	Severe	0.80 – 1.20	Nickel	Severe damage to plants and crops
H4	Severe	1.2 – 1.6	Quarter	Widespread glass and auto damage
H5	Destructive	1.6 – 2.0	Half Dollar	Widespread destruction of glass, roofs, and risk of injuries
H6	Destructive	2.0 – 2.4	Ping Pong Ball	Aircraft bodywork dented and brick walls pitted
H7	Very Destructive	2.4 – 3.0	Golf Ball	Severe roof damage and risk of serious injuries
H8	Very Destructive	3.0 – 3.5	Hen Egg	Severe damage to all structures
H9	Super Hailstorms	3.5 – 4.0	Tennis Ball	Extensive structural damage, could cause fatal injuries
H10	Super Hailstorms	4.0 +	Baseball	Extensive structural damage, could cause fatal injuries

The intensity scale in Table 10-1 ranges from H0 to H10, with increments of intensity or damage potential in relation to hail size (distribution and maximum), texture, fall speed, speed of storm translation, and strength of the accompanying wind. Based on the best available data regarding the previous occurrences for the area, the City of San Angelo and Tom Green County planning area may experience hailstorms ranging from an H0 (pea size) to an H10 (baseball size). The largest size hail to be reported since 1996 was 4.25 inches in diameter, or an H10, which is considered a super hailstorm that can cause extensive structural damage and potentially fatal

[2] NCEI Intensity Scale, based on the TORRO Hailstorm Intensity Scale.

injuries. An event of this magnitude occurred in the planning area on June 3, 2003. The event of record for the planning area measured 4.5 inches in diameter and occurred in May of 1995. This is likely the greatest extent the planning area can anticipate in the future, based on historical events.

HISTORICAL OCCURRENCES

Historical evidence shown in Figure 10-1 demonstrates that the planning area is vulnerable to hail events overall. Historical hail events in the City of San Angelo and Tom Green County planning area resulting in damages, injuries, or fatalities are shown in Table 10-2. A total of 508 reported historical hail events impacted the planning area between January 1996 and June 2025; these events were reported to NCEI and NOAA databases and may not represent all hail events to have occurred during the past 29.5 years. Only those events for the City of San Angelo and Tom Green County planning area with latitude and longitude available were plotted (Figure 10-1).

Historical hail event data for San Angelo ISD are provided within the Tom Green County or City of San Angelo events. In the NCEI database, special districts do not have events reported separate and apart from the reported county and city events. San Angelo ISD reported over $19 million in damages to their facilities from a May 2020 hail event which were not captured in the NCEI database; these damages have been incorporated into Table 10-2 below to create the most comprehensive dataset possible.

Figure 10-1. Spatial Historical Hail Events, January 1996 – June 2025

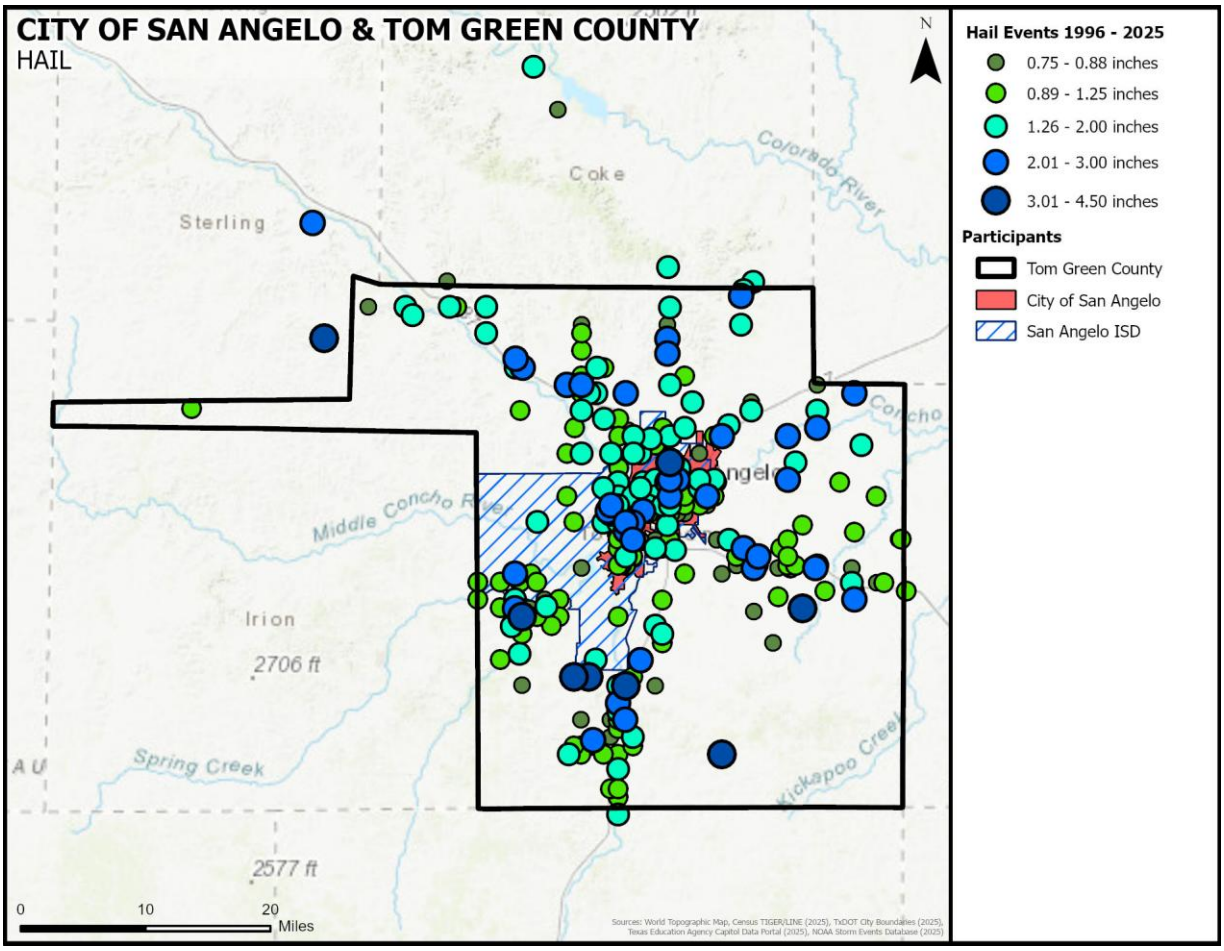


Table 10-2. Damaging Historical Hail Events, January 1996 – June 2025[3]

Jurisdiction	Date	Magnitude (inches)	Deaths	Injuries	Property Damage	Crop Damage
Tom Green County	6/2/1996	0.88	0	0	$206,800	$206,800
City of San Angelo	6/16/1997	1	0	0	$50,600	$50,600
City of San Angelo	3/19/2002	1.75	0	0	$28,991,200	$0
City of San Angelo	5/4/2002	1.75	0	0	$901,000	$0
City of San Angelo	5/27/2002	1.75	0	0	$90,100	$0
City of San Angelo	5/27/2002	1.75	0	0	$90,100	$0
City of San Angelo	6/1/2003	2.5	0	0	$17,636,200	$0

[3] Magnitude is provided where available. Monetary damages have been inflated to their 2026 value. No reports of injuries or fatalities were recorded in the NCEI database between 1996 and 2025.

Jurisdiction	Date	Magnitude (inches)	Deaths	Injuries	Property Damage	Crop Damage
City of San Angelo	6/1/2003	1.75	0	0	$7,054,500	$0
City of San Angelo	6/3/2003	4.25	0	0	$1,410,900	$0
City of San Angelo	5/31/2005	2.75	0	0	$50,000	$0
City of San Angelo	5/31/2005	4	0	0	$50,000	$0
Tom Green County	5/31/2005	2.75	0	0	$33,400	$0
City of San Angelo	5/31/2005	2.75	0	0	$16,700	$0
City of San Angelo	5/31/2005	1.5	0	0	$13,400	$0
City of San Angelo	4/28/2006	1.75	0	0	$24,200	$0
Tom Green County	5/6/2007	1.75	0	0	$14,100	$0
Tom Green County	5/29/2007	1.75	0	0	$9,400	$0
Tom Green County	6/3/2007	1	0	0	$7,800	$0
Tom Green County	6/15/2007	1.75	0	0	$12,500	$0
Tom Green County	6/15/2007	1.75	0	0	$10,900	$0
San Angelo ISD	5/21/2020	-	0	0	$19,002,000	$0
Totals		**(Max Extent)**	**0**	**0**	**$75,675,800**	**$257,400**

Table 10-3. Historical Hail Events Summary, January 1996 – June 2025

Jurisdiction	Number of Events	Max Magnitude (inches)	Deaths	Injuries	Property Damage	Crop Damage
Tom Green County	231	4	0	0	$294,900	$206,800
City of San Angelo	276	4.25	0	0	$56,378,900	$50,600
San Angelo ISD	1	-	0	0	$19,002,000	$0
Totals	**508**	**(Max Extent)**	**0**	**0**	**$75,933,200**	

Based on the list of historical hail events for City of San Angelo and Tom Green County planning area, 159 events were reported to the NCEI since the 2020 Plan.

SIGNIFICANT EVENTS

May 5, 1993

A severe thunderstorm moved over the City of San Angelo, pounding the city with baseball-size hail. There were numerous reports of damage to vehicles, roofs, windows, and aircraft at Mathis Field. In total, more than 800 vehicles and nearly 1,000 roofs were damaged, mainly in the southwestern part of the city. Total damage was estimated at $112,335,700 (2026 dollars).

March 19, 2002
In the early afternoon, large amounts of golf ball size hail fell on the southern half of the City of San Angelo, creating drifts several feet deep. The large hail damaged approximately 3,500 homes, 4,000 automobiles, and stripped leaves from numerous trees. Total damages were estimated at $28,991,200 (2026 dollars).

June 1, 2003
Large hail propelled by 70 mph winds caused significant damage within Tom Green County in the community of Grape Creek, including considerable tree, roof, and automobile damages. Almost every home in Grape Creek required roof repairs after the storm. The severe hailstorm then moved over the City of San Angelo, where golf ball size hail continued to cause widespread damage to cars and the roofs of businesses. In total, this hail damage was estimated at $24,690,700 (2026 dollars).

PROBABILITY OF FUTURE EVENTS

Based on available records of historic events, 508 events in a 29.5-year reporting period for the City of San Angelo and Tom Green County planning area provides an average annual occurrence of approximately 17 events per year. This frequency supports a “Highly Likely” probability of future events for the planning area, with an event probable within the next year.

CLIMATE CHANGE CONSIDERATIONS

Although the impact of climate change on the frequency and severity of hail events is uncertain, some climate studies attempt to give insight into the future conditions of hailstorms. As ocean temperatures rise due to climate change, more moisture is evaporating into the atmosphere. The warm and moist air masses that fuel severe weather may become more unstable on average, which could favor the increased development of thunderstorms and hail. However, it is also suggested that in a warming climate, the average melting level will rise in thunderstorms, meaning small hailstones will have more of a chance to melt as they fall to the ground. Therefore, hail may become less frequent, but large hail can be expected when it does occur, leading to the possibility of increased damages.[4]

VULNERABILITY AND IMPACT

Hailstorms cause an average of $10-15 billion in damages to homes, vehicles, and crops in the U.S. annually. These costs have surged significantly in recent years due to increased urban density in high-risk areas and larger, more frequent hailstones. Crops are typically the most vulnerable to the impacts of hail. Even relatively small hail can shred plants to ribbons in a matter of minutes. Vehicles, roofs of buildings and homes, and landscaping are most damaged by hail. Utility systems on roofs of buildings and critical facilities would be vulnerable and could be damaged.

Hail poses a significant threat to people, as they could be struck by hail and falling trees and branches. Outdoor activities and events may elevate the risk to residents and visitors when a hailstorm strikes with little warning. Portable buildings typically utilized by schools and commercial

[4] Yale Climate Connections, Hailstorms and Climate Change, March 17, 2022.

sites such as construction areas would be more vulnerable to hail events than the typical site-built structures.

The City of San Angelo and Tom Green County planning area features mobile or manufactured homes throughout the planning area. These structures are typically more vulnerable to hail events than typical site-built structures. The U.S. Census data indicates a total of 2,670 (5 percent of total housing stock) manufactured homes located in the planning area. In addition, 50 percent (25,944 structures) of the housing structures in the City of San Angelo and Tom Green County planning area were built before 1980. These structures would typically be built to lower or less stringent construction standards than newer construction and may be more susceptible to damage during hail events.

Table 10-4. Structures at Greater Risk by Participating Jurisdiction

Jurisdiction	Structures	
	SFR Built Before 1980	Manufactured Homes
Tom Green County	25,944	2,670
City of San Angelo	23,187	1,154
San Angelo ISD	100	19

While all citizens are at risk of the impacts of hail, forced relocation and disaster recovery disproportionately impacts low-income residents who lack the financial means to travel, afford a long-term stay away from home, and to repair their homes. An estimated 11 percent of the planning area population live below the poverty level (Table 10-5). While warning times for this type of hazard events should be substantial enough for these individuals to seek shelter, the elderly, children, and people with a disability may have trouble taking shelter due to mobility issues or a lack of awareness, making them more susceptible to injury or harm. In addition, people who speak a language other than English may face increased vulnerability due to language barriers that limit their access to important information such as weather-related warnings and instructions regarding safety measures.

Table 10-5. Populations at Greater Risk by Jurisdiction[5]

Jurisdiction	Population				
	65 and Older	Under 5	With a Disability	Below Poverty Level	Limited English Speaing
Tom Green County	20,295	7,368	17,826	13,273	6,329
City of San Angelo	16,795	5,905	14,943	10,964	5,245

[5] U.S. Census Bureau 2024 ACS data

San Angelo ISD also has vulnerable populations based on work location, as those working outdoors would be subject to greater hail risk if working outdoors when a hail event strikes (Table 10-6).

Table 10-6. Populations at Greater Risk by Special District

Independent School District	Population
	Works Outdoors
San Angelo ISD	126

The City of San Angelo and Tom Green County Planning Team identified the following critical facilities (Table 10-7) as assets that are considered the most important to the planning area and are susceptible to a range of impacts caused by hail events. For a comprehensive list by participating jurisdiction, please see Appendix D.

Table 10-7. Critical Facilities Vulnerable to Hail

Critical Facility Type	Potential Impacts
Emergency Response Services (EOC, Fire, Police, EMS), Hospitals and Medical Centers	• Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications. • Emergency vehicles can be damaged by hailstones. • Power outages could disrupt communications, delaying emergency response times. • Accumulated hail on the streets may impede emergency response vehicle access to areas.
Airport, Academic Institutions, Animal Shelter, Evacuation Centers & Shelters, Governmental Facilities, Residential/ Assisted Living Facilities	• Structures can be damaged by hailstones. • Power outages could disrupt critical care. • Backup power sources could be damaged. • Evacuations may be necessary due to extended power outages, gas line ruptures, or structural damage to facilities. • Power outages and infrastructure damage may prevent larger airports from acting as temporary command centers for logistics, communications, and emergency operations. • Temporary break in operations may significantly inhibit post event evacuations. • Damaged or destroyed highway infrastructure may substantially increase the need for airport operations.
Commercial Supplier (Food, fuel, etc.)	• Facilities or infrastructure may be damaged, destroyed or otherwise inaccessible. • Essential supplies like medicines, water, food, and equipment deliveries may be significantly delayed.

Critical Facility Type	Potential Impacts
Utility Services and Infrastructure (electric, water, wastewater, communications)	• Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications. • Power outages could disrupt communications, delaying emergency response times. • Accumulated hail on the streets may impede service response vehicle access to areas.

Hail has been known to cause injury to humans and occasionally has been fatal. Historically, no injuries have been reported due to hail within the City of San Angelo or Tom Green County since 1996. Overall, the total loss estimate of property and crops in the planning area is $75,933,200 (2026 dollars) with an average annualized loss of $2,574,000. Based on historic loss and damages, the impact of hail on the City of San Angelo and Tom Green County planning area, including San Angelo ISD, is considered "Limited" severity of impact, meaning minor quality of life lost, critical facilities and services shut down for 24 hours or less, and less than 10 percent of property destroyed or with major damage.

Table 10-7. Estimated Annualized Losses by Jurisdiction

Jurisdiction	Total Property & Crop Loss	Average Annual Loss Estimates
Tom Green County	$501,700	$17,000
City of San Angelo	$56,429,500	$1,912,900
San Angelo ISD	$19,002,000	$644,100
Totals	**$75,933,200**	**$2,574,000**

ASSESSMENT OF IMPACTS

Hail events have the potential to pose a significant risk to people and can create dangerous situations. Hail conditions can be frequently associated with a variety of impacts, including:

- Hail may create hazardous road conditions during and immediately following an event, potentially delaying critical staff from reporting for duty as well as delaying first responders from providing for or preserving public health and safety.
- Individuals and first responders who are exposed to the storm may be struck by hail, falling branches, or downed trees resulting in injuries or possible fatalities.
- Large hail events will likely cause extensive roof damage to residential structures along with siding damage and broken windows, creating a spike in insurance claims and a rise in premiums, and potentially result in physical harm to occupants.
- Automobile damage may be extensive depending on the size of the hail and length of the storm.
- Hail events can result in power outages over widespread areas increasing the risk to more vulnerable portions of the population who rely on power for health and/or life safety.

- Extended power outage can result in an increase in structure fires and/or carbon monoxide poisoning, as individuals attempt to cook or heat their home with alternate, unsafe cooking or heating devices, such as grills.
- First responders are exposed to downed power lines, damaged structures, hazardous spills, and debris that often accompany hail events, elevating the risk of injury to first responders and potentially diminishing emergency response capabilities.
- Some businesses not directly damaged by the hail event may be negatively impacted while roads are cleared and utilities are being restored, further slowing economic recovery.
- Businesses that are more reliant on utility infrastructure than others may suffer greater damage without a backup power source.
- Depending on the severity and scale of damage caused by large hail events, damage to power transmission and distribution infrastructure can require days or weeks to repair.
- A significant hail event could significantly damage agricultural crops, resulting in extensive economic losses for the community and surrounding area.
- Hail events may injure or kill livestock and wildlife or destroy wildlife habitat.
- A large hail event could impact the accessibility of recreational areas and parks due to extended power outages or debris clogged access roads.
- Historical sites and properties are placed at a higher risk of impact due to materials used and the inability to change properties due to their historic status. There are 70 historical sites listed on the National Archives Catalog in Tom Green County.

The economic and financial impacts of hail will depend entirely on the scale of the event, what is damaged, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning conducted by the community, local businesses, and citizens will contribute to the overall economic and financial conditions in the aftermath of any hail event.

Section 11
Lightning

SECTION 11: LIGHTNING

HAZARD DESCRIPTION

Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a "bolt" when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes thunder, which often accompanies lightning strikes. While most often affiliated with severe thunderstorms, lightning often strikes outside of heavy rain and might occur as far as 10 miles away from any rainfall.

According to the National Weather Service (NWS), the 10-year (2012–2021) average for fatalities is 23 people with an average of 300 injuries in the United States each year by lightning. Lightning can occur as cloud to ground flashes or as intra-cloud lightning flashes. Direct lightning strikes can cause significant damage to buildings, critical facilities, infrastructure, and communication equipment affecting emergency response. Lightning is also responsible for igniting wildfires that can result in widespread damages to property before firefighters have the ability to contain and suppress the resultant fire.

LOCATION

The City of San Angelo and Tom Green County planning area is in a region of the country that is moderately susceptible to lightning strikes. With no geographical boundaries, the entire planning area is uniformly exposed to the threat of lightning.

EXTENT

According to the 2025 Annual Lightning Report by Vaisala, the State of Texas ranks sixth in the U.S. for lightning strike density with an average of 176.4 flashes per square mile.[1] Vaisala's U.S. National Lightning Detection Network lightning flash density map shows an average of 116 lightning events per square mile per year for Tom Green County, which includes the City of San Angelo planning area. This rate equates to approximately 268,500 flashes per year for the entire planning area, or seven to eight flashes per 15-minute interval during storm events.

[1] Source: https://www.xweather.com/annual-lightning-report

HISTORICAL OCCURRENCES

The National Centers for Environmental Information (NCEI) database indicates 4 recorded lightning events for the City of San Angelo and Tom Green County planning area. It is highly likely multiple lightning occurrences have gone unreported before and during the recording period. The NCEI is a national data source organized under the National Oceanic and Atmospheric Administration and considered a reliable resource for hazards. However, the flash density for the planning area along with input from local team members indicates regular lightning occurrences that simply have not been reported.

Historical lightning event data for San Angelo ISD is provided within the City of San Angelo or Tom Green County events. In the NCEI database, these entities do not have events reported separate and apart from the reported county and jurisdiction events. The San Angelo ISD did not report any additional lightning events or damages that were not captured in the NCEI data.

Table 11-1. Historical Lightning Events, January 1996 – June 2025[2]

Jurisdiction	Date	Deaths	Injuries	Property Damage	Crop Damage
City of San Angelo	6/3/2003	0	0	$352,800	$0
City of San Angelo	8/26/2006	0	0	$0	$0
Tom Green County	3/30/2007	0	0	$12,700	$0
City of San Angelo	8/10/2023	0	0	$3,200	$0
Totals		**0**	**0**	**$368,700**	

Table 11-2. Historical Lightning Events Summary, January 1996 – June 2025[3]

Jurisdiction	Number of Events	Deaths	Injuries	Property Damage	Crop Damage
Tom Green County	1	0	0	$12,700	$0
City of San Angelo	3	0	0	$356,000	$0
San Angelo ISD	0	-	-	-	-
Totals	**4**	**0**	**0**	**$368,700**	**$0**

Based on the list of historical lightning events for the City of San Angelo and Tom Green County planning area, there has been one reported event since the 2020 Plan.

SIGNIFICANT EVENTS

June 3, 2003 – City of San Angelo

Severe thunderstorms rapidly developed around the Concho Valley throughout the evening and continued to spread southeast. The most severe thunderstorm of the evening was the one that formed directly over the City of San Angelo and continued to linger over the area for more than

[2] Values are in 2026 dollars. Database was searched for events between January 1996 and June 2025.

[3] Participating jurisdictions with no reported events show a "-" in table columns where damages, deaths or injuries would be otherwise reported.

an hour. As the storm lingered, it produced very large hail and damaging winds along with very frequent cloud to ground lightning strikes. During these storms, lightning struck and ignited a house fire, in which the house was destroyed. Around the city, appliances and televisions were knocked out and the National Weather Service office also got a lightning strike that knocked out their computer systems and an amateur radio transceiver. Damages for this incident were estimated at $352,800 (2026 dollars).

August 10, 2023 – City of San Angelo
Isolated to scattered thunderstorms developed across the region during the late afternoon and early evening. A few of these storms were severe and produced wind damage. As a result of these storms, an airport director reported that there was a damaged runway at the San Angelo Regional Airport. Damages for this incident were estimated at $3,200 (2026 dollars).

PROBABILITY OF FUTURE EVENTS

Based on historical records and input from the Planning Team the probability of occurrence for future lightning events in the City of San Angelo and Tom Green County planning area is considered “Highly Likely”, or an event probable in the next year. The flash density indicates that lightning occurs regularly in the area. According to the 2025 Annual Lightning Report by Vaisala, the City of San Angelo and Tom Green County is located in an area of the country that experiences approximately 116 lightning flashes per square mile per year (approximately 268,500 flashes per year). Given this estimated probability of events, it can be expected that future lightning events will continue to threaten life and cause minor property damage throughout the planning area. Impacts of climate change are not expected to increase the average frequency of lightning events but may lead to an increase in the intensity of events when they do occur.

CLIMATE CHANGE CONSIDERATIONS

As CO_2 increases and the land surface warms, stronger updrafts are more likely to produce lightning. In a climate with double the amount of CO_2, we may see fewer lightning storms overall, but 25 percent stronger storms, with a 5 percent increase in lightning. Lightning damage is also likely to increase because of its role in igniting forest fires, where dry vegetation, also caused by rising temperatures, creates more ‘fuel’ for fires, so even a small climate change may have huge consequences. While the impact climate change will have on our weather still remains uncertain, researchers agree that implementing simple measures like lightning detection systems and installing grounding systems in buildings could go a long way in avoiding deaths and injuries.[4]

Lightning events have the potential to pose a significant risk to people and property throughout the City of San Angelo and Tom Green County planning area. The economic and financial impacts of lightning on the area will depend entirely on the scale of the event, what is damaged, and how quickly repairs to critical components of the economy can be implemented. While no increase in the number of hazard events is anticipated, the impact of the hazard may see an increase in losses. As populations grow and urban development continues to rise, the overall vulnerability and impact are expected to increase in the next five years.

[4] Environmental Journal, Nathan Neal, January 11, 2021.

VULNERABILITY AND IMPACT

Vulnerability is difficult to evaluate since lightning events can occur at different strength levels, in random locations, and can create a broad range of damage depending on the strike location. Due to the randomness of these events, all existing and future structures and facilities in the City of San Angelo and Tom Green County planning area could potentially be impacted and remain vulnerable to possible injury and property loss from lightning strikes.

The direct and indirect losses associated with these events include injury and loss of life, damage to structures and infrastructure, agricultural losses, utility failure (power outages), and stress on community resources. The entire population of the City of San Angelo and Tom Green County planning area are considered exposed to the lightning hazard. The peak lightning season in the State of Texas is from June to August; however, the most fatalities occur in July. Fatalities occur most often when people are outdoors and/or participating in some form of recreation. The population located outdoors during a lightning event is considered at risk and more vulnerable to a lightning strike compared to those inside a structure. Moving to a lower risk location will decrease a person's vulnerability.

The entire general building stock and all infrastructure of the City of San Angelo and Tom Green County planning area are considered exposed to the lightning hazard. Lightning can be responsible for damages to buildings, cause electrical, forest and/or wildfires, and damage infrastructure such as power transmission lines and communication towers. Outdoor practice and sporting events increase vulnerability to students and faculty at San Angelo ISD should lightning be present. The ISD regularly monitors weather conditions and have proceedures in place to cancel outdoor activities when dangerous conditions are forcast.

While all citizens are at risk to the impacts of lightning, forced relocation and disaster recovery disproportionately impacts low-income residents who lack the financial means repair their homes. An estimated 12 percent of the planning area population live below the poverty level. In addition, people who speak a language other than English may face increased vulnerability due to language barriers that limit their access to important information such as weather-related warnings and instructions regarding safety measures (Table 11-3).

Table 11-3. Populations at Greater Risk by Jurisdiction[5]

Jurisdiction	Population	
	Below Poverty Level	Limited English Speaking
Tom Green County	13,273	6,329
City of San Angelo	10,964	5,245

San Angelo ISD also has vulnerable populations based on work location, as those working outdoors would be subject to greater lightning risk if working outdoors during periods of lightning activity (Table 11-4).

[5] U.S. Census Bureau, American Community Survey Five-Year Estimates, 2024

Table 11-4. Populations at Greater Risk by Special District

Independent School District	Population
	Works Outdoors
San Angelo ISD	126

The City of San Angelo and Tom Green County Planning Team identified the following critical facilities (Table 11-4) as assets that are considered the most important to the planning area and are susceptible to a range of impacts caused by lightning events. For a comprehensive list by participating jurisdiction, please see Appendix D.

Table 11-4. Critical Facilities Vulnerable to Lightning Events

Critical Facility Type	Potential Impacts
Emergency Response Services (EOC, Fire, Police, EMS), Hospitals and Medical Centers	• Emergency operations and services may be significantly impacted due to power outages, damaged facilities, fires and/or loss of communications as a result of lightning strikes. • Emergency vehicles, including critical equipment, can be damaged by lightning strikes or by falling trees damaged by lightning. • Power outages could disrupt communications, delaying emergency response times. • Downed trees due to lightning strikes can impede emergency response vehicle access to areas. • Lightning strikes can be associated with structure fires and wildfires, further straining the capacity and resources of emergency personnel.
Airport, Academic Institutions, Animal Shelter, Evacuation Centers & Shelters, Governmental Facilities, Residential/ Assisted Living Facilities	• Structures can be damaged by falling trees damaged by lightning. • Power outages could disrupt critical care. • Backup power sources could be damaged. • Evacuations may be necessary due to extended power outages, fires, or other associated damages to facilities.
Commercial Supplier (food, fuel, etc.)	• Facilities, infrastructure, or critical equipment including communications may be damaged, destroyed or otherwise inoperable. • Essential supplies like medicines, water, food, and equipment deliveries may be delayed. • Economic disruption due to power outages and fires negatively impact airport services as well as area businesses reliant on airport operations.
Utility Services and Infrastructure (electric, water, wastewater, communications)	• Emergency operations and critical services may be significantly impacted due to power outages, damaged facilities, fires and/or loss of communications as a result of lightning strikes.

Critical Facility Type	Potential Impacts
	• Emergency vehicles, including critical equipment, can be damaged by lightning strikes or by falling trees damaged by lightning. • Power outages could disrupt communications, delaying emergency response times. • Downed trees due to lightning strikes can impede emergency response vehicle access to areas. • Lightning strikes can be associated with structure fires and wildfires, further straining the capacity and resources of emergency personnel.

There are no recorded fatalities or injuries within the City of San Angelo and Tom Green County planning area due to lightning events. Overall, the total loss estimate of property and crops in the planning area is $368,700 (2026 dollars) with an average annualized loss of $12,500. Based on historic damages to the built environment, the impact of lightning on the City of San Angelo and Tom Green County planning area would be considered "Limited" severity of impact, meaning injuries or illness are treatable with first aid, critical facilities and services shut down for 24 hours or less and less than 10 percent of property destroyed or with major damage.

Table 11-5. Estimated Annualized Losses by Jurisdiction

Jurisdiction	Total Property & Crop Loss	Average Annualized Loss Estimates
Tom Green County	$12,700	$400
City of San Angelo	$356,000	$12,100
San Angelo ISD	$0	-
Totals	**$368,700**	**$12,500**

ASSESSMENT OF IMPACTS

Lightning events have the potential to pose a significant risk to people and can create dangerous and difficult situations for public health and safety officials. Additional impacts to the planning area can include:

- The City of San Angelo and Tom Green County planning area features developed parks and green spaces. Lightning events could impact recreational activities, placing residents and visitors in imminent danger, potentially requiring emergency services or park evacuation.
- Older structures built to less stringent building codes may suffer greater damage from a lightning strike as they are typically built with less fire-resistant materials and often lack any fire mitigation measures such as sprinkler systems. 50 percent of homes in the City of San Angelo and Tom Green County planning area were built before 1980. Similarly, historic buildings may lack fire mitigation materials or measures due to their historic status. 70 historic sites in the City of San Angelo and Tom Green County planning area, are listed on the National Archives Catalog.

- Vegetation in urban parks may be destroyed by lightning caused brush fires and result in poor air quality impacting public health.
- Individuals exposed to the storm can be directly struck, posing significant health risks and potential death.
- Structures can be damaged or crushed by falling trees damaged by lightning, which can result in physical harm to the occupants.
- Lightning strikes can result in widespread power outages increasing the risk to more vulnerable portions of the population who rely on power for health and/or life safety.
- Extended power outage often results in an increase in structure fires and carbon monoxide poisoning as individuals attempt to cook or heat their homes with alternate, unsafe cooking or heating devices, such as grills.
- Lightning strikes can be associated with structure fires and wildfires, creating additional risk to residents and first responders.
- Emergency operations and services may be significantly impacted due to power outages and/or loss of communications.
- City departments may be damaged, delaying response and recovery efforts for the entire community.
- Economic disruption due to power outages and fires negatively impacts the programs and services provided by the community due to short- and long-term loss in revenue.
- Some businesses not directly damaged by lightning events may be negatively impacted while utilities are being restored, further slowing economic recovery.
- Businesses that are more reliant on utility infrastructure than others may suffer greater damage without a backup power source.

The economic and financial impacts of lightning on the area will depend entirely on the scale of the event, what is damaged, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by the community, local businesses, and citizens will also contribute to the overall economic and financial conditions in the aftermath of any significant lightning event.

Section 12
Thunderstorm Wind

SECTION 12: THUNDERSTORM WIND

HAZARD DESCRIPTION

Thunderstorms create extreme wind events which includes straight-line winds. Wind is the horizontal motion of the air past a given point, beginning with differences in air pressures. Pressure that is higher at one place than another sets up a force pushing from high toward low pressure; the greater the difference in pressures, the stronger the force. The distance between the area of high pressure and the area of low pressure also determines how fast the moving air accelerates.

Thunderstorms are created when heat and moisture near the Earth's surface are transported to the upper levels of the atmosphere. By-products of this process are the clouds, precipitation, and wind that become the thunderstorm.

According to the National Weather Service (NWS), a thunderstorm occurs when thunder accompanies rainfall. Radar observers use the intensity of radar echoes to distinguish between rain showers and thunderstorms.

Straight-line winds are responsible for most thunderstorm wind damages. One type of straight-line wind, the downburst, is a small area of rapidly descending air beneath a thunderstorm. A downburst can cause damage equivalent to a strong tornado and make air travel extremely hazardous.

LOCATION

Thunderstorm wind events can develop in any geographic location and are considered a common occurrence in Texas. It is assumed that the entire City of San Angelo and Tom Green County planning area, including San Angelo ISD, is uniformly exposed to the threat of thunderstorm winds.

EXTENT

The extent or magnitude of a thunderstorm wind event is measured by the Beaufort Wind Scale. Table 12-1 describes the different intensities of wind in terms of speed and effects, from calm to violent and destructive.

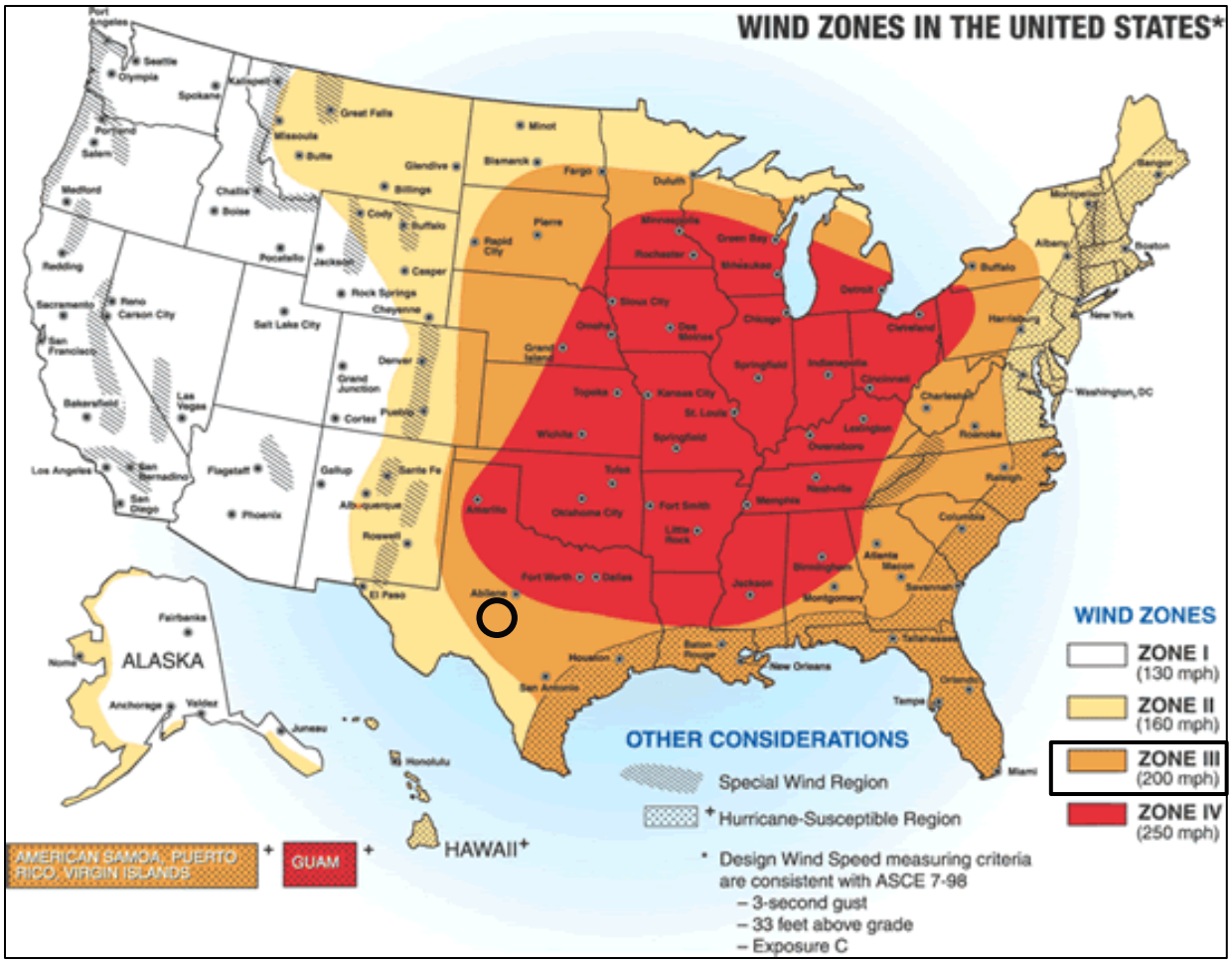
Table 12-1. Beaufort Wind Scale[1]

Force	Wind		WMO Classification	Appearance of Wind Effects
	(mph)	(knots)		
0	Less than 1	Less than 1	Calm	Calm, smoke rises vertically
1	1-3	1-3	Light Air	Smoke drift indicates wind direction, still wind vanes
2	4-7	4-6	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	8-12	7-10	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	13-18	11-16	Moderate Breeze	Dust, leaves and loose paper lifted, small tree branches move
5	19-24	17-21	Fresh Breeze	Small trees in leaf begin to sway
6	25-31	22-27	Strong Breeze	Larger tree branches moving, whistling in wires
7	32-38	28-33	Near Gale	Whole trees moving, resistance felt walking against wind
8	39-46	34-40	Gale	Whole trees in motion, resistance felt walking against wind
9	47-54	41-47	Strong Gale	Slight structural damage occurs, slate blows off roofs
10	55-63	48-55	Storm	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	64-72	56-63	Violent Storm	If experienced on land, widespread damage
12	72-83	64-71	Hurricane	Violence and destruction

Figure 12-1 displays the wind zones as derived from NOAA.

[1] Source: World Meteorological Organization

Figure 12-1. Wind Zones in the United States[2]



The City of San Angelo and Tom Green County planning area is located within Wind Zone III, meaning the planning area can experience maximum windspeeds up to 200 mph. The planning area has experienced a significant wind event, or an event with winds in the range of "Force 12" on the Beaufort Wind Scale with winds above 72 mph. The highest magnitude event occurred on June 19, 2023, with winds recorded at 96 knots, or approximately 110 mph. This is the worst to be anticipated for the entire planning area based on historic events.

HISTORICAL OCCURRENCES

The National Centers for Environmental Information (NCEI) Storm Events database is a national data source organized under the National Oceanic and Atmospheric Administration (NOAA). The NCEI is the largest archive available for historic storm events data; however, it is important to note that only incidents recorded in the NCEI have been factored into this risk assessment unless otherwise noted. It is likely that a high number of occurrences have gone unreported over the past 29.5 years. Tables 12-2, 12-3, and 12-4 depict historical occurrences of thunderstorm wind events for the City of San Angelo and Tom Green County planning area according to the NCEI database.

[2] The City of San Angelo and Tom Green County planning area is indicated by the black circle.

SECTION 12: THUNDERSTORM WIND

Since 1996, 318 thunderstorm wind events are known to have occurred in the City of San Angelo and Tom Green County planning area. Table 12-3 presents information on known historical events in the planning area which resulted in monetary damages, injuries, or fatalities. The highest magnitude event occurred on June 19, 2023, with winds recorded at 96 knots, or approximately 110 mph.

It is important to note that high wind events associated with other hazards, such as tornadoes, are not accounted for in this section. Property damage estimates are not always available. Where an estimate has been provided in a table for losses, the dollar amounts have been modified for inflation to indicate the damage in 2026 dollars.

Historical thunderstorm wind event data for San Angelo ISD is provided within the Tom Green County or City of San Angelo events. In the NCEI database, special districts do not have events reported separate and apart from the reported county and jurisdiction events. San Angelo ISD did report minor damages resulting from thunderstorm winds, though no significant impacts which were not captured in the NCEI database events.

Table 12-2. Historical Thunderstorm Wind Speeds, January 1996 – June 2025

Maximum Wind Speed Recorded (knots)	**Number of Reported Events**
0-30	0
31-40	3
41-50	20
51-60	184
61-70	79
71-80	10
81-90	4
91-100+	1
Unknown	17

Table 12-3. Damaging Historical Thunderstorm Wind Events, January 1996 – June 2025[3]

Jurisdiction	Date	Magnitude (knots)	Deaths	Injuries	Property Damage	Crop Damage
Tom Green County	5/10/1996	70	0	0	$103,500	$0
City of San Angelo	8/5/1996	-	0	0	$103,000	$0
City of San Angelo	11/23/1996	70	0	0	$408,600	$0
Tom Green County	2/20/1997	56	0	0	$609,000	$0

[3] Magnitude is listed when available. Damage values are in 2026 dollars.

SECTION 12: THUNDERSTORM WIND

Jurisdiction	Date	Magnitude (knots)	Deaths	Injuries	Property Damage	Crop Damage
Tom Green County	6/12/1997	50	0	0	$10,200	$0
City of San Angelo	6/14/1997	-	0	0	$202,200	$50,600
City of San Angelo	7/4/1997	66	0	0	$101,000	$0
City of San Angelo	5/26/1998	-	0	0	$6,000	$0
City of San Angelo	5/26/1998	-	0	0	$4,000	$0
City of San Angelo	5/26/1998	-	0	0	$3,000	$0
City of San Angelo	5/9/1999	-	0	0	$2,000	$0
Tom Green County	8/28/1999	-	0	0	$1,000	$0
Tom Green County	3/14/2001	-	0	0	$1,900	$0
City of San Angelo	4/10/2001	-	0	0	$3,700	$0
City of San Angelo	9/18/2001	-	0	0	$27,300	$0
City of San Angelo	9/18/2001	-	0	0	$18,200	$0
City of San Angelo	3/19/2002	-	0	0	$3,700	$0
City of San Angelo	3/19/2002	-	0	0	$2,800	$0
Tom Green County	5/27/2002	-	0	0	$45,100	$0
Tom Green County	6/13/2002	-	0	0	$5,500	$0
City of San Angelo	6/27/2002	52	0	0	$7,300	$0
City of San Angelo	7/28/2002	-	0	0	$18,000	$0
Tom Green County	8/13/2002	-	0	0	$9,000	$0
City of San Angelo	8/30/2003	60	0	0	$17,600	$0
Tom Green County	3/4/2004	52	0	0	$17,300	$0
City of San Angelo	3/4/2004	52	0	0	$7,000	$0
Tom Green County	7/4/2005	61	0	0	$13,300	$0
City of San Angelo	7/9/2005	61	0	0	$16,600	$0
City of San Angelo	4/28/2006	61	0	0	$24,200	$0
Tom Green County	2/24/2007	37	0	0	$8,000	$0
Tom Green County	5/2/2007	52	0	0	$15,600	$0
Tom Green County	5/2/2007	52	0	0	$15,600	$0

Jurisdiction	Date	Magnitude (knots)	Deaths	Injuries	Property Damage	Crop Damage
Tom Green County	5/2/2007	65	0	0	$12,500	$0
City of San Angelo	5/8/2007	52	0	0	$18,700	$0
Tom Green County	6/20/2007	52	0	0	$800	$0
Tom Green County	6/24/2007	52	0	0	$6,300	$0
Tom Green County	6/24/2007	52	0	0	$4,700	$0
Tom Green County	4/9/2008	65	0	0	$1,600	$0
Tom Green County	4/24/2009	55	0	0	$3,100	$0
Tom Green County	7/16/2014	70	0	1	$0	$0
Tom Green County	6/23/2017	82	0	0	$9,258,200	$0
City of San Angelo	6/24/2019	52	0	0	$6,400	$0
Tom Green County	6/22/2020	65	0	0	$50,300	$0
Tom Green County	6/23/2020	65	0	0	$37,800	$0
Totals		**(Max Extent)**	**0**	**1**	**$11,231,600**	**$50,600**

Table 12-4. Summary of Historical Events by Jurisdiction, January 1996 – June 2025[4]

Jurisdiction	Number of Events	Magnitude (knots)	Deaths	Injuries	Property Damage	Crop Damage
Tom Green County	204	96	0	1	$10,230,300	$0
City of San Angelo	114	83	0	0	$1,001,300	$50,600
San Angelo ISD	0	-	-	-	-	-
Totals	**318**	**(Max Extent)**	**0**	**1**	**$11,282,200**	

Based on the list of historical thunderstorm wind events for the City of San Angelo and Tom Green County planning area, 116 events were reported to the NCEI since the 2020 Plan.

SIGNIFICANT EVENTS

February 20, 1997

During a severe storm, which also brought heavy rains and flash flooding, severe wind gusts up to nearly 70 mph were reported within Tom Green County. These damaging winds impacted the City of San Angelo, as well as the rural communities of Quail Valley and Grape Creek. In these areas, wind damage consisted of downed fences, signs, and widespread damage to roofs and trees. In the City of San Angelo, a drive-through section of a bank was severely damaged, causing

[4] Participating jurisdictions with no reported events show a "-" in table columns where damages, deaths or injuries would be otherwise reported.

the roof to fall and destroy the ATM machines. Power outages were also reported during this event. Total damage was estimated at $609,000 (2026 dollars).

July 16, 2014
A powerful microburst struck approximately five miles northeast of the community of Grape Creek, causing extensive damage in the Indian Creek neighborhood near the intersection of Glass Road and Grape Creek Road. Impacts included widespread shingle and roof damage, a mobile home blown off its blocks, and several broken windows caused by wind-driven hail. Several outbuildings, including a large metal building which housed hay bales, were also destroyed. In addition to the damage to property, one injury occurred during the storm.

June 23, 2017
A cold front moved through Tom Green County during an exceptionally hot summer day, leading to a line of severe thunderstorms to develop. These storms formed just north of the City of San Angelo and quickly produced damaging downburst winds across the city and the Concho Valley. Damage surveys estimated these downbursts to have wind speeds from 75 mph up to 95 mph which impacted an area approximately 35 miles long and 20 miles wide. Numerous widespread impacts occurred in San Angelo and Grape Creek during the storm, including snapped power poles, uprooted trees, blown out garage doors, broken windows, and widespread damage to roofs and siding on homes and businesses. Total property damage was estimated at $9,258,200 (2026 dollars).

PROBABILITY OF FUTURE EVENTS

Most thunderstorm winds occur during the spring and fall seasons and during the months of March, April, May, and September. Based on available records of historic events, there have been a total of 318 events in a 29.5-year reporting period, which provides an estimated frequency of 10 to 11 events each year. Even though the intensity of thunderstorm wind events is not always damaging for the City of San Angelo and Tom Green County planning area, the frequency of occurrence for a thunderstorm wind event is “Highly Likely.” This means that an event is probable within the next year for the planning area.

CLIMATE CHANGE CONSIDERATIONS

The impacts on the frequency and severity of severe thunderstorm wind events due to climate change are unclear. According to the Texas A&M 2021 Climate Report Update, changes in severe thunderstorm reports over time have been more closely linked to changes in population than changes in the hazard event. Currently there is low confidence of an ongoing trend in the overall frequency and severity of thunderstorm events, due to the lack of climate data records for severe thunderstorms. Based on climate models that are available, the environmental conditions needed for severe thunderstorms are estimated to become more likely, resulting in an overall increase in the number of days capable of producing a severe thunderstorm event.[5]

[5] Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900-2036, Texas A&M University Office of the Texas State Climatologist, 2021 Update.

VULNERABILITY AND IMPACT

Vulnerability is difficult to evaluate since thunderstorm wind events can occur at different strength levels, in random locations, and can create relatively narrow paths of destruction. Due to the randomness of these events, all existing and future structures, and facilities within the City of San Angelo and Tom Green County planning area, could potentially be impacted and remain vulnerable to possible injury and property loss from strong winds.

Trees, power lines and poles, signage, manufactured housing, radio towers, concrete block walls, storage barns, windows, garbage recepticles, brick facades, and vehicles, unless reinforced, are vulnerable to thunderstorm wind events. More severe damage involves windborne debris; in some instances, patio furniture and other lawn items have been reported to have been blown around by wind and, very commonly, debris from damaged structures in turn have caused damage to other buildings not directly impacted by the event. In more severe instances, roofs have been reported as having been torn off of buildings. The portable buildings typically used at schools and construction sites would be more vulnerable to thunderstorm wind events than typical site-built structures and could potentially pose a greater risk for wind-blown debris.

According to the U.S. Census data, a total of 2,670 manufactured homes are located in the planning area (5 percent of total housing stock). In addition, 50 percent (25,944 structures) of the housing units were built before 1980. These structures would typically be built to lower or less stringent construction standards than newer construction and may be more susceptible to damage during significant wind events.

Table 12-5. Structures at Greater Risk by Participating Jurisdiction

Jurisdiction	Structures	
	SFR Built Before 1980	Manufactured Homes
Tom Green County	25,944	2,670
City of San Angelo	23,187	1,154
San Angelo ISD	100	19

While all citizens are vulnerable to the impacts of thunderstorm wind, forced relocation and disaster recovery disproportionately impacts low-income residents who lack the financial means to repair their homes. An estimated 11 percent of the planning area population live below the poverty level (Table 12-6). While warning times for these types of hazard events should be substantial enough for these individuals to seek shelter, the elderly, children, and people with a disability may have trouble taking shelter due to mobility issues or a lack of awareness, making them more susceptible to injury or harm. In addition, people who speak a language other than English may face increased vulnerability due to language barriers that limit their access to important information such as weather-related warnings and instructions regarding safety measures.

Table 12-6. Populations at Greater Risk by Jurisdiction[6]

Jurisdiction	Population				
	65 and Older	Under 5	With a Disability	Below Poverty Level	Limited English Speaking
Tom Green County	20,295	7,368	17,826	13,273	6,329
City of San Angelo	16,795	5,905	14,943	10,964	5,245

San Angelo ISD also has vulnerable populations based on work location, as those working outdoors would be subject to greater thunderstorm wind risk if working outdoors during periods of storm activity (Table 12-7).

Table 12-7. Populations at Greater Risk by Special District

Independent School District	Population
	Works Outdoors
San Angelo ISD	126

The City of San Angelo and Tom Green County Planning Team identified the following critical facilities (Table 12-8) as assets that are considered the most important to the planning area and are susceptible to a range of impacts caused by thunderstorm wind events. The critical infrastructure with the greatest vulnerability to thunderstorms are power and communications facilities. Failures of these facilities can result in a loss of service and cascading impacts such as posing enormous risk to individuals dependent on electricity as a medical necessity. For a comprehensive list by participating jurisdiction, please see Appendix D.

Table 12-8. Critical Facilities Vulnerable to Thunderstorm Wind Event

Critical Facility Type	Potential Impacts
Emergency Response Services (EOC, Fire, Police, EMS), Hospitals and Medical Centers	• Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications. • Emergency vehicles can be damaged by falling trees or flying debris. • Power outages could disrupt communications, delaying emergency response times. • Critical staff may be injured or otherwise unable to report for duty, limiting response capabilities. • Debris/downed trees can impede emergency response vehicle access to areas. • Increased number of structure fires due to gas line ruptures and downed power lines, further straining the capacity and resources of emergency personnel.

[6] US Census Bureau 2023 ACS data

Critical Facility Type	Potential Impacts
	• First responders are exposed to downed power lines, unstable and unusual debris, hazardous materials, and generally unsafe conditions.
Airport, Academic Institutions, Animal Shelter, Evacuation Centers & Shelters, Governmental Facilities, Residential/ Assisted Living Facilities	• Structures can be damaged by falling trees or flying debris. • Power outages could disrupt critical care. • Backup power sources could be damaged. • Critical staff may be injured or otherwise unable to report for duty, limiting response capabilities. • Evacuations may be necessary due to extended power outages, gas line ruptures, or structural damage to facilities. • Power outages and infrastructure damage may prevent larger airports from acting as temporary command centers for logistics, communications, and emergency operations. • Temporary break in operations may significantly inhibit post event evacuations. • Damaged or destroyed highway infrastructure may substantially increase the need for airport operations.
Commercial Supplier (food, fuel, etc.)	• Facilities, infrastructure, or critical equipment including communications may be damaged, destroyed or otherwise inoperable. • Essential supplies like medicines, water, food, and equipment deliveries may be delayed. • Economic disruption due to power outages and fires negatively impact airport services as well as area businesses reliant on airport operations.
Utility Services and Infrastructure (electric, water, wastewater, communications)	• Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications. • Emergency vehicles can be damaged by falling trees or flying debris. • Power outages could disrupt communications, delaying emergency response times. • Critical staff may be injured or otherwise unable to report for duty, limiting response capabilities. • Debris/downed trees can impede emergency response vehicle access to areas. • Increased number of structure fires due to gas line ruptures and downed power lines, further straining the capacity and resources of emergency personnel.

A thunderstorm wind event can also result in traffic disruptions, injuries and in rare cases, fatalities. Thunderstorm winds experienced in the planning area have resulted in one reported injury since 1996. Overall, in the past 29.5 years there has been an estimated total of $11,282,200 in damages (2026 dollars) in the City of San Angelo and Tom Green County planning area due to thunderstorm wind events. The estimated average annual loss from thunderstorm wind events is $382,400. Based on historic loss and property damages, the impact of thunderstorm wind on the planning area would be considered limited, meaning critical facilities and services shut down for 24 hours or less, and less than 10 percent of property destroyed or with major damage.

However, with previous reports of injury, the potential severity of impact for the City of San Angelo and Tom Green County planning area, including San Angelo ISD, is "Minor," meaning multiple injuries are possible depending on the magnitude and duration of the event.

Table 12-9. Estimated Annualized Losses by Participating Jurisdiction

Jurisdiction	Total Property & Crop Loss	Average Annual Loss Estimates
Tom Green County	$10,230,300	$346,800
City of San Angelo	$1,051,900	$35,700
San Angelo ISD	$0	-
Totals	**$11,282,200**	**$382,400**

ASSESSMENT OF IMPACTS

Thunderstorm wind events have the potential to pose a significant risk to people and can create dangerous and difficult situations for public health and safety officials. Thunderstorm wind conditions can be frequently associated with a variety of impacts, including:

- Individuals exposed to the storm can be struck by flying debris, falling limbs, or downed trees causing serious injury or death.
- Structures can be damaged or crushed by falling trees, which can result in physical harm to the occupants.
- Significant debris and downed trees can result in emergency response vehicles being unable to access areas of the community.
- Downed power lines may result in roadways being unsafe for use, which may prevent first responders from answering calls for assistance or rescue.
- Thunderstorm wind events often result in widespread power outages increasing the risk to more vulnerable portions of the population who rely on power for health and/or life safety.
- Extended power outage often results in an increase in structure fires and carbon monoxide poisoning, as individuals attempt to cook or heat their homes with alternate, unsafe cooking or heating devices, such as grills.
- Critical staff may be unable to report for duty, limiting response capabilities.
- Private sector entities that residents rely on, such as utility providers, financial institutions, and medical care providers may not be fully operational and may require assistance from neighboring communities until full services can be restored.
- Economic disruption negatively impacts the programs and services provided by the community due to short- and long-term loss in revenue.
- Some businesses not directly damaged by thunderstorm wind events may be negatively impacted while roads are cleared and utilities are being restored, further slowing economic recovery.
- Older structures, specifically those built before 1980 (50 percent of the planning area), were built to less stringent building codes may suffer greater damage as they are typically more vulnerable to thunderstorm winds.

- Recreational areas such as community parks and green spaces may be damaged or inaccessible due to downed trees or debris, causing temporary impacts to associated businesses in the area.
- Historical sites and properties are placed at a higher risk of impact due to materials used and the inability to change properties due to their historic status. There are 70 historical sites listed on the National Archives Catalog in Tom Green County.

The economic and financial impacts of thunderstorm winds on the area will depend entirely on the scale of the event, what is damaged, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by the community, local businesses, and citizens will also contribute to the overall economic and financial conditions in the aftermath of any thunderstorm wind event.

Section 13
Tornado

SECTION 13: TORNADO

HAZARD DESCRIPTION

Tornadoes are among the most violent storms on the planet. A tornado is a rapidly 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 and have wind speeds of 250 miles per hour (mph) or more. In extreme cases, winds may approach 300 mph. Damage paths can be in excess of one mile wide and 50 miles long.

The most powerful tornadoes are produced by "Supercell Thunderstorms." These thunderstorms are created when horizontal wind shears (winds moving in different directions at different altitudes) 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.

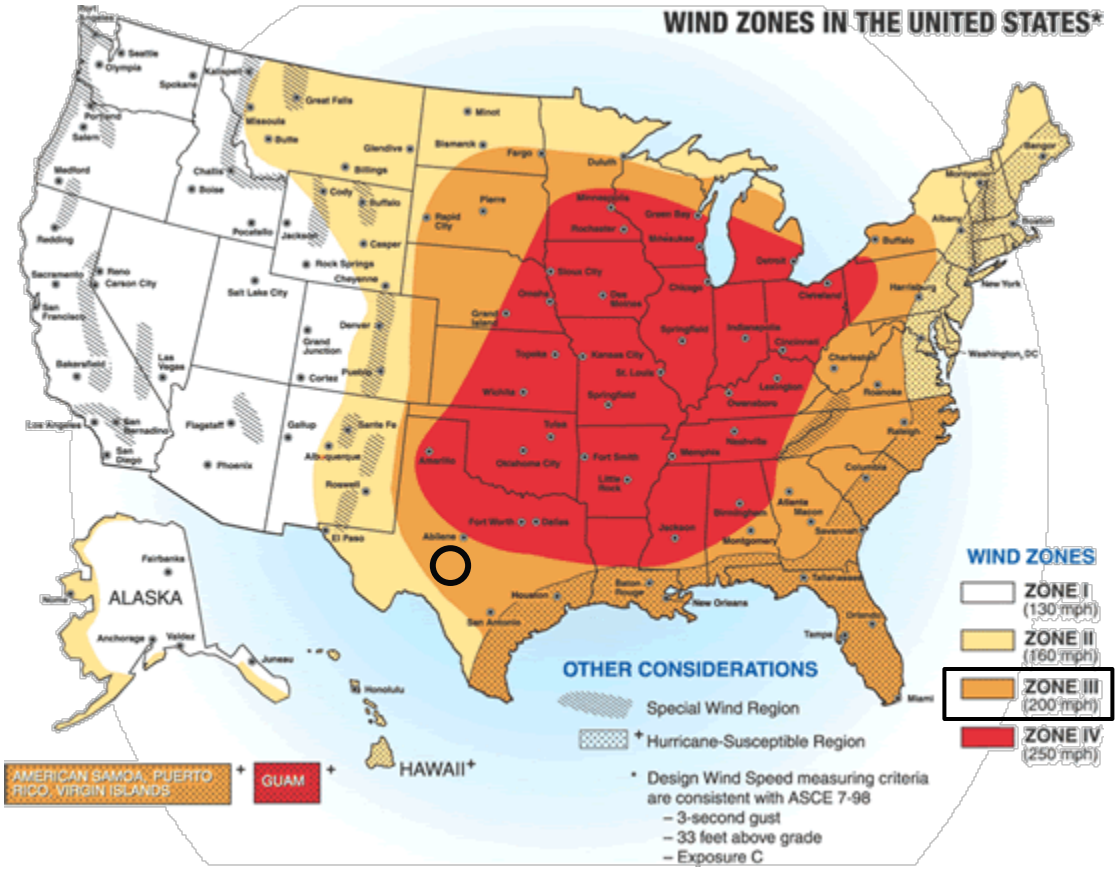
Table 13-1. Variations among Tornadoes

Weak Tornadoes	Strong Tornadoes	Violent Tornadoes
• 69% of all tornadoes • Less than 5% of tornado deaths • Lifetime 1-10+ minutes • Winds less than 110 mph	• 29% of all tornadoes • Nearly 30% of all tornado deaths • May last 20 minutes or longer • Winds 110–205 mph	• 2% of all tornadoes • 70% of all tornado deaths • Lifetime can exceed one hour • Winds greater than 205 mph

LOCATION

Tornadoes do not have any specific geographic boundary. Therefore the entire City of San Angelo and Tom Green planning area, including San Angelo ISD, is uniformly exposed to tornado activity. The planning area is in Wind Zone III, meaning tornado winds can be as high as 200 mph within the planning area (Figure 13-1).

Figure 13-1. FEMA Wind Zones in the United States[1]



EXTENT

The destruction caused by tornadoes ranges from light to inconceivable, depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light construction, such as residential homes (particularly mobile homes).

Tornado magnitudes prior to 2007 were determined using the traditional version of the Fujita Scale, which estimated tornado wind speeds based on the damage caused by an event. Since February 2007, the Enhanced Fujita Scale has been utilized to classify tornadoes, which included improvements to the original scale. The original Fujita scale had limitations, such as a lack of damage indicators, no account for construction quality and variability, and no definitive correlation between damage and wind speed. These limitations led to some tornadoes being rated in an inconsistent manner and, in some cases, an overestimate of tornado wind speeds. The Enhanced Fujita scale retains the same basic design and six strength categories as the previous scale. The newer scale reflects more refined assessments of tornado damage surveys, standardization, and damage consideration to a wider range of structures. Table 13-2 includes both scales for reference when analyzing historical tornadoes, since tornado events prior to 2007 will follow the original Fujita Scale.

[1] The City of San Angelo and Tom Green County planning area is indicated by the circle.

Table 13-2. The Fujita and Enhanced Fujita Tornado Scale[2]

Enhanced Fujita Scale				Fujita Scale			
Category	**Wind Speed**	**Damage Level**	**Damage**	**Category**	**Wind Speed**	**Intensity**	**Damage**
EF0	65-85 MPH	Gale	The environment sustained minor damage: tree branches are broken, some shallow-rooted trees are uprooted, and some chimneys are damaged.	**F0**	45-78 MPH	Gale	Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
EF1	86-110 MPH	Weak	The environment sustained moderate damage: mobile homes are tipped over, windows are broken, roof tiles may be blown off, and some tree trunks have snapped.	**F1**	79-117 MPH	Moderate	Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
EF2	111-135 MPH	Strong	The environment sustained considerable damage: mobile homes are destroyed, roofs are damaged, debris flies in the air, and large trees are snapped or uprooted.	**F2**	118-161 MPH	Significant	Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136-165 MPH	Severe	The environment sustained severe damage: roofs and walls are ripped off buildings, small buildings are destroyed, and most trees are uprooted.	**F3**	162-209 MPH	Severe	Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
EF4	166-200 MPH	Devastating	The environment sustained devastating damage: well-built homes are destroyed, buildings are lifted off their foundations, cars are blown away, and large debris flies in the air.	**F4**	210-261 MPH	Devastating	Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown, and large missiles generated.
EF5	200+ MPH	Incredible	The environment sustained incredible damage: well-built homes are lifted from their foundations, reinforced concrete buildings are damaged, the bark is stripped from trees, and car-sized debris flies through the air.	**F5**	262-317 MPH	Incredible	Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yds); trees debarked; incredible phenomena will occur.

[2] Source: http://www.tornadoproject.com/fscale/fscale.htm

Both the Fujita Scale and Enhanced Fujita Scale should be referenced in reviewing previous occurrences since tornado events that occurred before 2007 will follow the original Fujita Scale. The greatest magnitude reported within the planning area is F4 (an EF5 when converted to the Enhanced Fujita Scale), a devastating or incredible tornado capable of lifting or destroying well-built homes, sending car-size debris flying through the air, and snapping large trees. Based on the planning area's location in Wind Zone III, the planning area has the potential to experience anywhere from an EF0 to an EF5 depending on the wind speed. Previous tornado events in the City of San Angelo and Tom Green County planning area (converted from the Fujita Scale) have ranged between EF0 and EF5 magnitudes (Figure 13-2). This is the worst the planning area can anticipate based on historical events.

HISTORICAL OCCURRENCES

The National Centers for Environmental Information (NCEI) Storm Events database is a national data source organized under the National Oceanic and Atmospheric Administration (NOAA). The NCEI is the largest archive available for historic storm events data; however, it is important to note that only incidents recorded in the NCEI have been factored into this risk assessment unless otherwise noted. It is possible that some occurrences have gone unreported over time.

Figure 13-2 identifies the locations of previous occurrences in the City of San Angelo and Tom Green County planning area from January 1952 through June 2025. A total of 56 events have been recorded by NOAA's Storm Prediction Center and the NCEI Storm Events databases for the planning area. The strongest magnitude reported in the planning area was an F4 tornado which occurred on May 11, 1953 (Table 13-3).

Historical tornado event data for San Angelo ISD is provided within the Tom Green County or City of San Angelo events. In the NCEI database, special districts do not have events reported separate and apart from the reported county and jurisdiction events. San Angelo ISD did report sustaining minor damages during the May 18, 2019 event (Table 13-3), though no significant impacts which were not already captured in the NCEI database.

Figure 13-2. Spatial Historical Tornado Events, January 1952 – June 2025[3]

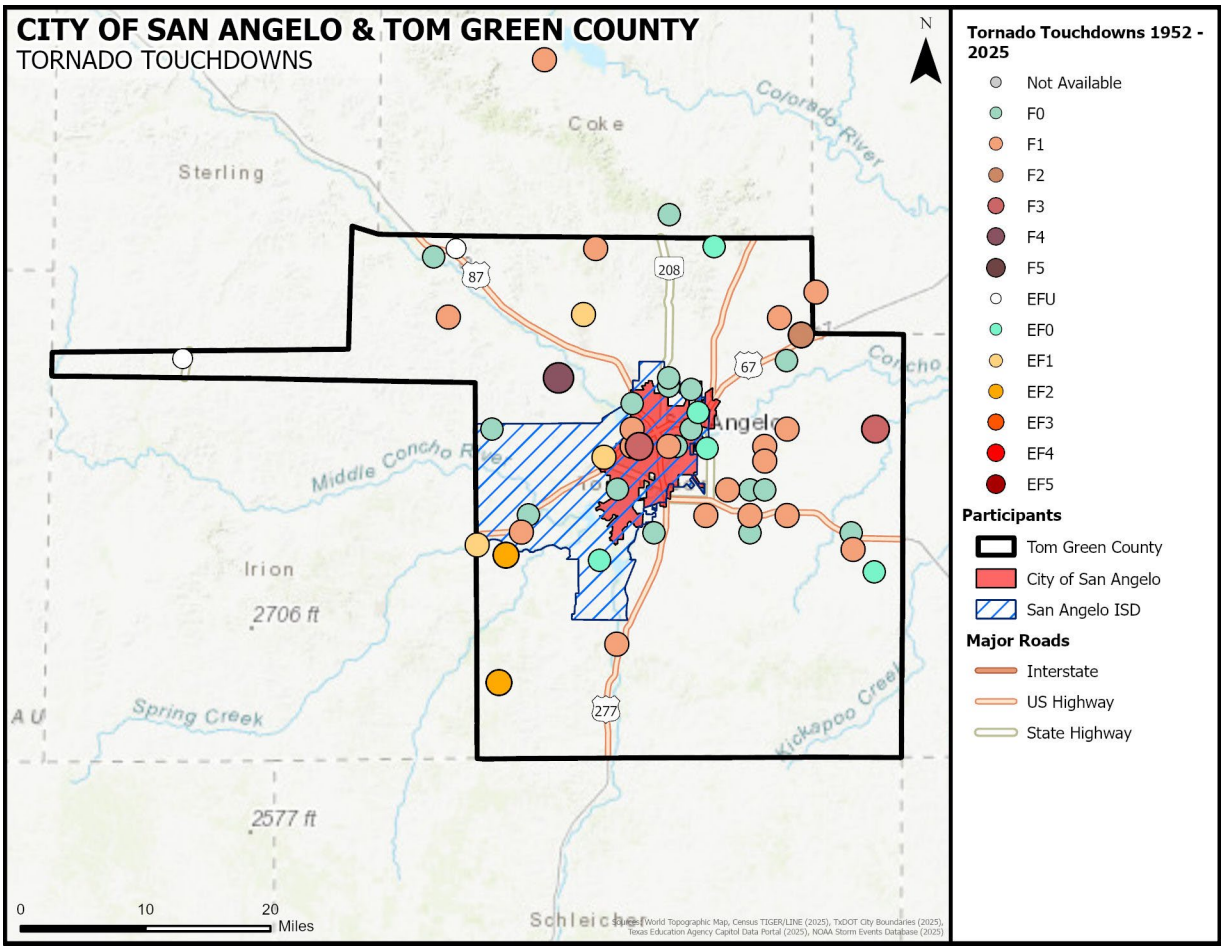


Table 13-3. Historical Tornado Events, January 1952 – June 2025[4]

Jurisdiction	Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
City of San Angelo	4/30/1952	F3	0	6	$3,068,000	$0
City of San Angelo	5/23/1952	F1	0	1	$30,700	$0
Tom Green County	5/11/1953	F4	13	159	$30,334,900	$0
Tom Green County	3/10/1973	F2	1	7	$1,870,600	$0
Tom Green County	5/4/1974	F1	0	0	$200	$0
Tom Green County	5/29/1977	F1	0	0	$200	$0
Tom Green County	4/20/1981	F1	0	0	$200	$0

[3] Source: NOAA Storm Prediction Center
[4] Damage values are in 2026 dollars. Magnitude is listed when available. Only events with injuries, fatalities, or damages were listed in the table.

SECTION 13: TORNADO

Jurisdiction	Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
City of San Angelo	5/18/1982	F1	0	0	$84,600	$0
Tom Green County	6/5/1984	F1	1	0	$78,200	$0
Tom Green County	5/14/1989	F1	0	0	$65,500	$0
Tom Green County	5/15/1989	F1	0	0	$654,300	$0
Tom Green County	5/13/1992	F1	0	0	$5,800	$0
Tom Green County	5/14/1995	F0	0	0	$21,300	$0
Tom Green County	5/14/1995	F3	0	0	$638,600	$0
Tom Green County	5/14/1995	F1	0	2	$532,200	$0
Tom Green County	5/14/1995	F1	0	0	$319,300	$0
Tom Green County	5/10/1996	F1	0	0	$2,068,900	$0
Tom Green County	5/26/1998	F1	0	2	$2,587,100	$995,100
Tom Green County	3/19/2002	F1	0	0	$18,200	$0
City of San Angelo	3/19/2002	F1	0	0	$3,700	$0
Tom Green County	3/4/2004	F1	0	0	$345,800	$0
City of San Angelo	5/31/2005	F1	0	0	$500,000	$0
City of San Angelo	5/31/2005	F1	0	0	$166,700	$0
City of San Angelo	5/31/2005	F0	0	0	$13,400	$0
Tom Green County	4/9/2008	EF1	0	0	$226,300	$0
Tom Green County	4/9/2008	EF0	0	0	$15,100	$0
Tom Green County	4/9/2008	EF0	0	0	$75,500	$0
City of San Angelo	4/9/2008	EF1	0	0	$9,048,700	$0
Tom Green County	10/13/2018	EF2	0	0	$256,300	$0
Tom Green County	5/18/2019	EF2	0	2	$9,488,100	$0
Totals		**(Max Extent)**	**15**	**179**	**$62,518,400**	**$995,100**

Table 13-4. Summary of Historical Tornado Events, January 1952 – June 2025[5]

Jurisdiction	Number of Events	Max Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Tom Green County	40	F4	15	172	$49,602,600	$995,100
City of San Angelo	16	F3	0	7	$12,915,800	$0
San Angelo ISD	0	-	-	-	-	-
Totals	**56**	**(Max Extent)**	**15**	**179**	**$63,513,500**	

Based on the list of historical tornado events for the City of San Angelo and Tom Green County planning area, four events were reported to the NCEI since the 2020 Plan.

SIGNIFICANT EVENTS

May 11, 1953

A violent F4 tornado touched down in the mid-afternoon, causing immense damage and destruction over a 20-mile-long path through the City of San Angelo. The tornado began 17 miles west-northwest of the City of San Angelo, and damaged or destroyed 519 homes, 19 businesses, and 150 cars as it moved toward and through the city. This event had by far the most devastating impact on the population of Tom Green County of any reported tornado since 1952, causing 13 fatalities and 159 injuries. Total property damage was estimated at $30,334,900 (2026 dollars).

May 26, 1998

A supercell developed just north of San Angelo near the community of Grape Creek, then drifting slowly east toward Veribest in northeast Tom Green County. At least two tornadoes developed from the storm, one being an F1 which destroyed two mobile homes and damaged an additional 15 houses. Two occupants of the destroyed mobile homes were injured during the storm. Total property damage was estimated at $2,587,100 (2026 dollars), with an additional $995,100 in crop damage.

April 9, 2008

A line of severe thunderstorms in West Central Texas led to multiple tornadoes developing in the region, four of which were reported within Tom Green County. The most damaging reported tornado was an EF1 which tracked across the Houston Harte Expressway, causing severe damage to a large distribution warehouse. Additionally, this tornado overturned two trailers and downed a communication tower, utility poles, and power lines. Other impacts included flipped cars, damaged roofs, and road signs. A second EF1 tornado occurred, with the only reported impacts being a roof and upper floor damage to a residential home. Two additional EF0 tornadoes were reported, causing damages including 20 destroyed sheep shelters, damaged irrigation equipment, overturning a travel trailer, and snapping tree limbs. Across multiple damage reports, total damages from this tornado outbreak were estimated at $9,365,600 (2026 dollars).

[5] Participating jurisdictions with no reported events show a "-" in table columns where damages, deaths or injuries would be otherwise reported.

May 18, 2019
An EF2 tornado touched down in Dove Creek, approximately 16 miles southwest of the City of San Angelo. Early in its path, the tornado removed the roofs and collapsed walls on several homes as well as severely damaging multiple outbuildings on the Boys Ranch before crossing over Twin Buttes Reservoir. The tornado then entered the Southland Subdivision, where the tornado weakened in strength but broadened to nearly a mile wide. Damages in this subdivision consisted of shingle damage, downed fences, broken windows, and uprooted trees. Similar damages occurred in the College Hills subdivision as the tornado continued northeast. The tornado then narrowed and strengthened as it neared Angelo State University, causing additional roof damage and destroying a gasoline canopy, fencing, and trees in the area. The tornado further intensified as it crossed Loop 306 near Main Street, striking the Bradford Elementary Subdivision in northern San Angelo. In total, the tornado destroyed 39 homes and damaged 90 more; two injuries were also reported. Total damages were estimated at $9,488,100 (2026 dollars).

April 19, 2025
A supercell thunderstorm moved across the community of Grape Creek, producing a brief EF1 tornado. Along its path through Grape Creek, the tornado damaged and uprooted multiple trees, damaged the roof of a home, damaged a metal outbuilding, and moved a metal carport at least 15 feet.

PROBABILITY OF FUTURE EVENTS

Tornadoes can occur at any time of year and at any time of day, but they are typically more common in the spring months during the late afternoon and evening hours. A smaller, high frequency period can emerge in the fall during the brief transition between the warm and cold seasons. With 56 historical events over a 73.5-year reporting period, the City of San Angelo and Tom Green County planning area can anticipate a tornado touchdown approximately every one to two years. This frequency supports a “Highly Likely” probability of future events for the City of San Angelo and Tom Green County planning area, meaning an event is probable within the next year.

CLIMATE CHANGE CONSIDERATIONS

The impacts on the frequency and severity of tornado events due to climate change are unclear. According to the Texas A&M 2021 Climate Report Update, the most robust trend in tornado activity in Texas is a likelihood for a greater number of tornadoes in large outbreaks, although the factors contributing to this trend are not expected to continue. Tornadoes spawn from less than 10 percent of thunderstorms, usually supercell thunderstorms that are in a wind shear environment that promotes rotation.[6] Based on climate models that are available, the environmental conditions needed for severe thunderstorm events are estimated to become more likely, resulting in an overall increase in the number of days capable of producing a severe thunderstorm event and potential tornadoes to develop from these storms.[7]

[6] Treisman, Rachel. *The exact link between tornadoes and climate change is hard to draw. Here’s why*. NPR. December 13, 2021. https://www.npr.org/2021/12/13/1063676832/the-exact-link-between-tornadoes-and-climate-change-is-hard-to-draw-heres-why

[7] Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900-2036, Texas A&M University Office of the Texas State Climatologist, 2021 update.

VULNERABILITY AND IMPACT

Because tornadoes often cross jurisdictional boundaries, all existing and future buildings, facilities, and populations in the entire City of San Angelo and Tom Green County planning area is considered to be exposed to this hazard and could potentially be impacted. The damage caused by a tornado is typically a result of high wind velocity and wind-blown debris.

The average tornado moves from southwest to northeast, but tornadoes have been known to move in any direction. Consequently, vulnerability of humans and property is difficult to evaluate since tornadoes form at different strengths, in random locations, and create relatively narrow paths of destruction. Although tornadoes strike at random, making all buildings vulnerable, three types of structures are more likely to suffer damage:

- Manufactured Homes;
- Homes built of peer and beam construction (more susceptible to lift); and
- Buildings with large spans, such as shopping malls, gymnasiums, and factories.

Tornadoes can cause a significant threat to people as they could be struck by flying debris, falling trees or branches, utility lines, and poles. Blocked roads could prevent first responders from responding to calls. Tornadoes commonly cause power outages which could cause health and safety risks to residents and visitors, as well as to patients in hospitals.

The City of San Angelo and Tom Green County planning area features mobile or manufactured homes throughout the planning area. These structures are typically more vulnerable to tornado events than typical site-built structures. The U.S. Census data indicates a total of 2,670 (5 percent of total housing stock) manufactured homes located in the planning area. In addition, 50 percent (25,944 structures) of the housing structures in the planning area were built before 1980. These structures would typically be built to lower or less stringent construction standards than newer construction and may be more susceptible to damage during significant tornado events (Table 13-5).

Table 13-5. Structures at Greater Risk by Participating Jurisdiction

Jurisdiction	Structures	
	SFR Built Before 1980	Manufactured Homes
Tom Green County	25,944	2,670
City of San Angelo	23,187	1,154
San Angelo ISD	100	19

While all citizens are at risk to the impacts of a tornado, forced relocation and disaster recovery disproportionately impacts low-income residents who lack the financial means to travel, afford a long-term stay away from home, and to rebuild or repair their homes. The elderly, children, and people with a disability may have trouble taking shelter due to mobility issues or a lack of awareness, making them more susceptible to injury or harm. In addition, people who speak a language other than English may face increased vulnerability due to language barriers that limit

their access to important information such as weather-related warnings and instructions regarding safety measures.

The population over 65 in the planning area is estimated at 17 percent of the total population and children under the age of 5 are estimated at 6 percent. The population with a disability is estimated at 15 percent of the total population. An estimated 11 percent of the planning area population live below the poverty level and 5 percent of the populations speak English 'less than very well' (Table 13-6).

Table 13-6. Populations at Greater Risk by Jurisdiction[8]

Jurisdiction	Population				
	65 and Older	Under 5	With a Disability	Below Poverty Level	Limited English Speaking
Tom Green County	20,295	7,368	17,826	13,273	6,329
City of San Angelo	16,795	5,905	14,943	10,964	5,245

San Angelo ISD also has vulnerable populations based on work location, as those working outdoors would be subject to greater tornado risk if working outdoors when an event strikes (Table 13-7).

Table 13-7. Populations at Greater Risk by Special District

Independent School District	Population
	Works Outdoors
San Angelo ISD	126

The City of San Angelo and Tom Green County Planning Team identified the following critical facilities as assets that are considered the most important to the planning area and are susceptible to a range of impacts caused by tornado events (Table 13-8). The critical infrastructure with the greatest vulnerability to tornadoes are power and communications facilities. Failures of these facilities can result in a loss of service and cascading impacts such as posing enormous risk to individuals dependent on electricity as a medical necessity. For a comprehensive list by participating jurisdiction, please see Appendix D.

Table 13-8. Critical Facilities Vulnerable to Tornado Event

Critical Facility Type	Potential Impacts
Emergency Response Services (EOC, Fire, Police, EMS), Hospitals and Medical Centers	• Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications. • Emergency vehicles can be damaged by falling trees or flying debris.

[8] US Census Bureau 2024 ACS data

Critical Facility Type	Potential Impacts
	• Power outages could disrupt communications, delaying emergency response times. • Critical staff may be injured or otherwise unable to report for duty, limiting response capabilities. • Debris/downed trees can impede emergency response vehicle access to areas. • Increased number of structure fires due to gas line ruptures and downed power lines, further straining the capacity and resources of emergency personnel. • First responders are exposed to downed power lines, unstable and unusual debris, hazardous materials, and generally unsafe conditions.
Airport, Academic Institutions, Animal Shelter, Evacuation Centers & Shelters, Governmental Facilities, Residential/ Assisted Living Facilities	• Structures can be damaged by falling trees damaged by tornadoes. • Power outages could disrupt critical care. • Backup power sources could be damaged. • Evacuations may be necessary due to extended power outages, fires, or other associated damage to facilities. • Power outages and infrastructure damage may prevent larger airports from acting as temporary command centers for logistics, communications, and emergency operations. • Temporary break in operations may significantly inhibit post event evacuations. • Damaged or destroyed highway infrastructure may substantially increase the need for airport operations.
Commercial Supplier (Food, fuel, etc.)	• Facilities or infrastructure may be damaged, destroyed or otherwise inaccessible. • Essential supplies like medicines, water, food, and equipment deliveries may be significantly delayed. • Additional emergency responders and critical aid workers may not be able to reach the area for days.
Utility Services and Infrastructure (electric, water, wastewater, communications)	• Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications. • Emergency vehicles can be damaged by falling trees or flying debris. • Power outages could disrupt communications, delaying emergency response times. • Critical staff may be injured or otherwise unable to report for duty, limiting response capabilities. • Debris/downed trees can impede emergency response vehicle access to areas. • Increased number of structure fires due to gas line ruptures and downed power lines, further straining the capacity and resources of emergency personnel. • First responders are exposed to downed power lines, unstable and unusual debris, hazardous materials, and generally unsafe conditions.

The total loss estimate due to tornado events in the City of San Angelo and Tom Green County planning area is $63,513,500 (2026 dollars), having an approximate average annual loss estimate of $864,100. Historically, tornadoes have also resulted in 179 injuries and 15 fatalities within the planning area. Based on historic damages to property and crops, the impact of tornadoes on the planning area would be considered minor severity of impact, meaning critical facilities and services shut down for up to a week, and more than 10 percent of property destroyed or with major damage. However, due to the numerous injuries and fatalities caused by tornadoes in the City of San Angelo and Tom Green County planning area, including the San Angelo ISD, the potential severity of impact is "Substantial," meaning multiple deaths are possible depending on the size and duration of the event.

Table 13-9. Estimated Average Annual Losses by Jurisdiction

Jurisdiction	Total Property & Crop Loss	Average Annual Loss Estimates
Tom Green County	$50,597,700	$688,400
City of San Angelo	$12,915,800	$175,700
San Angelo ISD	$0	-
Totals	**$63,513,500**	**$864,100**

ASSESSMENT OF IMPACTS

Tornadoes have the potential to pose a significant risk to the population and can create dangerous situations. Often, providing and preserving public health and safety is difficult. The impact of climate change could produce larger, more severe tornado events, exacerbating the current tornado impacts. More destructive tornado conditions can be frequently associated with a variety of impacts, including:

- Individuals exposed to the storm can be struck by flying debris, falling limbs, or downed trees causing serious injury or death.
- Structures can be damaged or crushed by falling trees, which can result in physical harm to the occupants.
- Manufactured homes (5 percent of total housing stock) may suffer substantial damage as they would be more vulnerable than typical site-built structures.
- Portable classrooms may also suffer substantial damage as they would be more vulnerable than other classroom structures.
- Significant debris and downed trees can result in emergency response vehicles being unable to access areas of the community.
- Downed power lines may result in roadways being unsafe for use, which may prevent first responders from answering calls for assistance or rescue.
- Tornadoes often result in widespread power outages increasing the risk to more vulnerable portions of the population who rely on power for health and/or life safety.
- Extended power outages can result in an increase in structure fires and/or carbon monoxide poisoning as individuals attempt to cook or heat their home with alternate, unsafe cooking or heating devices, such as grills.

- Tornadoes can destroy or make residential structures uninhabitable, requiring shelter or relocation of residents in the aftermath of the event.
- First responders must enter the damage area shortly after the tornado passes to begin rescue operations and to organize cleanup and assessments efforts, therefore they are exposed to downed power lines, unstable and unusual debris, hazardous materials, and generally unsafe conditions, elevating the risk of injury to first responders and potentially diminishing emergency response capabilities.
- Emergency operations and services may be significantly impacted due to damaged facilities, loss of communications, and damaged emergency vehicles and equipment.
- Private sector entities such as utility providers, financial institutions, and medical care providers may not be fully operational and may require assistance from neighboring communities until full services can be restored.
- Economic disruption negatively impacts the programs and services provided by the community due to short- and long-term loss in revenue, especially if damage is sustained to major employers within the planning area.
- Damage to infrastructure may slow economic recovery since repairs may be extensive and lengthy.
- When the community is affected by significant property damage it is anticipated that funding would be required for infrastructure repair and restoration, temporary services and facilities, overtime pay for responders, and normal day-to-day operating expenses.
- Displaced residents may not be able to immediately return to work, further slowing economic recovery.
- Residential structures destroyed by a tornado may not be rebuilt for years, reducing the tax base for the community.
- Large or intense tornadoes may result in a dramatic population fluctuation, as people are unable to return to their homes or jobs and must seek shelter and/or work outside of the affected area.
- Businesses that are uninsured or underinsured may have difficulty reopening, which results in a net loss of jobs for the community and a potential increase in the unemployment rate.
- Recreation activities may be unavailable, and tourism can be unappealing for years following a large tornado, devastating directly related local businesses.
- Tornadoes may destroy or degrade endangered species habitat; currently, there are four federally endangered, threatened, or candidate species in the planning area.
- Historical sites and properties are placed at a higher risk of impact due to materials used and the inability to change properties due to their historic status. There are 70 historical sites listed on the National Archives Catalog in Tom Green County.

The economic and financial impacts of a tornado event on the community will depend on the scale of the event, what is damaged, costs of repair or replacement, lost business days in impacted areas, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by the community, local businesses, and citizens will contribute to the overall economic and financial conditions in the aftermath of a tornado event.

Section 14
Wildfire

SECTION 14: WILDFIRE

HAZARD DESCRIPTION

Wildfire is an unplanned fire burning in natural or wildland areas such as forests, shrub lands, grasslands, or prairies.[1] Texas is one of the fastest growing states in the nation, with much of this growth occurring adjacent to metropolitan areas. This increase in population across the state will impact counties and communities that are located within the Wildland Urban Interface (WUI). The WUI is described as the area where structures and other human improvements meet and intermingle with undeveloped wildland or vegetative fuels. Population growth within the WUI substantially increases the risk of wildfire. In Texas nearly 85 percent of wildfires occur within two miles of a community.

Wildfires have the potential to spread quickly given the right environmental conditions, particularly within the wildland urban interface and intermix. Most ignition sources for wildfires are a result of human activities, such as an electrical line sparking dry grasses, an improperly discarded cigarette, burning debris, or arson.

Development has increased in west Texas, resulting in more populated areas within the wildland interface / intermix. Additionally, the area is experiencing hotter, drier climatic conditions. These factors combine to make south Texas at risk from wildfires. While the planning area is continually at some risk for wildfires, that risk is elevated during two periods each year: the winter wildfire season (February through April) and the summer wildfire season (August through October).[2]

The City of San Angelo and Tom Green County population is expected to increase over time following population trends over the last few decades. Continued housing development in the WUI will put more people at a greater risk of catastrophic wildfire and put more pressure on land managers and fire department personnel to mitigate fire risk.

Wildfires spread based on the type and quantity of fuel that surrounds it. Fuel can include everything from trees, underbrush and dry grassy fields to homes. The amount of flammable material that surrounds a fire is referred to as the fuel load. Conditions in the weather and environment, such as drought, winds and extreme heat, can cause a fire to spread more quickly.[3]

[1] FEMA: https://hazards.fema.gov/nri/wildfire
[2] Austin American Statesman, “Winter wildfire risk is rising in Central Texas. Here’s what you should know.” January 2023: https://www.statesman.com/story/news/environment/2023/01/30/wildfire-risk-is-rising-in-central-texas-what-you-should-know/69845234007/
[3] NOAA Weather Forecasting: https://scijinks.gov/wildfires/

A wildfire event often begins unnoticed and spreads quickly, lighting brush, trees, and homes on fire. For example, a wildfire may be started by a campfire that was not doused properly, a tossed cigarette, burning debris, or arson. Additionally, the City of San Angelo and Tom Green County planning team reports that wildfires are often caused by lightning and thunderstorm wind events.

Texas has seen a significant increase in the number of wildfires in the past 30 years, including wildland, urban interface, or intermix fires. Wildland fires are fueled almost exclusively by natural vegetation, while interface or intermix fires are urban / wildland fires in which vegetation and the built environment provide the fuel.

LOCATION

A wildfire incident can have devastating consequences due to human activities, drought conditions, lightning, or wind events, if the conditions allow. Wildfires can vary greatly in terms of size, location, intensity, and duration. While wildfires are not confined to any specific geographic location, they are most likely to occur in open grasslands.

The Texas A&M Forest Service Wildfire Risk Assessment Portal (TxWRAP) provides historical wildfire data for Texas counties along with mapping resources that include data layers on the WUI, ignition density, and fire damage potential for communities throughout the City of San Angelo and Tom Green County planning area, along with multiple tips, recommendations and mitigation solutions for communities and residents. The TxWRAP portal was utilized to produce the maps found in this profile.

The threat to people and property from a wildfire event is greater in the fringe areas where developed areas meet open grass lands, such as the Functional Wildland Urban Interface (WUI) (Figures 14-1 and 14-3). The Functional WUI is based on a comprehensive building footprint dataset, fire intensity modeling, and a simulation of ember production and transport. The Zones used in the Functional WUI are described below. Critical facilities are only mapped within the Direct Exposure Zone of the WUI, as these structures face the greatest risk from wildfire due to their proximity to flammable vegetation and potential fire pathways.

The **Direct Exposure Zone** is burnable land cover within 75 meters of a structure. Reducing fire intensity and ember production in this zone would reduce the exposure of nearby buildings to heat and embers. Buildings in this zone also require hardening of the structure to resist ignition.

The **Indirect Exposure Zone** is non-burnable land cover within 1,500 meters of burnable land cover that is within 75 meters of a structure, meaning that embers and home-to-home spread could reach within this zone. Indirectly exposed structures would benefit from the hardening of the structure to resist ignition from embers and nearby structures, but defensible space is usually not required due to the heavily developed nature of the zone.

The **Critical Fireshed** is the unpopulated land within about 2.4 kilometers of a group of structures. Fires that originate within or spread to the Critical Fireshed have an immediate threat of reaching the nearby structures; fuel treatments that slow fire spread in this zone can reduce risk to these structures.

The **Sources of Ember Load to Buildings (SELB) Zone** is a critical area or burnable land cover that produces embers capable of reaching nearby buildings. Ember production is a function of fire type and intensity, and ember travel is a function of wind speed and direction. Fuel treatment in this zone is a priority for reducing ember load to the nearby buildings.

The **Little-to-No Exposure Zone** is non-burnable land that is within 75 meters of a structure but greater than 1,500 meters from a large contiguous block of burnable land cover. Flames, even from home-to-home spread, and embers are unlikely to reach the Little-to-No Exposure Zone. However, smoke and evacuations could still impact this area. Support should be given to those most vulnerable in the community. The need for a wildfire evacuation in this zone is unlikely.

Figure 14-1. Wildland Urban Interface Map – City of San Angelo

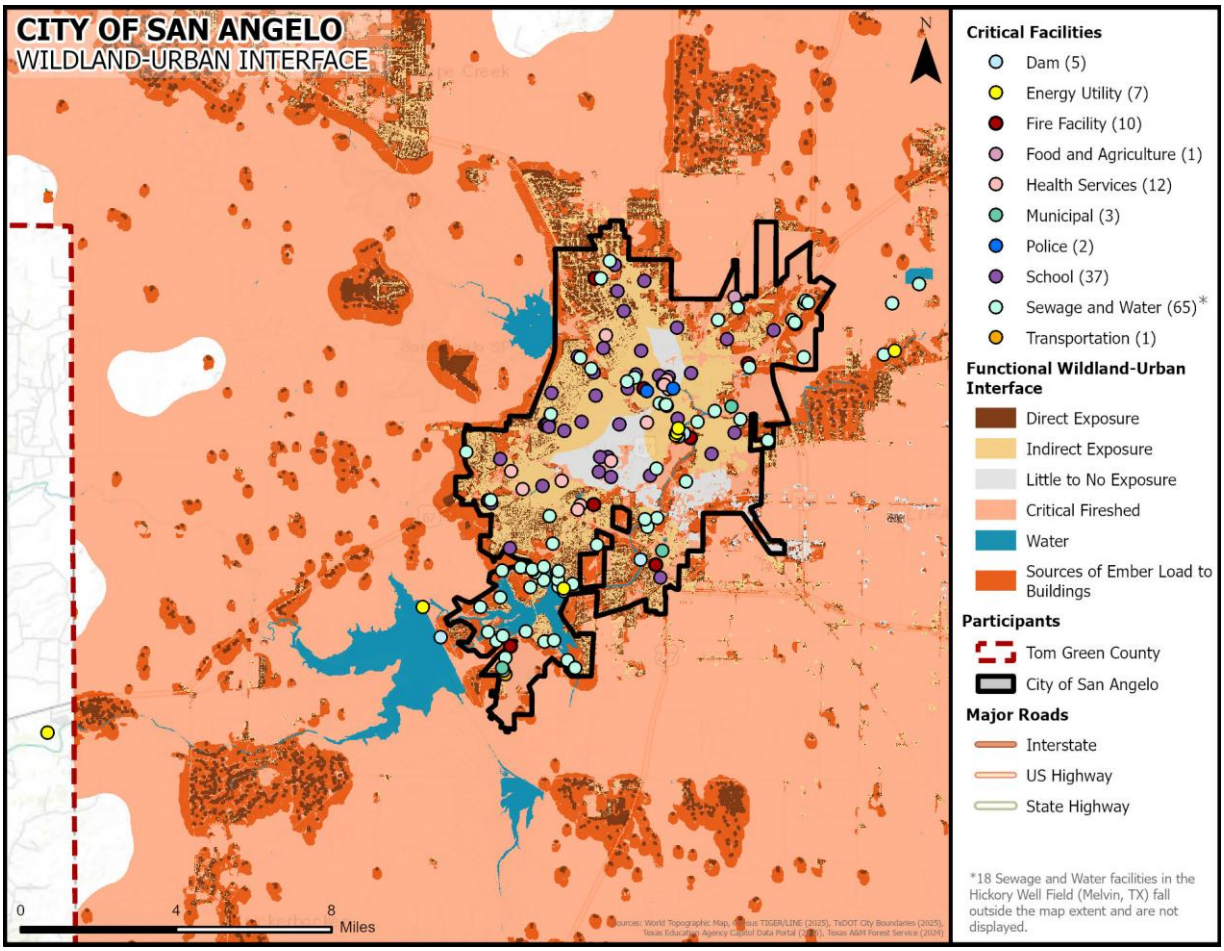


Figure 14-2. Wildland Urban Interface Map – Tom Green County

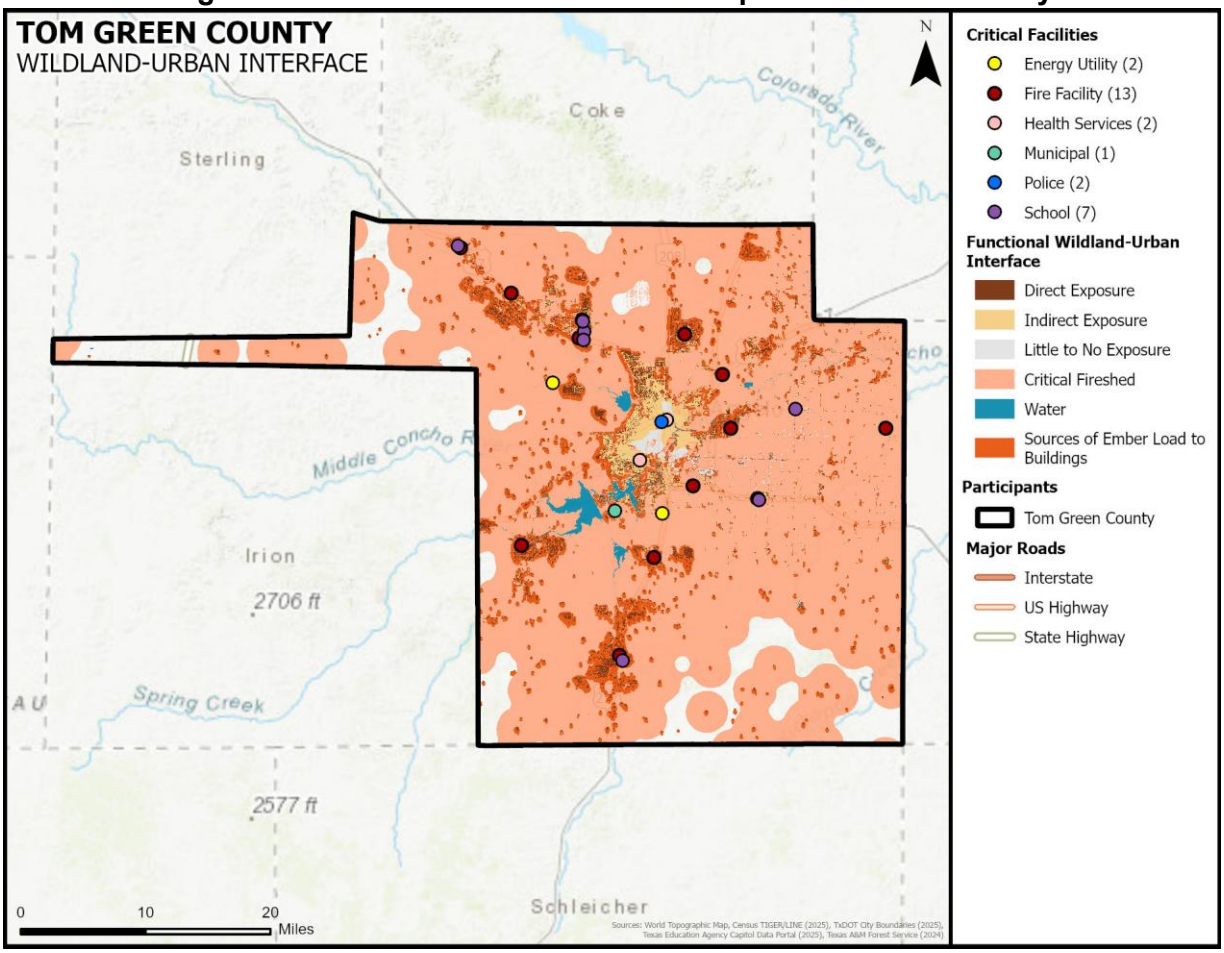
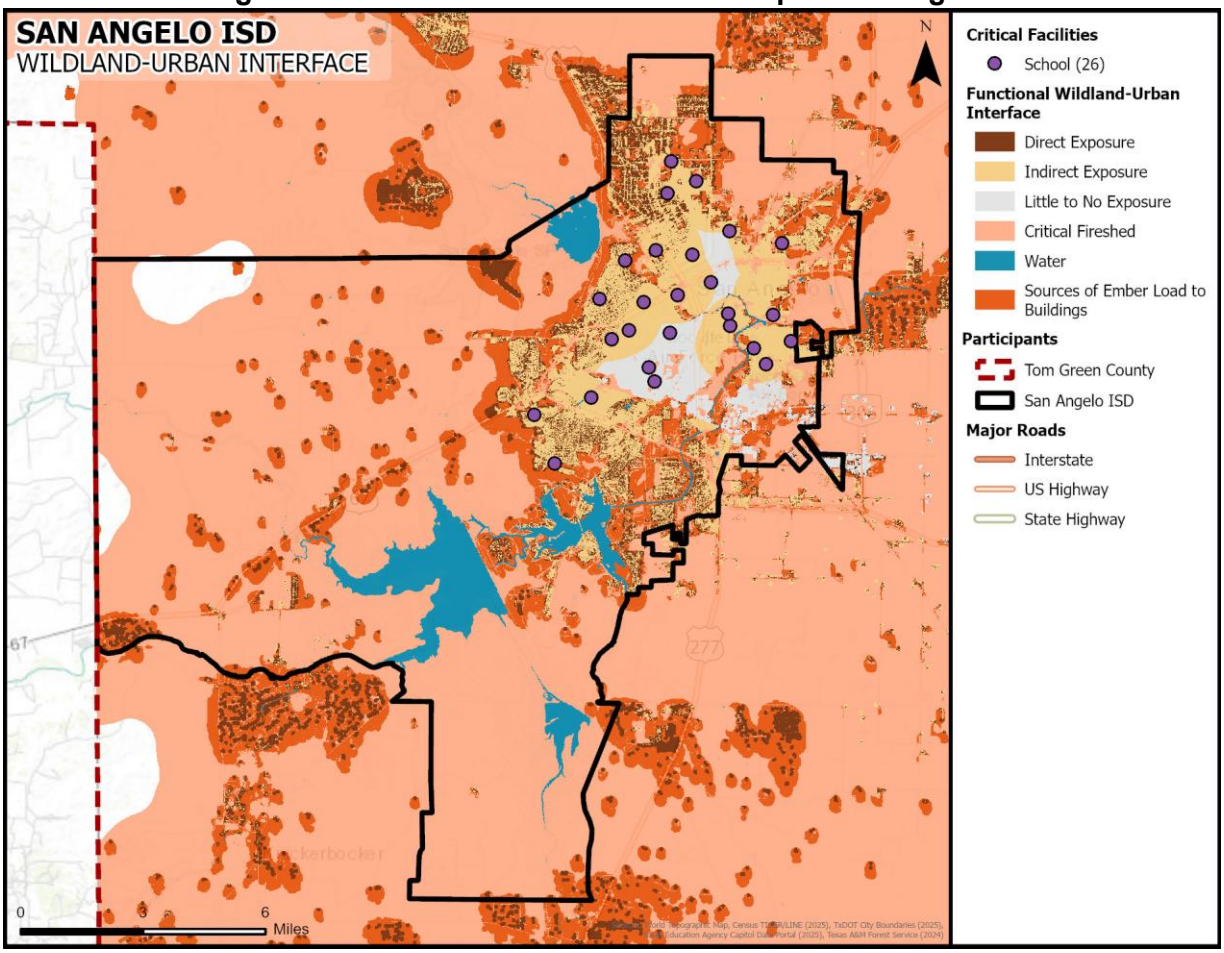


Figure 14-3. Wildland Urban Interface Map – San Angelo ISD



EXTENT

The Texas Forest Service's Fire Intensity Scale (FIS) identifies areas with high fuel hazards and dangerous fire behavior potential. This scale considers fuel conditions along with a range of wind and weather scenarios. These estimates include the contribution of crown fuel and crowning fire intensity. Crown fuels (the branches, leaves, and needles of tall trees) are the primary fuel layer in crown fires, and the intensity of a crown fire is determined by factors like fuel load, moisture content, and wind conditions, leading to rapid fire spread and high temperatures.

The FIS provides a standard scale to measure potential wildfire intensity. The FIS consists of 5 classes where the order of magnitude between classes is ten-fold. The minimum class, Class 1, represents very low wildfire intensities and the maximum class, Class 5, represents very high wildfire intensities. Refer to descriptions below.

Table 14-1. Characteristic Fire Intensity Scale (FIS)

FIS Class	Class Description
Class 1 (Very Low)	Very small, discontinuous flames, usually less than 1 foot in length; very low rate of spread; no spotting. Fires are typically easy to suppress by firefighters with basic training and non-specialized equipment.
Class 2 (Low)	Small flames, usually less than 2 feet long; small amount of very short range spotting possible. Fires are easy to suppress by trained firefighters with protective equipment and specialized tools.
Class 3 (Moderate)	Flames up to 9 feet in length; short-range spotting is possible. Trained firefighters will find these fires difficult to suppress without support from aircraft or engines, but dozer and plows are generally effective. Increasing potential for harm or damage to life and property.
Class 4 (High)	Large Flames, up to 40 feet in length; short-range spotting common; medium range spotting possible. Direct attack by trained firefighters, engines, and dozers is generally ineffective, indirect attack may be effective. Significant potential for harm or damage to life and property.
Class 5 (Very High)	Flames exceed 200 feet in length; expect extreme fire behavior.

The City of San Angelo and Tom Green County planning area is susceptible to wildfires of varying intensities. Figures 14-4 through 14-6 identifies the wildfire intensity for the planning area.

Figure 14-4. Fire Intensity Scale Map – City of San Angelo

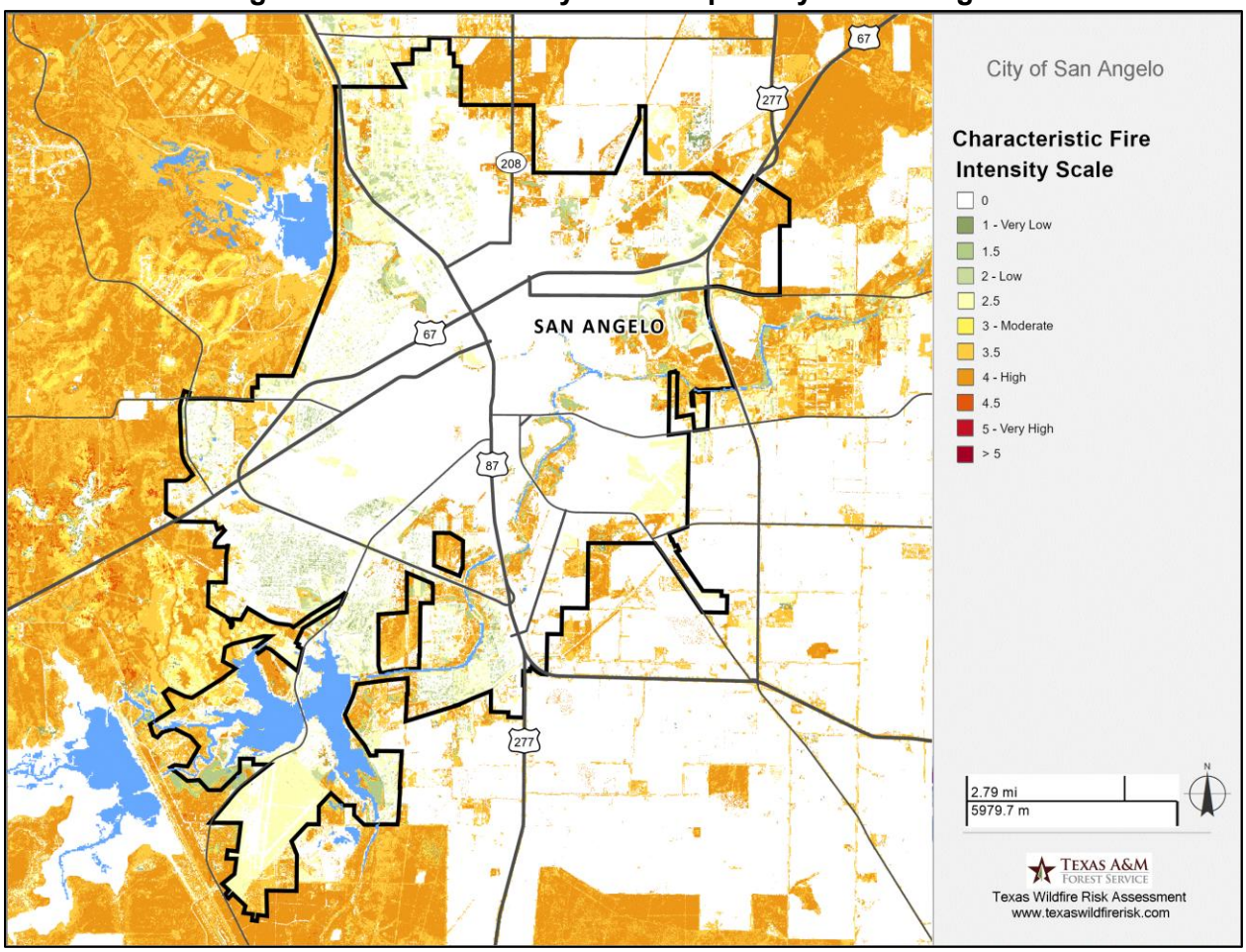


Figure 14-5. Fire Intensity Scale Map – Tom Green County

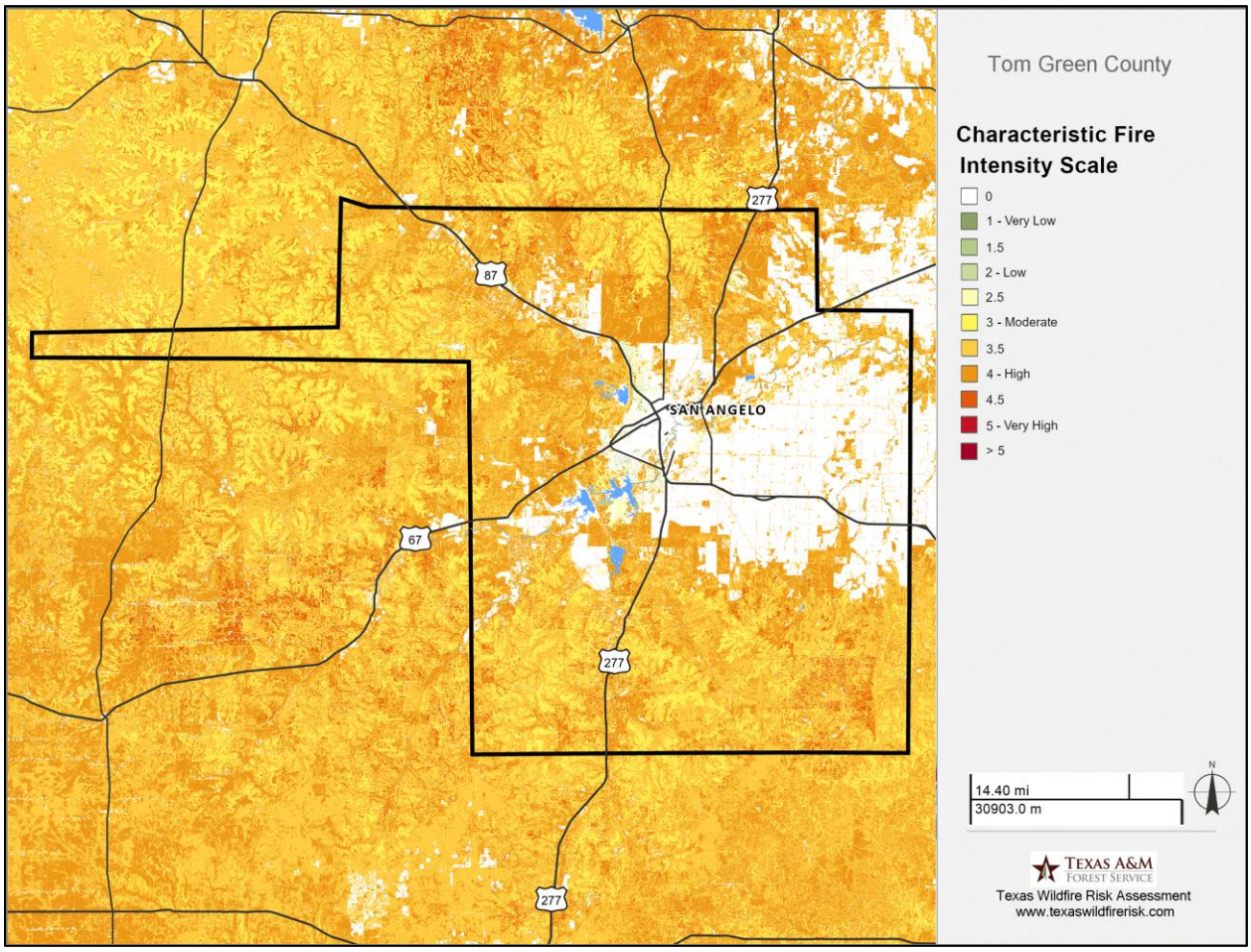
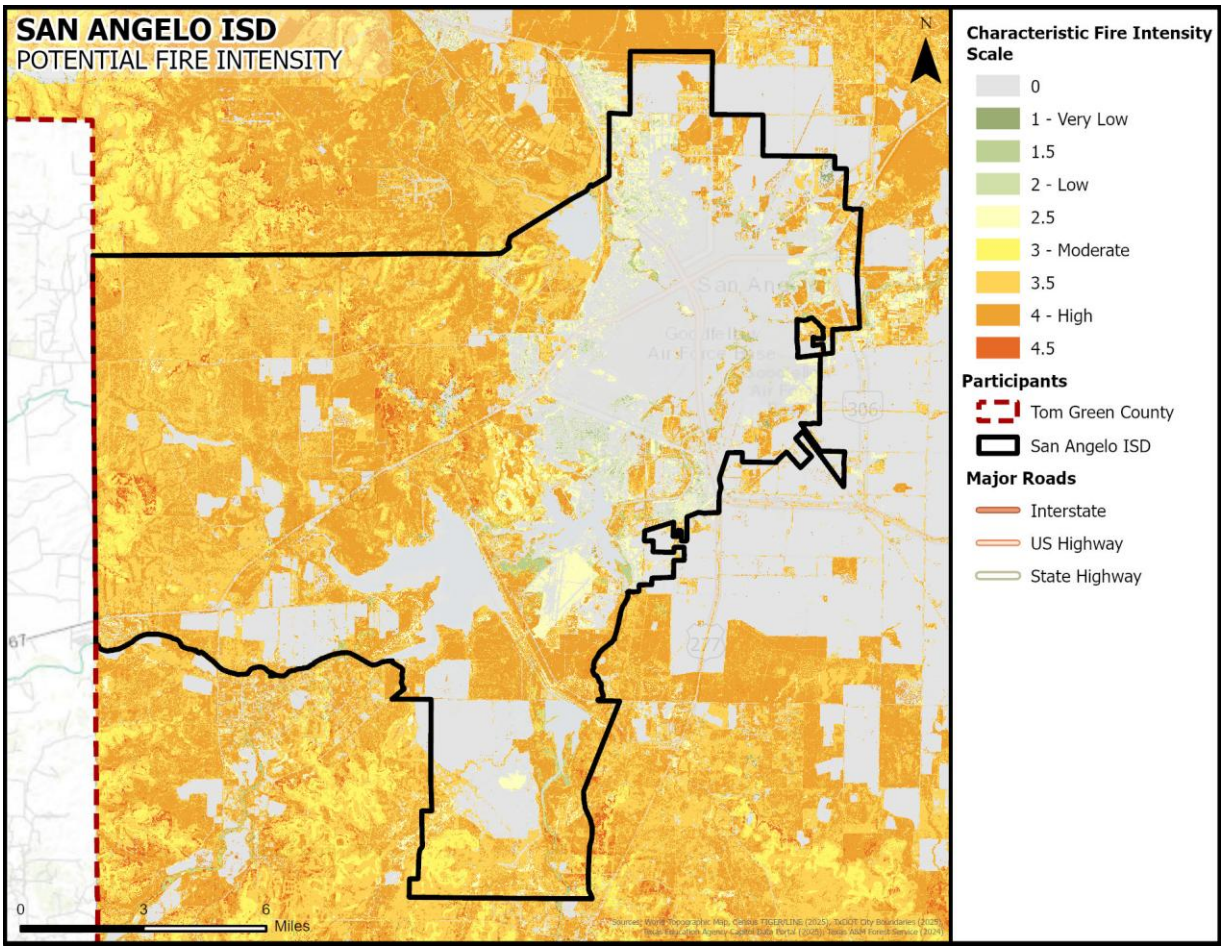


Figure 14-6. Fire Intensity Scale Map – San Angelo ISD



HISTORICAL OCCURRENCES

The National Centers for Environmental Information (NCEI) Storm Events Database includes six recorded wildfire events over the 20-year reporting period. It is assumed that all of these events are accounted for in the TxWRAP data. There are four reported injuries and no fatalities for the events reported in the NCEI. Damages were reported for three of the reported events totaling $489,200 (2026 dollars). Damages are typically not available for the majority of wildfires in the planning area. Therefore, it is assumed that total damages in the planning area are substantially higher.

The Texas A&M Forest Service (TFS) reported 1,271 wildfire events for the City of San Angelo and Tom Green County planning area between 2005 and 2024. The TFS started collecting wildfire reported by volunteer fire departments in 2005. Due to a lack of recorded data for wildfire events prior to 2005 and after 2024, frequency calculations are based on a 20-year reporting period, using only data from recorded years. Tables 14-2 through 14-4 identify the number of wildfires and total acreage burned each year within the county boundaries.

Historical wildfire data for the San Angelo ISD is provided within the reported city and county events as they do not have events reported separately and apart from the events reported to the TFS.

Table 14-2. Historical Wildfire Events Summary, 2005 - 2024[4]

Jurisdiction	Number of Events	Acres Burned
City of San Angelo	56	1,019
Tom Green County	1,271	65,591

Table 14-3. Historical Wildfire Events by Year

Year	City of San Angelo	Tom Green County
2005	1	65
2006	0	151
2007	0	75
2008	0	124
2009	3	147
2010	13	144
2011	11	187
2012	3	71
2013	5	60
2014	6	38
2015	4	37
2016	3	45
2017	0	27
2018	0	7
2019	4	27
2020	1	20
2021	0	4
2022	1	17
2023	0	16
2024	1	9
Totals	**56**	**1,271**

[4] Source: Texas A&M Forest Service

Based on the list of historical wildfire events for the City of San Angelo and Tom Green County planning area (Table 14-2), 182 events have occurred since the 2020 plan.

Table 14-4. Acreage of Suppressed Wildfire by Year

Year	City of San Angelo	Tom Green County
2005	190	1,337
2006	0	6,440
2007	0	652
2008	0	5,391
2009	5	4,025
2010	348	3,714
2011	227	26,912
2012	2	212
2013	4	180
2014	7	37
2015	6	6,844
2016	202	1,749
2017	0	640
2018	0	1,260
2019	23	3,979
2020	2	1,323
2021	0	504
2022	2	183
2023	0	87
2024	1	122
Totals	**1,019**	**65,591**

SIGNIFICANT EVENTS

There have been six declared disasters related to wildfire in City of San Angelo and Tom Green County between 1996 and 2025 (Table 14-5). Additional details on certain wildfire events are described below.

Table 14-5. Disaster Declarations for Wildfire, 1996-2025

Year	Declaration Title	Declaration Type	Disaster No.
1996	Extreme Fire Hazard	EM	EM-3117
1999	Extreme Fire Hazards	EM	EM-3142
2006	Extreme Wildfire Threat	DR	DR-1624
2008	Wildfires	EM	EM-3284
2011	Wildcat Fire	FM	FM-2892
2011	Wildfires	DR	DR-1999

December 3, 2005
The Quail Valley fire broke out just north of San Angelo amid record-high temperatures in the 80s and critically low relative humidity around 8 percent. The blaze destroyed two structures and temporarily closed Highway 277 during the afternoon.

January 19, 2006
A 325-acre wildfire erupted on a ranch just east of Grape Creek, destroying $60,000 worth of water testing equipment.

April 10, 2011
The Wildcat Fire scorched approximately 159,308 acres north of San Angelo, extending into Coke County, and achieved full containment by the end of April. Firefighters successfully protected more than 400 homes, though the blaze threatened communities including Grape Creek, Quail Valley, Bronte, Robert Lee, and Tennyson. It prompted evacuations in areas north of San Angelo and near Robert Lee and destroyed equipment for the San Angelo NOAA Weather Radio transmitter housed in a building.

On Tuesday, April 20th, a massive DC-10 air tanker bolstered the ongoing aerial firefighting efforts, which had started days earlier, by dropping thousands of gallons of retardant in a single pass along the east side of U.S. 277, aiming to halt the fire's eastward advance.

PROBABILITY OF FUTURE EVENTS

Wildfires can occur at any time of the year. As City of San Angelo and Tom Green County communities move into wildland, the potential area of occurrence of wildfire increases. With 1,271 events in a 20-year period, an event within the City of San Angelo and Tom Green County planning area, including all participating jurisdictions, is “Highly Likely”, meaning an event is probable within the next year.

CLIMATE CHANGE CONSIDERATIONS

Wildfires require the alignment of a number of factors, including temperature, humidity, and the lack of moisture in fuels, such as trees, shrubs, grasses, and forest debris. All these factors have strong direct or indirect ties to climate variability and climate change. 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 human-caused climate change have increased aridity of forest fuels during the fire season.[5]

Vapor pressure deficit, an indicator of the ability of moisture to evaporate, is projected to increase as temperatures rise and carbon dioxide fertilization reduces transpiration, leading to both lower humidity and increased surface dryness. Overall, increased dryness should extend the wildfire season in places where the fire season is presently constrained by low levels of aridity, such as eastern Texas.[6]

Additionally, it is projected that future changes to the City of San Angelo and Tom Green County will include increased temperatures, which according to the U.S. Climate Explorer, the planning area may experience a 6°F increase in the average extreme heat temperatures. Historically, extreme temperatures averaged 101°F in City of San Angelo and Tom Green County, but between 2035 and 2064 the average will be 107°F, increasing the severity and frequency of extreme heat events, contributing to favorable wildfire conditions.

Extreme heat and extended periods of drought contribute to wildfire risk in the planning area. Extreme temperatures and periods of drought destroy vegetation in the area, contributing to available fuels that spread wildfires. Additional climate change impacts from drought and extreme heat are discussed in Sections 6 and 8 of this Plan. The projected rise of severity in drought and extreme heat events suggest a growing likelihood of conditions that favor wildfires. Additional information and studies are needed to determine the degree and rate of any increased wildfire risk.

VULNERABILITY AND IMPACT

Periods of drought, dry conditions, high temperatures, and low humidity are factors that contribute to the occurrence of a wildfire event. Less developed areas, such as along interstates or in more remote areas where fuels are more prevalent have an increased risk of being affected by wildfire.

The more heavily populated areas of the planning area are not highly likely to experience large, sweeping fires. Unoccupied buildings and open spaces that have not been maintained have the greatest vulnerability to wildfire. The overall level of concern for wildfires is located across the county where wildland and urban areas interface. Figures 14-8 through 14-10[7] illustrate the areas that are the most vulnerable to wildfire throughout the City of San Angelo and Tom Green County planning area.

The City of San Angelo and Tom Green County Planning Team identified the following critical facilities (Table 14-6) as assets that are considered the most important to the planning area and are susceptible to a range of impacts caused by wildfire events. Critical facilities within the Direct Exposure Zone of the WUI are at the greatest risk from wildfire. For a comprehensive list of critical facilities by participating jurisdiction, please see Appendix D.

[5] NOAA Wildfire Climate Connection, August 2022: wildfire-climate-connection.
[6] Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900-2036, Texas A&M University Office of the Texas State Climatologist, 2021 update.
[7] TxWRAP portal at the following site: https://texaswildfirerisk.com/

Table 14-6. Critical Facilities and Critical Services Vulnerable to Wildfire Events

Critical Facility Type	Critical Facilities at Risk	Potential Impacts
Emergency Response Services (EOC, Fire, Police, EMS), Hospitals and Medical Centers	City of San Angelo: 8 Fire Stations, 1 Emergency Operations Center, 1 Municipal Office Tom Green County: 8 Fire Stations, 1 Emergency Operations Center,	• Emergency services may be disrupted during a wildfire if facilities are impacted, roadways are inaccessible, or personnel are unable to report for duty. • First responders are at greater risk of injury when in close proximity to the hazard while extinguishing flames, protecting property, or evacuating residents in the area. • Critical city departments may not be able to function and provide necessary services depending on the location of the fire and the structures or personnel impacted. • Roadways in or near the WUI could be damaged or closed due to smoke and limited visibility, slowing or preventing access for emergency response vehicles. • Fire suppression costs can be substantial, exhausting the financial resources of the community. • First responders can experience heart disease, respiratory problems, and other long-term related illnesses from prolonged exposure to smoke, chemicals, and heat. • Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications. • Power outages could disrupt communications, delaying emergency response times. • Structures can be damaged or destroyed in the path of the wildfire. • Power outages could disrupt critical care. • Backup power sources could be damaged or destroyed. • Critical staff may be injured or otherwise unable to report for duty, limiting response capabilities.

Critical Facility Type	Critical Facilities at Risk	Potential Impacts
Airport, Academic Institutions, Animal Shelter, Evacuation Centers & Shelters, Governmental Facilities, Residential/ Assisted Living Facilities	City of San Angelo: 2 Early Childhood Education Buildings, 10 Primary and Secondary Schools Tom Green County: 1 Health Center, 5 Primary and Secondary Schools San Angelo ISD: 2 Facility Buildings, 8 Primary and Secondary Schools	• Facilities or infrastructure may be damaged, destroyed or otherwise inaccessible. • Essential supplies like medicines, water, food, and equipment deliveries may be significantly delayed. • Additional emergency responders and critical aid workers may not be able to reach the area for days. • Power outages and infrastructure damage may prevent larger airports from acting as temporary command centers for logistics, communications, and emergency operations.
Commercial Supplier (food, fuel, etc.)	City of San Angelo: 1 Food and Agriculture Building, 1 Airport	• Facilities, infrastructure, or critical equipment including communications may be damaged, destroyed or otherwise inoperable. • Essential supplies like medicines, water, food, and equipment deliveries may be delayed. • Economic disruption due to power outages and fires negatively impact services as well as area businesses reliant on commercial suppliers.
Utility Services and Infrastructure (electric, water, wastewater, communications)	City of San Angelo: 2 Generators, 1 Booster Station, 22 Lift Stations, 4 Water Tanks/Towers, 6 Wells	• Wastewater and drinking water facilities and infrastructure may be damaged or destroyed resulting in service disruption or outage for multiple days or weeks. • Disruptions and outages impact public welfare as safe drinking water is critical. • A break in essential and effective wastewater collection and treatment is a health concern, potentially spreading disease. • Exposure to untreated wastewater is harmful to people and the environment. • Any service disruptions can negatively impact or delay emergency management operations.

Older structures face significantly higher wildfire risks due to combustible building materials (wood shakes, siding), lack of modern fire-rated, non-combustible construction materials, and features that trap embers like open eaves. Older structures often lack automatic sprinkler systems and modern ignition-resistant designs, leading to faster flame spread and higher destruction rates in suburban and historical areas. Manufactured homes are significantly more vulnerable to wildfire due to lighter construction materials and often closer placement of units within communities.

The City of San Angelo and Tom Green County planning area features mobile or manufactured homes throughout the planning area. The U.S. Census data indicates a total of 2,670 (5 percent of total housing stock) manufactured homes located in the planning area. In addition, 50 percent

(25,944 structures) of the housing structures in the planning area were built before 1980 (Table 13-5).

Table 13-5. Structures at Greater Risk by Participating Jurisdiction

Jurisdiction	Structures	
	SFR Built Before 1980	Manufactured Homes
Tom Green County	25,944	2,670
City of San Angelo	23,187	1,154
San Angelo ISD	100	19

Within the City of San Angelo and Tom Green County planning area, including the San Angelo ISD, a total of 1,271 fire events were reported from 2005 through 2024 by Texas A&M Forest Service. All events were suspected wildfires. Historic loss and annualized estimates of acres burned due to wildfires are presented in Table 14-7 below. The average frequency is approximately 63 events every year.

Table 14-7. Average Annualized Acreage Losses[8]

Jurisdiction	Total Acres Burned	Average Annual Acre Losses
City of San Angelo	1,019	51
Tom Green County	65,591	3,280
Totals	**66,610**	**3,331**

Damage Potential provides an index of potential damage to homes from wildfire. It considers factors like flame length and embers lofted from nearby fuel. Damage Potential is a relative index (from low to high), that provides a broad measure of the possible damage from wildfire, based generally on the landscape, rather than specific characteristics of a home or parcel. For planning uses and broad applications, the index is calculated for all areas regardless of whether a structure currently exists at that location. This index does not incorporate a measure of wildfire likelihood.[9] Figures 14-8 through 14-10 show the level of potential damage of wildfires in the City of San Angelo and Tom Green County planning area.

[8] Events divided by 20 years of data.
[9] TxWRAP portal at the following site: https://texaswildfirerisk.com/

Figure 14-8. Damage Potential – City of San Angelo

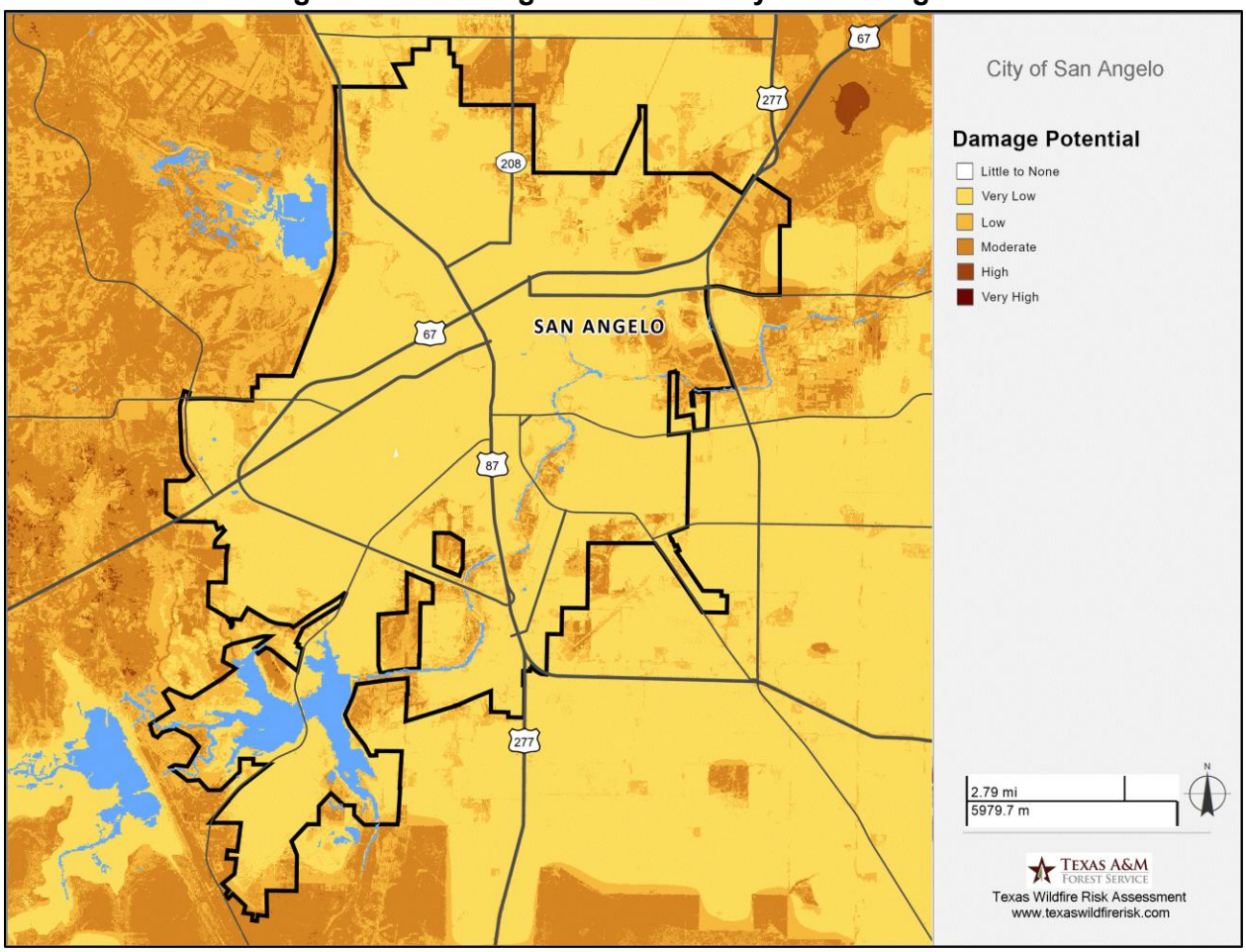


Figure 14-9. Damage Potential – Tom Green County

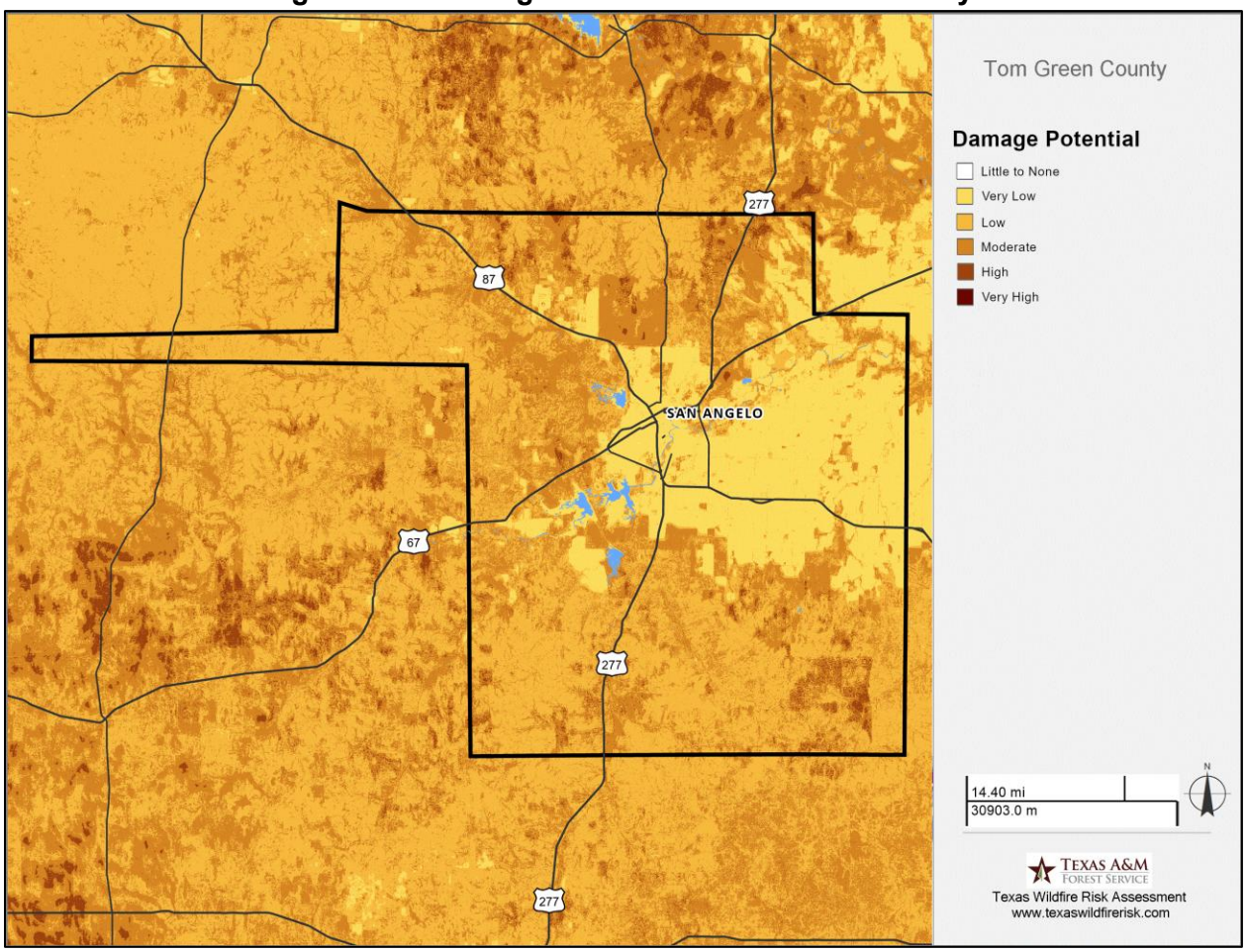
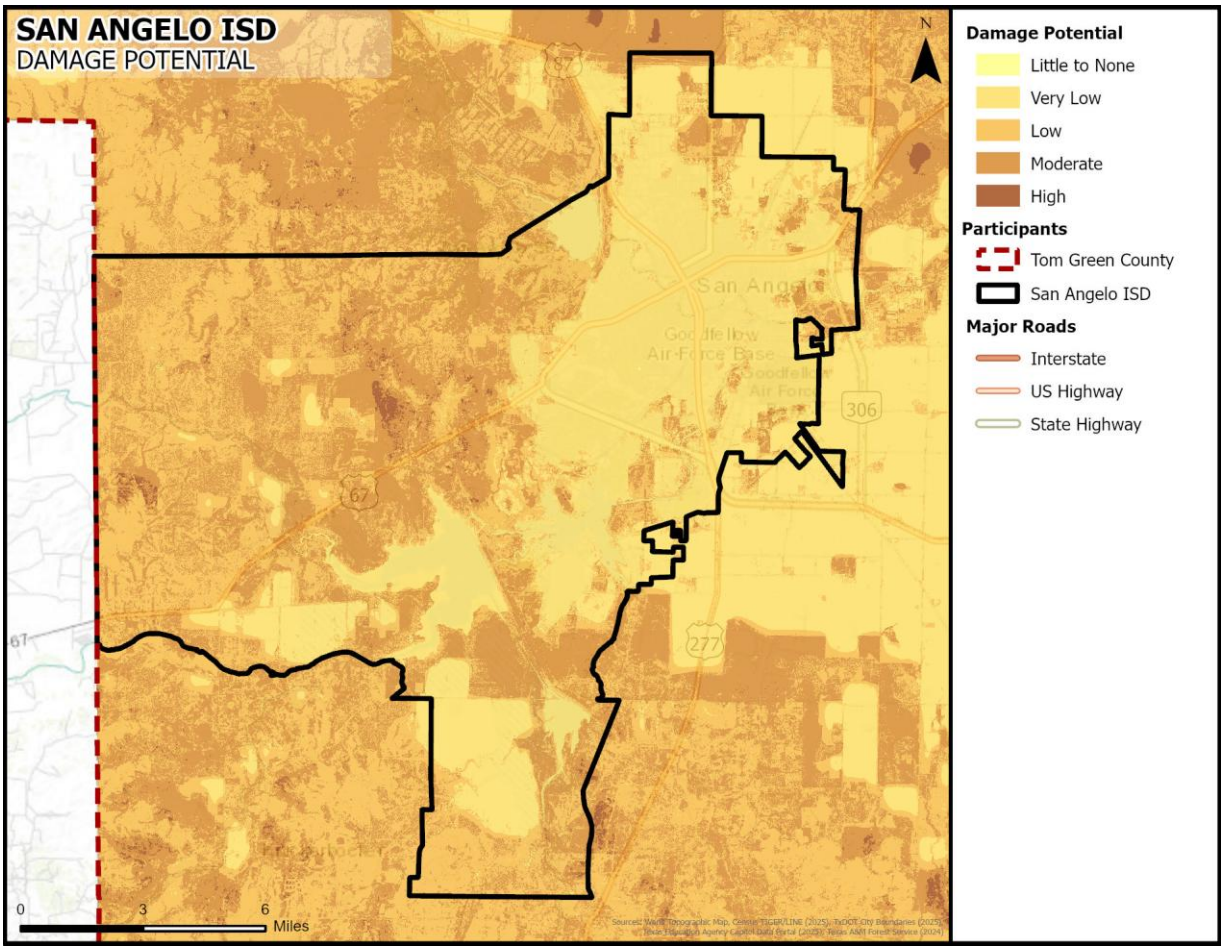


Figure 14-10. Damage Potential – San Angelo ISD



Diminished air quality is an environmental impact that can result from a wildfire event and pose a potential health risk. Wildfire smoke plumes may contain carcinogenic particles that can be inhaled. Fine particles of invisible soot and ash that are too small for the respiratory system to filter can cause immediate and possibly long-term health effects. The elderly or those individuals with compromised respiratory systems may be more vulnerable to the effects of diminished air quality after a wildfire event.

The Center for Disease Control (CDC) created a Social Vulnerability Index (SVI) which includes a database and mapping application that identifies and quantifies communities experiencing social vulnerability. The current CDC SVI uses 16 U.S. census variables from the 5-year American Community Survey (ACS) to identify communities that may need support before, during, or after disasters. All 16 variables fall under four broad categories including socioeconomic status (population in poverty, unemployment, etc.), household characteristics (age, disability status, etc.), racial and ethnic minority status, and housing type and transportation (mobile homes, no vehicles, etc.). Populations experiencing social vulnerability may be adversely impacted by natural hazards, disasters, and other community-level stressors. Figures 14-11 and 14-12 identify areas of social vulnerability using the CDC's SVI and where these areas overlap with the City of San Angelo and Tom Green County WUI areas, where wildfire risk is considered the highest.

Figure 14-11. Tom Green County's Social Vulnerability and WUI

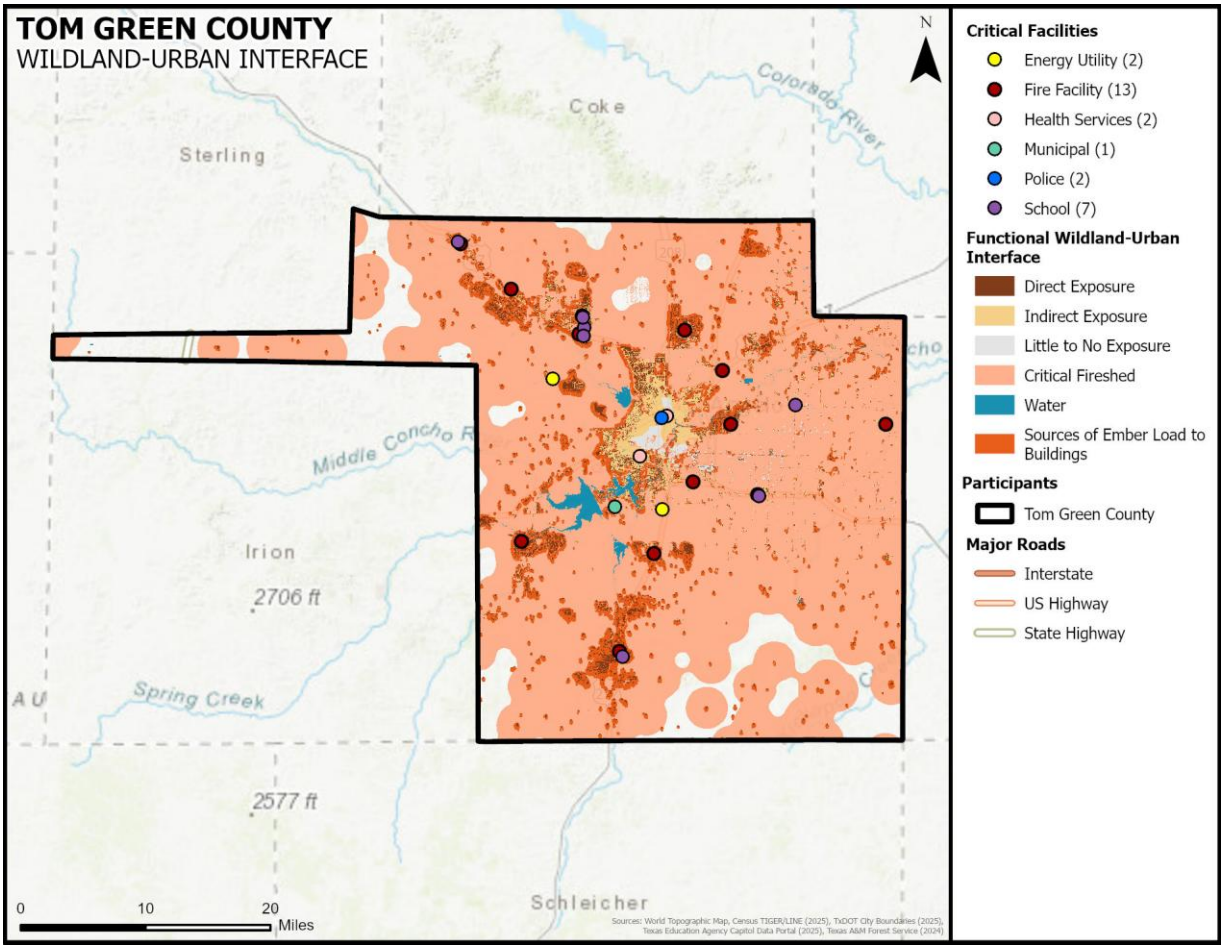
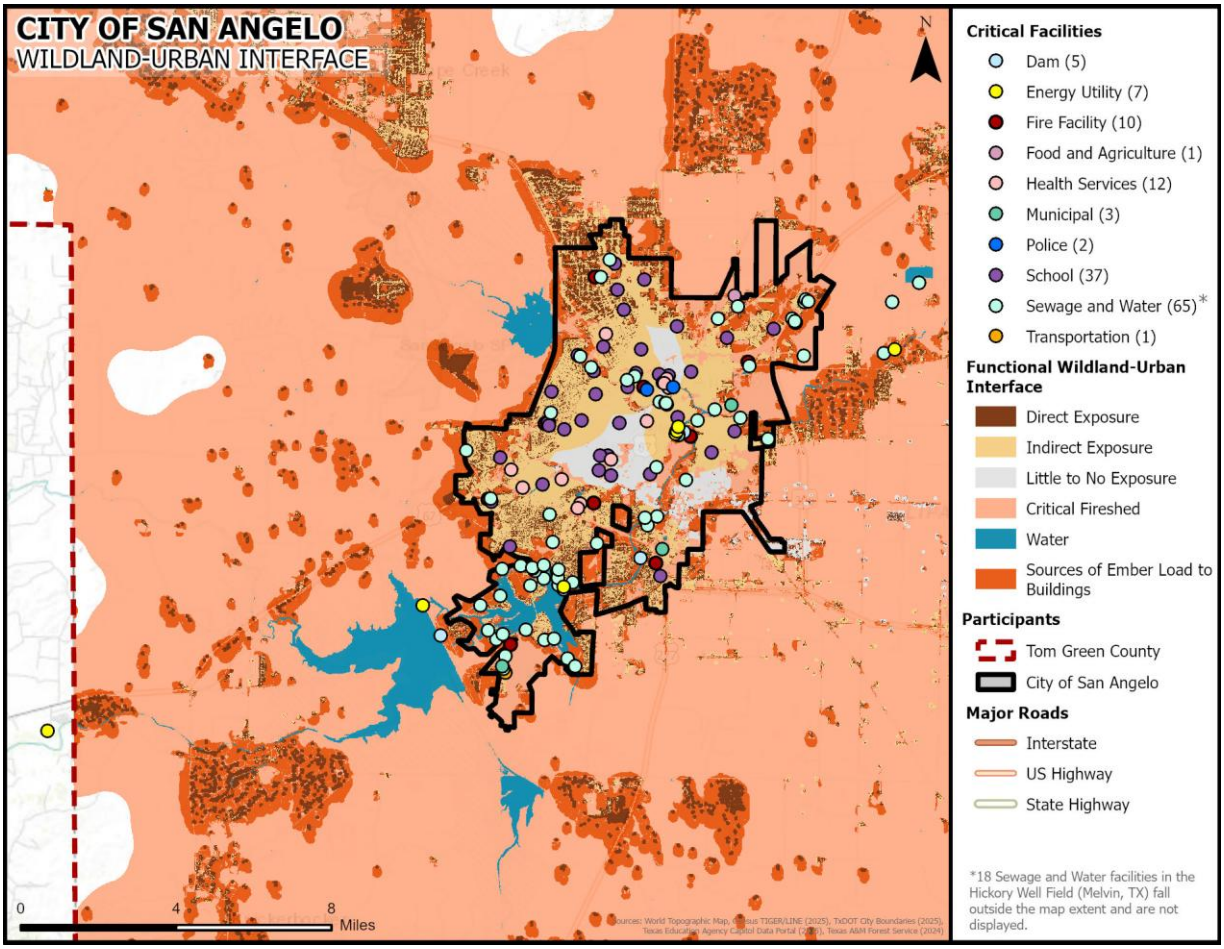


Figure 14-12. City of San Angelo's Social Vulnerability and WUI



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 wildfires. The intensity and rate at which wildfires spread are directly related to wind speed, temperature, and relative humidity.

The impact of a wildfire event for the City of San Angelo and Tom Green County planning area, including the San Angelo ISD, is considered "Limited," meaning injuries and/or illnesses are typically treatable with first-aid, complete shutdown of facilities and services for 24 hours or less and less than 10 percent of property is destroyed or with major damage. The severity of impact is gauged by acreage burned, homes and structures lost, injuries and fatalities.

Table 14-8. Impact for City of San Angelo and Tom Green County

Jurisdiction	Impact	Description
City of San Angelo	Limited	A majority of the city (81 percent) is in the "very low" damage potential category. In addition, 13 percent is in the "low" category, 6 percent is in the "moderate" category, 0 percent is in the "high" category, and 0 percent in the "little to none" category. City residents may suffer injuries that are treatable with first aid. Critical facilities could be shut down for 24 hours, and less than 10 percent of total property could be damaged.
Tom Green County	Limited	A majority of the county (45 percent) is in the "low" damage potential category. In addition, 24 percent is in the "very low" category, 29 percent is in the "moderate" category, and 2 percent are in the "high" category, and 0 percent is in the "little to none" category. County residents may suffer injuries that are treatable with first aid. Critical facilities could be shut down for 24 hours, and less than 10 percent of total property could be damaged.
San Angelo ISD	Limited	A majority of the ISD (38 percent) is in the "very low" damage potential category. In addition, 33 percent is in the "low" category, 28 percent is in the "moderate" category, 1 percent is in the "high" category, and 0 percent is in the "very high" category. Students and faculty may suffer injuries that are treatable with first aid. Critical facilities could be shut down for 24 hours, and less than 10 percent of total property could be damaged.

ASSESSMENT OF IMPACTS

A wildfire event poses a potentially significant risk to public health and safety, particularly if the wildfire is initially unnoticed and spreads quickly. The impacts associated with wildfire are not limited to direct damage. Significant wildfire events can be frequently associated with a variety of impacts, including:

- The City of San Angelo and Tom Green County planning area contains numerous open space areas. Wildfire may adversely affect or destroy endangered species' habitat, reduce air quality, increase erosion and risk of flash flooding, contribute to increased local temperatures, and disrupt other ecological functions.
- Recreation activities throughout the county and city parks may be unavailable and tourism can be unappealing for years following a large wildfire event, devastating directly related local businesses and negatively impacting economic recovery.
- Persons, pets, and wildlife in the area at the time of the fire are at risk for injury or death from burns and/or smoke inhalation. First responders are at greater risk of physical injury when in close proximity to the hazard while extinguishing flames, protecting property, or evacuating residents in the area.

- First responders can experience heart disease, respiratory problems, and other long-term related illnesses from prolonged exposure to smoke, chemicals, and heat.
- Emergency services may be disrupted during a wildfire if facilities are impacted, roadways are inaccessible, or personnel are unable to report for duty.
- Critical county and city departments may not be able to function and provide necessary services depending on the location of the fire and the structures or personnel impacted.
- Non-critical businesses may be directly damaged, suffer loss of utility services, or be otherwise inaccessible, delaying normal operations and slowing the recovery process.
- Displaced residents may not be able to immediately return to work, slowing economic recovery.
- Roadways in or near the WUI could be damaged or closed due to smoke and limited visibility.
- Some high-density neighborhoods feature small lots with structures close together, increasing the potential for fire to spread rapidly.
- Air pollution from smoke may exacerbate respiratory problems of vulnerable residents.
- Charred ground after a wildfire cannot easily absorb rainwater, increasing the risk of flooding and potential mudflows.
- Wildlife may be displaced or destroyed.
- Historical or cultural resources may be damaged or destroyed.
- Tourism can be significantly disrupted, further delaying economic recovery for the area.
- Economic disruption negatively impacts the programs and services provided by the community due to short- and long-term loss in revenue.
- Fire suppression costs can be substantial, exhausting the financial resources of the community.
- Residential structures lost in wildfire may not be rebuilt for years, reducing the tax base for the community.
- Direct impacts to municipal water supply may occur through contamination of ash and debris during the fire, destruction of aboveground delivery lines, and soil erosion or debris deposits into waterways after the fire.

The economic and financial impacts of a wildfire event on local government will depend on the scale of the event, what is damaged, costs of repair or replacement, lost business days in impacted areas, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by the community, local businesses, and citizens will contribute to the overall economic and financial conditions in the aftermath of a wildfire event.

Section 15
Winter Storm

SECTION 15: WINTER STORM

HAZARD DESCRIPTION

A severe winter storm event is identified as a storm with snow, ice, or freezing rain, typically combined with strong winds and cold temperatures. Wind chill, a function of temperature and wind, is the "feels like" temperature, representing the rate of heat loss from exposed skin due to combined cold and wind, rather than just the actual temperature alone. It serves as a vital indicator of health risks, as higher wind speeds accelerate body heat loss, significantly increasing the danger of frostbite and hypothermia.

Winter storms can cause significant problems including widespread power outages, hazardous travel conditions, and damage from falling trees or limbs. Winter weather that threatens the City of San Angelo and Tom Green County planning area usually begins as powerful cold fronts that push south from central Canada. This can cause a rapid temperature drop, occasionally plunging temperatures below freezing. This transition is frequently accompanied by cold, heavy rain that can occasionally be followed by risks like freezing rain, sleet, and ice accumulation.

The City of San Angelo and Tom Green County is located in an area that experiences 50 or fewer days of below freezing temperatures per year. The planning area is subject to a variety of winter weather including wind chill, frost, below freezing temperatures, freezing rain, sleet, and snow. Winters are generally short, mild to cool, dry, windy, and temperate, with average highs in the low-to-mid 60s°F and lows in the 30s°F. Rain is common, while freezing temperatures and snow are less common.

As indicated in Figure 15-1, the City of San Angelo and the Tom Green County planning area is located in USDA Hardiness Zone 8a, indicating annual minimum temperatures between 10°F and 15°F. During times of ice and snow accumulation, response times will increase until public works road crews are able to make major roads passable. Table 15-1 describes the types of winter weather possible to occur in the City of San Angelo and the Tom Green County planning area.

Figure 15-1. Annual Minimum Temperature[1]

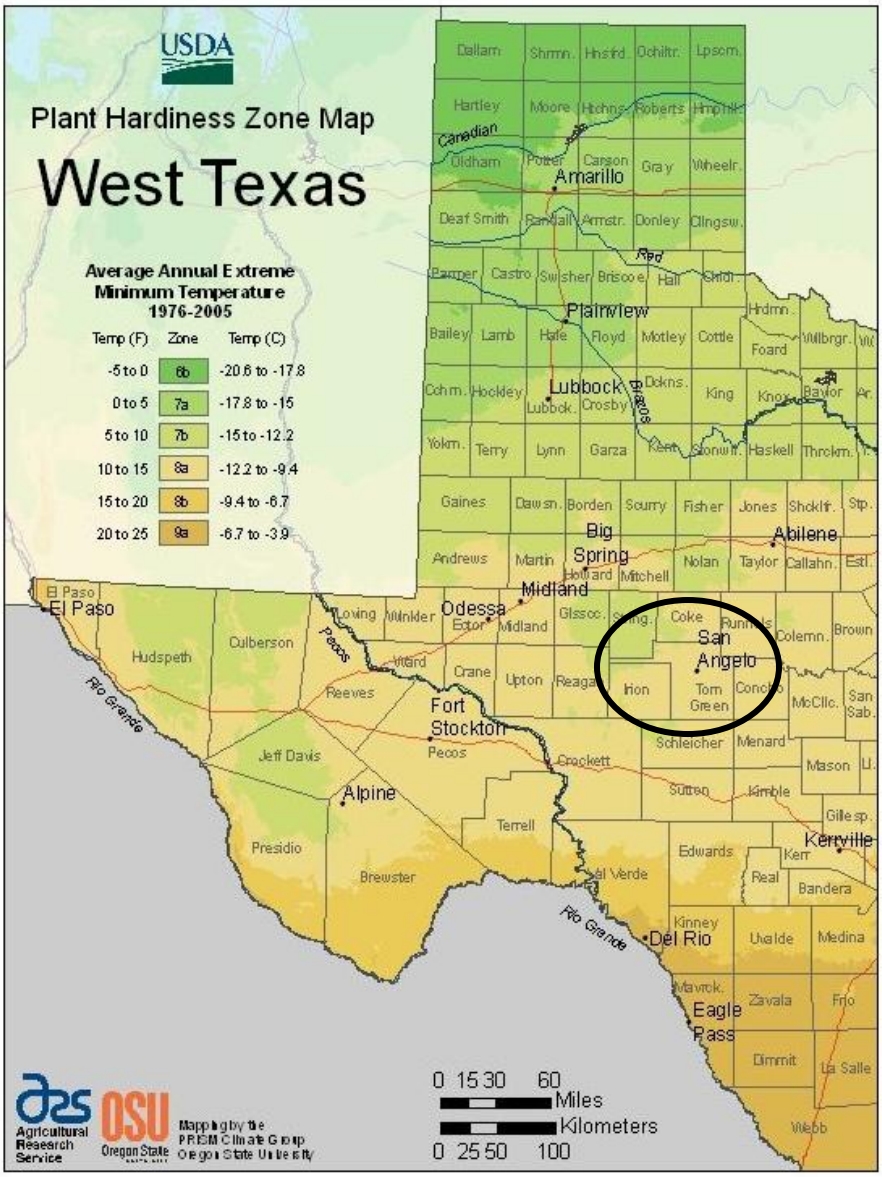


Table 15-1. Types of Winter Weather

Type of Winter Weather	Description
Freezing Rain or Freezing Drizzle	Rain or drizzle is likely to freeze upon impact, resulting in a coating of ice glaze on roads and all other exposed objects.
Sleet	Small particles of ice usually mixed with rain. If enough sleet accumulates on the ground, it makes travel hazardous.

[1] Source: USDA

Type of Winter Weather	Description
Blizzard	Sustained wind speeds of at least 35 mph are accompanied by considerable falling or blowing snow. This alert is the most perilous winter storm with visibility dangerously restricted.
Frost / Freeze	Below freezing temperatures are expected and may cause significant damage to plants, crops, and fruit trees.
Wind Chill	A strong wind combined with a temperature slightly below freezing can have the same chilling effect as a temperature nearly 50 degrees lower in a calm atmosphere. The combined cooling power of the wind and temperature on exposed flesh is called the wind-chill factor.

The City of San Angelo coordinates and promotes warming shelters during winter storm events. The primary facility is operated by the Salvation Army. The shelter is activated when temperatures are 35 degrees or lower. They offer overnight emergency sheltering and daytime warming centers. While the City and County do not run the warming shelters, they support local agencies including the Salvation Army and the Concho Valley Homeless Planning Coalition (CVCAA) that assist with services in the community.[2]

LOCATION

Winter storm events are not confined to specific geographic boundaries. Therefore, all existing and future buildings, facilities, and populations in the City of San Angelo and Tom Green County planning area, including San Angelo ISD, are vulnerable to winter weather hazards and could potentially be impacted.

EXTENT

The extent or magnitude of a severe winter storm is measured in intensity based on the temperature and level of accumulations as shown in Table 15-2.

Table 15-2. Magnitude of Severe Winter Storms

Intensity	Temperature Range (Fahrenheit)	Extent Description
Mild	40° – 50°	Winds less than 10 mph and freezing rain or light snow falling for short durations with little or no accumulations
Moderate	30° – 40°	Winds 10 – 15 mph and sleet and/or snow up to 4 inches
Significant	25° – 30°	Intense snow showers accompanied with strong gusty winds between 15 and 20 mph with significant accumulation
Extreme	20° – 25°	Wind driven snow that reduces visibility, heavy winds (between 20 to 30 mph), and sleet or ice up to 5 millimeters in diameter

[2] Source: https://www.sanangelo.gov/345/Warming-Shelter-Information

Intensity	Temperature Range (Fahrenheit)	Extent Description
Severe	Below 20°	Winds of 35 mph or more and snow and sleet greater than 4 inches

The City of San Angelo and Tom Green County planning area, including San Angelo ISD, have experienced all categories of winter storm intensity. Typical winter storm conditions in the planning area involve short term events with freezing rain, sleet, and sometimes light snow, with temperatures dropping into the 20s or low 30s°F. The greatest single day snowfall on record in Tom Green County was 13.0 inches, which occurred on February 25, 1924.[3] During a heavy snow event in November 2001, Tom Green County reported another instance of heavy snow, receiving up to 10 inches in some locations.

HISTORICAL OCCURRENCES

The National Centers for Environmental Information (NCEI) is a national data source organized under the National Oceanic and Atmospheric Administration and considered a reliable resource for historical event data. Winter storm data is provided at the county level only. According to historical NCEI records and information from the planning team, there have been 53 winter weather events in the City of San Angelo and Tom Green County planning area since 1996 (Table 15-3).

Historical winter storm event data for the San Angelo Independent School District (ISD) is provided within the Tom Green County events. In the NCEI database, these entities do not have events reported separate and apart from the reported county events. The ISD reported that several minor injuries have occurred from slipping on icy surfaces at their facilities during winter storms, they are reported as injuries on January 12, 2021, and February 18, 2021. No other impacts were reported by the ISD.

Table 15-3. Historical Winter Storm Events, 1996 – 2025[4]

Jurisdiction	Date	Deaths	Injuries	Property Damage	Crop Damage
Tom Green County	11/24/1996	0	0	$408,600	$408,600
Tom Green County	11/7/2000	0	0	$9,400	$0
Tom Green County	1/13/2007	0	0	$48,100	$0
Tom Green County	1/16/2007	0	0	$12,900	$0
Tom Green County	4/7/2007	0	0	$94,100	$47,100
Tom Green County	12/26/2017	0	0	$39,500	$0
Tom Green County/ San Angelo ISD	1/21/2021	0	1	$0	$0

[3] Source: NCEI. https://www.ncei.noaa.gov/access/monitoring/snowfall-extremes/TX
[4] Note: Monetary damages have been inflated to their 2026 value. Only events with injuries, fatalities, and/or damages have been included in the table.

Jurisdiction	Date	Deaths	Injuries	Property Damage	Crop Damage
Tom Green County	2/10/2021	1	0	$74,000	$0
Tom Green County/ San Angelo ISD	2/18/2021	0	1	$0	$0
Totals		**1**	**2**	**$1,142,300**	

Table 15-4. Historical Winter Storm Events Summary, 1996 – 2025

Jurisdiction	Number of Events	Deaths	Injuries	Property Damage	Crop Damage
Tom Green County	53	1	2	$686,600	$455,700

Eleven events have occurred since the 2020 Plan.

SIGNIFICANT EVENTS

January 13, 2007

An arctic cold front passed through West Central Texas on Friday the 12th, followed by light freezing rain and drizzle as temperatures rapidly fell below freezing. The freezing rain gradually shifted southward, spreading across all of West Central Texas by Sunday the 14th. Ice accumulations of up to two inches were reported along and north of Interstate 20, while amounts ranging from one-quarter to one-half inch were observed between Highway 87 and I-20 across the Heartland and northern Concho Valley. Approximately one-quarter inch of ice was reported between the Interstate 10 corridor and Highway 87.

A few power outages occurred across the western Big Country, and numerous traffic accidents were reported throughout the region. As the ice storm began to subside Sunday evening, the weight of the ice caused an Abilene television transmitter tower to collapse, also destroying a National Weather Service weather radio antenna mounted on the structure.

January 16, 2007

Following closely behind the ice storm that affected the region just days earlier, another surge of arctic air moved into West Central Texas on Monday the 15th. With an active subtropical jet overhead and multiple disturbances moving through it, snow began falling Tuesday morning, January 16th, across the northern Edwards Plateau and along the Interstate 10 corridor. The snowfall then spread north and east into the Concho Valley, including the City of San Angelo, before expanding northeast into the northwest Hill Country and reaching Coleman and Brownwood by Tuesday afternoon. Early Wednesday morning, snow spread across the Interstate 20 corridor into the southern Big Country.

Snowfall began to taper off early Wednesday morning from northwest to southeast. The heaviest accumulations occurred along and south of Interstate 10, where totals ranged from 4 to 8 inches. Farther north, snowfall amounts ranged from a trace to one inch along Interstate 20, with 1 to 3 inches measured between the I-20 and I-10 corridors. The heavy snow forced the closure of Interstate 10 between Junction and Ozona for two days. Elsewhere, many roads were covered with ice and snow, prompting numerous school districts to delay or cancel classes on Wednesday

the 17th. Ozona Emergency Management opened a shelter at the Ozona Convention Center for stranded motorists, and the ice and snow caused a few power outages in the Sweetwater area.

December 26, 2017
A motorist was killed after his vehicle struck a patch of ice and rolled several times in the 1300 block of the North Loop 306 ramp, just north of Pulliam Street. Patchy ice led to multiple crashes, particularly along Loop 306 in San Angelo.

Elsewhere across West Central Texas, light freezing rain, sleet, and freezing drizzle created hazardous travel conditions on the morning of December 27th, resulting in several fatalities. According to the Texas Department of Transportation, roadways became icy across the western half of the region, especially along and west of U.S. Highway 83.

February 10-14, 2021 – Winter Storm Uri (DR-4586)
Winter Storm Uri was one of the most impactful winter events in the state's history. The winter storm event lasted a week and brought snow, sleet, and freezing rain to much of the State of Texas. The presence of the storm began on February 10, 2021, when a cold front brought a surge of cold air to the Area. On February 13th, the winter storm hit the region, including Tom Green County, and many areas were placed under a Winter Storm Warning.

Fatalities across the state were attributed to hypothermia, vehicle accidents, carbon monoxide poisoning, and chronic medical conditions complicated by a lack of electricity over several days. Statewide, more than 69 percent of households lost power at some point during the event, with average disruptions lasting 42 hours. Water service was also disrupted, with 49 percent of households losing running water with an average disruption of 52 hours.[5]

In the City of San Angelo and Tom Green County the roads were coated with a glaze of ice, creating dangerous travel conditions. On February 11th, an 84-year-old man lost control of his vehicle on the icy roadway and rolled his truck and trailer into a ditch along U.S. Highway 87 near Carlsbad around 11:00 a.m. He was pronounced dead at the scene. The City of San Angelo and Tom Green County planning area also experienced widespread power and water service interruptions as well as significant damage to roads and water infrastructure.[6]

CLIMATE CHANGE CONSIDERATIONS

While winter weather events will still occur, climate change is expected to cause milder winters and less frequent winter weather events in the City of San Angelo and Tom Green County region.[7]

PROBABILITY OF FUTURE EVENTS

According to historical records, the City of San Angelo and Tom Greeen County planning area has experienced 53 winter weather events over a 29.5-year reporting period. The probability of a future winter weather event affecting the City of San Angelo and Tom Green County planning

[5] Source: Donald, Jess. "Winter Storm Uri. The Economic Impact of the Storm." October 2021. Fiscal Notes. Texas Comptroller of Public Accounts. https://comptroller.texas.gov/economy/fiscal-notes/2021/oct/winter-storm-impact.php
[6] Source: https://www.gosanangelo.com/story/news/2021/02/19/contaminated-water-winter-storm-declared-disasters-san-angelo/4507086001/?gnt-cfr=1&gca-cat=p&gca-uir=true&gca-epti=z11xx09d00----v11xx09d--xx--b--xx--&gca-ft=206&gca-ds=sophi
[7] Fourth National Climate Assessment. Chapter 23 Southern Great Plans. U.S. Global Change Program. 2018.

area, including the San Angelo ISD, is considered “Highly Likely,” with a winter storm event probable within the next year.

VULNERABILITY AND IMPACT

Severe winter weather is relatively rare for the City of San Angelo and Tom Green County. Aging infrastructure in the planning area was not designed for freezing temperatures. Older buildings, homes and pipes often lack insulation leading to damaged pipes and water damages. Freezing rain and ice accumulation can damage trees and, subsequently, power lines, leading to prolonged power outages. Elevated roads, bridges, and interchanges, particularly on Loop 306, are prone to icing, causing a shutdown of critical transit systems.

The City of San Angelo and Tom Green County, as well as surrounding areas in Texas have faced significant power grid strain and outages during severe winter weather events like Winter Storm Uri, which prompted emergency measures. The regional grid operator, Electric Reliability Council of Texas (ERCOT) directed local suppliers to implement "load shedding" or rolling blackouts to prevent more extensive, prolonged grid failure during the extreme demand of Winter Storm Uri. ERCOT is an independent system operator and reliability coordinator for about 90 percent of Texas. They monitor the grid in real time and when reserves critically low they can declare emergencies to shed a specific amount of load.

Due to the relative infrequency of winter storms, the City of San Angelo and Tom Green County does not have the capabilities (such as snowplows and material spreaders) necessary to respond to a significant winter storm, requiring expensive outsourcing for plowing or de-icing of the roads. During previous winter storm events the City and County use public works to pretreat the roads and work with TxDOT for state highways and interstates to prepare the planning area for winter storm conditions.

Additional economic impacts may occur during extreme winter weather due to increased consumption of heating fuel, which can lead to a spike in billing and a strain on residents. House fires and resulting deaths tend to occur more frequently from increased and improper use of alternate heating sources. Fires during winter weather events also present a greater danger because water supplies may freeze or water pressure may drop and impede firefighting efforts.

The City of San Angelo and Tom Green County Planning Team identified the following critical facilities (Table 15-5) as assets that are considered the most important to the planning area and are susceptible to a range of impacts caused by winter weather events. For a comprehensive list of critical facilities for each participant, please see Appendix D.

Table 15-5. Critical Facilities Vulnerable to Winter Storm Events

Critical Facility Type	Potential Impacts
Emergency Response Services (EOC, Fire, Police, EMS), Hospitals and Medical Centers	• Emergency operations, services and response times may be significantly impacted due to power outages, and/or loss of communications. • Roads may become impassable due to snow and/or ice impacting response times by emergency services
Airport, Academic Institutions, Animal Shelter, Evacuation	• Power outages could disrupt critical care. • Water pipes can freeze and burst leading to flooding within facilities.

Critical Facility Type	Potential Impacts
Centers and Shelters, Governmental Facilities, Residential/ Assisted Living Facilities	• Facilities, infrastructure, or critical equipment including communications may be damaged, destroyed or otherwise inoperable. • Economic disruption due to power outages negatively impacts airport services as well as area businesses reliant on airport operations. • Increased exposure risks for outdoor workers.
Commercial Supplier (food, fuel, etc.)	• Facilities, infrastructure, or critical equipment, including communications may be damaged, destroyed, or otherwise inoperable. • Essential supplies like medicines, water, food, and equipment deliveries may be delayed.
Utility Services and Infrastructure (electric, water, wastewater, communications)	• Utility operations, services and response times may be significantly impacted due to power outages, and/or loss of communications. • Roads may become impassable due to snow and/or ice impacting response times by emergency services. • Power outages could disrupt critical care. • Water pipes can freeze and burst leading to flooding within facilities.

Vulnerable populations are subject to health risks from extended exposure to cold air (Table 15-6). Elderly people are at greater risk of death from hypothermia, especially in neighborhoods with older housing stock. Disabled populations may face challenges due to factors like limited mobility, medical needs, or transportation challenges and may not be able to access appropriate sheltering to meet their functional needs. Inclusive measures are crucial to address these vulnerabilities and ensure their safety during severe weather events.

Substandard housing and older infrastructure make low-income residents more susceptible to winter storm impacts. Poor insulation is a significant contributor to the City of San Angelo and Tom Green County planning area having a high energy burden. In addition, people who speak a language other than English may face increased vulnerability due to language barriers that limit their access to important information such as weather-related warnings and instructions regarding safety measures.

The population over 65 in the City of San Angelo and Tom Green County planning area is estimated at 17 percent of the total population and children under the age of 5 are estimated at 6 percent. The population with a disability is estimated at 15 percent of the total population. An estimated 11 percent of the planning area population live below the poverty level and 5 percent of the populations speak English ‘less than very well’ (Table 15-6).

Table 15-6. Populations at Greater Risk of Winter Storm Events[8]

Jurisdiction	Population				
	65 and Older	Under 5	With a Disability	Below Poverty Level	Limited English Speaking
City of San Angelo	16,795	5,905	14,943	10,964	5,245
Tom Green County	20,295	7,368	17,826	13,273	6,329

The ISD also has vulnerable populations based on work location, as those working outdoors would be subject to greater winter storm risk if working outdoors during winter storms (Table 15-7).

Table 15-7. Populations at Greater Risk by Special District

Independent School District	Population
	Works Outdoors
San Angelo ISD	126

Older homes tend to be more vulnerable to the impacts of winter weather events. Homes built before 1980 are generally more vulnerable to winter storm damage because they were constructed before modern energy codes, insulation standards, and wind-resistance requirements became mandatory. These older homes frequently lack sufficient insulation, feature single-pane windows, and have outdated plumbing and electrical systems that cannot handle the stress of extreme cold or power outages. Approximately 50 percent (an estimated 25,944 structures) of the housing units in the planning area were built before 1980 (Table 15-8).

Table 15-8. Structures at Greater Risk of Winter Storm Events

Jurisdiction	Structures
	SFR Built Before 1980
City of San Angelo	23,187
Tom Green County	25,944
San Angelo Independent School District	100

Winter weather has been known to cause injury to humans and occasionally has been fatal; two injuries and one fatality have resulted from winter weather in the City of San Angelo and Tom Green County historically. Overall, the total loss estimate of property and crops in the planning area is $1,142,300 (in 2025 dollars) with an average annualized loss of $38,700. Based on historic loss and damages to the built environment, the impact of winter weather events on the City of

[8] Source: U.S. Census Bureau 2023 data for Tom Green County

San Angelo and Tom Green County planning area would be considered limited, meaning critical facilities and services shut down for 24 hours or less, and less than 10 percent of property destroyed or with major damage. However, with multiple historical injuries and one fatality, the winter storm severity of impact for the City of San Angelo and Tom Green planning area is considered "Substantial," meaning multiple fatalities are possible depending on the extent and duration of the event.

Table 15-9. Winter Storm Event Damage Totals, 1996 – 2025

Jurisdiction	Total Property & Crop Loss	Average Annual Loss Estimates
Tom Green County	$1,142,300	$38,700

ASSESSMENT OF IMPACTS

The greatest risk from a winter storm hazard is to public health and safety. The impact of climate change could produce longer, more intense winter storm events, exacerbating the current winter storm impacts. Worsening winter storm conditions can be frequently associated with a variety of impacts, including:

- In Tom Green County vulnerable populations, particularly the elderly (17 percent of total population), children under 5 (6 percent of total population), and those with a disability (15 percent of total population) can face serious or life-threatening health problems from exposure to extreme cold including hypothermia and frostbite.
- Loss of electric power or other heat source can result in increased potential for fire injuries or hazardous gas inhalation because residents burn candles for light or use fires or generators to stay warm.
- Response personnel, including utility workers, public works personnel, debris removal staff, tow truck operators, and other first responders, are subject to injury or illness resulting from exposure to extreme cold temperatures.
- Response personnel would be required to travel in potentially hazardous conditions, elevating the life safety risk due to accidents and potential contact with downed power lines.
- Operations or service delivery may experience impacts from electricity blackouts due to winter storms.
- Power outages are possible throughout the planning area due to downed trees and power lines and/or rolling blackouts.
- Critical facilities without emergency backup power may not be operational during power outages.
- Emergency response and service operations may be impacted by limitations on access and mobility if roadways are closed, unsafe, or obstructed.
- Hazardous road conditions will likely lead to increases in automobile accidents, further straining emergency response capabilities.
- Depending on the severity and scale of damage caused by ice and snow events, damage to power transmission and distribution infrastructure can require days or weeks to repair.
- Winter storms can reduce the efficacy of shaded fuel breaks for wildfire mitigation as treated areas were more likely to have downed trees and limbs than untreated areas.

- Winter storms can result in damage to endangered species habitat and increased fuel loads within forested habitats.
- Older structures built to less stringent building codes may suffer greater damage as they are typically more vulnerable to impacts of winter storm events. Approximately 50 percent of homes in the County were built before 1980. Similarly, historic buildings and sites are placed at a higher risk of impact due to materials used and the inability to change properties due to their historic status. There are 70 historical buildings and sites listed on the National Archives Catalog for Tom Green County.
- Schools may be forced to shut early due to treacherous driving conditions.
- Exposed water pipes may be damaged by severe or late season winter storms at both residential and commercial structures, causing significant damages.

The economic and financial impacts of winter weather on the community will depend on the scale of the event, what is damaged, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by the community, local businesses, and citizens will also contribute to the overall economic and financial conditions in the aftermath of a winter storm event.

Section 16
Mitigation Strategy

SECTION 16: MITIGATION STRATEGY

MITIGATION GOALS

Based on the results of the risk and capability assessments, the Planning Team developed and prioritized the mitigation strategy. This involved utilizing the results of both assessments and reviewing the goals and objectives that were included in the previous 2020 Plan. At the Risk Assessment and Mitigation Strategy Workshop in December 2025, Planning Team members reviewed the mitigation strategy from the previous Plan. The consensus among all members present was that the strategy developed for the 2020 Plan remains relevant and will continue to serve as the foundation for development and implementation of hazard mitigation initiatives in the Plan Update, with additional elements incorporated to further support overall resilience objectives.

GOAL 1

Protect public health and safety.

OBJECTIVE 1.1

Advise the public about health and safety precautions to guard against injury and loss of life from hazards.

OBJECTIVE 1.2

Maximize utilization of the latest technology to provide adequate warning, communication, and mitigation of hazard events.

OBJECTIVE 1.3

Reduce the danger to and enhance protection of high-risk areas during hazard events.

OBJECTIVE 1.4

Protect critical facilities and services.

GOAL 2

Build and support local capacity and commitment to continuously become less vulnerable to hazards.

OBJECTIVE 2.1

Foster ongoing local partnerships and collaborations to improve long-term vulnerability to hazards.

OBJECTIVE 2.2

Establish a cadre of committed volunteers to safeguard the community before, during, and after a disaster.

OBJECTIVE 2.3
Incorporate hazard mitigation concerns into County, City, and ISD planning and budgeting processes.

GOAL 3
Increase public understanding, support, and demand for hazard mitigation.

OBJECTIVE 3.1
Heighten public awareness regarding the full range of natural hazards the public may face.

OBJECTIVE 3.2
Educate the public on actions they can take to prevent or reduce the loss of life or property from all hazards and increase individual efforts to respond to potential hazards.

OBJECTIVE 3.3
Publicize and encourage the adoption of appropriate hazard mitigation measures.

GOAL 4
Protect new and existing properties.

OBJECTIVE 4.1
Reduce National Flood Insurance Program (NFIP) repetitive loss occurrences through increased mitigative intervention to structures that have been identified to have sustained repeated damage from hazards

OBJECTIVE 4.2
Use the most cost-effective approach to protect existing buildings and public infrastructure from hazards.

OBJECTIVE 4.3
Enact and enforce regulatory measures to ensure that future development will not endanger or increase threats to people and existing properties.

GOAL 5
Maximize the resources for investment in hazard mitigation.

OBJECTIVE 5.1
Maximize the use of outside sources of funding.

OBJECTIVE 5.2
Maximize participation of property owners in protecting their properties.

OBJECTIVE 5.3
Maximize insurance coverage to provide financial protection against hazard events.

OBJECTIVE 5.4
Prioritize mitigation projects, based on cost-effectiveness and sites facing the greatest threat to life, health, and property.

GOAL 6
Promote growth in a sustainable manner.

OBJECTIVE 6.1
Incorporate hazard mitigation activities into long-range planning and development activities.

OBJECTIVE 6.2
Promote beneficial uses of hazardous areas while expanding open space and recreational opportunities.

OBJECTIVE 6.3
Utilize regulatory approaches to prevent the creation of future hazards to life and property.

GOAL 7
Promote equity and protect vulnerable populations and underserved communities through hazard mitigation activities.

OBJECTIVE 7.1
Allocate resources and funding to implement hazard mitigation activities that directly benefit vulnerable and underserved communities.

OBJECTIVE 7.2
Build and support local partnerships to leverage resources and expertise in addressing hazard-related equity concerns.

OBJECTIVE 7.3
Establish internal decision-making processes that integrate equity into project selection.

OBJECTIVE 7.4
Monitor and evaluate the effectiveness of mitigation activities to ensure equitable outcomes and protection of vulnerable populations.

Section 17
Previous Actions

SECTION 17: PREVIOUS ACTIONS

SUMMARY

This section includes analysis from the 2020 Tom Green County / City of San Angelo Hazard Mitigation Action Plan . Planning Team members were given copies of the previous mitigation actions submitted in the 2020 Tom Green County / City of San Angelo Hazard Mitigation Plan at the Mitigation Strategy Workshop. Each previously participating jurisdiction reviewed the previous actions and provided an analysis as to whether the action had been completed, should be carried over as for future implementation, or be deleted from the Plan Update. The actions from the 2020 Plans are included in this section as they were written in 2020, except for the “2026 Analysis” section. **Any action in the analysis the team selected for future implementation (carried over) is considered a current action for potential implementation over the life cycle of this updated plan.** Additional new actions developed for this plan are detailed in Section 18. San Angelo ISD was not involved in the previous plan therefore they have no previous actions.

CITY OF SAN ANGELO

	City of San Angelo – Previous Action #1
Proposed Action:	Property acquisition / demolition of flood prone structures and construction of detention or retention ponds for collection of stormwater runoff.
BACKGROUND INFORMATION	
Site and Location:	City of San Angelo and ETJ
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Eliminate risk of flood damages to high risk structures and prevent future losses in high risk flood hazard areas; Reduce downstream impacts associated with development in the floodplain; Reduce risk of injuries to citizens; Reduce burden on emergency services during and after a flood event.
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to existing structures
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$2,000,000+
Potential Funding Sources:	Federal Grants, Revenues, In-kind
Lead Agency/Department Responsible:	City of San Angelo Operations
Implementation Schedule:	Within 24-36 months of plan adoption
Incorporation into existing plans:	Master Drainage Plan, Development Plans

2026 Analysis:
Delete Action. Amend proposed actioned to: “Develop a land acquisition program in a flood hazard areas. Acquire and demolish repetitive loss properties. Acquire high risk vacant land and maintain as an open space”. See new action #4.

	City of San Angelo – Previous Action #2
Proposed Action:	Remove structures through acquisition and demolition or relocation from flood prone areas to minimize future flood losses.
BACKGROUND INFORMATION	
Site and Location:	City of San Angelo and ETJ
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Eliminate risk of flood damages to high risk structures and prevent future losses in high risk flood hazard areas; Reduce downstream impacts associated with development in the floodplain; Reduce risk of injuries to citizens; Reduce burden on emergency services during and after a flood event.
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1,000,000+
Potential Funding Sources:	State and Federal Grants, Revenues, In-kind
Lead Agency/Department Responsible:	City of San Angelo Operations
Implementation Schedule:	Within 24-36 months of plan adoption
Incorporation into existing plans:	Master Drainage Plan, Development Plans

2026 Analysis:
Delete Action. Amend proposed actioned to: “Develop a land acquisition program in a flood hazard areas. Acquire and demolish repetitive loss properties. Acquire high risk vacant land and maintain as an open space”. See new action #4.

	City of San Angelo – Previous Action #3
Proposed Action:	Develop a drainage study with development strategies and mitigation activities.
BACKGROUND INFORMATION	
Site and Location:	City of San Angelo and ETJ
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce risk of flood damages and prevent future losses in high risk flood hazard areas; Reduce downstream impacts associated with development; Reduce risk of injuries to citizens; Reduce burden on emergency services during and after a flood event.
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$100,000+
Potential Funding Sources:	State and Federal Grants, Revenues, In-kind
Lead Agency/Department Responsible:	City of San Angelo Operations
Implementation Schedule:	Within 24-36 months of plan adoption
Incorporation into existing plans:	Master Drainage Plan, Development Plans

2026 Analysis:
Carryover to Plan Update.

	City of San Angelo – Previous Action #4
Proposed Action:	Provide access to Butler Farms subdivision through construction of a bridge structure on Foster Road as well as construction of a secondary access to the subdivision.
BACKGROUND INFORMATION	
Site and Location:	Foster Road, City of San Angelo
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Improve accessibility to residential subdivision during rain events; Protect lives.
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$2,000,000
Potential Funding Sources:	State and Federal Grants, Bonds, Revenues
Lead Agency/Department Responsible:	City of San Angelo Operations
Implementation Schedule:	Within 24-36 months of plan adoption
Incorporation into existing plans:	Master Drainage Plan

2026 Analysis:
Carryover to Plan Update.

	City of San Angelo – Previous Action #5
Proposed Action:	Implement wildfire protection measures through construction of firebreaks between urban and undeveloped areas to reduce the risk of property loss from wildfires as well as clearing of underbrush to reduce the risk of damage or loss from wildfires.
BACKGROUND INFORMATION	
Site and Location:	City of San Angelo and ETJ
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce risk of wildfires and the spread of wildfire through targeted firebreaks and fuels reduction program.
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Natural Systems Protection

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$250,000+
Potential Funding Sources:	State and Federal Grants, Revenues, In-Kind
Lead Agency/Department Responsible:	City of San Angelo Operations
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into existing plans:	Ordinance, Engineering & Development Plans

2026 Analysis:
Carryover to Plan Update.

	City of San Angelo – Previous Action #6
Proposed Action:	Develop ordinances for new development and existing development to provide for fire buffers and on-going maintenance requirements of fire buffers.
BACKGROUND INFORMATION	
Site and Location:	City of San Angelo and ETJ
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce risk of wildfires and the spread of wildfire through regulated development and maintenance.
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000
Potential Funding Sources:	Revenues, In-Kind
Lead Agency/Department Responsible:	City of San Angelo Operations
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into existing plans:	Local Ordinance, Engineering & Development Plans

2026 Analysis:
Carryover to Plan Update.

	City of San Angelo – Previous Action #7
Proposed Action:	Purchase equipment to mitigate damage from wildfires.
BACKGROUND INFORMATION	
Site and Location:	City of San Angelo and ETJ
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce risk of wildfires and the spread of wildfires.
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Preparedness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1,000,000+
Potential Funding Sources:	State and Federal Grants, Revenues
Lead Agency/Department Responsible:	City of San Angelo Operations
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into existing plans:	Operations Plan

2026 Analysis:
Carryover to Plan Update.

	City of San Angelo – Previous Action #8
Proposed Action:	Upgrade, improve, and expand drainage systems throughout the city. Implementation of sediment and scour control measures.
BACKGROUND INFORMATION	
Site and Location:	City of San Angelo and ETJ
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce risk of flood damages through improved drainage capacity; Reduce risk of injuries to citizens; Reduce burden on emergency services during and after a flood event.
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$2,000,000+
Potential Funding Sources:	State and Federal Grants, Revenues, In-Kind
Lead Agency/Department Responsible:	City of San Angelo Operations
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into existing plans:	Floodplain Management Plan, Drainage Plan

2026 Analysis:
Carryover to Plan Update.

City of San Angelo – Previous Action #9	
Proposed Action:	Develop and adopt criteria regarding development or activities to reduce the risk of damage from flooding or flow restriction. Implement inspections and ordinances restricting construction within flood prone areas or in areas that significantly contribute to flooding.
BACKGROUND INFORMATION	
Site and Location:	City of San Angelo and ETJ
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Protection of environmental, property, and personal damage from flooding.
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000+
Potential Funding Sources:	State and Federal Grants, Revenues
Lead Agency/Department Responsible:	City of San Angelo Operations
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into existing plans:	Development Plans / Manuals, Master Drainage Plan, Ordinances

2026 Analysis:
Carryover to Plan Update. Update Lead Agency to City of San Angelo Engineering.

	City of San Angelo – Previous Action #10
Proposed Action:	Purchase and install ups and surge protection for SCADA lift stations.
BACKGROUND INFORMATION	
Site and Location:	City-wide lift stations
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce risk of power outages and equipment damage during severe weather; Reduce risk of sanitary system overflows and associated damages.
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Lightning, Thunderstorm Wind, Winter Storm
Effect on New/Existing Buildings:	Reduce risk to existing infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1,500 x 50 stations= $75,000
Potential Funding Sources:	Water Capital, State and Federal Grants, Revenue
Lead Agency/Department Responsible:	City of San Angelo Water Utility
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into existing plans:	Emergency Operations Plan

2026 Analysis:
Carryover to Plan Update.

	City of San Angelo – Previous Action #11
Proposed Action:	Expand Hickory Well Field to maximum capacity.
BACKGROUND INFORMATION	
Site and Location:	Ford Ranch
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Allows city additional 4mgd of fresh water supply, bringing total production levels up to 12mgd; Improve wildfire fighting capabilities; Improve water quality.
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Drought, Flood, Wildfire
Effect on New/Existing Buildings:	Reduce risk to existing structures and infrastructure
Priority (High, Moderate, Low):	High
Estimated Cost:	$40,000,000
Potential Funding Sources:	Water Capital, Texas Water Development loan, State and Federal loans
Lead Agency/Department Responsible:	City of San Angelo Water Utility
Implementation Schedule:	Within 12-60 months of plan adoption
Incorporation into existing plans:	N/A

2026 Analysis:
Carryover to Plan Update.

SECTION 17: PREVIOUS ACTIONS

	City of San Angelo – Previous Action #12
Proposed Action:	Implement Concho River Augmentation indirect potable reuse project.
BACKGROUND INFORMATION	
Site and Location:	City farm property
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Allows city additional 7mgd of fresh water supply; Improve wildfire fighting capabilities; Improve water quality.
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Drought, Flood, Wildfire
Effect on New/Existing Buildings:	Reduce risk to existing structures and infrastructure
Priority (High, Moderate, Low):	High
Estimated Cost:	$110,000,000
Potential Funding Sources:	Water Capital, Texas Water Development loan, State and Federal loans
Lead Agency/Department Responsible:	City of San Angelo Water Utility
Implementation Schedule:	Within 12-60 months of plan adoption
Incorporation into existing plans:	N/A

2026 Analysis:
Carryover to Plan Update.

TOM GREEN COUNTY

	Tom Green County – Previous Action #1
Proposed Action:	Build safe room shelters at manufactured home parks, schools, and communities, so that residents can reach shelter in less than five minutes.
BACKGROUND INFORMATION	
Site and Location:	Various locations throughout Tom Green County
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce risk to citizens by providing shelter in high risk areas during extreme weather events.
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Tornado, Thunderstorm Wind
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$500,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Tom Green County Emergency Management
Implementation Schedule:	Within 48 months of plan adoption
Incorporation into existing plans:	Emergency Management Plan, Capital Improvement Plan

2026 Analysis:
Carryover to Plan Update. Amend action to include a cost update.

	Tom Green County – Previous Action #2
Proposed Action:	Increase drainage capacity through the addition of storm water detention and/or retention basins as deemed necessary to reduce flood risks.
BACKGROUND INFORMATION	
Site and Location:	Tom Green County
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce risk of flood damages through improved drainage capacity / stormwater diversion; Reduce risk of injuries to citizens; Reduce burden on emergency services during and after a flood event.
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$3,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Tom Green County Public Works
Implementation Schedule:	Within 36 months of plan adoption
Incorporation into existing plans:	Drainage Plan

2026 Analysis:
Carryover to Plan Update. Amend action to include a cost update.

COUNTYWIDE

	Countywide – Previous Action #1
Proposed Action:	Conduct public education program on fire risks and wildland fire mitigation. Include information on defensible space and reduction of wildland urban interface fuels.
BACKGROUND INFORMATION	
Site and Location:	Tom Green County and the City of San Angelo
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce risk and spread of wildfires through education and awareness programs; Reduce risk of damages and injuries.
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$2,500
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Local and County Emergency Management
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into existing plans:	N/A

2026 Analysis:
City of San Angelo: Delete Action. See new action #1, 24, and 25. Tom Green County: Delete Action. See new action #1, 7, and 8.

		Countywide – Previous Action #2
	Proposed Action:	Acquire and distribute NOAA weather radios for early warning and post-event information.
	BACKGROUND INFORMATION	
	Site and Location:	Distribute radios to critical facilities, area businesses, and vulnerable populations
	Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce risk to citizens through improved communications and early warning.
	Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1,125 x $45=$50,625
Potential Funding Sources:	Local Funds, State and Federal Grants, In-kind
Lead Agency/Department Responsible:	Local and County Emergency Management
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into existing plans:	Emergency Operations Plan

2026 Analysis:
City of San Angelo: Carryover to Plan Update. Tom Green County: Carryover to Plan Update.

	Countywide – Previous Action #3
Proposed Action:	Implement education and awareness program utilizing media, social media, bulletins, flyers, etc. to educate citizens of hazards that can threaten the area and mitigation measures to reduce injuries, fatalities, and property damages.
BACKGROUND INFORMATION	
Site and Location:	Tom Green County and the City of San Angelo
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Promote hazard awareness and protect citizens from potential injuries and damages.
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Drought, Extreme Heat, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds (staff time), State and Federal Grants
Lead Agency/Department Responsible:	Local and County Emergency Management
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into existing plans:	N/A

2026 Analysis:
City of San Angelo: Delete Action. See new action #1. Tom Green County: Delete Action. See new action #1

	Countywide – Previous Action #4
Proposed Action:	Acquire and install generators with hard wired quick connections at all critical facilities.
BACKGROUND INFORMATION	
Site and Location:	Community critical facilities
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Provide power for critical facilities during power outages and ensure continuity of critical services.
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$1,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Local and County Public Works
Implementation Schedule:	Within 12-24 months of plan adoption
Incorporation into existing plans:	Emergency Management Plan

2026 Analysis:
City of San Angelo: Delete Action. Amend proposed action to include all applicable hazards. Amend new project scope and verbiage to state “Acquire and install generators at every fire station and critical infrastructure site in the City of San Angelo and in Tom Green County, to include the purchase of mobile generator trailers.” See City of San Angelo new action # 22. Tom Green County: Delete Action. Amend proposed action to include all applicable hazards. Amend new project scope to state “Acquire and install generators at every fire station and critical infrastructure site in the City of San Angelo and in Tom Green County, to include the purchase of mobile generator trailers.” See Tom Green County new action # 25.

		Countywide – Previous Action #5
	Proposed Action:	Upgrade critical facilities to include drought mitigation measures such as greywater reuse systems, drought tolerant landscaping, and installation of a sprinkler system with regular watering schedule.
	BACKGROUND INFORMATION	
	Site and Location:	Community critical facilities
	Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce damages at critical facilities due to drought.
	Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Drought
Effect on New/Existing Buildings:	Reduce risk to existing and future structures
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$100,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Local and County Public Works
Implementation Schedule:	Within 12-24 months of plan adoption
Incorporation into existing plans:	Capital Improvement Plan (only Tom Green County)

2026 Analysis:
City of San Angelo: Carryover to Plan Update. Tom Green County: Carryover to Plan Update.

Section 18
Mitigation Actions

SECTION 18: MITIGATION ACTIONS

SUMMARY

The 44 CFR § 201.6(c)(3)(ii) states that the plan must include "A section that *identifies* and *analyzes* a comprehensive range of specific mitigation actions and projects *being considered* to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure." The mitigation planning process is designed to help communities identify feasible and cost-effective mitigation strategies, but implementation of actions is dependent on factors such as funding, staff time, and evolving community priorities, and there is no penalty for jurisdictions unable to implement projects throughout the plan's life.[1]

As discussed in Section 2, at the Mitigation Strategy Workshop, the Planning Team and stakeholders met to develop mitigation actions for each of the natural hazards included in the Plan Update. Each of the actions in this section were prioritized based on FEMA's Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLEE) criteria necessary for the implementation of each action.

As part of the economic evaluation of the STAPLEE analysis, jurisdictions analyzed each action in terms of the overall costs, measuring whether the potential benefit to be gained from the action outweighed the costs associated with it. As a result of this exercise, priority was assigned to each mitigation action by marking them as High (H), Moderate (M), or Low (L). An action that is ranked as "High" indicates that the action will be implemented as soon as funding is received. A "Moderate" action is one that may not be implemented right away, depending on the cost and number of citizens served by the action. Actions ranked as "Low" indicate that they will not be implemented without first seeking grant funding, and after "High" and "Moderate" actions have been completed.

Within each mitigation action, the Planning Team considered all potential funding sources that could be utilized to implement the proposed project. To ensure all potential funding resources are considered and are not limited to those sources identified within the action table, please see Appendix H for a list of all available State and Federal grant programs as of 2025. The Planning Team will continue to seek out other available funding sources during the 5-year cycle as notices of funding opportunity (NOFO) are released.

All mitigation actions created by Planning Team members are presented in this section in the form of a Mitigation Action Table. More than one hazard is sometimes listed for an action, if appropriate. Actions presented in this section represent a comprehensive range of mitigation actions per current State and FEMA Guidelines, including one action per hazard, and at least two different types for each participating jurisdiction. Section 17 includes an analysis of the actions identified in the previous 2020 Tom Green County / City of San Angelo Hazard Mitigation Action Plan. **Any**

[1] Cost, funding sources, and implementation schedules are subject to change upon full scoping of project and grant availability.

action in the analysis the team selected for future implementation (carried over) is considered a current action for potential implementation over the life cycle of this updated plan, in addition to the new actions outlined here in Section 18.

The City of San Angelo and Tom Green County are participants in the National Flood Insurance Program (NFIP). Flooding was identified as a significant risk for the community; therefore, many of the mitigation actions were developed with flood mitigation in mind. Actions related to NFIP compliance include additional narrative when deemed appropriate.

Table 18-1. City of San Angelo and Tom Green County Mitigation Action Matrix

Type of Action	
Action #1 – Plans/Regulations (Blue)	**Action #4 – Structural (Orange)**
Action #2 – Education/Awareness (Red)	**Action #5 – Preparedness/Response (Black)**
Action #3 – Natural Systems Protections (Green)	

Jurisdiction	City of San Angelo	Tom Green County	San Angelo ISD
Dam Failure	●●●●	●●●	●●●
Drought	●●●●●	●●●	●●●●
Earthquake	●●●●	●●●●	●●●●
Extreme Heat	●●●	●●●	●●●●●
Flood	●●●●●	●●●●●	●●●●●
Hail	●●●●	●●●	●●●●
Lightning	●●●●	●●●	●●●●
Thunderstorm Wind	●●●●	●●●	●●●●
Tornado	●●●●	●●●	●●●●
Wildfire	●●●●●	●●●●●	●●●●
Winter Storm	●●●●	●●●	●●●●
Cyber Attack	●●●●	●●	●●●●
Hazardous Materials	●●●●	●●	●●●●
Infectious Disease	●●●●	●●	●●●●
Invasive Species	●●●●	●●	●●●●
Terrorism	●●●●	●●●	●●●●
Water Contamination	●●●●	●●	●●●●

CITY OF SAN ANGELO

City of San Angelo Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
1	Implement education and awareness program utilizing media, social media, bulletins, flyers, etc. to educate citizens of hazards that can threaten the area and mitigation measures to reduce injuries, fatalities, and property damages. Include links to weather alerts and departmental phone listings with contact personnel for residents.	City of San Angelo	Promote hazard awareness and protect citizens from potential injuries and damages.	Education and Awareness	Dam Failure, Drought, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	Communication	N/A	M	$5,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Emergency Management	24 Months	N/A	Promotes public safety.
	Description of the Solution: Monthly tips can be promoted for each hazard type via social media or other media outlets: Example messaging could include: **Dam Failure**: Promote evacuation routes for the community; **Drought**: Promote drought tolerant landscaping guidance for home and business owners; **Earthquake:** Advise homeowners how to secure indoor appliances and furniture; **Extreme Heat**: Promote the signs of heat exhaustion and heat stroke; **Flood**: Promote elevation of indoor and outdoor appliances or knowledge of the BFE; **Hail**: Promote hail resistant roofing, siding and windows.; **Lightning**: Make homeowners and businesses aware of indoor surge protection; **Thunderstorm Wind**: Promote securing of outdoor items and structures; **Tornado**: Inform home and business owners know when and where in their home or business they can take shelter; **Wildfire**: Create a defensible space for homeowners campaign; **Winter Storm**: Promote information on wrapping exposed and outdoor pipes.													

City of San Angelo Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
2	Drainage way improvements including vegetation removal, regrading, flow and flood control measures and other related activities to include contracts, equipment rental, and equipment purchases to facilitate SHC activities.	City of San Angelo	Reduce risk of flooding by maintaining floodways.	Structure and Infrastructure	Flood	Water Systems	Y	H	$2,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations	36 Months	Development Plans / Manuals Master Drainage Plan Ordinances	Protects communities and reduces risk of flooding.
3	Equip sewer manholes with watertight covers and inflow guards.	City of San Angelo	Reduce risk of flood water contamination; Reduce risk of surface water infiltration and sewage backup.	Structure and Infrastructure	Flood	Safety/Security	Y	M	$2,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Water Utilities	24 Months	Capital Improvement Plan	Protects infrastructure, reduces cost of reparation, and prevents injury to residents.

SECTION 18: MITIGATION ACTIONS

City of San Angelo Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
4	Develop a land acquisition program in a flood hazard areas. Acquire and demolish repetitive loss properties. Acquire high risk vacant land and maintain as an open space.	City of San Angelo	Eliminate risk of flood damages to high-risk structures and prevent future losses in high-risk flood hazard areas.	Structure and Infrastructure	Flood	Safety/Security	N/A	H	$20,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations	12 Months	Capital Improvement Plan Floodplain Ordinance	Protects infrastructure, reduces cost of reparation, and prevents injury to residents.
5	Provide how-to information to residents for installing back flow valves to prevent reverse-flow floods; to include funding for disparate businesses in neighborhoods.	City of San Angelo	Reduce damage impact on residents after a flood event.	Education and Awareness	Flood, Water Contamination	Communication	N/A	H	$2,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Water Utilities	12 Months	Capital Improvement Plan	Protects infrastructure, reduces cost of reparation, and prevents injury to residents.

City of San Angelo Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
6	Floodproof sewage facilities and infrastructure in flood hazard and low-lying areas.	City of San Angelo	Reduce damages to infrastructure; Ensure continuity of critical services during and after event.	Structure and Infrastructure	Flood, Water Contamination	Safety/Security	Y	H	$25,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Water Utilities	12 Months	Capital Improvement Plan Master Drainage Plan	Protects communities and reduces risk of flooding.
7	Conduct studies on all dams in the city and in the county.	City of San Angelo	Reduce risk of damages and injuries.	Local Plans and Regulations	Dam Failure, Flood	Water Systems	Y	H	$1,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Water Utilities	12 Months	N/A	Protects communities and reduces risk of flooding.

SECTION 18: MITIGATION ACTIONS

City of San Angelo Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
9	Restrict future development in high risk areas.	City of San Angelo	Reduce risk of damages to new structures and infrastructure through building restrictions in high-risk areas.	Local Plans and Regulations	Dam Failure, Flood, Wildfire	Safety/Security	N/A	M	$1,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Community Development	24 Months	Floodplain Ordinance	Protects infrastructure, reduces cost of reparation, and prevents injury to residents.
10	Construct a new Fire Station 10 for the north east part of the city.	City of San Angelo	Reduce loss of life and property. This will provide protection to the community and the new data center being built on the north east part of the county.	Structure and Infrastructure	Dam Failure, Drought, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	Safety/Security	Y	H	$12,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Fire Department	24 Months	Capital Improvement Plan (COSA SAFD)	Promotes public safety.

City of San Angelo Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
11	Expanding Regional Training center to include the following training props: • Propane ARFF prop • Swiftwater training prop • Confined Space / trench rescue prop • Train yard props	City of San Angelo	Provide education and training to first responders.	Preparedness /Response	Dam Failure, Drought, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	Safety/Security	Y	H	$2,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Fire Department	24 Months	Capital Improvement Plan	Promotes public safety.
12	Improve water treatment facilities.	City of San Angelo	Improve infrastructure and security at water treatment facilities in the city.	Structure and Infrastructure	Dam Failure, Drought, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	Safety/Security	Y	H	$2,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Water Utilities	12 Months	Capital Improvement Plan	Protects communities and reduces risk of flooding.

SECTION 18: MITIGATION ACTIONS

City of San Angelo Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
13	Build a community safe room and emergency shelter for the public in locations where residents and visitors can get shelter in less than five minutes.	City of San Angelo	Reduce risk to citizens by providing shelter in high-risk areas during extreme weather events.	Structure and Infrastructure	Thunderstorm Wind, Tornado, Human Caused Hazards	Safety/Security	Y	H	$2,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Emergency Management, Tom Green County Emergency Management	12 Months	Capital Improvement Plan Emergency Management Action Plan	N/A
14	Adopt and implement a routine tree trimming program that clears tree limbs near power lines and/or hanging in right-of-way; Remove dead trees from right-of-way and drainage systems on a scheduled basis.	City of San Angelo	Reduce damages to infrastructure; Ensure continuity of services during and after event.	Structure and Infrastructure	Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm	Safety/Security, Energy (Power/Fuel)	Y	M	$3,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations	24 Months	Emergency Management Action Plan	Helps ensure critical facilities continue to provide services during a power outage caused by unforeseen events.

City of San Angelo Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
15	Create and implement vegetation management program that integrates mechanical, chemical, biological, and cultural methods of vegetation removal and management. Acquire vegetation clearing equipment.	City of San Angelo	Reduce risk of wildfires and the spread of wildfire through improved practices .	Natural Systems Protection Preparedness /Response	Drought, Flood, Wildfire	Safety/Security	N/A	H	$2,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations	12 Months	Capital Improvement Plan	Protects communities and reduces risk of flooding.
16	Adopt a landscape ordinance.	City of San Angelo	Reduce impact on groundwater.	Local Plans and Regulations	Drought, Flood, Wildfire	Communication	Y	M	$500,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Administration	24 Months	Drought Contingency Plan	Protects infrastructure, reduces cost of reparation, and prevents injury to residents.

City of San Angelo Mitigation Actions														
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Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
17	Establish, adopt and implement a "green infrastructure" program for parks, nature, preserves, greenbelts, etc.	City of San Angelo	Reduce impacts of flood through expanded greenspace and restoration of floodplains and wetlands.	Natural Systems Protection	Drought, Extreme Heat, Flood	Safety/Security	N/A	M	$500,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Administration	24 Months	Comprehensive Plan	Protects communities and reduces risk of flooding.
19	Install pedestrian and traffic control devices to ensure crowd control and safety measures during hazard events.	City of San Angelo	Reduce loss of life and property.	Preparedness /Response	Terrorism	Safety/Security	N/A	H	$2,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations	24 Months	Emergency Management Action Plan	N/A

City of San Angelo Mitigation Actions														
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Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
20	Acquire de-icing equipment and ice warning equipment for bridge de-icing.	City of San Angelo	Reduce loss of life and property.	Preparedness /Response	Winter Storm	Safety/Security	N/A	H	$3,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations	12 Months	Emergency Operations Plan	N/A
21	Assess the City and County for a suitable location for a new Emergency Operations Center for city and county and state/federal emergency response personnel & emergency management personnel to prepare, train, respond, and coordinate recovery during and after disasters.	City of San Angelo & Tom Green County	Allow city and county emergency response and emergency management personnel to coordinate all disasters in a tornado safe, reliable, centralized EOC.	Structure and Infrastructure	Dam Failure, Drought, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	Safety/Security	Y	H	$10,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Emergency Management, Tom Green County Emergency Management	60 Months	Emergency Management Action Plan Capital Improvement Plan	Protects communities and reduces risk of flooding.

City of San Angelo Mitigation Actions														
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Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
22	Acquire and install generators at every fire station and critical infrastructure site in the City of San Angelo and in Tom Green County, to include the purchase of mobile generator trailers. Ensure generators are equipped with alternative fuel capabilities to support continuity of operations.	City of San Angelo & Tom Green County*	Provide power for critical facilities during power outages and ensure continuity of critical services.	Structure and Infrastructure	Dam Failure, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	Energy (Power/Fuel)	Y	H	$1,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo EMC	12-24 Months	Emergency Management Plan	Helps ensure critical facilities continue to provide services during a power outage caused by unforeseen events.
	* Fire stations													
23	Upgrade/Acquire and implement an outdoor hazard warning system, including a system that detects and provides warnings during hazard events. For locations that currently have sirens evaluate locations for upgrades or additional sirens.	City of San Angelo & Tom Green County	Reduce risk to citizens through improved communication and early warning.	Education and Awareness Preparedness /Response	Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm	Communication	Y	M	$500,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Tom Green County EMC	12-24 Months	Emergency Management Action Plan Capital Improvement Plan	Promotes public safety.

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Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
24	Conduct county-wide community outreach to promote participation in Firewise Communities Program.	City of San Angelo & Tom Green County	Reduce Risk to people and property, protect vulnerable populations, structures and critical facilities, improve public outreach	Education and Awareness	Wildfire	Communication	N/A	H	$200,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Fire Department	24 Months	Emergency Management Action Plan	N/A
25	Vegetation and brush removal in residential areas to reduce the risks of wildfire to include contracts, equipment rental, and equipment purchases to facilitate SHC activities.	City of San Angelo & Tom Green County	Prevent wildfires in urban interface area.	Structure and Infrastructure	Wildfire	Safety/Security	N/A	H	$100,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations, Tom Green County Road and Bridge Dept	12 Months	Emergency Management Action Plan	N/A

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Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
26	Acquire/Update and install monitoring devices at low water crossings throughout the County. These sensors will be connected to a centralized system that will notify officials when water levels rise and alert community members that they cannot cross safely.	City of San Angelo & Tom Green County	Reduce risk of injuries, fatalities and damages through education and awareness.	Structure and Infrastructure	Flood	Safety/Security	Y	M	$500,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations	48 Months	Capital Improvement Plan	Promotes public safety.
27	Develop and maintain a bomb squad.	City of San Angelo & Tom Green County	Reduce loss of life and property.	Preparedness /Response	Terrorism	Safety/Security	Y	H	$2,000,000,	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo Police Department	24 Months	Emergency Operations Plan	N/A

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28	Develop a fusion crime prevention center.	City of San Angelo & Tom Green County	Reduce loss of life and property.	Preparedness /Response	Terrorism	Safety/Security	Y	H	$12,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo Police Department	24 Months	Emergency Operations Plan	N/A
29	Implement and enhance an area-wide telephone emergency notification system ("reverse 911").	City of San Angelo & Tom Green County	Reduce risk to citizens through improved communication and early warning.	Education and Awareness	Dam Failure, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	Communication	Y	M	$1,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo Fire Department	12 Months	Emergency Management Action Plan	Promotes public safety.

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30	Develop/provide additional means of access into existing single-entry neighborhoods; update subdivision codes for a higher level of ingress and egress.	City of San Angelo & Tom Green County	Reduce risk to residents through improved evacuation alternatives.	Local Plans and Regulations	Dam Failure, Earthquake, Flood, Wildfire	Safety/Security	N/A	M	$2,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations	12 Months	Transportation Plan	Promotes public safety.
31	Educate community on the dangers of low water crossings through the installation of warning signs and promotion of "Turn Around, Don't Drown" Program.	City of San Angelo & Tom Green County	Reduce risk of injuries, fatalities and damages through education and awareness.	Education and Awareness	Flood	Communication	N/A	H	$2,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Emergency Management	12 Months	Emergency Management Action Plan	Promotes public safety.

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Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
32	Work with state and local agencies to determine locations to reduce fuel on public and private lands. Implement fuels reduction program.	City of San Angelo & Tom Green County	Reduce risk of wildfires and the spread of wildfire through targeted fuels reduction programs.	Natural Systems Protection Structure and Infrastructure	Drought, Flood, Wildfire	Safety/Security	N/A	H	$45,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Tom Green County VFD, City of San Angelo Fire Department	12 Months	Emergency Management Action Plan	Promotes public safety.
33	Adopt and implement routine fire hydrant maintenance plan.	City of San Angelo & Tom Green County	Reduce risk and spread of wildfires through routine maintenance of fire hydrants	Structure and Infrastructure	Wildfire	Safety/Security	Y	H	$12,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Tom Green County VFD, City of San Angelo Fire Department	12 Months	Emergency Management Action Plan	N/A

City of San Angelo Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
34	Install warning signs at hazardous bridges and roadways subject to ice.	City of San Angelo & Tom Green County	Reduce risk of damages and injuries on roadways and bridges during winter storm events through education and awareness programs.	Structure and Infrastructure	Winter Storm	Communication	Y	M	$500,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Tom Green County Operations, City of San Angelo Operations	12 Months	Emergency Management Action Plan	N/A
35	Add building insulation to walls and attics and wrap/insulate pipes at public facilities.	City of San Angelo & Tom Green County	Reduce risk of damages at public buildings resulting from freezing temperatures.	Structure and Infrastructure	Winter Storm	Safety/Security	Y	M	$1,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations	24 Months	Emergency Management Action Plan	N/A

City of San Angelo Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
36	Provide rebate program for individual safe rooms in single-family residences.	City of San Angelo & Tom Green County	Reduce risk to citizens by providing in-home safe rooms in high-risk areas during extreme weather events.	Structure and Infrastructure	Earthquake, Thunderstorm Wind, Tornado	Communication, Safety/Security	N/A	H	$10,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Administration	12-24 Months	Capital Improvement Plan	N/A
37	Develop and implement a program to identify, prioritize, and remove or rehabilitate structurally unsafe and abandoned buildings to reduce wildfire risk.	City of San Angelo & Tom Green County	Reduce risk of wildfires and the spread of wildfire through targeted programs.	Local Plans and Regulations Structure and Infrastructure	Wildfire	Safety/Security	Y	M	$10,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Administration, City of San Angelo Fire Department, City of San Angelo Emergency Management	48 Months	Capital Improvement Plan	N/A

City of San Angelo Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
38	Incorporate targeted dredging activities into flood control planning and projects to maintain channel capacity, improve drainage efficiency, and reduce flood risk.	City of San Angelo & Tom Green County	Reduce risk of flooding, damages, and injuries.	Structure and Infrastructure	Flood	Safety/Security	Y	H	$10,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Emergency Management	48 Months	Capital Improvement Plan, Comprehensive Plan	Protects communities and reduces risk of flooding.
39	Establish policies and incentives requiring or encouraging developers to install underground utility infrastructure in new developments to reduce vulnerability to severe weather and improve system resilience.	City of San Angelo & Tom Green County	Reduces outage risk and infrastructure damage from severe weather.	Local Plans and Regulations	Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm	Safety/Security	Y	M	$10,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Administration	24 Months	Capital Improvement Plan, Comprehensive Plan	N/A

City of San Angelo Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
40	Promote and support the installation of fire sprinkler systems in residential, commercial, and high-risk structures through updated building codes, incentives, or retrofit programs to reduce wildfire impact on infrastructure.	City of San Angelo & Tom Green County	Reduces wildfire damage and enhances safety by increasing fire protection in buildings.	Local Plans and Regulations Structure and Infrastructure	Wildfire	Safety/Security	Y	M	$1,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Administration, City of San Angelo Fire Department, City of San Angelo Emergency Management	48 Months	Emergency Management Action Plan	N/A
41	Require all municipal vehicles to be equipped with OSHA-compliant first aid kits, and incorporate these requirements into fleet management and procurement processes.	City of San Angelo & Tom Green County	Enhances emergency response and safety for personnel during incidents.	Local Plans and Regulations Preparedness / Response	Dam Failure, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	Safety/Security	N/A	M	$10,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Administration, City of San Angelo Emergency Management	24 Months	Emergency Management Action Plan	Promotes public safety.

TOM GREEN COUNTY

Tom Green County Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
1	Implement education and awareness program utilizing media, social media, bulletins, flyers, etc. to educate citizens of hazards that can threaten the area and mitigation measures to reduce injuries, fatalities, and property damages. Include links to weather alerts and departmental phone listings with contact personnel for residents.	Tom Green County	Promote hazard awareness and protect citizens from potential injuries and damages.	Education and Awareness	Dam Failure, Drought, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	Communication	N/A	M	$5,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Tom Green County EMC	24 Months	N/A	Promotes public safety.
	Description of the Solution: Monthly tips can be promoted for each hazard type via social media or other media outlets: Example messaging could include: **Dam Failure**: Promote evacuation routes for the community; **Drought**: Promote drought tolerant landscaping guidance for home and business owners; **Earthquake:** Advise homeowners how to secure indoor appliances and furniture; **Extreme Heat**: Promote the signs of heat exhaustion and heat stroke; **Flood**: Promote elevation of indoor and outdoor appliances or knowledge of the BFE; **Hail**: Promote hail resistant roofing, siding and windows.; **Lightning**: Make homeowners and businesses aware of indoor surge protection; **Thunderstorm Wind**: Promote securing of outdoor items and structures; **Tornado**: Inform home and business owners know when and where in their home or business they can take shelter; **Wildfire**: Create a defensible space for homeowners campaign; **Winter Storm**: Promote information on wrapping exposed and outdoor pipes.													

Tom Green County Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
2	Construct a bridge over the crossing at Mineral Wells Crossing. Heavy rains lead to overflow low water crossing.	Mineral Wells Crossing at South Concho River	Reduce risk residents through improved evacuation alternatives and awareness efforts.	Structure and Infrastructure	Flood	Safety/Security	N/A	H	$5,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Tom Green County EMC	60 Months	Transportation Improvement Plan and Region 9 Flood Plan	Protects communities and reduces risk of flooding.
3	Upgrade undersized stormwater drains and culverts in low lying areas that flood during high water events.	Multiple County locations *	Reduce risk of flood damages through improved drainage capacity.	Structure and Infrastructure	Flood	Safety/Security	N/A	H	$2,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Tom Green County EMC	60 Months	N/A	Protects communities and reduces risk of flooding.
	*Locations Include: Lagoon Road, Twin Lakes Road, Guinn Road													

Tom Green County Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
4	Assess and Upgrade undersized stormwater drains and culverts in Grape Creek Rd, running from Wren Rd. to N. Concho River.	Grape Creek Road	Reduce risk of flood damages through improved drainage capacity.	Structure and Infrastructure	Flood	Safety/Security	N/A	H	$2,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Tom Green County EMC	60 Months	N/A	Protects communities and reduces risk of flooding.
5	Upgrade/Acquire and implement an outdoor hazard warning system, including a system that detects and provides warnings during hazard events. For locations that currently have sirens evaluate locations for upgrades or additional sirens.	Tom Green County*	Reduce risk to citizens through improved communication and early warning.	Education and Awareness Preparedness /Response	Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm	Communication	Y	M	$500,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Tom Green County EMC	12-24 Months	Emergency Management Action Plan Capital Improvement Plan	Promotes public safety.
	*Priority area is Buffalo Heights Subdivision.													

Tom Green County Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
6	Feasibility Study: Phase I: Assess the Grape Creek Fire Station for a suitability for a multipurpose room. This room would be a combination of an EOC, training center and safe room for responders. This study would create a shelf ready project for this multipurpose room. Phase II: Construct multipurpose room (EOC, training center, safe room) using shelf ready project from phase I.	Grape Creek Fire Station	Reduce risk to people and property, protect vulnerable populations, structures and critical facilities.	Structure and Infrastructure	Dam Failure, Drought, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	Safety/Security	Y	H	$5,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo EMC, Grape Creek Fire Station Administration	60 Months	Emergency Management Action Plan Capital Improvement Plan	Protects infrastructure, reduces cost of reparation, and prevents injury to residents.
7	Conduct county-wide community outreach to promote participation in Firewise Communities Program.	Tom Green County	Reduce Risk to people and property, protect vulnerable populations, structures and critical facilities, improve public outreach	Education and Awareness	Wildfire	Communication	N/A	H	$200,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Fire Department, Tom Green VFD	24 Months	Emergency Management Action Plan	N/A

Tom Green County Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
8	Adopt and implement a routine brush / vegetation removal program that clears brush / vegetation throughout the Couty, with priority to developed areas that are near heavy brush.	Tom Green County	Reduce damages to infrastructure.	Structure and Infrastructure	Drought, Wildfire	Safety/Security	Y	M	$100,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Tom Green County EMC	24 Months	Emergency Management Action Plan	N/A
9	Increase the size of culverts or build a bridge at the North Concho River crossing on Post Oak Rd.	Post Oak Road	Prevents residents in this area for being cut-off from access to emergency services.	Structure and Infrastructure	Flood	Safety/Security	Y	H	$3,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Tom Green County EMC	36 Months	N/A	Protects communities and reduces risk of flooding.

Tom Green County Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
10	Upgrade low water crossing at Swain Road and Red Creek.	Swain Road and Red Creek	Prevents residents in this area for being cut-off from access to emergency services.	Structure and Infrastructure	Flood	Safety/Security	Y	H	$500,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Tom Green County EMC	36 Months	N/A	Protects communities and reduces risk of flooding.
11	Community safe room for first responders in the community of Grape Creek. Will act a secondary EOC for local, state, and federal partners to prepare, train, respond, and coordinate recovery operations during and after a disaster.	Tom Green County	Allow city and county emergency response and emergency management personnel to coordinate all disasters in a tornado safe, reliable, centralized EOC.	Structure and Infrastructure	Thunderstorm Wind, Tornado	Safety/Security	Y	H	$10,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo Emergency Management, Tom Green County Emergency Management	36 Months	Emergency Management Plan Capital Improvement Plan	N/A

SECTION 18: MITIGATION ACTIONS

Tom Green County Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
12	Assess the City and County for a suitable location for a new Emergency Operations Center for city and county and state/federal emergency response personnel and emergency management personnel to prepare, train, respond, and coordinate recovery during and after disasters.	City of San Angelo & Tom Green County	Allow city and county emergency response and emergency management personnel to coordinate all disasters in a tornado safe, reliable, centralized EOC.	Structure and Infrastructure	Dam Failure, Drought, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	Safety/Security	Y	H	$10,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo Emergency Management, Tom Green County Emergency Management	60 Months	Emergency Management Action Plan Capital Improvement Plan	Protects communities and reduces risk of flooding.
13	Vegetation and brush removal in residential areas to reduce the risks of wildfire to include contracts, equipment rental, and equipment purchases to facilitate SHC activities.	City of San Angelo & Tom Green County	Prevent wildfires in urban interface area.	Structure and Infrastructure	Wildfire	Safety/Security	N/A	H	$100,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations, Tom Green County Road and Bridge Dept	12 Months	Emergency Management Action Plan	N/A

Tom Green County Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
14	Acquire/Update and install monitoring devices at low water crossings throughout the County. These sensors will be connected to a centralized system that will notify officials when water levels rise and alert community members that they cannot cross safely.	City of San Angelo & Tom Green County	Reduce risk of injuries, fatalities and damages through education and awareness.	Structure and Infrastructure	Flood	Safety/Security	Y	M	$500,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations	48 Months	Capital Improvement Plan	Promotes public safety.
15	Develop and maintain a bomb squad.	City of San Angelo & Tom Green County	Reduce loss of life and property.	Preparedness /Response	Terrorism	Safety/Security	Y	H	$2,000,000,	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo Police Department	24 Months	Emergency Operations Plan	N/A

Tom Green County Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
16	Develop a fusion crime prevention center.	City of San Angelo & Tom Green County	Reduce loss of life and property.	Preparedness /Response	Terrorism	Safety/Security	Y	H	$12,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo Police Department	24 Months	Emergency Operations Plan	N/A
17	Implement and enhance an area-wide telephone emergency notification system ("reverse 911").	City of San Angelo & Tom Green County	Reduce risk to citizens through improved communication and early warning.	Education and Awareness	Dam Failure, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	Communication	Y	M	$1,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo Fire Department	12 Months	Emergency Management Action Plan	Promotes public safety.

Tom Green County Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
18	Develop/provide additional means of access into existing single-entry neighborhoods; update subdivision codes for a higher level of ingress and egress.	City of San Angelo & Tom Green County	Reduce risk to residents through improved evacuation alternatives.	Local Plans and Regulations	Dam Failure, Earthquake, Flood, Wildfire	Safety/Security	N/A	M	$2,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations	12 Months	Transportation Plan	Promotes public safety.
19	Educate community on the dangers of low water crossings through the installation of warning signs and promotion of "Turn Around, Don't Drown" Program.	City of San Angelo & Tom Green County	Reduce risk of injuries, fatalities and damages through education and awareness.	Education and Awareness	Flood	Communication	N/A	H	$2,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations	12 Months	Emergency Management Action Plan	Promotes public safety.

Tom Green County Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
20	Work with state and local agencies to determine locations to reduce fuel on public and private lands. Implement fuels reduction program.	City of San Angelo & Tom Green County	Reduce risk of wildfires and the spread of wildfire through targeted fuels reduction programs.	Natural Systems Protection Structure and Infrastructure	Drought, Flood, Wildfire	Safety/Security	N/A	H	$45,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Tom Green County VFD, City of San Angelo Fire Department	12 Months	Emergency Management Action Plan	Promotes public safety.
21	Adopt and implement routine fire hydrant maintenance plan.	City of San Angelo & Tom Green County	Reduce risk and spread of wildfires through routine maintenance of fire hydrants	Structure and Infrastructure	Wildfire	Safety/Security	Y	H	$12,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Tom Green County VFD, City of San Angelo Fire Department	12 Months	Emergency Management Action Plan	N/A

Tom Green County Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
22	Install warning signs at hazardous bridges and roadways subject to ice.	City of San Angelo & Tom Green County	Reduce risk of damages and injuries on roadways and bridges during winter storm events through education and awareness programs.	Structure and Infrastructure	Winter Storm	Communication	Y	M	$500,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Tom Green County Road and Bridge Department, City of San Angelo Operations	12 Months	Emergency Management Action Plan	N/A
23	Add building insulation to walls and attics and wrap / insulate pipes at public facilities.	City of San Angelo & Tom Green County	Reduce risk of damages at public buildings resulting from freezing temperatures.	Structure and Infrastructure	Winter Storm	Safety/Security	Y	M	$1,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations	24 Months	Emergency Management Action Plan	N/A

Tom Green County Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
24	Provide rebate program for individual safe rooms in single-family residences	City of San Angelo & Tom Green County	Reduce risk to citizens by providing in-home safe rooms in high-risk areas during extreme weather events.	Structure and Infrastructure	Earthquake, Thunderstorm Wind, Tornado	Communication, Safety/Security	N/A	H	$10,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Administration	12-24 Months	Capital Improvement Plan	N/A
25	Acquire and install generators at every fire station and critical infrastructure site in the City of San Angelo and in Tom Green County, to include the purchase of mobile generator trailers.	Tom Green County	Provide power for critical facilities during power outages and ensure continuity of critical services.	Structure and Infrastructure	Dam Failure, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	Energy (Power/Fuel)	Y	H	$1,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Tom Green County EMC	12-24 Months	Emergency Management Plan	Helps ensure critical facilities continue to provide services during a power outage caused by unforeseen events.

SAN ANGELO INDEPENDENT SCHOOL DISTRICT (ISD)

San Angelo Independent School District (ISD) Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
1	Implement education and awareness program utilizing media, social media, bulletins, flyers, etc. to educate citizens of hazards that can threaten the area and mitigation measures to reduce injuries, fatalities, and property damages. Include links to weather alerts and departmental phone listings with contact personnel for residents.	District-wide facilities	Promote hazard awareness and protect citizens from potential injuries and damages.	Education and Awareness	Drought, Dam Failure, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	Communication	N/A	M	$5,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo ISD Administration	24 Months	N/A	N/A
	Description of the Solution: Monthly tips can be promoted for each hazard type via social media or other media outlets: Example messaging could include: **Dam Failure**: Promote evacuation routes for the community; **Drought**: Promote drought tolerant landscaping guidance for home and business owners; **Earthquake:** Advise homeowners how to secure indoor appliances and furniture; **Extreme Heat**: Promote the signs of heat exhaustion and heat stroke; **Flood**: Promote elevation of indoor and outdoor appliances or knowledge of the BFE; **Hail**: Promote hail resistant roofing, siding and windows.; **Lightning**: Make homeowners and businesses aware of indoor surge protection; **Thunderstorm Wind**: Promote securing of outdoor items and structures; **Tornado**: Inform home and business owners know when and where in their home or business they can take shelter; **Wildfire**: Create a defensible space for homeowners campaign; **Winter Storm**: Promote information on wrapping exposed and outdoor pipes.													

San Angelo Independent School District (ISD) Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
2	Acquire and install generators with hard wired quick connections at all critical facilities within the district.	District-wide facilities	Provide power for critical facilities during power outages and ensure continuity of critical services.	Structure and Infrastructure	Dam Failure, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	Safety/Security	Y	H	$500,000 - $1,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo ISD Administration	36 Months	Capital Improvements Plan	N/A
3	Acquire and distribute NOAA weather radios to all campus locations and administrative office locations.	District-wide facilities	Reduce risk to citizens through improved education.	Education and Awareness Preparedness /Response	Dam Failure, Drought, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	Communication	N/A	H	$50,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo ISD Administration	12 Months	Continuity of Operations Plan Emergency Operations Plan	N/A

San Angelo Independent School District (ISD) Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
4	Upgrade ISD campuses to include drought mitigation measures such as drought tolerant landscaping.	District-wide facilities	Reduce damages at critical facilities.	Structure and Infrastructure	Drought, Wildfire	Safety/Security	Y	M	$500,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo ISD Administration	36 Months	Capital Improvements Plan	N/A
5	Develop and build a new ISD facility that functions as a community-wide FEMA approved disaster Safe Room.	District-wide campuses	Reduce risk to citizens by providing shelter in high-risk areas during extreme weather events.	Structure and Infrastructure	Thunderstorm Wind, Tornado	Safety/Security	Y	M	$1,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo ISD Administration	60 Months	Capital Improvements Plan	N/A

San Angelo Independent School District (ISD) Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
6	Conduct public education program on fire risks and wildland fire mitigation, with the assistance of the Texas Forest Service.	District-wide facilities	Promote hazard awareness and protect citizens from potential injuries and damages.	Education and Awareness	Drought, Wildfire	Communication	N/A	M	$5,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo ISD Administration	24 Months	N/A	N/A
7	Digitize all district records.	District-wide facilities	Promote hazard awareness and maintain records of historical events.	Local Plans and Regulations Preparedness /Response	Drought, Dam Failure, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	Safety/Security	Y	H	$100,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo ISD Administration	36 Months	Continuity of Operations Plan	N/A

San Angelo Independent School District (ISD) Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
8	Create and implement a bioretention process for stormwater with district wide rain gardens.	District-wide facilities	Reduce rainfall runoff volume and risk of flooding.	Natural Systems Protection Structure and Infrastructure	Flood	N/A	N/A	M	$500,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo ISD Administration	48 Months	Capital Improvements Plan	N/A
9	Create and implement a process for adding urban forestry/trees throughout district campuses.	District-wide facilities	Reduce rainfall runoff volume and risk of flooding.	Natural Systems Protection	Extreme Heat, Flood	N/A	N/A	M	$500,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo ISD Administration	48 Months	Capital Improvements Plan	N/A

San Angelo Independent School District (ISD) Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
10	Improve Drainage at campus facilities.	District-wide facilities	Reduce damages to infrastructure.	Structure and Infrastructure	Flood	Safety/Security	Y	H	$500,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo ISD Administration	36 Months	Capital Improvements Plan	N/A
11	Elevate all primary electrical system components and, wherever possible, secondary components of buildings on platforms or pedestals.	District-wide facilities	Reduce risk of damages to structures through improved construction techniques.	Structure and Infrastructure	Flood	Safety/Security	Y	M	$100,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo ISD Administration	36 Months	Capital Improvements Plan	N/A

San Angelo Independent School District (ISD) Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
12	Improve low slope roof systems.	District-wide facilities	Reduce damages at critical facilities.	Structure and Infrastructure	Drought, Earthquake, Extreme Heat, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm	Safety/Security	Y	M	$500,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo ISD Administration	36 Months	Capital Improvements Plan	N/A
13	Elevate or relocate HVAC systems.	District-wide facilities	Reduce risk of damages to structures through improved construction techniques.	Structure and Infrastructure	Flood	Safety/Security	Y	M	$500,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo ISD Administration	36 Months	Capital Improvements Plan	N/A

San Angelo Independent School District (ISD) Mitigation Actions														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	**Proposed Action**	**Site**	**Benefit**	**Action Type**	**Hazards**	**Community Lifeline**	**Infra.***	**Priority (High, Mod., Low)**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**	**Existing Plans**	**NFIP**
14	Reinforce communication towers, masts and antennas.	District-wide facilities	Reduce damages at critical facilities.	Structure and Infrastructure	Dam Failure, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	Safety/Security	Y	M	$500,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	San Angelo ISD Administration	36 Months	Capital Improvements Plan Continuity of Operations Plan	N/A

CARRYOVER ACTIONS

Carryover Actions								
Previous Action #	**Proposed Action**	**Site**	**Type of Action**	**Hazards**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**
City of San Angelo								
3	Develop a drainage study with development strategies and mitigation activities.	City of San Angelo and ETJ	Local Plans and Regulations	Flood	$100,000+	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations	24-36 Months
4	Provide access to Butler Farms subdivision through construction of a bridge structure on Foster Road as well as construction of a secondary access to the subdivision.	Foster Road, City of San Angelo	Structure and Infrastructure	Flood	$2,000,000+	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations	24-36 Months
5	Implement wildfire protection measures through construction of firebreaks between urban and undeveloped areas to reduce the risk of property loss from wildfires as well as clearing of underbrush to reduce the risk of damage or loss from wildfires.	City of San Angelo and ETJ	Natural Systems Protection	Wildfire	$250,000+	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations	24 Months

Carryover Actions								
Previous Action #	**Proposed Action**	**Site**	**Type of Action**	**Hazards**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**
6	Develop ordinances for new development and existing development to provide for fire buffers and on-going maintenance requirements of fire buffers.	City of San Angelo and ETJ	Local Plans and Regulations	Wildfire	$5,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations	24 Months
7	Purchase equipment to mitigate damage from wildfires.	City of San Angelo and ETJ	Preparedness	Wildfire	$1,000,000+	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations	24 Months
8	Upgrade, improve, and expand drainage systems throughout the city. Implementation of sediment and scour control measures.	City of San Angelo and ETJ	Structure and Infrastructure	Flood	$2,000,000+	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Operations	24 Months
9	Develop and adopt criteria regarding development or activities to reduce the risk of damage from flooding or flow restriction. Implement inspections and ordinances restricting construction within flood prone areas or in areas that significantly contribute to flooding.	City of San Angelo and ETJ	Local Plans and Regulations	Flood	$5,000+	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Engineering	24 Months

Carryover Actions								
Previous Action #	**Proposed Action**	**Site**	**Type of Action**	**Hazards**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**
10	Purchase and install ups and surge protection for SCADA lift stations.	City-wide lift stations	Structure and Infrastructure	Lightning, Thunderstorm Wind, Winter Storm	$1,500 x 50 stations= $75,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Water Utility	24 Months
11	Expand Hickory Well Field to maximum capacity.	Ford Ranch	Structure and Infrastructure	Drought, Flood, Wildfire	$40,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Water Utility	12-60 Months
12	Implement Concho River Augmentation indirect potable reuse project.	City farm property	Structure and Infrastructure	Drought, Flood, Wildfire	$110,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Water Utility	12-60 Months
County-wide 2	Acquire and distribute NOAA weather radios for early warning and post-event information.	Distribute radios to critical facilities, area businesses, and vulnerable populations	Education and Awareness	Dam Failure, Drought, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	$1,125 x $45=$50,625	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Emergency Management	24 Months

Carryover Actions								
Previous Action #	**Proposed Action**	**Site**	**Type of Action**	**Hazards**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**
County-wide 5	Upgrade critical facilities to include drought mitigation measures such as greywater reuse systems, drought tolerant landscaping, and installation of a sprinkler system with regular watering schedule.	Community critical facilities	Structure and Infrastructure	Drought	$100,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	City of San Angelo Public Works	12-24 Months
Tom Green County								
1	Build safe room shelters at manufactured home parks, schools, and communities, so that residents can reach shelter in less than five minutes.	Various locations throughout Tom Green County	Structure and Infrastructure	Tornado, Thunderstorm Wind	$2,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Tom Green County Emergency Management	48 Months
2	Increase drainage capacity through the addition of storm water detention and/or retention basins as deemed necessary to reduce flood risks.	Tom Green County	Structure and Infrastructure	Flood	$4,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Tom Green County Public Works	36 Months

Carryover Actions								
Previous Action #	**Proposed Action**	**Site**	**Type of Action**	**Hazards**	**Cost**	**Potential Funding Sources**	**Lead Agency**	**Timeline**
County-wide 2	Acquire and distribute NOAA weather radios for early warning and post-event information.	Distribute radios to critical facilities, area businesses, and vulnerable populations	Education and Awareness	Dam Failure, Drought, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	$1,125 x $45=$50,625	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	County Emergency Management	24 Months
County-wide 2	Acquire and distribute NOAA weather radios for early warning and post-event information.	Distribute radios to critical facilities, area businesses, and vulnerable populations	Education and Awareness	Dam Failure, Drought, Earthquake, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Human Caused Hazards	$1,125 x $45=$50,625	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	County Emergency Management	24 Months

Section 19
Plan Maintenance

SECTION 19: PLAN MAINTENANCE

PLAN MAINTENANCE PROCEDURES

The following is an explanation of how the City of San Angelo, Tom Green County, San Angelo ISD, and the general public will be involved in implementing, evaluating, and enhancing the Plan over time. When the Plan is discussed in all maintenance procedures, it includes mitigation actions and hazard assessments. The sustained hazard mitigation planning process consists of four main parts:

- Incorporation
- Monitoring and Evaluation
- Updating
- Continued Public Involvement

INCORPORATION

The City of San Angelo, Tom Green County, and San Angelo ISD will be responsible for further development and implementation of mitigation actions. Each action has been assigned to a specific department within the City, County, and ISD. The following describes the process by which the City, County, and ISD will incorporate elements of the Mitigation Plan into other planning mechanisms.

PROCESS OF INCORPORATION

Upon formal adoption of the Plan Update, the City of San Angelo, Tom Green County, and San Angelo ISD will implement actions based on priority and the availability of funding. The participating jurisdictions are committed to implementing their mitigation actions and will adjust long-term plans and budgets to stay aligned with the updated Hazard Mitigation Plan. The potential funding sources noted for each action can guide participants when seeking support and include a timeline to promote timely completion and measure progress.

The City of San Angelo, Tom Green County, and San Angelo ISD will work to align their mitigation actions with existing plans and policies, such as construction standards and Emergency Management Plans, and ensure these actions appear in related planning efforts. Integrating these plans will help maximize funding, enable cost-sharing, and reduce risks to people and property.

The Planning Team members will work to integrate hazard mitigation strategies into other plans and codes as they are developed. Participating team members will conduct periodic reviews of relevant plans and policies at least annually and ensure that future capital improvement planning aligns with the goals of this Hazard Mitigation Plan Update to reduce long-term risk to life and

property from all hazards. To guide and manage development, the Planning Team will review the Comprehensive Land Use Plans, Capital Improvement Plans, Emergency Operations or Management Plans, and Transportation Plans, as applicable to each jurisdiction.

Table 19-1 identifies types of planning mechanisms and examples of methods for incorporating the Plan Update into other planning efforts. The team members, listed in Table 19-2 below, will be responsible for the review of these planning mechanisms and their incorporation of the Plan Update, with the exception of the Floodplain Management Plans; the Floodplain Administrator on staff will be responsible for incorporating the Plan when the Floodplain Management Plan is updated, or a new plan is developed.

Table 19-1. Methods of Incorporation of the Plan

Planning Mechanism	Department / Title Responsible	Incorporation of Plan
Annual Budget Reviews	**City of San Angelo –** Operations: Director **Tom Green County –** Government: County Judge **San Angelo ISD –** Business and Support Services: Assistant Superintendent	Various departments and key personnel that participated in the planning process will review the Plan Update and mitigation actions therein when conducting their annual budget review.
Capital Improvement Plans	**City of San Angelo –** Fire: Chief **Tom Green County –** Government: County Judge **San Angelo ISD –** Business and Support Services: Assistant Superintendent	The City, County, and ISD have a Capital Improvement Plan (CIP) in place or under development. Prior to any revisions to the CIP, City, County, and ISD departments will review the risk assessment and mitigation strategy sections of the HMAP, as limiting public spending in hazardous zones is one of the most effective long-term mitigation actions available to local governments.
Comprehensive Plans	**City of San Angelo –** Operations: Director **Tom Green County –** Government: County Judge	The City and County have a Comprehensive Land Use Plan in place or under development. Since Comprehensive Plans involve developing a unified vision for a community, the mitigation vision and goals of the Plan will be reviewed in the development or revision of a Comprehensive Plan.
Floodplain Management Plans	**City of San Angelo –** Floodplain Administrator **Tom Green County –** Floodplain Administrator	Floodplain Management Plans include preventative and corrective actions to address the flood hazard. Therefore, the actions for flooding and information found in Section 9 of

Planning Mechanism	Department / Title Responsible	Incorporation of Plan
		this Plan Update discussing the people and property at risk to flood will be reviewed and revised when the City and Countyupdate their Floodplain Management Plans or develops a new plan.
Grant Applications	**City of San Angelo – Public Works**: Grants Administrator **Tom Green County –** Financial Accounting and Grants: Grants Administrator **San Angelo ISD –** Student Services and School Safety: Director	The HMAP will be evaluated when grant funding is sought for mitigation projects. If a project is not in the Plan Update, a Plan Revision may be necessary to include the action in the Plan.
Regulatory Plans	**City of San Angelo –** Operations: Director **Tom Green County –** Government: County Judge **San Angelo ISD –** Student Services and School Safety: Director	Currently, all participating jurisdictions have regulatory plans in place or under development, such as Emergency Operations Plans, Land Use Plans, and/or Evacuation Plans. The Plan Update will be consulted when City, County, and ISD departments review or revise their current regulatory planning mechanisms, or in the development of regulatory plans that are not currently in place.

MONITORING, EVALUATING, AND UPDATING

This section outlines the procedures for monitoring and evaluating the Plan Update and for completing required reviews, revisions, and updates. Table 19-2 identifies the departments and titles responsible for these activities.

Table 19-2. Team Members Responsible for Monitoring, Evaluating, and Updating the Plan

Organization / Department	Title
Tom Green County – Government	Commissioner Pct 3
City of San Angelo – Emergency Management	Emergency Management Coordinator
City of San Angelo – Public Works	Grants Administrator
San Angelo ISD – Student Services and School Safety	Director

SECTION 19: PLAN MAINTENANCE

MONITORING

The Planning Team will be responsible for monitoring implementation of the mitigation strategy and coordinating regular updates to the Plan to ensure it remains an effective tool. The lead agency responsible for implementing each mitigation action in this Plan Update will submit annual progress reports to the City of San Angelo, Tom Green County, and San Angelo ISD.

The Planning Team will continue to facilitate meetings with the individuals holding the titles listed in Table 19-2 on an annual basis and will produce an annual report that includes updates on the implementation status of the Plan Update, updates to the risk assessment and capability assessment to incorporate new data and developments, and new mitigation action items. In addition to the annual monitoring, the Plan will be similarly reviewed following major weather events, including state or federal disaster declarations.

EVALUATING

As part of the evaluation process, the Planning Team members identified in Table 19-2 will assess changes in risk; determine whether the implementation of mitigation actions is on schedule; determine whether there are any implementation problems, such as technical, political, legal, or coordination issues; and identify changes in land development or programs that affect mitigation priorities for each respective department or organization. When needed, the goals, objectives, mitigation actions, and priorities will be changed to reflect the evolving needs of the community.

The Planning Team will meet on an annual basis to evaluate the Plan, including the risk and capability assessments, to identify any changes needed, and assess the effectiveness of the Plan in achieving its stated purpose and goals. The team will evaluate the number of mitigation actions implemented, changes in vulnerability due to the completion of mitigation projects, and the loss reduction associated with each action. In addition, the Plan will be similarly evaluated following any extreme weather events, including but not limited to state and federally declared disasters.

UPDATING

The full Executive and Advisory Planning Teams (Appendix B, Tables B-1 and B-2) will meet to review the Plan three years from the FEMA approval date for the development of a five-year update. Additionally, following a disaster, including state or federal disaster declarations, the Plan will be updated to reflect changes in the communities' vulnerabilities or mitigation priorities according to the process outlined above, as necessary.

Factors that may affect the content of the revised Plan include new development in identified hazard areas, increased exposure to hazards, disaster declarations, increase or decrease in capability to address hazards, and changes to federal or state legislation. The Plan update process also provides the Planning Team an opportunity to evaluate mitigation actions that have been successful, identify losses avoided due to the implementation of specific mitigation measures, and address mitigation actions that may not have been successfully implemented as assigned.

Upon completion of the review, revision, and update planning process, the revised Plan will be submitted to TDEM and FEMA for final review and approval in coordination with FEMA within the five-year cycle.

It is important to note that grant and planning cycles may extend beyond one year. Given the five-year lifespan of an approved plan, early consideration of update timelines is relevant to ensure continuity and avoid a lapse in plan status.

CONTINUED PUBLIC INVOLVEMENT

Public input was an integral part of the preparation of this Plan and will continue to be essential for Plan updates. The public will be directly involved in the annual evaluation, monitoring, reviews, and cyclical updates. Changes or suggestions to improve or update the Plan will provide opportunities for additional public input.

The public can review the Plan Update on the participating jurisdictions' and district's websites, where officials and the public are invited to provide ongoing feedback, via email.

The Planning Team may also designate voluntary citizens from the planning area or willing stakeholder members from the private sector businesses that were involved in the Plan's development to provide feedback on an annual basis. It is important that stakeholders and the immediate community maintain a vested interest in preserving the functionality of the planning area as it pertains to the overall goals of the mitigation plan. The Planning Team is responsible for notifying stakeholders and community members on an annual basis and maintaining the Plan.

Media, including local newspapers and radio stations, may be used to notify the public of any maintenance or periodic review activities during the implementation, monitoring, and evaluation phases. Additionally, local news media may be contacted to cover information regarding Plan updates, the status of grant applications, and project implementation. Local and social media outlets will keep the public and stakeholders apprised of potential opportunities to fund and implement mitigation projects identified in the Plan.

Appendix A
Human-Caused Hazards

APPENDIX A: HUMAN-CAUSED HAZARDS

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

Appendix B
Planning Team

APPENDIX B: PLANNING TEAM

PLANNING TEAM MEMBERS

The City of San Angelo and Tom Green County Hazard Mitigation Action Plan Update 2026 was organized using a direct representative model. An Executive Planning Team from the participating jurisdictions, shown in Table B-1, was formed to coordinate planning efforts and request input and participation in the planning process. Table B-2 reflects the Advisory Planning Team, consisting of area organizations and departments that participated throughout the planning process. All Executive and Advisory Planning Team members are involved in hazard mitigation activities; those with the authority to regulate development are identified within Tables B-1 and B-2 with an (R) after their title. Table B-3 is comprised of stakeholders who were invited to provide Plan Update input. Public outreach efforts and meeting documentation are provided in Appendix F.

Table B-1. Executive Planning Team

Organization / Department	Title
Tom Green County – Government	Commissioner Precinct 3 (R)
City of San Angelo – Emergency Management	Emergency Management Coordinator
City of San Angelo – Public Works	Grants Administrator
San Angelo ISD – Student Services and School Safety	Director

Table B-2. Advisory Planning Team

Organization / Department	Title
Tom Green County – Environmental Health Services	Senior Environmental Specialist Designative Representative / Site Evaluator
Tom Green County – Financial Accounting and Grants	Grants Administrator
Tom Green County – Government	County Judge (R)
City of San Angelo – Operations	Stormwater Program Administrator
City of San Angelo – Engineering	City Engineer
City of San Angelo – Finance	Assistant Director
City of San Angelo – Finance	Director
City of San Angelo – Fire	Assistant Fire Chief / Operations
City of San Angelo – Fire	Fire Chief
City of San Angelo – Government	Assistant City Attorney

APPENDIX B: PLANNING TEAM

Organization / Department	Title
City of San Angelo – Government	City Attorney
City of San Angelo – Government	City Manager (R)
City of San Angelo – Information Technology	IT Lead
City of San Angelo – Operations	Assistant Director
City of San Angelo – Operations	Director (R)
City of San Angelo – Planning and Development Services	Director (R)
City of San Angelo – Water Utilities	Director
City of San Angelo – Public Works	Executive Director (R)
San Angelo ISD – Administration	Superintendent (R)
San Angelo ISD – Business and Support Services	Assistant Superintendent
San Angelo ISD – Purchasing	Director

STAKEHOLDERS

The following groups listed in Table B-3 represent a list of organizations invited to stakeholder meetings, public meetings, and workshops throughout the planning process and include members of community groups, non-profit organizations, private businesses, utility providers, neighboring counties, schools, and state and federal agencies. Those that participated in the public meetings are identified with a plus symbol (+) next to their stakeholder type. The public was also invited to participate via e-mail throughout the planning process. Many of the invited organizations and stakeholders participated and were integral to providing comments and data for the Plan Update. For a list of meeting attendees, please see Appendix F.[1]

Table B-3. Stakeholders

Agency	Title	Stakeholder Type
American Red Cross, Texas Big Country Chapter	Executive Director	Non-Profit Organization
Angelo State University	Director of Risk and Emergency Management	Academia (+)
Carlsbad VFD	Fire Chief	Community Organization
Christoval ISD	Superintendent	Academia
Christoval VFD	Assistant Fire Chief	Community Organization

[1] Information contained in Appendix F is exempt from public release under the Freedom of Information Act (FOIA).

APPENDIX B: PLANNING TEAM

Agency	Title	Stakeholder Type
City of San Angelo	City Council Member	Local Government (+)
Concho County	County Judge	Neighboring Jurisdiction
Concho Valley Community Action Agency / Long Term Recovery Group (LTRG)	Executive Director	Non-Profit Organization
Concho Valley Council of Governments	Homeland Security Planner / Local Emergency Planning Committee Point of Contact	Regional Agency
Dove Creek VFD	Fire Chief	Community Organization
East Concho VFD	Fire Chief	Community Organization
Environmental Protection Agency (EPA)	Director of Superfund and Emergency Management Division	Federal Agency
Environmental Protection Agency (EPA)	Regional Administrator	Federal Agency
Grape Creek ISD	District Superintendent	Academia
Grape Creek VFD	Fire Chief	Community Organization
Howard College – San Angelo Campus	Workforce & Community Development Officer	Academia
Irion County	County Judge	Neighboring Jurisdiction
Lower Colorado River Authority (LCRA), Western Region	Regional Representative	Utility Provider
Meals for the Elderly	Executive Director	Non-Profit Organization
Mereta VFD	Fire Chief	Community Organization
My Health My Resources Concho Valley (MHMRCV)	Community Relations Coordinator	Healthcare Agency (+)
My Health My Resources Concho Valley (MHMRCV)	Crisis Counseling Assistance and Training Program Lead	Healthcare Agency (+)
National Weather Service (NWS)	Warning Coordination Meteorologist - San Angelo	Federal Agency (+)
Quail Valley VFD	Fire Chief	Community Organization
Runnels County	County Judge	Neighboring Jurisdiction
San Angelo Area Foundation	President & Chief Executive Officer (CEO)	Non-Profit Organization
Shannon Medical Center	Emergency Management Coordinator	Healthcare Agency (+)

APPENDIX B: PLANNING TEAM

Agency	Title	Stakeholder Type
Texas A&M AgriLife Extension	County Extension Director	State Agency
Texas A&M Forest Service	Wildland Urban Interface Coordinator	State Agency (+)
Texas Commission on Environmental Quality (TCEQ), Region 8	Dam Safety Program	State Agency
Texas Commission on Environmental Quality (TCEQ), Region 8	Regional Director	State Agency
Texas Department of Health and Human Services	Deputy Executive Commissioner, Community Services	State Agency
Texas Department of Health and Human Services	General Representative	State Agency
Texas Department of Health and Human Services	Preparedness Manager	State Agency
Texas Department of Homeland Security	Media Representative	State Agency
Texas Department of Housing and Community Affair	Director of Single-Family and Homeless Program	State Agency
Texas Department of Housing and Community Affair	Manager of Single-Family Program	State Agency
Texas Department of Transportation	Area Engineer	State Agency
Texas Department of Transportation	District Engineer, San Angelo District	State Agency
Texas Division of Emergency Management (TDEM), Region 7	Assistant Chief	State Agency
Texas Division of Emergency Management (TDEM), Region 7	District Chief 10 - San Angelo	State Agency (+)
Texas Division of Emergency Management (TDEM), Region 7	Recovery & Mitigation Section Chief	State Agency
Texas Division of Emergency Management (TDEM), Region 7	Regional Mitigation Coordinator	State Agency (+)
Texas Leadership Public Schools	District Emergency Management Coordinator	Academia (+)
Texas State Representative	House District 72	State Legislature

APPENDIX B: PLANNING TEAM

Agency	Title	Stakeholder Type
Texas State Senate	Senate District 28	State Senate
Texas State Soil & Water Conservation Board	Communications and Outreach Coordinator	State Agency
Texas State Soil & Water Conservation Board	Field Officer / Regional Representative	State Agency
Texas Water Development Board – Region F	Regional Water Planning Group Representative	State Agency
Texas Windstorm Associations	Public Information Officer (PIO)	State Agency
The Concho Observer	Journalist	Media (+)
The Concho Observer	Reporter	Media (+)
Tom Green County Library System – Stephens Central	Library Director	Community Organization
United States Army Corps of Engineers	Fort Worth / Galveston Office	Federal Agency
United States Fish & Wildlife	Southwest Regional Representative	Federal Agency
United Way Concho Valley / Long Term Recovery Group (LTRG)	Director	Non-Profit Organization (+)
United Way Concho Valley / Long Term Recovery Group (LTRG)	Director of Community Impact & Engagement	Non-Profit Organization (+)
United Way Concho Valley / Long Term Recovery Group (LTRG)	Vice President of Community Engagement & Marketing	Non-Profit Organization
Veribest ISD	School Board President	Academia
Wall ISD	Superintendent	Academia
Wall VFD	Fire Chief	Community Organization
Water Valley ISD	Superintendent	Academia
Water Valley VFD	Fire Chief	Community Organization (+)

Appendix C
Public Survey Results

APPENDIX C: PUBLIC SURVEY RESULTS

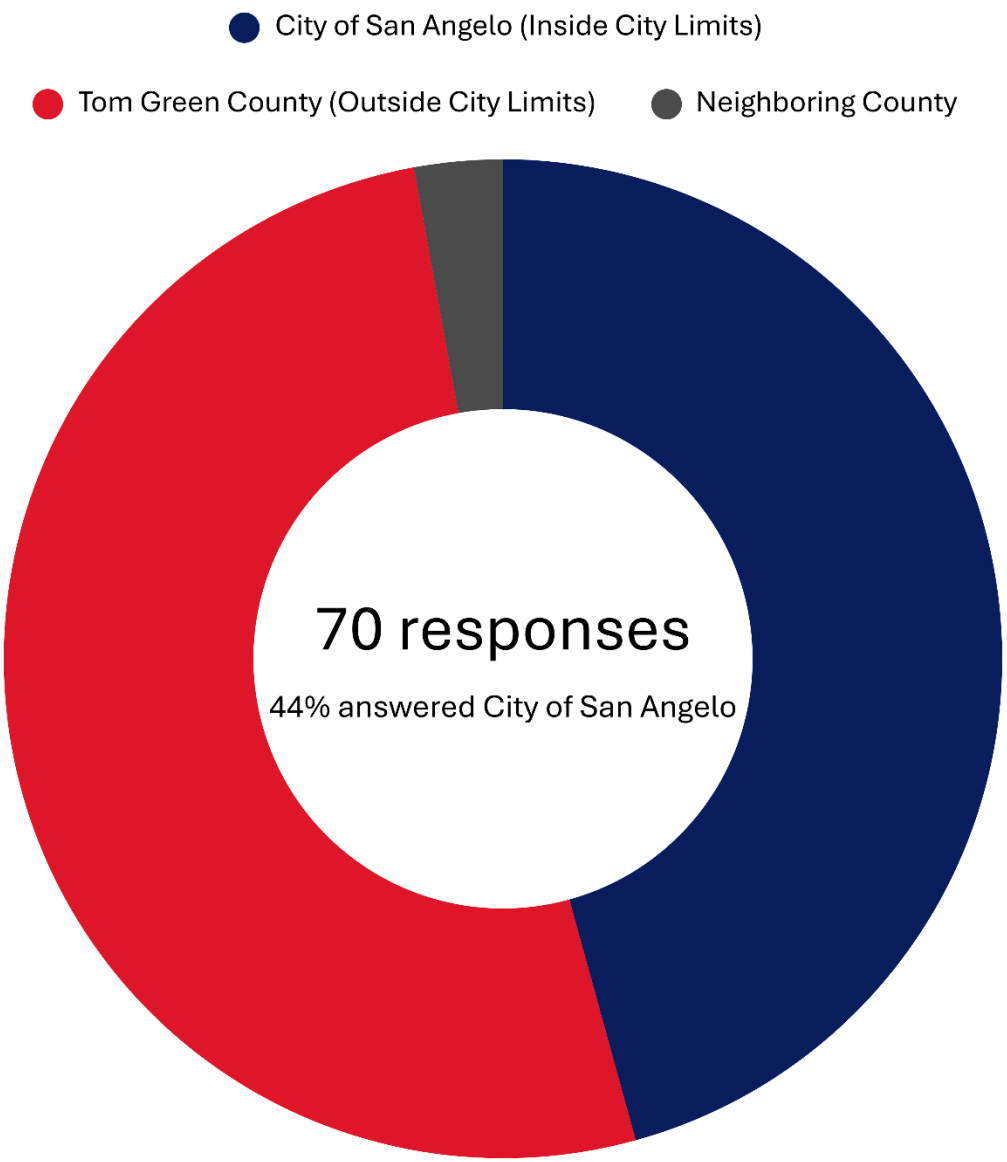
OVERVIEW

The City of San Angelo and Tom Green County prepared a public survey that requested public opinion on a wide range of questions relating to natural hazards. The survey was made available via the participating jurisdictions' websites. The survey link was also distributed at public meetings and stakeholder events throughout the planning process.

A total of 70 surveys were collected, and the results are presented in this appendix. The purpose of the survey was twofold: 1) to solicit public input during the planning process, and 2) to help the jurisdictions identify any potential mitigation actions or problem areas.

All public survey results were discussed and shared with the Planning Team during the Mitigation Strategy Workshop. These results are also provided below. The survey results provide information regarding the public's experience with natural hazards, their perceived hazards of concern, recommended mitigation actions, and additional valuable insights. Overall, the survey enhances the mitigation planning process by ensuring the Plan Update properly represents the community, is informed through local knowledge, and promotes equity.

PUBLIC SURVEY RESULTS



Some respondents were in neighboring counties, and due to their proximity to the planning area, their responses were included in the survey results.
Responses were received from Irion County.

Have you ever experienced or been impacted by a disaster?

59% Responded 'Yes'

Personal experiences shared in survey responses included:

"Flooding during July 2025 in which I second-handedly experienced what my community members had lost. Fellow coworkers experienced property damage and even needed temporary housing amidst the chaos."

"I commute to work in Downtown San Angelo. Ice storms and flooding have impacted my commute and safety. I also travel to San Angelo for medical care. The July 4th flooding event impacted my work and medical appointments."

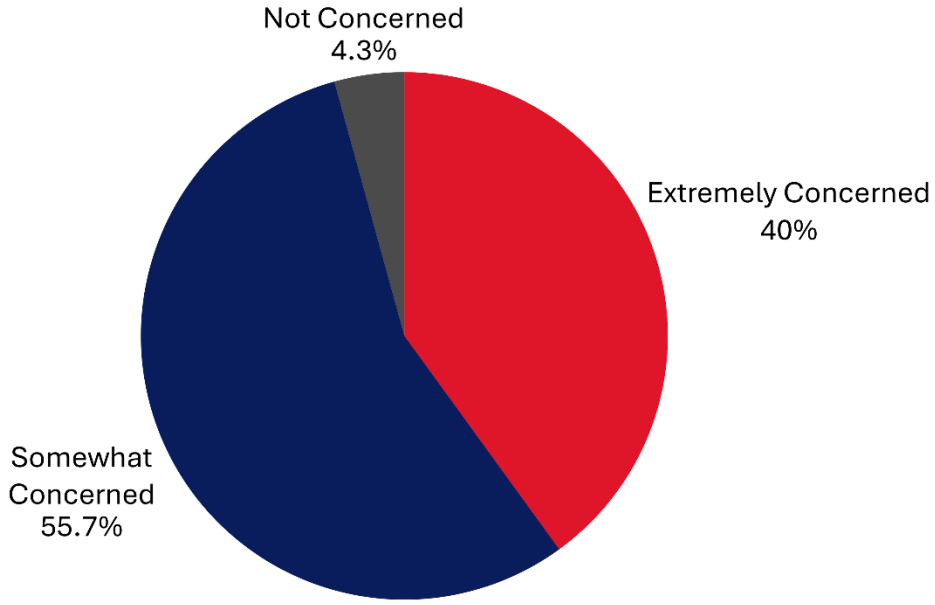
"I live in Dove Creek subdivision. When we have had heavy rains, the low water crossings prevent my daughter, who also lives in Dove Creek on the other side of Dove Creek from us, from coming over to check on us. Also, the road that crosses the low water crossing on Dove Creek has become so damaged by rain and ice that it is dangerous to use anymore."

"Road flooding during storms which blocks all exits to our subdivision. Lagoon Lane, part of Twin Lakes Lane, and the low water crossing that connects Dove Creek Rd East and Dove Creek Rd West."

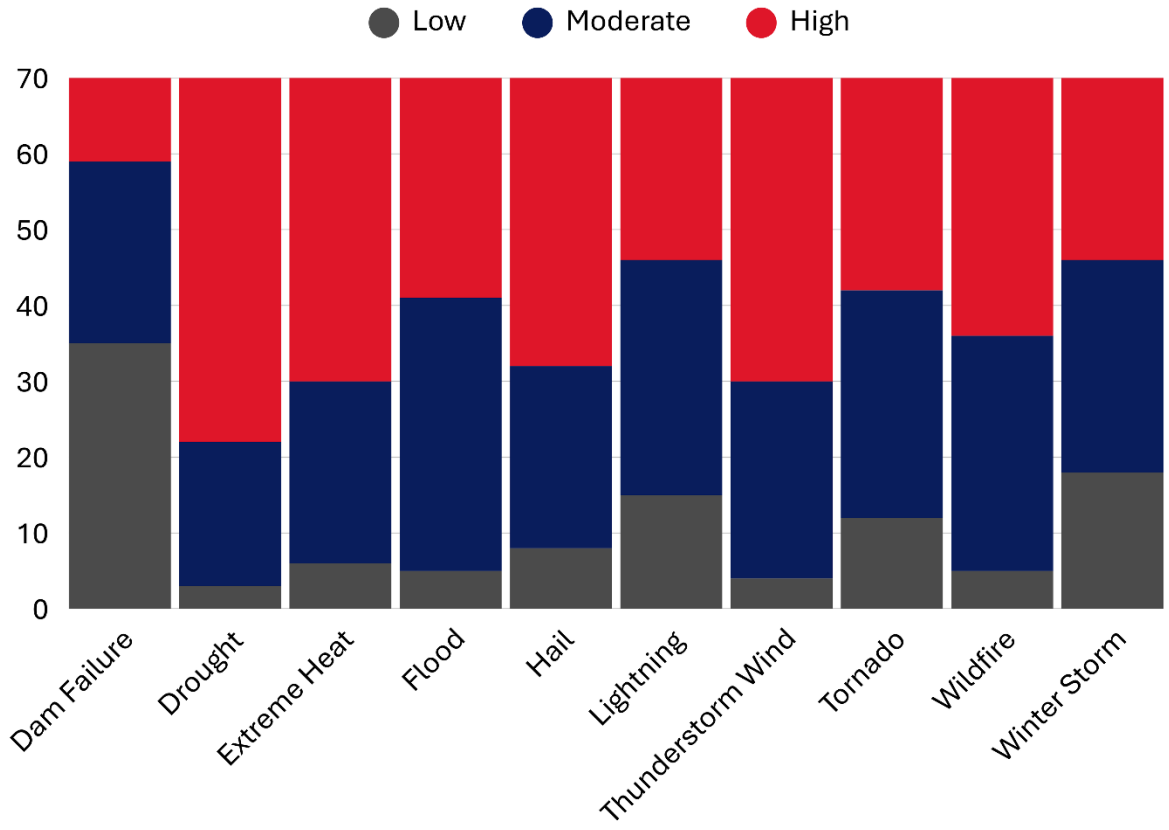
73% of those who have been impacted by a disaster mentioned flooding in their explanations.

27% of those who have been impacted by a disaster mentioned winter storm in their explanations.

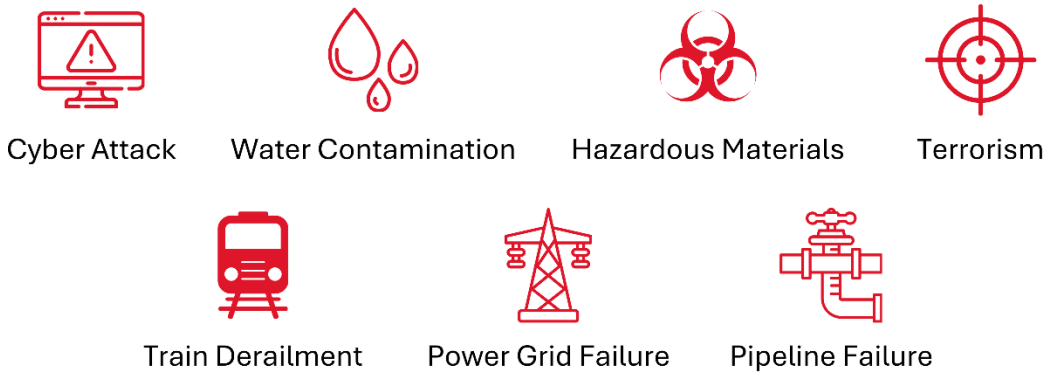
Concern level for the possibility of their community being impacted by a disaster.

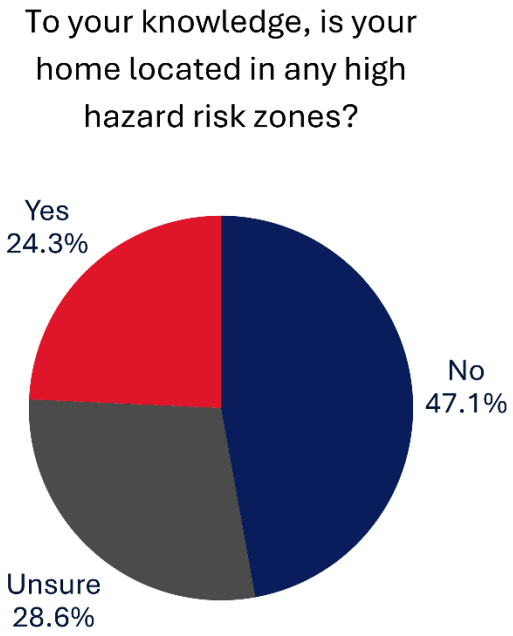


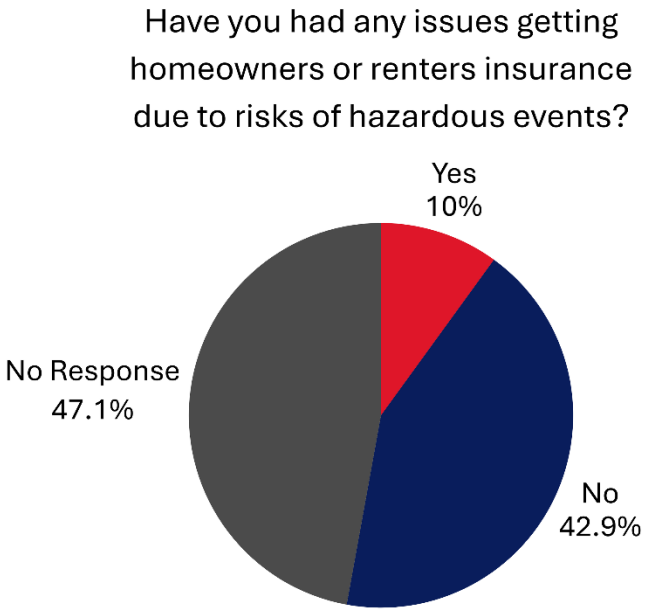
With the consideration of frequency of occurrence and potential impact severity, please indicate your concern level for each of the following hazards:

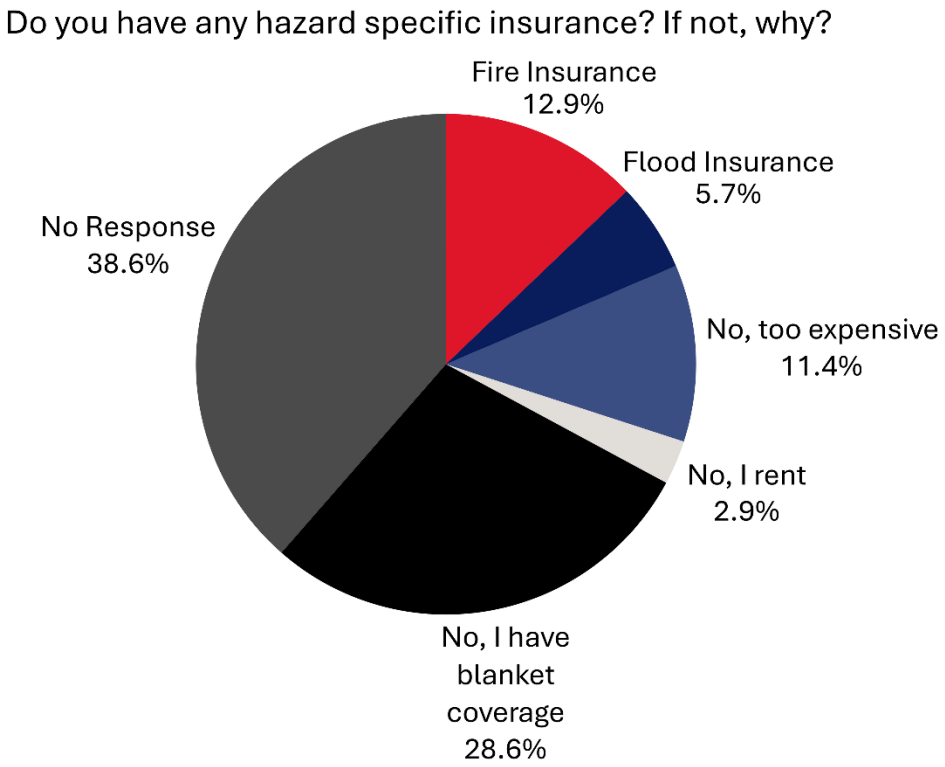


Is there another hazard not listed above that you think is a wide-scale threat to your neighborhood?

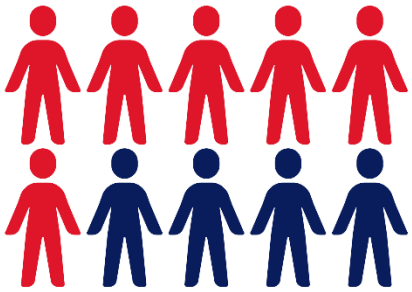



To your knowledge, is your home located in any high hazard risk zones?
Yes
24.3%
No
47.1%
Unsure
28.6%

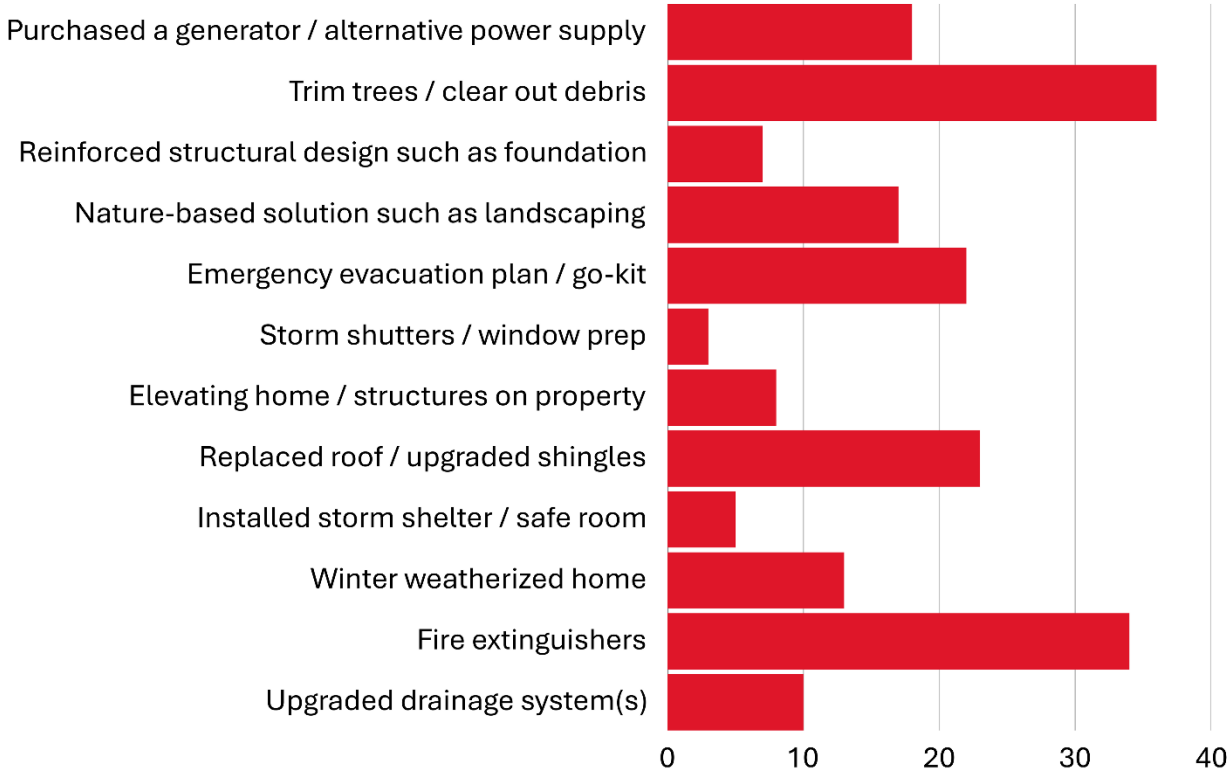

Have you had any issues getting homeowners or renters insurance due to risks of hazardous events?
Yes
10%
No Response
47.1%
No
42.9%


Do you have any hazard specific insurance? If not, why?
Fire Insurance
12.9%
Flood Insurance
5.7%
No, too expensive
11.4%
No, I rent
2.9%
No, I have
blanket
coverage
28.6%
No Response
38.6%

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

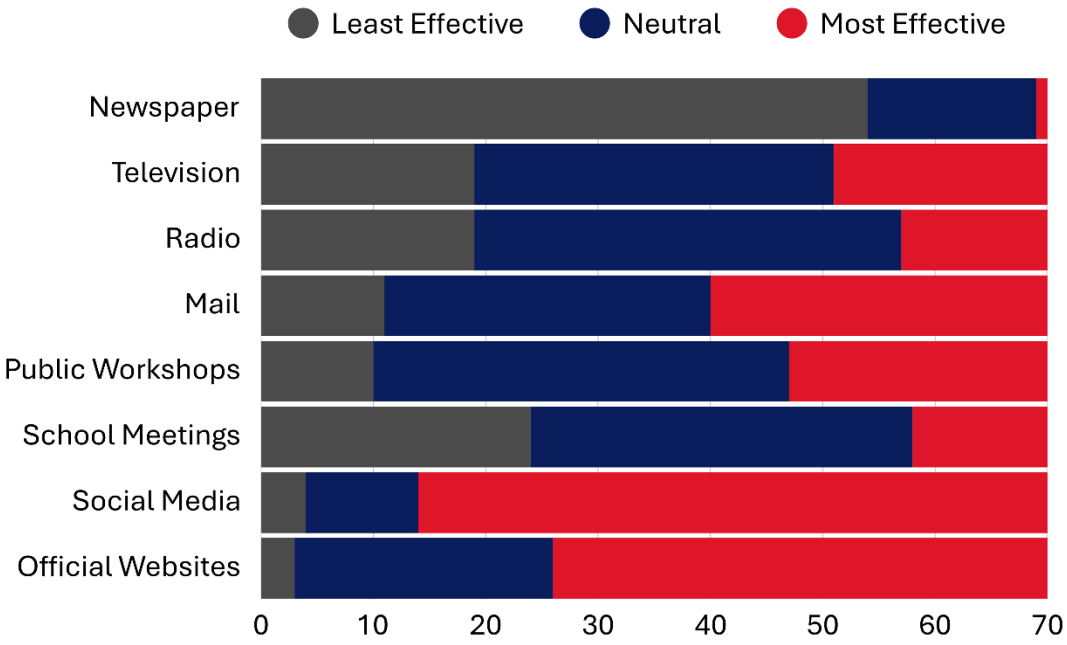


59% Responded ‘Yes’

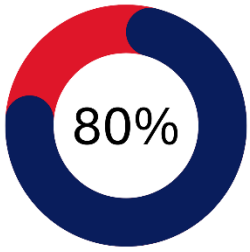


87% of survey responders are interested in making their homes or neighborhoods more resistant to hazards.

What is the most effective way for you to receive information about how to make your home and neighborhood more resistant to hazards?



Most effective form of communication method for receiving information



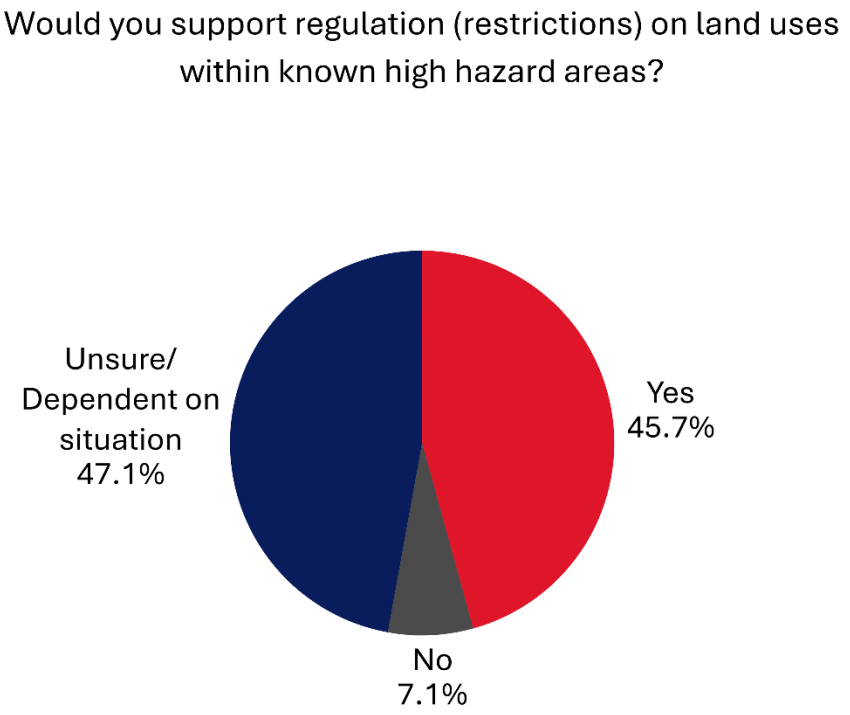
Social Media

Additional communication methods recommended:

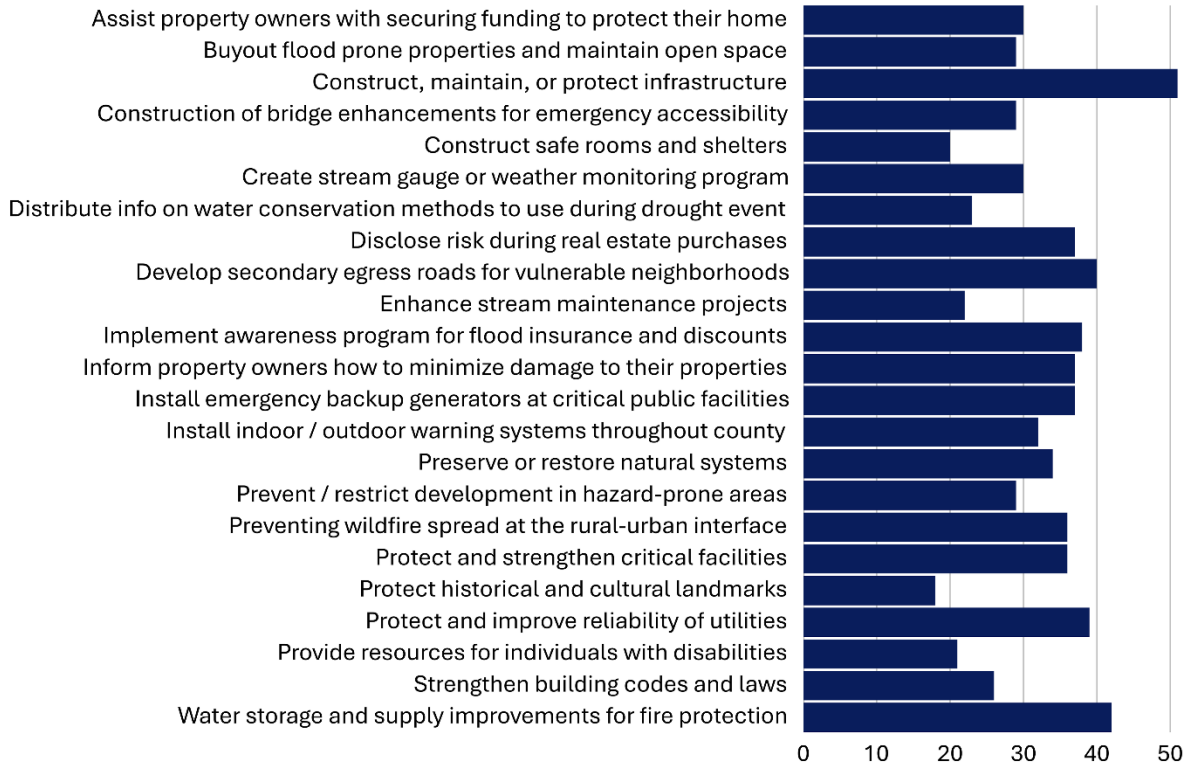
Text / Alert

Word of Mouth

Email


Would you support regulation (restrictions) on land uses within known high hazard areas?
Unsure/ Dependent on situation 47.1%
Yes 45.7%
No 7.1%

In your opinion, please select steps your local government should prioritize to reduce or eliminate the risk of future hazard damages in your neighborhood.



Are there any other projects you would like to see implemented to protect your community from hazardous events?

Flood Improvement Projects

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.

Emergency Services - 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.

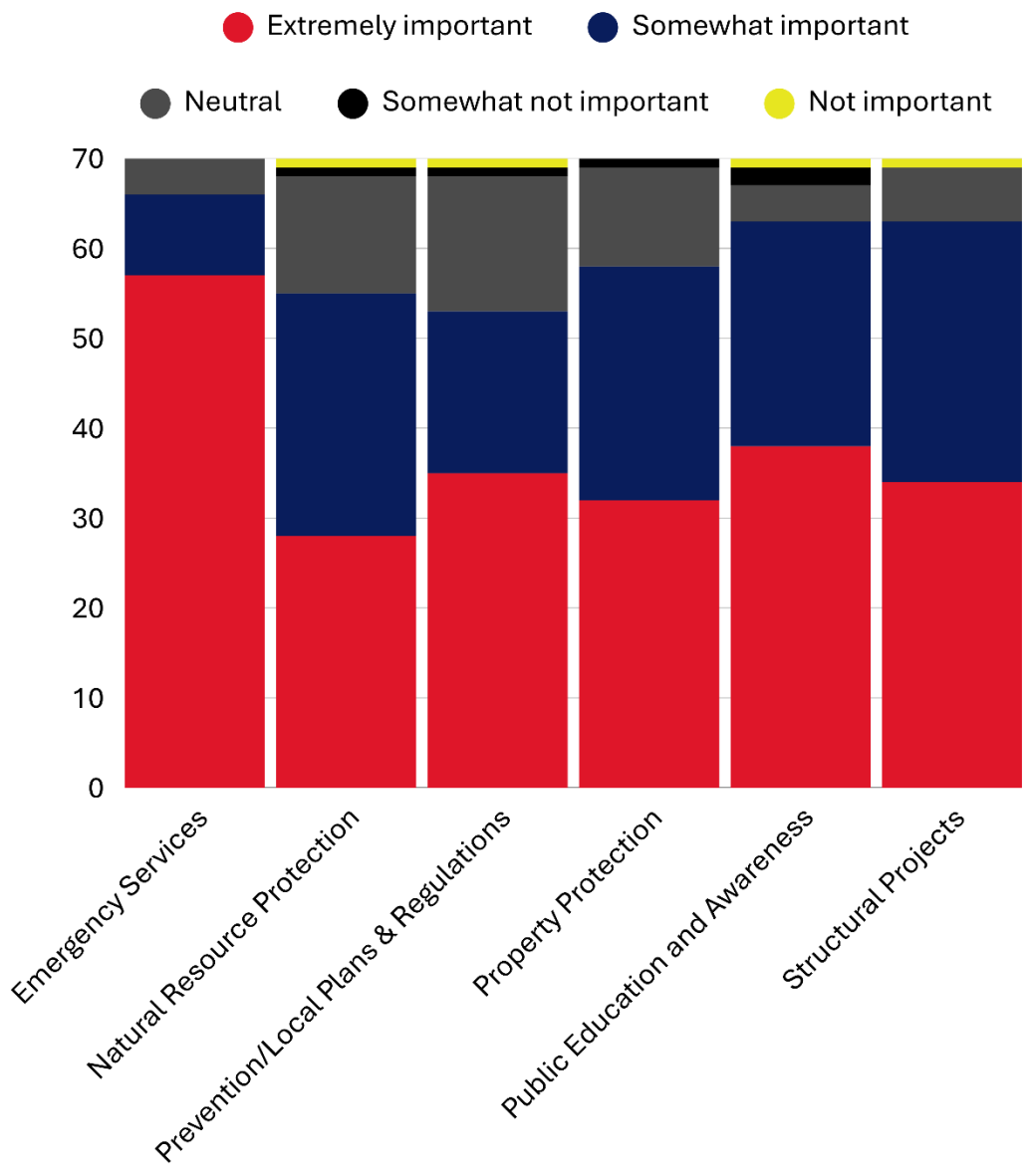
Prevention / Local Plans & Regulations - Administrative or regulatory actions that influence the way land is developed and buildings are built. Examples include planning and zoning, building codes, open space preservation, and floodplain regulations.

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.

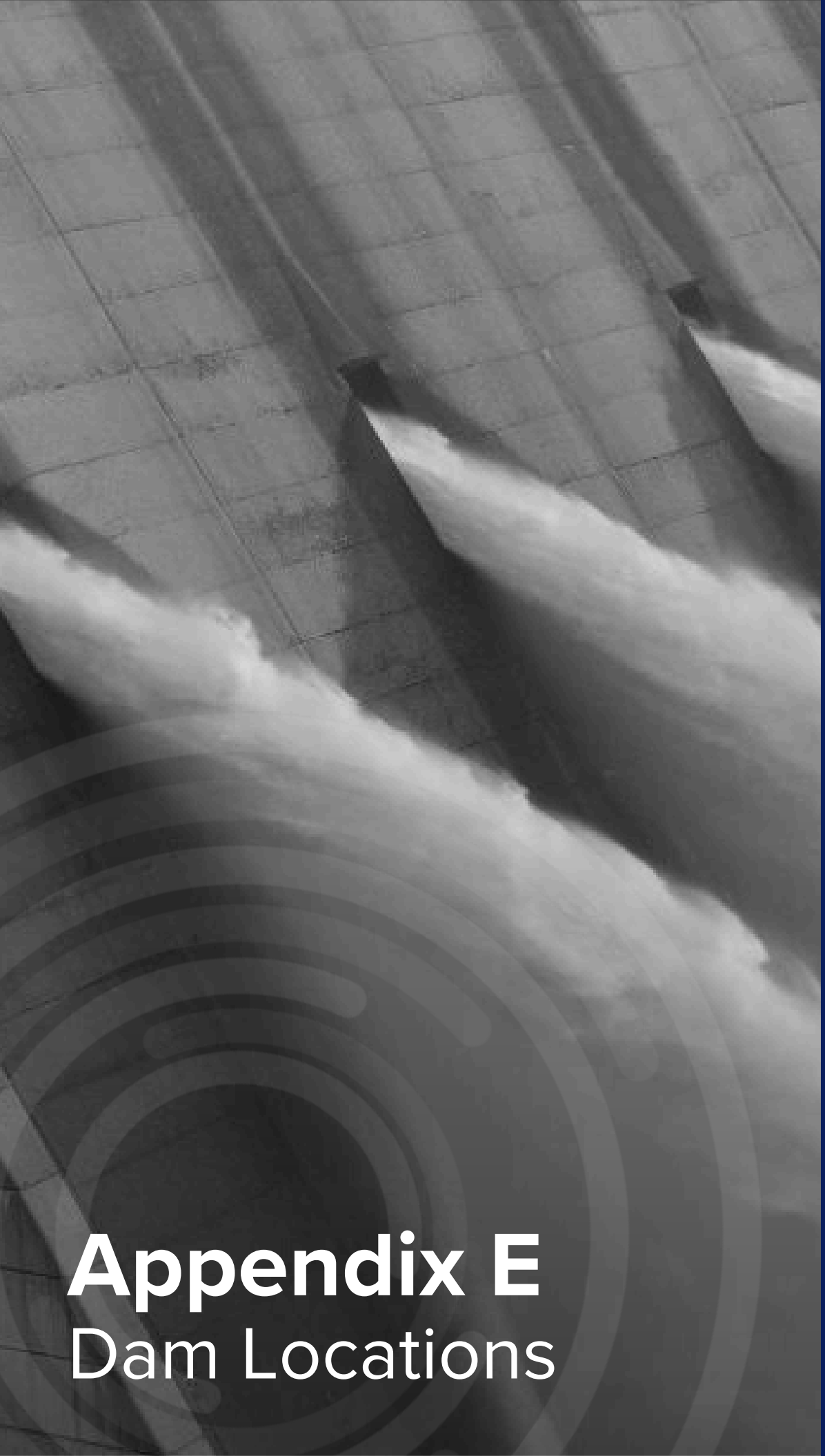
Please tell us how important you think each one is for your community to consider pursuing.



Appendix D
Critical Facilities

APPENDIX D: CRITICAL FACILITIES

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



Appendix E
Dam Locations

APPENDIX E: DAM LOCATIONS

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

Appendix F
Meeting Documentation

APPENDIX F: MEETING DOCUMENTATION

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

Appendix G
Capability Assessment

APPENDIX G: CAPABILITY ASSESSMENT

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

Appendix H
State and Federal Funding Opportunities

APPENDIX H: STATE AND FEDERAL FUNDING OPPORTUNITIES

OVERVIEW

Texas utilizes state funds to improve statewide hazard mitigation capabilities and advance their hazard mitigation goals to help identify, understand, and manage various risks associated with natural hazards. State funds also provide funding for state facilities and infrastructure upgrades, hazard mapping, mitigation planning, and other mitigation programmatic activities. Table H-1 describes a variety of loan and grant programs offered by state agencies for which mitigation activities may be eligible.

Table H-1. Summary of State Funded Mitigation Programs

Agency	Funding Program
Texas A&M Forest Service (TAMFS)	• Community Fire Protection Program • Community Wildfire Defense Grant • Fire-Adapted Communities Program (FAC) • Firewise USA Program • Forest Land Enhancement Program • Forest Legacy Program • Mitigation Project Support Fund Prescribed Fire Grants • Resilient Landscapes Program • Rural Fire Assistance Grant • State Fire Assistance for Mitigation (SFAM) - Mechanical Fuels Grants • State Fire Assistance for Mitigation (SFAM) - Vegetative Fuel Break Grant • Texas Longleaf Conservation Assistance Program • Urban Tree Canopy Project (UTC)
Texas Commission on Environmental Quality (TCEQ)	• Clean Water Act Section 319 Grants • High Hazard Potential Dam Program (HHPD) • Nonpoint Source Grant Program • U.S.-Mexico Border Water Infrastructure Program
Texas Department of Agriculture (TDA)	• Agricultural Management Assistance (AMA) • Agricultural Water Enhancement Program (AWEP) • Community Development Block Grant • Community Development Block Grant for Rural Texas • Conservation Innovation Grants (CIG) • Environmental Quality Incentives Program (EQUIP)
Texas Department of Housing and Community Affairs (TDHCA)	• Texas HOME Disaster Relief
Texas Department of State Health Services (TXDSHS)	• Hospital Preparedness Program (HPP) Cooperative Agreement • Public Health Emergency Preparedness (PHEP) Cooperative Agreement

APPENDIX H: STATE AND FEDERAL FUNDING OPPORTUNITIES

Agency	Funding Program
Texas Department of Transportation (TXDOT)	• Bridge Preventative Maintenance Program • Emergency Relief (ER) Program • Highway Bridge Replacement and Rehabilitation Program • Safe Rest Stops Program • Transportation Enhancement Program
Texas Division of Emergency Management (TDEM)	• Emergency Management Performance Grant (EMPG) • Fire Management Assistance Grants (FMAG) • Hazard Mitigation Planning Grants Program (HMGP) • Homeland Security Grant Program (HSGP) • Individual Assistance (IA) • National Earthquake Hazard Reduction Program (NEHRP) • Public Assistance (PA) Section 406 Funds
Texas Economic Development & Tourism (EDT)	• Economic Development Administration Grants and Investments
Texas General Land Office (TXGLO)	• Beach Act Grants • Beach Maintenance Reimbursement Fund • Coastal Erosion Planning and Response Act (CEPRA) • Coastal and Estuarine Land Conservation Program (CELCP) • Coastal Management Program (CMP) • Community Development Block Grant – Disaster Recovery (CDBG-DR) • Community Development Block Grant – Mitigation (CDBG-MIT) • Gulf of Mexico Energy Security Act (GOMESA) • Hazard Mitigation Grant Program Supplemental – LHMPP
Texas Parks and Wildlife Department (TPWD)	• Nation Resources Damage Assessment (NRDA) • National Wildlife Wetland Refuge System • North American Wetland Conservation Fund • Partners for Fish and Wildlife • Texas Farm and Ranch Lands Conservation Program (TFRLCP) • Wildlife Habitat Incentive Program (WHIP)
Texas State Soil and Water Conservation Board (TSSWCB)	• Clean Water Act Section 319 Grants • Nonpoint Source Grant Program
Texas Water Development Board (TWDB)	• Agricultural Water Conservation Grants • Agricultural Water Conservation Loans • Clean Water State Revolving Fund (CWSRF) • Community Assistance Program (CAP) • Drinking Water State Revolving Fund (DWSRF) • Economically Distressed Areas Program • Emergency Community Water Assistance Grants • Flood Infrastructure Fund (FIF)

Agency	Funding Program
	• Flood Mitigation Assistance (FMA) Program • Flood Protection Planning Program • Groundwater Conservation District Loan Program • Planning Assistance to States • Regional Facility Planning Grant Program • Regional Water Planning Group Grants • Research and Planning Fund and Fund Development Program • Risk MAP Program • Rural Development Grants • Rural Water Assistance Fund (RWAF) • Silver Jackets • Small Flood Control Projects (USACE Section 205) • State Participation Program – Regional Water and Wastewater Facilities • State Water Implementation Fund for Texas (SWIFT) • State Water Resources Research Act Program • Texas Infrastructure Resiliency Fund (TIRF) • Texas Water Development Fund (DFund) • Water Research Grant Program • WaterSMART - Drought Response Program

In addition to state-funded programs, many local jurisdictions benefit from federal mitigation funding opportunities. FEMA's Hazard Mitigation Assistance is a primary source for the implementation of mitigation projects throughout the nation. Table H-2 describes additional federal, state, local, and nonprofit mitigation funding sources specifically within the State of Texas.

Table H-2. Federal, State, Local and Non-Profit Mitigation Funding Sources in Texas

Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Agricultural Conservation Easement Program (ACEP)	Federal	NRCS		Provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits.
Agricultural and Food Research Initiative (AFRI)	Federal	USDA	NIFA	Provides $100,000 in funding to support research in two key areas: (1) understanding fundamental watershed processes; and (2) developing technologies and management practices that enhance the efficient use of water, both consumptive and non-consumptive, while protecting or improving water quality for agricultural and forestry production.

APPENDIX H: STATE AND FEDERAL FUNDING OPPORTUNITIES

Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Agricultural Management Assistance (AMA)	Federal	USDA, NRCS	TDA	Provides financial and technical assistance to agricultural producers to voluntarily address issues such as water management, water quality, and erosion control by incorporating conservation methods into their farming operations.
Agricultural Water Enhancement Program (AWEP)	Federal	USDA, NRCS	TDA	Voluntary conservation initiative that provides financial and technical assistance to agricultural producers to implement water enhancement activities on agricultural land to conserve surface and ground water and improve water quality.
Agricultural Water Conservation Grants	State	TWDB	TWDB	Funding is available to state agencies and political subdivisions for projects that advance the implementation of conservation or water management strategies identified in state and regional water plans. Applications are accepted annually, with up to $1.2 million in total funding available each year. Grant categories are subject to change annually.
Agricultural Water Conservation Loans	State	TWDB	TWDB	Agricultural water conservation loans to use either for facility improvements or as loans to individuals. Low-interest, fixed rates. Up to 10-year repayment terms. U.S. Iron and Steel requirements apply to certain projects. Eligible loan applicants include political subdivisions.
AmeriCorps - Corporation for National & Community Service (CNCS)	Federal	AmeriCorps	N/A	Provides funding for volunteers to serve communities, including disaster prevention. AmeriCorps/Vista has assisted local communities with wildfire mitigation projects.
American Recovery and Reinvestment Act (ARRA)	Federal	EPA		Provides significant funding for states to finance high priority water infrastructure projects through a $2 billion appropriation to the Drinking Water State Revolving Fund (DWSRF) program and a $4 billion appropriation to the Clean Water State Revolving Fund (CWSRF) program.

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Name	Level	Source Agency	Managing State Agency	Purpose of Funding
American Recovery and Reinvestment Act (ARRA)	Federal	DOT Federal Transit Administration	TDA	The American Recovery and Reinvestment Act (ARRA), commonly referred to as the Recovery Act, is a stimulus package enacted by the 111th U.S. Congress and signed into law by President Barack Obama in February 2009. Designed in response to the Great Recession, the primary goal of the Act was to preserve existing jobs and generate new employment opportunities as quickly as possible. Additional objectives include providing temporary relief to individuals most affected by the recession and investing in infrastructure, education, healthcare, and renewable energy.
Aquatic Ecosystem Restoration	Federal	DOD-USACE		Direct support for carrying out aquatic ecosystem restoration projects that will improve the equality of the environment.
Assistance to Firefighters program - Fire Prevention & Safety (FP&S) **Grants**	Federal	FEMA, AFG		Fire Prevention & Safety (FP&S) Grants support projects that enhance the safety of the public and firefighters from fire and related hazards.
BEACH Act Grants	Federal	EPA	TXGLO	EPA awards grants under the authority of the BEACH Act to eligible states, territories, and tribes with beaches on oceans and the Great Lakes coasts to develop and implement programs to monitor their beaches and notify the public when it is not safe to swim.
Beach Maintenance Reimbursement Fund	State	GLO	TXGLO	Allocates approximately $750,000 per year to help communities maintain their beaches. Applications are distributed to eligible participants in early fall and are due within a specified amount of time, no less than 30 days. Contracts are renewable annually.

Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Bridge Preventative Maintenance Program **Bridge Preventative Maintenance Program** (continued)	State	TXDOT	TXDOT	A planned, cost-effective treatment that preserves, improves, or delays future deterioration of the condition of a bridge. To be eligible, a bridge must have a condition rating of 5 or 6 for at least one of the following: deck, superstructure, substructure, culvert, or channel. Safety and improvements to the physical condition of the State's on-system bridges are TxDOT's main goals in the prioritization of the bridges using BMIP funds. Each FY, the Bridge Division develops and distributes an initial list of eligible bridges in each district for the annual program call.
Carbon Reduction Program (CRP)	Federal	USDOT	TXDOT, TCEQ	Provides funds for projects that are designed to reduce transportation emissions (CO2). This program can fund a wide range of projects designed to reduce carbon dioxide emissions from on-road highway sources.
Center for Integration of Natural Disaster Information	Federal	DOI/USGS, The Center for Integration of Natural Hazards Research	Texas A&M	Technical Assistance: Develops and evaluates technology for information integration and dissemination.
Clean School Bus Program	Federal	EPA	TCEQ	Provides assistance in replacing existing school buses with zero-emission and low-emission models.
Clean Water Act Section 319 Grants	Federal	EPA	TCEQ and TSSWCB	Provides grants for a wide variety of activities related to non-point source pollution runoff mitigation.
Clean Water State Revolving Fund (CWSRF)	Federal	EPA	TWDB	Provides low-cost financing for a wide range of wastewater, stormwater, reuse, and other pollution control projects.

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Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Climate Pollution Reduction Grant (CPRG)	Federal	EPA	TCEQ	Supports the state in creating two climate action plans (i.e., one priority plan and one comprehensive plan) for implementing effective greenhouse gas reduction strategies while ensuring the benefits of these actions are delivered to Texans, especially Low Income or Disadvantaged communities (LIDAC) as defined by US EPA. This grant will give Texas communities the opportunity to collaborate with the state to build projects and programs that provide high-quality jobs, improve health, and keep families safe where they live.
Coastal Erosion Planning and Response Act (CEPRA)	State	GLO	TXGLO	Since its inception in 2000, the Texas General Land Office's Coastal Erosion Planning and Response Program has secured over $62 million in state funding, complemented by an additional $62 million in matching funds. This program has facilitated the completion of more than 200 coastal erosion projects and studies. The application process for non-emergency project funding opens every even-numbered year in February and closes in early June of the same year.
Coastal and Estuarine Land Conservation Program (CELCP)	Federal	NOAA	TXGLO	When the National Oceanic and Atmospheric Administration (NOAA) provides funding for CELCP, the General Land Office (GLO) offers coastal communities the opportunity to submit up to three project applications per year. Federal grant awards for individual projects may not exceed $3 million.

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Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Coastal Management Program (CMP)	Federal	NOAA	TXGLO	Texas receives approximately $2 million annually in grants from NOAA and 90 percent of the funds are passed through to local governments and entities to address environmental needs and promote sustainable economic development along the coast. Projects must improve the management of the state's coastal resources and ensure long-term ecological and economic productivity. Section 306 administrative funds can be used for non- construction, coastal planning and education, and research. Section 306A improvement funds can be utilized for construction and land acquisition projects, preservation, and restoration. CMP funding categories include Coastal Natural Hazards Response, Critical Areas Enhancement, Public Access, Water/Sediment Quantity and Quality Improvements, Waterfront Revitalization and Ecotourism Development, Permit Streamlining/ Assistance, Governmental Coordination and Local Government Planning Assistance.
Community Assistance Program (CAP)	Federal	FEMA, NFIP	TWDB	Product-oriented financial assistance program directly related to the flood loss reduction objectives of the National Flood Insurance Program (NFIP).
Community Development Block Grant (CDBG)	Federal	HUD	TDA	The primary objective is to develop viable communities by providing decent housing and suitable living environments and expanding economic opportunities principally for persons of low- to moderate- income. Eligible applicants are non-entitlement cities under 50,000 in population and non-entitlement counties that have a non-metropolitan population under 200,000 and that are not eligible for direct CDBG funding from HUD may apply for funding through any of the Texas CDBG programs.

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Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Community Development Block Grant for Rural Texas	State	TDA	TDA	TDA administers the Community Development Block Grant for Rural Texas. The primary objective of the CDBG is to develop viable communities by providing decent housing and suitable living environments and expanding economic opportunities principally for persons of low- to moderate-income. Eligible applicants are non-entitlement cities under 50,000 in population and non-entitlement counties that have a non-metropolitan population under 200,000 and that are not eligible for direct CDBG funding from HUD may apply for funding through any of the Texas CDBG programs.
Community Development Block Grant – Disaster Recovery (CDBG-DR)	Federal	HUD	TXGLO	Often following a disaster, the state may receive a CDBG-DR Supplement intended for mitigation and disaster recovery projects in the affected areas. Funding can be used to acquire properties in hazard prone areas. Since CDBG funds lose their federal identify they can also be used to supplement state or local match requirements on other funds such as FEMA HMA grants. Funding also supports public facilities including water and wastewater.
Community Development Block Grant – Mitigation (CDBG-MIT)	Federal	HUD	TXGLO	Eligible grantees can use this assistance in areas impacted by recent disasters to carry out strategic and high-impact activities to mitigate disaster risks and reduce future losses. In February of 2018, Congress appropriated $12 billion dollars in Community Development Block Grant (CDBG) funds specifically for mitigation activities for qualifying disasters in 2015, 2016, and 2017. HUD was able to allocate an additional $3.9 billion, bringing the amount available for mitigation to nearly $16 billion.
Community Fire Protection Program	Federal	USDA	TAMFS	Mitigation is delivered via the USDA Forest Service and Private Forestry Coop Fire Program.

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Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Community Rating System (CRS)	Federal	FEMA		A voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. CRS not only assists communities in reducing flood risks, but also enhances public safety, reduces damage to property and public infrastructure, avoids economic disruption and losses, reduces human suffering, and protects the environment. Technical assistance in designing and implementing some activities is available at no charge. Participating in the CRS provides an incentive to maintain and improve a community's floodplain management program over the years. Implementing some CRS activities can help the project qualify for certain other Federal assistance funds.
Community Wildfire Defense Grant	Federal	USFS	TAMFS	Offers financial assistance to at-risk local communities with planning for and against the risk of catastrophic wildfire. This program is authorized in Public Law 117-58, the Infrastructure Investment and Jobs Act. Two primary objectives: The development and revision of Community Wildfire Protection Plans (CWPP), and the implementation of projects described in a CWPP that is less than ten years old. Prioritizes at-risk communities that are in an area identified as having high or very high wildfire hazard potential, are low-income, and/or have been impacted by a severe disaster with no minimum federal funding limit for projects.
Conservation Contracts	Federal	USDA-FSA		Debt reduction for delinquent and non-delinquent borrowers in exchange for conservation contracts placed on environmentally sensitive real property that secures FSA loans.
Conservation Innovation Grants (CIG)	Federal	USDA, NRCS	TDA	A voluntary program intended to stimulate the development and adoption of innovative conservation approaches and technologies while leveraging federal investment in environmental enhancement and protection, in conjunction with agricultural production.
Conservation Technical Assistance (CTA) **Program**	Federal	USDA-NRCS		Technical assistance for run-off retardation and soil erosion prevention to reduce hazards to life and property.

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Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Decision, Risk, and Management Science Program	Federal	NSF		Funding is provided for research and related educational activities focused on risk, perception, communication, and management, with an emphasis on technological hazards.
Disaster Mitigation Planning and Technical Assistance	Federal	DOC, EDA		Technical and planning assistance grants for capability building and mitigation project activities focusing on creating disaster resistant jobs and workplaces.
Division of Homeland Security Financial Assistance	Federal	US Department of Homeland Security	OOG	Supports a wide variety of funding and financial assistance programs that promote preparedness, resilience, and post-disaster relief.
Drinking Water State Revolving Fund (DWSRF)	Federal	EPA	TWDB	Provides funding for infrastructure improvements to drinking water systems. The program also emphasizes providing funds to small and disadvantaged communities and for programs that encourage pollution prevention as a tool for ensuring safe drinking water.
Economic Development Administration Grants and Investments	Federal	U.S. DOC, EDA	EDT	Provides grants and investments for community construction projects, including mitigation activities.
Economically Distressed Areas Program	State	TWDB	TWDB	Provides financial assistance for projects serving economically distressed areas where water or sewer services do not exist, or systems do not meet minimum state standards. Eligible EDAP applicants include cities, counties, water districts, nonprofit water supply corporations, and all other political subdivisions. The city or county where the project is located must adopt and enforce Model Subdivision Rules for the regulation of subdivisions prior to application for financial assistance. Projects must also be in an economically distressed area where the median household income is not greater than 75 percent of the median state household income.

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Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Economic Injury Disaster Loan	Federal	SBA		The COVID EIDL program ceased accepting applications on December 31, 2021, however, the disaster EIDL program continues to be available to businesses impacted by other publicly declared disasters.
Emergency Community Water Assistance Grants	Federal	USDA	TWDB	$150,000 to $500,000 available to rural communities with populations over 10,000 people with a median household income of less than $65,900. Aids communities that have experienced a decline in quantity or quality of drinking water as a result of an emergency, including drought.
Emergency Management / Mitigation Training	Federal	FEMA		Training in disaster mitigation, preparedness, and planning.
Emergency Management Institute	Federal	FEMA		Education training programs to prepare emergency management professionals to prepare for, respond to, and recover from disasters and emergencies.
Emergency Management Performance Grant (EMPG)	Federal	FEMA	TDEM	Provides a yearly allocation of funding to support state and local emergency management programs. This has included providing funding for local mitigation plans, mitigation-oriented studies, and related activities.
Emergency Relief (ER) **Program**	Federal	US DOT - FHWA	TXDOT	Provides funding for the repair or reconstruction of roads and bridges on Federal-aid highways that have sustained damage as a direct result of a natural disaster or a catastrophic failure due to an external cause.
Emergency Watershed Protection (EWP)	Federal	USDA, NRCS	TWDB	Provides funding and technical assistance for emergency measures, including floodplain easements in impaired watersheds. Funding is available through Simplified Acquisition Procedures (SAP), typically ranging from $25,000 to $100,000. Support is provided through contracts between project sponsors and the Natural Resources Conservation Service (NRCS); grants are not offered under this program. The NRCS covers up to 75 percent of total project costs.

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Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Environmental Justice Government-to-Government Program (EJG2G)	Federal	EPA		Provides funding to support government activities that lead to measurable environmental or public health impacts in communities disproportionately burdened by environmental harms.
Environmental Justice Collaborative Problem Solving Program	Federal	EPA		Provides funding directly to community-based organizations to address environmental injustices.
Environmental Quality Incentives Program (EQUIP)	Federal	USDA, NRCS	TDA	Provides funding and technical assistance to farmers and ranchers to promote agricultural production and environmental quality as compatible goals.
Farm Ownership Loans	Federal	USDA-FSA		Direct loans, guaranteed / insured loans, and technical assistance to farmers so that they may develop, construct, improve, or repair farm homes, farms, and service buildings, and to make other necessary improvements.
Federal Land Transfer / Federal Land to Parks Program	Federal	DOI-NPS		Identifies, assesses, and transfers available federal real property for acquisition for use in state and local parks and recreation, such as open space.
Fire-Adapted Communities Program (FAC)	Federal	FEMA, USFA	TAMFS	Collaborates to identify wildfire risk and take actionable steps to reduce risk of loss by protecting property and enhancing the safety of firefighters and residents.
Fire Management Assistance Grants (FMAG)	Federal	FEMA	TDEM	Provides fire suppression support to states when loss of life and property is imminent. Wildfire mitigation is also eligible under emergency protection if life is in imminent danger.
Fire Prevention and Safety Grant Program	Federal	US Fire Administration		Provides funding for projects that enhance the safety of the public and firefighters from fire and related hazards. The primary goal is to target high-risk populations and reduce injury and prevent death.

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Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Firewise USA Program	Federal	USDA, DOI, NASFF, NFPA	TAMFS	Provides a collaborative framework to help neighbors in a geographic area organize and enhance ignition resistance of their homes and community to reduce wildfire risks at the local level.
Flood Infrastructure Fund (FIF)	State	TWDB	TWDB	Provides financial assistance in the form of loans and grants for flood control, flood mitigation, and drainage projects. The Flood Intended Use Plan (Flood IUP) details the structure of each funding cycle and the SWIFT Advisory Committee serves as the oversight entity.
Flood Mitigation Assistance Program (FMA)	Federal	FEMA	TWDB	Repetitive flood loss property reduction and projects that mitigate losses to NFIP-insured properties.
Floodplain Management Services	Federal	DOD-USACE		Provides technical and planning assistance at the local, regional, or national level needed to support effective floodplain management.
Flood Protection Planning Program	State	TWDB	TWDB	Grant funding available to political subdivisions of the State of Texas for the evaluation of structural and nonstructural solutions to flooding problems. Upstream and/or downstream effects of proposed solutions must be considered in the planning and must be regional in nature by considering the flood protection needs of the entire watershed. Eligible planning activities include, but are not limited to, determining and describing flooding-related problems ; conducting hydrologic and hydraulic studies; identifying potential solutions; estimating the benefits and costs of potential solutions, including structural and nonstructural measures; determining the views and needs of the affected public regarding flooding problems; recommending feasible flood protection solutions; evaluating environmental, social, and cultural factors; and ensuring proposed solutions are consistent with regional or statewide plans as well as relevant laws and regulations.
Forest Land Enhancement Program	Federal	USDA, NRCS	TAMFS	Provides educational, technical, and financial assistance to help landowners implement sustainable forestry management objectives.

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Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Forest Legacy Program	Federal	USFS	TAMFS	Provides funding to protect private forest lands that are environmentally, economically, and socially critical, thereby reducing development in the wildland-urban interface.
Greenhouse Gas Reduction Fund (GGRF)	Federal	EPA		The program is designed to combat the climate crisis by mobilizing financing and private capital for greenhouse gas- and air pollution-reducing projects in communities across the country.
Grid Resilience Program (GRIP)	Federal	DOE		Enhance grid flexibility and improve the resilience of the nation's power grid against threats of extreme weather and climate change.
Hazard Mitigation Grant Program (HMGP)	Federal	FEMA	TDEM	Post-disaster multi-hazard mitigation funding for federally declared disasters. HMGP Post Fire funds are available for FMAG declarations.
Hazard Mitigation Grant Program Supplemental – Local Hazard Mitigation Plan Program (LHMPP)	Federal	FEMA	TXGLO	The Local Hazard Mitigation Plan Program (LHMPP) assists eligible entities by providing grants to develop or update local hazard mitigation plans, or to provide cost share for hazard mitigation planning activities funded through other federal sources. Grant awards range from $20,000 to $100,000.
Hazardous Materials Emergency Preparedness (HMEP) **Grant Program**	Federal	DOT	TDEM	Funding is available to help facilitate preparedness in transporting hazardous materials. The program recognizes Local Emergency Planning Committees (LEPCs) as applicants to maximize funding impact through regional partnerships.
Healthy Forests Reserve Program (HFRP)	Federal	NRCS		Assist landowners, on a voluntary basis, in restoring, enhancing and protecting forestland resources on private lands through various means, including conservation easements and cost-sharing agreements.
High Hazard Potential Dam Program (HHPD)	Federal	FEMA	TCEQ	Provides assistance for technical, planning, and design activities related to the repair, removal, and/or structural or nonstructural rehabilitation of eligible non-federal high hazard dams classified as high hazard potential by the state/territory dam safety agency, with an approved Emergency Action Plan (EAP) and rated in poor condition, through a pre-disaster or annual cycle.

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Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Highway Bridge Replacement and Rehabilitation Program	Federal	FHWA	TXDOT	Provides funding to enable states to improve the condition of highway bridges through replacement, rehabilitation, and systematic preventive maintenance. Also includes the National Historic Covered Bridge Preservation Program.
Homeland Security Grant Program (HSGP)	Federal	DHS	TDEM	Funding supports homeland security activities identified in state and local strategic plans, including threat and hazard risk identification for natural, technological, and human-caused hazards.
Hospital Preparedness Program (HPP) **Cooperative Agreement**	Federal	HHS	TXDSHS	The HPP is the primary source of federal funding for health care system preparedness and response. In collaboration with public health, it prepares health-care delivery systems to save lives through the development of health care coalitions (HCCs). Under the direction of the HPP providers, the HCCs develop plans, provide training, and coordinate regional exercises.
Hydrologic Research Grants	Federal	NOAA		Offers up to $125,000 to conduct joint research and development on pressing surface water hydrology issues common to national, regional, and local operational offices. Eligible applicants include federally recognized agencies of state or local governments, quasi-public institutions such as water supply or power companies, hydrologic consultants and companies involved in using and developing hydrologic forecasts.
Groundwater Conservation District Loan Program	State	TWDB	TWDB	Provides short-term loans to finance the start-up costs of Groundwater Conservation Districts. Funding is available for any Groundwater District or Authority with the ability to regulate water well spacing and/or production. The program is authorized under Texas Water Code Chap. 36, Subchapter. L, and governed by TWDB rules in 31 Tex. Admin. Code Chap. 363, Subchapter. H.

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Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Gulf of Mexico Energy Security Act (GOMESA)	Federal	DOI	TXGLO	GOMESA significantly enhances oil and gas leasing activities and creates revenue sharing provisions for the oil- and gas-producing states of Alabama, Louisiana, Mississippi, Texas, and their coastal political subdivisions (CPSs). The funds are used for coastal conservation, restoration, and hurricane protection. The second phase of GOMESA revenue sharing, which began in Fiscal Year 2017, expands the definition of qualified Outer Continental Shelf revenues to include receipts from Gulf of Mexico leases that are subject to withdrawal or moratoria restrictions. A revenue-sharing cap of $500 million per year for the four Gulf-producing states, their CPSs and the Land and Water Conservation Fund, effective from fiscal years 2016 through 2055.
Indian Housing Assistance - Housing Improvement Program (HIP)	Federal	DOI-BIA		The Housing Improvement Program (HIP) is a home repair, renovation, replacement and new housing grant program administered by the Bureau of Indian Affairs (BIA) and federally recognized Indian tribes. It is designed to assist American Indian and Alaska Native (AI/AN) individuals and families who lack immediate standard housing resources.
Individual Assistance (IA)	Federal	FEMA	TDEM	Following a disaster, funds can be used to mitigate hazards when repairing individual and family homes.
In-Lieu Fee Program Mitigation Projects	Federal	USACE	Community Applicants	Supports the restoration, establishment, enhancement, and/or preservation of aquatic resources through funds paid to a governmental or non-profit natural resources management entity to satisfy compensatory mitigation requirements for Department of the Army permits.
Land Acquisition	Federal	DOI-FWS		Acquires high-quality lands and waters, or easements thereon, for inclusion in the National Wildlife Refuge System.
Landowner Incentive Program	Federal	USFWS	EMNRD	Collaborates with the Forestry Division and private landowners to protect the habitats of at-risk species on private lands. Landowner involvement is voluntary.
Mapping Standards Support	Federal	DOI/USGS		Provides mapping and digital data standards expertise in support the National Flood Insurance Program (NFIP).

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Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Mitigation Banks	Federal	USACE	Community Applicants	Mitigation Banks are Corps-approved sites that sell compensatory mitigation credits for projects that cause unavoidable impacts to waters of the U.S. When a permit requires compensatory mitigation, it specifies the number of credits to be purchased from an approved mitigation bank.
National Dam Safety Program	Federal	FEMA		Provides technical assistance, training, and grants to enhance state dam safety programs.
National Digital Orthophoto Program	Federal	DOI-USGS		Develops topographic quadrangles for use in flood mapping and other hazards.
National Earthquake Hazards Reduction Program (NEHRP)	Federal	FEMA	TDEM	Provides funding to support enhanced earthquake risk assessments in local hazard mitigation plans, as well as other earthquake hazard mitigation and preparedness activities.
National Earthquake Hazard Reduction Program (NEHRP) **in Earth Sciences**	Federal	NSF		Conducts research on basic and applied earth and building sciences.
National Earthquake Hazard Reduction Program	Federal	DOI-USGS		NEHRP's work encompasses research, development, and implementation activities. Research helps to advance our understanding of why and how earthquakes occur and impact the natural and built environments. The program develops strategies, tools, techniques, and other measures that can reduce the adverse effects of earthquakes and facilitates and promotes implementation of these measures, thereby strengthening earthquake resilience among at-risk communities.
Natural Resources Damage Assessment (NRDA)	Federal	EPA	TPWD	Evaluates the likelihood of adverse ecological effects that are occurring or may occur as a result of exposure to physical (e.g., cleanup) or chemical (e.g., hazardous release) stressors at a site.

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Name	Level	Source Agency	Managing State Agency	Purpose of Funding
National Flood Insurance Program (NFIP)	Federal	FEMA	TWDB	Provides affordable insurance to property owners and encourages communities to adopt and enforce floodplain management regulations.
National Flood Insurance Program: Technical Mapping Advisory Council	Federal	DOI-USGS		Provides technical guidance and advice to coordinate FEMA's map modernization efforts for the National Flood Insurance Program (NFIP).
National Training and Education (NTE)	Federal	FEMA		Offers educational and training programs through online course catalog, which provides searchable, integrated information on courses provided or managed by FEMA's Center for Domestic Preparedness (CDP), Emergency Management Institute (EMI), and National Training and Education Division (NTED).
National Weather Service (NWS)	Federal	NOAA - NWS		The National Weather Service (NWS) offers storm spotter training as well as weather and flood safety guides. It may also provide funding to support severe weather signage in parks and other public areas.
National Wildlife Wetland Refuge System	Federal	USFWS	TPWD	Provides funding for the acquisition of land for inclusion in the National Federal Wildlife Refuge System.
Nonpoint Source Grant Program	Federal	EPA	TCEQ, TSSWCB	The Clean Water Act (CWA) requires states to develop programs to protect the water quality from the adverse effects of nonpoint source (NPS) water pollution. The Texas Commission on Environmental Quality (TCEQ) and the Texas State Soil and Water Conservation Board (TSSWCB) administer federal grants for activities that prevent or reduce NPS pollution.

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Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Non-Structural Alternatives to Structural Rehabilitation of Damaged Flood Control Works	Federal	DOD-USACT		Provides planning and construction grants for non-structural alternatives to the rehabilitation of flood control works damaged by floods or coastal storms.
North American Wetland Conservation Fund	Federal	USFWS	TPWD	Provides funding for wetland conservation projects.
NRCS Conservation Programs	Federal	USDA, NRCS	Community Applicants	Provides funding through various programs for the conservation of natural resources.
Office of Disaster Assistance	Federal	SBA		Provides financial assistance through low interest disaster loans to businesses of all sizes, private non-profit organizations, homeowners, and renters to repair or replace real estate, personal property, machinery and equipment, inventory and business assets that have been damaged or destroyed in a declared disaster.
Partners for Fish and Wildlife	Federal	USFWS	TPWD	Provides financial and technical assistance to landowners for wetland restoration projects in “focus areas” of the state.
Planning Assistance to States	Federal	USACE	TWDB	Aids states in planning for development, utilization, and conservation of water and related land resources.
Pollution Prevention Grant: Environmental Justice in Communities	Federal	EPA		Provides technical assistance to businesses aiming to improve human health and the environment in disadvantaged communities.
Pollution Prevention Grant: Environmental Justice Through Safer and More Sustainable Products	Federal	EPA		Provides technical assistance to businesses to increase the supply, demand, and use of safer, more sustainable products.

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Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Post-Disaster Economic Recovery Grants and Assistance	Federal	DOC-EDA		Provides funding to assist with the long-term economic recovery of communities, industries, and firms adversely impacted by disasters.
Pre-Disaster Mitigation Loan Program	Federal	SBA		Provides low-interest loans to small businesses for mitigation projects.
Pre-Disaster Mitigation (PDM)	Federal	FEMA		Congressional funding for local governments, tribes, and states to plan and implement sustainable, cost-effective measures designed to reduce risk to individuals and property from future natural hazards.
Preparedness (Non-Disaster) Grants	Federal	FEMA		Provides financial assistance to state and local governments for preparedness programs. Funding is allocated to enhance the capacity of emergency responders to prevent, respond to, and recover from terrorism incidents involving weapons of mass destruction—chemical, biological, radiological, nuclear, and explosive devices – as well as cyber-attacks.

Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Prescribed Fire Grants	State	TAMFS	TAMFS	The Texas A&M Forest Service's Mitigation & Prevention Department annually implements four prescribed fire grants to protect communities and restore ecosystems. (1) SFAM Plains Prescribed Fire Grant – Supports prescribed burns to reduce hazardous fuels near Texas communities at high risk for wildfires – specifically those threatened by Southern Plains Wildfire Outbreaks. Treatment areas are located adjacent to identified priority communities. (2) The Community Protection Program Grant – Funds prescribed burns on private lands within 10 miles of a National Forest boundary to reduce high-risk fuels. The goal is to protect nearby communities and forest resources by lowering the risk of catastrophic wildfire across public and private lands. (3) The State Fire Assistance for Mitigation Central & East Texas Grant – Provides funding for prescribed burns on private lands in 43 Central and East Texas counties that have approved Community Wildfire Protection Plans (CWPPs). The goal is to protect high-risk communities and restore ecosystems by reducing hazardous vegetation. Priority is given to sites that are within a CWPP, near Firewise communities or residential areas (as identified by the Texas Wildfire Risk Assessment Portal), and support ecosystems that benefit from prescribed fire. (4) Neches River and Cypress Basin Watershed Restoration Program – Assists landowners with prescribed burns to improve ecological health in the Neches River and Cypress Basin watersheds. The program benefits water quality and quantity, controls invasive species, and enhances wildlife habitat. Priority is given to treatment areas on private land that promote native ecosystem restoration, fall within priority watershed protection zones, and are located near public lands.

APPENDIX H: STATE AND FEDERAL FUNDING OPPORTUNITIES

Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Project Modifications for Improvement of the Environment	Federal	DOD-USACE		Provides funds for ecosystem restoration by modifying structures and/or operations of water resources projects constructed by the U.S. Army Corps of Engineers (USACE), or by restoring areas where a USACE project contributed to environmental degradation.
Protection of Essential Highways, Highway Bridge Approaches, and Public Works	Federal	USACE		Provides technical assistance to ensure bank protection for highways, highway bridges, essential public works, churches, hospitals, schools, and other nonprofit public services endangered by flood-caused erosion.
Public Assistance	Federal	FEMA	DHSEM	Funds are allocated to states and communities to repair damaged infrastructure and public facilities, and to help restore government or government-related services.
Public Assistance (PA) **Section 406 Funds**	Federal	FEMA	TDEM	Following a disaster, funds can be used to mitigate hazards while repairing damages to public structures or infrastructure. Wildfire mitigation is also eligible under emergency protection if lives are in imminent danger.
Public Health Emergency Preparedness (PHEP) **Cooperative Agreement**	Federal	CDC	TXDSHS	Aids health departments in building and strengthening their ability to effectively respond to a range of public health threats, including infectious diseases, natural disasters, and biological, chemical, nuclear, and radiological events. Preparedness activities funded by the PHEP Cooperative Agreement specifically target the development of emergency-ready public health departments that are both flexible and adaptable.
Public Housing Capital Fund	Federal	HUD		Funding available towards public housing agencies for modernization needs resulting from natural disasters including elevation, flood proofing, and retrofitting.

APPENDIX H: STATE AND FEDERAL FUNDING OPPORTUNITIES

Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Regional Facility Planning Grant Program	State	TWDB	TWDB	Provides funds to political subdivisions in Texas for studies and analyses to evaluate and determine the most feasible alternatives to meet regional water supply and wastewater facility needs, estimate the costs associated with implementing these alternatives, and identify institutional arrangements for providing regional water supply and wastewater services.
Regional Water Planning Group Grants	State	TWDB	TWDB	Developed to guide and support the planning of the State's water resources, this program administers and assists in the development of regional and state water plans. It aims to improve the planning process by providing clear guidance for stakeholders and utilizing the best available data, methodologies, and technical innovations for each funding cycle.
Repetitive Flood Claims Program	Federal	FEMA	DHSEM	Provides funds to assist states and communities reduce flood damages to insured properties that have had one or more claims under the National Flood Insurance Program (NFIP).
Research and Planning Fund and Fund Development Program	State	TWDB	TWDB	Provides funds to eligible applicants for the development or revision of regional water plans. Eligible activities include the development, revision, or improvement of regional water plans including public meetings, hearings, and special studies. Plans must comply with Texas Water Code, §16.053 and Chapter 357, or other special studies approved by the Texas Water Development Board (TWDB) that enhance water planning efforts in the region.
Resilient Landscapes Program	Federal	USDA, USFS	TAMFS	Provides coordination to restore healthy, resilient, fire-adapted ecosystems. Restoration efforts include thinning crowded forests and using prescribed fire on two to three million acres annually, which helps prevent the buildup of flammable vegetation that feeds extreme wildfires.
Risk MAP Program	Federal	FEMA, NFIP	TWDB	Establishes or updates floodplain mapping and multi-hazard risk products.
Rural Development Grants	Federal	USDA-Rural Development	TWDB	Provides grants and loans for the development and enhancement of infrastructure and public safety in rural areas, offering up to $100,000 or 75 percent of the total project cost, whichever is less.

APPENDIX H: STATE AND FEDERAL FUNDING OPPORTUNITIES

Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Rural Fire Assistance Grant	Federal	NIFC	TAMFS	Funds fire mitigation activities in rural communities.
Rural Utilities Service (RUS)	Federal	USDA-Rural Development		Programs designed to provide needed infrastructure or infrastructure improvements to rural communities, including water and wastewater treatment, electric power, and telecommunications services.
Rural Water Assistance Fund (RWAF)	State	TWDB	TWDB	Provides low-cost financing to assist small rural utilities with water and wastewater projects. The Rural Water Assistance Fund (RWAF) offers tax-exempt equivalent interest rate loans and long-term financing options.
Safe Rest Stops Program	State	TXDOT	TXDOT	Texas has 21 major highways that function as long-distance travel corridors. Along these routes, rest areas serve as critical safety features designed to reduce accidents caused by driver fatigue. These facilities provide travelers with an opportunity to pause, rest, and return to the road more alert and refreshed.
Section 108 Loan Guarantee Program	Federal	HUD		Provides loans to public entities for community and economic development projects, including mitigation measures.
Section 502 Loan Guaranteed Loan Program	Federal	USDA-RHS		Provides loans, loan guarantees, and technical assistance to very low- and low-income applicants seeking to purchase, build, or rehabilitate homes in rural areas.
Section 504 Loans for Housing	Federal	USDA-RHS		Provides repair loans, grants, and technical assistance to low-income senior homeowners in rural areas to address home repairs and eliminate health and safety hazards.
Societal Dimensions of Engineering, Science, and Technology Program	Federal	NSF		Provides funding for research and educational activities on topics such as ethics, values, risk assessment, communication, risk management, and risk perception.
Soil Survey	Federal	USDA-NRCS		Maintains soil surveys of counties or other areas to assist with farming, conservation, mitigation or related purposes.

APPENDIX H: STATE AND FEDERAL FUNDING OPPORTUNITIES

Name	Level	Source Agency	Managing State Agency	Purpose of Funding
State Fire Assistance for Mitigation (SFAM) **– Mechanical Fuels Grants**	State	TAMFS	TAMFS	Provides financial assistance for hazardous fuel reduction on private lands to decrease wildfire risk. The grant targets high-risk communities within 32 counties in Central Texas, as identified by the Texas A&M Forest Service Mitigation and Prevention Department. Priority is given to landowners who reside in one of the 32 high-risk counties, are located within a city or county with an active Community Wildfire Protection Plan (CWPP) or live in a recognized Firewise USA site.
State Fire Assistance for Mitigation (SFAM) **– Vegetative Fuel Break Grant**	State	TAMFS	TAMFS	Provides financial assistance for the creation of vegetative fuel breaks on private lands in Texas. Vegetative fuel breaks are trees and shrubs systematically planted adjacent to fields, homesteads, or feedlots to reduce or redirect wind. The goal of the grant is to protect high-risk communities by reducing the risk of catastrophic wildfires on private and public lands. Grant recipients will be reimbursed up to $2,500 for actual costs associated with creating a green, vegetative fuel break, consisting of a minimum of three rows of trees and 400 feet in length. Eligible projects must be located within the Texas High Plains.
Silver Jackets	Federal	USACE	TWDB	Provides funding for flood-related studies, public awareness efforts, risk analysis, flood response plans, and the construction of small flood control projects.
Small Flood Control Projects (USACE Section 205)	Federal	USACE	TWDB	Authorizes the U.S. Army Corps of Engineers (USACE) to conduct feasibility studies and construct small flood control projects.
State Participation Program – Regional Water and Wastewater Facilities	State	TWDB	TWDB	Provides funding and assumes a temporary ownership interest in regional water, wastewater, or flood control projects when local sponsors are unable to assume debt for an optimally sized facility. The program is intended to encourage the optimum regional development of projects by funding excess capacity for future use, where benefits can be documented and such development is otherwise unaffordable without state participation. The goal is to enable the rightsizing of projects by accounting for future demand.

APPENDIX H: STATE AND FEDERAL FUNDING OPPORTUNITIES

Name	Level	Source Agency	Managing State Agency	Purpose of Funding
State Water Implementation Fund for Texas (SWIFT)	State	TWDB	TWDB	The SWIFT program helps communities develop and optimize water supplies at cost-effective rates. It offers low-interest loans, extended repayment terms, deferred loan repayments, and incremental repurchase terms for projects with state ownership aspects.
State Water Resources Research Act Program	Federal	USGS	TWDB	The U.S. Geological Survey (USGS), in cooperation with the National Institutes for Water Resources (NIWR), issues an annual call for proposals that address water challenges and concerns of regional or interstate significance, or that relate to a specific program priority identified by the Secretary of the Interior and the Institutes.
Stream Gauging and Flood Monitoring Network	Federal	DOE-USGS		Operation of a network of over 7,000 stream gauging stations that provide data on river flooding characteristics.
Surface Transportation Program	Federal	USDOT/ FHWA		Provides funding for activities such as safety-related construction and transportation enhancements. These enhancements include a broad range of initiatives, from safety education to environmentally and historically focused activities.
Texas Farm and Ranch Lands Conservation Program (TFRLCP)	State	TPWD	TPWD	Maintains and enhances the ecological and agricultural productivity of lands through Agricultural Conservation Easements. The TFRLCP supports responsible stewardship and conservation of working lands, water, fish and wildlife, and agricultural production through: • Generating interest and awareness in easement programs and other options for conserving working lands. • Leveraging available monies to fund as many high-quality projects as possible. • Highlighting the ecological and economic value of working lands and the long-term opportunities for their conservation.

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Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Texas HOME Disaster Relief	Federal	TDHCA	TDHCA	The Texas HOME Disaster Relief Program is a long-term housing initiative designed to help eligible organizations assist income-qualified households affected by disasters. Funds are available for federal or state-declared disasters, as well as other natural or man-made events. It is the Department's practice to maintain a HOME Disaster Relief Fund balance of $1 million whenever possible. These funds may be used to support affected households located outside communities that receive HOME funds directly from the U.S. Department of Housing and Urban Development (HUD).
Texas Longleaf Conservation Assistance Program	Federal	National Fish and Wildlife Foundation (NFWF)	TAMFS	Provides eligible landowners with financial and technical assistance for establishing, enhancing, and managing longleaf pine. Landowners with property within 11 East Texas counties—including Angelina, Hardin, Jasper, Nacogdoches, Newton, Polk, San Augustine, Sabine, San Jacinto, Trinity, and Tyler— are eligible to apply. Approved participants may receive up to 50 percent payment not to exceed a standard cap rate, for implementing approved conservation practices. Approved conservation practices include prescribed burning, reforestation, site preparation, and forest stand improvement.
Texas Infrastructure Resiliency Fund (TIRF)	State	TWDB	TWDB	The purpose of this program is to provide loans, grants, and matching funds for flood projects through four separate accounts. It was enacted through Senate Bill 7 to address needs identified following the flood disasters of 2015, 2016, and 2017. Senate Bill 500 appropriated $685 million to support the program. Each account serves a distinct purpose. The oversight entity is the Texas Infrastructure Resiliency Fund (TIRF) Advisory Board, with the SWIFT Advisory Committee and the Texas Division of Emergency Management (TDEM) Director as non-voting members.

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Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Texas Water Development Fund (DFund)	State	TWDB	TWDB	Provides financing for various types of eligible infrastructure projects, including planning, design, acquisition, and construction of projects for: water supply (such as reservoirs and well fields), conservation, water quality enhancement, flood control, and wastewater. This program enables the Texas Water Development Board (TWDB) to fund multi-purpose projects (e.g., water and wastewater) through a single commitment. Eligible applicants include political subdivisions and nonprofit water supply corporations.
Transfers of Inventory Farm Properties to Federal and State Agencies for Conservation Purposes	Federal	USDA-FSA		Transfers the titles of certain inventory farm properties owned by the FSA to federal and state agencies for conservation purposes, including the restoration of wetlands and floodplain areas to reduce future flood potential.
Transportation Enhancement Program	Federal	FHWA	TXDOT	This program supports non-traditional transportation-related activities that extend beyond standard infrastructure initiatives. Eligible projects must demonstrate thoughtful integration with the surrounding environment, contributing meaningfully to community vitality, environmental quality, and the visual character of transportation corridors. Reimbursement of up to 80 percent of allowable costs is available for qualifying enhancement activities.
United States Geological Survey (USGS)	Federal	USGS		The U.S. Geological Survey (USGS) issues competitive grants and cooperative agreements to support research in earthquake hazards, the physics of earthquakes, earthquake occurrence, and earthquake safety policy.

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Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Urban Tree Canopy Project (UTC)	Federal	USDA, USFS	TAMFS	The urban tree canopy (UTC) refers to the layer of leaves, branches, and stems of trees that cover the ground when viewed from above. In urban environments, the UTC plays a crucial role in stormwater management by intercepting rainfall that would otherwise run off paved surfaces and enter local waterways through storm drainage systems, carrying pollutants along the way. Additionally, the UTC mitigates the urban heat island effect, reduces heating and cooling costs, lowers air temperatures, improves air quality, increases property values, provides wildlife habitat, and offers aesthetic and community benefits, including an enhanced quality of life.
Urban Waters Small Grants	Federal	EPA		Funding is allocated to improve urban water quality through activities that also support community revitalization and other local priorities, which may include the implementation of green infrastructure.
USDA Conservation Programs	Federal	USDA/FSA		These programs[1] work to address a large number of farming and ranching related conservation issues including drinking water protection, soil erosion reduction, wildlife habitat preservation, the preservation and restoration of forests and wetlands, and aiding farmers whose farms have been damaged by natural disasters.
U.S.- Mexico Border Water Infrastructure Program	Federal	EPA	TCEQ	Provides grant assistance to U.S. and Mexican communities located within 60 miles of the border for the development and construction of high-priority drinking water and wastewater facilities. The program furthers EPA's mission to protect human health and the environment by providing critical resources for what is often an area's first drinking water and basic sanitation services.
Water Research Grant Program	State	TWDB	TWDB	The Texas Water Development Board (TWDB) funds a variety of water planning and research studies and projects designed to support regional water planning efforts and address region-specific water resource questions.

[1] Note: Programs include Conservation Reserve Program, Conservation Reserve Enhancement Program, Emergency Conservation Program, Emergency Forest Restoration Program, Farmable Wetlands Program, Grassland Reserve Program, Source Water Protection Program.

Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Water Conservation Field Services Program	Federal	HUD	Texas A&M AgriLife	Encourage beneficiaries of federal water projects to conserve water and assists agricultural and urban water districts in developing and implementing water conservation plans in accordance with the Reclamation Reform Act (RRA) of 1982. Through the WCFSP, cost- shared financial assistance is available for developing water conservation plans, identification of water management improvements through System Optimization Reviews (SORs), design of water management improvements, and promotion of water conservation techniques through demonstration activities. WaterSMART also supports Reclamation's priorities to increase water reliability and resilience, advance racial and economic equity, and enhance water conservation, ecosystem health, and climate resilience.
Watershed Processes and Water Resources	Federal	Bureau of Reclamation	TWDB	Promotes up to $250,000 for projects that can be completed within 24 months and that reduce conflicts through water conservation, efficiency, and markets.
WaterSMART – Drought Response Program	Federal	Bureau of Reclamation	TWDB	Provides $500,000 to support innovative research focused on: (1) understanding the fundamental processes that influence the quality and quantity of water resources across diverse spatial and temporal scales; (2) improving water resource management in agricultural, forested, and rangeland watersheds; and (3) developing appropriate technologies to achieve these objectives.
Wetlands Protection – Development Grants	Federal	EPA		Provides funding to support the development and enhancement of state and tribal wetlands protection programs.
Wetlands Reserve Program	Federal	USDA, NRCS		Provides financial and technical assistance to protect and restore wetlands through the use of easements and restoration agreements.
Wildlife Habitat Incentive Program (WHIP)	Federal	USDA, NRCS	TPWD	A voluntary program for conservation-minded landowners seeking to develop and improve wildlife habitat on agricultural land, nonindustrial private forest lands, and tribal lands.

Adoption Resolutions