Van Zandt County
Hazard Mitigation Action Plan 2019

Planning Participants: Van Zandt County, City of Canton, City of Edgewood, City of Edom, City of Fruitvale, City of Grand Saline, City of Van, City of Wills Point

Mitigating Risk for a Safe, Secure, and Sustainable Future

DRAFT: October 2019

H2O PARTNERS

For more information, visit our website at:

vanzandtcounty.org

Written comments should be forwarded to:

H2O Partners, Inc.
P. O. Box 160130
Austin, Texas 78716
info@h2opartnersusa.com
www.h2opartnersusa.com

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Section 1: Introduction

BACKGROUND

Van Zandt County is located fifty miles east of Dallas in the Claypan Area of northeastern Texas. The County is bordered by Rains County to the north, Wood County to the northeast, Smith County to the east, Henderson County to the south, Kaufman County to the west, and Hunt County to the northwest.

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, Van Zandt County is susceptible to a wide range of natural hazards, including but not limited to drought, extreme heat, hail, and winter storms. 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 effect from many hazards to people and property can be lessened. This concept is known as hazard mitigation, which is defined by the Federal Emergency Management Agency (FEMA) 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.

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 to a hazard mitigation plan addresses hazard vulnerability that exists 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 AND PARTICIPATION

Van Zandt County's Plan is a multi-jurisdictional Plan. The participating jurisdictions include Van Zandt County, the City of Canton, the City of Edgewood, the City of Edom, the City of Fruitvale, the City of Grand Saline, the City of Van, and the City of Wills Point. These jurisdictions provided valuable input into the planning process. Throughout the plan, "Van Zandt County planning area" refers to the entire planning area including all participating jurisdictions. Similarly, the term "county-wide" refers to the entire planning area including all participating jurisdictions.

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

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 Van Zandt County and the participating jurisdictions. The hazard classification enables the participating jurisdictions to prioritize mitigation actions based on hazards which can present the greatest risk to lives and property in the geographic scope.

PURPOSE

The Plan was prepared by Van Zandt County, participating jurisdictions, and H2O Partners, Inc. The purpose of the Plan is to protect people and structures and to minimize the costs of disaster response and recovery. The goal of the Plan is to minimize or eliminate long-term risks to human life and property from known hazards by identifying and implementing cost-effective hazard mitigation actions. The planning process is an opportunity for participating jurisdictions within Van Zandt 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 Van Zandt County.

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

Participating jurisdictions within Van Zandt County, and planning participants identified twelve natural hazards to be addressed by the Plan. The specific goals of the Plan are to:

- Minimize disruption to participating jurisdictions within Van Zandt 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 grant and technical assistance programs offered by the State or Federal government. The Plan will enable participating jurisdictions within Van Zandt County to take advantage of rapidly developing mitigation grant opportunities as they arise; and
- Ensure that participating jurisdictions within Van Zandt County maintain eligibility for the full range of future Federal disaster relief.

AUTHORITY

The Plan is tailored specifically for participating jurisdictions within Van Zandt County and plan participants including Planning Team members, stakeholders, and the general public who participated in the Plan 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 Plan Review Guide" (October 2011), and the "Local Mitigation Planning Handbook" (March 2013). Additionally, the Plan is developed in accordance with FEMA's Community Rating System (CRS) Floodplain Management Plan standards and policies.

SUMMARY OF SECTIONS

Sections 1 and 2 of the Plan 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 Van Zandt County's population and economy.

Sections 4 through 16 present a hazard overview and information on individual natural hazards in the planning area. The hazards generally appear in order of priority based on potential losses to life and property, and other community concerns. For each hazard, the Plan presents a description of the hazard, a list of historical hazard events, and the results of the vulnerability and risk assessment process.

Section 17 presents hazard mitigation goals and objectives. Section 18 presents hazard mitigation actions for Van Zandt County and the participating jurisdictions. Section 19 identifies Plan maintenance mechanisms.

The list of planning team members and stakeholders is located in Appendix A. Public survey results are analyzed and presented in Appendix B. Appendix C contains a detailed list of critical facilities for the area, and Appendix D is dam locations. Appendix E contains information regarding workshops and meeting documentation. Capability Assessment results for participating jurisdictions within Van Zandt County are located in Appendix F.[3]

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

Section 2: Planning Process

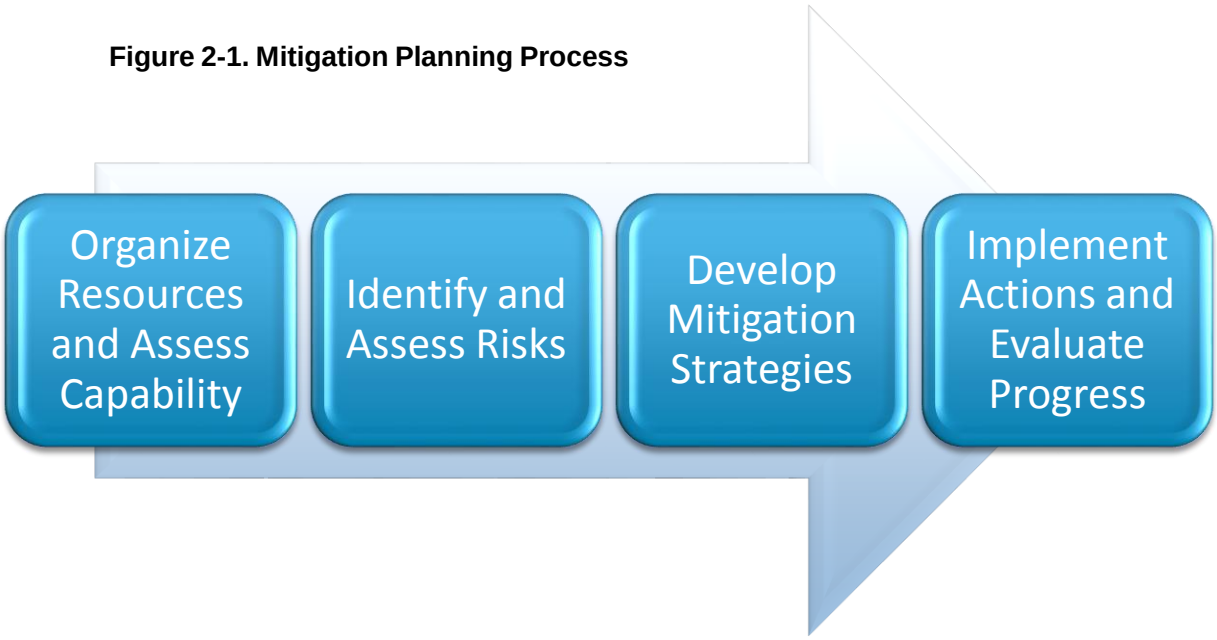
Plan Preparation and Development

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

Van Zandt County hired H2O Partners, Inc. (Consultant Team), to provide technical support and oversee the development of the Van Zandt County Hazard Mitigation Action Plan 2019. The Consultant Team used the FEMA "Local Mitigation Plan Review Guide" (October 1, 2011), and the "Local Mitigation Planning Handbook" (March 2013) to develop the Plan. The overall planning process is shown in Figure 2-1 below.

Figure 2-1. Mitigation Planning Process



Participating jurisdictions within Van Zandt County, and the Consultant Team met in November 2018 to begin organizing resources, identify Planning Team members, and conduct a Capability Assessment.

Planning Team

Key members of H2O Partners, Inc. developed the Plan 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 from each of the participating jurisdictions within Van Zandt County, 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 area organizations and departments from the participating jurisdictions within Van Zandt County that participated throughout the planning process.

Table 2-1. Executive Planning Team

ORGANIZATION / DEPARTMENT	TITLE
Van Zandt County	Emergency Management Coordinator
Van Zandt County	County Judge
City of Canton	Emergency Management Coordinator
City of Canton	Mayor
City of Edgewood	Mayor

ORGANIZATION / DEPARTMENT	TITLE
City of Edgewood	City Administrator
City of Edom	Mayor
City of Fruitvale	Mayor
City of Fruitvale	City Secretary
City of Grand Saline	Mayor
City of Grand Saline	City Administrator / Emergency Management Coordinator
City of Van	Mayor
City of Van	City Manager / Emergency Management Coordinator
City of Wills Point	Mayor
City of Wills Point	Emergency Management Coordinator

Table 2-2. Advisory Planning Team

ORGANIZATION / DEPARTMENT	TITLE
Van Zandt County	County Clerk
Van Zandt County	Volunteer Coordinator
Van Zandt County	County Commissioner – Precinct
Van Zandt County	County Commissioner – Precinct 2
Van Zandt County	County Commissioner – Precinct 4
Van Zandt County	County Auditor
City of Canton	City Manager
City of Canton	Fire Captain
City of Grand Saline	Public Safety Director
City of Van	City Secretary
City of Wills Point	City Administrator

Additionally, a Stakeholder Group was invited to participate in the planning process via e-mail. The Consultant Team, Planning Teams, and Stakeholder Group coordinated to identify mitigation goals, and develop mitigation strategies and actions for the Plan. Appendix A provides a complete listing of all participating Planning Team members and stakeholders from participating jurisdictions within Van Zandt County by organization and title.

Based on results of completed Capability Assessment, participating jurisdictions within Van Zandt County described methods for achieving future hazard mitigation measures by expanding existing capabilities. For example, several jurisdictions do not have a community wildfire protection plan in place. Other options for improving capabilities include the following:

- Establishing Planning Team members with the authority to monitor the Plan and identify grant funding opportunities for expanding staff.
- Identifying 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 preparingtexas.org.
- Reviewing current floodplain ordinances for opportunities to increase resiliency such as modifying permitting or building codes.
- Developing ordinances that will require all new developments to conform to the highest mitigation standards.

Sample hazard mitigation actions developed with similar hazard risk were shared at the meetings. These important discussions resulted in development of multiple mitigation actions that are included in the Plan to further mitigate risk from natural hazards in the future.

The Planning Team developed hazard mitigation actions for mitigating risk from all of the hazards including potential flooding, hail, and extreme heat. The actions include but are not limited to drainage improvement projects, installing generators at critical facilities, and educating citizens to practice hazard mitigation techniques.

Planning Process

The process used to prepare the Plan followed the four major steps included at Figure 2-1. After the Planning Team was organized, a capability assessment was developed and distributed at the Kick-Off Workshop. Hazards were identified and assessed, and results associated with each of the hazards were provided at the Risk Assessment Workshop. Based on Van Zandt County's identified vulnerabilities, specific mitigation strategies were discussed and developed at the Mitigation Strategy Workshop. Finally, Plan maintenance and implementation procedures were developed and are included in Section 19. Participation of Planning Team members, stakeholders, and the public at each of the workshops is documented in Appendix E.

At the Plan development workshops held throughout the planning process described herein, the following factors were taken into consideration:

- The nature and magnitude of risks currently affecting the community;
- Hazard mitigation goals to address current and expected conditions;
- Whether current resources will be sufficient for implementing the Plan;
- Implementation problems, such as technical, political, legal, and coordination issues that may hinder development;
- Anticipated outcomes; and
- How participating jurisdictions within Van Zandt County, agencies, and partners will participate in implementing the Plan.

Kickoff Workshop

The Kickoff Workshop was held at the Van Zandt County Courthouse on November 15, 2018. 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 including, but not limited to Chamber of Commerce, Independent School Districts, Texas A&M Agri-Life

Extension Service, and surrounding Counties. In addition to the kickoff presentation, participants received the following information:

- Project overview regarding the planning process;
- Public survey access information;
- Hazard Ranking form; and
- Capability Assessment survey for completion.

A risk ranking exercise was conducted at the Kickoff Workshop to get input from the Planning Team and stakeholders pertaining to various risks from a list of natural hazards affecting the planning area. Participants ranked hazards high to low in terms of perceived level of risk, frequency of occurrence, and potential impact.

Hazard Identification

At the Kickoff Workshop, and through e-mail 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 as a whole, the 2018 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 twelve natural hazards which pose a significant threat to the planning area.

RISK ASSESSMENT

An initial risk assessment for participating jurisdictions within Van Zandt County was completed in March 2019 and results were presented to Planning Team members at the Risk Assessment Workshop held on March 26, 2019. 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 property and citizens.

Property and crop damages were estimated by gathering data from the National Centers for Environmental Information (NCEI) and 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 impact on people and property. Each participant at the Risk Assessment Workshop was provided a risk ranking sheet that asked participants to rank hazards in terms of the probability or frequency of occurrence, extent of spatial impact, and the magnitude of impact. The results of the ranking sheets identified unique perspectives on varied risks throughout the planning area.

The assessments were also used to set priorities for hazard mitigation actions based on potential loss of lives and dollar losses. A hazard profile and vulnerability analysis for each of the hazards can be found in Sections 4 through 16.

MITIGATION REVIEW AND DEVELOPMENT

Developing the Mitigation Strategy for the Plan involved identifying mitigation goals and new mitigation actions. A Mitigation Strategy Workshop was held at the Van Zandt County Courthouse on June 25, 2019. In addition to the Planning Team, stakeholder groups were invited to attend the workshop. Regarding hazard mitigation actions, workshop participants emphasized the desire for flood and tornado projects. Additionally, the participating jurisdictions were proactive in identifying mitigation actions to lessen the risk of all the identified hazards included in the Plan.

An inclusive and structured process was used to develop and prioritize new hazard mitigation actions for the Plan. The prioritization method was based on FEMA's STAPLE+E criteria and included social, technical, administrative, political, legal, economic, and environmental considerations. As a result, each Planning Team Member assigned an overall priority to each hazard mitigation action. The overall priority of each action is reflected in the hazard mitigation actions found in Section 18.

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.

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, Planning Team Members utilized economic evaluation as a determining factor between hazard mitigation actions.
- Planning Team Members then selected and prioritized mitigation actions.

Hazard mitigation actions identified in the process were made available to the Planning Team for review. The draft Plan was made available to the general public for review on the County's website, along with the participating jurisdiction's website, with the chance to comment via sending an email.

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, National Oceanic and Atmospheric Administration (NOAA), the Texas Water Development Board (TWDB), the Texas Commission on Environmental Quality (TCEQ), the Texas State Data Center, Texas 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 (Sections 5-16) 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. The USACE studies were reviewed for their assessment of risk and potential projects in the region. State Data Center documents were used to obtain population projections. The State Demographer webpages were reviewed for population and other projections and included in Section

3 of the Plan. Information from the Texas 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 development requirements.

Incorporation of Existing Plans into the HMAP Process

A Capability Assessment was completed by key departments from the participating jurisdictions within Van Zandt County which provided information pertaining to existing plans, policies, ordinances and regulations to be integrated into the goals and objectives of the Plan. The relevant information was included in a master Capability Assessment, Appendix F.

Existing projects and studies were utilized as a starting point for discussing hazard mitigation actions among Planning and Consultant Team members. For example, numerous tornadoes have caused major damage throughout the county over the past several years. The County would like to apply for grants to help citizens acquire Storm Shelters. Additionally, policies and ordinances were reviewed by several of the participating jurisdictions. These jurisdictions have included actions to develop and implement routine debris clearing program, and restrict future development in high risk areas. Other plans were reviewed, such as Emergency Operations Plans and Capital Improvement Plan, to identify any additional mitigation actions. Finally, the 2018 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 2018 State Plan was also used as a guidance document, along with FEMA materials, in the development of the Van Zandt County Hazard Mitigation Action Plan 2019.

Incorporation of the HMAP into Other Planning Mechanisms

Planning Team members will integrate implementation of the Plan with other planning mechanisms for Van Zandt County, such as the Emergency Operations Plan. Existing plans for participating jurisdictions will be reviewed and incorporated into the Plan, as appropriate. This section discusses how the Plan will be implemented by the participating jurisdictions within Van Zandt County. It also addresses how the Plan will be evaluated and improved over time, and how the public will continue to be involved in the hazard mitigation planning process.

Participating jurisdictions within Van Zandt County will be responsible for implementing hazard mitigation actions contained in Section 18. Each hazard mitigation action has been assigned to a specific County or City department that is responsible for tracking and implementing the action.

A funding source has been listed for each identified hazard mitigation action and may be utilized to implement the action. An implementation time period has also been assigned to each hazard mitigation action as an incentive and to determine whether actions are implemented on a timely basis.

Participating jurisdictions within Van Zandt County will integrate hazard mitigation actions contained in the Plan with existing planning mechanisms such as Storm Water ordinances, Emergency Operations or Management Plans, Evacuation Plans, and other local and area planning efforts. Van Zandt County will work closely with area organizations to coordinate implementation of hazard mitigation actions that benefit the planning area in terms of financial and economic impact.

Upon formal adoption of the Plan, Planning Team members from the participating jurisdictions will review existing plans along with building codes to guide development and ensure that hazard mitigation actions are implemented. Each of the jurisdictions will be responsible for coordinating periodic review of the Plan with members of the Advisory Planning Team to ensure integration of hazard mitigation strategies into these planning mechanisms and codes. The Planning Team will also conduct periodic reviews of various existing planning mechanisms and analyze the need for any amendments or updates in light of the approved Plan. Participating jurisdictions within Van Zandt

County will ensure that future long-term planning objectives will contribute to the goals of the Plan to reduce the long-term risk to life and property from moderate and high risk hazards. Within one year of formal adoption of the Plan, existing planning mechanisms will be reviewed and analyzed as they pertain to the Plan.

Planning Team members will review and revise, as necessary, the long-range goals and objectives in its strategic plan and budgets to ensure that they are consistent with the Plan.

Furthermore, Van Zandt County will work with neighboring jurisdictions to advance the goals of the Plan as it applies to ongoing, long-range planning goals and actions for mitigating risk to natural hazards throughout the planning area.

Table 2-3 identifies types of planning mechanisms and examples of methods for incorporating the Plan into other planning efforts.

Table 2-3. Examples of Methods of Incorporation

Planning Mechanism	Incorporation of Plan
Annual Budget Review	Various departments and key personnel that participated in the planning process for participating jurisdictions within Van Zandt County will review the Plan and mitigation actions therein when conducting their annual budget review. Allowances will be made in accordance with grant applications sought, and mitigation actions that will be undertaken, according to the implementation schedule of the specific action.
Capital Improvement Plans	Several participating jurisdictions have a Capital Improvement Plan (CIP) in place. Prior to any revisions to the CIP, 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.
Grant Applications	The Plan will be evaluated by participating jurisdictions within Van Zandt County when grant funding is sought for mitigation projects. If a project is not in the Plan, an amendment may be necessary to include the action in the Plan.
Regulatory Plans	Currently, participating jurisdictions within Van Zandt County have regulatory plans in place, such as Emergency Management Plans, Economic Development, and Evacuation Plans. The Plan will be consulted when County and City departments review or revise their current regulatory planning mechanisms, or in the development of regulatory plans that are not currently in place.

Appendix F provides an overview of Planning Team members' existing planning and regulatory capabilities to support implementation of mitigation strategy objectives. Appendix F also provides

further analysis of how each intends to incorporate hazard mitigation actions into existing plans, policies, and the annual budget review as it pertains to prioritizing grant applications for funding and implementation of identified hazard mitigation projects.

It should be noted for the purposes of the Plan that the HMAP has been used as a reference when reviewing and updating all plans and ordinances for the entire planning area, including all participating jurisdictions. The Emergency Management Plans developed independently by Van Zandt County, the City of Canton, the City of Edgewood, the City of Edom, the City of Grand Saline, the City of Van, and the City of Wills Point are updated every 5 years and incorporates goals, objectives and actions identified in the mitigation plan.

Plan Review and Plan Update

As with the development of Plan, participating jurisdictions within Van Zandt 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 twice a year, by conference call or presentation, to re-evaluate prioritization of the hazard mitigation actions.

Timeline for Implementing Mitigation Actions

Both the Executive Planning Team (Table A-1, Appendix A) and the Advisory Planning Team (Table A-2, Appendix A) 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 individual Hazard Mitigation Action worksheets included in the Plan for participating jurisdictions within Van Zandt County.

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 process, budgetary constraints, and community needs. Participating jurisdictions within Van Zandt County are committed to addressing and implementing hazard mitigation actions that may be aligned with and integrated into the Plan.

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

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 implemented hazard mitigation actions. If citizens and stakeholders, such as local businesses, non-profits, 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.

The public was involved in the development of the Van Zandt County Hazard Mitigation Action Plan 2019 at different stages prior to official Plan approval and adoption. Public input was sought using three methods: (1) open public meetings; (2) survey instruments; and (3) making the draft Plan available for public review at participating jurisdictions' websites.

The draft Plan was made available to the general public for review and comment on participating jurisdictions' websites. The public was notified at the public meetings that the draft Plan would be available for review. No feedback was received on the draft Plan, although it was given on the public survey, and all relevant information was incorporated into the Plan. Public input was utilized to assist in identifying hazards that were of most concern to the citizens of the County and what actions they felt should be included and prioritized.

The Plan will be advertised and posted on Van Zandt County and participating jurisdictions' websites upon approval from FEMA, and a copy will be kept at the Van Zandt County courthouse.

Stakeholder Involvement

Stakeholder involvement is essential to hazard mitigation planning since a wide range of stakeholders can provide input on specific topics and from various points of view. Throughout the planning process, members of community groups, local businesses, neighboring jurisdictions, schools, and hospitals were invited to participate in development of the Plan. The Stakeholder Group (Table A-3 in Appendix A, and Table 2-4, below), included a broad range of representatives from both the public and private sector and served as a key component in Van Zandt County's outreach efforts for development of the Plan. Documentation of stakeholder meetings is found in Appendix E. A list of organizations invited to attend via e-mail is found in Table 2-4.

Table 2-4. Stakeholder Working Group

AGENCY	TITLE	PARTICIPATED
Canton ISD	Superintendent	
Chamber of Canton Commerce	President	
East Texas COG	Executive Director	
Edgewood ISD	Superintendent	
Fruitvale ISD	Superintendent	
Fruitvale ISD	School Resource Officer	X
Grand Saline ISD	Superintendent	
Henderson County	Emergency Management Coordinator	
Hunt County	Emergency Management Coordinator	
Kaufman County	Emergency Management Coordinator	
Rains County	Emergency Management Coordinator	
Smith County	Emergency Management Coordinator	
Texas A&M Agri-Life Extension Service	County Extension Agent	

AGENCY	TITLE	PARTICIPATED
Texas Department of Public Safety	District Coordinator, DC 6	
Texas State Representative	Texas State Representative	
Texas State Senator	Texas State Senator	
Van Chamber of Commerce	President	
Van ISD	Superintendent	
Van Zandt County Regional Airport	Manager	
Wills Point Chamber of Commerce	Secretary	
Wills Point ISD	Superintendent	
Wood County	Emergency Management Coordinator	

Stakeholders and participants from neighboring communities that attended the Planning Team and public meetings played a key role in the planning process. For example, thunderstorm wind was one of the concerns to stakeholders, so several participating jurisdictions included actions to obtain certification in the National Weather Service StormReady Program which will help educate citizens through education on hazards.

Public Meetings

A series of public meetings were held throughout the Van Zandt County 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. Each participating jurisdiction within Van Zandt County released information regarding the public meetings in their area to increase public participation in the Plan development process, through posting on their website, on social media sources including Facebook and Twitter, through the local media, and/or posting the information on bulletin boards in public facilities. A sampling of these notices can be found in Appendix E, along with the documentation on the public meetings. Representatives from area neighborhood associations and area residents were invited to participate.

Public meetings were held on the following dates and locations:

- November 15, 2018, Van Zandt County Courthouse
- March 26, 2019, Van Zandt County Courthouse
- June 25, 2019, Van Zandt County Courthouse

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 and 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 participating jurisdictions' websites. A total of 39 surveys were completed online. The survey results are analyzed in Appendix B. Participating jurisdictions within Van Zandt County reviewed the input from the surveys and decided which information to incorporate into the Plan as hazard mitigation actions. For example,

many citizens mentioned concerns about tornadoes and suggested improving the emergency notification system and/or sirens. In response, several actions were added to the Plan to acquire and install warning systems, acquire and distribute NOAA weather radios, and many jurisdictions added actions to build safe room shelters for residents to access quickly.

Section 3: County Profile

OVERVIEW

Van Zandt County was stablished by the legislature in 1848 from part of Henderson County and named for Republic of Texas leader Isaac Van Zandt. Sabine Lake (Jordan's Saline) was named the county seat, a crude log courthouse was built, and court was held for the first time in December 1848. In 1850, Wood County was carved out of Van Zandt County, and the Van Zandt county seat was moved to Canton.

When the Texas and Pacific Railway was completed through the northern portion of the county in 1873, it opened up the county for settlement and provided much better access to outside markets, causing a rapid expansion of the farming economy. Between 1870 and 1880, the population nearly doubled. The number of farms grew rapidly during the same period. The railroad also brought new problems as well. Wills Point, which grew up as a railroad point, quickly emerged as one of the county's leading shipping centers. In 1877 an election was held for relocating the county seat from Canton to Wills Point. The commissioner's court ordered county records removed from Canton to Wills Point, but a force of 50 men marched on the town to bring the records back. Governor Richard Hubbard had to order troops into the county to restore order. A short time later the Supreme Court ruled the election void and ordered the records were returned to Canton, ending the so-called "Wills Point War".

Van Zandt County covers 860 square miles, of which 843 square miles is land and 17 square miles is covered by water. The Neches River rises in eastern Van Zandt County, and the Sabine River forms part of the northeastern county line. Creeks in the eastern portion of the county are part of the Trinity River watershed. Natural resources include oil, gas, salt, iron ore and clays. The eastern two-thirds of the county is in the Post Oak Savannah vegetation area, with tall grasses and post and black jack oak predominating. The western third is in the Blackland Prairies vegetation region, which is characterized by tall grasses, mesquite, and oak, and pecan and elm trees along streams.

Figure 3-1 shows the general location of Van Zandt County along with the Cities that are located within the County.

Figure 3-1. Location of Van Zandt County

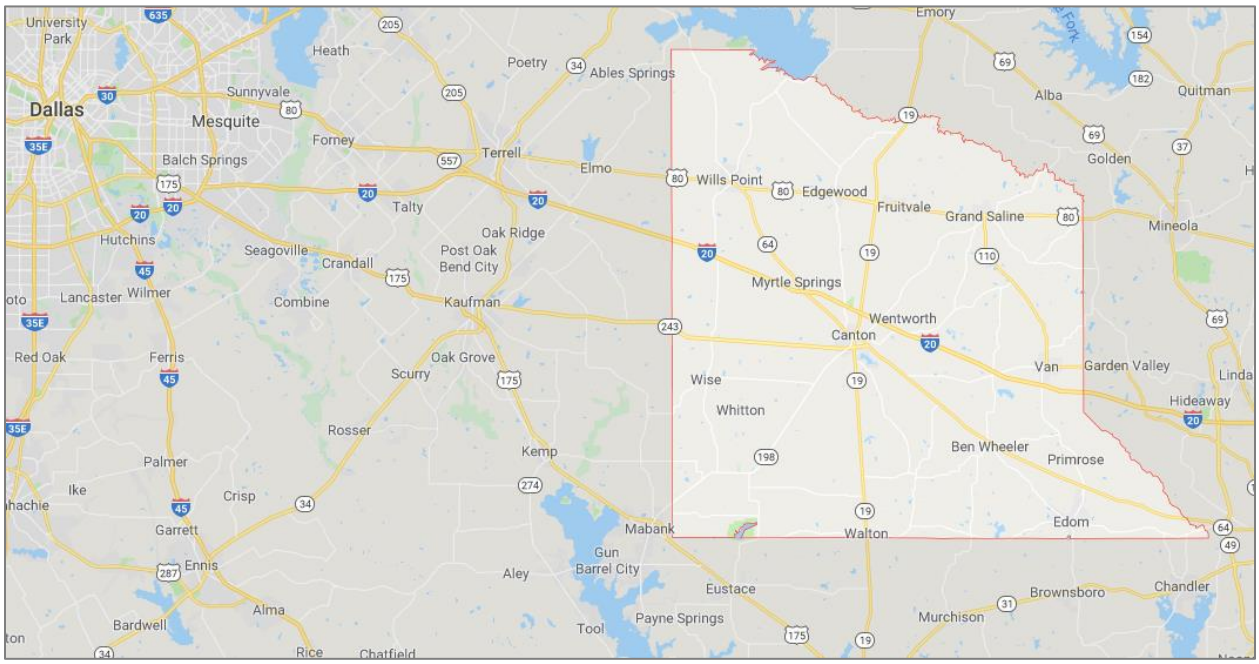
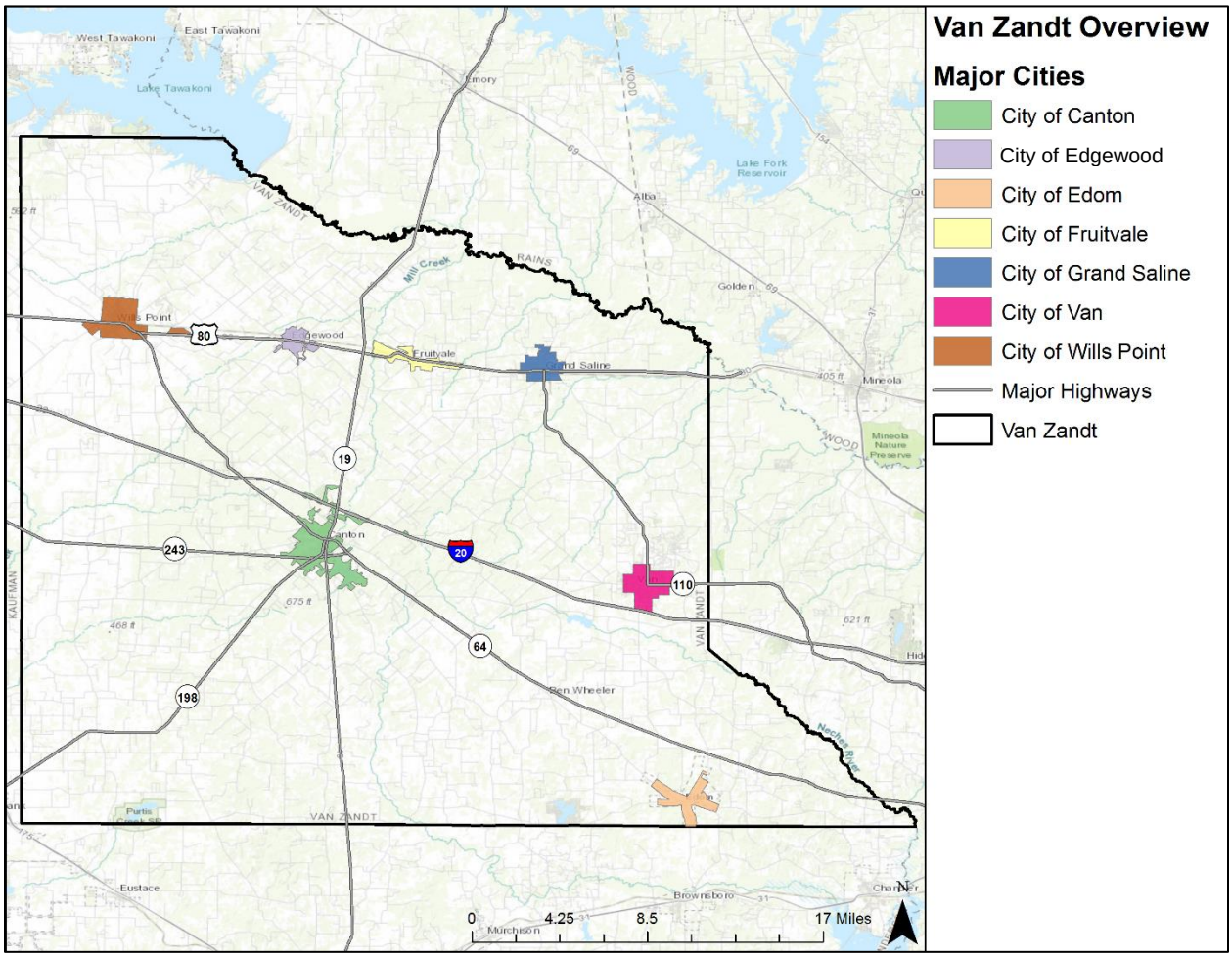


Figure 3-2 shows the participating jurisdictions within Van Zandt County that are covered in the risk assessment analysis of the Plan.

Figure 3-2. Van Zandt County Planning Area



Provided in Table 3-1 below is a listing of the jurisdictions in Van Zandt County that participated in the Van Zandt County Hazard Mitigation Action Plan 2019.

Table 3-1. Participating Jurisdictions

PARTICIPATING JURISDICTIONS
Van Zandt County
City of Canton
City of Edgewood
City of Edom
City of Fruitvale
City of Grand Saline
City of Van
City of Wills Point

POPULATION AND DEMOGRAPHICS

In the official Census population count, as of April 1, 2010, Van Zandt County has a population of 52,579 residents. By July 2017, the number was estimated at 53,607. Table 3-2 provides the population distribution by jurisdiction within Van Zandt County based on the 2010 Census information.[1]

Between official U.S. Census population counts, the estimate uses a formula based on new residential building permits and household size. It is simply an estimate and there are many variables involved in achieving an accurate estimation of people living in a given area at a given time.

Table 3-2. Population Distribution by Jurisdiction

JURISDICTION	TOTAL 2010 POPULATION	PERCENTAGE (based on 2010 Population)	2017 POPULATION ESTIMATE	ESTIMATED VULNERABLE OR SENSITIVE POPULATIONS[2]		
				Youth (Under 5)	Elderly (Over 65)	Below Poverty Level
City of Canton	3,581	6.81%	3,716	90	877	528
City of Edgewood	1,441	2.74%	1,927	121	275	301
City of Edom	375	0.71%	304	11	57	2
City of Fruitvale	408	0.78%	447	53	47	132
City of Grand Saline	3,136	5.96%	3,070	261	492	860
City of Van	2,632	5.01%	2,671	226	314	278
City of Wills Point	3,524	6.70%	3,536	284	635	916
Unincorporated Van Zandt County	37,482	71.29%	37,936	1,921	7,980	4,595
Van Zandt County Total	**52,579**	**100%**	**53,607**	**2,967**	**10,677**	**7,612**

Population Growth

The official 2010 Van Zandt County population is 52,579. Overall, Van Zandt County experienced an increase in population between 1980 and 2010 by 67.3%, or an increase by 21,153. All of the participating jurisdictions experienced an increase in their population from 1980 to 2010. Between 2000 and 2010, the City of Fruitvale experienced a slight decrease in population, while all of the other participating jurisdictions, including Van Zandt County as a whole, experienced a population growth. Table 3-3 provides historic growth rates in Van Zandt County.

[1] Source: https://www.census.gov/quickfacts/fact/table/vanzandtcountytexas/PST120218 and https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

[2] The Estimated Vulnerable or Sensitive Populations are based off of the 2017 American Community Survey.

Table 3-3. Population for Van Zandt County, 1980-2010

JURISDICTIONS	1980	1990	2000	2010	POP CHANGE 1980-2010	PERCENT OF CHANGE	POP CHANGE 2000-2010	PERCENT OF CHANGE
City of Canton	2,845	2,949	3,292	3,581	736	25.9%	289	8.8%
City of Edgewood	1,413	1,284	1,348	1,441	28	2.0%	93	6.9%
City of Edom	250	300	322	375	125	50.0%	53	16.5%
City of Fruitvale	367	349	418	408	41	11.2%	-10	-2.4%
City of Grand Saline	2,709	2,630	3,028	3,136	427	15.8%	108	3.6%
City of Van	1,881	1,854	2,362	2,632	751	39.9%	270	11.4%
City of Wills Point	2,631	2,986	3,496	3,524	893	33.9%	28	0.8%
Unincorporated Van Zandt County	19,330	25,592	33,874	37,482	18,152	93.9%	3,608	10.7%
Van Zandt County	**31,426**	**37,944**	**48,140**	**52,579**	**21,153**	**67.3%**	**4,439**	**9.2%**

FUTURE DEVELOPMENT

To better understand how future growth and development in the 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. This section includes an analysis of the projected population change and economic impacts.

Population projections from 2010 to 2040 are listed in Table 3-4, as provided by the Office of the State Demographer, Texas State Data Center, and the Institute for Demographic and Socioeconomic Research. Population projections are based on a 0.5 scenario growth rate, which is 50 percent of the population growth rate that occurred during 2000-2010. This information is only available at the County level; however, the population projection shows an increase in population density for the County, which would mean overall growth for the County.

Table 3-4. Van Zandt County Population Projections

County	LAND AREA (SQ MI)	2010		2020		2030		2040	
		Population							
		Total Number	Density (Land Area, SQ MI)	Total Number	Density (Land Area, SQ MI)	Total Number	Density (Land Area, SQ MI)	Total Number	Density (Land Area, SQ MI)
Van Zandt	843	52,579	62.4	55,778	66.2	58,720	69.7	60,374	71.6

Economic Impact

Building and maintaining infrastructure depends on the economy, and therefore, protecting infrastructure from risk due to natural hazards in the planning area is important to the participating jurisdictions within Van Zandt County. Whether it's expanding culverts under a road that washes out during flash flooding, shuttering a fire station, or flood-proofing a wastewater facility, infrastructure must be mitigated from natural hazards in order to continue providing essential utility and emergency response services in a fast-growing planning area. Major employers in the area are critical to the health of the economy, as well as effective transportation connectivity.

The Edgewood Economic Development Corporation (EEDC) was organized exclusively for the purpose of improving and promoting economic development by dedicating the revenues allocated from the economic development sales tax to job creating purposes. It is the sincere interest of the Edgewood EDC board to support the Business Growth and Improvement of the business community in a positive and impactful manner with actions in a cooperative effort with the Edgewood City Council.

The Fruitvale Economic Development Corporation (FEDC) is to promote, assist, and enhance economic development in compliance with the provisions of law, with focus on: business retention, expansion, and attraction to create, expand or retain primary jobs; development, improvement and maintenance of a positive business environment; support of community development initiatives that directly benefit business objectives; and, promote and encourage employment, and the public welfare of, for, and on the behalf of the City and for parks, auditoriums, learning center, open space improvements, athletic and exhibition facilities, and other related improvements.

The mission of the Grand Saline Texas Economic Development Corporation is to improve the local economy by financially assisting the development of new businesses and the expansion of existing businesses so as to increase sales tax revenue and to increase employment.

The Van Economic Development Corporation (VEDC) works tirelessly to grow Van's local economy through business attraction, retention, and expansion. With strategic foresight, dynamic marketing, targeted business incentives, and lively community events, VEDC is actively helping Van realize its full potential – a prosperous home for generations to come.

Wills Point Economic Development Corporation (EDC) is the economic heartbeat of the community in Wills Point. Through collaborative efforts with local businesses and the support of community, Wills Point EDC communicates and educates on the economic pulse while creating opportunities for businesses to thrive in the community.

Existing and Future Land Use and Development Trends

Comprehensive or economic development plans are part of a continuous process to provide an environment for the citizens and to consider the general desire of the community to conserve, preserve, and protect the natural environment. These plans are used to guide individuals in making decisions which affect the community with the understanding of the long term effects. The City of Canton, the City of Grand Saline, and the City of Van have a Comprehensive / Master Plan / Land Use Plan in place.

The City of Canton's Future Land Use Plan is one of the most critical elements of any comprehensive plan. This part of the Comprehensive Plan recommends the location of future land uses, such as

residential, retail, commercial, and industrial. Furthermore, the Future Land Use Plan serves as a framework upon which land use decisions can be based.

The City of Van's Future Land Use study describes the desired future for the development of the city in light of the current population, housing, and land uses in the community. Planning for a community's future based on knowledge about the past and present and what actions can be taken to influence the course of development in the community. Both internal and external forces create physical, social, and economic change in the communities, often changing the community's goals and priorities in the process. Therefore, this plan should be re-evaluated periodically and should be adapted, if necessary, to meet the needs of the community.

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 for the hazards identified. The Risk Assessment continues with Sections 5 through 16, which include hazard descriptions and vulnerability assessments.

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, participating jurisdictions within Van Zandt County identified twelve natural hazards that are addressed in the Hazard Mitigation Plan. Of the hazards identified, eleven natural hazards and one quasi-technological[1] hazard (dam failure) 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 2018 State of Texas Hazard Mitigation Plan (State Plan). Readily available online information from reputable sources such as federal and state agencies were also evaluated and utilized to supplement information as needed.

In general, there are three main categories of hazards: atmospheric, hydrologic, and technological. Atmospheric hazards are events or incidents associated with weather generated phenomenon. Atmospheric hazards that have been identified as significant for the Planning Area include 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 flood and drought.

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. The risks presented by natural hazards may be increased or decreased as a result of human activity, 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 purposes of description.

For the Risk Assessment, the earthquake, expansive soils, and wildfire hazards are considered “other,” since these hazards are not considered atmospheric, hydrologic, nor technological.

[1] While dam failure is generally considered a quasi-technological hazard, it is profiled in the Plan as a natural hazard, i.e. a breach caused by extensive rainfall or flooding or from an earthquake.

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	A thunderstorm occurs when an observer hears thunder. Radar observers use the intensity of the radar echo to distinguish between rain showers and thunderstorms. Lightning detection networks routinely track cloud-to-ground flashes, and therefore thunderstorms.
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 miles per hour, 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.
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.

HAZARD	DESCRIPTION
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	
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.
Expansive Soils	Expansive soils are soils and soft rock that tend to swell or shrink due to changes in moisture content. Changes in soil volume present a hazard primarily to structures built on top of expansive soils.
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 weren't considered significant and were not included in the Plan 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
Hurricane	The planning area is not located within 200 miles of the coast; therefore, hurricanes do not pose a risk. Any remnants of a hurricane or tropical storm system would only include thunderstorm winds and rainfall and would be covered under flood or thunderstorm wind mitigation measures.
Land Subsidence	There are no historical occurrences of land subsidence for the planning area and it is located in an area where occurrences are considered rare. There is no history of impact to critical structures, systems, populations or other community assets or vital services as a result of land subsidence and none is expected in the future.

Natural Hazards and Climate Change

Climate change is defined as a long-term hazard which can increase or decrease the risk of other weather hazards. It directly endangers property due to sea level rise and biological organisms due to habitat destruction.

Global climate change is expected to exacerbate the risks of certain types of natural hazards impacted through rising sea levels, warmer ocean temperatures, higher humidity, the possibility of stronger storms, and an increase in wind and flood damages due to storm surges. While sea level rise is a natural phenomenon and has been occurring for several thousand years, the general scientific consensus is that the rate has increased in the past 200 years, from 0.5 millimeters per year to 2 millimeters per year.

Texas is considered one of the more vulnerable states in the U.S. to both abrupt climate changes and to the impact of gradual climate changes to the natural and built environments. Mega-droughts can trigger abrupt changes to regional ecosystems and the water cycle, drastically increase extreme summer temperature and fire risk, and reduce availability of water resources, as Texas experienced during 2011-2012.

Paleoclimate records also show that the climate over Texas had large changes between periods of frequent mega-droughts and the periods of mild droughts that Texas is currently experiencing. While the cause of these fluctuations is unclear, it would be wise to anticipate that such changes could occur again and may even be occurring now.

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 retrieved from National Centers for Environmental Information (NCEI) and National Oceanic and Atmospheric Administration (NOAA) were reported for participating jurisdictions within Van Zandt County. Remaining records identifying the occurrence of hazard events in the planning area and the maximum recorded magnitude of each event were also evaluated.

The use of geographic information system (GIS) technology to identify and assess risks for Van Zandt County, and evaluate community assets and their vulnerability to the 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.

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 4-3, and impact statements are defined in Table 4-4 below.

Table 4-3. 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 4-4. 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 for at least two 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 more than 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 is the total of assets that are subject to damages 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 damages, 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.

To better understand how future growth and development in the Van Zandt 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 all participating jurisdictions within Van Zandt County was reviewed based on recent development changes that occurred throughout the planning area. Van Zandt County has increased

slightly between 2010 and 2017 according to the U.S. Census Bureau, therefore there has been no significant factors or development trends with a consequential effect or increase in vulnerability to the population, infrastructure and buildings for hazards.

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.

Section 5: 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 the high toward the 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 is accelerated.

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

Thunderstorms wind events can develop in any geographic location, and are considered a common occurrence in Texas. Therefore a thunderstorm wind event could occur at any location within Van Zandt County's planning area, including all participating jurisdictions, as these storms develop randomly and are not confined to any geographic area within the County. It is assumed that the entire Van Zandt County planning area is uniformly exposed to the threat of thunderstorms winds.

EXTENT

The extent or magnitude of a thunderstorm wind event is measured by the Beaufort Wind Scale. Table 5-1 describes the different intensities of wind in terms of speed and effects, from calm to violent and destructive.

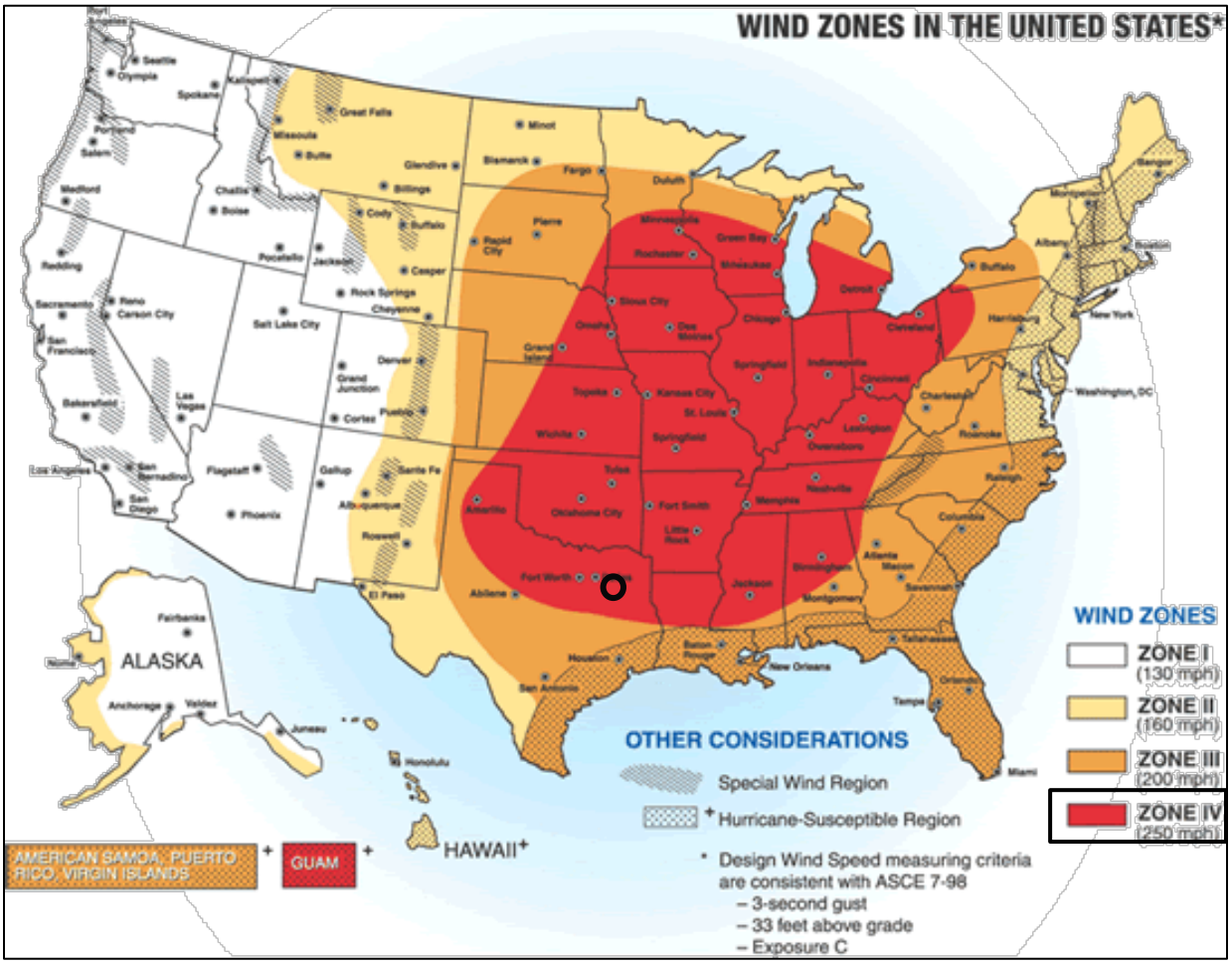
Table 5-1. Beaufort Wind Scale[1]

FORCE	WIND (MHP)	WMO CLASSIFICATION	APPEARANCE OF WIND EFFECTS
0	Less than 1	Calm	Calm, smoke rises vertically
1	1-3	Light Air	Smoke drift indicates wind direction, still wind vanes
2	4-8	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	9-14	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	15-21	Moderate Breeze	Dust, leaves and loose paper lifted, small tree branches move
5	22-28	Fresh Breeze	Small trees in leaf begin to sway
6	29-36	Strong Breeze	Larger tree branches moving, whistling in wires
7	37-44	Near Gale	Whole trees moving, resistance felt walking against wind
8	45-53	Gale	Whole trees in motion, resistance felt walking against wind
9	54-62	Strong Gale	Slight structural damage occurs, slate blows off roofs
10	63-72	Storm	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	73-83	Violent Storm	If experienced on land, widespread damage
12	84+	Hurricane	Violence and destruction

Figure 5-1 displays the wind zones as derived from NOAA.

[1] Source: World Meteorological Organization

Figure 5-1. Wind Zones in the United States[2]



On average, the planning area experiences three to four thunderstorm wind events every year. The planning area is located in Zone IV, meaning they can experience winds up to 250 mph. Van Zandt County has experienced a significant wind event or an event with winds in the range of "Force 12" on the Beaufort Wind Scale with winds at or above 84 mph. This is the most significant event that can be expected in the future for all participating jurisdictions.

Historical Occurrences

Tables 5-2, 5-3, and 5-4 depict historical occurrences of thunderstorm wind events for the Van Zandt County planning area according to the National Centers for Environmental Information (NCEI) data. Since January 1965, 174 thunderstorm wind events are known to have impacted the Van Zandt County planning area, based upon NCEI records. Table 5-3 presents information on known historical events impacting the Van Zandt County planning area with resulting damages, injuries or fatalities. It is important to note that high wind events associated with other hazards, such as tornadoes, are not accounted for in this section.

[2] Van Zandt County is indicated by the circle.

The NCEI is a national data source organized under the National Oceanic and Atmospheric Administration. The NCEI is the largest archive available for climate data; however, it is important to note that the only incidents recorded are those that are reported to the NCEI from 1965 through April of 2019 have been factored into this risk assessment. In the tables that follow throughout this section, some occurrences seem to appear multiple times in one table. This is due to reports from various locations throughout the County. In addition, property damage estimates are not always available. Where an estimate has been provided in a table for losses, the dollar amounts have been altered to indicate the damage in 2019 dollars.

Historical thunderstorm wind data for the all participating jurisdictions are provided on a County-wide basis per the NCEI database.

Table 5-2. Historical Thunderstorm Wind Events with Reported Damages, 1965-2019[3]

MAXIMUM WIND SPEED RECORDED (MPH)	NUMBER OF REPORTED EVENTS
0-30	56
31-40	0
41-50	17
51-60	41
61-70	26
71-80	3
81-90	1
91-100	0
Unknown	30

Table 5-3. Historical Thunderstorm Wind Events, 1965-2019[4]

JURISDICTION	DATE	TIME	MAGNITUDE (MPH)	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Van Zandt County	11/23/1983	12:25 AM	69	0	2	$0	$0
Van Zandt County	11/23/1983	12:25 AM	69	0	4	$0	$0
City of Canton	4/29/1994	9:30 PM	0	0	0	$85,745	$0
City of Wills Point	4/29/1994	8:45 PM	0	0	0	$85,745	$0
City of Wills Point	5/27/1994	6:45 PM	0	0	0	$85,687	$0
City of Edgewood	5/29/1994	10:05 AM	52	0	0	$8,569	$0

[3] Historical events are reported from January 1965 through April 2019.
[4] Only recorded events with fatalities, injuries or damages are listed. Magnitude is listed when available. Damage values are in 2019 dollars.

JURISDICTION	DATE	TIME	MAGNITUDE (MPH)	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
City of Wills Point	10/7/1994	4:50 PM	0	0	0	$8,454	$0
City of Canton	11/4/1994	6:15 PM	0	0	0	$8,443	$0
City of Wills Point	11/4/1994	6:15 PM	0	0	0	$8,443	$0
City of Wills Point	11/4/1994	11:30 PM	61	0	0	$8,443	$0
City of Wills Point	11/4/1994	11:30 PM	61	0	0	$8,443	$0
City of Canton	4/19/1995	4:02 PM	65	0	0	$41,602	$0
Van Zandt County	4/19/1995	3:55 PM	0	0	0	$66,564	$0
City of Canton	5/7/1995	11:15 PM	0	0	0	$332,163	$0
City of Canton	5/8/1995	12:05 AM	0	0	0	$24,912	$0
City of Canton	6/1/1996	12:15 PM	Unknown	0	0	$3,226	$0
Van Zandt County	6/1/1996	11:49 AM	Unknown	0	0	$3,226	$0
City of Canton	11/7/1996	1:36 AM	71	0	0	$3,188	$0
Van Zandt County	3/2/1997	8:25 AM	Unknown	0	0	$189,582	$0
City of Grand Saline	4/22/1997	4:50 AM	Unknown	0	0	$3,156	$0
City of Wills Point	4/22/1997	1:15 AM	Unknown	0	0	$3,156	$0
City of Canton	6/17/1997	12:28 AM	Unknown	0	0	$31,528	$0
City of Grand Saline	3/30/1998	9:25 PM	Unknown	0	0	$3,896	$0
City of Edgewood	7/17/1998	3:56 PM	Unknown	0	0	$15,489	$0
City of Canton	8/3/1998	5:30 PM	Unknown	0	0	$1,547	$0
City of Edom	8/11/1998	4:04 PM	Unknown	0	0	$3,094	$0
Van Zandt County	8/11/1998	2:40 PM	Unknown	0	0	$3,094	$0
Van Zandt County	8/11/1998	3:15 PM	Unknown	0	0	$3,094	$0
Van Zandt County	12/4/1998	4:40 AM	Unknown	0	0	$15,423	$0
City of Edgewood	3/8/1999	12:00 PM	Unknown	0	0	$7,660	$0
City of Canton	4/26/1999	8:45 AM	Unknown	0	0	$152	$0
City of Wills Point	4/26/1999	8:15 AM	Unknown	0	0	$7,605	$0

JURISDICTION	DATE	TIME	MAGNITUDE (MPH)	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Van Zandt County	4/26/1999	8:45 AM	Unknown	0	0	$456	$0
City of Wills Point	5/11/1999	9:20 PM	Unknown	0	0	$4,563	$0
City of Grand Saline	5/17/1999	5:15 PM	Unknown	0	0	$304	$0
Van Zandt County	5/17/1999	5:30 PM	Unknown	0	0	$760	$0
Van Zandt County	12/4/1999	10:35 AM	Unknown	0	0	$75,097	$0
Van Zandt County	4/7/2000	6:30 PM	Unknown	0	0	$2,951	$0
City of Canton	5/12/2000	8:30 PM	Unknown	0	0	$1,474	$0
City of Canton	8/22/2000	7:00 PM	Unknown	0	0	$7,314	$0
City of Fruitvale	8/25/2002	3:03 PM	52	0	0	$4,197	$0
City of Edom	12/30/2002	5:05 PM	52	0	0	$13,973	$0
City of Edgewood	8/26/2003	1:25 PM	52	0	0	$2,739	$0
City of Edgewood	8/27/2003	2:30 PM	52	0	0	$6,847	$0
City of Wills Point	3/4/2004	4:15 PM	60	0	0	$6,744	$0
City of Wills Point	3/4/2004	4:15 PM	60	0	10	$674,429	$0
City of Canton	6/1/2004	10:00 PM	61	0	0	$19,988	$0
City of Canton	3/31/2005	7:45 PM	60	0	0	$6,538	$0
City of Wills Point	5/25/2005	1:55 PM	50	0	0	$3,901	$0
City of Canton	4/29/2006	2:51 AM	65	0	0	$1,254,471	$0
City of Canton	4/29/2006	3:57 AM	65	0	0	$62,724	$0
City of Canton	8/6/2006	7:35 PM	61	0	0	$12,397	$0
City of Edom	3/3/2008	6:25 AM	56	0	0	$100,624	$0
City of Canton	5/2/2008	7:30 AM	61	0	0	$5,834	$0
City of Van	6/17/2008	12:22 PM	50	0	0	$3,466	$0
City of Wills Point	5/2/2009	6:26 PM	61	0	0	$2,364	$0
City of Edgewood	5/2/2009	6:52 PM	52	0	0	$1,182	$0
City of Grand Saline	6/10/2009	8:00 PM	52	0	0	$3,516	$0

Section 5: Thunderstorm Wind

JURISDICTION	DATE	TIME	MAGNITUDE (MPH)	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
City of Van	6/10/2009	8:09 PM	52	0	0	$4,688	$0
City of Wills Point	6/10/2009	7:27 PM	56	0	0	$1,172	$0
Van Zandt County	6/10/2009	8:11 PM	70	0	0	$9,375	$0
City of Van	4/24/2010	1:04 AM	61	0	0	$4,638	$0
City of Van	4/24/2010	1:12 AM	70	0	0	$115,948	$0
Van Zandt County	4/24/2010	12:45 AM	75	0	0	$115,948	$0
Van Zandt County	4/24/2010	12:50 AM	70	0	0	$3,478	$0
City of Canton	8/6/2010	3:35 PM	52	0	0	$579	$0
Van Zandt County	4/26/2011	4:00 PM	70	0	0	$899,135	$0
City of Wills Point	5/20/2011	4:30 PM	59	0	0	$50,340	$0
City of Grand Saline	7/1/2011	6:55 PM	50	0	0	$22,377	$0
City of Wills Point	6/6/2012	6:15 PM	48	0	0	$13,218	$0
City of Edgewood	12/19/2012	10:17 PM	61	0	0	$33,028	$0
City of Grand Saline	10/2/2014	4:14 PM	50	0	0	$5,323	$0
City of Grand Saline	10/2/2014	4:45 PM	61	0	0	$63,877	$0
City of Wills Point	10/2/2014	4:14 PM	72	0	0	$0	$21,292
City of Van	4/16/2015	5:37 PM	52	0	0	$2,137	$0
City of Van	4/16/2015	5:38 PM	52	0	0	$534	$0
City of Edgewood	4/24/2015	7:00 PM	65	0	0	$21,367	$0
City of Wills Point	5/25/2015	3:24 PM	50	0	0	$10,630	$0
Van Zandt County	12/13/2015	5:00 AM	48	0	0	$21,374	$0
TOTALS			**(Max Extent)**	**0**	**16**	**$4,749,348**	**$21,292**

Table 5-4. Summary of Historical Thunderstorm Wind Events, 1965-2019

JURISDICTION	NUMBER OF EVENTS	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Van Zandt County	74	85 mph	0	6	$1,409,557	$0
City of Canton	33	71 mph	0	0	$1,903,825	$0
City of Edgewood	11	65 mph	0	0	$96,881	$0
City of Edom	7	56 mph	0	0	$117,691	$0
City of Fruitvale	1	52 mph	0	0	$4,197	$0
City of Grand Saline	9	61 mph	0	0	$102,449	$0
City of Van	11	70 mph	0	0	$131,411	$0
City of Wills Point	28	72 mph	0	10	$983,337	$21,292
TOTAL LOSSES	**174**	**(Max Extent)**	**0**	**16**	**$4,770,640**	

Significant Events

March 4, 2004 – City of Wills Point
Several houses were damaged, many RV trailers destroyed, trees, and power lines were blown down.

April 29, 2006 – City of Canton
There was significant structural damage to several buildings near the intersection of Highway 19 and Highway 243. A damage survey conducted by the National Weather Service indicated that this damage was due to a downburst. More than 40 homes and 15 businesses were damaged.

April 26, 2011 – Van Zandt County
Nearly 100 homes and several outbuildings were damaged across the southern half of Van Zandt County from two strong supercells. These homes were damaged by either a tornado in the same region, damaging downburst winds, and/or RFD winds. It cannot be determined how many of the homes were damaged by the tornado and how many by the RFD or downburst winds. In addition, numerous trees were also knocked down and several were blocking roadways. Power lines were also down as well.

Probability of Future Events

Most thunderstorm winds occur during the months of March, April, May, and September. Based on available records of historic events, there have been 174 events in a 54 year reporting period. This frequency supports a probability of three to four events every year. Even though the intensity of thunderstorm wind events is not always damaging for the Van Zandt 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 Van Zandt County planning area, including all participating jurisdictions.

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 in the Van Zandt County planning area, including all participating jurisdictions, 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 numerous instances roofs have been reported as having been torn off of buildings. The portable buildings used at various locations within the planning area would be more vulnerable to thunderstorm wind events than typical site built structures and could potentially pose a greater risk for wind-blown debris. In addition, some commercial structures feature roof top Air Conditioning Units that would be vulnerable to high winds flying debris. These structures would also be more vulnerable. These units would also pose the additional threat of contributing to flying debris, causing additional damages to surrounding structures.

The US Census data indicates a total of 5,271 manufactured homes (approximately 22.8%) located in the Van Zandt County planning area, including all participating jurisdictions, (Table 5-5). In addition, 42.7% (approximately 9,881 structures) of the residential structures in the Van Zandt 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 damages during significant wind events.

Table 5-5. Structures at Greater Risk by Jurisdiction

JURISDICTION	MANUFACTURED HOMES	SFR STRUCTURES BUILT BEFORE 1980
Van Zandt County[5]	5,271	9,881
City of Canton	63	1,031
City of Edgewood	5	559
City of Edom	11	70
City of Fruitvale	15	80
City of Grand Saline	67	695
City of Van	87	738
City of Wills Point	43	1,021

[5] County totals includes all jurisdictions and unincorporated areas within the county.

The following critical facilities would be vulnerable to thunderstorm wind events in each participating jurisdiction:

Table 5-6. Critical Facilities at Risk by Jurisdiction

JURISDICTION	CRITICAL FACILITIES
Van Zandt County	15 Government Facilities, 1 Sheriff's Office, 10 Water/Wastewater Facilities, 3 Communications Towers, 6 Fire Stations, 1 Hospital, 1 Airport, 1 Juvenile Detention Facility
City of Canton	1 Fire Station, 1 Police Station, 1 County Jail, 3 Government Facilities, 1 ISD with 4 Schools, 2 Medical Facilities
City of Edgewood	2 Government Facility, 1 Police Station, 1 Fire Station, 5 Water/Wastewater Facilities, 1 Dam
City of Edom	5 Pump Stations, 1 Fire Station
City of Fruitvale	1 Government Facility, 1 Fire Station, 1 ISD with 3 Schools, 4 Pump Stations, 1 Disaster Relief Center
City of Grand Saline	6 Government Facilities, 1 Police Station, 3 Fire Stations, 6 Water/Wastewater Facilities, 1 Animal Shelter, 1 Shelter,
City of Van	2 Government Facilities, 1 Fire Station, 1 Police Station, 3 Schools
City of Wills Point	2 Government Facilities, 1 Police Station, 1 Fire Station, 1 School, 1 EMS, 1 Medical Facility, 1 Airport

A thunderstorm wind event can also result in traffic disruptions, injuries and in rare cases, fatalities. Impact of thunderstorms winds experienced in the Van Zandt County planning area has resulted in sixteen injuries and no fatalities. Impact of thunderstorm wind events experienced in the entire Van Zandt County planning area would be "Minor," and injuries and illnesses would be treatable with first aid, ten percent or more of property damaged or destroyed, and facilities would be shut down for up to one week. Overall, the average loss estimate (in 2019 dollars) is $4,770,640, having an approximate annual loss estimate of $88,345 (Table 5-7).

Table 5-7. Potential Annualized Losses by Jurisdiction

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Van Zandt County	$1,409,557	$26,103
City of Canton	$1,903,825	$35,256
City of Edgewood	$96,881	$1,794
City of Edom	$117,691	$2,179
City of Fruitvale	$4,197	$78
City of Grand Saline	$102,449	$1,897
City of Van	$131,411	$2,434
City of Wills Point	$1,004,629	$18,604

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Planning Area	$4,770,640	$88,345

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. Impacts to the planning area can include:

- 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.
- During exceptionally heavy wind events, first responders may be prevented from responding to calls, as the winds may reach a speed in which their vehicles and equipment are unsafe to operate.
- 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.
- First responders are exposed to downed power lines, unstable and unusual debris, hazardous materials, and generally unsafe conditions.
- Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications.
- Critical staff may be unable to report for duty, limiting response capabilities.
- City or county departments may be damaged, delaying response and recovery efforts for the entire community.
- Private sector entities that the City 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.
- 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 built to less stringent building codes may suffer greater damage as they are typically more vulnerable to thunderstorm winds.
- Large scale wind events can have significant economic impact on the affected area, as it must now fund expenses such as infrastructure repair and restoration, temporary services and facilities, overtime pay for responders, and normal day-to-day operating expenses.

- Businesses that are more reliant on utility infrastructure than others may suffer greater damages without a backup power source.
- Activities at locations such as Purtis Lake and State Park or Rhine Lake attract tourism including hiking, camping, boating, and fishing throughout the year. A large thunderstorm wind event could impact recreational activities, placing visitors in imminent danger, potentially requiring emergency services or evacuations.
- Recreational areas and parks may be damaged or inaccessible due to downed trees or debris, causing temporary impacts to area businesses.

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 6: 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 the 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 FEMA, an average of 300 people are injured and 80 people are killed in the United States each year by lightning. Direct lightning strikes also have the ability to cause significant damage to buildings, critical facilities, and infrastructure. 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.

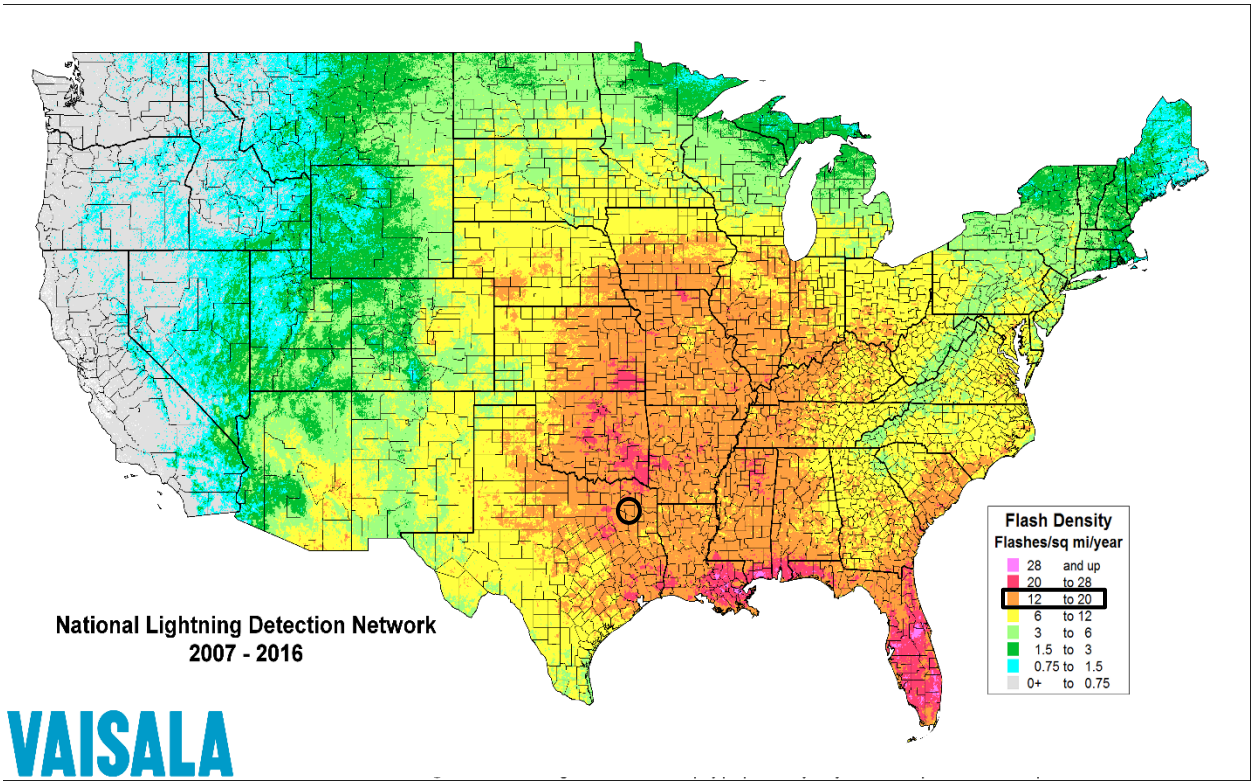
LOCATION

Lightning can strike in any geographic location and is considered a common occurrence in Texas. The Van Zandt County planning area, including all participating jurisdictions is located in a region of the country that is moderately susceptible to a lightning strike. Therefore, lightning could occur at any location within the entire planning area. It is assumed that the entire Van Zandt County planning area is uniformly exposed to the threat of lightning.

EXTENT

According to the NOAA, the average number of cloud-to-ground flashes for the State of Texas between 2007 and 2016 was 11.3 flashes per square mile. Vaisala's U.S. National Lightning Detection Network lightning flash density map (Figure 6-1) shows a range of twelve to twenty cloud-to-ground lightning flashes per square mile per year for the entire Van Zandt County planning area. This rate equates to approximately 10,320 to 17,200 flashes per year for the entire planning area.

Figure 6-1. Lightning Flash Density, 2007-2016



The extent for lightning can be expressed in terms of the number of strikes in an interval. NOAA utilizes lightning activity levels (LALs) on a scale from 1-6. LAL rankings reflect the frequency of cloud-to-ground lightning either forecast or observed (Table 6-1).

Table 6-1. NOAA Lightning Activity Levels (LAL)

LAL	CLOUD & STORM DEVELOPMENT	LIGHTNING STRIKES/ 15 MIN
1	No thunderstorms.	-
2	Cumulus clouds are common but only a few reach the towering cumulus stage. A single thunderstorm must be confirmed in the observation area. The clouds produce mainly virga, but light rain will occasionally reach the ground. Lightning is very infrequent.	1-8
3	Towering cumulus covers less than two-tenths of the sky. Thunderstorms are few, but two to three must occur within the observation area. Light to moderate rain will reach the ground, and lightning is infrequent.	9-15
4	Towering cumulus covers two to three-tenths of the sky. Thunderstorms are scattered and more than three must occur within the observation area. Moderate rain is common and lightning is frequent.	16-25
5	Towering cumulus and thunderstorms are numerous. They cover more than three-tenths and occasionally obscure the sky. Rain is moderate to heavy and lightning is frequent and intense.	>25

LAL	CLOUD & STORM DEVELOPMENT	LIGHTNING STRIKES/ 15 MIN
6	Similar to LAL 3 except thunderstorms are dry.	

The NCEI does not include the LAL for historical lightning events, therefore in order to determine the extent of lightning strikes, the yearly average range of estimated number of lightning strikes within the planning area (10,320 to 17,200 flashes) and a cloud-to-ground flash density of twelve to twenty per square mile were divided by the number[1] of thunderstorm events that occur annually in the planning area. Van Zandt County, including all participating jurisdictions, should expect an average range of eleven to thirty-eight lightning strikes within 15 minutes at any given time during a lightning or combined lightning and thunderstorm event, indicating lightning strikes have an average LAL range of 3 to 6. The highest being a 6 on the LAL for all participating jurisdictions in the future.

Historical Occurrences

Since January 1996, there have been only four recorded lightning events reported as having impacted the Van Zandt County Planning Area, based upon NCEI records. 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.

Table 6-2. Historical Lightning Events, 1996-2019[2]

JURISDICTION	DATE	INJURIES	FATALITIES	PROPERTY DAMAGE	CROP DAMAGE
Van Zandt County	8/8/1996	0	1	$0	$0
City of Canton	6/21/2001	0	0	$85,205	$0
Van Zandt County	4/24/2010	0	0	$231,895	$0
Van Zandt County	12/5/2011	0	0	$7,841	$0
TOTALS		**0**	**1**	**$324,941**	**$0**

Probability of Future Events

Based on historical records and input from the planning team the probability of occurrence for future lightning events in the Van Zandt County planning area, including all participating jurisdictions is considered highly likely, or an event probable in the next year. The planning team stated that lightning occurs regularly in the area. According to NOAA, the Van Zandt County planning area is located in an area of the country that experiences six to twenty lightning flashes per square mile per year (approximately 10,320 to 17,200 flashes per year). Given this estimated probability of events, it can

[1] Analysis includes the highest number of events recorded in a given year during the reporting period in order to account for typical under reporting of thunderstorm and lightning events.
[2] Historical events are reported from January 1996 through April 2019.

be expected that future lightning events will continue to threaten life and cause minor property damages throughout the planning area, including all participating jurisdictions.

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 damages depending on the strike location. Due to the randomness of these events, all existing and future structures and facilities in the entire Van Zandt County planning area could potentially be impacted and remain vulnerable to possible injury and property loss from lightning strikes. The Van Zandt County planning area has only four reported lightning events according to NCEI records.

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 Van Zandt County planning area, is 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. Population located outdoors is considered at risk and more vulnerable to a lightning strike compared to being inside a structure.

The entire general building stock and all infrastructure of the Van Zandt 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. Agricultural losses can be extensive due to lightning and resulting fires.

The following critical facilities would be vulnerable to lightning events in each participating jurisdiction:

Table 6-3. Critical Facilities at Risk by Jurisdiction

JURISDICTION	CRITICAL FACILITIES
Van Zandt County	15 Government Facilities, 1 Sheriff's Office, 10 Water/Wastewater Facilities, 3 Communications Towers, 6 Fire Stations, 1 Hospital, 1 Airport, 1 Juvenile Detention Facility
City of Canton	1 Fire Station, 1 Police Station, 1 County Jail, 3 Government Facilities, 1 ISD with 4 Schools, 2 Medical Facilities
City of Edgewood	2 Government Facility, 1 Police Station, 1 Fire Station, 5 Water/Wastewater Facilities, 1 Dam
City of Edom	5 Pump Stations, 1 Fire Station
City of Fruitvale	1 Government Facility, 1 Fire Station, 1 ISD with 3 Schools, 4 Pump Stations, 1 Disaster Relief Center
City of Grand Saline	6 Government Facilities, 1 Police Station, 3 Fire Stations, 6 Water/Wastewater Facilities, 1 Animal Shelter, 1 Shelter,
City of Van	2 Government Facilities, 1 Fire Station, 1 Police Station, 3 Schools
City of Wills Point	2 Government Facilities, 1 Police Station, 1 Fire Station, 1 School, 1 EMS, 1 Medical Facility, 1 Airport

Impact of lightning experienced in the Van Zandt County planning area has resulted in one fatality and no injuries. While the impact of lightning events experienced in the Van Zandt County planning area,

including all participating jurisdictions would be “Limited” with less than 10 percent of structures with major damage or destroyed, the fatality in the planning area indicates the impact to the planning area is “Substantial”. Overall, the average loss estimate for the entire Van Zandt County planning area is $324,941 with and estimated annualized loss of $14,127.

Table 6-4. Potential Annualized Losses by Jurisdiction[3]

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATE
Van Zandt County	$239,736	$10,423
City of Canton	$85,205	$3,704
City of Edgewood	$0	$0
City of Edom	$0	$0
City of Fruitvale	$0	$0
City of Grand Saline	$0	$0
City of Van	$0	$0
City of Wills Point	$0	$0
City of Canton	$0	$0
Planning Area	**$324,941**	**$14,127**

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. Impacts to the planning area can include:

- 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.

[3] Damage values are in 2019 dollars.

- City or county 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 damages 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 county, communities, local businesses, and citizens will also contribute to the overall economic and financial conditions in the aftermath of any lightning event.

Section 7: Drought

HAZARD DESCRIPTION

Drought is a period of time without substantial rainfall that persists from one year to the next. Drought is a normal part of virtually all climatic regions, including areas with high and low average rainfall. Drought is the consequence of anticipated natural precipitation reduction over an extended period of time, usually a season or more in length. Droughts can be classified as meteorological, hydrologic, agricultural, and socioeconomic. Table 7-1 presents definitions for these different types of drought.

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 lead to other hazards such as extreme heat and wildfires. Their impact on wildlife and area farming is enormous, often killing crops, grazing land, edible plants, and even in severe cases, trees. A secondary hazard to drought is wildfire because dying vegetation serves as a prime ignition source. Therefore, a heat wave combined with a drought is a very dangerous situation.

Table 7-1. 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.

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

LOCATION

Droughts occur regularly throughout Texas and the Van Zandt County planning area and are a normal condition. However, they can vary greatly in their intensity and duration. The Drought Monitor shows the planning area is currently experiencing normal conditions throughout the county (Figure 7-1). However, the planning area has experienced abnormally dry to exceptional drought conditions over the last twenty years (Figure 7-2). There is no distinct geographic boundary to drought; therefore, it can occur throughout the Van Zandt County planning area equally, including all participating jurisdictions.

Figure 7-1. U.S. Drought Monitor, July 2019

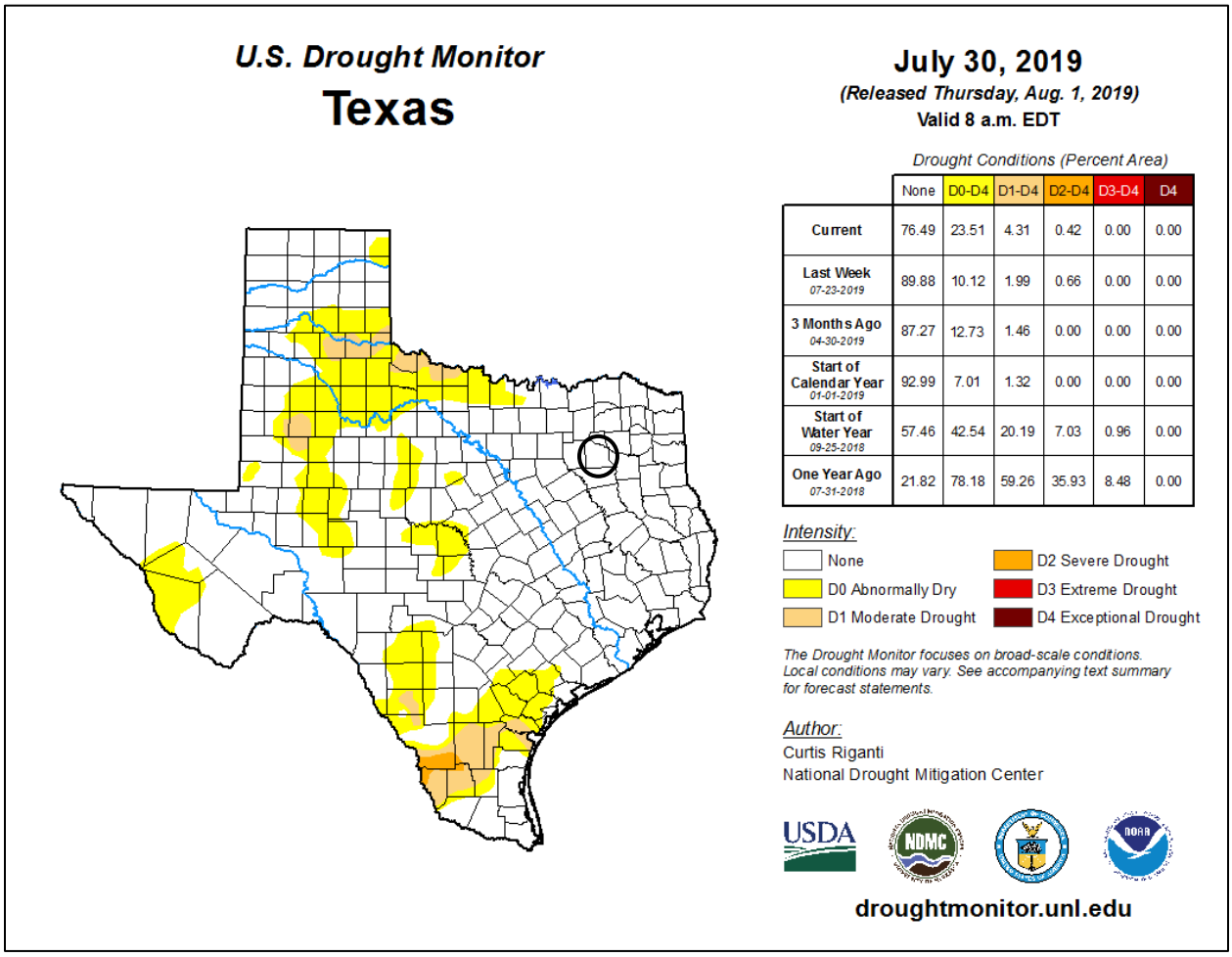
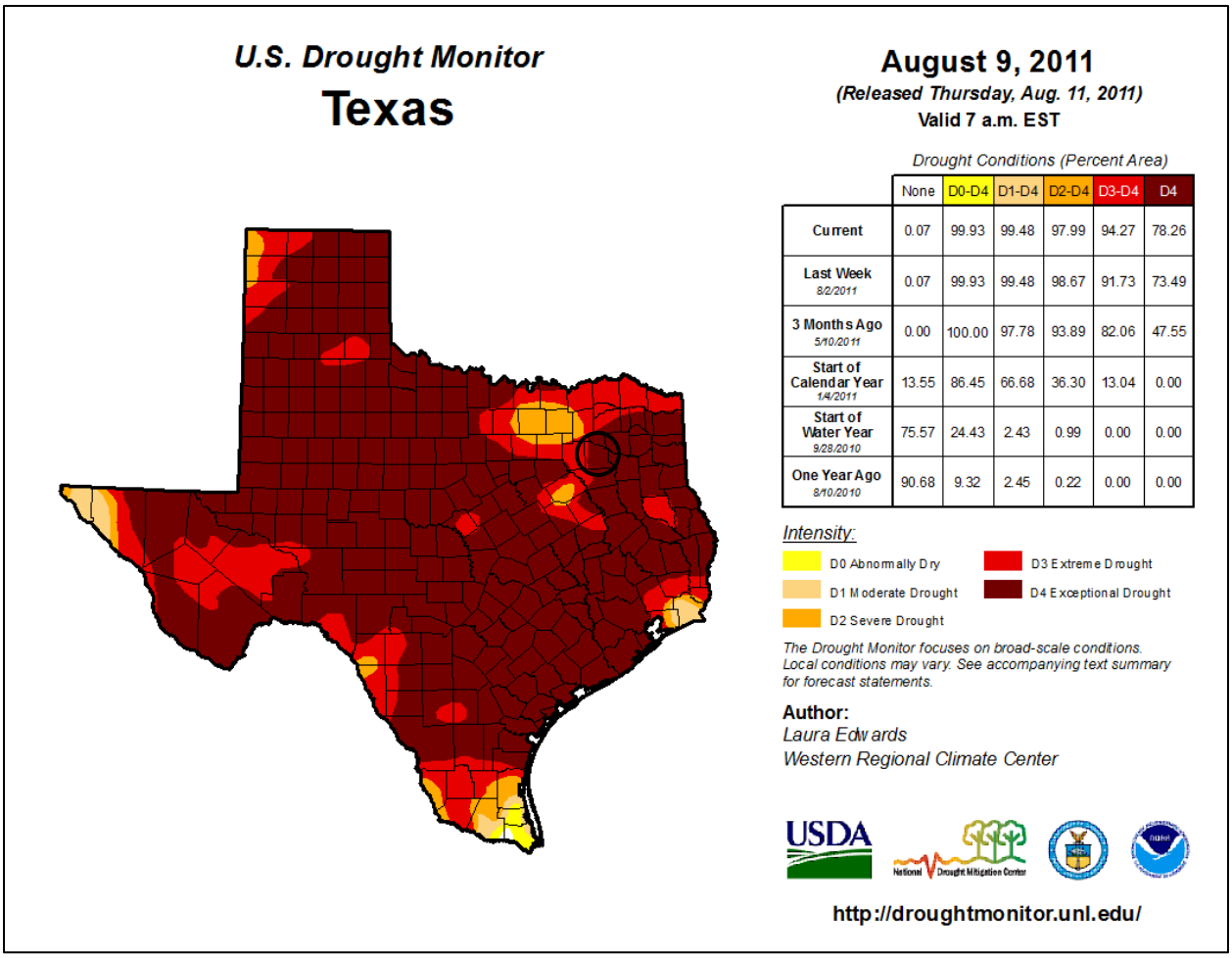


Figure 7-2. U.S. Drought Monitor, August 2011



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 7-2 depicts magnitude of drought, while Table 7-3 describes the classification descriptions.

Table 7-2. 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 7-3. 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 Van Zandt County planning area, including all participating jurisdictions, the area can anticipate a range of drought from abnormally dry to exceptional, or D0 to D4, based on the Palmer Drought Category. The entire planning area has

[2] Source: National Drought Mitigation Center

experienced exceptional drought conditions. This is the most extreme drought conditions the planning area can anticipate in the future.

HISTORICAL OCCURRENCES

The Van Zandt County planning area may typically experience a severe drought. Table 7-4 and 7-5 list historical events that have occurred in the Van Zandt County planning area as reported in the National Centers for Environmental Information (NCEI). 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 for all participating jurisdictions in the Van Zandt County planning area are provided on a county-wide basis per the NCEI database.

Table 7-4. Historical Drought Years, 1996-2019[3]

DROUGHT YEAR
1996
1998
2000
2005-2006
2006
2010-2011
2013
2013
2014
2014
2015
2016
2017
2018
14 unique events

[3] Historical events are reported from January 1996 through April 2019.

Table 7-5. Historical Drought Events, 1996-2019[4]

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Van Zandt County	8/1/1996	0	0	$0	$0
Van Zandt County	7/1/1998	0	0	$0	$0
Van Zandt County	8/1/2000	0	0	$0	$0
Van Zandt County	9/1/2000	0	0	$0	$0
Van Zandt County	7/1/2005	0	0	$0	$0
Van Zandt County	8/1/2005	0	0	$0	$0
Van Zandt County	9/1/2005	0	0	$0	$0
Van Zandt County	10/1/2005	0	0	$0	$0
Van Zandt County	11/1/2005	0	0	$0	$0
Van Zandt County	12/1/2005	0	0	$0	$0
Van Zandt County	1/1/2006	0	0	$0	$0
Van Zandt County	2/1/2006	0	0	$0	$0
Van Zandt County	3/1/2006	0	0	$0	$0
Van Zandt County	6/6/2006	0	0	$0	$0
Van Zandt County	7/1/2006	0	0	$0	$0
Van Zandt County	8/1/2006	0	0	$0	$0
Van Zandt County	9/1/2006	0	0	$0	$0
Van Zandt County	10/1/2006	0	0	$626,303	$626,303
Van Zandt County	11/1/2006	0	0	$0	$1,003,577
Van Zandt County	12/12/2010	0	0	$0	$6,920

[4] Historical events are reported from January 1996 through April 2019.

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Van Zandt County	1/1/2011	0	0	$0	$5,739
Van Zandt County	2/1/2011	0	0	$0	$5,711
Van Zandt County	3/1/2011	0	0	$0	$7,918
Van Zandt County	4/1/2011	0	0	$0	$33,718
Van Zandt County	5/1/2011	0	0	$0	$14,543
Van Zandt County	6/1/2011	0	0	$0	$33,596
Van Zandt County	7/1/2011	0	0	$0	$22,377
Van Zandt County	8/1/2011	0	0	$0	$0
Van Zandt County	9/1/2011	0	0	$0	$33,423
Van Zandt County	10/1/2011	0	0	$0	$11,164
Van Zandt County	11/1/2011	0	0	$0	$7,821
Van Zandt County	12/1/2011	0	0	$0	$3,360
Van Zandt County	5/14/2013	0	0	$0	$1,085
Van Zandt County	7/1/2013	0	0	$0	$2,164
Van Zandt County	8/1/2013	0	0	$0	$3,242
Van Zandt County	9/1/2013	0	0	$0	$3,239
Van Zandt County	6/1/2014	0	0	$0	$530
Van Zandt County	9/28/2014	0	0	$0	$0
Van Zandt County	10/1/2015	0	0	$2,126	$0
Van Zandt County	10/25/2016	0	0	$0	$1,046
Van Zandt County	11/1/2016	0	0	$0	$0

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Van Zandt County	12/1/2017	0	0	$0	$1,025
Van Zandt County	8/1/2018	0	0	$0	$1,002
TOTALS		**0**	**0**	**$628,429**	**$1,829,504**

Significant Events

December 2010- December 2011 – Van Zandt County

Rainfall deficits grew across North Texas in the month of December 2011, and thus drought conditions expanded across the region to include Van Zandt County. The drought conditions in Van Zandt County were observed across only the southern half of the county, and were classified as Severe Drought (D2). The following month drought conditions slightly improved across Van Zandt County according to the US Drought Monitor. At the beginning of the month the entire county was in extreme drought (D3). After several rain events during the month, the county ended January in severe drought (D2). These conditions continued through March and into April. The drought conditions in April began to increase to extreme drought (D3). The extreme drought conditions (D3) continued from April to August, when conditions increased to exceptional drought (D4). By October the county received up to three inches of rain which improved the drought status and was classified as extreme (D3) by the end of the month. These conditions remained through the month of November. In December the county received up to 6 inches of rainfall and was classified as moderate drought (D1) at the end of the month. January immediately brought normal conditions, ending the long term drought in the planning area.

Probability of Future Events

Based on available records of historic events, there have been fourteen extended time periods of drought (ranging in length from approximately 30 days to over 390 days) within a 23 year reporting period, which provides a probability of one event every one to two years. This frequency supports a highly likely probability of future events for the entire Van Zandt County planning area, including all participating jurisdictions.

Vulnerability and Impact

Loss estimates were based on 23 years of statistical data from the NCEI. 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. Table 7-6 shows annualized exposure.

Table 7-6. Potential Annualized Losses for Van Zandt County

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Van Zandt County	$2,457,933	$106,867

Drought impacts large areas and crosses jurisdictional boundaries. 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 and crop/livestock losses on agricultural lands and typically have no impact on buildings.

In terms of vulnerability, population, agriculture, property, socioeconomics and environment are all vulnerable to drought in the Van Zandt County planning area, including participating jurisdictions. Typical demand can deplete water 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 the ill. Population over 65 in the Van Zandt County planning area is estimated at 19.9% of the total population, and children under the age of 5 are estimated at 5.5% or an estimated total of 13,644[5] potentially vulnerable residents in the planning area based on age. In addition, an estimated 14.2% of planning area population live below the poverty level (Table 7-7) which may contribute to overall health impacts of a drought.

Table 7-7. Populations at Greater Risk by Jurisdiction

JURISDICTION	POPULATION 65 AND OLDER	POPULATION UNDER 5	POPULATION BELOW POVERTY LEVEL
Van Zandt County[6]	10,677	2,967	7,612
City of Canton	877	90	528
City of Edgewood	275	121	301
City of Edom	57	11	2
City of Fruitvale	47	53	132
City of Grand Saline	492	261	860
City of Van	314	226	278
City of Wills Point	635	284	916

The population 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 entire Van Zandt County planning area could be adversely affected by drought conditions, which could limit water supplies and present health threats. During summer drought, or hot and dry conditions, elderly persons, small children, infants and the chronically ill who do not have adequate cooling units in their homes may become more vulnerable to injury and/or death.

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.

[5] US Census Bureau 2017 data for Van Zandt County

[6] County totals includes all incorporated jurisdictions and unincorporated areas.

This complexity exists because water is integral to our ability to produce goods and provide services. If droughts extend over a number of years, the direct and indirect economic impact can be significant.

Habitat damage is a vulnerability of the environment during periods of drought for both aquatic and terrestrial species. The environment also becomes vulnerable during periods of extreme or prolonged drought due to severe erosion and land degradation.

Impact of droughts experienced in the Van Zandt County planning area, including all participating jurisdictions, has resulted in no injuries or fatalities supporting a "Limited" severity of impact meaning injuries and/or illnesses are treatable with first aid, shutdown of facilities and services for 24 hours or less, and less than 10% of property is destroyed or with major damage. Annualized loss over the 23-year reporting period in the Van Zandt County planning area is $106,867.

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: the 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 from Federal, State, and local agencies, as well as the general public. Table 7-8 lists the drought impacts to Van Zandt County from 2005 through April 2019 based on reports received by the Drought Impact Reporter.

Table 7-8. Drought Impacts, 2005-2019

DROUGHT IMPACTS 2005-2019	
Agriculture	37
Business & Industry	3
Energy	2
Fire	4
Plants & Wildlife	24
Relief, Response & Restrictions	11
Society & Public Health	3
Tourism & Recreation	1
Water Supply & Quality	15

Drought has the potential to impact people in the Van Zandt 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. Drought also is 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).
- Jurisdictions and residents may disagree 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.
- 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.
- 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 develop supplemental water resources.
- Long term drought may negatively impact future economic development.

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

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 Van Zandt County is no exception. The entire planning area, including all participating jurisdictions, typically experience extended heat waves. A heat wave is 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 severe summer 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.

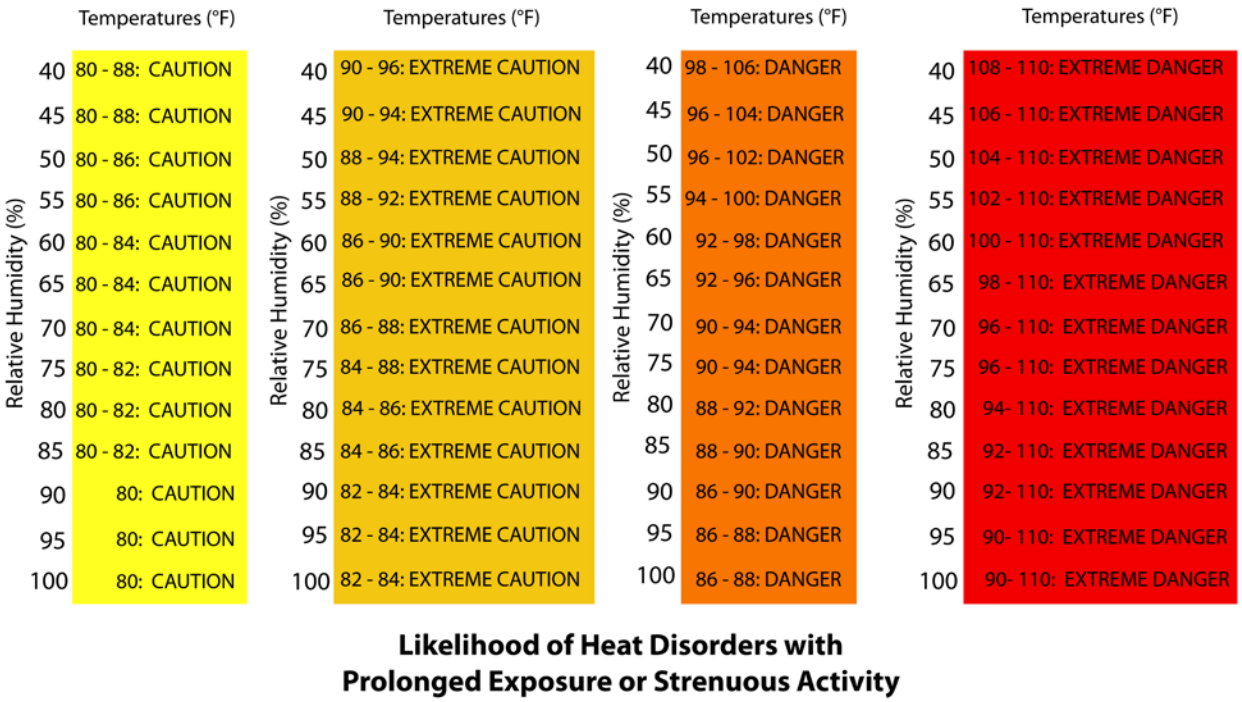
LOCATION

While there have been no deaths reported from extreme heat in the Planning Area, there is no specific geographic scope to the extreme heat hazard. Extreme heat could occur anywhere within the Van Zandt County planning area, including all participating jurisdictions.

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 Summer Heat[1]



The Extent Scale 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. “Caution” is the first category of intensity, and it indicates when fatigue due to heat exposure is possible. “Extreme Caution” indicates that sunstroke, muscle cramps, or heat exhaustion are possible, and a “Danger” level means that these symptoms are likely. “Extreme Danger” indicates that heat stroke is likely. The National Weather Service (NWS) initiates alerts based on the Heat Index as shown in Table 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.	A heat advisory will be issued to warn that the Heat Index may exceed 105°F.
Danger	103 – 124°F	Sunstroke, muscle cramps, and/or heat exhaustion are likely. Heatstroke possible with prolonged exposure and/or physical activity.	
Extreme Caution	90 – 103°F	Sunstroke, muscle cramps, and/or heat exhaustion 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

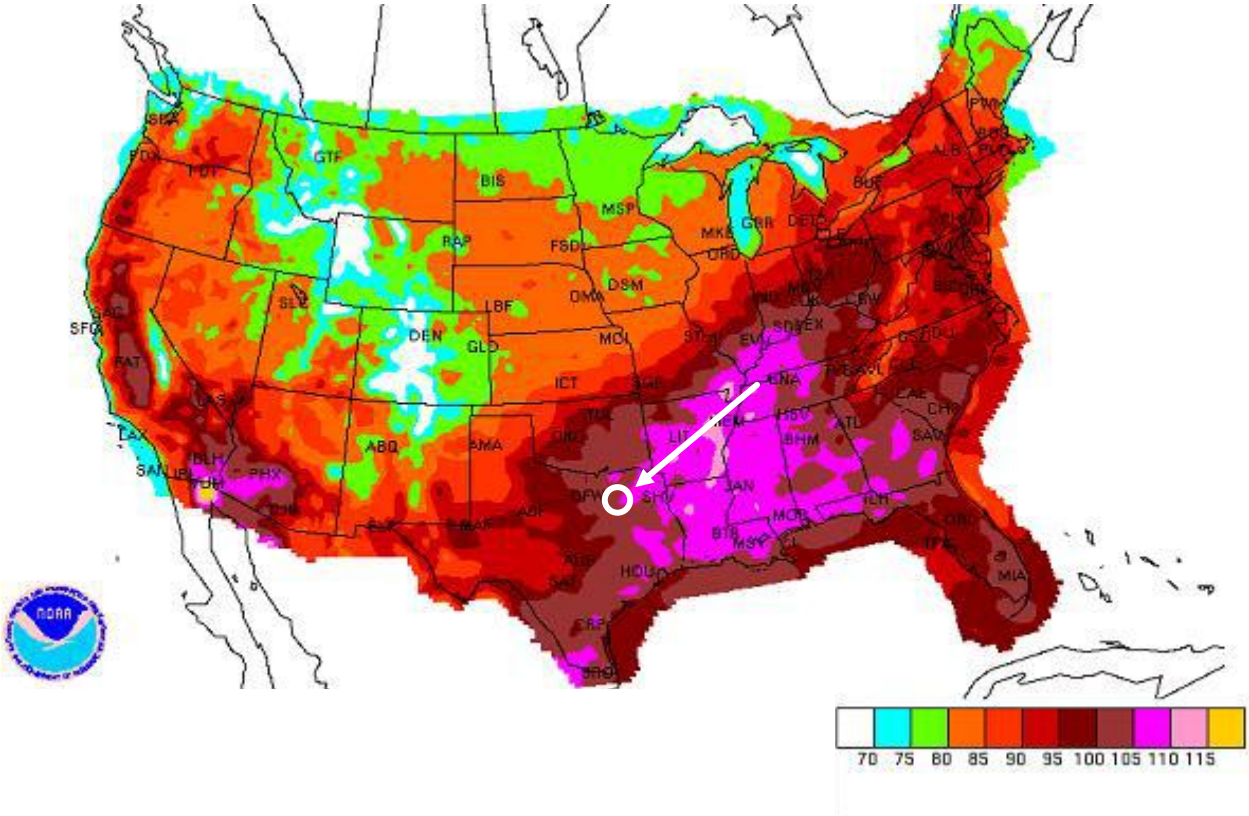
[1] Source: NOAA

CATEGORY	HEAT INDEX	POSSIBLE HEAT DISORDERS	WARNING TYPE
Caution	80 – 90°F	Fatigue is possible with prolonged exposure and/or physical activity.	hours during the day or above 80°F at night.

Van Zandt County's terrain is even to hilly. It comprises 860 square miles with an elevation range from 421 to 573 feet. The Neches River rises in eastern Van Zandt County, and the Sabine River forms part of the northeastern county line. Creeks in the eastern portion of the county are part of the Trinity River watershed. The average annual rainfall is 43 inches. Temperatures range from an average high of 97º F in July to an average low of 33º in January. The average growing season lasts 250 days.

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 Van Zandt County planning area. The violet and brown colors indicates a daily maximum heat index of 100° to 110°F. Van Zandt County, including all participating jurisdictions could experience extreme heat from 90° to 110°F in the future. The record high temperature for the Van Zandt County planning area was 115°F in August 1909. This is the highest temperature (danger category) the planning area can expect.

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



[2] Source: NRDC and the white circle indicates the Van Zandt County planning area.

HISTORICAL OCCURRENCES

Every summer, the hazard of heat-related illness becomes a significant public health issue throughout much of the US. Mortality from all causes increases during heat waves, and excessive heat is an important contributing factor to deaths from other causes, particularly among the elderly. Table 8-2 depicts historical occurrences of mortality from heat from 1994 to 2004 from the Texas Department of State Health Services and 2005 to 2019 from the NCEI database.

Table 8-2. Extreme Heat Related Deaths in Texas

YEAR	DEATHS
1994	1
1995	12
1996	10
1997	2
1998	66
1999	22
2000	71
2001	20
2002	1
2003	0
2004	3
2005	49
2006	2
2007	2
2008	7
2009	6
2010	4
2011	46
2012	3
2013	2
2014	0
2015	5
2016	6

YEAR	DEATHS
2017	3
2018	2

Because the Texas Department of State Health Services reports on total events statewide, previous occurrences for extreme heat are derived from the NCEI database. According to heat related incidents located solely within Van Zandt County, there are only six heat waves[3] on record for the Van Zandt County planning area (Table 8-3). Historical extreme heat information, as provided by the NCEI, shows extreme heat 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 extreme heat data for all participating jurisdictions are provided on a County-wide basis per the NCEI database. 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 before and 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 8-3. Historical Extreme Heat Events, 1998-2019[4]

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Van Zandt County	7/1/1998	0	0	$0	$0
Van Zandt County	8/1/1999	0	0	$0	$0
Van Zandt County	7/1/2000	0	0	$0	$0
Van Zandt County	8/1/2000	0	0	$0	$0
Van Zandt County	9/1/2000	0	0	$0	$0
Van Zandt County	8/1/2011	0	0	$0	$0
TOTALS		**0**	**0**	**$0**	**$0**

Probability of Future Events

Average high temperatures for the planning area through the summer months indicate a probability of one event or more every year. This frequency supports a highly likely probability of future events.

[3] Even though the County experiences heat waves each summer, NCEI data only records events reported. Based on reports, only one event is on record.

[4] Historical events are reported from January 1996 through April 2019.

VULNERABILITY AND IMPACT

There is no defined geographic boundary for extreme heat events. While the entire Van Zandt County planning area, including all participating jurisdictions, 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.

Extreme temperatures do however 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 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. In addition, populations living below the poverty level are unable to run air-conditioning on a regular basis and are limited in their ability to seek medical treatment. Another segment of the population at risk are those whose jobs consist of strenuous labor outdoors. Additionally, livestock and crops can become stressed, decreasing in quality or in production, during times of extreme heat.

The population over 65 in the Van Zandt County planning area is estimated at 19.9% of the total population and children under the age of 5 are estimated at 5.5%, or an estimated total of 13,644[5] potentially vulnerable residents in the planning area based on age. In addition, an estimated 14.2% of the planning area population live below the poverty level (Table 8-4).

Table 8-4. Populations at Greater Risk by Jurisdiction

JURISDICTION	POPULATION 65 AND OLDER	POPULATION UNDER 5	POPULATION BELOW POVERTY LEVEL
Van Zandt County	10,677	2,967	7,612
City of Canton	877	90	528
City of Edgewood	275	121	301
City of Edom	57	11	2
City of Fruitvale	47	53	132
City of Grand Saline	492	261	860
City of Van	314	226	278
City of Wills Point	635	284	916

Extreme high temperatures can have significant secondary impacts, leading to droughts, water shortages, increased fire danger, and prompt excessive demands for energy. The possibility of rolling blackouts increases with unseasonably high temperatures in what is a normally mild month with low power demands.

Typically more than 12 hours of warning time would be given before the onset of an extreme heat event. Only minor property damage would result. The potential impact of excessive summer heat is

[5] U.S. Census Bureau 2017 data for Van Zandt County

considered “Minor” as injuries and/or illnesses do not result in permanent disability for the Van Zandt County planning area, including all participating jurisdictions.

In terms of vulnerability to structures, the impact from extreme heat would be negligible. It is possible that critical facilities and infrastructure could be shut down for 24 hours if cooling units are running constantly, leading to a temporary power outage. Less than ten percent of residential and commercial property could be damaged if extreme heat events lead to structure fires.

The potential impact of extreme heat for the entire Van Zandt County planning area can be considered “Minor,” resulting in few injuries and minimal disruption to the quality of life. Based on historical records over a 23-year period, annualized losses for the Van Zandt County planning area are negligible.

Assessment of Impacts

The greatest risk from extreme heat is to public health and safety. Potential impacts the community may include:

- Vulnerable populations, particularly the elderly and infants, 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.
- Vehicles 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.
- Food suppliers can anticipate an increase in food costs due to increases in production costs and crop and livestock losses.
- Fisheries may be negatively impacted by extreme heat, suffering damage to fish habitats (either natural or man-made) and a loss of fish and/or other aquatic organisms due to decreased water flows or availability.
- Negatively impacted water suppliers may face increased costs resulting from the transport of water resources or development of supplemental water resources.
- Outdoor activities such as fishing, boating, and camping activities at Purtis Creek Lake and State Park may see an increase in 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 jurisdiction, local businesses, and citizens will impact the overall economic and financial conditions before, during, and after an extreme heat event.

Section 9: 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.

LOCATION

Hailstorms are an extension of severe thunderstorms that could potentially cause severe damage. As a result, they are not confined to any specific geographic location and can vary greatly in size, location, intensity, and duration. Therefore, the Van Zandt County planning area, including all participating jurisdictions, are equally at risk to the hazard of hail.

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 9-1.

Table 9-1. Hail Intensity and Magnitude[1]

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 9-1 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 available data regarding the previous occurrences for the area, the Van Zandt County planning area, including all participating jurisdictions, may experience hailstorms ranging from an H0 to an H10. The County can mitigate a storm from low risk or hard hail to a super hailstorm with baseball size hail that leads to severe structural damage and risk of serious injuries. The largest hail event in the Van Zandt County planning area resulted in hail measuring 4.5 inches in diameter, or a H10, Super Hailstorm. This is the worst extent the planning area can anticipate in the future.

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

HISTORICAL OCCURRENCES

Historical evidence shown in Figure 9-1 demonstrates that the planning area is vulnerable to hail events overall, which typically result from severe thunderstorm activity. Historical events with reported damages, injuries, or fatalities are shown in Table 9-2. A total of 143 reported historical hail events impacted the Van Zandt County planning area between 1973 through April 2019 (Summary Table 9-3). These events were reported to NCEI and NOAA databases and may not represent all hail events to have occurred during the past 46 years. Only those events for the Van Zandt County planning area with latitude and longitude available were plotted (Figure 9-1).

Figure 9-1. Spatial Historical Hail Events, 1973-2019

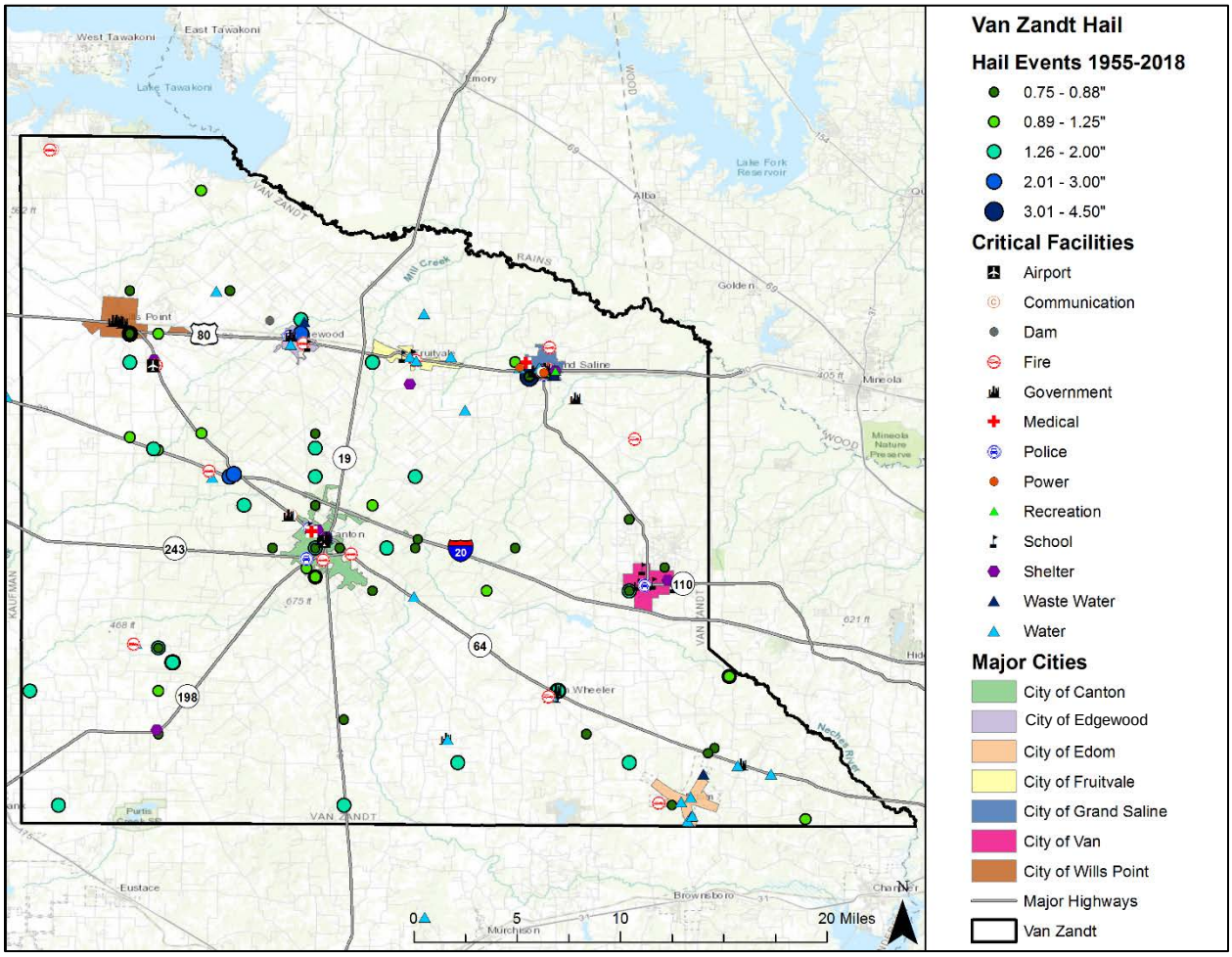


Table 9-2. Historical Hail Events, 1973-2019[2]

JURISDICTION	DATE	MAGNITUDE	INJURIES	FATALITIES	PROPERTY DAMAGE	CROP DAMAGE
Van Zandt County	4/19/1993	7:40 PM	0	0	$87,769	$0
Van Zandt County	1/18/1995	4:35 AM	0	0	$42,045	$0
City of Canton	1/18/1995	4:25 AM	0	0	$16,818	$0
City of Canton	1/18/1995	4:40 AM	0	0	$16,818	$0
City of Van	1/18/1995	4:50 AM	0	0	$58,863	$0
City of Canton	4/19/1995	3:58 PM	0	0	$4,992,284	$0
City of Canton	4/19/1995	4:02 PM	0	0	$8,320	$0
City of Canton	4/30/2004	10:05 PM	0	0	$13,446	$0
Van Zandt County	4/27/2014	4:58 PM	0	0	$63,974	$0
City of Edgewood	4/27/2014	5:02 PM	0	0	$21,325	$0
City of Edgewood	4/27/2014	5:05 PM	0	0	$95,962	$0
Van Zandt County	3/30/2016	2:05 PM	0	0	$8,492	$0
Van Zandt County	4/29/2016	4:22 PM	0	0	$21,130	$0
Van Zandt County	2/27/2017	12:40 PM	0	0	$3,113	$0
City of Wills Point	4/13/2019	1:00 AM	0	0	$10,000	$0
TOTALS		**(Max Extent)**	**0**	**0**	**$5,460,359**	**$0**

Table 9-3. Historical Hail Events Summary, 1973-2019

JURISDICTION	NUMBER of EVENTS	MAGNITUDE	INJURIES	FATALITIES	PROPERTY DAMAGE	CROP DAMAGE
Van Zandt County	54	3.5 inches	0	0	$226,523	$0
City of Canton	31	4.5 inches	0	0	$5,047,686	$0
City of Edgewood	8	2.75 inches	0	0	$117,287	$0
City of Edom	2	0.88 inches	0	0	$0	$0
City of Fruitvale	2	0.75 inches	0	0	$0	$0

[2] Only recorded events with fatalities, injuries, and/or damages are listed. Historical events are reported from January 1973 through April 2019.

JURISDICTION	NUMBER of EVENTS	MAGNITUDE	INJURIES	FATALITIES	PROPERTY DAMAGE	CROP DAMAGE
City of Grand Saline	12	1.75 inches	0	0	$0	$0
City of Van	6	1.75 inches	0	0	$58,863	$0
City of Wills Point	28	1.75 inches	0	0	$10,000	$0
TOTAL LOSSES	**143**	**(Max Extent)**	**0**	**0**	**$5,460,359**	

Significant Events

April 19, 1993 – Van Zandt County
Multiple windshields were broken on at least three vehicles, and damage to multiple roofs throughout the area.

April 19, 1995 – City of Canton
Large hail damaged automobiles, businesses, and homes**.**

April 27, 2014 – City of Canton
Broadcast media reported baseball sized hail had smashed several vehicle windows just west of Canton.

April 13, 2019 – City of Wills Point
Broadcast media reported golf ball size hail in the city of Wills Point, TX.

Probability of Future Events

Based on available records of historic events, 143 events in a 46 year reporting period for Van Zandt County provides a probability of three to four events per year. This frequency supports a highly likely probability of future events for the Van Zandt County planning area including all participating jurisdictions.

Vulnerability and Impact

Damage from hail approaches 1 billion dollars in the U.S. each year. Much of the damage inflicted by hail is to crops. Even relatively small hail can shred plants to ribbons in a matter of minutes. Vehicles, roofs of buildings and homes, and landscaping are most commonly damaged by hail.

Utility systems on roofs at school districts and critical facilities would be vulnerable and could be damaged. Hail could cause a significant threat to people as they could be struck by hail and falling trees and branches. Outdoor student activities and events may elevate the risk to students and faculty when a hailstorm strikes with little warning. Hail events during school hours could elevate the risk to students and faculty due to broken windows and flying debris.

The Van Zandt County planning area features mobile or manufactured home parks throughout the planning area, including all participating jurisdictions. These parks are typically more vulnerable to hail events than typical site built structures. In addition, manufactured homes are located sporadically throughout the planning area including all participations which would also be more vulnerable. The US

Census data indicates a total of 5,271 (22.8%) manufactured homes located in the Van Zandt County planning area including all participating jurisdictions (Table 9-4). In addition, 42.7 (approximately 9,881 structures) of the single family residential (SFR) structures in the Van Zandt 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 damages during significant hail events.

Table 9-4. Structures at Greater Risk by Jurisdiction

JURISDICTION	MANUFACTURED HOMES	SFR STRUCTURES BUILT BEFORE 1980
Van Zandt County[3]	5,271	9,881
City of Canton	63	1,031
City of Edgewood	5	559
City of Edom	11	70
City of Fruitvale	15	80
City of Grand Saline	67	695
City of Van	87	738
City of Wills Point	43	1,021

The following critical facilities would be vulnerable to hail events in each participating jurisdiction:

Table 9-5. Critical Facilities at Risk by Jurisdiction

JURISDICTION	CRITICAL FACILITIES
Van Zandt County	15 Government Facilities, 1 Sheriff's Office, 10 Water/Wastewater Facilities, 3 Communications Towers, 6 Fire Stations, 1 Hospital, 1 Airport, 1 Juvenile Detention Facility
City of Canton	1 Fire Station, 1 Police Station, 1 County Jail, 3 Government Facilities, 1 ISD with 4 Schools, 2 Medical Facilities
City of Edgewood	2 Government Facility, 1 Police Station, 1 Fire Station, 5 Water/Wastewater Facilities, 1 Dam
City of Edom	5 Pump Stations, 1 Fire Station
City of Fruitvale	1 Government Facility, 1 Fire Station, 1 ISD with 3 Schools, 4 Pump Stations, 1 Disaster Relief Center
City of Grand Saline	6 Government Facilities, 1 Police Station, 3 Fire Stations, 6 Water/Wastewater Facilities, 1 Animal Shelter, 1 Shelter,
City of Van	2 Government Facilities, 1 Fire Station, 1 Police Station, 3 Schools
City of Wills Point	2 Government Facilities, 1 Police Station, 1 Fire Station, 1 School, 1 EMS, 1 Medical Facility, 1 Airport

[3] County totals includes all incorporated jurisdictions and unincorporated areas.

Hail has been known to cause injury to humans and occasionally has been fatal. Overall, the average loss estimate of property and crops (in 2019 dollars) is $5,460,359, having an approximate annual loss estimate of $118,703. Based on historic loss and damages, the impact of hail damages on the Van Zandt County planning area, including all participating jurisdictions can be considered “Limited” severity of impact meaning injuries and illness can be treated with first aid, county area facilities are shut down for 24 hours or less, and less than ten percent of property destroyed or with major damage.

Table 9-6. Potential Annualized Losses by Jurisdiction

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATE
Van Zandt County	$226,523	$4,924
City of Canton	$5,047,686	$109,732
City of Edgewood	$117,287	$2,550
City of Edom	$0	$0
City of Fruitvale	$0	$0
City of Grand Saline	$0	$0
City of Van	$58,863	$1,280
City of Wills Point	$10,000	$217
Planning Area	**$5,460,359**	**$118,703**

Assessment of Impacts

Hail events have the potential to pose a significant risk to people and can create dangerous situations. Impacts to the planning area can include:

- Hail may create hazardous road conditions during and immediately following an event, 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.
- Residential structures can be damaged by falling trees, which can result in physical harm to occupants.
- 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.
- 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.
- Downed power lines and large debris, such as downed trees, can result in the inability of emergency response vehicles to access areas of the community.
- Hazardous road conditions may prevent critical staff from reporting for duty, limiting response capabilities.
- 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 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 damages without a backup power source.
- 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 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.
- A large hail event could impact the accessibility of recreational areas and parks due to extended power outages or debris clogged access roads.

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 10: 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 or more. In extreme cases, winds may approach 300 miles per hour. Damage paths can be in excess of one mile wide and 50 miles long.

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**.**

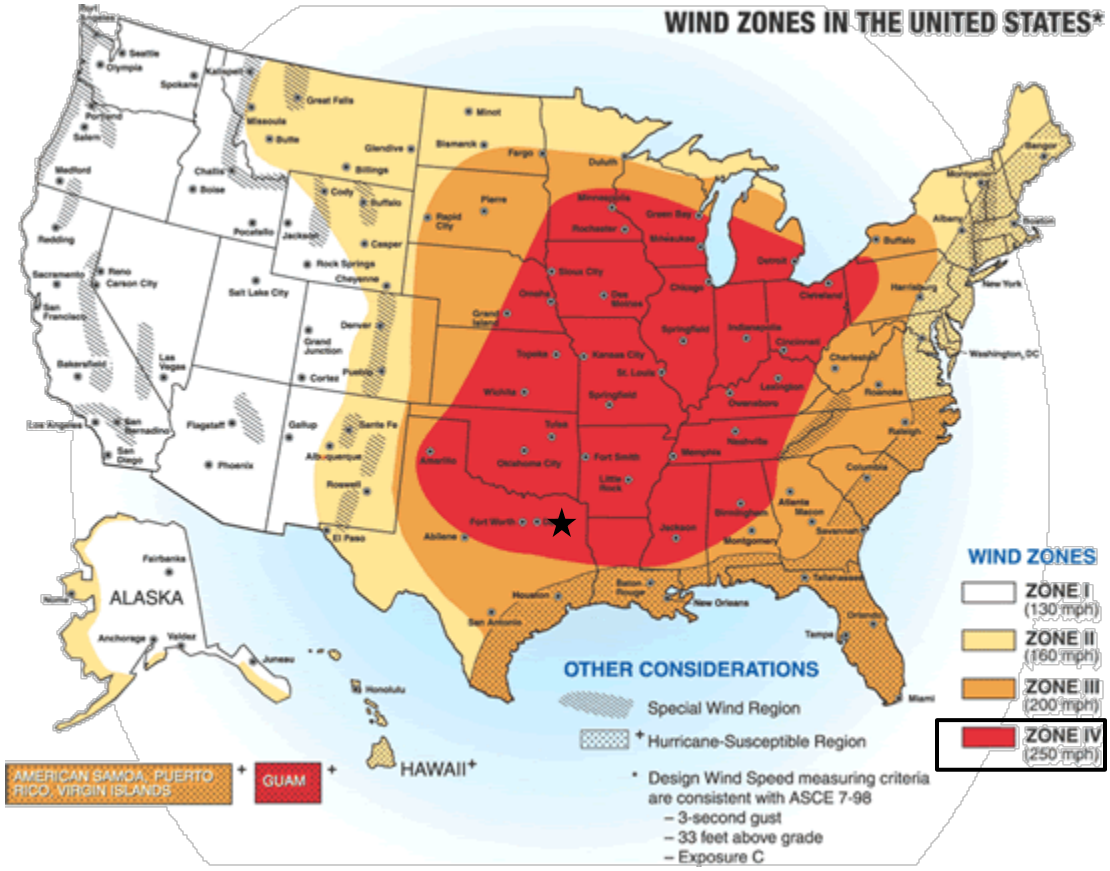
Table 10-1. Variations among Tornadoes

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 and can occur throughout the Van Zandt County planning area uniformly. It is assumed that the entire Van Zandt County planning area including all participating jurisdictions, are uniformly exposed to tornado activity. The entire Van Zandt County planning area is located in Wind Zone IV (Figure 10-1), where tornado winds can be as high as 250 mph.

Figure 10-1. 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).

[1] Van Zandt County is indicated by the star.

Table 10-2. The Fujita Tornado Scale[2]

F-SCALE NUMBER	INTENSITY	WIND SPEED (MPH)	TYPE OF DAMAGE DONE	PERCENT OF APPRAISED STRUCTURE VALUE LOST DUE TO DAMAGE
F0	Gale Tornado	40 – 72	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.	None Estimated
F1	Moderate Tornado	73 – 112	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads; attached garages may be destroyed.	0% – 20%
F2	Significant Tornado	113 – 157	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.	50% – 100%
F3	Severe Tornado	158 – 206	Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.	100%
F4	Devastating Tornado	207 – 260	Well-constructed homes leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.	100%
F5	Incredible Tornado	261 – 318	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles flying through the air in excess of 330 yards; trees debarked; steel reinforced concrete badly damaged.	100%

Tornado magnitudes prior to 2005 were determined using the traditional version of the Fujita Scale (Table 10-2). Since February 2007, the Fujita Scale has been replaced by the Enhanced Fujita Scale (Table 10-3), which retains the same basic design and six strength categories as the previous scale.

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

The newer scale reflects more refined assessments of tornado damage surveys, standardization, and damage consideration to a wider range of structures.

Table 10-3. Enhanced Fujita Scale for Tornadoes

STORM CATEGORY	DAMAGE LEVEL	3 SECOND GUST (MPH)	DESCRIPTION OF DAMAGES	PHOTO EXAMPLE
EF0	Gale	65 – 85	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.	
EF1	Weak	86 – 110	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads; attached garages may be destroyed.	
EF2	Strong	111 – 135	Considerable damage; roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.	
EF3	Severe	136 – 165	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.	
EF4	Devastating	166 – 200	Well-constructed homes leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.	
EF5	Incredible	200+	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles flying through the air in excess of 330 yards; trees debarked; steel reinforced concrete badly damaged.	

Both the Fujita Scale and Enhanced Fujita Scale should be referenced in reviewing previous occurrences since tornado events prior to 2007 will follow the original Fujita Scale. The largest magnitude reported within the planning area is an EF4 on the Fujita Scale, a “Devastating Tornado.” Based on the planning areas location in Wind Zone IV, the planning area could experience anywhere from an EF0 to EF5 depending on the wind speed.

The events in Van Zandt County have been between EF0 and EF4 (Table 10-4). Therefore, the range of intensity that the Van Zandt County planning area, including all participating jurisdictions, would be

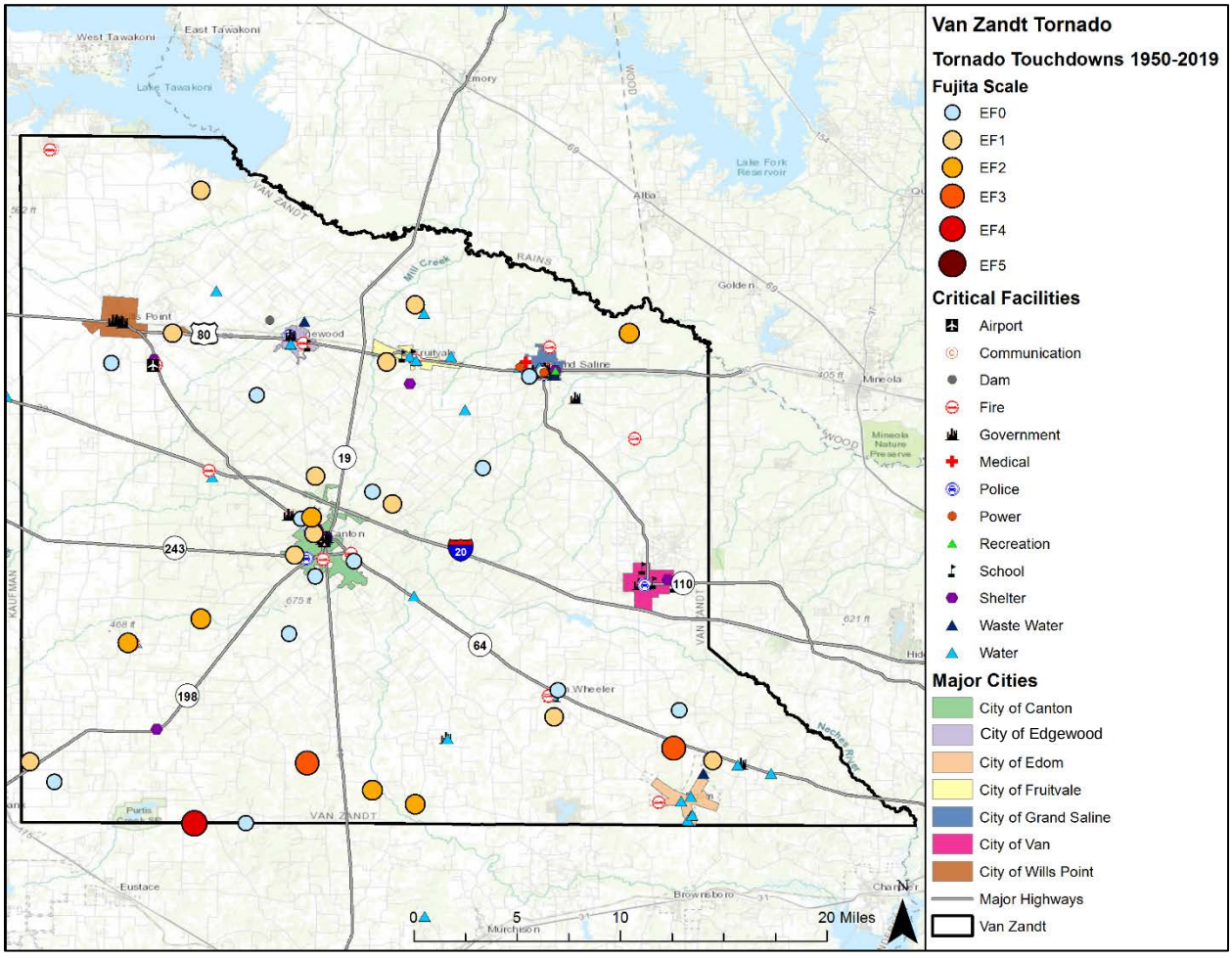
expected to mitigate is a tornado event that would be a low to devastating risk, an EF0 to EF4. Historically, the strongest tornado to strike the planning area was a EF4, this is the strongest event the planning area can anticipate in the future.

HISTORICAL OCCURRENCES

Only reported tornadoes were factored into the Risk Assessment. It is likely that a high number of occurrences have gone unreported over the past 61 years. Historical tornado data for the county, all participating jurisdictions are provided within a jurisdiction-wide basis per the NCEI database.

Figure 10-2 identifies the locations of previous occurrences in the Van Zandt County planning area from 1958 through April 2019. A total of 34 events have been recorded by the Storm Prediction Center (NOAA) and NCEI databases for the entire Van Zandt County planning area.

Figure 10-2. Spatial Historical Tornado Events, 1958-2019[3]



[3] Source: NOAA Records

Table 10-4. Historical Tornado Events, 1958-2019[4]

JURISDICTION	DATE	TIME	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Van Zandt County	1/14/1958	5:30 PM	F1	0	0	$22,096	$0
Van Zandt County	5/9/1965	8:00 PM	F2	0	0	$201,255	$0
Van Zandt County	4/13/1967	9:00 AM	F2	0	0	$19,092	$0
Van Zandt County	5/17/1968	8:30 PM	F0	0	0	$1,832	$0
Van Zandt County	5/5/1978	2:41 AM	Unknown	0	0	$97,975	$0
Van Zandt County	4/11/1979	10:20 AM	F2	0	0	$8,951	$0
Van Zandt County	5/13/1981	8:15 PM	F2	0	0	$703,719	$0
Van Zandt County	10/13/1981	9:25 AM	F1	0	0	$6,766	$0
Van Zandt County	4/4/1986	8:30 PM	F1	0	2	$581,897	$0
Van Zandt County	11/25/1988	7:15 PM	F1	0	2	$0	$0
Van Zandt County	5/11/1992	7:53 PM	F1	0	0	$45,236	$0
City of Canton	4/29/2006	2:52 AM	F0	0	0	$12,545	$0
Van Zandt County	3/3/2008	6:36 AM	EF1	0	0	$59,190	$0
City of Canton	5/2/2008	7:30 AM	EF1	0	8	$350,054	$0
City of Van	1/20/2010	5:19 PM	EF2	0	0	$1,166,549	$0
Van Zandt County	4/26/2011	4:45 PM	EF1	0	1	$224,784	$0
Van Zandt County	5/10/2015	7:46 PM	EF3	2	43	$42,518,198	$0
Van Zandt County	4/29/2017	3:15 PM	EF0	0	0	$0	$62,025
Van Zandt County	4/29/2017	4:40 PM	EF4	2	20	$723,623	$206,749
Van Zandt County	4/29/2017	5:00 PM	EF0	0	5	$310,124	$41,350
Van Zandt County	4/29/2017	5:08 PM	EF3	2	24	$620,248	$20,675
Van Zandt County	4/29/2017	6:13 PM	EF0	0	0	$5,169	$2,067
City of Canton	4/29/2017	4:10 PM	EF0	0	0	$62,025	$20,675

[4] Only recorded events with fatalities, injuries or damages are listed. Magnitude is listed when available. Damage values are in 2019 dollars. Historical events are reported from January 1958 through April 2019.

JURISDICTION	DATE	TIME	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
City of Edgewood	5/11/2017	2:55 PM	EF0	0	0	$4,131	$1,033
TOTALS			**(Max Extent)**	**6**	**105**	**$47,745,459**	**$354,574**

Table 10-5. Summary of Historical Events, 1958-2019[5]

JURISDICTION	Number of Events	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Van Zandt County	25	EF4	6	97	$46,150,155	$332,866
City of Canton	3	EF1	0	8	$424,624	$20,675
City of Edgewood	1	EF0	0	0	$4,131	$1,033
City of Edom	0	NA	NA	NA	NA	NA
City of Fruitvale	0	NA	NA	NA	NA	NA
City of Grand Saline	2	F0	0	0	$0	$0
City of Van	1	EF2	0	0	$1,166,549	$0
City of Wills Point	2	EF0	0	0	$0	$0
TOTAL LOSSES	**34**	**(Max Extent)**	**6**	**105**	**$48,100,033**	

Significant Events

May 10, 2015 – Van Zandt County/City Van

A storm survey team found EF-3 damage in the city of Van. This tornado began near highway 64, near Edom before moving north. The storm crossed Interstate 20 on the southeast side of Van, before carving a destructive path over the eastern side of the city. The greatest damage was done in a housing development to the north of the public school administration building, where over 50 homes were damaged or destroyed. Two fatalities occurred with this tornado, as a married couple was asleep in their mobile home when the tornado hit.

April 29, 2017 – Van Zandt County

The Henderson County tornado continued into Van Zandt County. A National Weather Service damage survey crew found the start of tornado number three began in Henderson County, approximately 3 miles due south of Eustace. This tornado eventually moved into Van Zandt County, where the storm produced EF4 damage. In Henderson County, several homes suffered EF2 damage, along with a considerable amount of tree damage and damage to farm buildings. As the storm moved into Van Zandt County, the tornado grew to a mile wide at the tornado's maximum width. Over 50 homes were either damaged or destroyed, with a continuous path noted between counties.

[5] Damages reported in 2019 dollars.

PROBABILITY OF FUTURE EVENTS

Tornadic storms 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. According to historical records, Van Zandt County, including all participating jurisdictions, can experience a tornado touchdown approximately once every one to two years. This frequency supports a highly likely probability of future events for Van Zandt County, including all participating jurisdictions.

VULNERABILITY AND IMPACT

Because tornadoes often cross jurisdictional boundaries, all existing and future buildings, facilities, and populations in the entire Van Zandt County planning area, including all participating jurisdictions, are 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, wind-blown debris, lightning, and large hail.

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 on crawlspaces (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/branches, utility lines, and poles. Blocked roads could prevent first responders to respond 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 Van Zandt County planning area features multiple mobile or manufactured home parks throughout the planning area, including all participation jurisdictions. These parks are typically more vulnerable to tornado events than typical site built structures. In addition, manufactured homes are located sporadically throughout the planning area including all participating jurisdictions and unincorporated areas of the county which would also be more vulnerable.

The portable buildings used at various school locations within the planning area would be more vulnerable to tornado events than typical site built structures and could potentially pose a greater risk for wind-blown debris. In addition, some of the ISD structures feature roof top Air Conditioning Units that would be vulnerable to high winds flying debris. These structures would also be more vulnerable. These units would also pose the additional threat of contributing to flying debris, causing additional damages to campus structures.

The US Census data indicates a total of 5,271 manufactured homes located in the Van Zandt County planning area (22.8%), including all participating jurisdictions and unincorporated areas of the county (Table 10-6). In addition, 42.7% (approximately 9,881 structures) of the single family residential (SFR) structures in the entire 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 damages during significant tornado events.

Table 10-6. Structures at Greater Risk by Jurisdiction

JURISDICTION	MANUFACTURED HOMES	SFR STRUCTURES BUILT BEFORE 1980
Van Zandt County[6]	5,271	9,881
City of Canton	63	1,031
City of Edgewood	5	559
City of Edom	11	70
City of Fruitvale	15	80
City of Grand Saline	67	695
City of Van	87	738
City of Wills Point	43	1,021

The following critical facilities would be vulnerable to tornado events in each participating jurisdiction:

Table 10-7. Critical Facilities at Risk by Jurisdiction

JURISDICTION	CRITICAL FACILITIES
Van Zandt County	15 Government Facilities, 1 Sheriff's Office, 10 Water/Wastewater Facilities, 3 Communications Towers, 6 Fire Stations, 1 Hospital, 1 Airport, 1 Juvenile Detention Facility
City of Canton	1 Fire Station, 1 Police Station, 1 County Jail, 3 Government Facilities, 1 ISD with 4 Schools, 2 Medical Facilities
City of Edgewood	2 Government Facility, 1 Police Station, 1 Fire Station, 5 Water/Wastewater Facilities, 1 Dam
City of Edom	5 Pump Stations, 1 Fire Station
City of Fruitvale	1 Government Facility, 1 Fire Station, 1 ISD with 3 Schools, 4 Pump Stations, 1 Disaster Relief Center
City of Grand Saline	6 Government Facilities, 1 Police Station, 3 Fire Stations, 6 Water/Wastewater Facilities, 1 Animal Shelter, 1 Shelter,
City of Van	2 Government Facilities, 1 Fire Station, 1 Police Station, 3 Schools
City of Wills Point	2 Government Facilities, 1 Police Station, 1 Fire Station, 1 School, 1 EMS, 1 Medical Facility, 1 Airport

The average loss estimate of property and crop is $48,100,033 (in 2019 dollars), having an approximate annual loss estimate of $788,525 (Table 10-8). Based on historic loss and damages, the impact of tornado on the Van Zandt County planning area, including all participating jurisdictions, can be considered "Limited," with less than 10 percent of property expected to be destroyed. However,

[6] County totals includes all incorporated jurisdictions and unincorporated areas.

with 6 fatalities and 105 injuries, the impact of tornado on the planning area is considered "Substantial," meaning multiple deaths are possible.

Table 10-8. Potential Annualized Losses by Jurisdiction

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Van Zandt County	$46,483,021	$762,017
City of Canton	$445,299	$7,300
City of Edgewood	$5,164	$85
City of Edom	$0	$0
City of Fruitvale	$0	$0
City of Grand Saline	$0	$0
City of Van	$1,166,549	$19,124
City of Wills Point	$0	$0
Planning Area	**$48,100,033**	**$788,525**

Assessment of Impacts

Tornadoes have the potential to pose a significant risk to the population and can create dangerous situations. Often times, providing and preserving public health and safety is difficult. Impacts to the planning area can include:

- 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 may suffer substantial damage as they would be more vulnerable than typical site built 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.
- City or county departments may be damaged or destroyed, delaying response and recovery efforts for the entire community.
- Private sector entities that the City 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.
- Economic disruption negatively impacts the programs and services provided by the community due to short and long term loss in revenue.
- Damage to infrastructure may slow economic recovery since repairs may be extensive and lengthy.
- Some businesses not directly damaged by the tornado may be negatively impacted while roads and utilities are being restored, 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, 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.

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 government, businesses, and citizens will contribute to the overall economic and financial conditions in the aftermath of a tornado event.

Section 11: 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 surface. Typically, floods are long-term events that may last for several days.

The primary types of general flooding are inland and coastal flooding. 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, thus 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.

LOCATION

The Digital Flood Insurance Rate Map (DFIRM) data provided by FEMA for Van Zandt 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 base flood elevations 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 Van Zandt County based on the digital Flood Insurance Rate Map (DFIRM) from FEMA are illustrated in Figures 11-1 through 11-8. Maps for the county and some incorporated jurisdictions in the planning area do not include base flood elevations however, some of the City of Canton floodplain maps do include base flood elevations.

Figure 11-1. Estimated Flood Zones in Van Zandt County

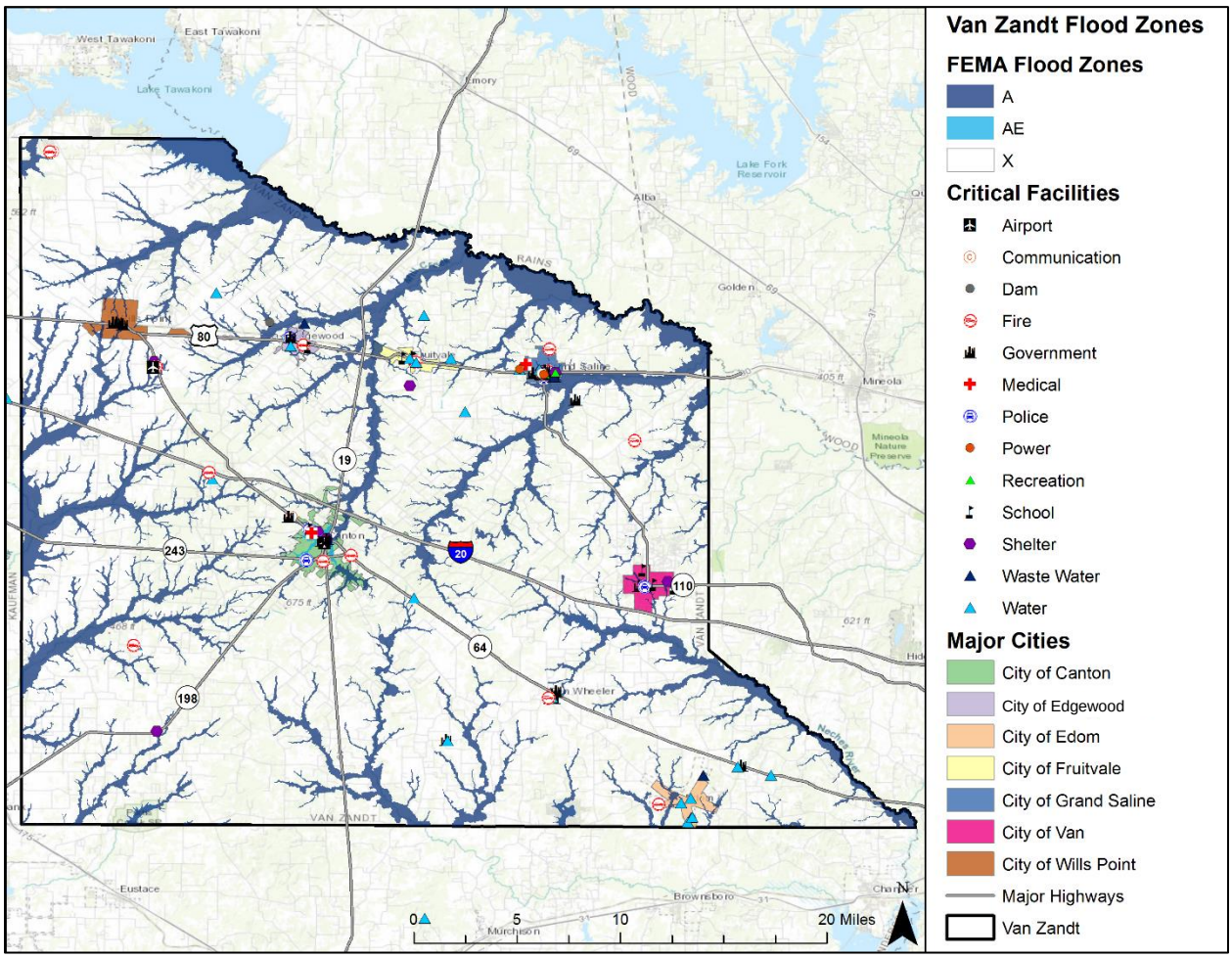


Figure 11-2. Estimated Flood Zones in the City of Canton

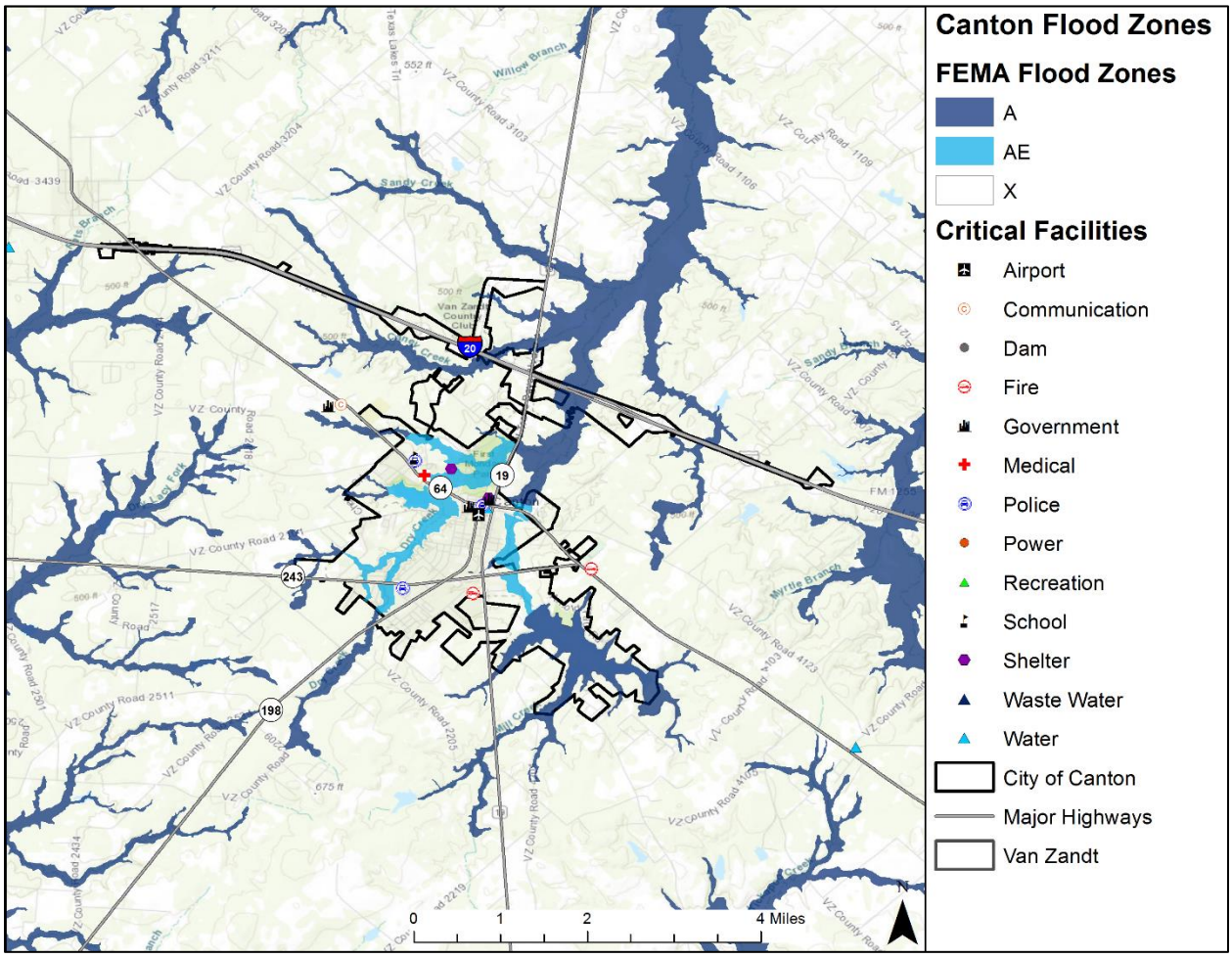


Figure 11-3. Estimated Flood Zones in City of Edgewood

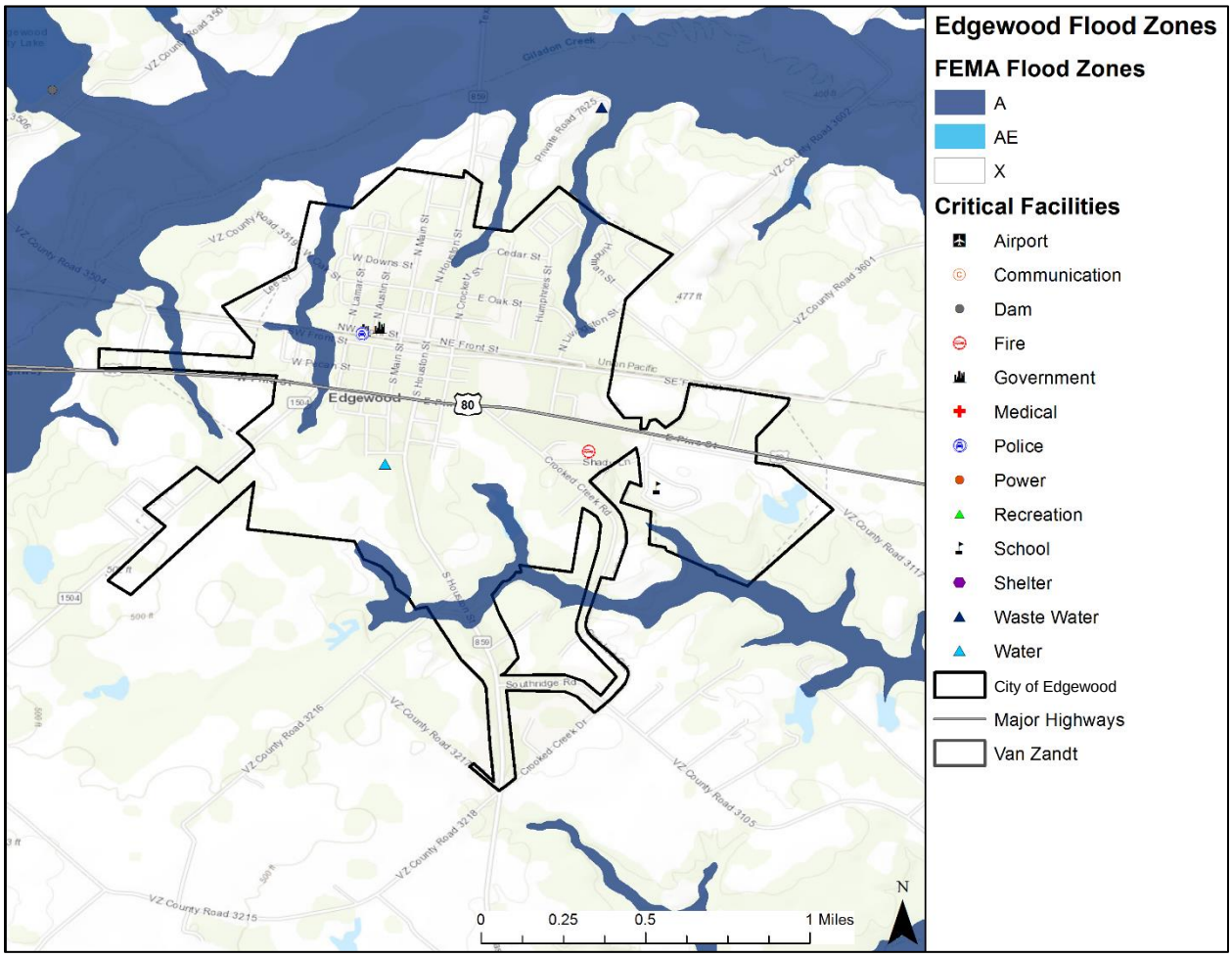


Figure 11-4. Estimated Flood Zones in the City of Edom

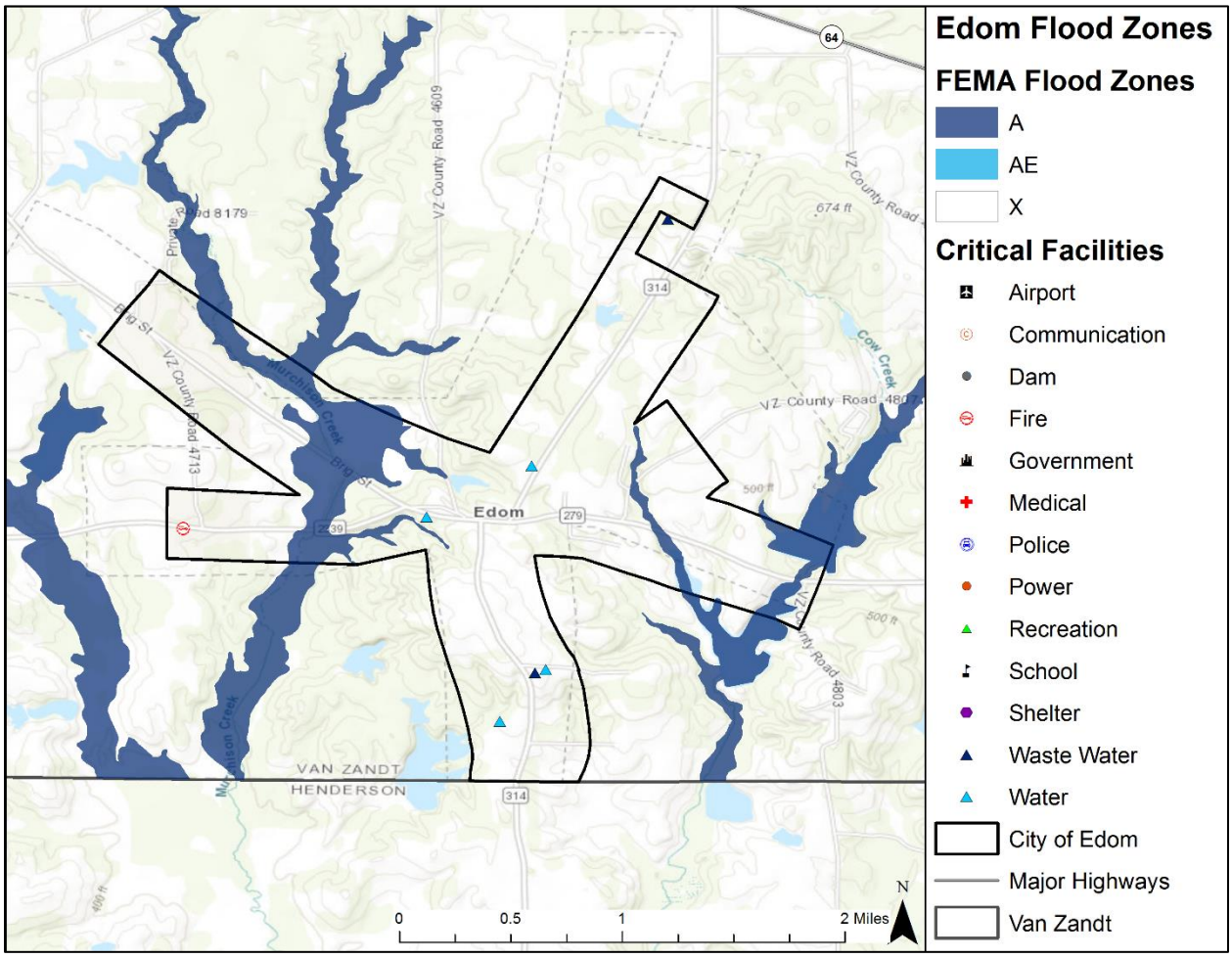


Figure 11-5. Estimated Flood Zones in the City of Fruitvale

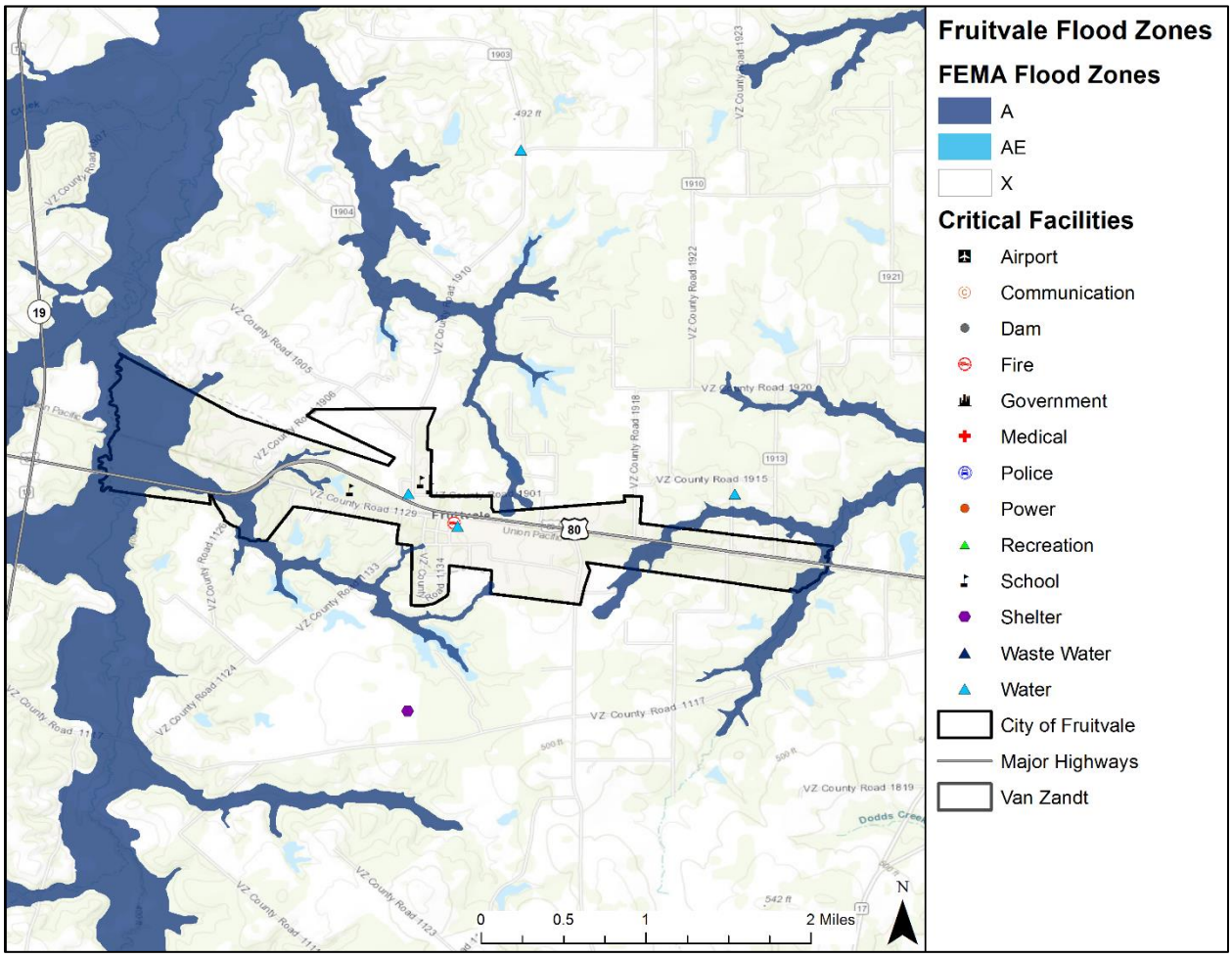


Figure 11-6. Estimated Flood Zones in the City of Grand Saline

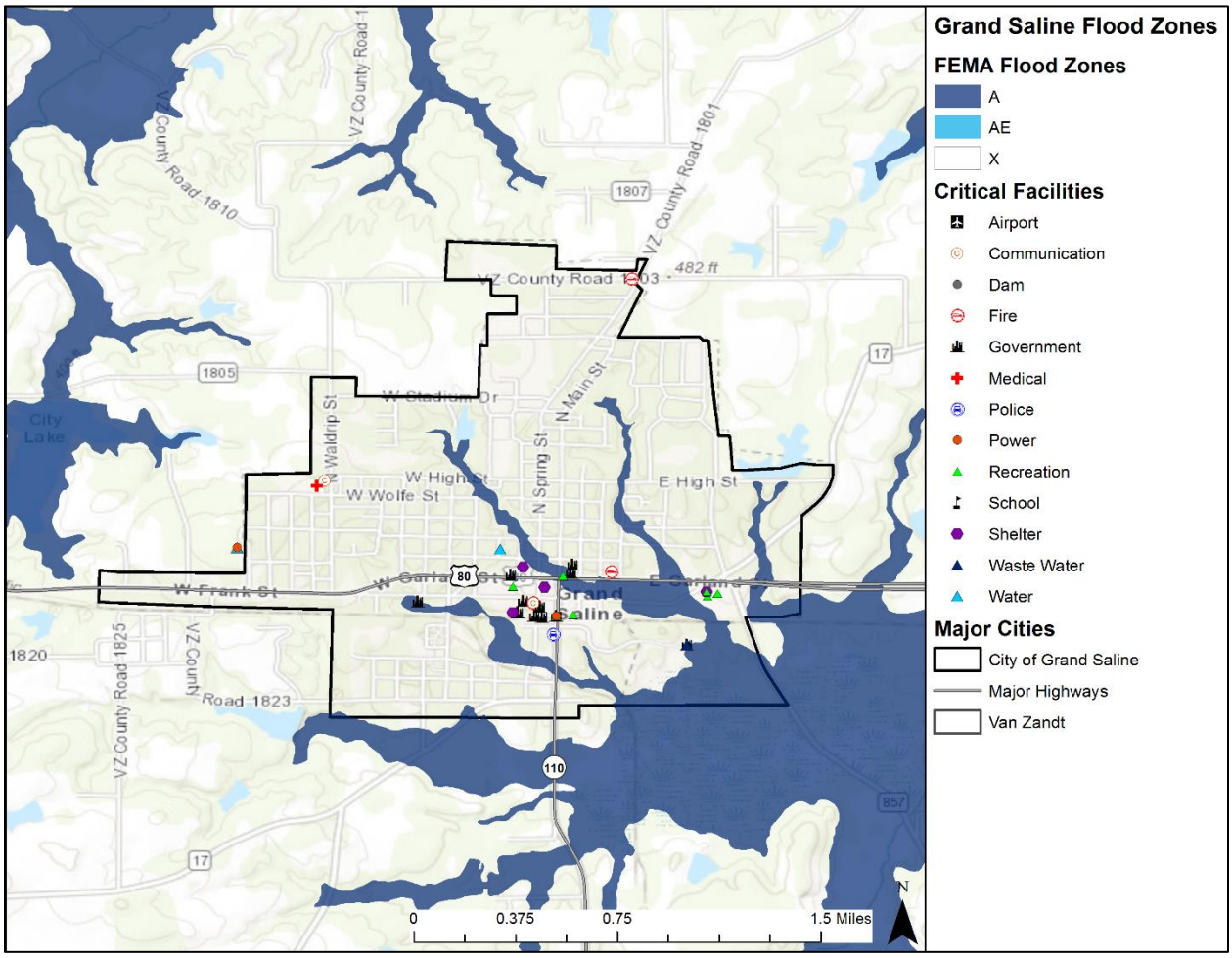


Figure 11-7. Estimated Flood Zones in the City of Van

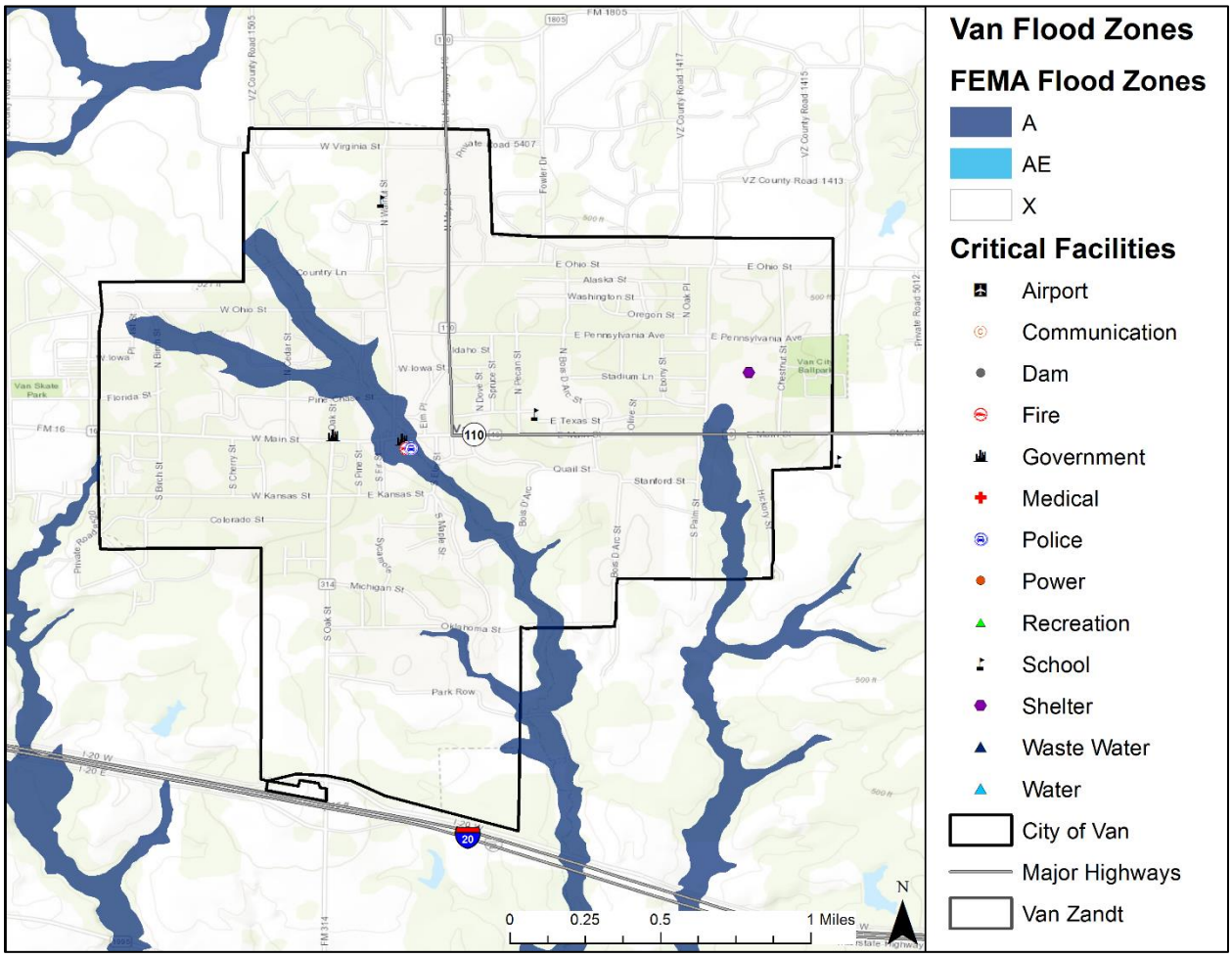
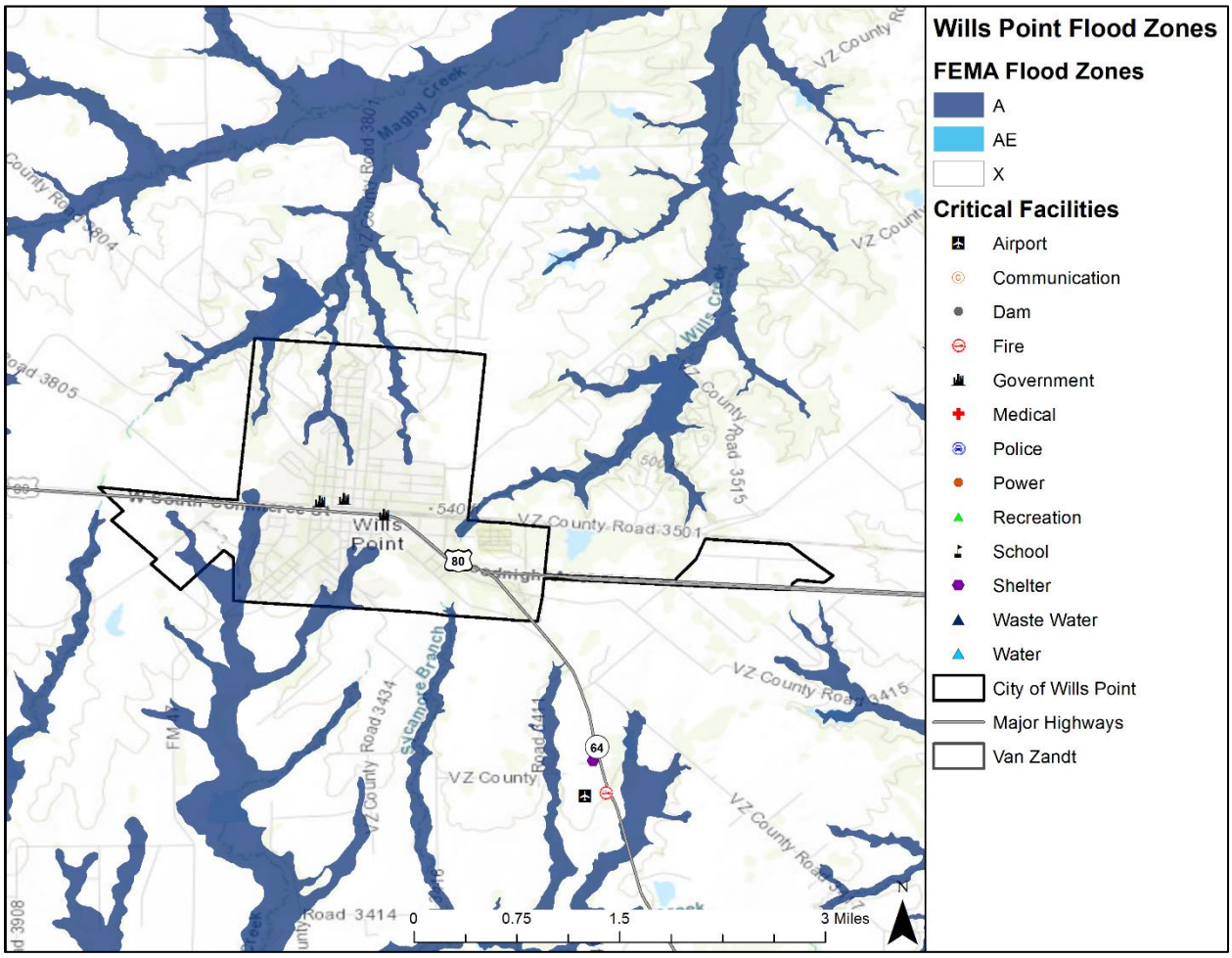


Figure 11-8. Estimated Flood Zones in the City of Wills Point



EXTENT

The severity of a flood event is determined by a combination of several factors including: stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and degree of vegetative clearing and impervious surface. 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 depths of flood waters. 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 Flood Insurance Rate Maps. Table 11-1 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 only hazard areas mapped in the region. Figures 11-1 through 11-8 should be read in conjunction with the extent for flooding in Tables 11-1 and 11-2 to determine the intensity of a potential flood event.

Table 11-1. Flood Zones

INTENSITY	ZONE	DESCRIPTION
HIGH	ZONE A	Areas with a one 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 base flood elevations 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 one percent or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from one to three 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 one percent annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from one to three feet. These areas have a 26 percent chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
	ZONE A99	Areas with a one 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 base flood elevations 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.
HIGH COASTAL	ZONE VE, V1-30	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26 percent chance of flooding over the life of a 30-year mortgage. No base flood elevations are shown within these zones.
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 one foot or with drainage areas less than one square mile; or an area protected by levees from 100-year flooding.

Zone A is interchangeably referred to as the 100-year flood, the one-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. Utility systems, such as heating, ventilation, air conditioning, fuel, electrical systems, sewage maintenance systems and water systems, if not elevated above base flood elevation, may also be damaged.

The intensity and magnitude of a flood event is also determined by the depth of flood waters. Table 11-2 describes the stream gauge data provided by the United States Geological Survey (USGS).

Table 11-2. Extent for Van Zandt County[1]

JURISDICTION[2]	PEAK FLOOD EVENT
Van Zandt County	Sabine River near Wills Point, Van Zandt County, Texas reached an overflow elevation of 19.11 feet in December 1990. The average peak flow for the Sabine River at this location is 13.95 feet.
Van Zandt County	Sabine River near Emory, Van Zandt County, Texas reached an overflow elevation of 25.06 feet in April of 1957. The average peak flow for the Sabine River at this site is 15.61 feet.
Van Zandt County	Burnett Branch near Canton, Van Zandt County, Texas reached an overflow elevation of 14.6 feet in May of 1969. The average peak flow for the Burnett Branch at this site is 12.9 feet.
Van Zandt County	Bethlehem Branch near Van, Van Zandt County, Texas reached an overflow elevation of 15.83 feet in April of 1966. The average peak flow for the Bethlehem Branch at this site is 13.14 feet.

The range of flood intensity that the County can experience is high, or Zone A. Based on historical occurrences, the planning area, including all participating jurisdictions, could expect to experience up to 9.7 inches of rainfall within a 24-hour period, resulting in flash flooding.

The data described in Tables 11-1 and 11-2, together with Figures 11-1 through 11-8, and historical occurrences for the area, provides an estimated potential magnitude and severity for the County. For example the City of Canton, as shown in Figure 11-2, has areas designated as Zone AE. Reading this figure in conjunction with Table 11-1 means the area is an area of high risk for flood.

HISTORICAL OCCURRENCES

Historical evidence indicates that areas within the planning area, including all participating jurisdictions, 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 11-3 identifies historical flood events that resulted in damages, injuries, or fatalities within the Van Zandt County planning area, including all participating jurisdictions. Table 11-4 provides the

[1] Severity estimated by averaging floods at certain stage level over the history of flood events. Severity and peak events are based on U.S. Geological Survey data.
[2] Severity is provided for jurisdictions where peak data was provided.

historical flood event summary by jurisdiction. Historical data is provided by the Storm Prediction Center (NOAA), NCEI database for Van Zandt County.

Table 11-3. Historical Flood Events, 1996-2019[3]

JURISDICTION	DATE	TIME	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Van Zandt County	6/15/2000	6:20 AM	0	0	$146,622	$0
City of Wills Point	3/30/2007	11:00 PM	1	0	$12,309	$0
City of Canton	6/16/2007	10:05 AM	0	0	$48,529	$0
Van Zandt County	7/6/2007	3:00 AM	0	0	$242,705	$0
City of Canton	7/6/2007	12:12 AM	0	0	$182,029	$0
City of Edgewood	6/10/2008	5:40 AM	0	0	$3,466	$0
Van Zandt County	5/3/2009	6:50 AM	0	0	$10,638	$0
Van Zandt County	10/13/2009	2:00 PM	0	0	$58,465	$0
City of Grand Saline	10/13/2009	12:40 PM	0	0	$11,693	$0
City of Van	10/13/2009	12:40 PM	0	0	$11,693	$0
Van Zandt County	10/26/2009	8:32 AM	0	0	$1,169	$0
Van Zandt County	6/10/2010	11:01 AM	0	0	$57,985	$0
City of Van	4/16/2015	7:10 PM	0	0	$21,367	$0
Van Zandt County	12/13/2015	7:30 AM	0	0	$3,206	$0
Van Zandt County	12/27/2015	4:00 PM	0	0	$10,687	$0
Van Zandt County	3/9/2016	9:30 AM	0	0	$8,492	$0
TOTALS			**1**	**0**	**$831,055**	**$0**

[3] Only recorded events with fatalities, injuries, and/or damages are listed, values are in 2019 dollars. Historical events are reported from January 1996 through April 2019.

Table 11-4. Summary of Historical Flood Events, January 1996-2019

JURISDICTION	NUMBER OF EVENTS	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Van Zandt County	22	0	0	$539,969	$0
City of Canton	13	0	0	$230,558	$0
City of Edgewood	1	0	0	$3,466	$0
City of Edom	0	NA	NA	NA	NA
City of Fruitvale	0	NA	NA	NA	NA
City of Grand Saline	1	0	0	$11,693	$0
City of Van	4	0	0	$33,060	$0
City of Wills Point	4	1	0	$12,309	$0
TOTAL LOSSES	**45**	**1**	**0**	**$831,055**	

Significant Events

March 31, 2007 – City of Wills Point
A man who had driven into high water on CR 3827 was found dead two days later. He had originally left his pick-up truck in the high water, then went back to help a passenger. The passenger was able to reach safety.

July 6, 2007 – City Canton/ Van Zandt County
FM 1256, FM 1861, and several other roads were flooded and made impassable. Numerous roads were closed due to culverts and bridges being washed out, including Highways 19, 243 and Highway 110. A house on CR 2311 was flooded when a levee broke in a creek beside the house. Most of the furniture and possessions in the 3,000 square-foot home were damaged.

Probability of Future Events

Based on recorded historical occurrences and extent within the Van Zandt County planning area, including all participating jurisdictions, flooding is highly likely and an event will likely occur within the next year.

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. The County and all participating jurisdictions encourage development outside of the floodplain. While the impact for flood for the entire planning area is considered "Limited" with facilities and services shut down for 24 hours or less and less than ten percent of properties damaged, the historical fatality indicates a potential impact of "Substantial", depending on the scale of the storm.

Table 11-5 includes the critical facilities identified in Appendix C that were determined to be located within the SFHA by DFIRM mapping and further by each participating jurisdiction.

Table 11-5. Critical Facilities in the Floodplain by Jurisdiction

JURISDICTION	CRITICAL FACILITIES
Van Zandt County	1 Juvenile Detention Facility
City of Canton	None
City of Edgewood	1 Dam
City of Edom	None
City of Fruitvale	None
City of Grand Saline	2 Government Facilities
City of Van	1 Government Facility, 1 Fire Station, 1 Police Station
City of Wills Point	None

Historic loss estimates due to flood are presented in Table 11-6 below. Considering 45 flood events over a 23-year period, frequency is approximately one to two events every year.

Table 11-6. Potential Annualized Losses by Jurisdiction

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Van Zandt County	$539,969	$23,477
City of Canton	$230,558	$10,024
City of Edgewood	$3,466	$151
City of Edom	$0	$0
City of Fruitvale	$0	$0
City of Grand Saline	$11,693	$508
City of Van	$33,060	$1,437
City of Wills Point	$12,309	$535
Planning Area	**$831,055**	**$36,133**

The severity of a flooding event varies depending on the relative risk to citizens and structures located in each city. Table 11-7 depicts the level of impact for Van Zandt County and each participating jurisdiction.

Table 11-7. Impact by Jurisdiction

JURISDICTION	IMPACT	DESCRIPTION
Van Zandt County	Limited	It is anticipated that Van Zandt County could anticipate an impact of "limited" with critical facilities would be shut down for 24 hours or less and less than 10 percent of property would be destroyed or damaged.
City of Canton	Limited	It is anticipated that the City of Canton could anticipate an impact of "limited" with critical facilities would be shut down for 24 hours or less and less than 10 percent of property would be destroyed or damaged.
City of Edgewood	Limited	It is anticipated that the City of Edgewood could anticipate an impact of "limited" with critical facilities would be shut down for 24 hours or less and less than 10 percent of property would be destroyed or damaged.
City of Edom	Limited	It is anticipated that the City of Edom could anticipate an impact of "limited" with critical facilities would be shut down for 24 hours or less and less than 10 percent of property would be destroyed or damaged.
City of Fruitvale	Limited	It is anticipated that the City of Fruitvale could anticipate an impact of "limited" with critical facilities would be shut down for 24 hours or less and less than 10 percent of property would be destroyed or damaged.
City of Grand Saline	Limited	It is anticipated that the City of Grand Saline could anticipate an impact of "limited" with critical facilities would be shut down for 24 hours or less and less than 10 percent of property would be destroyed or damaged.
City of Van	Limited	It is anticipated that the City of Van could anticipate an impact of "limited" with critical facilities would be shut down for 24 hours or less and less than 10 percent of property would be destroyed or damaged.
City of Wills Point	Substantial	While it is anticipated that the City of Wills Point could anticipate an impact of "minor" with critical facilities would be shut down for 24 hours or less and less than 10 percent of property would be destroyed or damaged, the historical fatality indicates a potential impact of "Substantial", depending on the scale of the storm

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 Van Zandt County planning area. Impacts to the planning area can include:

- 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.
- 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 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.

- 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 impacted by a flood event and 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 jurisdiction 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, and 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 such as fishing, boating, and camping activities at Purtis Creek and State Park, Rhine or Callendar Lake 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 psycho-social 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, potential increased livestock mortality due to stress and water borne disease, and increased cost for feed.

The overall extent of damages caused by floods is dependent on the extent, depth and duration of flooding, and the velocities of flows in the flooded areas. The level of preparedness and pre-event planning done by government, 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. Van Zandt County, the City of Canton, the City of Fruitvale, the City of Grand Saline, the City of Van, and the City of Wills Point are currently participating in the NFIP and are in good standing. The City of Edgewood and the City of Edom are not currently participating in the NFIP. Neither community currently has the staffing or financial resources to effectively participate in the NFIP.

All NFIP participating jurisdictions currently have in place minimum NFIP standards for new construction and substantial improvements of structures. These jurisdictions are considering adopting additional higher regulatory NFIP standards to limit floodplain development. The flood hazard areas throughout the planning area are subject to periodic inundation, which may result 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, of which adversely affect public safety.

These flood losses are created by the cumulative effect of obstructions in floodplains which cause an increase in flood heights and velocities, and by the occupancy of flood hazard areas by uses vulnerable to floods and hazardous to other lands because they 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 drainage systems and bridges and expanding drainage culverts and storm water structures to more adequately convey flood waters.

It is the purpose of Van Zandt County and all participating jurisdictions to continue to promote the public health, safety and general welfare by minimizing public and private losses due to flood conditions in specific areas. All of the NFIP participating jurisdictions in the Plan 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 for all of the participating jurisdictions 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, Van Zandt County and all participating jurisdictions seek to follow these guidelines to achieve flood mitigation by:

- 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 and/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

As mentioned, Van Zandt County and all participating jurisdictions have developed mitigation actions that relate to either NFIP participation, maintenance or compliance. Participation, compliance and maintenance actions can be found in Section 18.

Flooding was identified by the majority of participating communities as a moderate risk hazard during hazard ranking activities at the Risk Assessment Workshop. 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. 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 is focusing on NFIP public awareness activities. This includes promoting the availability of flood insurance by placing NFIP brochures and flyers in public libraries or public meeting places.

All participating jurisdictions in the NFIP have 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.

Repetitive Loss

The Severe Repetitive Loss (SRL) 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 severe repetitive loss residential structures insured under the NFIP. The Texas Water Development Board (TWDB) administers the SRL 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 10-year period, since 1978;
- May or may not be currently insured under the NFIP.

Severe Repetitive Loss properties are defined as residential properties that are:

- Covered under the NFIP and have at least four 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 two 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 two of the referenced claims must have occurred within any ten-year period and must be greater than 10 days apart.[4] None of the participating jurisdictions currently have any repetitive loss properties.

[4] Source: Texas Water Development Board

Section 12: Winter Storm

HAZARD DESCRIPTION

A severe winter storm event is identified as a storm with snow, ice, or freezing rain. This type of storm can cause significant problems for area residents. Winter storms are associated with freezing or frozen precipitation such as freezing rain, sleet, snow, and the combined effects of winter precipitation and strong winds. Wind chill is a function of temperature and wind. Low wind chill is a product of high winds and freezing temperatures.

Winter storms that threaten Van Zandt County planning area usually begin as powerful cold fronts that push south from central Canada. Although the county is at risk to ice hazards, extremely cold temperatures, and snow, the effects and frequencies of winter storm events are generally mild and short-lived. As indicated in Figure 12-1, on average, the Van Zandt County planning area, including all participating jurisdictions, typically experience approximately 18-24 extreme cold days a year, meaning up to 24 days are at or around freezing temperatures. During times of ice and snow accumulation, response times will increase until public works road crews are able to make major roads passable. Table 12-1 describes the types of winter storms possible to occur in the Van Zandt County planning area, including all participating jurisdictions.

Figure 12-1. Extreme Cold Days, 1960-2003[1]

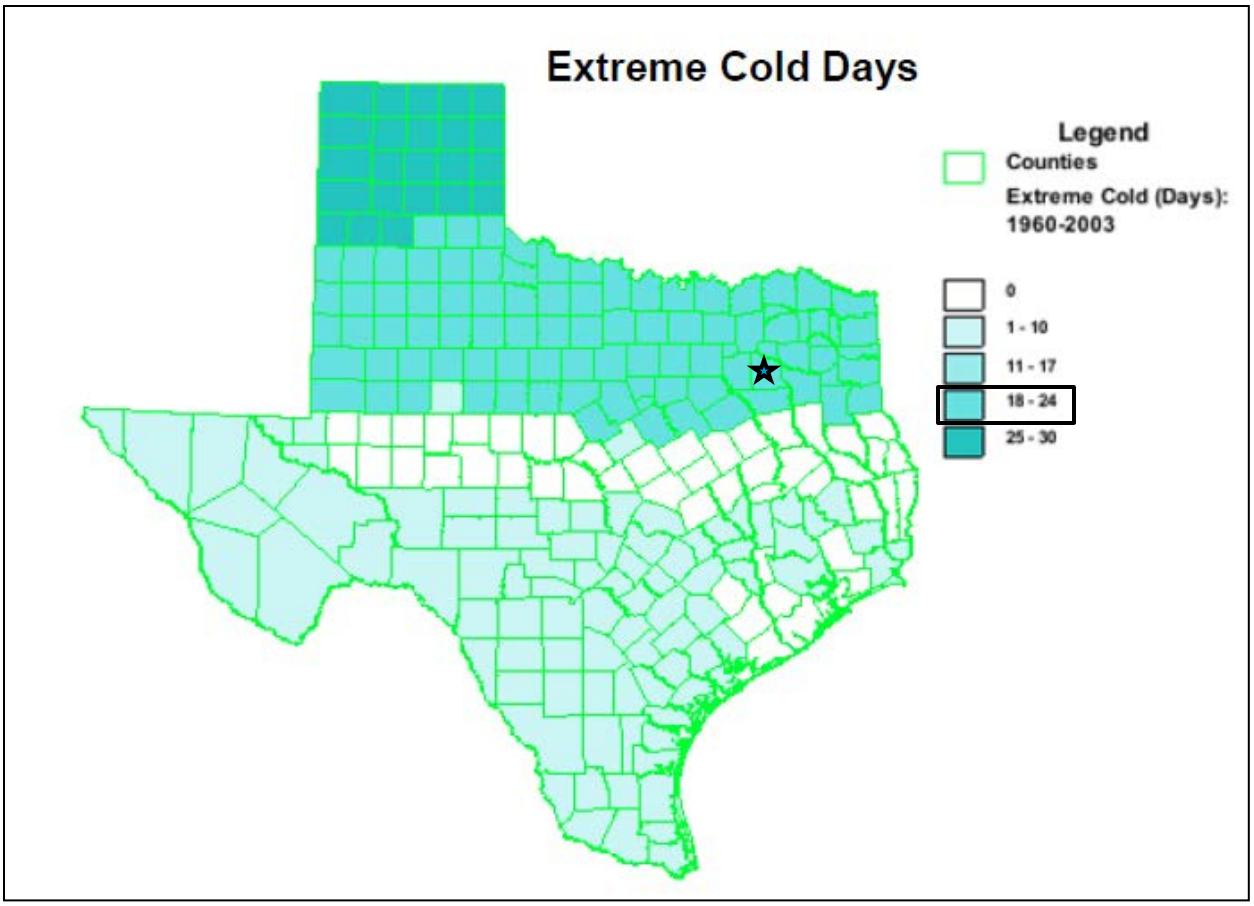


Table 12-1. Types of Winter Storms

TYPE OF WINTER STORM	DESCRIPTION
Winter Weather Advisory	This alert may be issued for a variety of severe conditions. Weather advisories may be announced for snow, blowing or drifting snow, freezing drizzle, freezing rain, or a combination of weather events.
Winter Storm Watch	Severe winter weather conditions may affect your area (freezing rain, sleet, or heavy snow may occur separately or in combination).
Winter Storm Warning	Severe winter weather conditions are imminent.
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: National Weather Service. Van Zandt County indicated by star.

TYPE OF WINTER STORM	DESCRIPTION
Blizzard Warning	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 Warning	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.

LOCATION

Winter storm events are not confined to specific geographic boundaries. Therefore, all existing and future buildings, facilities, and populations in the Van Zandt County planning area, including all participating jurisdictions, are considered to be exposed to a winter storm hazard and could potentially be impacted.

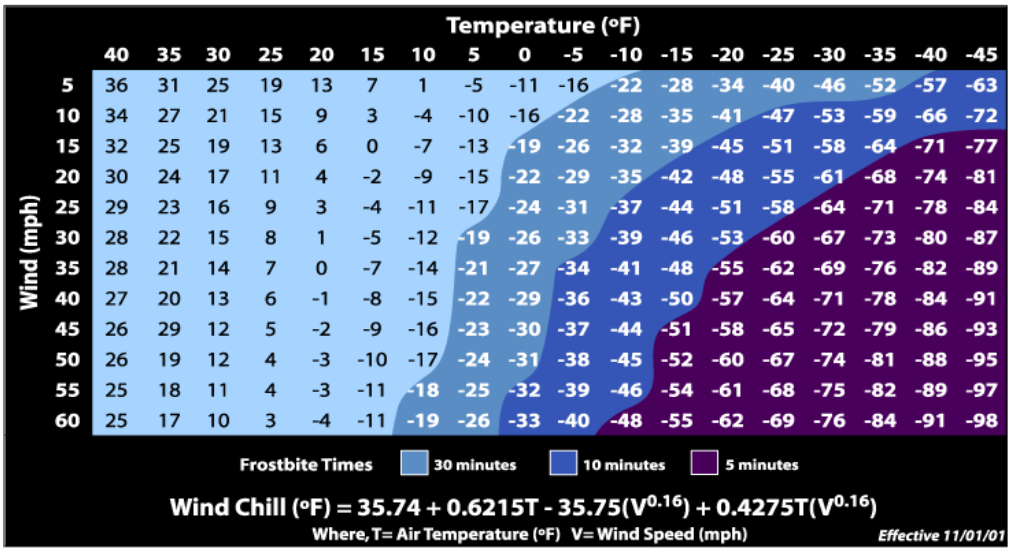
EXTENT

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 12-2. Table 12-2 should be read in conjunction with the wind-chill factor described in Figure 12-2 to determine the intensity of a winter storm. The chart is not applicable when temperatures are over 50°F or winds are calm. This is an index developed by the National Weather Service.

Table 12-2. 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
Severe	Below 20°	Winds of 35 mph or more and snow and sleet greater than 4 inches

Figure 12-2. Wind Chill Chart



Wind (mph)	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	29	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Wind chill temperature is a measure of how cold the wind makes real air temperature feel to the human body. Since wind can dramatically accelerate heat loss from the body, a blustery 30°F day would feel just as cold as a calm day with 0°F temperatures. The Van Zandt County planning area, including all participating jurisdictions, has never experienced a blizzard, but based on 14 previous occurrences recorded from 1996 through April 2019, it has been subject to winter storm watches, warnings, freezing rain, sleet, snow, and wind chill.

The average number of cold days is similar for the entire planning area, including all participating jurisdictions. Therefore, the intensity or extent of a winter storm event to be mitigated for the area ranges from mild to extreme according to the definitions at Table 12-2. The entire Van Zandt County planning area can expect anywhere between 0.1 to 4.0 inches of ice and snow during a winter storm event and temperatures between 20 and 50 degrees with winds ranging from 0 to 20 mph. This is the worst that can be anticipated to mitigate against in the future for all participating jurisdictions.

Historical Occurrences

Table 12-3 shows historical occurrences for Van Zandt County from 1996 through April 2019 provided by the NCEI database. There have been 14 recorded winter storm events in Van Zandt County, including all participating jurisdictions. Historical winter storm information, as provided by the NCEI, identifies winter storm 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 winter storm data for the county, all participating jurisdictions, are provided on a County-wide basis per the NCEI database. Table 12-3 shows historical incident information for the planning area.

Table 12-3. Historical Winter Storm Events, 1996-2019[2]

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Van Zandt County	11/24/1996	0	0	$0	$0
Van Zandt County	1/12/1997	0	0	$0	$0
Van Zandt County	1/14/1997	0	0	$0	$0
Van Zandt County	1/25/2000	0	0	$0	$0
Van Zandt County	12/12/2000	0	0	$0	$0
Van Zandt County	12/25/2000	0	0	$0	$0
Van Zandt County	12/31/2000	0	0	$0	$0
Van Zandt County	2/5/2002	0	0	$0	$0
Van Zandt County	2/24/2003	0	0	$0	$0
Van Zandt County	12/22/2004	0	0	$0	$0
Van Zandt County	12/7/2005	0	0	$0	$0
Van Zandt County	12/15/2008	0	0	$0	$0
Van Zandt County	3/5/2015	0	0	$0	$0
Van Zandt County	1/16/2018	0	0	$81,584	$0
TOTALS		**0**	**0**	**$81,584**	**$0**

Significant Events

March 5, 2015 – Van Zandt County
Approximately one inch of sleet was followed by 2 inches of snow.

January 1, 2018 – Van Zandt County
Several accidents were reported along Interstate 20 in Van Zandt County, near the city of Canton. Two to three inches of snow were reported in the county, as most roads were covered in a glaze of ice and snow

Probability of Future Events

According to historical records, the planning area experiences approximately one winter storm event each year. Hence, the probability of a future winter storm event affecting the Van Zandt County planning area, including all participating jurisdictions, is highly likely, with a winter storm likely to occur within the next year.

[2] Values are in 2019 dollars.

VULNERABILITY AND IMPACT

During periods of extreme cold and freezing temperatures, water pipes can freeze and crack, and ice can build up on power lines, causing them to break under the weight or causing tree limbs to fall on the lines. These events can disrupt electric service for long periods.

An economic impact may occur due to increased consumption of heating fuel, which can lead to energy shortages and higher prices. House fires and resulting deaths tend to occur more frequently from increased and improper use of alternate heating sources. Fires during winter storms also present a greater danger because water supplies may freeze and impede firefighting efforts.

All populations, buildings, critical facilities, and infrastructure in the entire Van Zandt County planning area, including all participating jurisdictions, are vulnerable to severe winter events.

The following critical facilities would be vulnerable to Winter Storm events in each participating jurisdiction:

Table 12-4. Critical Facilities by Jurisdiction

JURISDICTION	CRITICAL FACILITIES
Van Zandt County	15 Government Facilities, 1 Sheriff's Office, 10 Water/Wastewater Facilities, 3 Communications Towers, 6 Fire Stations, 1 Hospital, 1 Airport, 1 Juvenile Detention Facility
City of Canton	1 Fire Station, 1 Police Station, 1 County Jail, 3 Government Facilities, 1 ISD with 4 Schools, 2 Medical Facilities
City of Edgewood	2 Government Facility, 1 Police Station, 1 Fire Station, 5 Water/Wastewater Facilities, 1 Dam
City of Edom	5 Pump Stations, 1 Fire Station
City of Fruitvale	1 Government Facility, 1 Fire Station, 1 ISD with 3 Schools, 4 Pump Stations, 1 Disaster Relief Center
City of Grand Saline	6 Government Facilities, 1 Police Station, 3 Fire Stations, 6 Water/Wastewater Facilities, 1 Animal Shelter, 1 Shelter,
City of Van	2 Government Facilities, 1 Fire Station, 1 Police Station, 3 Schools
City of Wills Point	2 Government Facilities, 1 Police Station, 1 Fire Station, 1 School, 1 EMS, 1 Medical Facility, 1 Airport

People and animals are subject to health risks from extended exposure to cold air. Elderly people are at greater risk of death from hypothermia during these events, especially in the rural areas of the county where populations are sparse, icy roads may impede travel, and there are fewer neighbors to check in on the elderly. According to the U.S. Center for Disease Control, every year hypothermia kills about 600 Americans, half of whom are 65 years of age or older. In addition, populations living below the poverty level may not be able to afford to run heat on a regular basis

Population over 65 in the entire Van Zandt County planning area is estimated at 19.9% of the total population or an estimated total of 10,677[3] potentially vulnerable residents in the planning area based on age. An estimated 14.2% of the planning area population live below the poverty level (Table 12-5).

[3] US Census Bureau 2017 data for Van Zandt County

Table 12-5. Population at Greater Risk by Jurisdiction

JURISDICTION	POPULATION 65 AND OLDER	POPULATION BELOW POVERTY LEVEL
Van Zandt County[4]	10,677	7,612
City of Canton	877	528
City of Edgewood	275	301
City of Edom	57	2
City of Fruitvale	47	132
City of Grand Saline	492	860
City of Van	314	278
City of Wills Point	635	916

Historic loss, in 2019 dollars, is estimated at $81,584 in damages over the 23-year recording period giving an approximate loss of $3,547 in damages annually (Table 12-6). The potential severity of impact for the Van Zandt County planning area, including all participating jurisdictions, are “Limited” meaning injuries are treatable with first aid, shutdown of facilities and services for 24 hours or less, and less than 10% of property destroyed or with major damage.

Table 12-6. Potential Annualized Losses for Van Zandt County Planning Area

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Van Zandt County	$81,584	$3,547

Assessment of Impacts

The greatest risk from a winter storm hazard is to public health and safety. Potential impacts for the planning area may include:

- Vulnerable populations, particularly the elderly and infants, 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.

[4] County totals includes all incorporated jurisdictions and unincorporated areas.

- 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.
- A winter storm event could lead to tree, shrub, and plant damage or death.
- Severe cold and ice could significantly damage agricultural crops.
- 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 businesses and citizens will also contribute to the overall economic and financial conditions in the aftermath of a winter storm event.

Section 13: Wildfire

HAZARD DESCRIPTION

A wildfire event can rapidly spread out of control and occurs most often in the summer when the brush is dry and flames can move unchecked through a highly vegetative area. Wildfires can start as a slow burning fire along the forest floor, killing and damaging trees. The fires often spread more rapidly as they reach the tops of trees with wind carrying the flames from tree to tree. Usually, dense smoke is the first indication of a wildfire.

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.

Texas has seen a significant increase in the number of wildfires in the past 30 years, which included wildland, 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 event can be a potentially damaging consequence of drought. 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 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 WUI. (Figures 13-1 through 13-8). It is estimated that 90.2 percent of the total population in Van Zandt County live within the WUI. However, the entire Van Zandt County planning area is at risk for wildfires.

Figure 13-1. Wildland Urban Interface Map – Van Zandt County

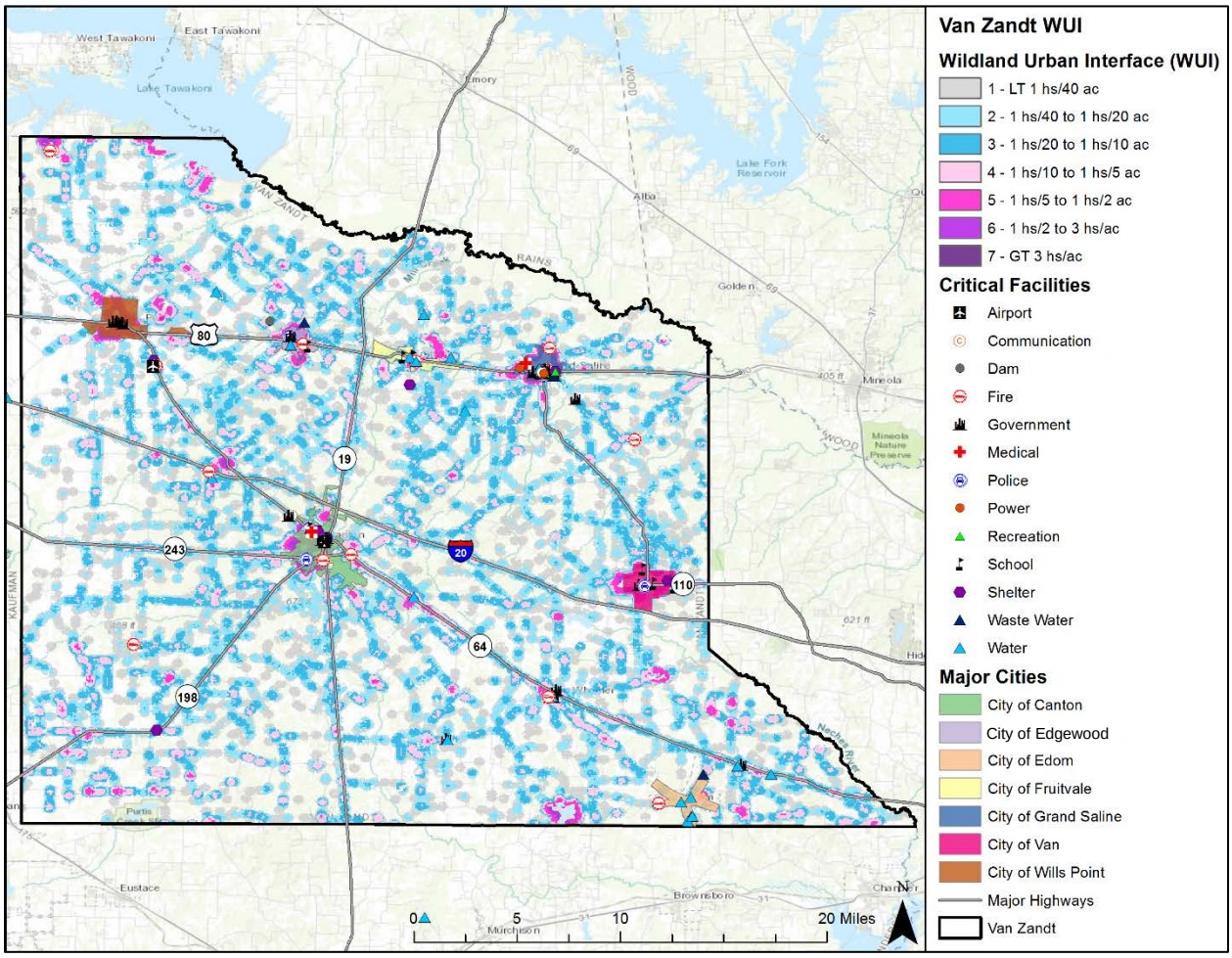
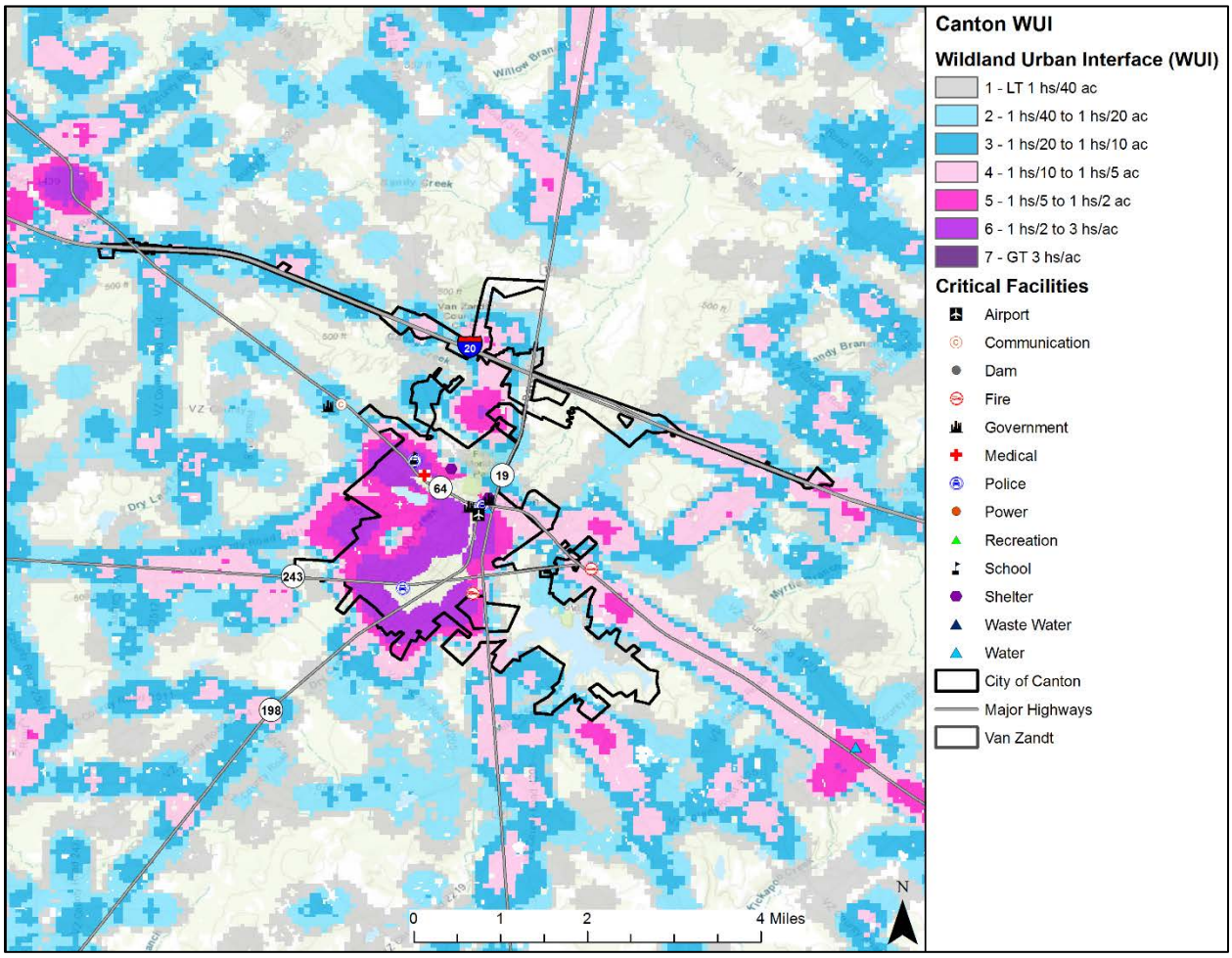
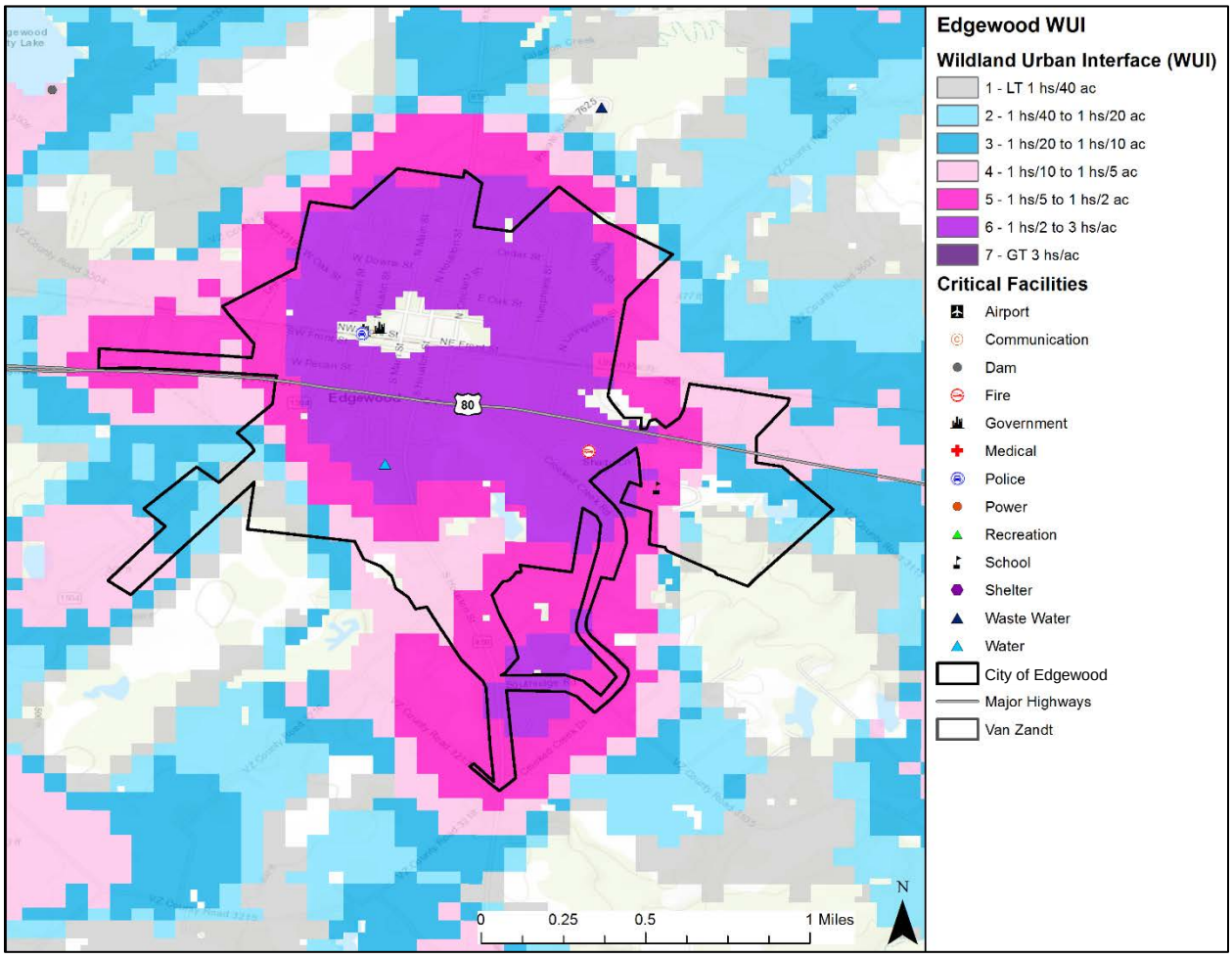


Figure 13-2. Wildland Urban Interface Map – City of Canton



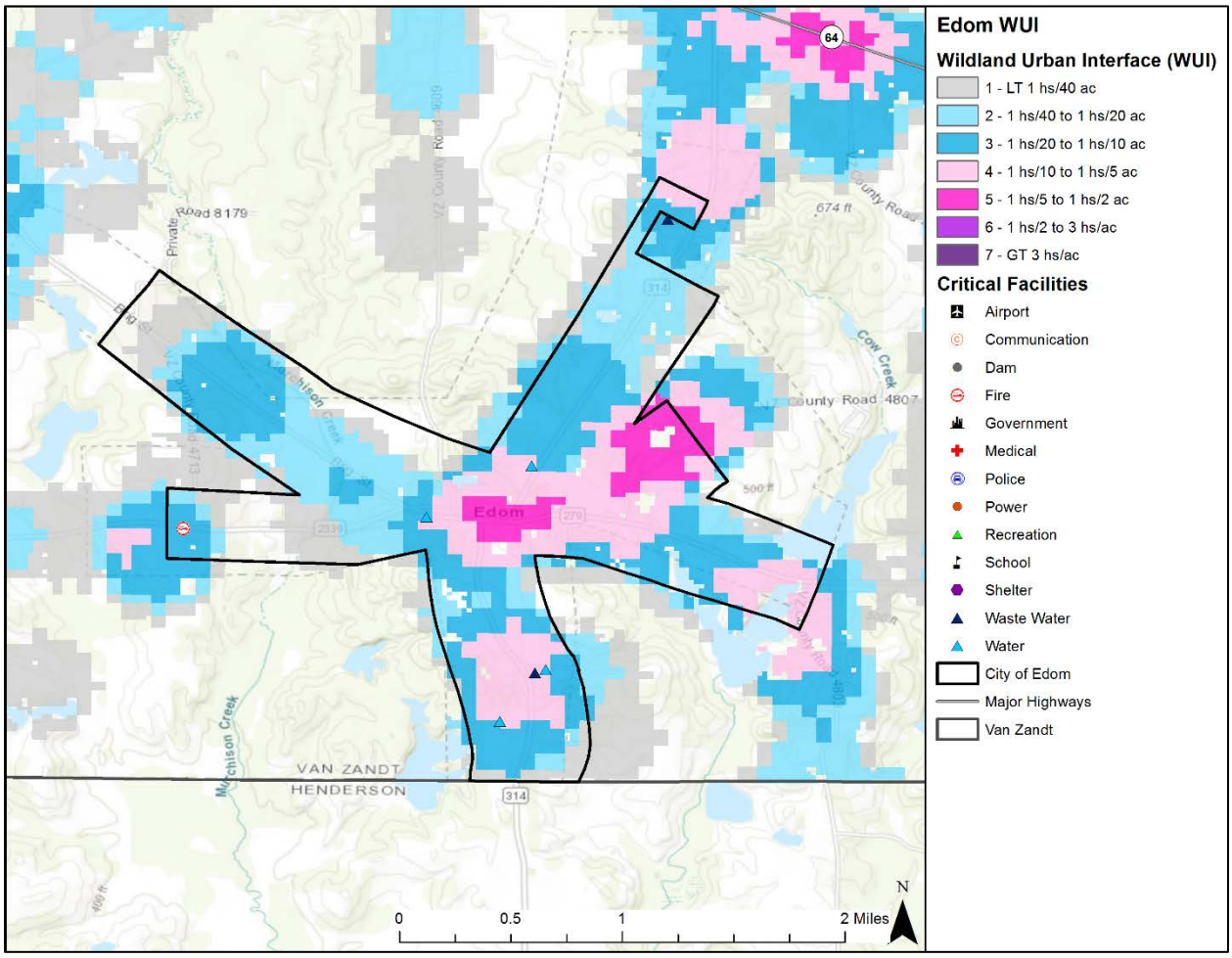
It is estimated that 84.6 percent of the total population in the City of Canton live within the WUI. However, the entire City of Canton is at risk for wildfires.

Figure 13-3. Wildland Urban Interface Map – City of Edgewood



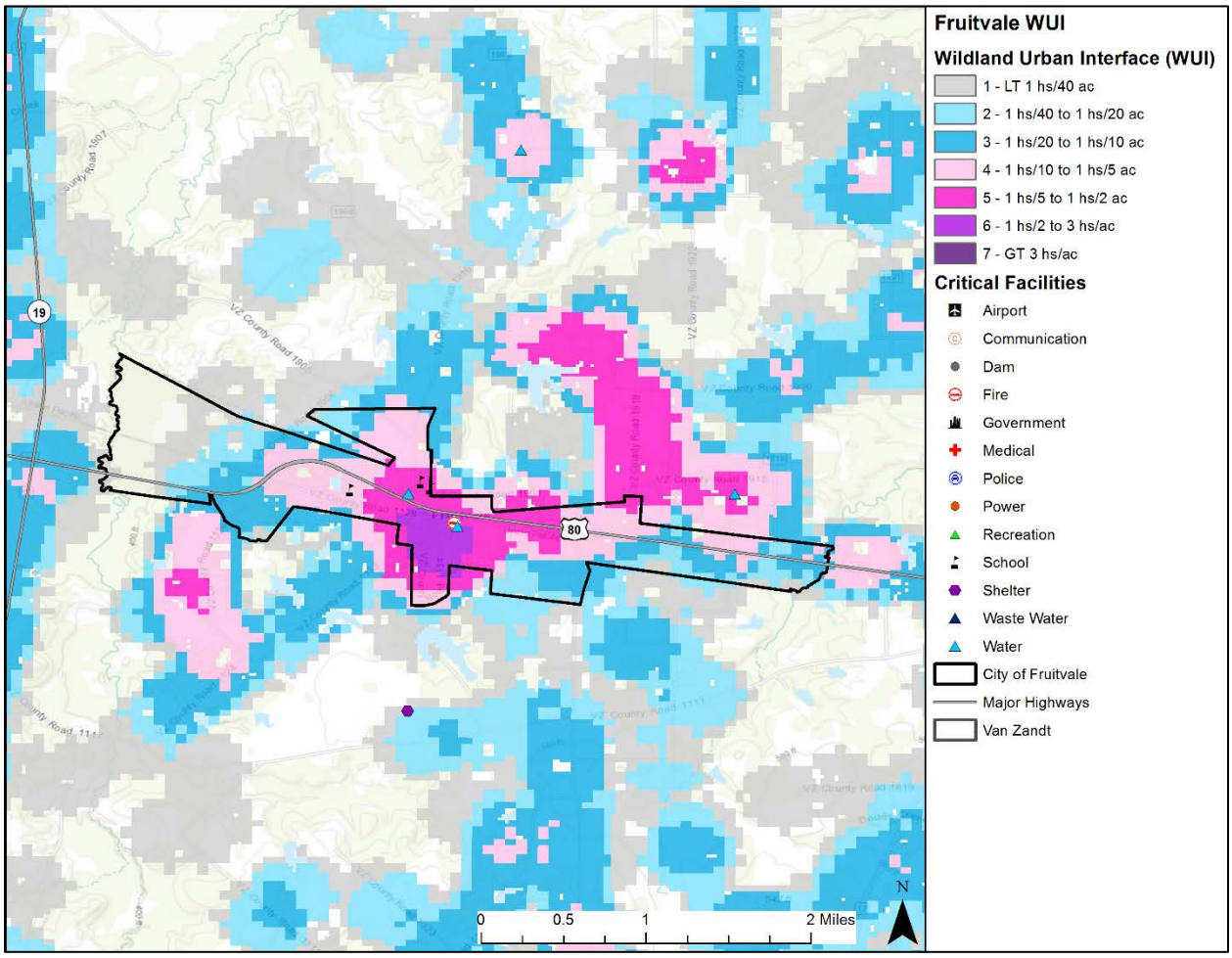
It is estimated that 96.3 percent of the total population in the City of Edgewood live within the WUI. However, the entire City of Edgewood is at risk for wildfires.

Figure 13-4. Wildland Urban Interface Map – City of Edom



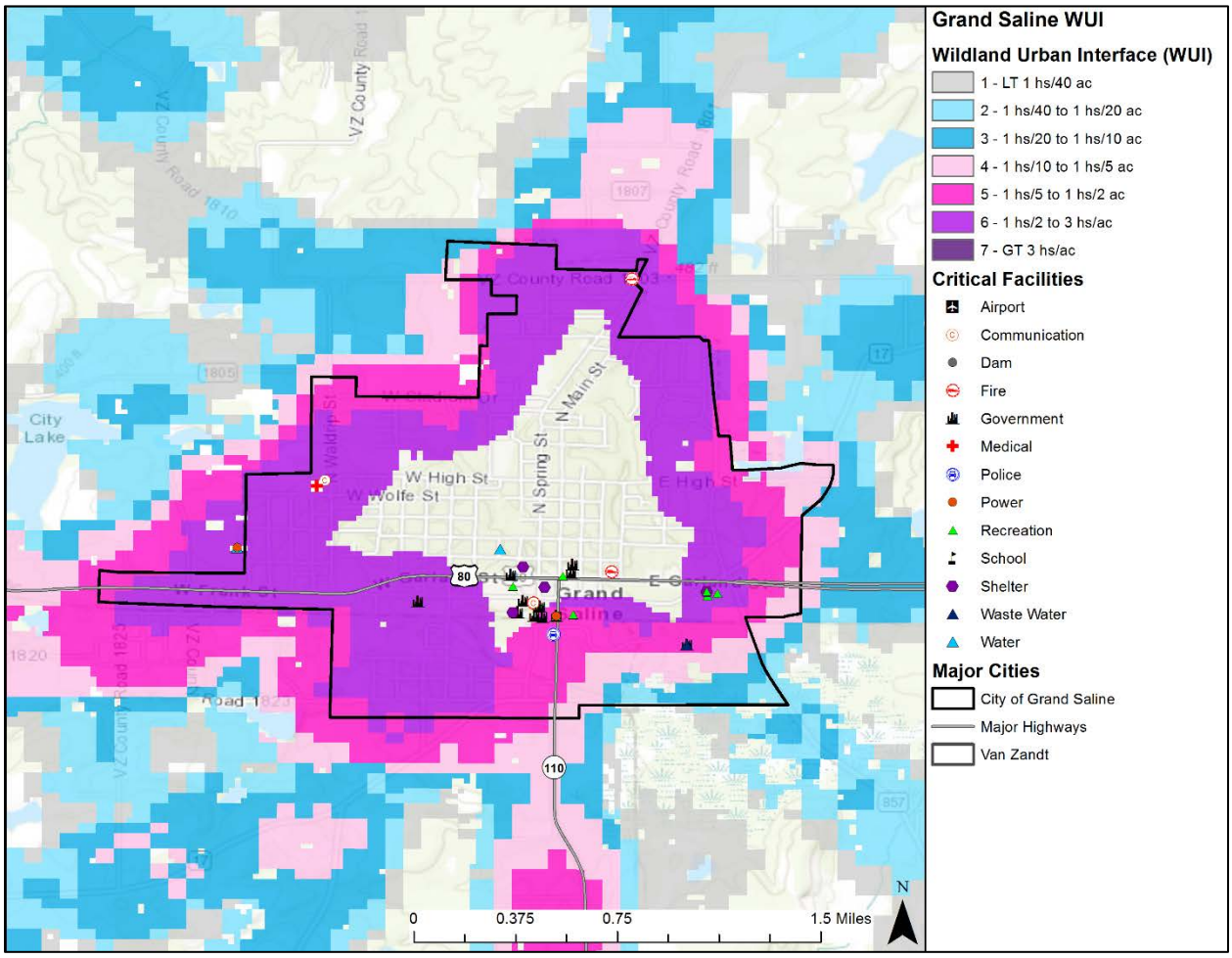
It is estimated that 99.3 percent of the total population in the City of Edom live within the WUI. However, the entire City of Edom is at risk for wildfires.

Figure 13-5. Wildland Urban Interface Map – City of Fruitvale



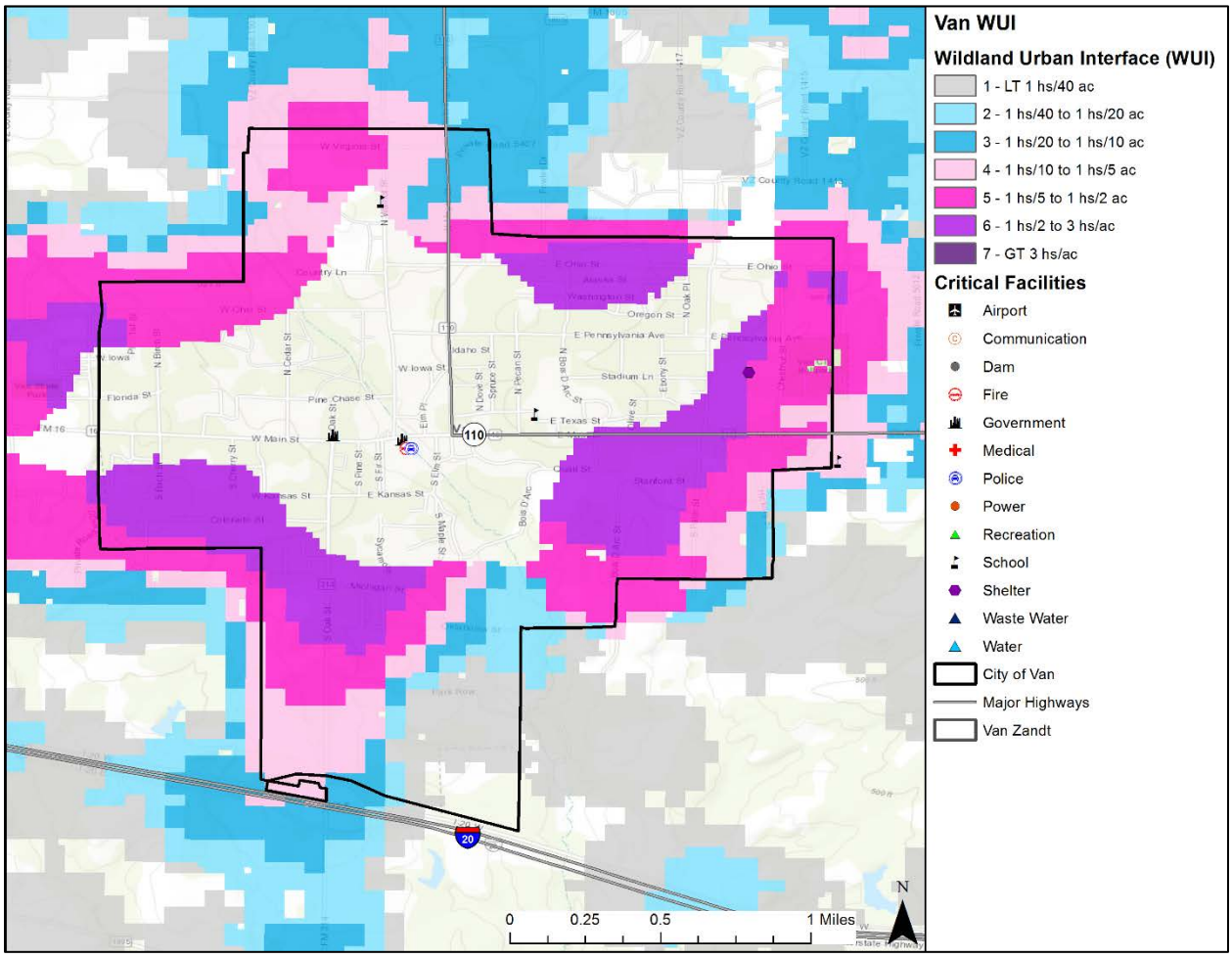
It is estimated that 98.5 percent of the total population in the City of Fruitvale live within the WUI. However, the entire City of Fruitvale is at risk for wildfires.

Figure 13-6. Wildland Urban Interface Map – City of Grand Saline



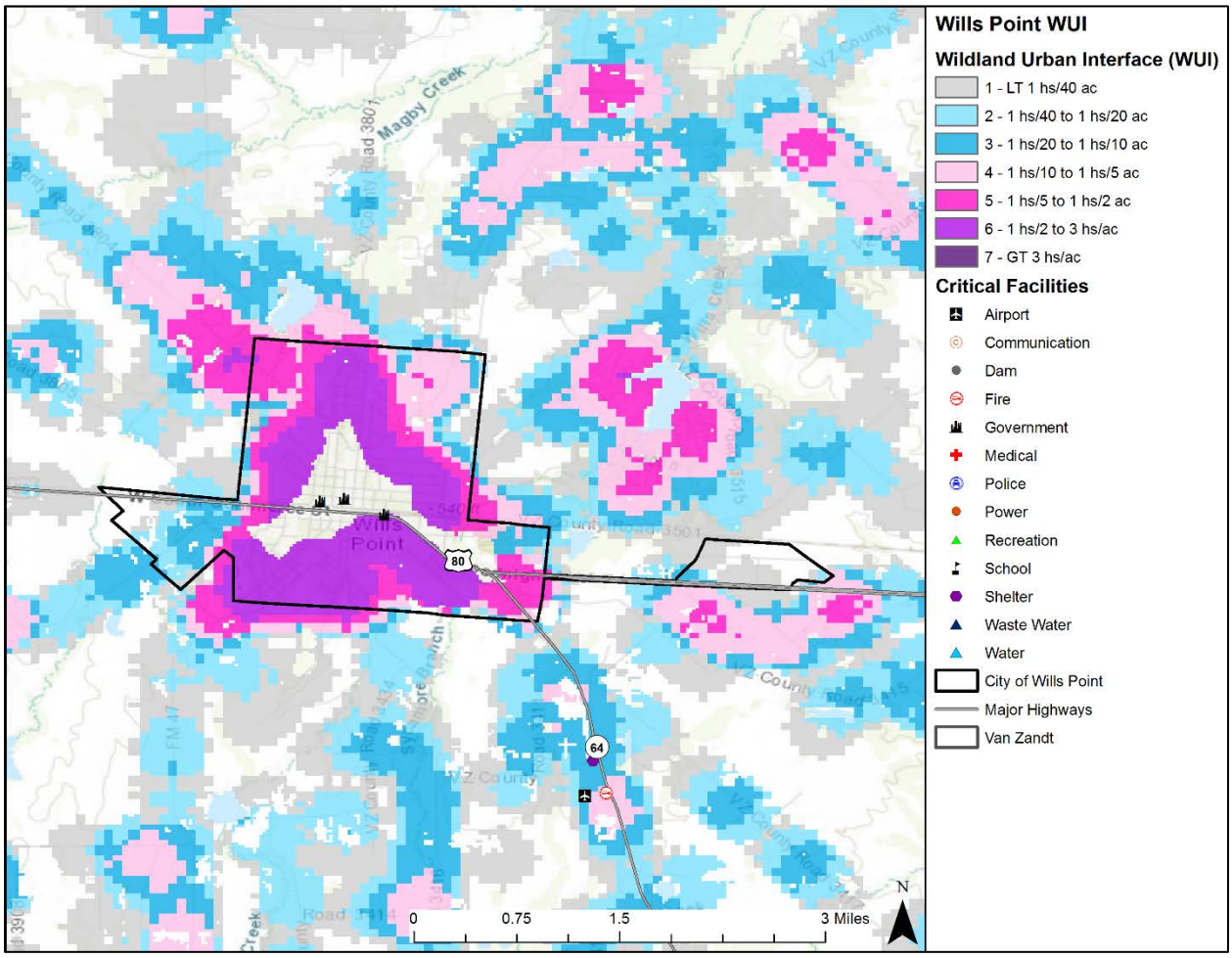
It is estimated that 54.6 percent of the total population in the City of Grand Saline live within the WUI. However, the entire City of Grand Saline is at risk for wildfires.

Figure 13-7. Wildland Urban Interface Map – City of Van



It is estimated that 43.1 percent of the total population in the City of Van live within the WUI. However, the entire City of Van is at risk for wildfires.

Figure 13-8. Wildland Urban Interface Map – City of Wills Point

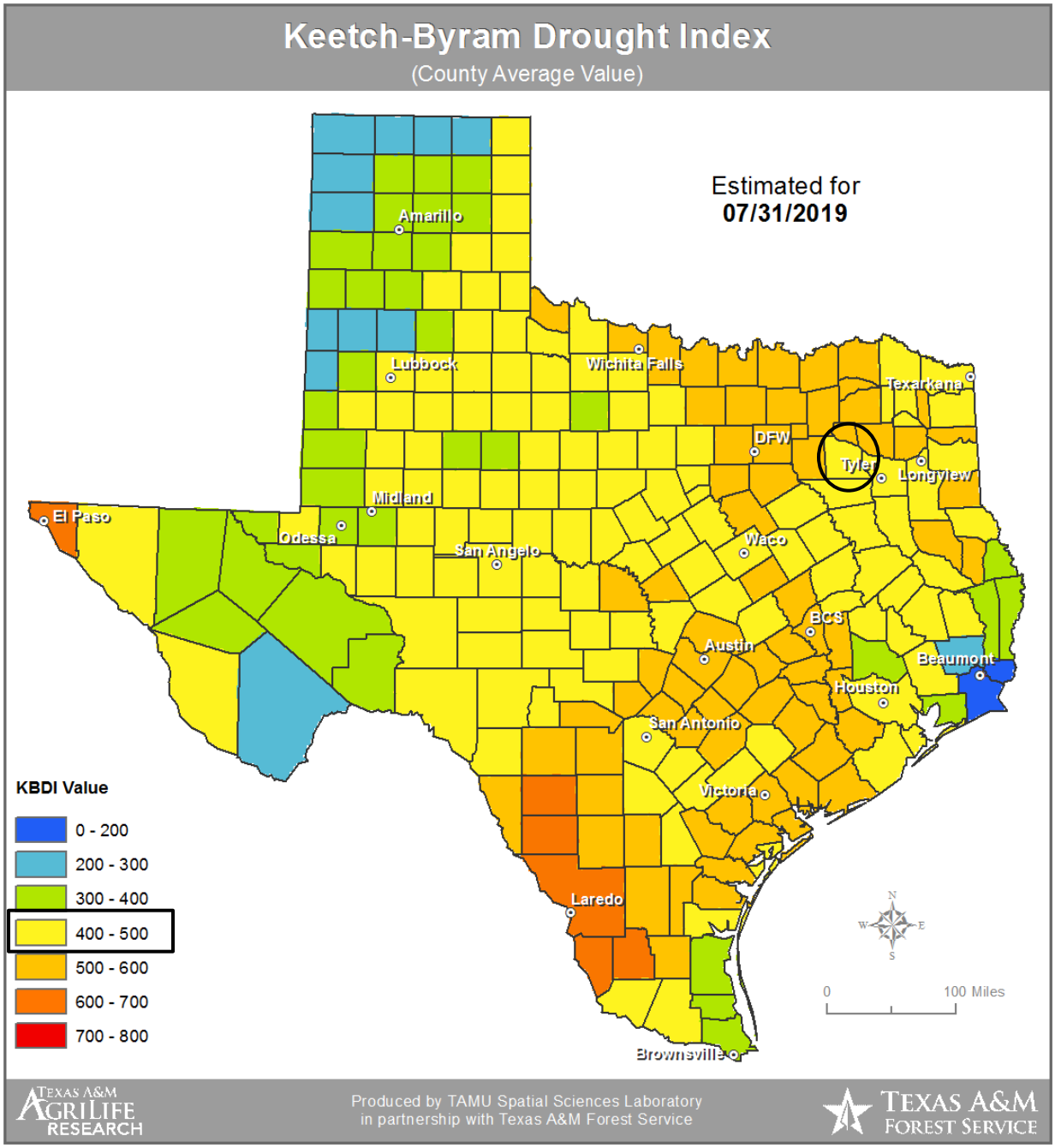


It is estimated that 76.2 percent of the total population in the City of Wills Point live within the WUI. However, the entire City of Wills Point is at risk for wildfires.

EXTENT

Risk for a wildfire event is measured in terms of magnitude and intensity using the Keetch Byram Drought Index (KBDI), a mathematical system for relating current and recent weather conditions to potential or expected fire behavior. The KBDI determines forest fire potential based on a daily water balance, derived by balancing a drought factor with precipitation and soil moisture (assumed to have a maximum storage capacity of eight inches), and is expressed in hundredths of an inch of soil moisture depletion.

Figure 13-9. Keetch-Byram Drought Index (KBDI) for the State of Texas, 2019[1]



Fire behavior can be categorized at four distinct levels on the KBDI:

- **0 -200:** Soil and fuel moisture are high. Most fuels will not readily ignite or burn. However, with sufficient sunlight and wind, cured grasses and some light surface fuels will burn in spots and patches.

[1] Van Zandt County is located within the black circle.

- **200 -400:** Fires more readily burn and will carry across an area with no gaps. Heavier fuels will not readily ignite and burn. Expect smoldering and the resulting smoke to carry into and possibly through the night.
- **400 -600:** Fires intensity begins to significantly increase. Fires will readily burn in all directions exposing mineral soils in some locations. Larger fuels may burn or smolder for several days creating possible smoke and control problems.
- **600 -800:** Fires will burn to mineral soil. Stumps will burn to the end of underground roots and spotting will be a major problem. Fires will burn through the night and heavier fuels will actively burn and contribute to fire intensity.

The KBDI is a good measure of the readiness of fuels for a wildfire event. It should be referenced as the area experiences changes in precipitation and soil moisture, while caution should be exercised in dryer, hotter conditions.

The range of intensity for the Van Zandt County planning area in a wildfire event is within 400 to 704. The average extent to be mitigated for the Van Zandt County planning area, including all participating jurisdictions, is a KBDI of 419. At this level fires intensity begins to significantly increase. Fires will readily burn in all directions exposing mineral soils in some locations. The worst the planning area can anticipate based on historical occurrences and readily available fuel is 600 to 800 as 704 falls within this range. At this level fires will burn to mineral soil. Stumps will burn to the end of underground roots and spotting will be a major problem. Fires will burn through the night and heavier fuels will actively burn and contribute to fire intensity.

The Texas Forest Service's Fire Intensity Scale identifies areas where significant fuel hazards and associated dangerous fire behavior potential exist based on weighted average of four percentile weather categories. Van Zandt County is between a potential low to moderate wildfire intensities. Figures 13-10 through 13-17 identify the wildfire intensity for the Van Zandt County planning area.

Figure 13-10. Fire Intensity Scale Map – Van Zandt County

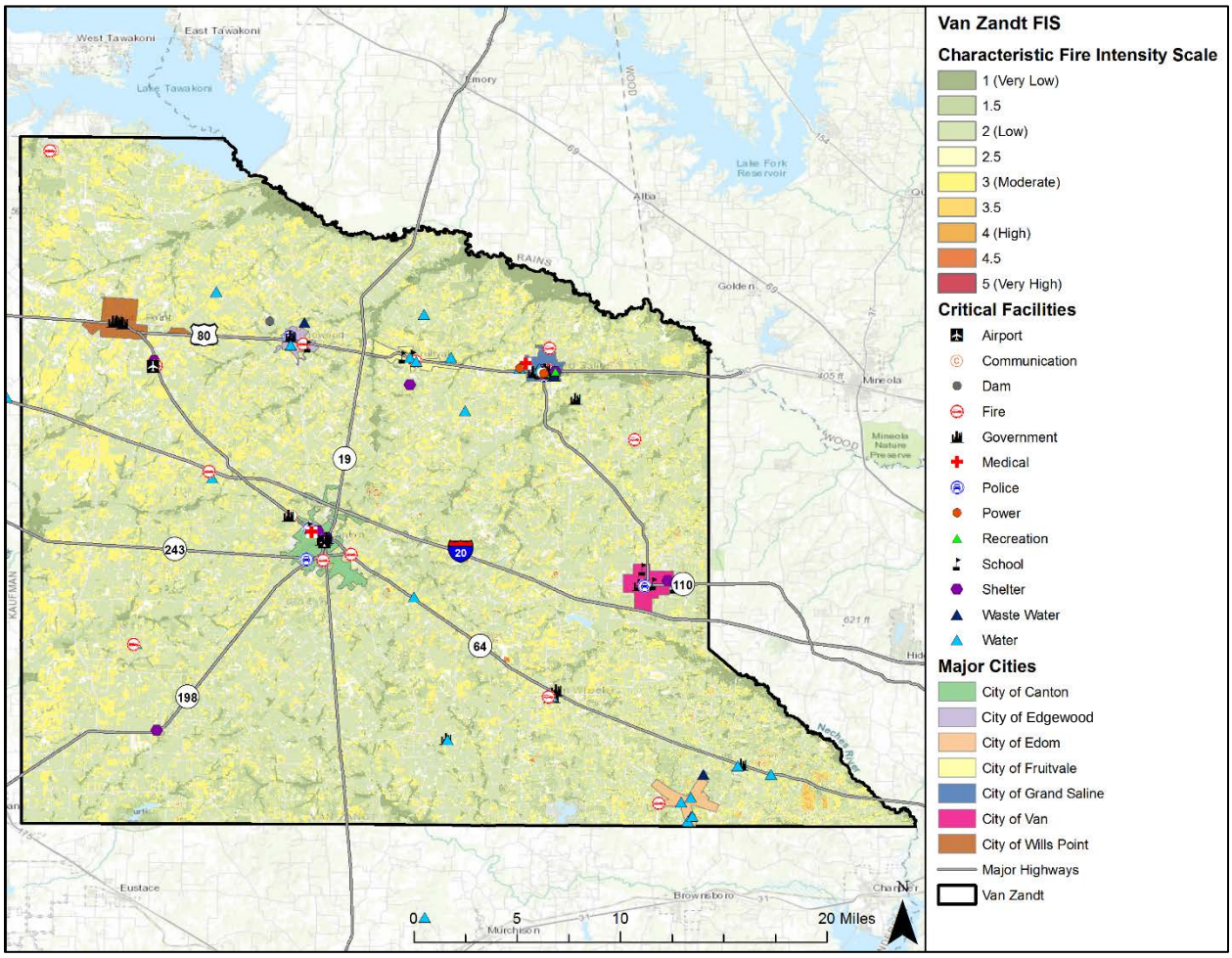


Figure 13-11. Fire Intensity Scale Map – City of Canton

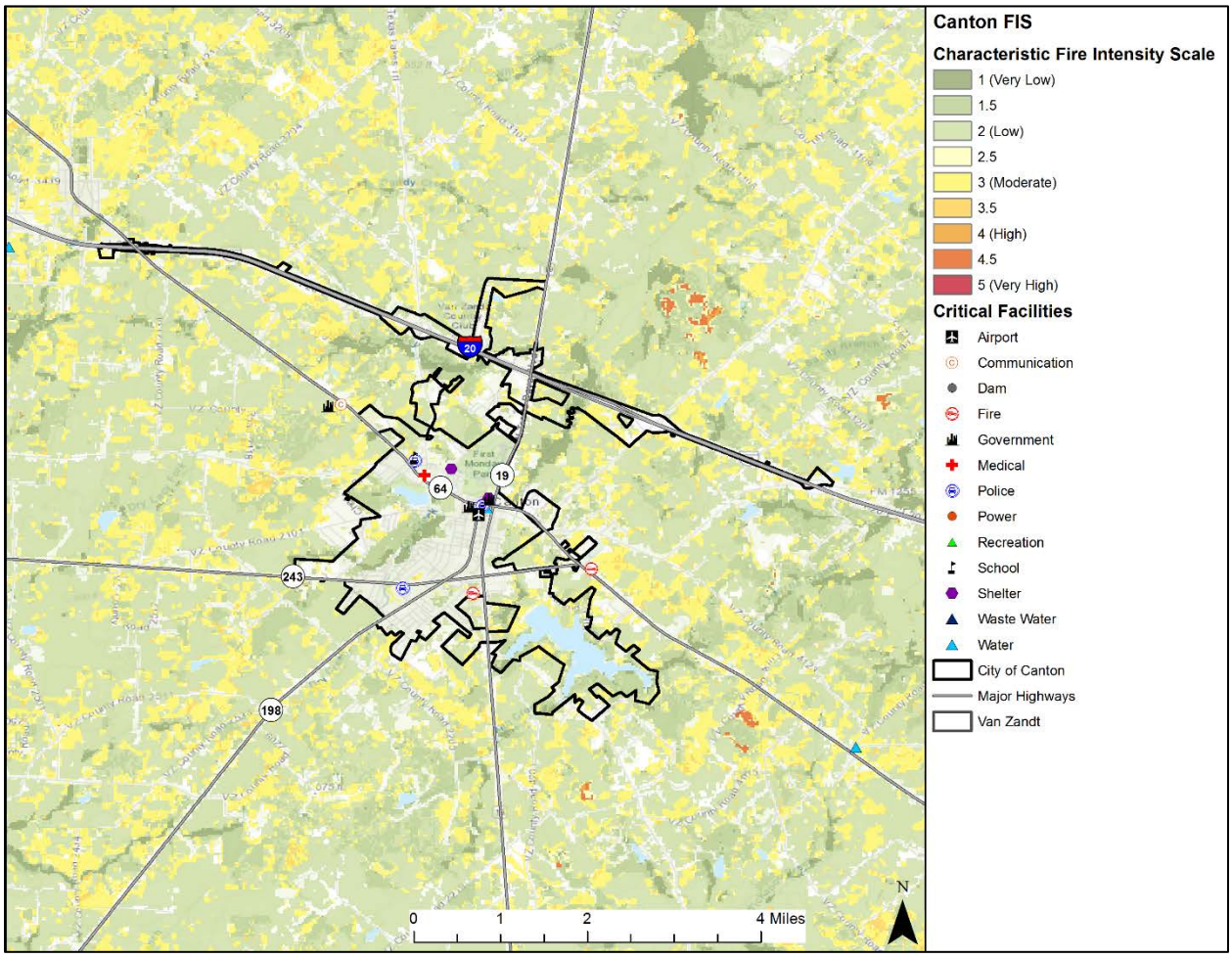


Figure 13-12. Fire Intensity Scale Map – City of Edgewood

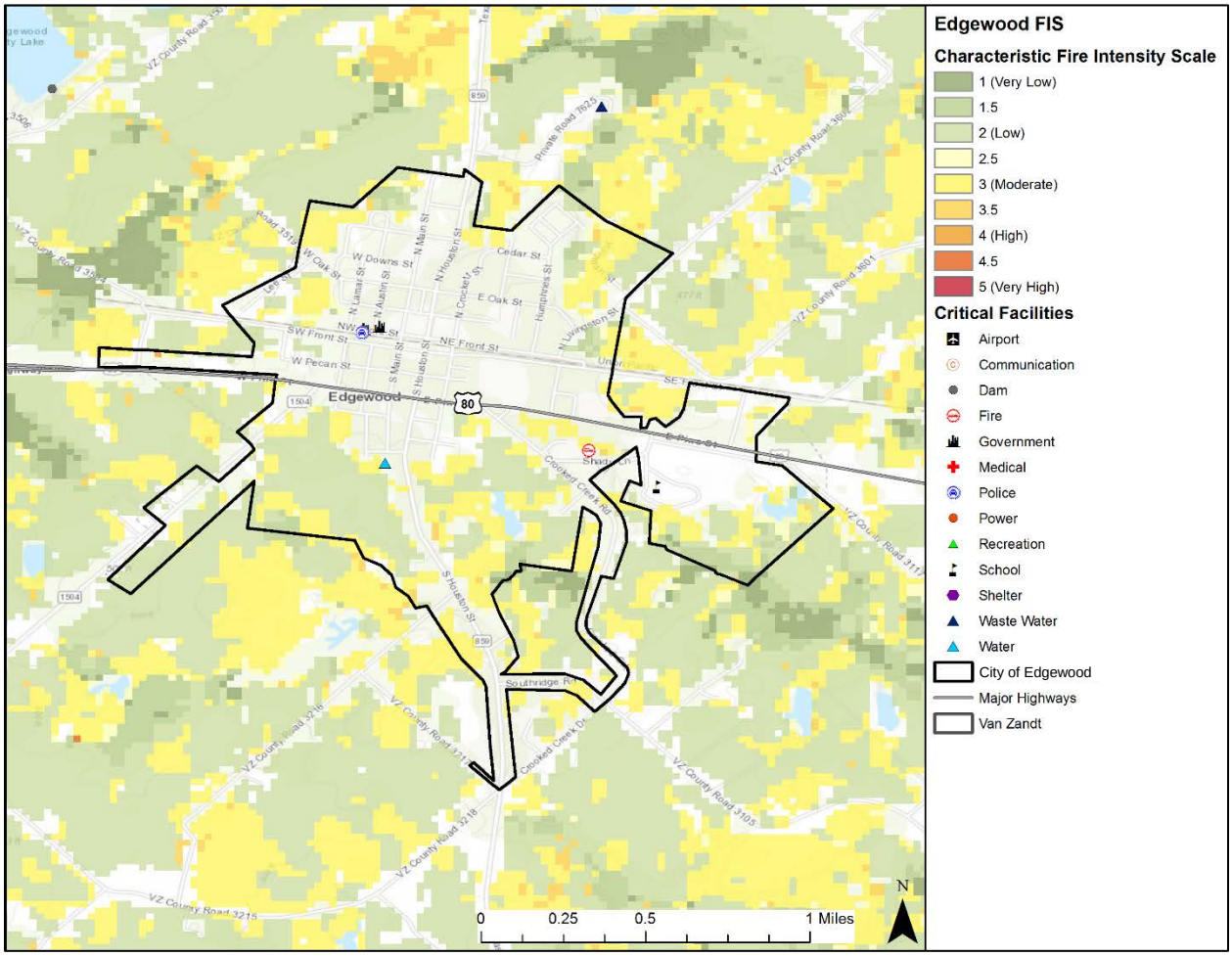


Figure 13-13. Fire Intensity Scale Map – City of Edom

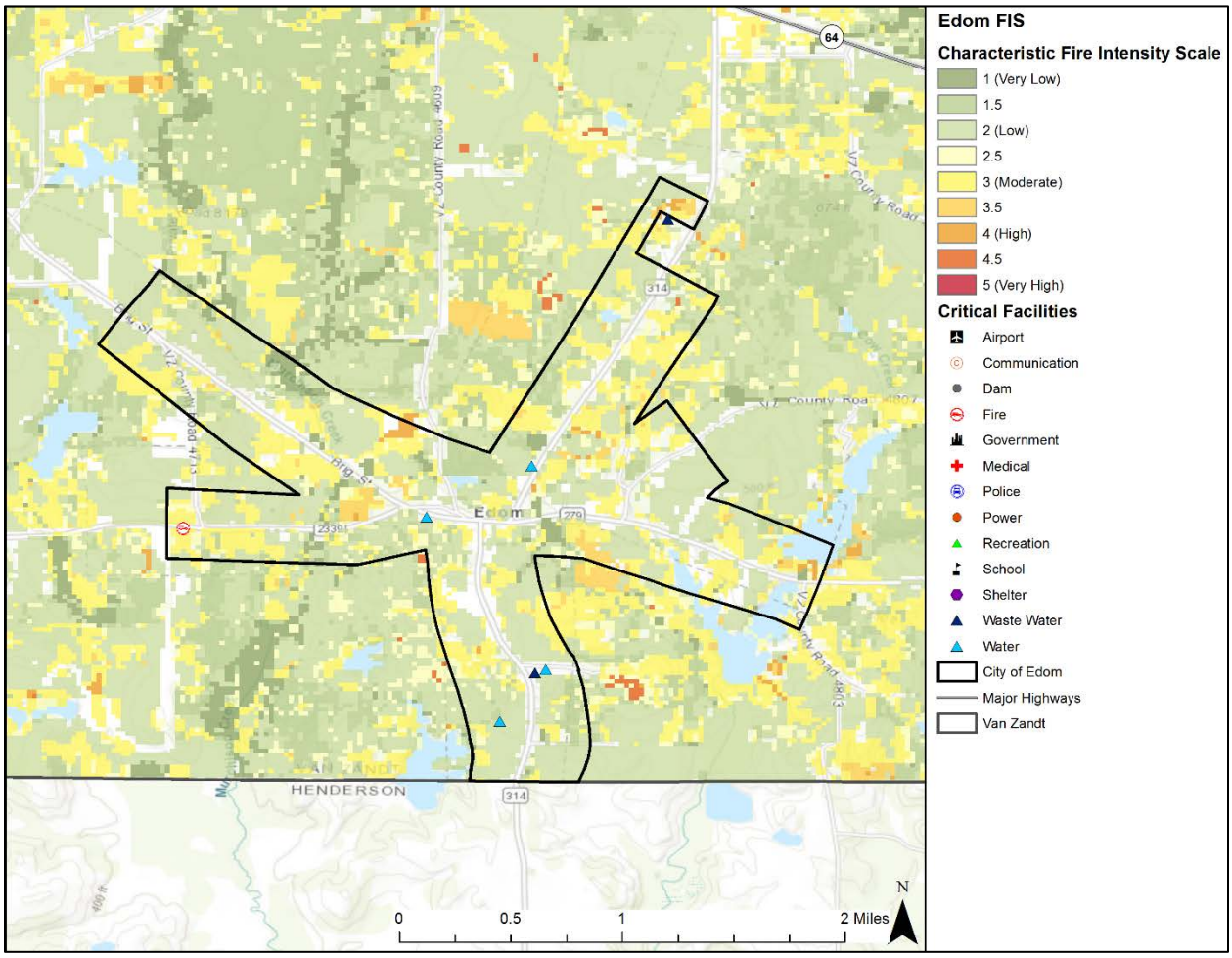


Figure 13-14. Fire Intensity Scale Map – City of Fruitvale

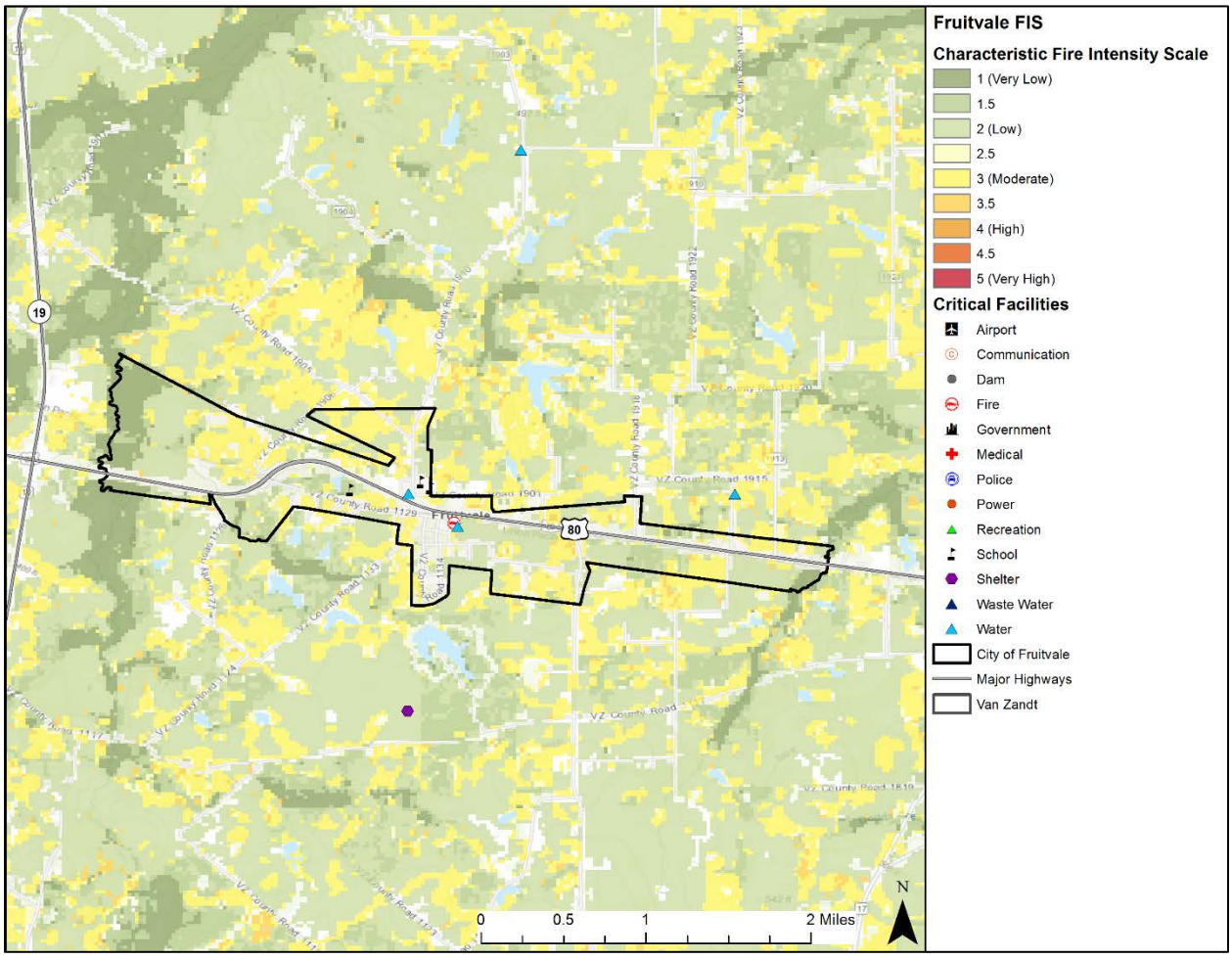


Figure 13-15. Fire Intensity Scale Map – City of Grand Saline

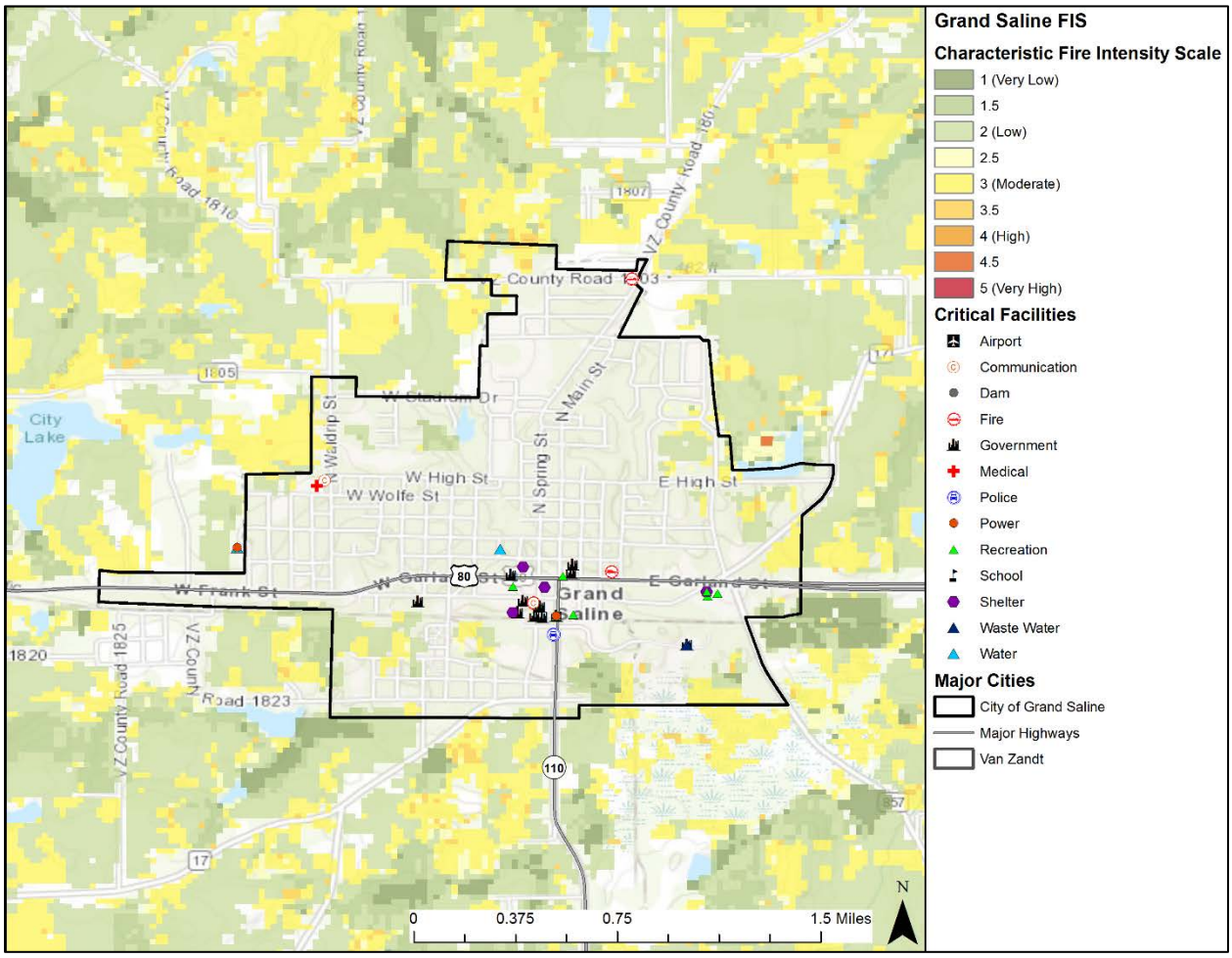


Figure 13-16. Fire Intensity Scale Map – City of Van

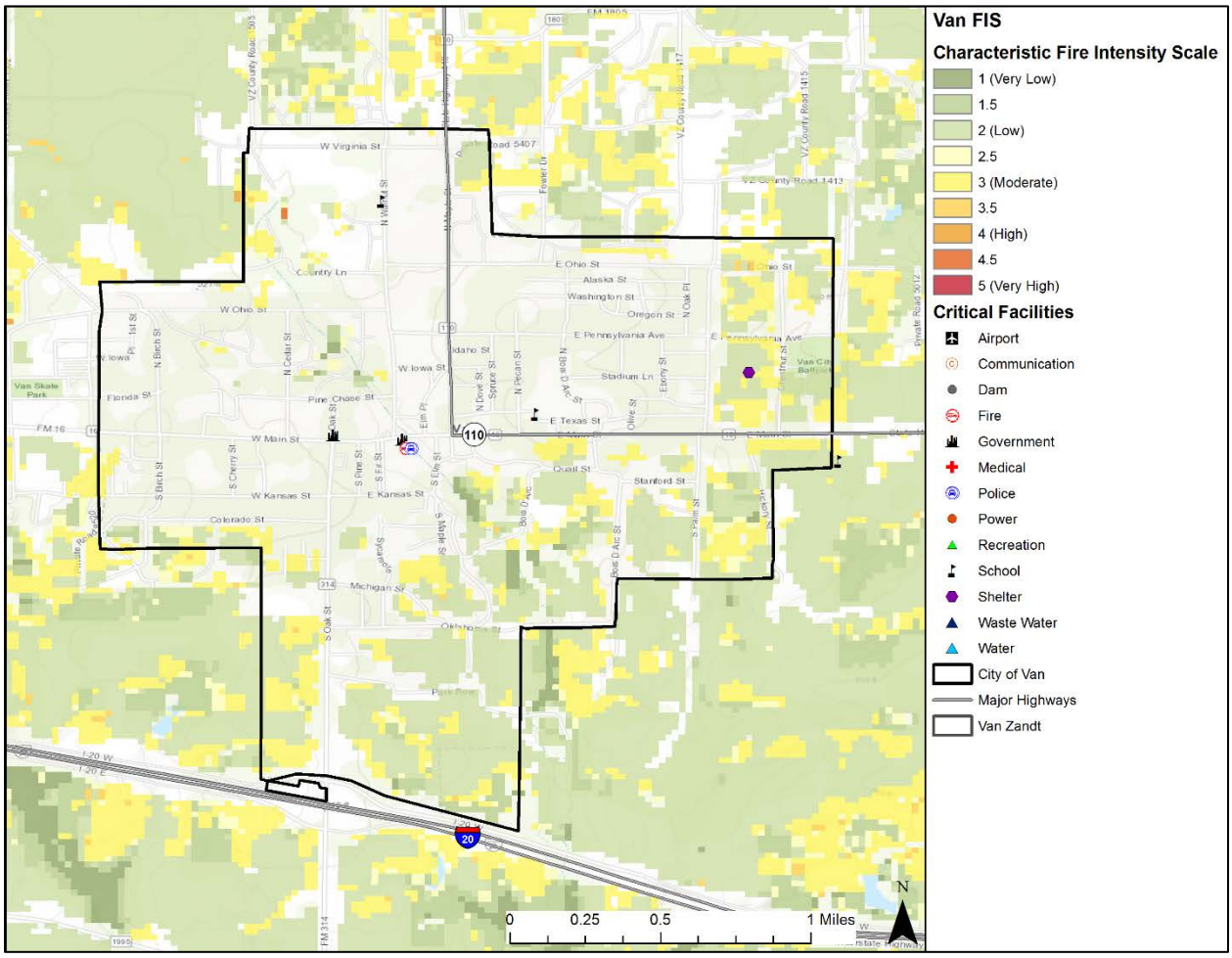
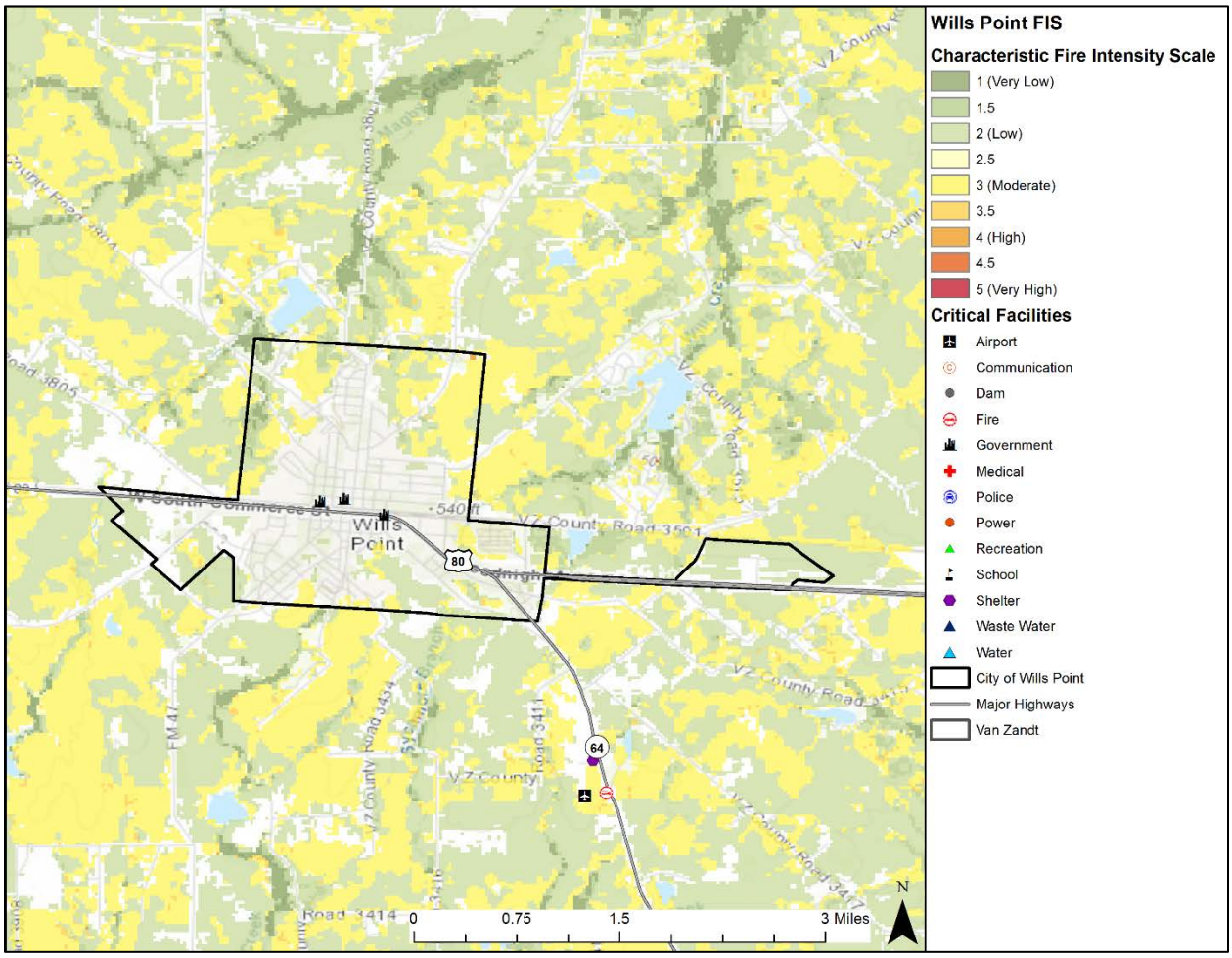


Figure 13-17. Fire Intensity Scale Map – City of Wills Point



HISTORICAL OCCURRENCES

The Texas Forest Service reported 1,823 wildfire events between 2005 and 2015. The National Center for Environmental Information (NCEI) reported 2 events from 1996 through 2018. Due to a lack of recorded data for wildfire events prior to 2005 and after 2015[2], frequency calculations are based on an eleven-year period using only data from recorded years. The map below shows approximate locations of wildfires, which can be grass or brushfires of any size (Figure 13-18). Table 13-1 identifies the number of wildfires by jurisdiction and total acreage burned.

[2] The Texas Forest Service data is currently only available through 2015.

Figure 13-18. Location and Historic Wildfire Events for Van Zandt County Planning Area

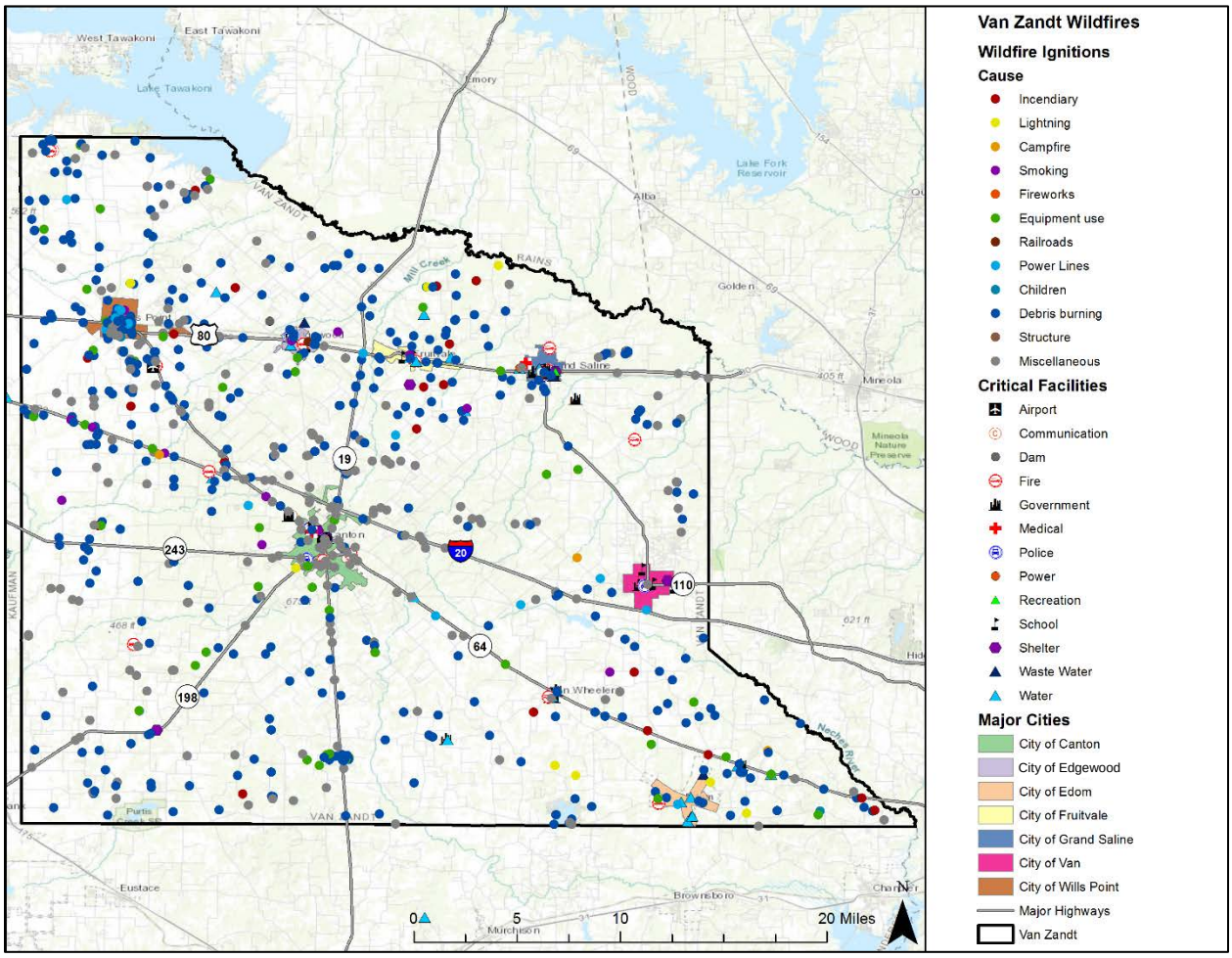


Table 13-1. Historical Wildfire Events Summary

JURISDICTION	NUMBER OF EVENTS	ACRES BURNED
Van Zandt County	1,345	11,028
City of Canton	181	500
City of Edgewood	44	602
City of Edom	4	23
City of Fruitvale	57	215
City of Grand Saline	8	86
City of Van	2	18
City of Wills Point	182	728

Table 13-2. Acreage of Suppressed Wildfire by Year

JURISDICTION	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Van Zandt County	413	1,286	1,255	843	1,234	454	3,319	523	621	427	653
City of Canton	0	0	0	22	0	99	212	52	46	56	13
City of Edgewood	0	0	0	0	2	14	586	0	0	0	0
City of Edom	0	0	0	0	3	10	0	10	0	0	0
City of Fruitvale	0	0	0	0	0	34	79	35	18	44	5
City of Grand Saline	0	1	0	0	0	10	23	27	0	0	25
City of Van	0	0	10	0	0	0	0	8	0	0	0
City of Wills Point	0	97	56	95	24	118	155	33	147	3	0

Significant Events

August 21, 2011 – Van Zandt County

A small fire on CR 1110, between Grand Saline and Canton, burned a barn, a shed, and some abandoned vehicles. The fire was likely started by fireworks.

September 28-30, 2015 – Van Zandt County

On September 28th, multiple departments were dispatched to a grass fire south of Wills Point, between FM47 and CR3918. The fire was reportedly triggered when workers in the area were clearing a portion of the land and brush got into old fencing or metal, creating sparks. This fire damaged or destroyed over 200 acres, and threatened homes, but no homes were damaged.

Probability of Future Events

Wildfires can occur at any time of the year. As the jurisdictions within the county move into wildland, the potential area of occurrence of wildfire increases. With 1,823 events in an 11 year period, an event within Van Zandt County, including all participating jurisdictions, is highly likely, meaning an event is probable within the next year.

Vulnerability and Impact

Periods of drought, dry conditions, high temperatures, and low humidity are factors that contribute to the occurrence of a wildfire event. Areas along railroads and people whose homes are in woodland settings have an increased risk of being affected by wildfire.

The heavily populated, urban areas of Van Zandt County are not likely to experience large, sweeping fires. Areas in the unincorporated areas of Van Zandt County are vulnerable, including rural areas along Interstate 20 southeast of Wentworth, Highway 19 between Canton and Walton. 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 mostly along the perimeter of the study area where

wildland and urban areas interface. Figures 13-1 through 13-8 illustrate the areas that are the most vulnerable to wildfire throughout the planning area.

The following critical facilities are located in the WUI and are more susceptible to wildfire in each participating jurisdiction:

Table 13-3. Critical Facilities Located in WUI by Jurisdiction

JURISDICTION	CRITICAL FACILITIES
Van Zandt County	12 Government Facilities,8 Water/Wastewater Facilities, 3 Communications Towers, 5 Fire Stations, 1 Hospital, 1 Airport
City of Canton	1 Fire Station, 1 Police Station, 1 County Jail, 2 Government Facilities
City of Edgewood	1 Fire Station, 1 School, 2 Water/Wastewater Facilities, 1 Dam
City of Edom	3 Pump Stations
City of Fruitvale	1 Fire Station, 1 ISD with 3 Schools, 4 Pump Stations, 1 Disaster Relief Center
City of Grand Saline	2 Fire Stations, 1 Water/Wastewater Facility, 1 Animal Shelter, 1 Shelter
City of Van	1 Government Facility, 2 Schools
City of Wills Point	2 Government Facilities, 1 Fire Station, 1 School, 1 Airport

Within Van Zandt County, a total of 1,823 fire events were reported from 2005 to 2015. All of these events were suspected wildfires. Historic loss and annualized estimates due to wildfires are presented in Table 13-4 below. The frequency is approximately 166 events every year.

Table 13-4. Potential Annualized Losses by Jurisdiction[3]

JURISDICTION	ACRES BURNED	ANNUAL ACRE LOSSES
Van Zandt County	11,028	1002.5
City of Canton	500	45.5
City of Edgewood	602	54.7
City of Edom	23	2.1
City of Fruitvale	215	19.5
City of Grand Saline	86	7.8
City of Van	18	1.6
City of Wills Point	728	66.2
Planning Area	**13,200**	**1,200**

[3] Events divided by 11 years of data.

Figures 13-19 through 13-26 show Van Zandt County and the threat of wildfire to the County and all participating jurisdictions.

Figure 13-19. Wildfire Ignition Density – Van Zandt County

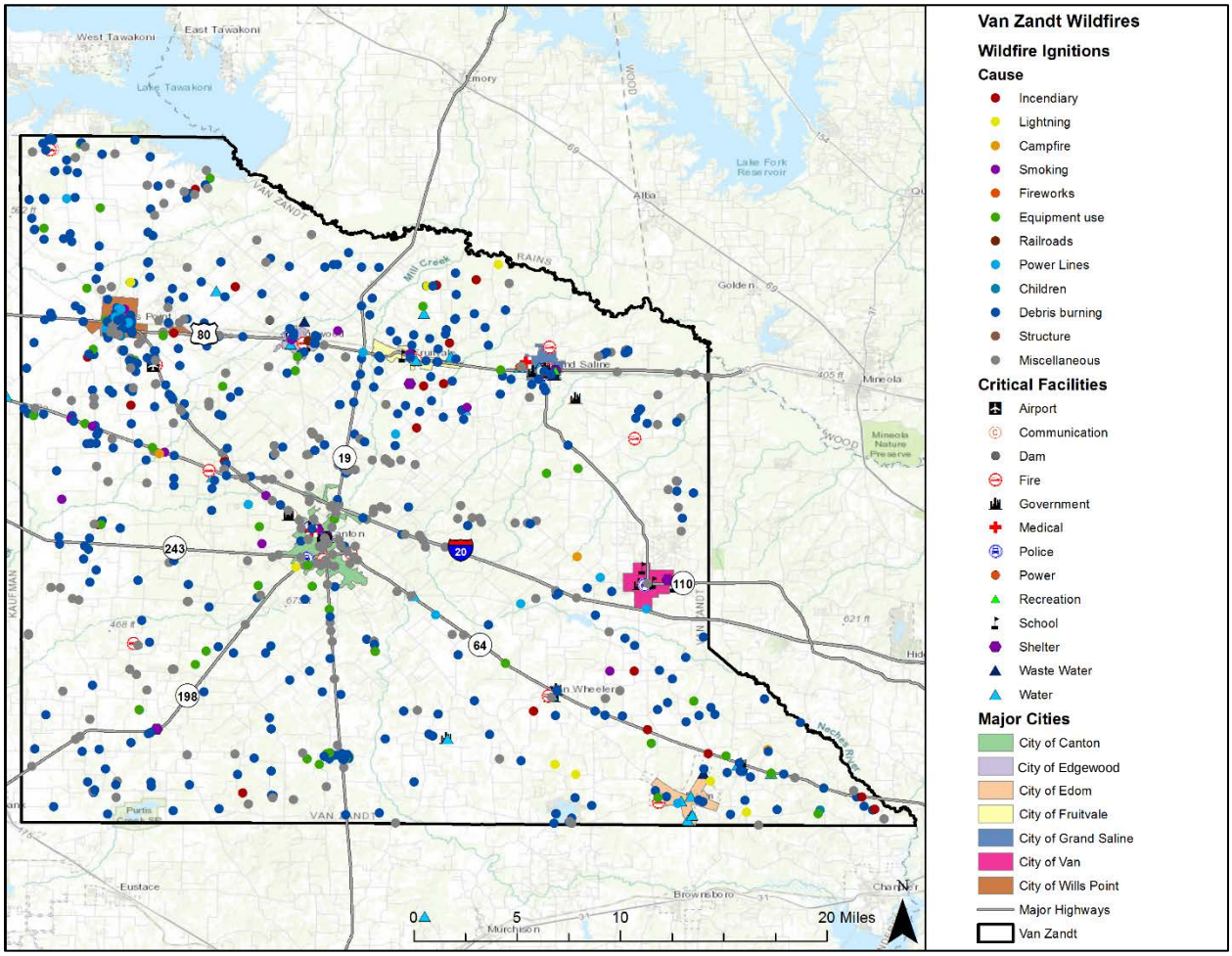


Figure 13-20. Wildfire Ignition Density – City of Canton

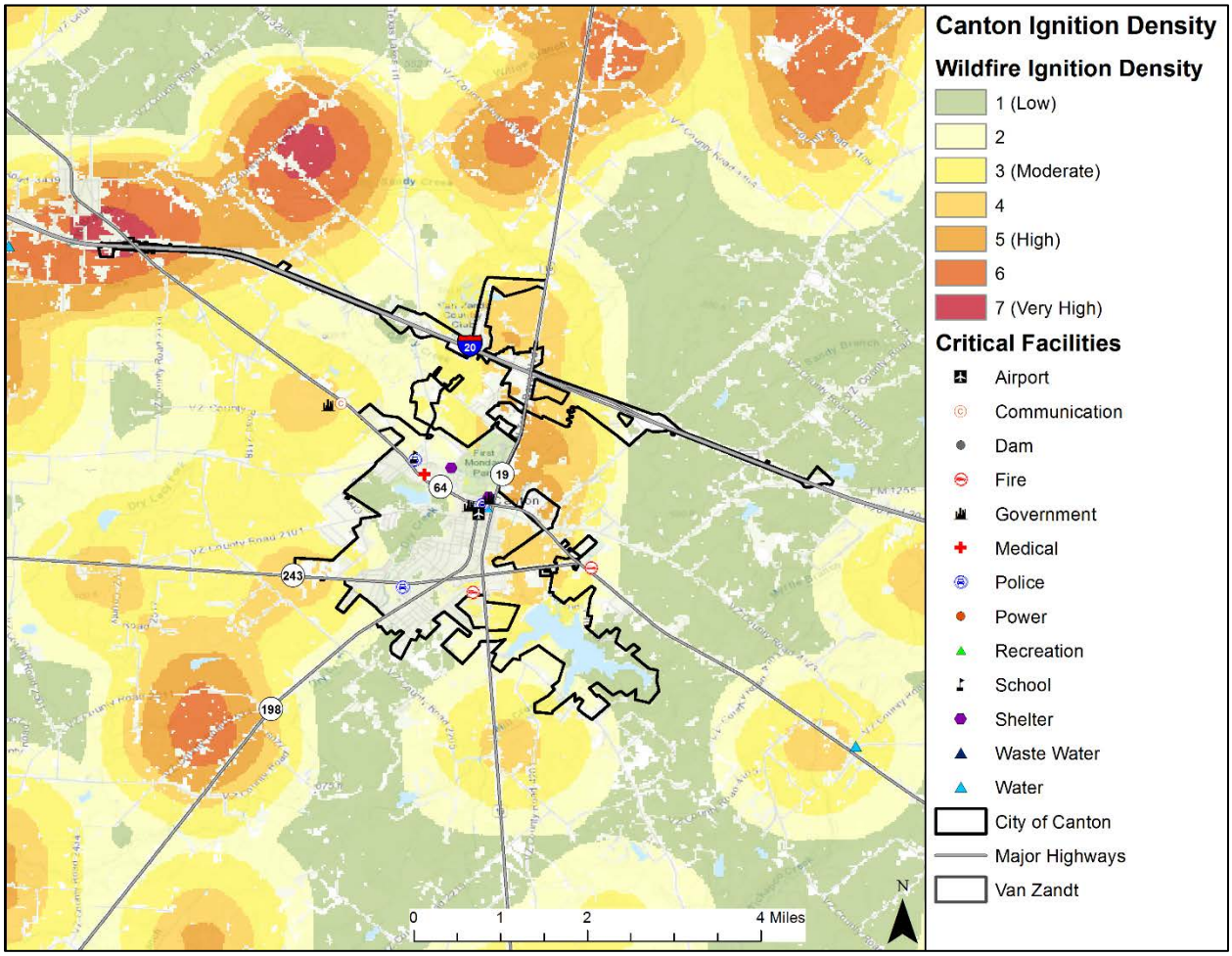


Figure 13-21. Wildfire Ignition Density – City of Edgewood

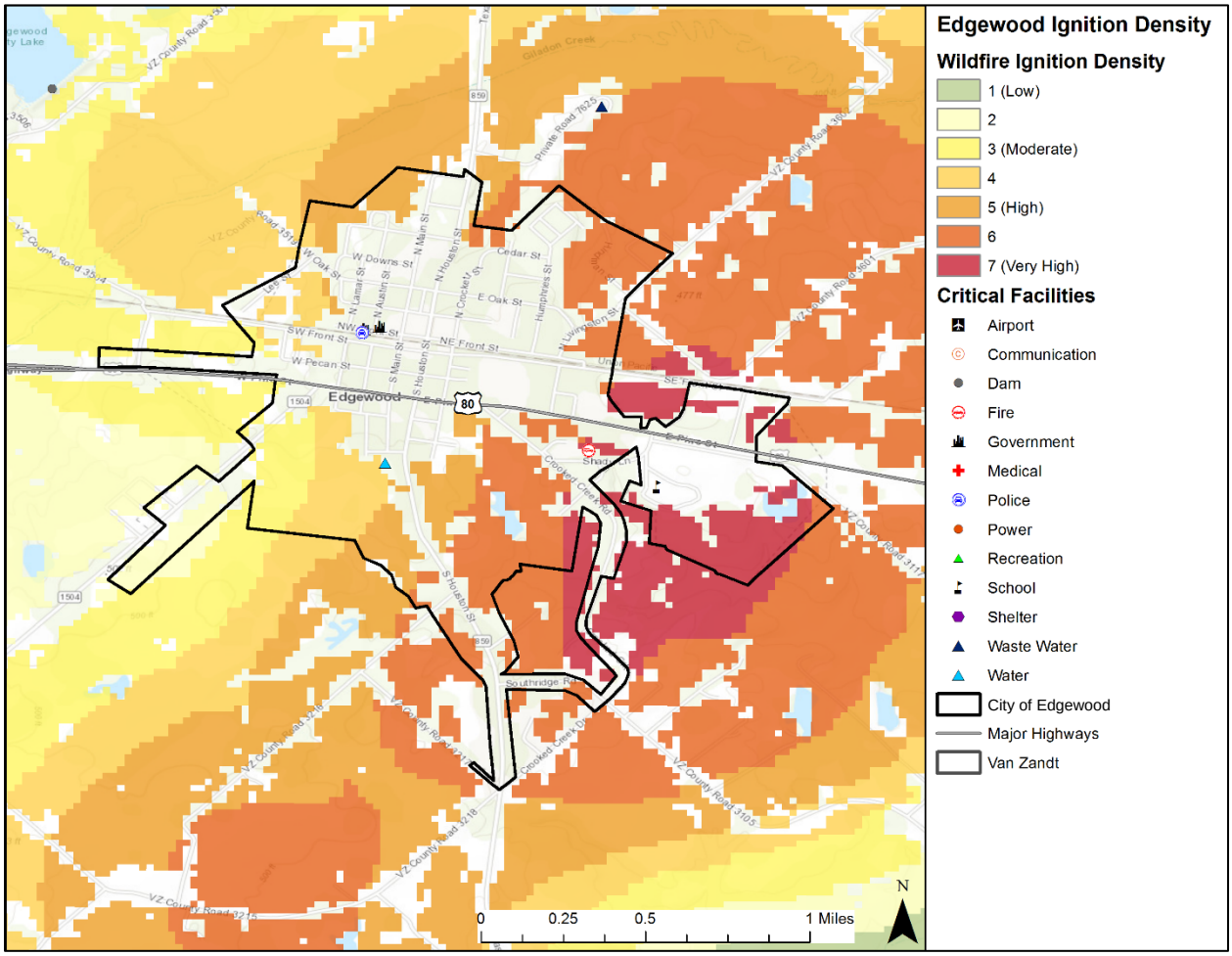


Figure 13-22. Wildfire Ignition Density – City of Edom

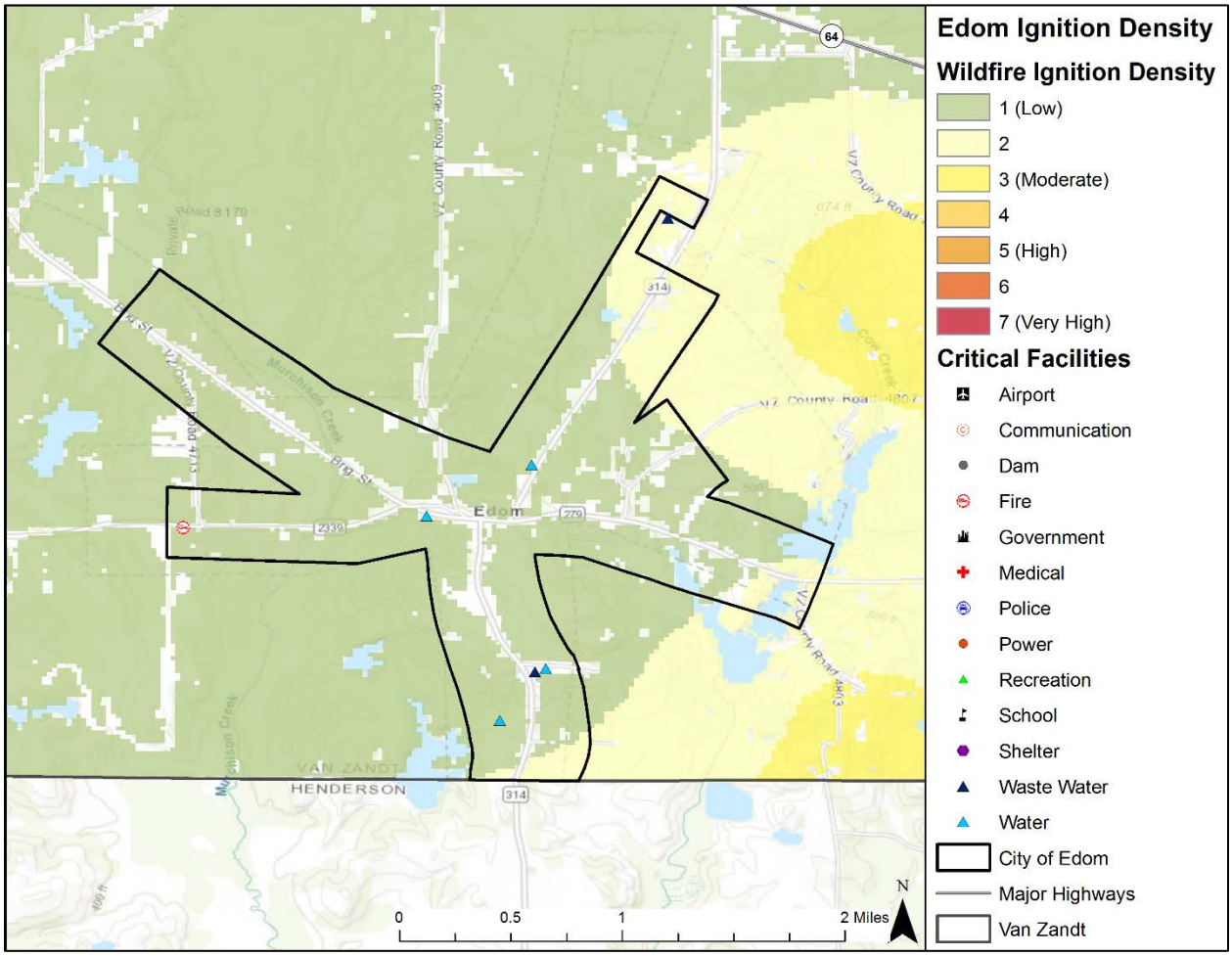


Figure 13-23. Wildfire Ignition Density – City of Fruitvale

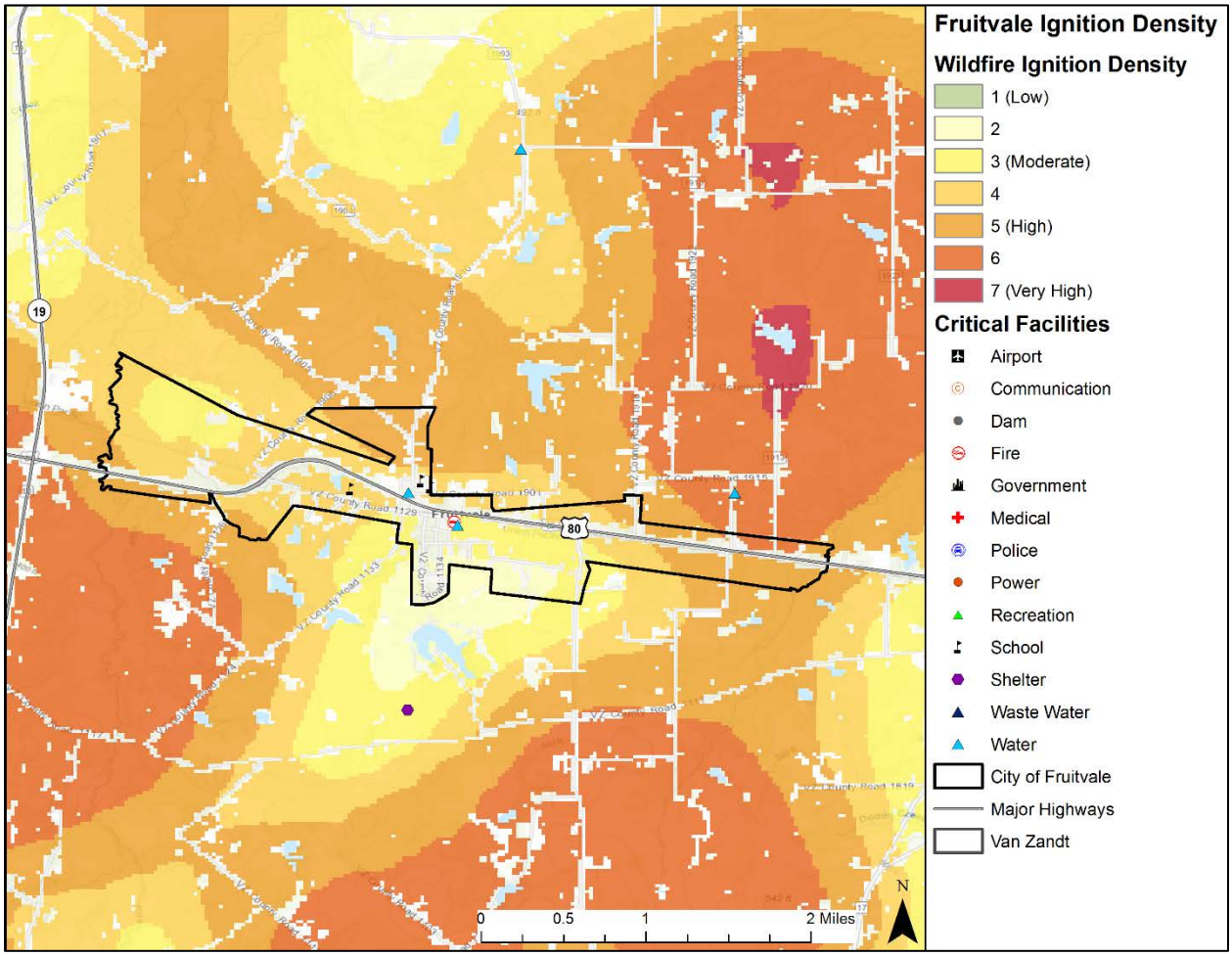


Figure 13-24. Wildfire Ignition Density – City of Grand Saline

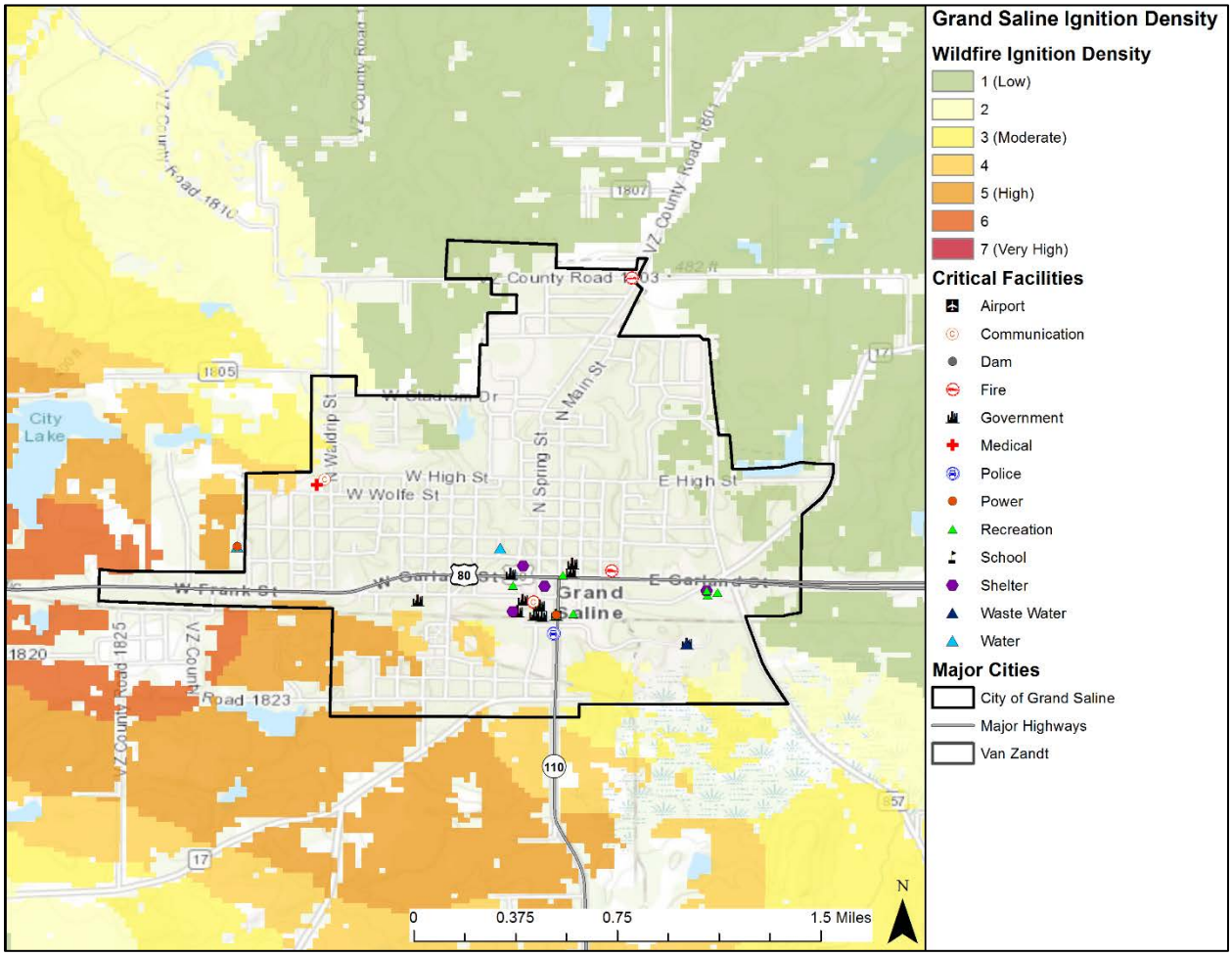


Figure 13-25. Wildfire Ignition Density – City of Van

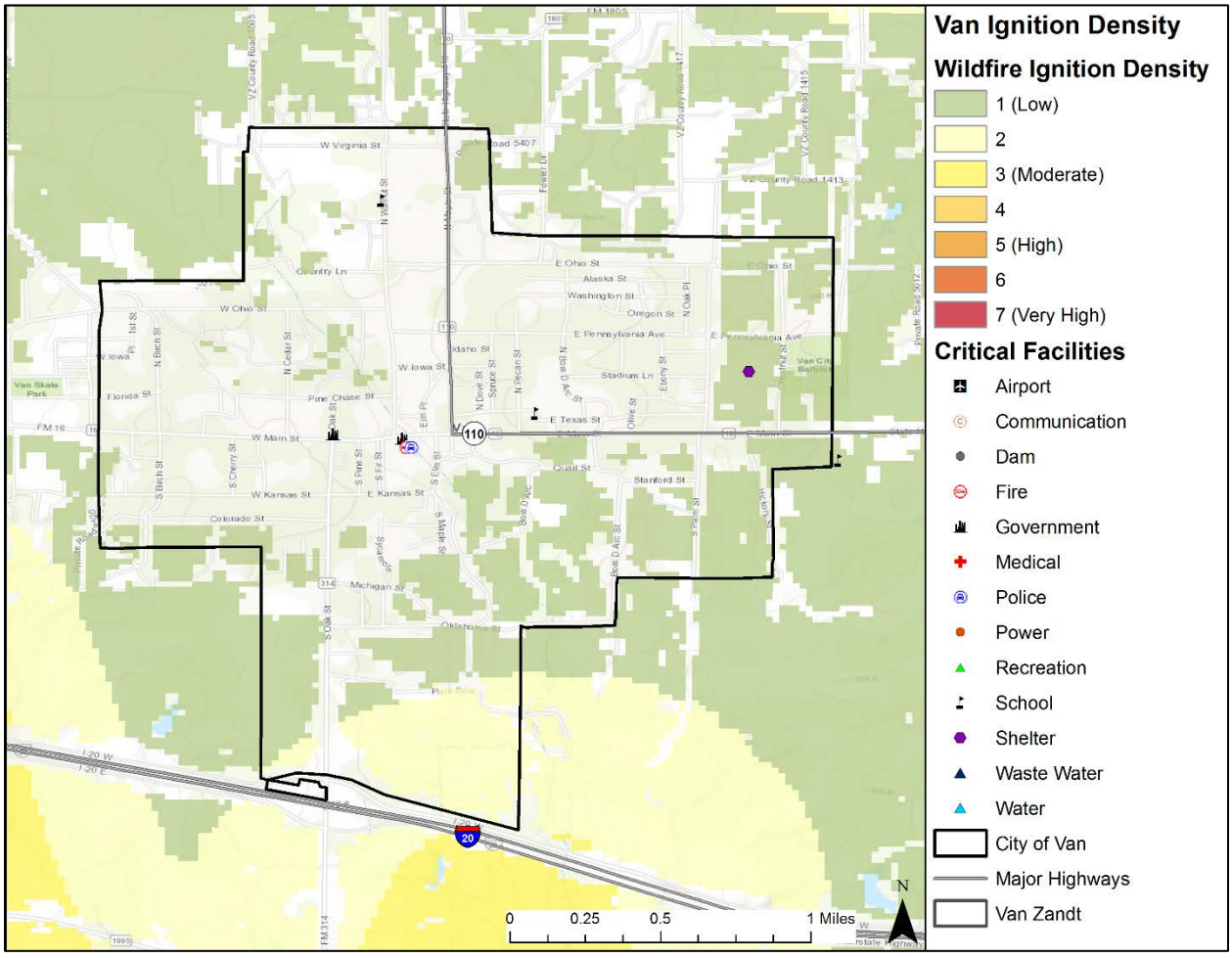
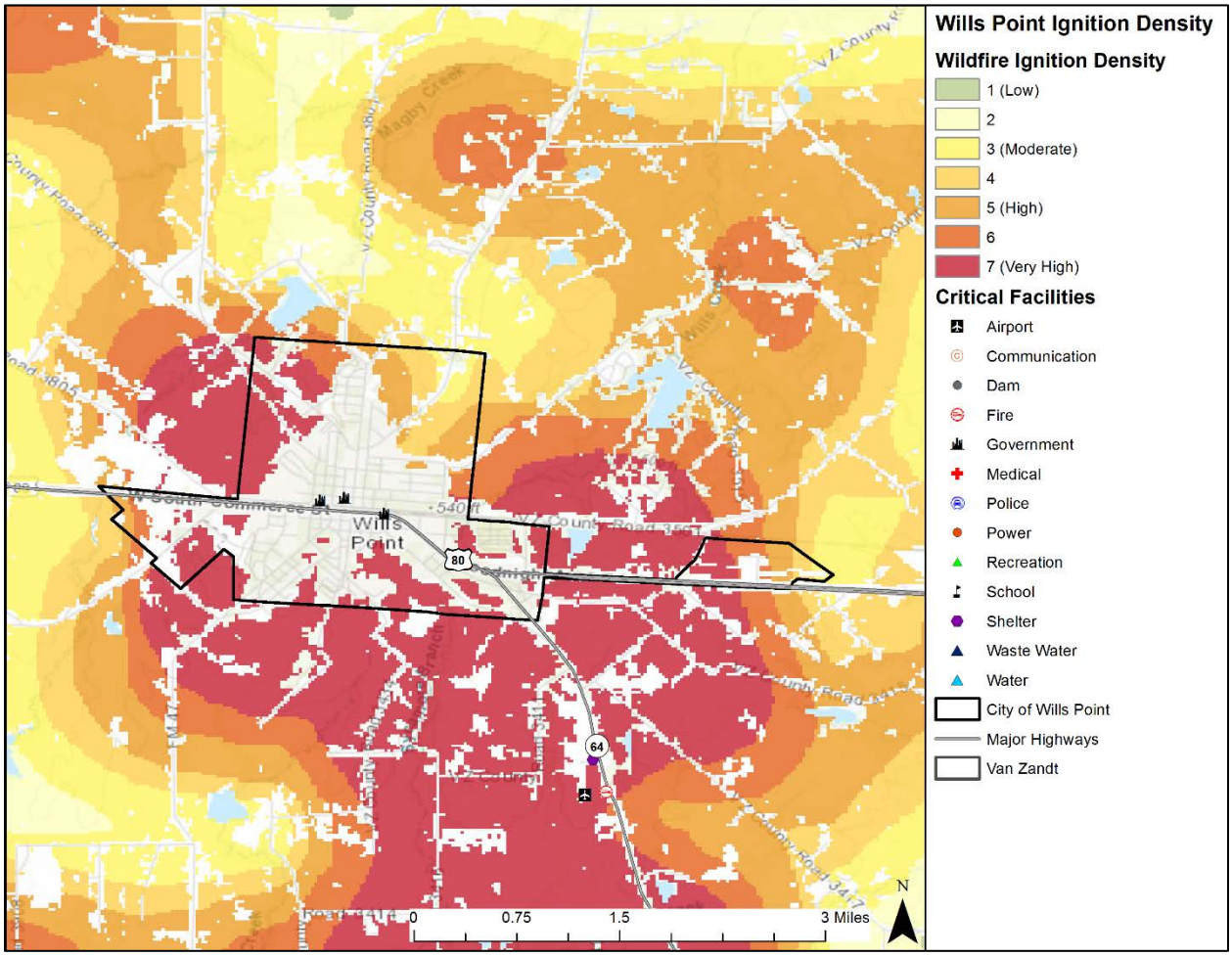


Figure 13-26. Wildfire Ignition Density – City of Wills Point



Diminished air quality is an environmental impact that can result from a wildfire event and pose a potential health risk. The smoke plumes from wildfires can contain potentially inhalable carcinogenic matter. 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.

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 severity of impact from major wildfire events can be substantial. Such events can cause multiple deaths, shut down facilities for 30 days or more, and cause more than 50 percent of affected properties to be destroyed or suffer major damage. Severity of impact is gauged by acreage burned, homes and structures lost, and the number of resulting injuries and fatalities.

For the Van Zandt County planning area, the impact from a wildfire event can be considered “Limited," meaning injuries and/or illnesses are treatable with first aid, shutdown of facilities and services for 24 hours or less, and less than 10 percent of property is destroyed or with major damage. Severity of

impact is gauged by acreage burned, homes and structures lost, injuries and fatalities. Based on this, impact for each participating jurisdiction is listed below in Table 13-5.

Table 13-5. Impact by Jurisdiction

JURISDICTION	IMPACT	DESCRIPTION
Van Zandt County	Minor	Van Zandt County has an estimated 46,889 people or 90.2 percent of the total population that live within the Wildland Urban Interface (WUI). Van Zandt County, including citizens in unincorporated areas, could be injured or suffer illnesses, but not permanent disability. Critical facilities could be shut down for a week, and 10 percent of total property could be damaged.
City of Canton	Minor	The largest population in the City of Canton live in an area that is semi-dense (1-3 houses per 1 acre) in the WUI, and the City has a low to moderate wildfire threat. Citizens could be injured or suffer illnesses, but not permanent disability. Critical facilities could be shut down for a week, and 10 percent of total property could be damaged.
City of Edgewood	Minor	The largest population in the City of Edgewood live in an area that is semi-dense (1-3 houses per 1 acre) in the WUI, and the City has a low to moderate wildfire threat. Citizens could be injured or suffer illnesses, but not permanent disability. Critical facilities could be shut down for a week, and 10 percent of total property could be damaged.
City of Edom	Minor	The largest population in the City of Edom live in an area that is mostly rural (1 house every 5 to 10 acres) in the WUI, and the City has a low to moderate wildfire threat. Citizens could be injured or suffer illnesses, but not permanent disability. Critical facilities could be shut down for a week, and 10 percent of total property could be damaged.
City of Fruitvale	Minor	The largest population in the City of Fruitvale live in an area that is mostly rural (1 house every 2 to 5 acres) in the WUI, and the City has a low to moderate wildfire threat. Citizens could be injured or suffer illnesses, but not permanent disability. Critical facilities could be shut down for a week, and 10 percent of total property could be damaged.
City of Grand Saline	Limited	The largest population in the City of Grand Saline live in an area that is semi-rural (1 to 3 houses per 1 acre) in the WUI, and the City has a low wildfire threat. Citizens could suffer injuries treatable with first aid. Critical facilities could be shut down for 24 hours or less, and less than 10 percent of total property could be damaged.

JURISDICTION	IMPACT	DESCRIPTION
City of Van	Limited	The largest population in the City of Van live in an area that is semi-rural (1 to 3 houses per 1 acre) in the WUI, and the City has a low wildfire threat. Citizens could suffer injuries treatable with first aid. Critical facilities could be shut down for 24 hours or less, and less than 10 percent of total property could be damaged.
City of Wills Point	Minor	The largest population in the City of Wills Point live in an area that is semi-dense (1-3 houses per 1 acre) in the WUI, and the City has a low to moderate wildfire threat. Citizens could be injured or suffer illnesses, but not permanent disability. Critical facilities could be shut down for a week, and 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 a wildfire are not limited to the direct damages. Potential impacts for the planning area include:

- Persons 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 since they are 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 city and/or county 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, further slowing economic recovery.
- Roadways in or near the WUI could be damaged or closed due to smoke and limited visibility.
- Older homes are generally exempt from modern building code requirements, which may require fire suppression equipment in the structure.
- 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.
- Wildfires can cause erosion, degrading stream water quality.
- 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.

- Vegetated dunes can be stripped, significantly damaging the function of the dunes to protect inland areas from the destructive forces of wind and waves.
- 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 a wildfire may not be rebuilt for years, reducing the tax base for the community.
- At locations like the Purtis Creek Lake and State Park and other area lakes such as Rhine and Callendar Lake, recreation and tourism can be unappealing for years following a large wildfire, devastating directly related businesses.
- 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 government, businesses, and citizens will contribute to the overall economic and financial conditions in the aftermath of a wildfire event.

Section 14: Dam Failure

Portions of the Van Zandt County Hazard Mitigation Plan are considered confidential and not for release to the public. The information in this section is covered under Privacy Act of 1974 (5 U.S.C. Section 552a).

Section 15: Expansive Soils

HAZARD DESCRIPTION

Expansive soils are soils and soft rocks with a relatively high percentage of clay minerals that are subject to changes in volume as they swell and shrink with changing moisture conditions. Drought conditions can cause soils to contract in response to a loss of soil moisture.

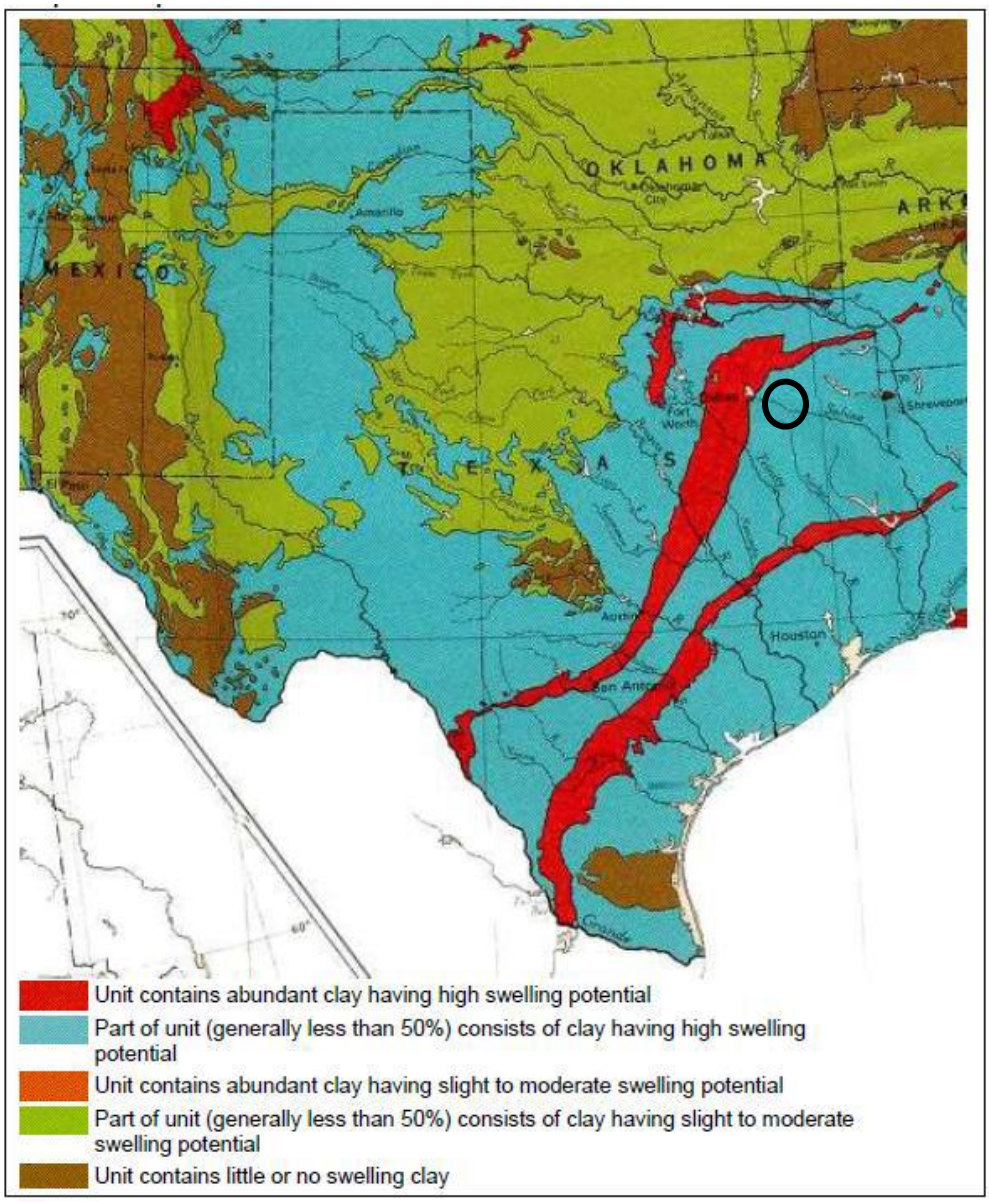
Expansive soils contain minerals such as smectite clays that are capable of absorbing water. When these clays absorb water they increase in volume and expand. Expansions in soil of 10 percent or more are not uncommon in the Van Zandt County planning area. The change in soil volume and resulting expansion can exert enough force on a building or other structure to cause damage.

Expansive soils will also lose volume and shrink when they dry. A reduction in soil volume can affect the support to buildings or other structures and result in damage. Fissures in the soil can also develop and facilitate the deep penetration of water when moist conditions or runoff occurs. This produces a cycle of shrinkage and swelling that places repetitive stress on structures.

LOCATION

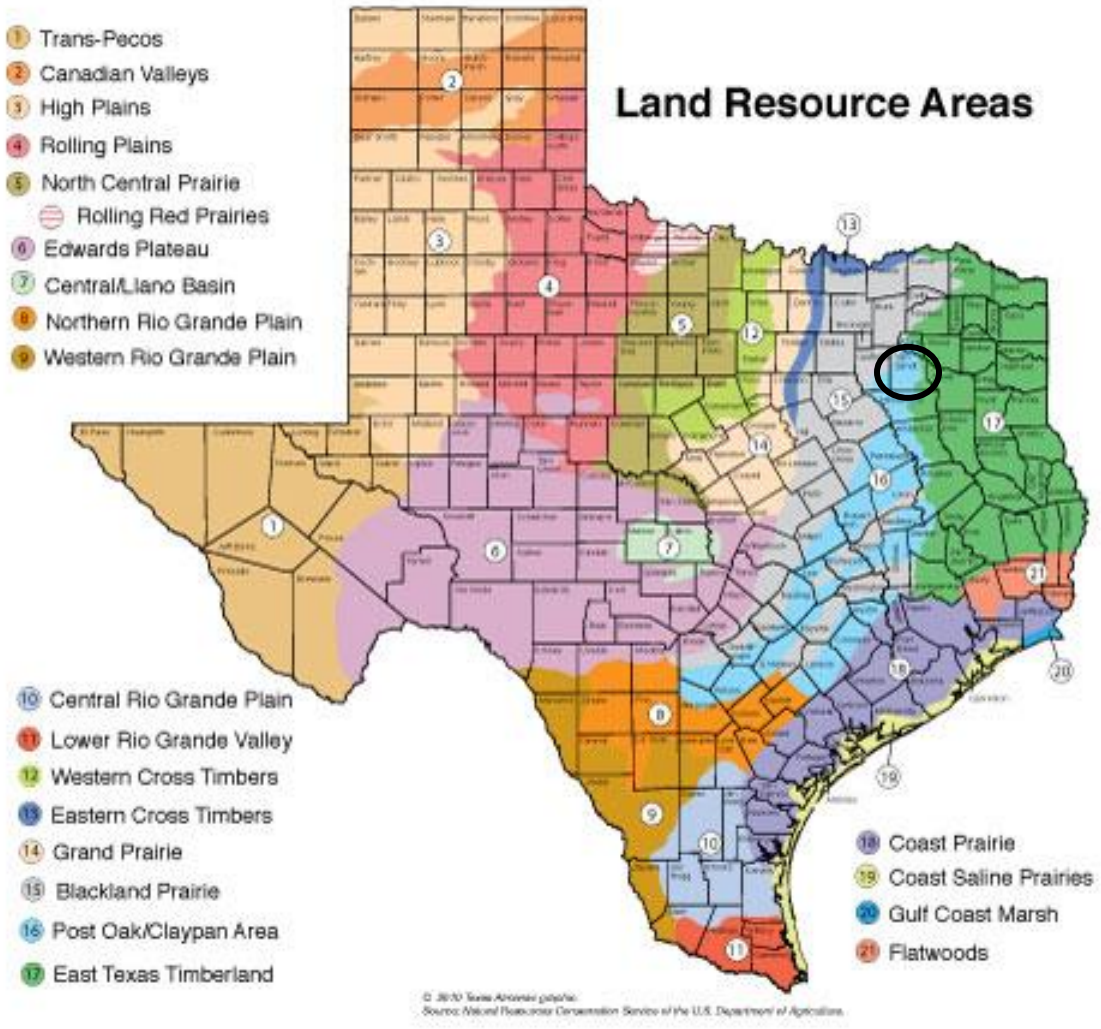
Van Zandt County, including all participating jurisdictions, may be affected by some degree of expansive soils. Figure 15-1 depicts expansive soils across the State of Texas and the Van Zandt Planning Area is identified within the black circle. These areas receive the most moisture and are also vulnerable to droughts, which can cause the soils to expand and contract. Figure 15-2 depicts the types of land resources in the State of Texas due to their soil types.

Figure 15-1. Texas Geological Survey[1]



[1] Source: United States Geological Survey, http://www.usgs.gov

Figure 15-2. Texas Geological Survey[2]



The Van Zandt County planning area, including and all participating jurisdictions, is located within the Post Oak/Claypan Area and the East Texas Timberland area, as identified within the black circle in Figure 15-2. The entire planning area is located in an area affected by slight to moderate expansive soils.

Post Oak/Claypan Area: The Claypan Area consists of about 6.1 million acres in east-central Texas just east of the Blackland Prairie. The landscape is a gently undulating to rolling, moderately dissected woodland also known as the Post Oak Belt or Post Oak Savannah. Surface drainage is moderate. Upland soils commonly have a thin, light-colored, acid sandy loam surface layer over dense, mottled red, yellow, and gray claypan subsoils. Some deep, sandy soils with less clayey subsoils exist. Bottomlands are deep, highly fertile, reddish-brown to dark-gray loamy to clayey soils. Land use is mainly rangeland. Some areas are in improved pastures. Most cropland is in bottomlands that are protected from flooding. Major crops are cotton, grain sorghums, corn, hay, and forage crops, most of which are irrigated. Brush control on rangeland and irrigation water management on cropland are the

[2] Source: USDA, http://www.nrcs.usda.gov

major soil-management problems. Water erosion is a serious problem on the highly erosive claypan soils, especially where they are overgrazed.

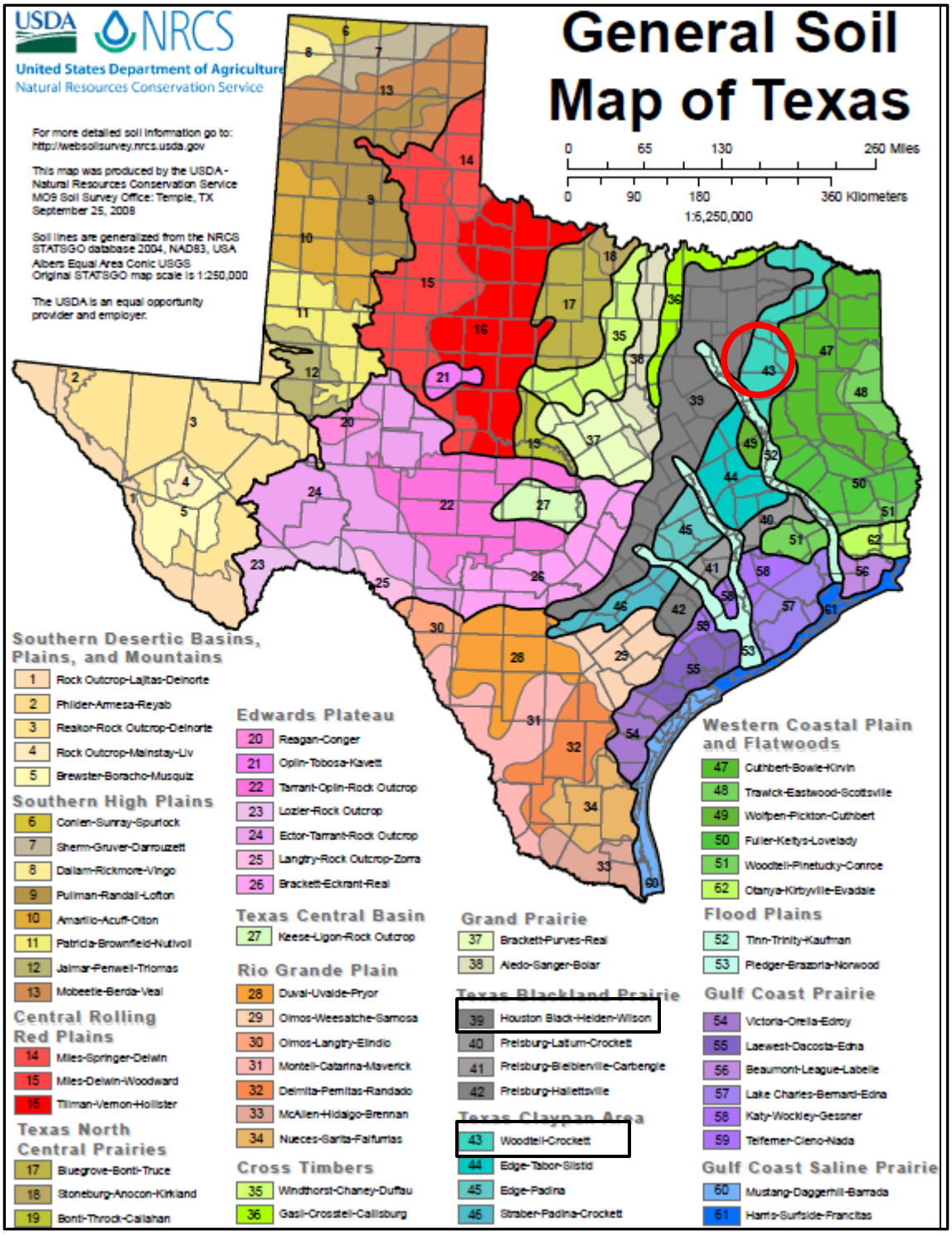
East Texas Timberland Area: The East Texas Timberlands area comprises about 16.1 million acres of the forested eastern part of the state. The land is gently undulating to hilly and well dissected by many streams. Surface drainage is moderate to rapid. This area has many kinds of upland soils but most are deep, light-colored, acid sands and loams over loamy and clayey subsoils. Deep sands are in scattered areas, and red clays are in areas of "redlands." Bottomland soils are mostly brown to dark-gray, acid loams and some clays. The land is used mostly for growing commercial pine timber and for woodland grazing. Improved pastures are scattered throughout and are used for grazing beef and dairy cattle and for hay production. Some commercial hardwoods are in the bottomlands. Woodland management problems include seedling survival, invasion of hardwoods in pine stands, effects of logging on water quality, and control of the southern pine beetle. Lime and fertilizers are necessary for productive cropland and pastures.

EXTENT

The extent to which soil expansion is present in an area can be determined using the predominant soil composition and associated permeability. The soil survey was developed by the USDA Soils Conservation Service and contains information that can be applied in determining the suitability of soils in the planning area when selecting sites for roads, structures, and infrastructure.[3] Figure 15-3 shows the predominant soil types throughout the state of Texas and the planning area.

[3] Source: United States Department of Agriculture Soil Conservation Service

Figure 15-3. USDA General Soil Map of Texas



The grey area marked as #39 indicates predominant soils including Houston Black, Heiden, and Wilson. The teal area marked as #43 indicates predominant soils including Woodtell and Crockett. The Van Zandt County Soil Survey provides a description of these predominant soils along with the plasticity index of each. Higher plasticity index soils exhibit greater sensitivity to drought conditions. The shrinking and swelling causes significant problems with foundations, roadways, sidewalks and

other structures and infrastructure. Table 15-1 includes the plasticity index value ranges and soil properties while Table 15-2 includes additional descriptions of the soil types predominant throughout the planning area with the assigned plasticity index per soil type by area as identified in Figure 15-3. The predominant soil types for each area can vary greatly from one plat to the next.

The Plasticity Index is provided for each type of soil within the planning area. However, without a detailed soil survey map of the area, it is not possible to differentiate the plasticity index from one jurisdiction to the next. The plasticity index ranges are provided on a county-wide basis for each predominant soil type. This data deficiency is addressed in the mitigation actions in Section 19 of this plan. The plasticity index for each soil type as well as the descriptions provided in the tables below represent a summary of the data provided in the USDA Soil Survey of Van Zandt County.[4]

Table 15-1. Value and Plasticity Index of Soils

PLASTICITY INDEX	SWELLING POTENTIAL
0-18	Low
18-22	Medium
22-35	High
>35	Very High

Table 15-2. Van Zandt County Soil Description by Area and Plasticity Index of Soils

AREA	SOILS	DESCRIPTION	PLASTICITY INDEX	POTENTIAL EXPANSION/EXTENT LEVEL
39	Houston Black-Heiden-Wilson	Houston Black series soil consists of very deep, moderately well drained, very slowly permeable soil. These nearly level to moderately sloping soils occur on interfluves and side slopes on upland This predominant soil type is typically suitable for crops. Heiden series soil consists of deep and very deep to mudstone, well drained, very slowly permeable soils. These nearly level to moderately steep soils occur on footslopes of base slopes, shoulders of interfluves, and backslopes of side slopes of ridges on dissected plains. This predominant soil type is typically	11-20; 25-37; 24-40	Low, Medium, High, Very High

[4] USDA Soil Survey of Van Zandt County, 1976, website: https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/texas/taylorTX1976/taylor.pdf

AREA	SOILS	DESCRIPTION	PLASTICITY INDEX	POTENTIAL EXPANSION/EXTENT LEVEL
		suitable for livestock grazing and hay production. Wilson series soil consists of very deep, moderately well drained, very slowly permeable soils. These nearly level to gently sloping soils are on treads of Pleistocene stream terraces. This predominant soil type is typically suitable for crops.		
43	Woodtell-Crockett	Woodtell series soil consists of soils that are deep to stratified loamy and clayey residuum derived from sandstone and shale. They are well drained and very slowly permeable. These soils are gently sloping to moderately steep which occur on interfluves and side slopes of ridges on inland dissected coastal plains. This predominant soil type is typically suitable for rangeland. Crockett series soils consists of soils that are deep to weathered shale of Cretaceous age. They are moderately well drained, and very slowly permeable. These soils are on broad ridges on the dissected plains. These nearly level to moderately sloping soils formed in alkaline residuum derived from interbedded shale and clay. This predominant soil type is typically suitable for crops.	3-15; 23-45; 15-45	Low, Medium High, Very High

High plasticity soils are prone to shrink and swell as soil moisture changes, which can degrade pavement, causing longitudinal cracking and edge drop-off. This effect can damage foundations of buildings and homes. The Van Zandt County planning area is subject to a range of plasticity Index levels including low, high, and very high, as indicated by the soils in Figure 15-3, and Tables 15-1 through 15-2 above. Plasticity of soils are highly subject to location and soil moisture content in any given time frame and location. Due to the broad plasticity index range throughout the Van Zandt planning area, the worst the entire planning area may anticipate is very high swelling potential.

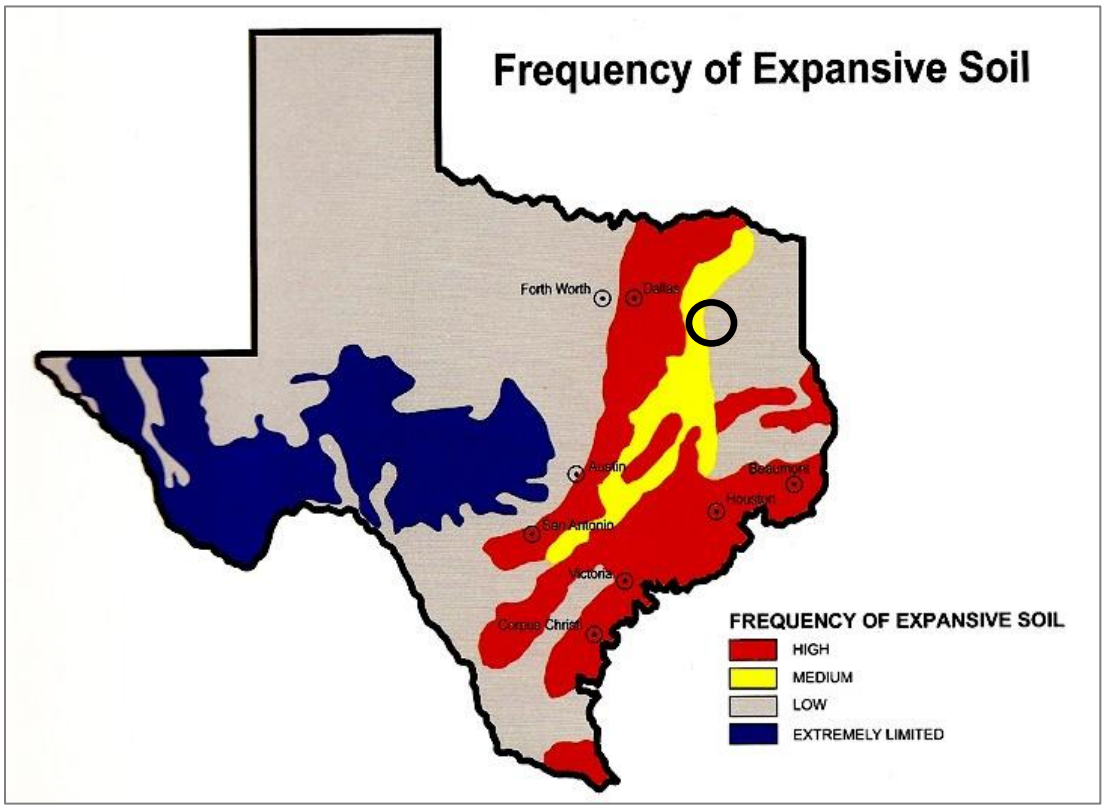
Historical Occurrences

Expansive soils is a condition that is native to Texas soil characteristics and cannot be documented as a time-specific event, except when it leads to structural and infrastructure damage. Extreme conditions can damage roads, structures, and infrastructure, including projects still under construction. Damages from expansive soils are typically associated with droughts. The limited data for historical expansive soil incidents is noted as a data deficiency for this planning cycle.

Probability of Future Events

Since no records of specific incidences of loss associated with expansive soils were found, and no specific occurrences of expansive soils were identified within the planning area, the probability of future events cannot be determined at this time. However, according to public opinion and team input, the probability of future events of loss due to expansive soils within the planning area, is highly likely, especially when periods of drought increase throughout the planning area. The Van Zandt County planning area, including all participating jurisdictions, is shown in the black circle and is subject to a range of frequency of expansive soils, with a maximum "medium" frequency. Though the frequency is considered low to medium expansive soils in Figure 15-4; highly likely is defined as one episode per year; therefore for the sake of mitigation planning in this plan highly likely is the probability of expansive soils in the planning area.

Figure 15-4. Frequency of Expansive Soils



VULNERABILITY AND IMPACT

The effects of expansive soils are most prevalent when periods of moderate to high precipitation are followed by drought and then again by periods of rainfall. Other cases of damage result from increases in moisture volume from such sources as broken or leaking water and sewer lines. Dry clays are capable of absorbing water and will increase in volume in an amount proportional to the amount of water absorbed. Soils capable of changes in volume present a hazard to structures built over them and to the pipelines buried in them. Houses and one-story commercial buildings are more apt to be damaged by the expansion of swelling clays than are multi-story buildings, which are usually heavy enough to counter swelling pressures. However, if constructed on wet clay, multi-story buildings may also be damaged by clay shrinkage when moisture levels are substantially reduced.

Cracked foundations and floors, jammed windows and doors, and ruptured pipelines are typical types of damage resulting from swelling soils. Damage to the upper floors of larger buildings can occur when motion in the structure is significant. While all infrastructure within the Van Zandt County planning area, including all participating jurisdictions, is vulnerable, slab on grade structures are more likely to suffer damages from expansive soils. In addition, older structures built to less stringent building codes may also be more susceptible to damages than new construction.

While the number of slab on grade structures is not available, the U.S. Census data indicates approximately 9,881 of the residential structures in the planning area were built before 1980 (Table 15-3) and may be more susceptible to damages.

Table 15-3. Structures at Greater Risk by Jurisdiction

JURISDICTION	SFR STRUCTURES BUILT BEFORE 1980
Van Zandt	9,881
City of Canton	1,031
City of Edgewood	559
City of Edom	70
City of Fruitvale	80
City of Grand Saline	695
City of Van	738
City of Wills Point	1,021

The following critical facilities would be vulnerable to expansive soils in the planning area by jurisdiction.

Table 15-4. Critical Facilities by Jurisdiction

JURISDICTION	CRITICAL FACILITIES
Van Zandt	15 Government Facilities, 1 Sheriff's Office, 10 Water/Wastewater Facilities, 3 Communications Towers, 6 Fire Stations, 1 Hospital, 1 Airport, 1 Juvenile Detention Facility
City of Canton	1 Fire Station, 1 Police Station, 1 County Jail, 3 Government Facilities, 1 ISD with 4 Schools, 2 Medical Facilities
City of Edgewood	2 Government Facility, 1 Police Station, 1 Fire Station, 5 Water/Wastewater Facilities, 1 Dam
City of Edom	5 Pump Stations, 1 Fire Station
City of Fruitvale	1 Government Facility, 1 Fire Station, 1 ISD with 3 Schools, 4 Pump Stations, 1 Disaster Relief Center
City of Grand Saline	6 Government Facilities, 1 Police Station, 3 Fire Stations, 6 Water/Wastewater Facilities, 1 Animal Shelter, 1 Shelter,
City of Van	2 Government Facilities, 1 Fire Station, 1 Police Station, 3 Schools
City of Wills Point	2 Government Facilities, 1 Police Station, 1 Fire Station, 1 School, 1 EMS, 1 Medical Facility, 1 Airport

The impact of expansive soils ranges from cosmetic cracks in walls to substantial foundation and structural damage that can result in a need for building demolition. Infrastructure such as pipelines can be damaged, causing increased maintenance and repairs, replacement, or damage to the point of failure. Sewer and water lines are also affected by shrink and swell soils. The movement of the soils can snap water and sewer lines, producing a minimum of temporary discomfort, and a maximum of a serious health and welfare risk.

Homeowners and public agencies that assume they cannot afford preventative measures such as more costly foundations and floor systems, often incur the largest percentage of damage and costly repairs from expanding soil. No figures are available for the total damage to homes in the planning area from expansive clays. In the Van Zandt planning area, including all participating jurisdictions, the most extensive damage from expansive soils can occur to bridges, highways, streets, and parking lots. The greatest damage occurs when structures are constructed when clays are dry (such as during a drought) and then subsequent soaking rains swell the clay.

The impact of expansive soils experienced in the Van Zandt County planning area has resulted in no injuries and fatalities, supporting a limited severity of impact meaning injuries and/or illnesses are treatable with first aid, shutdown of facilities and services for 24 hours or less, and less than 10 percent of property is destroyed or with major damage.

Section 16: Earthquake

HAZARD DESCRIPTION

An earthquake is the sudden movement of the Earth's surface cause 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 weaken 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.

Earthquakes' locations are described by their 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 16-1 describes definition of examples.

Table 16-1. 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.

[1] Source: USGS, 2012

HAZARD	DESCRIPTION
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.
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 US Geological Survey from lowest hazard to highest hazard areas. Figure 16-1 shows major earthquake hazard areas. An Earthquake Hazard Map, also known as a Percent Peak Ground Accelerations (%PGA) Map. The map shows the %PGA values with a 2% chance of being exceeded over 50 years. %PGA is an earthquake measurement that displays three things: the geographic area affected (all colored areas on the map), the probability of an earthquake of each given level of severity (2% chance in 50 years), and the strength of ground movement (severity) shown as percent of the acceleration force of gravity (%g) (the PGA is indicated by color). The Van Zandt County Planning Area including the NRPC, Holliday ISD, and all participating jurisdictions, is identified in Table 16-1, is located in a low hazard area of 4-8%g peak ground acceleration.

Figure 16-1. U.S. Map of Peak Ground Acceleration

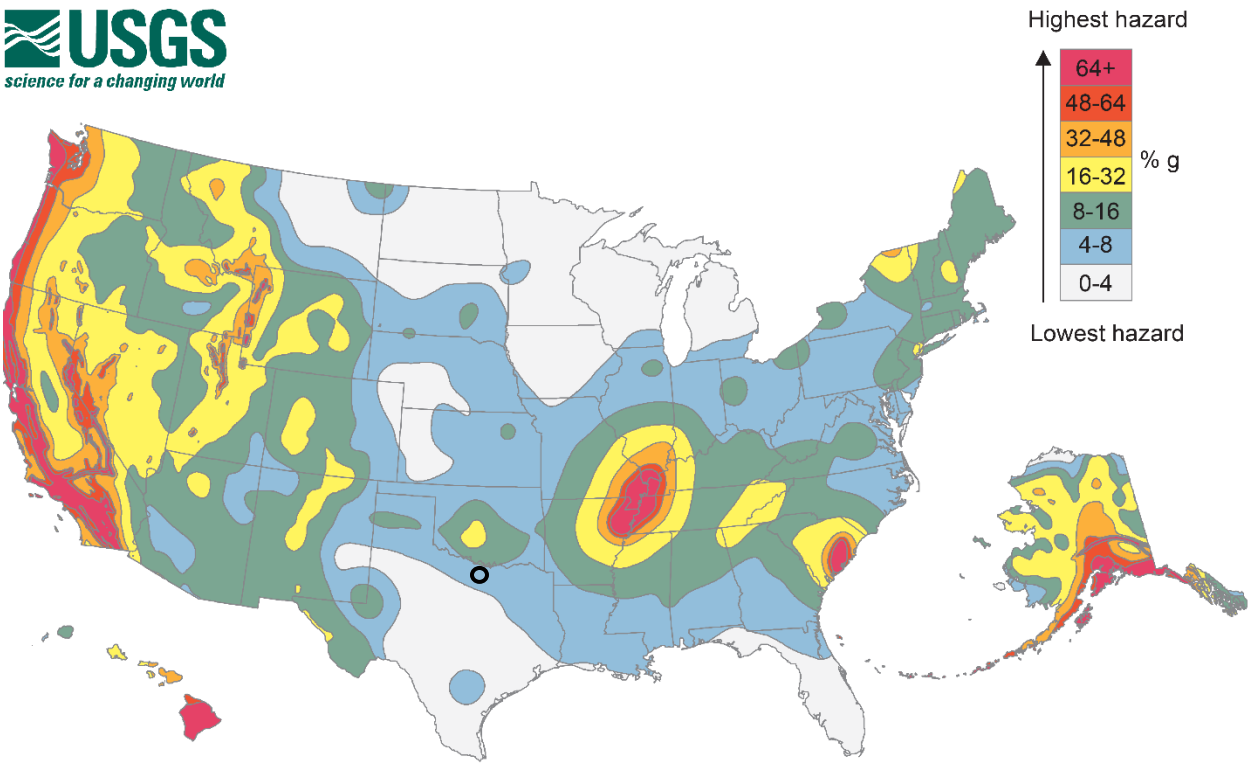
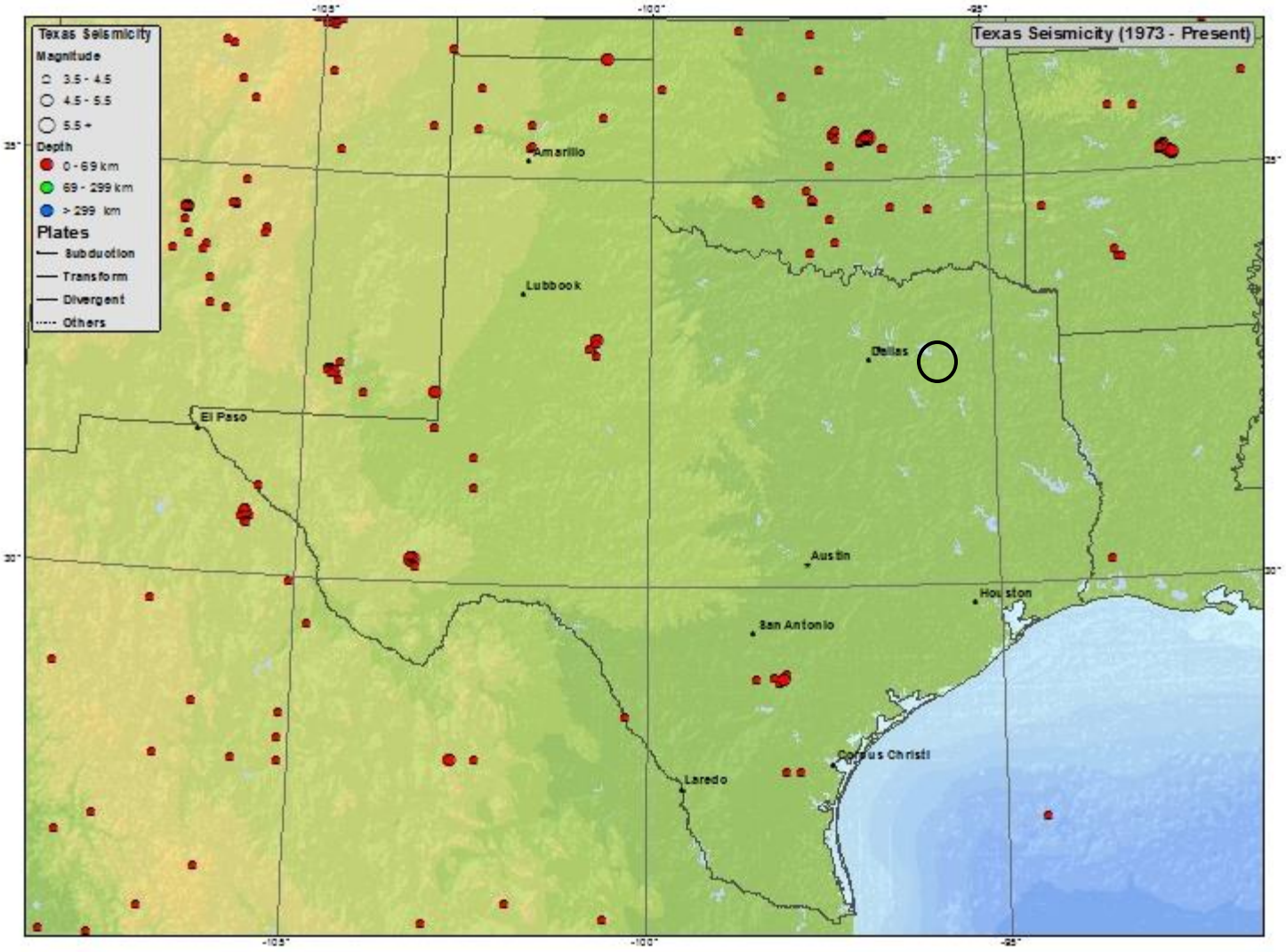


Figure 16-2 maps historic earthquake epicenters across Texas between 1973 and 2012.

Figure 16-2. Historic Earthquake Epicenters in Texas, 1973-2012



EXTENT

The magnitude, or intensity of an earthquake, is a recorded value of the amplitude of seismic waves. The Richter scale is the most commonly used scale that measures the magnitude of earthquakes. It has no upper limit and is not used to describe damage (Table 16-2).

Table 16-2. Richter Scale

RICHTER MAGNITUDES	EARTHQUAKE EFFECTS
2.5 or LESS	Usually not felt, but can be recorded by seismograph
2.5-5.4	Often felt, but only causes minor damage
5.5-6.0	Slight damage to buildings and other structures
6.1 TO 6.9	May cause a lot of damage in very populated areas
7.0 TO 7.9	Major earthquake; serious damage
8 OR GREATER	Great earthquake; can totally destroy communities near the epicenter

The intensity of an earthquake is expressed by the Modified Mercalli Scale, based on the effects of ground shaking on people, buildings, and natural features, and is location dependent. The Modified Mercalli Scale gives the intensity of the earthquake in values ranging from I to XII. Table 16-3 summarizes earthquake intensity as described by the Modified Mercalli Scale and provides a comparison between the Richter and Modified Mercalli Intensity Scales.

Table 16-3. Modified Mercalli Intensity (MMI) Scale

SCALE	INTENSITY	DESCRIPTION OF EFFECTS	CORRESPONDING RICHTER MAGNITUDE
I	INSTRUMENTAL	Not Felt except by a very few under especially favorable conditions	
II	FEEBLE	Felt only by a few persons at rest, especially on upper floors of buildings	< 4.2
III	SLIGHT	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration Estimated	
IV	MODERATE	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors, disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.	

SCALE	INTENSITY	DESCRIPTION OF EFFECTS	CORRESPONDING RICHTER MAGNITUDE
V	SLIGHTLY STRONG	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.	< 4.8
VI	STRONG	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.	< 5.4
VII	VERY STRONG	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken	< 6.1
VIII	DESTRUCTIVE	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned	
IX	RUINOUS	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.	< 6.9
X	DISASTROUS	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.	< 7.3
XI	VERY DISASTROUS	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.	< 8.1
XII	CATASTROPHIC	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.	> 8.1

Table 16-4 lists the Modified Mercalli Intensity (MMI) with the corresponding Acceleration (%g) (PGA), as well as the perceived shaking and potential damage expected.

Table 16-4. Modified Mercalli Intensity (MMI) and PGA Equivalents

MMI	ACCELERATION (%g) (PGA)	PERCEIVED SHAKING	POTENTIAL DAMAGE
I	<.17	Not Felt	None
II	.17-1.4	Weak	None
III	.17-1.4	Weak	None
IV	1.4-3.9	Light	None
V	3.9-9.2	Moderate	Very Light
VI	9.2-18	Strong	Light
VII	18-34	Very Strong	Moderate

Taking into consideration the possible extent of an earthquake for the area, by reviewing Tables 16-2 through 16-4 in conjunction with previous occurrences as depicted in Figure 16-2, Van Zandt County Planning Area, including all participating jurisdictions, experience on average less than 2.5 Richter Scale or Level IV or instrumental impact based on the Modified Mercalli intensity scale. This is the greatest extent the entire planning area can anticipate in the future.

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 Van Zandt 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 Van Zandt County Planning Area, including all participating jurisdictions.

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 Planning Area 5 has a PGA of 0-4%g for earthquakes with a 2-percent probability of occurring within 50 years. Based on historical records, the probability of an earthquake affecting the Van Zandt County Planning Area, including all participating jurisdictions, is unlikely, meaning that an event is probable in the next ten years.

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 Van Zandt County Planning Area, including and all participating jurisdictions.

Table 16-5 includes the critical facilities that would be vulnerable to Earthquake events in each participating jurisdiction:

Table 16-5. Critical Facilities by Jurisdiction

JURISDICTION	CRITICAL FACILITIES
Van Zandt County	15 Government Facilities, 1 Sheriff's Office, 10 Water/Wastewater Facilities, 3 Communications Towers, 6 Fire Stations, 1 Hospital, 1 Airport, 1 Juvenile Detention Facility
City of Canton	1 Fire Station, 1 Police Station, 1 County Jail, 3 Government Facilities, 1 ISD with 4 Schools, 2 Medical Facilities
City of Edgewood	2 Government Facility, 1 Police Station, 1 Fire Station, 5 Water/Wastewater Facilities, 1 Dam
City of Edom	5 Pump Stations, 1 Fire Station
City of Fruitvale	1 Government Facility, 1 Fire Station, 1 ISD with 3 Schools, 4 Pump Stations, 1 Disaster Relief Center
City of Grand Saline	6 Government Facilities, 1 Police Station, 3 Fire Stations, 6 Water/Wastewater Facilities, 1 Animal Shelter, 1 Shelter,
City of Van	2 Government Facilities, 1 Fire Station, 1 Police Station, 3 Schools
City of Wills Point	2 Government Facilities, 1 Police Station, 1 Fire Station, 1 School, 1 EMS, 1 Medical Facility, 1 Airport

With no historical events recorded, annualized loss-estimates for earthquakes are not available; neither is a breakdown of potential dollar losses of critical facilities and infrastructure. The potential severity of impact from an earthquake for the entire Van Zandt County Planning Area, including all participating jurisdictions, 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 17: Mitigation Strategy

MITIGATION GOALS

Based on the results of the risk and capability assessments, the Planning Team developed and prioritized the mitigation strategy. At the Mitigation Strategy Workshop in June 2019, Planning Team members refined the Plan's mitigation strategy. The following goals and objectives were identified.

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

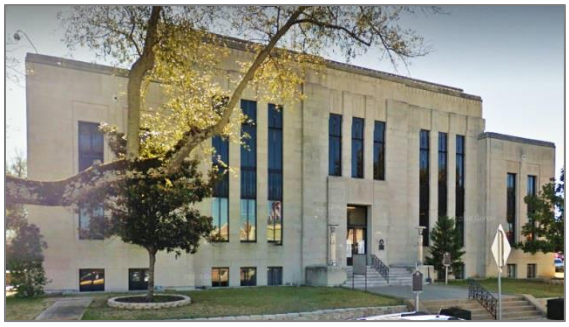
Reduce the danger to, and enhance protection of, high risk areas during hazard events.

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

Build and support local partnerships to continuously become less vulnerable to hazards.

OBJECTIVE 2.2

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

OBJECTIVE 2.3

Build hazard mitigation concerns into county and city 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 and man-made 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 repetitive losses to the National Flood Insurance Program (NFIP).

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 put people in harm's way or increase threats to 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.

Section 18: Mitigation Actions

SUMMARY

As discussed in Section 2, at the mitigation workshop the planning team and stakeholders met to develop mitigation actions for each of the natural hazards included in the Plan. 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 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.

All mitigation actions created by Planning Team members are presented in this section in the form of Mitigation Action Worksheets. 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 two actions, per hazard, and of two different types for each participating jurisdiction. The term county-wide refers to Van Zandt County and all participating jurisdictions.

Table 18-1. Van Zandt 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 Resources (Green)	

Jurisdiction	Thunderstorm Wind	Lightning	Drought	Extreme Heat	Hail	Tornado	Flood	Winter Storm	Wildfire	Dam Failure	Expansive Soils	Earthquake
Van Zandt County	xxx	xxx	xx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xx	xxx
City of Canton	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx
City of Edgewood	xxx	xxx	xx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xx	xxx
City of Edom	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	N/A	xxx	xxx
City of Fruitvale	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	N/A	xxx	xxx
City of Grand Saline	xxx	xxx	xx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xx	xxx
City of Van	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	N/A	xxx	xxx
City of Wills Point	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx

VAN ZANDT COUNTY – COUNTY-WIDE ACTIONS

		Van Zandt County-Wide – Action #1
	Proposed Action:	Acquire and install warning systems throughout the county, including incorporated jurisdictions.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	County-wide, including all participating jurisdictions
	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 (applicable jurisdictions), Flood, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$80,000
Potential Funding Sources:	Local Funds, HMGP, State and Federal Grants
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan (applicable jurisdictions)

COMMENTS

		Van Zandt County-Wide – Action #2
	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 damage.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	County-wide, including all participating jurisdictions
	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 (applicable jurisdictions), Drought, Earthquake, Expansive Soils, 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:	$10,000
Potential Funding Sources:	Local Funds (staff time), State and Federal Grants
Lead Agency/Department Responsible:	County and Local Emergency Management Coordinators
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

		Van Zandt County-Wide – Action #3
	Proposed Action:	Acquire and install generators with hard wired quick connections at all critical facilities.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	County-wide, including all participating jurisdictions, 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

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure (applicable jurisdictions), Earthquake, 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:	County and Local Emergency Management Coordinators
Implementation Schedule:	Within 12-24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan (applicable jurisdictions)

COMMENTS

		Van Zandt County-Wide – Action #4
	Proposed Action:	Incorporate higher standards for hazard resistance in local application of the building code.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	County-wide, including all participating jurisdictions
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk of damages to structures through improved construction techniques; Reduce recovery efforts for the community after an 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:	Dam Failure (applicable jurisdictions), Drought, Earthquake, Expansive Soils, Extreme Heat, Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm
Effect on New/Existing Buildings:	Reduce risk to new structures
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000
Potential Funding Sources:	Local Funds (staff time), State Grants
Lead Agency/Department Responsible:	County and Local Emergency Management Coordinators
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes (applicable jurisdictions)

COMMENTS

VAN ZANDT COUNTY

	Van Zandt County – Action #1
Proposed Action:	Adopt and implement a program for clearing debris from bridges, drains and culverts.
BACKGROUND INFORMATION	
Jurisdiction/Location:	County-wide, including Van Zandt County Road 2403
Risk Reduction Benefit *(Current Cost/Losses Avoided)*:	Reduce damages caused by flooding by maintaining or restoring drainage capacity.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

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:	$25,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Van Zandt County Road & Bridge, Pct. 2
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

		Van Zandt County – Action #2
	Proposed Action:	Upgrade and elevate major roads to allow adequate runoff and drainage into existing roadside ditches and culverts and reduce flooding that occurs in some areas of town.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	County-wide, including 2 miles of Van Zandt County Road 2708 North side of Van Zandt County Road 2602
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk of damages to roadways; Reduce flood damages to infrastructure; Ensure continuity of emergency services.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$525,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Van Zandt County Road & Bridge, Pct. 2
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

		Van Zandt County – Action #3
	Proposed Action:	Provide access to Van Zandt County Road 2704 through construction of an 18 x 20 foot bridge structure.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Van Zandt County Road 2704
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Improve accessibility and protect lives by mitigating low water crossing area.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$90,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Van Zandt County Road & Bridge
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

		Van Zandt County – Action #4
	Proposed Action:	Build safe room shelter / EOC for community use during inclement weather.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Build on county-owned property centrally located in the county
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to citizens by providing shelter in high risk areas during extreme weather events and would also serve as an EOC in order to continue operations during a disaster.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Extreme Heat, Thunderstorm Wind, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$1,000,000
Potential Funding Sources:	Local Funds, HMGP, PDM Grants
Lead Agency/Department Responsible:	County Public Works
Implementation Schedule:	Within 36 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

		Van Zandt County – Action #5
	Proposed Action:	Acquire and distribute NOAA weather radios.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	County-wide critical facilities
	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, Earthquake, 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:	$50,000
Potential Funding Sources:	Local Funds, HMGP, State and Federal Grants
Lead Agency/Department Responsible:	Emergency Management Coordinator
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

		Van Zandt County – Action #6
	Proposed Action:	Acquire and install generators with hard wired quick connections at critical facilities in the County as well as at Volunteer Fire Departments within the County.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	County-wide 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

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Earthquake, 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, HMGP, State and Federal Grants
Lead Agency/Department Responsible:	Emergency Management Coordinator
Implementation Schedule:	Within 12-24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

		Van Zandt County – Action #7
	Proposed Action:	Increase drainage capacity; Install French drains or elevate building and upgrade undersized pipe under State Hwy for water to run into creek.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	24632 St. Hwy 64, Canton
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk of flood damages through improved drainage capacity; Reduce continual cost to remove water from the building; Ensure offices remain open for business.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

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):	High
Estimated Cost:	$3,000,000
Potential Funding Sources:	Local Funds, HMGP, State and Federal Grants
Lead Agency/Department Responsible:	Emergency Management Coordinator
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Floodplain Management Plan

COMMENTS
County Annex East building floods every time the county experiences a heavy rain.

CITY OF CANTON

	City of Canton – Action #1
Proposed Action:	Build safe room shelters throughout the jurisdiction so that residents can reach shelter in less than five minutes.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
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

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm Wind, Tornado
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:	City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan, Capital Improvement Plan

COMMENTS

		City of Canton – Action #2
	Proposed Action:	Upgrade critical facilities to include drought mitigation measures and expansive soils protection such as greywater reuse systems, drought tolerant landscaping, installation of a sprinkler system with regular watering schedule and installation of French drains where high plasticity soils are indicated.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide critical facilities
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce damages at critical facilities.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Drought, Expansive Soils
Effect on New/Existing Buildings:	Reduce risk to new and existing structures
Priority (High, Moderate, Low):	Low
Estimated Cost:	$100,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	City Manager
Implementation Schedule:	Within 36 months of plan adoption
Incorporation into Existing Plans:	Capital Improvement Plan

COMMENTS

		City of Canton – Action #3
	Proposed Action:	Develop and implement a safe room rebate program for individual safe rooms in single-family residences.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to citizens by providing in-home safe rooms 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

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm Wind, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000 per safe room
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

		City of Canton – Action #4
	Proposed Action:	Require “safe rooms” to be added when constructing new schools, daycares, rest homes and critical care facilities.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to citizens by providing shelter in new critical facilities during extreme weather events.
	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:	Thunderstorm Wind, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes

COMMENTS

CITY OF EDGEWOOD

	City of Edgewood – Action #1
Proposed Action:	Build safe room shelters throughout the jurisdiction so that residents can reach shelter in less than five minutes.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
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

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm Wind, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Low
Estimated Cost:	$1,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	City Administrator
Implementation Schedule:	Within 36 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

		City of Edgewood – Action #2
	Proposed Action:	Develop and implement a safe room rebate program for individual safe rooms in single-family residences.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to citizens by providing in-home safe rooms 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

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm Wind, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000 per safe room
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	City Administrator
Implementation Schedule:	Within 12-24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

		City of Edgewood – Action #3
	Proposed Action:	Adopt and implement a Drought Contingency Plan; Adopt water restriction regulations during extreme drought periods.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk of water shortages through water restrictions and contingency planning.
	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:	Drought
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$3,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	City Administrator
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes / Ordinances

COMMENTS

		City of Edgewood – Action #4
	Proposed Action:	Install and upgrade undersized stormwater drains and culverts.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide drainage system
	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

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:	Public Works
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

City of Edgewood – Action #5	
Proposed Action:	Adopt and implement a program for clearing debris from bridges, drains and culverts.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Sabine River and Community-wide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce damages caused by flooding by maintaining or restoring drainage capacity.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

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:	$50,000 (annually)
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes / Ordinances

COMMENTS

		City of Edgewood – Action #6
	Proposed Action:	Increase drainage capacity; Add stormwater detention and / or retention basins as deemed necessary to reduce flood risk upstream of Edgewood City Dam.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Edgewood City Dam
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce flood risk through improved drainage capacity; Reduce risk of damages and injuries; Reduce emergency response demands.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000,000
Potential Funding Sources:	Local Funds, HMGP, CDBG, State and Federal Grants
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Within 24-48 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

		City of Edgewood – Action #7
	Proposed Action:	Purchase and install outdoor warning sirens.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Edgewood City Dam and Community-wide
	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, Flood, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$10,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

CITY OF EDOM

	City of Edom – Action #1
Proposed Action:	Build safe room shelters throughout the jurisdiction so that residents can reach shelter in less than five minutes.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
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

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm Wind, Tornado
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:	City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

		City of Edom – Action #2
	Proposed Action:	Upgrade critical facilities to include drought mitigation measures and expansive soils protection such as greywater reuse systems, drought tolerant landscaping, installation of a sprinkler system with regular watering schedule and installation of French drains where high plasticity soils are indicated.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide critical facilities
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce damages at critical facilities.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Drought, Expansive Soils
Effect on New/Existing Buildings:	Reduce risk to new and existing structures
Priority (High, Moderate, Low):	Low
Estimated Cost:	$100,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	City Manager
Implementation Schedule:	Within 36 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

		City of Edom – Action #3
	Proposed Action:	Develop and implement a safe room rebate program for individual safe rooms in single-family residences.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to citizens by providing in-home safe rooms 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

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm Wind, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000 per safe room
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

		City of Edom – Action #4
	Proposed Action:	Acquire and distribute NOAA weather radios.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide critical facilities
	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:	Earthquake, 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:	$50,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

CITY OF FRUITVALE

	City of Fruitvale – Action #1
Proposed Action:	Acquire and distribute NOAA weather radios.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide critical facilities
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:	Earthquake, 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:	$50,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	City Secretary
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

		City of Fruitvale – Action #2
	Proposed Action:	Obtain certification in the National Weather Service StormReady Program.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide critical facilities
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to citizens by educating the public on how to prepare for hazards and disasters.
	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:	Flood, Hail, Thunderstorm Wind, Tornado, Winter Storm
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000
Potential Funding Sources:	Local Funds (staff time), State and Federal Grants
Lead Agency/Department Responsible:	City Secretary
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

		City of Fruitvale – Action #3
	Proposed Action:	Implement and enhance an area-wide telephone Emergency Notification System (“Reverse 911”).
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to citizens through improved communication 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:	Earthquake, Flood, Thunderstorm Wind, Tornado, Wildfire, Winter Storm
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	City Secretary
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

		City of Fruitvale – Action #4
	Proposed Action:	Require “safe rooms” to be added when constructing new schools, daycares, rest homes and critical care facilities.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to citizens by providing shelter in new critical facilities during extreme weather events.
	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:	Thunderstorm Wind, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	City Secretary
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

		City of Fruitvale – Action #5
	Proposed Action:	Evaluate access and road conditions for response vehicles. Develop and implement options to improve access and / or add redundant access routes in high risk areas.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk and spread of wildfires through maintained and redundant access routes in high risk areas; Improve response time for emergency services; Reduce risk of injury or damages; Provide additional ingress / egress routes through high risk areas to prevent loss of life and avoid rescue efforts.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Wildfire
Effect on New/Existing Buildings:	Reduce risk to new or existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$500,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	City Secretary
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

		City of Fruitvale – Action #6
	Proposed Action:	Upgrade critical facilities to include drought mitigation measures and expansive soils protection such as greywater reuse systems, drought tolerant landscaping, installation of a sprinkler system with regular water schedule and installation of French drains where high plasticity soils are indicated.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide critical facilities
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce damages at critical facilities.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Drought, Expansive Soils
Effect on New/Existing Buildings:	Reduce risk to new and existing structures
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$100,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	City Secretary
Implementation Schedule:	Within 12-24 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

		City of Fruitvale – Action #7
	Proposed Action:	Build safe room shelters throughout the jurisdiction so that residents can reach shelter in less than five minutes.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide, including manufactured home parks
	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

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm Wind, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Low
Estimated Cost:	$500,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	City Secretary
Implementation Schedule:	Within 36 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

		City of Fruitvale – Action #8
	Proposed Action:	Develop and implement a safe room rebate program for individual safe rooms in single-family residences.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to citizens by providing in-home safe rooms 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

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm Wind, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000 per safe room
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	City Secretary
Implementation Schedule:	Within 12-24 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

CITY OF GRAND SALINE

	City of Grand Saline – Action #1
Proposed Action:	Acquire and distribute NOAA weather radios.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide critical facilities
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, Earthquake, 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:	$50,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Emergency Management Coordinator
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

		City of Grand Saline – Action #2
	Proposed Action:	Obtain certification in the National Weather Service StormReady Program.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide critical facilities
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to citizens by educating the public on how to prepare for hazards and disasters.
	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:	Flood, Hail, Thunderstorm Wind, Tornado, Winter Storm
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000
Potential Funding Sources:	Local Funds (staff time), State and Federal Grants
Lead Agency/Department Responsible:	Emergency Management Coordinator
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

		City of Grand Saline – Action #3
	Proposed Action:	Require “safe rooms” to be added when constructing new schools, daycares, rest homes and critical care facilities.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to citizens by providing shelter in new critical facilities during extreme weather events.
	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:	Thunderstorm Wind, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Emergency Management Coordinator
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes

COMMENTS

		City of Grand Saline – Action #4
	Proposed Action:	Evaluate access and road conditions for response vehicles. Develop and implement options to improve access and / or add redundant access routes in high risk areas.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk and spread of wildfires through maintained and redundant access routes in high risk areas; Improve response time for emergency services; Reduce risk of injury or damages; Provide additional ingress / egress routes through high risk areas to prevent loss of life and avoid rescue efforts.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Wildfire
Effect on New/Existing Buildings:	Reduce risk to new or existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$500,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Emergency Management Coordinator
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Capital Improvement Plan

COMMENTS

		City of Grand Saline – Action #5
	Proposed Action:	Adopt and implement a program for clearing debris from bridges, drains and culverts.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce damages caused by flooding by maintaining or restoring drainage capacity.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

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:	$50,000 (annually)
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Emergency Management Coordinator
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes / Ordinances

COMMENTS

City of Grand Saline – Action #6	
Proposed Action:	Build safe room shelters throughout the jurisdiction so that residents can reach shelter in less than five minutes.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide, including manufactured home parks
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

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm Wind, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Low
Estimated Cost:	$500,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Within 48 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan, Capital Improvement Plan

COMMENTS

		City of Grand Saline – Action #7
	Proposed Action:	Develop and implement a safe room rebate program for individual safe rooms in single-family residences.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to citizens by providing in-home safe rooms 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

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm Wind, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000 per safe room
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	City Manager
Implementation Schedule:	Within 12-24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

CITY OF VAN

	City of Van – Action #1
Proposed Action:	Acquire and distribute NOAA weather radios.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide critical facilities
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:	Earthquake, 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:	$50,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Emergency Management Coordinator
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

		City of Van – Action #2
	Proposed Action:	Obtain certification in the National Weather Service StormReady Program.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide critical facilities
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to citizens by educating the public on how to prepare for hazards and disasters.
	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:	Flood, Hail, Thunderstorm Wind, Tornado, Winter Storm
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000
Potential Funding Sources:	Local Funds (staff time), State and Federal Grants
Lead Agency/Department Responsible:	Emergency Management Coordinator
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

		City of Van – Action #3
	Proposed Action:	Require “safe rooms” to be added when constructing new schools, daycares, rest homes and critical care facilities.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to citizens by providing shelter in new critical facilities during extreme weather events.
	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:	Thunderstorm Wind, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Emergency Management Coordinator
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes

COMMENTS

		City of Van – Action #4
	Proposed Action:	Evaluate access and road conditions for response vehicles. Develop and implement options to improve access and / or add redundant access routes in high risk areas.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk and spread of wildfires through maintained and redundant access routes in high risk areas; Improve response time for emergency services; Reduce risk of injury or damages; Provide additional ingress / egress routes through high risk areas to prevent loss of life and avoid rescue efforts.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Wildfire
Effect on New/Existing Buildings:	Reduce risk to new or existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$500,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Emergency Management Coordinator
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Capital Improvement Plan

COMMENTS

		City of Van – Action #5
	Proposed Action:	Adopt and implement a program for clearing debris from bridges, drains and culverts.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce damages caused by flooding by maintaining or restoring drainage capacity.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

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:	$50,000 (annually)
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Emergency Management Coordinator
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes / Ordinances

COMMENTS

		City of Van – Action #6
	Proposed Action:	Upgrade critical facilities to include drought mitigation measures and expansive soils protection such as greywater reuse systems, drought tolerant landscaping, installation of a sprinkler system with regular watering schedule and installation of French drains where high plasticity soils are indicated.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide critical facilities
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce damages at critical facilities.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Drought, Expansive Soils
Effect on New/Existing Buildings:	Reduce risk to new and existing structures
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$100,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Emergency Management Coordinator
Implementation Schedule:	Within 12-24 months of plan adoption
Incorporation into Existing Plans:	Capital Improvement Plan

COMMENTS

	City of Van – Action #7
Proposed Action:	Build safe room shelters throughout the jurisdiction so that residents can reach shelter in less than five minutes.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
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

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm Wind, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Low
Estimated Cost:	$500,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Public Works / Emergency Management Coordinator
Implementation Schedule:	Within 36 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan, Capital Improvement Plan

COMMENTS

		City of Van – Action #8
	Proposed Action:	Develop and implement a safe room rebate program for individual safe rooms in single-family residences.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to citizens by providing in-home safe rooms 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

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm Wind, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	City Manager / Emergency Management Coordinator
Implementation Schedule:	Within 12-24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

CITY OF WILLS POINT

	City of Wills Point – Action #1
Proposed Action:	Acquire and distribute NOAA weather radios.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide critical facilities
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, Earthquake, 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:	$50,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Police Chief, City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

		City of Wills Point – Action #2
	Proposed Action:	Obtain certification in the National Weather Service StormReady Program.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide critical facilities
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to citizens by educating the public on how to prepare for hazards and disasters.
	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:	Flood, Hail, Thunderstorm Wind, Tornado, Winter Storm
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000
Potential Funding Sources:	Local Funds (staff time), State and Federal Grants
Lead Agency/Department Responsible:	Police Chief, City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

		City of Wills Point – Action #3
	Proposed Action:	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.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce damages to infrastructure; Ensure continuity of services during and after event; Reduce damages associated with power outages; Reduce risk of injuries or fatalities to vulnerable populations.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Hail, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm
Effect on New/Existing Buildings:	Reduce risk to new and existing structures
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$100,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Police Chief, City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Maintenance Plan

COMMENTS

		City of Wills Point – Action #4
	Proposed Action:	Implement and enhance an area-wide telephone Emergency Notification System (“Reverse 911”).
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to citizens through improved communication 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, Earthquake, Flood, Thunderstorm Wind, Tornado, Wildfire, Winter Storm
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Police Chief, City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Response Plan

COMMENTS

		City of Wills Point – Action #5
	Proposed Action:	Require “safe rooms” to be added when constructing new schools, daycares, rest homes and critical care facilities.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to citizens by providing shelter in new critical facilities during extreme weather events.
	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:	Thunderstorm Wind, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Police Chief, City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes

COMMENTS

		City of Wills Point – Action #6
	Proposed Action:	Evaluate access and road conditions for response vehicles. Develop and implement options to improve access and / or add redundant access routes in high risk areas.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk and spread of wildfires through maintained and redundant access routes in high risk areas; Improve response time for emergency services; Reduce risk of injury or damages; Provide additional ingress / egress routes through high risk areas to prevent loss of life and avoid rescue efforts.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Wildfire
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$500,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Police Chief, City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Capital Improvement Plan

COMMENTS

		City of Wills Point – Action #7
	Proposed Action:	Adopt and implement a program for clearing debris from bridges, drains and culverts.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce damages caused by flooding by maintaining or restoring drainage capacity.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

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:	$50,000 (annually)
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Police Chief, City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes / Ordinances

COMMENTS

		City of Wills Point – Action #8
	Proposed Action:	Increase freeboard requirements for permitting structures in the SFHA; Adopt a "no-rise" in BFE in the 100-year floodplain; Update local flood ordinance to prohibit granting of variance in SFHA; Include "cumulative damage" provision in local floodplain management ordinances.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce flood damages through development restrictions and improved construction requirements in flood-prone areas.
	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):	High
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Local Floodplain Administrator, Police Chief, City Manager
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	Flood Damage Prevention Ordinance

COMMENTS

		City of Wills Point – Action #9
	Proposed Action:	Educate community on the dangers of low water crossings through the installation of warning signs and promotion of "Turn Around, Don't Drown" Program.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk of injuries, fatalities and damages through education and awareness.
	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:	Flood
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$10,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Police Chief, City Manager
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

City of Wills Point – Action #10	
Proposed Action:	Implement stream restoration / channelization program to ensure adequate drainage / diversion of stormwater.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
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

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:	Police Chief, City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

City of Wills Point – Action #11	
Proposed Action:	Upgrade critical facilities to include drought mitigation measures and expansive soils protection such as greywater reuse systems, drought tolerant landscaping, installation of a sprinkler system with regular watering schedule and installation of French drains where high plasticity soils are indicated.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide critical facilities
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce damages at critical facilities.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Drought, Expansive Soils
Effect on New/Existing Buildings:	Reduce risk to new and existing structures
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$100,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Public Works, Police Chief, City Manager
Implementation Schedule:	Within 12-24 months of plan adoption
Incorporation into Existing Plans:	Capital Improvement Plan

COMMENTS

City of Wills Point – Action #12	
Proposed Action:	Build safe room shelters throughout the jurisdiction so that residents can reach shelter in less than five minutes.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide, including manufactured home parks
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

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm Wind, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Low
Estimated Cost:	$500,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Public Works, Police Chief, City Manager
Implementation Schedule:	Within 48 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan, Capital Improvement Plan

COMMENTS

		City of Wills Point – Action #13
	Proposed Action:	Develop and implement a safe room rebate program for individual safe rooms in single-family residences.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to citizens by providing in-home safe rooms 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

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm Wind, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000 per safe room
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Police Chief, City Manager
Implementation Schedule:	Within 12-24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

Section 19: Plan Maintenance

Plan Maintenance Procedures

The following is an explanation of how the participating jurisdictions within Van Zandt County, 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

Participating jurisdictions within Van Zandt County will be responsible for further development and implementation of mitigation actions. Each action has been assigned to a specific department within the participating jurisdictions. The following describes the process by which participating jurisdictions will incorporate elements of the mitigation plan into other planning mechanisms.

Process of Incorporation

Once the Plan is adopted, participating jurisdictions within Van Zandt County will implement actions based on priority and the availability of funding. The Planning Area currently implements policies and programs to reduce loss to life and property from hazards. The mitigation actions developed for this Plan enhance this ongoing effort and will be implemented through other program mechanisms where possible.

The potential funding sources listed for each identified action may be used when the jurisdiction seeks funds to implement actions. An implementation time period or a specific implementation date has been assigned to each action as an incentive for completing each task and gauging whether actions are implemented in a timely manner.

Participating jurisdictions within Van Zandt County will integrate implementation of their mitigation actions with other plans and policies such as construction standards and emergency management

plans, and ensure that these actions, or proposed projects, are reflected in other planning efforts. Coordinating and integrating components of other plans and policies into goals and objectives of the Plan will further maximize funding and provide possible cost-sharing of key projects, thereby reducing loss of lives and property and mitigating hazards affecting the area.

Upon formal adoption of the Plan, planning team members from each participating jurisdiction will work to integrate the hazard mitigation strategies into other plans and codes as they are developed. Participating team members will conduct periodic reviews of plans and policies, once per year at a minimum, and analyze the need for amendments in light of the approved Plan. The planning team will review all comprehensive land use plans, capital improvement plans, annual budget reviews, emergency operations or management plans, and transportation plans to guide and control development. Participating jurisdictions will ensure that capital improvement planning in the future will also contribute to the goals of this hazard mitigation Plan to reduce the long-term risk to life and property from all hazards. Within one year of formal adoption of the hazard mitigation Plan, existing planning mechanisms will be reviewed by each jurisdiction.

Van Zandt County is committed to supporting the cities, communities, and participating jurisdictions as they implement their mitigation actions. Planning team members will review and revise, as necessary, the long-range goals and objectives in strategic plan and budgets to ensure that they are consistent with this mitigation action plan. Additionally, the Planning Area will work to advance the goals of this hazard mitigation plan through its routine, ongoing, long-range planning, budgeting, and work processes.

Table 19-1 identifies types of planning mechanisms and examples of methods for incorporating the Plan 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, with the exception of the Floodplain Management Plans; the jurisdictions who have a Floodplain Administrator on staff will be responsible for incorporating the plan when floodplain management plans are updated or new plans are developed.

Table 19-1. Methods of Incorporation of the Plan

PLANNING MECHANISM	DEPARTMENT / TITLE RESPONSIBLE	INCORPORATION OF PLAN
Annual Budget Review	Van Zandt County: EMC City of Canton: EMC City of Edgewood: Mayor City of Edom: Mayor City of Fruitvale: Mayor City of Grand Saline: EMC City of Van: EMC City of Wills Point: EMC	Various departments and key personnel that participated in the planning process for participating jurisdictions within Van Zandt County will review the Plan and mitigation actions therein when conducting their annual budget review. Allowances will be made in accordance with grant applications sought, and mitigation actions that will be undertaken, according to the implementation schedule of the specific action.
Capital Improvement Plans	City of Canton: EMC City of Grand Saline: EMC City of Van: EMC City of Wills Point: EMC	Several participating jurisdictions have a Capital Improvement Plan (CIP) in place. Prior to any revisions to the CIP, departments will review the risk assessment and mitigation strategy

PLANNING MECHANISM	DEPARTMENT / TITLE RESPONSIBLE	INCORPORATION OF PLAN
		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.
Grant Applications	Van Zandt County: EMC City of Canton: EMC City of Edgewood: Mayor City of Edom: Mayor City of Fruitvale: Mayor City of Grand Saline: EMC City of Van: EMC City of Wills Point: EMC	The Plan will be evaluated by participating jurisdictions within Van Zandt County when grant funding is sought for mitigation projects. If a project is not in the Plan, an amendment may be necessary to include the action in the Plan.
Regulatory Plans	Van Zandt County: EMC City of Canton: EMC City of Edgewood: Mayor City of Edom: Mayor City of Grand Saline: EMC City of Van: EMC City of Wills Point: EMC	Currently, participating jurisdictions within Van Zandt County have regulatory plans in place, such as Emergency Management Plans, Economic Development, and Evacuation Plans. The Plan will be consulted when County and City departments review or revise their current regulatory planning mechanisms, or in the development of regulatory plans that are not currently in place.

MONITORING AND EVALUATION

Periodic revisions of the Plan are required to ensure that goals, objectives, and mitigation actions are kept current. When the plan is discussed in these sections it includes the risk assessment and mitigation actions as a part of the monitoring, evaluating, updating and review process. Revisions may be required to ensure the Plan is in compliance with federal and state statutes and regulations. This section outlines the procedures for completing Plan revisions, updates, and review. Table 19-2 indicates the department and title of the party responsible for Plan monitoring, evaluating, updating, and review of the Plan.

Table 19-2. Team Members Responsible for Plan Monitoring, Evaluating, Updating, and Review of the Plan

JURISDICTION	TITLE
Van Zandt County	Emergency Management Coordinator
City of Canton	Emergency Management Coordinator
City of Edgewood	Mayor
City of Edom	Mayor

JURISDICTION	TITLE
City of Fruitvale	Mayor
City of Grand Saline	Emergency Management Coordinator
City of Van	Emergency Management Coordinator
City of Wills Point	Emergency Management Coordinator

Monitoring

Designated Planning Team members are responsible for monitoring, evaluating, updating, and reviewing the Plan, as shown in Table 19-2. Individuals holding the title listed in Table 19-2 will be responsible for monitoring the Plan on an annual basis. Plan monitoring includes reviewing and incorporating into the Plan other existing planning mechanisms that relate or support goals and objectives of the Plan; monitoring the incorporation of the Plan into future updates of other existing planning mechanisms as appropriate; reviewing mitigation actions submitted and coordinating with various County and City departments to determine if mitigation actions need to be re-evaluated and updated; evaluating and updating the Plan as necessary; and monitoring plan maintenance to ensure that the process described is being followed, on an annual basis, throughout the planning process. The Planning Team will develop a brief report that identifies policies and actions in the plan that have been successfully implemented and any changes in the implementation process needed for continued success. A summary of meeting notes will report the particulars involved in developing an action into a project. In addition to the annual monitoring, the Plan will be similarly reviewed immediately after extreme weather events including but not limited to state and federally declared disasters.

Evaluation

As part of the evaluation process, the Planning Team 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.

The Planning Team will meet on an annual basis to evaluate the Plan and identify any needed changes, and assess the effectiveness of the plan achieving its stated purpose and goals. The team will evaluate the number of mitigation actions implemented along with the loss-reduction associated with each action. Actions that have not been implemented will be evaluated to determine if any social, political or financial barriers are impeding implementation and if any changes are necessary to improve the viability of an action. The team will evaluate changes in land development and/or programs that affect mitigation priorities in their respective jurisdictions. The annual evaluation process will help to determine if any changes are necessary. In addition, the Plan will be similarly evaluated immediately after extreme weather events including but not limited to state and federally declared disasters.

UPDATING

Plan Amendments

At any time, minor technical changes may be made to update the Van Zandt County Hazard Mitigation Action Plan 2019. Material changes to mitigation actions or major changes in the overall direction of

the Plan or the policies contained within it, must be subject to formal adoption by the participating jurisdictions.

The participating jurisdictions within Van Zandt County will review proposed amendments and vote to accept, reject, or amend the proposed change. Upon ratification, the amendment will be transmitted to TDEM.

In determining whether to recommend approval or denial of a Plan amendment request, participating jurisdictions will consider the following factors:

- Errors or omissions made in the identification of issues or needs during the preparation of the Plan;
- New issues or needs that were not adequately addressed in the Plan; and
- Changes in information, data, or assumptions from those on which the Plan was based.

Five (5) Year Review

The Plan will be thoroughly reviewed by the Planning Team at the end of three years from the approval date, to determine whether there have been significant changes in the planning area that necessitate changes in the types of mitigation actions proposed. Factors that may affect the content of the 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 review process provides the participating jurisdictions within Van Zandt County 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.

It is recommended that the full Executive and Advisory Planning Team (Section 2, Tables 2-1 and 2-2) meet to review the Plan at the end of three years because grant funds may be necessary for the development of a five-year update. Reviewing planning grant options in advance of the five-year Plan update deadline is recommended considering the timelines for grant and planning cycles can be in excess of a year.

Following the Plan review, any revisions deemed necessary will be summarized and implemented according to the reporting procedures and Plan amendment process outlined herein. Upon completion of the review, update, and amendment process the revised Plan will be submitted to TDEM for final review and approval in coordination with FEMA.

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, reviewing 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 on the participating jurisdictions' 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 newspaper and radio stations, will be used to notify the public of any maintenance or periodic review activities during the implementation, monitoring, and evaluation phases. Additionally, local news media will be contacted to cover information regarding Plan updates, status of grant applications, and project implementation. Local and social media outlets, such as Facebook and Twitter, will keep the public and stakeholders apprised of potential opportunities to fund and implement mitigation projects identified in the Plan.

Appendix A: Planning Team

Planning Team Members

The Van Zandt County Hazard Mitigation Action Plan 2019 was organized using a direct representative model. An Executive Planning Team from the participating jurisdictions, shown in Table A-1, was formed to coordinate planning efforts and request input and participation in the planning process. Table A-2 reflects the Advisory Planning Team, consisting of area organizations and departments that participated throughout the planning process. Table A-3 is comprised of stakeholders who were invited to provide Plan input. Public outreach efforts and meeting documentation is provided in Appendix E.

Table A-1. Executive Planning Team

ORGANIZATION / DEPARTMENT	TITLE
Van Zandt County	Emergency Management Coordinator
Van Zandt County	County Judge
City of Canton	Emergency Management Coordinator
City of Canton	Mayor
City of Edgewood	Mayor
City of Edgewood	City Administrator
City of Edom	Mayor
City of Fruitvale	Mayor
City of Fruitvale	City Secretary
City of Grand Saline	Mayor
City of Grand Saline	City Administrator / Emergency Management Coordinator
City of Van	Mayor
City of Van	City Manager / Emergency Management Coordinator
City of Wills Point	Mayor
City of Wills Point	Emergency Management Coordinator

Table A-2. Advisory Planning Team

ORGANIZATION / DEPARTMENT	TITLE
Van Zandt County	County Clerk
Van Zandt County	Volunteer Coordinator
Van Zandt County	County Commissioner – Precinct
Van Zandt County	County Commissioner – Precinct 2
Van Zandt County	County Commissioner – Precinct 4
Van Zandt County	County Auditor
City of Canton	City Manager
City of Canton	Fire Captain
City of Grand Saline	Public Safety Director
City of Van	City Secretary
City of Wills Point	City Administrator

STAKEHOLDERS

The following groups listed in Table A-3 represent a list of organizations invited to stakeholder meetings, public meetings, and workshops throughout the planning process and include: non-profit organizations, private businesses, universities, and legislators. The public were 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. For a list of attendees at meetings, please see Appendix E[1].

Table A-3. Stakeholders

AGENCY	TITLE
Canton ISD	Superintendent
Chamber of Canton Commerce	President
East Texas COG	Executive Director
Edgewood ISD	Superintendent
Fruitvale ISD	Superintendent
Fruitvale ISD	School Resource Officer
Grand Saline ISD	Superintendent

[1] Information contained in Appendix E is exempt from public release under the Freedom of Information Act (FOIA).

Appendix A: Planning Team

AGENCY	TITLE
Henderson County	Emergency Management Coordinator
Hunt County	Emergency Management Coordinator
Kaufman County	Emergency Management Coordinator
Rains County	Emergency Management Coordinator
Smith County	Emergency Management Coordinator
Texas A&M Agri-Life Extension Service	County Extension Agent
Texas Department of Public Safety	District Coordinator, DC 6
Texas State Representative	Texas State Representative
Texas State Senator	Texas State Senator
Van Chamber of Commerce	President
Van ISD	Superintendent
Van Zandt County Regional Airport	Manager
Wills Point Chamber of Commerce	Secretary
Wills Point ISD	Superintendent
Wood County	Emergency Management Coordinator

Appendix B: Public Survey Results

OVERVIEW

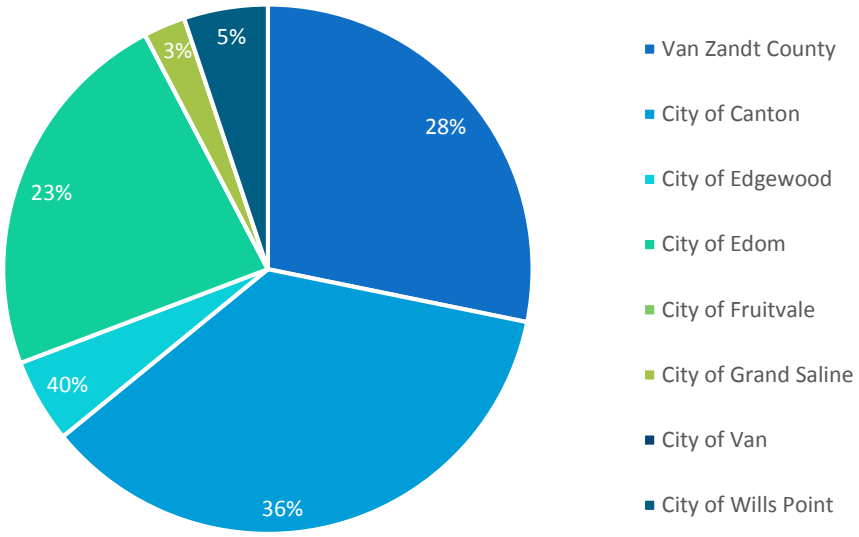
Van Zandt County prepared a public survey that requested public opinion on a wide range of questions relating to natural hazards. The survey was made available via the County's websites, along with participating jurisdictions. This survey link was also distributed at public meetings and stakeholder events throughout the planning process.

A total of 39 surveys were collected, the results of which are analyzed in Appendix B. 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 actions or problem areas.

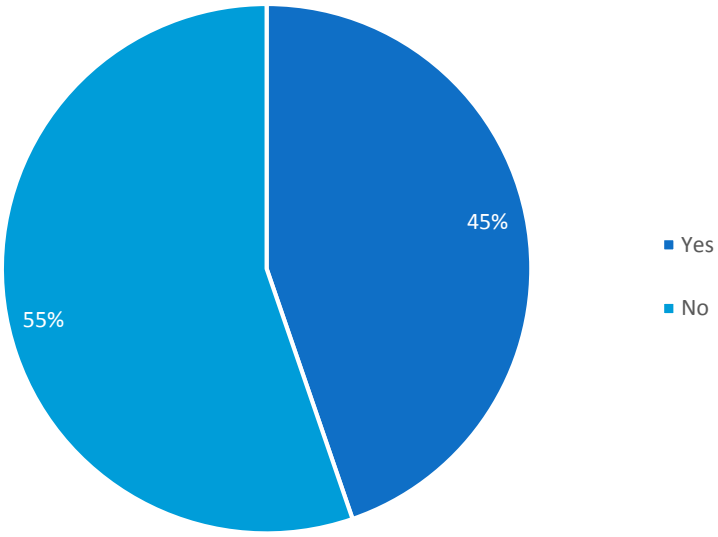
The following survey results depict the percentage of responses for each answer. Similar responses have been summarized for questions that did not provide a multiple-choice answer or that required an explanation.

PUBLIC SURVEY RESULTS

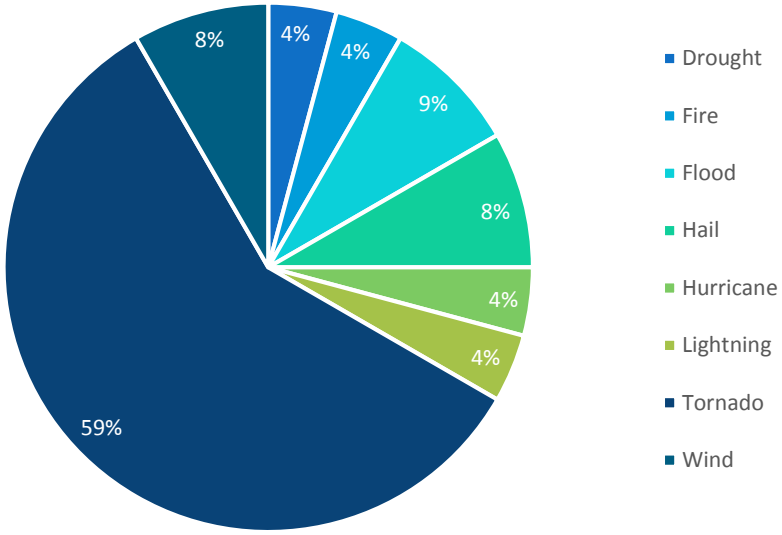
1. Please state the jurisdiction (city or community) where you reside.



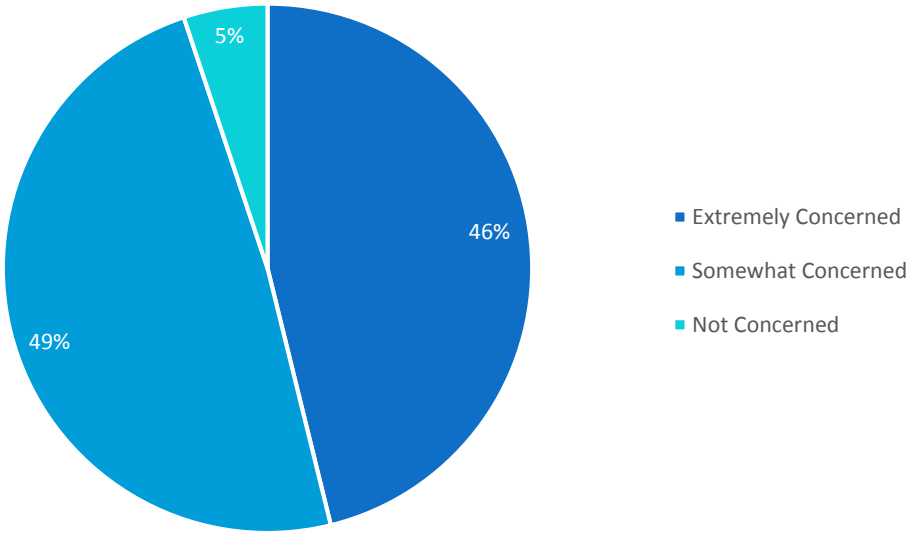
2. A. Have you ever experienced or been impacted by a disaster?



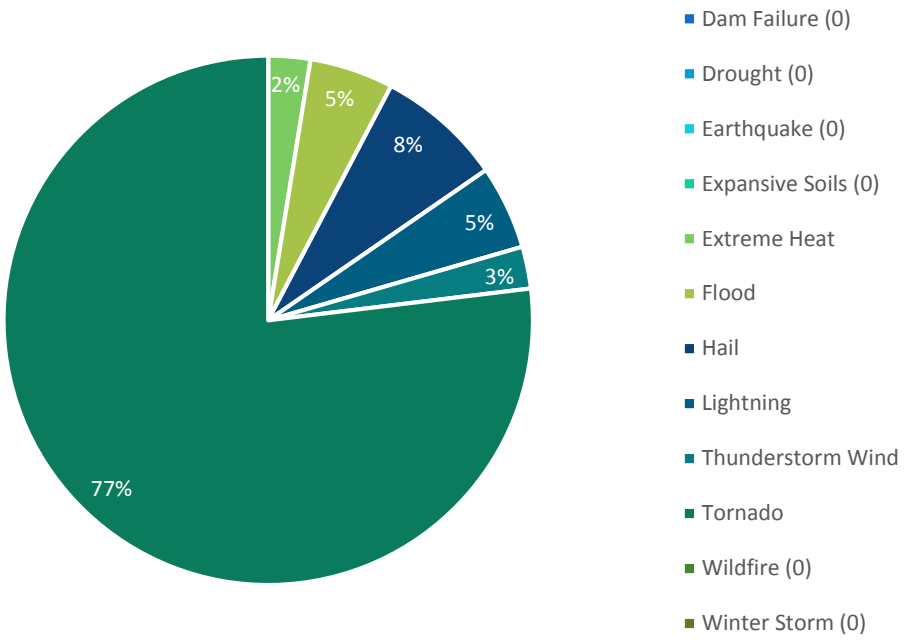
2. B. If “Yes”, please explain:



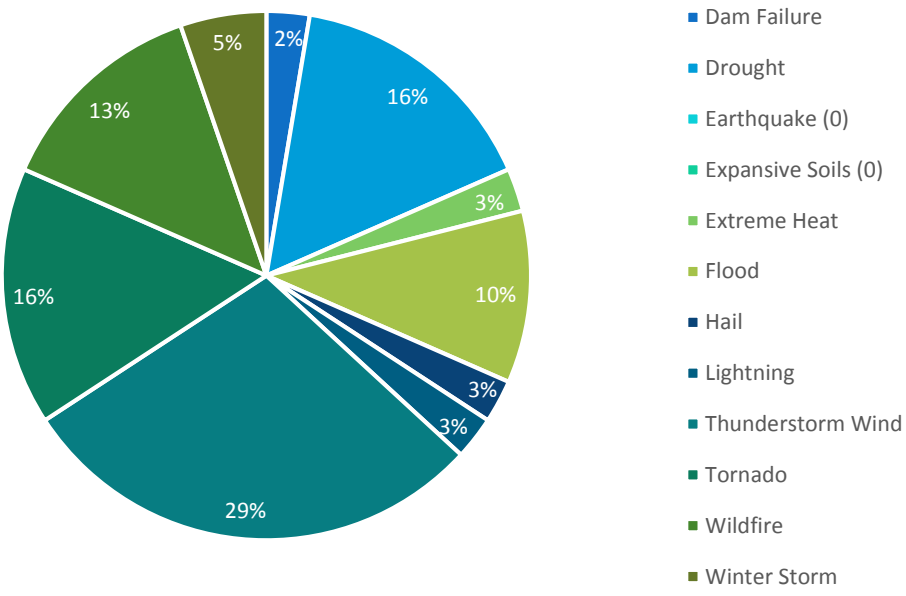
3. How concerned are you about the possibility of your community being impacted by a disaster?



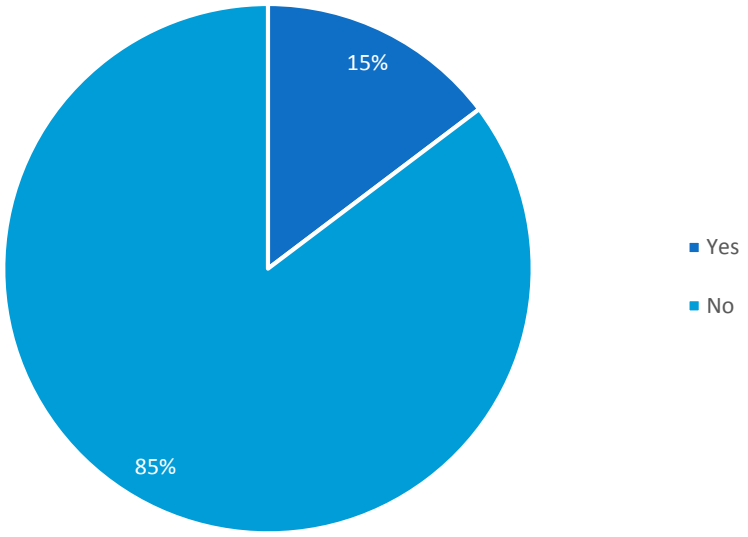
4. Please select the one hazard you think is the highest threat to your neighborhood:



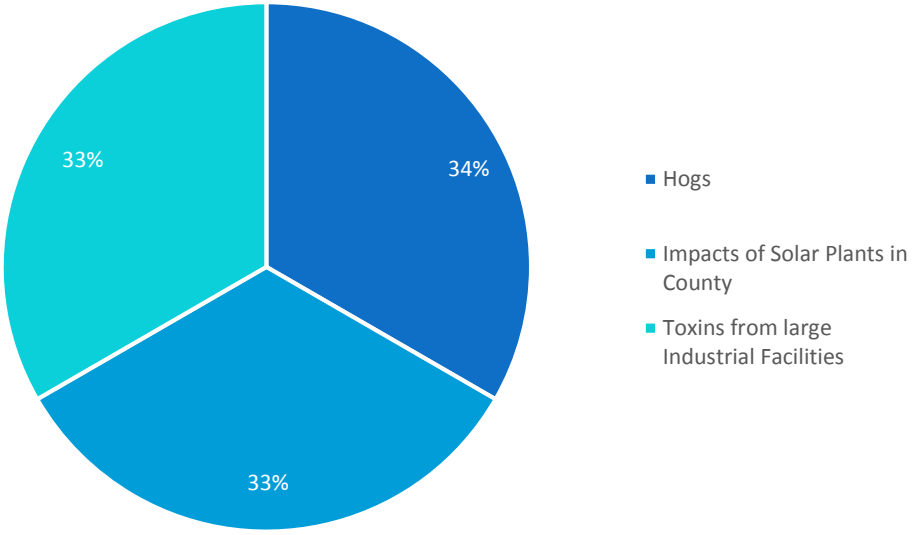
5. Please select the one hazard you think is the second highest threat to your neighborhood:



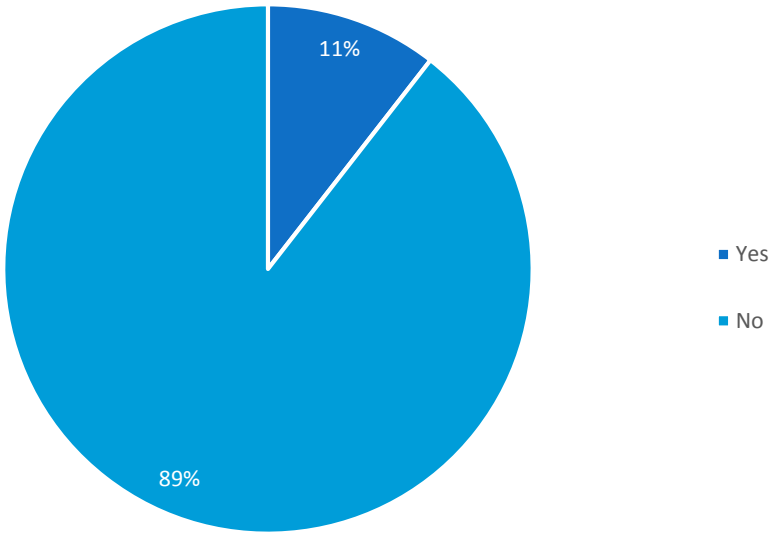
6. A. Is there another hazard not listed above that you this is a wide-scale threat to your neighborhood?



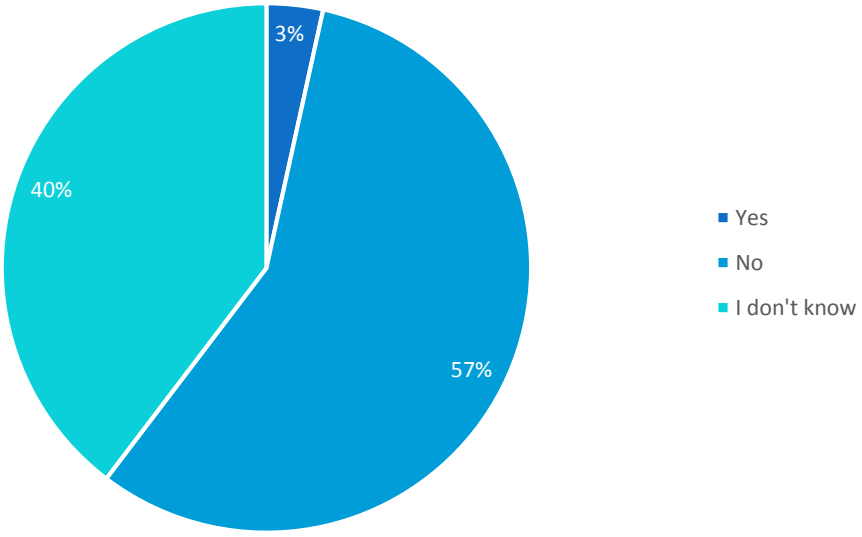
6. B. If “Yes”, please explain:



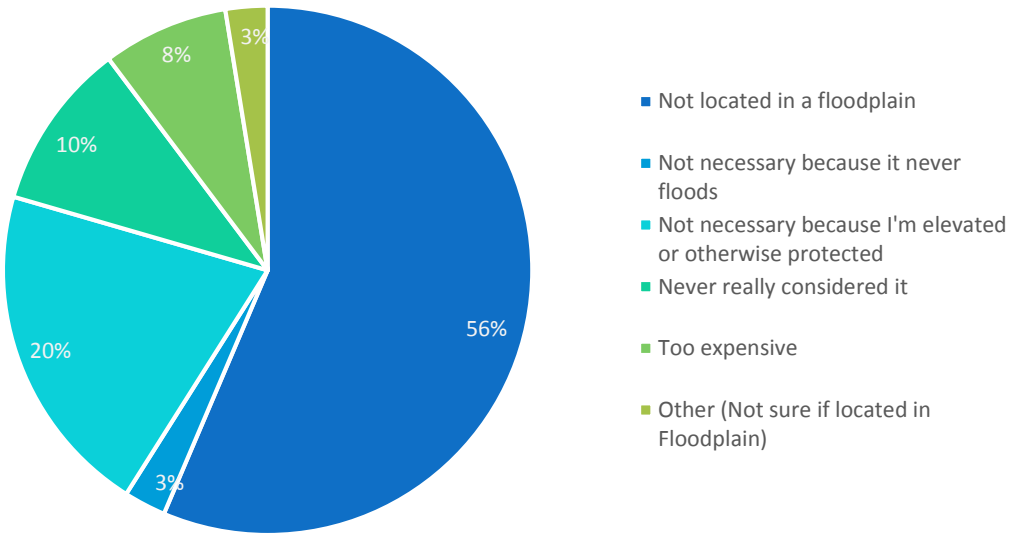
7. Is your home located in a floodplain?



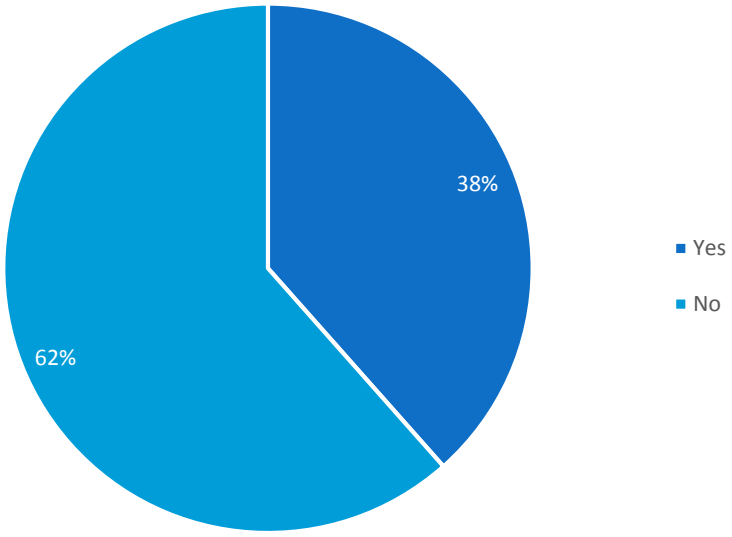
8. Do you have flood insurance?



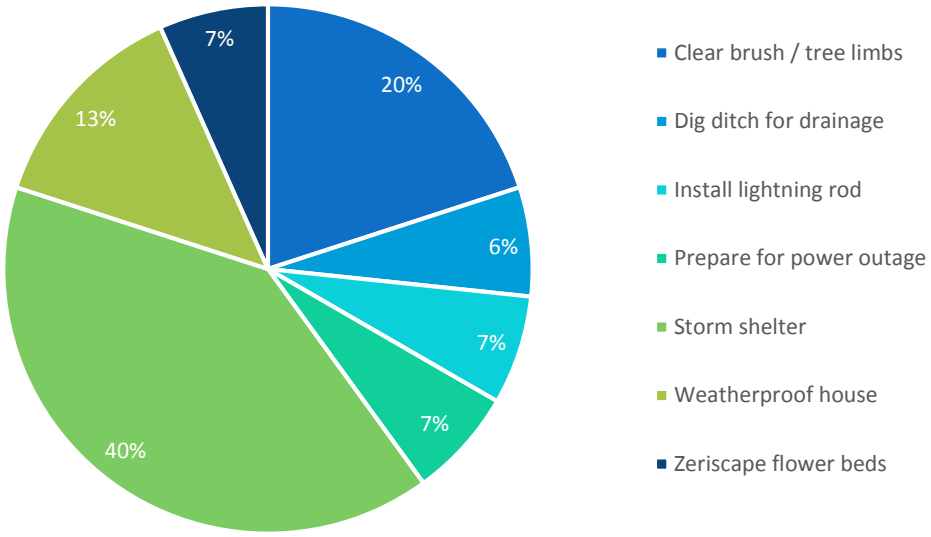
9. If you do not have flood insurance, why not?



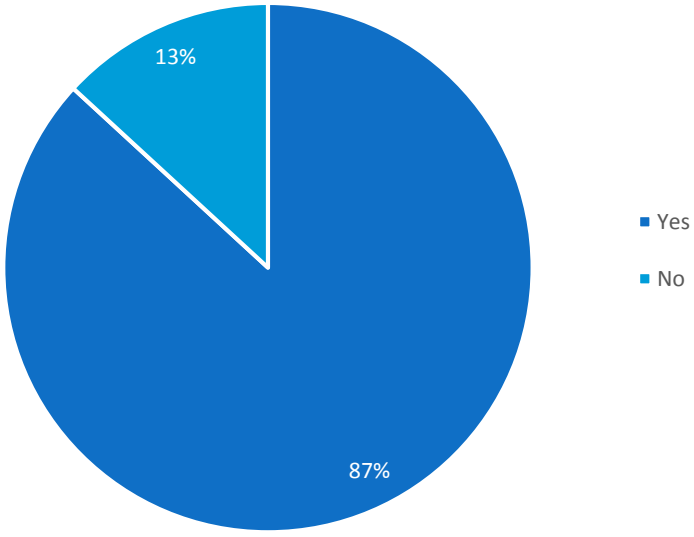
10. A. Have you taken any actions to make your home or neighborhood more resistant to hazards?



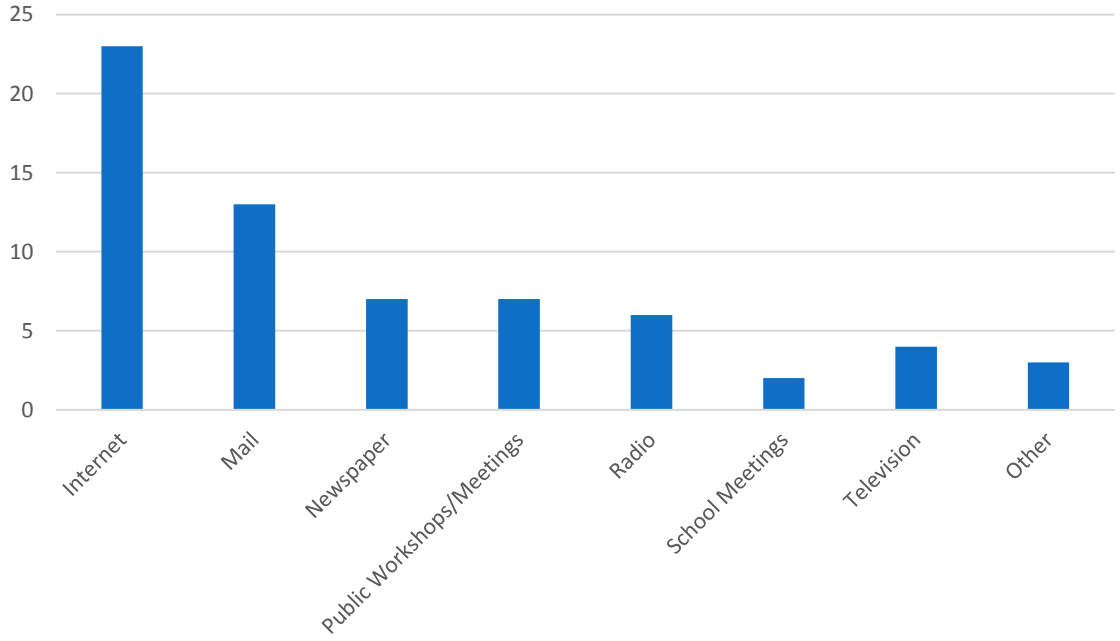
10. B. If “Yes”, please explain:



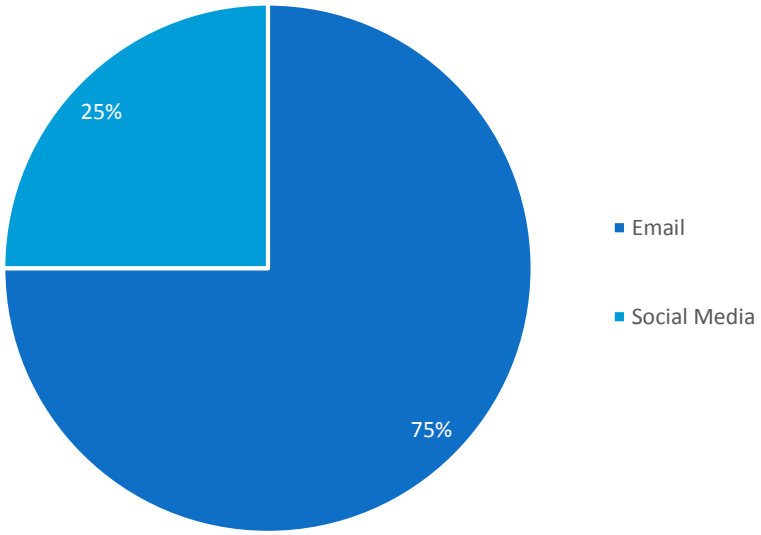
11. Are you interested in making your home or neighborhood more resistant to hazards?



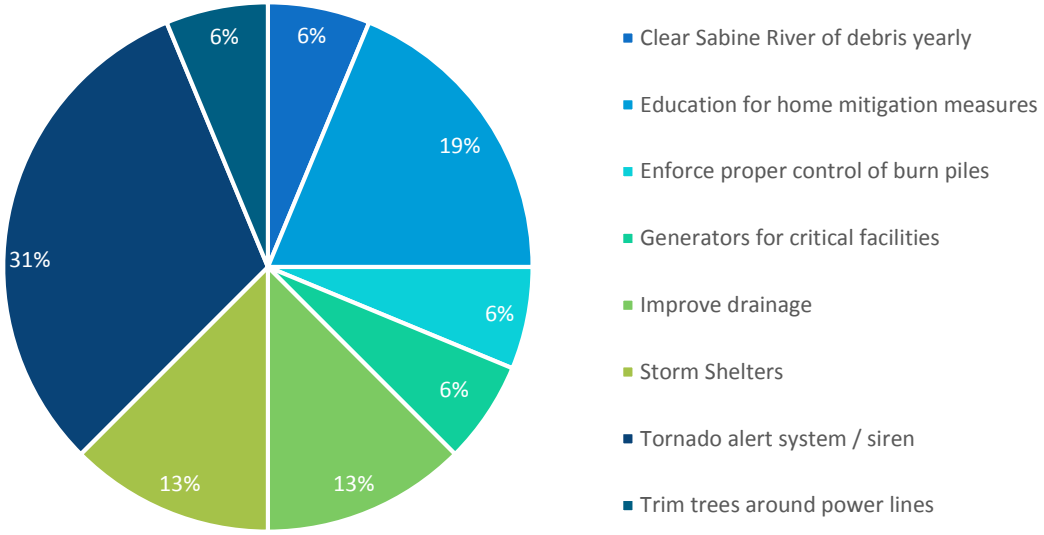
12. A. What is the most effective way for you to receive information about how to make your home and neighborhood more resistant to hazards?



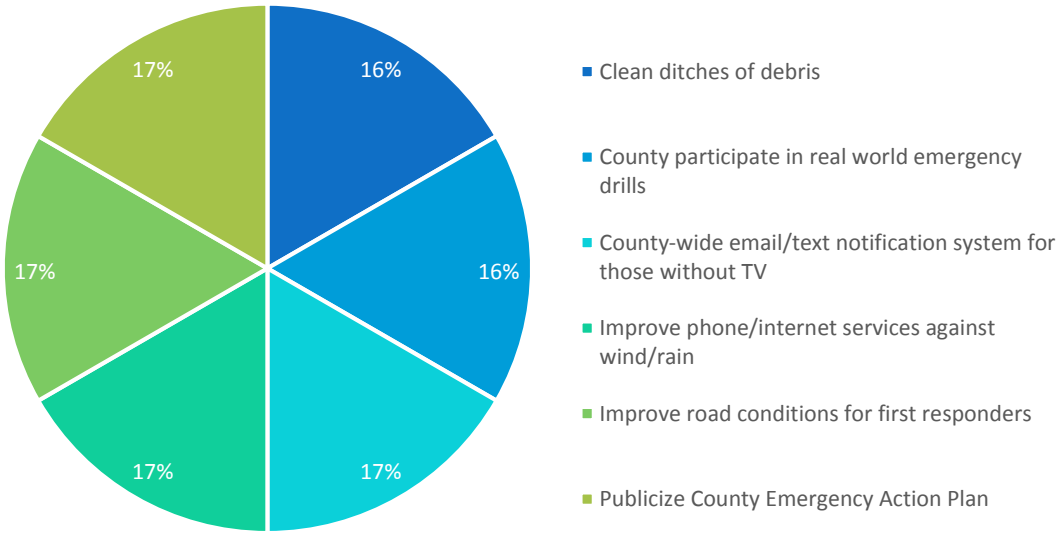
12. B. If “Other”, please explain:



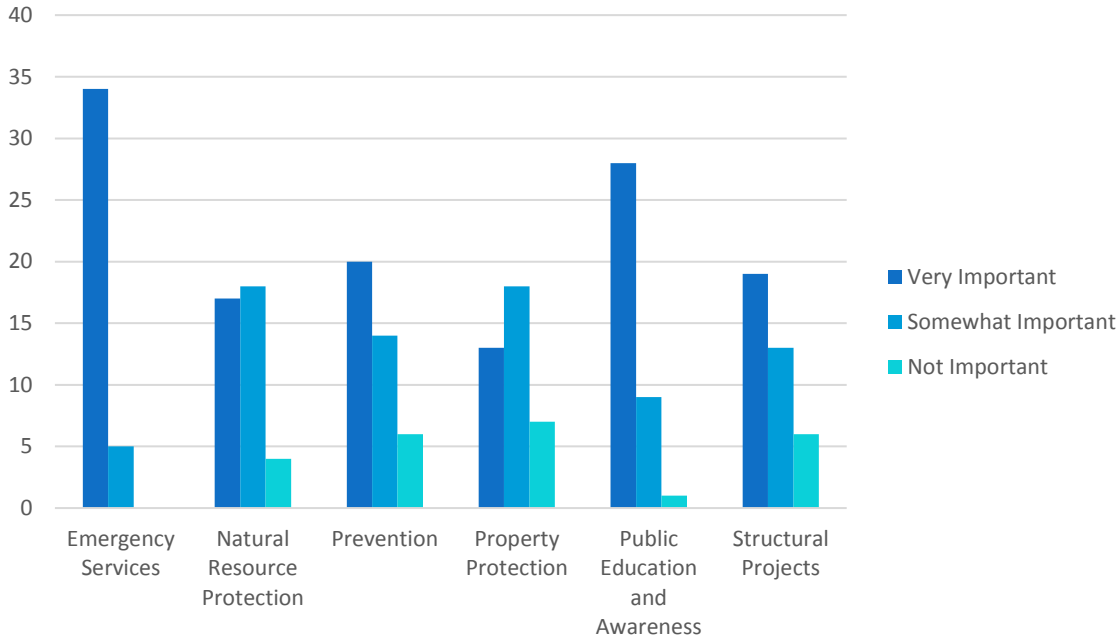
13. In your opinion, what are some steps your local government could take to reduce or eliminate the risk of future hazard damages in your neighborhood?



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



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



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.

Appendix C: Critical Facilities

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

Appendix D: Dam Locations

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

Appendix E: Meeting Documentation

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

Appendix F: Capability Assessment

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