

# KENDALL COUNTY HAZARD MITIGATION ACTION PLAN



## UPDATE 2023

**March 9th, 2023 - March 8th, 2028**

Maintaining a Safe, Secure, and Sustainable Community

For more information, visit our website at:

co.kendall.tx.us

Written comments should be forwarded to:

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**FEMA**

March 9, 2023

Josh Davies, State Hazard Mitigation Officer  
Texas Division of Emergency Management  
P.O. Box 285  
Del Valle, TX 78617-9998

RE: Approval of the Kendall County, Texas Multi-Jurisdiction Hazard Mitigation Plan

Dear Mr. Davies:

This office has concluded its review of the referenced plan and we are pleased to provide our approval of this plan in meeting the criteria set forth by 44 CFR § 201.6. By receiving this approval, eligibility for the Hazard Mitigation Assistance Grants will be ensured for five years from the date of this letter, expiring on March 8, 2028.

This approval does not demonstrate approval of projects contained in the plan. This office has provided the enclosed Local Hazard Mitigation Planning Tool with reviewer's comments, to further assist the community in refining the plan going forward. Please advise the referenced community of this approval.

If you have any questions, please contact David Freeborn, HM Community Planner, at (940) 898-5323.

Sincerely,

A handwritten signature in dark ink, appearing to read "Ronald C. Wanhanen".

Ronald C. Wanhanen  
Chief, Risk Analysis Branch

Enclosures: Approved Participants

## Approved Participants

Attached is the list of approved participating governments included in the March 9, 2023 review of the referenced Hazard Mitigation plan.

Community Name
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- |                   |
|-------------------|
| 1) Boerne city    |
| 2) Kendall County |



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## BACKGROUND

Kendall County is located in South-central Texas and is largely covered by rolling hills. The county's center is set on Cibolo Creek, thirty miles northwest of San Antonio. Kendall County is surrounded by the following counties: Gillespie to the north, Blanco to the Northeast, Comal to the southeast, Bandera and Bexar to the South, and Kerr to the west. The City of Kendall is the county seat.

Texas is prone to extremely heavy rains and flooding with half of the world's record rainfall rates (48 hours or less).<sup>1</sup> While flooding is a well-known risk, Kendall County is susceptible to a wide range of natural hazards, including but not limited to hurricane, tornadoes, winter storms, and wildfires. 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 of 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*.<sup>2</sup> 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.

In 2017, Kendall County and the City of Boerne originally developed their Hazard Mitigation Action Plan (HMAP) as an investment in their community's safety and sustainability. The Disaster Mitigation Act requires that hazard mitigation plans be reviewed and revised every five years to maintain eligibility for Hazard Mitigation Assistance (HMA) grant funding. Since FEMA approved the Kendall County HMAP in 2017, the County began the process of developing a Hazard Mitigation Action Plan Update in order to maintain eligibility for grant funding within the five-year window.

The HMAP Update planning process provided an opportunity for Kendall County and the City of Boerne to evaluate successful mitigation actions and explore opportunities to avoid future disaster loss. The 2017 HMAP Update will expire in 2022, therefore the Kendall County planning team selected H2O Partners, Inc. to write and develop the 2023 HMAP Update, hereinafter titled: "Kendall County Hazard Mitigation Action Plan Update 2023: Maintaining a Safe, Secure, and

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<sup>1</sup> <http://www.floodsafety.com/texas/regional-info/san-antonio-flooding/>

<sup>2</sup> <http://www.fema.gov/hazard-mitigation-planning-resources>



## SECTION 1: INTRODUCTION

Sustainable Community” (Plan or Plan Update). This is a multi-jurisdictional plan; the participating jurisdictions include: Kendall County and the City of Boerne.

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

### SCOPE

The focus of the Plan Update is to identify activities to mitigate hazards classified as “high” or “moderate” risk, as determined through a detailed hazard risk assessment conducted for Kendall County and the City of Boerne. 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 Update was prepared by Kendall County, City of Boerne, and H2O Partners, Inc. The purpose of the Plan Update is to protect people and structures and to minimize the costs of disaster response and recovery. The goal of the Plan Update is to minimize or eliminate long-term risks to human life, property, operations, and the environment from known hazards by identifying risks and implementing cost-effective hazard mitigation actions. The planning process is an opportunity for Kendall County, the City of Boerne, 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 Kendall County.

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

Kendall County, the City of Boerne, and planning participants identified twelve natural hazards and four man-made hazards to be addressed by the Plan Update. The specific goals of the Plan Update are to:

- Provide a comprehensive update to the 2017 HMAP;
- Minimize disruption to Kendall County and the City of Boerne 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 Kendall County and the City of Boerne to take advantage of rapidly developing mitigation grant opportunities as they arise; and
- Ensure that Kendall County and City of Boerne maintain eligibility for the full range of future Federal disaster relief.

# SECTION 1: INTRODUCTION

## AUTHORITY



The Plan is tailored specifically for Kendall County and the City of Boerne and plan participants including Planning Team members, stakeholders, and the general public who participated in the Plan Update development process. The Plan complies with all requirements promulgated by the Texas Division of Emergency Management (TDEM) and all applicable provisions of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Section 104 of the Disaster Mitigation Act of 2000 (DMA 2000) (P.L. 106-390), and the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004 (P.L. 108-264), which amended the National Flood Insurance Act (NFIA) of 1968 (42 U.S.C. 4001, et al). Additionally, the Plan complies with the Interim Final Rules for the Hazard Mitigation Planning and Hazard Mitigation Grant Program (44 CFR, Part 201), which specify the criteria for approval of mitigation plans required in Section 322 of the DMA 2000 and standards found in FEMA's "Local Mitigation 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 Update outline the Plan's purpose and development, including how Planning Team members, stakeholders, and members of the general public were involved in the planning process. Section 3 profiles Kendall County's population and economy.

Sections 4 through 20 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 Update presents a description of the hazard, a list of historical hazard events, and the results of the vulnerability and risk assessment process.

Section 21 presents hazard mitigation goals and objectives. Section 22 gives an analysis for the previous actions and Section 23 presents hazard mitigation actions for Kendall County and the City of Boerne. Section 24 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. Appendix D contains information regarding Dam locations within Kendall County. Appendix E contains workshops and meeting documentation. Capability Assessment results for Kendall County and the City of Boerne are in Appendix F.<sup>3</sup>

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<sup>3</sup> Information contained in some of these appendices are exempt from public release under the Freedom of Information Act (FOIA).

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## PLAN PREPARATION AND DEVELOPMENT

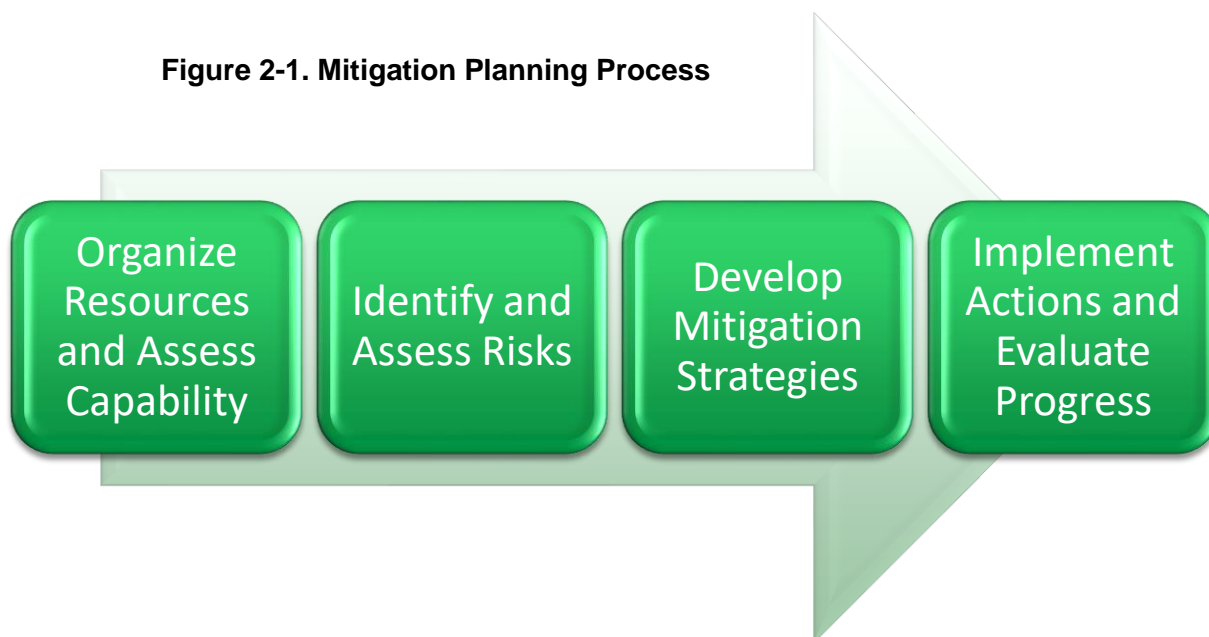
Hazard mitigation planning involves coordination with various constituents and stakeholders to develop a more disaster-resistant community. Section 2 provides an overview of the planning process including the identification of key steps and a detailed description of how stakeholders and the public were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

### OVERVIEW OF THE PLAN

Kendall County and the City of Boerne hired H2O Partners, Inc. (Consultant Team), to provide technical support and oversee the development of the Kendall County Hazard Mitigation Action Plan Update 2023. 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 Update. The overall planning process is shown in Figure 2-1 below.

## SECTION 2: PLANNING PROCESS

**Figure 2-1. Mitigation Planning Process**



Kendall County, the City of Boerne and the Consultant Team met in January 2022 to begin organizing resources, identify Planning Team members, and conduct a Capability Assessment.

### PLANNING TEAM

Key members of H2O Partners, Inc. developed the Plan Update in conjunction with the Planning Team. The Planning Team was established using a direct representation model. Some of the responsibilities of the Planning Team included: completing Capability Assessment surveys, providing input regarding the identification of hazards, identifying mitigation goals, and developing mitigation strategies. An Executive Planning Team consisting of key personnel from Kendall County and the City of Boerne, 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 departments within Kendall County and the City of Boerne that participated throughout the planning process.

**Table 2-1. Executive Planning Team**

ORGANIZATION / DEPARTMENT	TITLE
Kendall County	Emergency Management Coordinator / Fire Marshall
City of Boerne	Emergency Management Coordinator / Fire Marshall

**Table 2-2. Advisory Planning Team**

ORGANIZATION / DEPARTMENT	TITLE
Kendall County	Assistant County Engineer
Kendall County	Chief Sheriff's Deputy

## SECTION 2: PLANNING PROCESS

ORGANIZATION / DEPARTMENT	TITLE
Kendall County	County Clerk
Kendall County	County Engineer
Kendall County	County Engineering Staff
Kendall County	County Judge
Kendall County	County Sheriff
Kendall County	Deputy Fire Marshall
Kendall County	EMS Administrator
Kendall County	Geographic Information Systems (GIS) Coordinator
Kendall County	Human Resource Director
Kendall County	Precinct 1 Commissioner
Kendall County	Precinct 2 Commissioner
Kendall County	Precinct 3 Commissioner
Kendall County	Precinct 4 Commissioner
Kendall County	Road and Bridge Operations Manager
Kendall County	Road and Bridge Supervisor
Kendall County	Road and Bridge Supervisor
City of Boerne	Assistant City Manager (1)
City of Boerne	Assistant City Manager (2)
City of Boerne	City Manager
City of Boerne	City Secretary
City of Boerne	Director of Development Services
City of Boerne	Emergency Management Coordinator / Police Chief
City of Boerne	Geographic Information Systems (GIS) Coordinator
City of Boerne	IT Specialist
City of Boerne	Mayor
City of Boerne	Mayor Pro-Team
City of Boerne	Planning and Community Development Director

## SECTION 2: PLANNING PROCESS

ORGANIZATION / DEPARTMENT	TITLE
City of Boerne	Public Information Office (POI) / Media
City of Boerne	Utilities Director
City of Boerne	Assistant City Manager (1)
City of Boerne	Assistant City Manager (2)
City of Boerne	City Manager
City of Boerne	City Secretary
City of Boerne	Director of Development Services
City of Boerne	Emergency Management Coordinator / Police Chief
City of Boerne	Geographic Information Systems (GIS) Coordinator
City of Boerne	IT Specialist
City of Boerne	Mayor
City of Boerne	Mayor Pro-Team
City of Boerne	Planning and Community Development Director
City of Boerne	Public Information Office (POI) / Media
City of Boerne	Utilities Director

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 Kendall County and the City of Boerne by organization and title.

Based on the results of the completed Capability Assessment, Kendall County and the City of Boerne described methods for achieving future hazard mitigation measures by expanding existing capabilities. For example, neither the County nor the City have a Wildfire Ordinance 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](http://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.



## SECTION 2: PLANNING PROCESS

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 Update 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, wildfire, and winter storms. These actions include but are not limited to updating critical facilities, enforcing adopted County Fire Code, and educating citizens to practice hazard mitigation techniques.

### PLANNING PROCESS

The process used to prepare the Plan Update 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 Kendall 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 24. 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 Update;
- Implementation problems, such as technical, political, legal, and coordination issues that may hinder development;
- Anticipated outcomes; and
- How Kendall County, the City of Boerne, agencies, and partners will participate in implementing the Plan Update.

### KICKOFF WORKSHOP

The Kickoff Workshop was held on January 10, 2022, at the Kendall County Courthouse. 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 local emergency service districts (ESDs), local independent school districts 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.

## SECTION 2: PLANNING PROCESS

### 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 and four man-made hazards which pose a significant threat to the planning area.

### RISK ASSESSMENT

An initial risk assessment for Kendall County and the City of Boerne was completed in March 2022 and results were presented to Planning Team members at the Risk Assessment Workshop held on March 28, 2022, at the Kendall County Courthouse. 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 20.

### MITIGATION REVIEW AND DEVELOPMENT

Developing the Mitigation Strategy for the Plan involved identifying mitigation goals and new mitigation actions. A Mitigation Workshop was held on June 27, 2022, at the Kendall County Courthouse. 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 thunderstorm wind projects. Additionally, the participating jurisdictions were proactive in identifying mitigation actions to lessen the risk of all the identified hazards included in the Plan Update.

An inclusive and structured process was used to develop and prioritize new hazard mitigation actions for the Plan Update. 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 23.

## SECTION 2: PLANNING PROCESS

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 Update, 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 Update was maintained on file by the Kendall County Office of Emergency Management and was made available to the general public for review.

## REVIEW AND INCORPORATION OF EXISTING PLANS

### REVIEW

Background information utilized during the planning process included various studies, plans, reports, and technical information from sources such as FEMA, the United States Army Corps of Engineers (USACE), the U.S. Fire Administration, 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 5-20) 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 Update development requirements.

## SECTION 2: PLANNING PROCESS

### INCORPORATION OF EXISTING PLANS INTO THE HMAP PROCESS

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

Existing projects and studies were utilized as a starting point for discussing hazard mitigation actions among Planning and Consultant Team members. For example, in 2016 Kendall County adopted fire codes effective January 1, 2016, and hired additional staff to assist with the fire code program. Additionally, policies and ordinances were reviewed by the County and the City. They have included actions to develop and adopt higher building code standards. Other plans were reviewed, such as Emergency Operations 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 Kendall County Hazard Mitigation Action Plan Update 2023.

### INCORPORATION OF THE HMAP INTO OTHER PLANNING MECHANISMS

Planning Team members will integrate implementation of the Plan Update with other planning mechanisms for Kendall County and the City of Boerne, such as the Emergency Operations Plan. Existing plans will be reviewed and incorporated into the Plan Update, as appropriate. This section discusses how the Plan will be implemented by Kendall County and the City of Boerne. 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.

Kendall County and the City of Boerne will be responsible for implementing hazard mitigation actions contained in Section 23. 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.

Kendall County and the City of Boerne will integrate hazard mitigation actions contained in the Plan Update with existing planning mechanisms such as ordinances, Emergency Operations or Management Plans, and other local and area planning efforts. Kendall County and the City of Boerne 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 Update, 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 Update 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 revisions or updates in light of the approved Plan Update. Kendall County and the City of Boerne will ensure that future long-term planning objectives will contribute

## SECTION 2: PLANNING PROCESS

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 Update.

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 Update.

Furthermore, Kendall County will work with neighboring jurisdictions to advance the goals of the Plan Update 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 Kendall County and the City of Boerne 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	Kendall County and the City of Boerne have a Capital Improvement Plan (CIP) in place. Prior to any revisions to the CIP, County and City departments will review the risk assessment and mitigation strategy sections of the HMAP, as limiting public spending in hazardous zones is one of the most effective long-term mitigation actions available to local governments.
Comprehensive Plans	Kendall County and the City of Boerne have Long-term Comprehensive Development Plans in place. Since comprehensive plans involve developing a unified vision for a community, the mitigation vision and goals of the Plan will be reviewed in the development or revision of a Comprehensive Plan.
Floodplain Management Plans	Floodplain management plans include preventative and corrective actions to address the flood hazard. Therefore, the actions for flooding and information found in Section 5 of this Plan Update discussing the people and property at risk to flood will be reviewed and revised when Kendall County and the City of Boerne update their management plans or develops new plans.

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Planning Mechanism	Incorporation of Plan
Grant Applications	The Plan will be evaluated by Kendall County and the City of Boerne when grant funding is sought for mitigation projects. If a project is not in the Plan Update, a Plan Revision may be necessary to include the action in the Plan.
Regulatory Plans	Currently, Kendall County and the City of Boerne have regulatory plans in place, such as Emergency Management Plans, Continuity of Operations Plans, Land Use Plans, and Evacuation Plans. The Plan Update 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 Update 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 for Kendall County and the City of Boerne are updated every 5 years and incorporate goals, objectives and actions identified in the mitigation plan.

### PLAN REVIEW AND PLAN UPDATE

As with the development of Plan Update, Kendall County and the City of Boerne will oversee the review and update process for relevance and if necessary, make adjustments. At the beginning of each fiscal year, Planning Team Members will meet to evaluate the Plan and review other planning mechanisms to ensure consistency with long-range planning efforts. In addition, planning participants will also meet once a year, by conference call or presentation, to re-evaluate prioritization of the hazard mitigation actions.

### 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 Update for Kendall County and the City of Boerne.

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



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actions will partially be directed by participating jurisdictions' comprehensive planning process, budgetary constraints, and community needs. Kendall County and the City of Boerne are committed to addressing and implementing hazard mitigation actions that may be aligned with and integrated into the Plan Update.

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

### 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 Kendall County Hazard Mitigation Action Plan Update 2023 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 Update available for public review on participating jurisdictions' websites.

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

The Plan Update will be advertised and posted on Kendall County and City of Boerne's websites upon approval from FEMA, and a copy will be kept at the Kendall County Office of Emergency Management.

### 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 Update. 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 Kendall County's outreach efforts for development of the Plan Update. 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.

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**Table 2-4. Stakeholder Working Group**

AGENCY	TITLE	PARTICIPATED
211 Texas Health and Human Services Commission	Resource Manager	
Alamo Springs Volunteer Fire Department	Fire Chief	X
American Red Cross	Hill Country Chapter / Regional Manager of Communications	
Bandera County	Emergency Management Coordinator	
Bandera Electric Cooperative	Engineering Supervisor	
Bergheim Volunteer Fire Department	Fire Chief	
Bexar County	Office of Emergency Management	
Bexar County ESD No.4 / Leon Springs Volunteer Fire Department	President	X
Bexar County ESD No.8 / Grey Forest Volunteer Fire Department	President	
Blanco County	Emergency Management Coordinator	
Boerne Chamber of Commerce	Owner / Chair	
Boerne Independent School District	Chief Financial Officer	
Boerne Independent School District	Chief Operations Officer	X
Boerne Independent School District	Deputy Superintendent	X
Boerne Independent School District	Superintendent	
Boerne Independent School District	Superintendent Secretary	
Boerne Independent School District	Director of Safety	X
Boerne – Kendall County Economic Development Corporation	Chief Executive Officer	
Boerne Radio 103.9 FM	General	
Boerne Star	General / Editor	X
Bulverde Spring Branch Fire & EMS 2	Chief of Operations	
Capital Area Council of Governments	Director of Regional Planning and Services	
Capital Area Council of Governments	Regional Service Program Specialist	

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AGENCY	TITLE	PARTICIPATED
Comal County	Emergency Management Coordinator	
Comfort Area Foundation	President	X
Comfort Chamber of Commerce	General Staff	
Comfort Fire Department	Fire Chief	X
Comfort Floodplain Coalition	President	
Comfort Independent School District	Director of Operations	X
Comfort Independent School District	Operations Coordinator	
Comfort Independent School District	Superintendent	
Comfort Independent School District	Superintendent Secretary	
Comfort News	General / Editor	
Cow Creek Groundwater Conservation District	General Manager	
Cow Creek Groundwater Conservation District	President	
Department of Homeland Security	General Staff	
Environment Protection Agency	Region 6 Administrator	
Gillespie County	Floodplain Administrator	
Hill Country Weekly	Editor	X
Kendalia Volunteer Fire Department	Fire Chief	
Kendall Amateur Radio Society	General	
Kerr County	County Engineer	
Legislator	District 73 Representative	
Lower Colorado River Authority	Emergency Management Coordinator	
Methodist Healthcare System	Emergency Management Committee Director	
Methodist Healthcare System – Boerne Emergency Department	Direct of the Emergency Department	
NOAA	Chief of Policy / Planning and Communications	
Pedernales Electric Cooperative	General	

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AGENCY	TITLE	PARTICIPATED
Pipe Creek Volunteer Fire Department	President	
Senate	District 25 Senator – District Director	X
Sisterdale Volunteer Fire Department	Fire Chief	X
Southwest Texas Regional Advisory Council	Executive Director	
Texas A&M Argilife Extension	District Representative	
Texas Commission on Environment Quality (TCEQ)	Regional Director	
Texas Commission on Environment Quality (TCEQ)	ERC	
Texas Department of Transportation	District Engineer	
Texas Division of Emergency Management (TDEM)	Regional Coordinator	
Texas Forest Service	Regional Fire Coordinator	
Texas Water Board	Outreach Specialist	
U.S. Army Corps of Engineers	Southwest Division Representative	
U.S. Fish and Wildlife	Regional Outreach Coordinator	
U.S. Fish and Wildlife	Public Affairs State Representative	
Waring Fire Department	Fire Chief	X

Stakeholders and participants from neighboring communities that attended the Planning Team and public meetings played a key role in the planning process. For example, winter storms were one of the concerns to stakeholders, so participating jurisdictions included actions to provide warming sites and public education for extreme weather conditions.

### PUBLIC MEETINGS

A series of public meetings were held throughout the planning area to collect public and stakeholder input. Topics of discussion included the purpose of hazard mitigation, discussion of the planning process, and types of natural hazards. Kendall County and the City of Boerne released information regarding the public meetings in their area to increase public participation in the Plan Update 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:

- January 10, 2022, Kendall County Courthouse

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- March 28, 2022, Kendall County Courthouse
- June 27, 2022, Kendall 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 313 surveys were completed online. The survey results are analyzed in Appendix B. Kendall County and the City of Boerne 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 floods, and suggested drainage improvements. In response, several actions were added to the Plan to clean drainage ditches along County Road and Dry Creek beds to allow water to flow efficiently.

# SECTION 3: COUNTY PROFILE

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## OVERVIEW

Originally, the majority of Kendall County land was actually a part of Bexar County, established in 1836 by the Republic of Texas; it later transitioned into Kerr County in 1856. In 1862, the state legislature granted the petition of Boerne and Sisterdale to create a new county, named in honor of George Wilkins Kendall. Later that year, the first County officials were elected, and Boerne was chosen as the county seat.

The preeminent issue at the time of the county's creation was the Civil War. Kerr County, which in 1861 included the future Kendall County, passed an ordinance of secession; however, the precinct that became Kendall County opposed the measure. The strong Unionist sentiment of the area was largely due to the wide number of German immigrants, most of whom disagreed with both slavery and secession. A number of these German Union supporters fought a Confederate force at the battle of Nueces; those who were killed at the battle were buried in a common grave in Comfort after the war and a monument was erected in their honor.

Following the Civil War and throughout the Reconstruction period, Kendall County suffered significant economic setbacks like most areas in the South. The county experienced the majority of loss from declines in total farm acreage, farm value, and livestock value until seeing economic recovery in 1880. Crops such as corn, wheat, cotton, and oats took up a third of the land, while livestock encompassed the rest. Sheep ranching, which had been introduced by George W. Kendall in the 1850s, had become the county's principal industry.

Kendall County upholds much of its German heritage, emulated in many of the surnames of its citizens, as well as in the ambience of its communities. Residents celebrate their local history through the annual Abendskanzart summer evening concert series and the Berges Fest in June. Events such as these and the Guadalupe River State Park have attracted many visitors to the area.

Kendall County has a total area of 663 square miles, of which 662 square miles is land and 0.6 square miles is water. Much of its terrain is rolling to hilly in the Edwards Plateau region. Major rivers and waterways include the Guadalupe River which drains from west to east, the Blanco River in the north, and Cibolo Creek in the south. Soils in Kendall County consists mainly of alkaline soils which produce tall grasses, live oak, juniper, and mesquite.

By 2002, the county had 967 ranches and farms, totaling 326,926 acres.



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

**Figure 3-1. Location of Kendall County**

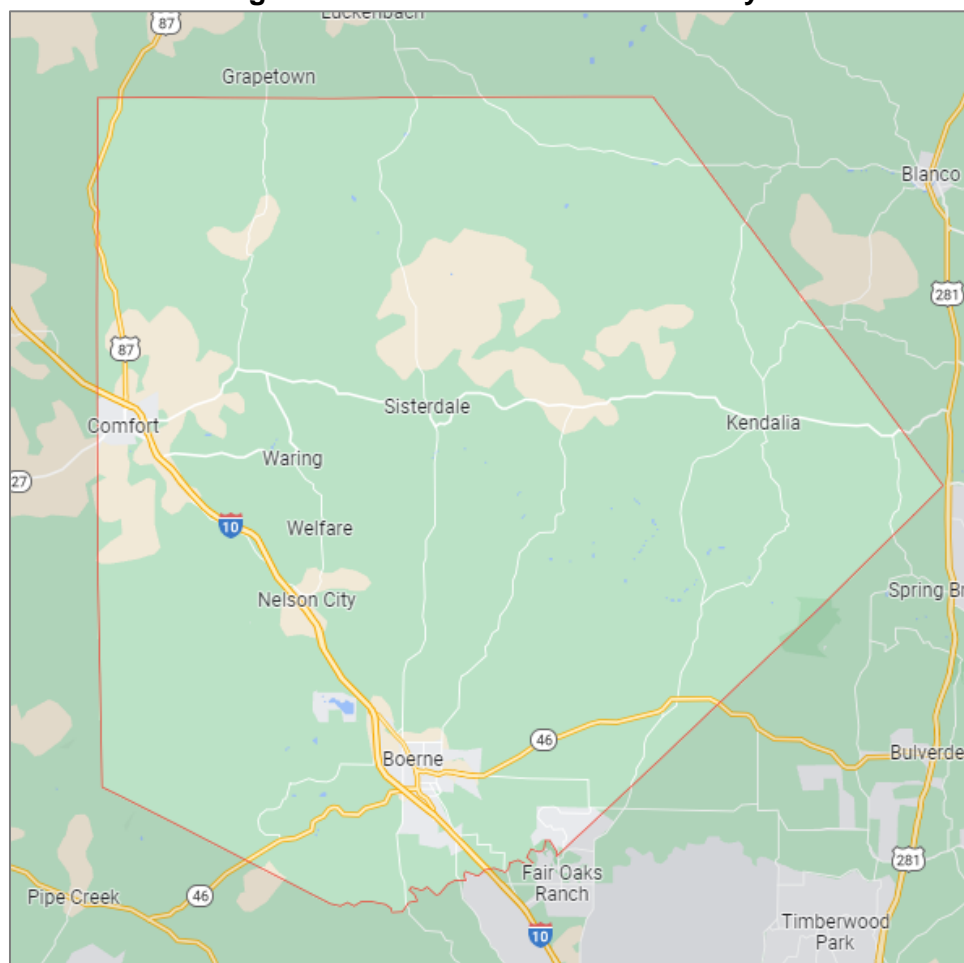
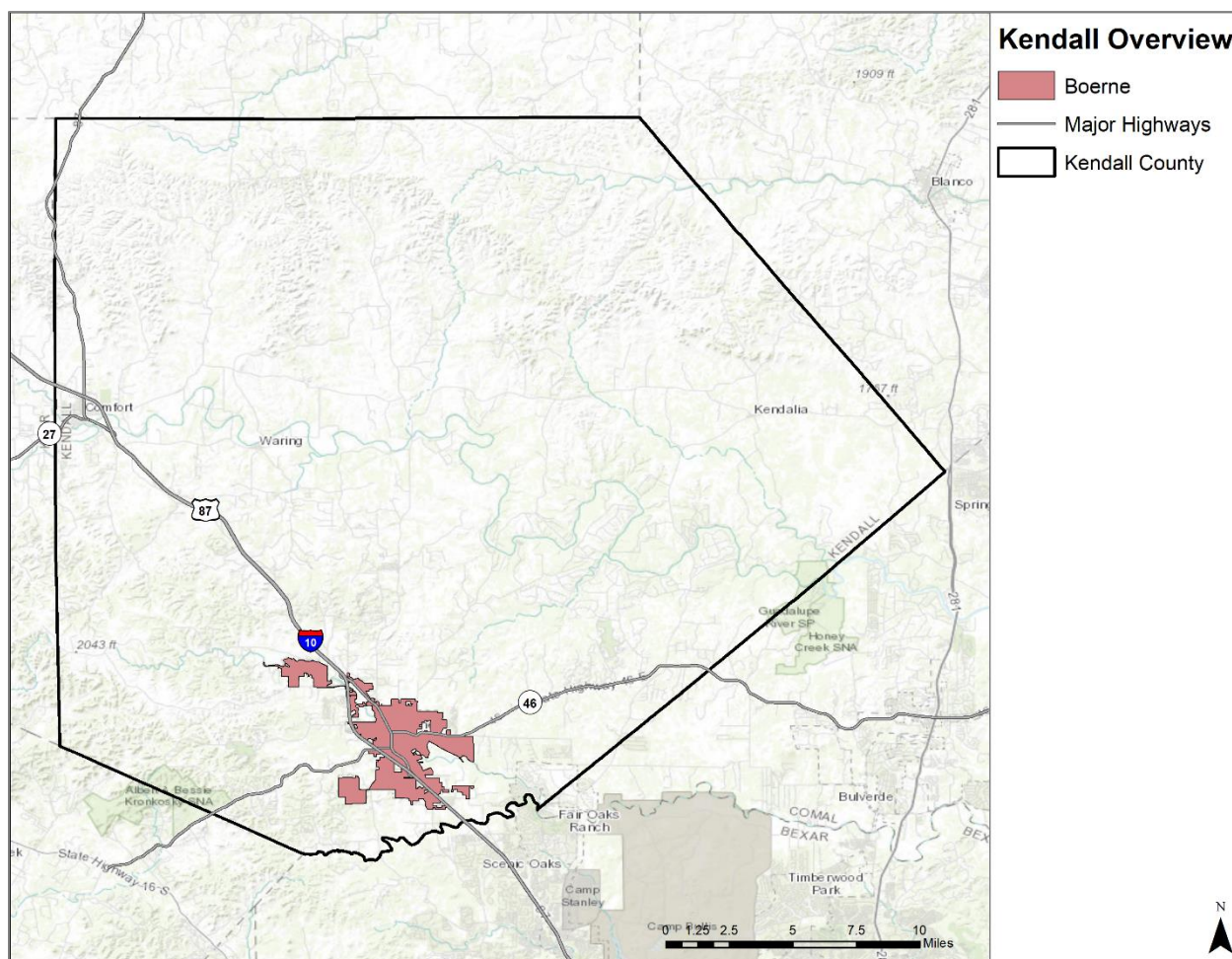


Figure 3-2 shows Kendall County and the City of Boerne that are covered in the risk assessment analysis of the Plan Update.

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**Figure 3-2. Kendall County Planning Area**



Provided in Table 3-1 below is a listing of the jurisdictions in Kendall County that participated in the Kendall County Hazard Mitigation Action Plan Update 2023.

**Table 3-1. Participating Jurisdictions**

PARTICIPATING JURISDICTIONS	
	Kendall County
	City of Boerne

## POPULATION AND DEMOGRAPHICS

In the official Census population count, as of April 1, 2020, Kendall County has a population of 44,279 residents. Table 3-2 provides the population distribution by jurisdiction within Kendall County based on the 2010 and 2020 Census information.<sup>1</sup>

<sup>1</sup> Source: <https://demographics.texas.gov/Data/Decennial/2010/> ; <https://www.census.gov/> ; and <https://www.census.gov/acs/www/data/data-tables-and-tools/data-profiles/2020/>

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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	TOTAL 2020 POPULATION	PERCENTAGE (based on 2020 Population)	ESTIMATED VULNERABLE OR SENSITIVE POPULATIONS <sup>2</sup>		
				Youth (Under 5)	Elderly (Over 65)	Below Poverty Level
City of Boerne	10,471	17,850	40.3%	1,112	3,024	1,065
Unincorporated Kendall County	22,939	26,429	59.7%	1,009	5,725	1,118
<b>Kendall County</b>	<b>33,410</b>	<b>44,279</b>	<b>100%</b>	<b>2,121</b>	<b>8,749</b>	<b>2,184</b>

### POPULATION GROWTH

The official 2020 Kendall County population is 44,279. Overall, Kendall County experienced an increase in population between 1980 and 2020 by 316%, or an increase of 33,644. Both the City of Boerne and unincorporated Kendall County experienced an increase from 1980 to 2020. Between 2010 and 2020, the City of Boerne and Kendall County as a whole experienced a population growth. Table 3-3 provides historic growth rates in Kendall County.

**Table 3-3. Population for Kendall County, 1980-2020**

JURISDICTIONS	1980	1990	2000	2010	2020	POP CHANGE 1980- 2020	PERCENT OF CHANGE	POP CHANGE 2010- 2020	PERCENT OF CHANGE
City of Boerne	3,229	4,361	6,178	10,471	17,850	14,621	452.80%	7,379	70.47%
Unincorporated Kendall County	7,406	10,228	17,565	22,939	26,429	19,023	256.86%	3,490	15.21%
<b>Kendall County</b>	<b>10,635</b>	<b>14,589</b>	<b>23,743</b>	<b>33,410</b>	<b>44,279</b>	<b>33,644</b>	<b>316.35%</b>	<b>10,869</b>	<b>32.53%</b>

### 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 2050 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

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<sup>2</sup> The Estimated Vulnerable or Sensitive Populations are based off the 2020 American Community Survey 5-Year Estimates Data Profiles.

## SECTION 3: COUNTY PROFILE

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. Kendall County Population Projections**

LAND AREA (SQ MI)	2010		2020		2030		2040		2050	
	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)	Total Number	Density (Land Area, SQ MI)
662.45	33,410	50	46,278	69.9	67,443	101.8	97,357	147.0	137,844	208.1

### 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 Kendall County and the City of Boerne. 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 City of Boerne's Economic Development department encourages commercial development opportunities for new and existing businesses while preserving the character, natural resources, and historical charm that makes Boerne a wonderful place to live and work.

### EXISTING AND FUTURE LAND USE AND DEVELOPMENT TRENDS

The Kendall County and the City of Boerne have a Building Code Official. Both the Kendall County and the City of Boerne have land use restrictions as well as subdivision regulations. These plans, regulations and restrictions are an important part of mitigation planning for the existing use and future planning of the community. These can ensure that current and future land use is beneficial, a smart investment and safe for the community.

Currently, the Kendall County Parks Department is working on an update to their 10-year Comprehensive Parks, Recreation, and Open Space Master Plan that will provide the foundation for establishment and growth of a county system of parks, greenways and open space.

The Boerne Master Plan provides a vision that will serve as a blueprint for future development in Boerne for the next 10 years and beyond. The Boerne Master Plan identifies key challenges and opportunities, defines goals and objectives, develops a strategic vision, and establishes implementation strategies to be achieved over 10 years.

# SECTION 4: RISK OVERVIEW

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## 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 20, which include hazard descriptions and vulnerability assessments.

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, Kendall County and the City of Boerne identified twelve natural hazards and four man-made hazards that are addressed in the Hazard Mitigation Action Plan Update. Of the natural hazards identified, eleven natural hazards and one quasi-technological 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 natural 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 lightning, thunderstorm wind, tornado, winter storm, extreme heat, hail, and hurricane/tropical 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, expansive soils, 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 wildfire hazard is considered “other,” since this hazard is not considered atmospheric, hydrologic, nor technological.

The man-made hazards include: hazardous material, pipeline failure, terrorism, and infectious disease.



## SECTION 4: RISK OVERVIEW

**Table 4-1. Hazard Descriptions**

HAZARD	DESCRIPTION
<b>ATMOSPHERIC</b>	
<b>Extreme Heat</b>	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.
<b>Hail</b>	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.
<b>Hurricane Wind</b>	A hurricane is an intense tropical weather system of strong thunderstorms with a well-defined surface circulation and maximum sustained winds of 74 mph or higher.
<b>Lightning</b>	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.
<b>Thunderstorm Wind</b>	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.
<b>Tornado</b>	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.
<b>Winter Storm</b>	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.
<b>HYDROLOGIC</b>	
<b>Drought</b>	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.

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HAZARD	DESCRIPTION
<b>Expansive Soil</b>	Expansive soils are soils and soft rock that tend to swell or shrink due to changes in moisture content. Changes in soils volume present a hazard primarily to structures built on top of expansive soils.
<b>Flood</b>	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.
<b>OTHER</b>	
<b>Wildfire</b>	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.
<b>TECHNOLOGICAL</b>	
<b>Dam Failure</b>	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.
<b>MAN-MADE</b>	
<b>Hazardous Materials</b>	A hazardous material (solid, liquid, or gaseous contaminants) of flammable or poisonous material that would be a danger to life or to the environment if released without precaution.
<b>Pipeline Failure</b>	Fuel pipeline breach or pipeline failure addresses the rare, but serious hazard of an oil or natural gas pipeline that, when breached, has the potential to cause extensive property damage and loss of life.
<b>Terrorism</b>	Incidents involving the application of one or more modes of harmful force to the built environment. These modes may include contamination (chemical, biological, radiological, or nuclear), energy (explosives, arson, electromagnetic waves), or denial of service (sabotage, infrastructure breakdown, and transportation service disruption) Terrorism is categorized as either domestic or international.
<b>Infectious Disease</b>	A clinically evident disease resulting from the presence of pathogenic microbial agents. These infecting agents may be transmitted through liquids, food, bodily fluids, contaminated objects, airborne inhalation, or through vector-borne dissemination.

## SECTION 4: RISK OVERVIEW

Hazards that weren't considered significant and were not included in the Plan Update are located in Table 4-2, 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
<b>Coastal Erosion</b>	The planning area is not located on the coast, therefore coastal erosion does not pose a risk.
<b>Earthquake</b>	The planning area does not have any historically significant recorded events. This hazard is not anticipated to occur or impact the planning area in the future.
<b>Land Subsidence</b>	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.



## SECTION 4: RISK OVERVIEW

Records retrieved from National Centers for Environmental Information (NCEI) and National Oceanic and Atmospheric Administration (NOAA) were reported for participating jurisdictions within Kendall 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 Kendall 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
<b>Highly Likely</b>	Event is probable in the next year.
<b>Likely</b>	Event is probable in the next three years.
<b>Occasional</b>	Event is probable in the next five years.
<b>Unlikely</b>	Event is probable in the next ten years.

**Table 4-4. Impact Statements**

POTENTIAL SEVERITY	DESCRIPTION
<b>Substantial</b>	Multiple deaths. Complete shutdown of facilities for 30 days or more. More than 50 percent of property destroyed or with major damage.
<b>Major</b>	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.
<b>Minor</b>	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.
<b>Limited</b>	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.

## SECTION 4: RISK OVERVIEW

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. Risk and consequences will be addressed and covered within each hazard profile under the Vulnerability and Impact section as well as under the Assessment of Impact sections, where applicable.

To better understand how future growth and development in the Kendall 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 Kendall County was reviewed based on recent development changes that occurred throughout the planning area. Kendall County has increased slightly between 2010 and 2020 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.

**Table 4-5. Hazard Risk Ranking**

HAZARD	FREQUENCY OF OCCURENCE	POTENTIAL SEVERITY
Flood	Highly Likely	Substantial
Wildfire	Highly Likely	Minor
Drought	Highly Likely	Limited
Extreme Heat	Highly Likely	Limited
Thunderstorm Wind	Highly Likely	Limited
Tornado	Likely	Minor
Hail	Highly Likely	Limited
Winter Storm	Highly Likely	Limited
Dam Failure	Unlikely	Limited
Hurricane Wind	Unlikely	Limited
Lightning	Highly Likely	Limited
Expansive Soils	Highly Likely	Limited

# SECTION 5: FLOOD

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## 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 Kendall County and the City of Boerne shows the following flood hazard areas:

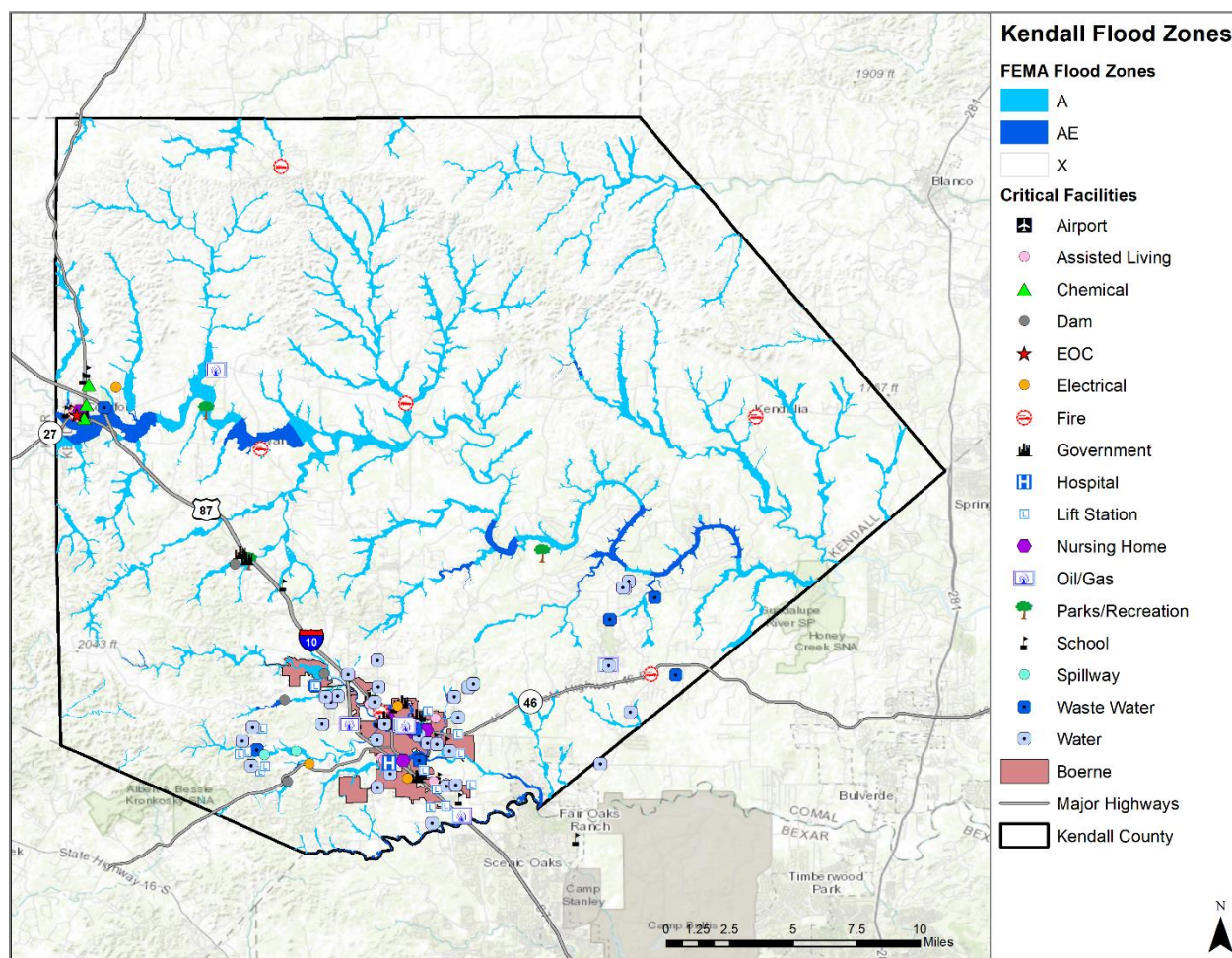
- Zone A: Areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown. Mandatory flood insurance requirements and floodplain 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.

## SECTION 5: FLOOD

- 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 Kendall County and the City of Boerne are based on the Digital Flood Insurance Rate Maps (DFIRM) from FEMA are illustrated in Figures 5-1 to 5-2.

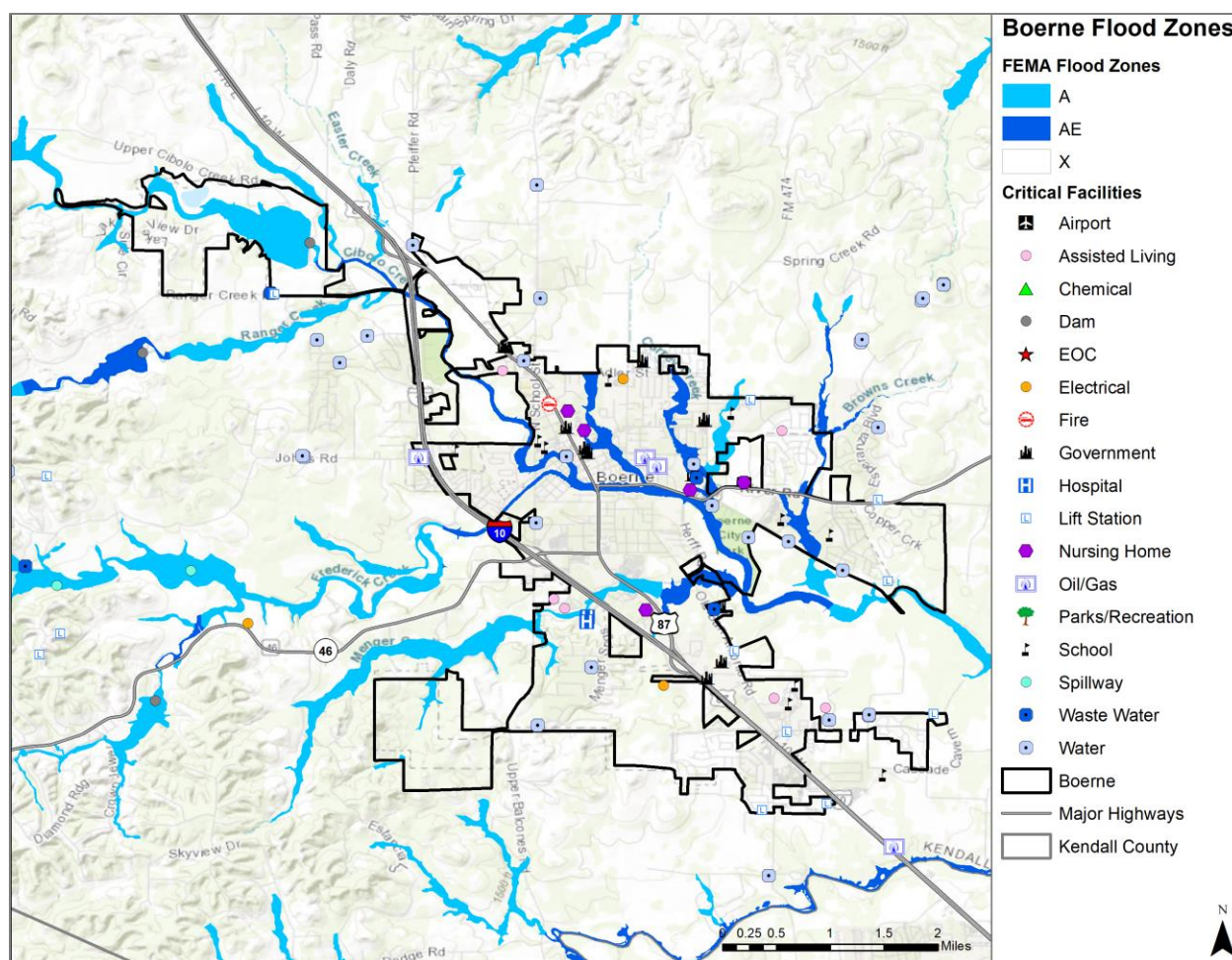
**Figure 5-1. Estimated Flood Zones in Kendall County**





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**Figure 5-2. Estimated Flood Zones in the City of Boerne**



### 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 5-1 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 5-1 through 5-2 should be read in conjunction with the extent for flooding in Tables 5-1 and 5-2 to determine the intensity of a potential flood event.

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**Table 5-1. 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.

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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 5-2 describes the stream gauge data provided by the United States Geological Survey (USGS).

**Table 5-2. Extent for Kendall County and the City of Boerne<sup>1</sup>**

JURISDICTION <sup>2</sup>	PEAK FLOOD EVENT
Kendall County	Guadalupe River at Comfort, Kendall County, Texas reached an overflow elevation of 40.9 feet in August of 1978. The average peak flow for Guadalupe River is 17.2 feet at this site.
City of Boerne	Cibolo Creek near Boerne, Kendall County, Texas reached an overflow elevation of 19.8 feet in May of 2015. The average peak flow for Cibolo Creek is 8.4 feet at this site.

The range of flood intensity that the planning area can experience is high, or Zone A. Based on historical occurrences, the planning area, including the County and the City of Boerne could expect to experience 11 to 21 inches of rainfall within a 48-hour period, resulting in flash flooding.

The data described in Tables 5-1 and 5-2, together with Figures 5-1 through 5-2, and historical occurrences for the area, provides an estimated potential magnitude and severity for the County. For example, the City of Boerne, as shown in Figure 5-2, has areas designated as Zone AE. Reading this figure in conjunction with Table 5-1 means the area is an area of high risk for flood.

### HISTORICAL OCCURRENCES

Historical evidence indicates that areas within Kendall County and the City of Boerne 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 5-3 identifies historical flood events that resulted in damages, injuries, or fatalities within Kendall County and the City of Boerne. Table 5-4 provides the historical flood event summary by jurisdiction. Historical data is provided by the Storm Prediction Center (NOAA), NCEI database for Kendall County.

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<sup>1</sup> 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.

<sup>2</sup> Severity is provided for jurisdictions where peak data was provided.



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**Table 5-3. Historical Flood Events, 1996-2022<sup>3</sup>**

JURISDICTION	DATE	TIME	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	2/20/2019	11:00 AM	0	0	\$27,836	\$0
Kendall County	4/4/1997	7:00 AM	0	0	\$18,488	\$0
Kendall County	5/19/1997	9:30 PM	0	0	\$5,500	\$0
Kendall County	5/27/1997	7:30 PM	0	0	\$36,998	\$0
Kendall County	6/6/1997	3:00 PM	0	0	\$9,238	\$0
Kendall County	6/21/1997	10:30 AM	0	0	\$27,714	\$0
Kendall County	6/22/1997	12:30 AM	0	5	\$9,238,022	\$1,847,604
Kendall County	8/8/1997	12:00 PM	0	0	\$9,209	\$0
Kendall County	2/21/1998	6:00 PM	0	0	\$5,488	\$0
Kendall County	3/16/1998	1:00 AM	0	0	\$36,519	\$0
Kendall County	8/22/1998	1:00 PM	0	0	\$18,126	\$36,251
Kendall County	10/17/1998	12:00 PM	0	10	\$90,296	\$90,296
Kendall County	10/23/2000	5:00 AM	0	0	\$85,107	\$17,021
Kendall County	11/2/2000	5:30 PM	0	0	\$42,529	\$0
Kendall County	8/27/2001	5:30 PM	0	0	\$16,686	\$0
Kendall County	8/31/2001	7:30 PM	0	0	\$33,371	\$50,057
Kendall County	9/5/2001	5:00 PM	0	0	\$33,222	\$0
Kendall County	11/15/2001	6:45 AM	0	5	\$83,475	\$0
Kendall County	6/30/2002	7:30 AM	0	0	\$49,389	\$0
Kendall County	7/3/2002	8:00 PM	1	0	\$0	\$0
Kendall County	10/7/2002	8:45 PM	0	0	\$16,336	\$0
Kendall County	10/24/2002	8:30 AM	0	0	\$49,008	\$0
Kendall County	2/20/2003	8:00 AM	0	0	\$8,088	\$0
Kendall County	2/21/2003	4:15 AM	0	0	\$16,175	\$0
Kendall County	3/25/2003	6:30 PM	0	0	\$8,039	\$0

<sup>3</sup> Only recorded events with fatalities, injuries, and/or damages are listed, values are in 2022 dollars. Historical events are reported from January 1996 through May 2022.

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JURISDICTION	DATE	TIME	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	6/13/2003	6:30 PM	0	0	\$8,061	\$0
Kendall County	6/28/2003	5:00 PM	0	0	\$8,061	\$0
Kendall County	1/16/2004	5:30 PM	0	0	\$7,996	\$0
Kendall County	5/2/2007	9:00 PM	2	0	\$0	\$0
City of Boerne	8/16/2007	4:00 PM	2	0	\$427,340	\$0
Kendall County	5/29/2016	1:06 AM	1	0	\$0	\$0
<b>TOTALS</b>			<b>6</b>	<b>20</b>	<b>\$10,416,368</b>	<b>\$2,041,230</b>

**Table 5-4. Summary of Historical Flood Events, January 1996 - May 2022**

JURISDICTION	NUMBER OF EVENTS	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	70	4	20	\$9,989,028	\$2,041,230
City of Boerne	11	2	0	\$427,340	\$0
<b>TOTAL LOSSES</b>	<b>81</b>	<b>6</b>	<b>20</b>	<b>\$12,457,598</b>	

Based on the list of historical flood events for the Kendall County planning area (listed above) two of the events have occurred since the 2017 Plan.

### SIGNIFICANT EVENTS

#### Flash Flood on May 29, 2016 – Kendall County

Thunderstorms developed in a moist, conditionally unstable airmass along an outflow boundary from the previous day's convection in north Texas. Some of these storms produced large hail, damaging wind gusts, and heavy rain that led to flash flooding.

A young lady drowned on Cypress Creek near the intersection of Highway 27 and Water Street in Comfort. The car was swept off into the creek due to heavy rain. Two occupants made it to safety. One other occupant drowned and was recovered several miles downstream.

#### Flash Flood on August 16, 2007 – Boerne

Extremely heavy rainfall associated with the remains of Tropical Storm Erin moved into Kendall County in the afternoon of August 16, producing between 3 and 5 inches over most of the county. Highest rain totals were 8 inches between Boerne and Sisterdale. Most roads in the county were closed and several families had to be evacuated along Cypress Creek due to flooding. City Lake was reported to be only six feet below the spillway. It had only been topped twice in the past 10 years. Near 7:00 PM CST on the evening of April 16, a man and his son were in a truck traveling along FM 473 when they attempted to drive across a bridge near FM 1376 that was already flooded by Sister Creek. The truck stalled and both men crawled out of the cab through the rear window and stood in the truck bed. Rescuers who arrived within minutes were unable to pass

## SECTION 5: FLOOD

them life jackets or to secure a rope to the truck before a surge of water lifted the vehicle and swept it over the bridge. The father and son were washed into the creek and drowned.

### **Flash Flood on June 22, 1997 – Kendall County**

The heavy rain Friday night into Saturday afternoon had left South Central Texas soils saturated. The situation worsened Saturday evening into Sunday as heavy rain associated with the upper low pressure system redeveloped over the western Texas Hill Country. Very heavy rains over the Texas Hill Country Saturday night and Sunday morning caused widespread flooding as well as flash flooding across numerous counties.

The Guadalupe River first crested at Comfort at 25.9 feet early on June 22nd, then an additional 4.5 inches of rain in the Cypress Creek drainage area sent a flood wave downstream that flooded homes in Comfort. Further downstream, the Guadalupe at Spring Branch rose to within a foot of the flood of record, 45.45 feet. Canyon Lake rose to within 5 feet of the record elevation and within 6 feet of the emergency spillway height.

An estimated 12 to 15 inches of rain fell between Bandera and Boerne, with up to 20 inches west of Boerne, produced flooding along Cibolo Creek that filled two flood retention dams as well as Boerne City Lake. The Boerne Police Chief was trapped in his home by the flood wave down the spillway, and reported a television set washing through the window of one of the flooded homes. Cibolo Creek in Boerne crested at over 16 feet, the highest level since 1964. About 20 percent of the homes facing Cibolo Creek were flooded to some extent. Downstream, the Creek flooded several homes in Bulverde. The most massive damage was in Schertz, where blocks of the Pecan Grove Trailer Park were inundated. Trailers washed downstream into each other, lodging in trees. The Red Cross reported 330 persons evacuated and seeking alternate housing. The flood wave reached LaVernia early Monday afternoon, flooding two homes, and causing 25 families to be evacuated.

The Red Cross and FEMA totals for homes and businesses damaged or destroyed in this flood in South Central Texas included nearly 300 homes across the Highland Lakes northwest of the Austin area. In addition, homes and businesses damaged or destroyed numbered approximately 200 in Guadalupe County, 150 in each of Bandera and Bexar Counties, 100 in each of Medina and Kendall Counties, and 50 in each of Real, Uvalde and Comal Counties.

## PROBABILITY OF FUTURE EVENTS

Based on recorded historical occurrences and extent within the Kendall County planning area, 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. Kendall County and the City of Boerne encourage development outside of the floodplain, and the impact for flood for the entire planning area is limited as facilities and services would be shut down for 24 hours or less, depending on the scale of the storm.

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

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

JURISDICTION	CRITICAL FACILITIES
Kendall County	1 Wastewater Facility, 1 Water Well, 2 Spillway, 1 Dam, 1 Park
City of Boerne	1 VFD, 1 Wastewater Facility, 1 Water Well, 2 Dams

Historic loss estimates due to flood are presented in Table 5-6 below. Considering 81 flood events over a 26-year period, frequency is approximately three to four events every year.

**Table 5-6. Potential Annualized Losses by Jurisdiction**

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Kendall County	\$12,030,258	\$462,702
City of Boerne	\$427,340	\$16,436
<b>Planning Area</b>	<b>\$12,457,598</b>	<b>\$479,138</b>

While all citizens are at risk to the impacts of a flood, forced relocation and disaster recovery drastically impacts low-income residents who lack the financial means to travel, afford a long-term stay away from home, and to rebuild or repair their homes. An estimated 4.8% of the planning area population live below the poverty level (Table 5-7).

**Table 5-7. Populations at Greatest Risk by Jurisdiction<sup>4</sup>**

JURISDICTION	POPULATION BELOW POVERTY LEVEL
Kendall County	2,184
City of Boerne	1,065

The severity of a flooding event varies depending on the relative risk to citizens and structures located within each city. Table 5-8 depicts the level of impact for Kendall County including the City of Boerne.

**Table 5-8. Impact by Jurisdiction**

JURISDICTION	IMPACT	DESCRIPTION
Kendall County	Substantial	Impact of floods experienced in Kendall County has resulted in 20 injuries and 6 fatalities supporting a 'Substantial' severity of impact meaning a complete shutdown of facilities for 30 days or more, multiple deaths, and more than 50% of property destroyed or with major damage.

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<sup>4</sup> US Census Bureau 2020 American Community Survey data for Kendall County

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JURISDICTION	IMPACT	DESCRIPTION
City of Boerne	Substantial	Impact of floods experienced in the City of Boerne has resulted in a fatality, supporting a 'Substantial' severity of impact meaning a complete shutdown of facilities for 30 days or more, multiple deaths, and more than 50% of property destroyed or with major damage.

### 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 Kendall 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.

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- 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 at locations such as Joshua Springs Park & Preserve or James Kiehl River Bend Park 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. Kendall County and the City of Boerne are currently participating in the NFIP and are in good standing.

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Kendall County and the City of Boerne currently have in place minimum NFIP standards for new construction and substantial improvements of structures. They 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 Kendall County and the City of Boerne to continue to promote the public health, safety and general welfare by minimizing public and private losses due to flood conditions in specific areas. Kendall County and City of Boerne 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, Kendall County and the City of Boerne 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



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- 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, Kendall County and the City of Boerne have developed mitigation actions that relate to either NFIP maintenance or compliance. Compliance and maintenance actions can be found in Section 23.

Flooding was identified by both participating communities as a high-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.

Kendall County and the City of Boerne both 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.

## SECTION 5: FLOOD

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.<sup>5</sup> Table 5-9 shows repetitive loss and severe repetitive loss properties for each participating jurisdiction in the planning area.

**Table 5-9. Repetitive Loss and Severe Repetitive Loss Properties**

JURISDICTION	BUILDING TYPE	NUMBER OF STRUCTURES	NUMBER OF LOSSES
Kendall County	Residential		38
City of Boerne	Residential		4
	Non-Residential		4

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<sup>5</sup> Source: Texas Water Development Board

# SECTION 6: WILDFIRE

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## 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.

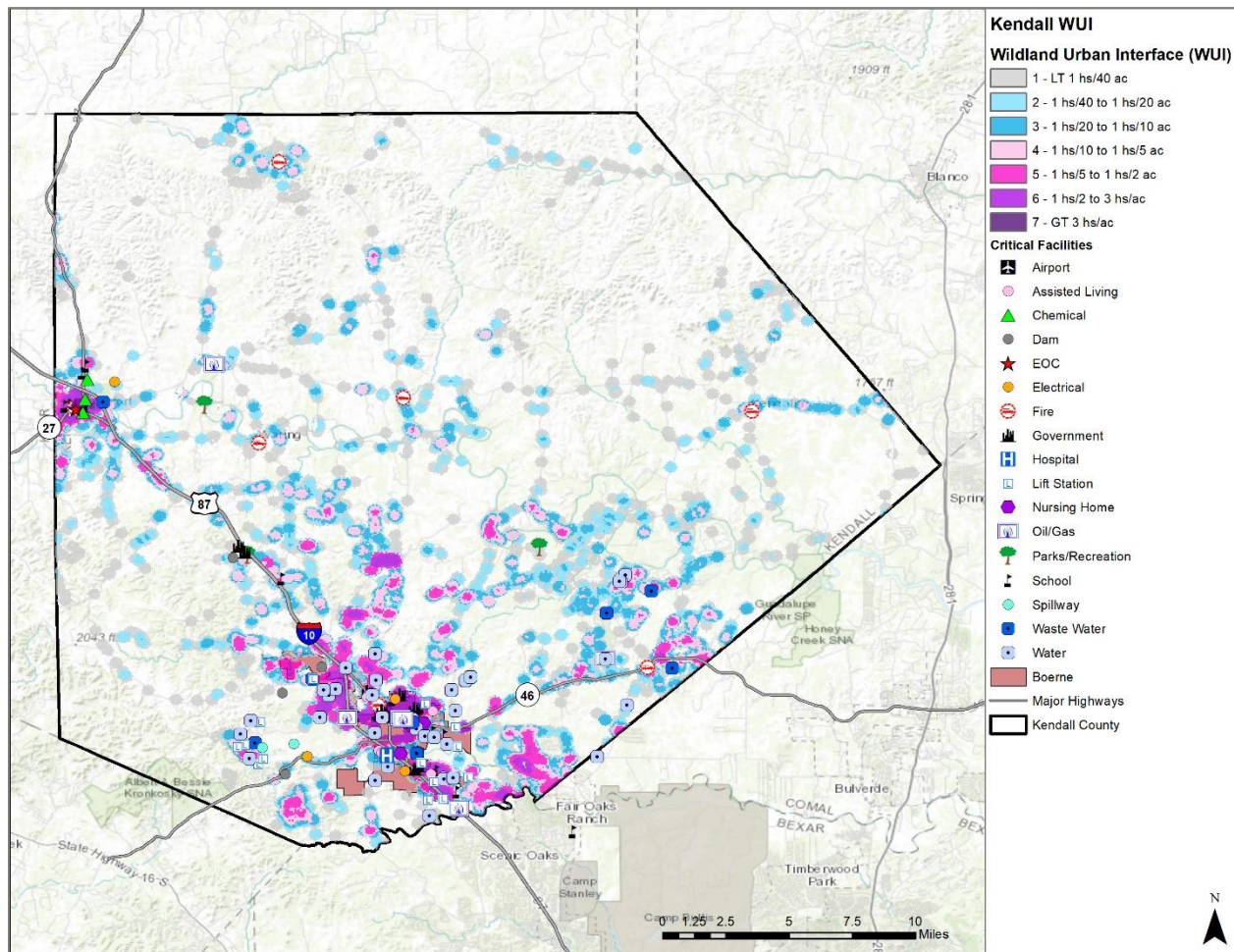
Texas has seen a significant increase in the number of wildfires in the past 30 years, which included wildland, interface, or intermix fires. Wildland fires are fueled almost exclusively by natural vegetation, while interface or intermix fires are urban/wildland fires in which vegetation and the built-environment 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 6-1 through 6-2). It is estimated that 93.9 percent of the total population in Kendall County live within the WUI. However, the entire Kendall County planning area is at some risk for wildfires.

## SECTION 6: WILDFIRE

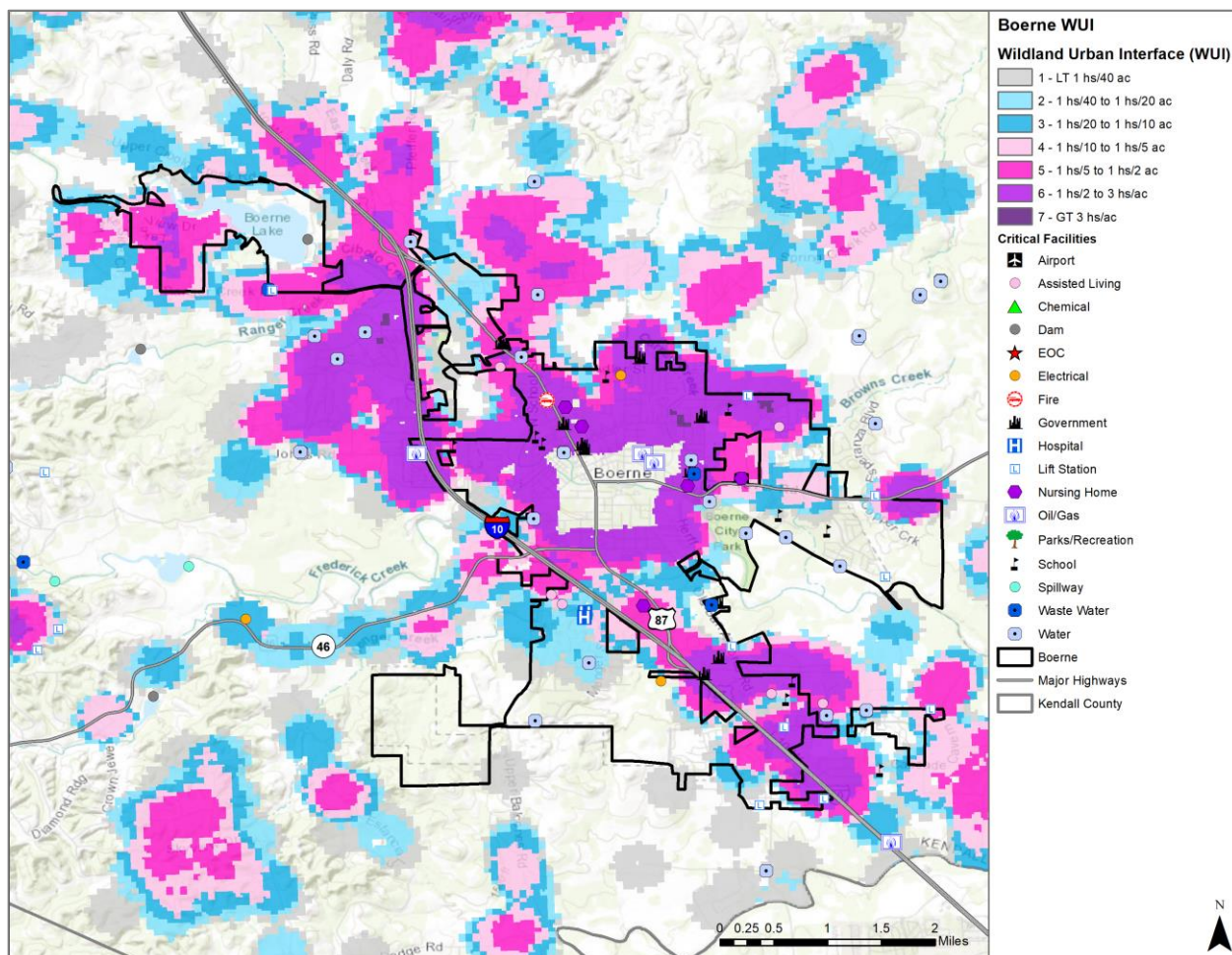
Figure 6-1. Wildland Urban Interface Map – Kendall County





## SECTION 6: WILDFIRE

Figure 6-2. Wildland Urban Interface Map – City of Boerne



It is estimated that 81.5 percent of the total population in the City of Boerne live within the WUI. However, the entire City of Boerne is at some risk for wildfires

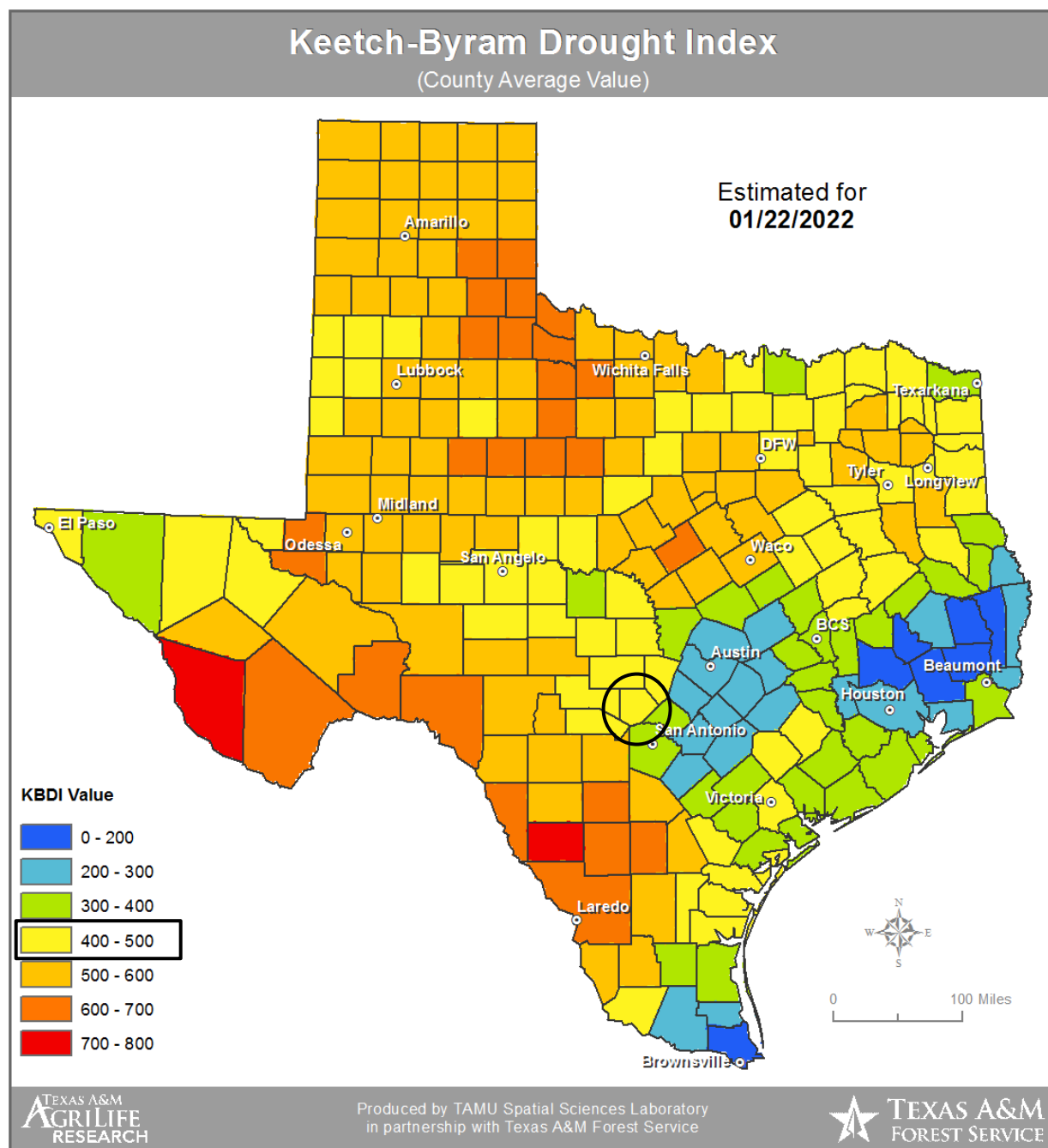
### EXTENT



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.

## SECTION 6: WILDFIRE

Figure 6-3. Keetch-Byram Drought Index (KBDI) for the State of Texas, 2022<sup>1</sup>



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.

<sup>1</sup> Kendall County is located within the black circle.

## SECTION 6: WILDFIRE

- **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.

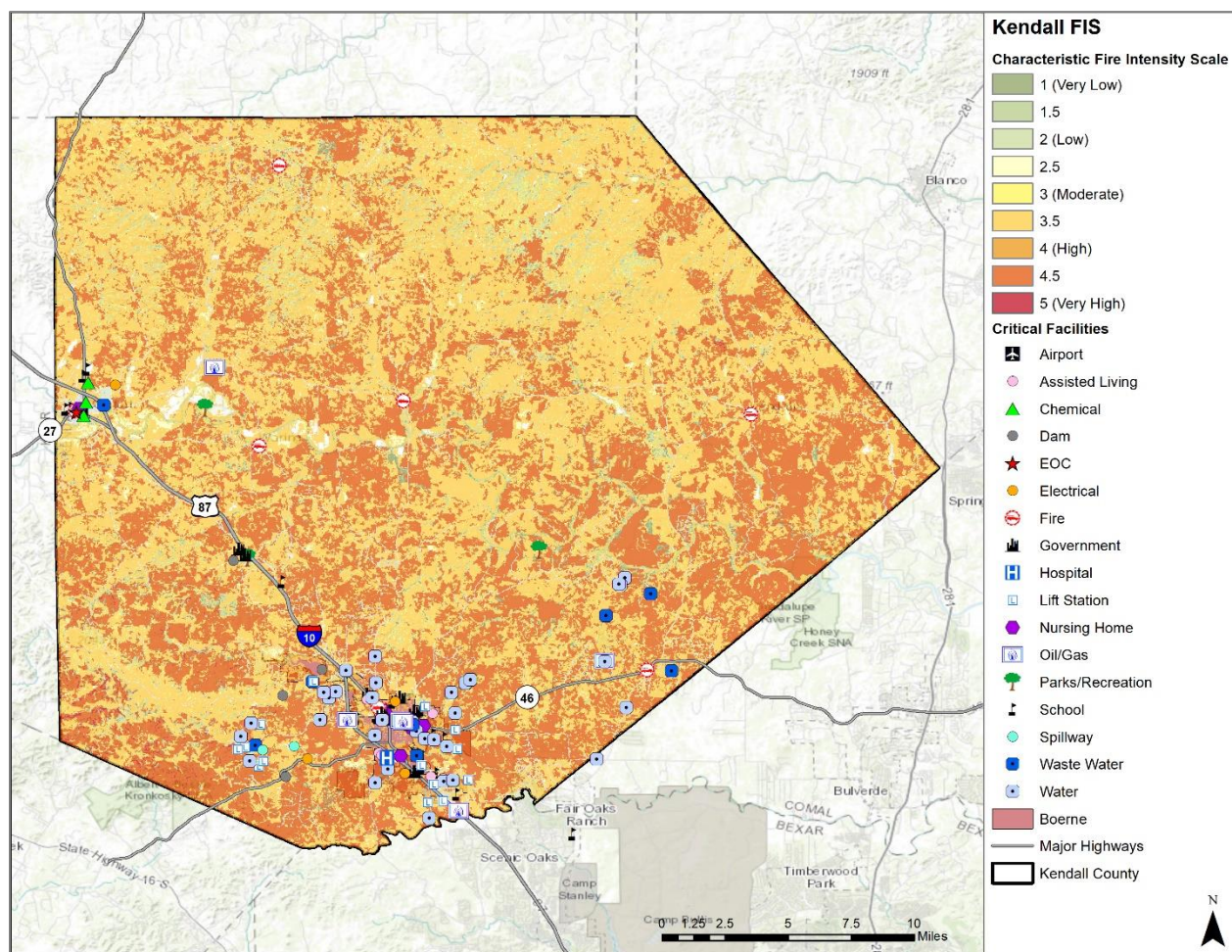
The range of intensity for the Kendall County planning area in a wildfire event is within 97 to 788. The average extent to be mitigated for Kendall County and the City of Boerne is a KBDI of 420. At this level fires intensity begins to significantly increase. Fire will readily burn in all directions 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 788 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. Kendall County is between a potential limited to moderate wildfire intensities. Figures 6-4 through 6-5 identify the wildfire intensity for Kendall County and the City of Boerne.



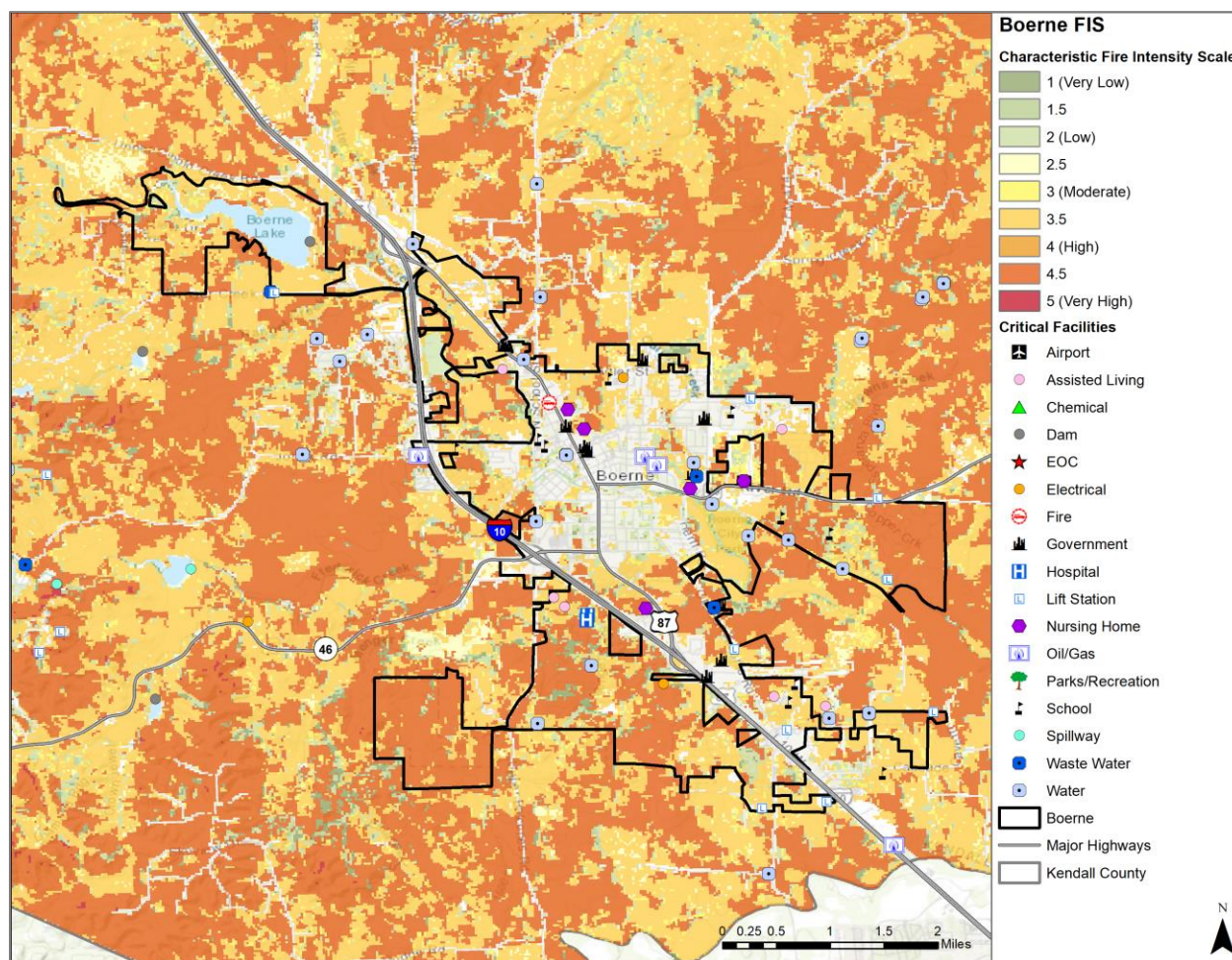
## SECTION 6: WILDFIRE

**Figure 6-4. Fire Intensity Scale Map – Kendall County**



## SECTION 6: WILDFIRE

Figure 6-5. Fire Intensity Scale Map – City of Boerne



### HISTORICAL OCCURRENCES

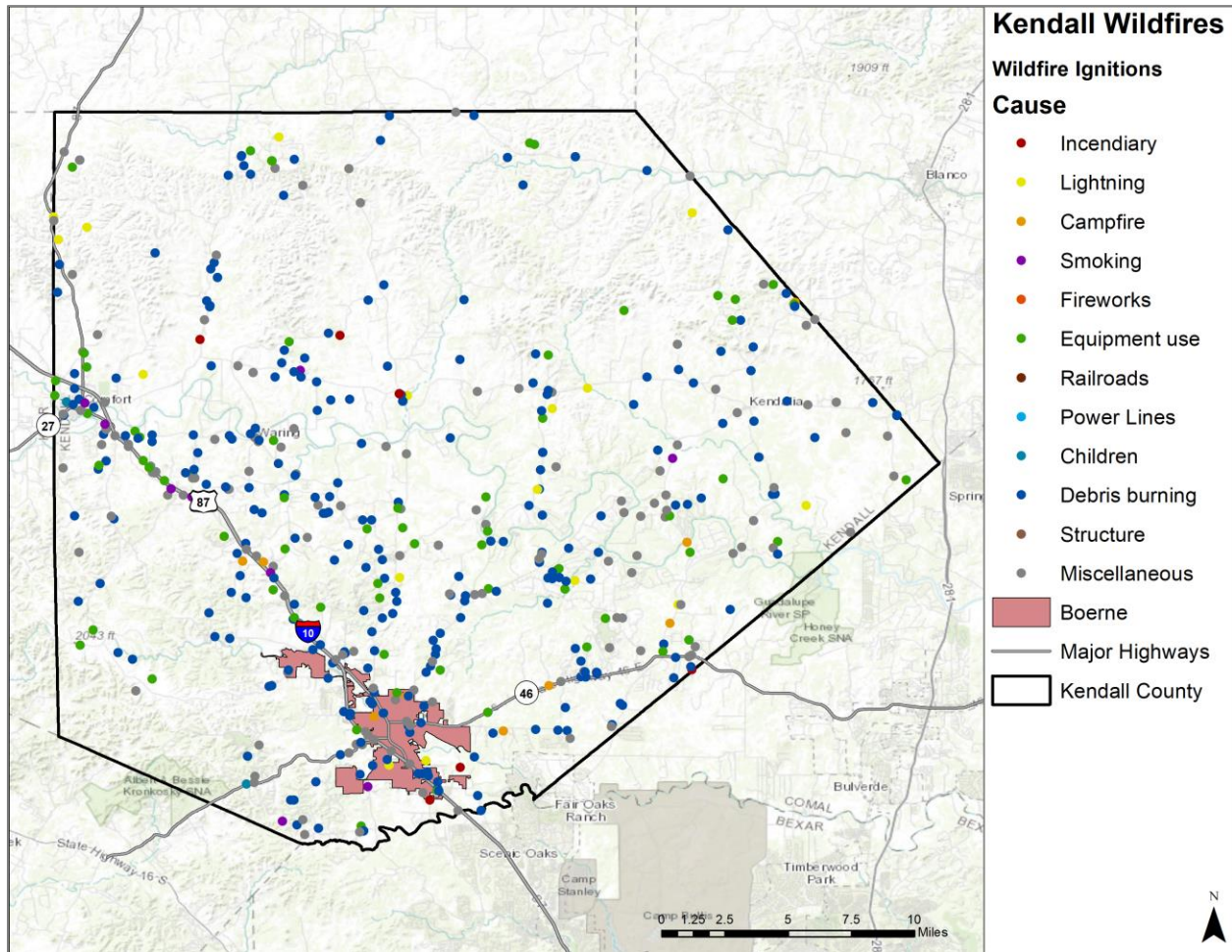
The Texas Forest Service reported 554 wildfire events between 2005 and 2020. The National Centers for Environmental Information (NCEI) only reported one event from 1996 through May 2022. Due to a lack of recorded data for wildfire events prior to 2005 and after 2020<sup>2</sup>, frequency calculations are based on a sixteen-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 6-6). Table 6-1 identifies the number of wildfires by jurisdiction and total acreage burned.

<sup>2</sup> The Texas Forest Service data is currently only available through 2020.



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**Figure 6-6. Location and Historic Wildfire Events for Kendall County Planning Area**



**Table 6-1. Historical Wildfire Events Summary**

JURISDICTION	NUMBER OF EVENTS	ACRES BURNED
Kendall County	526	9,184
City of Boerne	28	68

**Table 6-2. Acreage of Suppressed Wildfire by Year**

YEAR	KENDALL COUNTY	CITY OF BOERNE
2005	36	0
2006	735	8
2007	412	2
2008	4,398	54
2009	2,133	3

## SECTION 6: WILDFIRE

YEAR	KENDALL COUNTY	CITY OF BOERNE
2010	20	0
2011	774	1
2012	19	0
2013	122	0
2014	148	0
2015	116	0
2016	43	0
2017	144	0
2018	31	0
2019	15	0
2020	38	0
<b>TOTAL</b>	<b>9,184</b>	<b>68</b>

Based on the list of historical wildfire events for the Kendall County planning area 42 of the events have occurred since the 2017 Plan.

### SIGNIFICANT PAST EVENTS

#### June 6, 2011 – Kendall County

The Green Cedar wildfire in Kendall County between Boerne and Comfort was spread by southerly winds that gusted between 25 and 30 mph. Temperatures were near 100 degrees. The fire burned 140 acres including an RV park on Interstate 10. One structure and seven recreational vehicles were destroyed by the fire.

### 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 554 events in a 16-year period, an event within Kendall County and the City of Boerne 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 urban populated areas of Kendall County are not likely to experience large, sweeping fires. The sparsely populated rural areas of Kendall County are capable of experiencing large sweeping fires, especially where areas of vegetation are not maintained. Areas along major highways in Comfort, and along Interstate Highway 10 in Kendall County have an increased vulnerability

## SECTION 6: WILDFIRE

where empty lots and unoccupied areas are located. Figures 6-1 and 6-2 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 6-3. Critical Facilities Located in WUI by Jurisdiction**

JURISDICTION	CRITICAL FACILITIES
Kendall County	4 VFD, 1 Government Building, 4 Schools, 2 Chemical Facilities, 1 Natural Gas Facility, 1 Gas/Propane Facility, 1 Petroleum Facility, 1 Fertilizer Storage, 1 Electrical Transport Facility, 1 Wastewater Facility, 1 Wastewater Treatment Plant, 1 Water Plant, 2 Water Reclamation Facilities, 2 Water Treatment Facilities, 3 Water Storage Tanks, 2 Booster Stations, 2 Electrical Substations, 11 Lift Stations, 5 Pump Stations, 12 Water Wells, 1 Park, 1 EM Helipad
City of Boerne	2 VFD, 10 Government Buildings, 10 Schools, 1 Hospital, 6 Assisted Living Facilities, 5 Nursing Homes, 1 Gas/Propane Facility

Within Kendall County, a total of 554 fire events were reported from 2005 to 2020. All of these events were suspected wildfires. Historic loss and annualized estimates due to wildfires are presented in Table 6-4 below. The frequency is approximately 35 events every year.

**Table 6-4. Potential Annualized Losses by Jurisdiction<sup>3</sup>**

JURISDICTION	ACRES BURNED	ANNUAL ACRE LOSSES
Kendall County	9,184	574
City of Boerne	68	4.25
<b>Planning Area</b>	<b>9,252</b>	<b>578.25</b>

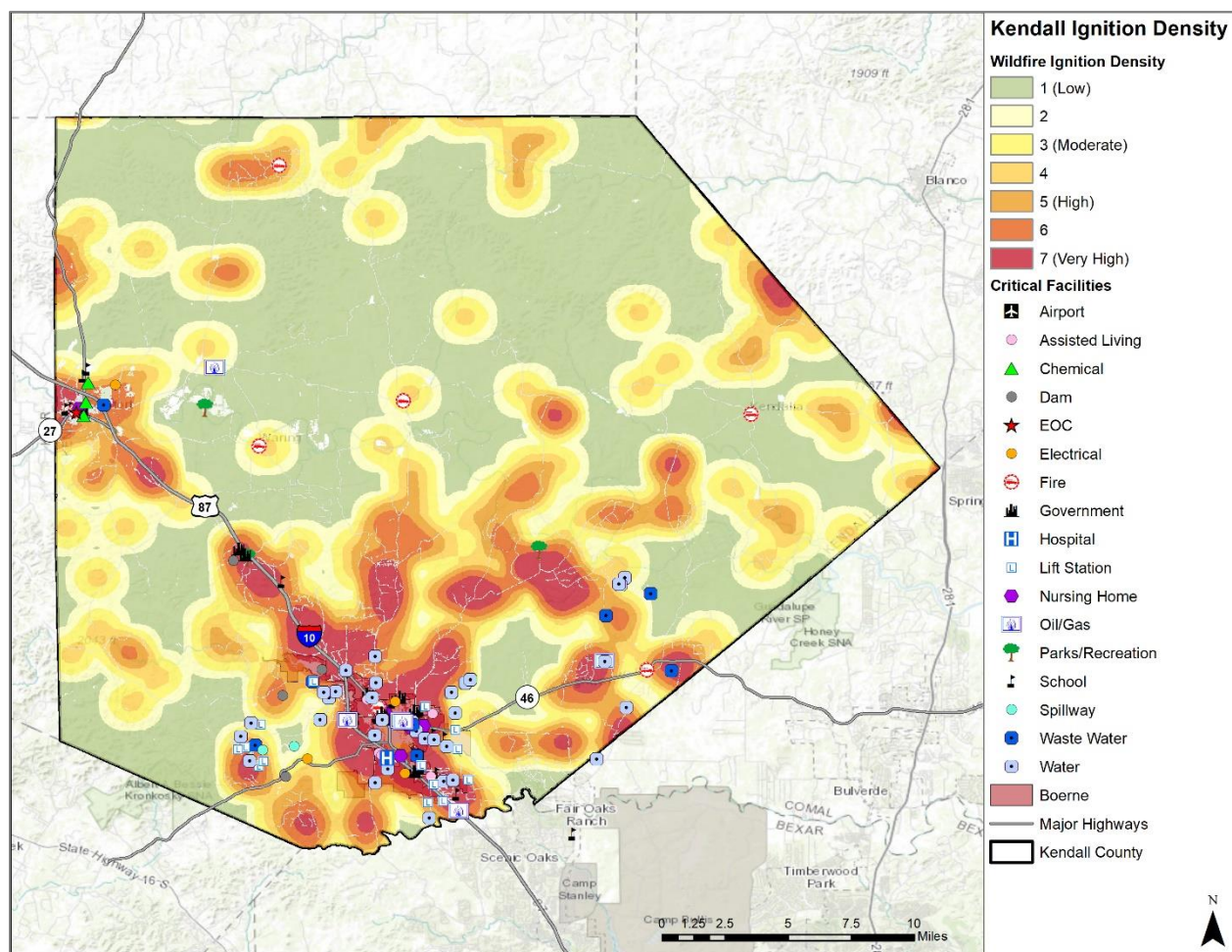
Figures 6-7 through 6-8 show the threat of wildfire to Kendall County and the City of Boerne.

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<sup>3</sup> Events divided by 16 years of data.

## SECTION 6: WILDFIRE

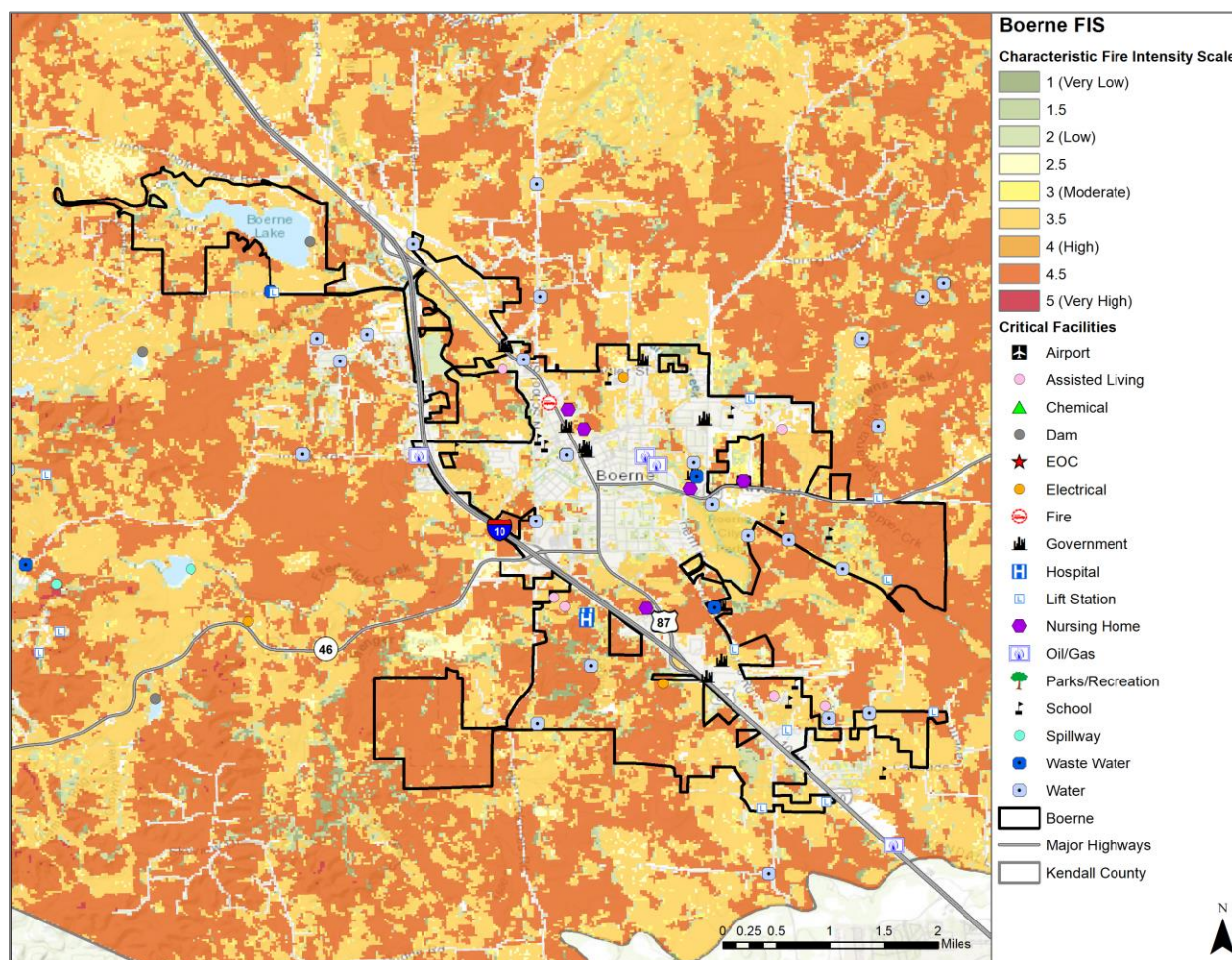
**Figure 6-7. Wildfire Ignition Density – Kendall County**





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Figure 6-8. Wildfire Ignition Density – City of Boerne



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 Kendall County planning area, the impact from a wildfire event can be considered "Minor," meaning could be injured or suffer illnesses treatable with first aid. Critical facilities could be shut down for one week or less and more than 10 percent of total property could be damaged. Severity



## SECTION 6: WILDFIRE

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 6-5.

**Table 6-5. Impact by Jurisdiction**

JURISDICTION	IMPACT	DESCRIPTION
Kendall County	Minor	Kendall County has an estimated 31,976 people or 93.9 percent of the total population that live within the Wildland Urban Interface (WUI). Citizens in Kendall County, including citizens in unincorporated areas, could be injured or suffer illnesses treatable with first aid. Critical facilities could be shut down for one week or less and more than 10 percent of total property could be damaged.
City of Boerne	Minor	The largest population in the City of Boerne live in an area that is semi-dense (1-3 houses per 1 acre) in the WUI, and the City has an estimated 7,088 people or 81.5 percent of the total population live within the Wildland Urban Interface (WUI). Citizens could be injured or suffer illnesses, but not permanent disability. Critical facilities could be shut down for 24 hours or less and less than 10 percent of total property could be damaged.

### ASSESSMENT OF IMPACTS

A wildfire event poses a potentially significant risk to public health and safety, particularly if the wildfire is initially unnoticed and spreads quickly. The impacts associated with 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.

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- 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 Joshua Springs Park & Preserve or James Kiehl River Bend Park, 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 7: DROUGHT

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## 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<sup>1</sup>**

<b>METEOROLOGICAL DROUGHT</b>	The degree of dryness or departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales.
<b>HYDROLOGIC DROUGHT</b>	The effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels.
<b>AGRICULTURAL DROUGHT</b>	Soil moisture deficiencies relative to water demands of plant life, usually crops.
<b>SOCIOECONOMIC DROUGHT</b>	The effect of demands for water exceeding the supply as a result of a weather-related supply shortfall.

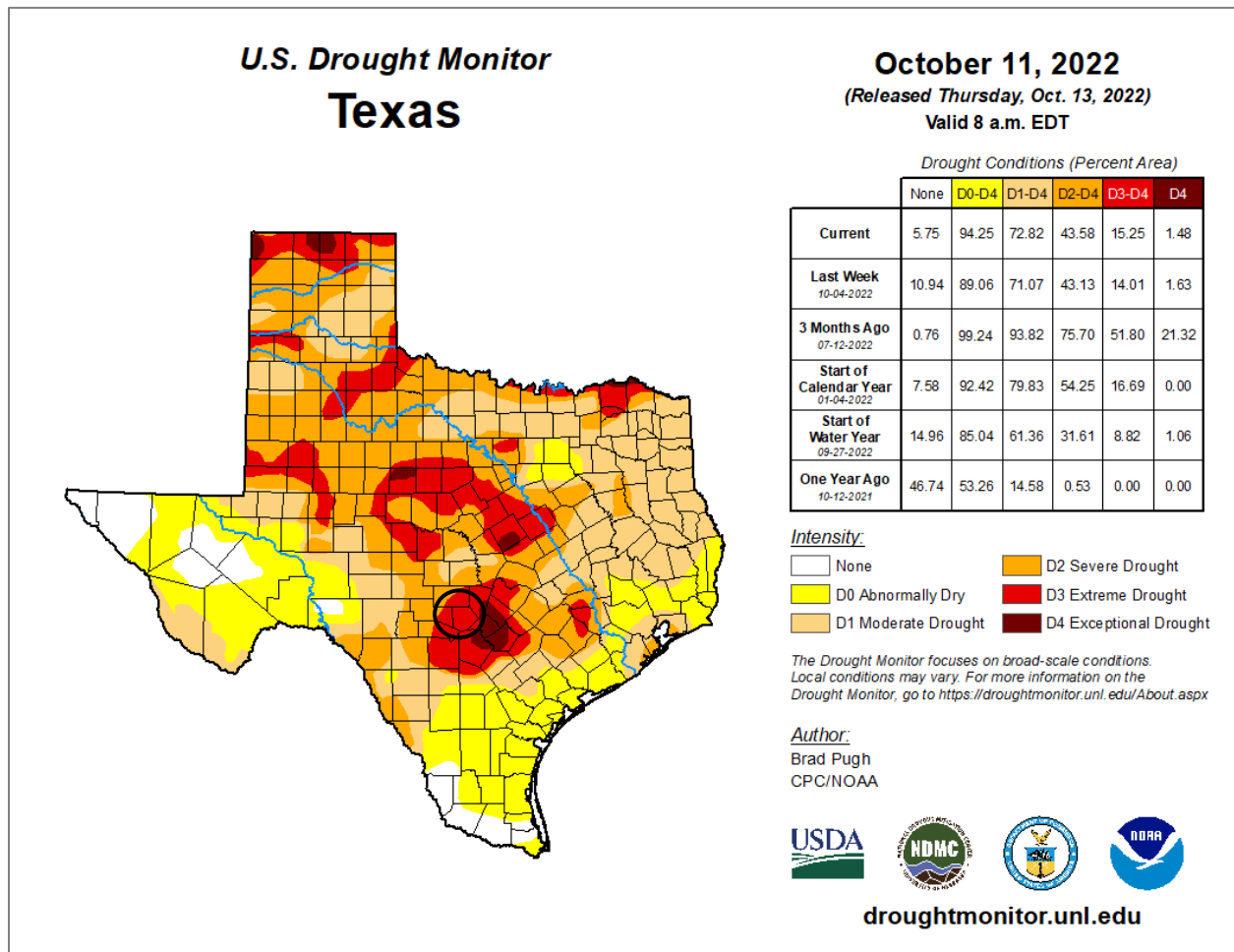
<sup>1</sup> Source: Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy, FEMA

## SECTION 7: DROUGHT

### LOCATION

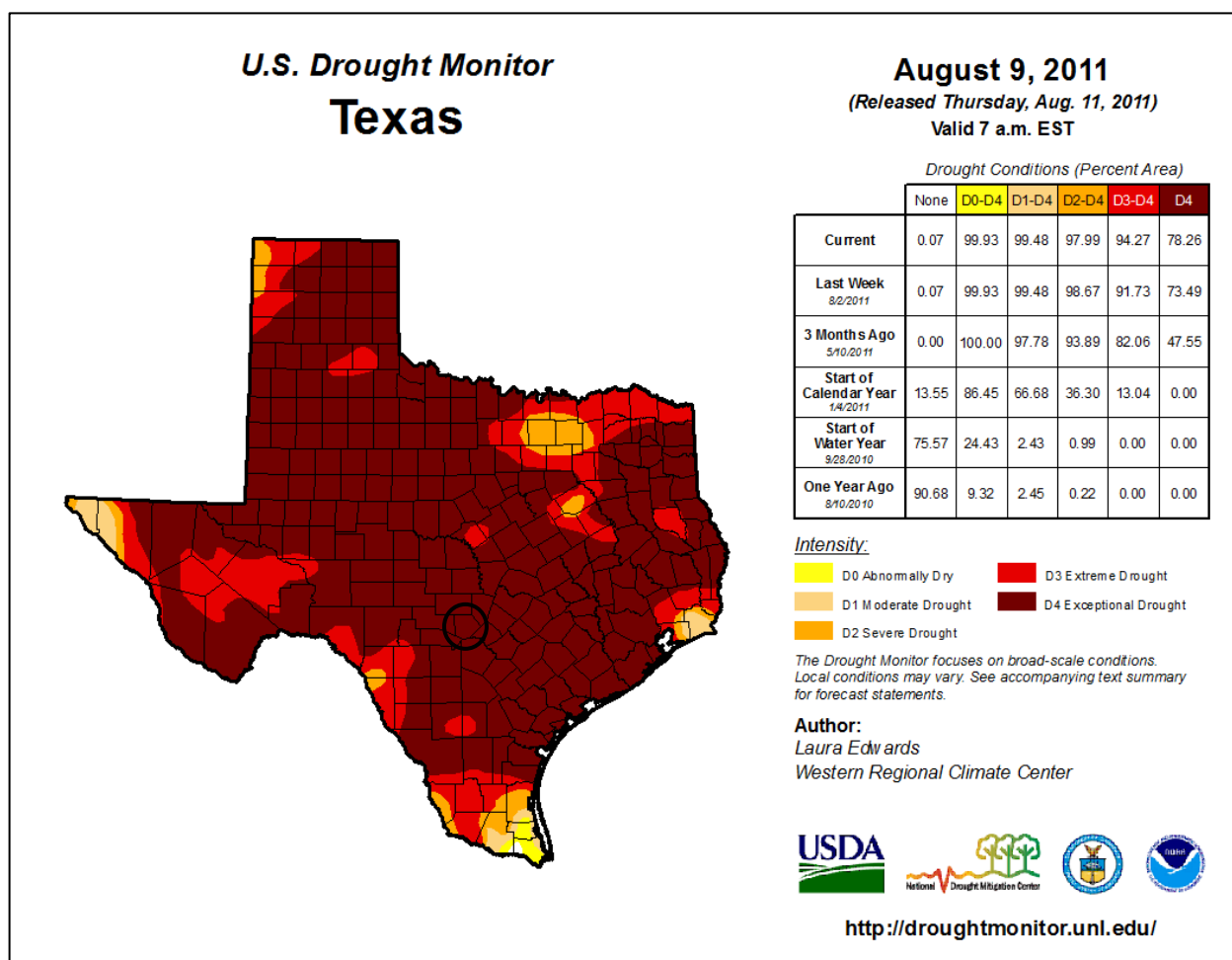
Droughts occur regularly throughout Texas and the Kendall County planning area and are a normal condition. However, they can vary greatly in their intensity and duration. The Drought Monitor shows the planning area is currently experiencing extreme drought conditions throughout the county (Figure 7-1). However, the planning area has experienced normal conditions 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 Kendall County and the City of Boerne equally.

Figure 7-1. U.S. Drought Monitor, October 2022



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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.

## SECTION 7: DROUGHT

**Table 7-2. Palmer Drought Index**

DROUGHT INDEX	DROUGHT CONDITION CLASSIFICATIONS						
	Extreme	Severe	Moderate	Normal	Moderately Moist	Very Moist	Extremely Moist
<b>Z Index</b>	-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
<b>Meteorological</b>	-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
<b>Hydrological</b>	-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<sup>2</sup>**

CATEGORY	DESCRIPTION	POSSIBLE IMPACTS	PALMER DROUGHT INDEX
<b>D0</b>	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
<b>D1</b>	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
<b>D2</b>	Severe Drought	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed.	-3.0 to -3.9
<b>D3</b>	Extreme Drought	Major crop/pasture losses; extreme fire danger; widespread water shortages or restrictions.	-4.0 to -4.9
<b>D4</b>	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

<sup>2</sup> Source: National Drought Mitigation Center



## SECTION 7: DROUGHT

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 Kendall County and the City of Boerne, the area can anticipate a range of drought from abnormally dry to exceptional, or D0 to D4, based on the Palmer Drought Category.

### HISTORICAL OCCURRENCES

The Kendall County planning area may typically experience a severe drought. Table 7-4 and 7-5 list historical events that have occurred in the Kendall 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 Kendall County and the City of Boerne are provided on a county-wide basis per the NCEI database.

**Table 7-4. Historical Drought Years, 1996-2022**

DROUGHT YEAR
1996
2000
2011-2012
2012 <sup>3</sup>
2013
2013-2015
2015
2018
2019
2020
2021
2022
13 unique events

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<sup>3</sup> Two unique events recorded in 2012: June – August 2012; and December 2012

## SECTION 7: DROUGHT

**Table 7-5. Historical Drought Events, 1996-2022<sup>4</sup>**

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	4/1/1996	0	0	\$0	\$0
Kendall County	5/1/1996	0	0	\$0	\$0
Kendall County	6/1/1996	0	0	\$0	\$0
Kendall County	7/1/1996	0	0	\$0	\$0
Kendall County	8/1/1996	0	0	\$0	\$0
Kendall County	9/1/1996	0	0	\$0	\$0
Kendall County	10/1/1996	0	0	\$0	\$0
Kendall County	11/1/1996	0	0	\$0	\$0
Kendall County	6/1/2000	0	0	\$0	\$0
Kendall County	7/1/2000	0	0	\$0	\$0
Kendall County	8/1/2000	0	0	\$0	\$0
Kendall County	9/1/2000	0	0	\$0	\$0
Kendall County	10/1/2000	0	0	\$0	\$0
Kendall County	5/1/2011	0	0	\$0	\$0
Kendall County	6/1/2011	0	0	\$0	\$0
Kendall County	7/1/2011	0	0	\$0	\$0
Kendall County	8/1/2011	0	0	\$0	\$0
Kendall County	9/1/2011	0	0	\$0	\$0
Kendall County	10/1/2011	0	0	\$0	\$0
Kendall County	11/1/2011	0	0	\$0	\$0
Kendall County	12/1/2011	0	0	\$0	\$0
Kendall County	1/1/2012	0	0	\$0	\$0
Kendall County	2/1/2012	0	0	\$0	\$0
Kendall County	3/1/2012	0	0	\$0	\$0
Kendall County	4/1/2012	0	0	\$0	\$0

<sup>4</sup> Events are reported from January 1, 1996, through May 2022

## SECTION 7: DROUGHT

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	6/1/2012	0	0	\$0	\$0
Kendall County	7/1/2012	0	0	\$0	\$0
Kendall County	8/1/2012	0	0	\$0	\$0
Kendall County	12/1/2012	0	0	\$0	\$0
Kendall County	2/1/2013	0	0	\$0	\$0
Kendall County	3/1/2013	0	0	\$0	\$0
Kendall County	4/1/2013	0	0	\$0	\$0
Kendall County	6/1/2013	0	0	\$0	\$0
Kendall County	7/1/2013	0	0	\$0	\$0
Kendall County	8/1/2013	0	0	\$0	\$0
Kendall County	9/1/2013	0	0	\$0	\$0
Kendall County	10/1/2013	0	0	\$0	\$0
Kendall County	11/1/2013	0	0	\$0	\$0
Kendall County	12/1/2013	0	0	\$0	\$0
Kendall County	1/1/2014	0	0	\$0	\$0
Kendall County	2/1/2014	0	0	\$0	\$0
Kendall County	3/1/2014	0	0	\$0	\$0
Kendall County	4/1/2014	0	0	\$0	\$0
Kendall County	5/1/2014	0	0	\$0	\$0
Kendall County	6/1/2014	0	0	\$0	\$0
Kendall County	7/1/2014	0	0	\$0	\$0
Kendall County	8/1/2014	0	0	\$0	\$0
Kendall County	9/1/2014	0	0	\$0	\$0
Kendall County	10/1/2014	0	0	\$0	\$0
Kendall County	11/1/2014	0	0	\$0	\$0
Kendall County	12/1/2014	0	0	\$0	\$0
Kendall County	1/1/2015	0	0	\$0	\$0

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JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	2/1/2015	0	0	\$0	\$0
Kendall County	3/1/2015	0	0	\$0	\$0
Kendall County	4/1/2015	0	0	\$0	\$0
Kendall County	9/1/2015	0	0	\$0	\$0
Kendall County	10/1/2015	0	0	\$0	\$0
Kendall County	6/1/2018	0	0	\$0	\$0
Kendall County	7/1/2018	0	0	\$0	\$0
Kendall County	8/1/2018	0	0	\$0	\$0
Kendall County	9/1/2018	0	0	\$0	\$0
Kendall County	9/1/2019	0	0	\$0	\$0
Kendall County	10/1/2019	0	0	\$0	\$0
Kendall County	11/1/2019	0	0	\$0	\$0
Kendall County	12/1/2019	0	0	\$0	\$0
Kendall County	1/1/2020	0	0	\$0	\$0
Kendall County	11/1/2020	0	0	\$0	\$0
Kendall County	12/1/2020	0	0	\$0	\$0
Kendall County	1/1/2021	0	0	\$0	\$0
Kendall County	3/1/2021	0	0	\$0	\$0
Kendall County	4/1/2021	0	0	\$0	\$0
Kendall County	1/1/2022	0	0	\$0	\$0
Kendall County	2/1/2022	0	0	\$0	\$0
Kendall County	3/1/2022	0	0	\$0	\$0
Kendall County	4/1/2022	0	0	\$0	\$0
Kendall County	5/1/2022	0	0	\$0	\$0
Kendall County	6/1/2022	0	0	\$0	\$0
<b>TOTALS</b>		<b>0</b>	<b>0</b>	<b>\$0</b>	<b>\$0</b>

Based on the list of historical drought events for the Kendall County planning area (listed above) 20 events over 5 periods have occurred since the 2017 Plan.

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### SIGNIFICANT EVENTS

#### **January 1, 2022 – Kendall County**

In Blanco, Karnes, Kendall, and Kerr Counties the drought worsened to Exceptional (D4) drought. All public water systems encouraged at least voluntary water restrictions and many had mandatory restrictions in effect. Some the larger systems had the following: Fredericksburg Stage 3, New Braunfels Stage 2, San Antonio Stage 2, San Marcos Stage 2, Austin Stage 1, Del Rio Stage 1, Kerrville Stage 1, and Pleasanton Stage 1. The Edwards Aquifer was 26.4 feet below normal. Area reservoirs were below normal Conservation Pool level. Lake Amistad was 58.0 feet below normal, Medina Lake was 61.5 feet below normal, and Lake Travis was 28.5 feet below normal. Rivers across the region were below or much below normal seven-day streamflow at the end of the month. All of the counties in D2 or worse drought had outdoor burn bans in effect at the end of the month.

#### **June 1, 2013 - April 1, 2015 – Kendall County**

June was feast or famine for rainfall across South Central Texas. Most of the region had less than 50 percent of normal. However, the southwestern corner of the area received in excess of 150 percent of normal rainfall and parts of Maverick and Dimmit Counties had as much as four times normal. At the same time, the lack of rain led to drought conditions worsening to stage D3 in Bastrop and Lee Counties, and to stage D2 in Blanco, Burnet, Caldwell, Comal, Fayette, Gonzales, Guadalupe, Hays, Kendall, and Travis Counties. Fire danger at the end of the month was moderate. Of the counties in D2 or worse drought Caldwell, Dimmit, Edwards, Fayette, Frio, Kinney, Lee, Llano, Maverick, Medina, and Val Verde had outdoor burn bans in effect at the end of the month. The seven-day stream flow averages were much below normal (less than 10 percent) across the Colorado River basin. The Upper and Middle Guadalupe, Nueces, Rio Grande, and Frio River basins were reporting below normal (10 to 24 percent) flow. Area lakes and reservoirs continued well below normal pool elevations.

Lake Amistad was around 59 feet below normal. Lake Travis was 54 feet below normal and Medina Lake 83 feet below normal which left it at 5 percent of capacity. The Edwards Aquifer was nearly 17 feet below normal, and 3.2 feet below the level at the end of June 2012.

#### **September 1, 2011 – April 1, 2012 – Kendall County**

El Nino Southern Oscillation conditions moved back into a La Nina phase and the drought continued over South Central Texas. Most of the area remained in exceptional drought conditions (Stage D4). Fire danger in South Central Texas was high to very high and burn bans continued for all of the counties. The Texas A&M Agricultural program report indicated ranchers continued to provide heavy supplemental feeding for livestock or began to liquidate herds. There was little or no sign of appreciable forage growth. At the end of the month, the seven-day stream flow average remained in the below or much below normal range for basins across South Central Texas and the Rio Grande Plains. Area lakes and reservoirs remained below normal pool elevations with the Edwards Aquifer 21.5 feet below normal and 32.8 feet below the level from one year ago. Many communities across South Central Texas continued with some level of water restrictions.

#### **October 1, 1996 – November 1, 1996 – Kendall County**

Drought persisted from October through January across the southwestern part of South Central Texas, although heavy rainfall alleviated conditions over much of the Hill Country near the end of

## SECTION 7: DROUGHT

the month in October. Brief periods of light rain, sleet, and snow during the month again added some moisture to soils across the area December through January.

### PROBABILITY OF FUTURE EVENTS

Based on available records of historic events, there have been thirteen extended time periods of drought (ranging in length from approximately 30 days to over 600 days) within a 26-year reporting period, which provides a probability of one event probable every year. This frequency supports a highly likely probability of future events for the entire Kendall County and the City of Boerne.

### VULNERABILITY AND IMPACT

Loss estimates were based on 26 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 Kendall County**

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Kendall County	\$0	\$0

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 Kendall County and the City of Boerne. 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 Kendall County planning area is estimated at 19.2% of the total population, and children under the age of 5 are estimated at 4.7% or an estimated total of 10,870 potentially vulnerable residents in the planning area based on age. In addition, an estimated 4.8% of planning area population live below the poverty level (Table 7-7) which may contribute to overall health impacts of a drought.



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**Table 7-7. Populations at Greater Risk by Jurisdiction<sup>5</sup>**

JURISDICTION	POPULATION 65 AND OLDER	POPULATION UNDER 5	POPULATION BELOW POVERTY LEVEL
Kendall County	8,749	2,121	2,184
City of Boerne	3,024	1,112	1,065

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 Kendall 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. 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 Kendall County and the City of Boerne 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 26-year reporting period in the Kendall County planning area is considered negligible.

### 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 Kendall County from January 2005 through May 2022 based on reports received by the Drought Impact Reporter.

**Table 7-8. Drought Impacts, 2005- May 2022**

DROUGHT IMPACTS 2005- May 2022	
Agriculture	79

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<sup>5</sup> US Census Bureau 2020 American Community Survey data for Kendall County

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DROUGHT IMPACTS 2005- May 2022	
Business & Industry	5
Energy	2
Fire	39
Plants & Wildlife	74
Relief, Response & Restrictions	39
Society & Public Health	8
Tourism & Recreation	3
Water Supply & Quality	56

Drought has the potential to impact people in the Kendall 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.

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- 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

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## 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 Kendall County is no exception. The entire Kendall County and the City of Boerne, 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

Though a death from extreme heat has not been recorded at a specific location in the County, there is no specific geographic scope to the extreme heat hazard. Extreme heat could occur anywhere within Kendall County and the City of Boerne.

## 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.

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**Figure 8-1. Extent Scale for Extreme Summer Heat<sup>1</sup>**

Temperatures (°F)		Temperatures (°F)		Temperatures (°F)		Temperatures (°F)	
40	80 - 88: CAUTION	40	90 - 96: EXTREME CAUTION	40	98 - 106: DANGER	40	108 - 110: EXTREME DANGER
45	80 - 88: CAUTION	45	90 - 94: EXTREME CAUTION	45	96 - 104: DANGER	45	106 - 110: EXTREME DANGER
50	80 - 86: CAUTION	50	88 - 94: EXTREME CAUTION	50	96 - 102: DANGER	50	104 - 110: EXTREME DANGER
55	80 - 86: CAUTION	55	88 - 92: EXTREME CAUTION	55	94 - 100: DANGER	55	102 - 110: EXTREME DANGER
60	80 - 84: CAUTION	60	86 - 90: EXTREME CAUTION	60	92 - 98: DANGER	60	100 - 110: EXTREME DANGER
65	80 - 84: CAUTION	65	86 - 90: EXTREME CAUTION	65	92 - 96: DANGER	65	98 - 110: EXTREME DANGER
70	80 - 84: CAUTION	70	86 - 88: EXTREME CAUTION	70	90 - 94: DANGER	70	96 - 110: EXTREME DANGER
75	80 - 82: CAUTION	75	84 - 88: EXTREME CAUTION	75	90 - 94: DANGER	75	96 - 110: EXTREME DANGER
80	80 - 82: CAUTION	80	84 - 86: EXTREME CAUTION	80	88 - 92: DANGER	80	94 - 110: EXTREME DANGER
85	80 - 82: CAUTION	85	84 - 86: EXTREME CAUTION	85	88 - 90: DANGER	85	92 - 110: EXTREME DANGER
90	80: CAUTION	90	82 - 84: EXTREME CAUTION	90	86 - 90: DANGER	90	92 - 110: EXTREME DANGER
95	80: CAUTION	95	82 - 84: EXTREME CAUTION	95	86 - 88: DANGER	95	90 - 110: EXTREME DANGER
100	80: CAUTION	100	82 - 84: EXTREME CAUTION	100	86 - 88: DANGER	100	90 - 110: EXTREME DANGER

### Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

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 above 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.  An Excessive Heat Warning is issued if the Heat Index
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	

<sup>1</sup> Source: NOAA

## SECTION 8: EXTREME HEAT

CATEGORY	HEAT INDEX	POSSIBLE HEAT DISORDERS	WARNING TYPE
		with prolonged exposure and/or physical activity.	risers above 105°F at least 3 hours during the day or above 80°F at night.
Caution	80 – 90°F	Fatigue is possible with prolonged exposure and/or physical activity.	

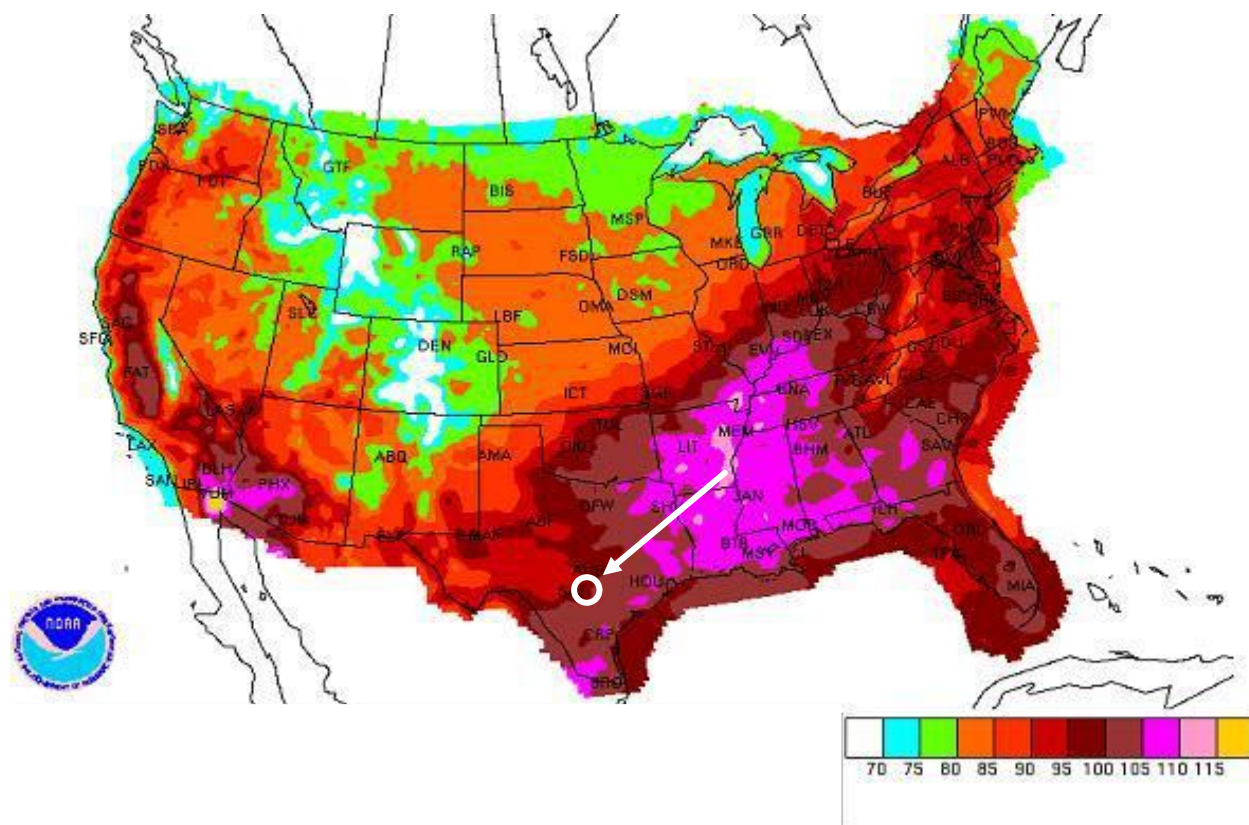
The Kendall County planning area is comprised of gently rolling terrain and is located in South Central Texas on the southern edge of the Edwards Plateau and northwest of the Gulf Coastal Plains. Soils are black-land clay and silt loam on the Plains and thin limestone soils on the Edwards Plateau. The area's gently rolling terrain is dotted with oak trees, mesquite, and cacti. Due to its geography, and its warm, muggy semitropical climate with hot summers, Kendall County can expect an extreme heat event each summer. Citizens, especially children and the elderly should exercise caution by staying out of the heat for prolonged periods when a heat advisory or excessive heat warning is issued. Also at risk are those working or remaining outdoors.

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 Kendall County planning area. The dark red and brown color indicates a daily maximum heat index of 95° to 105°F. Kendall County and the City of Boerne, could experience extreme heat from 90° to 105°F and should mitigate to the extent of “extreme caution,” which can include sunstroke, muscle cramps, and heat exhaustion.



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**Figure 8-2. Average Daily Maximum Heat Index Days<sup>2</sup>**



### 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 through June 2021 from the NCEI database.

**Table 8-2. Extreme Heat Related Deaths in Texas**

YEAR	DEATHS
1994	1
1995	12
1996	10
1997	2

<sup>2</sup> Source: NRDC and the white circle indicates the Kendall County planning area.

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YEAR	DEATHS
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
2017	3
2018	2
2019	3
2020	2
2021	0

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

## SECTION 8: EXTREME HEAT

related incidents located solely within Kendall County, there is only one heat waves<sup>3</sup> on record for the Kendall 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 Kendall County and the City of Boerne, 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, 1996-2022<sup>4</sup>**

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	7/23/2018	0	0	\$0	\$0
<b>TOTALS</b>		<b>0</b>	<b>0</b>	<b>\$0</b>	<b>\$0</b>

Based on the list of historical extreme heat events for the Kendall County planning area (listed above), the reported event occurred since the 2017 Plan.

### 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.

### VULNERABILITY AND IMPACT

There is no defined geographic boundary for extreme heat events. While the entire Kendall County and the City of Boerne 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

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

<sup>4</sup> Historical events are reported from January 1, 1996, through May 31, 2022.

## SECTION 8: EXTREME HEAT

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 Kendall County planning area is estimated at 19.2%, and the total population of children under the age of 5 are estimated at 4.7%, or an estimated total of 10,870 potentially vulnerable residents in the planning area based on age. In addition, an estimated 4.8% of the planning area population live below the poverty level (Table 8-4).

**Table 8-4. Populations at Greater Risk by Jurisdiction<sup>5</sup>**

JURISDICTION	POPULATION 65 AND OLDER	POPULATION UNDER 5	POPULATION BELOW POVERTY LEVEL
Kendall County	8,749	2,121	2,184
City of Boerne	3,024	1,112	1,065

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 considered “limited” as injuries and/or illnesses would be treatable with first aid. In terms of vulnerability to structures, the impact from extreme heat would be negligible for the Kendall County and the City of Boerne. 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. Based on historical records over a 26-year period, annualized losses for the Kendall 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, infants, children under five, can face serious or life-threatening health problems from exposure to extreme heat including hyperthermia, heat cramps, heat exhaustion, and heat stroke (or sunstroke).
- Residents that live below the poverty line are often more vulnerable as they may not have access to air conditioning.
- 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.

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<sup>5</sup> U.S. Census Bureau 2020 American Community Survey data for Kendall County

## SECTION 8: EXTREME HEAT

- High energy demand periods can outpace the supply of energy, potentially creating the need for rolling brownouts which would elevate the risk of illness to vulnerable residents.
- Highways and roads may be damaged by excessive heat causing asphalt roads to soften and concrete roads to shift or buckle.
- Vehicle's 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 at Joshua Springs Park & Preserve or James Kiehl River Bend 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: THUNDERSTORM WIND

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## 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

Thunderstorm 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 Kendall County and the City of Boerne, as these storms develop randomly and are not confined to any geographic area within the County. It is assumed that the entire Kendall County planning area is uniformly exposed to the threat of thunderstorms winds.



## SECTION 9: THUNDERSTORM WIND

### EXTENT

The extent or magnitude of a thunderstorm wind event is measured by the Beaufort Wind Scale. Table 9-1 describes the different intensities of wind in terms of speed and effects, from calm to violent and destructive.

**Table 9-1. Beaufort Wind Scale<sup>1</sup>**

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

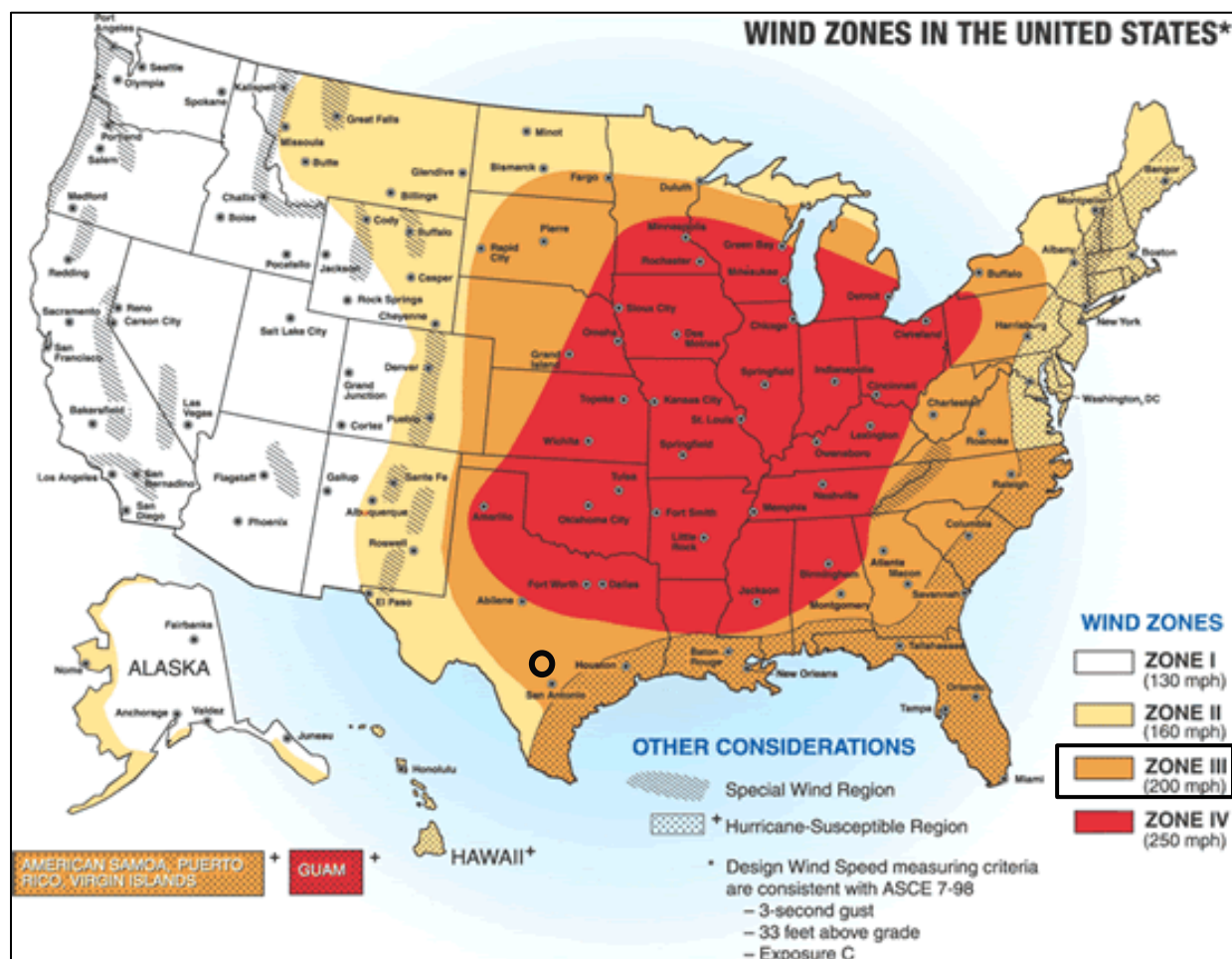
Figure 9-1 displays the wind zones as derived from NOAA.

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<sup>1</sup> Source: World Meteorological Organization

## SECTION 9: THUNDERSTORM WIND

Figure 9-1. Wind Zones in the United States<sup>2</sup>



On average, the planning area experiences one to two thunderstorm wind events every year. The planning area is located in Zone III, meaning they can experience winds up to 200 mph. Kendall County has experienced a significant wind event or an event with winds in the range of “Force 11” on the Beaufort Wind Scale with winds between 73 and 83 mph. This is the most significant event that can be expected in the future for Kendall County and the City of Boerne.

### HISTORICAL OCCURRENCES

Tables 9-2, 9-3, and 9-4 depict historical occurrences of thunderstorm wind events for the Kendall County planning area according to the National Centers for Environmental Information (NCEI) data. Since January 1980, 36 thunderstorm wind events are known to have impacted the Kendall County planning area, based upon NCEI records. Table 9-3 presents information on known historical events impacting Kendall County and the City of Boerne 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.

<sup>2</sup> Kendall County is indicated by the circle.

## SECTION 9: THUNDERSTORM WIND

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 January 1980 through May 2022 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 2022 dollars. Historical thunderstorm wind data for all participating jurisdictions are provided on a County-wide basis per the NCEI database.

**Table 9-2. Historical Thunderstorm Wind Events with Reported Damages, 1980-2022<sup>3</sup>**

MAXIMUM WIND SPEED RECORDED (MPH)	NUMBER OF REPORTED EVENTS
0-30	10
31-40	1
41-50	4
51-60	8
61-70	5
71-80	2
81-90	0
91-100	0
Unknown	6

**Table 9-3. Historical Thunderstorm Wind Events, 1980-2022<sup>4</sup>**

JURISDICTION	DATE	TIME	MAGNITUDE (MPH)	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
City of Boerne	10/12/1993	10:30 PM	0	0	0	\$10,164	\$0
City of Boerne	6/23/1994	6:30 PM	0	0	0	\$10,006	\$100
Kendall County	9/3/1997	6:10 PM	Unknown	0	0	\$55,119	\$0
Kendall County	9/3/1997	6:30 PM	Unknown	0	0	\$55,119	\$0
Kendall County	3/27/1999	8:30 PM	Unknown	0	0	\$26,925	\$0
City of Boerne	5/20/2001	11:45 PM	Unknown	0	0	\$83,335	\$0

<sup>3</sup> Historical events are reported from January 1980 through May 2022.

<sup>4</sup> Only recorded events with fatalities, injuries or damages are listed. Magnitude is listed when available. Damage values are in 2022 dollars.

## SECTION 9: THUNDERSTORM WIND

JURISDICTION	DATE	TIME	MAGNITUDE (MPH)	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	10/12/2001	9:45 PM	Unknown	0	0	\$166,669	\$0
City of Boerne	5/28/2002	12:30 AM	Unknown	0	0	\$82,361	\$0
Kendall County	3/25/2003	6:30 PM	75	0	0	\$128,630	\$0
City of Boerne	6/3/2003	1:00 PM	55	0	0	\$16,123	\$0
City of Boerne	6/4/2003	12:15 AM	60	0	0	\$80,613	\$0
City of Boerne	6/15/2003	1:30 AM	55	0	0	\$161,225	\$0
Kendall County	7/23/2003	1:45 PM	60	0	1	\$80,525	\$0
Kendall County	7/30/2009	2:20 PM	39	0	0	\$27,506	\$0
Kendall County	6/2/2010	6:55 PM	43	0	0	\$2,718	\$0
Kendall County	9/27/2011	5:35 PM	52	0	0	\$26,107	\$0
City of Boerne	4/2/2017	6:20 AM	78	0	0	\$30,280	\$0
Kendall County	5/28/2017	6:03 PM	61	0	0	\$6,051	\$0
City of Boerne	6/16/2019	10:43 PM	65	0	0	\$3,469	\$0
City of Boerne	6/28/2019	7:47 PM	52	0	0	\$231	\$0
<b>TOTALS</b>			<b>(Max Extent)</b>	<b>0</b>	<b>1</b>	<b>\$1,053,176</b>	<b>\$100</b>

**Table 9-4. Summary of Historical Thunderstorm Wind Events, 1980-2022**

JURISDICTION	NUMBER OF EVENTS	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	22	75 mph	0	1	\$575,369	\$0
City of Boerne	14	78 mph	0	0	\$477,807	\$100
<b>TOTAL LOSSES</b>	<b>36</b>	<b>(Max Extent)</b>	<b>0</b>	<b>1</b>	<b>\$1,053,276</b>	

Based on the list of historical thunderstorm wind events for Kendall County and the City of Boerne (listed above) 7 of the events have occurred since the 2017 Plan.

### SIGNIFICANT EVENTS

#### May 28, 2017 – Kendall County

Thunderstorms developed along a cold front. Some of these storms produced severe hail and damaging wind gusts. A thunderstorm produced wind gusts estimated at 70 mph that blew down numerous trees on the property of the Sisterdale COOP observer.

## SECTION 9: THUNDERSTORM WIND

### **July 23, 2003 – Kendall County**

The east-west oriented line of thunderstorms associated with the cold front continued to move southward through Blanco County. As it moved into the southern part of the county, it produced a downburst between Waring and areas of Kendall County that knocked over many trees. One person was injured when struck by debris.

### **May 20, 2001 – City of Boerne**

Severe storms struck the City of Boerne on the evening of May 20, 2001. Severe thunderstorm winds damaged the roofs of homes, and windows in homes and cars. The winds also blew down trees and light poles.

### **September 3, 1997 – Kendall County**

Severe thunderstorm winds blew down trees over much of Comal and Kendall Counties, and damaged roofs in the Sisterdale area of Kendall County. Severe winds damaged roofs and the sides off several barns west of Kendall. They also damaged a garage roof and blew a shed over 100 feet near Maxwell.

## 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 36 events in a 42-year reporting period. This frequency supports a probability of one event every year. Even though the intensity of thunderstorm wind events is not always damaging for the Kendall 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 Kendall County and the City of Boerne.

## 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 Kendall County and the City of Boerne, 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 receptacles, 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 US Census data indicates a total of 813 manufactured homes (approximately 4.9%) located in Kendall County (Table 9-5). In addition, 20.3% (approximately 3,352 structures) of the residential structures in Kendall County 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.

## SECTION 9: THUNDERSTORM WIND

**Table 9-5. Structures at Greater Risk by Jurisdiction**

JURISDICTION	MANUFACTURED HOMES	SFR STRUCTURES BUILT BEFORE 1980
Kendall County <sup>5</sup>	813	3,352
City of Boerne	33	970

While all citizens are at risk to the impacts of thunderstorm wind, forced relocation and disaster recovery drastically impacts low-income residents who lack the financial means to travel, afford a long-term stay away from home, and to rebuild or repair their homes. An estimated 4.8% of the planning area population live below the poverty level (Table 9-6).

**Table 9-6. Populations at Greatest Risk by Jurisdiction<sup>6</sup>**

JURISDICTION	POPULATION BELOW POVERTY LEVEL
Kendall County	2,184
City of Boerne	1,065

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

**Table 9-7. Critical Facilities at Risk by Jurisdiction**

JURISDICTION	CRITICAL FACILITIES
Kendall County	1 Emergency Management Service, 7 VFD, 1 Police Department, 9 Government Buildings, 16 Schools, 2 Hospital, 6 Assisted Living Facilities, 6 Nursing Homes, 1 Agriculture Center, 2 Chemical Facilities, 2 Natural Gas Facilities, 3 Gas/Propane Facilities, 1 Petroleum Facility, 1 Fertilizer Storage, 1 Electrical Transport Facility, 3 Wastewater Facilities, 3 Wastewater Treatment Plants, 1 Water Plant, 2 Water Reclamation Facility, 1 Water Treatment Facility, 8 Water Storage Tanks, 3 Booster Stations, 3 Electrical Substations, 16 Lift Stations, 1 Pressure Station, 11 Pump Stations, 16 Water Wells, 1 Spillway, 4 Dams, 3 Parks, 1 EM Helipad
City of Boerne	1 Emergency Management Service, 2 VFD, 1 Police Department, 7 Government Buildings, 11 Schools, 1 Hospital, 6 Assisted Living Facilities, 5 Nursing Homes, 3 Gas/Propane Facilities, 4 Wastewater Facilities, 3 Electrical Substations, 1 Dam, 1 Natural Park

<sup>5</sup> County totals includes all incorporated jurisdictions and unincorporated areas.

<sup>6</sup> US Census Bureau 2020 American Community Survey data for Kendall County



## SECTION 9: THUNDERSTORM WIND

A thunderstorm wind event can also result in traffic disruptions, injuries and in rare cases, fatalities. Impact of thunderstorms winds experienced in the Kendall County planning area has resulted in no injuries or fatalities. Impact of thunderstorm wind events experienced in the entire Kendall County planning area would be “Limited,” and injuries and illnesses would be treatable with first aid, less than ten percent property damaged or destroyed, and facilities would be shut down for 24 hours or less. Overall, the average loss estimate (in 2022 dollars) is \$1,053,276, having an approximate annual loss estimate of \$25,078 (Table 9-8).

**Table 9-8. Potential Annualized Losses by Jurisdiction**

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Kendall County	\$575,369	\$13,699
City of Boerne	\$477,907	\$11,379
<b>Planning Area</b>	<b>\$1,053,276</b>	<b>\$25,078</b>

### 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.

## SECTION 9: THUNDERSTORM WIND

- 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 Joshua Springs Park & Preserve and James Kiehl River Bend Park 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.

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## 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
<ul style="list-style-type: none"> <li>• 69% of all tornadoes</li> <li>• Less than 5% of tornado deaths</li> <li>• Lifetime 1-10+ minutes</li> <li>• Winds less than 110 mph</li> </ul>	<ul style="list-style-type: none"> <li>• 29% of all tornadoes</li> <li>• Nearly 30% of all tornado deaths</li> <li>• May last 20 minutes or longer</li> <li>• Winds 110 – 205 mph</li> </ul>	<ul style="list-style-type: none"> <li>• 2% of all tornadoes</li> <li>• 70% of all tornado deaths</li> <li>• Lifetime can exceed one hour</li> <li>• Winds greater than 205 mph</li> </ul>

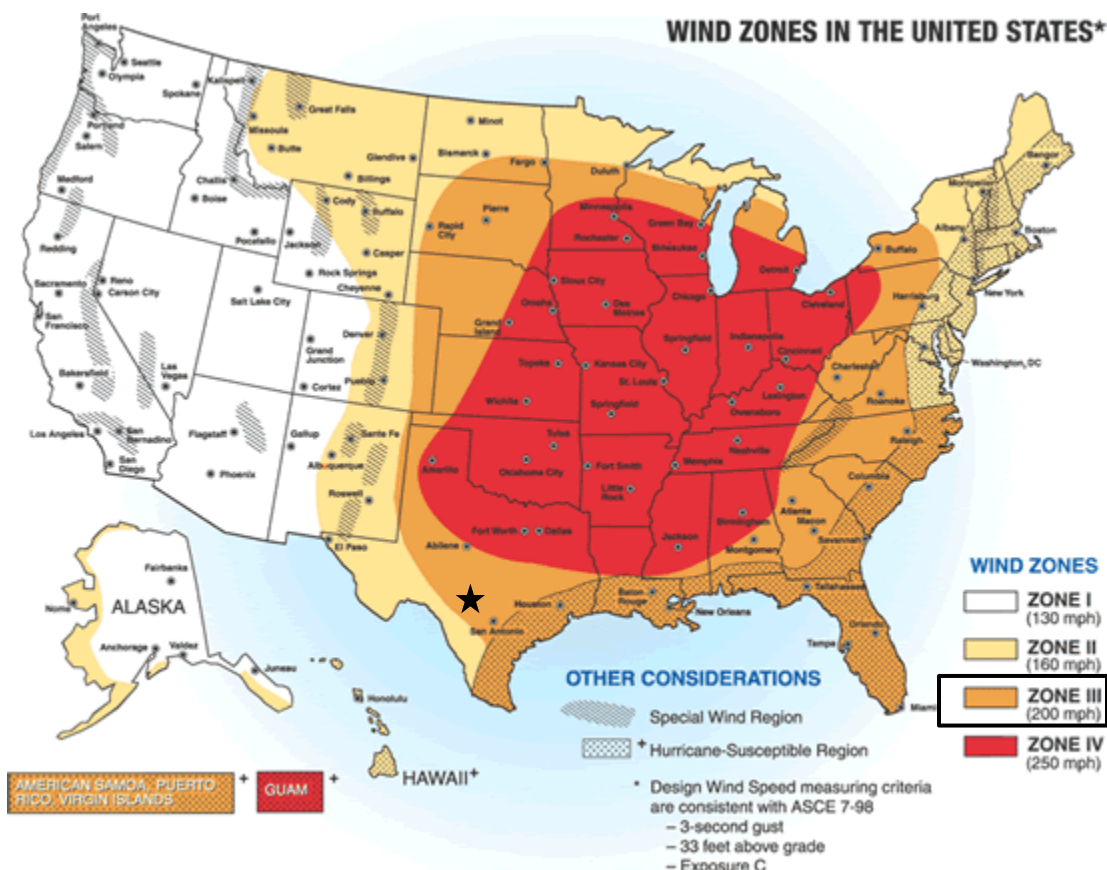
## LOCATION

Tornadoes do not have any specific geographic boundary and can occur throughout the Kendall County planning area uniformly. It is assumed that the entire Kendall County and the City of

## SECTION 10: TORNADO

Boerne, are uniformly exposed to tornado activity. The entire Kendall County planning area is located in Wind Zone III (Figure 10-1), where tornado winds can be as high as 200 mph.

**Figure 10-1. FEMA Wind Zones in the United States<sup>1</sup>**



### 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).

<sup>1</sup> Kendall County is indicated by the star.

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**Table 10-2. The Fujita Tornado Scale<sup>2</sup>**







F-SCALE NUMBER	INTENSITY	WIND SPEED (MPH)	TYPE OF DAMAGE DONE	PERCENT OF APPRAISED STRUCTURE VALUE LOST DUE TO DAMAGE
<b>F0</b>	Gale Tornado	40 – 72	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.	None Estimated
<b>F1</b>	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%
<b>F2</b>	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%
<b>F3</b>	Severe Tornado	158 – 206	Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.	100%
<b>F4</b>	Devastating Tornado	207 – 260	Well-constructed homes leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.	100%
<b>F5</b>	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%

<sup>2</sup> Source: <http://www.tornadoproject.com/fscale/fscale.htm>

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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. 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



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magnitude reported within the planning area is an F3 on the Fujita Scale, a “Severe Tornado.” Based on the planning area’s location in Wind Zone III, the planning area could experience anywhere from an EF0 to EF4 depending on the wind speed.

The events in Kendall County have been between EF0 and EF5 (Table 10-4). Therefore, the range of intensity that the Kendall County planning area, including the City of Boerne, would be expected to mitigate is a tornado event that would be a low to incredible risk, an EF0 to EF5. Historically, the strongest tornado to strike the planning area was a F3, which would be an EF5 on the Enhanced Fujita Scale with the highest wind speed. This is the strongest event the planning area can anticipate in the future.

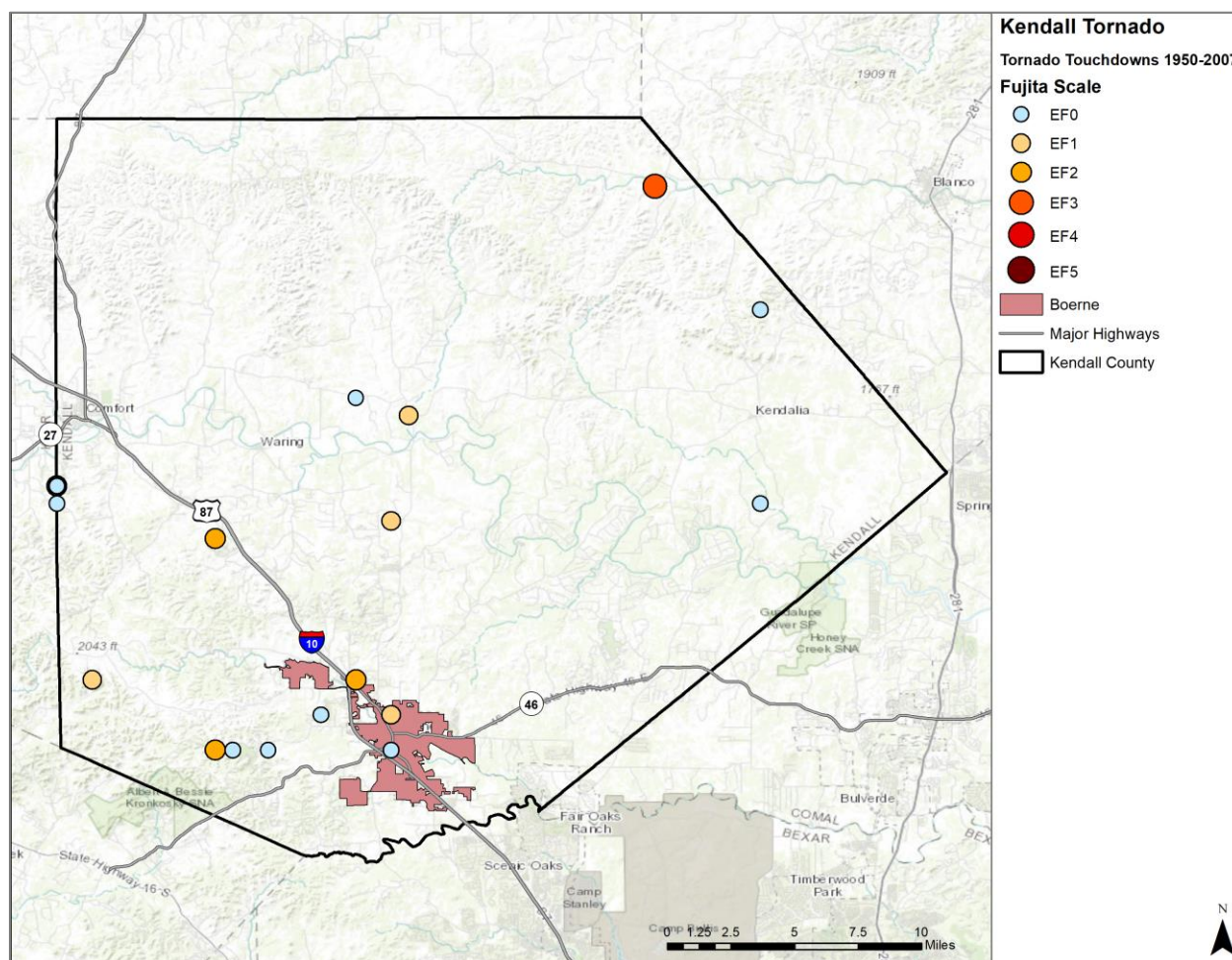
### HISTORICAL OCCURRENCES

Only reported tornadoes were factored into the Risk Assessment. It is likely that a high number of occurrences have gone unreported over the past 72 years. Historical tornado data for Kendall County and the City of Boerne are provided within a jurisdiction-wide basis per the NCEI database.

Figure 10-2 identifies the locations of previous occurrences in the Kendall County planning area from 1950 through May 2022. A total of 20 events have been recorded by the Storm Prediction Center (NOAA) and NCEI databases for the entire Kendall County and the City of Boerne.

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**Figure 10-2. Spatial Historical Tornado Events, 1950-2022<sup>3</sup>**



**Table 10-4. Historical Tornado Events, 1950-2022<sup>4</sup>**

JURISDICTION	DATE	TIME	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	5/15/1950	12:01 AM	F2	0	0	\$312,417	\$0
Kendall County	3/20/1957	7:15 PM	F1	0	0	\$26,634	\$0
Kendall County	3/31/1957	7:55 AM	F2	0	0	\$26,634	\$0
Kendall County	5/6/1969	12:30 PM	F3	0	0	\$203,414	\$0
Kendall County	3/30/1976	2:40 AM	F2	0	0	\$13,245,572	\$0
Kendall County	3/2/1979	8:55 PM	F1	0	0	\$106,078	\$0
Kendall County	3/4/1983	7:15 AM	F1	0	0	\$75,631	\$0

<sup>3</sup> Historical events are reported from January 1950 through May 2022. Source: NOAA Records

<sup>4</sup> Only recorded events with fatalities, injuries or damages are listed. Magnitude is listed when available. Damage values are in 2022 dollars.

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JURISDICTION	DATE	TIME	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	3/4/1983	7:20 AM	F2	0	1	\$756,310	\$0
Kendall County	3/4/1983	7:35 AM	F0	0	0	\$756	\$0
Kendall County	4/7/1984	3:40 PM	F0	0	0	\$86	\$0
City of Boerne	11/15/2001	5:20 AM	F0	0	2	\$166,951	\$0
City of Boerne	11/15/2001	5:05 AM	F0	0	0	\$16,695	\$0
City of Boerne	8/16/2007	4:53 PM	EF1	0	0	\$14,245	\$0
<b>TOTALS</b>			<b>(Max Extent)</b>	<b>0</b>	<b>3</b>	<b>\$14,951,423</b>	<b>\$0</b>

**Table 10-5. Summary of Historical Events, 1950-2022<sup>5</sup>**

JURISDICTION	Number of Events	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	17	F3	0	1	\$14,753,532	\$0
City of Boerne	3	EF1	0	2	\$197,891	\$0
<b>TOTAL LOSSES</b>	<b>20</b>	<b>(Max Extent)</b>	<b>0</b>	<b>3</b>	<b>\$14,951,423</b>	

Based on the list of historical tornado events for the Kendall County planning area (listed above) no events have occurred since the 2017 Plan.

### SIGNIFICANT EVENTS

#### **November 15, 2001 – City of Boerne**

A large tornado was observed by the Kendall County Sheriff's Department 4 miles west of Boerne along State Highway 46. This tornado moved toward the northeast, causing extensive damage to mobile homes, trees, fences, and roofs. The path of the tornado was 4 miles long with a maximum width of 200 yards. The damage from the tornado was rated F0. No injuries were reported.

#### **March 4, 1983 – Kendall County**

A severe thunderstorm developed in western Kerr County and moved eastward into Kendall County. It produced at least three known tornadoes. The tornado near Comfort moved northeast, crossing highway 473. The path of the tornado was four miles and the maximum width was 100 yards. Multiple trees and fences were damaged. Power lines were downed and several barns and sheds were destroyed. One woman sought shelter in a shed that was destroyed. The woman received numerous cuts and bruises but survived.

#### **March 30, 1976 – Kendall County**

A tornado touched down just south of the Guadalupe River on the east side of central Kendall County and moved in an easterly direction. The path of the tornado was 15.2 miles long with a

<sup>5</sup> Damages reported in 2022 dollars.

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maximum width of 200 yards. The damage from the tornado was rated F2 with maximum winds estimated over 110 mph. The tornado damage exceeded 2.5 million 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, Kendall County and the City of Boerne can experience a tornado touchdown approximately once every two to three years. This frequency supports a likely probability of future events for Kendall County and the City of Boerne.

### VULNERABILITY AND IMPACT

Because tornadoes often cross jurisdictional boundaries, all existing and future buildings, facilities, and populations in the entire Kendall County and the City of Boerne, 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.

Kendall County and the City of Boerne feature multiple mobile or manufactured home parks. 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 US Census data indicates a total of 813 manufactured homes located in the Kendall County planning area (4.9%), including all jurisdictions and unincorporated areas of the county (Table 10-6). In addition, 20.3% (approximately 3,352 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.

## SECTION 10: TORNADO

**Table 10-6. Structures at Greater Risk by Jurisdiction**

JURISDICTION	MANUFACTURED HOMES	SFR STRUCTURES BUILT BEFORE 1980
Kendall County <sup>6</sup>	813	3,352
City of Boerne	33	970

While all citizens are at risk to the impacts of a tornado, forced relocation and disaster recovery drastically impacts low-income residents who lack the financial means to travel, afford a long-term stay away from home, and to rebuild or repair their homes. An estimated 4.8% of the planning area population live below the poverty level (Table 10-7).

**Table 10-7. Populations at Greatest Risk by Jurisdiction<sup>7</sup>**

JURISDICTION	POPULATION BELOW POVERTY LEVEL
Kendall County	2,184
City of Boerne	1,065

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

**Table 10-8. Critical Facilities at Risk by Jurisdiction**

JURISDICTION	CRITICAL FACILITIES
Kendall County	1 Emergency Management Service, 7 VFD, 1 Police Department, 9 Government Buildings, 16 Schools, 2 Hospital, 6 Assisted Living Facilities, 6 Nursing Homes, 1 Agriculture Center, 2 Chemical Facilities, 2 Natural Gas Facilities, 3 Gas/Propane Facilities, 1 Petroleum Facility, 1 Fertilizer Storage, 1 Electrical Transport Facility, 3 Wastewater Facilities, 3 Wastewater Treatment Plants, 1 Water Plant, 2 Water Reclamation Facility, 1 Water Treatment Facility, 8 Water Storage Tanks, 3 Booster Stations, 3 Electrical Substations, 16 Lift Stations, 1 Pressure Station, 11 Pump Stations, 16 Water Wells, 1 Spillway, 4 Dams, 3 Parks, 1 EM Helipad
City of Boerne	1 Emergency Management Service, 2 VFD, 1 Police Department, 7 Government Buildings, 11 Schools, 1 Hospital, 6 Assisted Living Facilities, 5 Nursing Homes, 3 Gas/Propane Facilities, 4 Wastewater Facilities, 3 Electrical Substations, 1 Dam, 1 Natural Park

<sup>6</sup> County totals includes all incorporated jurisdictions and unincorporated areas.

<sup>7</sup> US Census Bureau 2020 American Community Survey data for Kendall County

## SECTION 10: TORNADO

The average loss estimate of property and crop is \$14,951,423 (in 2022 dollars), having an approximate annual loss estimate of \$207,659 (Table 10-9). Based on historic loss and damages, the impact of tornado on Kendall County and City of Boerne can be considered “Minor,” with more than 10 percent of property expected to be destroyed, treatable injuries that are not permanently disabling, and critical facilities shut down for one week or more.

**Table 10-9. Potential Annualized Losses by Jurisdiction**

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Kendall County	\$14,753,532	\$204,910
City of Boerne	\$197,891	\$2,748
<b>Planning Area</b>	<b>\$14,951,423</b>	<b>\$207,659</b>

### 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.



## SECTION 10: TORNADO

- 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: HAIL

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## 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, Kendall County and the City of Boerne 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 11-1.

## SECTION 11: HAIL

**Table 11-1. Hail Intensity and Magnitude<sup>1</sup>**

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 11-1 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, Kendall County and the City of Boerne, 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 ball size hail that leads to extensive structural damage and could cause fatal injuries. The largest hail event in Kendall County and City of Boerne resulted in hail measuring 4.25 inches in diameter, or a H10, which is considered a super hailstorm. This is the worst extent the planning area can anticipate in the future.

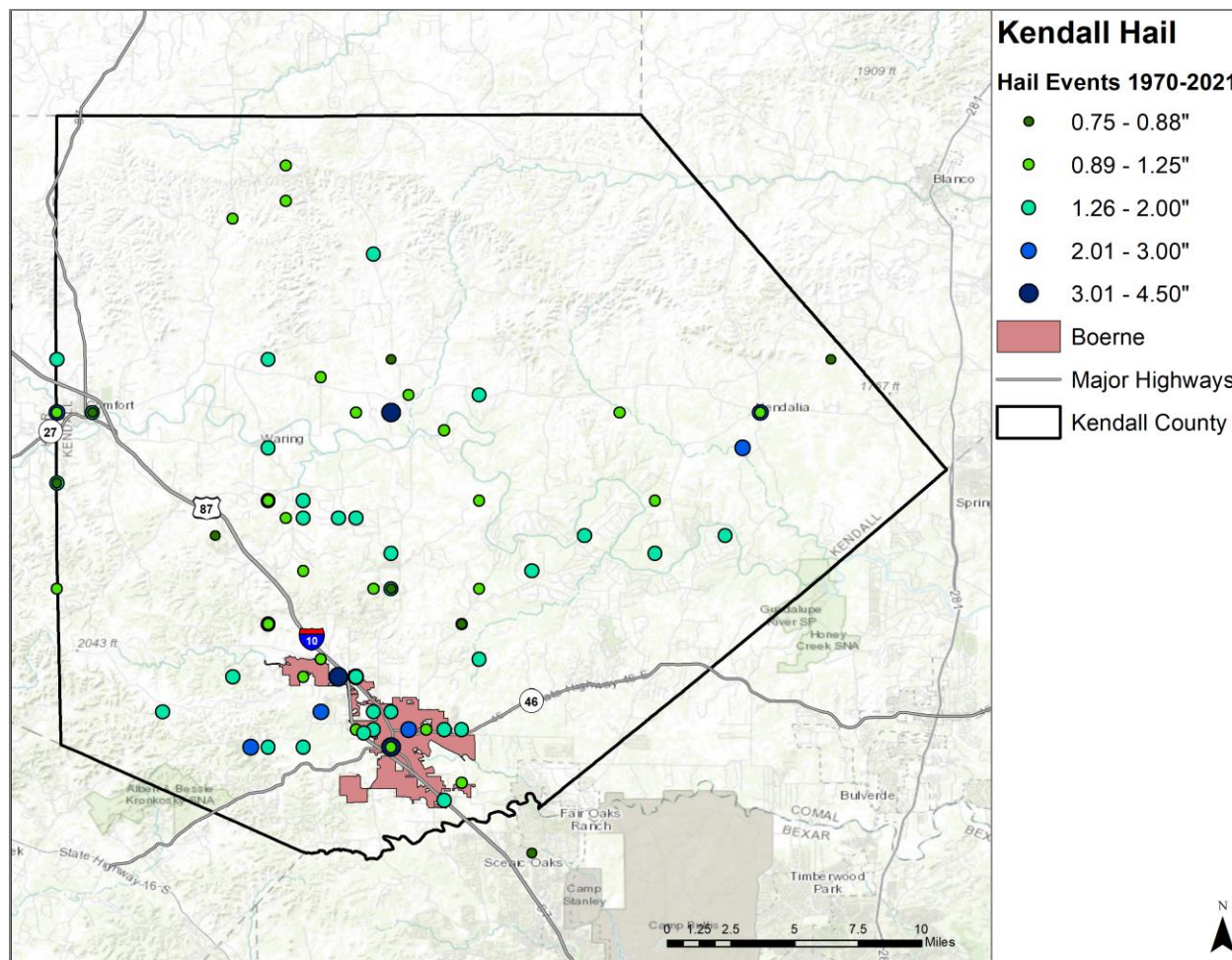
<sup>1</sup> NCEI Intensity Scale, based on the TORRO Hailstorm Intensity Scale.

## SECTION 11: HAIL

### HISTORICAL OCCURRENCES

Historical evidence shown in Figure 11-1 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 11-2. A total of 113 reported historical hail events impacted the Kendall County planning area between January 1970 and May 2022 (Summary Table 11-3). These events were reported to NCEI and NOAA databases and may not represent all hail events to have occurred during the past 52 years. Only those events for the Kendall County planning area with latitude and longitude available were plotted (Figure 11-1).

**Figure 11-1. Spatial Historical Hail Events, 1970-2022<sup>2</sup>**



**Table 11-2. Historical Hail Events, 1970-2022<sup>3</sup>**

JURISDICTION	DATE	MAGNITUDE	INJURIES	FATALITIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	10/12/1993	2.75	0	0	\$101,637	\$0
Kendall County	10/12/1993	1.75	0	0	\$10,164	\$0

<sup>2</sup> Historical events reported from January 1970 through May 2022.

<sup>3</sup> Only recorded events with fatalities, injuries, and/or damages are listed.

## SECTION 11: HAIL

JURISDICTION	DATE	MAGNITUDE	INJURIES	FATALITIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	3/6/1994	0.75	0	0	\$0	\$10,060
Kendall County	6/5/1998	2	0	0	\$54,510	\$0
City of Boerne	5/20/2001	4	0	0	\$33,334	\$0
Kendall County	4/18/2006	2.5	0	0	\$73,492	\$0
Kendall County	5/4/2006	4.25	0	0	\$14,626	\$0
Kendall County	4/7/2010	1.5	0	0	\$6,793	\$0
<b>TOTALS</b>		<b>(Max Extent)</b>	<b>0</b>	<b>0</b>	<b>\$294,556</b>	<b>\$10,060</b>

**Table 11-3. Historical Hail Events Summary, 1970-2022**

JURISDICTION	NUMBER of EVENTS	MAGNITUDE	INJURIES	FATALITIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	77	4.25 inches	0	0	\$261,222	\$10,060
City of Boerne	36	4.0 inches	0	0	\$33,334	\$0
<b>TOTAL LOSSES</b>	<b>113</b>	<b>(Max Extent)</b>	<b>0</b>	<b>0</b>	<b>\$304,616</b>	

Based on the list of historical hail events for Kendall County and the City of Boerne (listed above) 25 of the events have occurred since the 2017 Plan.

### SIGNIFICANT EVENTS

#### **May 3, 2021 – City of Boerne**

A dryline moved into a moist, conditionally unstable airmass and generated thunderstorms. Some of these storms produced baseball size hail at the Tapatio Springs Hill Country Golf Club outside Boerne.

#### **April 4, 2015 – Kendall County**

A line of severe thunderstorms moved southeast across the Hill Country, the Interstate 35 corridor and through eastern South Central Texas during the evening hours. Half dollar size hail was reported by an observer southeast of the City of Comfort. Ping pong ball size hail was reported among mostly quarter sized hail by a trained spotter about two miles east of the town of Welfare.

#### **May 4, 2006 – Kendall County**

On May 4, 2006, softball size hail was reported in Kendall County near Sisterdale. A Department of Public Safety vehicle was significantly damaged with body damage and a busted windshield. The hail was reported as 4.25 inches in diameter.

#### **June 5, 1998 – Kendall County**

A thunderstorm produced half dollar size hail that accumulated on the ground in Paige. A house was damaged by the wind driven hail.



## SECTION 11: HAIL

### October 12, 1993 – Kendall County

On October 12, 1993, golf ball to baseball-size hail was reported in Comfort. The County Sheriff's Office reported large signs blown down and wind damage to a gas pump in Boerne. Multiple cars were damaged across the County. The hail was reported as 2.75 inches in diameter.

## PROBABILITY OF FUTURE EVENTS

Based on available records of historic events, 113 events in a 52-year reporting period for Kendall County provides a probability of two to three events per year. This frequency supports a highly likely probability of future events for Kendall County and the City of Boerne.

## 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.

Kendall County and City of Boerne feature mobile or manufactured home parks. 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 813 (4.9%) manufactured homes located in Kendall County, (Table 11-4). In addition, 20.3% (approximately 3,352 structures) of the single family residential (SFR) structures in Kendall County 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 11-4. Structures at Greater Risk by Jurisdiction**

JURISDICTION	MANUFACTURED HOMES	SFR STRUCTURES BUILT BEFORE 1980
Kendall County <sup>4</sup>	813	3,352
City of Boerne	33	970

While all citizens are at risk to the impacts of hail, forced relocation and disaster recovery drastically impacts low-income residents who lack the financial means to travel, afford a long-term stay away from home, and to rebuild or repair their homes. An estimated 4.8% of the planning area population live below the poverty level (Table 11-5).

**Table 11-5. Populations at Greatest Risk by Jurisdiction<sup>5</sup>**

JURISDICTION	POPULATION BELOW POVERTY LEVEL
Kendall County	2,184
City of Boerne	1,065

<sup>4</sup> County totals includes all incorporated jurisdictions and unincorporated areas.

<sup>5</sup> US Census Bureau 2020 American Community Survey data for Kendall County



## SECTION 11: HAIL

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

**Table 11-6. Critical Facilities at Risk by Jurisdiction**

JURISDICTION	CRITICAL FACILITIES
Kendall County	1 Emergency Management Service, 7 VFD, 1 Police Department, 9 Government Buildings, 16 Schools, 2 Hospital, 6 Assisted Living Facilities, 6 Nursing Homes, 1 Agriculture Center, 2 Chemical Facilities, 2 Natural Gas Facilities, 3 Gas/Propane Facilities, 1 Petroleum Facility, 1 Fertilizer Storage, 1 Electrical Transport Facility, 3 Wastewater Facilities, 3 Wastewater Treatment Plants, 1 Water Plant, 2 Water Reclamation Facility, 1 Water Treatment Facility, 8 Water Storage Tanks, 3 Booster Stations, 3 Electrical Substations, 16 Lift Stations, 1 Pressure Station, 11 Pump Stations, 16 Water Wells, 1 Spillway, 4 Dams, 3 Parks, 1 EM Helipad
City of Boerne	1 Emergency Management Service, 2 VFD, 1 Police Department, 7 Government Buildings, 11 Schools, 1 Hospital, 6 Assisted Living Facilities, 5 Nursing Homes, 3 Gas/Propane Facilities, 4 Wastewater Facilities, 3 Electrical Substations, 1 Dam, 1 Natural Park

Hail has been known to cause injury to humans and occasionally has been fatal. Overall, the average loss estimate of property and crops (in 2022 dollars) is \$304,616, having an approximate annual loss estimate of \$5,858. Based on historic loss and damages, the impact of hail damages on Kendall County and the City of Boerne, 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 11-7. Potential Annualized Losses by Jurisdiction**

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATE
Kendall County	\$271,281	\$5,217
City of Boerne	\$33,334	\$641
<b>Planning Area</b>	<b>\$304,615</b>	<b>\$5,858</b>

### 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.

## SECTION 11: HAIL

- 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 12: WINTER STORM

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Vulnerability and Impact .....	7
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## HAZARD DESCRIPTION

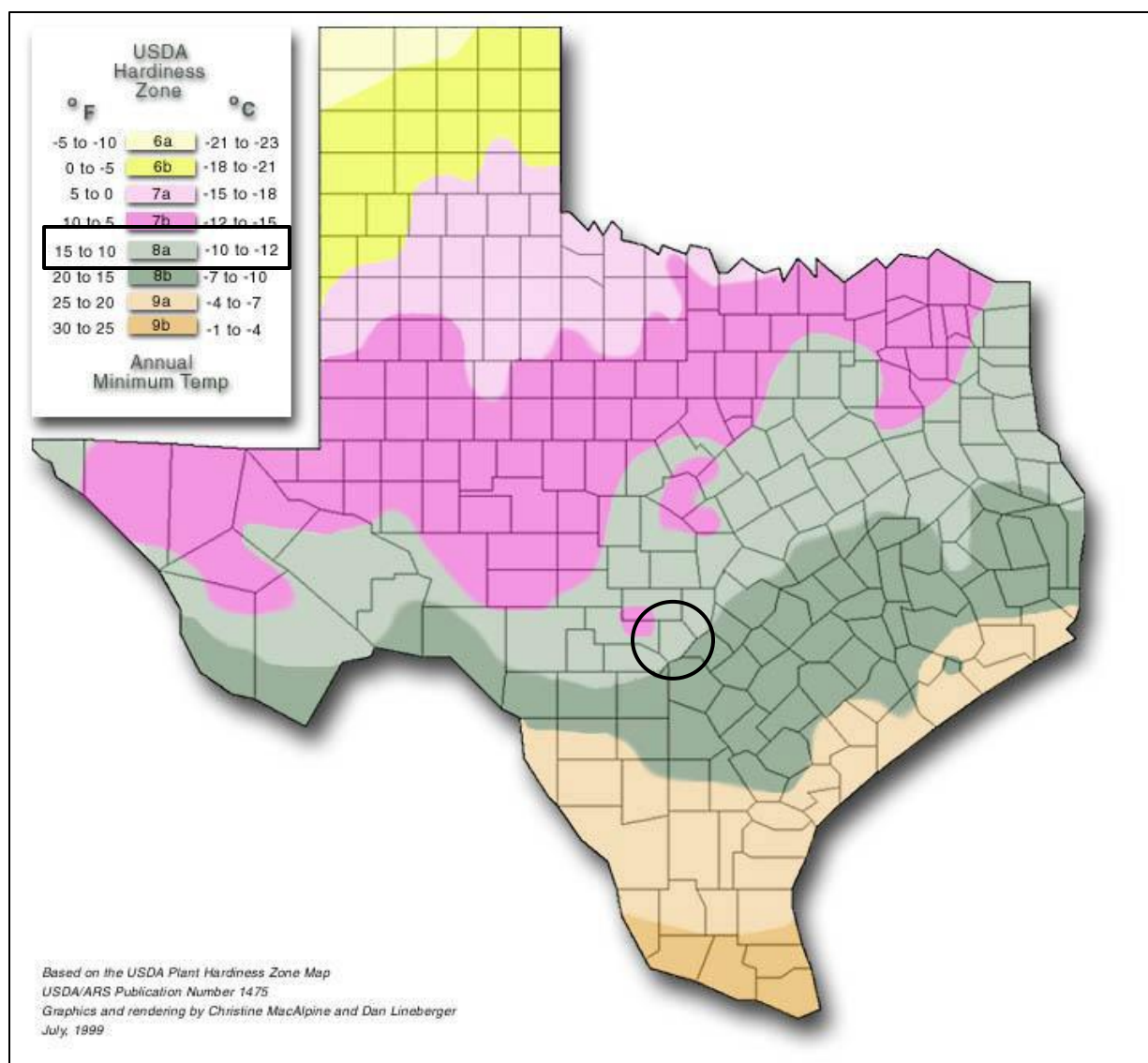


A severe winter storm event is identified as a storm with snow, ice, or freezing rain. This type of storm can cause significant problems for area residents. Winter storms are associated with freezing or frozen precipitation such as freezing rain, sleet, snow, and the combined effects of winter precipitation 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 Kendall County and the City of Boerne 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, Kendall County and the City of Boerne are located in USDA Hardiness Zone 8a, with annual minimum temperatures between 10° and 15°. During times of ice and snow accumulation, response times will increase until public works road crews are unable to make major roads passable. Table 12-1 describes the types of winter storms possible to occur in Kendall County and the City of Boerne.

## SECTION 12: WINTER STORM

**Figure 12-1. Annual Minimum Temperature<sup>1</sup>**



**Table 12-1. Types of Winter Storms**

TYPE OF WINTER STORM	DESCRIPTION
<b>Winter Weather Advisory</b>	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.
<b>Winter Storm Watch</b>	Severe winter weather conditions may affect your area (freezing rain, sleet, or heavy snow may occur separately or in combination).
<b>Winter Storm Warning</b>	Severe winter weather conditions are imminent.

<sup>1</sup> Source: National Weather Service. Kendall County indicated by circle.

## SECTION 12: WINTER STORM

TYPE OF WINTER STORM	DESCRIPTION
Freezing Rain or Freezing Drizzle	Rain or drizzle is likely to freeze upon impact, resulting in a coating of ice glaze on roads and all other exposed objects.
Sleet	Small particles of ice usually mixed with rain. If enough sleet accumulates on the ground, it makes travel hazardous.
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 Kendall County and the City of Boerne, are considered to be exposed to a winter storm hazard and could potentially be impacted.

### EXTENT

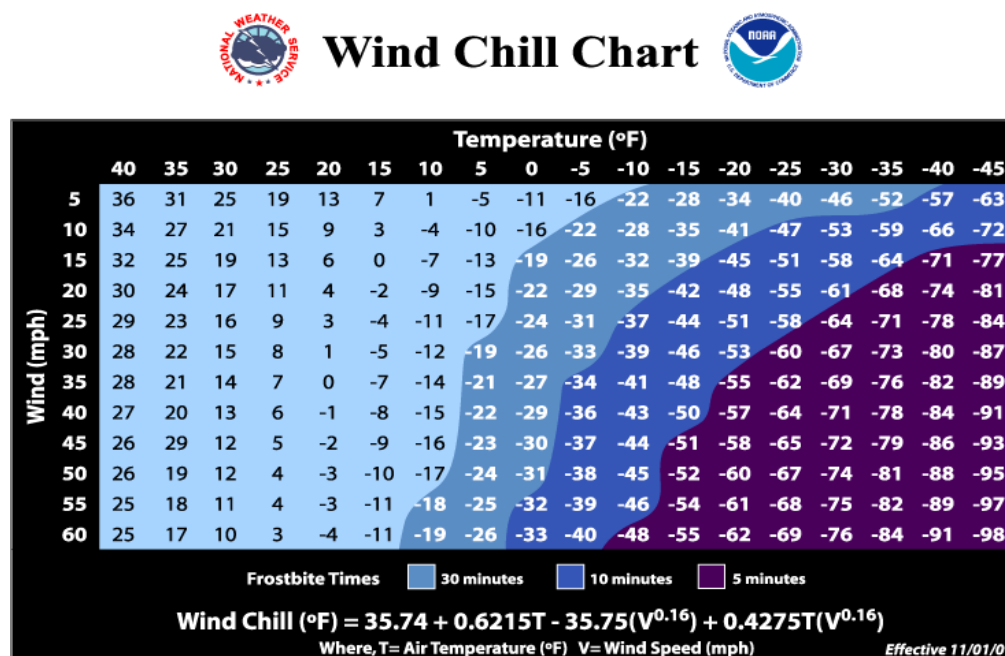
The extent or magnitude of a severe winter storm is measured in intensity based on the temperature and level of accumulations as shown in Table 12-2. Table 12-2 should be read in conjunction with the wind-chill factor described in Figure 12-2 to determine the intensity of a winter storm. The chart is 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

## SECTION 12: WINTER STORM

Figure 12-2. Wind Chill Chart



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. Kendall County and the City of Boerne have never experienced a blizzard, but based on 25 previous occurrences recorded from 1996 through May 2022, it has been subject to winter storm watches, warnings, freezing rain, sleet, snow, and wind chill.

The minimum annual temperature is similar for the entire Kendall County and the City of Boerne. Therefore, the intensity or extent of a winter storm event to be mitigated for the area ranges from mild to severe according to the definitions at Table 12-2. The entire Kendall County and City of Boerne can expect temperatures between 10° and 50° with winds ranging from 0 to 35 mph.

## HISTORICAL OCCURRENCES

Table 12-3 shows historical occurrences for Kendall County from 1996 through May 2022 provided by the NCEI database. There have been 25 recorded winter storm events Kendall County and the City of Boerne. Historical winter storm information, as provided by the NCEI, identifies winter storm activity across a multi-county forecast area for each event. Historical winter storm data for the county and city 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, 1996-2022<sup>2</sup>

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	2/1/1996	0	0	\$0	\$0

<sup>2</sup> Values are in 2022 dollars. Historical events are reported from January 1996 through May 2022.



## SECTION 12: WINTER STORM

Kendall County	1/7/1997	0	0	\$0	\$0
Kendall County	1/11/1997	0	0	\$0	\$0
Kendall County	12/23/1998	0	0	\$0	\$0
Kendall County	12/12/2000	0	0	\$0	\$0
Kendall County	11/28/2001	0	0	\$0	\$0
Kendall County	2/24/2003	0	0	\$0	\$0
Kendall County	1/15/2007	0	0	\$0	\$0
Kendall County	2/3/2011	0	0	\$0	\$0
Kendall County	11/23/2013	0	0	\$0	\$0
Kendall County	11/25/2013	0	0	\$0	\$0
Kendall County	11/26/2013	0	0	\$0	\$0
Kendall County	1/9/2015	0	0	\$0	\$0
Kendall County	1/23/2015	0	0	\$0	\$0
Kendall County	2/16/2015	0	0	\$0	\$0
Kendall County	2/27/2015	0	0	\$0	\$0
Kendall County	12/7/2017	0	0	\$0	\$0
Kendall County	1/16/2018	0	0	\$0	\$0
Kendall County	11/11/2019	0	0	\$0	\$0
Kendall County	2/5/2020	0	0	\$0	\$0
Kendall County	1/10/2021	0	0	\$0	\$0
Kendall County	2/13/2021	0	0	\$0	\$0
Kendall County	2/16/2021	0	0	\$0	\$0
Kendall County	1/20/2022	0	0	\$0	\$0
Kendall County	2/3/2022	0	0	\$0	\$0
<b>TOTALS</b>		<b>0</b>	<b>0</b>	<b>\$0</b>	<b>\$0</b>

Based on the list of historical winter storm events for Kendall County and the City of Boerne (listed above) 9 of the events have occurred since the 2017 Plan.

## SECTION 12: WINTER STORM

### SIGNIFICANT EVENTS

#### **Winter Storm Uri, February 13- 16, 2021 – Kendall County**

A series of weather systems brought several rounds of winter weather to South Central Texas from February 11 through February 18. The second round came on the 13th and 14th with cold air still in place in the low levels, another upper-level shortwave trough moved across Texas providing lift for precipitation. The deeper atmosphere had warm air above the cold leading to a second round of freezing rain. The third round of winter weather was initiated by another upper-level shortwave trough on the 14th and 15th. This system brought cooler air above the boundary layer and turned precipitation to snow. Most of the area had only snow, but there were also short periods of freezing rain in a few places. In addition to the snow, bitterly cold air and breezy winds combined to bring extreme wind chill values on the 15th.

With a FOIA (Freedom of Information Act) the state of Texas DSHS has produced some fatality numbers (direct vs indirect) for this event. However, there are no details provided on gender, exact location, or time of death. Direct deaths are from hypothermia. Indirect deaths are listed as deaths from falls, carbon monoxide, heating related fire, motor vehicle accidents, drowning, exacerbation of chronic illness, and frostbite. In some cases where fatality information was obtained by emergency managers, some details have been documented. Dates of deaths were placed on Feb 15 as an estimate and to be consistent of when some of the coldest temperatures occurred. In addition, overall monetary losses for individual counties cannot be computed with the substantial number of insured loss claims due to water pipes bursting in homes and businesses along with monetary loss due to rolling power blackouts. Insured loss numbers are not passed onto individual NWS offices. In the more urbanized counties where population is larger, overall uninsured and insured losses likely will total in the 100s of millions of dollars. The state of Texas will likely accumulate billions in losses with this winter event.

#### **February 27, 2015 – Kendall County**

A cold front moved through South Central Texas on February 26th and brought freezing temperatures. On February 27th low level flow from the south to southeast started to produce isentropic upglide and light precipitation. In places where the temperatures remained below freezing the precipitation fell as freezing drizzle and freezing rain. Light ice accumulation on elevated surfaces, bridges, and overpasses resulted in travel impacts. Icy bridges and overpasses were reported in Williamson, Travis, Gillespie, Burnet, and Kendall Counties. There were numerous accidents due to icy roads. One fatality occurred two miles west of Bertram in Burnet County on Highway 29 where there was an accident involving an 18-wheel tractor trailer and a car. Freezing precipitation continued into the morning of February 28th ending shortly before 10 AM.

#### **February 3, 2011 – Kendall County**

An upper-level storm approached the area the evening of February 3rd and produced light freezing drizzle which quickly formed a thin layer of ice on all exposed surfaces, making travel very dangerous. The precipitation later turned mostly to light snow along with a few reports of sleet. The greatest snow amounts were from 1 to 2 inches, mainly across portions of Travis and Williamson Counties with generally less than one inch, across the Hill Country, portions of San Antonio, and areas east of I-35. There were over 500 traffic accidents reported in San Antonio and Austin during the overnight hours as well as others in most of the other counties including Kendall County. The icy roads forced all of the major highways in San Antonio to close during the

## SECTION 12: WINTER STORM

night. For a time, I-35 was closed from San Marcos through San Antonio into Atascosa County, a stretch of nearly 100 miles. Many other highways were closed across the area including parts of I-10, US Hwy 90, US Hwy 77, and US Hwy 290. Most area schools were closed February 4th.

### **December 12, 2000 – Kendall County**

Bitterly cold arctic winds swept down on South Central Texas during the morning and early afternoon of December 12th. Temperatures that had warmed in many locations to the 70s plunged rapidly into the 40s and 50s shortly after the front's arrival. Northerly winds gusting to 30 and 35 mph further emphasized this dramatic temperature change. By mid-afternoon, temperatures over the Texas Hill Country had fallen below the freezing mark and light rain and drizzle had begun to change into freezing rain and freezing drizzle. By the late afternoon, a thin layer of ice was reported over Hill Country bridges, overpasses and elevated highways. However, because the soils over South Central Texas had been quite warm for the previous several weeks, no accumulations on the ground were indicated until late in the evening period.

The combination of freezing rain, freezing drizzle, and sleet continued to spread across the area through the late afternoon and nighttime hours, reaching the Austin area near 4 pm and the San Antonio area near 10 pm. In anticipation of the winter storm threat, many area schools and universities, as well as city and county agencies and private businesses closed down early on the afternoon of the 12th and planned to open late on the morning of the 13th. The wintry precipitation mix continued through the night and early the next morning, requiring the cancellation of several flights at both San Antonio International Airport and Austin Bergstrom International Airport. The layer of icing also forced the closing of numerous bridges and overpasses across the 25 counties involved. Late on the evening of the 12th, counties began to report widespread ice forming on roadways. Interstate 10 was closed between Kerrville and San Antonio from the evening of the 12th until the mid-morning of the 13th. The city of San Antonio closed all interstates within its boundaries from shortly after midnight until mid-morning on the 13th. Drivers were forced to travel on the frontage road. By 10 am on the morning of the 13th, the freezing rain had ended over all but the extreme northeast section of South Central Texas, and by 4 pm that afternoon the last of the warnings and advisories were lifted.

## PROBABILITY OF FUTURE EVENTS

According to historical records, the planning area experiences approximately one winter storm event every year. Hence, the probability of a future winter storm event affecting Kendall County and the City of Boerne is highly likely, with a winter storm likely to occur within the next year.

## 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.

## SECTION 12: WINTER STORM

All populations, buildings, critical facilities, and infrastructure in the entire Kendall County and the City of Boerne 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
Kendall County	1 Emergency Management Service, 7 VFD, 1 Police Department, 9 Government Buildings, 16 Schools, 2 Hospital, 6 Assisted Living Facilities, 6 Nursing Homes, 1 Agriculture Center, 2 Chemical Facilities, 2 Natural Gas Facilities, 3 Gas/Propane Facilities, 1 Petroleum Facility, 1 Fertilizer Storage, 1 Electrical Transport Facility, 3 Wastewater Facilities, 3 Wastewater Treatment Plants, 1 Water Plant, 2 Water Reclamation Facility, 1 Water Treatment Facility, 8 Water Storage Tanks, 3 Booster Stations, 3 Electrical Substations, 16 Lift Stations, 1 Pressure Station, 11 Pump Stations, 16 Water Wells, 1 Spillway, 4 Dams, 3 Parks, 1 EM Helipad
City of Boerne	1 Emergency Management Service, 2 VFD, 1 Police Department, 7 Government Buildings, 11 Schools, 1 Hospital, 6 Assisted Living Facilities, 5 Nursing Homes, 3 Gas/Propane Facilities, 4 Wastewater Facilities, 3 Electrical Substations, 1 Dam, 1 Natural Park

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 Kendall County is estimated at 19.2% of the total population or an estimated total of 8,749 potentially vulnerable residents in the planning area based on age. Children under five in the planning area is estimated at 4.7%, or approximately 2,121. An estimated 4.8% of the planning area population live below the poverty level (Table 12-5).

**Table 12-5. Population at Greater Risk by Jurisdiction<sup>3</sup>**

JURISDICTION	POPULATION 65 AND OLDER	POPULATION UNDER 5	POPULATION BELOW POVERTY LEVEL
Kendall County	8,749	2,121	2,184
City of Boerne	3,024	1,112	1,065

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<sup>3</sup> US Census Bureau 2020 American Community Survey data for Kendall County.

## SECTION 12: WINTER STORM

The potential severity of impact for Kendall County and the City of Boerne is “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 Kendall County Planning Area**

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Kendall County	\$0	\$0

### 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 young children, can face serious or life-threatening health problems from exposure to extreme cold including hypothermia and frostbite.
- Loss of electric power or other heat source can result in increased potential for fire injuries or hazardous gas inhalation because residents burn candles for light or use fires or generators to stay warm.
- Response personnel, including utility workers, public works personnel, debris removal staff, tow truck operators, and other first responders, are subject to injury or illness resulting from exposure to extreme cold temperatures.
- Response personnel would be required to travel in potentially hazardous conditions, elevating the life safety risk due to accidents and potential contact with downed power lines.
- Operations or service delivery may experience impacts from electricity blackouts due to winter storms.
- Power outages are possible throughout the planning area due to downed trees and power lines and/or rolling blackouts.
- Critical facilities without emergency backup power may not be operational during power outages.
- Emergency response and service operations may be impacted by limitations on access and mobility if roadways are closed, unsafe, or obstructed.
- Hazardous road conditions will likely lead to increases in automobile accidents, further straining emergency response capabilities.
- Depending on the severity and scale of damage caused by ice and snow events, damage to power transmission and distribution infrastructure can require days or weeks to repair.
- 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

## SECTION 12: WINTER STORM

citizens will also contribute to the overall economic and financial conditions in the aftermath of a winter storm event.



# SECTION 13: DAM AND LEVEE FAILURE

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Portions of the Kendall 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 14: HURRICANE WIND

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## HAZARD DESCRIPTION

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

Hurricanes often begin as tropical depressions that intensify into tropical storms when maximum sustained winds increase to between 35 – 64 knots (39 – 73 mph). At these wind speeds, the storm becomes more organized and circular in shape and begins to resemble a hurricane. Tropical storms resulting in high winds and heavy rainfall can be equally problematic without ever becoming a hurricane and can be dangerous to people and property, resulting in high winds and heavy rainfall, as Tropical Storm Hermine did for Travis and Williamson Counties in September 2010. Once sustained winds reach or exceed 74 mph, the storm becomes a hurricane. The intensity of a land falling hurricane is expressed in categories relating wind speeds to potential damage. Tropical storm-force winds are strong enough to be dangerous to those caught in them.



## LOCATION

Kendall County and the City of Boerne are located inland from the coast and are outside of the hurricane wind speed hazard areas. Thus, Kendall County and the City of Boerne are in a low-risk area for hurricane wind speeds of 90 miles per hour (mph) or less. However, Kendall County and the City of Boerne are susceptible to the indirect threats of a hurricane, including high winds and flooding. Additionally, Kendall County and the City of Boerne have hosted coastal area residents who evacuate during hurricane events.

## SECTION 14: HURRICANE WIND

### EXTENT

As a hurricane develops, the barometric pressure (measured in millibars or inches) at its center falls and winds increase. If the atmospheric and oceanic conditions are favorable, it can intensify into a tropical depression. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center in Miami, Florida. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane.

Hurricanes are categorized according to the strength and intensity of their winds using the Saffir-Simpson Hurricane Scale (Table 14-1). A Category 1 storm has the lowest wind speeds, while a Category 5 hurricane has the highest. However, a lower category storm can inflict greater damage than higher category storms depending on where they strike, the amount of storm surge, other weather they interact with, and how slow they move.

**Table 14-1. Extent Scale for Hurricanes<sup>1</sup>**

CATEGORY	MAXIMUM SUSTAINED WIND SPEED (Mph)	MINIMUM SURFACE PRESSURE (Millibars)	STORM SURGE (Feet)
1	74 – 95	Greater than 980	3 – 5
2	96 – 110	979 – 965	6 – 8
3	111 – 130	964 – 945	9 – 12
4	131 – 155	944 – 920	13 – 18
5	155 +	Less than 920	19+

Based on the historical storm tracks for hurricanes and the location of Kendall County and the City of Boerne which is outside of the hurricane wind hazard area, the highest extent to be mitigated is for a Category 1 storm for the planning area.

### HISTORICAL OCCURRENCES

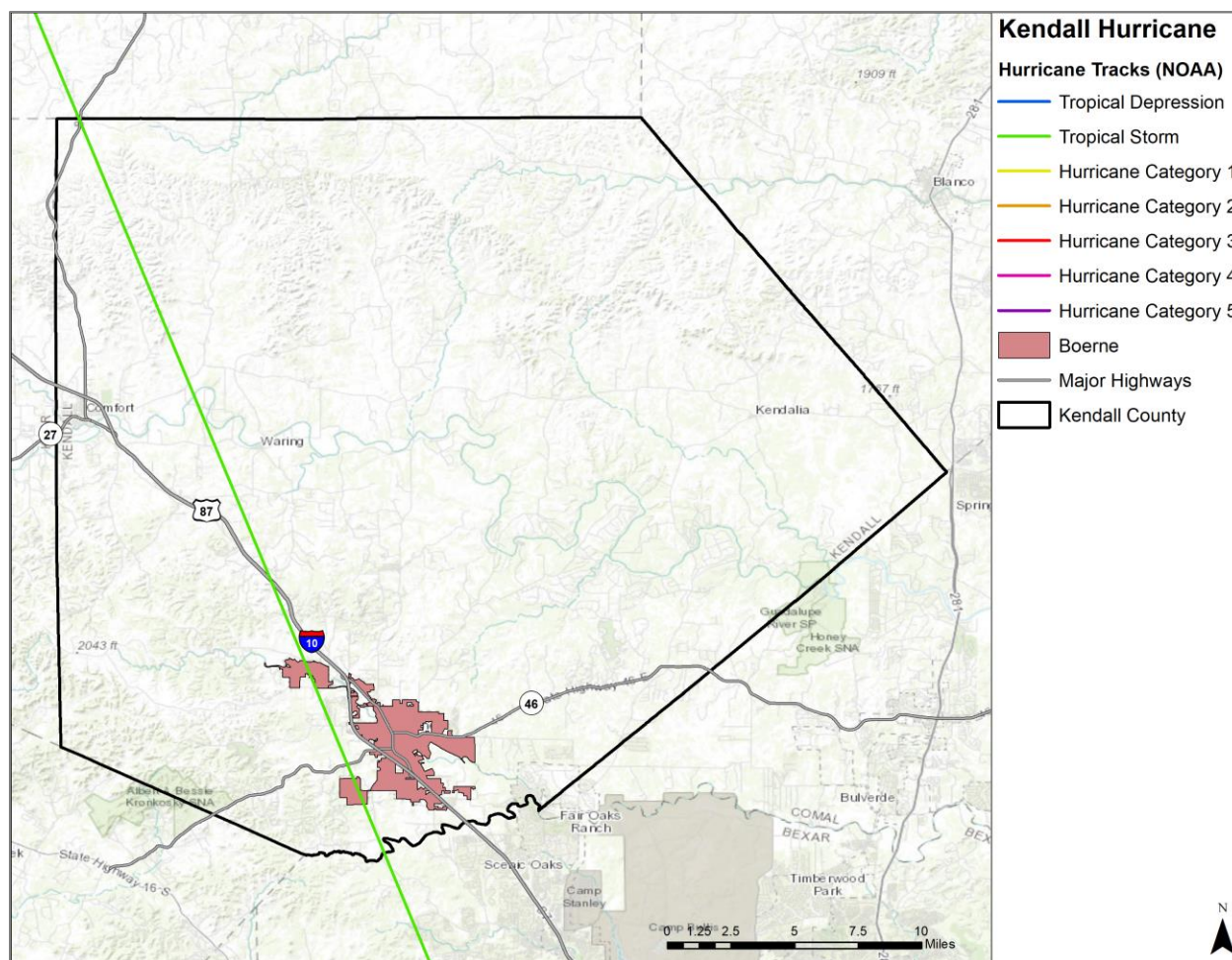
By the time hurricanes and tropical storms have made landfall at various magnitudes (categories) in Kendall County and the City of Boerne, the storms have usually weakened to tropical storms or depressions, being near the end of their life cycle. With the storms having reduced winds, extreme rainfall is the hazard of concern. In Figure 14-1 below, hurricane tracks are reflective of their strength in Kendall County and the City of Boerne. Table 14-2 lists the storms that have tracked through the planning area. Historical hurricane data for Kendall County and the City of Boerne is provided on a County-wide basis per the National Centers for Environmental Information (NCEI) and National Oceanic and Atmospheric Administration (NOAA) databases.

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<sup>1</sup> Source: National Hurricane Center

## SECTION 14: HURRICANE WIND

**Figure 14-1. Location of Historic Storm Tracks**



**Table 14-2. Historic Storms**

YEAR	STORM NAME	CATEGORY
2010	Hermine	Tropical Storm
2017	Harvey	Hurricane

Based on the list of historical hurricane and tropical storm events for Kendall County and the City of Boerne (listed above) one event has occurred since the 2016 Plan.

### SIGNIFICANT EVENTS

#### **Tropical Storm Hermine, September 3-9, 2010 Kendall County**

Tropical storm Hermine made landfall near the Texas/Mexico border on the night of September 6. The storm moved northward through South Texas into South Central Texas. Strong winds and flooding rain began in South Central Texas on September 7. On September 8 the winds subsided, but the flooding rain continued as the remnants of Hermine moved northward into Oklahoma. South Central Texas was hit very hard with widespread rains of 8-12 inches across much of the I-35 corridor from Austin down to San Antonio. The hardest hit area was north Austin, Round

## SECTION 14: HURRICANE WIND

Rock, Cedar Park, and Georgetown. Sixteen inches of rain fell in Georgetown, with the Georgetown Co-op observer reporting 16.37 inches for the 2-day rain event.

Flash flooding in the Kendall County planning area forced multiple road closings including FM473, FM1376, FM1320, FM962, Highway 46, and County Road 1320. In addition, flash flooding closed the 400 block of FM 474 in Boerne and Old Fredericksburg Road near the Gillespie County line.

### PROBABILITY OF FUTURE EVENTS

Based on historical occurrences of significant hurricane wind events, the probability of future events is Unlikely, with a frequency of occurrence of one event every ten years or more for Kendall County and the City of Boerne.

### VULNERABILITY AND IMPACT

Hurricane-force winds can cause major damage to large areas; hence all existing buildings, facilities and populations are equally exposed and vulnerable to this hazard and could potentially be impacted. Most structures in the planning area can resist the effects of all but the most severe wind storms. Kendall County and the City of Boerne feature multiple mobile or manufactured home parks throughout the planning area. These parks are typically more vulnerable to hurricane events than typical site-built structures. In addition, manufactured homes are located sporadically throughout the planning area which would also be more vulnerable. The US Census data indicates a total of 813 (4.9%) manufactured homes located in Kendall County (Table 14-3). In addition, 20.3% (approximately 3,352 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 hurricane events.

**Table 14-3. Kendall County Structures at Greater Risk**

JURISDICTION	MANUFACTURED HOMES	SFR STRUCTURES BUILT BEFORE 1980
Kendall County <sup>2</sup>	813	3,352
City of Boerne	33	970

The following critical facilities would be vulnerable to hurricane events in the planning area:

**Table 14-4. Kendall County Critical Facilities at Risk**

JURISDICTION	CRITICAL FACILITIES
Kendall County	1 Emergency Management Service, 7 VFD, 1 Police Department, 9 Government Buildings, 16 Schools, 2 Hospital, 6 Assisted Living Facilities, 6 Nursing Homes, 1 Agriculture Center, 2 Chemical Facilities, 2 Natural Gas Facilities, 3 Gas/Propane Facilities, 1 Petroleum Facility, 1 Fertilizer Storage, 1 Electrical Transport Facility, 3 Wastewater Facilities,

<sup>2</sup> County totals includes all incorporated jurisdictions and unincorporated areas.



## SECTION 14: HURRICANE WIND

JURISDICTION	CRITICAL FACILITIES
	3 Wastewater Treatment Plants, 1 Water Plant, 2 Water Reclamation Facility, 1 Water Treatment Facility, 8 Water Storage Tanks, 3 Booster Stations, 3 Electrical Substations, 16 Lift Stations, 1 Pressure Station, 11 Pump Stations, 16 Water Wells, 1 Spillway, 4 Dams, 3 Parks, 1 EM Helipad
City of Boerne	1 Emergency Management Service, 2 VFD, 1 Police Department, 7 Government Buildings, 11 Schools, 1 Hospital, 6 Assisted Living Facilities, 5 Nursing Homes, 3 Gas/Propane Facilities, 4 Wastewater Facilities, 3 Electrical Substations, 1 Dam, 1 Natural Park

Storm track data was available for the past 150 years; and property and crop loss data was available from 1950 to the present. Only hurricane wind events that have been reported have been factored into this Risk Assessment. It is likely that additional hurricane wind occurrences have gone unreported before and during the recording period. Table 14-5 shows the annualized losses based on historical incident information for the planning area. The average annual loss estimate for Kendall County and the City of Boerne are considered negligible as most damages related to hurricane and tropical storm events are recorded under the flood profile (Section 5).

**Table 14-5. Potential Annualized Losses by Jurisdiction**

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Kendall County	\$0	\$0

While all citizens are at risk to the impacts of a hurricane, forced relocation and disaster recovery drastically impacts low-income residents who lack the financial means to travel, afford a long-term stay away from home, and to rebuild or repair their homes. An estimated 4.8% of the planning area population live below the poverty level (Table 14-6).

**Table 14-6. Populations at Greatest Risk by Jurisdiction<sup>3</sup>**

JURISDICTION	POPULATION BELOW POVERTY LEVEL
Kendall County	2,184
City of Boerne	1,065

The impact of hurricane wind events experienced in Kendall County and the City of Boerne have resulted in no injuries or fatalities. Based on the level of risk and historical occurrences for hurricane winds in the Kendall County planning area, including the City of Boerne, there is a “Limited” severity of impact; meaning the shutdown of critical facilities and services could be for

<sup>3</sup> US Census Bureau 2020 American Community Survey data for Kendall County



## SECTION 14: HURRICANE WIND

24-hours or less, and less than ten percent of property can be destroyed or experience major damage.

### ASSESSMENT OF IMPACTS

Hurricane events have the potential to pose a significant risk to people and can create dangerous and difficult situations for public health and safety officials. The impact of climate change could produce larger, more severe hurricane events, exacerbating the current hurricane impacts. Worsening hurricane conditions can be frequently associated with a variety of impacts, including:

- Individuals exposed to the storm can be struck by flying debris, falling limbs, or downed trees causing serious injury or death.
- Structures can be damaged or crushed by falling trees, which can result in physical harm to the occupants.
- Driving conditions in all jurisdictions may be dangerous during a hurricane event, especially over elevated bridges, elevating the risk of injury and accidents during evacuations if not timed properly.
- Additional resources may be required for emergency preparedness and response during the summer months due to increases in populations along the coast.
- Emergency evacuations may be necessary prior to a hurricane landfall, requiring emergency responders, evacuation routing and temporary shelters in the planning area.
- 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 hurricane landfall, 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.
- Hurricane 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.
- Extreme hurricane events may rupture gas lines and down trees and power lines, increasing the risk of structure fires during and after a storm event.
- Extreme hurricane events may lead to prolonged evacuations during search and rescue, and immediate recovery efforts requiring additional emergency personnel and resources to prevent entry, and protect citizens and property.
- 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.

## SECTION 14: HURRICANE WIND

- 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 hurricane 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 hurricane damage.
- Large scale hurricanes 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, as well as 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.

The economic and financial impacts of a hurricane 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 hurricane event.

# SECTION 15: LIGHTNING

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## 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

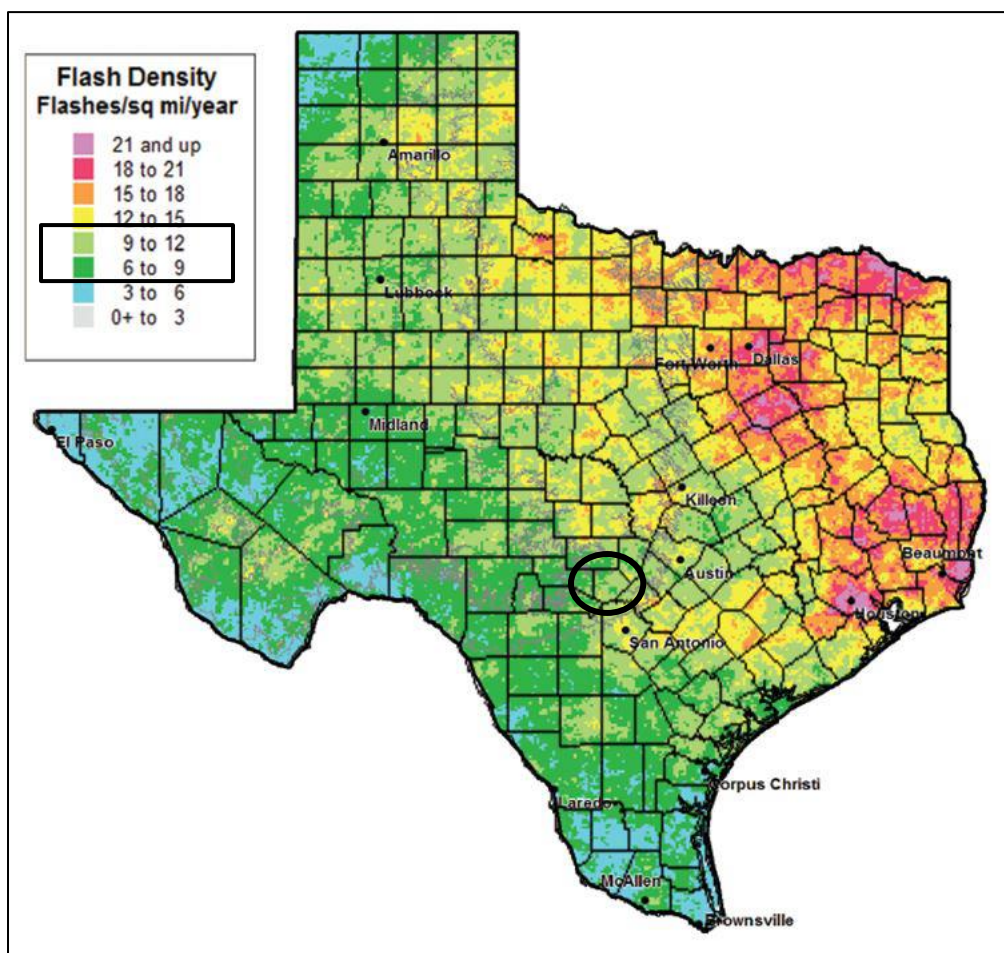
Lightning can strike in any geographic location and is considered a common occurrence in Texas. Kendall County and the City of Boerne are located in a region of the country that is moderately susceptible to a lightning strike. Therefore, lightning could occur at any location within the entire planning area. It is assumed that the entire Kendall County and the City of Boerne 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 15-1) shows a range of six to twelve cloud-to-ground lightning flashes per square mile per year for the entire Kendall County planning area. This rate equates to approximately 3,978 to 7,956 flashes per year for the entire planning area.

## SECTION 15: LIGHTNING

**Figure 15-1. 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 15-1).

**Table 15-1. 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

## SECTION 15: LIGHTNING

LAL	CLOUD & STORM DEVELOPMENT	LIGHTNING STRIKES/ 15 MIN
4	Towering cumulus covers two to three-tenths of the sky. Thunderstorms are scattered and more than three must occur within the observation area. Moderate rain is common and lightning is frequent.	16-25
5	Towering cumulus and thunderstorms are numerous. They cover more than three-tenths and occasionally obscure the sky. Rain is moderate to heavy and lightning is frequent and intense.	>25
6	Similar to LAL 3 except thunderstorms are dry.	

The 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 (3,978 to 7,956 flashes) and a cloud-to-ground flash density of six to twelve flashes per square mile were divided by the number<sup>1</sup> of thunderstorm events that occur annually in the planning area. Kendall County and the City of Boerne should expect an average range of six to twelve 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 2 to 3. The highest being a 3 on the LAL for all participating jurisdictions in the future.

### HISTORICAL OCCURRENCES

Since January 1996, there have been no recorded lightning events reported as having impacted Kendall County and the City of Boerne, 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.

### PROBABILITY OF FUTURE EVENTS

Based on the annual lightning flash density and input from the planning team the probability of occurrence for future lightning events in Kendall County and the City of Boerne 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, Kendall County and the City of Boerne are located in an area of the country that experiences six to twelve lightning flashes per square mile per year (approximately 3,978 to 7,956 flashes per year). Given this estimated probability of events, it can be expected that future lightning events will continue to threaten life and cause minor property damage throughout Kendall County and the City of Boerne.

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<sup>1</sup> 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.

## SECTION 15: LIGHTNING

### 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 Kendall County and the City of Boerne could potentially be impacted and remain vulnerable to possible injury and property loss from lightning strikes. The Kendall County planning area has no reported lightning events however Kendall County and the City of Boerne are vulnerable and could be impacted by lightning.

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 Kendall 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.

The entire general building stock and all infrastructure of the Kendall 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.

While all citizens are at risk to the impacts of lightning, forced relocation and disaster recovery drastically impacts low-income residents who lack the financial means to travel, afford a long-term stay away from home, and to rebuild or repair their homes. An estimated 4.8% of the planning area population live below the poverty level (Table 15-2).

**Table 15-2. Populations at Greatest Risk by Jurisdiction<sup>2</sup>**

JURISDICTION	POPULATION BELOW POVERTY LEVEL
Kendall County	2,184
City of Boerne	1,065

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

**Table 15-3. Critical Facilities at Risk by Jurisdiction**

JURISDICTION	CRITICAL FACILITIES
Kendall County	1 Emergency Management Service, 7 VFD, 1 Police Department, 9 Government Buildings, 16 Schools, 2 Hospital, 6 Assisted Living Facilities, 6 Nursing Homes, 1 Agriculture Center, 2 Chemical Facilities, 2 Natural Gas Facilities, 3 Gas/Propane Facilities, 1 Petroleum Facility, 1 Fertilizer Storage, 1 Electrical Transport Facility, 3 Wastewater Facilities,

<sup>2</sup> US Census Bureau 2020 American Community Survey data for Kendall County.



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JURISDICTION	CRITICAL FACILITIES
	3 Wastewater Treatment Plants, 1 Water Plant, 2 Water Reclamation Facility, 1 Water Treatment Facility, 8 Water Storage Tanks, 3 Booster Stations, 3 Electrical Substations, 16 Lift Stations, 1 Pressure Station, 11 Pump Stations, 16 Water Wells, 1 Spillway, 4 Dams, 3 Parks, 1 EM Helipad
City of Boerne	1 Emergency Management Service, 2 VFD, 1 Police Department, 7 Government Buildings, 11 Schools, 1 Hospital, 6 Assisted Living Facilities, 5 Nursing Homes, 3 Gas/Propane Facilities, 4 Wastewater Facilities, 3 Electrical Substations, 1 Dam, 1 Natural Park

Impact of lightning experienced in Kendall County and the City of Boerne has resulted in no injuries or fatalities. Impact of lightning events experienced in Kendall County and the City of Boerne, would be “Limited,” and injuries and illnesses would be treatable with first aid. The quality of life lost would be minor, and facilities would be shut down for 24 hours or less. Overall, the average loss estimate for the entire Kendall County planning area is negligible.

### 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.
- 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.

## SECTION 15: LIGHTNING

- 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 16: EXPANSIVE SOILS

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## 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. 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 Kendall County and the City of Boerne. 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. Drought conditions can cause soils to contract in response to a loss of soil moisture. 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. The effect of expansive soil is most prevalent in regions prone to prolonged periods of drought followed by periods of moderate to high precipitation.

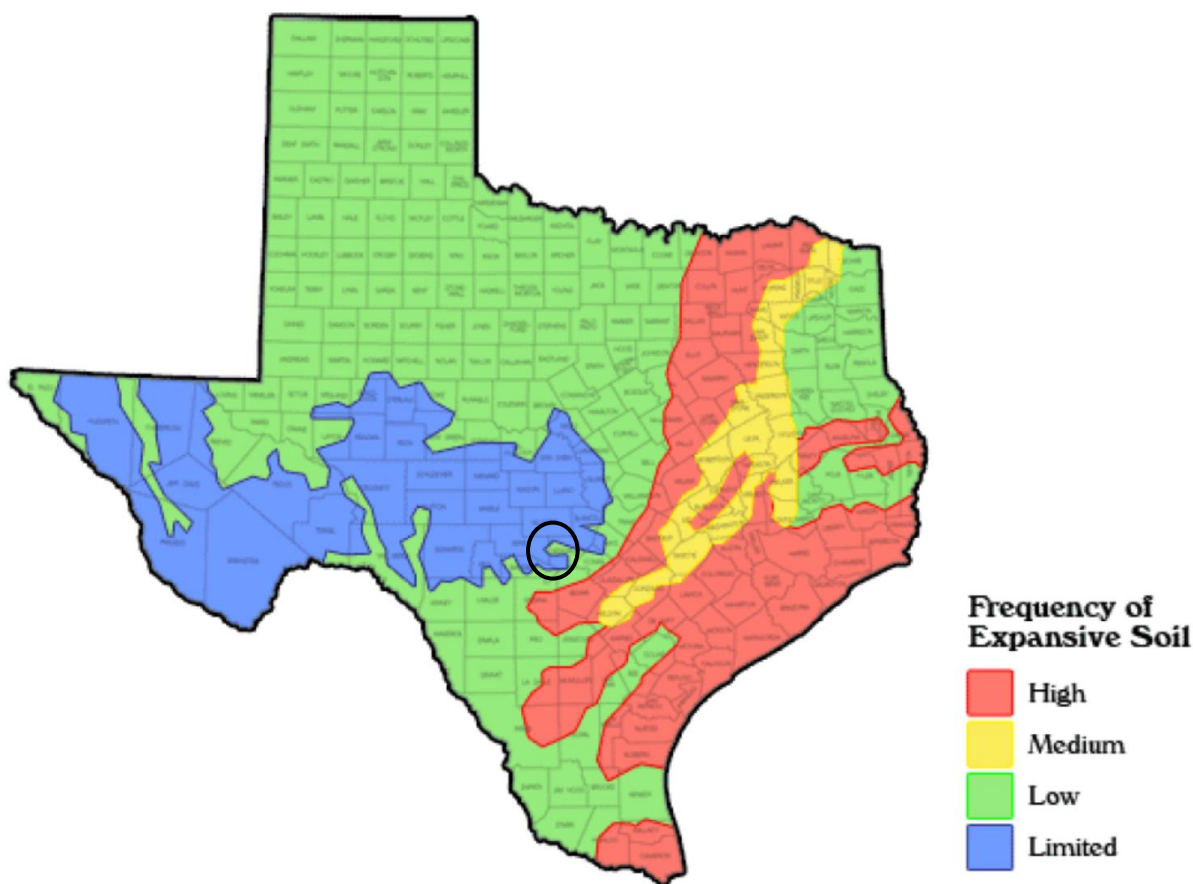
## LOCATION

Damages from expansive soils are most prevalent when periods of moderate to high precipitation are followed by drought and then again by periods of heavy rainfall. Soils capable of changes in volume present a hazard to structures built on them and to the pipelines, sewer and water lines, buried within 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.

While all infrastructures in the higher-risk areas (Figure 16-1) are vulnerable, slab-on-grade structures are most likely to suffer damages from expansive soils. In addition, older structures built to less stringent building codes may be more susceptible to damages than new construction. Bridges, highways, streets, and parking lots are especially vulnerable when they are constructed when clays are dry, such as during a drought, and then subsequent soaking rains swell the clay.

## SECTION 16: EXPANSIVE SOILS

**Figure 16-1. Expansive Soils: Location of Expansive Soils in Texas<sup>1</sup>**



### EXTENT

Expansive soils risk is measured by the degree to which soils may shrink or swell. Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures.<sup>2</sup> Texas features the full range of expansive soil categories from low to very high. The planning area can experience low linear extensibility.

<sup>1</sup> Source: [https://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/16/nrcs143\\_019308.pdf](https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/16/nrcs143_019308.pdf)

<sup>2</sup> (2009). *Soil Reports*. Natural Resources Conservation Service. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/[https://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/nrcs141p2\\_016186.pdf](https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs141p2_016186.pdf)

## SECTION 16: EXPANSIVE SOILS

**Table 16-1. Expansive Soils: NRCS Soil Linear Extensibility Risk Categories**

POTENTIAL CATEGORY	LINEAR EXTENSIBILITY %	CLAY %
Low	< 3%	< 25 %
Moderate	3 – 6%	25% – 35%
High	6 – 9%	35% - 45%
Very High	> 9%	> 45%

### HISTORICAL OCCURRENCES

Structural foundation issues occur throughout the state, however, there is little documentation of site-specific past events from local, state, or national datasets. Expansive soil damages that are commonly found in residential structures are shouldered by homeowners and are not a matter of public record unless disclosed in real estate transactions. State universities have been studying the impacts of expansive soils for decades, however a system for tracking private or public damages resulting from expansive soils has not yet been developed. This makes it difficult to quantify damage on a statewide or local level.

Expansive soil 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. Expansive soils have been observed throughout the planning area. The limited reported data for historical expansive soil incidents is noted as a data deficiency for this planning cycle. An action has been created to enhance data collection for expansive soil incidents in future plan updates.

### PROBABILITY OF FUTURE EVENTS

The Texas Department of Licensing and Regulation requires structures built after 2005 to include soil tests to be conducted for the likelihood of soil expansion, compression or shifting. In such cases, top or subsoils are required to be removed and remaining soils stabilized. Builders must assure that water drains away from the structure on all sides and building owners notified of the potential for damage if changes in drainage flow occur. These measures significantly reduce the probability of expansive soil impacts on newer and future development. It is “Highly Likely” that high risk areas in the state will experience some expansive soil impacts such as problems with foundations, roadways, sidewalks and other structures and infrastructure in the next year. Older structures will be impacted with greater frequency due to the soil testing and stabilization requirements for newer structures.

## SECTION 16: 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 Kendall County planning area, including the City of Boerne, 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 slabs on grade structures is not available, the U.S. Census data indicates approximately 3,352<sup>3</sup> of the residential structures in the planning area were built before 1980 (Table 16-2) and may be more susceptible to damages.

**Table 16-2. Structures at Greater Risk by Jurisdiction**

JURISDICTION	SFR STRUCTURES BUILT BEFORE 1980
Kendall County	3,352
City of Boerne	970

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

**Table 16-3. Critical Facilities**

JURISDICTION	CRITICAL FACILITIES
Kendall County	1 Emergency Management Service, 7 VFD, 1 Police Department, 9 Government Buildings, 16 Schools, 2 Hospital, 6 Assisted Living Facilities, 6 Nursing Homes, 1 Agriculture Center, 2 Chemical Facilities, 2 Natural Gas Facilities, 3 Gas/Propane

<sup>3</sup> Structures under the county include all incorporated and unincorporated areas of the county and includes all participating jurisdictions.



## SECTION 16: EXPANSIVE SOILS

JURISDICTION	CRITICAL FACILITIES
	Facilities, 1 Petroleum Facility, 1 Fertilizer Storage, 1 Electrical Transport Facility, 3 Wastewater Facilities, 3 Wastewater Treatment Plants, 1 Water Plant, 2 Water Reclamation Facility, 1 Water Treatment Facility, 8 Water Storage Tanks, 3 Booster Stations, 3 Electrical Substations, 16 Lift Stations, 1 Pressure Station, 11 Pump Stations, 16 Water Wells, 1 Spillway, 4 Dams, 3 Parks, 1 EM Helipad
City of Boerne	1 Emergency Management Service, 2 VFD, 1 Police Department, 7 Government Buildings, 11 Schools, 1 Hospital, 6 Assisted Living Facilities, 5 Nursing Homes, 3 Gas/Propane Facilities, 4 Wastewater Facilities, 3 Electrical Substations, 1 Dam, 1 Natural Park

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 Kendall planning and the City of Boerne, the most extensive damage from expansive soils can occur to bridges, highways, streets, infrastructure, 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 Kendall County and the City of Boerne 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 17: MITIGATION STRATEGY

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## MITIGATION GOALS

Based on the results of the risk and capability assessments, the Planning Team developed and prioritized the mitigation strategy. This involved utilizing the results of both assessments and reviewing the goals and objectives that were included in the previous 2017 Plan. At the Mitigation Workshop in January 2022, Planning Team members reviewed the mitigation strategy from the previous 2017 Plan. The consensus among all members present was that the strategy developed for the 2017 Plan did not require changes, as it identified overall improvements to be sought in the Plan Update. However, the order and priority of the goals and objectives were reorganized.

### 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.

## SECTION 17: MITIGATION STRATEGY

### *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.

### *GOAL 6*

Promote growth in a sustainable manner.

### *OBJECTIVE 6.1*

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

## SECTION 17: MITIGATION STRATEGY

### *OBJECTIVE 6.2*

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

### *OBJECTIVE 6.3*

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

# SECTION 18: PREVIOUS ACTIONS

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## SUMMARY

Planning Team members were given copies of the previous mitigation actions submitted in the 2017 Plan at the mitigation workshop. Kendall County and the City of Boerne reviewed the previous actions and provided an analysis as to whether the action had been completed, should be deferred as an ongoing activity, or be deleted from the Plan Update. The actions from the 2017 Plan are included in this section as they were written in 2017, with the exception of the “2022 Analysis” section.

## SECTION 18: PREVIOUS ACTIONS

### KENDALL COUNTY

Kendall County– Action #1	
<b>Proposed Action:</b>	All critical facilities should have a back-up power supply. Conduct survey to identify these facilities that do not have back-up power and prioritize facilities. Install back-up power with permanent quick connections at facilities as funding become available.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide facilities
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Assure that during power outages that all County Facilities have the ability to have back-up power to conduct day-to-day and critical activities. Ensure continuity of services during hazard events.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure; Extreme Heat; Flood; Hail; Thunderstorm Wind; Tornado; Wildfire; Winter Storm; Hurricane Wind; Terrorism; Lightning
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	TBD per site
<b>Potential Funding Sources:</b>	Local Budget; HMA Grants
<b>Lead Agency/Department Responsible:</b>	Facility Maintenance; Emergency Management
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending available funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

2022 ANALYSIS:
Completed and Defer to Plan Update. The following critical facilities need back-up power: Kendall County Courthouse Bergheim FD, Alamo Springs FD, Kendalia FD, Sisterdale FD, Waring FD, Kendall County Elections and possibly some others. Duplicate action to #5.



## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #2	
<b>Proposed Action:</b>	Create and implement stricter water restrictions in Cow Creek Ground Water district to mitigate drought impacts. Assist Cow Creek Ground Water District in enforcing water restrictions. Use law enforcement to enforce water restrictions when Cow Creek issues critical water level concerns and expresses a need for strict conservation.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit (Current Cost/Losses Avoided):</b>	Provide for water retention and avoid depreciation of ground water sources.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Drought
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	Minimal – Staff Time
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	Cow Creek w/ Law Enforcement assistance
<b>Implementation Schedule:</b>	Within 12 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Operations Plan

2022 ANALYSIS:
Delete Action. Until counties are given more authority to use law enforcement to enforce, action should be removed. The county already has provisions for water retention in the county subdivision rules and regulations.

## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #3	
<b>Proposed Action:</b>	Purchase, build, and place hazardous warning signs, or auto barricades at low water crossings. Place auto barricades or permanent pull-out barricades at these locations so when auto sensed, a barricade would drop and close the roadway. If using the pull-out type, all responders would have a key to open the container and close the roadway.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide at low water crossings
<b>Risk Reduction Benefit (Current Cost/Losses Avoided):</b>	Provide early warning that the roadway is flooded and not to drive through; Turn Around – Don't Drown.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure; Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$500, 000
<b>Potential Funding Sources:</b>	HMA Grants; Local budget (limited amount each year)
<b>Lead Agency/Department Responsible:</b>	Road and Bridge
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Road and Bridge Flooding Plans

2022 ANALYSIS:
Defer to Plan Update. The County R&B department has done some work with this. We have asked to have automatic low water crossings and gauges included in the Regional Flood Plan. The Lead Agency/Department Responsible should be the Engineer's Office not Road and Bridge.

## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #4	
<b>Proposed Action:</b>	Creation of a GIS map showing all low water crossing in the County and improve county flood risk assessment. Build site, make public, then educate public how to access and use.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Having this site easily accessible to the public, citizens, visitors, and others to pull up and see during times of potential flooding events.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations; Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood; Thunderstorm Wind; Hurricane Wind
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	Minimal
<b>Potential Funding Sources:</b>	Budget through the GIS department
<b>Lead Agency/Department Responsible:</b>	GIS Department
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Operations Plan

2022 ANALYSIS:
Completed. This has been done through the GIS. We have the locations of the low water crossings. Will need to create a new action to make a publicly available map or app.

## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #5	
<b>Proposed Action:</b>	Purchase and place generators with permanent quick connections at the County Courthouse and all Fire Stations in the County that do not have them. Survey each station to see what energy requirements are required. Purchase generators with auto switches to power the station during outages.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Alamo Springs; Bergheim; Kendalia; Sisterdale; and Waring Fire Stations, Kendall County Courthouse
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	During Flooding, Sever Thunderstorm, Winter Storm, or other events that could cause power disruption, the fire stations would have emergency power to continue their mission.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood; Thunderstorm Wind; Winter Storm; Hail; Wildfire; Extreme Heat; Tornado; Hurricane Wind; Lightning
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$250,000
<b>Potential Funding Sources:</b>	HMA Grants; Local Budget (limited amount each year)
<b>Lead Agency/Department Responsible:</b>	Fire Chiefs
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Continuity of Operations Plan

2022 ANALYSIS:
Defer to Plan Update. Duplicate to action #1.

## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #6	
<b>Proposed Action:</b>	Conduct Hailstorm, Lightning and Tornado safety awareness and education about the dangers of these events. Educate citizens on mitigation measures to protect property and lives during hail, lightning, and tornado events.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Prevent property damage, loss of life and prevention of injury due to hailstorms and tornados.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hail; Tornado; Lightning
<b>Effect on new/existing buildings:</b>	Reduce damage to existing structures
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget; Donations; HMA Grants
<b>Lead Agency/Department Responsible:</b>	Public Safety Responders
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Local Plans & Public Regulations SOP's

2022 ANALYSIS:
Defer to Plan Update. Ongoing.

## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #7	
<b>Proposed Action:</b>	Provide training for first responders that could be involved in a Hazardous Material Incident. Provide 2016 Emergency Response Guidebook training to all 1 <sup>st</sup> responders. Provide Awareness training to all FD, EMS, and Law Enforcement staff.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide – all 1 <sup>st</sup> responders
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the risk of injury and/or death to 1 <sup>st</sup> responders and reduce the risk posed by the Hazardous Material.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hazardous Material
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	Training Budget; HMA Grants
<b>Lead Agency/Department Responsible:</b>	Emergency Management, Fire Department, Law Enforcement
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Local SOP's

2022 ANALYSIS:
Completed. All responders have received at least awareness training, and all have been issued the 2020 Emergency Response Guide.



## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #8	
<b>Proposed Action:</b>	Provide advanced training for first responders that want to advance to the operations and/or technical level to operate in the hot zone of a Hazardous Materials Incident. Provide opportunity for staff that want to achieve an advance level of training to do so.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide – department members wanting to advance
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the risk of injury and/or death to responders and reduce the risk posed by the Hazardous Material as well as reduce the time to mitigate the incident versus waiting for response companies to get here from outside the county.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hazardous Material
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$250 to \$750 per student
<b>Potential Funding Sources:</b>	Training Budget; HMA Grants; Loans
<b>Lead Agency/Department Responsible:</b>	Emergency Management, Fire Department, Law Enforcement
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Local SOP's

2022 ANALYSIS:
Completed and Defer to Plan Update. We have a few that have done this, but not enough.

## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #9	
<b>Proposed Action:</b>	Ensure that businesses which use, store, manufacture, or sell hazardous materials is in compliance with the Adopted County Fire Code. Annual fire inspections of facilities that use, store, manufacture or sell hazardous materials.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce potential for Hazardous Material release.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hazardous Materials
<b>Effect on new/existing buildings:</b>	Reduce risk to existing facilities
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	None – staff time
<b>Potential Funding Sources:</b>	N/A
<b>Lead Agency/Department Responsible:</b>	Fire Marshal – Health Inspector
<b>Implementation Schedule:</b>	Within 12 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Fire, Health, and Safety Codes

2022 ANALYSIS:
Completed and Defer to Plan Update. Ongoing. Since the adoption of the 2015 Fire Codes all new construction has a plan review prior to getting a permit to build. All new developments are reviewed to make sure prior to construction that the roadways are built to code. Fire Marshal's office conducts annual inspections of identified facilities. We perform annual fire inspections on all businesses in the County. Also, effective January 1, 2022, we now use the 2021 IFC.

## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #10	
<b>Proposed Action:</b>	Provide cooling sites and public education for extreme heat conditions. Provide locations for the public and citizens to gather where they are in a cooler environment. Public service announcements and handouts on cooling locations and personal protection.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk of injury and/or illness to citizens during extreme heat days.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Extreme Heat
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Nonprofit organizations buildings and sponsored pamphlets
<b>Lead Agency/Department Responsible:</b>	Emergency Management
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

2022 ANALYSIS:
Completed. We use many of the Faith Based facilities and their staff when necessary.

## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #11	
<b>Proposed Action:</b>	Provide subsidized fans and other cooling devices to citizens that are in need of them. Through public service have people purchase fans and cooling devices and drop off at a public safety building location. After devices are dropped off, we can work with family services, faith base organizations and others to get the cooling devices in the hands of those in need.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit (Current Cost/Losses Avoided):</b>	Reduce the injury, illness and deaths from long exposure to extreme heat days.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Extreme Heat
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	Minimal
<b>Potential Funding Sources:</b>	Donations of devices
<b>Lead Agency/Department Responsible:</b>	Public Safety w/ Family Services and Faith Base organizations assistance
<b>Implementation Schedule:</b>	Within 24 hours of plan adoption
<b>Incorporation into Existing Plans:</b>	Local and Emergency Response Plans

2022 ANALYSIS:
Completed and Defer to Plan Update. Ongoing.

## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #12	
<b>Proposed Action:</b>	Strengthen subdivision rules and regulations to encourage higher densities only outside of known hazard areas and stronger construction standards to mitigate against hazards including wind, hail, wildfire, and flood. As development rules and regulations are reviewed and updated, we propose to add this to future rules and regulations and educate developers to find areas outside known hazard areas and to build disaster resistant structures.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit (Current Cost/Losses Avoided):</b>	Deduce damage to structures while reducing risk to life safety.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure; Flood; Thunderstorm Wind; Wildfire; Tornado; Hail; Hurricane Wind
<b>Effect on new/existing buildings:</b>	Reduce risk to new structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	Development Management, Floodplain Manager, GIS
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Local Ordinances and building codes

2022 ANALYSIS:
Completed and Defer to Plan Update. Kendall County updated our flood damage prevention order in 2020 to adopt higher standards for development including: Build 1 foot above BFE, fill standards for the placement of earthen fill within the floodplain, Elimination of storage of equipment and materials, & Floodway development requirements within the floodplain including employed a consultant to work with County Development Manager and County Engineer to draft updated Subdivision. The Lead Agency/Department Responsible should be the Engineer's Office not Road and Bridge.

## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #13	
<b>Proposed Action:</b>	Provide early warning and post event information. Either purchase or encourage citizens to purchase NOAA All Hazard Radios for early warning and post-event information for public, businesses, schools, event venues.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Provide for life safety issues for the public and 1 <sup>st</sup> responders.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood; Thunderstorm Wind; Hail; Wildfire; Winter Storm; Hurricane Wind; Tornado; Dam Failure; Extreme Heat
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures through early warning
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	TBD
<b>Potential Funding Sources:</b>	Donations, HMA Grants, Local Budget
<b>Lead Agency/Department Responsible:</b>	Emergency Management
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

2022 ANALYSIS:
Completed and Defer to Plan Update. Ongoing. Through i-info and social media we send out messages as needed.



## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #14	
<b>Proposed Action:</b>	Through use of Fire Codes & Subdivision Rules and Regulations, adopt minimum residential street width to accommodate emergency response vehicles. Through code, rules, and regulation enforcement we can make residential streets safer for responders.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Allows for a safer and quicker response time.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure; Flood; Hurricane Wind; Thunderstorm Wind; Wildfire; Winter Storm; Tornado; Hail
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$1,000
<b>Potential Funding Sources:</b>	Developer Responsibility
<b>Lead Agency/Department Responsible:</b>	Fire Marshal, Development Management
<b>Implementation Schedule:</b>	Within 24 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Fire Code and Development Rules and Regulations

2022 ANALYSIS:
Completed. This was started on January 1, 2016 and continues today with us amending the current court order to adopt the 2021 IFC and requires minimum roadway widths to accommodate emergency response vehicles. Effective January 1, 2022. New actions to address the proposal of new subdivision rules which will include wider streets within new small lot subdivisions to ensure first responders can navigate past parked cars. The Lead Agency/Department Responsible should be the Fire Marshal and Engineer's Office (not Development Management).

## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #15	
<b>Proposed Action:</b>	Make sure 1 <sup>st</sup> responders are trained in the recognition and procedure for a pipeline failure. Include how to locate pipelines in the County. Provide opportunity for responders to attend Pipeline safety courses taught in the area and around the state and/or conduct local training on pipeline failure.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide 1 <sup>st</sup> responders
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the risk of injury and/or death to responders and reduce the risk posed by a pipeline failure and what actions to take if responding to a failure.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Pipeline Failure
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	Most courses are free, maybe minimal travel cost
<b>Potential Funding Sources:</b>	Training Budget
<b>Lead Agency/Department Responsible:</b>	Emergency Management, Fire Department, Law Enforcement
<b>Implementation Schedule:</b>	Within 36 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Local SOPs

2022 ANALYSIS:
Completed and Defer to Plan Update. Annual. Many 1 <sup>st</sup> responders attend the annual pipeline emergency training along with department heads and some elected officials.

## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #16	
<b>Proposed Action:</b>	Educate the public and landowners of the dangers of a Pipeline Failure, how to recognize and contact assistance as well as activities conducted on and around pipelines. Provide opportunity for the public and landowners to understand the dangers of Pipeline Failure and how to recognize and report.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide in area where Pipelines exist
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the risk of injury and/or death to citizens and landowners and how to request assistance during a failure.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Pipeline Failure
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	\$2,500
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	Emergency Management, Fire Department, Law Enforcement
<b>Implementation Schedule:</b>	Within 36 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Local SOPs and Public Awareness

2022 ANALYSIS:
Defer to Plan Update.

## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #17	
<b>Proposed Action:</b>	Establish local response procedures for suspicious packages received. Have local procedures in all offices that receive mail and/or packages.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide facilities
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the risk of opening and/or receiving suspicious packages and/or mail.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Terrorism
<b>Effect on new/existing buildings:</b>	Reduce risk to existing facilities
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$1,000
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	Law Enforcement, Emergency Management
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Local Plans, Department SOPs

2022 ANALYSIS:
Completed. Local fire department and Law Enforcement have adopted policies on this.

## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #18	
<b>Proposed Action:</b>	Provide awareness training with reference to terrorism. Provide terrorism awareness training to all county staff on what to look for that may indicate suspicious activity or left behind objects.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide facilities
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the risk of having a terrorism incident in a county facility or during a county sponsored function.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Terrorism
<b>Effect on new/existing buildings:</b>	Reduce risk to existing facilities
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	Law Enforcement, Emergency Management
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Local Plans, Department SOPs

2022 ANALYSIS:
Completed and Defer to Plan Update. Annual. We do this by having several tabletop exercises throughout the year.

## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #19	
<b>Proposed Action:</b>	Reimbursement program for safe rooms in new and existing homes, businesses, schools and places of assembly. Provide a reimbursement program for new home builders, existing home builders and others that elect to have a safe room place in their home.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the injury and death during a tornado or severe storm.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Tornado; Thunderstorm Wind; Hurricane Wind
<b>Effect on new/existing buildings:</b>	Provide safe haven for occupants
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	TBD per structure
<b>Potential Funding Sources:</b>	HMA Grant
<b>Lead Agency/Department Responsible:</b>	Emergency Management & Auditor
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

2022 ANALYSIS:
Defer to Plan Update.



## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #20	
<b>Proposed Action:</b>	Implement FireWise Community Program for County. Work with subdivision homeowner, homeowner associations, Texas Forest Service and the National Firewise Program to reduce risk. Public Education on Wildfire Safety and Strategies.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide with then emphasis on subdivision throughout the County and area close to the City of Boerne
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	With the risk of wildfire during dry and drought conditions we could reduce the loss of homes and other structures. This would also build defensive area should a wildfire occur.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Wildfire
<b>Effect on new/existing buildings:</b>	Reduce losses to existing and future structures and infrastructure
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$1,000
<b>Potential Funding Sources:</b>	Homeowners doing for themselves, HMA Grants, Local Budget, National Firewise Program and Texas Forest Service
<b>Lead Agency/Department Responsible:</b>	County Fire Marshal, Fire Departments, County Development Management
<b>Implementation Schedule:</b>	Within 24 months of plan adoption
<b>Incorporation into Existing Plans:</b>	As new Development Rules and Regulations are updated, reviewed and renewed, we could incorporate Firewise strategies into these rules

2022 ANALYSIS:
Defer to Plan Update. This was in the process of being done and COVID hit, and program was pushed to a standstill. County Fire Marshal monitors fire danger and drought statistics county wide and advises Commissioners Court regarding imposition of Burn Ban and restricting sales of certain types of fireworks. County is beginning to coordinate with a local volunteer to implement a FireWise Community Program.

## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #21	
<b>Proposed Action:</b>	Fire Code Adoption in 2015. Continue to enforce fire code per the Kendall County Fire Code. Provide annual fire safety inspections on commercial business, public buildings, multi-family living units and other types of both new and existing per the adopted Fire Code.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide for commercial, public assembly, multi- family living units (4 or more)
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	With the adoption of Fire Codes, we can reduce the risk of structure fire in commercial, public, multi- family buildings thus reducing the risk of structure fire in the Urban Wildland Interface areas.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Wildfire
<b>Effect on new/existing buildings:</b>	Reduce risk to existing and future structures and infrastructure
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$50,000 to \$70,000 annually
<b>Potential Funding Sources:</b>	Use of fee collected for permits
<b>Lead Agency/Department Responsible:</b>	County Fire Marshal
<b>Implementation Schedule:</b>	Within 24 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Kendall County Adopted Fire Codes January 1, 2016, as this program develops and grows, we will slowly incorporate Fire Codes in with Development Rules and Regulations

2022 ANALYSIS:
Completed. The 2021 IFC was adopted and effective January 2022.

## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #22	
<b>Proposed Action:</b>	Develop and implement water use restrictions to mitigate damage caused by drought such as restrictions and ordinances for residential and commercial requirements for drought tolerant landscaping.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduces water usage and waste.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Drought
<b>Effect on new/existing buildings:</b>	Reduce risk to existing and future structures and facilities
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	\$2,500
<b>Potential Funding Sources:</b>	Annual budget
<b>Lead Agency/Department Responsible:</b>	Development Management
<b>Implementation Schedule:</b>	Within 48 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Local Ordinances

2022 ANALYSIS:
Defer to Plan Update. Hard to do until legislation gives County the authority to do more. The Lead Agency/Department Responsible should be the Cow Creek Groundwater Conservation District.

## SECTION 18: PREVIOUS ACTIONS

Kendall County– Action #23	
<b>Proposed Action:</b>	Educate citizens on taking water-saving measures such as low-flow toilets and shower heads, adjusting sprinklers, water saving measures in daily activities, and installation of graywater systems.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Educate water consumers on proper water use, as not to waste water.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Drought
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget, HMA Grants
<b>Lead Agency/Department Responsible:</b>	Development Management
<b>Implementation Schedule:</b>	Within 48 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Public Works SOP

2022 ANALYSIS:
Defer to Plan Update. Minimal effort on this done.

## SECTION 18: PREVIOUS ACTIONS

### CITY OF BOERNE

City of Boerne– Action #1	
<b>Proposed Action:</b>	Include wind engineering measures such as structural bracing in local building codes to reduce damage risk during tornados.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the risk of severe property damage due to tornados through stronger construction practices.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Tornado; Thunderstorm Wind; Hurricane Wind
<b>Effect on new/existing buildings:</b>	Reduce damage risk to new structures
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget, General Funds, HMA Grants
<b>Lead Agency/Department Responsible:</b>	Fire Department / Fire Marshal
<b>Implementation Schedule:</b>	Within 36 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan, Local Building

2022 ANALYSIS:
Defer to Plan Update. Update lead agency to include code enforcement. Update Existing Plans to include UDC and Engineering Code.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #2	
<b>Proposed Action:</b>	Adopt more stringent building codes designed to protect against natural hazards including wind, hail, fire, lightning and flood resistant construction
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce damages to structures through improved construction practices.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Thunderstorm Wind; Tornado; Flood; Hail; Wildfire; Hurricane Wind; Lightning
<b>Effect on new/existing buildings:</b>	Reduce risk to new and substantially improved structures
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	Local Budget, General Funds
<b>Lead Agency/Department Responsible:</b>	City Code Enforcement and Fire Marshal
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Local building codes

2022 ANALYSIS:
Completed and Defer to Plan Update. Update lead agency to remove Fire Marshal. Currently in UDC, update existing plans to state.



## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #3	
<b>Proposed Action:</b>	Adopt codes and ordinances to aid in the reduction of fire spreads. Regulations may include required signage, fire hydrants, water availability requirements, vegetation management, and construction design guidelines.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits with emphasis being on future subdivision annexation
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce fire related loss, costs and hazards.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Wildfire
<b>Effect on new/existing buildings:</b>	Reduce fire hazard to new and existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget, HMA Grants
<b>Lead Agency/Department Responsible:</b>	Fire Department / Fire Marshal
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan, CWPP

2022 ANALYSIS:
Completed. In City Unified Development Code (UDC) and Engineering Design Manual.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #4	
<b>Proposed Action:</b>	Implement yearly inspection of dams with NRCS and County representatives.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Dam site I – City Lake Dam site II – Lake Oz
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Yearly inspection of dam sites to record maintenance needed.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	Minimal - Staff time
<b>Potential Funding Sources:</b>	Operating Budget
<b>Lead Agency/Department Responsible:</b>	Emergency Management / Public Works
<b>Implementation Schedule:</b>	Within 12 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Standard Operations Plan

2022 ANALYSIS:
Completed and Defer to Plan Update. Annual.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #5	
<b>Proposed Action:</b>	Brush clearing and erosion control performed at dam sites I and II.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Dam site I – City Lake Dam site II – Lake Oz
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Keep dam in good condition to reduce possibility of dam failure.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$25,000
<b>Potential Funding Sources:</b>	Local Budget, Federal Grants, HMA Grants
<b>Lead Agency/Department Responsible:</b>	Emergency Management / Public Works
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Dam Safety Plan

2022 ANALYSIS:
Defer to Plan Update. In progress.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #6	
<b>Proposed Action:</b>	Implement Education Program and acquire adequate equipment for first responders.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits and fire department response area
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk of injuries to first responders.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hazardous Materials
<b>Effect on new/existing buildings:</b>	Dependent on extent of exposure
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	TBD
<b>Potential Funding Sources:</b>	Local Budget, Federal Grants
<b>Lead Agency/Department Responsible:</b>	Fire Department / Fire Marshal
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

2022 ANALYSIS:
Completed. BFD trained on Hazardous Material Response.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #7	
<b>Proposed Action:</b>	Implement Firewise Community program for the City of Boerne.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits with emphasis being on future subdivisions annexation
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce fire related loss.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Property Protection

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Wildfire
<b>Effect on new/existing buildings:</b>	Reduce fire hazard to new and existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	Local Budget, Texas Forest Service Grants
<b>Lead Agency/Department Responsible:</b>	Fire Department / Fire Marshal
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan, CWPP

2022 ANALYSIS:
Defer to Plan Update. Training is in progress.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #8	
<b>Proposed Action:</b>	Flood Education for the public, including “Turn Around, Don’t Drown”, flood mitigation measures, and flood notification through I-Info.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Educate the public about the dangers of high water, mitigation measures that can be implement in homes, and notify the public of possible flooding through I-Info.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$25,000
<b>Potential Funding Sources:</b>	Local Budget, HMA Grants
<b>Lead Agency/Department Responsible:</b>	Emergency Management
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

2022 ANALYSIS:
Completed. City uses Regroup Alert Manager for notifications.



## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #9	
<b>Proposed Action:</b>	Continue inspection of pipelines; repair or replace inadequate gas distribution systems; train yearly on proper procedures for employees and first responders.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City of Boerne gas customers and gas systems
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Inspection and replacement of lines reduces the possibility of future problems.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness, Structure and Infrastructure

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Pipeline Failure
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$30,000 per year
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	Public Works
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Operations Plan

2022 ANALYSIS:
Defer to Plan Update. In progress, and on-going.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #10	
<b>Proposed Action:</b>	Educate citizens on safety procedures during hailstorms and mitigation measure to reduce damages. Training through public service announcements, pamphlets and presentations.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Possible reduction of injuries and damage during hailstorms through education.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hail
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	HMA Grants
<b>Lead Agency/Department Responsible:</b>	Emergency Management
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

2022 ANALYSIS:
Completed and Defer to Plan Update. Ongoing, communication is sent out via social media.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #11	
<b>Proposed Action:</b>	Place hazard warning signs and auto barricades at low water crossings. Include installation of new barricades and maintenance of existing barricades in the annual City budget.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Low water crossings in the City limits and newly annexed areas
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk to citizens and first responders.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	TBD per site
<b>Potential Funding Sources:</b>	Local Budget, HMA Grants, and other Federal Programs
<b>Lead Agency/Department Responsible:</b>	Emergency Management / Street Department
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

2022 ANALYSIS:
Defer to Plan Update. Funds have been budgeted in EOC account for barricades at low water crossings.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #12	
<b>Proposed Action:</b>	Educate citizens to reduce the risk of injury and illness due to extreme heat. Educate citizens on the dangers of extreme heat and the steps they can take to protect themselves, as well as mitigation measures that can reduce the effect of extreme heat on residential property.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits and future annexations
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the risk of heat related injury and illness.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Extreme Heat
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	Fire Department
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

2022 ANALYSIS:
Completed and Defer to Plan Update. Ongoing.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #13	
<b>Proposed Action:</b>	Educate and notify citizens of possible hurricane winds through I-Info. Educate citizens on mitigation measures to implement when a hurricane event is eminent.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce injuries and damage of property through preparations and early warning of hurricane force winds.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hurricane Winds
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	Local Budget, HMA Grants
<b>Lead Agency/Department Responsible:</b>	Emergency Management
<b>Implementation Schedule:</b>	Within 36-48 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Operations Plan, Emergency Management Plan

2022 ANALYSIS:
Completed. Currently utilizing Regroup Alert Manager for all mass communication notifications.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #14	
<b>Proposed Action:</b>	Notification / early warning of possible hail storms with the use of I-Info.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City of Boerne and surrounding area
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce injuries and damages through early warning.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hail
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures and property through early warning
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$7,000
<b>Potential Funding Sources:</b>	HMA Grant, Local Budget
<b>Lead Agency/Department Responsible:</b>	Emergency Management
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending fund
<b>Incorporation into Existing Plans:</b>	Emergency Operations Plan

2022 ANALYSIS:
Completed.



## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #15	
<b>Proposed Action:</b>	Protect City Infrastructure, including water plant, gas lines, sewer plants, dam sites, through installment of better fencing, installment of additional cameras and training for personnel.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City of Boerne infrastructure
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk of possible terrorist attack.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure, Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Terrorism
<b>Effect on new/existing buildings:</b>	Potential risk reduction to existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$50,000
<b>Potential Funding Sources:</b>	Local Budget, Federal Grants
<b>Lead Agency/Department Responsible:</b>	All City Departments
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Operations Plan

2022 ANALYSIS:
Completed. Fencing and cameras have been installed.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #16	
<b>Proposed Action:</b>	Educate citizens of natural gas safety and response. Educate through pamphlets and presentations. Notifications through I-Info.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City of Boerne gas customers
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce injuries and damage through education of natural gas safety.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Pipeline Failure
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	Public Works / Customer Service
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Operations Plan

2022 ANALYSIS:
Completed and Defer to Plan Update. Ongoing.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #17	
<b>Proposed Action:</b>	Educate citizens to reduce risk of injury during winter storms. Educate on preparations to make before a storm as well as safety measures to take during and immediately after an event to protect lives and reduce damages.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce injuries and emergency services needed during severe winter storms. Reduce damages to structures including fire from heating sources.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Winter Storm
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	Local Budget, HMA Grants
<b>Lead Agency/Department Responsible:</b>	Fire Department / Fire Marshal
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

2022 ANALYSIS:
Completed and Defer to Plan Update. Ongoing. Update lead agency to include EOC.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #18	
<b>Proposed Action:</b>	Reduce risk of wildfires through public education on residential fuels reduction, interior and exterior sprinkler systems, safe waste disposal, defensible space, and safe storage of flammable materials.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce wildfire risk and property loss.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Wildfire
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	Local Budget, Texas Forest Service Grants
<b>Lead Agency/Department Responsible:</b>	Fire Department / Fire Marshal
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

2022 ANALYSIS:
Completed. Use of social media.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #19	
<b>Proposed Action:</b>	Public education to decrease the possibility of injury or long-term illness due to exposure to hazardous materials.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk of injury and potential illness due to exposure.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hazardous Materials
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	Fire Department / Fire Marshal
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

2022 ANALYSIS:
Completed and Defer to Plan Update. Ongoing during training. Update lead agency to include EOC.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #20	
<b>Proposed Action:</b>	Designate shelters for travelers who are unable to drive during winter storms due to ice on the roadways.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Accommodate travelers with housing due to icy conditions which prevent travel when highways are closed by the State.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Winter Storm
<b>Effect on new/existing buildings:</b>	Reduce risk to existing infrastructure
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	TBD
<b>Potential Funding Sources:</b>	Local Budgets, Grants
<b>Lead Agency/Department Responsible:</b>	Fire Department / Fire Marshal
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

2022 ANALYSIS:
Completed and Defer to Plan Update. Use of warming centers. Update lead agency to include EOC.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #21	
<b>Proposed Action:</b>	Terrorism recognition training for public and first responders.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce loss of life and injuries.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Terrorism
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$25,000
<b>Potential Funding Sources:</b>	Local Budget and Federal Grants
<b>Lead Agency/Department Responsible:</b>	Emergency Management / Fire Marshal / Fire Department
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

2022 ANALYSIS:
Completed and Defer to Plan Update. Ongoing. Update lead agency to include Law Enforcement.



## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #22	
<b>Proposed Action:</b>	Educate citizens on the benefits of wind retrofits and lightning rods and notify citizens early through the use of I-Info for potential thunderstorms.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Allows the citizens to be better prepared and reduce potential damages in the event of thunderstorm winds or lightning events.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Thunderstorm Wind; Lightning
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	HMA Grants, Local Budget
<b>Lead Agency/Department Responsible:</b>	Emergency Management
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

2022 ANALYSIS:
Completed and Defer to Plan Update. Ongoing.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #23	
<b>Proposed Action:</b>	Educate citizens of tornado risk and warning signs of possible tornadic activity. Educate citizens on mitigation measures to protect lives and property during tornado events.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the risk due to tornado directly impacting the City.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Tornado
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures through education and preparedness
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget and HMA Grants
<b>Lead Agency/Department Responsible:</b>	Fire Department / Fire Marshal
<b>Implementation Schedule:</b>	Within 36-48 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

2022 ANALYSIS:
Completed and Defer to Plan Update. Ongoing.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #24	
<b>Proposed Action:</b>	Develop and implement water use restrictions to mitigate damage caused by drought such as restrictions and ordinances for residential and commercial requirements for drought tolerant landscaping.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce water usage and waste.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Drought
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	City staff – Municipal Department
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Local Ordinances

2022 ANALYSIS:
Completed.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #25	
<b>Proposed Action:</b>	Educate citizens on taking water-saving measures such as low-flow toilets and shower heads, adjusting sprinklers, water saving measures in daily activities, and installation of graywater systems.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City of Boerne Water Customers
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Educate water consumers on proper water use, as not to waste water.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Drought
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget, HMA Grants
<b>Lead Agency/Department Responsible:</b>	Multiple City Departments
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	City policies and public works SOP (insert into water bills)

2022 ANALYSIS:
Completed. Education provided during drought restrictions.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #26	
<b>Proposed Action:</b>	Educate citizens on the risk of Dam Failure, warning systems for dam failure, and evacuation routes.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk to citizens through education.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure
<b>Effect on new/existing buildings:</b>	Reduce damage to existing structures
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	Emergency Management / Public Works
<b>Implementation Schedule:</b>	Within 36 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

2022 ANALYSIS:
Completed and Defer to Plan Update. Ongoing.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #27	
<b>Proposed Action:</b>	Install canopy covers in public parks for shade and relief for heat during extreme temperatures
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City public parks
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Protect health of citizens by providing shaded areas in public parks.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Extreme Heat
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	Local Budget, HMA Grants
<b>Lead Agency/Department Responsible:</b>	Public Works
<b>Implementation Schedule:</b>	Within 36 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Comprehensive Plan

2022 ANALYSIS:
Completed.

## SECTION 18: PREVIOUS ACTIONS

City of Boerne– Action #28	
<b>Proposed Action:</b>	Implement tree trimming program around power lines to reduce the risk of power outages during winter storms and lightning events.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk of power outages due to downed power lines.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Winter Storm; Lightning
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	TBD
<b>Potential Funding Sources:</b>	Local Budget, HMA Grants
<b>Lead Agency/Department Responsible:</b>	Public Works
<b>Implementation Schedule:</b>	Within 36-48 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

2022 ANALYSIS:
Completed.



# SECTION 19: MITIGATION ACTIONS

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## 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 Update. Each of the actions in this section were prioritized based on FEMA's Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLEE) criteria necessary for the implementation of each action.

As part of the economic evaluation of the STAPLEE analysis, jurisdictions analyzed each action in terms of the overall costs, measuring whether the potential benefit to be gained from the action outweighed 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.

## SECTION 19: MITIGATION ACTIONS

**Table 19-1. Kendall County Mitigation Action Matrix**

TYPE OF ACTION	
Action #1 – Plans/Regulations (Blue)	Action #4 – Structural (Orange)
Action #2 – Education/Awareness (Red)	Action #5 – Preparedness/Response (Black)
Action #3 – Natural Systems Protections (Green)	

Jurisdiction	Flood	Wildfire	Drought	Extreme Heat	Thunderstorm Wind	Tornado	Hail	Winter Storm	Dam and Levee Failure	Hurricane Wind	Lightning	Expansive Soils
Kendall County	XXX	XXX	XXX	XX	XXX	XXX	XXX	XXX	XXX	XXX	XX	XXX
City of Boerne	XXX	XX	XX	XX	XX	XX	XX	XX	XXX	XX	XX	XX

## SECTION 19: MITIGATION ACTIONS

### KENDALL COUNTY

Kendall County – Action #1		
	<b>Proposed Action:</b>	Conduct education and awareness information through media, social media, flyer, public service announcement, bulletins, and other ways to educate the public, citizens of different hazards that can threaten the County and mitigations actions they can do to reduce fatalities, injuries, and property damage.
	<b>BACKGROUND INFORMATION</b>	
	<b>Site and Location:</b>	County-wide
	<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Promote hazard awareness. Reduce the possibility of injuries, fatalities, and property damage in the County through smart mitigation efforts.
	<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure, Drought, Extreme Heat, Expansive Soils, Flood, Hail, Hurricane Wind, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, and man-made hazards
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Communication
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Funds (staff time)
<b>Lead Agency/Department Responsible:</b>	County Emergency Management / Administration
<b>Implementation Schedule:</b>	Within 6-12 months of plan adoption, and ongoing
<b>Incorporation into Existing Plans:</b>	Local Plans, Emergency Managements Plan

COMMENTS:
Previous Action: #6
NFIP & WHY MITIGATION ACTION IS APPROPRIATE:
Promotes public safety.

## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #2	
<b>Proposed Action:</b>	Provide warming sites and public education for extreme weather conditions. Provide locations for the public and citizens to gather where they are in a warmer/cooler environment. Public service announcements and handouts on warming/cooling locations and personal protection.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the risk of injury, illness and/or fatalities to citizens during extreme weather conditions.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Extreme Heat, Winter Storm
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security, Health/Medical
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	County Emergency Management
<b>Implementation Schedule:</b>	Within 6-12 months of plan adoption, and ongoing
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:

## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #3	
<b>Proposed Action:</b>	Clean drainage ditches along County Road and Dry Creek beds to allow water to flow and not backup.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide
<b>Risk Reduction Benefit (Current Cost/Losses Avoided):</b>	Reduce flood risk through improved drainage capacity. Reduce risk of damages and injuries. Reduce emergency response demands.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security
<b>Effect on new/existing buildings:</b>	Reduce risk to new and existing structures and infrastructure
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$8,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	Kendall County Road & Bridge Department
<b>Implementation Schedule:</b>	Within 12 months of plan adoption and ongoing
<b>Incorporation into Existing Plans:</b>	SOP's

COMMENTS:
The County Road and Bridge crews monitor the drainage ditches along county roads and creek beds along county roads daily. When they see a problem that would restrict the flow of runoff or cause water to back-up and flood nearby roads and/or facilities they will clean out the debris and correct water flow problem.
NFIP & WHY MITIGATION ACTION IS APPROPRIATE:
Protects communities and reduces risk of flooding.

## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #4	
<b>Proposed Action:</b>	Create an education program for property owners of the benefits of clearing of drainage ditches and channels for creeks that are on privately owned properties.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce flood risk through improved drainage capacity. Reduce risk of damages and injuries. Reduce emergency response demands.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security
<b>Effect on new/existing buildings:</b>	Reduce risk to new and existing structures and infrastructure
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$1,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	County Emergency Management and Road & Bridge Department
<b>Implementation Schedule:</b>	Within 12 months of plan adoption and ongoing
<b>Incorporation into Existing Plans:</b>	SOP's

COMMENTS:
Most creeks are on private property, except for the area within the ROW (on County property), maintenance would be the responsibility of the property owner.
NFIP & WHY MITIGATION ACTION IS APPROPRIATE:
Protects communities and reduces risk of flooding.

## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #5	
<b>Proposed Action:</b>	Implement a program and/or local requirement that County will be notified when fence installation is being constructed on a county-road in order to clean out the drainage ditches and remove obstructions between the road and fence line.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk of flooding by increasing drainage capacity along county-roads. Reduce risk of damages, injuries, and fatalities.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure, Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood
<b>Community Lifeline</b> (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):	Safety/Security
<b>Effect on new/existing buildings:</b>	Reduce risk to new and existing structures
<b>Priority</b> (High, Moderate, Low):	High
<b>Estimated Cost:</b>	\$20,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	Kendall County Road & Bridge Department, Building/Permits
<b>Implementation Schedule:</b>	Within 12-24 month of plan adoption
<b>Incorporation into Existing Plans:</b>	SOP's

COMMENTS:
The ROW ditches should be cleaned as deemed necessary during routine activities. Fences are not always built on the property line (can be set back for topography, etc.).
NFIP & WHY MITIGATION ACTION IS APPROPRIATE:
Protects communities and reduces risk of flooding.



## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #6	
<b>Proposed Action:</b>	Rehabilitate High Hazard Flood Control Structures on Upper Cibolo Creek watershed. Rehabilitation of the High Hazard Flood Control Structures will reduce the hazard rating to Low.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Upper Cibolo Creek Floodwater Retarding Structure #2 Upper Cibolo Creek Floodwater Retarding Structure #4
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk of flooding by increasing drainage capacity. Reduce the risk of flooding along Cibolo Creek in unincorporated areas of Kendall County and the City of Boerne. Reduce risk of damages, injuries and fatalities.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security
<b>Effect on new/existing buildings:</b>	Reduce risk to new and existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$250,000 per site location
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	County Engineer Department and Emergency Management
<b>Implementation Schedule:</b>	Within 12-24 month of plan adoption
<b>Incorporation into Existing Plans:</b>	SOP's

<b>COMMENTS:</b>
<b>NFIP &amp; WHY MITIGATION ACTION IS APPROPRIATE:</b>
Protects communities and reduces risk of flooding.

## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #7	
<b>Proposed Action:</b>	Work with Ground Water Districts, and other water providers in the County to enforce water restrictions when drought conditions exist.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Provide for water retention and depreciation of water sources in the County.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Drought
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security, Health/Medical
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$2,000
<b>Potential Funding Sources:</b>	Local Funds (staff time)
<b>Lead Agency/Department Responsible:</b>	County Emergency Management / Administration, Local water providers, and Cow Creek Groundwater Conservation District
<b>Implementation Schedule:</b>	Within 6 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Local Plans

COMMENTS:

## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #8	
<b>Proposed Action:</b>	Acquire and install generators with hard wired quick connections at all critical facilities to ensure continuity of emergency services. Surveys have been conducted to determine the size of back-up power needed.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide critical facilities, including Kendall County Courthouse, Bergheim FD, Alamo Springs FD, Kendalia FD, Sisterdale FD, Waring FD, Kendall County Elections, Main EMS Station, and others
<b>Risk Reduction Benefit (Current Cost/Losses Avoided):</b>	Provide power for critical facilities and service during power outages. Ensure continuity of critical services.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure, Extreme Heat, Flood, Hail, Hurricane Wind, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Hazardous Materials, Pipeline Failure, Terrorism, Infectious Disease
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Energy
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$250,000 plus per site.
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	County Emergency Management, Facility Maintenance and Department Head
<b>Implementation Schedule:</b>	Within 6 months of plan adoption and ongoing based on available funds
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
Previous Action #1, 5
NFIP & WHY MITIGATION ACTION IS APPROPRIATE:
Helps ensure critical facilities continue to provide services during a power outage caused by unforeseen events.

## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #9	
<b>Proposed Action:</b>	Conduct hail and tornado safety awareness education about the dangers of hailstorms and tornados.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk of property damage, loss of life, and injuries.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hail, Tornado
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Communication
<b>Effect on new/existing buildings:</b>	Reduce risk to new and existing structures and infrastructures
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$3,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	County Emergency Management, along with community leaders, elected officials, and public safety responders
<b>Implementation Schedule:</b>	Within 12-24 months of plan adoption or upon available funding
<b>Incorporation into Existing Plans:</b>	Public Regulations SOP's, Local Plans

COMMENTS:
When Elected Officials, Public Safety Responders, Community Leaders attend homeowner association meetings, school functions and/or other community events they can take time to educate and inform the public about tornados and hailstorm damages and protection for themselves.

## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #10	
<b>Proposed Action:</b>	Provided continued education and training to County Road and Bridge Department employees through the Texas Forest Service for building fire lines around wildfires and control burns.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the number of acres burned by providing a quicker means of containing the fire. Reduce risk of property damage, injury and fatalities. Reduce risk of injury to emergency response personnel and critical employees.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Wildfire
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security
<b>Effect on new/existing buildings:</b>	Reduce risk to new and existing structures and infrastructure
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$2,000
<b>Potential Funding Sources:</b>	Local Funds (staff time)
<b>Lead Agency/Department Responsible:</b>	County Fire Marshal, Road and Bridge Supervisor
<b>Implementation Schedule:</b>	Within 12-48 months of plan adoption based on availability of training opportunities
<b>Incorporation into Existing Plans:</b>	Local Plans and SOP's

COMMENTS:

## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #11	
<b>Proposed Action:</b>	Enforce adopted County Fire Code. Annual fire inspections of facilities to assure if they have Hazardous Materials they are stored, manufactured and sold comply with fire code. Review new facilities to assure they will be compliant with construction is complete.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide – with focus on commercial development areas within the County
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk of property damage, injury, and loss of life due to wildfire and/or Hazardous Material release.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Wildfire, Hazardous Materials
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security
<b>Effect on new/existing buildings:</b>	Reduce risk to new and existing structures and infrastructures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Funds (staff time)
<b>Lead Agency/Department Responsible:</b>	Fire Marshal
<b>Implementation Schedule:</b>	Within 6-12 months of plan adoption, and ongoing
<b>Incorporation into Existing Plans:</b>	Adopted Fire Code, Fire, Health, and Safety Codes

COMMENTS:

## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #12	
<b>Proposed Action:</b>	Make Kendall County a Fire Wise Community.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide including City of Boerne
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the risk of property damages, injury or fatalities as a result of a wildfire event.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Wildfire
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security
<b>Effect on new/existing buildings:</b>	Reduce risk to new and existing structures and infrastructures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$4,000
<b>Potential Funding Sources:</b>	Local Funds (staff time)
<b>Lead Agency/Department Responsible:</b>	County/City Fire Marshals
<b>Implementation Schedule:</b>	Within 12 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Local and EOP

COMMENTS:
Currently have a committee working on developing a Fire Wise Community Plan and then implementation as soon as the plan is finished.



## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #13	
<b>Proposed Action:</b>	Develop and implement a plan for inspection and maintenance of fire water storage tanks.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the risk of property damages, injury or fatalities as a result of a wildfire event.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Wildfire
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security
<b>Effect on new/existing buildings:</b>	Reduce risk to new and existing structures and infrastructures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$4,000
<b>Potential Funding Sources:</b>	Local Funds (staff time)
<b>Lead Agency/Department Responsible:</b>	County Fire Marshals
<b>Implementation Schedule:</b>	Within 12 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Local and EOP

COMMENTS:
Currently have a committee working on developing a Fire Wise Community Plan and then implementation as soon as the plan is finished.

## SECTION 19: MITIGATION ACTIONS

Kendall County– Action #14	
<b>Proposed Action:</b>	Implement a program or an application to educate the public on identified low water crossing locations throughout the County.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk of injury and fatalities by promoting the avoidance of high-risk areas during potential flooding events.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$2,000
<b>Potential Funding Sources:</b>	Local Funds (staff time)
<b>Lead Agency/Department Responsible:</b>	County Emergency Management and GIS Department
<b>Implementation Schedule:</b>	Within 12 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Emergency Operations Plan

COMMENTS:
NFIP & WHY MITIGATION ACTION IS APPROPRIATE:
Promotes public safety.

## SECTION 19: MITIGATION ACTIONS

Kendall County– Action #15	
<b>Proposed Action:</b>	"Turn Around, Don't Drown" Program: Continue to assess at risk areas and purchase, build, and/or place hazardous warning signs or auto barricades at low-water crossings. Place warning signs, auto or permanent pull-out barricades at locations so when auto sense, a flashing beacon would flash, or barricade will drop to signal roadway is closed.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide at low-water crossings
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk of injuries, fatalities and damages through education and awareness.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	County Engineer Department
<b>Implementation Schedule:</b>	Within 12 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Regional Flood Plan

COMMENTS:
Previous Action: #3
NFIP & WHY MITIGATION ACTION IS APPROPRIATE:
Promotes public safety.

## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #16	
<b>Proposed Action:</b>	Provide training for first responders that potentially could be involved with a hazardous Material Incident. Provide 2020 Emergency Response Guidebooks, books, and training to all 1 <sup>st</sup> responders.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide – all first responders
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk of injury and/or death to responders and reduce risks posed by the Hazardous Material.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hazardous Materials
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security, Health/Medical
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Funds (staff time)
<b>Lead Agency/Department Responsible:</b>	County Emergency Management, Fire Department, EMS Department and Law Enforcement
<b>Implementation Schedule:</b>	Within 6-12 months of plan adoption, and ongoing
<b>Incorporation into Existing Plans:</b>	Local Plans, Department SOP's

COMMENTS:

## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #17	
<b>Proposed Action:</b>	Provide awareness training with reference to terrorism. Provide terrorism awareness training to all county staff on what to look for and what to do if a suspicious activity or object is observed.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide facilities
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the risk and/or prevent a terrorism incident in a county facility at any time.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Terrorism
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security, Health/Medical
<b>Effect on new/existing buildings:</b>	Reduce risk to new and existing structures and infrastructures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Funds (staff time)
<b>Lead Agency/Department Responsible:</b>	County Emergency Management, Elected Officials, County Department Heads, and Law Enforcement
<b>Implementation Schedule:</b>	Within 6-12 months of plan adoption, and ongoing
<b>Incorporation into Existing Plans:</b>	Local Plans, Department SOP's

COMMENTS:
Previous Action: #18

## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #18	
<b>Proposed Action:</b>	Upgrade / Reconstruct widening of Adler Road and bridge for enhanced evacuation routes.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Adler Road
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk to resident through improved evacuation efforts.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure, Flood, Hurricane Wind, Wildfire
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$20,000,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	County Engineer Department and Emergency Management
<b>Implementation Schedule:</b>	Within 12-48 month of plan adoption
<b>Incorporation into Existing Plans:</b>	Capital Improvement Plan, Emergency Response Plan

<b>COMMENTS:</b>
<b>NFIP &amp; WHY MITIGATION ACTION IS APPROPRIATE:</b>
Promotes public safety.

## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #19	
<b>Proposed Action:</b>	Elevate bridge located at Welfare Road. Ensure continuity of emergency services, preserve/protect critical means of access and egress for residents, first responders.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Welfare Road
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk to resident through improved evacuation efforts. Reduce risk of damages due to elevating structure out of high-risk area.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure, Flood, Hurricane Wind, Wildfire
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$20,000,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	County Engineer Department and Emergency Management, TXDOT
<b>Implementation Schedule:</b>	Within 12-48 month of plan adoption
<b>Incorporation into Existing Plans:</b>	Capital Improvement Plan, Emergency Response Plan

<b>COMMENTS:</b>
<b>NFIP &amp; WHY MITIGATION ACTION IS APPROPRIATE:</b>
Protects infrastructure, reduces cost of reparation, and prevents injury to residents.



## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #20	
<b>Proposed Action:</b>	Repair the bridge abutment on the upstream side of the bridge.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Edge Falls Road at the Guadalupe River- Upstream Side
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Risk of loss and continued damages of critical infrastructure. Reduces risk of injury and fatalities by promoting community access for evacuation and first responders.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structure
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$50,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	Kendall County Road and Bridge, Precinct 3
<b>Implementation Schedule:</b>	Within 12-36 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Capital Improvement Plan, Emergency Response Plan

<b>COMMENTS:</b>
<b>NFIP &amp; WHY MITIGATION ACTION IS APPROPRIATE:</b>
Protects infrastructure, reduces cost of reparation, and prevents injury to residents.

## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #21	
<b>Proposed Action:</b>	Install new culvert and widen roadway.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Sisterdale-Lindale Road approximately .32 miles from RM 1376
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk of flooding. Reduces risk of injury and fatalities by promoting community access for evacuation and first responders.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$86,146
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	Kendall County Road and Bridge and Precinct 3
<b>Implementation Schedule:</b>	Within 12-36 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Capital Improvement Plan, Emergency Response Plan

<b>COMMENTS:</b>
<b>NFIP &amp; WHY MITIGATION ACTION IS APPROPRIATE:</b>
Protects infrastructure, reduces cost of reparation, and prevents injury to residents.

## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #22	
<b>Proposed Action:</b>	Conduct a study to determine if the construction of one or more flood control dams in Cypress Creek watershed above Comfort is feasible. If determined to be feasible, County will work toward promoting it to an FMP and securing funding from TWDB.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Cypress Creek watershed
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk of flooding. Reduces risk of damages, injury, and fatalities. Ensures emergency response.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure, Flood
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security, Communication
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$150,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	Kendall County Emergency Management and local Precinct Commissioners
<b>Implementation Schedule:</b>	Within 12-36 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Capital Improvement Plan, Emergency Response Plan, Guadalupe Regional Flood Plan

COMMENTS:
It is anticipated these structures would also help augment recharge of the local aquifer. The study is already in the Guadalupe Regional Flood Plan as a FME Project (111000138).
NFIP & WHY MITIGATION ACTION IS APPROPRIATE:
Protects communities and reduces risk of flooding.

## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #23	
<b>Proposed Action:</b>	Install a remote sensing gaging station in the Cypress Creek watershed above Comfort and implement an annual maintenance program of the gaging station.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Cypress Creek watershed
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk of flooding. Reduces risk of damages, injury, and fatalities. Ensures emergency response.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure, Flood
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security, Communication
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$40,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants, TWBD
<b>Lead Agency/Department Responsible:</b>	Kendall County Emergency Management, Precinct 4 Commissioner
<b>Implementation Schedule:</b>	Within 12-36 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Capital Improvement Plan, Emergency Response Plan

COMMENTS:
Once the gaging station location has been finalized, Precinct 4 work to get the maintenance agreement with USGS funded by the County.
NFIP & WHY MITIGATION ACTION IS APPROPRIATE:
Protects communities and reduces risk of flooding.

## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #24	
<b>Proposed Action:</b>	Install an early flood warning siren or alarm to be a part of gaging station at Cypress Creek watershed above Comfort.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Cypress Creek watershed
<b>Risk Reduction Benefit (Current Cost/Losses Avoided):</b>	Reduce risk of flooding. Reduces risk of damages, injury, and fatalities. Ensures emergency response.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure, Flood
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security, Communication
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$50,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	Kendall County Emergency Management, Precinct 4 Commissioner, local Fire Department
<b>Implementation Schedule:</b>	Within 12-36 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Capital Improvement Plan, Emergency Response Plan

COMMENTS:
The USGS currently has a policy that they will not allow a remote early flood warning siren or alarm to be a part of their gaging station, Precinct 4 will work with other vendors to integrate an automatic cellular notification system with third party hardware and/or volunteer Fire Department personnel to close the early flood warning notification loop.
NFIP & WHY MITIGATION ACTION IS APPROPRIATE:
Protects communities and reduces risk of flooding.

## SECTION 19: MITIGATION ACTIONS

Kendall County – Action #25	
<b>Proposed Action:</b>	Elevate bridge on Old Fredericksburg Road at the County line. Ensure continuity of emergency services, preserve/protect critical means of access and egress for residents, first responders.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Old Fredericksburg Road
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk to resident through improved evacuation efforts. Reduce risk of damages due to elevating structure out of high-risk area.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure, Flood, Hurricane Wind, Wildfire
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structure
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$2,500,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	County Engineer Department and Emergency Management, T Precinct 1 Commissioner, Precinct 2, TXDOT
<b>Implementation Schedule:</b>	Within 12-36 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Capital Improvement Plan, Emergency Response Plan

<b>COMMENTS:</b>
<b>NFIP &amp; WHY MITIGATION ACTION IS APPROPRIATE:</b>
Protects infrastructure, reduces cost of reparation, and prevents injury to residents.

## SECTION 19: MITIGATION ACTIONS

Kendall County– Action #26	
<b>Proposed Action:</b>	Provide subsidized fans and other cooling devices to citizens that need of them. Through public service have people purchase fans and cooling devices and drop off at a public safety building location. After devices are dropped off, we can work with family services, faith base organizations and others to get the cooling devices in the hands of those in need.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide
<b>Risk Reduction Benefit (Current Cost/Losses Avoided):</b>	Reduces risk of potential injuries and fatalities to vulnerable or at-risk populations.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Extreme Heat
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants, Donations
<b>Lead Agency/Department Responsible:</b>	Kendall County Public Safety w/ Family Services and Faith Based organizations assistance
<b>Implementation Schedule:</b>	Ongoing
<b>Incorporation into Existing Plans:</b>	Local and Emergency Response Plans

COMMENTS:
Previous Action: #11



## SECTION 19: MITIGATION ACTIONS

Kendall County– Action #27	
<b>Proposed Action:</b>	Strengthen subdivision rules and regulations to encourage higher densities only outside of known hazard areas and stronger construction standards to mitigate against hazards 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.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk of damages, injuries, and fatalities.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure, Drought, Flood, Hail, Hurricane Wind, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Expansive Soils
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security
<b>Effect on new/existing buildings:</b>	Reduce risk to new structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Funds (staff time), State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	Kendall County Development Management, Engineer's Office, Fire Marshal and GIS
<b>Implementation Schedule:</b>	Within 12 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Local Ordinances and building codes

COMMENTS:
Previous Action: #12, 14. Propose new subdivision rules to include wider streets within new small lot subdivisions to ensure first responders can navigate past parked cars. Hire a consultant to work with County Development Manager and County Engineer to draft updated Subdivision.

## SECTION 19: MITIGATION ACTIONS

Kendall County– Action #28	
<b>Proposed Action:</b>	Purchase or encourage citizens to purchase NOAA All Hazard Radios for early warning and post-event information for public, businesses, schools, event venues.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk to cities through improved communication and early warning.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure, Drought, Flood, Extreme Heat, Hail, Hurricane Wind, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Expansive Soils, and man-made hazards
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Communication
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$50,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants, Donations
<b>Lead Agency/Department Responsible:</b>	Kendall County Emergency Management
<b>Implementation Schedule:</b>	Ongoing
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
Previous Action: #13

## SECTION 19: MITIGATION ACTIONS

Kendall County– Action #29	
<b>Proposed Action:</b>	Reimbursement program for safe rooms in new and existing homes, businesses, schools, and places of assembly. Provide a reimbursement program for new home builders, existing home builders and others that elect to have a safe room place in their home.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk injuries and fatalities during severe weather events.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure, Local Plans and Regulations, Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hurricane Wind, Tornado, Thunderstorm Wind
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$10,000 per site location
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	Kendall County Emergency Management, County Auditor
<b>Implementation Schedule:</b>	Within 24-48 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
Previous Action: #19

## SECTION 19: MITIGATION ACTIONS

Kendall County– Action #30	
<b>Proposed Action:</b>	Implement FireWise Community Program for County. Work with subdivision homeowner, homeowner associations, Texas Forest Service and the National Firewise Program to reduce risk. Public Education on Wildfire Safety and Strategies.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide with emphasis on subdivision throughout the County and the City of Boerne
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	With the risk of wildfire during dry and drought conditions we could reduce the loss of homes and other structures. This would also build defensive area should a wildfire occur.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations, Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Wildfire
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security
<b>Effect on new/existing buildings:</b>	Reduce losses to existing and future structures and infrastructure
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$1,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	County Fire Marshal, Local Fire Departments, County Development Management
<b>Implementation Schedule:</b>	Within 24 months of plan adoption
<b>Incorporation into Existing Plans:</b>	N/A

COMMENTS:
Previous Action: #20

## SECTION 19: MITIGATION ACTIONS

Kendall County– Action #31	
<b>Proposed Action:</b>	Develop and implement water use restrictions to mitigate damage caused by drought such as restrictions and ordinances for residential and commercial requirements for drought tolerant landscaping.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce damages to properties and reduces risk to vulnerable and at-risk populations.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Drought
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security
<b>Effect on new/existing buildings:</b>	Reduce risk to existing and future structures and facilities
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	\$2,500
<b>Potential Funding Sources:</b>	Local Funds
<b>Lead Agency/Department Responsible:</b>	Cow Creek Groundwater Conservation District
<b>Implementation Schedule:</b>	Within 48 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Local Ordinances

COMMENTS:
Previous Action: #22

## SECTION 19: MITIGATION ACTIONS

Kendall County– Action #32	
<b>Proposed Action:</b>	Educate citizens on taking water-saving measures such as low-flow toilets and shower heads, adjusting sprinklers, water saving measures in daily activities, and installation of graywater systems.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Educate water consumers on proper water use, as not to waste water. Reduce damages to properties and reduces risk to vulnerable and at-risk populations.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Drought
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Communication
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	Cow Creek Groundwater Conservation District
<b>Implementation Schedule:</b>	Within 48 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Public Works SOP

COMMENTS:
Previous Action: #23

## SECTION 19: MITIGATION ACTIONS

Kendall County– Action #33	
<b>Proposed Action:</b>	Provide advanced training for first responders that want to advance to the operations and/or technical level to operate in the hot zone of a Hazardous Materials Incident. Provide opportunity for staff that want to achieve an advance level of training to do so.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide – department members wanting to advance
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the risk of injury and/or death to responders and reduce the risk posed by the Hazardous Material as well as reduce the time to mitigate the incident versus waiting for response companies to get here from outside the county.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hazardous Material
<b>Community Lifeline</b> (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):	Communication
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$250 to \$750 per first responder
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	Kendall County Emergency Management, Fire Department, Law Enforcement
<b>Implementation Schedule:</b>	Ongoing
<b>Incorporation into Existing Plans:</b>	Local SOP's

COMMENTS:
Previous Action: #8



## SECTION 19: MITIGATION ACTIONS

Kendall County– Action #34	
<b>Proposed Action:</b>	Ensure that businesses which use, store, manufacture, or sell hazardous materials follows the Adopted County Fire Code. Annual fire inspections of facilities that use, store, manufacture or sell hazardous materials.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce potential for Hazardous Material release.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hazardous Materials
<b>Community Lifeline</b> (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):	Safety/Security
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Funds
<b>Lead Agency/Department Responsible:</b>	Kendall County Fire Marshal – Health Inspector
<b>Implementation Schedule:</b>	Ongoing
<b>Incorporation into Existing Plans:</b>	2015 Fire Codes, Health and Safety Codes

COMMENTS:
Previous Action: #9

## SECTION 19: MITIGATION ACTIONS

Kendall County– Action #35	
<b>Proposed Action:</b>	Annual attendance for pipeline emergency training including Include how to locate pipelines in the County and safety courses taught in the area and around the state and/or conduct local training on pipeline failure.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide emergency responders
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the risk of injury and/or death to responders and reduce the risk posed by a pipeline failure and what actions to take if responding to a failure.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Pipeline Failure
<b>Community Lifeline</b> (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):	Communication
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	Most courses are free, maybe minimal travel cost
<b>Potential Funding Sources:</b>	Local Funds - Training Budget
<b>Lead Agency/Department Responsible:</b>	Kendall County Emergency Management, Fire Department, Law Enforcement
<b>Implementation Schedule:</b>	Annually
<b>Incorporation into Existing Plans:</b>	Local SOP's

COMMENTS:
Previous Action: #15

## SECTION 19: MITIGATION ACTIONS

Kendall County– Action #36	
<b>Proposed Action:</b>	Educate the public and landowners of the dangers of a Pipeline Failure, how to recognize and contact assistance as well as activities conducted on and around pipelines. Provide opportunity for the public and landowners to understand the dangers of Pipeline Failure and how to recognize and report.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide in area where pipelines exist
<b>Risk Reduction Benefit (Current Cost/Losses Avoided):</b>	Reduce the risk of injury and/or death to citizens and landowners and how to request assistance during a failure.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Pipeline Failure
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Communication
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	\$2,500
<b>Potential Funding Sources:</b>	Local Funds
<b>Lead Agency/Department Responsible:</b>	Kendall County Emergency Management, Fire Department, Law Enforcement
<b>Implementation Schedule:</b>	Ongoing
<b>Incorporation into Existing Plans:</b>	Local SOP's and Public Awareness

COMMENTS:
Previous Action: #16

## SECTION 19: MITIGATION ACTIONS

Kendall County– Action #37	
<b>Proposed Action:</b>	Continual annual terrorism training and exercises to all county staff.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	County-wide facilities
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the risk of having a terrorism incident in a county facility or during a county sponsored function.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Terrorism
<b>Community Lifeline</b> (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):	Communication
<b>Effect on new/existing buildings:</b>	Reduce risk to existing facilities
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Funds
<b>Lead Agency/Department Responsible:</b>	Kendall County Law Enforcement, Emergency Management
<b>Implementation Schedule:</b>	Annually
<b>Incorporation into Existing Plans:</b>	Local Plans, Department SOP's

COMMENTS

## SECTION 19: MITIGATION ACTIONS

Kendall County– Action #38	
<b>Proposed Action:</b>	Rehabilitate High Hazard Flood Control Structures on Upper Cibolo Creek watershed. Rehabilitation of the High Hazard Flood Control Structures will reduce the hazard rating to Low.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Upper Cibolo Creek Floodwater Retarding Structure #2 Upper Cibolo Creek Floodwater Retarding Structure #4
<b>Risk Reduction Benefit (Current Cost/Losses Avoided):</b>	Reduce the risk of flooding along Cibolo Creek in unincorporated areas of Kendall County and the City of Boerne.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Infrastructure Project

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flooding
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	
<b>Effect on new/existing buildings:</b>	Reduce risk to loss of life and existing development
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$250,000 per location
<b>Potential Funding Sources:</b>	Local Funds
<b>Lead Agency/Department Responsible:</b>	Engineer's Office, Emergency Management
<b>Implementation Schedule:</b>	Annually
<b>Incorporation into Existing Plans:</b>	Local Plans, Department SOPs

2022 ANALYSIS:
Deferred action #18

## SECTION 19: MITIGATION ACTIONS

### CITY OF BOERNE

City of Boerne– Action #1	
<b>Proposed Action:</b>	Include wind engineering measures such as structural bracing in local building codes to reduce risk of damages.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City-wide
<b>Risk Reduction Benefit (Current Cost/Losses Avoided):</b>	Reduce the risk damages, injuries and fatalities.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hurricane Wind, Thunderstorm Wind, Tornado
<b>Community Lifeline (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):</b>	Safety/Security
<b>Effect on new/existing buildings:</b>	Reduce damage risk to new structures
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	City of Boerne Code Enforcement, Fire Department / Fire Marshal
<b>Implementation Schedule:</b>	Within 36 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan, Local Building Code, UDC

COMMENTS:
Previous Action: #1

## SECTION 19: MITIGATION ACTIONS

City of Boerne– Action #2	
<b>Proposed Action:</b>	Adopt and enforce more stringent building codes designed to protect against natural hazards.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City-wide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce damages to structures through improved construction practices.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure, Drought, Flood, Extreme Heat, Hail, Hurricane Wind, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Expansive Soils
<b>Community Lifeline</b> (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):	Safety/Security
<b>Effect on new/existing buildings:</b>	Reduce risk to new and existing structures
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	City of Boerne Code Enforcement
<b>Implementation Schedule:</b>	Ongoing
<b>Incorporation into Existing Plans:</b>	UDC

COMMENTS:
Previous Action: #2
NFIP & WHY MITIGATION ACTION IS APPROPRIATE:
Protects infrastructure, reduces cost of reparation, and prevents injury to residents.



## SECTION 19: MITIGATION ACTIONS

City of Boerne– Action #3	
<b>Proposed Action:</b>	Conduct annual inspections of dams with NRCS and County representatives. Educate citizens on the risk of Dam Failure, warning systems for dam failure, and evacuation routes.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Dam site I – City Lake Dam site II – Lake Oz
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the risk damages, injuries and fatalities.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure, Flood
<b>Community Lifeline</b> (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):	Safety/Security
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	Local Funds (staff time)
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	City of Boerne Emergency Management / Public Works
<b>Implementation Schedule:</b>	Annually
<b>Incorporation into Existing Plans:</b>	Standard Operations Plan

COMMENTS:
Previous Action: #4
NFIP & WHY MITIGATION ACTION IS APPROPRIATE:
Protects infrastructure, reduces cost of reparation, and prevents injury to residents.

## SECTION 19: MITIGATION ACTIONS

City of Boerne– Action #4	
<b>Proposed Action:</b>	Brush clearing and erosion control performed at dam sites I and II.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Dam site I – City Lake Dam site II – Lake Oz
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the risk damages, injuries and fatalities.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Structure and Infrastructure

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure, Flood
<b>Community Lifeline</b> (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):	Safety/Security
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$25,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	City of Boerne Emergency Management / Public Works
<b>Implementation Schedule:</b>	In-progress, and ongoing
<b>Incorporation into Existing Plans:</b>	Dam Safety Plan

COMMENTS:
Previous Action: #5
NFIP & WHY MITIGATION ACTION IS APPROPRIATE:
Protects communities and reduces risk of flooding.

## SECTION 19: MITIGATION ACTIONS

City of Boerne– Action #5	
<b>Proposed Action:</b>	Implement Firewise Community program for the City of Boerne. Conduct training amongst first responders and education to community.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City-wide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce the risk damages, injuries, and fatalities.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations, Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Wildfire
<b>Community Lifeline</b> (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):	Safety/Security, Communication
<b>Effect on new/existing buildings:</b>	Reduce risk to new and existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	City of Boerne Fire Department / Fire Marshal
<b>Implementation Schedule:</b>	In-progress and ongoing
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan, CWPP

COMMENTS:
Previous Action: #7

## SECTION 19: MITIGATION ACTIONS

City of Boerne– Action #6	
<b>Proposed Action:</b>	Implement an education and awareness program to educate citizens on hazards that threaten the area and mitigation measure to reduce injuries, fatalities, and property damages.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Promotes hazard awareness and protect citizens from potential injuries and damages.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure, Drought, Flood, Extreme Heat, Hail, Hurricane Wind, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Expansive Soils, Hazardous Materials, Pipeline Failure, Terrorism, Infectious Disease
<b>Community Lifeline</b> (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):	Communication
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	City of Boerne Emergency Management
<b>Implementation Schedule:</b>	Ongoing
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
Previous Action: #10, 12, 16, 17, 19, 22, 23, 26
NFIP & WHY MITIGATION ACTION IS APPROPRIATE:
Promotes public safety.

## SECTION 19: MITIGATION ACTIONS

City of Boerne– Action #7	
<b>Proposed Action:</b>	Place hazard warning signs and auto barricades at low water crossings. Include installation of new barricades and maintenance of existing barricades.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City-wide low water crossings
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Promote hazard awareness and protect citizens from potential injuries and damages. Reduce risk to emergency response personnel.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood
<b>Community Lifeline</b> (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):	Communication
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$500,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	City of Boerne Emergency Management / Street Department
<b>Implementation Schedule:</b>	Within 12-24 months of plan adoption, then annually
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
Previous Action: #11
NFIP & WHY MITIGATION ACTION IS APPROPRIATE:
Promotes public safety.

## SECTION 19: MITIGATION ACTIONS

City of Boerne– Action #8	
<b>Proposed Action:</b>	Designate warming centers/ shelters for vulnerable or at-risk populations during winter storms.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City-wide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk of injury and fatalities during severe weather events.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Winter Storm
<b>Community Lifeline</b> (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):	Safety/Security
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$100,000
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	City of Boerne Emergency Management
<b>Implementation Schedule:</b>	Ongoing
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
Previous Actions: #20

## SECTION 19: MITIGATION ACTIONS

City of Boerne– Action #9	
<b>Proposed Action:</b>	Continue inspection of pipelines; repair or replace inadequate gas distribution systems; train yearly on proper procedures for employees and first responders.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City-wide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce risk of damages, injury and fatalities in the event of pipeline failure or damage.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Local Plans and Regulations, Structure and Infrastructure

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Pipeline Failure
<b>Community Lifeline</b> (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):	Safety/Security
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$30,000 per year
<b>Potential Funding Sources:</b>	Local Funds, State and Federal Grants
<b>Lead Agency/Department Responsible:</b>	City of Boerne Public Works
<b>Implementation Schedule:</b>	Annually
<b>Incorporation into Existing Plans:</b>	Operations Plan

COMMENTS:
Previous Action: #9



## SECTION 19: MITIGATION ACTIONS

City of Boerne– Action #10	
<b>Proposed Action:</b>	Continue annual / ongoing terrorism recognition training for public and first responders.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City-wide
<b>Risk Reduction Benefit</b> (Current Cost/Losses Avoided):	Reduce loss of life and injuries. Ensure continuity of critical services in the event of a terrorist event.
<b>Type of Action:</b> (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Terrorism
<b>Community Lifeline</b> (Safety/Security, Health/Medical, Energy (Power/Fuel), Communication):	Communication
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$25,000
<b>Potential Funding Sources:</b>	Local Budget and Federal Grants
<b>Lead Agency/Department Responsible:</b>	City of Boerne Law Enforcement
<b>Implementation Schedule:</b>	Ongoing
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS
Previous Action: #21

# SECTION 20: PLAN MAINTENANCE

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Incorporation .....	1
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Monitoring .....	4
Evaluation .....	4
Updating .....	5
Plan Revisions .....	5
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## PLAN MAINTENANCE PROCEDURES

The following is an explanation of how Kendall County, the City of Boerne, 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 and Reviewing
- Continued Public Involvement

## INCORPORATION

Kendall County and the City of Boerne will be responsible for further development and implementation of mitigation actions. Each action has been assigned to a specific department within the County and City. 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 Update is adopted, Kendall County and the City of Boerne 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 Update 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.

## SECTION 20: PLAN MAINTENANCE

Kendall County and the City of Boerne 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 Update 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 Update, planning team members from both the County and the City 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 revisions in light of the approved Plan. The planning team will review all 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 Update to reduce the long-term risk to life and property from all hazards. Within one year of formal adoption of the hazard mitigation Plan Update, existing planning mechanisms will be reviewed by each jurisdiction.

Kendall County is committed to supporting the City of Boerne 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 20-1 identifies types of planning mechanisms and examples of methods for incorporating the Plan Update into other planning efforts. The team members, listed in Table 20-2 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 20-1. Methods of Incorporation of the Plan**

PLANNING MECHANISM	DEPARTMENT / TITLE RESPONSIBLE	INCORPORATION OF PLAN
Annual Budget Review	Kendall County: Emergency Management Coordinator City of Boerne: Emergency Management Coordinator	Various departments and key personnel that participated in the planning process for Kendall County and the City of Boerne 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	Kendall County: Emergency Management Coordinator City of Boerne: Emergency Management Coordinator	Kendall County and the City of Boerne have a Capital Improvement Plan (CIP) in place. Prior to any revisions to the CIP, County and City departments will review the risk

## SECTION 20: PLAN MAINTENANCE

PLANNING MECHANISM	DEPARTMENT / TITLE RESPONSIBLE	INCORPORATION OF PLAN
		assessment and mitigation strategy sections of the HMAP, as limiting public spending in hazardous zones is one of the most effective long-term mitigation actions available to local governments.
Comprehensive Plans	Kendall County: Emergency Management Coordinator City of Boerne: Emergency Management Coordinator	Kendall County and the City of Boerne have Long-term Comprehensive Development Plans in place. Since comprehensive plans involve developing a unified vision for a community, the mitigation vision and goals of the Plan will be reviewed in the development or revision of a Comprehensive Plan.
Floodplain Management Plans	Kendall County: Floodplain Administrator City of Boerne: Floodplain Administrator	Floodplain management plans include preventative and corrective actions to address the flood hazard. Therefore, the actions for flooding and information found in Section 5 of this Plan Update discussing the people and property at risk to flood will be reviewed and revised when Kendall County and the City of Boerne update their management plans or develops new plans.
Grant Applications	Kendall County: Emergency Management Coordinator City of Boerne: Emergency Management Coordinator	The Plan will be evaluated by Kendall County and the City of Boerne when grant funding is sought for mitigation projects. If a project is not in the Plan Update, a Plan Revision may be necessary to include the action in the Plan.
Regulatory Plans	Kendall County: Emergency Management Coordinator City of Boerne: Emergency Management Coordinator	Currently, Kendall County and the City of Boerne have regulatory plans in place, such as Emergency Management Plans, Continuity of Operations Plans, Land Use Plans, and Evacuation Plans. The Plan Update 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.

## SECTION 20: PLAN MAINTENANCE

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 20-2 indicates the department and title of the party responsible for Plan monitoring, evaluating, updating, and review of the Plan.

**Table 20-2. Team Members Responsible for Plan Monitoring, Evaluating, Updating, and Review of the Plan**

JURISDICTION	TITLE
Kendall County	Emergency Management Coordinator
City of Boerne	Emergency Management Coordinator

### MONITORING

Designated Planning Team members are responsible for monitoring, evaluating, updating, and reviewing the Plan, as shown in Table 20-2. Individuals holding the title listed in Table 20-2 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 include 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.

## SECTION 20: PLAN MAINTENANCE

### UPDATING

#### PLAN REVISIONS

At any time, minor technical changes may be made to update the Kendall County Hazard Mitigation Action Plan Update 2023. 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.

Kendall County and the City of Boerne will review proposed revisions and vote to accept, reject, or amend the proposed change. Upon ratification, the Revision will be transmitted to TDEM.

In determining whether to recommend approval or denial of a Plan Revision 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 Update;
- New issues or needs that were not adequately addressed in the Plan Update; and
- Changes in information, data, or assumptions from those on which the Plan Update 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 Kendall County and the City of Boerne 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 Revision process outlined herein. Upon completion of the review, update, and revision 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, reviews and cyclical updates. Changes or suggestions to improve or update the Plan will provide opportunities for additional public input.

## SECTION 20: PLAN MAINTENANCE

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 .....	1
Stakeholders .....	2

## PLANNING TEAM MEMBERS

The Kendall County Hazard Mitigation Action Plan 2023 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
Kendall County	Emergency Management Coordinator / Fire Marshall
City of Boerne	Emergency Management Coordinator / Fire Chief

**Table A-2. Advisory Planning Team**

ORGANIZATION / DEPARTMENT	TITLE
Kendall County	Assistant County Engineer
Kendall County	Chief Sheriff's Deputy
Kendall County	County Clerk
Kendall County	County Engineer
Kendall County	County Engineering Staff
Kendall County	County Judge
Kendall County	County Sheriff
Kendall County	Deputy Fire Marshall
Kendall County	EMS Administrator
Kendall County	Geographic Information Systems (GIS) Coordinator
Kendall County	Human Resource Director
Kendall County	Precinct 1 Commissioner

## APPENDIX A: PLANNING TEAM

ORGANIZATION / DEPARTMENT	TITLE
Kendall County	Precinct 2 Commissioner
Kendall County	Precinct 3 Commissioner
Kendall County	Precinct 4 Commissioner
Kendall County	Road and Bridge Operations Manager
Kendall County	Road and Bridge Supervisor
City of Boerne	Assistant City Manager (1)
City of Boerne	Assistant City Manager (2)
City of Boerne	City Manager
City of Boerne	City Secretary
City of Boerne	Director of Development Services
City of Boerne	Emergency Management Coordinator / Police Chief
City of Boerne	Geographic Information Systems (GIS) Coordinator
City of Boerne	IT Specialist
City of Boerne	Mayor
City of Boerne	Mayor Pro-Team
City of Boerne	Planning and Community Development Director
City of Boerne	Public Information Office (POI) / Media
City of Boerne	Utilities Director

## 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<sup>1</sup>.

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<sup>1</sup> Information contained in Appendix E is exempt from public release under the Freedom of Information Act (FOIA).

## APPENDIX A: PLANNING TEAM

**Table A-3. Stakeholders**

AGENCY	TITLE
211 Texas Health and Human Services Commission	Resource Manager
Alamo Springs Volunteer Fire Department	Fire Chief
American Red Cross	Hill Country Chapter / Regional Manager of Communications
Bandera County	Emergency Management Coordinator
Bandera Electric Cooperative	Engineering Supervisor
Bergheim Volunteer Fire Department	Fire Chief
Bexar County	Office of Emergency Management
Bexar County ESD No.4 / Leon Springs Volunteer Fire Department	President
Bexar County ESD No.8 / Grey Forest Volunteer Fire Department	President
Blanco County	Emergency Management Coordinator
Boerne Chamber of Commerce	Owner / Chair
Boerne Independent School District	Chief Financial Officer
Boerne Independent School District	Chief Operations Officer
Boerne Independent School District	Deputy Superintendent
Boerne Independent School District	Superintendent
Boerne Independent School District	Superintendent Secretary
Boerne Independent School District	Director of Safety
Boerne – Kendall County Economic Development Corporation	Chief Executive Officer
Boerne Radio 103.9 FM	General
Boerne Star	General / Editor
Bulverde Spring Branch Fire & EMS 2	Chief of Operations
Capital Area Council of Governments	Director of Regional Planning and Services
Capital Area Council of Governments	Regional Service Program Specialist
Comal County	Emergency Management Coordinator
Comfort Area Foundation	President

## APPENDIX A: PLANNING TEAM

AGENCY	TITLE
Comfort Chamber of Commerce	General Staff
Comfort Fire Department	Fire Chief
Comfort Floodplain Coalition	President
Comfort Independent School District	Director of Operations
Comfort Independent School District	Operations Coordinator
Comfort Independent School District	Superintendent
Comfort Independent School District	Superintendent Secretary
Comfort News	General / Editor
Cow Creek Groundwater Conservation District	General Manager
Cow Creek Groundwater Conservation District	President
Department of Homeland Security	General Staff
Environment Protection Agency	Region 6 Administrator
Gillespie County	Floodplain Administrator
Hill Country Weekly	Editor
Kendalia Volunteer Fire Department	Fire Chief
Kendall Amateur Radio Society	General
Kerr County	County Engineer
Legislator	District 73 Representative
Lower Colorado River Authority	Emergency Management Coordinator
Methodist Healthcare System	Emergency Management Committee Director
Methodist Healthcare System – Boerne Emergency Department	Direct of the Emergency Department
NOAA	Chief of Policy / Planning and Communications
Pedernales Electric Cooperative	General
Pipe Creek Volunteer Fire Department	President
Senate	District 25 Senator
Sisterdale Volunteer Fire Department	Fire Chief

## APPENDIX A: PLANNING TEAM

AGENCY	TITLE
Southwest Texas Regional Advisory Council	Executive Director
Texas A&M Argilife Extension	District Representative
Texas Commission on Environment Quality (TCEQ)	Regional Director
Texas Commission on Environment Quality (TCEQ)	ERC
Texas Department of Transportation	District Engineer
Texas Division of Emergency Management (TDEM)	Regional Coordinator
Texas Forest Service	Regional Fire Coordinator
Texas Water Board	Outreach Specialist
U.S. Army Corps of Engineers	Southwest Division Representative
U.S. Fish and Wildlife	Regional Outreach Coordinator
U.S. Fish and Wildlife	Public Affairs State Representative
Waring Fire Department	Fire Chief

# APPENDIX B: PUBLIC SURVEY RESULTS

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Overview .....	1
Public Survey Results .....	2

## OVERVIEW

Kendall County and the City of Boerne 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 and City’s websites. This survey link was also distributed at public meetings and stakeholder events throughout the planning process.

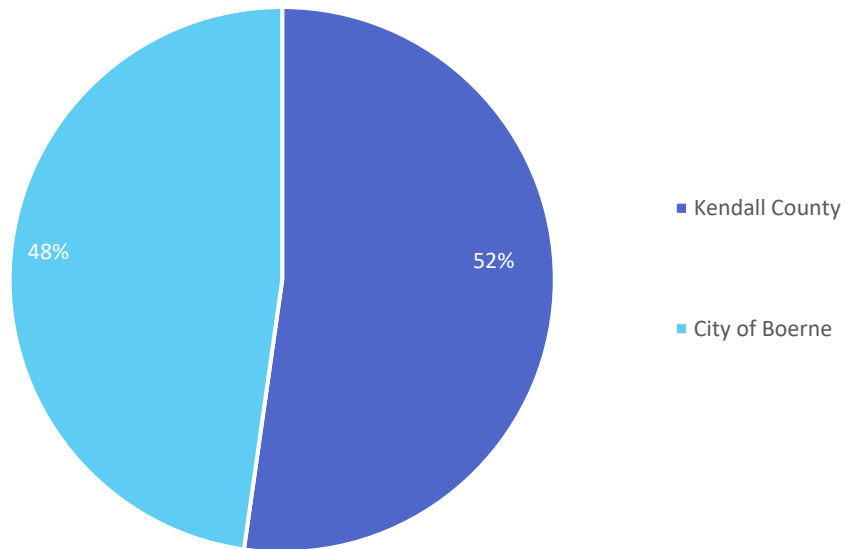
A total of 313 surveys were collected, the results of which are analyzed in Appendix B. The purpose of the survey was twofold: 1) to solicit public input during the planning process, and 2) to help the jurisdictions identify any potential actions or problem areas.

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.

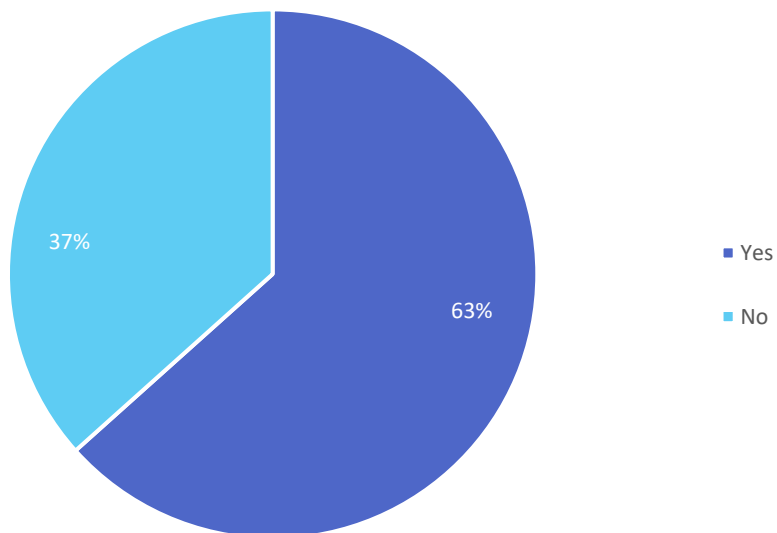
## APPENDIX B: PUBLIC SURVEY RESULTS

### PUBLIC SURVEY RESULTS

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



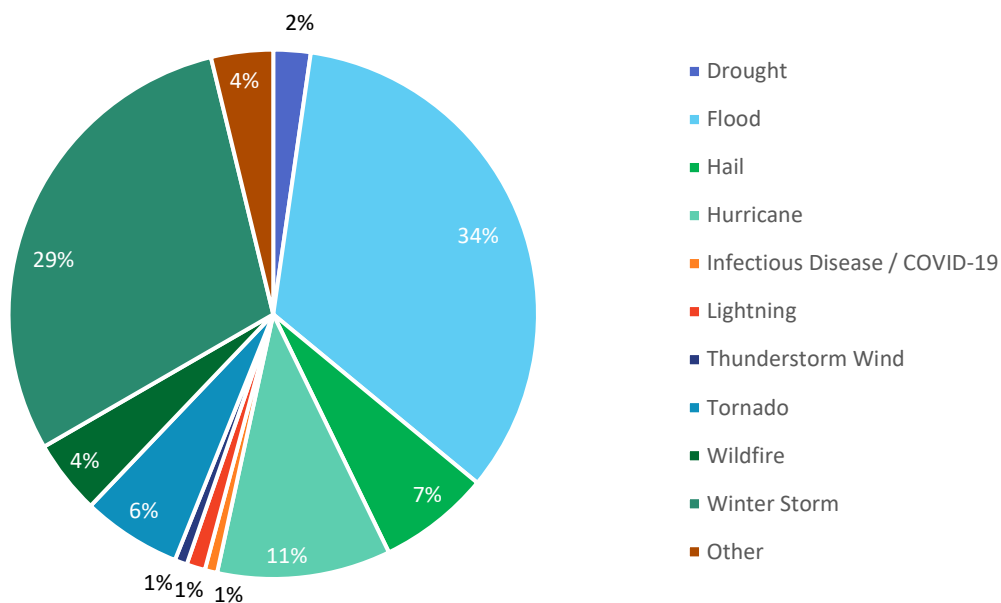
2. Have you ever experienced or been impacted by a disaster?



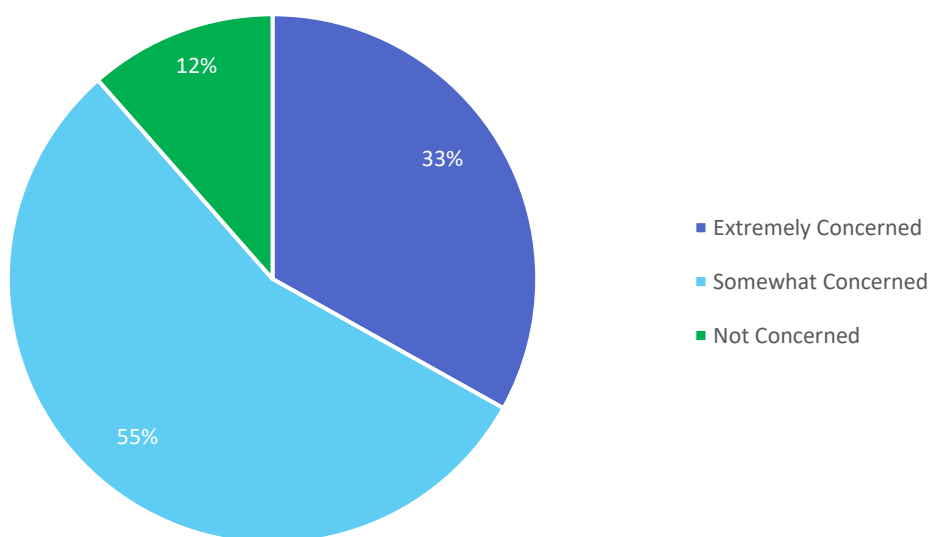


## APPENDIX B: PUBLIC SURVEY RESULTS

3. If you answered “Yes” to Question #2, please explain.

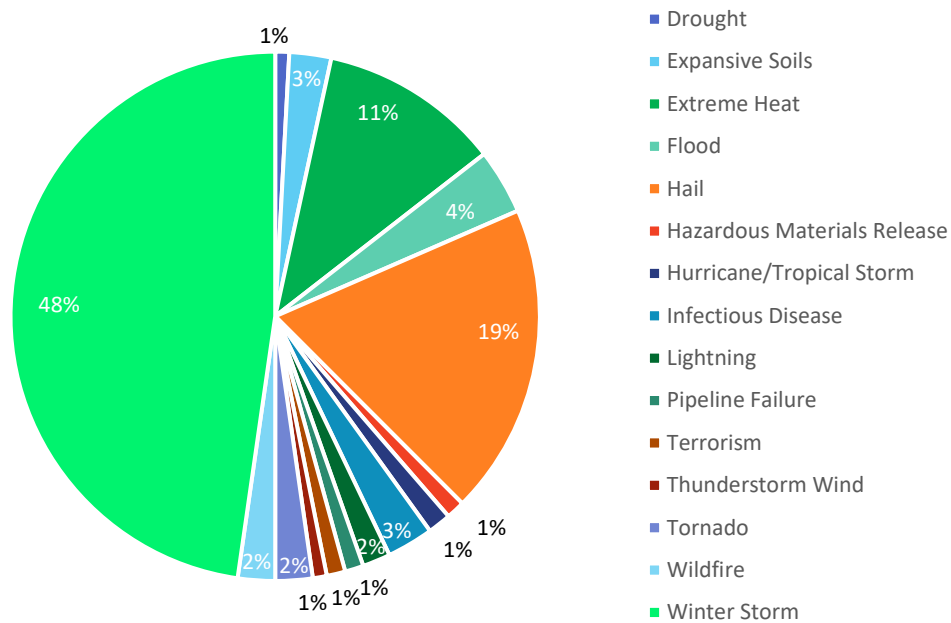


4. How concerned are you about the possibility of your community being impacted by a disaster?

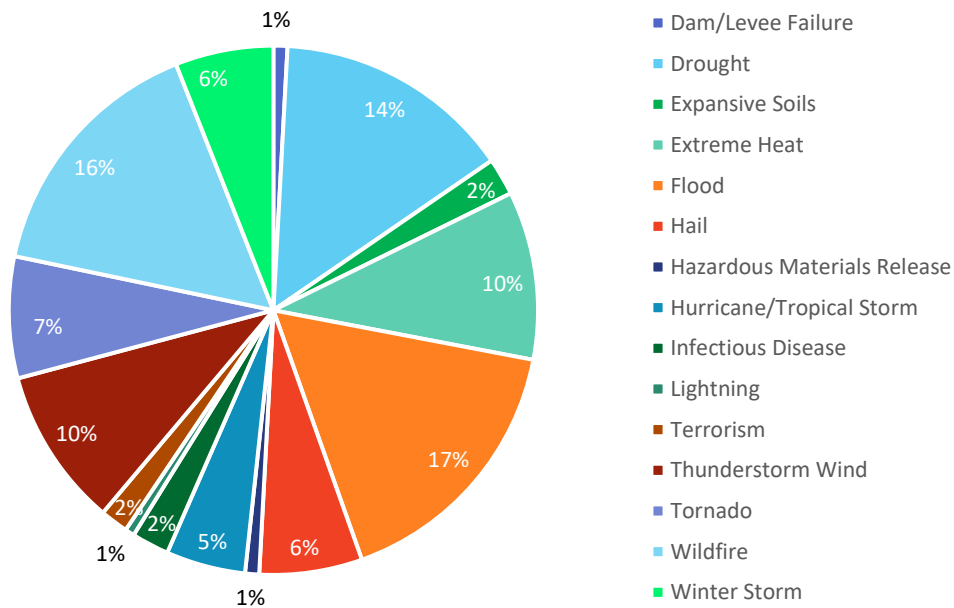


## APPENDIX B: PUBLIC SURVEY RESULTS

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

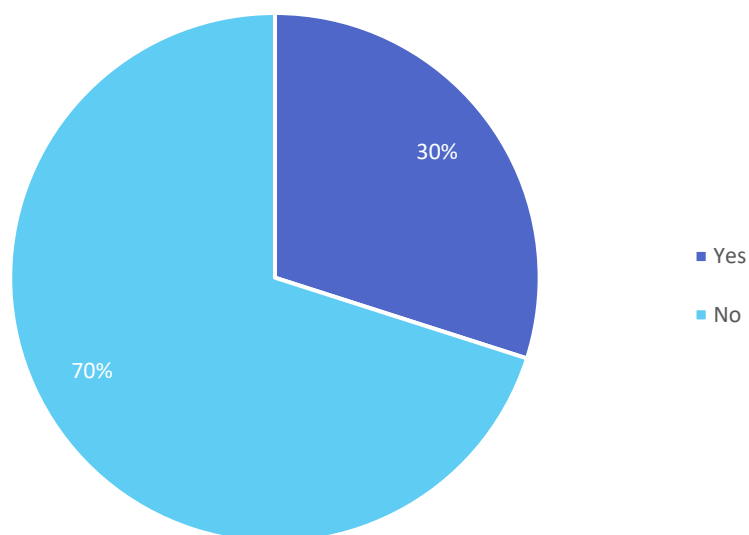


6. Please select the one hazard you think is the second highest threat to your neighborhood:

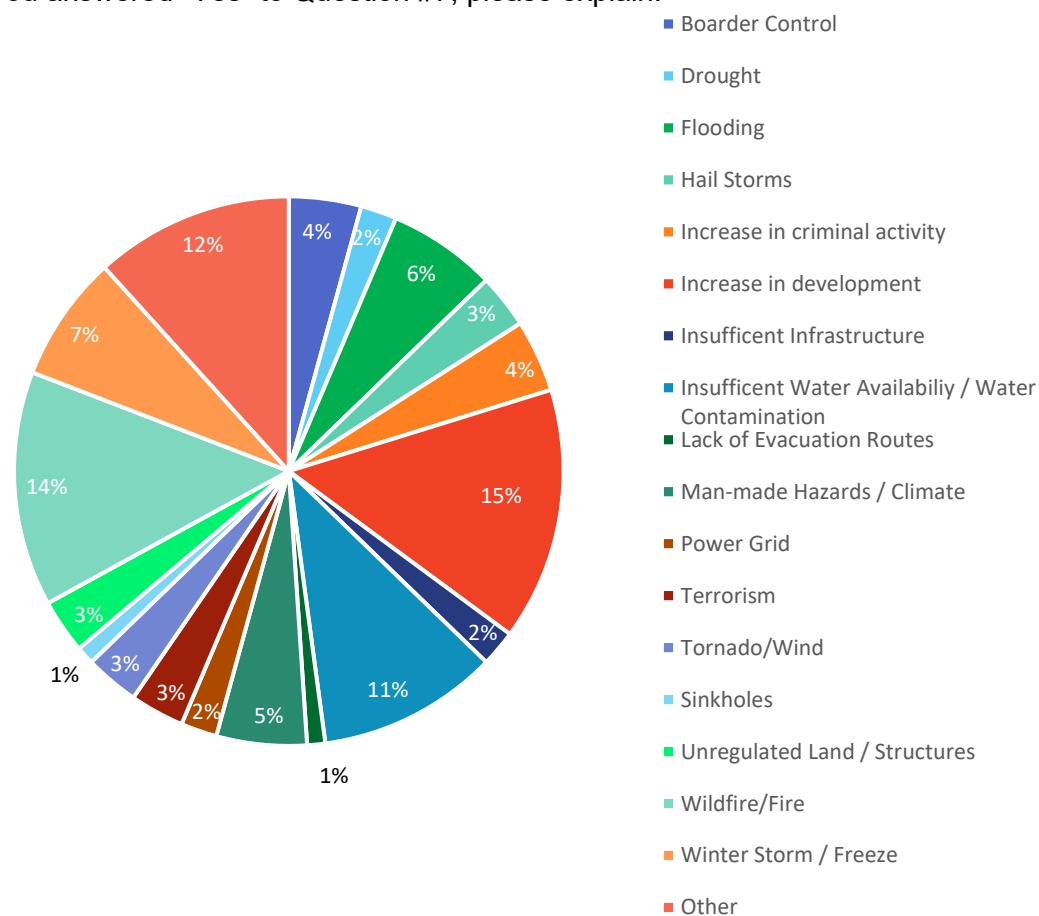


## APPENDIX B: PUBLIC SURVEY RESULTS

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

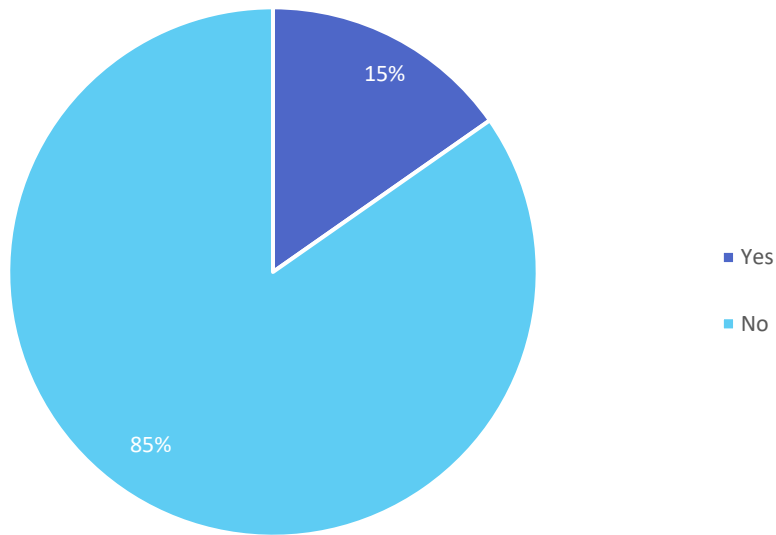


8. If you answered "Yes" to Question #7, please explain.

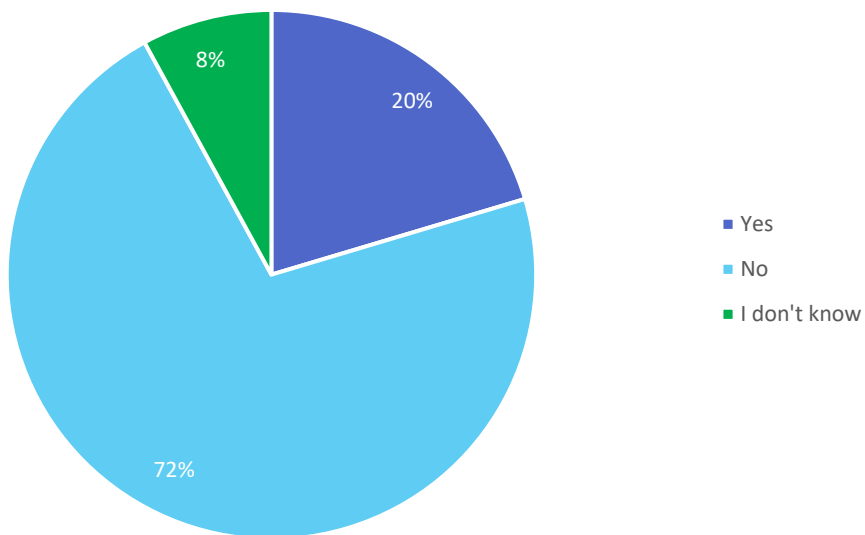


## APPENDIX B: PUBLIC SURVEY RESULTS

9. Is your home located in a floodplain?

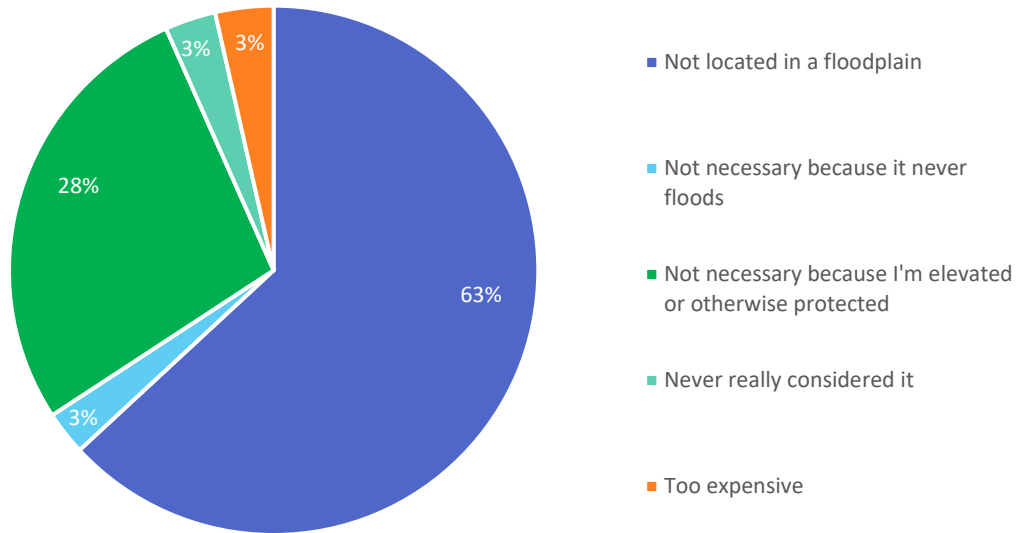


10. Do you have flood insurance?

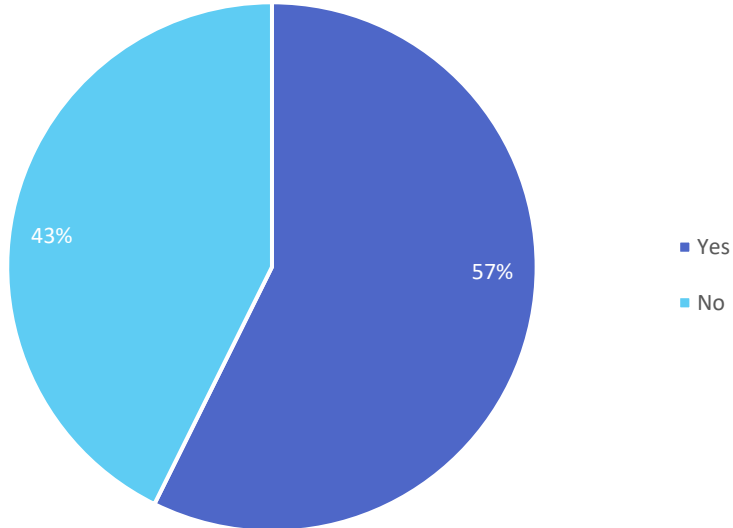


## APPENDIX B: PUBLIC SURVEY RESULTS

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

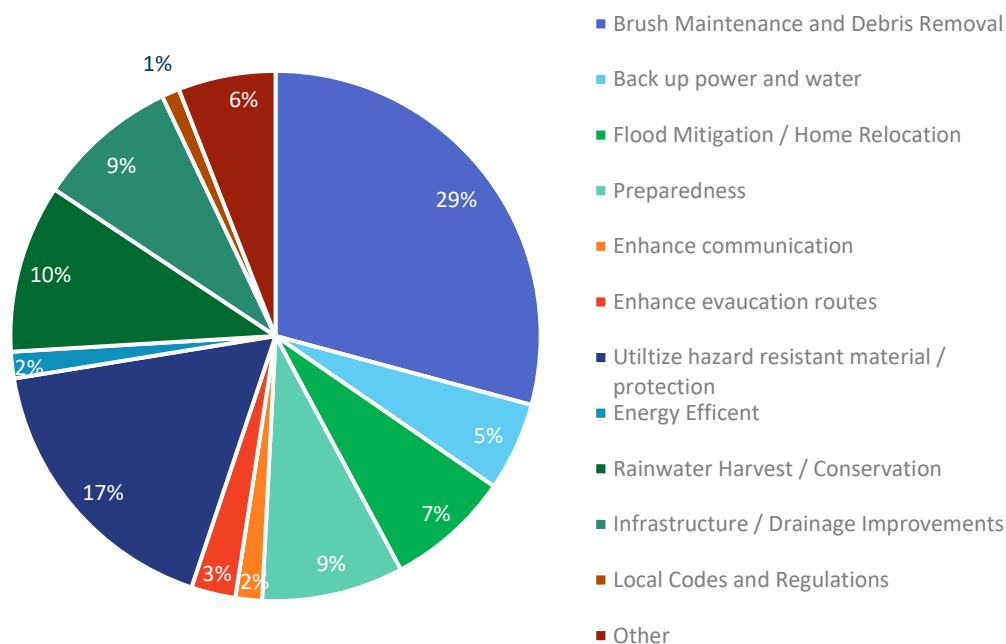


12. Have you taken any actions to make your home or neighborhood more resistant to hazards?

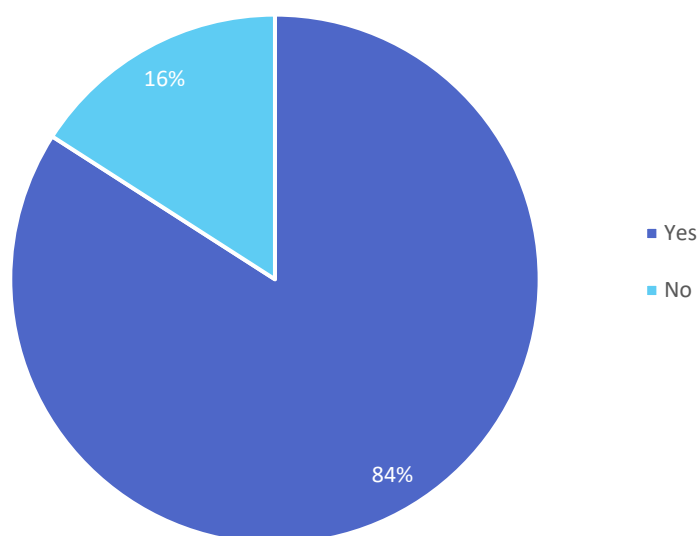


## APPENDIX B: PUBLIC SURVEY RESULTS

13. If you answered “Yes” to Question #12, please explain.

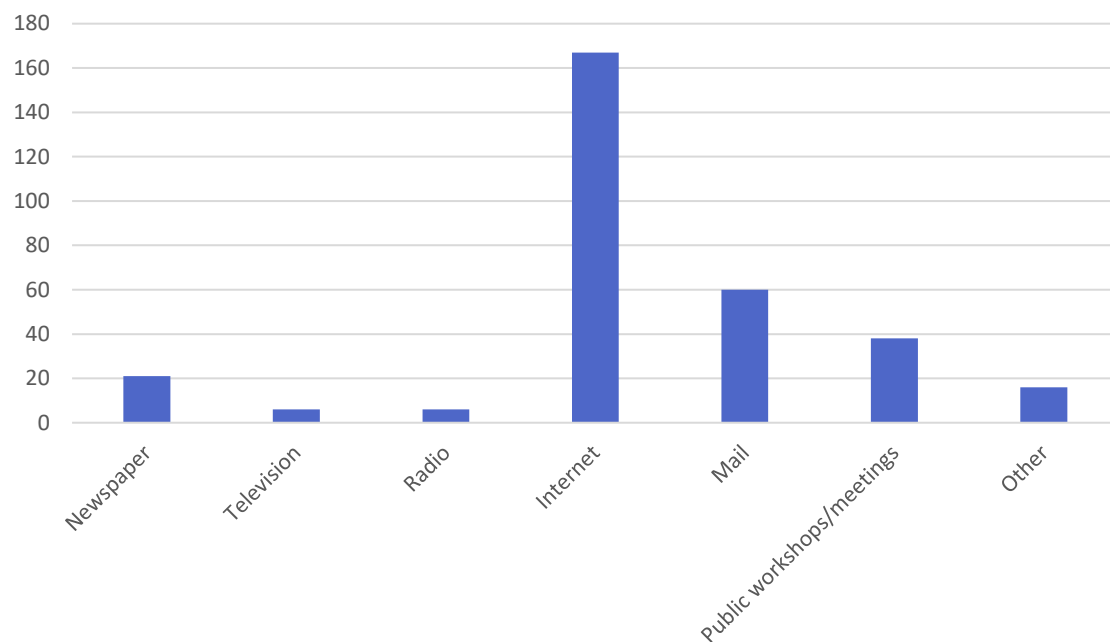


14. Are you interested in making your home or neighborhood more resistant to hazards?

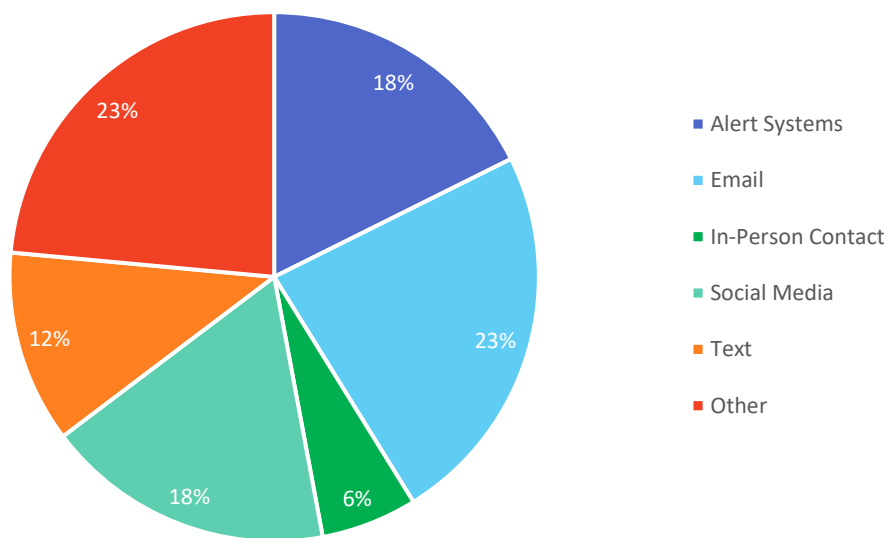


## APPENDIX B: PUBLIC SURVEY RESULTS

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



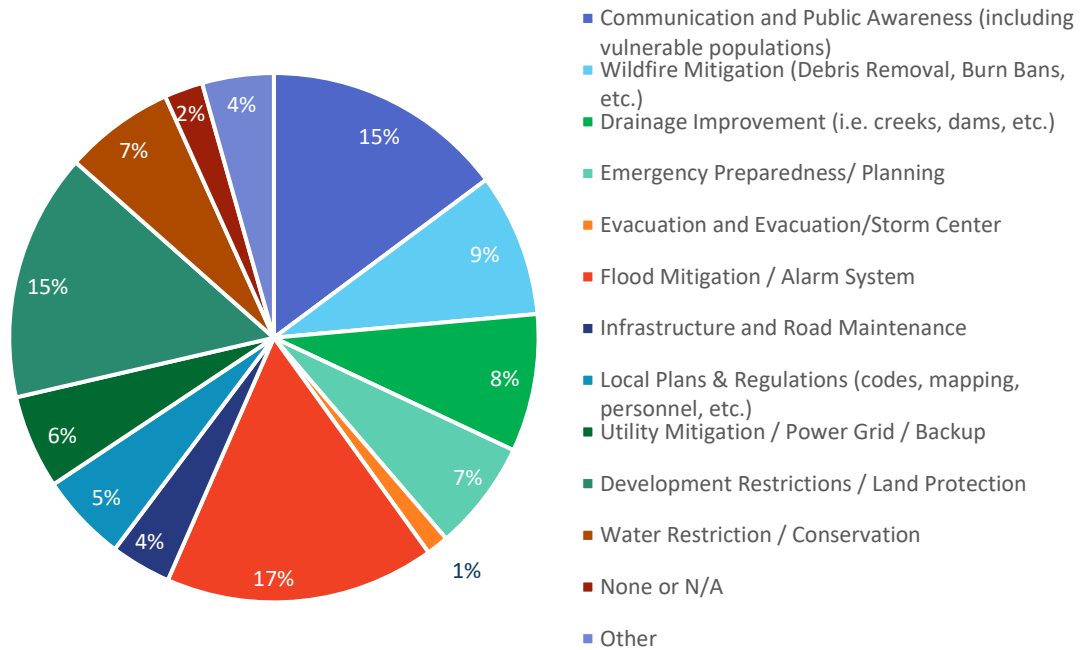
16. If you answered "Other" to Question #15, please explain.



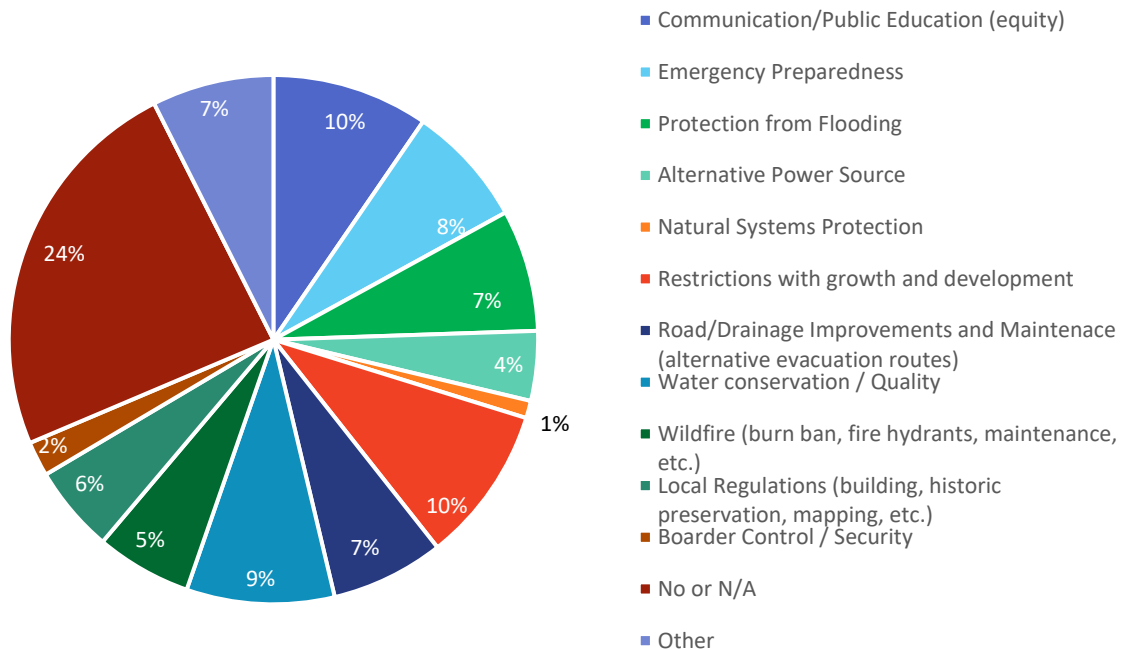


## APPENDIX B: PUBLIC SURVEY RESULTS

17. 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?

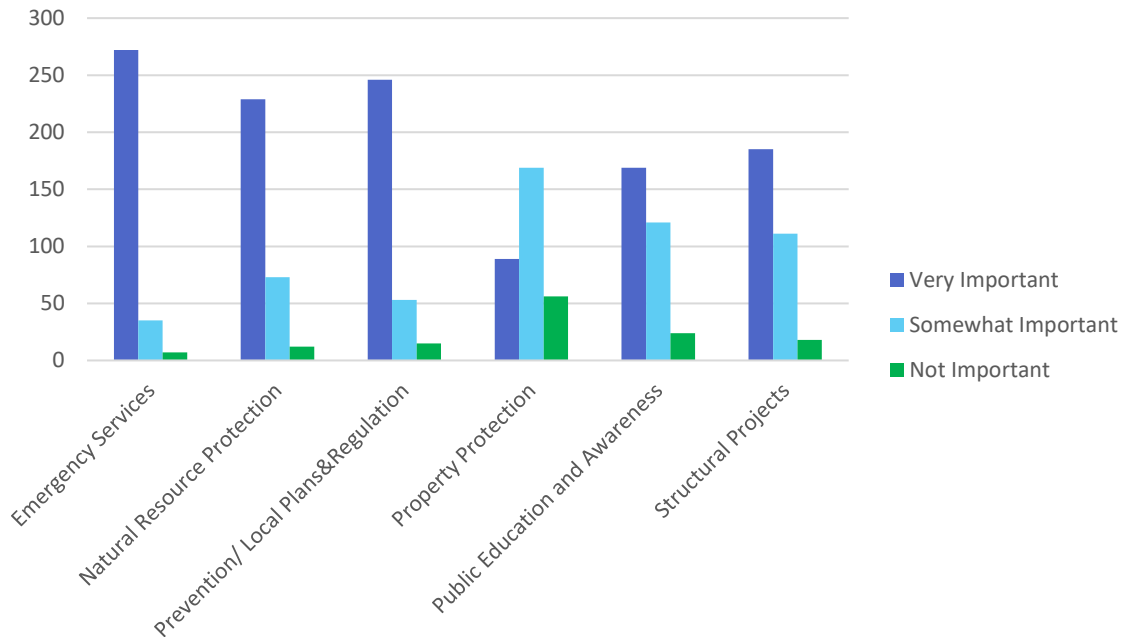


18. Are there any other issues regarding the reduction of risk and loss associated with hazards or disaster in the community that you think are important?



## APPENDIX B: PUBLIC SURVEY RESULTS

19. 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

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

# APPENDIX D: DAM LOCATIONS

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

# APPENDIX E: MEETING DOCUMENTATION

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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

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

# APPENDIX G: MANMADE HAZARDS

Overview.....	1
Hazard Profiles, Vulnerability, and Impact.....	1
Hazardous Materials.....	2
Pipeline Failure.....	6
Terrorism.....	11
Infectious Disease .....	14

## OVERVIEW

During the early stages of the planning process the team analyzed several technological hazards including Hazardous Material Incidents, Pipeline Failure, Terrorism, and Infectious Disease. A description of the hazard and Kendall County’s overall vulnerability to that hazard was developed. Annualized loss data is provided where available and impact is addressed looking at the warning time or potential speed of onset of the hazard, where appropriate.

## HAZARD PROFILES, VULNERABILITY, AND IMPACT

For each of the four technological hazards, a description of the hazard and Kendall County’s overall vulnerability to that hazard was developed. Impact is addressed looking at the warning time or potential speed of onset of the hazard. Impact statements are defined in Table A-1 below.

**Table A-1. Impact Statements**

POTENTIAL SEVERITY	DESCRIPTION
<b>Substantial</b>	Multiple deaths. Complete shutdown of facilities for 30 days or more. More than 50 percent of property destroyed or with major damage.
<b>Major</b>	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.
<b>Minor</b>	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.
<b>Limited</b>	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.

The term “technological hazards” refers to the origins of incidents that can arise from human activities such as (for the purposes of this risk assessment) the use of gas and oil pipeline and their manufacture, transportation, and storage. The use of hazardous materials across all



## APPENDIX G: MANMADE HAZARDS

industries is a technological hazard, as well as pipeline failure, infectious diseases, and acts of terrorism.

The scope of this risk assessment assumes that hazardous material incidents and pipeline failure events addressed in this section would be accidental in nature and that their consequences are unplanned and unintended.

### HAZARDOUS MATERIALS

Hazardous materials come in the form of explosives, flammable and combustible substances, poisons, and radioactive materials. A hazardous material (HAZMAT) incident involves a substance outside normal safe containment in sufficient concentration to pose a threat to life, property, or the environment.

Chemicals are found everywhere. They purify drinking water, increase crop production, and simplify household chores. But chemicals also can be hazardous to humans or the environment if used or released improperly. Hazards can occur during production, storage, transportation, use, or disposal. You and your community are at risk if a chemical is used unsafely or released in harmful amounts into the environment where you live, work, or play.

In a hazardous materials incident, solid, liquid, and/or gaseous contaminants may be released from fixed or mobile containers. This profile focuses on fixed sites. Weather conditions will directly affect how the hazard develops.

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

- The facility falls within one of the following industrial categories: manufacturing; metal mining; coal mining; electric generating facilities that combust coal and/or oil; chemical wholesale distributors; petroleum terminals and bulk storage facilities; Resource Conservation and Recovery Act (RCRA) Subtitle C Treatment, Storage and Disposal (TSD) facilities; and solvent recovery services.
- Have ten or more full-time employee equivalents.
- Manufactures or processes more than 25,000 pounds or otherwise uses more than 10,000 pounds of any listed chemical during the calendar year. Persistent, Bio-accumulative and Toxic (PBT) chemicals are subject to different thresholds of ten pounds, 100 pounds or 0.1 grams depending on the chemical.

Tier II data is a publicly available database from the Texas Department of State Health Services Tier II Chemical Reporting Program. Under EPCRA, all facilities which store significant quantities of hazardous chemicals must share this information with state and local emergency responders and planners. Facilities in Texas share this information by filing annual hazardous chemical inventories with the Texas Department of State Health Services (DSHS), Local Emergency Planning Committees (LEPCs), and local fire departments. The Texas Tier II Report contains

## APPENDIX G: MANMADE HAZARDS

facility identification information and detailed chemical data about hazardous chemicals stored at the facility.

A facility must report if it meets the following criteria:

- Any company using chemicals that could present a physical or health hazard must report them, according to Tier II requirements.
- If an industry has an Occupational Safety and Health Administration (OSHA) deemed hazardous chemical that exceeds the appropriate threshold at a certain point in time, then the chemical must be reported. These chemicals may be on the list of 356 Extremely Hazardous Substances (EHS) or could be one of the 650,000 reportable hazardous substances (not on the EHS list). This reporting format is for a "snapshot in time." EHS chemicals have to be reported if the quantity is either greater than 500 pounds, or if the Threshold Planning Quantity (TPQ) amount is less than 500 pounds.

### LOCATION

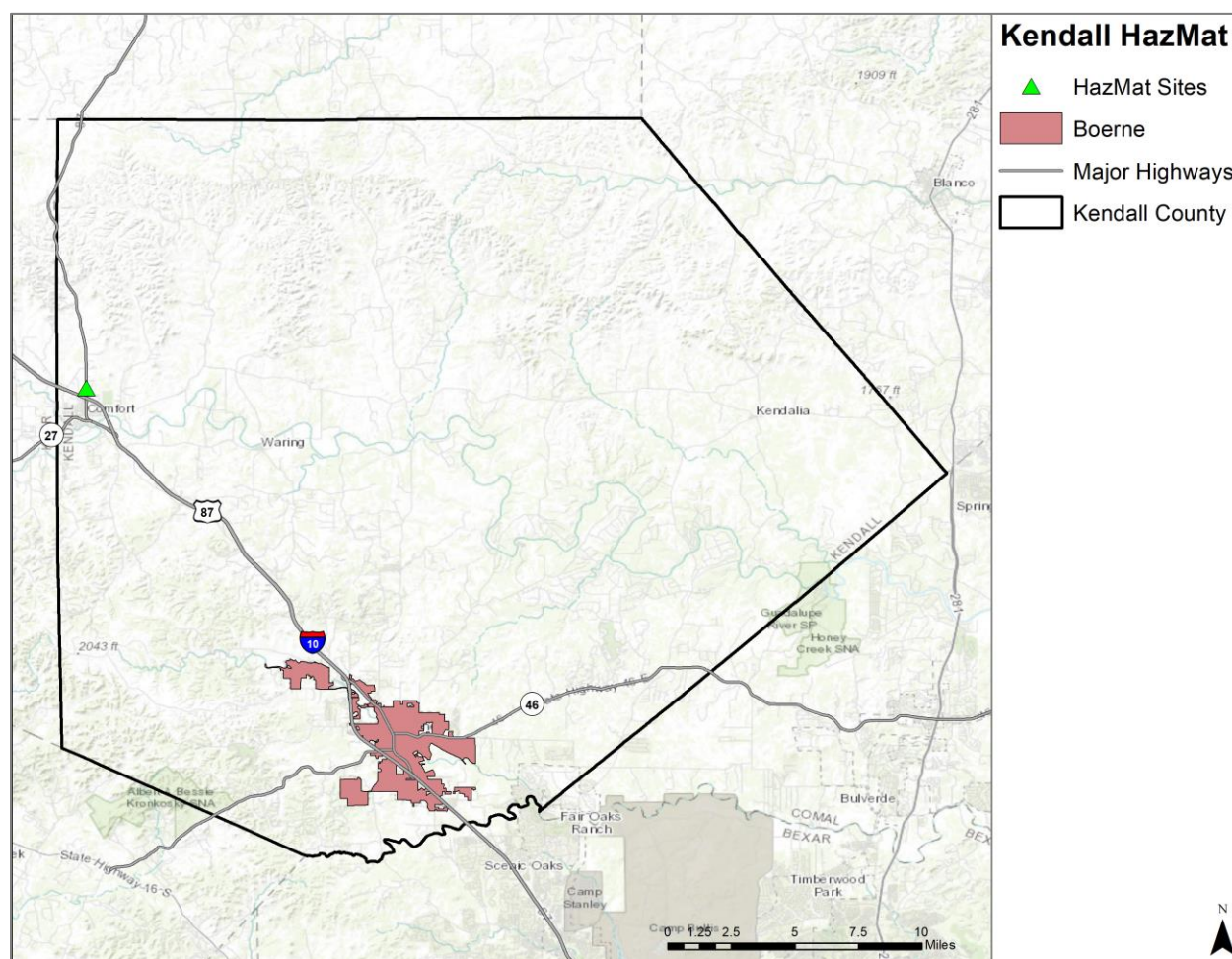
A hazardous material spill occurring along major highways near population centers in Kendall County and the City of Boerne is of concern to local emergency managers. Trains and trucks can carry a variety of materials that would, in large quantity, threaten the health and safety of people and the natural environment in the vicinity of a spill.

Under the Community Right-to-Know program laws upheld at the state and federal level, all facilities which store significant quantities of hazardous chemicals must share this information with state and local emergency responders and planners. Facilities in Texas share this information by filing annual hazardous chemical inventories with the state, with Local Emergency Planning Committees (LEPCs), and with local fire departments.

Figure A-1 shows the locations of available georeferenced TRI and Tier II toxic sites in and around Kendall County and the City of Boerne. Only toxic sites that have georeferenced data available were analyzed and the circle buffers are drawn around each hazardous material site.

## APPENDIX G: MANMADE HAZARDS

**Figure A-1. Fixed HAZMAT Analysis Locations**



### **EXTENT**

The extent of a hazardous material release will depend on whether it is from a mobile or fixed site and the size of impact. The range of intensity will vary greatly depending on the circumstances. These factors and conditions include the material, toxicity, duration of the release, and environmental conditions such as the wind and precipitation.

Hazardous materials or toxic releases can have substantial impact on communities. Such events can cause multiple deaths, completely shut down facilities for 30 days or more, and cause more than 50 percent of affected properties to be destroyed or suffer major damage. In a hazardous materials incident, solid, liquid and/or gaseous contaminants may be released from fixed or mobile containers. Weather conditions would directly affect how the hazard develops. The micro-meteorological effects on buildings and terrain can alter travel patterns and duration of agents. Shielding in the form of permanent shelter can protect people from harmful effects. Non-compliance with fire and building codes, as well as failure to maintain existing fire and containment features can substantially increase damage from a hazardous materials release. The duration of a hazardous materials incident can range from hours to days. Warning time is minimal to none.

The spatial extent of a hazardous material release is minimal or expected to affect less than 10% of people or property.

## APPENDIX G: MANMADE HAZARDS

### *HISTORICAL OCCURRENCES*

Hazardous materials are substances which if released or misused can cause death, serious injury, long-lasting health effects, and damage to structure and other properties as well as to the environment. Many products containing hazardous chemicals are used and stored in homes routinely. These products are also shipped daily on the nation's highways, railroads, waterways, and pipelines.

A total of 9 transportation incidents have been reported in Kendall County and the City of Boerne over the last 22 years. The data collected is from 1999 to 2021 and identifies the hazardous materials transportation incidents as in-transit, loading, and unloading of transport vehicles. The reported events with damages or fatalities are listed in Table A-2 below. The Planning Team also provided information that a fatality occurred many years ago, and several injuries have occurred over the years, relating to a hazardous materials event but were unable to provide the exact event information.

**Table A-2. Hazardous Material Incident Events, Kendall County**

JURISDICTION	DATE	FATALITIES	PROPERTY DAMAGE (2022 DOLLARS)
City of Boerne	3/11/1999	0	\$221,257
Kendall County	9/29/2003	0	\$705
Kendall County	7/28/2007	0	\$0
Kendall County	12/9/2012	0	\$3,878
City of Boerne	12/27/2013	0	\$12,011
City of Boerne	9/7/2014	0	\$0
Kendall County	7/12/2015	0	\$4,353
Kendall County	1/10/2018	0	\$0
Kendall County	1/11/2018	0	\$0
<b>TOTAL LOSSES</b>		<b>0</b>	<b>\$242,204</b>

Based on the list of historical hazardous materials incident events for Kendall County and the City of Boerne (listed above) 2 of the events have occurred since the 2017 Plan.

### *PROBABILITY OF FUTURE EVENTS*

Hazardous material spills are the result of human error and/or accidents, which cannot be predicted. However, given the amount of traffic through the planning area and the large population, the probability of a hazardous material spill is estimated by local officials to be probable in any given year. Nevertheless, most spills will not lead to negative health and safety impacts and will not cause substantial negative impacts on the air, soil, or groundwater. The probability of a spill threatening the health of thousands and of having long-term negative environmental consequences is, based on previous experience, estimated to be less than 1 percent in any given year.

## APPENDIX G: MANMADE HAZARDS

Based on the historic incident records and team input, the frequency of occurrence for significant hazard material incidents is considered “Highly Likely” and an event can be expected in the next year for the Kendall County planning area.

### VULNERABILITY AND IMPACT

Based on the prevalence and geographic proximity of hazardous materials transportation routes and fixed locations, less than half of the Kendall County planning area is vulnerable. The risk to the population depends on a variety of factors, including type and amount of chemical released, weather conditions, prevailing winds, time of day, and season. The environment is often vulnerable in a hazardous materials incident and can be heavily damaged by a hazardous materials incident.

It is anticipated that Kendall County and the City of Boerne could anticipate an impact of limited with critical facilities shut down for 24 hours or less, and less than 10 percent of property would be destroyed or damaged. However, with a reported fatality and several injuries historically, the potential impact is conserved “Substantial” with multiple deaths possible depending on the size of the event.

### ASSESSMENT OF IMPACTS

It is possible that a hazardous materials incident could involve a number of fatalities. It is likely that inhaled hazardous gasses may result in respiratory problems, including burning sensations in the lungs, nose, and throat. Releases that involve solids or liquids can be absorbed through the skin and may cause burns on contact. In some instances, the threat to health and safety may not be evident for an extended period of time.

The particular transportation route and fixed site involved are significant factors in determining the risk to public health and safety and will determine the number of people in proximity to the hazard. Depending on the nature of the hazardous materials incident, the public could be required to either evacuate the area or shelter in place, which will interrupt normal routines.

### PIPELINE FAILURE

Energy pipeline breach or pipeline failure of an oil or natural gas pipeline is a serious hazard event. An estimated 2.4 million miles of pipelines in the United States carry hazardous materials. Natural gas pipelines transport natural gas and oil. Liquid petroleum pipelines transport crude oil and refined products from crude oils, such as gasoline, home heating oil, jet fuel, kerosene, liquefied propane, ethylene, butane and petrochemical products. Oil pipelines can also transport liquefied gases, such as carbon dioxide.



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

### LOCATION

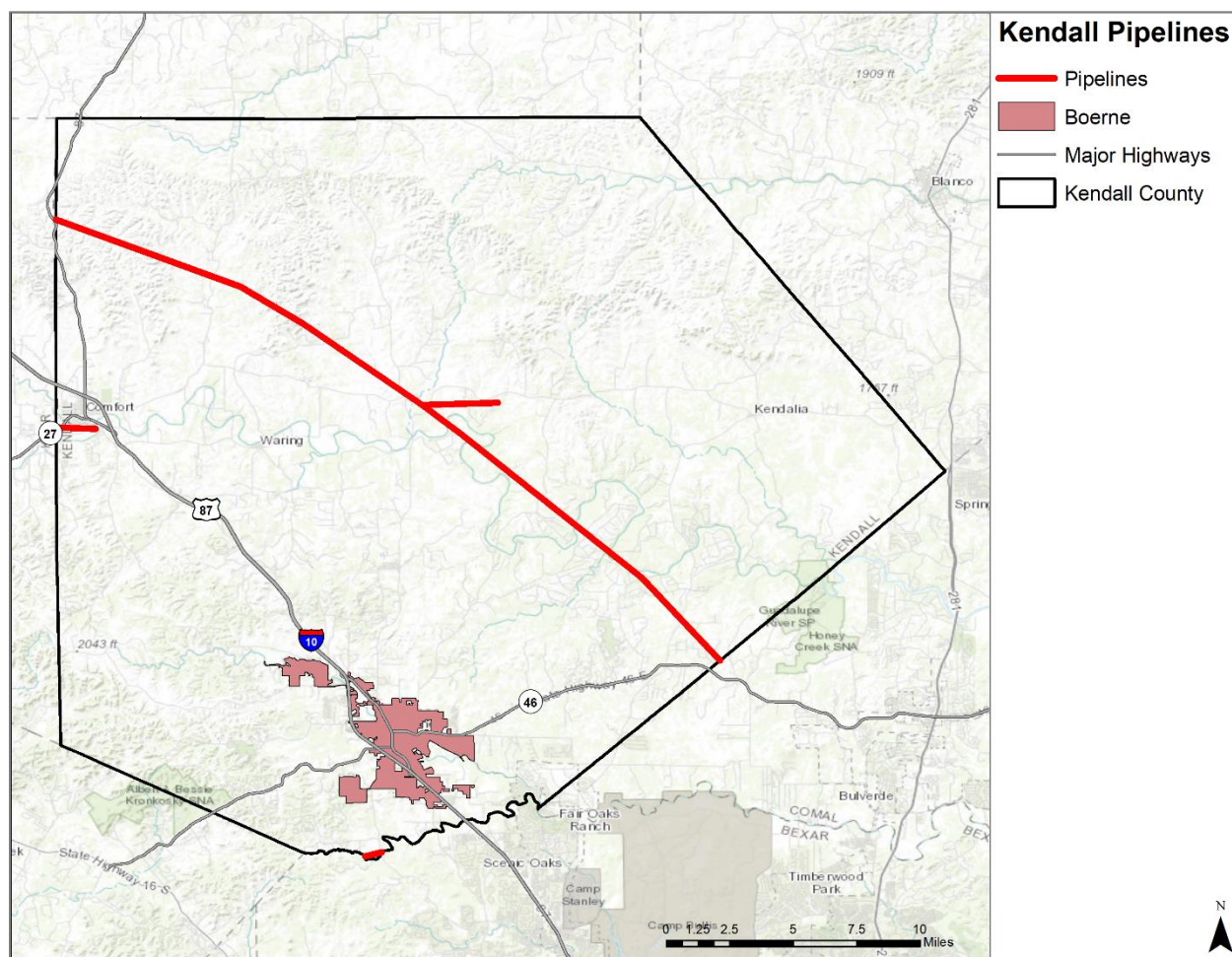
Figure A-2 shows the location of gas and oil energy pipelines in the Kendall County planning area according to the Pipeline and Hazardous Materials Safety Administration and Railroad



## APPENDIX G: MANMADE HAZARDS

Commission of Texas. While the pipelines are shown by geographical location it is important to note that all participating jurisdictions can be impacted by pipeline failure.

**Figure A-2. Kendall County Planning Area Pipeline Locations**



### EXTENT

The U.S. Department of Transportation's (DOT) Pipeline and Hazardous Material Safety Administration (PHMSA), acting through the Office of Pipeline Safety (OPS), administers the Department's national regulatory program to assure the safe transportation of natural gas, petroleum, and other hazardous materials by pipeline. The OPS develops regulations and other approaches to risk management to assure safety in design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. Since 1986, the pipeline safety program has been funded by a user-fee assessed on a per-mile basis for all pipeline operators that OPS regulates.

### HISTORICAL OCCURRENCES

Pipeline failure events can be caused by corrosion, equipment failure, damage from excavations, incorrect operation, and natural forces. Incidents are generally categorized by severity and type of affected pipeline system component.

The PHMSA defines significant events as those incidents reported by pipeline operators when any of the following occur:

## APPENDIX G: MANMADE HAZARDS

- Fatality or injury requiring in-patient hospitalization;
- \$50,000 or more in total costs, measured in 1984 dollars;
- Highly volatile liquid releases of 5 barrels or more or other liquid releases of 50 barrels or more; and
- Liquid releases resulting in an unintentional fire or explosion.

The PHMSA defines a serious pipeline incident as an event involving a fatality or injury requiring in-patient hospitalization.

There have been no historical pipeline events for the Kendall County planning area.

### *PROBABILITY OF FUTURE EVENTS*

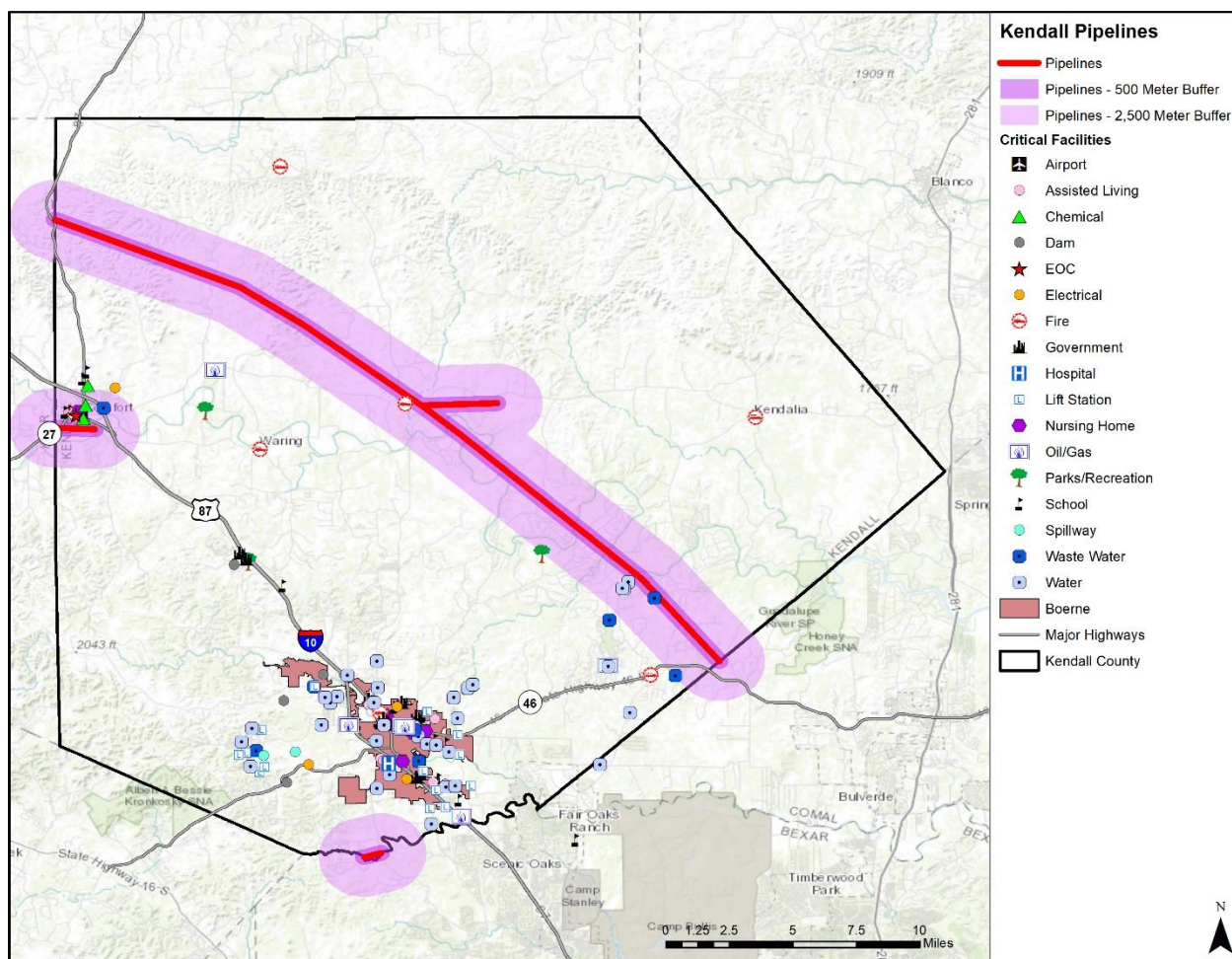
According to the historical incident data, a pipeline incident for Kendall County and the City of Boerne is Unlikely, and an event is probable on average once every ten years.

### *VULNERABILITY AND IMPACT*

The analysis for gas pipelines is for natural gas and the analysis for oil pipelines is for natural gas liquids. The immediate and primary area of impact for both types of pipeline events is a 500-meter buffer. The secondary area of impact for both types of pipeline events is a 2,500-meter buffer. Figure A-3 shows the pipeline buffer areas. Both types of impact can inflict substantial damage on the surrounding areas. Pipeline breaches have the potential to cause multiple deaths and complete shutdown of facilities for 30 days or more.

## APPENDIX G: MANMADE HAZARDS

**Figure A-3. Pipeline Location with 500- and 2,500-meter buffer**



Based on historic incidents, pipeline failure can have a “minor” impact on human health and area properties. Pipeline failure events can cause injuries and illnesses that do not result in permanent disability. These events can also cause facilities in the Kendall County planning area to shut down for approximately one week and cause more than ten percent of affected properties to be destroyed or suffer major damage.

The following facilities in Table A-3 are located within the 500 meter buffer zone and facilities in the Table A-4 are located within the 2,500 meter buffer zone for the pipelines located in the planning area and are considered vulnerable in the event of a pipeline failure.

**Table A-3. Facilities within 500 Meter Buffer Zone**

JURISDICTION	FACILITY NAME	ADDRESS	TYPE
County	GBRA	2393 Rio Cordillera	Wastewater
County	Sisterdale VFD	1207 FM 1376	Fire Station



## APPENDIX G: MANMADE HAZARDS

**Table A-4. Facilities within 2,500 Meter Buffer Zone**

JURISDICTION	FACILITY NAME	ADDRESS	TYPE
County	Comfort Elementary	605 3rd St	School
County	Comfort Helipad	618 Front St	EOC
County	Comfort Middle School	216 High St	School
County	Comfort VFD	224 FM 473	Fire
County	GBRA		Water
County	GBRA		Water
County	GBRA	110 Riverwood	Water
County	GBRA	2393 Rio Cordillera	Wastewater
County	GBRA	45 Voss Pkwy	Wastewater
County	James Avery Craftsman	29 US Hwy 87	Chemical
County	JP Precinct 4 / Constable	105A Amber Dr	Government
County	Kendall County WCID#1	10 FM 473	Wastewater
County	Lindner Feed	818 Front St	Chemical
County	Sisterdale VFD	1207 FM 1376	Fire
County	Trinity Nursing	615 Faltin St	Nursing Home

### ASSESSMENT OF IMPACTS

The risk to public health and safety during a pipeline failure event depends on a number of factors, including the type and amount of chemical(s) involved, location, weather conditions, time of day, and presence of an ignition source. The location of pipelines determines the potential number of people in proximity to the hazard and is a significant factor when determining the risk to public health and safety. It is possible that a release of materials from a pipeline failure could involve a number of fatalities. It is likely that inhaled hazardous gases may result in respiratory problems, including burning sensations in the lungs, nose, and throat. A release of solids or liquids can be absorbed through the skin and may cause burns on contact. In some instances, the threat to health and safety may not be evident for an extended period of time.

Depending on the nature and extent of a pipeline failure, the public could be required to either evacuate the area or shelter in place, which will interrupt normal routines. Response personnel are also at risk from more concentrated or prolonged exposure to the agent involved in the event. Through response efforts, response personnel may respond and come in contact with hazardous substances before the nature of the hazard is determined. Response personnel also have a greater likelihood of impacts from secondary explosions or leaks.

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Generally, pipeline failure events will interrupt operations and services within a limited area. The nature of the interruption will depend on the facilities in the impacted area. For example, if the event results in the temporary closure or evacuation of a hospital, this will also impact all hospitals in the area because area hospitals may be expected to assume the patient load for the now-inaccessible facility. However, if the event is near non-essential businesses, the operational or service interruption might not be as far-reaching. While the closure of businesses would result in negative impacts for those businesses, this scenario would not have the same community impacts as the first example.

Damage to roadways, railways, and physical infrastructure resulting from a pipeline failure event can impair normal operations and delivery of services.

During a pipeline failure event, the pressure in a pipeline can disrupt the soil above a break. Any facility or piece of infrastructure over or adjacent to a rupture could be damaged or destroyed. If gas ignites, it will set flammable objects near it on fire. Depending on environmental factors such as wind, proximity of vegetation or other fuels, and dryness of the environment, the fire could spread to other nearby structures damaging or destroying them.

Any infrastructure in the area of the incident could be impacted by a pipeline failure event. Gas lines, water lines, sewer lines, and communication lines can be interrupted or destroyed, depending on the nature of the event. If the event is significant enough, utilities in the area may need to be temporarily suspended or disconnected, which would impact multiple facilities and properties.

Environmental risks from pipeline failure events can range from nonexistent to catastrophic, depending on the nature and extent of the release.

### TERRORISM

The Federal Bureau of Investigation (FBI) categorizes terrorism in the United States as one of two types—domestic terrorism or international terrorism. Domestic terrorism involves groups or individuals whose terrorist activities are directed at elements of our government or population without foreign direction. International terrorism involves groups or individuals whose terrorist activities are foreign-based and/or directed by countries or groups outside of the United States, or whose activities transcend their national boundaries.

A terrorist attack can take several forms, depending on the technological means available to the terrorist, the nature of issue motivating the attack, and the points of weakness of the terrorist's target. Bombings are the most frequently used terrorist method in the United States. A terrorist using a chemical or biological weapon is of particular concern to officials. Special training and equipment is needed in order to safely manage a Weapons of Mass Destruction incident.

Biological agents are infectious microbes or toxins used to produce illness or death in people, animals or plants. Biological agents can be dispersed as aerosols or airborne particles. Terrorists may use biological agents to contaminate food or water, as they are extremely difficult to detect.

Chemical agents kill or incapacitate people, destroy livestock, or ravage crops. Some chemical agents are odorless and tasteless and are therefore difficult to detect. These chemical agents can have an immediate effect (a few seconds to a few minutes) or a delayed effect (several hours to several days).

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The Department of Defense estimates that as many as 26 nations may possess chemical agents and/or weapons, and an additional 12 may be seeking to develop them. The Central Intelligence Agency reports that at least 10 countries are believed to possess or are currently conducting research on biological agents for weaponization.

Terrorist incidents – as with other natural and technological disasters – involve the application of one or more modes of harmful force to the built environment. These modes include contamination (as in the case of chemical, biological radiological or nuclear hazards), energy (explosives, arson, and even electromagnetic waves), or denial of service (sabotage, infrastructure breakdown, and transportation service disruption).

### LOCATION

There is no distinct geographic boundary to the threat of terrorism. An event is possible throughout Kendall County and the City of Boerne.

### EXTENT

The Homeland Security Advisory System, issued by the U. S. Department of Homeland Security, previously used a color-coded terrorism warning system that identified five threat levels. In 2011, the Department of Homeland Security (DHS) replaced the color-coded alerts of the Homeland Security Advisory System (HSAS) with the National Terrorism Advisory System (NTAS), designed to more effectively communicate information about terrorist threats by providing timely, detailed information to the American public.

NTAS now consists of two types of advisories: Bulletins and Alerts. DHS has added Bulletins to the advisory system to be able to communicate current developments or general trends regarding threats of terrorism. NTAS Bulletins permit the Secretary to communicate critical terrorism information that, while not necessarily indicative of a specific threat against the United States, can reach homeland security partners or the public quickly, thereby allowing recipients to implement necessary protective measures. Because DHS may issue NTAS Bulletins in circumstances not warranting a more specific warning, NTAS Bulletins provide the Secretary with greater flexibility to provide timely information to stakeholders and members of the public.

When there is specific, credible information about a terrorist threat against the United States, DHS will share an NTAS Alert with the American public when circumstances warrant doing so. The Alert may include specific information, if available, about the nature of the threat, including the geographic region, mode of transportation, or critical infrastructure potentially affected by the threat, as well as steps that individuals and communities can take to protect themselves and help prevent, mitigate or respond to the threat. The Alert may take one of two forms: Elevated, if there is credible threat information, but only general information about timing and target such that it is reasonable to recommend implementation of protective measures to thwart or mitigate against an attack; or Imminent, if the threat is believed credible, specific, and impending in the very near term. Terrorism Advisory System Alerts are described in Figure A-4.<sup>1</sup>

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<sup>1</sup> Source: Department of Homeland Security, <https://www.dhs.gov/national-terrorism-advisory-system>

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**Figure A-4. National Terrorism Advisory**



Red Cross also issues Advisory System Recommendations for individuals, families, neighborhoods, schools and businesses for each alert level. These may be found at: [www.redcross.org](http://www.redcross.org).

Heightened periods for terrorism risk are based on intelligence and other information. A potential terrorist event could devastate the community physically, economically and psychologically for many years to come. Warning time for terrorism is minimal to none.

### ***HISTORICAL OCCURRENCES***

The history of terrorism on United States soil includes the attacks of September 11, 2001, on the World Trade Center in New York and the Pentagon in Washington, D.C. and the ensuing anthrax attacks; the 1995 bombing of the Murrah Federal Building in Oklahoma City; and the bombing of the World Trade Center in 1993.

Kendall County planning area has not experienced a terrorist act. While complete prevention of an attack may not be attainable, the County and City of Boerne can lessen the likelihood and/or the potential effects of an incident. The County and City continues to improve its readiness to

## APPENDIX G: MANMADE HAZARDS

respond to a terrorist incident through participation in state and federal programs that provide training and equipment for agencies that would respond to a local terrorist incident, and in exercises that help to improve agency coordination and test local response plans.

### *PROBABILITY OF FUTURE EVENTS*

The types, frequencies, and locations of many natural hazards are identifiable and, even in some cases, predictable, as the laws of physics and nature govern them. Malevolence, however, cannot be forecast with any accuracy. There is, therefore, some potential for most, if not all, types of intentional terrorist acts to occur anywhere and at any time.

### *VULNERABILITY AND IMPACT*

There is no defined geographic boundary for a terrorist event. All of the population, buildings, critical facilities, infrastructure and lifelines and hazardous materials facilities are considered exposed to the hazards of terrorism and could potentially be affected.

There are no past local events. Therefore, all assets and facilities are potentially at risk to damages that may, for the most part, be secondary.

Terrorist events can have a “substantial” severity of impact. They can cause multiple deaths, completely shut down facilities for 30 days or more, and cause more than 50 percent of affected properties to be destroyed or suffer major damage.

### *INFECTIOUS DISEASE*

An infectious disease is as a clinically evident disease resulting from the presence of pathogenic microbial agents. According to FEMA, infectious diseases are a major threat around the world, killing millions globally each year. Transmission of an infectious disease may occur through one or more means including physical contact with infected individuals. These infecting agents may also be transmitted through liquids, food, bodily fluids, contaminated objects, airborne inhalation or through vector-borne dissemination.

There are three classifications of disease impacts: endemic, epidemic, and pandemic. An endemic is always present at a low frequency, such as chicken pox in the United States. An epidemic is a sudden severe outbreak of disease, such as the bubonic plague during Medieval Times. A pandemic is an epidemic that becomes very widespread and affects a whole region, a continent, or the world, for example the 1957 flu pandemic caused at least 70,000 deaths in the United States and one to two million deaths worldwide. In recent years, fears of pandemic have risen because the globalized economy and growing population fosters large scale international travel and trade. Growing populations increase the vulnerability of all areas to disease because a denser population increases the risk of exposure to an infectious disease and advances the spread of infection.

The top 10 infectious diseases according to the World Health Organization (WHO) based upon number of deaths are presented in Table A-5.

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**Table A-5. Worldwide Mortality Due to Infectious Disease<sup>2</sup>**

RANK	CAUSE OF DEATH	APPROXIMATE WORLDWIDE DEATHS IN 2018
1	Lower Respiratory Infections	4.4 million
2	Diarrheal diseases	3.1 million
3	Tuberculosis (TB)	3.1 million
4	Malaria	2.1 million
5	Hepatitis B	1.1 million
6	HIV/AIDS	1.0 million
7	Measles	1.0 million
8	Tetanus	160,000
9	Whooping Cough	355,000
10	Intestinal Worm Disease	135,000

While all of these diseases are monitored by Kendall County and the City of Boerne on a regular basis, the primary disease of concern at the time of this planning process was the Coronavirus disease (COVID-19) due to its rapid spread and impact on the global economy.

Coronavirus disease (COVID-19) is an infectious disease caused by a recently discovered new strain of coronavirus. Most people infected with the COVID-19 virus will experience mild to moderate respiratory illness and recover without requiring special treatment. Older people, and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illness.

The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes, so it's important that you also practice respiratory etiquette (for example, by coughing into a flexed elbow). Many months into the COVID-19 pandemic, the coronavirus is still spreading uncontrolled through the country and throughout the world. Public health authorities including the U.S. Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) recommend citizens to remain six feet apart, wash hands frequently, disinfect frequently touched surfaces, and wear masks. There is a growing school of evidence that COVID-19 cases are transmitted through aerosols (sometimes referred to as airborne).

Approximately twelve months prior to drafting of this plan, three vaccines for COVID-19 were approved by the Food and Drug Administration (FDA). To date more than 58% of Texans have been fully vaccinated against the virus. Similar to communities around the globe, Kendall County

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<sup>2</sup> Source: World Health Organization

## APPENDIX G: MANMADE HAZARDS

has been dramatically impacted by this virus with 9,425 confirmed cases and 128 related deaths.<sup>3</sup> The economic impact of the virus has been devastating for the planning area. The planning area continues to slowly recover from the effects of the pandemic but, economic recovery is likely to take years. The COVID-19 infection was declared a pandemic by the World Health Organization on March 11, 2020.

The CDC contains the latest information and guidance on the COVID-19 pandemic and provides recommendations on protecting citizens and reducing the spread of the disease

### LOCATION

Pandemics are random and only a few happen every century. The impacts from an infectious disease event can affect all areas of the world, therefore all areas are vulnerable, as evidenced by the current COVID-19 pandemic. Since air travel and worldwide shipping have increased, it has become increasingly difficult to contain localized outbreaks as infected or exposed people travel across the globe in a matter of hours. Third world countries have fewer resources to fight disease and may be more vulnerable than more industrialized nations. In the United States, the U.S. public health system works at the federal, state and local level to monitor diseases, plan and prepare for outbreaks, and prevent epidemics where possible.

There is no distinct geographic boundary to infectious disease, therefore, it can occur throughout Kendall County and the City of Boerne.

### EXTENT

The severity of a pandemic virus can be evaluated from the perspective of the individual who has been infected; or from the population level, how many complications and deaths might be expected as a whole. The most common measure of severity for a pandemic virus event is the case-fatality rate (CFR) as depicted in Figure A-5.

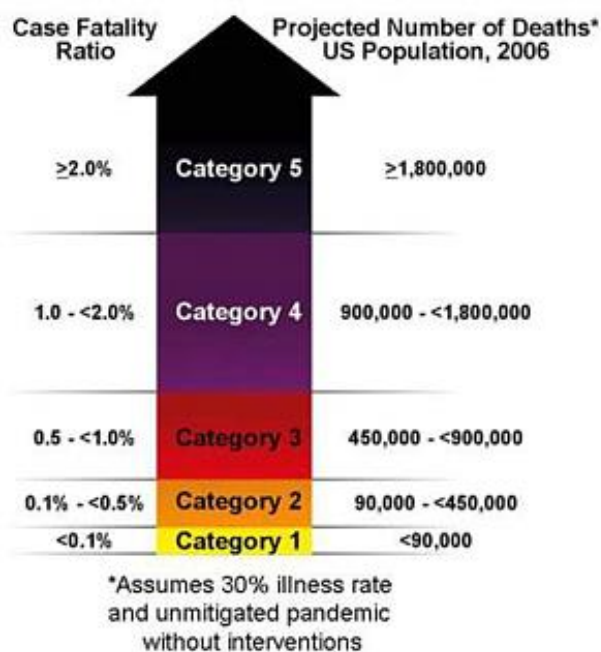
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<sup>3</sup> The number of confirmed cases and related deaths from COVID-19 as of October 2022.  
<https://usafacts.org/visualizations/coronavirus-covid-19-spread-map/state/texas/county/kendall-county>



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**Figure A-5. Case-Fatality Rate for Severity**



The magnitude of a pandemic event is identified in terms of warning levels based on population. Figure A-6 illustrates the various warning levels for pandemic. The current COVID-19 pandemic warning level is at Phase 6.

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**Figure A-6. Risk levels for Pandemic (World Health Organization)**



### **HISTORICAL OCCURRENCES**

Occurrences of a biological event hazard are fairly common. Historically, there have been a number of *E. coli* and similar outbreaks traced to issues or deficiencies in the nation's food supply. In Texas, there have been several occurrences of biological hazards, as reported by the Center for Disease Control (CDC). From 2011 to 2015, the average number of *E. coli* outbreaks in Texas was 563 cases per year. In 2017, there was the largest mumps outbreak with 470 cases in Texas since 1990.

In March of 2009, a novel strain of Influenza A (H1N1 or "Swine Flu") virus was detected in Mexico and the United States. The virus spread worldwide. Final infection estimates were published in 2011. These final estimates were that from April 12, 2009 to April 10, 2010 approximately 60.8 million cases, 274,304 hospitalizations, and 12,469 deaths occurred in the United States due to H1N1<sup>4</sup>. The most commonly reported symptoms include cough, fever, sore throat, and gastrointestinal symptoms, such as vomiting and diarrhea. Most individuals infected with H1N1 did not require hospitalization and had symptoms that lasted four days.<sup>5</sup>

<sup>4</sup> SDS website: [https://www.cdc.gov/h1n1flu/estimates\\_2009\\_h1n1.htm](https://www.cdc.gov/h1n1flu/estimates_2009_h1n1.htm)

<sup>5</sup> Carrat, F. et al. Timelines of Infection and Disease in Human Influenza: A Review of Volunteer Challenge Studies. American Journal of Epidemiology, 2008, 167: 775–785.

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COVID-19 is the disease caused by a new strain of coronavirus called SARS-CoV-2. The World Health Organization (WHO) first learned of this new strain of virus on December 31, 2019, following a report of a cluster of cases of 'viral pneumonia' in Wuhan, People's Republic of China. The virus quickly spread worldwide in the early spring of 2020. Since the early spring of 2020, 9,425 number of COVID-19 cases have been reported for the planning area with 128 associated fatalities.<sup>6</sup> The disease has been associated with a long list of potential symptoms, the worst of which are significant respiratory issues that can lead to death. Most individuals infected with COVID-19 did not require hospitalization. While the length of symptoms is still being studied, most patients experience symptoms for a few days to one week but can be infections for up to fourteen days, even after symptoms have subsided.<sup>7</sup>

### PROBABILITY OF FUTURE EVENTS

Epidemics and pandemics have occurred in human and animal populations for thousands of years. As humans began to gather and congregate in urban areas, the potential for pandemics and epidemics increased. As trade routes became established and contact with other cities became more frequent, the potential for transmission of illnesses increased. In modern society, the ease of global travel has created a situation where viruses and bacteria can spread quickly from one continent to another.

Historical evidence shows that the population of Kendall County and the City of Boerne is vulnerable to disease outbreak, and the probability of future infectious disease or pandemic events is possible. Local public health officials maintain surveillance in hopes of identifying disease prominence and containing potential threats before they become epidemics. Of concern is the reduction and treatment of COVID-19.

With the current COVID-19 pandemic, the probability of an infectious disease epidemic or pandemic in Kendall County and the City of Boerne is unlikely and an event has the probability of occurring once every ten years or more. At the time this plan was being developed, the Kendall County planning area was still suffering the impacts of the 2020 World Pandemic of COVID-19.

### VULNERABILITY AND IMPACT

Estimated potential losses to the built environment are difficult to calculate because infectious disease causes little damage to the built environment and generally losses are experienced through public health response and medical costs, and lost wages of patients. Therefore, it is assumed that all buildings and facilities are exposed to disease but would experience negligible damage in the occurrence of an outbreak event. For example, upkeep and maintenance of buildings and facilities would fall behind due to the high absenteeism of employees or the closing of facilities.

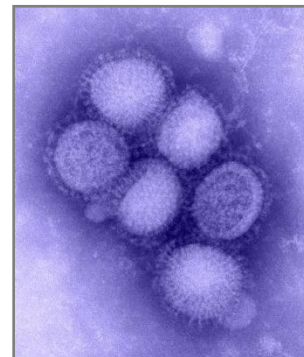
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<sup>6</sup> The number of confirmed cases and related deaths from COVID-19 as of October 31, 2022.

<sup>7</sup> University of Maryland Medical System: <https://www.umms.org/coronavirus/what-to-know/treat-covid-at-home>

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Critical infrastructure services, such as emergency services, utility services, water services and telecommunications can be limited by an infectious disease event. With the COVID-19 pandemic, most of the people affected have mild illness and do not require hospitalization. People at the highest risk for developing complications from COVID-19 include adults 60 years of age and older. In addition, people who have medical conditions, such as heart disease; chronic lung disease; blood, endocrine, kidney, liver or metabolic disorders; obesity, or a weakened immune system, can experience a worsening of existing conditions if they contract the COVID-19.



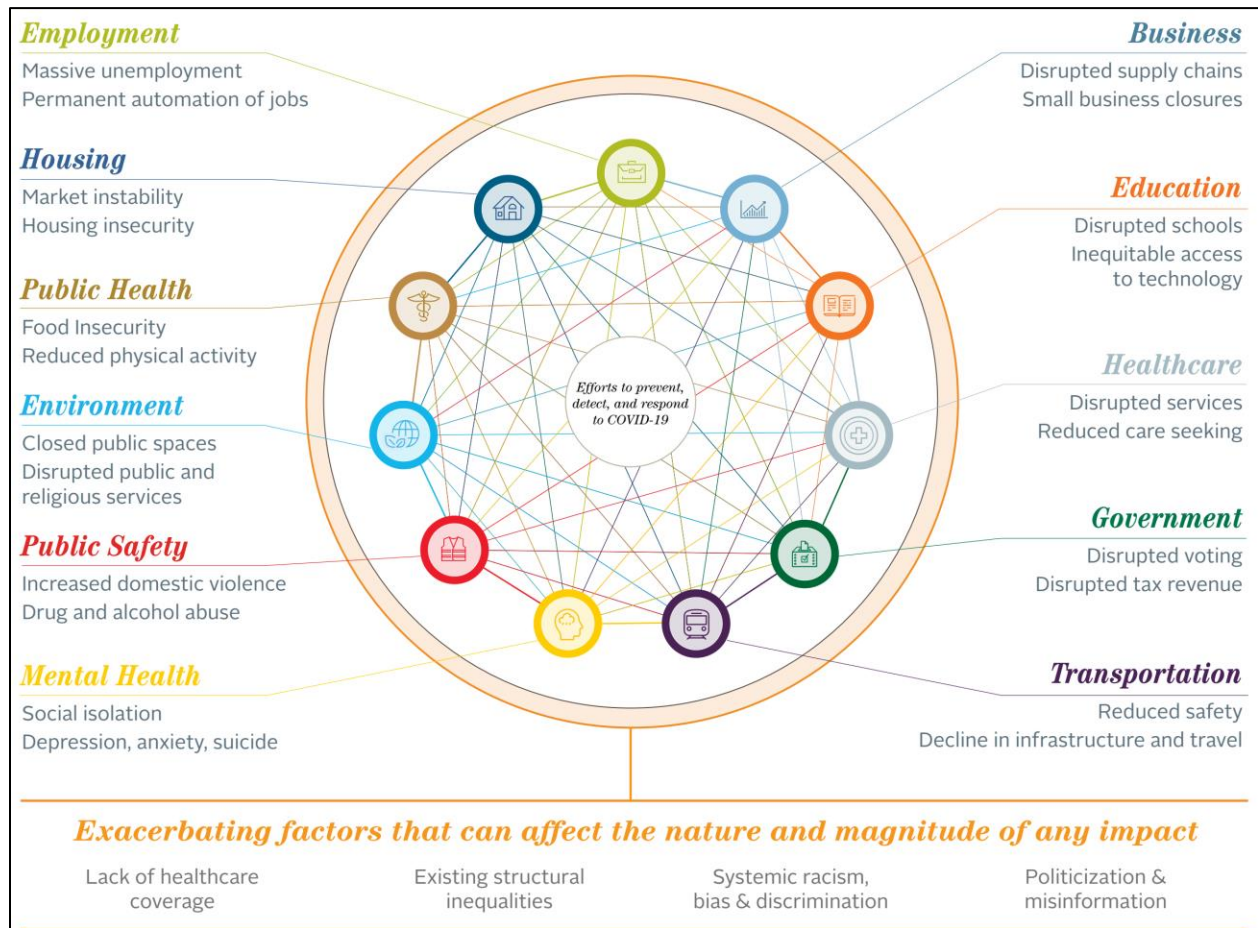
The current COVID-19 pandemic has demonstrated that the response costs to the public health sector for an outbreak, the economic impact, and the impact to health as a whole for Kendall County and the City of Boerne is “Substantial.” Multiple deaths can be expected, and Kendall County and City of Boerne facilities could be shut down for at least 4 weeks. Property damage could result from high absenteeism of persons responsible for property management.

Kendall County and the City of Boerne executed a mandatory shutdown of non-essential businesses for three weeks as a direct result of COVID-19. The gradual re-opening of businesses and restaurants was completed in incremental stages to try and limit the spread of the infection and protect consumers while restarting the economy. Larger gatherings of people were limited to 50 and below and at times to 10 and below. Area school districts closed all campuses and implemented remote learning in the spring of 2020 and for the first weeks of the 2020-2021 school year. At the time of the drafting of this plan, in-person and remote learning was on-going with contact tracing for infected students.

The impacts of COVID-19, the mandatory shutdown, large gathering limits, ISD closures and pervasive unemployment have led to extensive secondary impacts. Figure A-7 provides an overview of secondary impacts of COVID-19 in the United States.

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**Figure A-7. Secondary Impacts of the COVID-19 Pandemic in the United States**



### ASSESSMENT OF IMPACTS

Pandemics impact larger than normal segments of the population, and few sectors of the population are left untouched by infectious disease, as evidenced by the current pandemic. The physical problems associated with the infectious disease may be short term or may lead to long-term physical maladies.

The impact of an infectious disease event will be measured by the number of fatalities, how the community is affected, and to what extent. If a large number of people get sick simultaneously, major social consequences will occur. Absenteeism in the workplace can have negative impacts on the overall functioning of society, particularly if it is prolonged.

The risks to public health and safety include first responders and others with increased exposure to the disease. Response personnel likely to experience the greatest impact would be those with medical responsibilities, such as fire fighters, ambulance workers, and clinic and hospital personnel. Response personnel could be in frequent contact with those who are either sick or infected and are prone to suffer proportionally higher impacts as a result.

Depending on the severity of the infectious disease event, there could be serious problems with continuity of operations and delivery of services. If county or city staff stay home due to illness, someone in their home is ill, or because they fear becoming ill, the ability of local government to maintain operations and deliver services could be seriously limited or compromised. A pandemic

## APPENDIX G: MANMADE HAZARDS

illness that impacts county and city staff could have significant negative impacts, particularly for departments that do not have or exercise a Continuity of Operations Plan (COOP). Without a COOP that takes into account department-specific issues, or regular exercise of that COOP, critical departments may not be able to function and provide necessary services.

A pandemic event may result in heightened stress for responders, health care providers, public health workers, individuals, and communities. A vital part of pandemic planning is the development of strategies and tactics to address these potential problems. Psychological health resources should be provided to ensure that special populations are identified prior to the event and that unique service and transportation needs are incorporated into the local pandemic influenza emergency management plan. Stress management support to those who are symptomatic, those who believe they are ill, and to staff who are dealing with the increased workloads and personal concerns will be required. The public will require information on how to recognize and cope with the short- and long-term risks of sustained stress during mass vaccinations, for those debilitated by an illness, and their caregivers.

An infectious disease hazard affects living beings, therefore the vulnerability of property to an infectious disease event is minimal. Pandemics are unlikely to directly result in physical damage to the built environment. However, there is the possibility of indirect damage resulting from staff absenteeism and lack of routine operations and maintenance. Increased absenteeism of maintenance staff could result in reduced maintenance operations, which could negatively impact the operation of the system.

Human infectious diseases do not normally pose a risk to the natural environment. Infectious diseases tend to be specific to humans, and therefore pose little threat to the natural environment or non-mammalian species. However, certain exceptions exist including the avian flu, which can affect both birds and humans. It is possible that other pathogens may affect more than one species, but those pathogens would likely be limited to specific species.

Seasonal flu occurs annually and is estimated to cost the U.S. economy between \$71 million and \$167 million per year.<sup>8</sup> Severe pandemics have been predicted to cause more than \$700 billion in economic losses, and to result in a 5.5% decrease in U.S. Gross Domestic Product (GDP).<sup>9</sup>

Major infectious disease events and pandemics can be expected to have larger and deeper impacts to the local and national economy. If the disease is slow-progressing, particularly long-lasting, or has long-term residual effects, the impact to the economy could be extended.

If the normal movement of the epidemic within society needs to be curtailed, a process known as "social distancing," then a greater impact to the local economy could occur. Social distancing can be accomplished by a number of means; two ways of increasing social distance activity restrictions are to cancel events and close buildings or to restrict access to certain sites or buildings. These measures are sometimes called "focused measures to increase social distance."

Depending on the situation, examples of cancellations and building closures might include cancellation of public events, such as concerts, sports events, movies, plays; and closure of recreational facilities, such as community swimming pools, youth clubs, gymnasiums. While

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<sup>8</sup> Source: World Health Organization

<sup>9</sup> Source: Federal Reserve Bank of St. Louis



## APPENDIX G: MANMADE HAZARDS

necessary to limit the spread of the pathogen, facility closures could have economic ramifications.<sup>10</sup>

Infectious disease events are complicated hazards. Accurate information and clear, concise explanation during an infectious disease event are critical when conveying messages to the public. When a communication to the public fails, it can result in a loss of credibility, and can result in a loss of public confidence in leadership.

Infectious disease events can undermine the public's confidence in its government and leaders. Public dissatisfaction with government response will typically increase as the number of cases rise and public fear increases. Perceptions of inequality in medical care, particularly if those inequalities are based on socioeconomic status, ethnicity, age, gender, or seniority, can lead to increased dissatisfaction with government and leadership, and may result in a weakening of social order or hostility towards those in leadership or medical roles. Required rationing of supplies or vaccinations should be conscientiously carried out to avoid the appearance of bias or impropriety. Decisions regarding vaccinations, guidance, and treatment should be explained clearly and consistently to the public.

There could be significant public resistance to a decision to quarantine those who are ill or exposed, to restrict travel, or to implement social distancing. Any decision to restrict individual movement must be accompanied by a major public relations campaign to assure the public that these actions are necessary. If decisions are perceived by the public as necessary for their protection, the public is more likely to comply with official instruction.

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<sup>10</sup> Source: GlobalSecurity.org