CITY OF AUSTIN

Hazard Mitigation Plan Update

Maintaining a Safe, Secure, and Sustainable Community

Draft: October 2015

H_2O PARTNERS
PLAN YOUR RECOVERY

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Glossary of Acronyms

AISD – Austin Independent School District

A/TCHHSD – Austin/Travis County Health & Human Services Department

BFE – Base Flood Elevation

CAMPO – Capital Area Metropolitan Planning Organization

DFIRM – Digital Flood Insurance Rate Map

DMA 2000 – Disaster Mitigation Act of 2000

EMS – Emergency Medical Services

EOP – Emergency Operations Plan

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

FOIA – Freedom of Information Act

FMA – Flood Mitigation Assistance Grant Program

FOUO – For Official Use Only

HMGP – Hazard Mitigation Grant Program

HMAP – Hazard Mitigation Action Plan

HSEM – Office of Homeland Security and Emergency Management (Austin)

LCRA – Lower Colorado River Authority

NCDC – National Climatic Data Center

NFHL – National Flood Hazard Layer

NFIP – National Flood Insurance Program

NOAA – National Oceanic and Atmospheric Administration

NRCS – Natural Resources Conservation Service

NWS – National Weather Service

OEM – Office of Emergency Management

PDM – Pre Disaster Mitigation Grant Program

PoC – Point of Contact

RFP – Request for Proposal

SHELDUS – Spatial Hazard Events & Losses Database for the United States

SSGD – Soil Survey Geographic Database

SWPC – Space Weather Prediction Center (NOAA's)

TCEQ – Texas Commission on Environmental Quality

TDEM – Texas Division of Emergency Management

TWDB – Texas Water Development Board

USACE – United States Army Corps. Of Engineers

USGS – United States Geological Survey

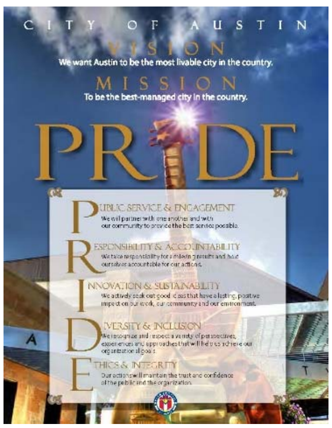
WUI – Wildland Urban Interface

US – United States

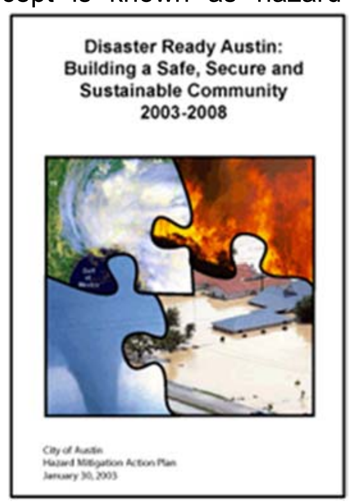
Section 1: Introduction

Background

The City of Austin is the Capital of the State of Texas. It is a vibrant community known for the arts, culture, education, and live music. Austinites share a sense of community pride and a determination towards Austin's vision, to become the most livable city in the country. The City of Austin is committed to providing the highest level of service to its citizens and supports the City's vision through: city council priorities; organizational values; comprehensive planning; and corporate initiatives.[1]



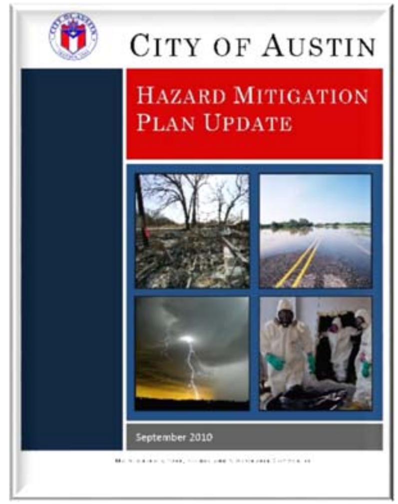
Despite the planning mechanisms currently utilized by the City, Austin is subject to natural and man-caused or technological hazards. Life-threatening hazards can destroy property, disrupt the economy and lower the overall quality of life for individuals. While it is impossible to prevent a hazard event from occurring, the effect from hazards to people and property can be lessened. This concept is known as hazard mitigation, which is defined by the Federal Emergency Management Agency (FEMA) as *sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects.*[2] Communities participate in hazard mitigation by developing hazard mitigation plans. The Texas Division of Emergency Management (TDEM) and FEMA have the authority to review and approve hazard mitigation plans through the Disaster Mitigation Act of 2000.



In 2003, the City of Austin developed the initial Hazard Mitigation Action Plan (HMAP) titled, "Disaster Ready Austin: Building a Safe, Secure and Sustainable Community." This plan was developed by the City and the Lower Colorado River Authority (LCRA) and was one of the first hazard mitigation plans approved by FEMA in 2004 for the State of Texas.

[1] http://www.austintexas.gov/department/pride-vision-and-values
[2] http://www.fema.gov/hazard-mitigation-planning-resources

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 originally approved the Austin HMAP in 2004, the City began the process of developing a HMAP Update in order to maintain eligibility for grant funding within the five-year window by applying for a Hazard Mitigation Grant Program (HMGP) planning grant in 2008. The City was awarded grant funds in September of 2008 and selected the consultant team of H2O Partners, Inc. and subcontractor Post, Buckley, Schuh & Jernigan, Inc. (PBS&J) to write and develop the HMAP Update. The HMAP Update planning process provided an opportunity for the City to evaluate successful mitigation actions and explore opportunities to avoid future disaster loss. The HMAP Update was developed for the City of Austin and its extraterritorial jurisdictions, and approved by FEMA in November 2010.[3] The 2010 HMAP Update will expire in November of 2015. Therefore, the City has selected H2O Partners, Inc. to write and develop the 2015 HMAP Update, hereinafter titled: "City of Austin Hazard Mitigation Plan Update 2015: Maintaining a Safe, Secure and Sustainable Community" (Plan or Plan Update).



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 update to a hazard mitigation plan addresses hazard vulnerabilities that exist today and in the foreseeable future. Therefore, it is essential that a Plan identify projected patterns of how future development will increase or decrease a community's overall hazard vulnerability.

HSEM
OFFICE OF HOMELAND SECURITY AND EMERGENCY MANAGEMENT

The Office of Homeland Security and Emergency Management (HSEM) is responsible for overseeing the development of the Plan Update for the City of Austin. The Vision of HSEM is to continually develop and maintain a "Disaster Ready Austin," where the whole community cooperates to ensure our evolving City is resilient and prepared for all hazards.[4]

Scope and Participation

The City of Austin and the Austin Independent School District (ISD) are the only participants for the 2015 Plan Update. Other entities and businesses, including The University of Texas, Austin Community College, Capital Metro, and the Red Cross, participated as stakeholders and provided valuable input into the planning process.

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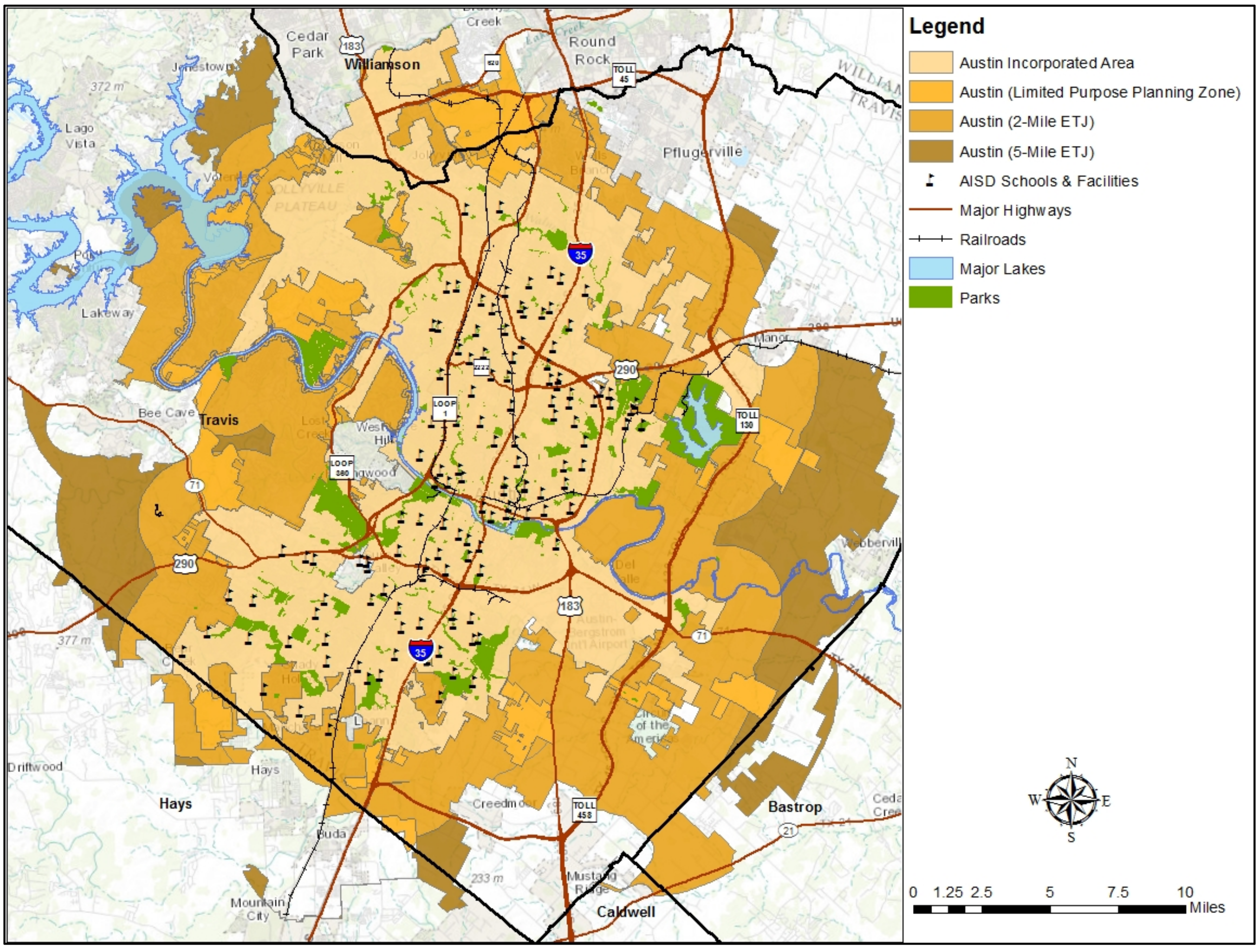
[3] http://www.austintexas.gov/department/emergency-operations
[4] http://www.austintexas.gov/department/about-hsem

The focus of the 2015 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 the City of Austin and Austin ISD. Hazards that pose a "low" or "negligible" risk will continue to be evaluated during future updates to the Plan, but may not be fully addressed until they are determined to be a high or moderate risk. The hazard classification enables the City and Austin ISD to prioritize mitigation actions based on hazards which can present the greatest risk to lives and property in the geographic scope (i.e., planning area).

The planning area for the Plan Update includes all areas within the City of Austin and its extraterritorial jurisdictions as displayed in Figure 1-1 below.

Figure 1-1. Area Covered in the Plan Update



Purpose

The 2015 Plan Update was prepared by the City of Austin, Austin ISD, and H2O Partners, Inc. The purpose of the Plan Update is to protect people and structures, and to minimize the costs of disaster response and recovery. The goal of the Plan Update is to minimize or eliminate long-term risks to human life and property from known hazards by identifying and implementing cost-effective mitigation actions. The planning process is an opportunity for the City of Austin, Austin ISD, Stakeholders, and the general public to evaluate and develop successful hazard mitigation actions to reduce future risk of loss of life, and damage to property resulting from a disaster in the City of Austin.

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

The City of Austin, Austin ISD, and planning participants identified ten (10) natural hazards and seven (7) technological and man-caused hazards to be addressed by the Plan Update. The specific goals of the Plan Update are to:

- Provide a comprehensive update to the 2010 HMAP;
- Minimize disruption to the City of Austin and Austin ISD 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 Update will enable the City and ISD to take advantage of rapidly developing mitigation grant opportunities as they arise; and
- Ensure that the City and ISD maintain eligibility for the full range of future Federal disaster relief.

Authority

The Plan is tailored specifically for the City of Austin, Austin ISD, and plan participants. The Plan complies with all requirements promulgated by the Texas Division of Emergency Management (TDEM) and all applicable provisions of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Section 104 of the Disaster Mitigation Act of 2000 (DMA 2000) (P.L. 106-390), and the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004 (P.L. 108–264), which amended the National Flood Insurance Act (NFIA) of 1968 (42 U.S.C. 4001, et al). Additionally, the Plan complies with the Interim Final Rules for the Hazard Mitigation Planning and Hazard Mitigation Grant Program (44 CFR, Part 201), which specify the criteria for approval of mitigation plans required in Section 322 of the DMA 2000 and standards found in FEMA's "Local Mitigation Plan Review Guide" (October 2011), and the "Local Mitigation Planning Handbook" (March 2013). Additionally, the Plan is developed in accordance with FEMA's Community Rating System (CRS) Floodplain Management Plan standards and policies.

Summary of Sections

Sections 1 and 2 of the Plan outline the Plan's purpose and development, including how Plan participants, stakeholders, and members of the general public were involved in the planning process. Section 3 profiles the planning area's population and economy. Sections 4 through 21 present a hazard overview and information on individual, natural, technological and man-caused hazards in the planning area. The hazards generally appear in order of priority based on potential losses to life and property, and other community concerns. For each hazard, the Plan presents a description of the hazard, a list of historical hazard events, and the results of the vulnerability and risk assessment process. Section 22 presents hazard mitigation goals and objectives, Section 23 gives an analysis for the previous actions and Section 24 presents hazard mitigation actions for the City and ISD. Section 25 identifies Plan maintenance mechanisms.

A list of planning team members is located in Appendix A. Public survey results are analyzed and presented in Appendix B. Appendix C contains a detailed list of critical facilities for the area, and Appendix D provides a list of dam locations. Appendix E contains information regarding workshops and meeting documentation, and the capability assessment for the City is located in Appendix F.[5]

[5] Information contained in some of these appendices are exempt from public release under the Freedom of Information Act (FOIA).
[6] Picture provided by http://www.city-data.com/picfilesc/picc77173.php

Section 2: Planning Process

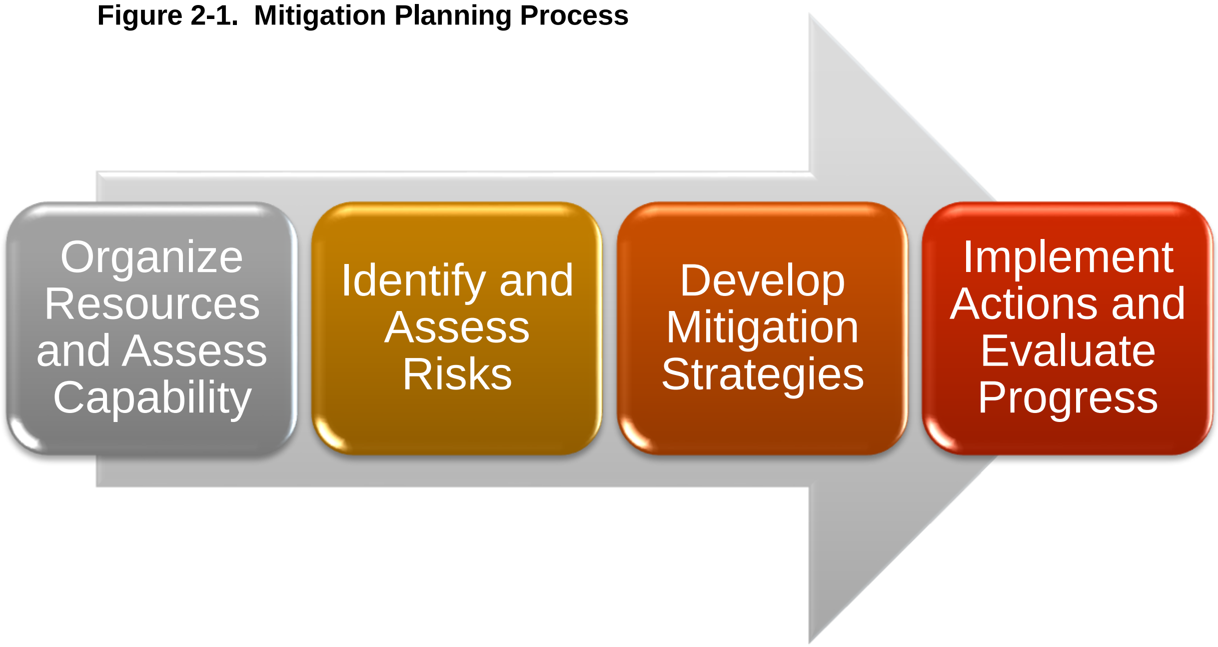
Plan Preparation and Development

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

Overview of the Plan

The City of Austin hired the consultant team, H2O Partners, Inc., to provide technical support and oversee the development of the Plan. The consultants used the FEMA "Local Mitigation Plan Review Guide" (October 1, 2011), and the "Local Mitigation Planning Handbook" (March 2013) to develop the Plan. The overall planning process is shown in Figure 2-1 below.

Figure 2-1. Mitigation Planning Process



The City of Austin, Austin ISD, and the consultant team met in March 2015 to begin organizing resources, identify Planning Team Members, and conduct a capability assessment.

Planning Team

Key members of H2O Partners, Inc. developed the Plan in conjunction with the Planning Team. The Planning Team was established using a direct representation model. Some of the responsibilities of the Planning Team included: completing capability assessment surveys, providing input regarding the identification of hazards, identifying mitigation goals, and developing mitigation strategies. The Planning Team is comprised of the City of Austin Office of Emergency Management staff, City staff from various departments, Austin ISD Emergency Management and officials from area organizations.

Additionally, a large Stakeholder Working Group was invited to participate in the planning process via email, and met on a monthly basis. The consultant team, Planning Team, and Stakeholder Working 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 by organization and title.

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;
- Mitigation goals to address current and expected conditions;
- Whether current resources will be appropriate for implementing the Plan;
- Implementation problems, such as technical, political, legal, or coordination issues that may hinder development;
- Anticipated outcomes; and
- How the City of Austin, Austin ISD, agencies, and partners will participate in the implementation process.

Based on results of completed Capability Assessments, the City and ISD described methods for achieving future hazard mitigation measures by expanding on existing capabilities. For example, Austin ISD has an Evacuation Plan in place for evacuating students during a disaster, but no shelter-in-place in the event of tornado. Other options for improving capabilities include the following:

- Establishing planning team members with the authority to monitor the Plan Update 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 ad the Texas Division of Emergency Management (TDEM) by monitoring classes and availability through preparetexas.org.
- Reviewing current floodplain ordinances for opportunities to increase resiliency such as modifying permitting or building codes.
- Developing ordinances that will require all new developments to conform to the highest mitigation standards.

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

The Planning Team developed hazard mitigation actions for mitigating risk from potential flooding and wildfire, including promoting the FireWise program, practicing hazard mitigation techniques, and retrofitting current facilities to mitigate flood water damage. In order to reduce the damage resulting from city-wide flooding that occurs during heavy rain periods, the Plan also includes city-wide actions to construct scour and erosion protection of bridges and culverts with high scour potential.

Table 2-1. Executive Planning Team

DEPARTMENTS	TITLE
Office of Homeland Security & Emergency Management	Director
Office of Homeland Security & Emergency Management	Sr. Emergency Plans Officer
Office of Homeland Security & Emergency Management	Accountant
Office of Homeland Security & Emergency Management	Deputy Buildings Officer
Office of Homeland Security & Emergency Management	Public Information & Marketing Program Officer
Office of Homeland Security & Emergency Management	Public Information Specialist
Office of Homeland Security & Emergency Management	Community Preparedness Program Coordinator
Office of Homeland Security & Emergency Management	Administrative Manager, Administration & Finance Programs
Office of Homeland Security & Emergency Management, Disaster Ready	Administrator, Network Systems Sr.

Table 2-2. Advisory Planning Team

DEPARTMENTS	TITLE
Austin Fire Department	Fire Captain
Austin Fire Department	Fire Adapted Communities Coordinator
Austin Health & Human Services	Chief Epidemiologist
Austin Health & Human Services	Epidemiologist
Austin Independent School District	Emergency Management Coordinator
Austin Police Department	Sergeant
Austin Travis County Emergency Management Services	Division Chief - Emergency Management
Communications & Technology Management	Security
Communications & Technology Management	Information Systems Division Manager
Geographic Information Systems	Programmer Analyst Supervisor
Historic Landmark Commission	Planning
Office of Sustainability	Environmental Program Coordinator
Planning and Development Review Department	Principal Planner
Public Works Department	City Engineer
Public Works Department	Supervising Engineer
Public Works Department	Consulting Engineer
Watershed Protection Department	Program Manager, Environmental Conservation

Planning Process

The process used to prepare the 2015 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 ad assess, and results associated with each of the hazards were provided at the Risk Assessment Workshop. Based on the City's identified vulnerabilities, specific mitigation strategies were discussed and developed at the Mitigation Workshop. Finally, plan maintenance and implementation procedures were developed and are included with this Plan at Section 25. Participation of Planning Team members, stakeholders, and the public at each of the workshops is documented in Appendix E.

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

- The nature and magnitude of risks currently affecting the community;
- Hazard mitigation goals to address current and expected conditions;
- Whether current resources will be sufficient for implementing the Plan;
- Implementation problems, such as technical, political, legal, and coordination issues that may hinder development;
- Anticipated outcomes; and
- How the City, ISD, agencies, and partners will participate in implementing the 2015 Plan Update.

Kickoff Workshop

The Kickoff Workshop was held at the City of Austin Office HSEM on March 10, 2015. The initial workshop informed City officials, key department personnel, and the ISD about how the planning process pertained to their distinct roles and responsibilities, and engaged stakeholder groups such as the Capital Area Metropolitan Planning Organization (CAMPO) and area universities. In addition to the kickoff presentation, participants received the following information:

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

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

Hazard Identification

At the Kickoff Workshop, and through e-mail and phone correspondence, the Planning Team conducted preliminary hazard identification. The Planning Team in coordination with the Consulting Team reviewed and considered a full range of natural and man-caused hazards. Once identified, the teams narrowed the list to significant hazards by reviewing hazards affecting the area as a whole, the 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 ten (10) natural hazards and seven (7) technological, or human-caused hazard, which pose a significant threat to the planning area.

Risk Assessment

An initial risk assessment for the City and ISD was completed in April 2015 and results were presented to Planning Team members at the Risk Assessment Workshop held on April 28, 2015. 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.

Potential dollar losses from each hazard were estimated using the Federal Emergency Management Agency's Hazards U.S. Multi-Hazards (MH) Model (HAZUS-MH) and other HAZUS-like modeling techniques. The assessments examined the impact of various hazards on the built environment, including general building stock (e.g., residential, commercial, industrial), 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 dollar losses and loss of lives. A hazard profile and vulnerability analysis for each of the hazards can be found in Sections 4 through 21.

Mitigation Review and Development

Developing the Mitigation Strategy for the Plan involved identifying mitigation goals and new mitigation actions. A Mitigation Workshop was held at the City of Austin HSEM on August 4, 2015. In addition to the Planning Team, stakeholder groups and the public were invited to attend the workshop. Regarding hazard mitigation actions, Workshop participants emphasized the desire for flood and wildfire projects. Additionally, the City and ISD were proactive in identifying mitigation actions to lessen the risk of all the identified hazards included in the Plan.

An inclusive and structured process was used to develop and prioritize new hazard mitigation actions for the 2015 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 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 24.

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.
- Mitigation 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 2015 Plan Update, Team Members utilized economic evaluation as a determining factor between hazard mitigation actions.

- 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 2015 Plan Update was made available to the general public for review and comment on the City of Austin's website.

Review and Incorporation of Existing Plans

Review

Background information utilized during the planning process include 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 Austin/Travis County Health and Human Services Department (A/TCHHSD), 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 5-21) 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 Climatic Data Center (NCDC) and Austin/Travis County Health and Human Services Department. Results of past hazard events were found through searching the NCDC. 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 and City of Austin Demographer webpages were reviewed for population and other projections and included in Section 3 of the Plan. Information from the Texas Forest Service was used to appropriately rank the wildfire hazard, and to help identify potential grant opportunities. Materials from FEMA and TDEM were reviewed for guidance on plan development requirements.

Incorporating Existing Plans into the HMAP Process

A Capability Assessment was completed by key City and ISD departments which provided information pertaining to existing plans, policies, ordinances and regulations to be integrated into the goals and objectives of the 2015 Plan Update. The relevant information was included in a master Capability Assessment which is included as Appendix F.

Existing projects and studies were utilized as a starting point for discussing hazard mitigation actions among Team members. For example, the City has completed an Extreme Weather Vulnerability Assessment to assist in planning future growth initiatives and safe growth objectives for the community including, quality land development, and preservation of the community's unique historic and environmental features. The City of Austin's Comprehensive Plan is incorporated into the 2015 Hazard Mitigation Plan Update as it pertains to mitigating risk from natural disasters and the resulting effects on transportation, and development in floodplain areas; and educating residents on how to protect themselves and their property. Additionally, mitigation actions from other plans were reviewed, such as Floodplain Management Plans and Stormwater Management Plans. Finally, the State of Texas 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 State Plan was also used as a guidance document, along with FEMA materials, in the development of the Plan.

Incorporation of the HMAP into Other Planning Mechanisms

Team members will integrate implementation of the Plan with other planning mechanisms for the City, such as the Emergency Management Plan. Existing plans for the City will be reviewed in light of the Plan, and incorporated into the hazard mitigation plan, as appropriate. This section discusses how the Plan will be implemented by the City and Austin ISD. 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.

A major element of fiscal responsibility, as it pertains to incorporating existing studies and other planning mechanisms into the Plan, rests in the budgeting process, which is the process of allocating resources and prioritizing needs of a local jurisdiction, school district, or other organizations. In most cases, for a governmental entity, the budget represents the legal authority to spend money, and implied set of decisions by city administrators or other governing Boards that match resources found in existing planning mechanisms, and with objectives and goals of the Plan. As such, the budget is a product of the planning process, including mitigation planning and reducing risk from natural hazards. The annual Budget Review is an important tool in controlling and executing mitigation goals and objectives, and funding identified mitigation actions. The City of Austin and Austin ISD, and the identified contact persons for the city and AISD, will participate in their local budgetary process for tracking identified mitigation actions, recommending prioritization for grant funding, and updating and maintaining the mitigation strategy developed for the community.

The City and AISD will be responsible for implementing mitigation actions contained in Section 24. Each action has been assigned to a specific person or local government office that is responsible for tracking and implementing the action.

A funding source has been listed for each identified action. This source may be used when the jurisdiction begins to seek funds to implement the action. An implementation time period has also been assigned to each action as an incentive for seeing the action through to completion and to gauge whether actions are implemented on a timely basis.

The City and AISD will integrate implementation of its mitigation action plans with other, existing planning mechanisms such as the Capital Improvement Plans, long range Comprehensive Development Plans, Master Storm Water and Drainage Plans, Flood Studies, Emergency Operations or Management Plans, and other local and area planning efforts. The City of Austin will work closely with Travis County, and other area organizations to coordinate implementation of mitigation actions that benefit the metropolitan planning area in terms of financial and economic impact. The City will ensure that the actions contained in the mitigation plan are integrated into these coordinated planning efforts.

Upon formal adoption of the Plan, Planning Team members from the City and AISD will review existing plans identified here, along with building codes to guide and control development. Both the City of Austin and Austin ISD will be responsible for coordinating periodic review of the Plan with members of the Advisory Planning Team to ensure integration of hazard mitigation strategies into these planning mechanisms and codes. The designated Planning Team will also conduct periodic reviews of its various existing planning mechanisms and analyze the need for any amendments or updates in light of the approved Plan. The City and ISD will ensure that future long-term planning objectives will contribute to the goals of this hazard mitigation 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 hazard mitigation plan, existing planning mechanisms will be reviewed and analyzed as they pertain to the hazard mitigation plan.

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

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

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

Table 2-3. Examples of Methods of Incorporation

PLANNING MECHANISM	METHOD OF INCORPORATION
Grant Applications	The City will consult the Plan whenever there are yearly grant funding cycles available through FEMA, including the Pre-Disaster Mitigation (PDM) cycle, and when there is a Disaster Declaration for Texas triggering Hazard Mitigation Grant Program (HMGP) funds. Mitigation actions for each jurisdiction will be reviewed by the planning team members and information will be updated for completing applications, such as maps and risk assessment data. If a project is not in the Plan, an amendment may be developed.
Annual Budget Review	The City will review the Plan and mitigation actions therein when conducting its annual budget review. When allocating funds for upcoming operating and construction budgets, high priority mitigation actions will be reviewed during City Council meetings. Each identified staff member/planning Team member will be responsible for bringing mitigation actions to the meeting to discuss feasibility of the potential project in terms of the availability of funds, grant assistance, and preliminary cost benefit review.
Emergency Planning	The Plan will be consulted during updates to the local emergency and/or disaster recovery plan. Risk assessment and vulnerability data will be pulled from the plan and analyzed in conjunction with the review, renewal, or re-writing of an Emergency Operations or Management Plan. This data will either be included within the new emergency planning mechanism or included as an appendix. Mitigation projects that relate to prevention and protection will also be reviewed for relevance to determine if they should be included.

PLANNING MECHANISM	METHOD OF INCORPORATION
Comprehensive/Capital Improvements	Before any updates to the Comprehensive/Capital Improvement Plans (CIP) are conducted, the City will review the risk assessment and mitigation strategy sections of the Plan, as limiting public spending in hazardous zones is one of the most effective long-term mitigation actions available to local governments. Profile information and data regarding NFIP compliance and maintenance will be reviewed in conjunction with any CIP that is developed. If new census or land use data is available, this information should be added to the Plan Update.
Floodplain Management Plan and Fire Protection	The Plan will be utilized in updating and maintaining floodplain management and fire protection plans, as the goals of both planning mechanisms are similar. In updating or maintaining these plans, the Plan will be consulted for NFIP compliance, flood risk, wildfire risk, and extent. Information from these sections will be reviewed for inclusion. In addition, mitigation actions that address wildfire and flood will be reviewed for inclusion.

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 mitigation actions into existing plans, policies, and the annual budget review as it pertains to prioritizing grant applications for funding and implementation of identified mitigation projects.

Plan Review and Plan Update

As with the development of this Plan, the City of Austin will oversee the review and update process for relevance and to make adjustments, as necessary. At the beginning of each fiscal year, Team Members will meet to evaluate the Plan and review other planning mechanisms to ensure consistency with long-range planning efforts. In addition, participants will also meet twice a year, by conference call or presentation, to re-evaluate prioritization of the 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 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 Mitigation Action worksheets included in the Plan for the City of Austin and Austin ISD.

Both the Executive and Advisory Planning Team will evaluate and prioritize the most suitable mitigation actions for the community to implement. The timeline for implementation of actions will partially be directed by the city's comprehensive planning process, Capital Improvements Plan, budgetary constraints, and community needs. The City and ISD are committed to addressing and implementing mitigation actions that may be aligned with and integrated into the hazard mitigation plan.

Overall, the Planning Team is in agreement that goals and actions of the hazard mitigation plan shall be aligned with the timeframe for implementation of 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 City of Austin's 2015 Plan Update at different stages prior to official Plan approval and adoption. Public input was sought using three methods: (1) open public meetings; (2) survey instruments; and (3) making the draft Plan available for public review at the City of Austin's website, government offices, and public libraries.

Stakeholder Involvement

Stakeholder involvement is essential to hazard mitigation planning since a wide range of stakeholders can provide input on specific topics and input 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 2015 Plan Update. The "Stakeholder Working Group" (Table A-3 in Appendix A, and Table 2-3, below), included a broad range of representatives from both the public and private sector, and served as a key component in the City's outreach efforts for development of the Plan. Documentation of stakeholder meetings is found in Appendix E. A list of organizations invited to attend via e-mail is found in Table 2-3.

Table 2-3. Stakeholder Working Group

AGENCY	TITLE	PARTICIPATED
Austin Community College (ACC)	Emergency Management Coordinator	X
Austin/Travis County Integral Care	Coordinator, Disaster Mental Health	
Capital Area Council of Governments (CAPCOG)	Director, Homeland Security	X
Capital Area Council of Governments (CAPCOG)	Homeland Security Planning Coordinator	X
Capital Area Metropolitan Planning Organization (CAMPO)	Planner	X
Capital Area Metropolitan Planning Organization (CAMPO)	Air Quality Program Manager	X

AGENCY	TITLE	PARTICIPATED
Capital Area Trauma Regional Advisory Council (CATRAC)	Executive Director	
Capital Metro	Quality Control Specialist	X
Red Cross	Disaster Services Chair	
Travis County Medical Society	Chief Operating Officer	
University of Texas	Director, Campus Security	

Stakeholders and participants from neighboring communities that attended the Planning Team and public meetings played a key role in the planning process. For example, the Austin Police Department identified the need for an Uninterrupted Power Source (UPS) for their Main Station. The Department Operations Center is located in the Main Station which lost connectivity at a crucial time while coordinating public safety response efforts during the Memorial Day flooding event. Another public meeting attendee was concerned about watershed protection and the potential effects of increasing development, including development in areas that are flood-prone.

Public Meetings

A series of public meetings were held at local library branches 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 and human-caused hazards. Representatives from area neighborhood associations were invited to participate, and residents located in and around the area. Additionally, the City utilized social media sources including Facebook, Twitter, and the local media. The City also posted notices of meetings at City Hall and kiosks in public gathering places. Documentation on the public meetings are found in Appendix E.

Public meetings were held on the following dates and locations:

- March 10, 2015, Pleasant Hill Branch Library
- March 12, 2015, Howson Branch Library & Spicewood Springs Branch Library
- March 16, 2015, Carver Branch Library
- July 13, 2015, Pleasant Hill Branch Library & Spicewood Springs Branch Library
- July 16, 2015, Howson Branch Library & Carver Branch Library

Public Participation Survey

In addition to the public meetings, the 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 actions or problem areas. The survey was promoted by local officials and a link to the survey was posted on the City of Austin's website. A total of 158 surveys were completed online, and an additional 12 surveys were completed at public meetings. The survey results are analyzed in Appendix B. The City of Austin reviewed the input from the survey and decided which information to incorporate into the Plan as mitigation actions. For example, many citizens mention concerns about flooding and several actions were added on controlling flooding by implementing a program to inspect bridges and culverts and constructing scour and erosion protection where needed.

Section 3: Community Profile

Overview

Section three provides an overall description of the City of Austin and the Austin Independent School District (AISD), including available data on the following:

- History and Government;
- Geography and the Environment;
- Population and Demographics;
- Housing and Household Income; and
- Economy and Industry

History and Government

The City of Austin, founded in 1839, is the capital of Texas and the county seat for Travis County.

For hundreds of years, nomadic tribes of Tonkawa, Comanche, and Lipan Apaches camped and hunted along the creeks, including what is now known as Barton Springs. In the late 1700s, the Spanish set up temporary missions in the area. In the 1830s, the first permanent Anglo settlers arrived and called their village Waterloo.

Congress Avenue, Early 20th Century. Source: Austin History Center

In 1839, Waterloo was chosen to be the capital of the new Republic of Texas. A new city was built quickly in the wilderness, and was named after Stephen F. Austin, "the father of Texas." Judge Edwin Waller, who was later to become the City's first mayor, surveyed the site and laid out a street plan that has survived largely intact to this day. In October 1839, the entire government of the Republic arrived from Houston in oxcarts. By the next January, the town's population had grown to 856 people. The new town plan included a hilltop site for a capitol building looking down toward the Colorado River from the head of a broad Congress Avenue. For over 150 years, "The Avenue" and Pecan Street (now 6th Street) have remained Austin's principal business streets. After

Texas was annexed by the United States in 1845, it took two statewide elections to keep Austin the capital city of Texas.

In the 1850's the City of Austin began to grow with the construction of the permanent capitol building and Governor's Mansion, and the arrival of the Houston and Texas Central Railway in 1871. After a fire destroyed the original building, the current Capitol building was completed in 1888, standing taller than the nation's Capital. Soon thereafter the Austin skyline began to take shape with the establishment of the University of Texas in 1883 and the opening of the Driskill Hotel in 1886.[1]

Along with the changing skyline, the population of Austin became more diverse in the early and mid-1900s when large numbers of Germans, Swedes, and Mexicans migrated to the area. Several neighborhood communities began to spring up in the early part of the 19th century, including the community of Clarksville, which was settled by Charles Clark, a freeman, in 1871. The Clarksville area became the heart of the African-American community.[2] The African-American community later migrated east of downtown, and had a significant influence in the development of jazz and blues clubs and Austin's early music scene.[3] Diverse cultural groups have been attracted to Austin throughout its history, including immigrants from Europe, Africa, Mexico, and, most recently, Asia. All of these groups have enriched Austin's civic and cultural life, including its recent development as a draw for music fans.[4]

In 1918, the City acquired Barton Springs, a group of springs that are counted as the fourth largest spring in Texas. Barton Springs has been attracting attention since the members of various Native American tribes found them to be a reliable and comfortable campsite thousands of years ago. The two major springs were named after Barton's daughters Parthenia and Eliza. Although widely popular as a public swimming hole, campground, and picnic site during the late 1800s, it was 1918 before the springs came under public ownership, when Andrew Zilker donated the land around the springs to the Austin school district, which in turn sold the land to the City of Austin for public park land. Barton Springs remains a popular tourist attraction today.

In 1924, the City adopted a council-manager government, focusing on city planning and beautification. After the development of the City Plan in 1928, Austin passed a bond that provided for the funding of streets, sewers, libraries, hospitals, and multiple parks. The development of parks, pools and recreational areas, combined with the development of the first municipal airport in 1930, attracted many people to the area. By 1936, the student population for the University of Texas had almost doubled, and the City had funded more municipal projects than any other city in Texas.

As Austin has continued to grow, it has become known as a leader in music, film and most recently, technology. Austin has attracted businesses, entrepreneurs, families, musicians, artists and students worldwide. It is a green and welcoming community, appropriately referred to as the "Live Music Capital of the World" as it is home to over 250 live music venues and festivals. The Austin Marathon draws 20,000 runners from around the world. The Austin Food + Wine Festival welcomes visitors from across the nation and showcase the best innovative cuisine. Fun Fun Fun Fest is known as the nation's best underground punk and alternative music festival; and Fantastic Fest, which features sci-fi, horror, fantasy and other genre films, has become a favorite of film buffs

[1] Source: Handbook of Texas Online, available at: http//www.tshaonline.org/handbook/online/articles/AA/hda3.html
[2] Source: Handbook of Texas Online, available at: http://www.tshaonline.org/handbook/online/articles/CC/hpc1.html
[3] Source: Austin Visitor Center, available at: http://www.austintexas.org/visit/things-to-do/history/
[4] Source: http://library.austintexas.gov/ahc/brief-history-austin

and celebrities alike. SXSW Music, Film and Interactive Conferences and Festivals expand every year and the Austin City Limits Music Festival welcomes over 70,000 fans per day to Zilker Park for performances by more than 100 bands.[5]

Newest to Austin is the Circuit of the Americas (COTA), attracting over hundreds of thousands of people year round. COTA is a world class destination for performance, education and business. It is the first purpose–built Grand Prix facility in the United States designed for any and all classes of racing, from motor power to human power, and is the U.S. home to the 2015 FORMULA 1 USGP™ (F1) October 23 – 25.[6] F1 attracted over 265,000 people in 2013 for its inaugural race. Additionally, the COTA master plan features a variety of permanent structures designed for business, education, entertainment and race use; and its signature element is a 3.4 mile circuit track. Other support buildings include an expansive outdoor live music space, which promotes high profile concerts year round; a conference center, a banquet hall as well as a state–of–the–art medical facility. Future proposed amenities include a driving and riding experience, a motorsports driving club, kart track, grand plaza event center and tower, and a trackside recreational vehicle park.

The abundant presence of music, art, film, technology and natural resource attractions, brings millions of tourists to the Austin area annually.

AISD

As of July 2015, Austin Independent School District (AISD) educates 84,791 students in 129 schools. AISD has 261 National Board Certified Teachers, more than any school district in Texas. AISD's mission is to provide a comprehensive educational experience that is high quality, challenging, and inspiring to all students, making a positive contribution to society.[7]

Government

The City of Austin is "Home Rule" city, meaning that the City Charter operates as the Constitution for the City and allows for the creation of regulations the City deems necessary unless prohibited by state law. The City Charter for Austin also establishes the community as a council and manager form of government. The Austin City Council is made up of 10 members plus the Mayor, all of whom are elected at large to a three-year term. The Mayor and Council Members may serve in their respective seats for a maximum of six years, or two consecutive terms. The City Manager is appointed by the City Council, and has overall responsibility for the management of all City employees and the administration of all City affairs.

There are no political subdivisions in the City of Austin, but the City has over 30 different departments organized under six broad service categories:

- Capital Improvement and Management;
- Development and Environmental Services;
- Community Services;
- Transportation Services;
- Public Safety; and
- Financial and Administrative Support.

[5] Source: http://www.austintexas.org/visit/things-to-do/festivals/
[6] Source: http://www.austinchamber.com/austin/visit/formula-one.php
[7] Source: http://www.austinisd.org/about-us

The various departments are either financed from an enterprise fund; set up like a business, where customers are charged a fee for services; or through a general fund, financed through taxes and fees.

AISD

AISD is governed by a nine-member Board of Trustees who are the district's elected leaders. The trustees employ the superintendent, approve the budget, monitor expenditures, set the tax rate, and may call for a bond or tax rate election.

Almost 75% of the fiscal year 2014 budget comes from the General fund. AISD has the highest bond and State Financial Accountability ratings that school districts can earn in Texas. These ratings reflect AISD's stable financial management and operations, healthy reserves, and manageable debt profile.[8]

Geography

Austin is located primarily in Travis County, although part of the City border extends into Williamson and Hays Counties. The City is situated on the Colorado River and is located at the eastern edge of the Hill Country and Edwards Plateau, about 236 miles from the Mexican Border. The western portion of Austin is made up of scenic rolling hills and limestone rock, whereas the eastern portion is more flat. Interstate 35 runs through the City, which occupies a total land area of 301.86 square miles in the Central Texas Hill Country. The City is approximately 541 feet above sea level and is known for its parks and green space, including greenbelts and lakes. The City includes three man-made lakes within the city limits: Lady Bird Lake, Lake Austin, and Lake Walter E. Long. Additionally, the foot of Lake Travis, including Mansfield Dam, is located within the City's limits. The City contains a mixture of soils from silt clays to fine sandy loams and clay loams over limestone. A popular limestone formation is Mount Bonnell, which overlooks Lake Austin on the Colorado River and is approximately 780 feet above sea level.

Austin is within the Lower Colorado River Basin, which encompasses 21,000 square miles of contributing drainage area, and receives an average of 30 to 40 inches of rain per year. A total of 123 watersheds exist in Austin, of which 13 are urban and 120 are in surrounding, non-urban areas. Of these 123 watersheds, 50 are monitored as part of the Environmental Integrity Index (EII), which measures water quality with parameters such as chemical, recreational, aesthetics, and macro-invertebrates scores.[9]

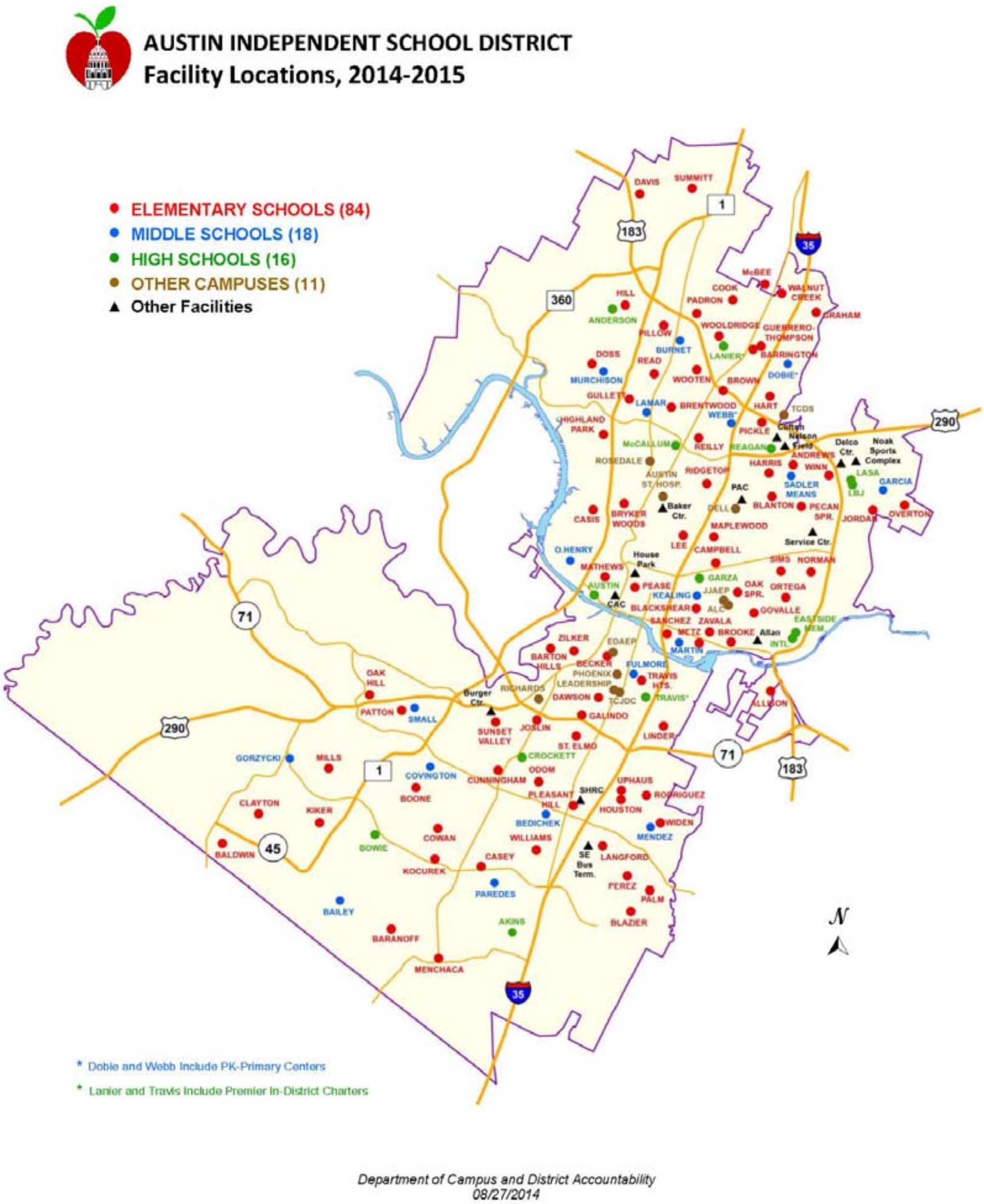
AISD

AISD is comprised of 129 schools and other facilities as seen in Figure 3-1.

[8] Source: http://www.austinisd.org

[9] Source: City of Austin Watershed Development

Figure 3-1. Map of AISD Facility Locations[10]



Population & Demographics

Figure 3-2 shows the extent of the core planning area (the incorporated limits of the City of Austin) along with the population distribution in this area at the census block level (based on Census 2010 census and parcel level date).

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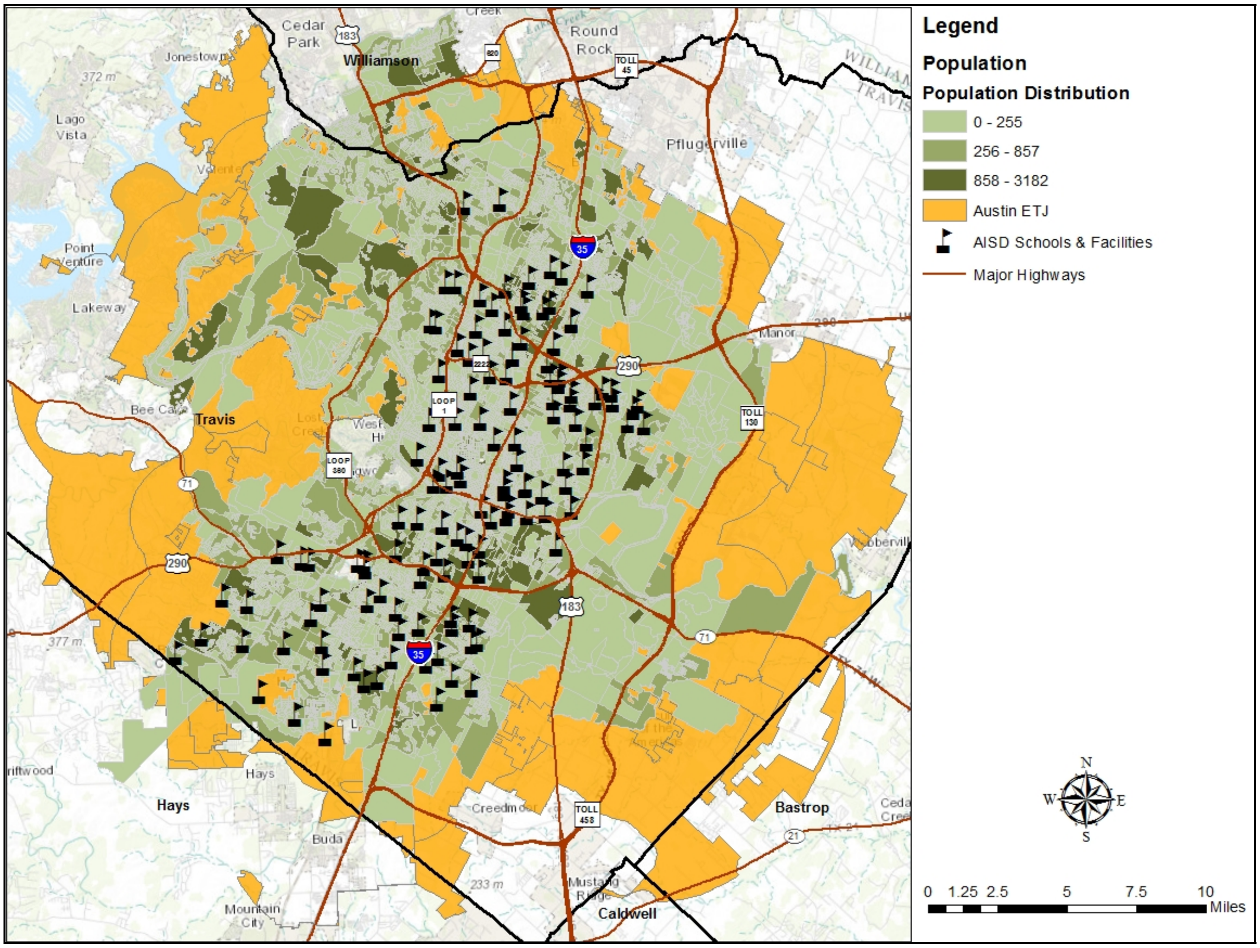
[10] Source: http://www.austinisd.org

Figure 3-2. Map of Population Distribution



A numeric breakdown of the population, including two groups of special needs populations: elderly (persons over the age of 65) and low income (less than $20,000 annual income) are shown in Table 3-1.

Table 3-1. Population Distribution/Special Needs Populations

TOTAL POPULATION (CENSUS 2010)	SPECIAL NEEDS POPULATIONS	
	Elderly (Over 65)	Low Income (< $20,000)
790,390	55,695	32,564

Austin is one of the top five fastest growing metropolitan areas in the U.S. Population estimates from 1970 to 2010 and population projections from 2020 to 2040 are listed in Table 3-2 and illustrated in Figure 3-2, as provided by the U.S. Census Bureau American Community Survey (ACS). Over the past four decades the City of Austin has become increasingly more developed and urbanized (92 percent urban as of 2005). The City's total population in 1970 was 251,808 and increased by 38 percent to 656,562 by 2000. Between 2000 and 2006, the population increased 7.6 percent. The percent change for the state of Texas between 2000 and 2006 was 12.7 percent. The 2010 population estimate for the City of Austin was 790,390, and 836,800 in

2013, a population increase of 9.2 percent. By 2040, the City's population is projected to nearly double the 2007 population, for a projected population count of 1,287,510.

Table 3-2. City of Austin Census Totals, Population Estimates, and Projections

YEAR	POPULATION
1970 (a)	251,808
1990 (a)	465,622
2000 (a)	656,562
2006 (e)	709,893
2007 (e)	743,074
2010 (e)	790,390
2020 (p)	991,992
2030 (p)	1,151,247
2040 (p)	1,287,510

(a) = actual census data (e) = population estimate (p) = population projection

Age & Sex

According to the ACS, males make up 50.3 percent of the City of Austin's population, a slight majority over females at 49.7 percent. Even though males make up a majority of the population overall, females make up the majority of the population age 65 and older. The median age for the city is 32, with 73 percent of the population over the age of 21.

Ethnicity

The demographic components of Austin's rapid population growth are transforming it into an urban place that hosts four racial groups: Caucasian, Hispanic, African American, and Asian. The Hispanic share of Austin's total population decreased from 35.9 percent in 2008 to 34 percent in 2013, and the Asian share of the total population increased from almost 5.5 percent in 2008 to 6.1 percent.

The City of Austin has become a Majority-Minority city, meaning no ethnic or demographic group exists as a majority of the city's population. The City's Anglo share of total population has dropped below 50 percent, and is predicted to remain below 50 percent for the foreseeable due to the growth of other ethnic groups outpacing the growth of Anglo households. For example, the growth rate of Latino and Asian households far exceeds the growth of Anglo households in Austin.[11]

Figure 3-3, below, depicts the ethnicity shares in Austin in 2014 and Table 3-3 displays the percentage of languages spoken at home other than English in Austin, the State of Texas, and the U.S.

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[11] Source: http://www.austintexas.gov/page/top-ten-demographic-trends-austin-texas

Figure 3-3. City of Austin Race and Ethnicity[12]

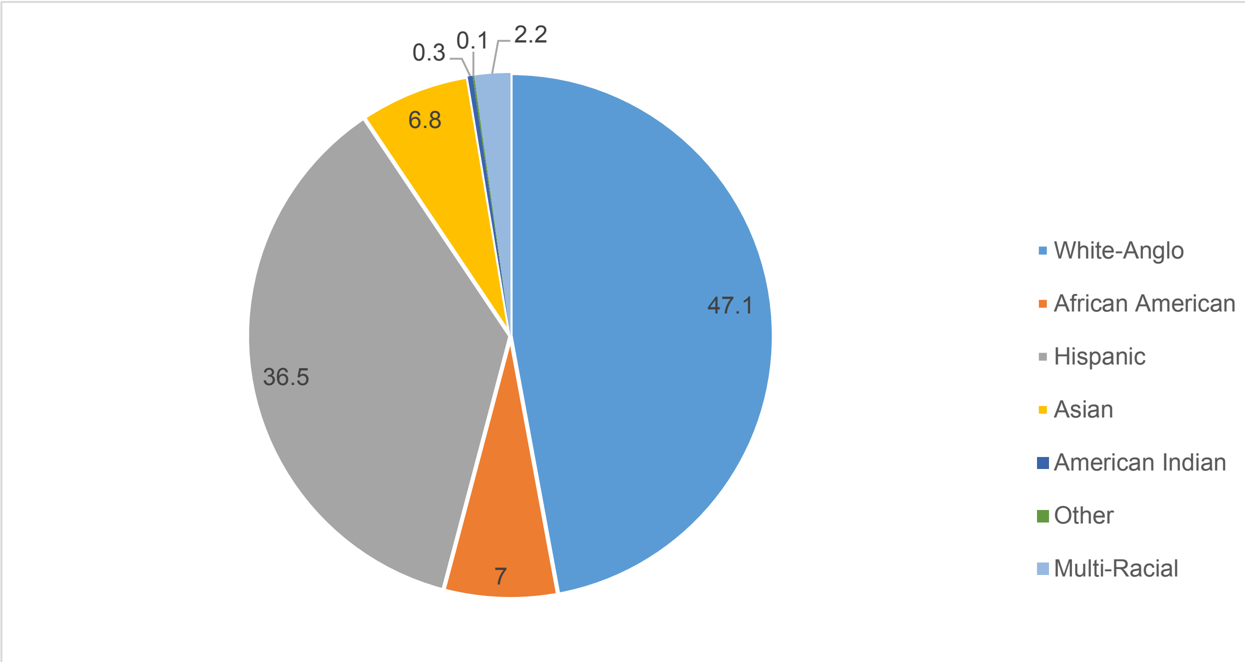


Table 3-3. Language Spoken at Home Other than English[13]

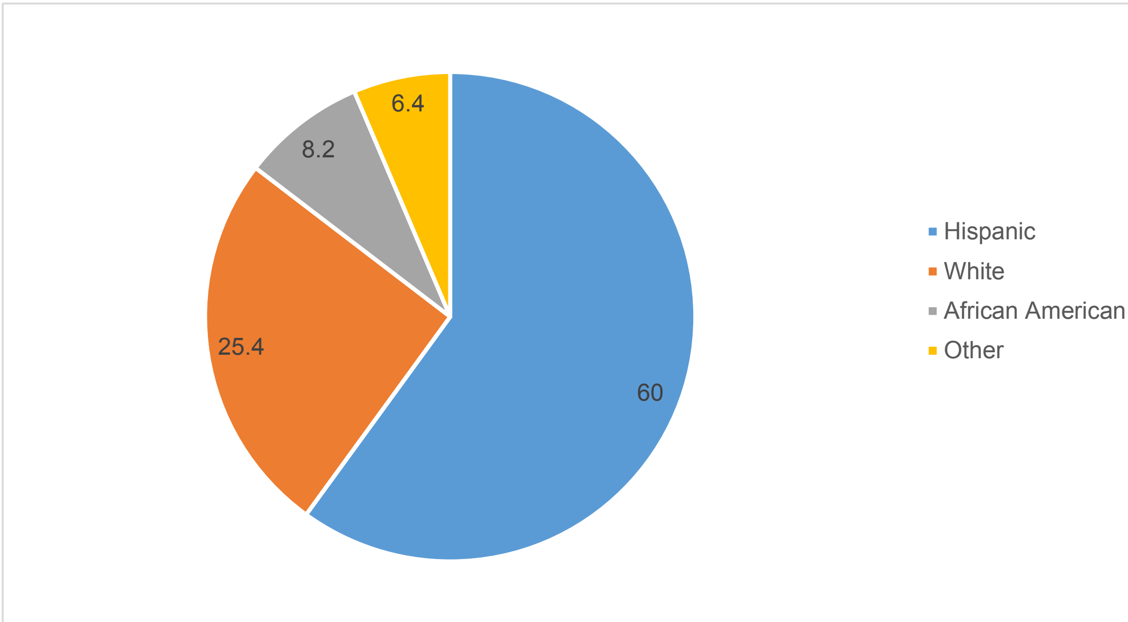
Austin MSA	Texas	United States
32.3%	34.7%	20%

AISD

The 2013-2014 AISD ethnicity breakdown is shown on Figure 3-4.

[12] Source: http://www.austintexas.gov/sites/default/files/files/Planning/Demographics/COA_Travis_MSA_2014_Race_and_Ethnicity_estimates.pdf
[13] Source: U.S. Census Bureau

Figure 3-4. AISD Ethnicity Breakdown[14]



Education

The American Community Survey for 2013 estimates that 86.7 percent of the population of Austin, age 25 and older have earned a high school diploma or higher degree of education. While the U.S. and Texas each have a higher percentage for high school graduates and those with some college or an Associate's degree among citizens age 25 and older, the City has a higher percentage of citizen's that have obtained a Bachelor's, graduate, or professional degree. Among those residents age 25 and older, 29 percent have a Bachelor's degree or higher, while 16.6 percent have a graduate or professional degree, which is almost double the percentage for the state as a whole.

Table 3-4. Educational Attainment – Ages 25 and Older

Educational Level	Austin MSA	Texas	United States
High School Graduate	16.4%	25.3%	28.1%
Some college/Associate's Degree	24.7%	29%	27.5%
Bachelor's Degree	29%	17.7%	18%
Graduate/Professional Degree	16.6%	8.9%	10.8%

[14] Source: http://www.austinisd.org/

Table 3-5. Austin's Largest Institutions of Higher Education

University of Texas at Austin
Austin Community College
St. Edward's University
Graduate/Professional Degree
Concordia University at Austin
ITT Technical Institute
Huston-Tillotson College
Austin Business College
Allied Health Careers
Austin Presbyterian Theological Seminary
Southern Careers Institute
DeVry University
Capital City Trade and Technical School
Episcopal Theological Seminary

Housing & Household Income

According to estimates by the ACS, there were 366,459 housing units for the City in 2013. The average household size for the City of Austin is 2.59 people, compared with 2.93 for the state.[15] For family households, the City also maintains a lower number with 52.7 percent compared to 69.8 percent for Texas. An emerging trend for the City is the decline in the number of households consisting of families with children.[16] Even though the overall number of families has increased, the total number of households consisting of families with children has decreased.[17] The percentage of families with children has declined from a little over 32 percent in 1970 to just fewer than 26.2 percent in 2013.

Median home values in Austin are the highest in Texas at $220,500. Statewide, median home values in metropolitan areas are $128,900, compared to $176,700 nationally (Table 3-6).

Table 3-6. Median Value of Owner Occupied Housing - 2013

Austin MSA	Texas	United States
$220,500	$128,900	$176,700

According to a 2013 American Study Survey, the Austin median household income is $53,946, which is up from $50,520 in 2010.

[15] Source: U.S. Census Bureau
[16] Source: *Ibid.*
[17] Source: *Ibid.*

Table 3-7. Median Family Income, 2013

Austin MSA	Texas	United States
$53,946	$51,900	$53,046

Economy & Industry

Austin, Texas is a home for creativity and business, and was designated as the number one place for small businesses to thrive[18]. Additionally, Austin is leading the region's growth (Best City for the Decade – *Kiplinger Finance Magazine*) while maintaining a global competitive advantage.[19] The rate of unemployment is below both state and national rates as shown in Table 3-8.

Table 3-8. Unemployment Rate – American Community Survey 2013

Austin MSA	Texas	United States
7.4%	8.1%	9.7%

The Austin economy led the entire nation in percentage growth of gross metro product in 2013. Additionally, Austin led the nation's cities in 2013 with a gross metro product growth, the sum of all goods and services produced annually in a city, of 4.6 percent. The City is expected to hold onto the number one ranking though 2020, with an average annual gross metro product growth of 4.4 percent from between 2013 and 2020.[20]

In addition to a growing industry based on high technology and innovation, the City's biomedical and pharmaceuticals industry is also growing. The University of Texas at Austin provides world-class programs in bioengineering and pharmaceutical research, and is a leader in the number of science and engineering doctoral degrees it awards.

Austin also attracts corporate regional offices and national headquarters. Dell Inc. is based in Austin and one of the area's largest employers (See Table 3-9). A diverse array of companies also elected to make Austin their headquarters including National Instruments Corp. and Whole Foods Market, Inc.

Austin strives to serve citizens by influencing and increasing economic development. The City has established an Economic Growth and Redevelopment Services Office (EGRSO). EGRSO is directed by the City Council and is responsible for implementing economic development policy to increase economic viability.

In 2005, the City developed an economic policy to outline measures adopted by the City Council and evaluate projects based on fiscal impact and the impact on City services. In 2007 the City evaluated its economic context and forecast, which showed that indicators of job growth, tax revenue and building activity were all positive.

[18] Source: https://www.austintexas.gov/blog/wallethub-ranks-austin-number-1-nation-small-business-vitality
[19] Source: http://austintexas.gov/department/economic-development
[20] Source: http://www.bizjournals.com/austin/news/2014/06/20/austins-strong-metro-economy-will-stay-ahead-of.html

The City also offers incentive programs such as tax abatements, enterprise zone exemptions, public utility incentives, and financing programs for new and existing companies.

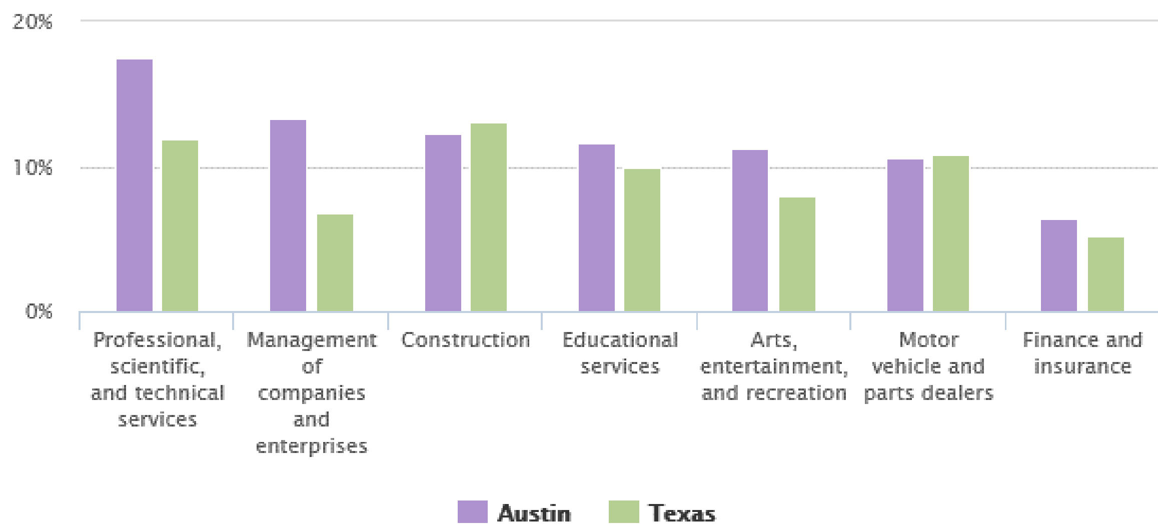
Table 3-9 lists major employers for the City, while Figures 3-5 and 3-6 illustrate major industries for males and females in 2013.

Table 3-9. Major Employers for the City of Austin[21] (employees of 6,000 or more)

Employer	Business Type
University of Texas at Austin	Higher Education
Dell Computer Corp.	Personal Computer Systems
City of Austin	City Government
Austin Independent School District	Education
St. David's Healthcare Partnership	Healthcare
IBM Corporation	Circuit cards, hardware and software
Seton Healthcare Network	Healthcare
Federal Government	Government
State of Texas	Government

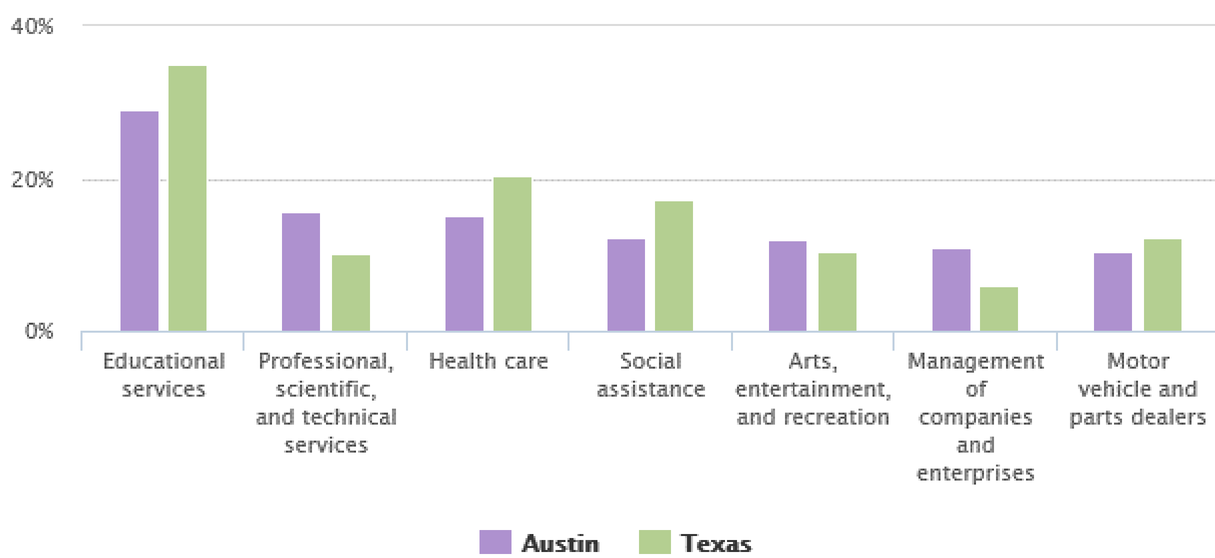
[21] Source: Austin Chamber of Commerce

Figure 3-5. Most Common Industries among Males (Austin/State) - 2013



As Figure 3-5 illustrates, the most popular industry for males is professional, scientific, and technical services with approximately 17.5 percent, followed by management of companies and enterprises at 13.3 percent. In contrast the third largest industry for females is healthcare, as shown in Figure 3-6, which did not have a high enough percentage to rank among males.

Figure 3-6 Most Common Industries among Females (Austin/State) - 2013



Section 4: Risk Overview

Hazard Identification

Section four 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 21, which include hazard descriptions and vulnerability assessments.

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, the City of Austin, including AISD, identified ten natural hazards, one technological hazard, and six human-caused hazards that are to be addressed in the 2015 Hazard Mitigation Action Plan Update (Plan or Update). Of the hazards identified, eight 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 2013 State of Texas Hazard Mitigation Plan (State Plan). Readily available online information from reputable sources such as federal and state agencies were also evaluated to supplement information as needed.

In general there are three main categories of hazards including 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 City of Austin Planning area include extreme heat, extreme wind, tornado, hail, and winter storm (See Table 4-1).

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

Technological hazards, refers to the origins of incidents that can arise from human activities, such as the construction and maintenance of dams. Incidents 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, referred to as "technological," in Table 4-1 for purposes of description.

For purposes of the risk assessment, the wildfire hazard is considered "other," since a wildfire may be natural or human-caused, and is not considered atmospheric or hydrologic.

Table 4-1. Hazard Descriptions

HAZARD	DESCRIPTION
ATMOSPHERIC	
Extreme Heat	Extreme heat is the condition whereby temperatures hover ten degrees or more above the average high temperature in a region for an extended period of time.
Hail	Hailstorms are a potentially damaging outgrowth of severe thunderstorms. Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and subsequent cooling of the air mass.
Thunderstorm	A severe thunderstorm contains large damaging hail of 1 inch (2.7 cm) diameter or larger, and/or damaging winds greater than 58 mph (95 km/h or 50 knots) or greater. Isolated tornadoes are also possible but not expected to be the dominant severe weather event.
Tornado	A tornado is a violently rotating column of air that has contact with the ground and is often visible as a funnel cloud. Its vortex rotates cyclonically with wind speeds ranging from as low as 40 mph to as high as 300 mph. The destruction caused by tornadoes ranges from light to catastrophic, depending on the intensity, size, and duration of the storm.
Winter Storm	Severe winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Blizzards, the most dangerous of all winter storms, combine low temperatures, heavy snowfall, and winds of at least 35 miles per hour, reducing visibility to only a few yards. Ice storms occur when moisture falls and freezes immediately upon impact on trees, power lines, communication towers, structures, roads, and other hard surfaces. Winter storms and ice storms can down trees, cause widespread power outages, damage property, and cause fatalities and injuries to human life.
Hurricane Wind	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.
Expansive Soils	Expansive soils are soils and soft rock that tend to swell or shrink due to changes in moisture content. Changes in soil volume present a hazard primarily to structures built on top of expansive soils.
HYDROLOGIC	
Drought	A prolonged period of less than normal precipitation such that the lack of water causes a serious hydrologic imbalance. Common

HAZARD	DESCRIPTION
	effects of drought include crop failure, water supply shortages, and fish and wildlife mortality.
Flood	The accumulation of water within a body of water, which results in the overflow of excess water onto adjacent lands, usually floodplains. The floodplain is the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that is susceptible to flooding. Most floods fall into the following three categories: riverine flooding, coastal flooding, and shallow flooding.
OTHER	
Wildfire	A wildfire is an uncontrolled fire burning in an area of vegetative fuels such as grasslands, brush, or woodlands. Heavier fuels with high continuity, steep slopes, high temperatures, low humidity, low rainfall, and high winds all work to increase the risk for people and property located within wildfire hazard areas or along the urban/wildland interface. Wildfires are part of the natural management of forest ecosystems, but most are caused by human factors.
TECHNOLOGICAL	
Dam Failure	Dam failure is the collapse, breach, or other failure of a dam structure resulting in downstream flooding. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and severe property damage if development exists downstream of the dam.
HUMAN-CAUSED	
Hazardous Materials (Transportation & Fixed-Site)	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.
Terrorism	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.
Pipeline Failure	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.
Infectious Disease	A clinically evident disease resulting from the presence of pathogenic microbial agents. These infecting agents may be transmitted through liquids, food, bodily fluids, contaminated

HAZARD	DESCRIPTION
	objects, airborne inhalation, or through vector-borne dissemination.
Cyber	A cyber-attack is any type of offensive maneuver employed by individuals or whole organizations that targets computer information systems, infrastructures, computer networks, and/or personal computer devices by various means of malicious acts usually originating from an anonymous source that either steals, alters, or destroys a specified target by hacking into a susceptible system.
Technological Disruption	Technological disruptions can be caused by solar flares, geomagnetic storms, and power disruptions. Solar flares are a sudden, rapid, and intense flash of brightness observed over the sun's surface and they occur when magnetic energy that has built up in the solar atmosphere is suddenly released.

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, and also 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 .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.

In Central Texas, the Colorado River Basin is experiencing an unprecedented drought that could continue to strain water resources for years to come. Inflow of total water volume to Lakes Travis and Buchanan is a key measure of the drought's intensity and these have been dramatically low; the top five lowest annual inflows have occurred since 2006. Another key measure of the drought's intensity and duration is the combined storage volume in Lakes Travis and Buchanan, which dropped to 35 percent capacity in February 2015. In 2014 the combined storage dropped alarmingly close to the all-time minimum. Additional climate impacts which have required tens of millions of dollars to address recovery efforts locally include:

- During the summer of 2011, Austin had 90 days with temperatures of at least 100 degrees Fahrenheit.
- Multiple wildfires destroyed over 1,500 homes and 32,000 acres of forest surrounding Bastrop in 2011.
- The Halloween flood of 2013 resulted in loss of life, caused extensive damage to homes and businesses around Onion Creek, and displaced many people from their homes. In addition,

the loss of vegetation from intense precipitation combined with prolonged drought conditions may increase flooding severity in the future.

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 the 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.

Climate change in Texas is consistent with larger-scale trends observed across the U.S. and the world. Based on the data collected at the Camp Mabry weather station in Austin, projected climate changes include:[1]

- Increases in annual and seasonal average temperatures,
- more frequent high temperature extremes,
- little change in annual average precipitation,
- more frequent extreme precipitation,
- slight increase in the number of dry days per year, and
- more frequent drought conditions in summer due to hotter weather.

The State of Texas will leverage state-of-the-art technologies such as remote sensing and crowd-sourcing and high-resolution digital elevation and climate modeling databases, resulting in a scalable platform that not only disseminates information to the public but allows user-uploaded data to help populate key databases on building and community exposure. Once developed, the system will provide short- and long-term risk information to governments at all levels for prioritizing hazard mitigation and climate adaption policies, as well as to individual homeowners and business owners for self-motivated activities. This system will directly support the objectives of NOAA Next Generation Strategic Plan of developing an integrated environment modeling system and fostering partnerships for climate adaption and mitigation. Furthermore, it will advance our capability to assess risk, prepare for, and respond to the impacts of climate change, which is the focus of FY13 COCA competition.

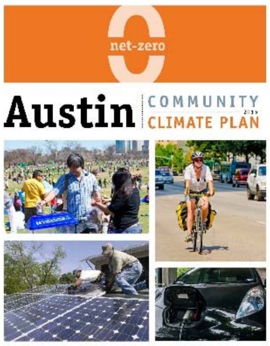
The key components of the proposed web-based system consist of:

- Regional maps showing the magnitude of coastal hazards (i.e., flooding, hurricanes, storm surge) based on benchmarks and future projections, including both local subsidence and climate change;
- Exposure databases describing the density of urban development along the coast by land use type;
- Region-specific vulnerability models for buildings and critical infrastructure;
- Risk indices quantifying relative levels of impact or damage by hazard;
- Community awareness programs guiding local communities on risk management;
- User-friendly interface enabling the public to contribute to the improvement of exposure database; and
- Real-time and/or simulated feeds of current and future disasters for rapid impact assessment.

[1] http://austintexas.gov/sites/default/files/files/Sustainability/Climate/Toward_a_Climate_Resilient_Austin.pdf

The initial focus for database and platform development will be on Texas and Louisiana; however, transferability will be a key consideration when designing the framework, and a long-term implementation plan for other states along the Atlantic and Gulf Coasts will be prepared as part of this project. Project partners sought for this study will include NOAA labs, DHS/FEMA, NASA, local and state governments, universities, and disaster relief organizations.

Austin Community Climate Plan



On April 10, 2014, Austin City Council passed Resolution 20140410-024 that established a new long-term goal of reaching net zero community-wide greenhouse gas emissions by 2050, or earlier if feasible. The Office of Sustainability initiated efforts to develop energy, transportation, waste, and industrial sector actions plans to meet this goal, which included collaborations with community experts, City departments, and input from the general public.

On June 4, 2015, the Austin City Council passed a resolution adopting the Austin's Community Climate Plan and gives additional direction on next steps. The actions identified in this plan will result in both immediate and cumulative reductions in emissions resulting from electricity and natural gas production, transportation, materials management, and industrial process sources.[2]

[2] https://austintexas.gov/page/community-greenhouse-gas-emissions

Overview of Hazard Analysis

The methodologies utilized to develop the risk assessment are HAZUS-MH (FEMA's loss estimation software) and a statistical approach. Both methodologies provide an estimate of potential impact by using a common, systematic framework for evaluation.

HAZUS-MH is FEMA's standardized loss estimation software program built upon an integrated geographic information system (GIS) platform. HAZUS-MH was utilized in the risk assessment to develop regional profiles and estimate losses due to damage caused by a flood event for the 2015 Hazard Mitigation Plan Update.

The HAZUS-MH software and resulting risk assessment methodology are parametric, in that distinct hazard and inventory parameters (e.g., wind speed and building types) are modeled to determine the impact (e.g., damages and losses) on the built environment.

Records retrieved from National Climatic Data Center (NCDC) and SHELDUS were reported for the Austin planning area. Remaining records identifying the occurrence of hazard events in the planning area and the maximum recorded magnitude of each event were also evaluated.

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 4-2, and impact statements are defined in Table 4-3 below.

Table 4-2. Frequency of Return Statements

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

Table 4-3. Impact Statements

POTENTIAL SEVERITY	DESCRIPTION
Substantial	Multiple deaths. Complete shutdown of facilities for 30 days or more. More than 50 percent of property destroyed or with major damage.
Major	Injuries and illnesses resulting in permanent disability. Complete shutdown of critical facilities for at least two weeks. More than 25 percent of property destroyed or with major damage.

POTENTIAL SEVERITY	DESCRIPTION
Minor	Injuries and illnesses do not result in permanent disability. Complete shutdown of critical facilities for more than one week. More than 10 percent of property destroyed or with major damage.
Limited	Injuries and illnesses are treatable with first aid. Minor quality of life lost. Shutdown of critical facilities and services for 24 hours or less. Less than 10 percent of property destroyed or with major damage.

Each of the hazard profiles includes a description of a general vulnerability assessment. Vulnerability is the total of assets that are subject to damages from a hazard, based on historic recorded damages. Assets in the region were inventoried and defined in hazard zones where appropriate. The total amount of damages, including property and crop damages, for each hazard is divided by the total number of assets (building value totals) in that community to determine the percentage of damage that each hazard can cause to the community.

To better understand how future growth and development in the City might affect hazard vulnerability, it is useful to consider population growth, occupied and vacant land, the potential for future development in hazard areas, and current planning and growth management efforts. Hazard vulnerability for the City of Austin was reviewed based on recent changes in development that occurred throughout the planning area.

Once loss estimates and hazard vulnerability were determined for the planning area, an impact statement was developed. The impact statement describes the potential impact of the hazard to the assets within the planning area.

Section 5: Flood

Hazard Description

Floods generally result from excessive precipitation, and the severity of a flooding event is typically determined by a combination of several major factors, including: stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and the degree of vegetative clearing and impervious surface. Generally, floods are long-term events that may last for several days.

The primary types of general flooding are inland and coastal flooding. Due to the City of Austin's inland location, only inland flooding is profiled in this section. Inland or riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. It is natural and inevitable as it is the overbank flooding of rivers and streams, typically resulting from large-scale weather systems that generate prolonged rainfall over a wide geographic area. Some river floods occur seasonally when winter or spring rainfalls fill river basins with too much water, too quickly. Torrential rains from decaying hurricanes or tropical systems can also produce river flooding.

Location

The Digital Flood Insurance Rate Mate (DFIRM) data provided by FEMA for the City of Austin shows the following flood hazard areas:

- Zone A: Areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown. Mandatory flood insurance requirements and floodplain management standards apply.
- Zone AE: Areas subject to inundation by 1-percent-annual-chance shallow flooding. It is the base floodplain where base flood elevations are provided. AE zones are now used on new format FIRMs instead of A1-30 zones.
- Zone AO: Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet. Average flood depths derived hydraulic analyses are shown in this zone. Mandatory flood insurance purchase requirements and floodplain management standards apply.

- 0.2% Annual Chance Flood Hazard: Area of minimal flood hazard, usually depicted on FIRMs as above the 500-year flood level.

Locations of flood zones in the City of Austin based on the digital Flood Insurance Rate Map (DFIRM) from FEMA are illustrated in Figures 5-1 and 5-2.

Figure 5-1. Estimated Flood Zones in the City of Austin and ETJ

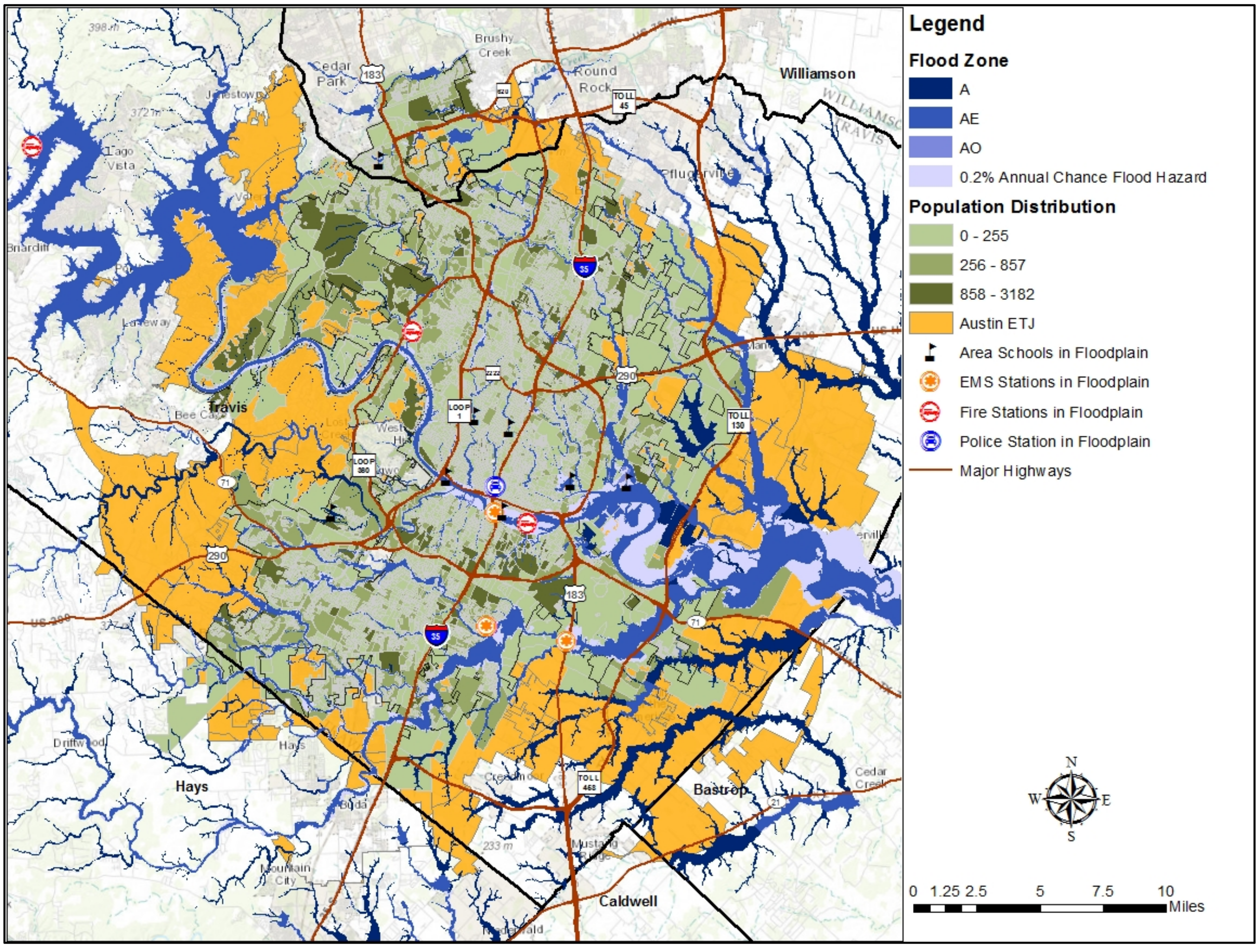
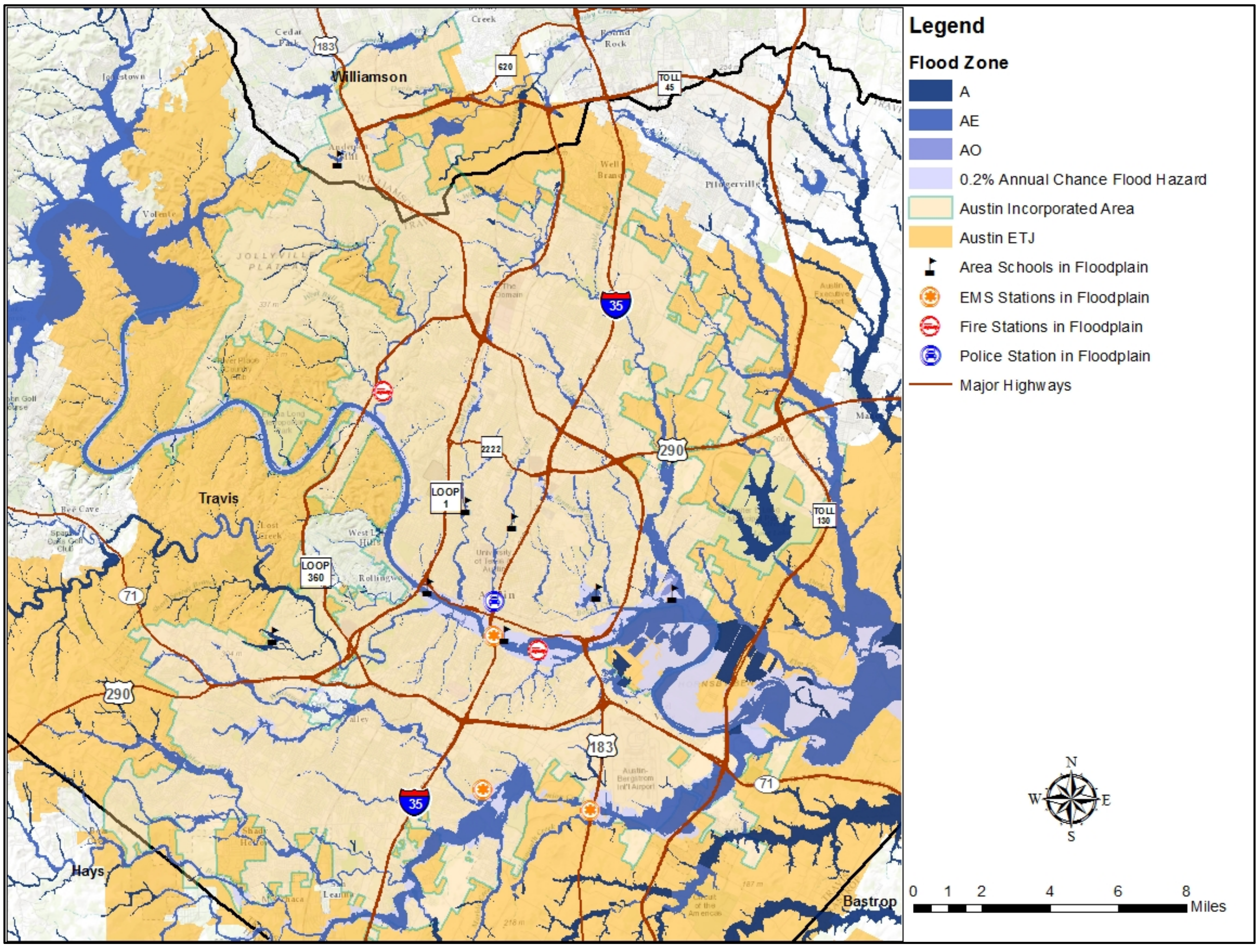


Figure 5-2. Estimated Flood Zones in the City of Austin



Extent

The severity of a flood event is typically determined by a combination of several factors including: stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and degree of vegetative clearing and impervious surface. Generally floods are 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 Zone A, AE and AO are the only hazard areas mapped in the planning area. Figures 5-1 and 5-2 should be read in conjunction with the extent for flooding in Tables 5-1, 5-2, and 5-3 to determine the intensity of a potential flooding event.

Table 5-1. Flood Zones

INTENSITY	ZONE	DESCRIPTION
HIGH	ZONE A	Areas with a 1% annual chance of flooding and a 26% 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 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 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
	ZONE AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% 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 1% 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.
MODERATE to LOW	ZONE X 500	An area inundated by 500-year flooding; an area inundated by 100-year flooding with average depths of less than 1 foot or with drainage areas less than 1 square mile; or an area protected by levees from 100-year flooding.

Zone A is interchangeably referred to as the 100-year flood, the one-percent-annual chance flood, or the Special Flood Hazard Area (SFHA), or more commonly, the base flood. By any name, it is the area that will convey the base flood. This area constitutes a threat to the planning area.

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

In addition to the flood zones, extent is provided in terms of depth of flood waters. Table 5-2 below describes the category of risk and potential magnitude of an event. The water depths depicted in Table 5-2 are an approximation based on elevation data (above sea level rather than above ground). Table 5-3 reflects extent associated with stream gauge data provided by the USGS.

Table 5-2. Extent Scale – Water Depth (Mean Sea Level, MSL)

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

Table 5-3. Extent for the City of Austin

JURISDICTION	ESTIMATED SEVERITY PER FLOOD EVENT[1]	PEAK FLOOD EVENT
City of Austin	Below Flood Stage, 0 to 15 feet	Major Action Stage: Colorado River in Austin had floodwaters reach 273 feet in December 1913 and 46 feet in July 1869.

The range of intensity that the City can experience is high, or Zone A. Based on reporting from the USGS peak MSL data, the average flood event places the City at the extent of "Below Action Stage" as shown in Tables 5-2 and 5-3. However, the City of Austin has experienced flooding over 33 feet MSL. Based on historical occurrences, the planning area could expect to experience anywhere from 2.5 inches up to 14 inches of water within a 4 hour window due to flooding.

Reading Tables 5-1 through 5-3 together with Figures 5-1 and 5-2 and historical occurrences for the area provide estimated and potential magnitude and severity for the City of Austin. The City may experience a range of flooding events from below 15 feet upwards to above 33 feet or from "Below Flood Stage" to almost a "Major Flood Stage."

Historical Occurrences

Historical evidence shows that areas within the City 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. It is likely that additional flood occurrences have gone unreported before and during this recording period. Table 5-4 shows historical incident information for the City of Austin.

Table 5-4. Historical Flood Events, 1960-2015

DATE	TIME	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
8/24/1996	11:30 a.m.	$30,000	$0	$44,879.92	$0
8/24/1996	10:30 a.m.	$10,000	$0	$14,959.97	$0
5/27/1997	4:00 p.m.	$5,000	$0	$7,312.21	$0
6/17/1997	4:30 a.m.	$10,000	$0	$14,624.42	$0
7/30/1997	6:00 p.m.	$50,000	$0	$73,122.12	$0
10/17/1998	10:00 a.m.	$1,000,000	$50,000	$1,440,012.27	$72,000.61
8/31/2001	9:00 p.m.	$20,000	$0	$26,507.28	$0

[1] Severity estimated by averaging floods at certain stage level over the history of flood events.

DATE	TIME	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
7/2/2002	3:33 p.m.	$0	$0	$0	$0
6/3/2007	8:50 p.m.	$50,000	$0	$56,602.62	$0
7/6/2007	7:00 p.m.	$0	$0	$0	$0
6/11/2009	9:00 p.m.	$2,000,000	$0	$2,188,172.67	$0
9/7/2010	11:00 p.m.	$0	$0	$0	$0
10/31/2013	2:00 a.m.	$100,000,000	$0	$100,757,651	$0
11/22/2013	11:30 a.m.	$0	$0	$0	$0
9/18/2014	1:00 a.m.	$0	$0	$0	$0

Table 5-5. Summary of Historical Flood Events, 1960-2015

EVENTS	DEATHS	INJURIES	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
76 events	**10**	**50**	**$104,623,845**	**$72,001**

Significant Events

Flash Flood on October 31, 2013 – City of Austin

Prolonged flow from the Gulf of Mexico produced a deep moist layer at the surface with perceptible water values at two standard deviations above the mean on area surroundings. An upper level trough of low pressure moved out of northern New Mexico and across the Texas Panhandle providing lift to produce showers and thunderstorms. A surface trough was the focus of training storms which produced heavy rainfall that led to major flooding across the Onion Creek and Blanco/San Marcos River watersheds.

Heavy rains in excess of 14 inches upstream of Austin in the Onion Creek Watershed near Wimberly caused a flash flood that hit portions of South Austin in the early morning hours. Water started to rise and flood portions of the Onion Creek area near Interstate 35 by 4-5 a.m. on the morning of the 31st, and water continued to rise into the early morning hours. USGS gauges were overtopped near Twin Creek Road and this record flood water continued to move along Onion Creek, passing under I-35 and inundating several neighborhoods between I-35 and US Highway 183. A reverse 911 was utilized by the City of Austin to help evacuate residents but flood waters rose so quickly that most residents sheltered in place and were rescued by truck and helicopter later that morning. Those that tried to escape the flood waters via their vehicles got caught in the rising waters and this led to several fatalities. A mother and infant son died when their SUV vehicle was swept off the Onion Creek bridge on Bluff Springs Road in the predawn hours around 4:30 a.m. Another resident in a neighborhood along Onion Creek was also found drowned as his vehicle got swept off the road and was recovered near Pleasant

Valley Drive and William Cannon. Almost 2 weeks later the body of a homeless man was found in Williamson Creek near South First Street and Heartwood. He was presumed a flood fatality from this event. Manual readings were performed by USGS at the Onion Creek/Highway 183 gauge site ATIT2. The creek crested just over 40 feet at 9:30 a.m. on the morning of October 31st. This was a new record height for this location and translated to about 135,000 cubic feet per second. In total across Travis County and the City of Austin, over 700 homes were damaged by flooding, of which over 100 were destroyed. Most of the affected homes did not have insurance and were within the 100 year floodplain of Onion Creek. Flood recovery lasted for several weeks including debris removal. Damage estimates were still being calculated when reported, but damages across the County and City were estimated to exceed $100 million.

Flash Flood on June 11, 2009 – City of Austin

A mesoscale convective system developed along a dryline in Central Texas and moved southeastward through the northwestern part of South Central Texas. Thunderstorms within this system produced severe winds and large hail. The bridge at 12th Street and Red River Street in Austin was washed out .The flash flood caused $2 million in damages.

Flash Flood and Flood on October 17, 1998 – City of Austin

Shoal Creek at West 12th Street in Austin crested at 15.4 feet. This level flooded several businesses downstream up to two feet, and put nearly a foot of water over Shoal Creek Boulevard just above West 12th Street. Flow reached to the Lamar Street Bridge, close to flooding many businesses near West 6th Street. Williamson Creek at Oak Hill on Highway 290 West crested at 6.8 feet at 11 a.m. on October 17th, flooding businesses in the shopping mall. Onion Creek crested at 24.9 feet, with flood stage 7 feet. This produced 19 feet of flow over the FM 150 bridge near Driftwood and put two feet of water into several mobile homes. The William Cannon Drive bridge floor had near 20 feet of flow over it. At Highway 183, Onion Creek crested at 32.0 feet, where flood stage is 20 feet. Walnut Creek crested just above 25 feet, causing minor flooding.

Probability of Future Events

Based on recorded historical occurrences and extent, flooding is highly likely meaning an event will occur within the next year.

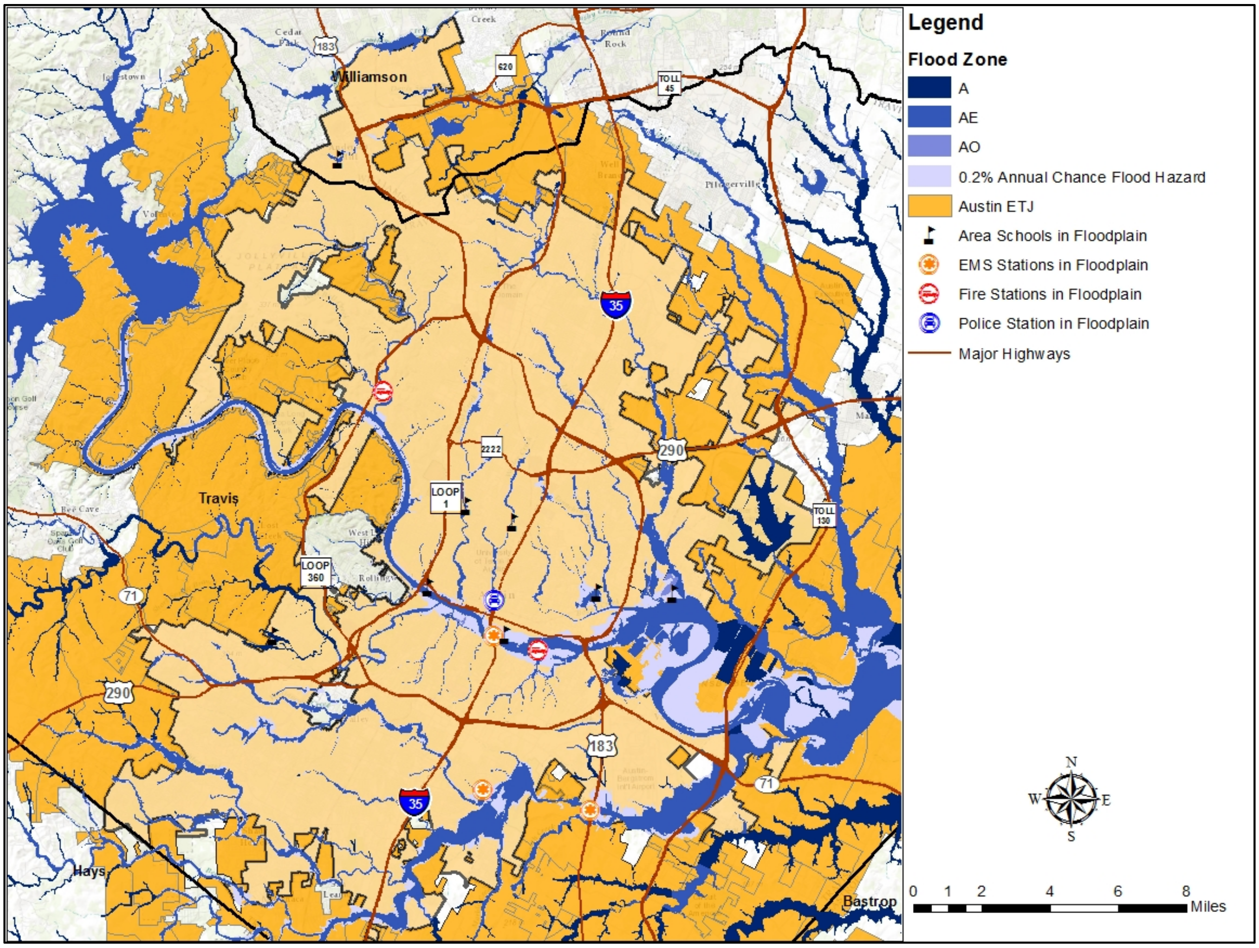
Vulnerability and Impact

A property's vulnerability to a flood depends on its location in, or in proximity, to the floodplain. Structures that lie along banks of a waterway are the most vulnerable and are often repetitive loss structures.

The City of Austin has experienced high growth (36% growth since 2000, according to the U.S. Census), resulting in greater flood losses due to extensive development in this area. However, due to the generally flat terrain of this Central Texas County, homes and businesses in the floodplain remain at risk of flash flooding. During periods of heavy rainfall, homes and businesses located in some areas of the City experience rapid runoff and are vulnerable to flooding from the many major and minor waterways.

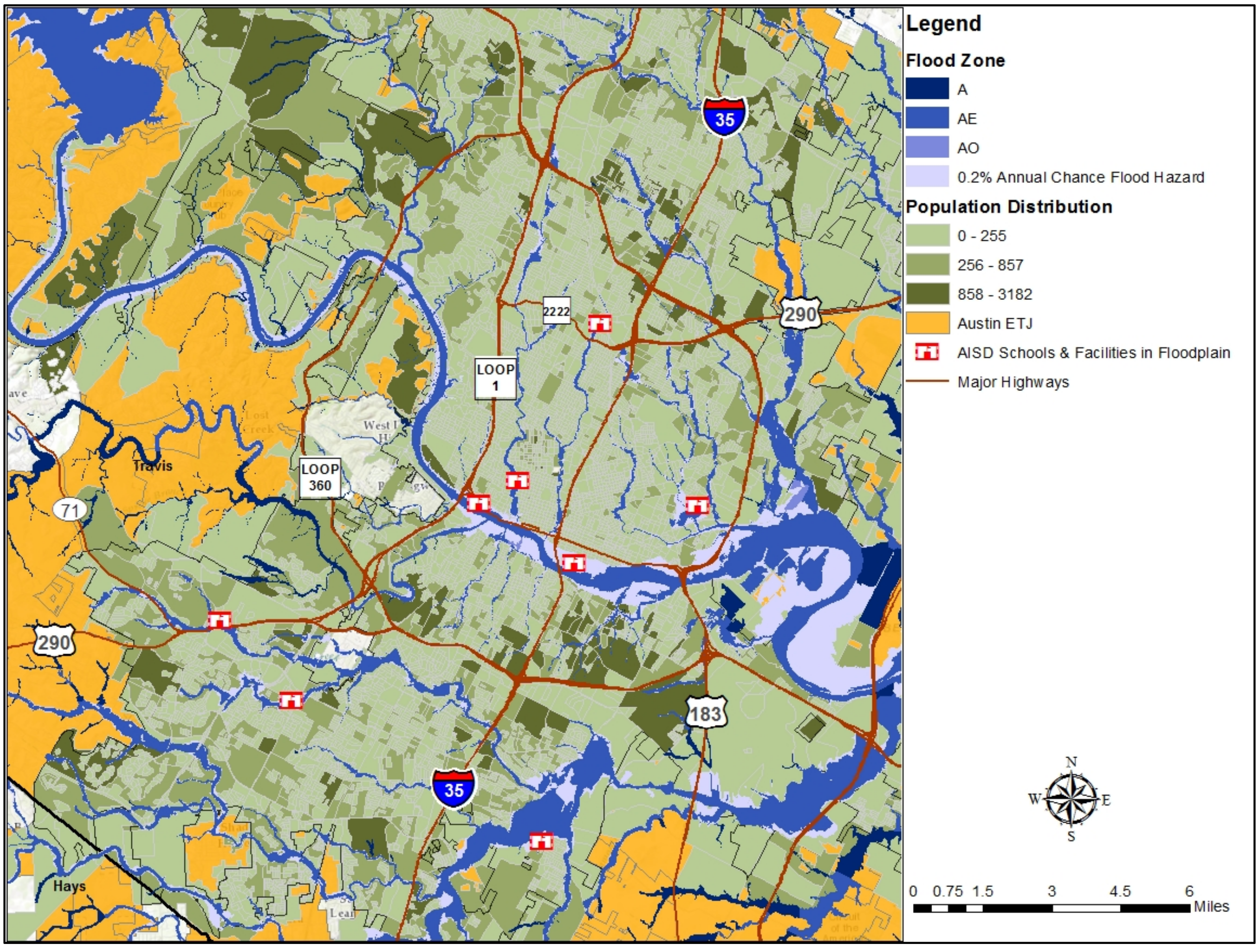
Although the City has encouraged development outside of the floodplain, impact for flood for the City is "Substantial" as it could result in the shutdown of facilities for 30 days, depending on the scale of the storm.

Figure 5-3. Critical Facilities Vulnerable to Flooding



The City of Austin critical facilities located in the floodplain include: Travis County State Jail, Noel Grisham Middle, The Griffin School, Regents School of Austin, Ace Academy, Fire station/EMS Station #24, EMS Station #28, EMS Headquarters, Fire Station #107, Fire Station #31, Austin Fire Department Wellness, and Police Headquarters.

Figure 5-4. Austin ISD Schools and Facilities Vulnerable to Flooding



Austin ISD schools that are located in the floodplain and are vulnerable to flood include: Austin High, Covington Middle, House Park, Martin Middle, Oak Hill Elementary, Ortega Elementary, Palm Elementary, and Reilly Elementary.

Historic loss estimates due to flood (in 2015 dollars) is $104,695,845, having an approximate annual loss estimate of $5,816,436. Historic loss estimates are based off data that has been recorded, therefore there could be damages that were not reported. Considering 76 flood events over an 18-year period, frequency is approximately four events every year.

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. The City of Austin participates in the NFIP. As an additional indicator of floodplain management responsibility, communities may choose to participate in FEMA's Community Rating System (CRS). This is an incentive-based program that allows communities to undertake flood mitigation activities that go beyond NFIP requirements. The City of Austin participates in CRS program in order to reduce risk and provide flood insurance incentives to expand the community's current NFIP policy base, and reduce risk through adoption of higher regulatory standards. The City has recently and are in the process of acquiring numerous structures that have previously experienced one or more floods with substantial damage, in an effort to protect open space adjacent to floodplains.

The Legislature of the State of Texas has, in Section 16.315, Texas Water Code, delegated the responsibility of local government units to adopt regulations designed to minimize flood losses. The City of Austin has adopted ordinances to regulate the floodplain, or any land area susceptible to being inundated by water from any source. The City's floodplain ordinances go above and beyond the requirement of the NFIP. The Austin City Council recently supports hazard mitigation by denying floodplain variances.

The City of Austin is currently engaged in floodplain buyouts in the Onion Creek watershed. Current mitigation projects include: buyouts, upgrading of low water crossings (Old San Antonio Rd.), several local flood projects under construction, Waller Creek tunnel project, and others.

The flood hazard areas of Austin 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.

It is the purpose of the City to promote the public health, safety and general welfare and to minimize public and private losses due to flood conditions in specific areas by 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, the City of Austin follows these guidelines:

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

NFIP Compliance and Maintenance

As part of continual compliance with the NFIP, the City has developed a Floodplain Management plan and has a current NFIP ordinance. The Flood Damage Prevention Ordinance was revised and updated in 2008. The City also periodically conducts education programs for area Homebuilders and through public contact with citizens to bring awareness to the FEMA requirements for Flood Plain Management.

As part of the NFIP Program, and in conjunction with developing new mitigation actions to include in the HMAP, the City has implemented previous mitigation projects related to compliance and maintenance associated with the NFIP program.

The City of Austin has also developed new mitigation actions that relate to NFIP compliance. These actions can be found in Section 24.

Flooding was identified as a high risk hazard during hazard ranking activities at the Risk Assessment Workshop by the Planning Team and many of the mitigation actions were developed with flood mitigation in mind. A majority of these flood actions address reducing flood risk through structural alterations and drainage projects, and implementing flood awareness programs. The City of Austin recognizes the need and are adopting higher NFIP regulatory standards to further minimize flood risk in their community.

The prioritization method for implementing actions was based on FEMA's STAPLEE criteria and included social, technical, administrative, political, legal, economic and environmental considerations. As a result of this exercise, an overall priority was assigned to each mitigation action by each Team Member. The overall priority of each action is reflected in the mitigation actions found in Section 24 for the City of Austin and Austin ISD. In prioritizing actions a community must consider many factors. Of primary consideration is targeting specific mitigation actions for implementation following a major disaster. Other factors that determine prioritization are, in part, ease of implementation by the community, cost of the project vs. perceived benefit, timeframe for implementing the action, and available personnel to oversee and implement the project.

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.

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

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

In either scenario, at least two of the referenced claims must have occurred within any ten-year period, and must be greater than 10 days apart.[2] Table 5-6 shows repetitive loss and severe repetitive loss properties for the City of Austin.

Table 5-6. Repetitive Loss and Severe Repetitive Loss Properties

JURISDICTION	INSURED?	BUILDING TYPE	LOSSES	TOTAL PAID	SRL INDICATOR[3]
City of Austin	SDF	ASSMD CONDO	4	$301,673.60	PN
City of Austin	NO	SINGLE FMLY	4	$24,331.66	-
City of Austin	NO	SINGLE FMLY	2	$98,125.20	-
City of Austin	NO	SINGLE FMLY	2	$21,331.97	-
City of Austin	NO	SINGLE FMLY	3	$17,573.40	-
City of Austin	NO	SINGLE FMLY	3	$33,839.82	-
City of Austin	NO	ASSMD CONDO	2	$50,403.08	-
City of Austin	NO	SINGLE FMLY	2	$9,539.18	-
City of Austin	NO	SINGLE FMLY	2	$39,169.67	-
City of Austin	NO	SINGLE FMLY	2	$94,253.32	-
City of Austin	NO	SINGLE FMLY	2	$39,472.69	-
City of Austin	YES	SINGLE FMLY	2	$32,751.22	-
City of Austin	YES	SINGLE FMLY	2	$42,613.02	-
City of Austin	NO	SINGLE FMLY	2	$221,765.95	-
City of Austin	YES	SINGLE FMLY	3	$14,600.65	-
City of Austin	YES	SINGLE FMLY	4	$38,227.55	-
City of Austin	NO	SINGLE FMLY	2	$5,274.53	-
City of Austin	NO	SINGLE FMLY	2	$71,377.89	-
City of Austin	NO	SINGLE FMLY	2	$11,711.85	-
City of Austin	YES	SINGLE FMLY	3	$13,589.24	-

[2] Source: Texas Water Development Board
[3] In this column: "V" stands for "Validated"; "VN" stands for "Validated Nonresidential"; "VU" stand for "Validated Uninsured"; "VNU" stands for "Validated Nonresidential Uninsured"; "P" stands for "Pending"; "PU" stands for "Pending Uninsured"; and "PN" stands for "Pending Nonresidential".

JURISDICTION	INSURED?	BUILDING TYPE	LOSSES	TOTAL PAID	SRL INDICATOR[3]
City of Austin	SDF	NON RESIDNT	4	$38,299.46	VN
City of Austin	NO	SINGLE FMLY	2	$28,868.32	-
City of Austin	YES	SINGLE FMLY	2	$58,183.70	-
City of Austin	YES	SINGLE FMLY	2	$42,135.44	-
City of Austin	NO	SINGLE FMLY	3	$35,791.61	-
City of Austin	NO	SINGLE FMLY	2	$7,284.35	-
City of Austin	YES	SINGLE FMLY	2	$15,831.72	-
City of Austin	NO	SINGLE FMLY	2	$22,398.68	-
City of Austin	YES	SINGLE FMLY	2	$3,675.77	-
City of Austin	NO	SINGLE FMLY	3	$58,226.75	-
City of Austin	NO	SINGLE FMLY	2	$36,863.38	-
City of Austin	NO	SINGLE FMLY	2	$28,038.36	-
City of Austin	NO	SINGLE FMLY	3	$68,306.95	-
City of Austin	NO	SINGLE FMLY	2	$20,421.75	-
City of Austin	NO	SINGLE FMLY	2	$41,200.26	-
City of Austin	NO	SINGLE FMLY	2	$53,321.47	-
City of Austin	NO	SINGLE FMLY	2	$20,433.64	-
City of Austin	YES	SINGLE FMLY	2	$12,410.32	-
City of Austin	NO	SINGLE FMLY	2	$69,004.91	-
City of Austin	YES	SINGLE FMLY	2	$153,187.43	-
City of Austin	NO	SINGLE FMLY	2	$136,428.21	-
City of Austin	YES	SINGLE FMLY	3	$5,947.10	-
City of Austin	NO	SINGLE FMLY	2	$8,959.29	-
City of Austin	YES	OTHER RESID	2	$6,698.13	-
City of Austin	YES	OTHER RESID	3	$87,217.30	-
City of Austin	NO	SINGLE FMLY	3	$7,724.62	-

JURISDICTION	INSURED?	BUILDING TYPE	LOSSES	TOTAL PAID	SRL INDICATOR[3]
City of Austin	YES	SINGLE FMLY	3	$97,793.58	-
City of Austin	YES	SINGLE FMLY	2	$51,561.24	-
City of Austin	NO	SINGLE FMLY	2	$11,116.01	-
City of Austin	YES	SINGLE FMLY	2	$29,996.57	-
City of Austin	NO	SINGLE FMLY	2	$10,282.68	-
City of Austin	YES	SINGLE FMLY	2	$17,155.24	-
City of Austin	YES	ASSMD CONDO	2	$197,449.70	-
City of Austin	NO	NON RESIDNT	2	$15,546.84	-
City of Austin	SDF	NON RESIDNT	8	$579,305.01	VN
City of Austin	YES	NON RESIDNT	4	$109,562.13	-
City of Austin	SDF	NON RESIDNT	4	$66,527.39	VN
City of Austin	YES	NON RESIDNT	2	$20,024.74	-
City of Austin	NO	NON RESIDNT	4	$121,788.66	-
City of Austin	YES	NON RESIDNT	4	$123,826.01	-
City of Austin	NO	SINGLE FMLY	6	$36,545.36	-
City of Austin	NO	SINGLE FMLY	3	$28,767.88	-
City of Austin	YES	SINGLE FMLY	3	$133,439.10	-
City of Austin	YES	SINGLE FMLY	2	$50,667.38	-
City of Austin	NO	SINGLE FMLY	2	$11,331.38	-
City of Austin	NO	SINGLE FMLY	3	$16,805.29	-
City of Austin	NO	SINGLE FMLY	2	$16,060.56	-
City of Austin	NO	SINGLE FMLY	3	$59,490.90	-
City of Austin	NO	SINGLE FMLY	2	$3,014.38	-
City of Austin	YES	SINGLE FMLY	2	$13,226.60	-
City of Austin	YES	SINGLE FMLY	2	$87,378.92	-
City of Austin	NO	SINGLE FMLY	2	$63,067.47	PU

JURISDICTION	INSURED?	BUILDING TYPE	LOSSES	TOTAL PAID	SRL INDICATOR[3]
City of Austin	YES	SINGLE FMLY	2	$140,845.13	-
City of Austin	YES	SINGLE FMLY	3	$147,986.55	-
City of Austin	YES	SINGLE FMLY	3	$88,511.34	-
City of Austin	NO	OTHER RESID	2	$2,421.34	-
City of Austin	YES	SINGLE FMLY	2	$30,846.35	-
City of Austin	NO	SINGLE FMLY	2	$39,733.60	-
City of Austin	NO	SINGLE FMLY	2	$38,054.74	-
City of Austin	SDF	SINGLE FMLY	6	$127,612.31	V
City of Austin	NO	SINGLE FMLY	2	$184,808.46	-
City of Austin	NO	NON RESIDNT	3	$130,075.28	-
City of Austin	NO	SINGLE FMLY	5	$23,397.98	-
City of Austin	SDF	NON RESIDNT	10	$188,557.76	VN
City of Austin	NO	SINGLE FMLY	2	$13,212.52	-
City of Austin	NO	NON RESIDNT	2	$27,499.86	-
City of Austin	YES	NON RESIDNT	2	$29,057.71	-
City of Austin	NO	NON RESIDNT	2	$47,942.80	-
City of Austin	YES	NON RESIDNT	3	$6,823.20	-
City of Austin	NO	SINGLE FMLY	2	$11,481.40	-
City of Austin	NO	2-4 FAMILY	2	$74,095.04	-
City of Austin	NO	NON RESIDNT	2	$8,090.87	-
City of Austin	NO	SINGLE FMLY	2	$3,721.91	-
City of Austin	NO	NON RESIDNT	2	$6,735.82	-
City of Austin	NO	SINGLE FMLY	2	$24,297.46	-
City of Austin	NO	SINGLE FMLY	3	$58,876.66	-
City of Austin	NO	SINGLE FMLY	3	$23,983.53	-
City of Austin	NO	SINGLE FMLY	3	$79,714.67	-

JURISDICTION	INSURED?	BUILDING TYPE	LOSSES	TOTAL PAID	SRL INDICATOR[3]
City of Austin	NO	SINGLE FMLY	2	$65,891.04	-
City of Austin	NO	ASSMD CONDO	2	$122,230.76	-
City of Austin	NO	2-4 FAMILY	2	$6,436.20	-
City of Austin	NO	SINGLE FMLY	2	$38,036.00	-
City of Austin	NO	SINGLE FMLY	4	$18,969.28	-
City of Austin	NO	NON RESIDNT	2	$29,306.75	-
City of Austin	NO	NON RESIDNT	2	$11,800.40	-
City of Austin	NO	NON RESIDNT	2	$79,366.00	-
City of Austin	NO	NON RESIDNT	2	$42,124.04	-
City of Austin	NO	NON RESIDNT	3	$158,416.35	-
City of Austin	YES	SINGLE FMLY	3	$7,038.58	-
City of Austin	YES	ASSMD CONDO	3	$105,936.96	-
City of Austin	YES	SINGLE FMLY	2	$4,093.03	-
City of Austin	YES	SINGLE FMLY	4	$64,804.03	-
City of Austin	YES	SINGLE FMLY	4	$109,525.27	MV
City of Austin	NO	SINGLE FMLY	2	$22,140.86	-
City of Austin	NO	SINGLE FMLY	4	$28,403.62	-
City of Austin	NO	SINGLE FMLY	2	$18,362.51	-
City of Austin	NO	SINGLE FMLY	2	$10,787.58	-
City of Austin	NO	SINGLE FMLY	3	$4,500.54	-

Section 6: Drought

Hazard Description

Drought is a period of time without substantial rainfall that persists from one year to the next. Drought is a normal part of virtually all climatic regions, including areas with high and low average rainfall. Drought is the consequence of anticipated natural precipitation reduction over an extended period of time, usually a season or more in length. Droughts can be classified as meteorological, hydrologic, agricultural, and socioeconomic. Table 6-1 presents definitions for these different types of drought.

Table 6-1. Drought Classification Definitions[1]

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

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.

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

Location

Droughts occur regularly throughout Texas and the Austin planning area, and are a normal condition. However, they can vary greatly in their intensity and duration. There is no distinct geographic boundary to drought; therefore, it can occur throughout the entire City of Austin planning area and Austin ISD equally.

Extent

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

Table 6-2. Palmer Drought Index

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

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

CATEGORY	DESCRIPTION	POSSIBLE IMPACTS	PALMER DROUGHT INDEX
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures; fire risk above average. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.	-1.0 to -1.9
D1	Moderate Drought	Some damage to crops, pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing or imminent, voluntary water use restrictions requested.	-2.0 to -2.9
D2	Severe Drought	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed.	-3.0 to -3.9

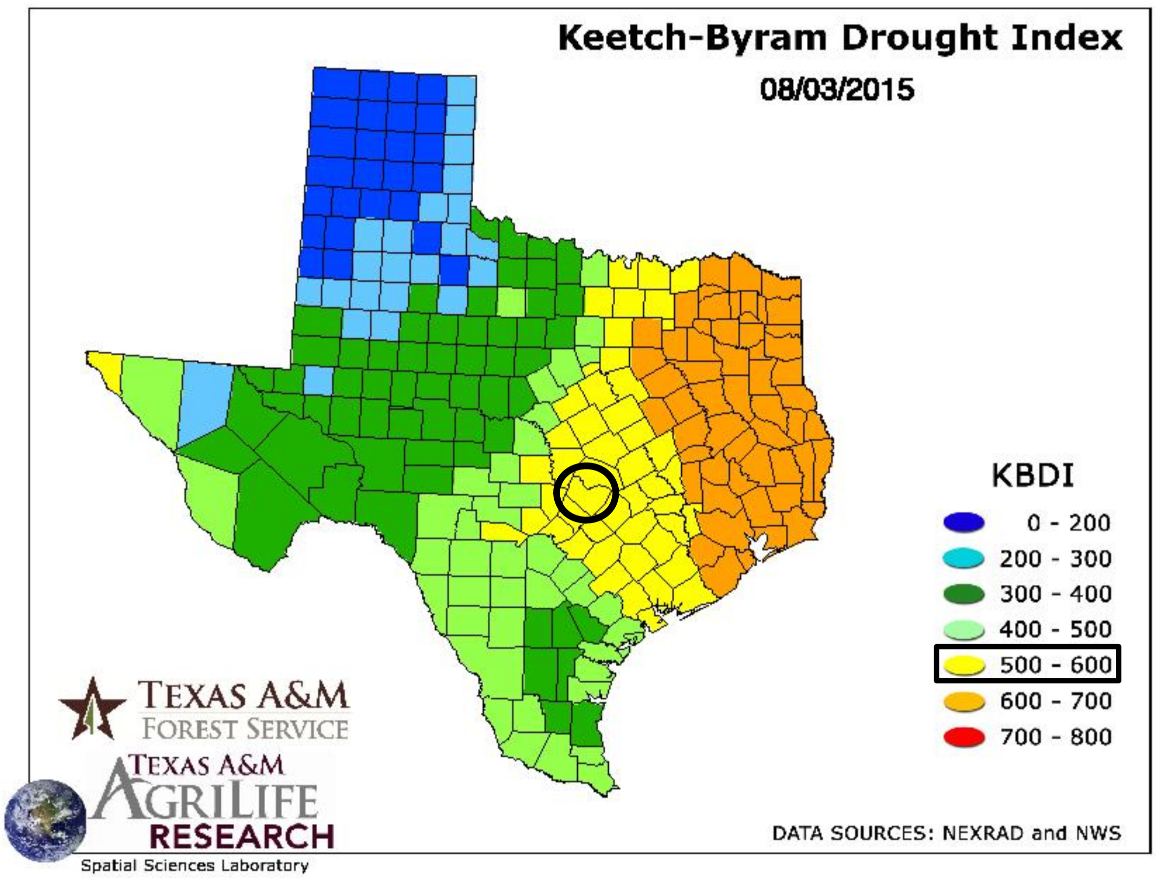
[2] Source: National Drought Mitigation Center

CATEGORY	DESCRIPTION	POSSIBLE IMPACTS	PALMER DROUGHT INDEX
D3	Extreme Drought	Major crop/pasture losses; extreme fire danger; widespread water shortages or restrictions.	-4.0 to -4.9
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells, creating water emergencies.	-5.0 or less

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

Based on historical occurrences for drought and the location of the City of Austin, the planning area can anticipate a range of drought from severe drought to exceptional drought or D2 to D4 based on the Palmer Drought Category.

Figure 6-1. Texas Drought Index according to Keetch-Byram Drought Index



The Texas Forest Service uses the Keetch-Byram Drought Index to determine the fire potential (based on daily water balance, precipitation and soil moisture), which uses a rating classification that is color coded with a scale of 0 to 800 (Low risk to high risk). The County average for the City of Austin planning area is at moderate risk, as seen in Figure 6-1. Which means fire intensity begins to significantly increase. Fires will readily burn in all directions, exposing mineral soils in some locations.

Historical Occurrences

The City of Austin planning area may typically experience a severe drought. Table 6-4 and 6-5 lists historical events that have occurred in Travis County as reported in the National Climatic Data Center (NCDC) and SHELDUS. Historical drought information, as provided by the NCDC and SHELDUS, 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.

Table 6-4. Historical Drought Years, 1950-2014

DROUGHT YEAR
1977
1996
2000
2011
2012
2013
2014
10 unique events

Table 6-5. Historical Drought Events, 1950-2014

JURISDICTION	DATE	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
Travis County	5/1/1977	$7,042	$70,423	$27,159	$27,159
Travis County	4/1/1996	$2,443,182	$4,886,364	$3,639,189	$7,278,377
Travis County	7/1/2000	$0	$0	$0	$0
Travis County	5/1/2011	$0	$0	$0	$0
Travis County	1/1/2012	$0	$0	$0	$0
Travis County	6/1/2012	$0	$0	$0	$0
Travis County	12/1/2012	$0	$0	$0	$0

JURISDICTION	DATE	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
Travis County	2/1/2013	$0	$0	$0	$0
Travis County	6/1/2013	$0	$0	$0	$0
Travis County	8/1/2014	$0	$0	$0	$0

Significant Past Events

March 1, 2013 – Travis County, Austin

March was another dry month across South Central Texas. Most of the region received less than normal rainfall with most of the southern and western areas getting less than 25 percent of normal. In addition to the dry month, March ended a dry six month period from October 2012 through March 2013. These six months ranked in the ten driest October to March periods at Del Rio, Austin Camp Mabry, and Austin Bergstrom International Airport. As a result, the drought worsened in 13 counties and only Atascosa and Frio Counties remained in the severe category (Stage D2) drought. Maverick County moved into the exceptional category (Stage D4); Bastrop, Caldwell, Dimmit, Fayette, Gonzales, Guadalupe, Williamson, and Zavala counties moved to extreme (Stage D3); and Bexar, Lavaca, Medina, and Wilson counties moved to severe (Stage D2). Edwards, Kinney and Val Verde counties remained in exceptional (Stage D4); Hays, Kerr, and Real counties remained in extreme (Stage D3); and Bandera, Blanco, Burnet, Comal, De Witt, Gillespie, Karnes, and Kendall counties remained in severe (Stage D2). Fire danger at the end of the month was low to moderate due to rain toward the end of March. Of the counties in Stage D2 or worse drought, 14 had outdoor burn bans in effect at the end of the month. These were Bexar, Dimmit, Edwards, Guadalupe, Hays, Karnes, Kendall, Kinney, Maverick, Medina, Travis, Uvalde, Val Verde, and Wilson. The Texas Crop and Weather Report issued by Texas A&M Agricultural indicated soil moisture was a problem in dry land corn, sorghum, and cotton. Area lakes and reservoirs continued below normal pool elevations with Lake Amistad around 52 feet below normal, Lake Travis 50 feet below normal, and Medina Lake nearly 80 feet below normal which left it at 6.5 percent of capacity. The Edwards Aquifer was 19.9 feet below normal, and 4.7 feet below the level it was at the end of March 2013.

June 1, 2012 – Travis County, Austin

A lack of rainfall resulted in 21 counties in South Central Texas going back into severe or extreme drought conditions. Most of these counties received one half inch or less of rain during the month. Williamson County moved into extreme drought category (State D3) while the other counties went to severe category (Stage D2). Eleven counties had burn bans in effect, and fire danger at the end of the month was moderate to high. The Texas crop and weather report issued by Texas A&M Agricultural indicated conditions were very dry, and grasshopper pressure was high. Brush was showing signs of heat and water stress and was losing color. Pastures deteriorated, and row crops began to show moisture stress. Area lakes and reservoirs started to fall again and were generally well below normal pool elevations with Lake Travis around 40 feet below normal and Medina Lake 55 feet below normal. The seven day stream flow average over most of the region was in the below normal range, but the Upper Guadalupe and Lower Colorado basins were much below normal. The Edwards Aquifer was 22 feet below normal.

May 1, 2011 – Travis County, Austin

The drought continued over South Central Texas and worsened in some counties. Most of the area was in exceptional drought conditions (Stage D4). Lack of rain this month moved Bandera, Bexar, Blanco, Caldwell, Comal, Frio, Gillespie, Gonzales, Guadalupe, Hays, Kendall, Medina, Travis, and Williamson counties into this stage and De Witt and Karnes counties into extreme drought conditions (Stage D3). This means all of South Central Texas was in either extreme or exceptional drought conditions. Fire danger in South Central Texas remained moderate to high and burn bans were in effect for all of the counties except Llano. The Texas A&M agricultural program report indicated the agricultural situation was rapidly deteriorating. Forage availability remained below average. Many stock tanks remained extremely low and some were in danger of drying up. 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. The Rio Grande was in normal stream flow. Area lakes and reservoirs remained below normal pool elevations with Lake Travis around 32 feet below normal and Medina Lake near 27 feet below normal. The Edwards Aquifer was 20.4 feet below normal and 29.3 feet below the level from one year ago. The San Antonio Water System (SAWS) moved into Stage 2 water restrictions, the City of Kerrville was in Stage 3, the City of San Marcos was in Stage 2, and the City of Austin was in Stage 1. Many other communities across South Central Texas continued with some level of water restrictions.

Probability of Future Events

Based on 10 recorded drought events over the 37-year reporting period, the City of Austin planning area, including Austin ISD averages one drought every three years. This frequency supports a likely probability of future events.

Vulnerability and Impact

Loss estimates were based on 64 years of statistical data from the NCDC and SHELDUS. 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 6-6 shows annualized exposure.

Table 6-6. Drought Event Damage Totals, 1950-2014

JURISDICTION	NUMBER OF EVENTS	PROPERTY DAMAGES	CROP DAMAGES	PROPERTY DAMAGES (2015 DOLLARS)	CROP DAMAGES (2015 DOLLARS)
Travis County	10	$2,450,244.08	$4,956,786.17	$3,666,347.44	$7,305,536.01
TOTAL LOSSES:		**$7,407,010.25**		**$10,971,883.45**	

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, and environment are all vulnerable to drought. The average person will survive only a few days without water, and this timeframe can be drastically shortened for those people with more fragile health – typically children, the elderly, and the ill. 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.

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. Based on the 10 reported previous occurrences and potential exposure for the hazard, the potential severity of impact of droughts is “Limited” with less than 10 percent of property destroyed and has resulted in no injuries or fatalities. Annualized loss over the 64-year reporting period in Travis County is $296,537 annually.

Section 7: Wildfire

Hazard Description

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

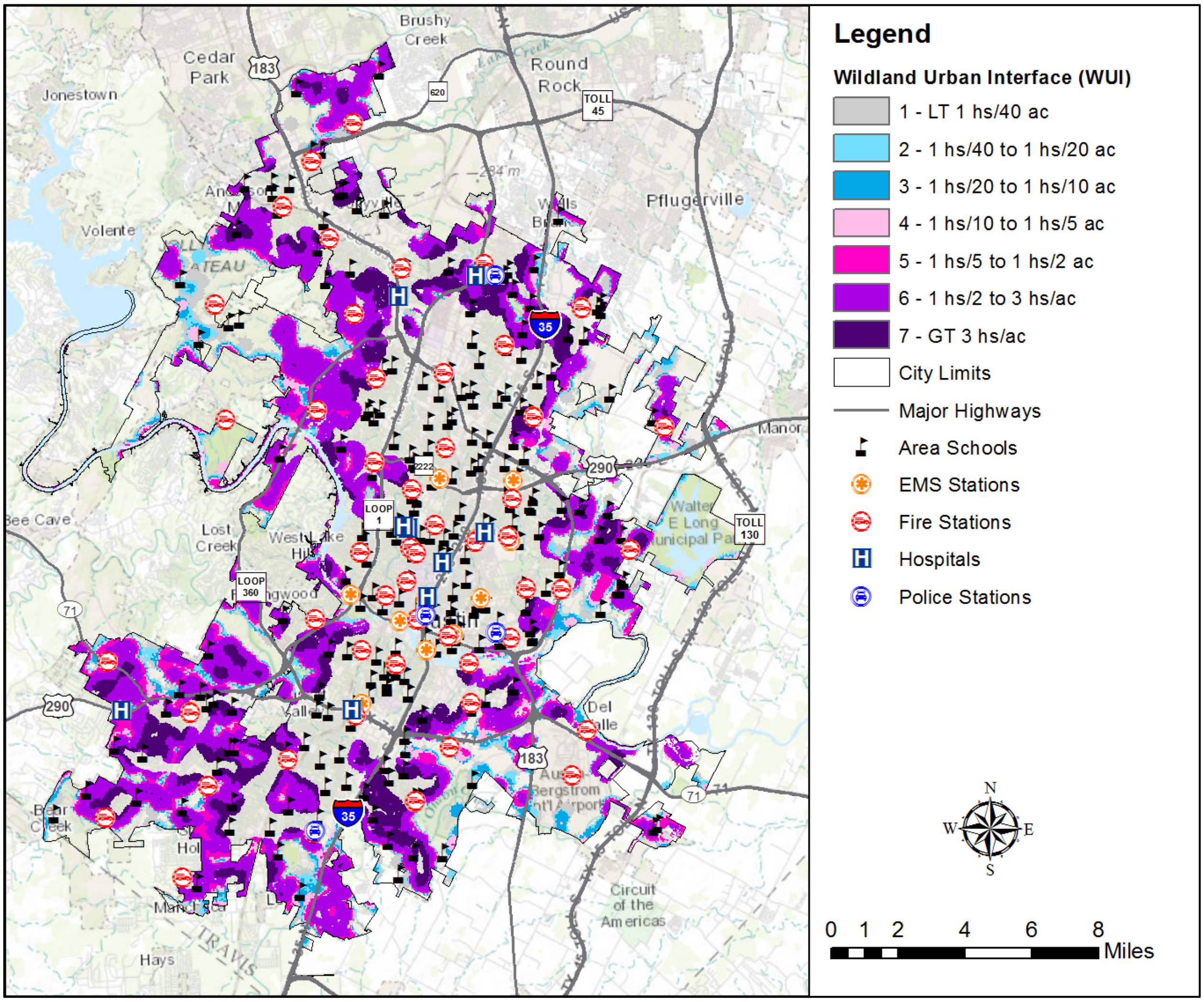
A wildfire event often begins unnoticed and spreads quickly, lighting brush, trees and homes on fire. For example, a wildfire may be started by a campfire that was not doused properly, a tossed cigarette, burning debris, or arson.

Texas has seen a significant increase in the number of wildfires in the past 30 years, which included wildland, interface, or intermix fires. Wildland Urban Interface or Intermix (WUI) fires occur in areas where structures and other human improvements meet or intermingle with undeveloped wildland or vegetative fuels.

Location and Historical Occurrences

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 (see Figure 7-1). It is estimated that 34.5 percent of the total population in the City of Austin live within the WUI. However, the entire City of Austin planning area is equally at risk for wildfires.

Figure 7-1. Wildland Urban Interface Map – City of Austin



From 2005 to 2015 the Texas Forest Service (TFS) database reported 305 wildfire events within the City of Austin boundaries. TFS started collecting wildfire data in 1985, but volunteer fire departments did not start reporting events until 2005. Due to lack of recording prior to 2005, frequency calculations were based on a 10 year period, and only data received during those years were included in the calculations. The map below shows approximate locations of wildfires, which can be grass or brushfires of any size (see Figure 7-2). Tables 7-1 thru 7-3 provide information (provided by local volunteer fire departments) on number of wildfires by ignition causes, number of fires reported by year, number of fires by month, and acreage of suppressed wildfire by year.

Historical wildfire data for the following are provided within a City-wide basis per the NCDC and SHELDUS databases; Austin ISD is included in Austin.

Figure 7-2. Location and Historic Wildfire Events for Austin

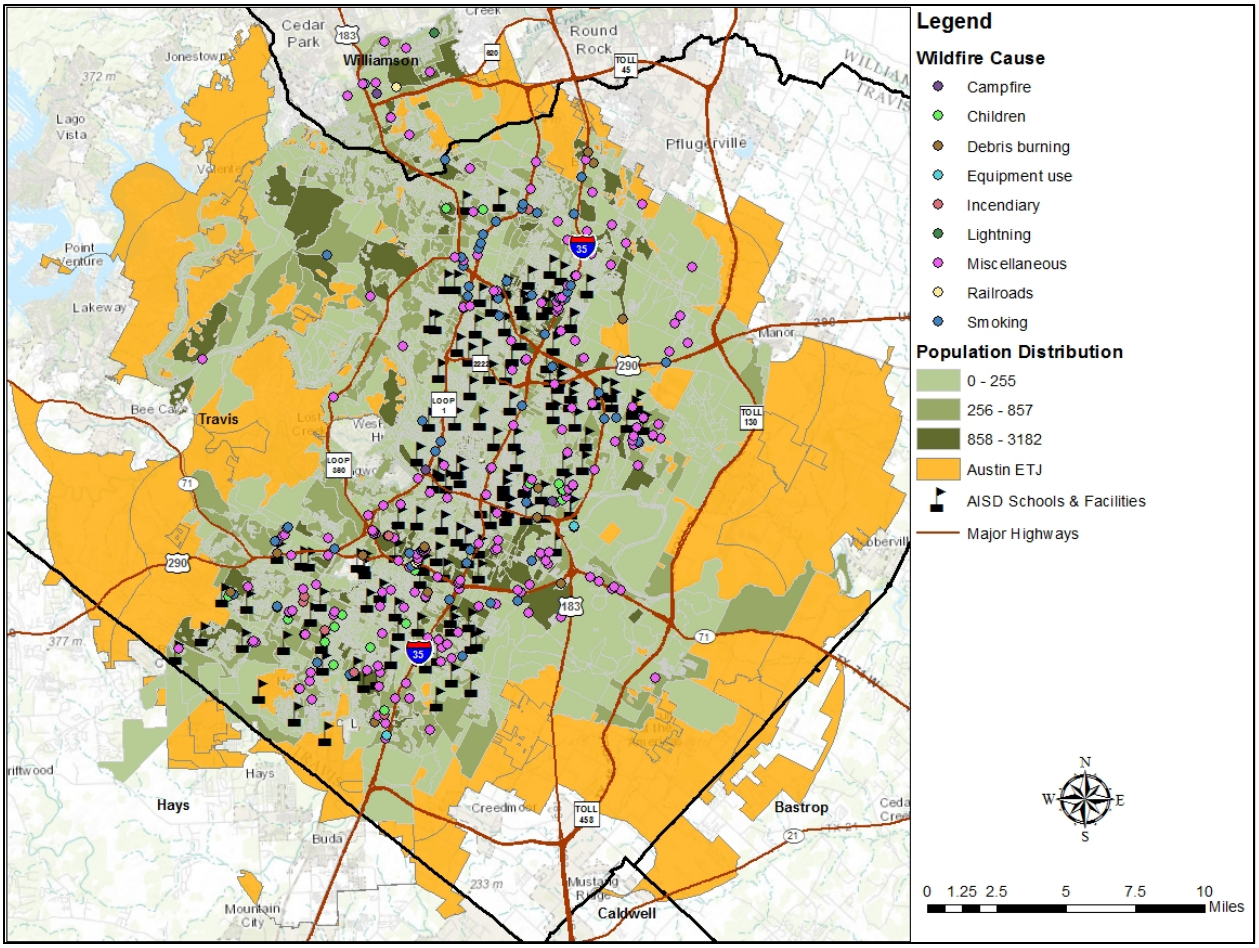


Table 7-1. Number of Wildfires by Cause for Austin

CAUSE	NUMBER
Miscellaneous	195
Debris Burning	12
Equipment Use	4
Children	17
Campfire	4
Smoking	60
Lightning	1
Incendiary	9
Railroads	3

CAUSE	NUMBER
TOTAL	305

Table 7-2. Acreage of Suppressed Wildfire by Year

JURISDICTION	2005	2006	2007	2008	2009
City of Austin	32	124.1	46	249	24.1

Table 7-3. Number of Wildfires by Year

JURISDICTION	2005	2006	2007	2008	2009
City of Austin	27	108	42	112	16

Significant Past Events

September 4, 2011 – Steiner Ranch Wildfire

The Steiner Ranch Wildfire started on September 4th behind Tropical Storm Lee and a cold front that brought northerly winds. The peak wind at Austin Bergstrom International Airport was 36 mph. The fire burned 125 acres, destroyed 24 homes, and damaged 30 others.

April 17, 2011 – Oak Hill Wildfire

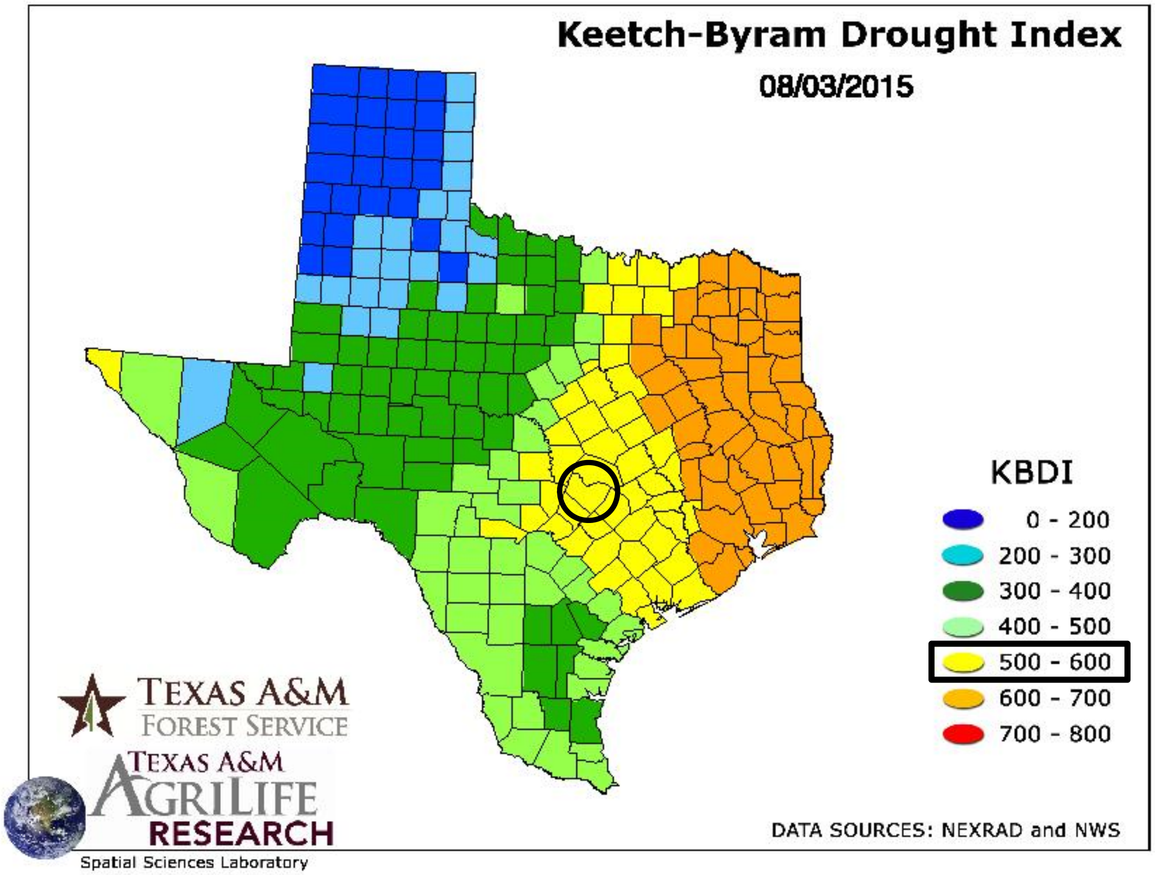
A human caused wildfire started around noon in the Oak Hill area of southwest Austin. The Oak Hill fire burned 100 acres and spread to nearby neighborhoods. Eleven homes were destroyed and 10 others were damaged. Most of the damage occurred on South Brook Drive and Callbram Lane. At the peak of the fire, 450 homes were threatened and 100 firefighters were fighting the fire, which is approximately half of the Austin Fire Department.

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.

Each color in Figure 7-3 represents the drought index at that location. The drought index ranges from 0 to 800. A drought index of 0 represents no moisture depletion, and a drought index of 800 represents absolutely dry conditions.

Figure 7-3. Keetch-Byram Drought Index (KBDI) for the State of Texas, 2015[1]



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

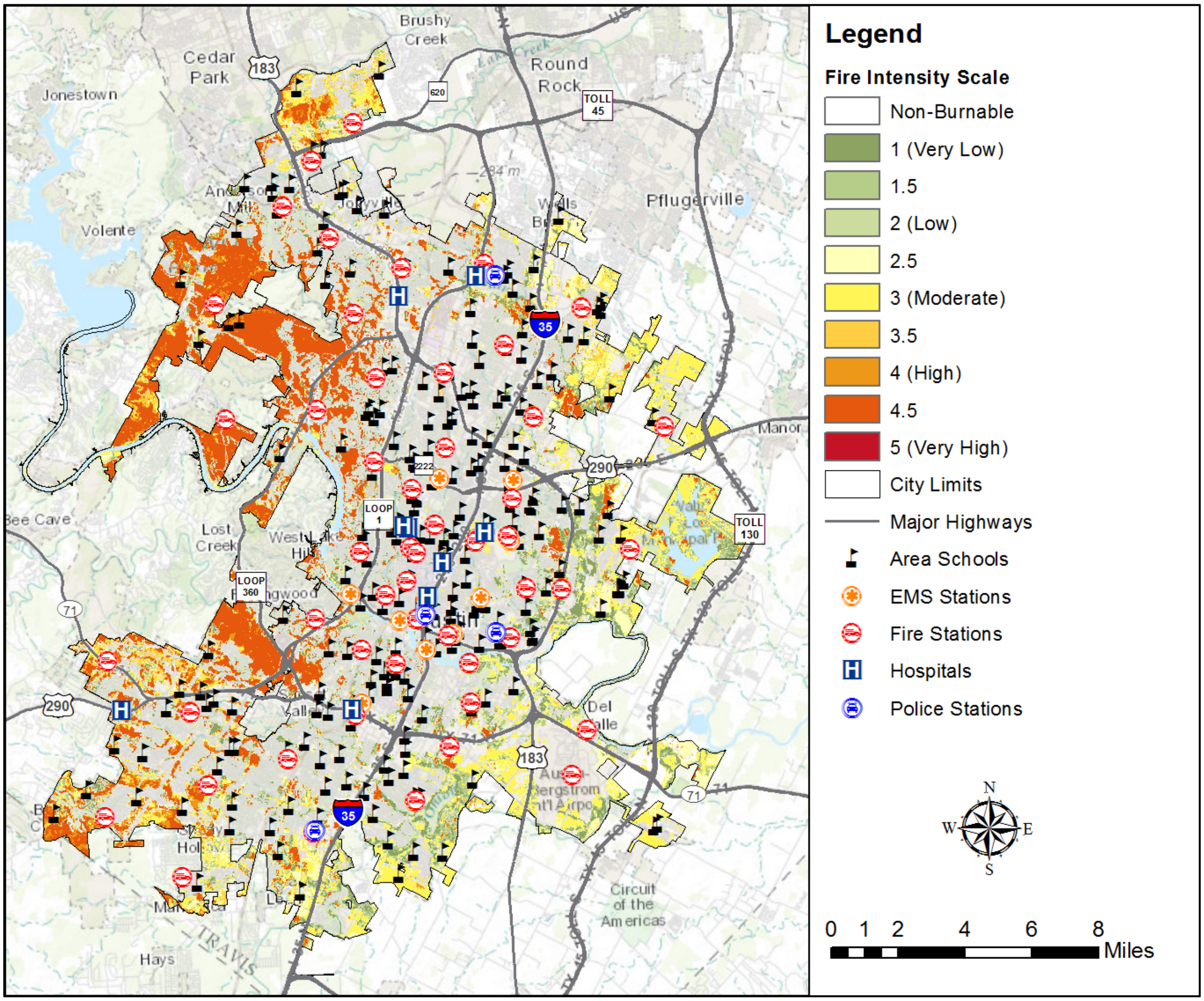
- **0 – 200:** Soil and fuel moisture are high. Most fuels will not readily ignite or burn. However, with sufficient sunlight and wind, cured grasses and some light surface fuels will burn in spots and patches.
- **200 – 400:** Fires more readily burn and will carry across an area with no gaps. Heavier 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. The KBDI should be referenced as the area experiences changes in precipitation and soil moisture, and caution exercised in dryer, hotter conditions.

[1] The City of Austin is located within the black circle.

The range of intensity for the City of Austin in a wildfire event is within 500 to 600. The average extent to be mitigated for the City of Austin planning area is a KBDI of 521. At 521 KBDI, fires will burn readily, exposing mineral soils in some locations. Wildfires may burn or smolder for several days possibly creating smoke and control problems. Figure 7-4 identifies the wildfire intensity for the City of Austin.

Figure 7-4. Fire Intensity Scale Map – City of Austin



Probability of Future Events

Wildfires can occur at any time of the year. As the City grows and develops more within wild land, the potential area for a wildfire event increases. With 305 events in a ten-year period, an event within the City of Austin and Austin ISD is highly likely and an event is probable within the next year.

Vulnerability and Impact

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

The heavily populated, urban areas of the City of Austin are not likely to experience large, sweeping fires. Areas outside of the City in the unincorporated areas of Travis County are vulnerable. Unoccupied buildings and open spaces that have not been maintained have the greatest vulnerability to wildfire. The overall level of concern for wildfires is located mostly along the perimeter of the WUI.

Areas along railroads and people with homes in wooded, rural areas have an increased risk of wildfire. Seton Southwest Hospital has a moderate risk to wildfire. The fire and EMS stations that have a low risk to wildfire are: 5309 E. Riverside Dr., 1330 E. Rundberg Ln., 517 S. Pleasant Valley Rd., 11612 Four Irons Dr., 5811 Nuckols Crossing Rd., 5500 Burleson Rd., 6702 Wentworth Dr., 9421 Spectrum Dr., 3704 Deer Ln., 9409 Bluegrass Dr., 4201 Spicewood Springs Rd., 2434 Cardinal Loop, 11205 Harris Branch Pkwy, 7701 River Place Blvd., 2307-A Foster Ave., 5905 Nuckols Crossing Rd., and 2454 Cardinal Loop. Schools with a low risk to wildfire are the following: Allison Elementary, Baty Elementary, Brentwood Christian School, Cooperfield Elementary, Deerpark Middle, Dobie Middle, Dobie PK Center, Harmony School of Excellence, Harmony School of Science – Austin, Harmony Science Academy North Austin, Hart Elementary, John B Connally High, Kipp Austin Vista Middle School, Linder Elementary, Live Oak Elementary, Mendez Middle, Nyos Charter School, River Oaks Elementary, Rodriguez Elementary, The East Austin College Prep Academy, The Real Learning Academy, TNC Campus (Texas Neurorehabilitation Cent), Widen Elementary, Akins High, Austin Discovery School, Bannockburn Christian Academy, Baranoff Elementary, Barton Hills Elementary, Blazier Elementary, Bluebonnet Trail Elementary, Canyon Creek Elementary, Canyon Vista Middle, Country Home Learning Center No. 7, Covington Middle, Cowan Elementary, Cunningham Elementary, Del Valle Elementary, Del Valle Middle, Dessau Middle, Forest North Elementary, Garcia Young Mens Leadership Academy, Hillcrest Elementary, Jordan Elementary, Kipp Austin Academy of Arts & Letters, Kipp Austin College Prep, Kipp Austin Collegiate, Kipp Austin Comunidad, Kipp Austin Connections Elementary, Langford Elementary, Lasa High, Laurel Mountain Elementary, LBJ High School, Oak Meadows Elementary, Overton Elementary, Palm Elementary, Paredes Middle, Patsy Sommer Elementary, Perez Elementary, Pioneer Crossing Elementary, Richards School for Young Women Leaders, Rutledge Elementary, Smith Elementary, St. Theresa Catholic School Austin, and Travis County State Jail.

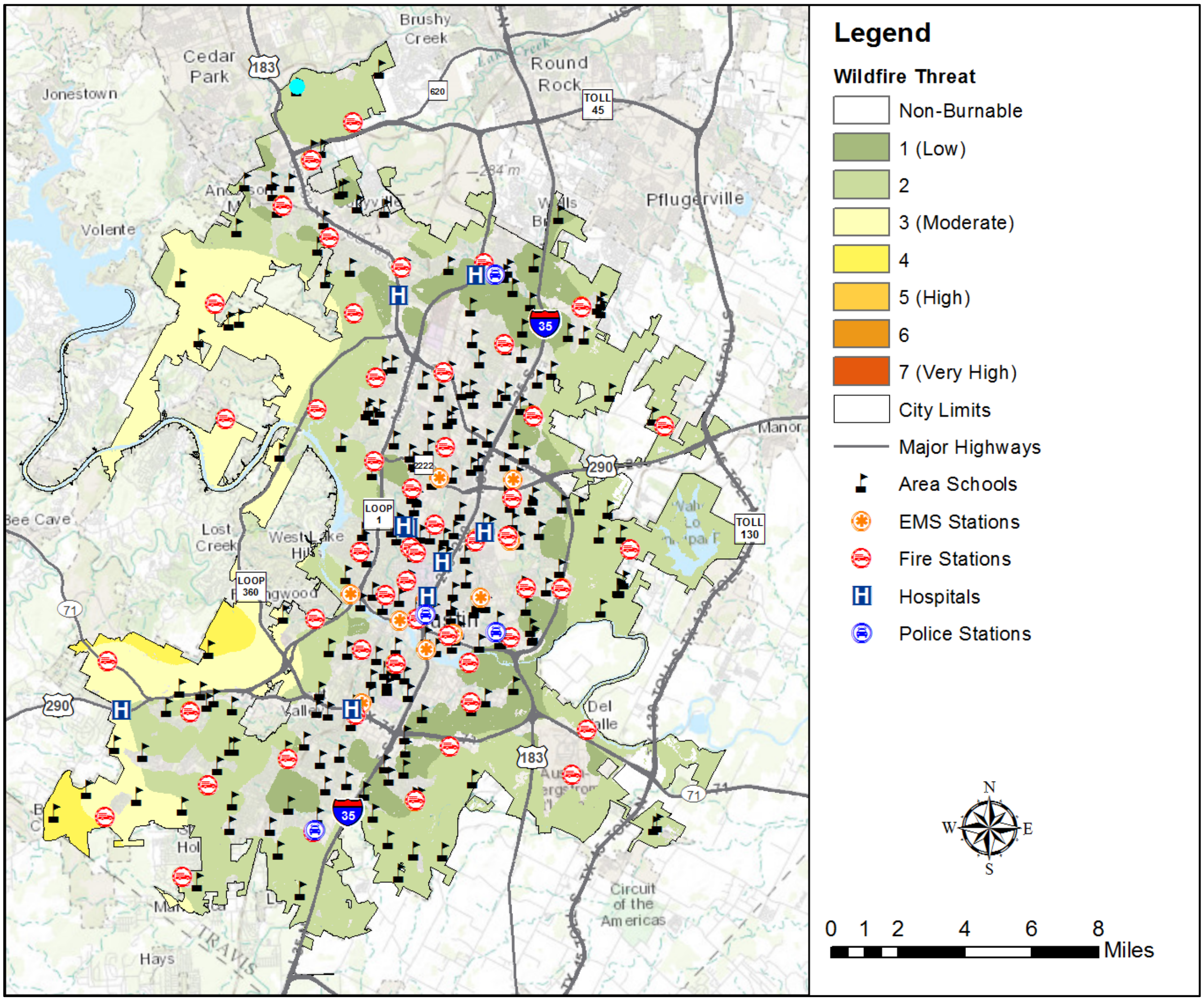
Five fire and EMS stations in the City have a moderate risk to wildfire: 8700 W SH 71, 7701 River Place Blvd., 4200 City Park Rd., 11401 Escarpment Blvd, and 3625 Davis Ln. The schools with a moderate risk are: Austin Montessori School, Bowie High, Bridge Point Elementary, Cedar Creek Elementary, Clayton Elementary, Four Points Middle, Gorzycki Middle, Grandview Hills Elementary, Kiker Elementary, Oak Hill Elementary, River Place Elementary, Vandegrift High, Baldwin Elementary, and Regents School of Austin.

Within the City of Austin, a total of 305 fire events were reported from 2005 to 2015. All of these events were suspected wildfires. Historic loss and annualized loss estimates due to wildfires are presented in Table 7-4. The frequency is approximately 30 events every year. Figure 7-5 illustrates the likelihood of a wildfire event in the City of Austin.

Table 7-4. Historic Loss Estimates Due to Wildfire[2]

JURISDICTION	NUMBER OF EVENTS	ACRES BURNED	INJURIES	DEATHS	ANNUAL LOSSES	ANNUAL ACRE LOSSES
City of Austin	307	475.2	0	0	$1,246,775	70

Figure 7-5. Likelihood of Wildfire Starting – City of Austin



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 microscopic 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.

[2] Events divided by 10 years of data.

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 City of Austin and Austin ISD, the impact from a wildfire event can be considered “Minor," and injuries are possible but may not result in permanent disability, complete shutdown of critical area facilities for more than one week, and more than ten percent of property destroyed or with major damage.

Section 8: Extreme Heat

Hazard Description

Extreme heat is the condition whereby temperatures hover ten degrees or more above the average high temperature in a region for an extended period. Extreme heat during the summer months is a common occurrence throughout the State of Texas, and the City of Austin is no exception. Severe, excessive summer heat is characterized by a combination of exceptionally high temperatures and humidity. When these conditions persist over a period of time, it is defined as a heat wave. The City of Austin typically experiences extended heat waves.

Although heat can damage buildings and facilities, it presents a more significant threat to the safety and welfare of citizens and animals. 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 injuries or death from extreme heat has been recorded in Travis County, there is no specific geographic scope to the extreme heat hazard. Extreme heat could occur in any area of the City of Austin and the AISD.

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 NOAA, this relationship is referred to as the "Heat Index," and is depicted in Figure 8-1. This index measures how hot it feels outside when humidity is combined with high temperatures.

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

Temperature (ºF)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	126	130					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Streuous Activity

Caution Extreme Caution Danger Extreme Danger

The extent scale in Figure 8-1 displays varying degrees of caution depending on the relative humidity combined with the temperature. For example, when the temperature is at 90 degrees Fahrenheit (ºF) or lower, caution should be exercised if the humidity level is at or above 40 percent.

The shaded zones on the chart indicate varying symptoms or disorders that could occur depending on the magnitude or intensity of the event. "Caution" is the first level of intensity where fatigue due to heat exposure is possible. "Extreme Caution" indicates that sunstroke, muscle cramps or heat exhaustion are possible, whereas a "Danger" level means that these symptoms are likely. "Extreme Danger" indicates that heat stroke is likely. The National Weather Service (NWS) initiates alerts based on the Heat Index as shown in Table 8-1.

[1] Source: NOAA

Table 8-1. Heat Index & Warnings

CATEGORY	HEAT INDEX	POSSIBLE HEAT DISORDERS	WARNING
Extreme Danger	130° F and higher	Heat stroke or sun stroke likely.	A heat advisory will be issued to warn that the Heat Index may exceed 105° F.
Danger	105 – 129° F	Sunstroke, muscle cramps, and/or heat exhaustion are likely. Heatstroke possible with prolonged exposure and/or physical activity.	
Extreme Caution	90 – 105° F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.	An Excessive Heat Warning is issued if the Heat Index rises above 105° F at least 3 hours during the day or above 80° F at night.
Caution	80 – 90° F	Fatigue is possible with prolonged exposure and/or physical activity.	

Due to its location, and its urban makeup, the City of Austin, including the Austin ISD, can expect an extreme heat event each summer. The City of Austin created an Emergency Operations Heat Plan in 2011 after the Heat Wave of 2009. The Heat Plan is triggered when the National Weather Service issues advisories or warnings for excessive heat above 105° F for more than three hours per day, and two days in a row. Emergency visits and calls due to heat-related illness is monitored by the Austin/Travis County Health and Human Services Department and reported to the City of Austin.

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 for prolonged periods of time. Due to the abundance of concrete and metal infrastructure, the effects of an extreme heat event can be intensified. Concrete and metal absorb heat energy and emit that energy at night, thereby trapping heat, and causing the temperature to feel as much as 10 degrees higher than surrounding areas. This is known as the “heat island” effect.

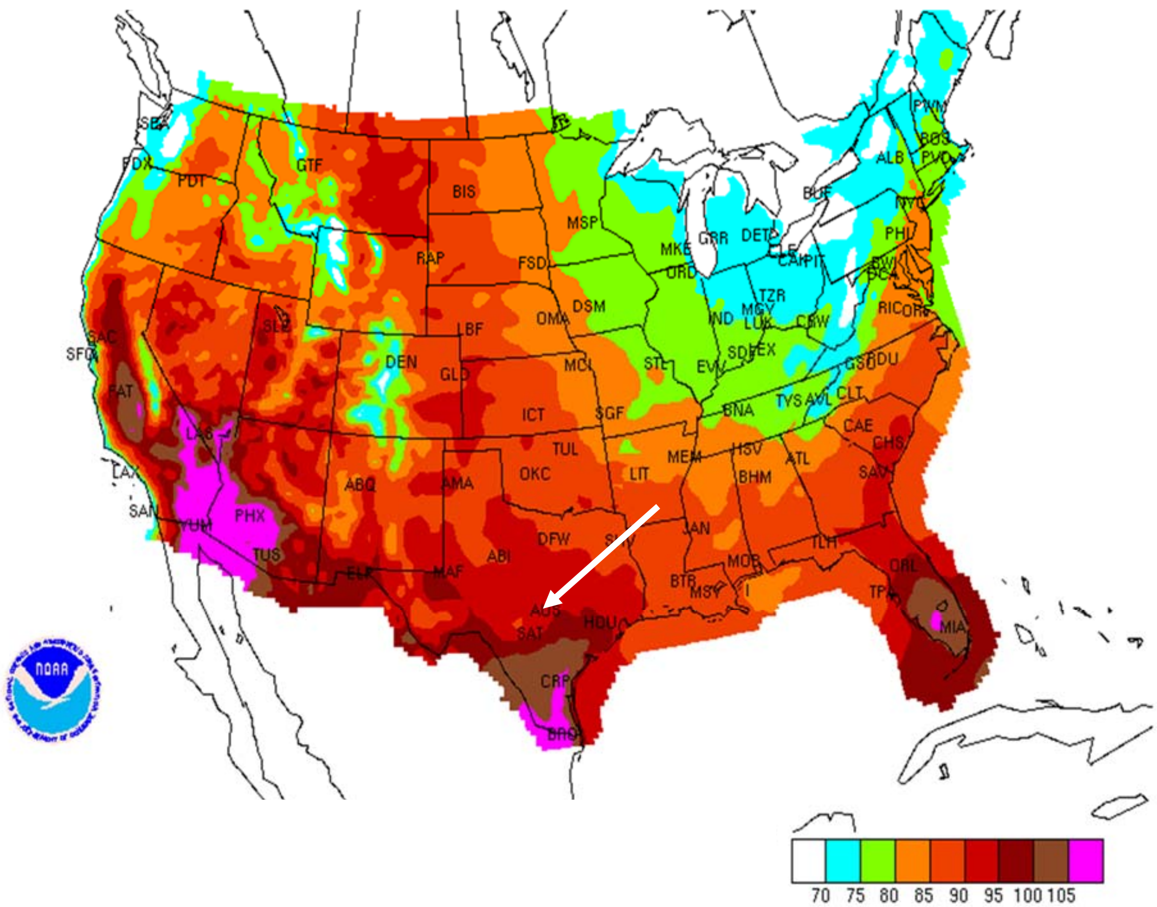
Daytime temperatures in summer are hot, with highs over 90 degrees about 80 percent or more of the time. Cool fronts may affect the area and drop overnight lows to the 50s on some occasions. In these cases, warm winds quickly return, pushing lows to the 70s in a few days. In very hot summers, the continental regime of West and North Texas can have an impact of keeping daytime highs near and above 100 degrees, especially with hot west and southwest winds. Most of the time, the moderating effects of the Gulf of Mexico limit daytime highs; however, they also add to the discomfort with higher humidity. Sometimes, when weak fronts that have lost most of their cool air properties and move through the area, warmer than normal daytime highs follow, as the area is blocked from the moderating effects of the Gulf of Mexico. [2]

Figure 8-2 displays the daily maximum heat index as derived from NOAA based on data compiled from 1849 to 2014. Red indicates a daily maximum heat index of 90-95 degrees F. The City of Austin

[2] http://www.srh.noaa.gov/images/ewx/climate/ausclisum.pdf

and Austin ISD should caution to "Danger" using the Heat Index, meaning the average extent to mitigate for citizens in the planning area is sunstroke, muscle cramps, and heat exhaustion.

Figure 8-2. Average Daily Maximum Heat Index[3]



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. Data from the Texas Department of State Health Services suggest that between 2003 and 2008, record high summer temperatures in Texas resulted in 439 heat-related deaths statewide. The highest temperature of record at Austin Mabry was 112º F on September 5, 2000 and August 28, 2011. The highest temperature of record at Austin Bergstrom International Airport was 112º F on September 5, 2000.[4] Table 8-2 depicts historical occurrences of mortality due to heat from 2008 to 2014 provided by the Austin/Travis County Health and Human Services Department.

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[3] Source: NOAA and the white arrow points to the City of Austin.

[4] http://www.srh.noaa.gov/images/ewx/climate/ausclisum.pdf

Table 8-2. Extreme Heat Related Deaths in Austin

YEAR	DEATHS
2008	3
2009	1
2010	1
2011	5
2012	0
2013	5
2014	2

According to heat related incidents located solely within Travis County there are 12 heat waves[5] on record (Table 8-3). Historical extreme heat information, as provided by the NCDC and SHELDUS, 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.

Table 8-3. Historical Extreme Heat, 1950-2014

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
Travis County	7/1/1980	3	1	$5,319	$531,915	$15,086	$1,508,644
Travis County	7/29/1999	1	0	$0	$0	$0	$0
Travis County	8/14/1999	1	0	$0	$0	$0	$0
Travis County	8/16/1999	1	0	$0	$0	$0	$0
Travis County	7/4/2000	1	0	$0	$0	$0	$0
Travis County	7/5/2000	1	0	$0	$0	$0	$0
Travis County	7/18/2000	1	0	$0	$0	$0	$0
Travis County	7/23/2000	1	0	$0	$0	$0	$0
Travis County	7/23/2000	1	0	$0	$0	$0	$0
Travis County	7/15/2009	0	0	$0	$0	$0	$0

[5] Even though the City experiences heat waves each summer, NCDC and SHELDUS data only records events reported. Based on reports, only 12 events are on record.

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
Travis County	5/25/2011	0	0	$0	$0	$0	$0
Travis County	8/9/2011	1	0	$0	$0	$0	$0

Significant Past Events

June 15, 2009

A water well drilling construction worker was found unresponsive in a vehicle. He died from heat exhaustion.[6]

June 5, 2012

An Austin highway construction worker died due to heat stress.[7]

July 8 & July 14, 2014

Austin/Travis County Health & Human Services Department reported 2 deaths due to hyperthermia.

Probability of Future Events

According to historical records, Travis County, including the City of Austin and Austin ISD, reported 12 events in a 34 year period, which provides a frequency of an event to potentially occur every year. Hence, the likelihood or future probability of excessive summer heat in the City of Austin and Austin ISD is highly likely.

Vulnerability and Impact

Because extreme heat events are not confined to specific geographic boundaries, all existing and future buildings, facilities, and populations are considered to be exposed to this hazard and could potentially be impacted.

Although heat can damage buildings and facilities, it presents a more significant threat to the safety and welfare of citizens, particularly the elderly population or the infirmed that live within the City of Austin planning area and cannot afford air conditioning or to run it on a regular basis. Students at the participating Independent School District are also susceptible as sporting events and practices are often held outside during early fall or late spring when temperatures are at the highest. The major human risks associated with severe summer heat include: heat cramps; sunburn; dehydration; fatigue; heat exhaustion; and even heat stroke. Also area mobile home housing may not be equipped to cool residents. These individuals may need a place to go during the hottest daytime hours. Additionally, livestock and crops can become stressed, decreasing in quality or in production, during times of extreme heat, causing food prices to escalate.

[6] https://www.osha.gov/SLTC/heatillness/map_text.html
[7] Ibid

Extreme high temperatures can have significant secondary impacts, leading to droughts, water shortages, increased fire danger, and prompt excessive demands for energy. The economic and financial impacts of extreme heat on the City of Austin and AISD will depend on the duration of the event, demand for energy, drought associated with extreme heat, and many other factors. The possibility of rolling blackouts increases with unseasonably high temperatures in what is a normally mild month with low power demands.

Infrastructure in Central Texas is generally designed to withstand relatively high temperatures. However, extreme heat can contribute to accelerated pavement deterioration, thermal misalignments in rail lines, and can affect maintenance and construction crews. In addition to having physical impacts on assets, extreme temperatures can affect operations and maintenance across modes of transportation. Temperatures above 100° F create a health and safety hazard for maintenance and construction crews. When temperatures reach 105° F, employees must take 10-minute hydration breaks every 50 minutes. Rail lines in the Austin area are set with a rail-neutral temperature between 100° F and 115° F, after which the risk of thermal misalignment increases. Thermal misalignments, in turn, can increase the risk of train derailments and cause operational disruptions and/or slower operating speeds. Thermal misalignments on Capital Metro rail have occurred in the past, but the agency issues precautionary speed restrictions during high heat days to reduce the risk of derailments. Freight lines have lower thresholds for speed restrictions than passenger lines.[8]

Impact of extreme heat experienced in the City, including AISD, has a major severity as injuries and/or illnesses can result in permanent disability; although in terms of structures, the City is considered to have a limited severity of impact meaning shutdown of facilities and services for 24 hours or less, and less than 10% of property is destroyed or with major damage.

Loss estimates were based on 64 years of statistical data from the NCDC and SHELDUS. An extreme heat event frequency-impact was then developed to determine an impact profile on estimated potential losses due to extreme heat in the area. Table 8-4 shows annualized losses. The average annualized loss is approximately $44,816 per year.

Table 8-4. Extreme Heat Event Damage Totals, 1950-2014

JURISDICTION	NUMBER OF EVENTS	PROPERTY DAMAGES	CROP DAMAGES	PROPERTY DAMAGES (2015 DOLLARS)	CROP DAMAGES (2015 DOLLARS)
Travis County	12	$5,319	$531,915	$15,086	$1,508,644
TOTAL LOSSES:		**$537,234**		**$1,523,730**	

[8] Source: Central Texas Extreme Weather & Climate Change Vulnerability Assessment of Regional Transportation Infrastructure

Section 9: Thunderstorm

Hazard Description

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, and sub-hazards of thunderstorms are hail and tornadoes.

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.

Location

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

Thunderstorms occur randomly, and therefore it is impossible to predict where they will strike within the City. Thus, it is assumed that the City of Austin, including the Austin ISD, is uniformly exposed to the threat of thunderstorms.

Extent

The extent or magnitude of a thunderstorm 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[1]

FORCE	WIND (KNOTS)	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	4-7	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	8-12	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	13-18	Moderate Breeze	Dust, leaves and loose paper lifted, small tree branches move
5	19-24	Fresh Breeze	Small trees in leaf begin to sway
6	25-31	Strong Breeze	Larger tree branches moving, whistling in wires
7	32-38	Near Gale	Whole trees moving, resistance felt walking against wind
8	39-46	Gale	Whole trees in motion, resistance felt walking against wind
9	47-54	Strong Gale	Slight structural damage occurs, slate blows off roofs
10	55-63	Storm	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	64-72	Violent Storm	If experienced on land, widespread damage
12	73+	Hurricane	Violence and destruction

On average, the planning area experiences two to three thunderstorms every year. According to the available data for previous occurrences, high winds are common to the Austin area when accompanied by thunderstorms. The City of Austin, including the AISD, has experienced a significant wind event, or an event with winds in the range of “Force 10” on the Beaufort Wind Scale, with the average measurement of severe winds with a thunderstorm having winds at 55-63 knots. Therefore, planning participants on average could experience a range of wind speeds where whole trees are broken or uprooted.

Historical Occurrences

Figure 9-1 shows the locations of previous occurrences in the City of Austin planning area from 1958 to 2014. Tables 9-2 and 9-3 on the following page lists historical occurrences of thunderstorm events for the City of Austin planning area according to the NCDC data. Since January 1956, 211 severe thunderstorm events are known to have impacted Travis County, based upon NCDC and SHELDUS records. The table presents information on 135 of those historical events known to have specifically

[1] Source: World Meteorological Organization

impacted the City of Austin planning area. It is important to note that high wind events associated with other hazards, such as tornadoes, are not accounted for in this section.

Figure 9-1. Spatial Historical Thunderstorm Events, 1958–2014[2]

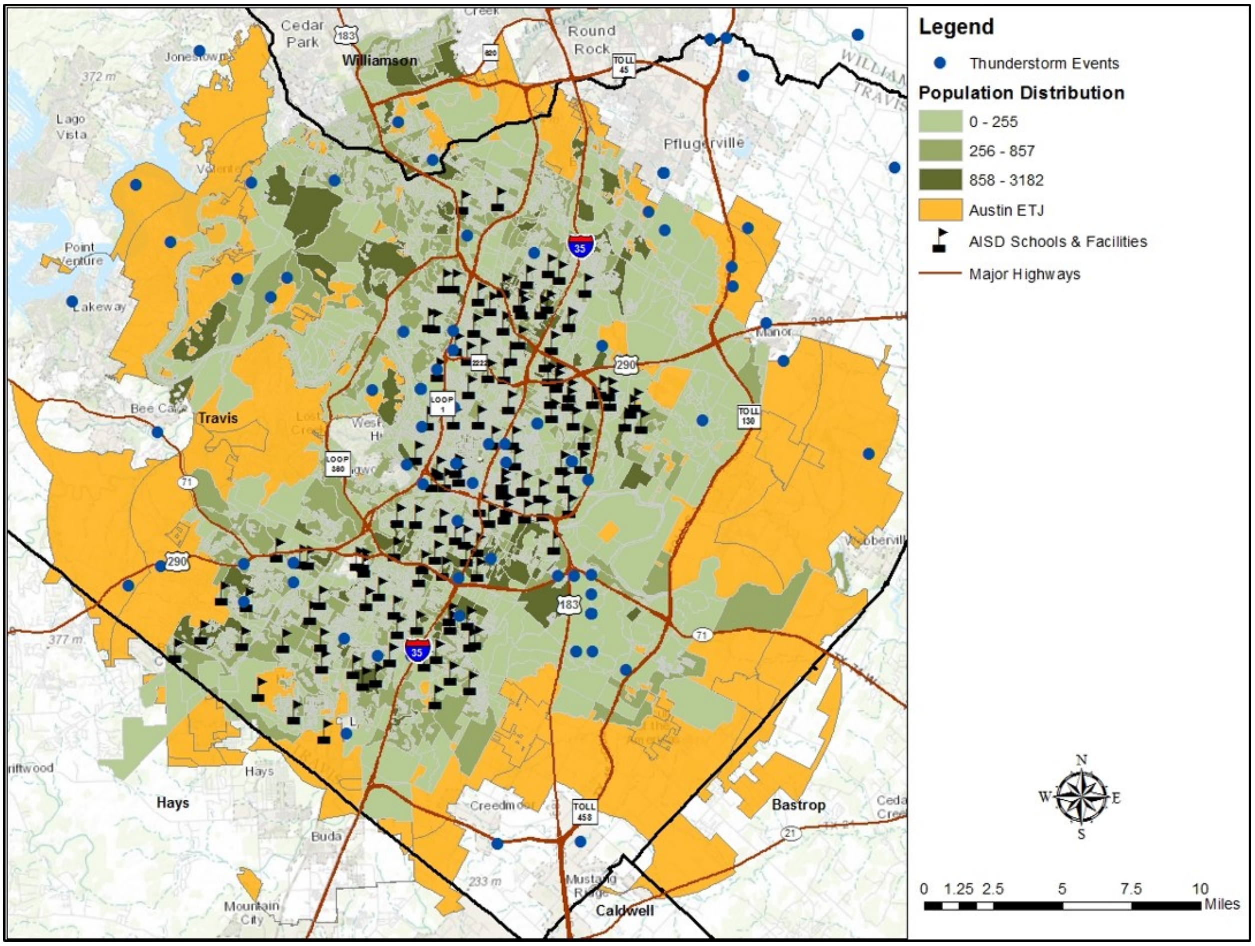


Table 9-2. Historical Thunderstorm Wind Events, 1958-2014

DATE	TIME	MADNITUDE (knots)	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
7/6/1958	6:45 PM	0	$0	$0	$0	$0
5/25/1961	2:11 PM	52	$0	$0	$0	$0
8/4/1961	1:15 PM	0	$0	$0	$0	$0
5/29/1962	1:00 AM	62	$0	$0	$0	$0
6/9/1962	8:15 PM	0	$0	$0	$0	$0

[2] Source: NOAA Records

DATE	TIME	MADNITUDE (knots)	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
3/4/1964	1:00 AM	50	$0	$0	$0	$0
5/16/1965	2:18 PM	0	$5,000	$0	$37,096	$0
8/14/1969	8:50 PM	55	$0	$0	$0	$0
3/12/1971	7:00 PM	0	$125,000	$0	$721,318	$0
5/1/1972	10:53 PM	54	$0	$0	$0	$0
1/20/1973	8:15 PM	0	$500	$0	$2,632	$0
5/31/1974	11:46 PM	50	$0	$0	$0	$0
5/23/1975	4:30 PM	0	$0	$0	$0	$0
5/23/1975	4:41 PM	0	$0	$0	$0	$0
5/23/1975	6:00 PM	69	$625,000	$62,500	$2,714,998	$271,500
2/17/1976	11:15 AM	65	$500,000	$0	$2,053,664	$0
3/30/1976	3:40 AM	0	$8,333	$833	$34,228	$34,228
5/26/1976	6:17 PM	61	$0	$0	$0	$0
5/26/1976	6:49 PM	53	$0	$0	$0	$0
8/26/1976	4:40 PM	0	$5,000	$0	$20,537	$0
5/2/1978	7:00 PM	75	$0	$0	$0	$0
7/10/1979	3:00 PM	0	$0	$0	$0	$0
2/29/1980	8:30 PM	50	$50,000	$0	$141,813	$0
5/8/1980	6:50 AM	0	$0	$0	$0	$0
5/13/1980	12:00 PM	0	$55,000	$10,000	$155,994	$28,363
7/28/1980	1:38 PM	60	$50,000	$0	$141,813	$0
8/22/1980	4:00 PM	0	$50,000	$0	$141,813	$0
10/16/1980	12:00 AM	0	$50,000	$0	$141,813	$0
5/24/1981	10:07 PM	50	$5,000	$0	$12,855	$0
9/3/1981	4:20 PM	0	$5,000	$0	$12,855	$0
4/20/1982	8:25 AM	65	$50,000	$500	$121,092	$1,211

DATE	TIME	MADNITUDE (knots)	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
5/12/1982	12:25 AM	0	$0	$0	$0	$0
5/12/1982	12:45 AM	67	$0	$0	$0	$0
5/12/1982	12:55 AM	65	$200,000	$0	$484,367	$0
5/13/1982	7:10 AM	0	$5,000	$0	$12,109	$0
6/22/1982	4:30 PM	0	$0	$0	$0	$0
6/22/1982	5:39 PM	0	$50,000	$0	$121,092	$0
6/22/1982	5:47 PM	0	$0	$0	$0	$0
6/26/1982	10:00 PM	0	$0	$0	$0	$0
2/9/1983	9:10 AM	0	$0	$0	$0	$0
11/22/1983	11:00 PM	54	$0	$0	$0	$0
7/18/1984	12:18 PM	54	$5,000	$0	$11,247	$0
7/2/1985	6:05 PM	50	$0	$0	$0	$0
5/15/1986	7:00 AM	0	$0	$0	$0	$0
6/25/1987	3:45 PM	61	$0	$0	$0	$0
9/10/1987	3:56 PM	70	$0	$0	$0	$0
8/9/1988	1:00 PM	0	$0	$0	$0	$0
8/9/1988	1:45 PM	0	$0	$0	$0	$0
3/28/1989	6:00 AM	51	$0	$0	$0	$0
4/29/1989	7:23 PM	0	$0	$0	$0	$0
4/29/1989	7:00 PM	54	$0	$0	$0	$0
5/17/1989	7:00 AM	0	$0	$0	$0	$0
2/1/1990	4:15 PM	61	$0	$0	$0	$0
4/26/1990	6:45 AM	0	$0	$0	$0	$0
4/28/1990	12:02 AM	0	$0	$0	$0	$0
5/27/1990	11:54 PM	60	$0	$0	$0	$0
4/7/1991	4:00 AM	0	$0	$0	$0	$0

DATE	TIME	MADNITUDE (knots)	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
4/14/1991	4:20 AM	56	$0	$0	$0	$0
4/14/1991	4:04 AM	52	$0	$0	$0	$0
4/14/1991	4:01 AM	0	$0	$0	$0	$0
5/4/1991	4:25 PM	0	$0	$0	$0	$0
6/11/1991	2:15 PM	0	$0	$0	$0	$0
3/3/1992	9:52 PM	59	$0	$0	$0	$0
5/27/1992	6:44 PM	55	$0	$0	$0	$0
9/3/1992	7:10 PM	52	$0	$0	$0	$0
9/21/1992	5:35 PM	61	$0	$0	$0	$0
5/30/1993	6:59 PM	51	$0	$5,000	$0	$8,087
10/19/1993	11:25 PM	0	$5,000	$5,000	$8,087	$8,087
5/29/1994	10:52 PM	53	$50,000	$5,000	$78,849	$7,885
11/4/1994	11:55 PM	57	$5,000	$0	$7,884.85	$0
6/11/1995	1:26 AM	65	$10,000	$10,000	$15,335	$15,335
9/7/1995	8:00 PM	0	$3,100,000	$0	$4,753,883	$0
9/7/1995	8:03 PM	65	$0	$0	$0	$0
9/7/1995	7:46 PM	56	$0	$0	$0	$0
4/28/1996	10:15 PM	57	$0	$0	$0	$0
6/4/1996	4:05 AM	57	$0	$0	$0	$0
9/20/1996	8:55 PM	0	$20,000	$0	$29,791	$0
4/4/1997	6:15 PM	51	$0	$0	$0	$0
4/4/1997	6:30 PM	58	$0	$0	$0	$0
4/4/1997	6:30 PM	0	$200,000	$0	$291,224	$0
4/4/1997	6:32 PM	51	$0	$0	$0	$0
5/27/1997	4:15 PM	56	$0	$0	$0	$0
3/7/1998	5:50 PM	0	$150,000	$0	$215,068	$0

DATE	TIME	MADNITUDE (knots)	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
4/26/1998	7:50 PM	0	$80,000	$0	$114,703	$0
5/17/1999	9:27 PM	60	$0	$0	$0	$0
5/17/1999	9:46 PM	60	$0	$0	$0	$0
5/24/1999	8:30 PM	0	$50,000	$0	$70,140	$0
5/26/1999	5:26 PM	51	$0	$0	$0	$0
5/26/1999	5:25 PM	0	$70,000	$0	$98,196	$0
4/11/2000	11:42 PM	51	$20,000	$0	$27,144	$0
5/27/2000	9:01 PM	50	$0	$0	$0	$0
5/27/2000	9:22 PM	51	$0	$0	$0	$0
3/12/2001	1:30 AM	0	$150,000	$0	$197,945	$0
5/20/2001	8:30 PM	57	$0	$0	$0	$0
9/3/2001	8:05 PM	0	$50,000	$0	$65,982	$0
11/15/2001	5:39 PM	54	$0	$0	$0	$0
6/16/2002	2:00 AM	0	$50,000	$0	$64,955	$0
6/26/2002	7:08 PM	56	$0	$0	$0	$0
6/26/2002	7:20 PM	0	$100,000	$0	$129,909	$0
12/23/2002	6:25 AM	0	$10,000	$0	$12,991	$0
6/13/2003	3:45 PM	56	$100,000	$0	$127,015	$0
8/8/2003	3:23 PM	57	$100,000	$0	$127,015	$0
8/11/2003	7:05 PM	60	$600,000	$0	$762,088	$0
6/27/2004	10:13 AM	50	$0	$0	$0	$0
6/28/2004	4:40 PM	60	$20,000	$0	$24,744	$0
3/25/2005	9:15 PM	50	$0	$0	$0	$0
3/31/2005	6:15 PM	60	$0	$0	$0	$0
5/29/2005	8:25 PM	70	$0	$0	$0	$0
7/7/2005	7:00 PM	60	$0	$0	$0	$0

DATE	TIME	MADNITUDE (knots)	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
4/20/2006	8:30 PM	60	$0	$0	$0	$0
5/4/2006	9:18 PM	63	$0	$0	$0	$0
5/4/2006	9:25 PM	70	$0	$0	$0	$0
5/4/2006	9:30 PM	64	$100,000	$0	$115,926	$0
10/10/2006	6:17 AM	55	$100,000	$0	$115,926	$0
4/13/2007	8:30 PM	55	$50,000	$0	$56,358	$0
6/3/2007	8:10 PM	65	$0	$0	$0	$0
5/14/2008	11:30 PM	70	$50,000,000	$0	$54,273,976	$0
5/14/2008	11:30 PM	51	$0	$0	$0	$0
5/14/2008	11:30 PM	70	$0	$0	$0	$0
5/15/2008	12:00 AM	55	$0	$0	$0	$0
6/21/2008	1:00 PM	50	$5,000	$0	$5,427	$0
2/10/2009	9:55 PM	60	$0	$0	$0	$0
3/25/2009	4:45 PM	39	$50,000	$0	$54,468	$0
4/2/2009	10:29 AM	45	$10,000	$0	$10,894	$0
4/2/2009	1:07 PM	45	$10,000	$0	$10,894	$0
4/2/2009	1:37 PM	40	$10,000	$0	$10,894	$0
4/2/2009	1:55 PM	39	$10,000	$0	$10,894	$0
4/2/2009	2:17 PM	40	$10,000	$0	$10,894	$0
8/12/2009	2:55 PM	50	$2,000	$0	$2,179	$0
8/26/2009	7:32 PM	52	$2,000	$0	$2,179	$0
8/27/2009	4:40 PM	50	$10,000	$0	$10,894	$0
8/24/2010	5:15 PM	50	$0	$0	$0	$0
5/12/2011	9:08 AM	52	$0	$0	$0	$0
5/12/2011	9:45 AM	50	$0	$0	$0	$0
5/20/2011	7:10 PM	40	$1,000	$0	$1,039	$0

DATE	TIME	MADNITUDE (knots)	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
1/25/2012	3:00 AM	52	$0	$0	$0	$0
5/7/2012	6:50 PM	52	$0	$0	$0	$0
7/13/2012	3:30 PM	50	$0	$0	$0	$0
7/15/2012	4:25 PM	50	$15,000	$0	$15,269	$0
4/2/2013	4:10 PM	67	$0	$0	$0	$0
7/26/2013	11:25 PM	51	$0	$0	$0	$0
9/4/2013	6:50 PM	50	$0	$0	$0	$0
4/7/2014	6:35 PM	48	$2,000	$0	$1,974	$0
5/26/2014	11:00 AM	35	$1,000	$0	$987	$0
6/12/2014	9:00 PM	52	$0	$0	$0	$0
6/12/2014	9:20 PM	52	$0	$0	$0	$0
8/26/2014	3:35 PM	54	$0	$0	$0	$0

Table 9-3. Summary of Historical Thunderstorm Wind Events, 1958-2014

EVENTS	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
135 events	**55 knots (max extent)**	**5**	**18**	**$69,017,348**	**$374,694**

Significant Past Events

June 12, 2014 – Austin

An upper level low and surface cold front moved through South Central Texas producing thunderstorms. These storms produced a few tornadoes and damaging wind gusts across many areas of South Central Texas. The thunderstorm produced wind gusts estimated at 60 mph that tore five inch diameter branches off of some Lace Bark Elms.

July 15, 2012 – Austin

A stagnant upper air pattern of a weak trough combined with deep subtropical moisture to cause thunderstorms for several days. These storms produced isolated areas of heavy rain leading to flash flooding along with some strong winds and large hail. A thunderstorm produced wind gusts estimated at 58 mph that flipped over six boats at the Emerald Point Marina on Lake Travis.

May 14, 2008 – Austin

A severe thunderstorm to the southwest of Austin moved northeast across the downtown area causing extensive damage from winds and large hail. Widespread damage occurred over portions of central Austin when a large severe thunderstorm rolled through the downtown area. Numerous reports of large trees and branches were down along with wind-blown hail. The hardest hit area was downtown near Tarrytown, Hyde Park, UT campus, and the I-35 corridor just north of the river. The combination of baseball size hail and winds of 70 to 80 mph blew out building and apartment windows throughout this area. Windows on the Texas Capitol building were blown out as well. Lion's golf course and Morris Williams course sustained damage and had to briefly close. Power was knocked off to nearly 20000 customers. Large old oak trees were damaged and the city of Austin spent over 2 million dollars in cleanup and response. Total monetary losses are being estimated at 50 million dollars.

April 4, 1997 – Austin

Storms ripped roofs off 16 apartment buildings in Austin. High winds also resulted in widespread (1,500) power failures across Austin. Aircrafts were damaged at Robert Mueller Airport by severe wind gusts.

September 7, 1995 – Austin

Power was out to 75,000 homes and businesses. Numerous structural fires occurred due to lightning strikes. Hundreds of power and phone lines were down leaving many without power for over 48 hours. The combined effect of high winds and heavy rain caused the collapse of a wall in one building and destroyed the roof of another building in a downtown Austin apartment complex. This forced the evacuation of 50 residents. The driver and passenger in a vehicle were injured when a construction barrier was blown over onto their truck. Another driver was injured slightly when lightning struck a truck, tossing out bricks that were stacked in the truck bed. Other minor injuries were reported in Austin due to flying pieces of broken glass. A boatload of tourists on Lake Travis had to be rescued due to rough waters stirred up by high winds. Several football games were cancelled or terminated early, preventing potential injuries.

Probability of Future Events

Most thunderstorms occur during the spring, in the months of March, April and May, and in the fall, during the month of September. Even though the intensity of thunderstorms is not always damaging for the City's entire planning area, the frequency of occurrence for a thunderstorm event is highly likely, meaning that two to three events are probable for every year for the City of Austin and Austin ISD.

Vulnerability and Impact

Vulnerability is difficult to evaluate since thunderstorms can occur at different strength levels, in random locations, and can create relatively narrow paths of destruction. Due to the randomness of this event, all existing and future structures, and facilities in the City of Austin's planning area could potentially be impacted and remain vulnerable to possible injury and/or property loss from hail and strong winds associated with severe thunderstorm.

Trees, power lines and poles, signage, manufactured housing, radio towers, concrete block walls, storage barns, windows, garbage recepticles, brick facades, and vehicles, unless reinforced, are vulnerable to severe winds associated with thunderstorm 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.

A severe thunderstorm can also result in heavy rains, traffic disruptions, injuries and in rare cases, fatalities, can occur. Impact of thunderstorms experienced in the City of Austin planning area would be “Minor”, meaning injuries and/or illnesses do not result in permanent disability, shutdown of facilities and services will be for more than 1 week, and more than 10 percent of property is destroyed or with major damage. Overall, the average loss estimate (in 2015 dollars) is $69,392,042, having an approximate annual loss estimate of $1,239,144.

Section 10: Hail

Hazard Description

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 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 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 byproduct 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 not confined to any specific geographic location, and can vary greatly in terms of size, location, intensity and duration. All areas for the City of Austin, including Austin ISD, are considered to be exposed to this hazard equally.

Extent

The National Weather Service (NWS) classifies a storm as "Severe," if hail of three-quarters of an inch in diameter (approximately the size of a penny) or greater are present. The size determination is based on radar intensity or seen by observers. The intensity category of a hailstorm depends on its size and the potential damage it could cause, as depicted in the National Climatic Data Center (NCDC) Intensity Scale in Table 10-1.

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

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

The scale in Table 10-1 extends from H0 to H10, with increments of intensity or damage potential related to hail size (distribution and maximum), texture, fall speed, speed of storm translation, and strength of the accompanying wind.

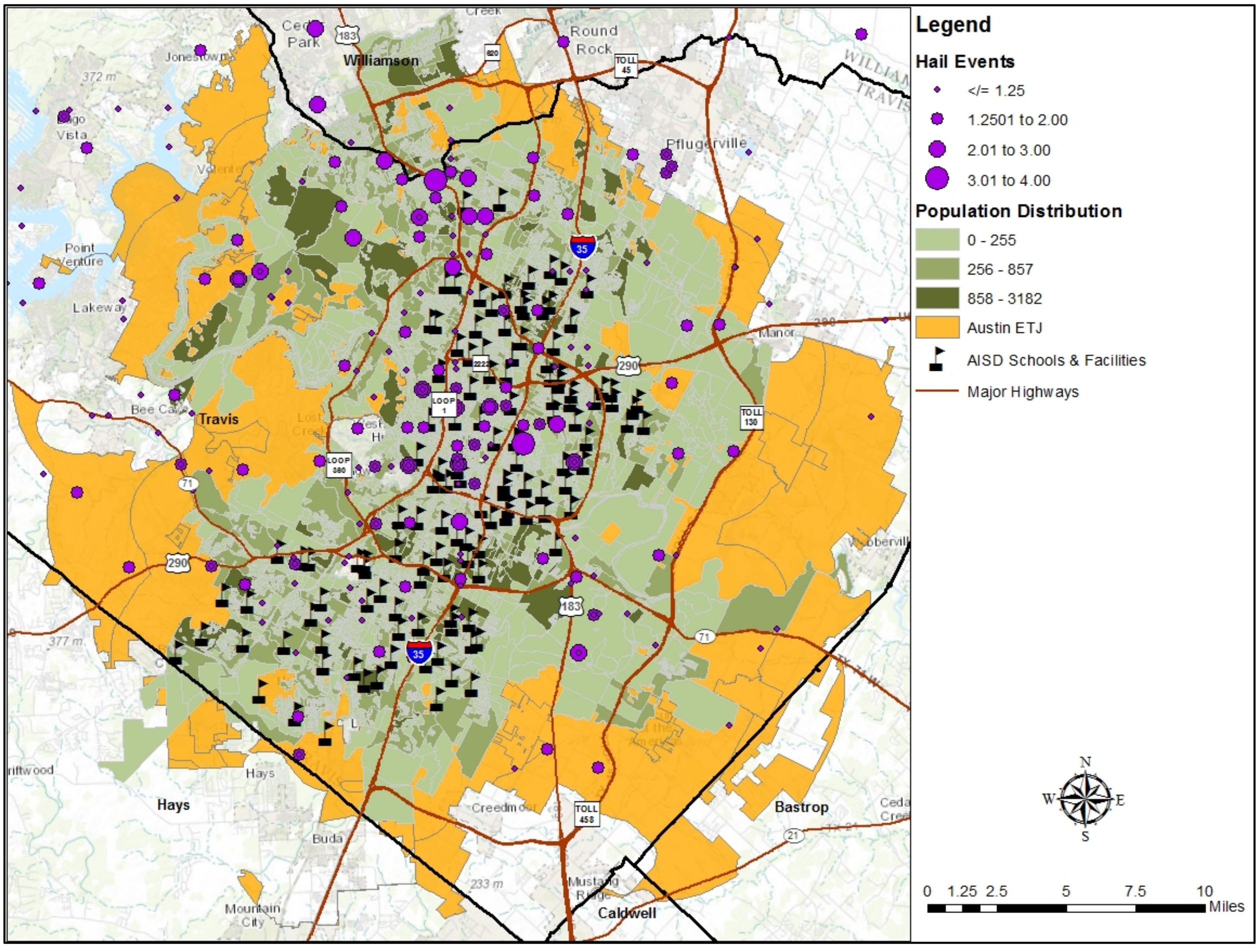
The City experienced two of the worst hailstorms in its history in May of 2008 and March of 2009. Reports indicate that the magnitude of the March 25, 2009 event was close to an H8 or H9 in terms of size and may have caused up to $160 million in damages. The May 2008 event caused approximately $50 million in damages with a magnitude of H9. Although both storms were rare, they indicate the potential destructiveness and danger of an intense hailstorm. Therefore, the City can mitigate a storm from H0 – non-damaging pea size hail, up to a H9 – super hailstorm with tennis ball size hail that leads to severe roof damage and risk of serious injuries.

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

Historical Occurrences

Historical evidence shown in Figure 10-1 shows that the Austin planning area is vulnerable to hail events overall, which typically result from severe thunderstorm activity. Between 1966 and 2014, 162 historical hail events are known to have impacted The City of Austin (Table 10-2). These hail events represent only those that were reported to NCDC, NOAA, and SHELDUS databases, and may not represent all hail events to have occurred during the past 48 years. Only those events for Travis County with latitude and longitude available were plotted on the map (Figure 10-1).

Figure 10-1. Spatial Historical Hail Events, 1950–2014[2]



[2] Source: NOAA/NCDC Records

Table 10-2. Historical Hail Events, 1950-2014

DATE	TIME	MAGNITUDE	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
4/12/1966	4:51 PM	1.50	$0	$0	$0	$0
4/12/1966	5:00 PM	0.75	$0	$0	$0	$0
4/12/1966	10:15 AM	1.5	$0	$0	$0	$0
4/23/1967	11:55 AM	0.75	$0	$0	$0	$0
11/27/1968	4:31 PM	1.50	$0	$0	$0	$0
9/6/1975	6:17 PM	1.75	$0	$0	$0	$0
5/26/1976	5:30 PM	2.50	$50,000	$5,000	$205,366	$20,537
4/14/1977	6:45 PM	1.75	$0	$0	$0	$0
4/14/1977	10:00 PM	1.75	$50,000	$5,000	$192,828	$19,283
3/23/1978	7:45 PM	1.75	$2,500	$250.00	$8,961	$896
5/2/1978	4:10 AM	1.75	$0	$0	$0	$0
5/8/1980	4:10 AM	1.75	$0	$0	$0	$0
5/8/1980	10:00 PM	1.00	$5,000,000	$ 500,000	$1,418,125	$1,418,125
4/19/1982	8:10 AM	3.00	$5,000	$0	$12,109	$0
4/20/1982	9:06 AM	1.75	$0	$0	$0	$0
2/9/1983	9:19 AM	0.75	$0	$0	$0	$0
2/9/1983	5:45 PM	1.75	$0	$0	$0	$0
10/20/1984	6:06 AM	1.00	$0	$0	$0	$0
10/21/1984	7:14 AM	2.00	$0	$0	$0	$0
10/21/1984	8:27 PM	2.00	$5,000,000	$0	$11,246,728	$0
4/19/1986	6:15 AM	0.75	$0	$0	$0	$0
5/15/1986	9:12 PM	1.75	$0	$0	$0	$0
5/3/1987	5:23 PM	1.00	$0	$0	$0	$0
5/19/1987	7:00 AM	1.00	$0	$0	$0	$0
3/21/1989	10:05 PM	1.50	$0	$0	$0	$0

DATE	TIME	MAGNITUDE	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
3/28/1989	8:05 PM	1.75	$0	$0	$0	$0
4/29/1989	3:32 PM	1.00	$0	$0	$0	$0
5/13/1989	4:15 PM	1.75	$0	$0	$0	$0
5/13/1989	4:35 PM	1.75	$0	$0	$0	$0
5/13/1989	4:28 PM	1.75	$0	$0	$0	$0
5/21/1990	4:50 PM	2.75	$0	$0	$0	$0
5/21/1990	5:19 PM	2.75	$0	$0	$0	$0
5/21/1990	12:04 AM	3.00	$0	$0	$0	$0
6/4/1990	2:15 PM	1.75	$0	$0	$0	$0
4/13/1991	3:30 PM	2.50	$0	$0	$0	$0
4/18/1991	5:41 PM	1.00	$0	$0	$0	$0
4/18/1991	6:03 PM	1.50	$0	$0	$0	$0
4/18/1991	4:32 PM	1.75	$0	$0	$0	$0
5/12/1992	4:55 PM	1.00	$0	$0	$0	$0
5/12/1992	5:35 PM	1.00	$0	$0	$0	$0
5/27/1992	5:54 PM	1.5	$0	$0	$0	$0
5/27/1992	6:05 PM	1.00	$0	$0	$0	$0
5/27/1992	6:47 PM	0.75	$0	$0	$0	$0
9/3/1992	6:38 PM	1.00	$0	$0	$0	$0
9/21/1992	6:58 PM	0.75	$0	$0	$0	$0
9/21/1992	7:18 PM	1.75	$0	$0	$0	$0
9/21/1992	7:40 PM	0.75	$0	$0	$0	$0
10/7/1992	5:32 PM	0.75	$0	$0	$0	$0
3/25/1993	5:37 PM	0.75	$0	$5,000	$0	$8,087
3/25/1993	5:39 PM	1.75	$50,000	$0	$80,867	$0
3/25/1993	5:40 PM	1.00	$0	$0	$0	$0

DATE	TIME	MAGNITUDE	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
3/25/1993	5:55 PM	1.25	$0	$0	$0	$0
3/25/1993	6:25 PM	1.75	$500,000	$0	$808,675	$0
3/25/1993	6:30 PM	0.88	$0	$5,000	$0	$8,087
3/25/1993	7:00 PM	2.00	$75,000,000	$5,000	$121,301,211	$8,087
5/30/1993	3:00 PM	0.75	$0	$0	$0	$0
4/5/1994	12:15 AM	0.75	$500,000	$50,000	$788,485	$78,849
4/20/1995	11:30 AM	1.75	$0	$0	$0	$0
5/11/1995	1:00 AM	1.50	$0	$0	$0	$0
11/1/1995	11:20 AM	0.75	$0	$0	$0	$0
4/20/1996	12:01 AM	0.75	$0	$0	$0	$0
9/20/1996	4:45 PM	1.00	$0	$0	$0	$0
10/17/1996	4:42 PM	-	$10,000	$0	$14,895	$0
10/17/1996	4:10 AM	1.50	$20,000	$0	$29,791	$0
6/17/1997	4:15 AM	1.75	$0	$0	$0	$0
6/17/1997	4:20 AM	1.75	$0	$0	$0	$0
6/17/1997	10:10 PM	1.00	$0	$0	$0	$0
2/25/1998	3:40 PM	0.75	$0	$0	$0	$0
5/1/1998	4:00 PM	0.75	$0	$0	$0	$0
5/1/1998	5:18 PM	1.00	$0	$0	$0	$0
3/16/2000	7:05 PM	1.75	$0	$0	$0	$0
4/7/2000	11:50 PM	0.75	$0	$0	$0	$0
4/11/2000	4:25 PM	1.00	$0	$0	$0	$0
10/22/2000	11:05 PM	1.75	$0	$0	$0	$0
10/20/2002	8:05 PM	1.75	$500,000	$0	$649,547	$0
3/25/2003	7:37 PM	0.75	$0	$0	$0	$0
3/25/2003	5:59 PM	0.75	$0	$0	$0	$0

DATE	TIME	MAGNITUDE	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
6/13/2003	7:10 PM	0.75	$0	$0	$0	$0
8/11/2003	3:15 PM	1.75	$100,000	$0	$127,015	$0
4/10/2004	4:08 PM	0.75	$0	$0	$0	$0
5/31/2004	4:10 PM	1.00	$0	$0	$0	$0
5/31/2004	4:25 PM	1.75	$0	$0	$0	$0
5/31/2004	4:37 PM	1.75	$0	$0	$0	$0
6/28/2004	8:55 AM	0.75	$0	$0	$0	$0
11/23/2004	4:55 PM	0.75	$0	$0	$0	$0
3/19/2005	9:10 PM	0.88	$0	$0	$0	$0
3/25/2005	9:15 PM	1.50	$0	$0	$0	$0
3/25/2005	9:23 PM	1.00	$0	$0	$0	$0
3/25/2005	9:25 PM	0.75	$0	$0	$0	$0
3/25/2005	9:30 PM	1.75	$0	$0	$0	$0
3/25/2005	9:30 PM	0.75	$0	$0	$0	$0
3/25/2005	9:35 PM	0.88	$0	$0	$0	$0
3/25/2005	9:40 PM	1.75	$0	$0	$0	$0
3/25/2005	9:45 PM	2.00	$0	$0	$0	$0
3/25/2005	7:32 PM	1.00	$0	$0	$0	$0
4/5/2005	7:35 PM	1.00	$0	$0	$0	$0
4/5/2005	7:45 PM	0.75	$0	$0	$0	$0
4/5/2005	7:55 PM	1.00	$0	$0	$0	$0
4/5/2005	11:25 PM	1.00	$0	$0	$0	$0
4/10/2005	12:30 AM	0.75	$0	$0	$0	$0
4/11/2005	7:40 PM	1.00	$0	$0	$0	$0
5/29/2005	8:02 PM	1.75	$0	$0	$0	$0
5/29/2005	8:09 PM	1.00	$0	$0	$0	$0

DATE	TIME	MAGNITUDE	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
5/29/2005	9:03 PM	1.75	$0	$0	$0	$0
4/18/2006	9:25 PM	1.00	$0	$0	$0	$0
4/18/2006	2:20 PM	0.75	$0	$0	$0	$0
4/20/2006	2:30 PM	1.00	$0	$0	$0	$0
4/20/2006	3:50 PM	1.00	$0	$0	$0	$0
4/20/2006	3:53 PM	3.00	$0	$0	$0	$0
4/20/2006	4:00 PM	2.00	$0	$0	$0	$0
4/20/2006	4:00 PM	1.00	$0	$0	$0	$0
4/20/2006	4:20 PM	2.5	$0	$0	$0	$0
4/20/2006	4:40 PM	1.75	$0	$0	$0	$0
4/20/2006	4:17 PM	1.75	$0	$0	$0	$0
5/2/2006	9:00 PM	1.00	$0	$0	$0	$0
5/4/2006	9:31 PM	1.00	$0	$0	$0	$0
5/4/2006	9:50 PM	1.25	$0	$0	$0	$0
5/4/2006	2:01 AM	1.25	$0	$0	$0	$0
5/6/2006	6:00 PM	0.88	$0	$0	$0	$0
5/6/2006	6:30 PM	0.88	$0	$0	$0	$0
5/6/2006	6:40 PM	1.00	$0	$0	$0	$0
5/6/2006	4:35 PM	1.00	$0	$0	$0	$0
9/23/2006	12:11 AM	1.00	$0	$0	$0	$0
5/3/2007	7:00 AM	0.88	$0	$0	$0	$0
4/4/2008	6:50 AM	0.75	$0	$0	$0	$0
4/4/2008	7:03 AM	0.75	$0	$0	$0	$0
4/4/2008	7:03 AM	0.75	$0	$0	$0	$0
4/4/2008	7:07 AM	0.75	$0	$0	$0	$0
4/4/2008	7:10 AM	0.88	$0	$0	$0	$0

DATE	TIME	MAGNITUDE	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
4/4/2008	8:50 PM	0.75	$0	$0	$0	$0
4/25/2008	9:02 PM	0.88	$0	$0	$0	$0
4/25/2008	8:32 PM	0.88	$0	$0	$0	$0
4/25/2008	6:25 PM	0.88	$0	$0	$0	$0
5/10/2008	6:27 PM	1.00	$0	$0	$0	$0
5/10/2008	6:38 PM	1.00	$0	$0	$0	$0
5/10/2008	6:40 PM	1.75	$0	$0	$0	$0
5/10/2008	6:41 PM	2.50	$0	$0	$0	$0
5/10/2008	6:20 PM	1.75	$0	$0	$0	$0
5/10/2008	6:20 PM	1.25	$0	$0	$0	$0
5/10/2008	6:22 PM	1.25	$0	$0	$0	$0
5/10/2008	6:15 PM	1.50	$0	$0	$0	$0
5/10/2008	6:27 PM	1.75	$0	$0	$0	$0
5/10/2008	6:27 PM	2.25	$0	$0	$0	$0
5/10/2008	6:30 PM	2.00	$0	$0	$0	$0
5/10/2008	6:45 PM	1.75	$0	$0	$0	$0
5/10/2008	6:14 PM	1.75	$0	$0	$0	$0
5/10/2008	11:30 PM	1.00	$0	$0	$0	$0
5/14/2008	11:30 PM	2.75	$100,000	$0	$108,548	$0
5/14/2008	11:35 PM	2.75	$100,000	$0	$108,548	$0
5/14/2008	11:45 PM	1.75	$0	$0	$0	$0
5/14/2008	11:45 PM	4.00	$1,000	$0	$1,085	$0
5/14/2008	11:30 PM	1.75	$0	$0	$0	$0
5/14/2008	8:30 PM	1.75	$1,000	$0	$1,085	$0
5/14/2008	11:27 PM	2.50	$0	$0	$0	$0
5/14/2008	11:30 PM	1.00	$0	$0	$0	$0

DATE	TIME	MAGNITUDE	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
5/14/2008	12:15 AM	2.00	$100,000	$0	$108,548	$0
5/15/2008	5:05 PM	1.00	$0	$0	$0	$0
11/11/2008	4:42 PM	0.75	$0	$0	$0	$0
3/25/2009	4:40 PM	1.75	$0	$0	$0	$0
3/25/2009	4:44 PM	1.00	$0	$0	$0	$0
3/25/2009	4:45 PM	1.75	$0	$0	$0	$0
3/25/2009	4:55 PM	2.50	$0	$0	$0	$0
3/25/2009	7:40 PM	2.00	$0	$0	$0	$0
6/11/2009	7:45 PM	1.00	$0	$0	$0	$0
6/11/2009	7:49 PM	0.75	$0	$0	$0	$0
6/11/2009	8:07 PM	0.75	$0	$0	$0	$0
6/11/2009	5:45 PM	0.88	$0	$0	$0	$0
5/17/2010	3:53 AM	0.88	$0	$0	$0	$0
4/11/2011	8:37 AM	0.88	$0	$0	$0	$0
5/12/2011	9:08 AM	0.75	$0	$0	$0	$0
5/12/2011	9:08 AM	0.88	$0	$0	$0	$0
5/12/2011	4:05 AM	0.88	$0	$0	$0	$0
5/25/2011	4:07 AM	1.00	$0	$0	$0	$0
5/25/2011	10:45 AM	1.50	$0	$0	$0	$0
1/24/2012	11:14 AM	0.88	$0	$0	$0	$0
3/9/2012	4:38 PM	0.88	$0	$0	$0	$0
4/3/2012	4:50 PM	0.75	$0	$0	$0	$0
4/3/2012	1:40 AM	0.75	$0	$0	$0	$0
3/20/2013	1:40 AM	0.75	$0	$0	$0	$0
3/20/2013	6:40 PM	1.00	$0	$0	$0	$0
5/10/2013	3:35 PM	1.00	$0	$0	$0	$0

DATE	TIME	MAGNITUDE	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
3/28/2014	3:30 PM	1.00	$0	$0	$0	$0
3/28/2014	3:38 PM	1.00	$0	$0	$0	$0
3/28/2014	3:42 PM	1.00	$0	$0	$0	$0
3/28/2014	3:44 PM	1.75	$0	$0	$0	$0
3/28/2014	3:45 PM	1.75	$0	$0	$0	$0
3/28/2014	3:45 PM	1.00	$0	$0	$0	$0
3/28/2014	3:52 PM	1.75	$0	$0	$0	$0
3/28/2014	6:15 PM	1.00	$0	$0	$0	$0
4/7/2014	9:51 AM	0.88	$0	$0	$0	$0
4/14/2014	9:50 AM	1.75	$0	$0	$0	$0
4/14/2014	9:54 AM	0.75	$0	$0	$0	$0
4/14/2014	10:00 AM	1.00	$0	$0	$0	$0
4/14/2014	10:05 AM	1.25	$0	$0	$0	$0
4/14/2014	9:44 AM	1.25	$0	$0	$0	$0
4/14/2014	9:58 AM	1.00	$0	$0	$0	$0
4/14/2014	5:18 PM	1.00	$0	$0	$0	$0
4/27/2014	7:15 PM	1.25	$1,000	$0	$987	$0
5/27/2014	7:15 PM	0.88	$0	$0	$0	$0
5/27/2014	7:16 PM	1.50	$0	$0	$0	$0
5/27/2014	7:17 PM	0.75	$0	$0	$0	$0
5/27/2014	7:19 PM	1.00	$0	$0	$0	$0
5/27/2014	7:26 PM	1.75	$0	$0	$0	$0

Table 10-3. Summary of Historical Hail Events, 1950-2014

EVENTS	MAGNITUDE (Inches)	DEATHS	INJURIES	PROPERTY DAMAGE (2015 Dollars)	CROP DAMAGE (2015 Dollars)
162	4.0 (max extent)	0	0	$137,213,404.82	$1,561,949.29

Significant Past Events

April 27, 2014 – City of Austin

A cold front pushed the dry-line ahead of it into eastern sections of South Central Texas and caused thunderstorms. Some of these storms produced large hail. In Elroy, a thunderstorm produced 1.25 inch hail that damaged a plastic patio cover.

January 24, 2012 – City of Austin

A deep upper level low pressure center brought a frontal system through Texas which caused thunderstorms across South Central Texas. These storms formed into a mesoscale convective system and produced several tornadoes, wind damage, large hail, and heavy rain that resulted in flash flooding.

March 25, 2009 – City of Austin

A cold front stalled across South Central Texas on the morning of March 25, 2009. The subtropical jet and a mid/upper-level short wave trough pushed into the region. Convection initiated across the San Angelo County warning area in the morning and spread to the southwest. Thunderstorms reached the Edwards Plateau by early afternoon and continued moving east into the evening. Total estimated loss from this storm is around $160 million dollars, the most ever for an Austin hail storm. The top three hail storms that have hit Austin have all occurred on a March 25th. March 25, 1993 saw losses at $125 million, and March 25, 2005 had $100 million in losses. A thunderstorm moved through the north Austin and Round Rock area, and produced hail ranging in size from golf ball to hen egg size. NOAA received three reports of severe hail with this storm. This hail dented cars and caused minor damage to some roof shingles in the north Austin area.

May 14, 2008 – City of Austin

A severe thunderstorm to the southwest of Austin moved northeast across the downtown area causing extensive damage from winds and large hail. Golf ball to baseball size hail damaged 26 cars at the Combined Transportation, Emergency and Communications Center (CTECC).

October 20, 2002 – City of Austin

Large hail dented roofs and broke windows in mainly the southwest part of Austin. Some home owners reported holes in their roofs from the hail.

April 5, 1994 – City of Austin

Numerous reports were received of 0.75-inch hail over west Austin by thunderstorms moving toward the southeast at 20 mph.

March 25, 1993 – City of Austin

During the evening hours, north and northeast Austin were hit by large hail. An estimated $125 million in damage was reported to cars, roofs, greenhouses and vegetation.

Probability of Future Events

Based on the 162 events over the last 48 years (1966 – 2014), a hail event is a highly likely occurrence for the City of Austin and Austin ISD and is estimated to occur approximately one event every year. Most hailstorms occur during the spring (March, April and May), and in the fall during the month of September. Warning time for a hailstorm is generally minimal or there is no warning.

Vulnerability and Impact

Damage from hail approaches $1 billion 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, homes, and landscaping are the other things most commonly damaged by hail.

Utility systems on roofs at schools would be vulnerable and could be damaged. Hail could cause significant threat to people as they could be struck by hail and falling trees and branches. First responders could not be able to respond to calls due to blocked roads. Also, hail could cause power outages which could cause health and safety risks to faculty and students at schools.

Hail has been known to cause injury to humans, and occasionally has been fatal. Overall, the average loss estimate of property and crops (in 2015 dollars) is $138,775,354, having an approximate annual loss estimate of $2,891,153. Based on historic loss and damages, the impact of hail damages on the City of Austin planning area, including Austin ISD, can be considered “Minor” severity of impact, meaning injuries and illnesses are possible but may not result in permanent disability, shutdown of facilities and services for more than a week, and more than 10 percent of property is destroyed or experiences major damage.

Section 11: Tornado

Hazard Description

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

The most powerful tornadoes are produced by “super cell thunderstorms.” Super-cell 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**.**

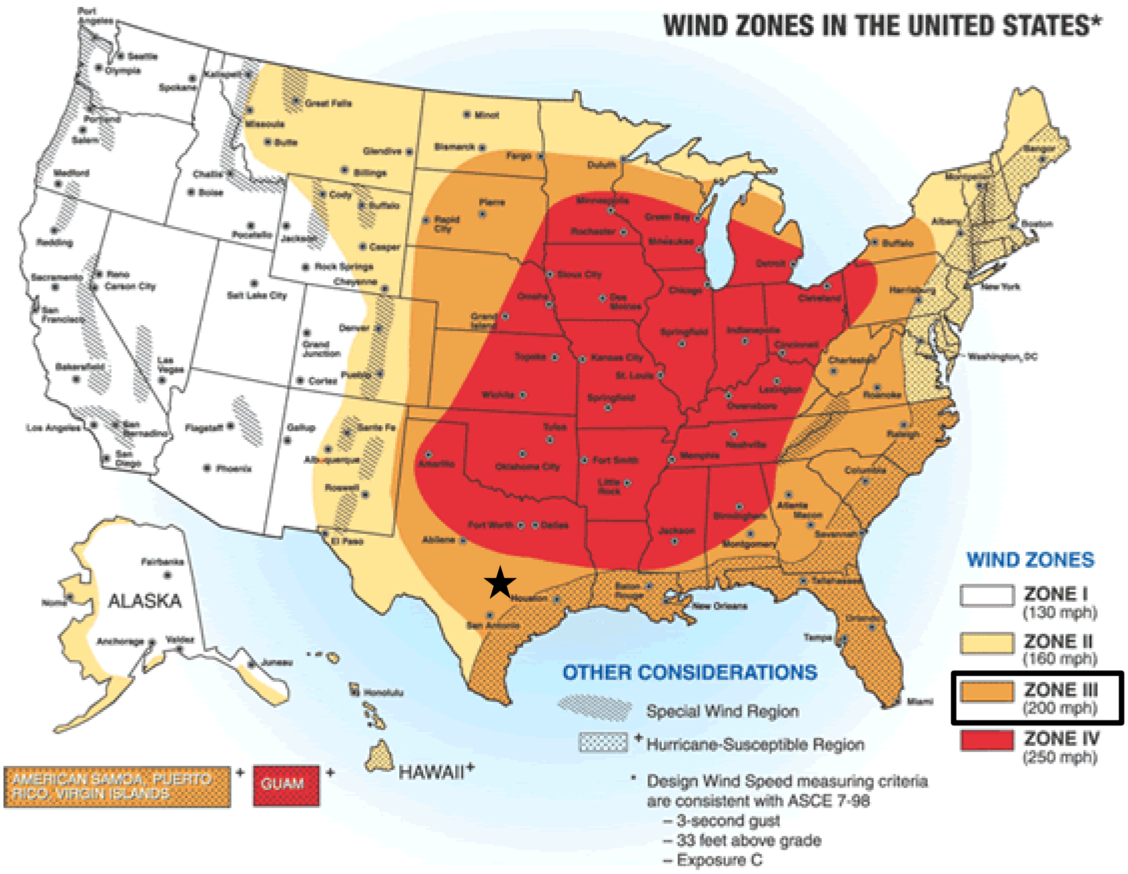
Table 11-1. Tornado Variations

WEAK TORNADOES	STRONG TORNADOES	VIOLENT TORNADOES
• 69% of all tornadoes • Less than 5% of tornado deaths • Lifetime 1-10+ minutes • Winds less than 110 mph	• 29% of all tornadoes • Nearly 30% of all tornado deaths • Lifetime 20+ minutes • Winds 110 – 205 mph	• 2% of all tornadoes • 70% of all tornado deaths • Lifetime can exceed one hour • Winds greater than 205 mph

Location

As with thunderstorms, tornadoes do not have any specific geographic boundary and can occur throughout the City of Austin and Austin ISD. It is assumed that the City of Austin planning area is uniformly exposed to tornado activity. The City of Austin, including Austin ISD, is located in Wind Zone III, meaning tornado winds can be as high as 200 mph.

Figure 11-1. FEMA Wind Zones in the United States[1]



Extent

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

Tornado magnitudes prior to 2005 were determined using the traditional version of the Fujita Scale (Table 11-2). Since February 2007, the Fujita Scale (FS) has been replaced by the Enhanced Fujita Scale (EFS) (Table 11-3), which retains the same basic design as its predecessor with six strength categories. The newer scale reflects more refined assessments of tornado damage surveys, standardization, and damage consideration to a wider range of structures.

[1] The City of Austin is indicated by the star.

Table 11-2. The Fujita Tornado Scale[2]

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

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

Table 11-3. 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; and damages sign boards.	
EF1	Weak	86 – 110	The lower wind speed is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads; and 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; and light object missiles generated.	
EF3	Severe	136 – 165	Roof and some walls torn off well-constructed houses; trains overturned; and most trees in forest uprooted.	
EF4	Devastating	166 – 200	Well-constructed homes leveled; structures with weak foundations blown off some distance; and 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; and steel reinforced concrete badly damaged.	

Both the Fujita Scale and Enhanced Fujita Scale are referenced in reviewing previous occurrences as tornado events prior to 2007 follow the Fujita Scale. The largest tornado magnitude reported within the City of Austin planning area was an F3 on the Fujita Scale, or a severe tornado.

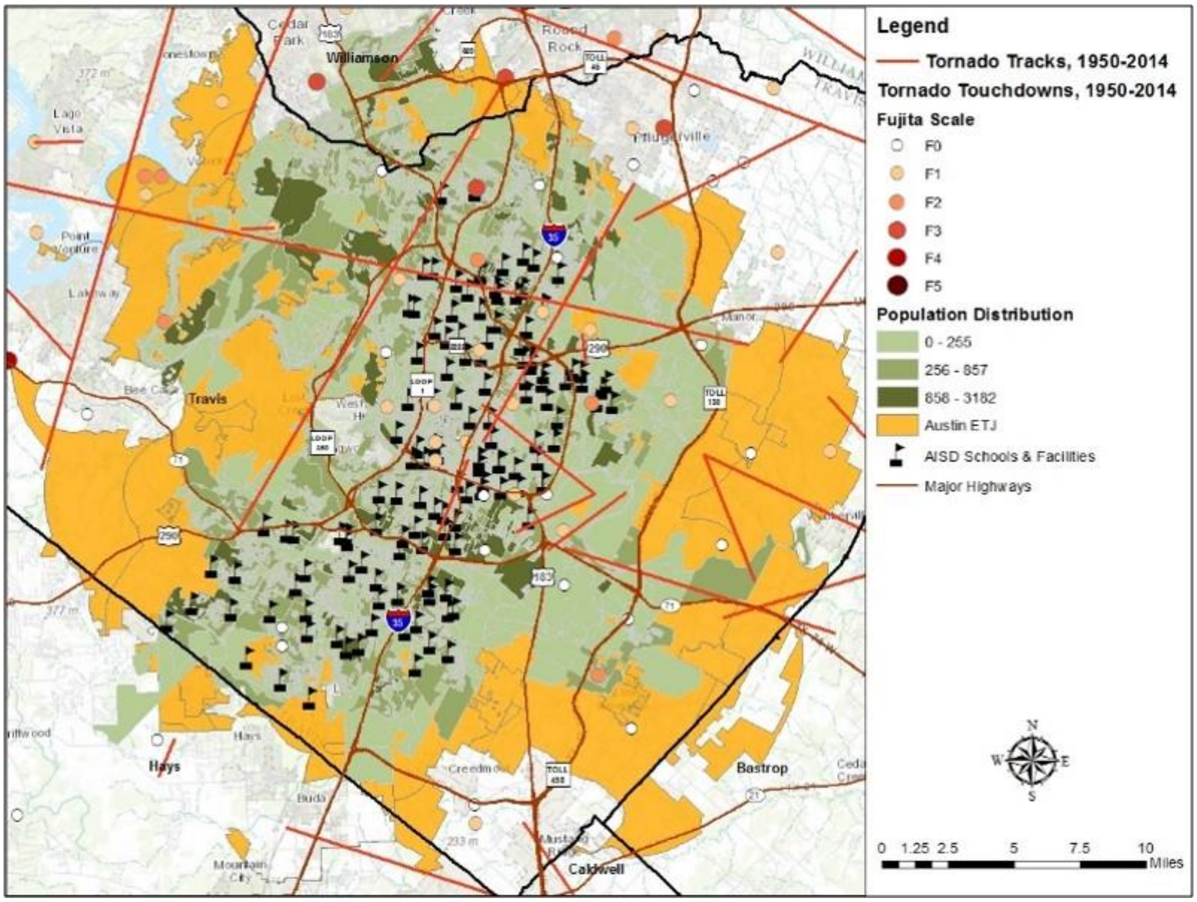
Although, the Austin planning area, including the Austin ISD, could experience a storm with a category up to an EF3 depending on the wind speed, the majority of storms only rise to a level of EF0 to an EF2 (Table 11-4). Therefore, the range of intensity that the City of Austin planning area would be expected to mitigate for a tornado event would be a “low” to “severe” risk, or an EF0 to an EF3.

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 64 years.

Figure 11-2 shows the locations of previous occurrences in the City of Austin planning area from 1953 to 2014. A total of 61 tornado events have been recorded by the Storm Prediction Center (NOAA), NCDC, and SHELDUS databases for Travis County and 30 events have occurred in the City of Austin. One severe storm event was categorized as a severe tornado (F3); four events were significant tornadoes (F2); 13 events were categorized as moderate tornadoes (F1); and the other 12 were gale force tornadoes (F0).

Figure 11-2. Spatial Historical Tornado Events, 1950–2014[3]



[3] Source: NOAA Records

Table 11-4. Historical Tornado Events, 1950-2014

DATE	TIME	MADNITUDE	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 Dollars)	CROP DAMAGE (2015 Dollars)
10/23/1953	1:00 AM	F1	$25,000	$0	$218,827	$0
10/20/1956	12:56 PM	F1	$0	$0	$0	$0
3/31/1957	9:05 AM	F2	$250,000	$0	$2,079,244	$0
5/10/1959	3:20 PM	F3	$ 250,000	$0	$2,007,792	$0
7/20/1960	6:15 AM	F1	$2,500	$0	$19,739	$0
4/16/1964	3:00 PM	F0	$0	$0	$0	$0
5/17/1965	1:30 AM	F1	$250	$0	$2,226	$0
9/20/1967	10:00 AM	F1	$2,500	$0	$17,493	$0
9/20/1967	10:00 AM	F0	$2,500	$0	$17,493	$0
9/21/1967	12:00 PM	F0	$2,500	$0	$17,493	$0
7/4/1970	6:00 PM	F2	$0	$0	$30,117	$0
8/3/1972	11:10 AM	F0	$25,000	$0	$139,777	$0
1/20/1973	9:00 PM	F2	$25,000	$0	$26,318	$0
3/6/1973	8:05 AM	F1	$0	$0	$0	$0
3/10/1973	5:45 AM	F1	$250,000	$0	$1,315,918	$0
5/5/1975	1:25 PM	F0	$0	$0	$0	$0
5/23/1975	3:15 PM	F0	$0	$0	$21,720	$0
5/29/1975	7:00 AM	F1	$0	$0	$0	$0
3/5/1976	1:15 AM	F0	$25,000	$0	$123,220	$0
5/12/1976	7:50 PM	F1	$0	$0	$205,366	$0
5/1/1979	9:33 AM	F0	$0	$0	$0	$0
8/10/1980	1:40 PM	F2	$250,000,000	$0	$709,062,500	$0
6/13/1981	3:00 PM	F1	$25,000	$0	$64,276	$0
5/18/1990	5:25 PM	F0	$0	$0	$0	$0
5/27/1997	3:15 PM	F1	$5,000	$0	$14,561	$0

DATE	TIME	MADNITUDE	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 Dollars)	CROP DAMAGE (2015 Dollars)
3/16/2000	4:20 PM	F0	$0	$0	$0	$0
11/15/2001	3:50 PM	F1	$100,000	$0	$131,963	$0
11/15/2001	4:45 PM	F0	$30,000	$0	$39,589	$0
11/15/2001	5:30 PM	F1	$80,000	$0	$105,571	$0
11/15/2001	5:44 PM	F0	$15,000	$0	$19,794	$0

Table 11-5. Summary of Historical Thunderstorm Wind Events, 1953-2014

EVENTS	MAGNITUDE (Fujita)	DEATHS	INJURIES	PROPERTY DAMAGE (2015 Dollars)	CROP DAMAGE (2015 Dollars)
30 events	**F3** (max extent)	**11**	**1**	**$715,680,997**	**$0**

Significant Past Events

November 15, 2001 – City of Austin

An F1 tornado estimated to be .25 mile wide formed at a location near William Cannon Road and about .25 mile east of I-35 in Austin. The tornado moved northeast for just over two miles. In the North Bluff Estates Trailer Park, at least two dozen mobile homes sustained minor to extensive damage. One mobile home was overturned upside down against another mobile home and a car. The mobile home was tied-down. There were no reports of injuries as both trailers were empty at the time. In addition, tree and roof damage was evident to businesses in the area and an apartment complex across William Cannon from the trailer park. Several trees were sheared at the top or completely uprooted. One pickup truck was lifted and placed on top of a pile of debris. It is possible there were two tornadoes in this event, especially due to the width of the damage path. However, based on the reports received, and the survey made, the best conclusion is that one tornado occurred.

May 27, 1997 – City of Austin

The Cedar Park tornado formed around 3:05 pm CST from a different supercell thunderstorm. The tornado first touched down about 3.5 miles north of Cedar Park at a location 0.6 miles south of CR 178 and 1.4 miles east of the intersection of US 183 and CR 178. The initial damage was to trees, however, the ground survey revealed damage nearby to a church and a trucking company. The aerial survey did not reflect the nearby damage as being in line with the damage path. It is quite possible this damage was caused by strong wind near the tornado. The beginning point was in a relatively open area with damage primarily to a few trees and minor shingle damage to one house.

The tornado moved south-southwestward skirting a residential area before it crossed CR 180 immediately east of US 183. A historic train located on the north side of CR 180 just to the east of US

183 was in the direct path of the tornado. While the engine remained on the track, a coal tender converted to hold diesel fuel and weighing approximately 65,000 pounds, including the 1,000 gallons of diesel fuel, was flipped over and thrown a short distance.

Continuing across CR 180, the tornado entered a shopping center where it weakened and slightly pushed the north wall of a grocery store inward. It also pushed large metal doors inward that were built to open toward the outside. Damage at this point had been generally F2 and briefly F3 as the tornado knocked the train tender off the track and damaged the wall and doors of the food store. It tore off much of a weakly supported roof of a grocery store. The manager of the store, who had been a victim of the Wichita Falls Tornado of 1979, saw the approaching tornado, and made an announcement to all in the store to meet him in the middle of the store. He then led everyone he could gather into the meat locker. This very quick and decisive action probably saved several lives.

The tornado crossed US 183 causing additional damage to a number of businesses. One business on the west side of US 183 lost nearly the entire roof. Most damage to other businesses was minor. After crossing US 183 the tornado moved across Marquis Lane and North Park Circle through an area with widely scattered housing and a relative abundance of trees. Again, most damage to structures in this area was minor.

From North Park Circle the tornado moved into the northwestern portion of Buttercup Creek, a subdivision of well-constructed homes. At this point the damage level ranged from F0 to F2. Damage to homes was irregular with one house losing a roof but the house next door losing only shingles. Two homes in the area were nearly destroyed. One home was damaged when a pickup truck was lifted and tossed against its front wall. Eleven homes were destroyed, with damage reported to over 100 homes. The tornado track was taking a gentle right turn when it became more southwesterly. The tornado moved into a wooded area crossing into Travis County before ending 1.1 miles from Lake Travis. Damage in the wooded area was irregular ranging from near total destruction of all trees to sections with about ten percent of the trees down.

July 4, 1970 – City of Austin

A small tornado and high thunderstorm winds ripped through resort areas on Lake Travis northwest of Austin, resulting in the death of one person while injuring four others. The Hurst Creek boat dock was reduced to a twisted mass of metal by the storm. Mr. C. Wesley Collier drowned when he and his wife were caught underneath the 100 foot dock. Although injured, Collier's wife came to the surface and was rescued. Three other persons were injured at the Hurst Creek docks. The storm also hit the Lakeway area, two miles east of the Hurst Creek dock, ripping the roofs off several houses and damaging a dock at the marina. Several persons were injured by flying glass, but none required hospitalization. During the height of the storm, an iron pipe was driven through the roof of the one lakeside home near the Hurst Creek docks. The pipe dropped into the living room but injured no one.

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 storm period can also emerge in the fall, during the brief transition between the warm and cold seasons. According to historical records, the City of Austin experiences a tornado touchdown every one to two years. Hence, the probability of future tornado occurrences affecting the City of Austin and Austin ISD is highly likely, meaning an event may occur in the next 2 years.

Vulnerability and Impact

Because tornadoes often cross-jurisdictional boundaries, all existing and future buildings, facilities and populations in the City of Austin, including AISD, 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, and large hail.

The average tornado moves from southwest to northeast. However, tornadoes have been known to move in any direction at different strengths, in random locations, and typically create relatively narrow paths of destruction. Thus, it is difficult to evaluate the vulnerability of people and property to the impacts of a tornado. 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 that span a large area, such as shopping malls, gymnasiums, and factories.

Trees, power lines and poles, signage, manufactured housing, radio towers, concrete block walls, storage barns, windows, garbage recepticles, brick facades, and vehicles, unless reinforced, are vulnerable to severe winds associated with tornado 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.

Utility systems on roofs at schools would be vulnerable and could be damaged by debris and high winds. Tornadoes can possibly cause a significant threat to people as they could be struck by flying debris, falling trees/branches, utility lines, and poles. First responders could also not be able to respond to calls due to blocked roads. Tornadoes commonly cause power outages which could cause health and safety risks to faculty and students at schools, as well as to patients in hospitals.

Overall, the average loss estimate of property and crop (in 2015 dollars) is $715,680,997, having an approximate annual loss estimate of $11,732,475. Based on historic loss estimates, the impact of tornado damages on the City of Austin, including the AISD, can be considered “Major,” with more than 25 percent of property destroyed or with major damage, injuries and illnesses resulting in permanent disability, and critical facilities shut down for at least 2 weeks.

Section 12: Expansive Soils

Hazard Description

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

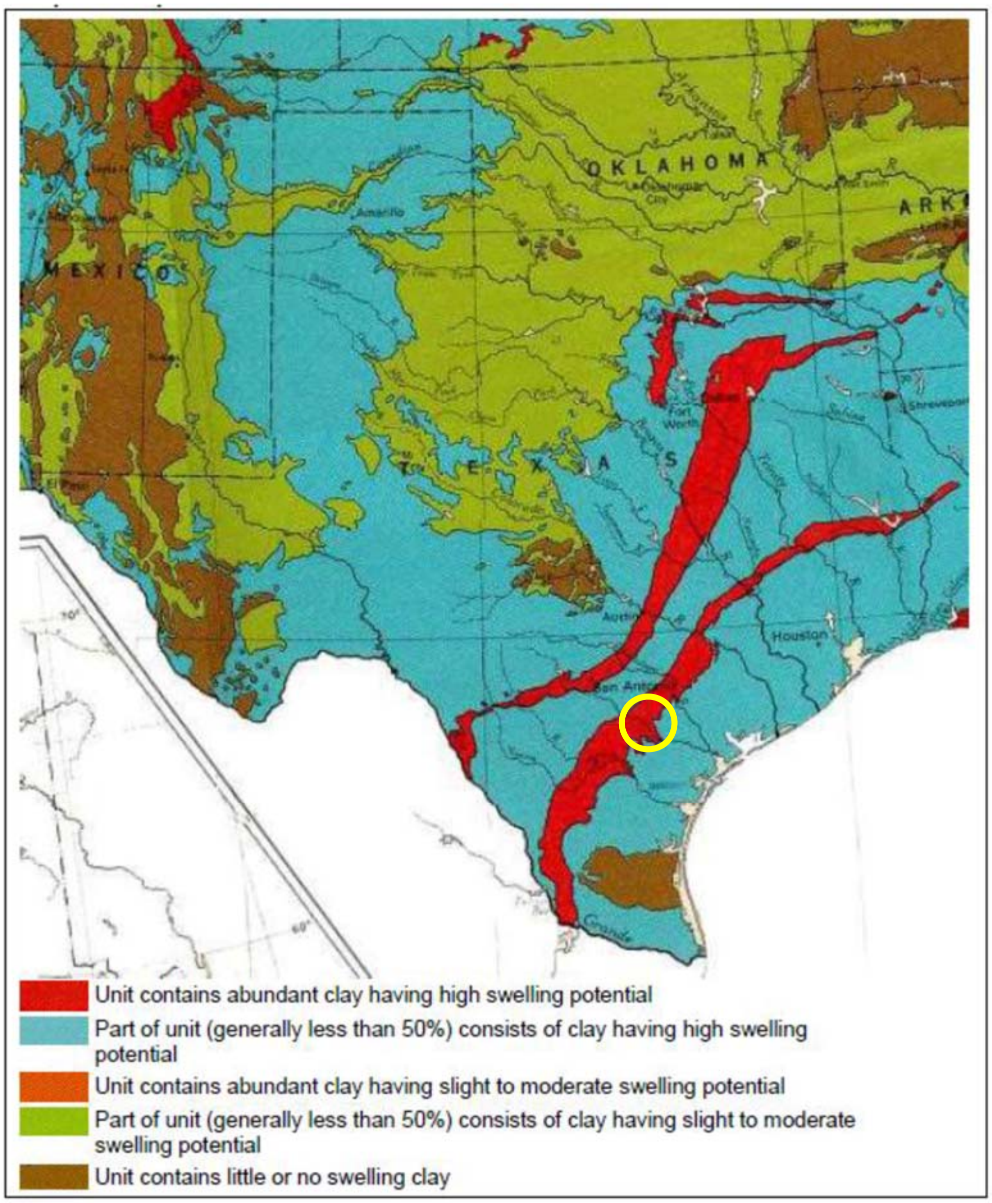
Expansive soils contain minerals such as smectite clays that are capable of absorbing water. When these clays absorb water they increase in volume and expand. Expansions in soil of ten percent or more are not uncommon in the City of Austin planning area. The change in soil volume and resulting expansion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

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

Location

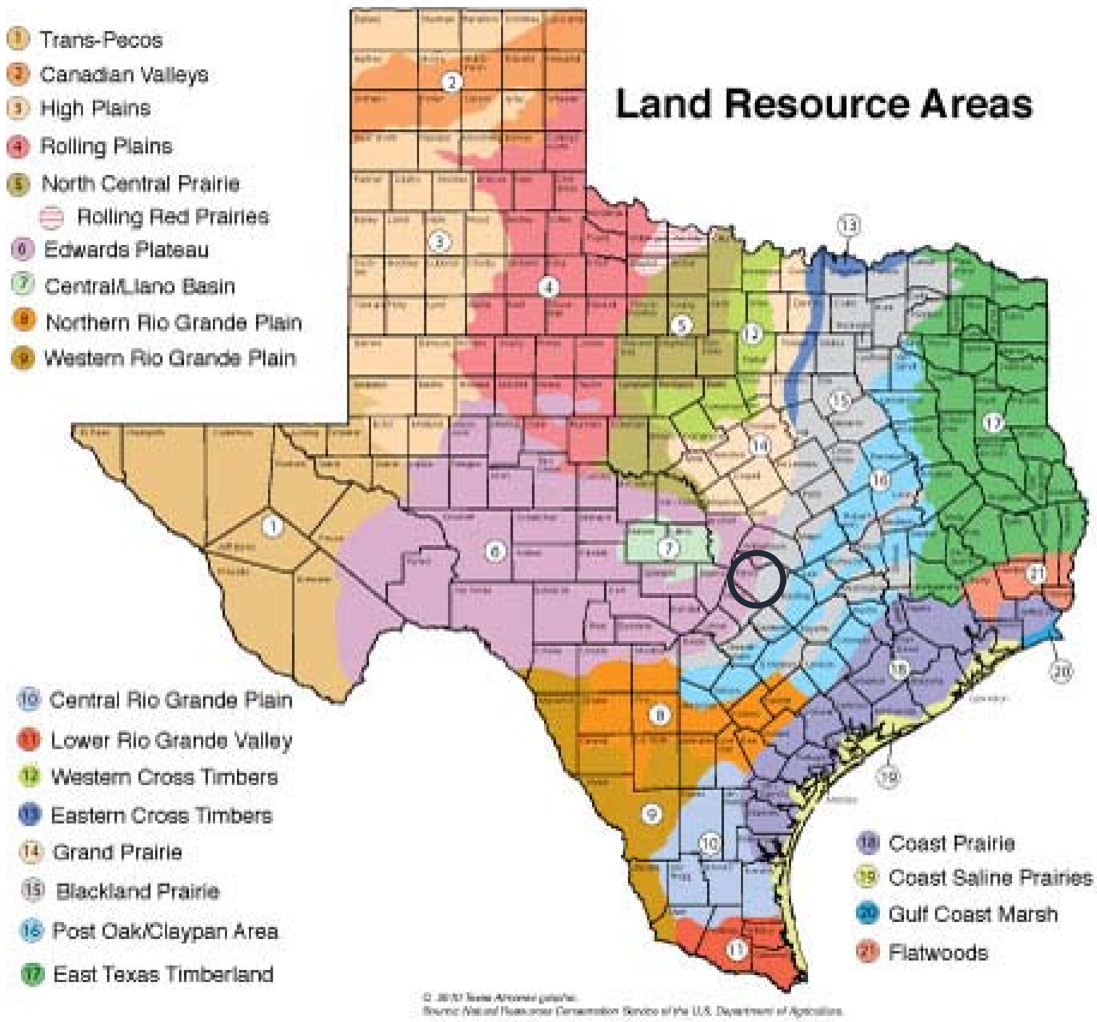
The City of Austin planning area may be affected by the band of expansive soils stretching from northeast Dallas, southwest through San Antonio, towards Laredo, and along an area also known as the I-35 corridor, which is illustrated in Figure 12-1. These areas receive the most moisture and are also vulnerable to droughts, which can cause the soils to expand and contract. Figure 12-2 depicts the types of land resources of the State of Texas due to their soil types.

Figure 12-1. Texas Geological Survey[1]



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

Figure 12-2. Texas Geological Survey



The City of Austin, including the Austin ISD, is located within the Edwards Plateau and Blackland Prairie.

Edwards Plateau: The 22.7 million acres of the Edwards Plateau are in South Central Texas east of the Trans-Pecos and west of the Blackland Prairie. Uplands are nearly level to undulating, except near large stream valleys, where the landscape is hilly with deep canyons and steep slopes. There are many cedar brakes in this area and surface drainage is rapid.

Upland soils are mostly shallow, stony, or gravelly, and consisting of dark alkaline clays and clay loams underlain by limestone. Lighter-colored soils are on steep sideslopes and deep, less-stony soils are in the valleys. Bottomland soils are mostly deep, dark-gray or brown, with alkaline loams and clays.

Raising beef cattle is the main enterprise in this region, but it is also the center of Texas' and the nation's mohair and wool production. The area provides a major deer habitat, and hunting leases produce income. Cropland is mostly in the valleys on the deeper soils and is used mainly for growing forage crops and hay. The major soil-management concerns are brush control, large stones, low fertility, excess lime, and limited soil moisture.

Blackland Prairie: The Blackland Prairies consist of about 12.6 million acres of east-central Texas extending southwesterly from the Red River to Bexar County. There are smaller areas to the southeast. The landscape is undulating with few scattered wooded areas that are mostly in the bottomlands. Surface drainage is moderate to rapid.

Both upland and bottomland soils are deep, dark-gray to black, and consist of alkaline clays. Some soils in the western part are shallow to moderately deep over chalk. Soils on the eastern edge are typically neutral to slightly acidic, grayish clays and loams over mottled clay subsoils (sometimes called graylands). Blackland soils are known as “cracking clays” because of their high shrink-swell property and large, deep cracks that form in dry weather. The high shrink-swell property can cause serious damage to foundations, highways, and other structures; and is a safety hazard in pits and trenches.

Land use is almost equally cropland and grassland. Cotton, grain sorghums, corn, wheat, oats, and hay are grown in this area. Grassland is mostly improved pastures, with native range on the shallower and steeper soils. Water erosion, cotton root rot, soil tilth, and brush control are the major management problems.

Extent

The extent to which soil expansion is present in an area can be measured using the Soil Expansion Potential standard (ASTM D-4829). The expansion index (EI) provides an indication of swelling potential for a compacted soil. [2]

Table 12-1. Swelling Potential of Soils and Plasticity Index

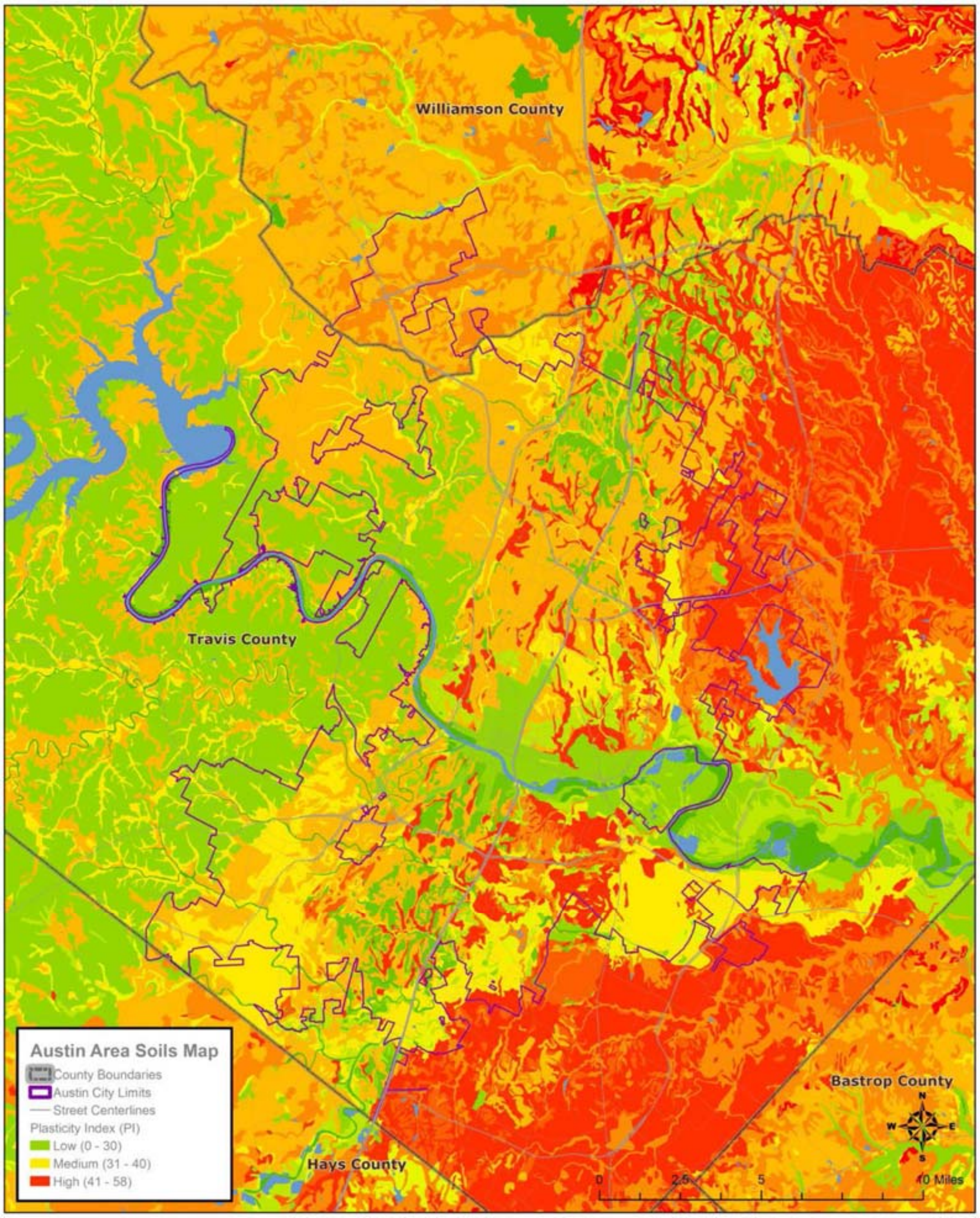
Swelling Potential Plasticity Index	
Low	0 – 15
Medium	10 – 35
High	20 – 55
Very High	35 and above

The amount and depth of potential swelling that can occur in a clay material are, to some extent, functions of the cyclical moisture content in the soil. In dryer climates where the moisture content in the soil near the ground surface is low because of evaporation, there is a greater potential for extensive swelling than the same soil in wetter climates where the variations of moisture content are not as severe. Volume changes in highly expansive soils range between 7 and 10 percent, however under abnormal conditions, they can reach as high as 25 percent.

The Web Soil Survey is used to measure the extent of expansive soils by measuring the type of soils and their moisture content. Figure 12-3 depicts the plasticity index of the soils in the Austin planning area.

[2] http://publicecodes.cyberregs.com/icod/ibc/2009f2cc/icod_ibc_2009f2cc_18_par012.htm

Figure 12-3. Plasticity Index of Austin Area Soils [3]



Red and orange indicate areas with relatively higher plasticity soils, which can exhibit greater sensitivity to drought conditions. High plasticity soils are prone to shrink and swell as soil moisture changes, which can degrade pavement, causing longitudinal cracking and edge drop-off. This effect can damage foundations of buildings and homes.

[3] Source: National Cooperative Soil Survey

Historical Occurrences

Expansive soils is a condition that is native to Texas soil characteristics, and cannot be documented as a time-specific event, except when it leads to structural and infrastructure damage.

The photos below represent the types of longitudinal cracking damage that expansive soils have caused in the Austin area. All of the pictures feature relatively new roads that were damaged, in part, by changes in soil moisture. Roads in Austin have been damaged to expansive soils in 2008, 2009, and in the summer of 2011, according to the Capital Area Metropolitan Planning Organization Risk Assessment.[4]

Extreme conditions can damage new roads, including projects still under construction. The Texas State Highway (SH) 130 tollway, under construction in 2011 in neighboring Caldwell County, suffered an estimated $30 million in damage from cracks across several sections. In response, builders repaired cracks and also changed the substructure to create moisture barriers designed to mitigate soil moisture-related damage in the future.

Left: Photo of pavement cracks in a new Austin subdivision in 2009. Right: Longitudinal cracking on Golden Falls Drive in Travis County in 2008. Photo credit: City of Austin.

Photo of a severe pavement crack on Hamann Lane in Travis County in 2005. Photo credit: City of Austin.

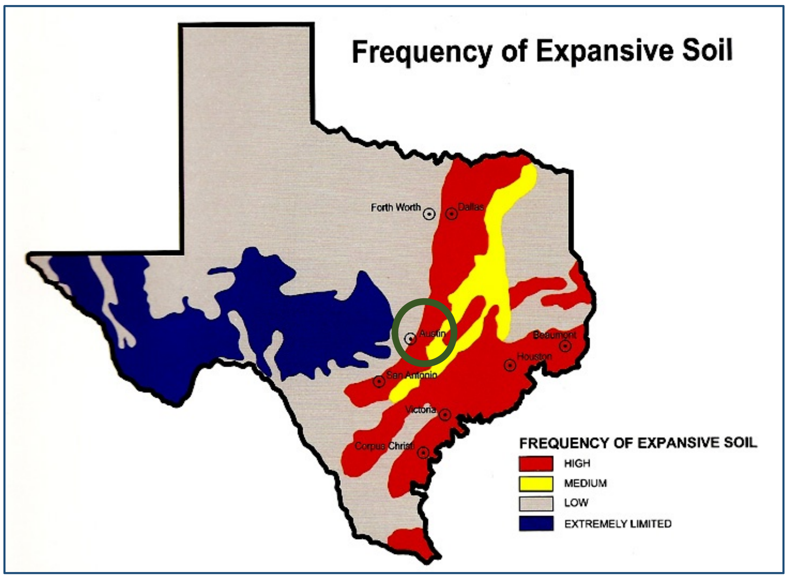
[4] Source: CAMPO Extreme Weather Vulnerability Assessment

Probability of Future Events

According to the CAMPO Extreme Weather Vulnerability Assessment, the MetroRail Red Line at Boggy Creek may have a high sensitivity to drought. This rating is based on the soil plasticity near the asset. The Red Line is built over some of the most expansive soils in the region, with a soil plasticity index of 55 (on a scale of 0 to 58) See Figure 12-4. This high plasticity indicates that soils could expand and contract dramatically with changes in soil moisture, and in turn damage infrastructure.

Since no other records of specific incidences of loss associated with expansive soils were found and no specific occurrences of expansive soils were identified within Travis County, Probability of future events cannot be determined at this time. However, according to public opinion, the probability of future events of loss due to expansive soils within Travis County is highly possible, especially when periods of drought increase throughout the planning area.

Figure 12-4. Frequency of Expansive Soil



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.

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 Austin planning area from expansive clays. However, several examples are known where the cost of repairs has exceeded the value of homes. Additionally, in some areas of Austin, streets and highways have required frequent and very expensive reconstruction or maintenance due to damage from expansive clay.

For the City of Austin and Austin ISD, the most extensive damage from expansive soils can occur to bridges, highways, and streets. 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.

Section 13: Winter Storm

Hazard Description

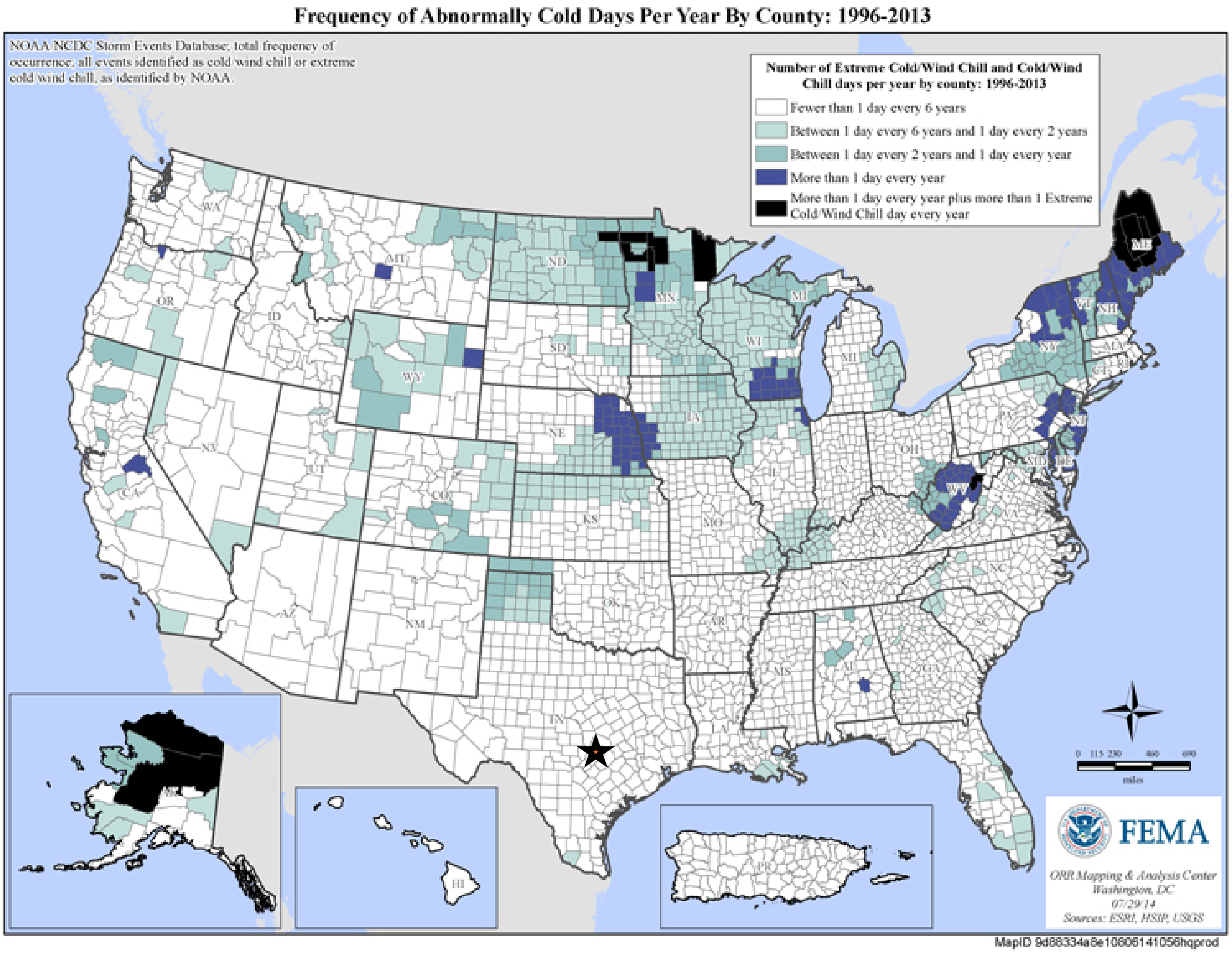
Winter storms can cause significant problems for area residents. A severe winter storm event is identified as a storm with snow, and ice or freezing rain. Winter storms are associated with freezing or frozen precipitation such as freezing rain, sleet, snow and the combined effects of winter precipitation 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 the City of Austin planning area usually begin as powerful cold fronts that push south from central Canada. Although the City, including Austin ISD, is at risk to ice hazards, snow, and extremely cold temperatures, the effects and frequency of winter storm events are generally mild and short-lived.

Data from the NOAA and NCDC Storm Events Database shows the total frequency of occurrence of all events identified as blizzards, heavy snow, ice storm, lake-effect snow, and winter storm or winter weather. As indicated in Figure 13-1, on average, the Austin planning area experiences less than one extreme cold day every six years. Figure 13-2 indicates that on average, the Austin planning area experiences one or fewer of the listed winter storm types per year.[1] Figure 13-3 indicates that the Austin planning area could expect a snow accumulation of 0.1-3.0 inches a year. During times of ice and snow accumulation, response times can increase until major roads become passable.

[1] http://community.fema.gov/hazard/winter-storm/be-smart

Figure 13-1. Extreme Cold Days, 1996-2013[2]



[2] The City of Austin indicated by star.

Figure 13-2. Frequency of Winter Storm Events, 1996-2013

Frequency of Winter Storm Events By County: 1996-2013

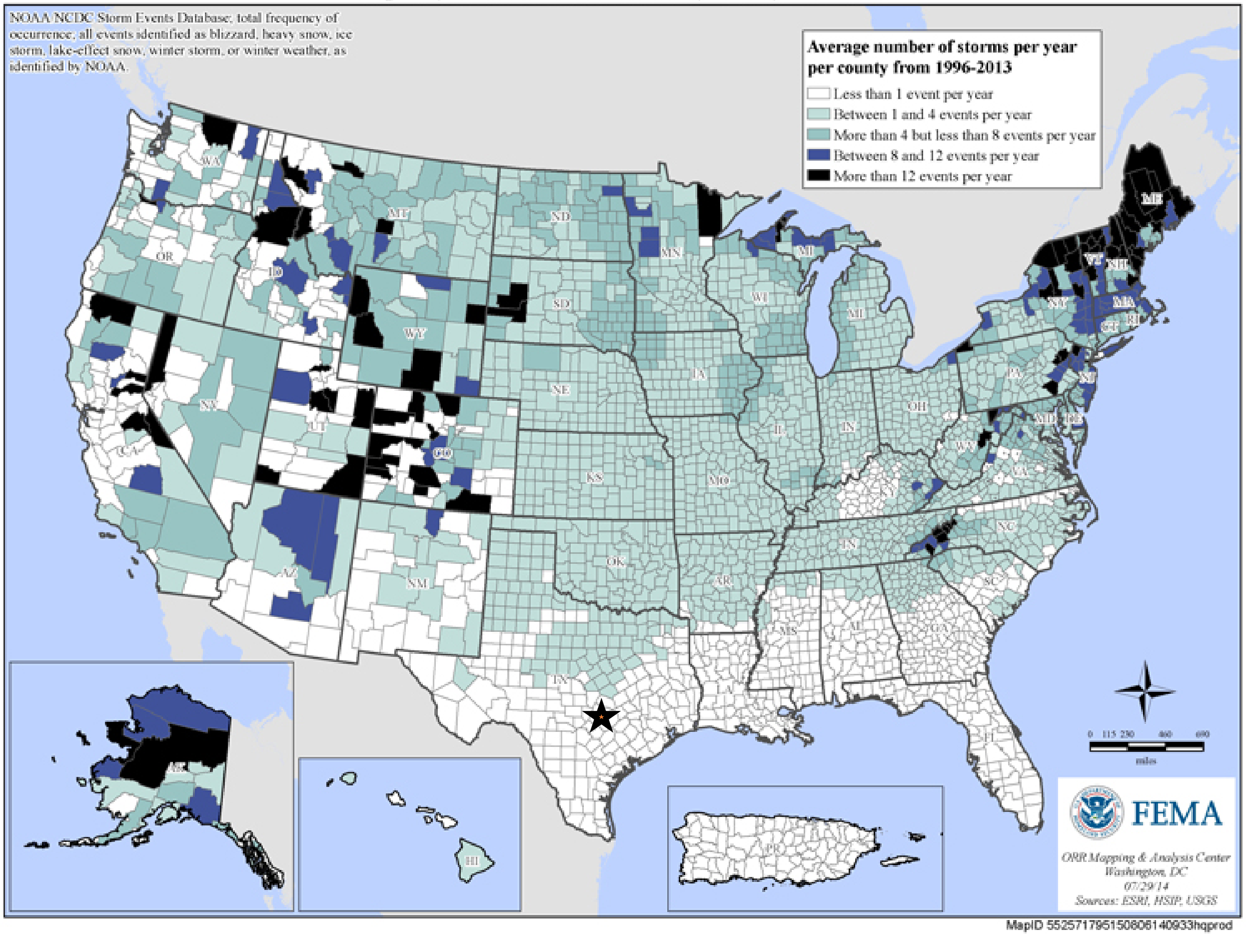


Figure 13-3. Annual Mean Snowfall for Texas

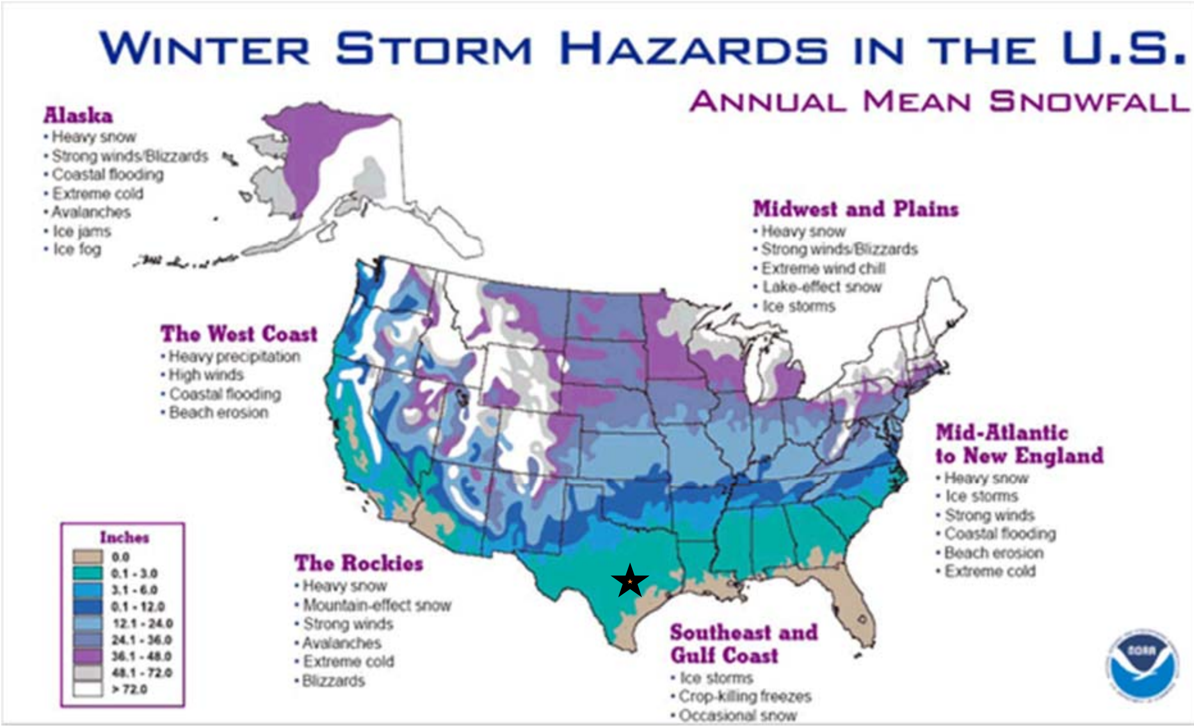


Table 13-1 describes the types of winter storms possible to occur in the City of Austin planning area.

Table 13-1. Types of Winter Storms

TYPE OF WINTER STORM	DESCRIPTION
Winter Weather Advisory	This alert may be issued for a variety of severe conditions. Weather advisories may be announced for snow, blowing or drifting snow, freezing drizzle, freezing rain, or a combination of weather events.
Winter Storm Watch	Severe winter weather conditions may include freezing rain, sleet or heavy snow, and conditions may occur separately or in combination.
Winter Storm Warning	Severe winter weather conditions are imminent.
Freezing Rain or Freezing Drizzle	Rain or drizzle is likely to freeze upon impact, resulting in a coating of ice glaze on roads and all other exposed objects.
Sleet	Small particles of ice usually mixed with rain. If enough sleet accumulates on the ground, it makes travel hazardous.
Blizzard Warning	Sustained wind speeds of at least 35 mph are accompanied by considerable falling or blowing snow. These are the most perilous winter storm conditions 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

TYPE OF WINTER STORM	DESCRIPTION
	atmosphere. The combined cooling power of the wind and temperature on exposed flesh is called the wind-chill factor.

Location

Because winter storm events are not confined to specific geographic boundaries, all existing and future buildings, facilities, and populations within the City of Austin and Austin ISD are considered to be exposed to this hazard and could potentially be impacted.

Extent

The extent or magnitude of severe winter storms is measured in intensity based on the temperature and level of accumulations as shown in Table 13-2. The intensity index was developed by the National Weather Service. Table 13-2 is not applicable when temperatures are over 50° or winds are calm, and can be read in conjunction with the wind chill factor described in Figure 13-4.

Table 13-2. Magnitude of Severe Winter Storms

INTENSITY	TEMPERATURE RANGE	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 between 10 and 15 mph with sleet and snow up to 4 inches.
Significant	25° – 30°	Intense snow showers accompanied with strong gust winds, between 15 and 20 mph, and significant snow 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 accumulation greater than 4 inches.

Figure 13-4. Wind Chill Chart

Wind Chill Chart

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

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

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° day would feel just as cold as a calm day with 0° temperatures. The City of Austin has never experienced a blizzard, but based on 31 previous occurrences recorded from 1950 to 2014 for Travis County, it has been subject to winter storm watches, warnings, freezing rain, sleet, snow and wind chill.

Based on the data for historical occurrences and the area where the City of Austin is located, the average event for the planning area to mitigate would be mild to moderate winter storm. The City can expect anywhere between 0.1 to 3.0 inches of ice and snow during a winter storm event and temperatures between 30 and 50 degrees with winds ranging from 0 to 15 mph.

Historical Occurrences

Table 13-3 shows the type and historical occurrence of winter storm events for Travis County from 1950 to 2014, provided by the NCDC and SHELDUS databases. There have been 31 recorded winter storm events in Travis County. Historical winter storm information, as provided by the NCDC and SHELDUS, shows winter storm activity across a multi-county forecast area for each event, the appropriate percentage of the total property and crop damage reported for the entire forecast area has been allocated to each county impacted by the event.

Table 13-3. Historical Winter Storm Events, 1950-2014

DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2013 DOLLARS)	CROP DAMAGE (2013 DOLLARS)
1/9/1962	0	0	$19,686	$19,686	$152,339	$152,339
12/10/1972	0	0	$197	$0	$1,100	$0
1/8/1973	0	0	$1,969	$196,850	$10,362	$1,036,156
3/2/1980	0	0	$0	$53,191	$0	$150,864
3/18/1980	0	0	$0	$5,319	$0	$15,086
4/14/1980	0	0	$0	$5,319	$0	$15,086
1/10/1982	0	0	$31,250	$31,250	$75,682	$75,682
1/11/1982	0	0	$31,250	$0	$75,682	$0
1/12/1985	0	0	$7,246	$0	$15,739	$0
3/29/1987	0	0	$0	$35,971	$74,003	$0
2/4/1989	1	0	$5,682	$5,682	$10,709	$10,709
12/22/1989	1	0	$1,612,903	$1,612,903	$3,039,893	$3,039,893
2/1/1996	0	0	$0	$0	$0	$0
2/1/1996	0	0	$78,947	$2,632	$117,594	$3,920
1/7/1997	0	0	$0	$0	$0	$0
1/7/1997	0	0	$500,000	$10,000	$728,059	$14,561
1/11/1997	0	0	$37,037	$740,741	$53,930	$1,078,606
12/23/1998	0	0	$0	$0	$0	$0
12/12/2000	0	0	$0	$0	$0	$0
11/28/2001	0	0	$0	$0	$0	$0
2/24/2003	0	0	$0	$0	$0	$0
12/7/2005	0	0	$0	$0	$0	$0
1/15/2007	0	0	$1,600,000	$0	$1,803,451	$0
1/27/2009	0	0	$0	$0	$0	$0
2/3/2011	0	0	$0	$0	$0	$0

DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2013 DOLLARS)	CROP DAMAGE (2013 DOLLARS)
2/9/2011	0	0	$0	$0	$0	$0
12/5/2013	0	0	$0	$0	$0	$0
12/7/2013	0	0	$0	$0	$0	$0
1/23/2014	0	0	$0	$0	$0	$0
1/27/2014	0	0	$0	$0	$0	$0
3/4/2014	0	0	$0	$0	$0	$0

Significant Past Events

March 4, 2014 – Travis County

In the wake of a strong cold front, a shallow layer of cold air settled over South Central Texas in March 2014. An upper level trough moved across the southern plains and caused elevated thunderstorms during the evening of March 3rd. Some of these storms produced small hail. Then an isentropic upglide of warm moist air froze the precipitation during the early morning hours of the 4th. The first report of freezing rain occurred at 12:40am in Travis County. Icy bridges and overpasses were reported in Travis, Williamson, Fayette, and Caldwell Counties. In Fayette County, county offices and school openings were delayed on March 4th.

January 27, 2014 – Travis County

A cold front brought an arctic air mass to South Central Texas January 27th. An isentropic upglide of warm moist air over the cold surface air led to sleet and freezing rain across the area. The first reports of sleet were just before 9:30pm in Kerr and Williamson Counties. The winter precipitation spread as far as Bexar and Comal Counties by the morning of January 28th. Icy bridges and overpasses were reported from Georgetown to Jarrell, and in the Austin metro area. Several accidents were reported in Austin.

December 7, 2013 – Travis County

Light freezing drizzle was reported as early as 6:40 pm will little to no accumulation. Later in the evening the eastern half of the Travis County, mainly east of I-35, experienced an accumulation of freezing drizzle that produced icy spots on roads, bridges, and exposed surfaces. The Toll Road 130 on the east side, experienced icing as well as the Highway 183 area near the Austin Bergstrom Airport. A small area just north of the airport experienced a dusting of snow which lead to a 25 car accident on Highway 183.

February 9, 2011 – Travis County

An arctic cold front brought winter weather to eastern sections of South Central Texas during the morning of February 9th. The precipitation was mainly freezing drizzle and rain and started in the north in Kerr and Llano counties with a few reports of icy roads before sunrise. The freezing rain spread southward and eventually affected much of the eastern half of South Central Texas. Although ice accumulations were light, they produced icy roads, bridges, and overpasses. Later in the morning there were some reports of snow in Travis, Williamson, and Gillespie counties with one inch reported in Fredericksburg.

Probability of Future Events

According to historical records, the City of Austin planning area experiences one winter storm event every one to two years. Hence, the probability of a future winter storm event affecting the City planning area 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 time periods.

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

All populations, buildings, critical facilities, and infrastructure in the City of Austin planning area are vulnerable to severe winter events. 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 planning area where populations are sparse, and icy roads may impede travel. 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.

Based on the level of risk and historical occurrences for winter storms in the City of Austin, including the AISD, there is a “limited” severity of impact for winter storm events in the planning area; meaning injuries and illnesses are treatable with first aid, facilities and services can be shut down for 24 hours or less, and less than 10 percent of property can be destroyed or experience major damage.

Overall, the average loss estimate of property and crop (in 2015 dollars) is $11,751,449.24, having an approximate annual loss estimate of $225,989. Loss estimates were based on 52 years of statistical data from the NCDC. Table 13-4 shows annualized exposure.

Table 13-4. Winter Storm Event Damage Totals, 1996-2014

JURISDICTION	NUMBER OF EVENTS	PROPERTY DAMAGES	CROP DAMAGES	PROPERTY DAMAGES (2015 DOLLARS)	CROP DAMAGES (2015 DOLLARS)
Travis County	31	$3,926,767	$2,719,544	$6,158,545	$5,592,904
TOTAL LOSSES:		$6,645,711		$11,751,449	

Section 14: Dam Failure

Hazard Description

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

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

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

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

One major issue with the safety of dams is their age. The average age of America's 84,000 dams is 52 years. More than 2,000 dams near population centers are in need of repair, according to statistics released in 2009 by the Association of State Dam Safety Officials[1]. In addition to the continual aging

[1] Association of State Dam Safety Officials, Journal of Dam Safety

of dams there have not been significant increases in the number of safety inspectors resulting in haphazard maintenance and inspection.

The Association of State Dam Safety Officials estimate that $18.2 billion will be needed to repair all high-hazard dams, but the total for all state dam-safety budgets is less than $11 million[2]. The current maintenance budget does not match the scale of America's long-term modifications of its watersheds. Worse still, more people are moving into risky areas. As the American population grows, dams that once could have failed without major repercussions are now upstream of cities and development.

Location

The State of Texas has 7,126 dams, all regulated by the Texas Commission on Environmental Quality (TCEQ). Of these, 1,046 are considered "high-hazard," 725 are considered "significant-hazard," and 5,355 are considered "low-hazard." According to the American Society of Civil Engineers "Report Card," the Association of State Dam Safety Officials reports that there are 403 unsafe dams in Texas.[3] For dams in the City of Austin location, volume, elevation, condition, and classification information was factored into the risk ranking in Figure 14-1, which illustrates general locations for each dam in the area. Currently, there are 41 dams located in the Austin planning area: 31 are classified as "high-hazard", 5 as "significant-hazard", and 5 as "low-hazard" dams. All dams are listed in Table 14-1 along with regulation information.

[2] www.damsafety.org
[3] Source: http://www.asce.org/reportcard/pdf/tx.pdf

Figure 14-1. Dam Locations in Austin

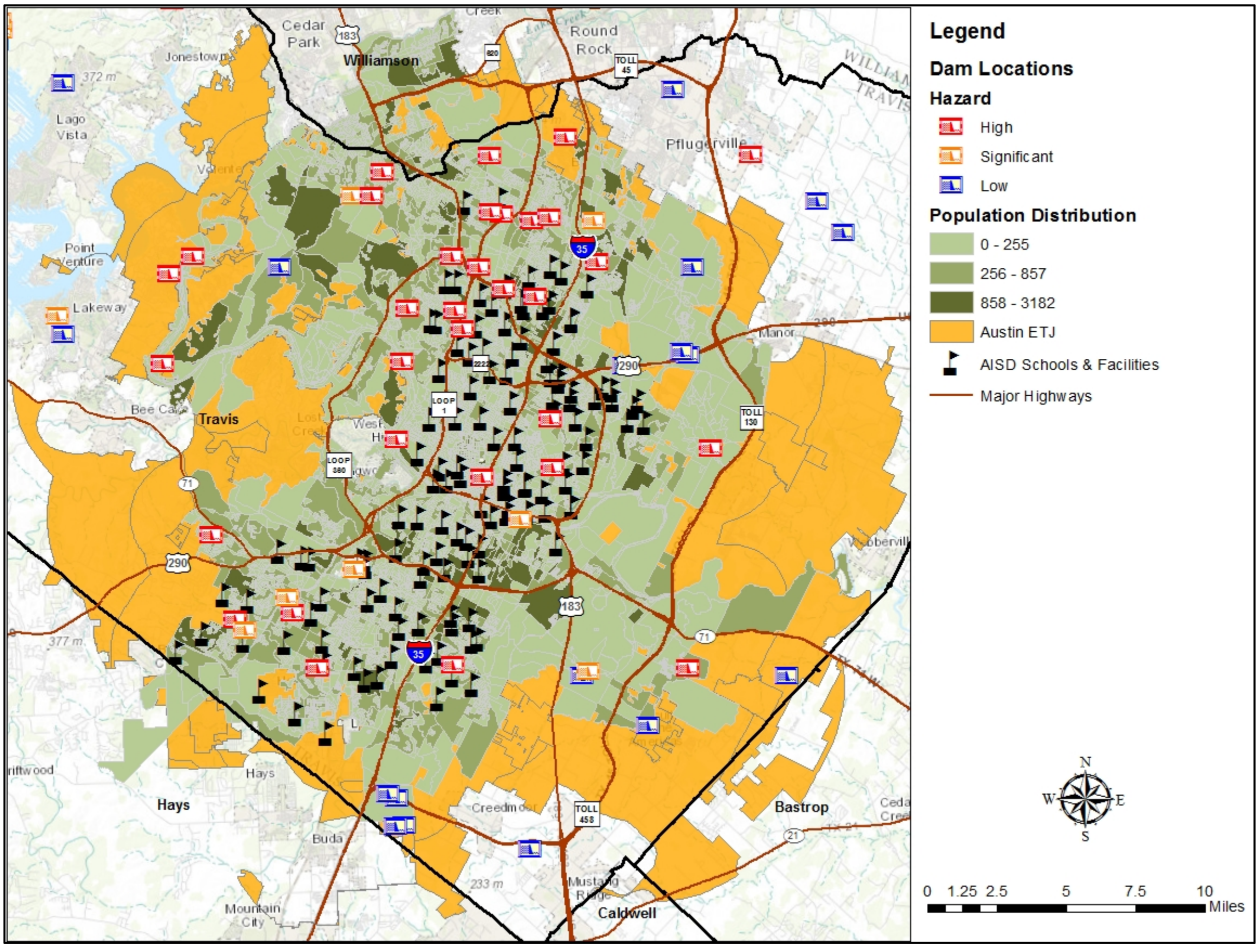


Table 14-1. City of Austin Dam Survey

JURISDICTION	DAM NAME	HEIGHT (Ft.)	STORAGE (Acre Ft.)	CONDITION	POTENTIAL HAZARD
Austin	ARBORETUM STORMWATER DETENTION POND DAM	30	30	Not Rated	High
Austin	BARTHOLOMEW PARK DAM	21	150	Not Rated	High
Austin	BROWN SCHOOLS DAM	12		Not Rated	High
Austin	CHIMNEYHILL STORMWATER HOLDING POND	26	40	Not Rated	Low
Austin	COUGAR RUN DAM	58	50	Not Rated	High
Austin	DECKER CREEK DAM	75	45,200	Not Rated	High
Austin	DICK NICHOLS PARK DAM	22	300	Not Rated	Significant

JURISDICTION	DAM NAME	HEIGHT (Ft.)	STORAGE (Acre Ft.)	CONDITION	POTENTIAL HAZARD
Austin	DUVAL DAM EAST	36	140	Not Rated	High
Austin	DUVAL DAM WEST	28	70	Not Rated	High
Austin	ESCARPMENT DAM NORTH	20	448	Not Rated	High
Austin	EVERGREEN DAM	36		Not Rated	High
Austin	GREAT NORTHERN DAM	24.77	64.7	Not Rated	High
Austin	GWENDOLYN DAM	8	57.9	Satisfactory	High
Austin	HIDDEN LAKE	42	183	Not Rated	High
Austin	HIGHWAY 71 DAM	25	176.8	Not Rated	High
Austin	LAKE BLUEBONNET DAM NO 1	9	83	Not Rated	Low
Austin	LAKE BLUEBONNET DAM NO 2	9	197	Not Rated	Low
Austin	LONGHORN DAM	65	6,850	Fair	Significant
Austin	MANSFIELD DAM	277	3,223,000	Fair	High
Austin	MAUAI DAM	11	43.4	Satisfactory	High
Austin	MC CALLEN DAM	14	99	Not Rated	Significant
Austin	MC NEIL DAM	18.3	309	Not Rated	High
Austin	MEARNS MEADOW DAM	14	62.4	Not Rated	High
Austin	NORTH MOPAC DAM	7	98.2	Satisfactory	High
Austin	NORTHWEST PARK DAM	22	225	Not Rated	High
Austin	OLD LAMPASAS DAM	33.5	84	Not Rated	High
Austin	OLD LAMPASAS WEST DAM	37	506	Not Rated	Significant
Austin	PARK BEND DAM	16	90.2	Fair	High
Austin	PARMER DAM	21	84	Satisfactory	High
Austin	RIVER PLACE MUD DAM	50	120	Not Rated	Low
Austin	SOUTH METRIC DAM	12	56.6	Fair	High
Austin	SOUTH MOPAC DAM	14.5	225	Not Rated	Significant
Austin	STEINER RANCH LAKE DAM	26		Not Rated	High
Austin	THANNAS DAM	17.3	50	Satisfactory	High

JURISDICTION	DAM NAME	HEIGHT (Ft.)	STORAGE (Acre Ft.)	CONDITION	POTENTIAL HAZARD
Austin	THOME VALLEY DAM	6.5	64.1	Satisfactory	High
Austin	TOM MILLER DAM	85	115,404	Fair	High
Austin	TROTWOOD DAM	24.5	15	Satisfactory	High
Austin	TX NO NAME NO 8 DAM	21	100	Not Rated	Low
Austin	WATERLOO PARK DAM	19	34.6	Not Rated	High
Austin	WOOD HOLLOW DAM	33	60	Fair	High
Austin	YETT CREEK PARK DAM	16	204.3	Not Rated	High

For dams with a maximum storage capacity of 100,000 acre-feet or more, all census blocks within five miles are considered to be at risk to potential dam failure hazards. For dams with a maximum storage capacity between 10,000 and 100,000 acre-feet, all census blocks within three miles are considered to be at risk to potential dam failure hazards. For dams with a maximum storage capacity of less than 10,000 acre-feet, all census blocks within one mile are considered to be at risk to potential dam failure hazards. With developments downstream of the dams, all populations located downstream of the dams are considered to be at risk to potential safety hazard if a dam failure occurred, especially areas downstream at a lower elevation.

Extent

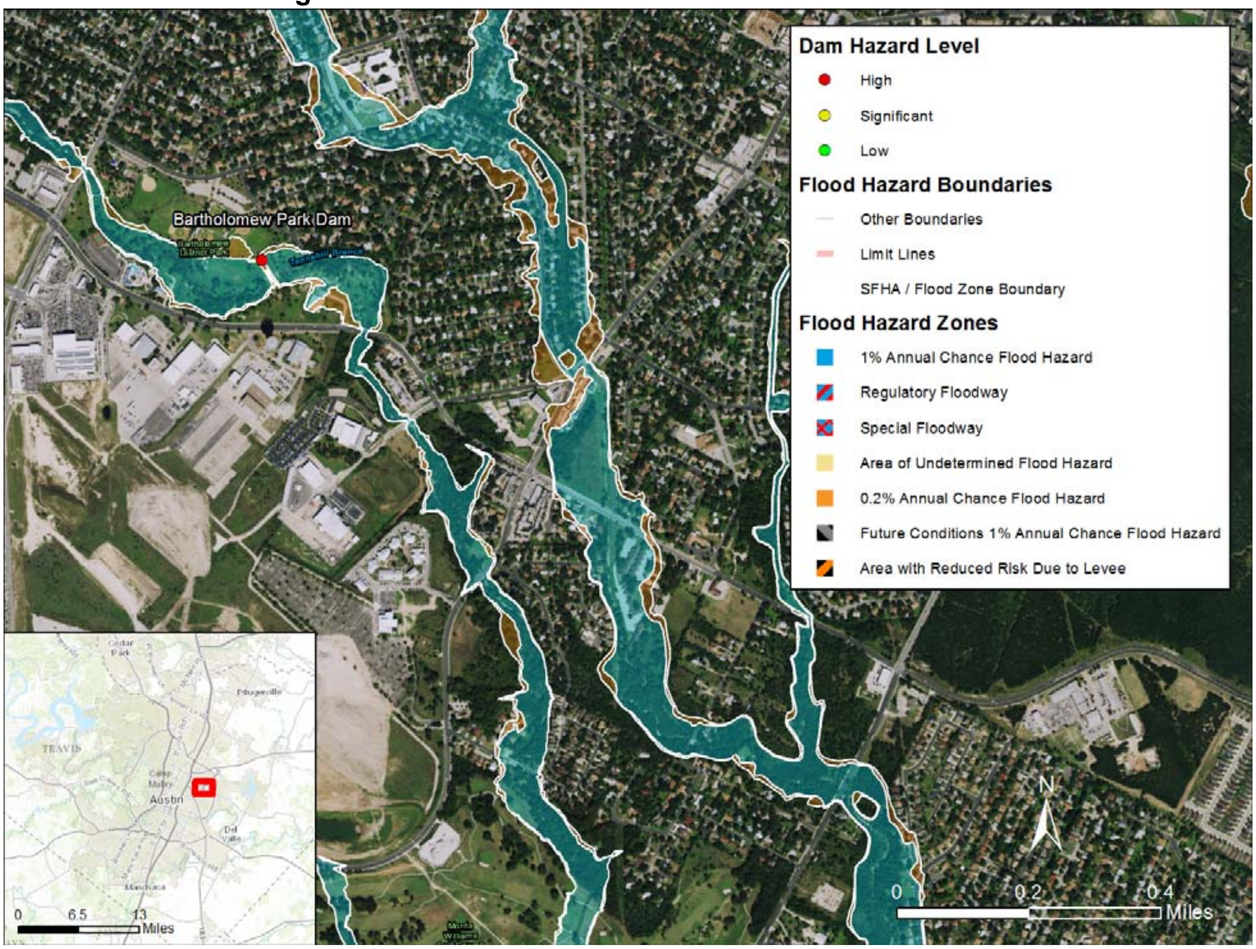
The extent or magnitude of a dam failure event is described in terms of the classification of damages that could result from a dam's failure; not the probability of failure. The National Interagency Committee on Dam Safety defines high hazard dams as those where failure or mis-operation would cause loss of human life. Prior to 2009, high hazard dams were defined as those at which failure or mis-operation would probably cause loss of human life. Dams classified as "significant" were those at which failure or mis-operation probably would not result in loss of human life but could cause economic loss, environmental damage, and disruption of lifeline facilities or other significant damage. Low hazard potential dams are those at which failure or mis-operation probably would not result in loss of human life but would cause limited economic and/or environmental losses. Losses would be limited mainly to the owner's property. Classifications for extent after 2009 are found in Table 14-2 below. Figures 14-2 through 14-24 are inundation maps that show the flood risk areas for each high hazard dam that needs to be mitigated, according to the FEMA National Flood Hazard Layer (NFHL); in the event of a dam breach, the flow of water is expected to follow the same path of flood as the NFHL. An estimated depth for dam breach is indicated in the paragraph below Figures 14-2 through 14-24.[4] The following high hazard dams do not need to be mitigated due to no risk or inundation area: Arboretum Stormwater Detention Pond Dam, Great Northern Dam, Gwendolyn Dam, Mauai Dam, Steiner Ranch Lake Dam, Thannas Dam, Wood Hollow Dam, and Yett Creek Park Dam.

[4] Dam breach depth is an estimate based on best available data, not statistical data.

Table 14-2. Extent Classifications

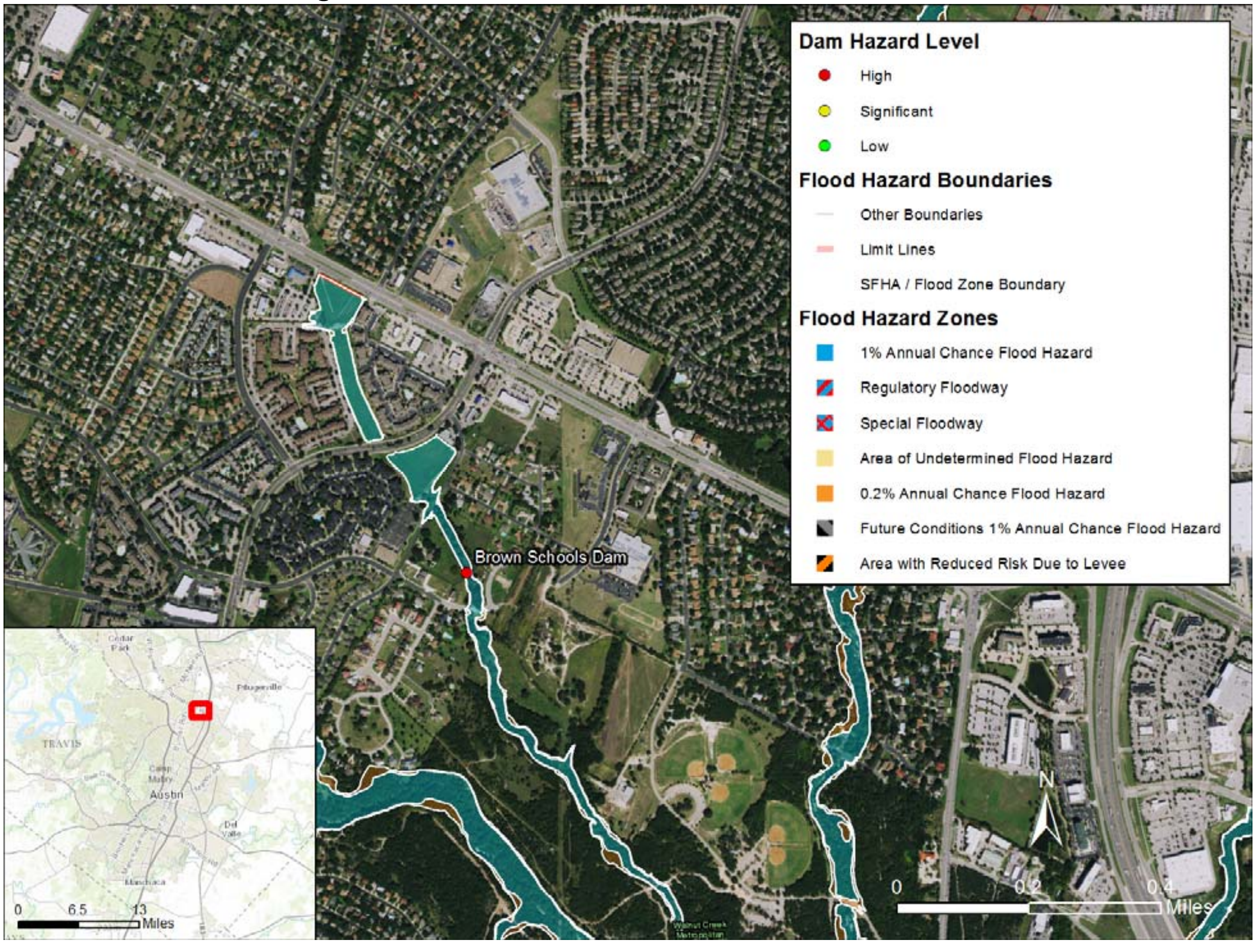
HAZARD POTENTIAL CLASSIFICATION	LOSS OF HUMAN LIFE	DAM STORAGE CAPACITY
Low	None Expected	Less than 10,000 acre-feet
Significant	Probable (1 to 6)	Between 10,000 and 100,000 acre-feet
High	Loss of Life Expected (7 or More)	100,000 acre-feet or more

Figure 14-2. Bartholomew Park Dam Flood Risk Areas



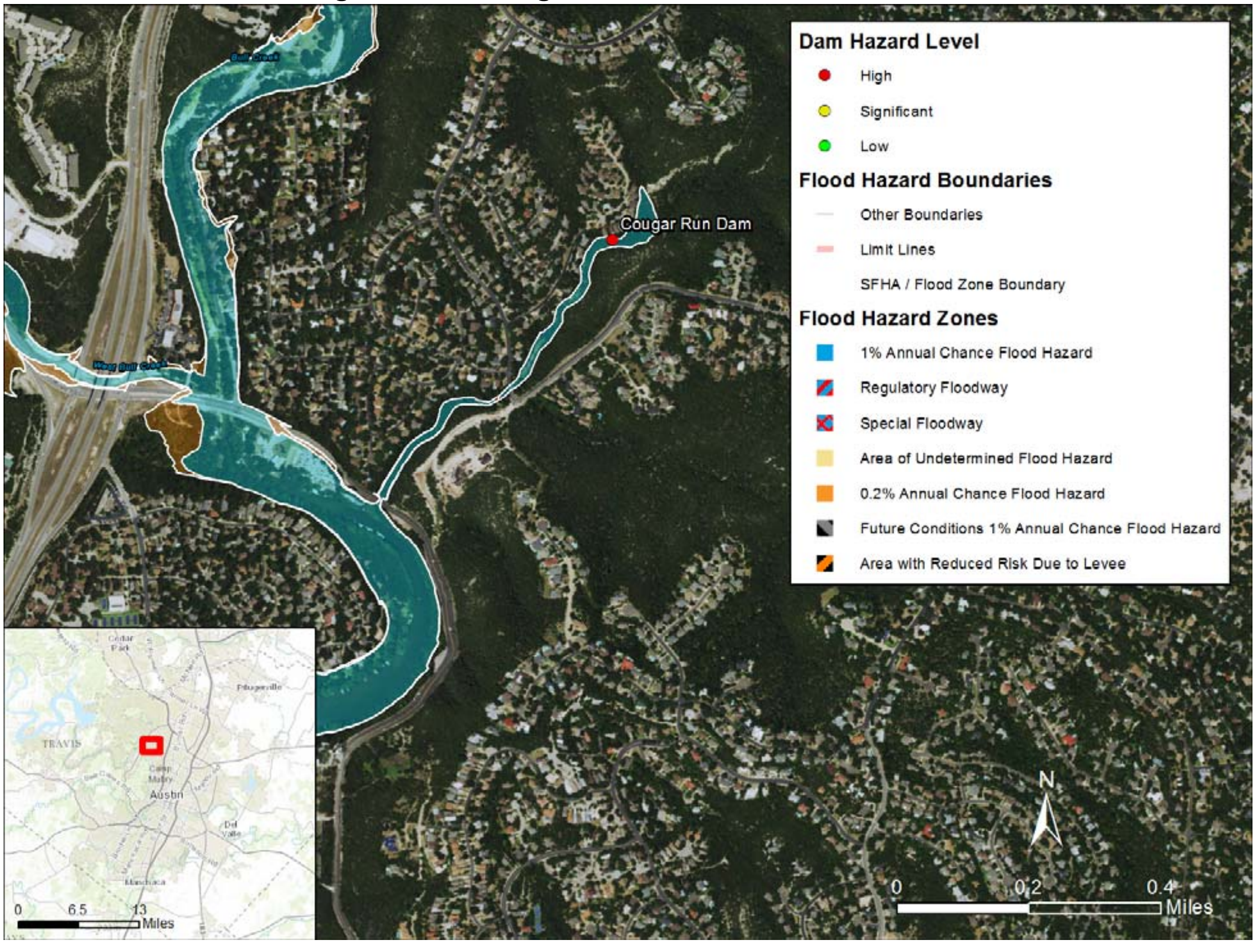
Bartholomew Park Dam is on the Tannehill Branch River in the City of Austin and is used for flood control purposes. It is owned by the City of Austin and was constructed in 1997. It is of earthen construction. The extent classification is considered high and the area located near the dam is a densely populated area. A dam failure could cause power outages and disrupt utility systems. Bartholomew Park, residential and commercial structures, and residents would be vulnerable. In the event of a breach, it is estimated the average breach width would be 150.5 feet with a maximum breach flow of 42,858 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of 0 to 15 feet.

Figure 14-3. Brown Schools Dam Flood Risk Areas



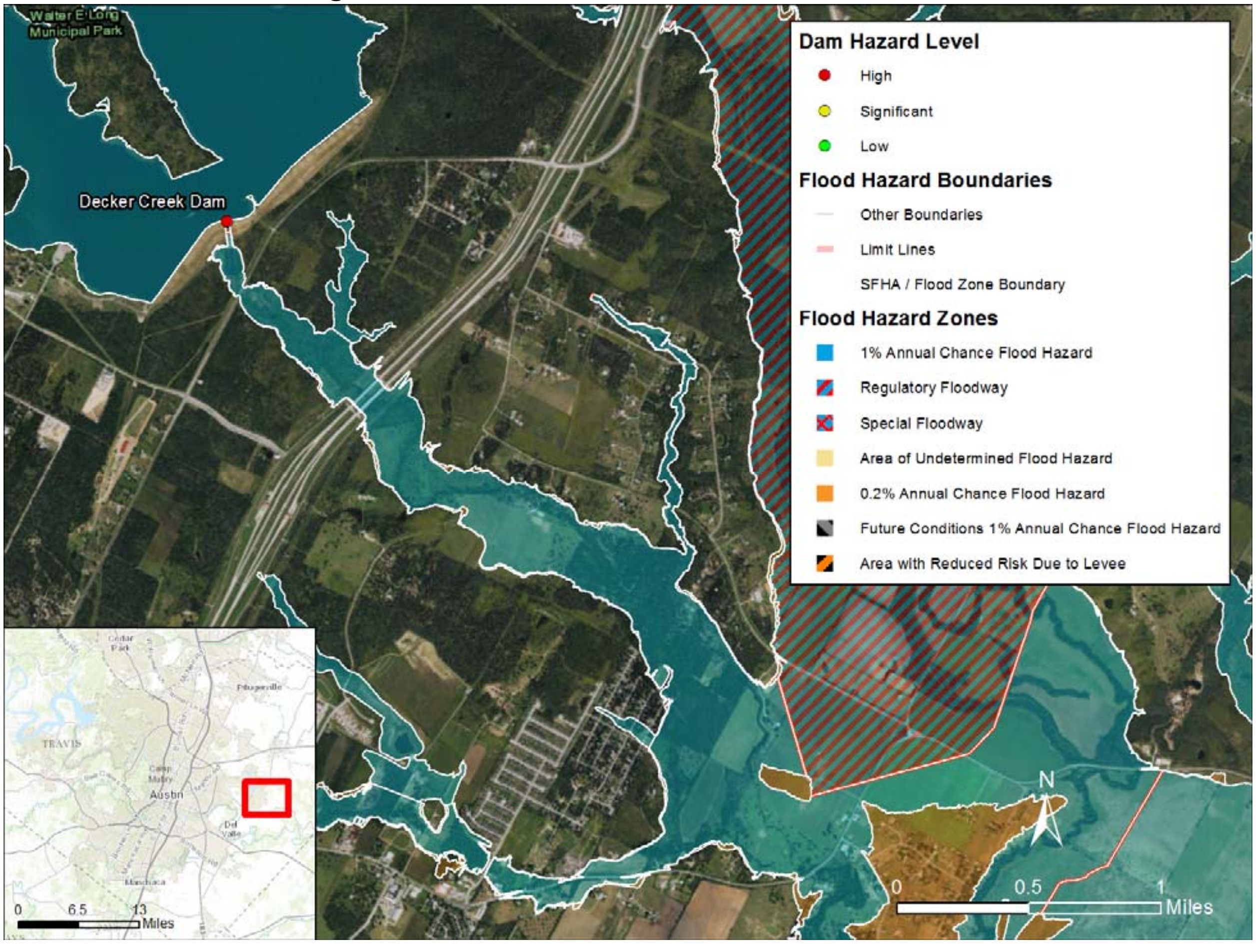
Brown Schools Dam is on the Tar Branch River in the City of Austin. The dam is owned by the Brown Schools and was constructed in 1800. The extent classification is considered high and the area located near the dam is densely populated. There is not a maximum capacity reported, therefore the NWS dam break equation couldn't be run. A dam breach could result in an estimated depth of 0 to 15 feet.

Figure 14-4. Cougar Run Dam Flood Risk Areas



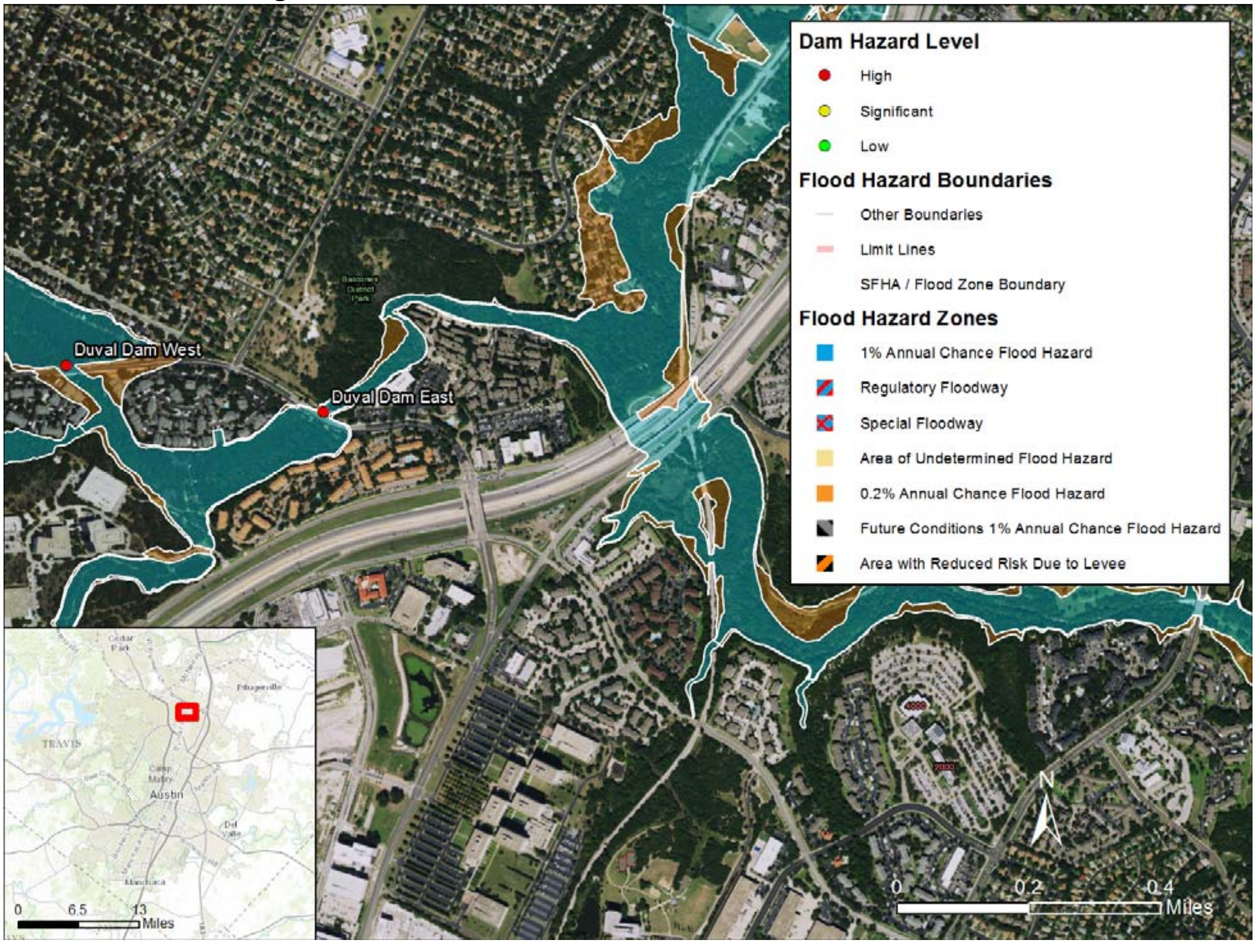
Cougar Run Dam is on the tributary of Bull Creek in the City of Austin. The dam is owned by the City and was constructed in 1982. The extent classification is considered high and the area located near the dam is a densely populated area. A dam failure could cause power outages and disrupt utility systems. In the event of a breach, it is estimated the average breach width would be 69.7 feet with a maximum breach flow of 84,418 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet.

Figure 14-5. Decker Creek Dam Flood Risk Areas



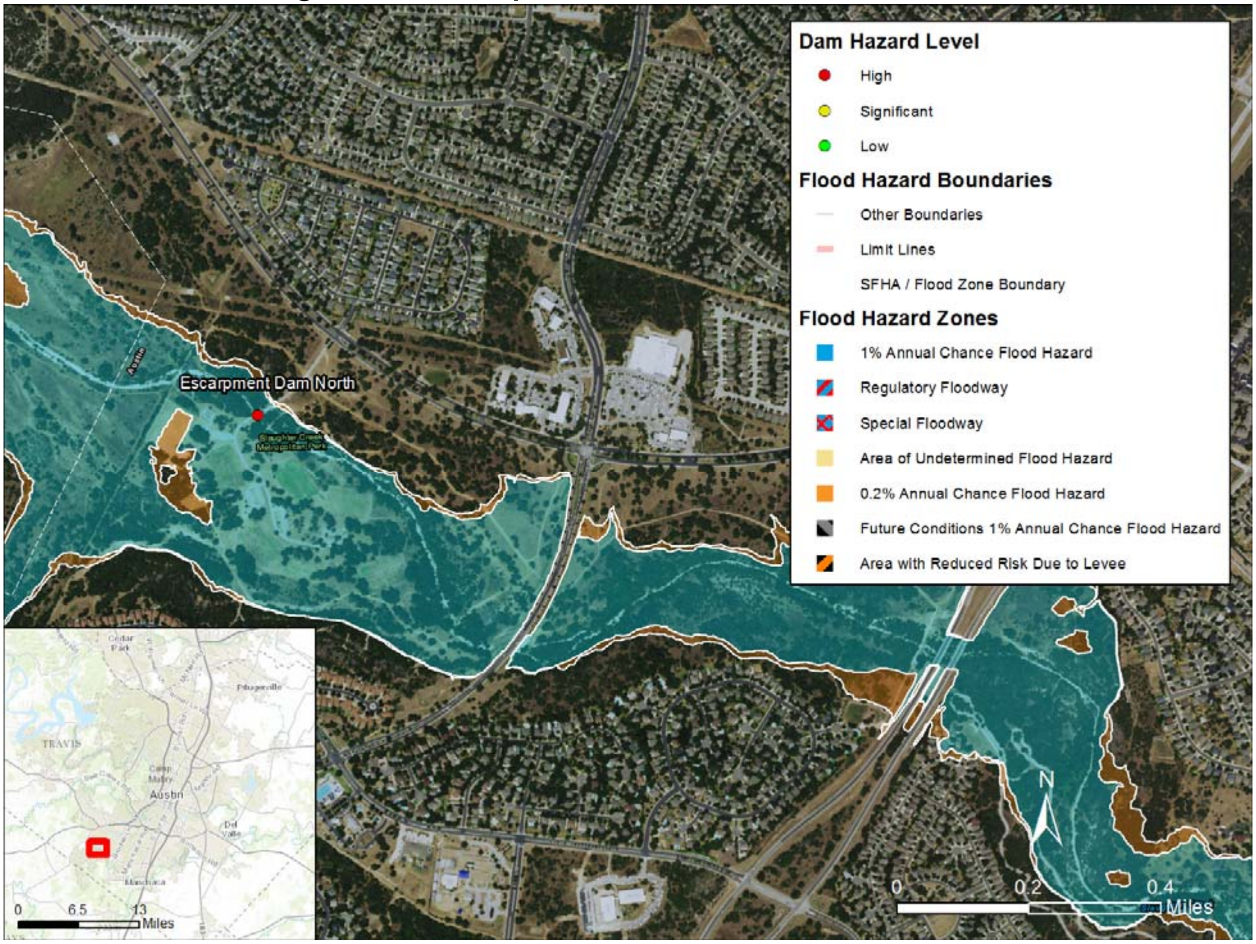
Decker Creek Dam is located in the City of Austin on Decker Creek and is used for recreation purposes. The earthen dam with a metal core and a foundation of rock and soil is owned by Austin Energy. It was constructed in 1967. The extent classification is considered high and the area located near the dam is semi-densely populated area. A dam failure could cause power outages and disrupt utility systems. In the event of a breach, it is estimated the average breach width would be 407.6 feet with a maximum breach flow of 806,256 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 25 feet.

Figure 14-6. Duval Dams East and West Flood Risk Areas



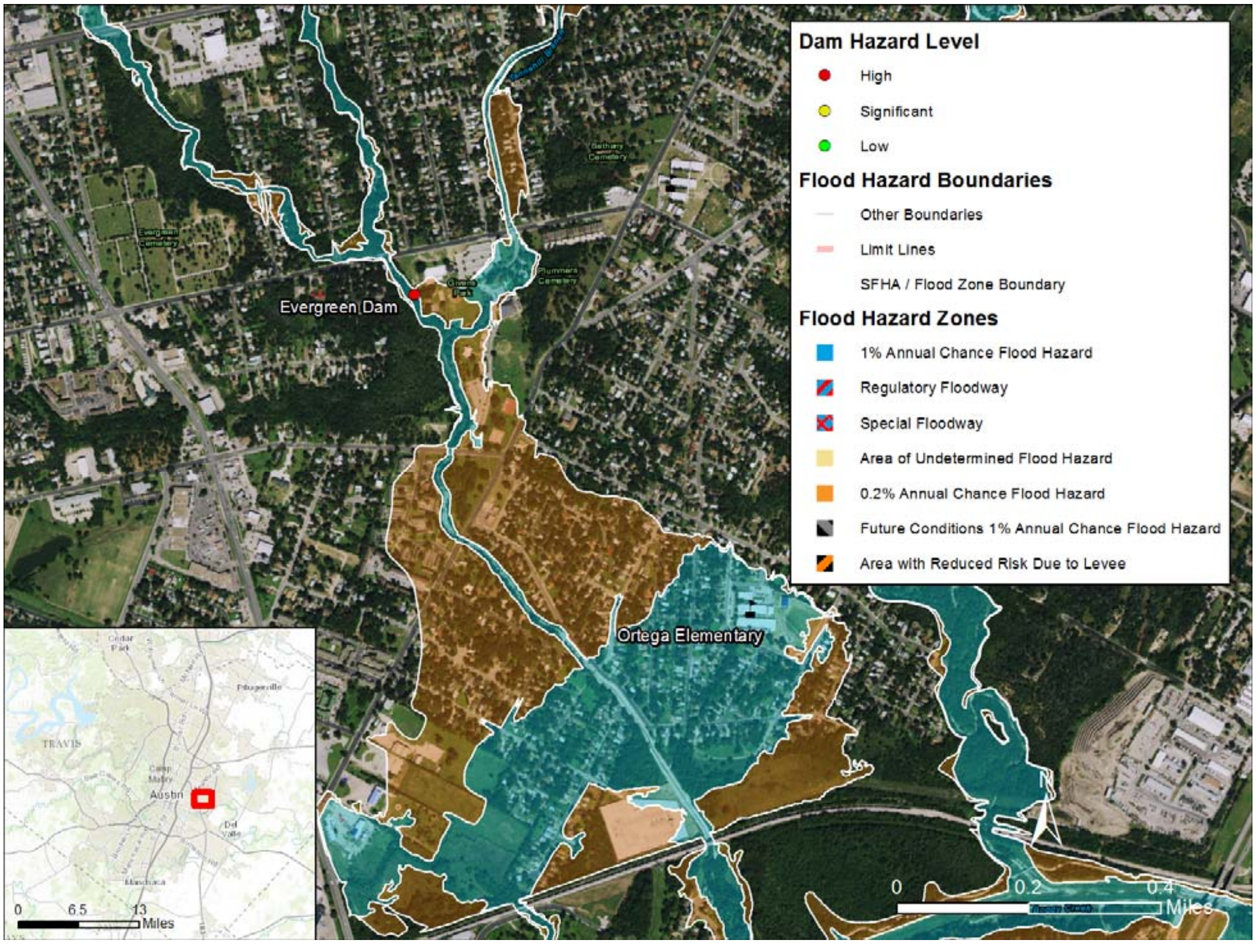
Duval Dams East and West are on the Walnut Creek in the City of Austin and are owned by the City. The dams were constructed in 1984. The extent classification is considered high and the area located near the dam is a densely populated area. A dam failure could cause power outages and disrupt utility systems. In the event of a breach, it is estimated the average breach width would be 80 feet with a maximum breach flow of 48,505 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet.

Figure 14-7. Escarpment Dam North Flood Risk Areas



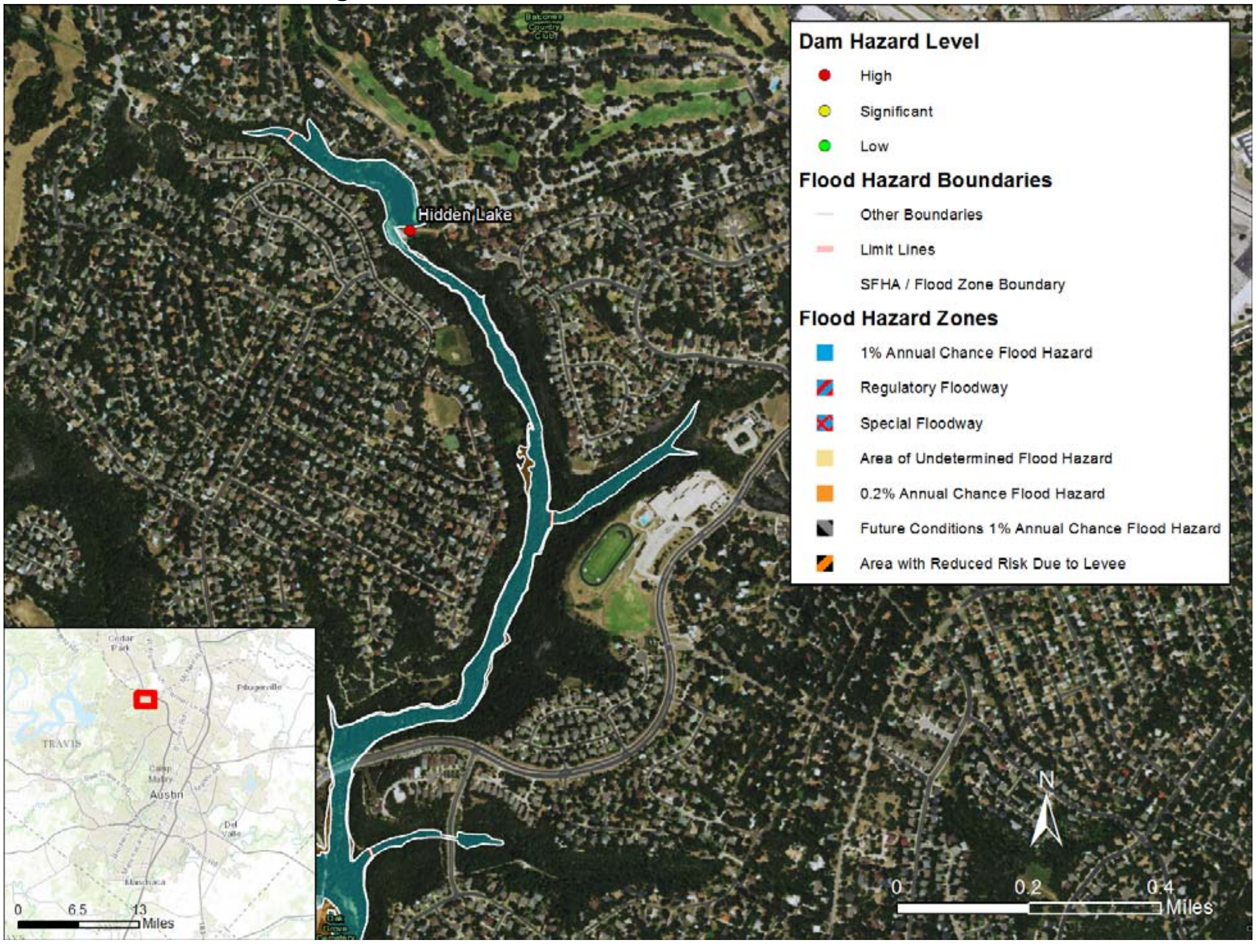
Escarpment Dam North is on the Slaughter Creek in the City of Austin. The dam is owned by the City and was constructed in 1986. The extent classification is considered high and the area located near the dam is a densely populated area. A dam failure could cause power outages and disrupt utility systems. Slaughter Creek Metropolitan Park would be vulnerable in the event of a dam failure. In the event of a breach, it is estimated the average breach width would be 92.4 feet with a maximum breach flow of 23,670 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet.

Figure 14-8. Evergreen Dam Flood Risk Areas



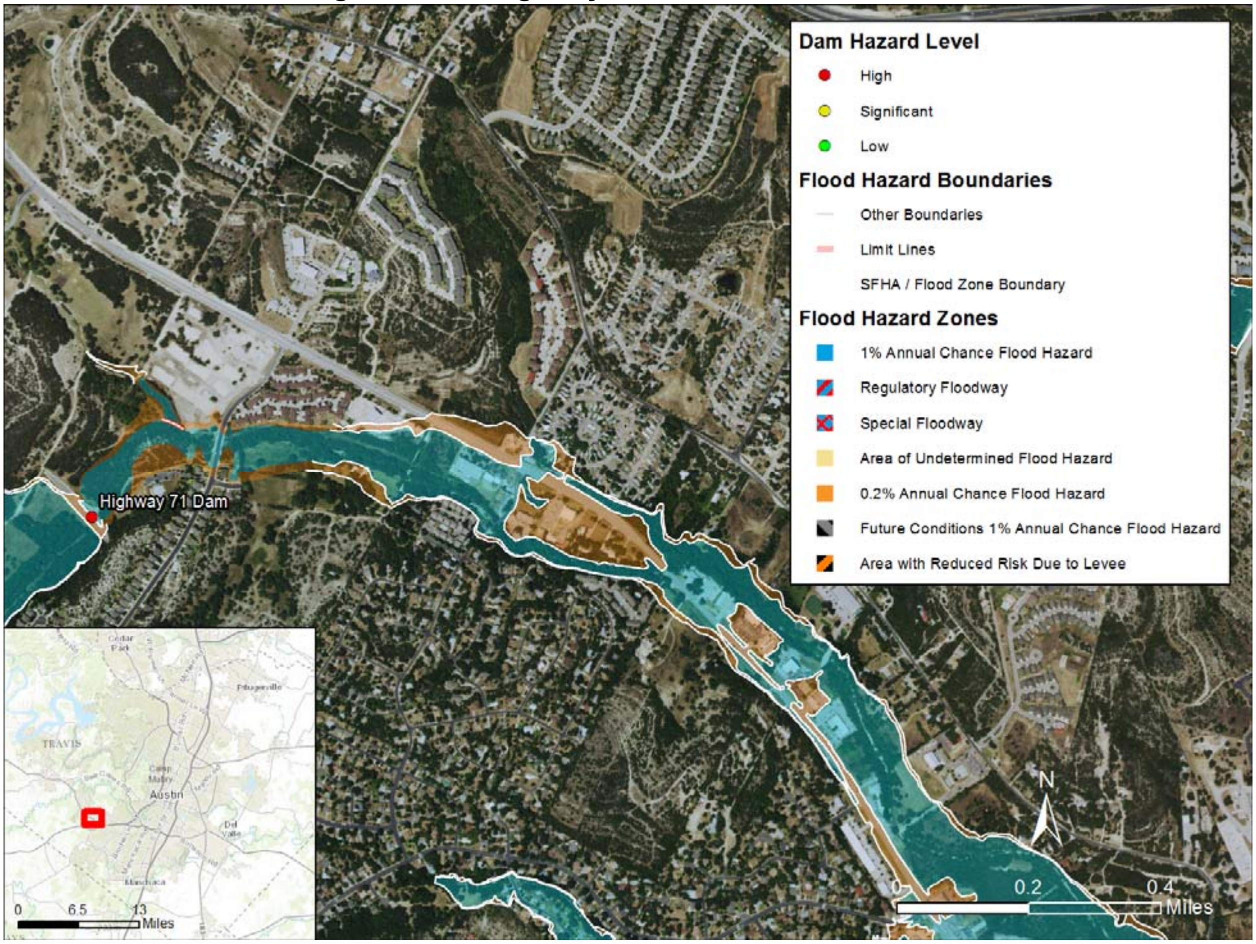
Evergreen Dam is on the Tannehill Branch River in the City of Austin and is used for flood control purposes. The earthen dam is owned by the City of Austin. The extent classification is considered high and the area located near the dam is a densely populated area. A dam failure could cause power outages and disrupt utility systems. Givens Park, Ortega Elementary, residential and commercial structures, and residences would be vulnerable in the event of a dam failure. Maximum capacity data isn't recorded for the dam, therefore the NWS dam breach equation couldn't be run. A dam breach could result in an estimated depth of up to 15 feet.

Figure 14-9. Hidden Lake Dam Flood Risk Areas



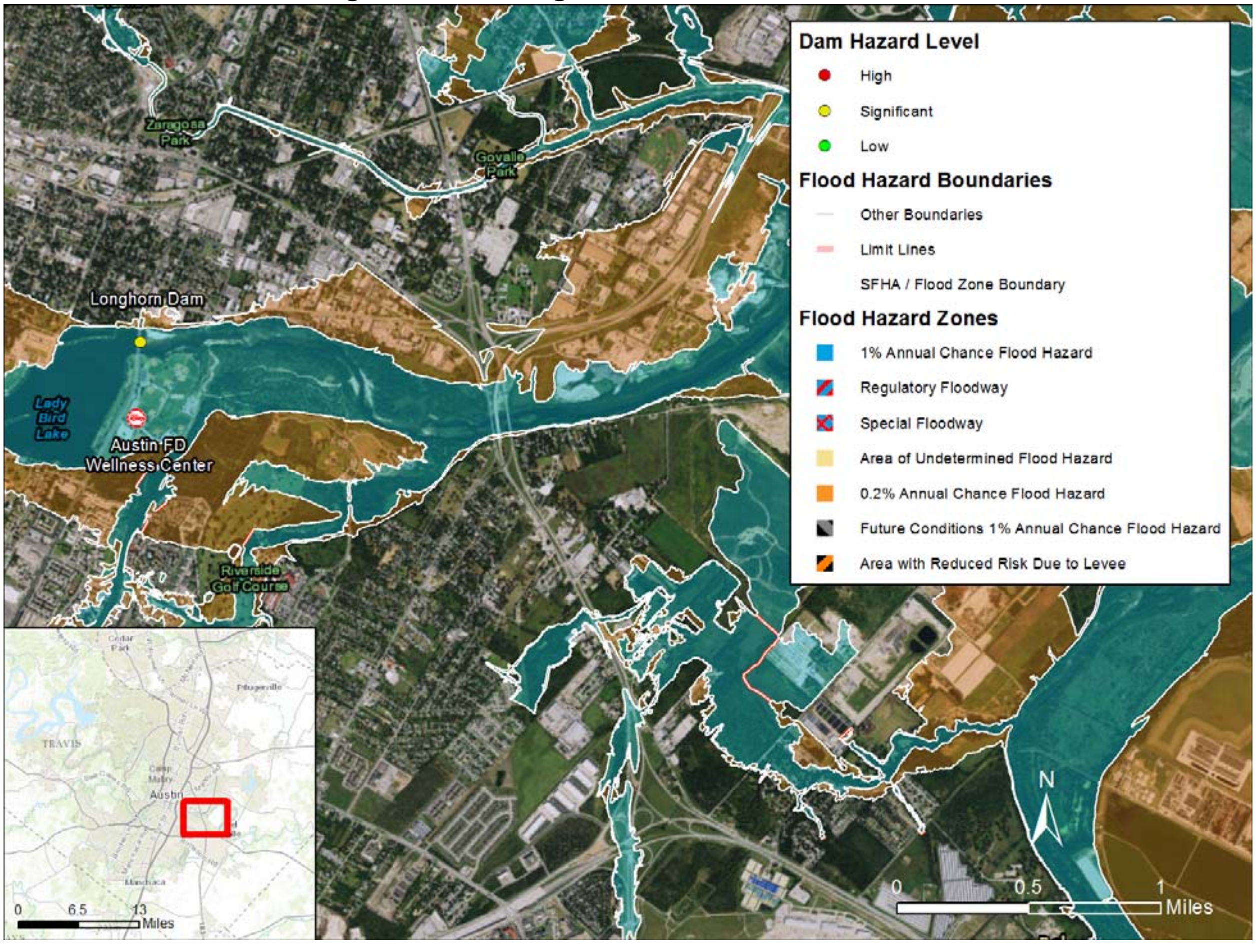
Hidden Lake Dam is on a tributary of Bull Creek in the City of Austin. The dam is owned by the Balcones Country Club Membership Association Inc. and was constructed in 1969. The extent classification is considered high and the area located near the dam is a densely populated area. A dam failure could cause power outages and disrupt utility systems. In the event of a breach, it is estimated the average breach width would be 89 feet with a maximum breach flow of 68,561 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet.

Figure 14-10. Highway 71 Dam Flood Risk Areas



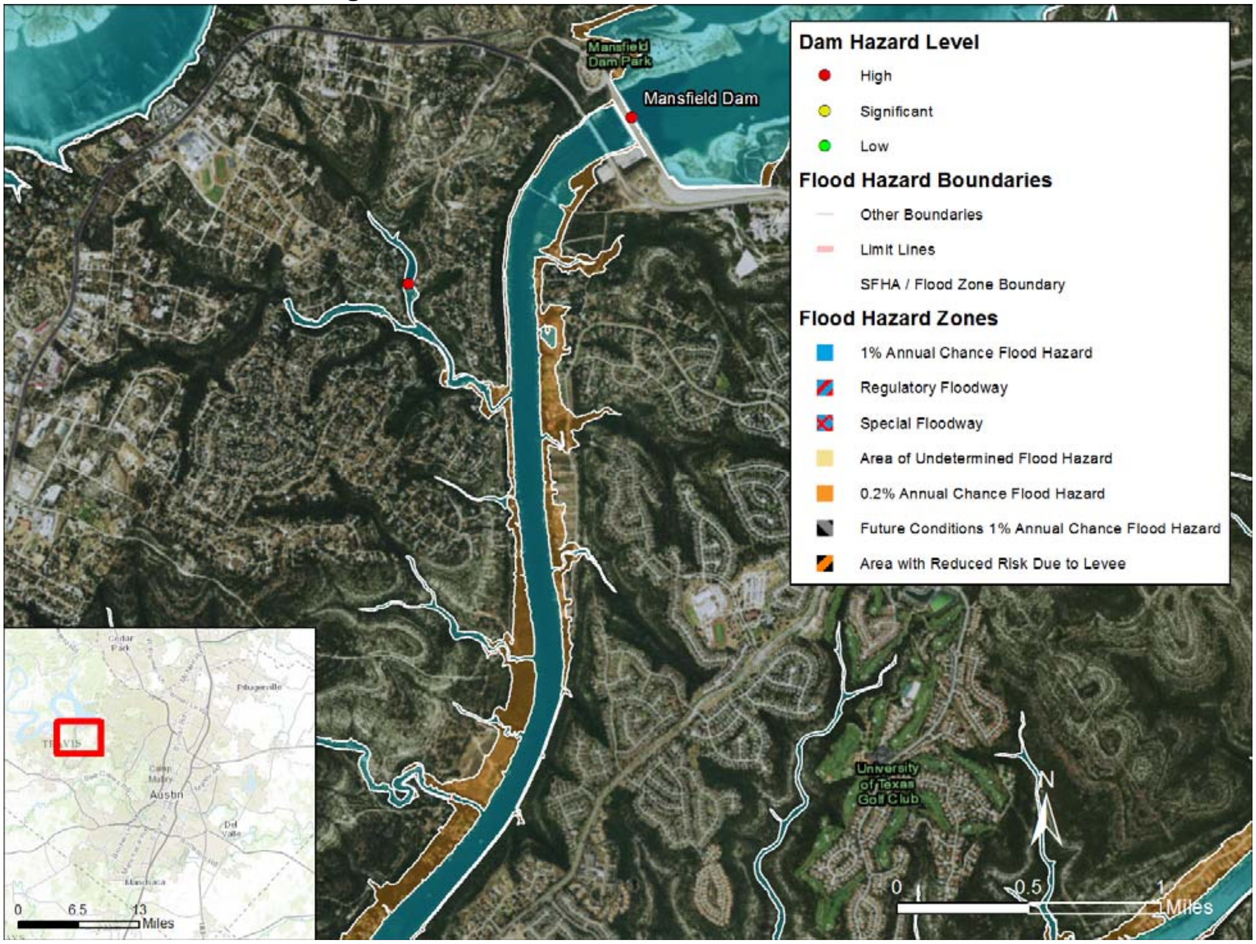
Highway 71 Dam is owned by the City of Austin and was constructed in 1999. The extent classification is considered high and the area located near the dam is a densely populated area. A dam failure could cause power outages and disrupt utility systems. In the event of a breach, it is estimated the average breach width would be 77.5 feet with a maximum breach flow of 27,182 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet.

Figure 14-11. Longhorn Dam Flood Risk Areas



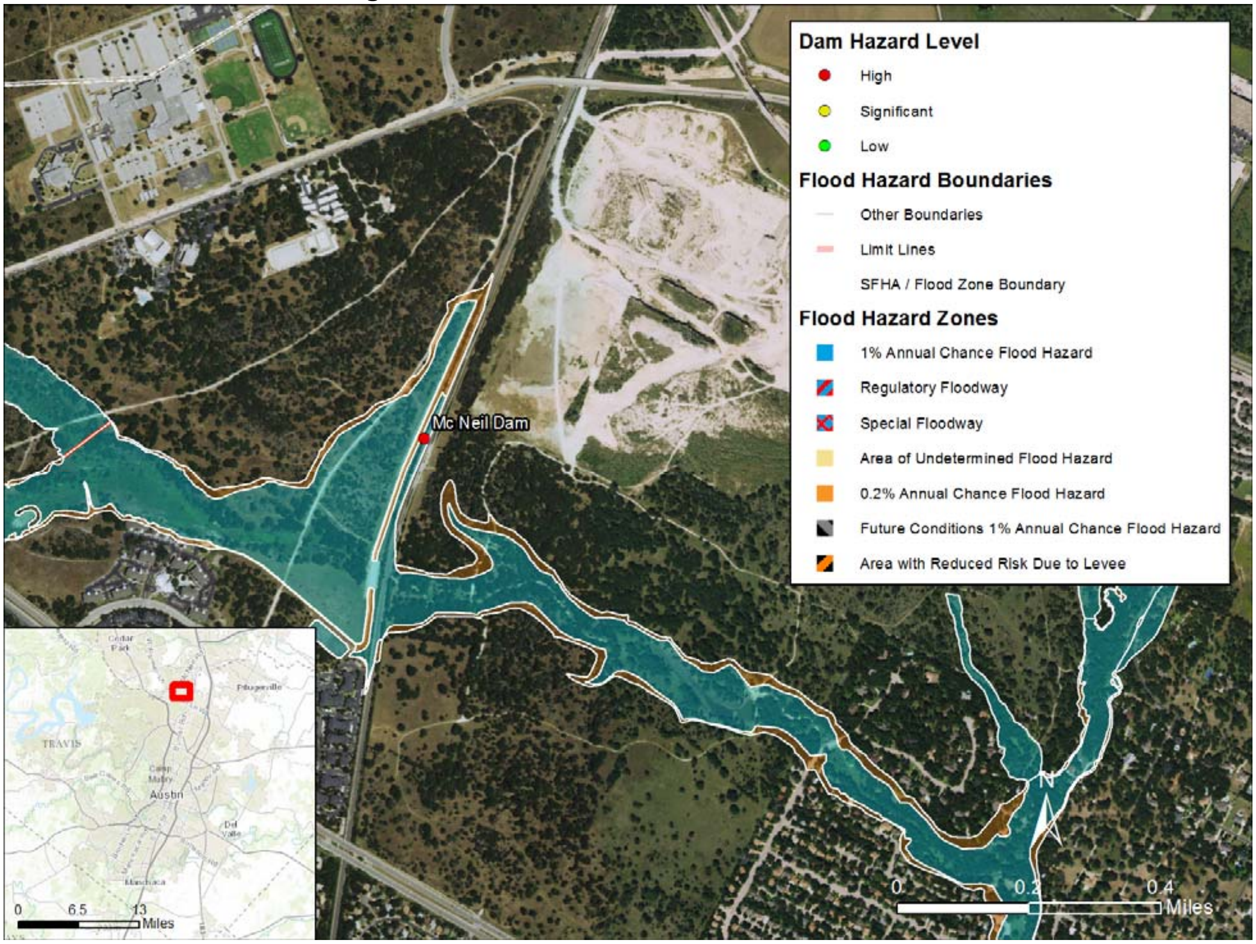
Longhorn Dam is on the Colorado River in the City of Austin and is used for multiple purposes including recreation. The earthen dam is owned by Austin Energy and was constructed in 1960. The extent classification is considered high and the area located near the dam is a densely populated area. A dam failure could cause power outages and disrupt utility systems. Austin Fire Department Wellness Center, Riverside Golf Course, residential and commercial structures, and residences would be vulnerable in the event of a dam failure. In the event of a breach, it is estimated the average breach width would be 245.4 feet with a maximum breach flow of 386,527 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 25 feet.

Figure 14-12. Mansfield Dam Flood Risk Areas



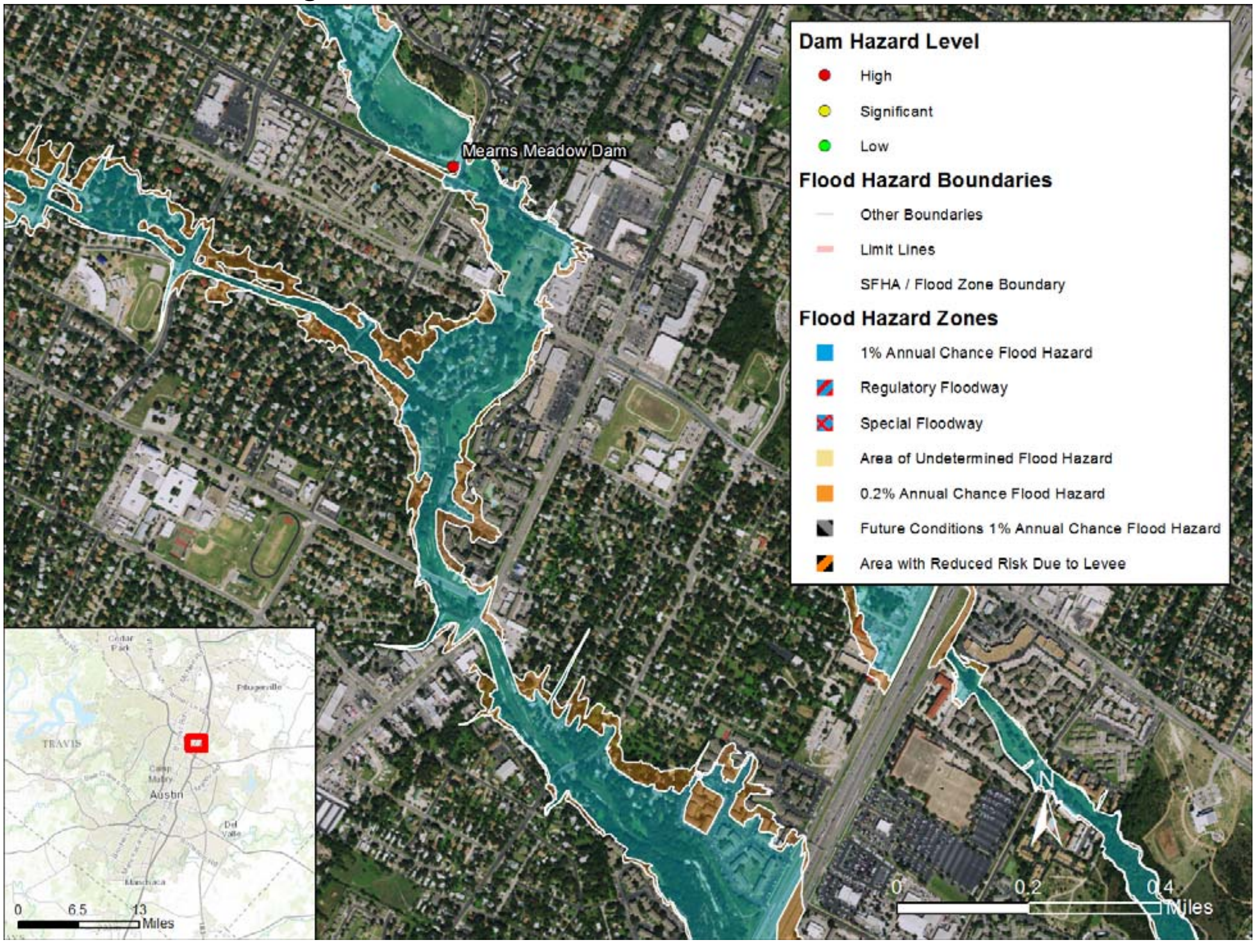
Mansfield Dam is on the Colorado River in the City of Austin and is used for irrigation and hydroelectric power purposes. The earthen construction, gravity dam, rock fill is owned by the Lower Colorado River Authority and was constructed in 1942. The extent classification is considered high and the area located near the dam is a densely populated area. A dam failure could cause power outages and disrupt utility systems. In the event of a breach, it is estimated the average breach width would be 1642.1 feet with a maximum breach flow of 23,365,810 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 25 feet.

Figure 14-13. McNeil Dam Flood Risk Areas



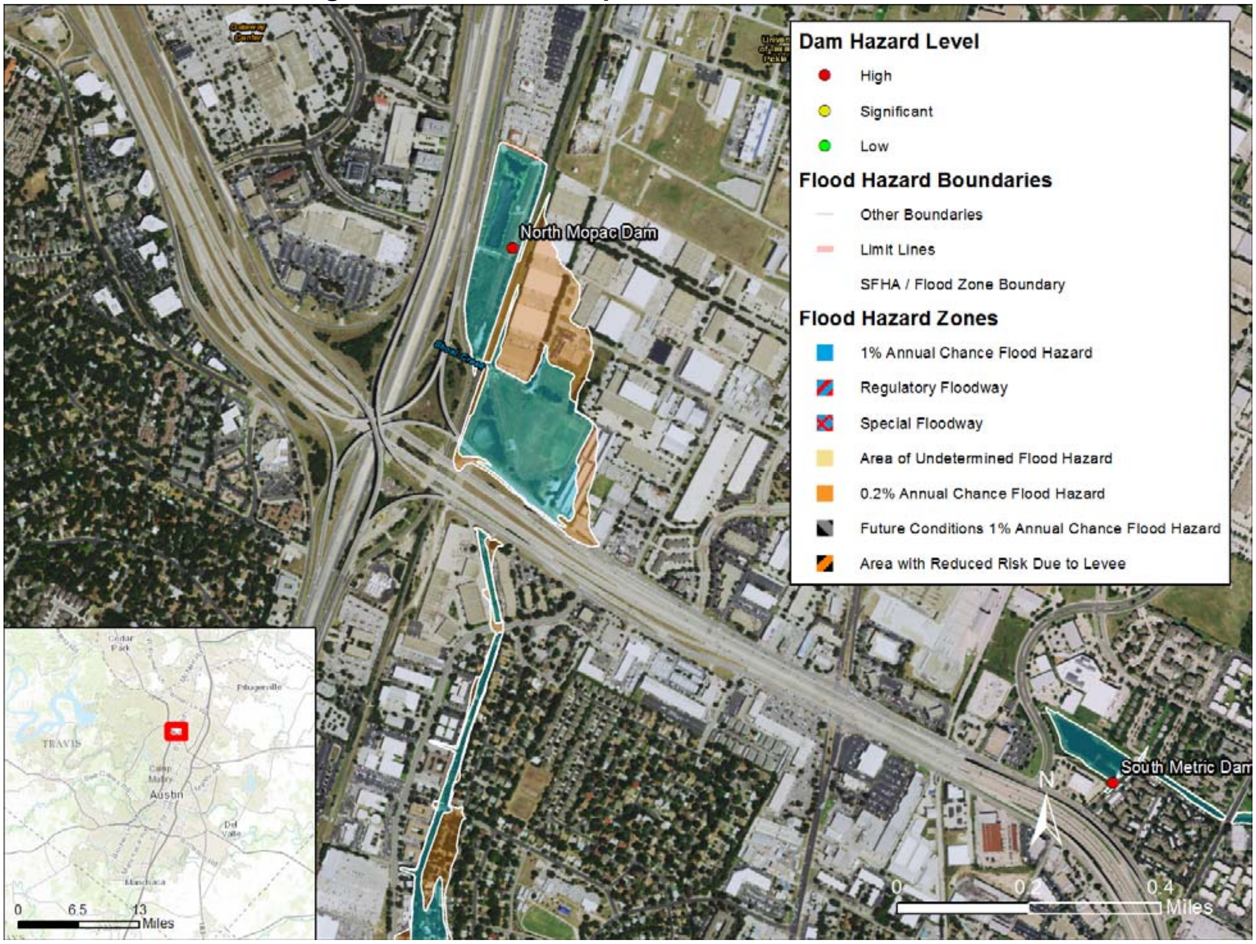
McNeil Dam is located in Travis County and owned by the City of Austin. The dam was constructed in 1960. The extent classification is considered high and the area located near the dam is a semi-dense area. A dam failure could cause power outages and disrupt utility systems. In the event of a breach, it is estimated the average breach width would be 82.4 feet with a maximum breach flow of 18,285 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet.

Figure 14-14. Mearns Meadow Dam Flood Risk Areas



Mearns Meadow Dam is on the Little Walnut Creek in the City of Austin. The dam is owned by the City and was constructed in 1994. The extent classification is considered high and the area located near the dam is a densely populated area. In the event of a breach, it is estimated the average breach width would be 51.6 feet with a maximum breach flow of 7,258 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet.

Figure 14-15. North Mopac Dam Flood Risk Areas

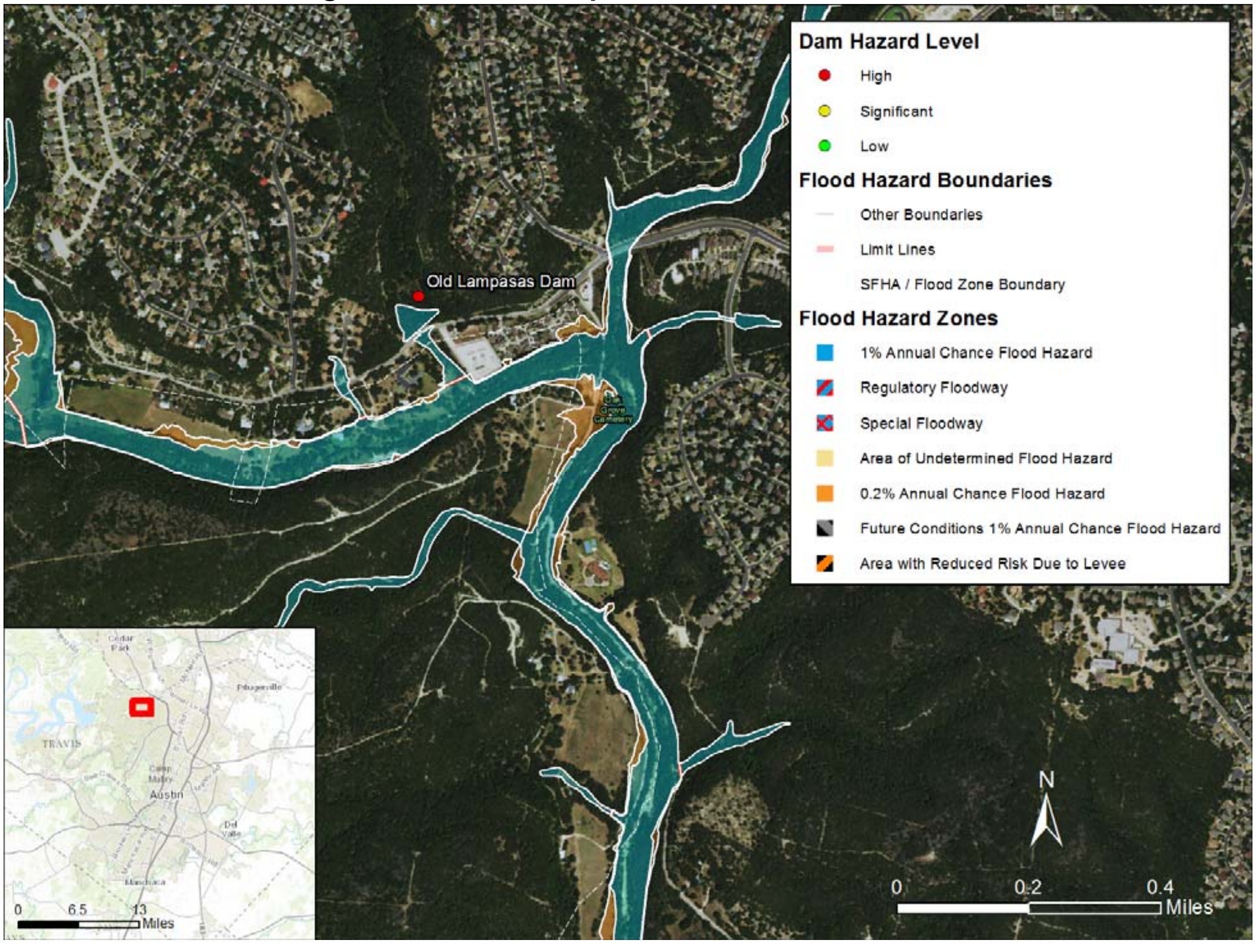


North Mopac Dam is located in the City of Austin and is owned by the City. The dam was constructed in 1960. The extent classification is considered high and the area located near the dam is a densely populated area. In the event of a breach, it is estimated the average breach width would be 48.6 feet with a maximum breach flow of 2,422 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet.

Figure 14-16. Northwest Park Dam Flood Risk Areas

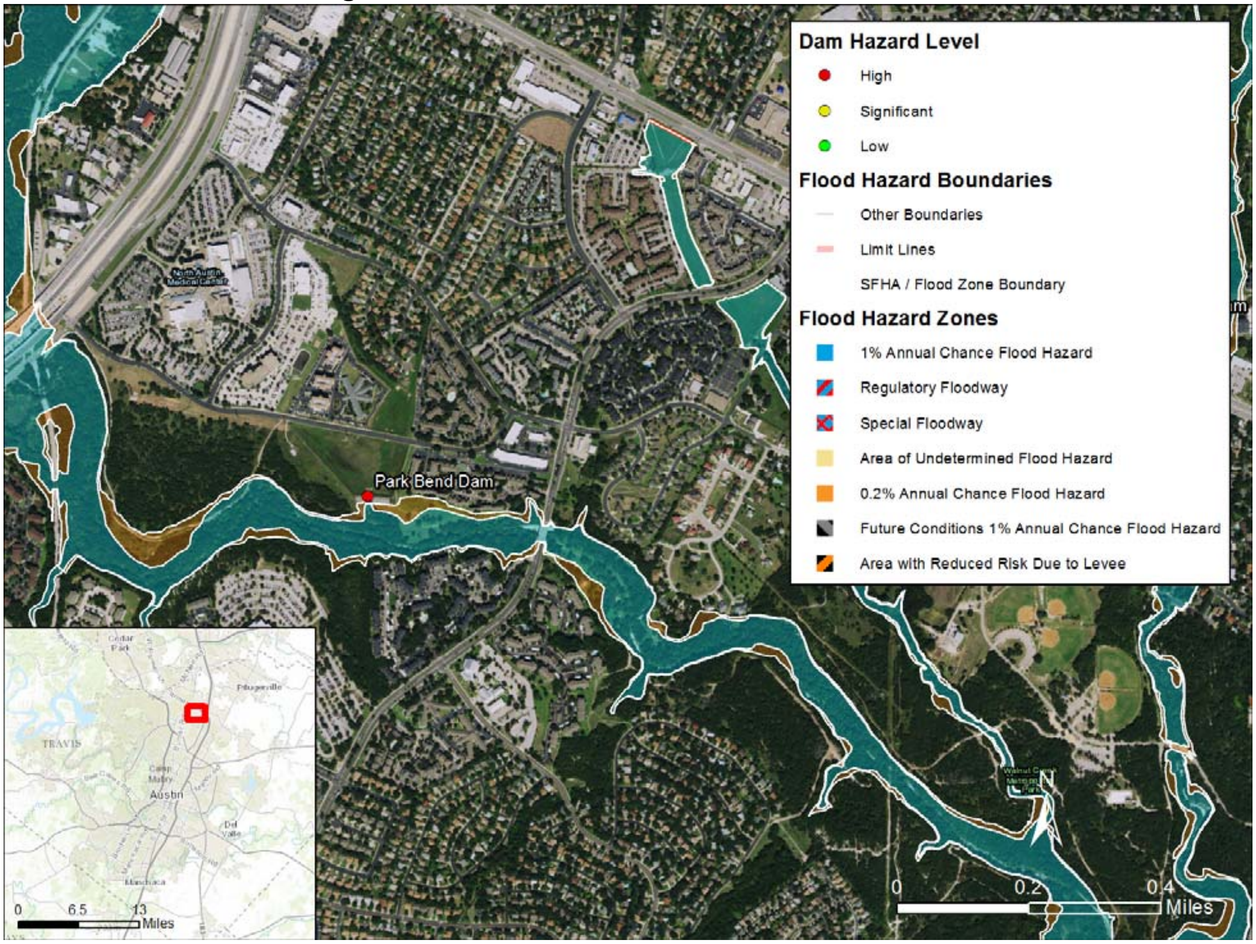
Northwest Park Dam is owned by the City of Austin and was constructed in 1960. The extent classification is considered high and the area located near the dam is a densely populated area. A dam failure could cause power outages and disrupt utility systems. In the event of a breach, it is estimated the average breach width would be 79.7 feet with a maximum breach flow of 23,188 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet.

Figure 14-17. Old Lampass Dam Flood Risk Areas



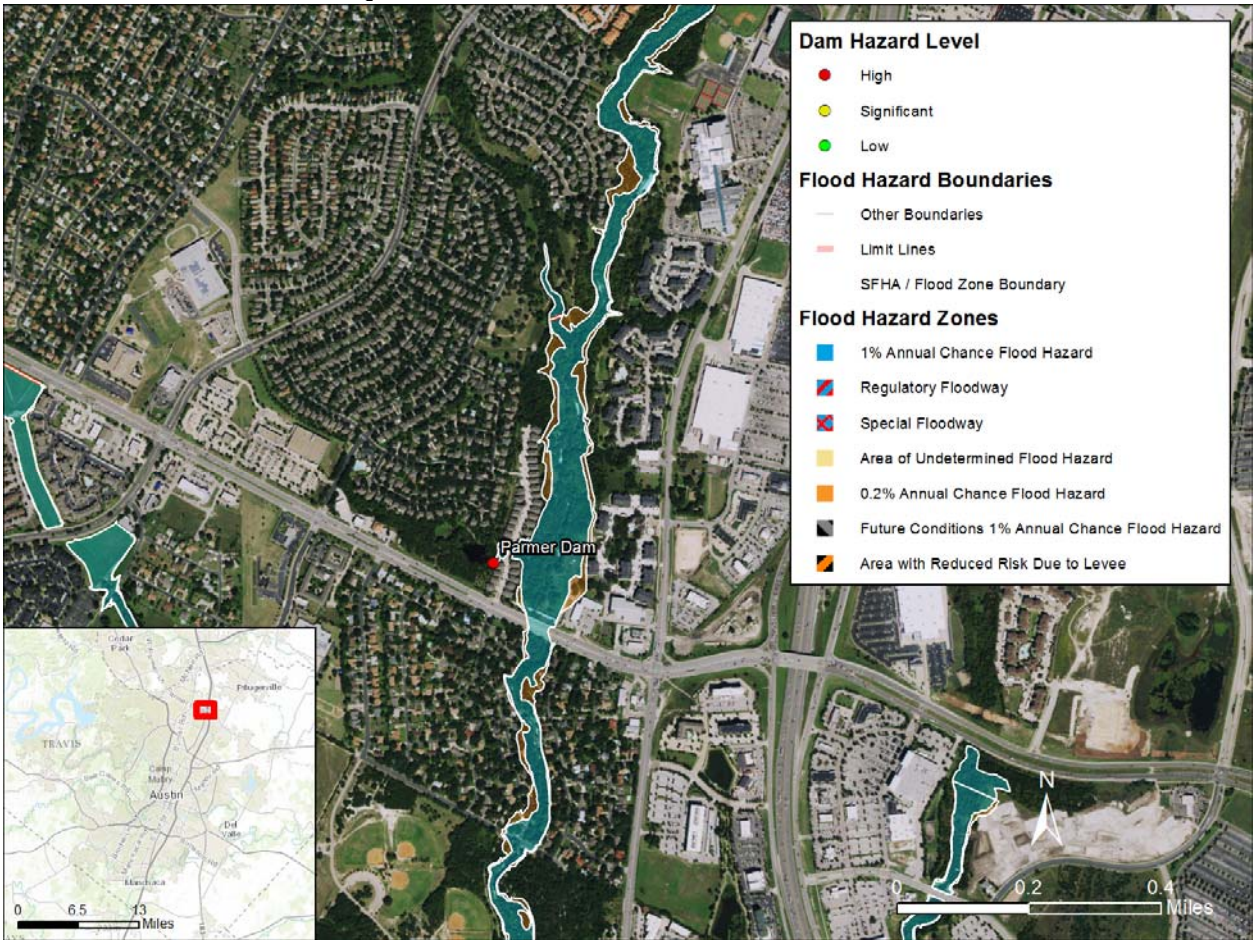
Old Lampass Dam is owned by the City of Austin and was constructed in 1960. The extent classification is considered high and the area located near the dam is a semi-densely populated area. A dam failure could cause power outages and disrupt utility systems. In the event of a breach, it is estimated the average breach width would be 69.2 feet with a maximum breach flow of 37,027 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet.

Figure 14-18. Park Bend Dam Flood Risk Areas



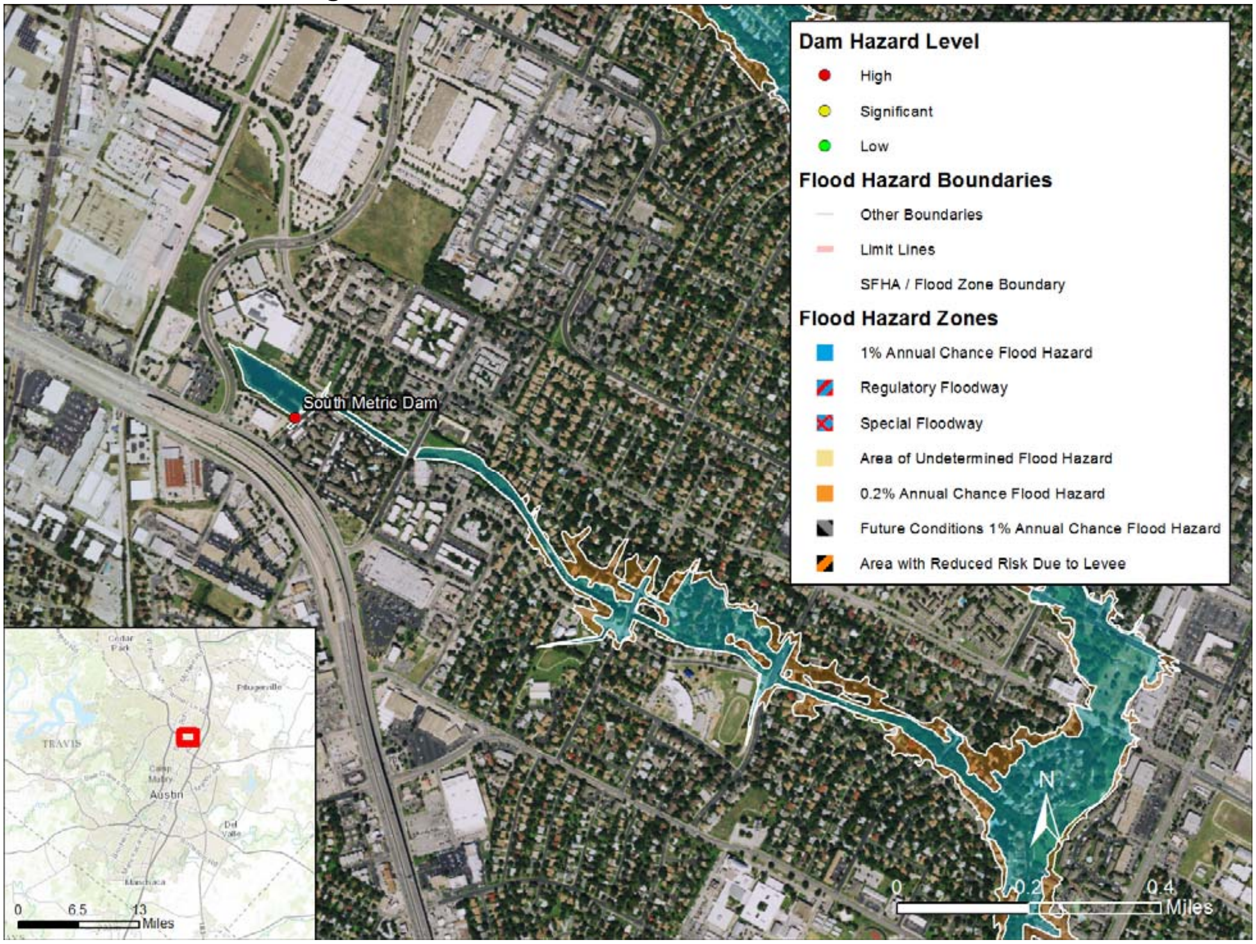
Park Bend Dam is on a tributary of Walnut Creek in the City of Austin. The dam is owned by the City and was constructed in 1983. The extent classification is considered high and the area located near the dam is a densely populated area. A dam failure could cause power outages and disrupt utility systems. In the event of a breach, it is estimated the average breach width would be 58.6 feet with a maximum breach flow of 10,222 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet.

Figure 14-19. Parmer Dam Flood Risk Areas



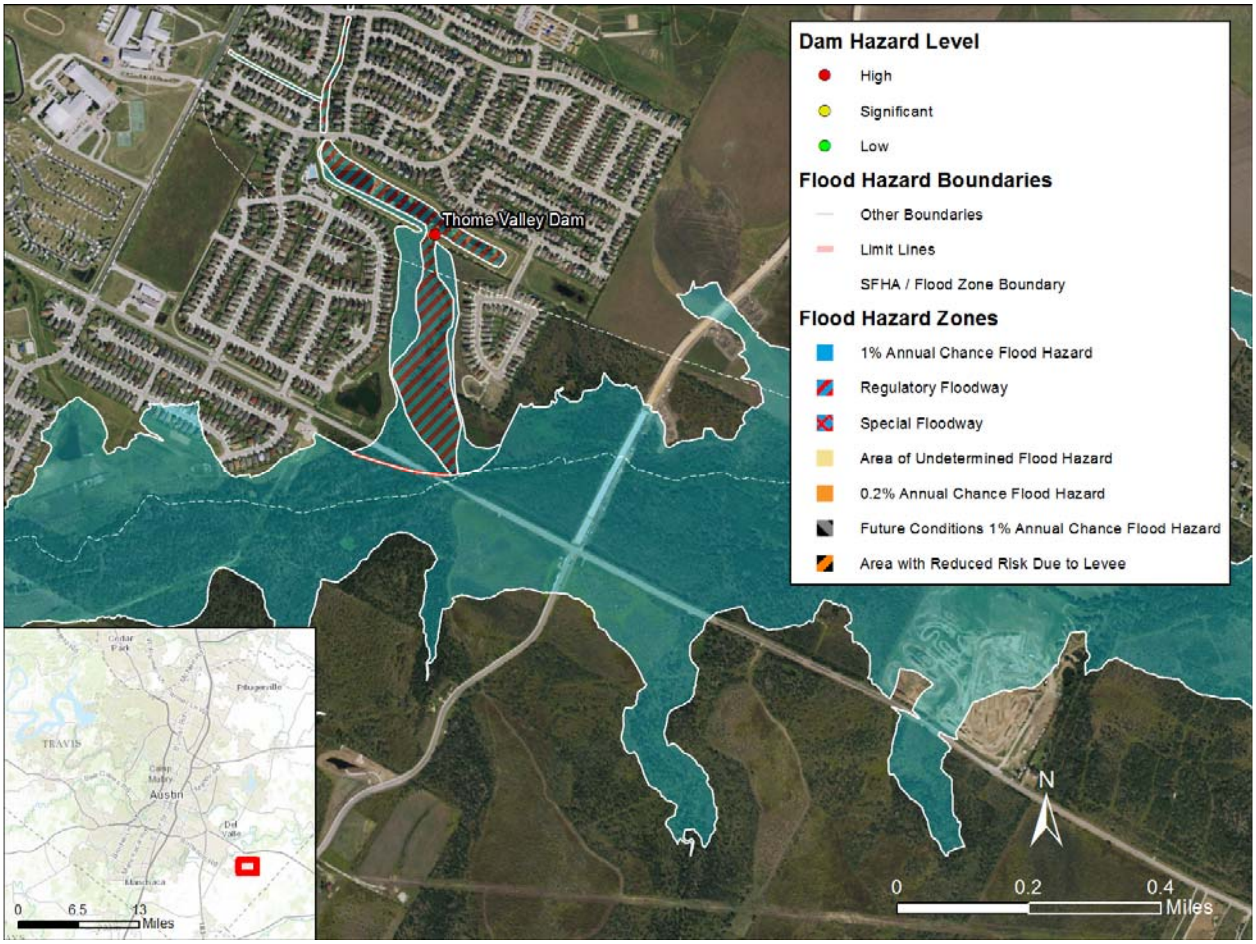
Parmer Dam is owned by the City of Austin and was constructed in 1960. The extent classification is considered high and the area located near the dam is a densely populated area. A dam failure could cause power outages and disrupt utility systems. In the event of a breach, it is estimated the average breach width would be 61.6 feet with a maximum breach flow of 16,208 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of 0 to 15 feet.

Figure 14-20. South Metric Dam Flood Risk Areas



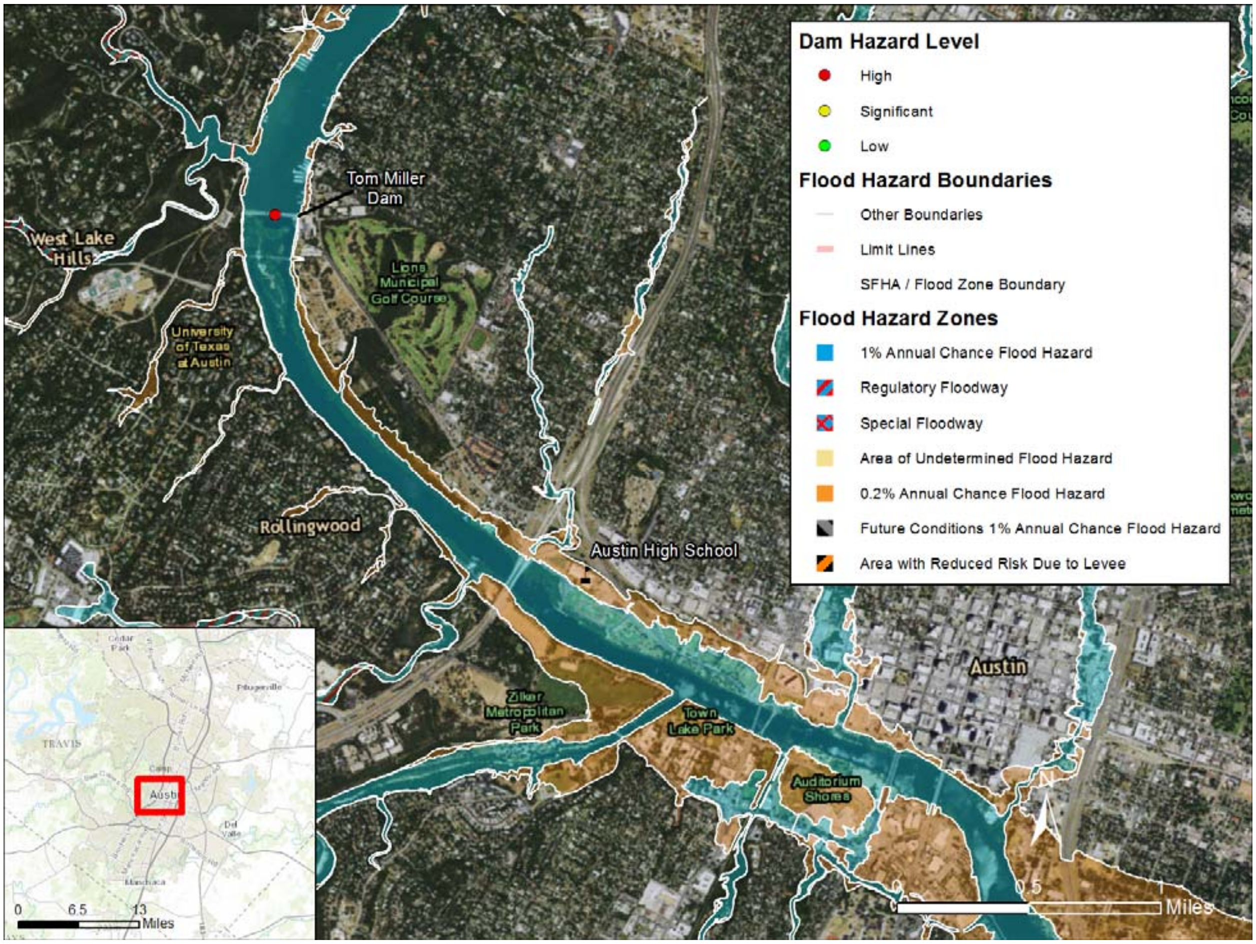
South Metric Dam is on a tributary of Little Walnut Creek in the City of Austin. The dam is owned by the City. The extent classification is considered high and the area located near the dam is a densely populated area. A dam failure could cause power outages and disrupt utility systems. In the event of a breach, it is estimated the average breach width would be 48.5 feet with a maximum breach flow of 5,368 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet.

Figure 14-21. Thome Valley Dam Flood Risk Areas



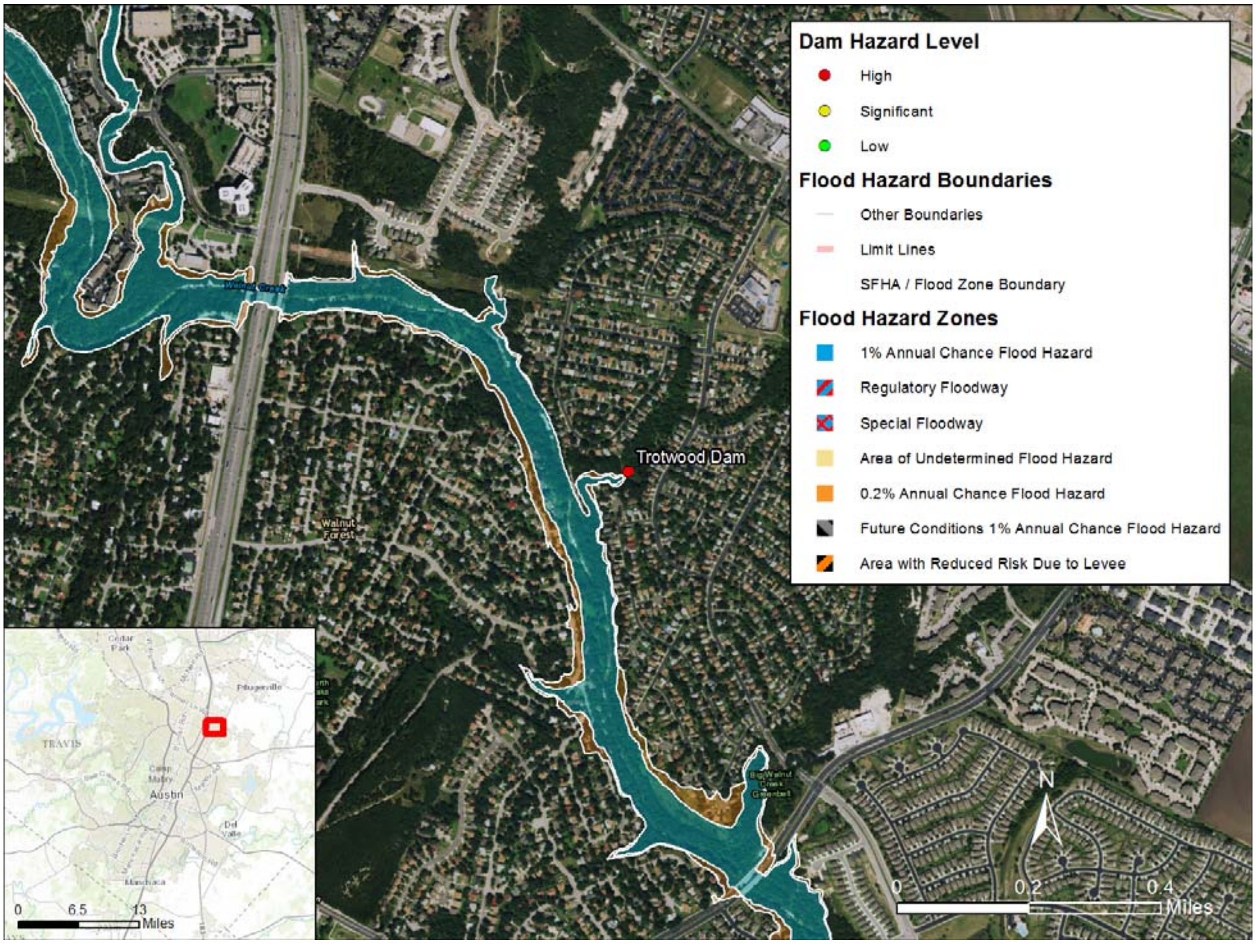
Thome Valley Dam is located in and owned by the City of Austin. The extent classification is considered high and the area located near the dam is a densely populated area. A dam failure could cause power outages and disrupt utility systems. In the event of a breach, it is estimated the average breach width would be 41.6 feet with a maximum breach flow of 1,843 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet.

Figure 14-22. Tom Miller Dam Flood Risk Areas



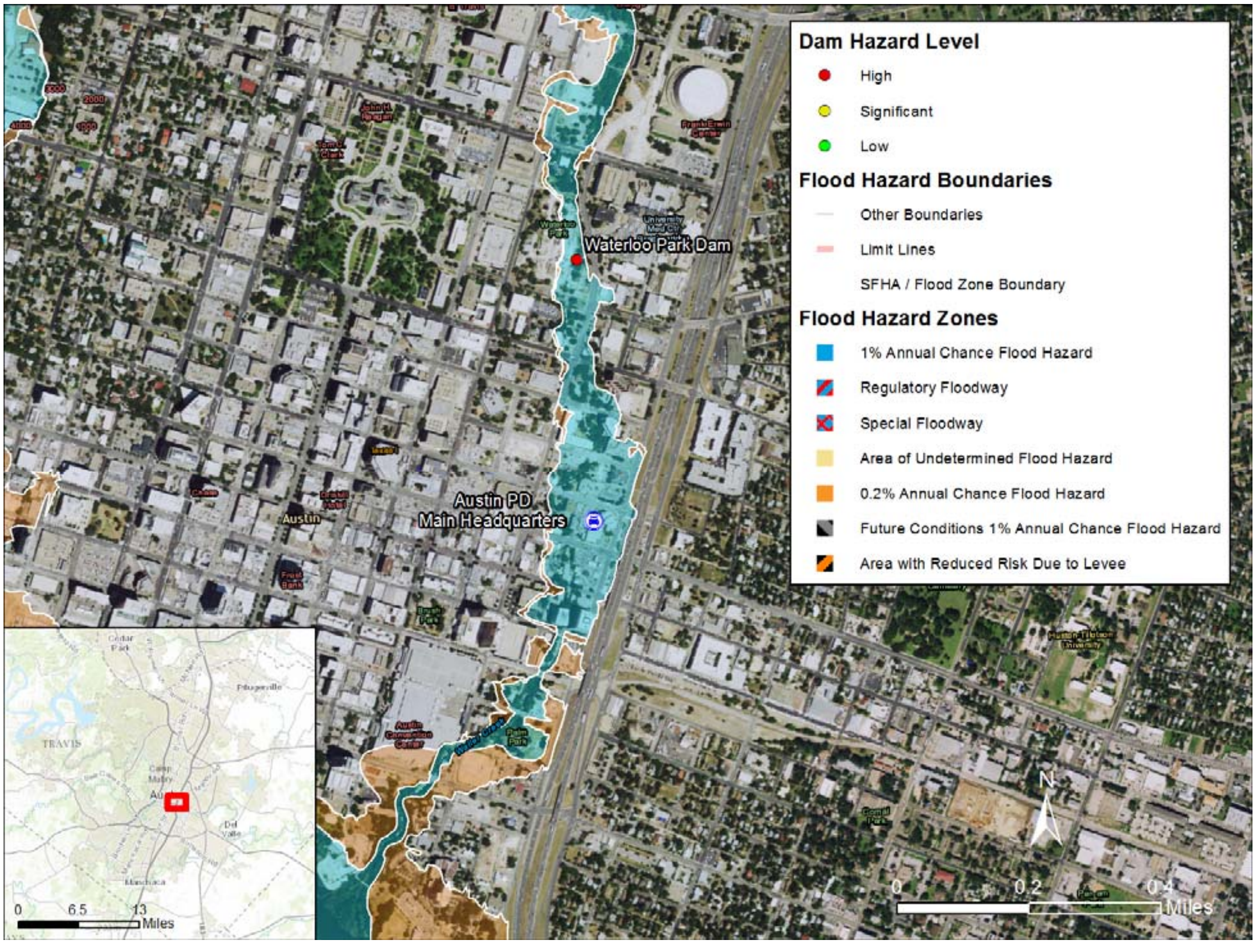
Tom Miller Dam is on the Colorado River in the City of Austin and used for hydroelectric power and recreation purposes. The concrete, gravity dam is owned by the City and was constructed in 1939. The extent classification is considered high and the area located near the dam is a densely populated area. A dam failure could cause power outages and disrupt utility systems. Austin High, Zilker Metropolitan Park, Town Lake Park, Auditorium Shores, residential and commercial structures, and residences would be vulnerable in the event of a dam failure. In the event of a breach, it is estimated the average breach width would be 531.7 feet with a maximum breach flow of 1,274,306 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 25 feet.

Figure 14-23. Trotwood Dam Flood Risk Areas



Trotwood Dam is located in and owned by City of Austin. The dam was constructed in 1960. The extent classification is considered high and the area located near the dam is a densely populated area. A dam failure could cause power outages and disrupt utility systems. In the event of a breach, it is estimated the average breach width would be 41.6 feet with a maximum breach flow of 12,863 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet.

Figure 14-24. Waterloo Park Dam Flood Risk Areas



Waterloo Park Dam is on the Waller Creek in the City of Austin and owned by the City. The extent classification is considered high and the area located near the dam is a densely populated area. A dam failure could cause power outages and disrupt utility systems. In the event of a breach, it is estimated the average breach width would be 48.1 feet with a maximum breach flow of 10,504 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet.

Table 14-3 represents the “average” extent or magnitude of a dam failure event that could be expected for the City of Austin and Austin ISD planning area. The ‘Extent Classification’ column was determined by taking the average of dams in the City and weighing low hazard dams as a one, significant hazard dams as a two, and high hazard dams as a three based on the potential severity, warning time, and duration.

Table 14-3. Extent for the City of Austin and Austin ISD

JURISDICTION	DAMS & CLASSIFICATION	EXTENT CLASSIFICATION	LEVEL OF INTENSITY TO MITIGATE
Austin	41 – Total 5 – Low 5 – Significant 31 – High	High	Dam failure presents a high threat for the City as there are 31 high hazard dams located within the City of Austin. Loss of life is expected and economic loss is significant in the event of a dam failure.
Austin ISD	None	Significant	There are multiple schools downstream of dams and if they were to experience a breach, it is possible for there to be an effect on schools. Therefore, loss of life is probable, if a dam failure were to occur.

Historical Occurrences

There are approximately 87,000 dams in the United States today.[5] Catastrophic dam failures have occurred frequently throughout the past century. Between 1918 and 1958, 33 major U.S. dam failures caused 1,680 deaths. From 1959 to 1965, nine major dams failed worldwide. Some of the largest disasters in the U.S. have resulted from dam failures. More than 90 dam incidents, including 23 dam failures, were reported in the past ten years to the National Performance of Dams Program, which collects and archives information on dam performance from state and federal regulatory agencies and dam owners.

In the State of Texas there have been 171 dam failures since 1900, although the State has not experienced loss of life or extensive economic damage due to a dam failure since the first half of the twentieth century. However, there may be many incidents that are not reported and, therefore, the actual number of incidents is likely to be greater.

There have been two major dam failures that have affected the City of Austin. In April of 1900 Lake Austin Dam broke at a point of 300 feet from the east end when the Colorado River rose eleven feet after torrential rains in the area. Twenty-three people died, over 200 were injured, and the dam failure caused $1.4 million (1900 dollars) in damages. The dam failed again in September 1915 during a large flood. Twenty of the twenty-eight large gates and all twenty-six small gates were destroyed. The dam was rebuilt in 1940 as the Tom Miller Dam and anchored to prevent overturning or sliding in 2004-2005.

Probability of Future Events

Based on historical occurrences of dam failures, the probability for future of events is unlikely for the City of Austin and Austin ISD, meaning an event is possible in the next ten years.

[5] Federal Emergency Management Agency, Dam Safety Program

Vulnerability and Impact

There are 41 dams in the City of Austin planning area; five of them considered low hazard dams, five considered significant hazard dams and 31 considered high hazard dams based on their classification. While low hazard dams are those at which failure or mis-operation probably would not result in loss of human life and would cause limited economic and/or environmental losses, damage to agriculture and housing is possible due to the number of low hazard dams in the City.

Flooding is the most prominent effect of dam failure. If the dam failure is extensive, a large amount of water would enter the downstream waterways forcing them out of their banks. There may be significant environmental effects, resulting in flooding that could disperse debris and hazardous materials downstream that can damage local ecosystems. If the event is severe, debris carried downstream can block traffic flow, cause power outages, and disrupt local utilities, such as water and wastewater, which could result in school closures. While not all Austin ISD schools and facilities are at risk to dam failure, there are a few facilities that are downstream of dams. For specific vulnerability, please refer to the narratives below each high hazard dam in this section.

Annualized loss-estimates for dam failure are not available; neither is a breakdown of potential dollar losses for critical facilities, infrastructure and lifelines, or hazardous-materials facilities. If a major dam should fail, however, the severity of impact could be substantial.

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

Section 15: Hurricane Wind

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. 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.

Location

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

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 15-1). A Category 1 storm has the lowest wind speeds, while a Category 5 hurricane has the highest. However, a lower category storms can inflict greater damage than higher category storms depending on where they strike, the amount of storm surge, other weather they interact with, and how slow they move.

Table 15-1. Extent Scale for Hurricanes[1]

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 the City of Austin planning area, which is outside of the hurricane wind hazard area, the average 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 the City of Austin planning area, 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 15-1 below, hurricane tracks are reflective of their strength in the City of Austin. Table 15-2 lists the storms that have tracked through the planning area. Historical hurricane data for Austin and Austin ISD are provided on a County-wide basis per the NCDC, NOAA, and SHELDUS databases.

[1] Source: National Hurricane Center

Figure 15-1. Location of Historic Storm Tracks

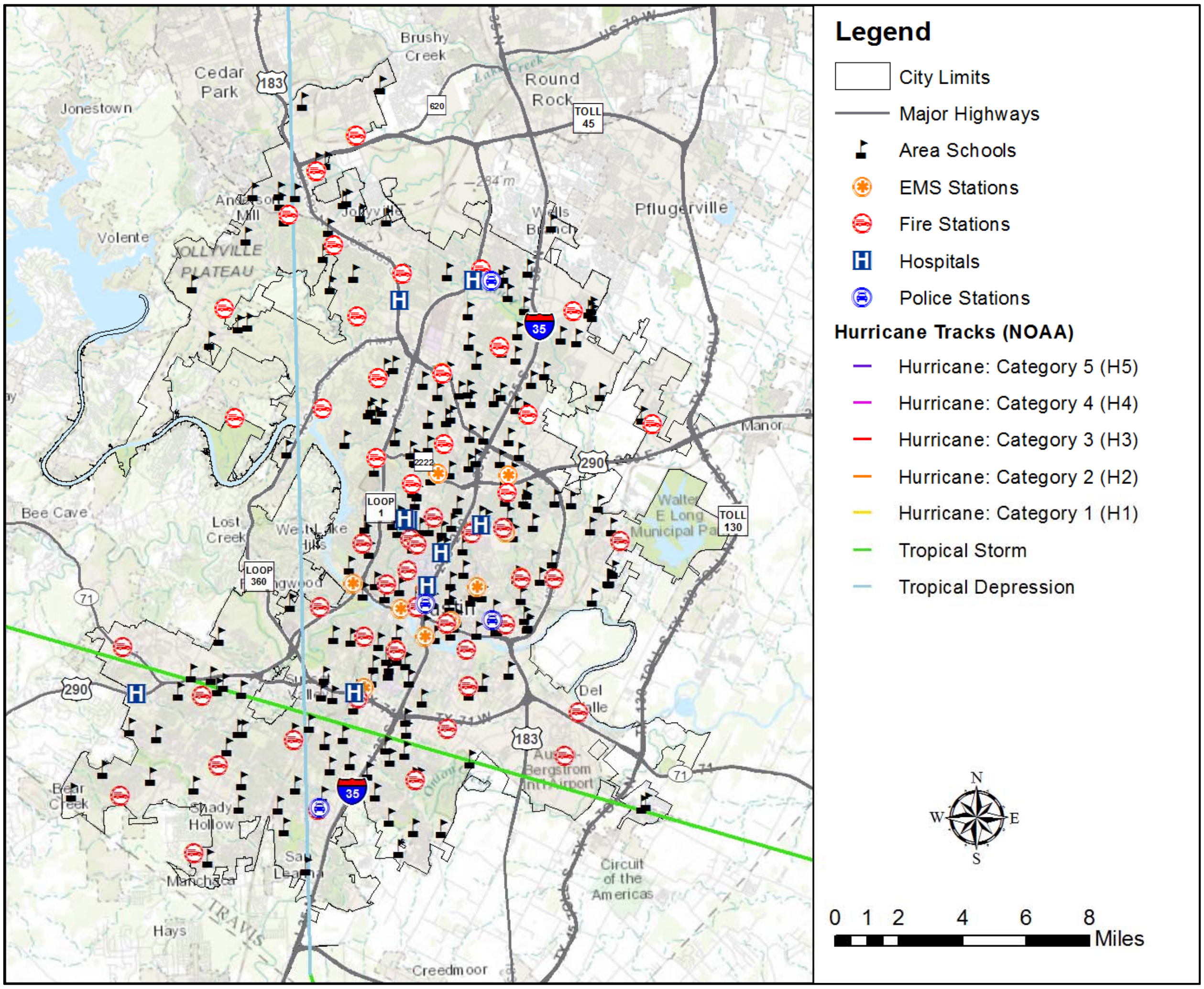


Table 15-2. Historic Storms[2]

YEAR	STORM NAME	CATEGORY	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLALRS)
1961	Carla	Category 4	$505,051	505,051	3,947,620	3,947,620
1967	Beulah	Category 4	714,286	71,429	4,998,01	499,801
1968	Candy	Category 1	N/A	N/A	N/A	N/A
1970	Celia	Category 3	657,895	67,568	3,962,748	406,985
1971	Edith	Category 5	877	877	5,062	5,062
1973	Delia	Tropical Storm	N/A	N/A	N/A	N/A

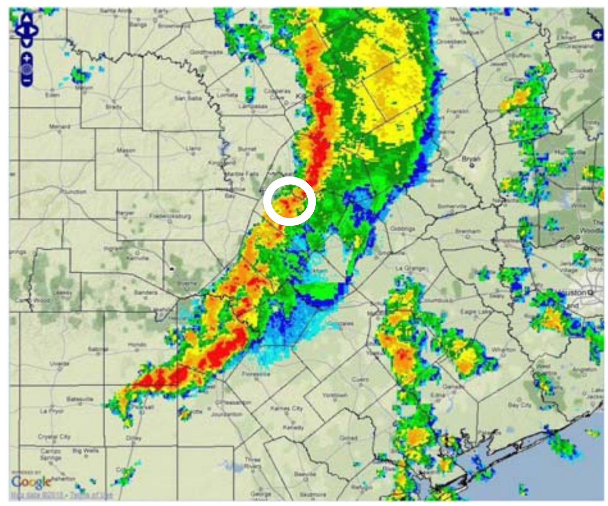
[2] N/A means data was not available.

YEAR	STORM NAME	CATEGORY	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLALRS)
1980	Allen	Category 5	5,319,150	531,915	15,086,439	1,508,644
2010	Hermine	Tropical Storm	N/A	N/A	N/A	N/A

Significant Past Events

Tropical Storm Hermine, September 3, 2010 – Travis County

On Tuesday afternoon an intense rainband developed primarily along the I-35 stretching several hundred miles from Waco to south of San Antonio due to tropical storm Hermine. Rain rates of 2-3 inches per hour were experienced in the Austin-San Antonio I-35 corridor and brought widespread flash flooding by Tuesday evening. Widespread rain totals of 5-6 inches were common along the corridor during the evening hours and the torrential rains continued over the next eight hours well past midnight early Wednesday morning. Camp Mabry in Austin set a daily rainfall record for September 7, receiving 7.04 inches in that 24 hour period[3].



During the overnight hours early Wednesday September 8, tropical rains continued to fall across portions of Travis and Williamson Counties. The Shoal Creek and Brushy Creek watersheds were hit hardest. Several swift water rescues were performed as creeks overflowed their banks and flooded many low water crossings. The most intense rains of 10 - 16 inches occurred over the area from central Williamson County down into northern Travis County. A National Weather Service Cooperative Observer near Lake Georgetown recorded a total of 16.37 inches from September 7 - 9 with 14.57 inches of that total coming in a 24 hour time period. Shelters were set up as homes began to flood and RV parks were evacuated along Brushy Creek. For a time, I-35 in Georgetown was shut down with witnesses saying that water was as high as the center concrete barrier.

Probability of Future Events

Based on historical occurrences of significant hurricane wind events, the probability of future events is occasional, with a frequency of occurrence of one event every five years for the City of Austin and Austin ISD.

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.

[3] The City of Austin indicated within the circle.

Warning time for hurricanes has lengthened due to modern and early warning technology. Hurricane-force winds can easily destroy poorly constructed buildings and mobile homes; and debris such as signs, roofing materials, and small items left outside can become extremely hazardous in hurricanes and tropical storms. Extensive damage to trees, towers, and underground utility lines (from uprooted trees) and fallen poles can cause considerable civic disruption.

Storm track data was available for the past 150 years; and property and crop loss data was available from 1950 to the present. Annual loss estimates are based on the 64 year reporting period for property and crop loss. The average annual loss estimate for Travis County is approximately $648,453.

Table 15-3. Summary Historic Hurricane Events, 1950-2014

EVENTS	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE (2015 DOLLARS)	CROP DAMAGE (2015 DOLLARS)
8 events	**Category 5 (max extent)**	**11**	**1**	**$27,999,880**	**$6,368,111**
TOTAL LOSSES:				**34,367,992**	

The impact of hurricane wind events experienced in Travis County has resulted in 11 injuries and 1 fatality. Based on the level of risk and historical occurrences for hurricane winds in the City of Austin, including the AISD, there is a “minor” severity of impact for the City of Austin planning area; meaning injuries and illnesses do not result in permanent disability, the shutdown of facilities and services could be for 1 week or less, and more than 10 percent of property can be destroyed or experience major damage.

Section 16: Cyber-Attack

Hazard Description

A cyber-attack is any type of offensive maneuver employed by individuals or organizations that targets computer information systems, infrastructures, computer networks, and personal computer devices by various means of malicious acts. The malicious act usually originates from an anonymous source that either steals, alters, or destroys a specified target by hacking into a susceptible system.

Cyberspace and its underlying infrastructure are vulnerable to a wide range of risk including both physical and cyber threats and hazards. Sophisticated cyber actors and nation-states exploit vulnerabilities to steal information and money and can develop capabilities to disrupt, destroy, or threaten the delivery of essential services. Various crimes are perpetrated through cyberspace including the production and distribution of child pornography and child exploitation conspiracies, banking and financial fraud, intellectual property violations, and other crimes, all of which have substantial human and economic consequences.

Cyberspace is particularly difficult to secure from cyber-attack events, due to a number of factors including the ability of malicious actors to operate from anywhere in the world, the links between cyberspace and physical systems, and the difficulty of reducing vulnerabilities and consequences in complex cyber networks. Of growing concern is the cyber threat to critical infrastructure, which is increasingly subject to sophisticated cyber intrusions that pose new risks. As information technology becomes increasingly integrated with physical infrastructure operations, there is increased risk for wide scale or high-consequence events that could cause harm or disrupt services upon which our economy and the daily lives of millions of Americans depend. In light of the risk and potential consequences of cyber events, strengthening the security and resilience of cyberspace has become an important homeland security mission.[1]

The City of Austin has enjoyed continued growth over the past 30 years. As a university town, with an educated workforce, a large number of technological companies have selected the City as home. To address the City's growth, the City of Austin has become a leader in its use of computers, networks, and the data stored on them. The City has been proactive in securing the cybersecurity assets using

[1] Source: Department of Homeland Security

best practices. Section 16 reviews the hazards to the cybersecurity assets for the City of Austin and Austin ISD.

Hazards

Denial of service attacks:

A denial of service attack (DoS) is the attempt to make a computer or network resource unavailable to its intended users. A DoS attack may come from one or several computers, while a distributed denial of service attack (DDoS) will be launched from many, often thousands of computers. While a DoS attack may occur frequently and typically can be handled by the City's equipment, a DDoS attack can overload the City's network or computer resources resulting in extended downtime. Often these attacks rely on lower level network vulnerabilities.

Data loss/leakage:

Data loss can result from a variety of reasons, both intentional and unintentional. Data loss may result from a failure to properly backup or have disaster recovery equipment and processes, employees improperly handling sensitive data, and criminal activities such as espionage, theft, sabotage and other malicious acts.

Infrastructure loss/failure:

Loss of computer and network resources may result from a variety of natural and man-made disasters including tornadoes, hurricanes, and explosions due to accident, power loss, terrorism, and fire.

Insider threats:

Insider threats are malicious threats to the planning are that comes from City employees, contractors, and volunteers who have access to the City's computers, networks, and data. An insider can initiate a DoS attack, leak or steal data, and sabotage the infrastructure and data.

Organized cybercrime, state-sponsored hackers espionage:

Organized cybercrime, which may include state-sponsored cybercrime, are attacks on the City's computers, network, and data by criminal organizations. These criminals may be motivated by money or political reasons. Often these attacks are well planned out, difficult to identify due to their more limited scope, and can result in extensive damage.

Third party mismanagement:

Reliance on third parties for cyber services implies acceptance of the risk that the third party will properly protect the cyber resources from loss or unavailability. Hazards from the use of third parties include DoS, DDoS, data loss and leakage, infrastructure loss and failure, insider threats, and organized cybercrime.

Advanced persistent threats:

An advanced persistent threat (APT) is a stealthy and continuous attack on the City over a long period of time. The "advanced" process signifies sophisticated techniques using malware to exploit vulnerabilities in systems. The "persistent" process suggests that an external command and control system is continuously monitoring and extracting data from a specific target. The "threat" process indicates human involvement in orchestrating the attack.

Civil disorder:

Civil disorder may impact the cybersecurity of the planning area by directly or indirectly impacting the City's and ISD'S ability to support its computers, networks, and data. Civil disorder can result in the planning area not having resources due to direct impact to the computers and networks, and indirectly by limiting the resources necessary to run the computers and networks.

Location

Cyberwar is deceptive, invisible to most, and fought out of sight. It takes place in cyberspace, a location that cannot be seen, touched, or felt. The physical instruments, such as computers, routers, and cables can be seen; however these instruments interact in cyberspace, a virtual and unseen realm. Thus, the source of the hazard can extend from one part of the world to attacks on public or private sector entities in another part of the world, and the perpetrator can remain unknown in a legally provable sense. The entire City of Austin planning area can be affected by a cyber-attack.

Extent

Currently an official index for measuring the extent of a cyber-attack does not exist. The extent, nature, and timing of cyber-attack events are impossible to predict. There may or may not be any warning. Some cyber-attack events take a long time (weeks, months or years) to be discovered and identified.[2] Therefore, the City of Austin planning area is vulnerable to all types of cyber-attack, and can occur anywhere, and at any time.

The extent of damages is based on historical incidents in the City planning area which are classified as low, medium, and high; third party information regarding the impact; and if the City has experienced an occurrence of the incident.

Denial of service attacks: Low

A DoS and DDoS attack could result in an extended cyber-outage in the planning area. The outage, although impacting the daily business of the City and AISD, would not have a substantial economic impact to the City and AISD.

Data loss/leakage: High

Data loss and leakage experienced by the City could result in costly remediation efforts to ensue. For example, if personally identifiable information (PII) is leaked, the City may be required to pay for credit protection services. Since the City manages a large quantity of sensitive information, the possibility of costly remediation efforts is high.

Infrastructure loss/failure: High

Loss of a cyber-processing facility could result in very high expenses to remediate, repair, and recover from the loss.

[2] http://www.ready.gov/cyber-attack

Insider threats: Medium

Insider threats can result in substantial impacts to the organization, depending on what data the insider has accessed. The City has remediated insider threats by using the industry standard separation of duties, and performing background checks of its employees, contractors, and volunteers.

Organized cybercrime, state-sponsored hackers' espionage: High

The planning area is a target for organized criminals and state-sponsored hackers due to its political environment and the size of the organization. Due to the potential extent of attacks by organized criminals, the possibility and severity of resulting damages are great.

Third party mismanagement: Low

Since each vendor is isolated to the service it performs, the damages from one third party's mismanagement is fairly low.

Advanced persistent threats: High

The impact of an APT to the planning area can be severe because a large number of systems can be affected and the remediation of such an attack could be expensive to recover from.

Civil disorder: High

The impacts of civil disorder on cybersecurity could be extensive due to the typical physical nature of the attacks.

Historical Occurrences & Probability of Future Events

USA Today reported that the electric grid is attacked every four days either physically or through cyber threats. Austin's Homeland Security official expressed that the numbers of attacks are accelerating, and becoming more sophisticated. ERCOT reportedly has a team of professionals and a series of procedures they utilized to protect the planning area systems from cyber-attacks.

Even though cyber-attack events are virtually impossible to predict, the City of Austin and its entire planning area have the potential of an occurrence happening at any time.

The probability of occurrence based on historical incidents at the City are classified as low, medium, and high; as well as third party information regarding the likelihood of incidents if the City has not had an occurrence of the incident.

Denial of service attacks: Medium

The planning area has daily DOS attacks which are not severe enough to cause impact to the City and AISD's service levels. Historically the City has had one DDoS attack over the last year which successfully impacted services.

Data loss/leakage: Medium

The planning area is subject to several compliance requirements which specifically address data loss and leakage. These compliance standards include but are not limited to:

- Payment Card Industry Security Standard (PCI/DSS)
- Health Insurance Portability and Accountability Act of 1996 (HIPAA)
- Criminal Justice Information Services Division (CJIS)

Historically, the City had one instance of data loss over the last year which resulted in the City having to remediate the situation.

Infrastructure loss/failure: Low

The planning area has multiple data centers which are hardened in various ways to minimize the possibility of outage. Resilience and redundancy are continuously being reviewed and addressed to reduce the risk of loss or failure. Historically, the infrastructure has had few outages that were extended.

Insider threats: Low

The planning area requires anyone who has access to the City's enterprise network and resources to have gone through a background check, which is regularly reviewed. There has never been evidence of insider attacks.

Organized cybercrime, state-sponsored hackers' espionage: Medium

Over the last year the City had several instances of organized attack via DDoS and malware by an organization. Because the City is a large public entity, it is more prone to these types of attacks.

Third party mismanagement: Low

The City utilizes third parties for its cyber activities, and vets all contracts prior to final agreement. As part of the contractual agreements, all data are required to be stored within the U.S., and segregated from other entities' data. There has not been an instance of Third party mismanagement to date.

Advanced persistent threats: Medium

The City maintains systems which monitor symptoms of APT, and over the last year there has been one instance of an infection by malware which had a command and control system.

Civil disorder: Low

The City has had instances of civil disorder in the past and is more subject to such events due to it being the Capital of Texas. Although this is the case in general, the City has relatively low civil disorder.

Vulnerability and Impact

With the internet being largely open and unregulated, it leaves the planning area vulnerable to cyber-attacks and threats. The attack can be on information systems resulting in a data breach, or the spread of a virus. With the growing dependence on digital interconnectivity even a small incident may have widespread, and damaging consequences.

Transportation, public safety, and utility services are all critical, and highly dependent on information technology. The motive behind such disruptions can be driven by religious, political, other objectives.

A cyber-attack can last a few minutes to a couple of days, although large-scale events and their impacts can last much longer. Cyber-attacks differ by motive, type, vector, and perpetrator profile.

Cybersecurity involves protecting infrastructure by preventing, detecting, and responding to cyber-attack incidents. Unlike physical threats that prompt immediate action, such as “stop, drop, and roll,” in the event of a fire; cyber threats are often difficult to identify and comprehend. Among these dangers are viruses erasing entire systems, intruders breaking into systems and altering files, intruders using a computer or device to attack others, and intruders stealing confidential information. The spectrum of cyber-attack risks is limitless. Threats of cyber-attack can have wide-ranging effects on the individual, community, organizational, and national level. Risks from cyber-attack include:

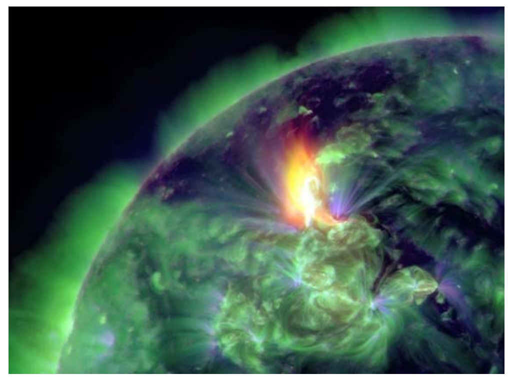
- Organized cybercrime, state-sponsored hackers, and cyber espionage, which can pose national security risks to our country.
- Transportation, power, and other services may be disrupted by large scale cyber incidents, and the extent of the disruption is highly uncertain as it will be determined by many unknown factors including the target and size of the incident.
- Vulnerability to data breach and loss increases if an organization’s network is compromised, and therefore information about a company, its employees, and its customers can be at risk.
- Individually-owned devices such as computers, tablets, mobile phones, and gaming systems that connect to the Internet are vulnerable to intrusion, and therefore personal information may be at risk without proper security.[3]

[3] http://www.ready.gov/cyber-attack

Section 17: Technological Disruption

Hazard Description

Technological disruptions can be caused by solar flares, geomagnetic storms, and power disruptions. A solar flares is a sudden, rapid, and intense flash of brightness observed over the sun's surface that occurs when built-up magnetic energy from the solar atmosphere is suddenly released. Flares generally cannot pass through the Earth's magnetosphere and atmosphere, so the planning area is not vulnerable to powerful bursts of particles. However solar flares can impact satellite and radio transmissions, cause flights to be re-routed due to changes in the Earth's magnetic field, and cause radio blackouts due to radiation. Geomagnetic storms are a major disturbance of Earth's magnetosphere that occur when there is a very efficient exchange of energy from solar wind into the space environment surrounding Earth. Magnetic storms can affect the performance of equipment, upset radio communications, blackout radars, and disrupt radio navigation systems.



Location

Space weather impacts various aspects of everyday life including a variety of phenomena that occur due to the variability of the sun over periods ranging from hours to years. A technological disruption can happen anywhere and at any time within the entire world, including the planning area.

Extent

The NOAA Space Weather Scales were introduced as a way to publicly communicate the current and future space weather conditions and their possible effects on people and systems. Many of the SWPC (Space Weather Prediction Center) products describe the space environment, but few have described the effects that can be experienced as the result of environmental disturbances. The scales describe the environmental disturbances for three event types including geomagnetic storms, solar radiation storms, and radio blackouts. The scales have numbered levels, analogous to events that convey severity including hurricanes, tornadoes, and earthquakes. The scales identify possible effects of an event, how frequently events occur, and the intensity of the physical causes.[1]

[1] http://www.swpc.noaa.gov/noaa-scales-explanation

Table 17-1. Geomagnetic Storms

SCALE	DESCRIPTION	EFFECT	PHYSICAL MEASURE	AVERAGE FREQUENCY (1 CYCLE = 11 YEARS)
G 5	Extreme	**Power systems:** Widespread voltage control problems and protective system problems can occur, and some grid systems may experience complete collapse or blackouts. Transformers may experience damage. **Spacecraft operations:** Problems with extensive surface charging, and orientation, uplink/downlink, and tracking satellites can occur. **Other systems:** Pipeline currents can reach hundreds of amps, HF (high frequency) radio propagation may be impossible in many areas for one to two days, satellite navigation may be degraded for days, low-frequency radio navigation can be out for hours, and aurora has been seen as low as Florida and southern Texas (typically 40° geomagnetic lat.).	Kp = 9	4 per cycle (4 days per cycle)
G 4	Severe	**Power systems:** Possible widespread voltage control problems and some protective systems will mistakenly trip out key assets from the grid. **Spacecraft operations:** Problems with surface charging and tracking can occur, and corrections may be needed for orientation problems. **Other systems:** Induced pipeline currents can affect preventive measures, HF radio propagation is sporadic, satellite navigation degraded for hours, low-frequency radio navigation disrupted, and aurora has been seen as low as Alabama and northern California (typically 45° geomagnetic lat.).	Kp = 8, including a 9	100 per cycle (60 days per cycle)
G 3	Strong	**Power systems:** Voltage corrections can be required, and false alarms triggered on some protection devices. **Spacecraft operations:** Surface charging can occur on satellite components, drag can increase on low-	Kp = 7	200 per cycle (130 days per cycle)

SCALE	DESCRIPTION	EFFECT	PHYSICAL MEASURE	AVERAGE FREQUENCY (1 CYCLE = 11 YEARS)
		Earth-orbit satellites, and corrections may be needed for orientation problems. **Other systems:** Intermittent satellite navigation and low-frequency radio navigation problems can occur, HF radio can be intermittent, and aurora has been seen as low as Illinois and Oregon (typically 50° geomagnetic lat.).		
G 2	**Moderate**	**Power systems:** High-latitude power systems can experience voltage alarms, and long-duration storms can cause transformer damage. **Spacecraft operations:** Corrective actions to orientation can be required by ground control, and possible changes in drag can affect orbit predictions. **Other systems:** HF radio propagation can fade at higher latitudes, and aurora has been seen as low as New York and Idaho (typically 55° geomagnetic lat.).	Kp = 6	600 per cycle (360 days per cycle)
G 1	**Minor**	**Power systems:** Weak power grid fluctuations can occur. **Spacecraft operations:** Minor impact on satellite operations are possible. **Other systems:** Migratory animals are affected, and aurora is commonly visible at high latitudes (northern Michigan and Maine).	Kp = 5	1700 per cycle (900 days per cycle)

Table 17-2. Solar Radiation Storms

SCALE	DESCRIPTION	EFFECT	PHYSICAL MEASURE (Flux level of >= 10 MeV particles)	AVERAGE FREQUENCY (1 Cycle = 11 Years)
S 5	**Extreme**	**Biological:** Unavoidable high radiation hazard to astronauts on EVA (extra-vehicular activity) occurs; and passengers and crew in high-flying aircraft at high latitudes can be exposed to radiation risk.	10^5	Fewer than 1 per cycle

SCALE	DESCRIPTION	EFFECT	PHYSICAL MEASURE (Flux level of >= 10 MeV particles)	AVERAGE FREQUENCY (1 Cycle = 11 Years)
		Satellite operations: Satellites can be rendered useless, memory impacts can cause loss of control, serious noise in image data can occur, star-trackers may be unable to locate sources; and permanent damage to solar panels is possible. **Other systems:** Complete blackout of HF (high frequency) communications is possible through the polar regions, and position errors make navigation operations extremely difficult.		
S 4	Severe	**Biological:** Unavoidable radiation hazard to astronauts on EVA can occur; and passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. **Satellite operations:** Memory device problems and noise on imaging systems can occur; star-tracker problems can cause orientation problems, and solar panel efficiency can be degraded. **Other systems:** Blackout of HF radio communications through the polar regions and increased navigation errors over several days are likely.	10^4	3 per cycle
S 3	Strong	**Biological:** Radiation hazard avoidance is recommended for astronauts on EVA, and passengers and crew in high-flying aircraft at high latitudes can be exposed to radiation risk. **Satellite operations:** Single-event upsets, noise in imaging systems, and slight reduction of efficiency in solar panel are likely. **Other systems:** Degraded HF radio propagation through the polar regions and navigation position errors are likely.	10^3	10 per cycle
S 2	Moderate	**Biological:** Passengers and crew in high-flying aircraft at high latitudes can be exposed to elevated radiation risk.	10^2	25 per cycle

SCALE	DESCRIPTION	EFFECT	PHYSICAL MEASURE (Flux level of >= 10 MeV particles)	AVERAGE FREQUENCY (1 Cycle = 11 Years)
		Satellite operations: Infrequent single-event upsets are possible. **Other systems:** Small effects on HF propagation through the polar regions can occur, and navigation at polar cap locations can be possibly affected.		
S 1	Minor	**Biological:** None. **Satellite operations:** None. **Other systems:** Minor impacts on HF radio in the polar regions.	10	50 per cycle

Table 17-3. Radio Blackouts

SCALE	DESCRIPTION	EFFECT	PHYSICAL MEASURE	AVERAGE FREQUENCY (1 CYCLE = 11 YEARS)
R 5	Extreme	**HF Radio:** Complete HF (high frequency) radio blackout on the entire sunlit side of the Earth lasting for a number of hours can occur. This results in no HF radio contact with mariners and en route aviators in this sector. **Navigation:** Low-frequency navigation signals used by maritime and general aviation systems can experience outages on the sunlit side of the Earth for many hours, causing loss in positioning. Increased satellite navigation errors in positioning for several hours can occur on the sunlit side of Earth, which may spread into the night side.	X20 (2×10^{-3})	Less than 1 per cycle
R 4	Severe	**HF Radio:** HF radio communication blackout on most of the sunlit side of Earth can occur for one to two hours, and HF radio contact is lost during this time. **Navigation:** Outages of low-frequency navigation signals can cause increased error in positioning for one to two hours, and minor disruptions of satellite	X10 (10^{-3})	8 per cycle (8 days per cycle)

SCALE	DESCRIPTION	EFFECT	PHYSICAL MEASURE	AVERAGE FREQUENCY (1 CYCLE = 11 YEARS)
		navigation are possible on the sunlit side of Earth.		
R 3	Strong	**HF Radio:** Wide area blackout of HF radio communication, and loss of radio contact for about an hour on sunlit side of Earth can occur. **Navigation:** Low-frequency navigation signals can be degraded for about an hour.	X1 (10^{-4})	175 per cycle (140 days per cycle)
R 2	Moderate	**HF Radio:** Limited blackout of HF radio communication on the sunlit side of the Earth, and loss of radio contact for tens of minutes can occur. **Navigation:** Degradation of low-frequency navigation signals for tens of minutes can occur.	M5 (5×10^{-5})	350 per cycle (300 days per cycle)
R 1	Minor	**HF Radio:** Weak or minor degradation of HF radio communication on the sunlit side of the Earth, and occasional loss of radio contact can occur. **Navigation:** Low-frequency navigation signals can be degraded for brief intervals.	M1 (10^{-5})	2000 per cycle (950 days per cycle)

The societal and economic impacts of a geomagnetic disturbance scenario have been mapped in Figure 17-1. Texas is at a zero percent for an at-risk transformer capacity. This does not mean that Texans are safe from power-grid failure. In recent years, utilities have joined grids together to allow long-distance transmission of low-cost power to areas experiencing sudden demand. The Interconnectedness of the power-grid makes the system susceptible to wide-ranging "cascade failures." [2]

The U.S. electric grid has three main components including generation (creation of electricity), transmission (long haul transport of electricity), and distribution (shorter distances connecting the electricity to the consumer and end user). The electric grid is complex with in increasing number of connection points. The U.S. has 80,000 miles of extra-high voltage (EHV) transmission lines comprising the backbone of the transmission grid that enables the long-haul transport of electricity. EHV transformers are considered critical equipment on the transmission grid and 90 percent of consumed power passes through a high voltage transformer at some point. If EHV transformers fail, especially in large numbers, the resulting damage could be extensive.

[2] http://science.nasa.gov/science-news/science-at-nasa/2009/21jan_severespaceweather/

EHV transformers are huge, weighing hundreds of tons, making them difficult to transport, and in some cases rare and specialized rail cars must be used for transport. Many of the EHV transformers installed in the U.S. are approaching or exceeding the end of their design lifetimes (approx. 30-40 years), increasing their vulnerability to failure. Although the utility industry does maintain limited spares, the ability to quickly and rapidly replace several transformers at once could be a challenge.[3]

Figure 17-1. At Risk Extra High Voltage (EHV) Transformer Capacity Map by State

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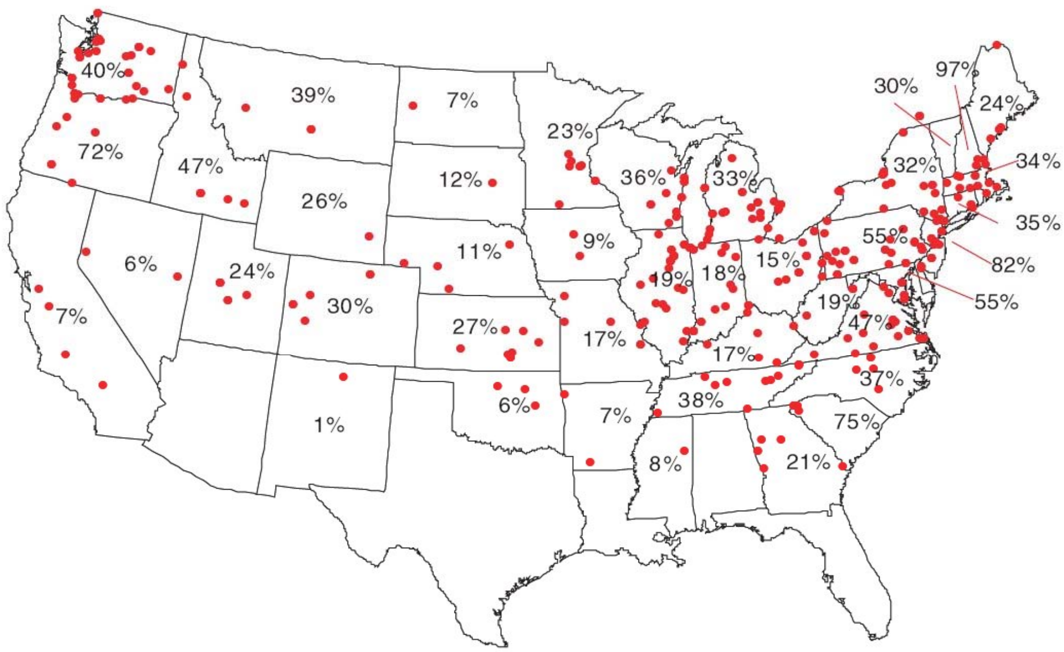


FIGURE 7.2 A map showing the at-risk EHV transformer capacity (estimated at ~365 large transformers) by state for a 4800 nT/min geomagnetic field disturbance at 50° geomagnetic latitude. Regions with high percentages of at-risk capacity could experience long-duration outages that could extend multiple years. SOURCE: J. Kappenman, Metatech Corp., "The Future: Solutions or Vulnerabilities?," presentation to the space weather workshop, May 23, 2008.

Historical Occurrences

October-November 2003

The Halloween Solar Storms were a series of solar flares and coronal mass ejections that occurred from mid-October to early November 2003, peaking around October 28–29. Satellite-based systems and communications were affected, aircraft were advised to avoid high altitudes near the Polar Regions, and a one-hour-long power outage occurred in Sweden as a result of the solar activity. Aurorae were observed at latitudes as far south as Texas and the Mediterranean countries of Europe.

[3] http://www.dhs.gov/science-and-technology/power-hungry-prototyping-replacement-ehv-transformers

The SOHO satellite failed temporarily, and the Advanced Composition Explorer was damaged by the solar activity. Numerous other spacecraft were damaged or experienced downtime. Some spacecraft were intentionally put into safe mode in order to protect sensitive equipment. Astronauts aboard the International Space Station had to stay inside the more shielded parts of the Russian Orbital Segment to protect themselves against the increased radiation levels. Both the Ulysses spacecraft which was near Jupiter at the time, and Cassini, approaching Saturn, were able to detect the emissions. In April 2004, Voyager 2 was also able to detect them as they reached the spacecraft.

These events occurred during solar cycle 23, approximately three years after its peak in 2000, which was marked by another occurrence of solar activity known as the Bastille Day Flare.

March 9-13, 1989

The March 1989 geomagnetic storm was a severe storm that caused the collapse of Hydro-Québec's electricity transmission system. It occurred during solar cycle 22.

The storm began on Earth with extremely intense auroras at the poles. The aurora could be seen as far south as Texas and Florida. As this occurred during the Cold War, an unknown number of people worried that a nuclear first-strike might be in progress. Others considered the intense auroras to be associated with the Space Shuttle mission STS-29, which had been launched on March 13th at 9:57:00 AM. The burst caused short-wave radio interference, including the disruption of radio signals from Radio Free Europe into Russia. It was initially believed that the signals had been jammed by the Soviet government.

Through the evening of March 13th, a river of charged particles and electrons in the ionosphere flowed from west to east, inducing powerful electrical currents in the ground that surged into many natural nooks and crannies.

Some satellites in polar orbits lost control for several hours. GOES weather satellite communications were interrupted, causing weather images to be lost. NASA's TDRS-1 communication satellite recorded over 250 anomalies caused by the increased particles flowing into its sensitive electronics. The Space Shuttle Discovery was having its own problems: a sensor on one of the tanks supplying hydrogen to a fuel cell was showing unusually high pressure readings on March 13th. The problem went away after the solar storm subsided.

May 13 -15, 1921

The May 1921 geomagnetic storm was a significant event caused by the impact of an extraordinarily powerful coronal mass ejection on Earth's magnetosphere. It took place May 13th through May 15th, and was part of solar cycle 15. This event occurred before extensive interconnectivity of electrical systems and the general electrical dependency across infrastructures in the developed world, so the effect was restricted to certain sectors. Resulting ground currents were up to an order of magnitude greater than those of the March 1989 geomagnetic storm that blacked out large parts of northeastern North America. At the time, scientists estimated the size of the sunspot that began on May 10th and caused the storm, as being 94,000 by 21,000 miles (131,000 km by 33,800 km).

August 28-September 2, 1859

The 1859 Solar Flare is the largest magnetic explosion recorded and is referred to as the Carrington Event, named for British Astronomer Richard Carrington, who witnessed growing sunspots and documented a bright white flash that lasted about five minutes. The impacts on Earth were colorful and bright auroras were seen as far south as Hawaii and Cuba. Telegraph operators experienced sparks from telegraph equipment that started fires. Scientists predict that such an event today would be devastating to the internet, communications, and power transformers, satellites, airplanes, or any GPS guided system. Solar activity is closely monitored as the sun storms have increased since 2011. Studies have shown that a solar storm of this magnitude occurring today would likely cause widespread problems for modern civilization. The solar storm of 2012 was of similar magnitude, but it passed Earth's orbit without striking the planet.

Probability of Future Events

Technological Disruptions are expected to continue in the near future. Solar storm activity is expected to increase and is being mapped by NASA's Solar Shield Project and NOAA's Space Weather Prediction Center to show strong currents and warn power companies to protect their systems. The entire Austin planning area could be affected should there be another major solar flare, dependent on location of penetration within the Earth's atmosphere.

Vulnerability and Impact

Different types of space weather can affect different technologies at Earth. Solar flares can produce strong x-rays that degrade or block high-frequency radio waves used for radio communication during events known as Radio Blackout Storms. Solar Energetic Particles (energetic protons) can penetrate satellite electronics and cause electrical failure. These energetic particles also block radio communications at high latitudes during Solar Radiation Storms. Space weather has been recognized as causing problems with new technology since the invention of the telegraph in the 19th century.

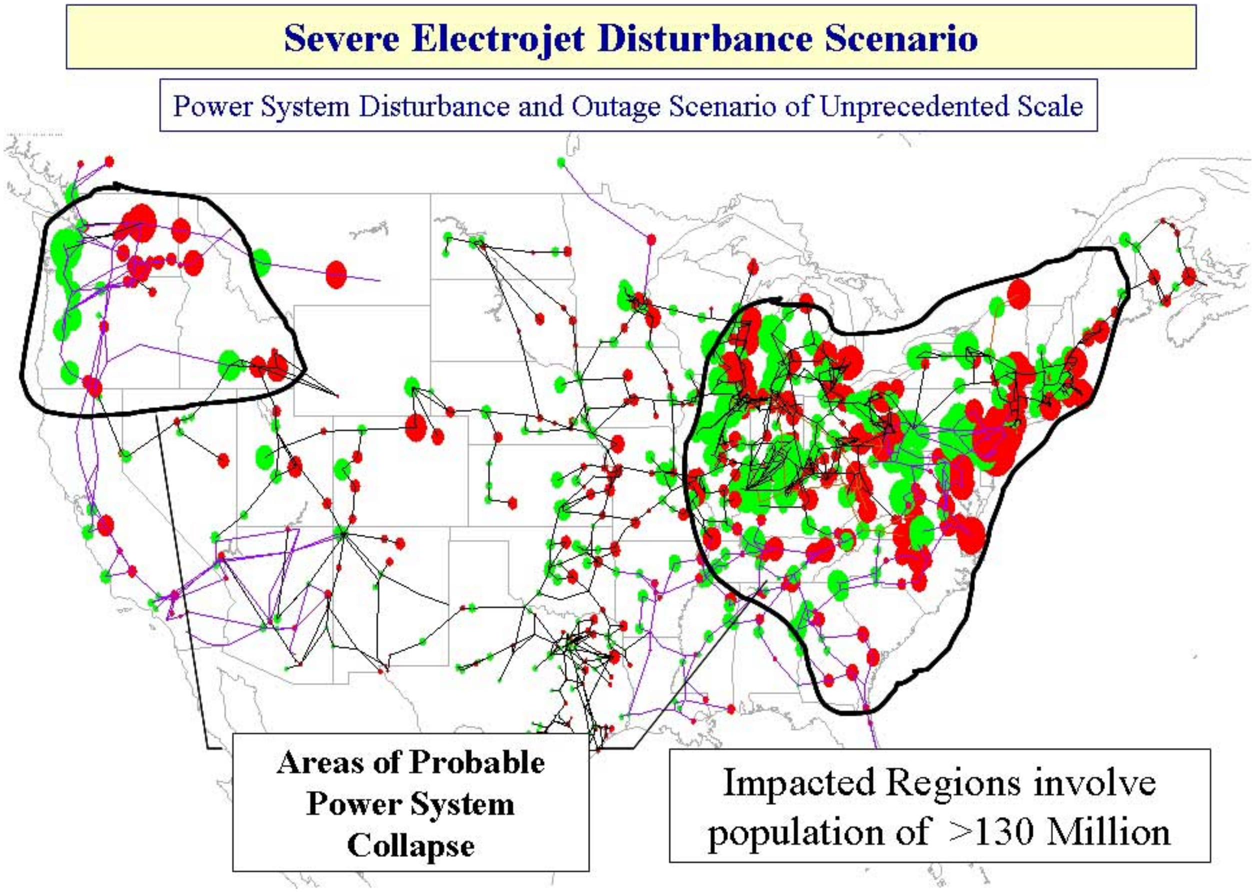
Besides emitting a continuous stream of plasma called the solar wind, the sun periodically releases billions of tons of matter called coronal mass ejections. These immense clouds of material, when directed toward Earth, can cause large magnetic storms in the magnetosphere and upper atmosphere. Such space weather can affect the performance and reliability of space-borne and ground-based technological systems. Coronal Mass Ejections (CMEs) can cause Geomagnetic Storms at Earth and induce extra currents in the ground that can degrade power grid operations.

Geomagnetic storms can modify the signal from radio navigation systems (GPS and GNSS) causing degraded accuracy. Geomagnetic storms also produce the aurora. Space weather will impact people who depend on all of these technologies.

A catastrophic failure of commercial and government infrastructure in space and on the ground can be mitigated through raising public awareness, improving vulnerable infrastructure and developing advanced forecasting capabilities. Without preventive actions or plans, the trend of increased dependency on space-weather sensitive technology, could make society more vulnerable to a technological disruption event in the future.

Figure 17-2 identifies a hypothetical scenario presented by a study on potential extreme space weather events that could result in a partial, wide-spread collapse of the U.S. electric power grid with enormous consequences for the affected population. As seen in Figure 17-2, the Austin planning area would be affected. Improvements in space weather forecasting, public awareness and infrastructure preparedness can mitigate the potential effects of technological disruption.

Figure 17-2. Power System Disturbance Scenario[4]



[4] Source: NASA

Section 18: Infectious Diseases

Hazard Description

An infectious disease is 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 present at all times 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 because more densely populated areas increase the risk of exposure to an infectious disease, allowing the disease to rapidly advance the spread of the infection.

The top 11 infectious diseases according to the Global Burden of Disease Study of 2013 (GBD 2013)[1], based upon number of deaths, are presented in Table 18-1.

[1] http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(14)61682-2/fulltext

Table 18-1. Worldwide Mortality Due to Infectious Disease

RANK	CAUSE OF DEATH	APPROXIMATE WORLDWIDE DEATHS IN 2013
1	Lower Respiratory Infections	4.2 million
2	Tuberculosis (TB)	1.94 million
3	Diarrheal diseases	1.9 million
4	HIV/AIDS	1.85 million
5	Malaria	1.2 million
6	Meningitis	430,000
7	Syphilis	190,000
8	Measles	130,000
9	Hepatitis B	110,000
10	Pertussis	80,000
11	Tetanus	80,000

There are many different types of infectious diseases. Due to the rise in certain diseases, Austin and Austin ISD are closely monitoring the following diseases that have affected the city and communities.

Human Immunodeficiency Virus

Human immunodeficiency virus (HIV) is spread through bodily fluids such as blood, semen, vaginal fluids, and breast milk. In the United States, HIV is most commonly transmitted from one person to another through unprotected anal or vaginal sex and through sharing needles or other drug paraphernalia. Transmission also can occur through transfusion of blood or its components from infected persons. In addition, a mother can pass HIV to her baby during pregnancy, during labor, or through breastfeeding. HIV infection is diagnosed by testing blood or saliva for antibodies to the virus or by directly testing for the presence of the virus. HIV damages the immune system leading to immunodeficiency; that is, the immune system is deficient in its ability to fight off infectious agents and cancer. Acquired immunodeficiency syndrome (AIDS) is the clinical stage of infection with HIV. The time from HIV infection to the development of AIDS is extremely variable ranging from less than one year to over 15 years.

The term most often used for people who are HIV positive is “person living with HIV/AIDS.” This is often abbreviated as PLWHA or PLWH.

The Centers for Disease Control and Prevention estimates that over one million persons, aged 13 years and older, are living with HIV infection. In the United States, gay, bisexual, and other men who have sex with men (MSM) are considered most at risk of HIV infection.

Prevalent Foodborne Diseases

Foodborne disease is a term used to describe illnesses resulting from the consumption of contaminated foods. These diseases may be caused by bacteria, viruses, or toxins produced by these organisms. Contamination may occur during food production and preparation via inadequate sanitization, improper food handling, or holding food items at inadequate temperatures. The Centers for Disease Control and Prevention (CDC) estimate that one in six Americans, approximately 48 million people, have a foodborne illness each year.[2] Additionally, foodborne diseases kill thousands in the United States each year and cause billions of dollars in healthcare-related and industry costs annually.[3]

Foodborne disease rates in Travis County are significantly higher than those reported for Texas. Foodborne diseases are commonly underreported, and only a small proportion of illnesses are confirmed by laboratory testing; as a result, the higher Travis County rates could reflect an increased disease burden or a higher proportion of diseases identified and reported as compared to Texas overall.

The most common foodborne diseases reported in Travis County and Texas were Salmonellosis, Campylobacteriosis, Shigellosis, and Cyclosporiasis. Other forms of foodborne diseases are E Coli, Hepatitis A, and Listeriosis, which are also listed in Table 18-2.

Commonly associated with contaminated food, water, or contact with infected animals, salmonellosis has been associated with many food items and animal exposures over the past few years. Nationally, salmonellosis is identified more frequently in children which is also the case in Travis County.[4] Travis County has seen a steady increase in salmonellosis cases from 2006 to 2012, which follows the national trend.

Campylobacteriosis is associated with eating raw or undercooked poultry, raw milk dairy products, contaminated produce and drinking water. Travis County has seen a stable trend in campylobacteriosis cases from 2006 to 2012.

Shigellosis is an illness caused by Shigella bacteria. It is transmitted by hand-to-mouth contact with stool (feces) from a sick person or animal, eating contaminated foods, or drinking contaminated water. Children and people who work in day care facilities are prone to contracting this disease. Other ways of contracting the disease may be through sexual practices or caring for someone who has Shigellosis; or traveling to other countries where the food/water supply is contaminated and unsafe.[5]

Cyclosporiasis is an intestinal illness caused by consuming food or water contaminated with the Cyclospora parasite. The major symptom is watery diarrhea lasting a few days to a few months. Additional symptoms may include loss of appetite, fatigue, weight loss, abdominal cramps, bloating, increased gas, nausea, vomiting and a low fever. To kill the parasite, fruits and vegetables must be fully cooked.[6] Last year, Texas had 200 cases, some of which were associated with cilantro from the Puebla region in Mexico. In 2015, there have been 77 reported cases of Cyclospora for Travis County.

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[2] http://www.cdc.gov/foodborneburden/
[3] http://www.cdc.gov/WinnableBattles/FoodSafety/index.html?s_cid=fb165
[4] Ibid
[5] http://www.dshs.state.tx.us/idcu/disease/shigellosis/
[6] http://www.dshs.state.tx.us/news/updates.shtm

Prevalent Vectorborne Diseases

West Nile Virus

West Nile virus infection is the most common vectorborne disease in the United States. In nature, West Nile virus is spread between mosquitos and birds. Infected mosquitos will infect birds while getting a blood meal. Mosquitos can become infected by feeding on infected birds. West Nile virus is primarily transmitted to humans by the bite of an infected mosquito.

Transmission also may occur through blood transfusions, organ transplants, and from mother to baby during pregnancy, delivery, or breastfeeding. Most persons with a West Nile virus infection experience a fever with headache, body aches, and joint pains. Severe symptoms in some persons include encephalitis or meningitis.

Influenza A (H1N1)

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 has since spread worldwide. As of September 27, 2009, more than 340,000 cases of H1N1 have been confirmed worldwide and approximately 4,100 deaths have been reported.[7]

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.[8]

H5N1 Avian Flu (Bird Flu)

H5N1 is a highly pathogenic avian (bird) flu virus that has caused serious outbreaks in domestic poultry in parts of Asia and the Middle East. Highly pathogenic refers to the virus's ability to produce disease. Although H5N1 does not usually infect humans, nearly 650 cases of human cases of H5N1 have been reported from 15 countries since 2003.[9]

- Most human cases of "highly pathogenic" H5N1 virus infection have occurred in people who had recent contact with sick or dead poultry that were infected with H5N1 viruses. About 60% of people infected with the virus died from their illness.
- Unlike other types of flu, H5N1 usually does not spread between people.
- There have been no reported infections with these viruses in birds, poultry, or people in the United States.
- You cannot get infected with these viruses from properly handled and cooked poultry or eggs.

It is rare for humans to be infected with this virus. But flu viruses are constantly changing and animal flu viruses can change such that they may gain the ability to infect people easily and spread among people, causing a pandemic.

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. Since air travel and worldwide shipping have increased, it has become increasingly difficult to contain localized outbreaks

[7] World Health Organization

[8] 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.

[9] http://www.flu.gov/about_the_flu/h5n1/index.html

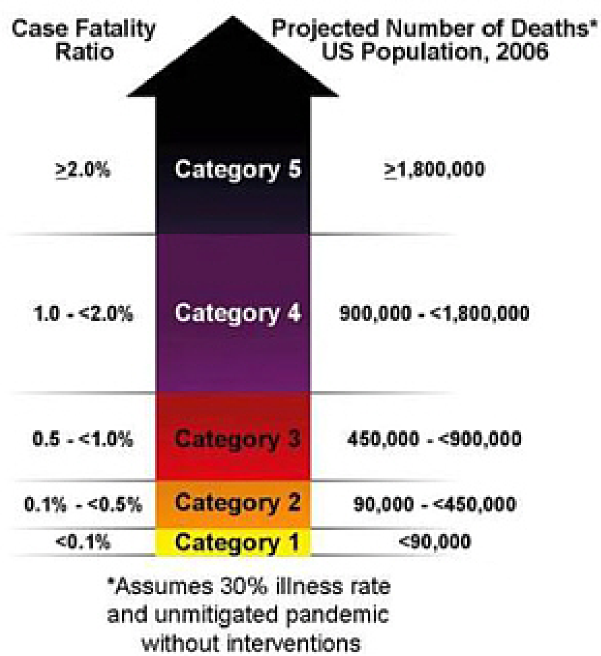
as infected or exposed people travel across the globe in a matter of hours. Third world countries have fewer resources to fight disease and may be more vulnerable than more industrialized nations. In the United States, the U.S. public health system works at the federal, state and local level to monitor 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 the City of Austin and Austin ISD planning area.

Extent

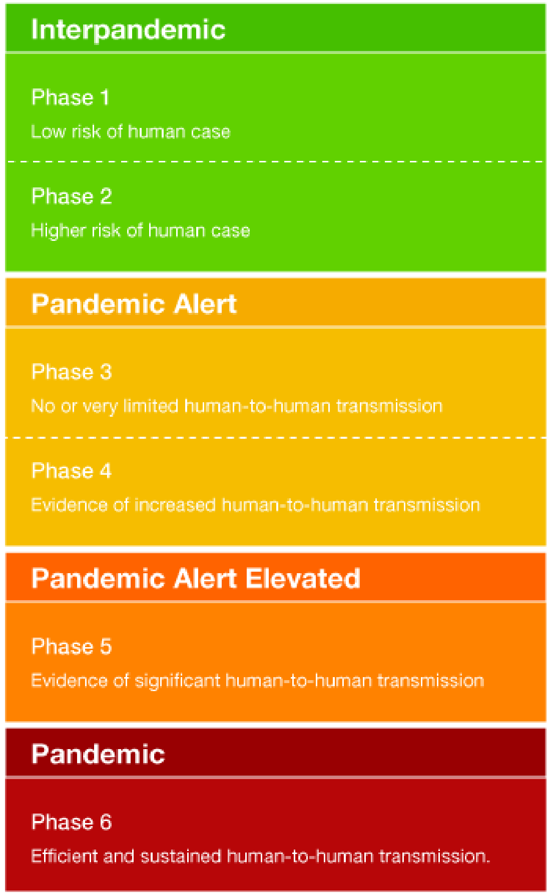
The severity of a pandemic virus can be evaluated from the perspective of the individual who has been infected; or from the population level, how many complications and deaths might be expected as a whole. The most common measure of severity for a pandemic virus event is the case-fatality rate (CFR) as depicted in Figure 18-1.

Figure 18-1. Case-Fatality Rate for Severity



The magnitude of a pandemic event is identified in terms of warning levels based on population. Figure 18-2 illustrates the various warning levels for pandemic.

Figure 18-2. Risk levels for Pandemic (World Health Organization)



Historical Occurrences

The Austin/Travis County Health and Human Services Department has produced a 2015 Critical Health Indicators Report to illustrate health conditions and disparities in Travis County. Information in the 2015 report was primarily obtained from the United States Census Bureau, Texas Department of State Health Services, the Texas Behavioral Risk Factor Surveillance Survey, and from morbidity and mortality reports collected by the Disease Prevention and Health Promotion Division. The Critical Health Indicators Report was prepared by epidemiologists and staff in the Disease Prevention and Health Promotion Division using the most recent county, state, and national data available.[10]

The number of infectious disease cases and rates are included in Table 18-2. Rates for each year were configured using the number of cases per 100,000 total population. Rates based on fewer than 20 cases are likely to be unstable and imprecise. On average, 9,676 cases of infectious disease are reported annually for Travis County.

[10] http://www.austintexas.gov/sites/default/files/files/Health/Info_to_Post/Critical_Health_Indicators_2015.pdf

Table 18-2. Historical Infectious Disease for Austin and Travis County, 2008 – 2012[11]

INFECTIOUS DISEASE	2008		2009		2010		2011		2012	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
AIDS	148	15.0	153	15.1	129	12.6	127	12.2	112	10.6
Amebiasis	102	10.3	112	11.1	41	4.0	17	1.6	22	2.1
Anthrax	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Botulism	0	0.0	0	0.0	1	0.1	0	0.0	1	0.1
Brucellosis	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Campylobacteriosis	114	11.5	131	12.9	182	17.8	140	13.4	182	17.2
Chicken Pox (Varicella)	255	25.8	140	13.8	127	12.4	98	9.4	143	13.5
Chlamydia	5,417	548.1	5,916	584.1	5,804	566.6	6,133	588.6	6,623	62.4
Cholera	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Creutzfeldt-Jakob Disease	0	0.0	1	0.1	1	0.1	0	0.0	0	0.0
Cryptosporidiosis	168	17.0	10	1.0	8	0.8	11	1.1	12	1.1
Cyclosporiasis	0	0.0	1	0.1	0	0.0	0	0.0	0	0.0
Cysticercosis	1	0.1	0	0.0	1	0.1	0	0.0	2	0.2
Dengue	4	0.4	2	0.2	1	0.1	3	0.3	2	0.2
Diphtheria	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Ehrlichiosis	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Encephalitis	0	0.0	0	0.0	0	0.0	0	0.0	2	0.2
Encephalitis, Nonarboviral	4	0.4	0	0.0	0	0.0	2	0.2	4	0.4
Escherichia coli , Shiga toxin-producing (STEC)	3	0.3	4	0.4	8	0.8	8	0.8	8	0.8
Gonorrhea	1,733	175.3	1,439	142.1	1,437	140.3	1,470	141.1	1,637	154.4
Haemophilus influenzae type b, invasive	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1
Hantavirus	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

[11] Source: Austin/Travis County Health & Human Services

INFECTIOUS DISEASE	2008		2009		2010		2011		2012	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Hemolytic Uremic Syndrome (HUS)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Hepatitis A, Acute	9	0.9	9	0.9	12	1.2	6	0.6	5	0.5
Hepatitis B, Acute	27	2.7	31	3.1	18	1.8	10	1.0	11	1.0
Hepatitis B, Perinatal	1	0.1	0	0.0	0	0.0	1	0.1	1	0.1
Hepatitis C, Acute	0	0.0	0	0.0	1	0.1	2	0.2	1	0.1
Hepatitis Other, Acute	1	0.1	0	0.0	0	0.0	0	0.0	0	0.0
HIV	207	20.9	191	18.9	195	19.0	237	22.7	252	23.8
Influenza-associated pediatric mortality	0	0.0	2	0.2	1	0.1	0	0.0	1	0.1
Legionellosis	5	0.5	3	0.3	5	0.5	4	0.4	7	0.7
Leishmaniasis	0	0.0	0	0.0	0	0.0	0	0.0	2	0.2
Listeriosis	6	0.6	2	0.2	7	0.7	0	0.0	0	0.0
Lyme Disease	8	0.8	8	0.8	4	0.4	9	0.9	3	0.3
Malaria	5	0.5	5	0.5	10	1.0	3	0.3	5	0.5
Measles	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Meningitis, Aseptic	96	9.7	102	10.1	124	12.1	162	15.5	130	12.3
Meningitis, Bacterial and Other	12	1.2	2	0.2	7	0.7	2	0.2	7	0.7
Meningococcal Infection	7	0.7	4	0.4	1	0.1	1	0.1	2	0.2
Mumps	1	0.1	1	0.1	5	0.5	1	0.1	0	0.0
Pertussis	91	9.2	701	69.2	908	88.6	224	21.5	276	26.0
Plague	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Poliomyelitis	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Primary Amoebic Meningoencephalitis (PAM)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Q Fever, Acute	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Rabies, human	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

INFECTIOUS DISEASE	2008		2009		2010		2011		2012	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Rubella	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Salmonellosis	244	24.7	199	19.6	259	25.3	274	26.3	250	23.6
Shigella	148	15.0	75	7.4	176	17.2	316	30.3	146	13.8
Smallpox	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Spotted Fever Rickettsiosis	5	0.5	5	0.5	2	0.2	4	0.4	7	0.7
Streptococcus, Group A	28	2.8	24	2.4	18	1.8	24	2.3	26	2.5
Streptococcus, Group B	44	4.5	49	4.8	54	5.3	50	4.8	48	4.5
Streptococcus pneumonia	109	11.0	129	12.7	128	12.5	79	7.6	89	8.4
Syphilis[12]	294	29.7	307	30.3	284	27.7	365	35.0	411	38.8
Taeniasis	0	0.0	2	0.2	0	0.0	0	0.0	0	0.0
Tetanus	0	0.0	0	0.0	0	0.0	1	0.1	0	0.0
Trichinosis	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Tuberculosis[13]	44	4.5	61	6.0	67	6.5	52	5.0	37	3.5
Tularemia	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Typhoid Fever	4	0.4	5	0.5	4	0.4	2	0.2	2	0.2
Typhus, Murine	33	3.3	34	3.4	15	1.5	54	5.2	42	4.0
Vancomycin-intermediate resistant Staphylococcus aureus (VISA)	1	0.1	4	0.4	1	0.1	1	0.1	1	0.1
Vancomycin-resistant Staphylococcus aureus (VRSA)	1	0.1	0	0.0	0	0.0	0	0.0	1	0.1
Vibrio Infections	2	0.2	5	0.5	6	0.6	4	0.4	2	0.2
West Nile Virus	2	0.2	2	0.2	2	0.2	0	0.0	153	14.4
Yellow Fever	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Yersiniosis	0	0.0	0	0.0	2	0.2	1	0.1	2	0.2

HIV and AIDS

Table 18-3 reports the number of new HIV and AIDS cases in Travis County during 2003 through 2012. The number of cases of AIDS are those who were diagnosed in that year regardless of whether they were previously diagnosed as HIV only or if they were newly diagnosed and had already met the AIDS case definition. The annual number of new HIV diagnoses ranged from 191 to 252.

Table 18-3. Number of New HIV and AIDS Diagnoses, Travis County, Texas, 2003 – 2012[12]

DIAGNOSIS YEAR	HIV	AIDS
2003	207	140
2004	191	136
2005	221	169
2006	223	150
2007	224	161
2008	207	148
2009	191	153
2010	195	129
2011	237	127
2012	252	112
Total	**2,148**	**1,425**

Influenza

During the 2013-2014 influenza season (September 29, 2013 through September 27, 2014) in Texas, the dominant strain during the first half was influenza A. Influenza B viruses and 2009 H1N1 were the dominant strain for the second half of the season. The season produced higher influenza-like illnesses (ILI) reported by providers than previous seasons with a total of 4,024 patient visits for ILI. Visits were highest in people aged 5 to 24 years old and lowest in adults from 50 to 64 years old.[13]

During the current influenza season, there have already been 15 associated deaths with the City of Austin and Travis County residents. Figure 18-3 illustrates the percentage of visits to Travis County hospitals for influenza-like symptoms. Figure 18-4 displays the City of Austin influenza and pneumonia mortality rate from 2010 through 2015.

[12] TB/HIV/STD Epidemiology and Surveillance Branch, Texas Department of State Health Services
[13] https://www.dshs.state.tx.us/idcu/disease/influenza/surveillance/2014/

Figure 18-3. Percentage of Visits Due to Influenza-like-Illness, Travis County[14]

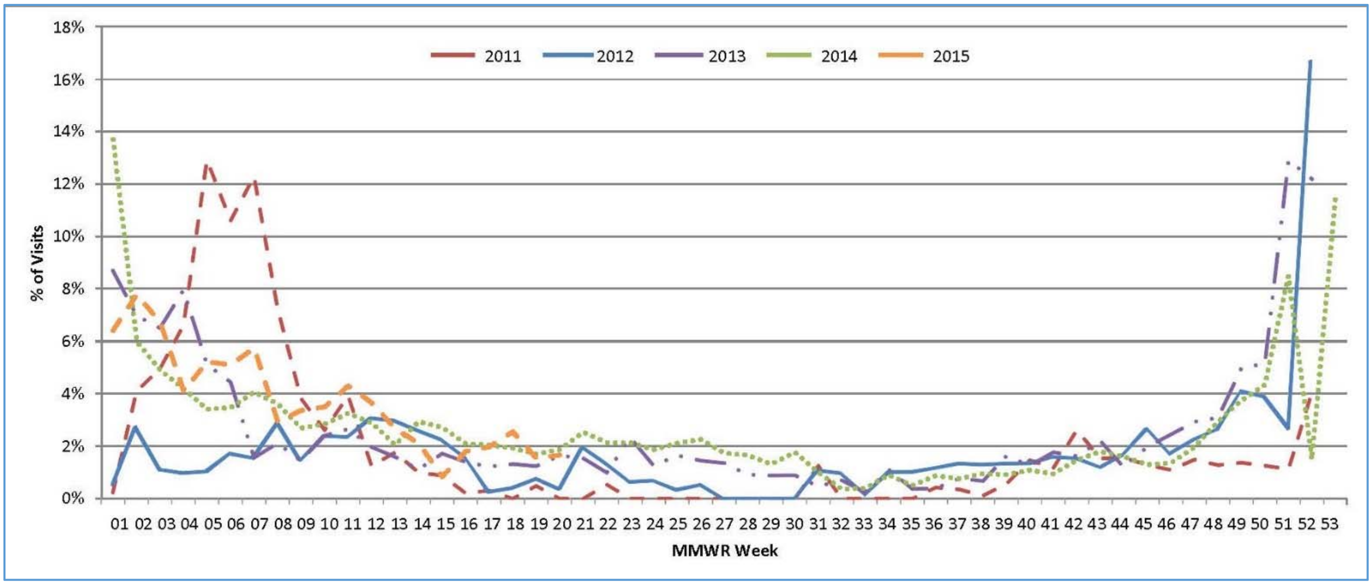
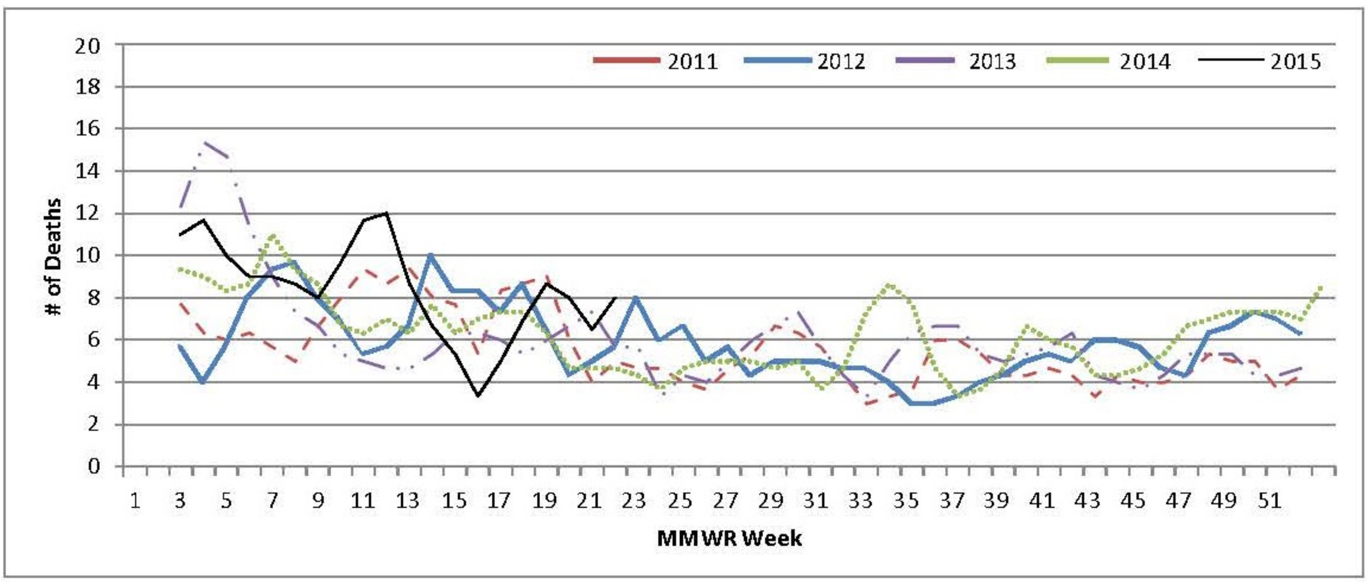


Figure 18-4. City of Austin Pneumonia and Influenza Mortality, 2010 – 2015[15]



West Nile Virus

During 2008 through 2011, only two West Nile virus cases were reported in Travis County. In 2012, the United States experienced an outbreak of West Nile virus with 5,674 cases reported.[16] A total of 286 persons in the United States died due to West Nile virus in 2012.[17] In 2012, over 1,800 cases were reported in Texas, with 153 of those cases occurring in Travis County causing 6 deaths. Ill

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[14] http://www.austintexas.gov/department/influenza
[15] Center for Disease Control and Prevention 122 Cities Mortality: http://wonder.cdc.gov/mmwr/mmwrmort.asp
[16] Centers for Disease Control and Prevention, Morbidity and Mortality Weekly Report; 62:513-517
[17] Ibid

persons had onset of symptoms during July through October. The initial cases had onset of illness the second week of July.

There were 379 cases of West Nile virus in Texas in 2014 causing 6 deaths. Currently, there have been 6 reported cases in 2015, although none of those cases have occurred in Travis County.[18]

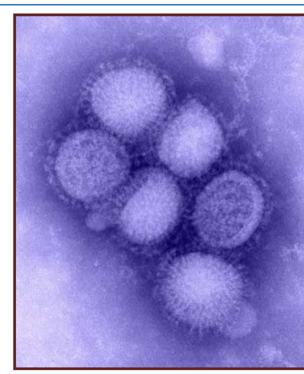
Probability of Future Events

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 the City of Austin and Austin ISD are 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 particular concern is the reduction and treatment of H1N1 flu virus.

The probability of an infectious disease epidemic or pandemic in the City of Austin planning area is occasional and an event has the probability of occurring once every five years.

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. However, upkeep and maintenance of buildings and facilities would fall behind due to the high absenteeism of employees or the closing of facilities.

Critical infrastructure services, such as emergency services, utility services, water services and telecommunications can be limited by an infectious disease event. Certain strains of disease are highly infectious and can be communicable by coughing, touching, and even breathing. Austin has seen a rise in West Nile Virus over the last few years. Other more prevalent diseases are Influenza and Chicken Pox (Varicella). Children within the school district are most likely to begin the spread of an infectious disease in the classroom setting, based on the number of children that share a classroom together. The Austin ISD educates children and parents on the importance of hygiene for prevention of spreading infectious diseases.

People at the highest risk for developing complications from infectious diseases include children younger than five, adults 65 year of age and older, and pregnant women. People who have medical conditions, such as asthma; heart disease; chronic lung disease; blood, endocrine, kidney, liver or

[18] https://www.dshs.state.tx.us/news/updates.shtm

metabolic disorders; or a weakened immune system, could experience a worsening of existing conditions.

The response costs to the public health sector for an outbreak, and the impact to health as a whole for the Austin planning area and Austin ISD, could potentially be "Major." Injuries or illnesses that result in permanent disability could occur and City area facilities could be shut down for at least 2 weeks. Property damage could result from high absenteeism of persons responsible for property management.

AISD Disease Prevention

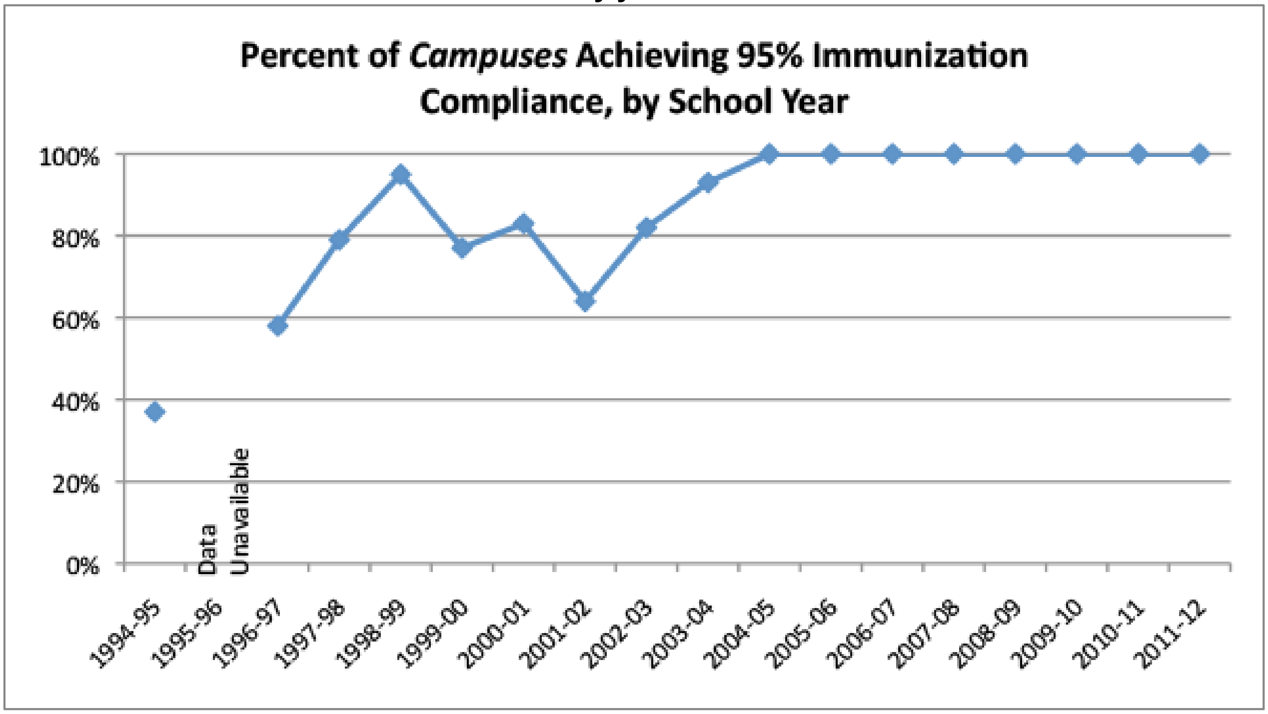
It is a well-known fact that children are highly susceptible to infectious diseases, and some are spread throughout entire school districts. Austin ISD works hard to educate children and their parents on disease prevention and takes steps to prevent the spread of the flu, including H1N1. Their goal is to decrease the exposure to the seasonal flu and H1N1, while limiting the disruption to learning. Austin ISD works closely with the Center for Disease Control (CDC), Texas Department of State Health Services, and local Health Departments to monitor the situation. Austin ISD enforces State mandated immunizations and also encourages flu vaccinations for all students.[19]

In 1996, Austin Independent School District established a formal relationship with the Seton Healthcare Family to provide school health services on a contracted basis, in response to a need identified by the District. This program, named Children's/AISD Student Health Services, is committed to optimizing the health and well-being of children and families, and is the first of its kind in the nation.[20]

Figure 18-5 illustrates the percentage of Austin ISD campuses that have achieved 95% immunization compliance from 1996 through 2012 school years.

[19] http://www.austinisd.org/health/h1n1
[20] http://aisd.dellchildrens.net/

Figure 18-5. Percentage of AISD campuses that have achieved 95% immunization compliance, by year



Section 19: Terrorism

Hazard Description

The Federal Bureau of Investigation (FBI) categorizes terrorism in the United States as 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 directed by countries or groups outside the United States, or whose activities transcend their national boundaries.

A terrorist attack event can take several forms depending on the technological means available to the terrorist, nature of the issue motivating the attack, and points of weakness of the terrorist's target. Bombing is the most frequently occurring terrorist event in the United States. A chemical or biological terrorist event is of particular concern to officials. Additionally, special training and equipment are necessary 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 and may be extremely difficult to detect.

Chemical agents can kill and incapacitate people, destroy livestock, and ravage crops. Some chemical agents are odorless and tasteless and are therefore difficult to detect. Chemical agents can have an immediate effect, within a few seconds to a few minutes; or a delayed effect, within several hours to several days.

The U.S. Department of Defense estimates that 26 nations may possess chemical agents and weapons, and an additional 12 may be seeking to develop them. The Central Intelligence Agency reports that at least ten countries are believed to be in possession or conducting research on biological agents for weaponization.

Terrorist events involve the application of one or more modes of harmful force to the built environment. These modes include contamination, such as chemical, biological, radiological, and nuclear hazards; energy, such as explosives, arson, and electromagnetic waves; or denial of service, such as sabotage, infrastructure breakdown, and transportation service disruption.

Location

There is no distinct geographic boundary to the threat of terrorism. An event is possible throughout the City of Austin and Austin ISD.

Terrorists most often search for highly visible targets that can be impacted while avoiding detection. However, the motivation behind at terrorist event can be varied and the target's surrounding area is considered at risk.

Extent

The Homeland Security Advisory System, issued by the U.S. Department of Homeland Security, is a color-coded terrorism warning system that identifies five threat levels. Terrorism Warning Threat Levels are described in Table 19-1.

Table 19-1. Terrorism Warning System Threat Levels[1]

Color	Threat Level[2]	Governmental actions to be taken
Green	Low: Low risk of attacks.	Requires "protective measures" such as regularly assessing facilities for weaknesses, implementing methods to reduce vulnerability, and ensuring State and local government employees are trained to handle terrorist events.
Blue	Guarded: General risk of attacks.	Requires government agencies to review and update emergency response procedures and communications systems, and provide the public with necessary information.
Yellow	Elevated: Significant risk of attacks.	Includes increasing surveillance of critical locations, coordinating emergency plans with nearby jurisdictions, and implementing contingency and emergency response plans.
Orange	High: High risk of attacks.	Requires coordinating security efforts with armed forces or law enforcement agencies, taking additional precautions at public events, preparing to work at an alternative site or with a dispersed workforce, and restricting access to essential personnel.
Red	Severe: Severe risk of attacks.	Includes assigning emergency response personnel and setting up specially trained teams; monitoring, redirecting, or constraining transportation systems; closing public and government facilities; and increasing or redirecting personnel to address emergency needs.

The 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.*

[1] Department of Homeland Security
[2] Current threat levels can be found at: http://www.dhs.gov/xinfoshare/programs/Copy_of_press_release_0046.shtm.

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. The City of Austin planning area could encounter any level of threat of terrorism as there is usually very little warning time and terrorist events are not typically foreseeable.

Historical Occurrences

In 2007, the Texas Department of Public Safety, which is responsible for Homeland Security in Texas, reported that individuals with ties to Hezbollah, Hamas, and al-Qaida were arrested crossing the border from Mexico. From March 2006 to September 2007, almost 350 individuals “from terrorism-related countries" were arrested at the border.

April 25, 2007 – Austin

A bomb was left in a women's clinic in Austin Texas, but failed to explode.

February 18, 2010 – Austin

Andrew Joseph Stack, III flew his single engine plane into the Austin Texas IRS building killing himself and one IRS employee and injured 13 others. The event is considered a suicide attack. Stack left a suicide note online, comparing the IRS to Big Brother from the novel written in 1984.

May 31, 2013 – Austin ISD

An acid bomb was seized before detonation.

July 19, 2013 – Austin

A Homeland Security warning was sent out July 19, 2013 warning of “unconfirmed” possible “random terrorist attacks” that while considered “random” specified several targets, noting supposed “plans to plant back-pack style bombs on 6th street on either 8 or 9 August.”

The threat advisory claimed there were plans to “attack a school and a theological seminary in the downtown Austin area and complete the attack with operations at the Austin Bergstrom International Airport.” The “unconfirmed” warning of “random” attacks further noted a backup date, August 29th, if the 8th and 9th weren’t considered “a viable option.”

March 31, 2014 – Austin ISD

An act of Arson was committed on Cunningham Campus.

June 18, 2014 – Austin

Rahatul Ashikim Khan of the Austin suburb of Round Rock and Michael Todd Wolfe of Austin, both 23, face up to 15 years in federal prison if convicted of conspiring to provide material support to terrorists, according to the federal Justice Department and the Central Texas Joint Terrorism Task Force. Both men have been arrested and are awaiting trial.

November 28, 2014 - Austin

Right-wing and anti-government extremist Larry Steven McQuilliams set a fire at the Mexican Consulate and shot towards several government buildings. Police arrived on scene and shot him dead. McQuilliams had a prior criminal history including drug possession and robbery.

Probability of Future Events

The type, frequency, and location of many natural hazards are identifiable and somewhat predictable because natural hazards are governed by the laws of physics and nature. However, malevolence cannot be forecast with any accuracy. Therefore, there is potential for intentional terrorist acts to occur anywhere and at any time. According to the historical incident data, a terrorism incident for the City of Austin planning area is likely, with an event occurring on average once every three years.

Vulnerability and Impact

There is no defined geographic boundary for a terrorist event. All of the population, buildings, critical facilities, infrastructure, lifelines, and hazardous materials facilities in the planning area are considered exposed to the hazards of terrorism and could potentially be affected.

Because there have been terrorist attacks within Austin and the Austin ISD, all assets and facilities are potentially at risk to damages.

Terrorist events can have a "Major" severity of impact. They can cause injuries and illnesses, and result in permanent disability, complete shutdown of City area facilities for at least two weeks, and cause more than 25 percent of affected properties to be destroyed or suffer major damage.

Terrorism poses a potentially significant risk to public health and safety. Persons in the area at the time of a terrorist attack are at risk for injury or death from a variety of threats.

The chance for death, injury, and financial loss increases as population density increases. Therefore, locations in Austin planning area with high population density should be considered to have the most risk.

Response personnel face similar potential impacts as the general public. Response personnel can be at increased risk of physical injury because the nature of their responsibilities may bring them closer to the hazard and secondary incendiary devices are often directed at response personnel. Additionally, response personnel can be subjected to more long-term impacts resulting from prolonged exposure to chemicals or biological weapons.

Damage from a terrorist event can either directly or indirectly impact utility infrastructure. Damage to utility infrastructure can result in a temporary loss of function for businesses in the planning area that rely on utilities for operation. Additionally, businesses can suffer interruption from closed or blocked roadways; for example, firefighters and law enforcement personnel may need to close a roadway during response and investigative operations. This could negatively impact other businesses in the area that were not otherwise damaged.

Most property, facilities, and infrastructure within the planning area are at risk from damage or destruction from a terrorist event, including residential and commercial structures and their supporting utilities, vehicles and transportation infrastructure, and community buildings, such as hospitals, police stations, and schools. Roadways in or near a terrorist event could be impacted because of damage or closure due to response or investigative operations.

Due to the varied ways a terrorist event can occur, there are many potential environmental impacts. The environmental impacts associated with terrorism include, but are not limited to:

- Air pollution,
- soil contamination,
- water pollution and hydrologic impacts, and
- radiological contamination.

Examples of potential terrorist impacts on the environment:

- During severe drought, a terrorist group conducts an arson campaign with multiple fire-bomb attacks that result in large-scale fires throughout the area. Fire affected regions sustain losses to agriculture and forest areas.
- An intentional release of hazardous materials into soil, water, or air that leads to environmental contamination and potential changes of the ecosystem, such as habitat loss.
- Failure of control systems of major utility companies due to cyber-attack, leading to damages of critical infrastructure and consequent environmental impacts, such as uncontrolled release of chemicals into the environment, initiation of random fires, or radiological contamination.

The economic and financial impacts of a terrorist 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 businesses and citizens will also contribute to the overall economic and financial conditions in the aftermath of a terrorist event.

Section 20: Hazardous Materials

Hazard Description

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. 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 2 data is a publicly available database from the Texas Department of State Health Services Tier 2 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 2 Report contains facility identification information and detailed chemical data about hazardous chemicals stored at the facility.

A facility must report if it meets the following criteria:

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

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 20-1 shows the locations of available georeferenced TRI and Tier 2 toxic sites in and around the City of Austin study area and Figure 20-2 shows the corridors are mobile hazardous materials. For fixed site analysis, only toxic sites that have georeferenced data available were analyzed and the circle buffers are drawn around each hazardous material site. Two size buffers, 500 and 2,500 meters are assumed in respect to the different levels of effect – immediate (primary) and secondary.

Figure 20-1. Fixed HazMat Analysis Locations and Buffers

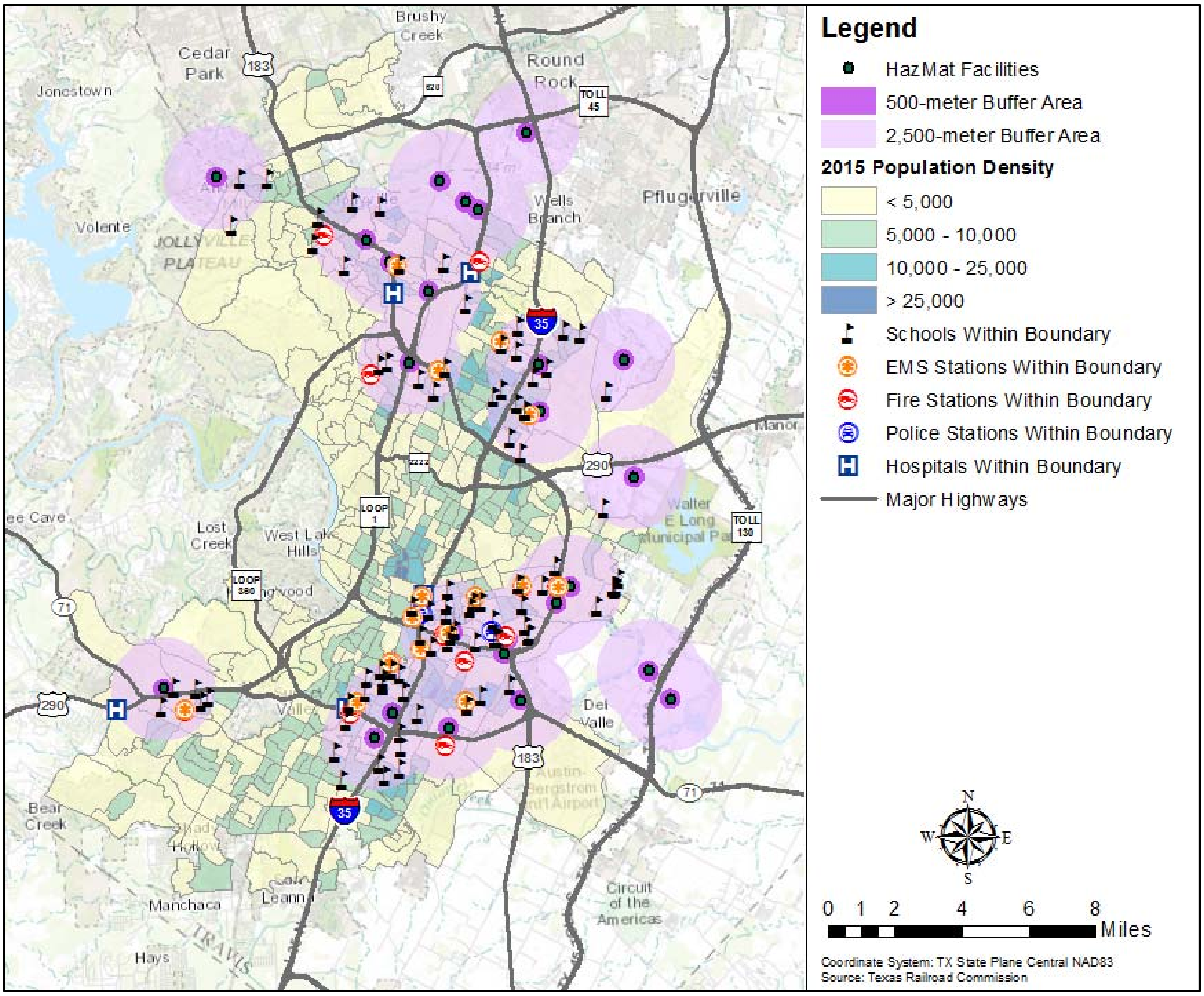


Figure 20-2. Mobile HazMat Analysis Corridors and Buffers

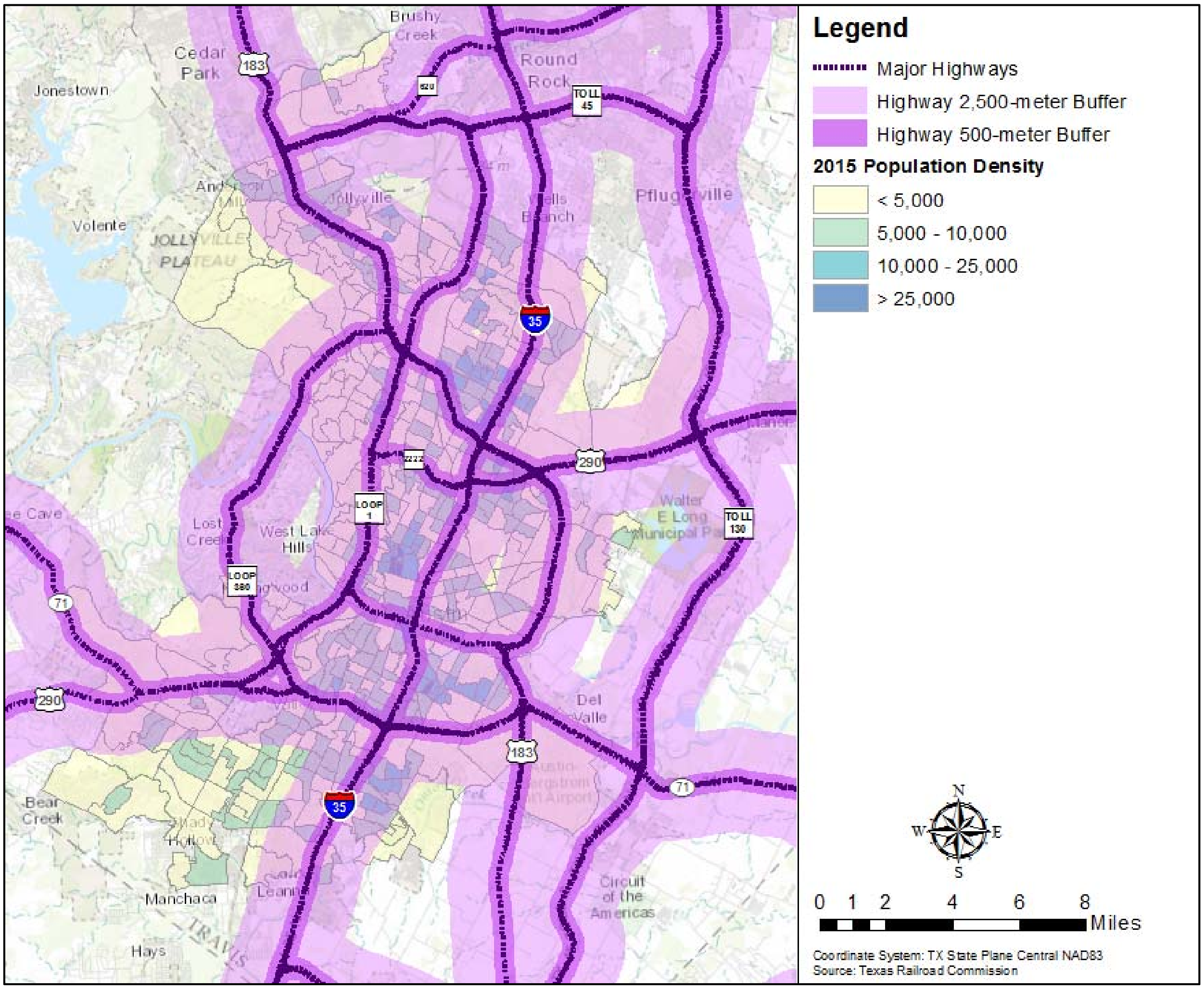


Table 20-1. TRI HazMat Facilities within Austin Area

JURISDICTION	FACILITY NAME	ADDRESS	TOTAL RELEASES	CHEMICALS
AUSTIN	3M CO-AUSTIN RESEARCH BOULEVARD SITE	11705 RESEARCH BLVD	100.27	LEAD COMPOUNDS
AUSTIN	APAC - TEXAS INC/WHEELER COMPANIES/973	2860 N FM 973	0.2001	LEAD
AUSTIN	AUSTIN COUNTER TOPS INC	11108 BLUFF BEND DR	14364	STYRENE

JURISDICTION	FACILITY NAME	ADDRESS	TOTAL RELEASES	CHEMICALS
AUSTIN	AUSTIN MANUFACTURING SERVICES	4616 W HOWARD LN BLDG 5 STE 550	0	LEAD COMPOUNDS
AUSTIN	AUSTIN WHITE LIME CO	14001 MCNEIL RD	23075.8	BARIUM COMPOUNDS
AUSTIN	AUSTIN WHITE LIME CO	14001 MCNEIL RD	404.39	LEAD COMPOUNDS
AUSTIN	AUSTIN WHITE LIME CO	14001 MCNEIL RD	3.846	MERCURY COMPOUNDS
AUSTIN	BAE SYSTEMS INFORMATION & ELECTRONIC SYSTEMS INTEGRATION INC	6500 TRACOR LN	71.7	LEAD
AUSTIN	BORDEN DAIRY CO OF TEXAS LLC	71 STRANDTMAN COVE	0	NITRATE COMPOUNDS
AUSTIN	BORDEN DAIRY CO OF TEXAS LLC	71 STRANDTMAN COVE	0	NITRIC ACID
AUSTIN	CELESTICA AEROSPACE TECHNOLOGIES CORP	4616 W HOWARD LN BLDG 1 SUITE 100	0.197181	LEAD
AUSTIN	ERGON ASPHALT & EMULSIONS INC - AUSTIN	8803 N MOPAC EXPRESSWAY	0	POLYCYCLIC AROMATIC COMPOUNDS
AUSTIN	ERGON ASPHALT & EMULSIONS INC - AUSTIN	8803 N MOPAC EXPRESSWAY	0	BENZO(G,H,I)PERYLENE
AUSTIN	FLEXTRONICS AMERICA LLC	12455 RESEARCH BLVD	61.44	LEAD
AUSTIN	FLEXTRONICS AMERICA LLC	12455 RESEARCH BLVD	14.49	COPPER
AUSTIN	FLINT HILLS RESOURCES CORPUS CHRISTI LLC AUSTIN	9011 JOHNNY MORRIS RD	1839	N-HEXANE

JURISDICTION	FACILITY NAME	ADDRESS	TOTAL RELEASES	CHEMICALS
AUSTIN	FLINT HILLS RESOURCES CORPUS CHRISTI LLC AUSTIN	9011 JOHNNY MORRIS RD	20	NAPHTHALENE
AUSTIN	FLINT HILLS RESOURCES CORPUS CHRISTI LLC AUSTIN	9011 JOHNNY MORRIS RD	0	POLYCYCLIC AROMATIC COMPOUNDS
AUSTIN	FLINT HILLS RESOURCES CORPUS CHRISTI LLC AUSTIN	9011 JOHNNY MORRIS RD	1154	XYLENE (MIXED ISOMERS)
AUSTIN	FLINT HILLS RESOURCES CORPUS CHRISTI LLC AUSTIN	9011 JOHNNY MORRIS RD	827	TOLUENE
AUSTIN	FLINT HILLS RESOURCES CORPUS CHRISTI LLC AUSTIN	9011 JOHNNY MORRIS RD	1	LEAD COMPOUNDS
AUSTIN	FLINT HILLS RESOURCES CORPUS CHRISTI LLC AUSTIN	9011 JOHNNY MORRIS RD	264	1,2,4-TRIMETHYLBENZENE
AUSTIN	FLINT HILLS RESOURCES CORPUS CHRISTI LLC AUSTIN	9011 JOHNNY MORRIS RD	175	CYCLOHEXANE
AUSTIN	FLINT HILLS RESOURCES CORPUS CHRISTI LLC AUSTIN	9011 JOHNNY MORRIS RD	0	BENZO(G,H,I)PERYLENE
AUSTIN	FLINT HILLS RESOURCES CORPUS CHRISTI LLC AUSTIN	9011 JOHNNY MORRIS RD	148	CUMENE
AUSTIN	FLINT HILLS RESOURCES CORPUS CHRISTI	9011 JOHNNY MORRIS RD	159	BENZENE
AUSTIN	FLINT HILLS RESOURCES CORPUS CHRISTI LLC AUSTIN	9011 JOHNNY MORRIS RD	51	ETHYLBENZENE

JURISDICTION	FACILITY NAME	ADDRESS	TOTAL RELEASES	CHEMICALS
AUSTIN	FREESCALE SEMICONDUCTOR - ED BLUESTEIN FACILITY	3501 ED BLUESTEIN BLVD	750	NITRIC ACID
AUSTIN	FREESCALE SEMICONDUCTOR - ED BLUESTEIN FACILITY	3501 ED BLUESTEIN BLVD	7056	ETHYLENE GLYCOL
AUSTIN	FREESCALE SEMICONDUCTOR - ED BLUESTEIN FACILITY	3501 ED BLUESTEIN BLVD	237	HYDROGEN FLUORIDE
AUSTIN	FREESCALE SEMICONDUCTOR - ED BLUESTEIN FACILITY	3501 ED BLUESTEIN BLVD	0	OZONE
AUSTIN	FREESCALE SEMICONDUCTOR - ED BLUESTEIN FACILITY	3501 ED BLUESTEIN BLVD	18	SULFURIC ACID
AUSTIN	FREESCALE SEMICONDUCTOR - ED BLUESTEIN FACILITY	3501 ED BLUESTEIN BLVD	366	N-METHYL-2-PYRROLIDONE
AUSTIN	FREESCALE SEMICONDUCTOR - ED BLUESTEIN FACILITY	3501 ED BLUESTEIN BLVD	0	NITRATE COMPOUNDS
AUSTIN	FREESCALE SEMICONDUCTOR OAK HILL FACILITY	6501 WILLIAM CANNON DR W	1	LEAD
AUSTIN	FREESCALE SEMICONDUCTOR OAK HILL FACILITY	6501 WILLIAM CANNON DR W	1245	ETHYLENE GLYCOL
AUSTIN	FREESCALE SEMICONDUCTOR OAK HILL FACILITY	6501 WILLIAM CANNON DR W	312	HYDROGEN FLUORIDE
AUSTIN	FREESCALE SEMICONDUCTOR OAK HILL FACILITY	6501 WILLIAM CANNON DR W	339	NITRIC ACID
AUSTIN	FREESCALE SEMICONDUCTOR OAK HILL FACILITY	6501 WILLIAM CANNON DR W	0	NITRATE COMPOUNDS
AUSTIN	FREESCALE SEMICONDUCTOR OAK HILL FACILITY	6501 WILLIAM CANNON DR W	60	N-METHYL-2-PYRROLIDONE

JURISDICTION	FACILITY NAME	ADDRESS	TOTAL RELEASES	CHEMICALS
AUSTIN	FREESCALE SEMICONDUCTOR OAK HILL FACILITY	6501 WILLIAM CANNON DR W	808	HYDROCHLORIC ACID
AUSTIN	FREESCALE SEMICONDUCTOR OAK HILL FACILITY	6501 WILLIAM CANNON DR W	0	OZONE
AUSTIN	FREESCALE SEMICONDUCTOR OAK HILL FACILITY	6501 WILLIAM CANNON DR W	0	SULFURIC ACID
AUSTIN	HANSON PIPE & PRECAST LLC AUSTIN	801 AIRPORT BLVD	0.44	LEAD
AUSTIN	HOSPIRA INC-AUSTIN SITE	3900 HOWARD LN	22.26	DI(2-ETHYLHEXYL) PHTHALATE
AUSTIN	HUBBELL BUILDING AUTOMATION	9601 DESSAU RD BLDG 1 SUITE 100	0.394735	LEAD
AUSTIN	NATIONAL INSTRUMENTS CORP	11500 N MOPAC EXPWY.	0	LEAD
AUSTIN	OLDCASTLE ARCHITECTURAL WEST INC	4433 TERRY-O LN	0.05	LEAD
AUSTIN	PALM HARBOR HOMES INC	830 BASTROP HWY	0	DIISOCYANATES
AUSTIN	PURE CASTINGS CO	2110 E 4TH ST	676.26	CHROMIUM
AUSTIN	PURE CASTINGS CO	2110 E 4TH ST	360.43	NICKEL
AUSTIN	SACHEM INC	821 WOODWARD ST	0	NITRIC ACID
AUSTIN	SACHEM INC	821 WOODWARD ST	0	NITRATE COMPOUNDS
AUSTIN	SACHEM INC	821 WOODWARD ST	0	CHLORINE
AUSTIN	SAMSUNG AUSTIN SEMICONDUCTOR	12100 SAMSUNG BLVD	13573	N-METHYL-2-PYRROLIDONE

JURISDICTION	FACILITY NAME	ADDRESS	TOTAL RELEASES	CHEMICALS
AUSTIN	SAMSUNG AUSTIN SEMICONDUCTOR	12100 SAMSUNG BLVD	13747	ETHYLENE GLYCOL
AUSTIN	SAMSUNG AUSTIN SEMICONDUCTOR	12100 SAMSUNG BLVD	18565	SULFURIC ACID
AUSTIN	SAMSUNG AUSTIN SEMICONDUCTOR	12100 SAMSUNG BLVD	2065	OZONE
AUSTIN	SAMSUNG AUSTIN SEMICONDUCTOR	12100 SAMSUNG BLVD	4179	HYDROGEN FLUORIDE
AUSTIN	SAMSUNG AUSTIN SEMICONDUCTOR	12100 SAMSUNG BLVD	77795	SODIUM DIMETHYLDITHIO CARBAMATE
AUSTIN	SAMSUNG AUSTIN SEMICONDUCTOR	12100 SAMSUNG BLVD	4	NITRATE COMPOUNDS
AUSTIN	SAMSUNG AUSTIN SEMICONDUCTOR	12100 SAMSUNG BLVD	5898	NITRIC ACID
AUSTIN	SAMSUNG AUSTIN SEMICONDUCTOR	12100 SAMSUNG BLVD	3365	COPPER COMPOUNDS
AUSTIN	SAMSUNG AUSTIN SEMICONDUCTOR	12100 SAMSUNG BLVD	13841	HYDROCHLORIC ACID
AUSTIN	SAMSUNG AUSTIN SEMICONDUCTOR	12100 SAMSUNG BLVD	748	CHLORINE
AUSTIN	SAMSUNG AUSTIN SEMICONDUCTOR	12100 SAMSUNG BLVD	2031.042	FLUORINE
AUSTIN	SAMSUNG AUSTIN SEMICONDUCTOR	12100 SAMSUNG BLVD	14219	AMMONIA
AUSTIN	SPANSION LLC	5204 E BEN WHITE BLVD	0	NITRATE COMPOUNDS
AUSTIN	SPANSION LLC	5204 E BEN WHITE BLVD	876	HYDROGEN FLUORIDE
AUSTIN	SPANSION LLC	5204 E BEN WHITE BLVD	350	SULFURIC ACID

JURISDICTION	FACILITY NAME	ADDRESS	TOTAL RELEASES	CHEMICALS
AUSTIN	SPANSION LLC	5204 E BEN WHITE BLVD	0	FLUORINE
AUSTIN	SPANSION LLC	5204 E BEN WHITE BLVD	157	OZONE
AUSTIN	SPANSION LLC	5204 E BEN WHITE BLVD	350	AMMONIA
AUSTIN	SPANSION LLC	5204 E BEN WHITE BLVD	88	NITRIC ACID
AUSTIN	TXI-GREEN READY MIX	13101 HAROLD GREEN RD	0.0005	MERCURY COMPOUNDS
AUSTIN	TXI-GREEN READY MIX	13101 HAROLD GREEN RD	0.155	LEAD COMPOUNDS
AUSTIN	TXI-VOLENTE READY MIX	12210 VOLENTE RD	0.076	LEAD COMPOUNDS
AUSTIN	WAYNE FUELING SYSTEMS	3814 JARRETT WAY	0.4	LEAD

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.

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.

It's estimated as many as 40 percent of the transport trucks moving through Central Texas and Travis County are carrying some form of hazardous materials, according to a 2009 report by TxDOT and the Federal Highway Administration. But that's just a guess based on national trends that break down transported goods by mode: truck, rail, pipeline, water, and air.

There's data on truck traffic volume in a study done last year by researchers for TxDOT. While most of the traffic is local, they counted 4,290 trucks of all kinds that could be moved off I-35 -- about 14% of overall traffic. Every normal weekday last year, up to 226,000 vehicles traveled past I-35 and Braker Lane on their way through the Austin region, the study found.

Compared to larger centers in Texas like Houston and its fuel transportation-based economy, truck accidents involving hazardous materials are relatively rare along Austin's piece of IH-35 and surrounding commuter corridors. But they do happen. Federal Hazardous Materials Safety Administration (FHMSA) data show since 2008, 91 spills involving some kind of dangerous truck cargo in Central Texas, most during loading or unloading.

The most dramatic happened during transit and include:

Oct 30th, 2010 – US183 and MoPac. 9,500 gallons of gasoline burned when a tanker rolled off an overpass. The intense heat threatened the structure's stability.

March 28th, 2012 – Toll 130 and Maha Loop. 9,500 gallons of gasoline burned when a car slammed into a tanker truck, killing the car's driver.

Sep 27th, 2012 – I-35 NB at Slaughter Lane. 2,900 gallons of a gasoline mix spilled when a tanker rolled into the grassy median. The driver said he veered to avoid an animal in the roadway. No one else was injured.

Probability of Future Events

The likelihood or future probability of occurrence of a hazardous materials release in the City of Austin planning area is low, with more than a 25 percent chance of an event occurring in a given year.

Vulnerability and Impact

Based on the prevalence and geographic proximity of hazardous materials transportation routes and fixed locations, the majority of the City of Austin's 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. 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.

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.

Hazardous Material Releases were included in the 2010 Plan, and also in this Update as toxic releases can have a substantial impact. 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.

Table 20-2. Critical Facilities Vulnerable to Hazardous Material Releases, 500 Meter Buffer

NAME	TYPE
East Sub-Station	Police Department
Station 10	EMS Station
Station 13	EMS Station
Demand 1	EMS Station
ALLAN ELEMENTARY	School
ZAVALA ELEMENTARY	School
UNIVERSITY OF TEXAS ELEMENTARY CHARTER SCHOOL	School

Table 20-2. Critical Facilities Vulnerable to Hazardous Material Releases, 2,500 Meter Buffer

NAME	TYPE
Main Headquarters	Police Department
North Austin Medical Center	Hospital
Seton Northwest Hospital	Hospital
Seton Southwest Hospital	Hospital
South Austin Medical Center	Hospital
University Medical Center at Brackenridge	EMS Station

NAME	TYPE
Station 01	EMS Station
Station 03	EMS Station
Station 04	EMS Station
Station 06	EMS Station
Station 07	EMS Station
Station 11	EMS Station
Station 12	EMS Station
Station 18	EMS Station
Demand 3	EMS Station
Headquarters	EMS Station
Education Development & Wellness Div	EMS Station
EMS Garage	EMS Station
HARMONY SCHOOL OF EXCELLENCE	School
TRAVIS COUNTY DAY SCHOOL	School
KIPP AUSTIN COLLEGIATE	School
THE EAST AUSTIN COLLEGE PREP ACADEMY	School
OAK MEADOWS ELEMENTARY	School
PIONEER CROSSING ELEMENTARY	School
EDEN PARK ACADEMY	School
AUSTIN CAN ACADEMY CHARTER SCHOOL	School
KIPP AUSTIN ACADEMY OF ARTS & LETTERS	School
GARCIA YOUNG MENS LEADERSHIP ACADEMY	School
HARMONY SCIENCE ACADEMY - AUSTIN	School
TRAVIS COUNTY JUVENILE DETENTION CENTER	School

NAME	TYPE
PHOENIX ACADEMY	School
SMALL MIDDLE	School
MCBEE ELEMENTARY	School
RODRIGUEZ ELEMENTARY	School
TEXAS EMPOWERMENT ACADEMY	School
LEADERSHIP ACADEMY	School
PLEASANT HILL ELEMENTARY	School
BATY ELEMENTARY	School
TRAVIS COUNTY STATE JAIL	School
CANYON CREEK ELEMENTARY	School
TRAVIS HIGH	School
ANDERSON HIGH	School
GARZA INDEPENDENCE HIGH	School
FULMORE MIDDLE	School
KEALING MIDDLE	School
BURNET MIDDLE	School
MARTIN MIDDLE	School
DOBIE MIDDLE	School
ALLISON ELEMENTARY	School
BLACKSHEAR ELEMENTARY	School
BROOKE ELEMENTARY	School
DAWSON ELEMENTARY	School
GOVALLE ELEMENTARY	School
METZ ELEMENTARY	School
OAK SPRINGS ELEMENTARY	School
ORTEGA ELEMENTARY	School

NAME	TYPE
SANCHEZ ELEMENTARY	School
ST ELMO ELEMENTARY	School
SUMMITT ELEMENTARY	School
SIMS ELEMENTARY	School
TRAVIS HEIGHTS ELEMENTARY	School
PATTON ELEMENTARY	School
PATTON ELEMENTARY	School
OAK HILL ELEMENTARY	School
BARRINGTON ELEMENTARY	School
NORMAN ELEMENTARY	School
PILLOW ELEMENTARY	School
HILL ELEMENTARY	School
GRAHAM ELEMENTARY	School
LINDER ELEMENTARY	School
HOUSTON ELEMENTARY	School
HART ELEMENTARY	School
GALINDO ELEMENTARY	School
DAVIS ELEMENTARY	School
COPPERFIELD ELEMENTARY	School
NOEL GRISHAM MIDDLE	School
CANYON VISTA MIDDLE	School
KATHY CARAWAY ELEMENTARY	School
PURPLE SAGE ELEMENTARY	School
POND SPRINGS ELEMENTARY	School
JOLLYVILLE ELEMENTARY	School
WALNUT CREEK ELEMENTARY	School

NAME	TYPE
GEORGE M KOMETZKY SCHOOL	School
AUSTIN DISCOVERY SCHOOL	School
INTERNATIONAL HIGH	School
KIPP AUSTIN COLLEGE PREP	School
AMERICAN YOUTHWORKS SERVICE LEARNING ACADEMY	School
EASTSIDE MEMORIAL AT JOHNSTON CAMPUS	School
HARMONY SCHOOL OF SCIENCE - AUSTIN	School
KIPP AUSTIN COMUNIDAD	School
KIPP AUSTIN CONNECTIONS ELEMENTARY	School
KIPP AUSTIN BEACON PREP	School
THE EAST AUSTIN COLLEGE PREP AT MLK	School
IDEA ALLAN COLLEGE PREP	School
PREMIER HIGH SCHOOL AT TRAVIS	School
IDEA ALLAN ACADEMY	School
DOBIE PK CENTER	School
GUERRERO THOMPSON ELEMENTARY	School
SAN JUAN DIEGO CATHOLIC HIGH SCHOOL	School
ST IGNATIUS MARTYR SCHOOL	School
CATHEDRAL SCHOOL OF ST MARY - AUSTIN	School
OUR SAVIOR LUTHERAN SCHOOL AUSTIN	School
BRENTWOOD CHRISTIAN SCHOOL	School
HOLY WORD LUTHERAN SCHOOL	School
AUSTIN MONTESSORI SCHOOL	School

NAME	TYPE
COUNTRY HOME LEARNING CENTER NO 8	School
COUNTRY HOME LEARNING CENTER NO 7	School
PADRON ELEMENTARY	School
ALTERNATIVE LEARNING CENTER	School

Section 21: Pipeline Failure

Hazard Description

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 21-1 shows the location of energy pipelines (gas and oil) in and around the City of Austin. Figure 21-2 shows the population density around the pipelines within the Austin Area. If any of these energy pipelines, oil or gas, were to rupture, such an event could endanger property and lives in the immediate area (up to 500 meters for immediate [primary] impact and up to 2,500 meters for secondary impact).

Figure 21-1. Location of Pipelines in City of Austin

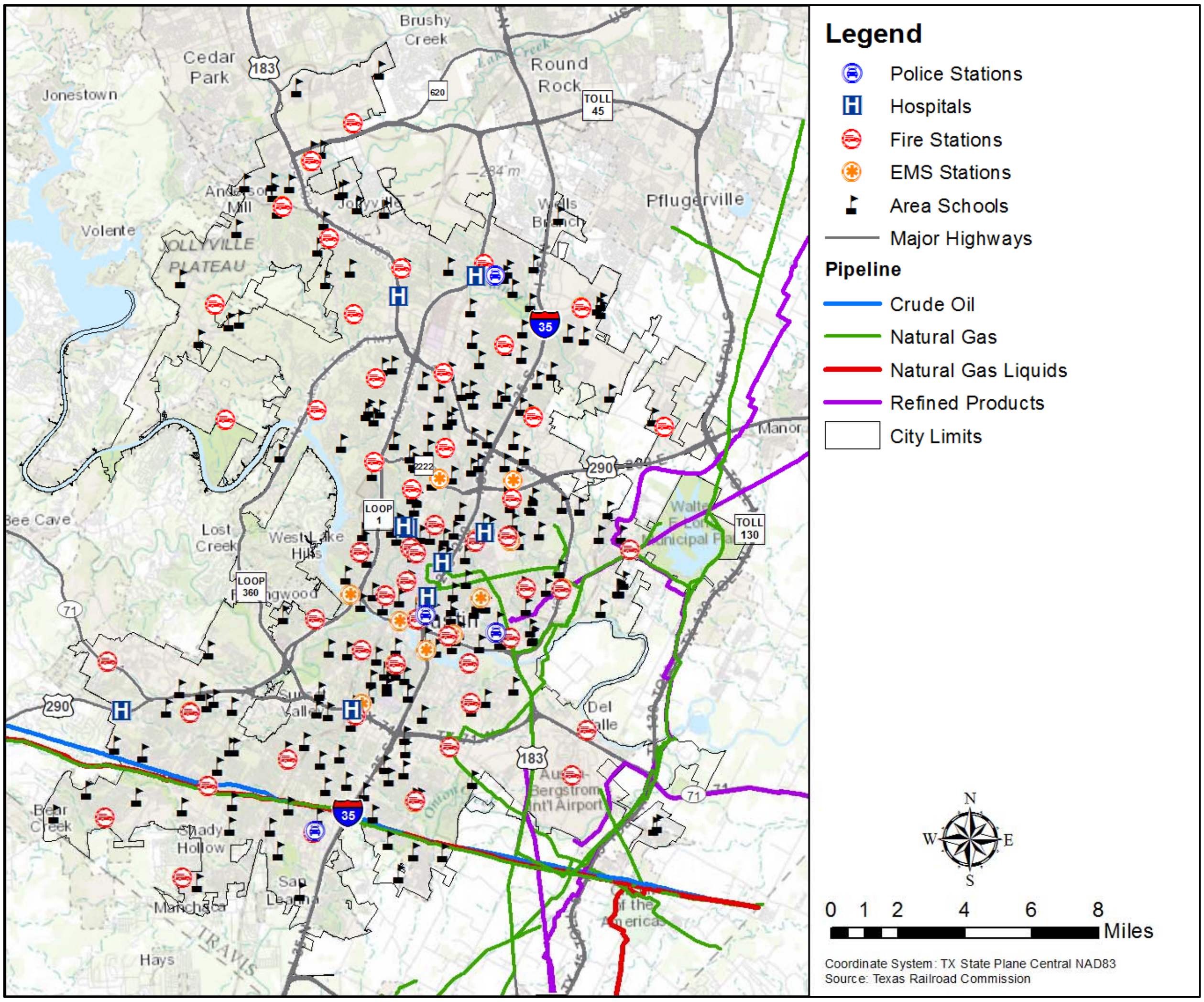
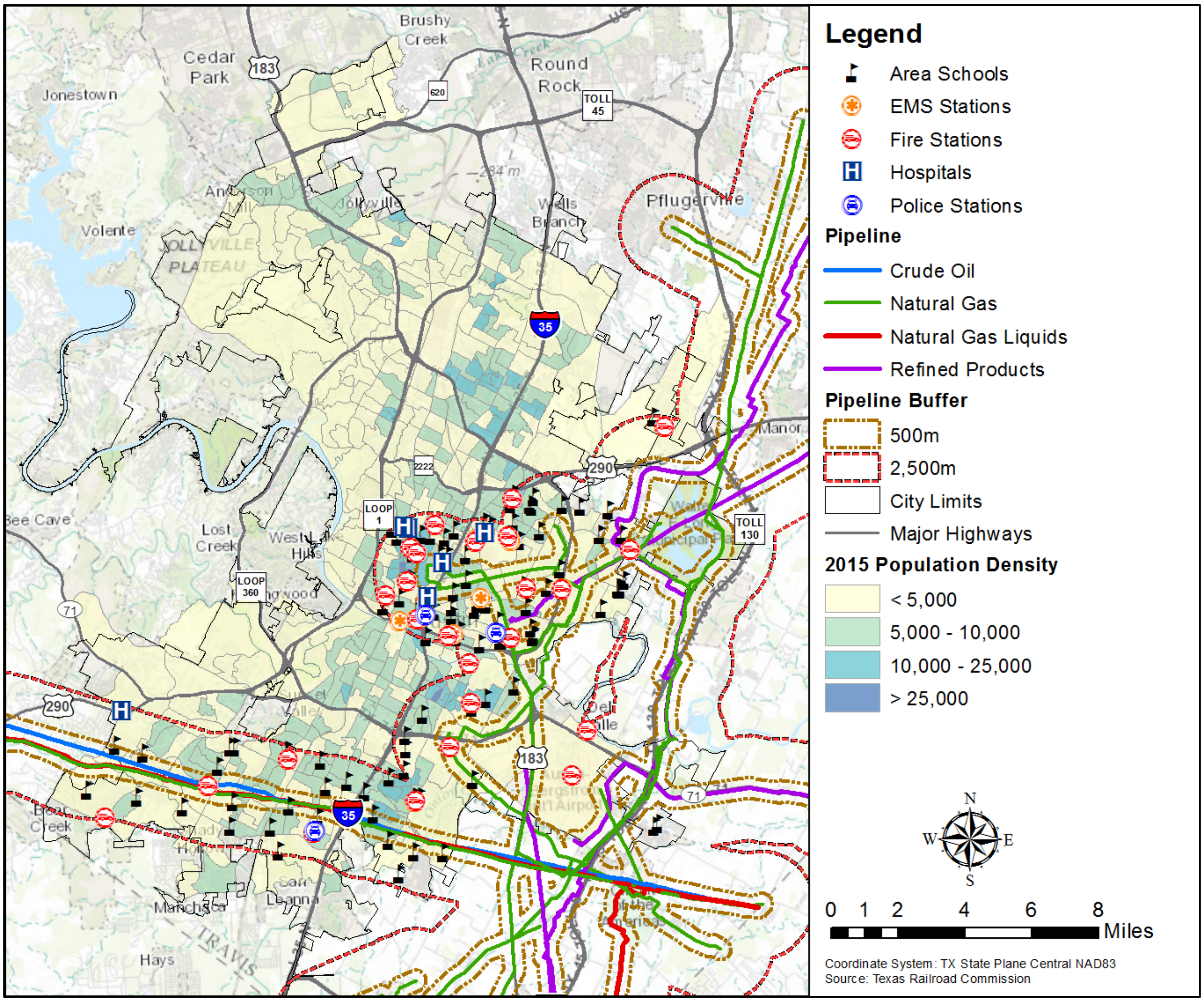


Figure 21-2. Pipelines & Population Density within City of Austin



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.

The spatial extent of a fuel pipeline breach is “Minimal,” expected to affect less than 10% of people and property in Austin.

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:

1. Fatality or injury requiring in-patient hospitalization;
2. $50,000 or more in total costs, measured in 1984 dollars;
3. Highly volatile liquid releases of 5 barrels or more, or other liquid releases of 50 barrels or more; and
4. 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.

Table 21-1. Historical Pipeline Events, 2004 – 2014

LOCATION	INCIDENT DATE	TYPE	INJURIES	DEATHS	OPERATOR
Austin	03/05/2004	Natural Gas	0	0	TEXAS GAS SERVICE COMPANY
Austin	07/18/2005	Gasoline	0	0	MAGELLAN PIPELINE COMPANY, L.P.
Austin	01/11/2007	Natural Gas	0	0	TEXAS GAS SERVICE COMPANY
Austin	05/03/2007	Natural Gas	0	0	TEXAS COMMUNITY PROPANE, LTD.
Austin	02/02/2009	Natural Gas	0	0	TEXAS GAS SERVICE COMPANY
Austin	03/05/2009	Natural Gas	0	0	TEXAS GAS SERVICE COMPANY
Austin	03/17/2009	Natural Gas	0	0	TEXAS GAS SERVICE COMPANY
Austin	01/09/2012	Natural Gas	1	1	TEXAS GAS SERVICE COMPANY

LOCATION	INCIDENT DATE	TYPE	INJURIES	DEATHS	OPERATOR
Austin	12/27/2012	Propane Gas	2	1	TEXAS COMMUNITY PROPANE, LTD.
Austin	08/13/2013	Crude Oil	0	0	MAGELLAN PIPELINE COMPANY, LP
Austin	12/03/2014	Gas	0	0	TEXAS GAS SERVICE COMPANY, A DIVISION OF ONE GAS, INC.

More information on historical incidents:

- October 8, 1959. A 10 inch propane pipeline burst in Austin, Texas. 400 families had to be evacuated due to the explosion and fire hazard. Eventually, the fumes dissipated without incident. The rupture was caused by a weak section of pipe.
- February 22, 1973. In Austin, Texas, a 19 inch natural gas liquids (NGL) pipeline ruptured due to an improper weld. A passing truck appeared to set off a vapor cloud explosion and fire. Six people were killed, and 2 others injured.
- January 9, 2012. A man was killed, and another person injured, in a fiery house explosion in Austin, Texas, from a leaking 4-inch cast iron gas main installed in 1950. Gas had been smelled in the area for several weeks prior to this. Gas company crews had looked along the affected property for a leak, but were unable to find it.
- August 14, 2013. A leak developed on a valve on Longhorn Pipeline in Austin, Texas during maintenance, spilling about 300 gallons of crude oil. There were no evacuations.

Probability of Future Events

The likelihood or future probability of occurrence of a pipeline failure in the City of Austin is low, with more than a 25 percent chance of an event occurring in a given year.

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. Both types of impact can inflict substantial damage on the surrounding areas. These buffer areas are depicted above, in Figure 21-2. The severity of impact depends on a variety of factors, including type of pipeline and volume released; weather conditions; prevailing winds; time of day; and presence of ignition source. Pipeline breaches have the potential to cause multiple deaths and complete shutdown of facilities for 30 days or more.

Pipelines traverse the watersheds that supplies water to the City, including those that supply water to well-dependent residents and environmentally-sensitive areas such as Barton Springs and the Edwards Aquifer. A leak or spill from these pipelines could threaten neighborhoods, contaminate water supplies, or pollute environmentally-sensitive land. A pipeline accident could have a major impact by causing injuries that result in death or permanent disability or completely shutting down critical facilities.

Pipeline failure can have a “major” impact on human health and area properties. Pipeline failure events can cause injuries, illnesses, and result in permanent disability. These events can also cause facilities in the City planning area to shut-down for at least two weeks and cause more than twenty-five percent of affected properties to be destroyed or suffer major damage.

Section 22: Mitigation Strategy

Mitigation Goals

Based on the results of the risk and capability assessments, the Planning Team developed and prioritized the mitigation strategy. This involved utilizing the results of both assessments and reviewing the goals and objectives that were included in the previous 2010 Plan.

At the Mitigation Workshop in August 2015, Planning Team members reviewed the mitigation strategy from the previous 2010 Plan. The consensus among all members present was that the strategy developed for the 2010 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.

Objective 2.3

Build hazard mitigation concerns into 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.

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 23: Previous Actions

Summary

Planning Team members were given copies of the previous mitigation actions submitted in the 2010 Plan at the mitigation workshop. The City of Austin 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. The actions from the 2010 Plan are included in this section as they were written in 2010, with the exception of the “2015 Analysis” section.

City of Austin

City of Austin (Past Action) – 1	
Proposed Action:	**Develop a geospatially coded tool that will allow users to: use climate-related EPHI (environmental public health indicator) surveillance to plan and prioritize environmental management decisions and policy changes related to climate change; track the likely impact of policy decisions over temporal and geographic scales; assess progress toward protecting public health; and, trigger emergency alerts when identified key variables coincide.**
BACKGROUND INFORMATION	
Site and Location:	Austin, Texas Travis County, Texas
History of Damages:	**Extreme Heat**: 8 mortalities from 1999-2000 reported to NCDC. 9 mortalities in 2002-2004 reported by TX Dept of State Health Services Department of Health Statistics. **Flood**: 4 mortalities, 61 injuries, $590K property damage from 2001-2007 reported to NCDC.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Flood, Wildland Fire, Drought, Extreme Heat
Effect on new/existing buildings:	Extreme heat can compromise the habitability of buildings with little or no insulation, no radiant barrier, and/or lacking air conditioning. Flooding can cause structural and moisture damage.
Priority (High, Moderate, Low):	High
Estimated Cost:	$500,000
Potential Funding Sources:	US EPA
Lead Agency/Department Responsible:	Austin/Travis County Department of Health and Human Services
Target Completion Date:	2011-2013

2015 Analysis:
Completed *– The Travis County Health and Human Services Department (HHSD) currently conducts public health surveillance on heat-related illness and mortality. This completed mitigation action did not include HHSD Epidemiology or emergency preparedness staff responsible for conducting public health surveillance. HHSD Epidemiology and Health Statistics Unit utilizes other analytical methods to assess the impact of heat on the community.* See new Action Item #1.*

City of Austin (Past Action) – 2	
Proposed Action:	**Establish new data gathering techniques and data sharing agreements across departments to improve environmental public health surveillance.**
BACKGROUND INFORMATION	
Site and Location:	Austin, Texas Travis County, Texas
History of Damages:	**Extreme Heat**: 8 mortalities from 1999-2000 reported to NCDC. 9 mortalities in 2002-2004 reported by TX Dept of State Health Services Department of Health Statistics. **Flooding**: 4 mortalities, 61 injuries, $590K property damage from 2001-2007 reported to NCDC.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Flood, Wildland Fires, Drought, Extreme Heat
Effect on new/existing buildings:	Extreme heat can compromise the habitability of buildings with little or no insulation, no radiant barrier, and/or lacking air conditioning. Flooding can cause structural and moisture damage.
Priority (High, Moderate, Low):	High
Estimated Cost:	$500,000 - $2,000,000
Potential Funding Sources:	US EPA
Lead Agency/Department Responsible:	Austin/Travis County Department of Health and Human Services
Target Completion Date:	2011-2013

2015 Analysis:
Completed *– HHSD uses syndromic surveillance data and mortality data to assess the impact from extreme weather. Data are summarized and distributed as defined in the City of Austin Heat Plan.*

City of Austin (Past Action) – 3	
Proposed Action:	**Implement urban heat island mapping.**
BACKGROUND INFORMATION	
Site and Location:	Map pockets of heat throughout the area in Travis County to see where measures need to be taken to reduce the heat impact.
History of Damages:	Seasonal extreme temperature for the city leads to harmful effects to health.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Extreme Heat
Effect on new/existing buildings:	Potential for reflective or green roofs to keep existing buildings cool.
Priority (High, Moderate, Low):	High
Estimated Cost:	TBD
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	Austin Climate Protection Program (ACPP)
Target Completion Date:	Eighteen months after receipt of funding

2015 Analysis:
Delete Action *– Action was not completed. There is no process to use the data if gathered, gathering the data would negatively alter the operations of…, and therefore this exercise would not be useful.*

City of Austin (Past Action) – 4	
Proposed Action:	**Develop a study to determine the relationship between allergies and climate change.**
BACKGROUND INFORMATION	
Site and Location:	Citywide
History of Damages:	Allergies increase as the city experiences more extreme weather, especially extreme heat. The purpose of the study would be to determine the relationship between climate change and the increase in allergies.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Extreme Heat, Infectious Disease, Drought
Effect on new/existing buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	TBD
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	ACPP in coordination with the Health Dept. and UT
Target Completion Date:	Twelve months after receipt of funds

2015 Analysis:
Delete Action – *Action was not completed. No demand for this information. Allergies are not a mandated notifiable disease condition. Without a specific case definition for “allergies” this condition cannot be tracked or quantified.*

City of Austin (Past Action) – 5	
Proposed Action:	**Institute a tree planting program to reduce heat island impacts and flood damage.**
BACKGROUND INFORMATION	
Site and Location:	Citywide
History of Damages:	The city experiences seasonal flooding and extreme temperature. Planting trees will help reduce floodwaters and also reduce temperatures.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Extreme Heat, Flood
Effect on new/existing buildings:	Planting trees around existing buildings will help keep temperature down as well as reduce energy cost. In addition, trees can help to reduce the effect of floodwaters.
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	TBD
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	ACPP
Target Completion Date:	TBD

2015 Analysis:
Completed *– Austin's Urban Forest Plan was adopted by Austin City Council on Thursday March 6th, 2014 which outlines future tree planting goals.*

City of Austin (Past Action) – 6	
Proposed Action:	**Complete a study to determine the effect thermal comfort/power outages have on people.**
BACKGROUND INFORMATION	
Site and Location:	Citywide
History of Damages:	The city experiences high temperatures throughout the summer and is currently experiencing record heat for 2009. Although winters are milder in Austin, power outages are common.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Extreme Heat, Winter Storm
Effect on new/existing buildings:	This action would determine the effect on people rather than property
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	TBD
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	ACPP
Target Completion Date:	TBD

2015 Analysis:
Delete Action *– Action was not completed. No demand for this study by any City or AISD departments.*

		City of Austin (Past Action) – 7
	Proposed Action:	**Complete a study for the Capitol Metropolitan region to downscale US climate change models to show climate change impacts expected in our region.**
	BACKGROUND INFORMATION	
	Site and Location:	Region-wide
	History of Damages:	The city is in a period of record drought for 2009 which leads to wildfires and water shortage.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Extreme Heat, Wildland Fire, Drought, Flood, Infectious Disease
Effect on new/existing buildings:	This action would determine the effect on people rather than property
Priority (High, Moderate, Low):	High
Estimated Cost:	TBD
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	ACPP
Target Completion Date:	2011 and Ongoing

2015 Analysis:
Completed – *The Central Texas Extreme Weather and Climate Change Vulnerability Assessment of Regional Transportation Infrastructure was one of 19 Federally sponsored projects nationwide intended to "pilot approaches to conduct climate change and extreme weather vulnerability assessments of transportation infrastructure and to analyze options for adapting and improving resiliency." The Assessment was led by the Capital Area Metropolitan Planning Organization, or CAMPO, in partnership with the City of Austin, and features the contributions of other state, regional, and local entities.*

City of Austin (Past Action) – 8	
Proposed Action:	**Develop a study to determine the relationship between infectious disease and climate change.**
BACKGROUND INFORMATION	
Site and Location:	Citywide
History of Damages:	No history currently, but as we start to see climate change impacts in our region it would be useful to develop a study to prepare for potential increases in infectious diseases.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Extreme Heat, Infectious Disease, Drought
Effect on new/existing buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	TBD
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	ACPP in coordination with the Health Dept. and UT
Target Completion Date:	Twelve months after receipt of funds

2015 Analysis:
Completed – *The Health Department does track infectious diseases (specifically arboviruses) that could be affected by extreme weather.*

		City of Austin (Past Action) – 9
	Proposed Action:	**Develop Community Wildfire Protection Plan for the City of Austin and/or surrounding communities.**
	BACKGROUND INFORMATION	
	Site and Location:	City of Austin and surrounding communities/natural areas.
	History of Damages:	There is limited data on the damages resulting from wildfires and few damaging wildfires have been identified, however the potential is generally accepted to be moderate to high.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Wildland Fire
Effect on new/existing buildings:	Increased protection of new and existing structures
Priority (High, Moderate, Low):	High
Estimated Cost:	Dependent on design - $200,000 for contract-reduced direct cost if done by city staff
Potential Funding Sources:	Dependent on design - Department budgets and/or grants
Lead Agency/Department Responsible:	Dependent on design – AFD, HSEM. and/or interagency working group
Target Completion Date:	Dependent on design – 6 months to 1 year

2015 Analysis:
Completed *– The Community Wildfire Protection Plan (CWPP) was developed in a collaborative manner and adopted by Austin and Travis County.*

City of Austin (Past Action) – 10	
Proposed Action:	**Establish an interdepartmental/interagency wildland fuels crew to implement mechanical fuel reduction projects, conduct prescribed burns, and suppress wildland fires.**
BACKGROUND INFORMATION	
Site and Location:	City of Austin and surrounding communities/natural areas
History of Damages:	There is limited data on the damages resulting from wildfires and few damaging wildfires have been identified, however the potential is generally accepted to be moderate to high.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Wildland Fire
Effect on new/existing buildings:	Increased protection on new/existing structures
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Dependent on design - 6 person crew - $500,000/yr plus $200,000 startup expenses
Potential Funding Sources:	Dependent on design - Department budgets and/or external partners
Lead Agency/Department Responsible:	Dependent on design – Wildland fire management agency that follows the National Wildfire Coordinating Group (NWCG) standards
Target Completion Date:	Dependent on design – multi-year, year round

2015 Analysis:
Completed *– The Austin Fire Department established a Wildfire Mitigation Division to address hazardous fuels reduction including mechanical Fuel Reduction projects, Prescribed Burns and Wildland Fire Suppression.*

City of Austin (Past Action) – 11	
Proposed Action:	**Establish a position for an interdepartmental/interagency wildland fire and/or wildland urban interface program coordinator.**
BACKGROUND INFORMATION	
Site and Location:	City of Austin and surrounding communities/natural areas
History of Damages:	There is limited data on the damages resulting from wildfires and few damaging wildfires have been identified, however the potential is generally accepted to be moderate to high.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Wildland Fire
Effect on new/existing buildings:	Increased protection on new/existing Structures
Priority (High, Moderate, Low):	High
Estimated Cost:	Dependent on design - $150,000/yr
Potential Funding Sources:	Dependent on design - Department budgets and/or external partners
Lead Agency/Department Responsible:	Dependent on design – AFD, HSEM, or wildland fire management agency that follows NWCG standards
Target Completion Date:	Dependent on design – multi-year, year round

2015 Analysis:
Completed *– The Austin Fire Department established a Wildfire Mitigation Division which includes a Wildfire Mitigation Program Manager position that is equivalent to a Wildland Urban Interface (WUI) program Coordinator.*

City of Austin (Past Action) – 12	
Proposed Action:	**Expand the capability of the city's communication system for citizens.**
BACKGROUND INFORMATION	
Site and Location:	Citywide
History of Damages:	The City has a 24-hour notification system, but a new system is needed that is more interactive. The new system will allow citizens to review documents and respond to the City. This system would provide efficient/user-friendly site without a webmaster.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Dam Failure, Drought, Extreme Heat, Flood, Hail, Hazardous Material Release, Hurricane Wind, Infectious Disease, Pipeline Failure, Tornado, Thunderstorm, Terrorism, Wildland Fire, Winter Storm
Effect on new/existing buildings:	N/A
Priority (High, Moderate, Low):	N/A
Estimated Cost:	$100,000
Potential Funding Sources:	Grant funds for a pilot program
Lead Agency/Department Responsible:	HSEM
Target Completion Date:	2009 and ongoing

2015 Analysis:
***Completed*.**

City of Austin (Past Action) – 13	
Proposed Action:	**Conduct a large-scale public education program on the home care and treatment of individuals and family members during a pandemic influenza.**
BACKGROUND INFORMATION	
Site and Location:	Citywide
History of Damages:	Pandemics have occurred in 1918, 1956, 1967 and 2009.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Infectious Disease
Effect on new/existing buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	FEMA and CDC grants
Lead Agency/Department Responsible:	HSEM, HHSD
Target Completion Date:	September 2009

2015 Analysis:
Completed *– The City of Austin Office of Homeland Security and Emergency Management (HSEM) distributes public information on ways to prevent the flu, through their annual preparedness calendar.*

		City of Austin (Past Action) – 14
	Proposed Action:	**Construct a multi-purpose structure that could provide an ongoing commercial purpose until needed, at which point it could be re-configured as a disaster-safe shelter.**
	BACKGROUND INFORMATION	
	Site and Location:	Downtown Austin
	History of Damages:	The City has routinely opened shelters as a result of a CASHP activation and winter weather events.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Extreme Heat, Infectious Disease, Winter Storm
Effect on new/existing buildings:	May require new construction as well as the demolition of existing structures depending on the ultimate location of the facility
Priority (High, Moderate, Low):	High
Estimated Cost:	$10,000,000 to $15,000,000
Potential Funding Sources:	Grants and private funding
Lead Agency/Department Responsible:	Building Services
Target Completion Date:	18 months after receipt of funds

2015 Analysis:
***Delete Action*.**

		City of Austin (Past Action) – 15
	Proposed Action:	**Retrofit AISD facilities for wind resistance/safe room.**
	BACKGROUND INFORMATION	
	Site and Location:	Austin ISD locations and critical facilities
	History of Damages:	Austin ISD area schools housed evacuees from Hurricane Ike and also were minimally damaged from hurricane winds. Stronger windows are needed to resist hurricane winds and also damage from hail, ice or flooding during a hazard event.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Hurricane Wind, Tornado, Winter Storm, Hail, Thunderstorm, Flood
Effect on new/existing buildings:	This action would strengthen current buildings by making them more resistant to hurricane and high winds.
Priority (High, Moderate, Low):	High
Estimated Cost:	TBD
Potential Funding Sources:	Federal and state grants
Lead Agency/Department Responsible:	AISD – Office of Homeland Security and Emergency Management
Target Completion Date:	2010-2011

2015 Analysis:
Defer Action *– Will include in 2015 Plan Update.*

City of Austin (Past Action) – 16	
Proposed Action:	**Develop an AISD center that will also function as a disaster-safe shelter.**
BACKGROUND INFORMATION	
Site and Location:	To be determined
History of Damages:	During Hurricane Ike, Austin area schools housed evacuees. Supplies were short and also there was not enough available space. A disaster-safe shelter could provide room for evacuees, a shelter for the Austin community, and also function as an auditorium or gym for AISD.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Dam Failure, Flood, Hail, Hazardous Material Release, Hurricane Wind, Infectious Disease, Thunderstorm, Terrorism, Tornado, Wildland Fire, Winter Storm
Effect on new/existing buildings:	This action would allow for more efficient use of current buildings as well as the development of a new shelter
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$2,500,000
Potential Funding Sources:	Federal and state grants
Lead Agency/Department Responsible:	AISD – Office of Homeland Security and Emergency Management
Target Completion Date:	2010-2011

2015 Analysis:
Defer Action *– Will include in 2015 Plan Update.*

City of Austin (Past Action) – 17	
Proposed Action:	**Develop an awareness campaign for extreme temperature and promote through the City of Austin Website, home safe calendar and pamphlets to neighborhood associations.**
BACKGROUND INFORMATION	
Site and Location:	Citywide
History of Damages:	Because the city experiences mild winter, many residents do not properly protect their property or enact home mitigation measures. In addition the city experience extreme heat every summer. Heat strokes and even fatalities can occur if citizens are unaware of the dangers of extreme heat.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Extreme Heat, Winter Storm
Effect on new/existing buildings:	Retrofit existing structures and construct new structures with double pane windows and other methods to reduce effects of extreme heat and winter storm
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000 annually
Potential Funding Sources:	Federal and state grants/ general revenue
Lead Agency/Department Responsible:	HSEM, Public Health Dept., EMS
Target Completion Date:	2010 and ongoing

2015 Analysis:
Completed *– HSEM produces and distributes a highly popular calendar and children's workbook to the public, that promotes the concept of extreme heat awareness.*

City of Austin (Past Action) – 18	
Proposed Action:	**Develop a safe room program to retrofit residences in order to protect against a tornado or hurricane wind event.**
BACKGROUND INFORMATION	
Site and Location:	To be determined
History of Damages:	During Hurricane Ike, the City experienced high winds and often is prone to mild tornados which cause damage to buildings and property and threaten the safety of citizens.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Tornado, Hurricane Wind
Effect on new/existing buildings:	This action would strengthen existing buildings and residences by making them more resistant to damage from tornadoes and hurricane winds
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$6,000 per safe room
Potential Funding Sources:	Federal Grants
Lead Agency/Department Responsible:	HSEM
Target Completion Date:	To be implemented after receipt of funds

2015 Analysis:
Defer Action *– Will include in 2015 Plan Update.*

City of Austin (Past Action) – 19	
Proposed Action:	**Conduct public awareness campaign for realtors, insurance agents, lenders, surveyors and other professionals on benefits of flood insurance under the National Flood Insurance Program (NFIP).**
BACKGROUND INFORMATION	
Site and Location:	Citywide
History of Damages:	Austin experiences flooding and flash flooding which leads to damage to property and even fatalities. The NFIP benefits those who have purchased flood insurance for their homes. More training is needed regarding policies for agents, lenders and other professionals.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Flood, Thunderstorm
Effect on new/existing buildings:	This action would reduce the impact of flooding for existing and new structures
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time
Potential Funding Sources:	General Revenue
Lead Agency/Department Responsible:	Partner with other associations and groups currently providing NFIP training
Target Completion Date:	Ongoing

2015 Analysis:
Ongoing Action *– Will include in 2015 Plan Update.*

City of Austin (Past Action) – 20	
Proposed Action:	**Increase public awareness regarding the National Flood Insurance Program (NFIP) and Preferred Risk Policy for residents outside of the Special Flood Hazard Area (SFHA).**
BACKGROUND INFORMATION	
Site and Location:	Citywide
History of Damages:	Austin experiences flooding and flash flooding which leads to damage to property and even fatalities. Flood insurance provides protection to those who have purchased flood insurance for their homes. Over 30% of NFIP claims occur outside of the SFHA.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Flood, Thunderstorm
Effect on new/existing buildings:	This action would result in stronger buildings if citizens purchased flood insurance
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000 per year
Potential Funding Sources:	Grants and general revenue
Lead Agency/Department Responsible:	HSEM – partnering with organizations providing free NFIP training where available.
Target Completion Date:	Annually

2015 Analysis:
***Ongoing Action** – Will include in 2015 Plan Update.*

City of Austin (Past Action) – 21	
Proposed Action:	**Install perimeter lighting at Tom Miller, Decker and Longhorn Dam.**
BACKGROUND INFORMATION	
Site and Location:	Tom Miler Dam – 20.294°N, 97.786°W Decker Dam – 30.285°N, 97.597°W Longhorn Dam – 30.250° N, 97.714°W
History of Damages:	The city has not experienced a major dam failure since the early 1930s. Perimeter lighting would help increase security at the above locations.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Dam Failure, Terrorism
Effect on new/existing buildings:	Prevent flood damage to existing structures within the inundation area for each dam
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	TBD
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	HSEM
Target Completion Date:	2011

2015 Analysis:
Defer Action *– Will include in 2015 Plan Update.*

City of Austin (Past Action) – 22	
Proposed Action:	**Strengthen access restrictions at Tom Miller, Decker and Longhorn Dam.**
BACKGROUND INFORMATION	
Site and Location:	Tom Miler Dam – 20.294°N, 97.786°W Decker Dam – 30.285°N, 97.597°W Longhorn Dam – 30.250° N, 97.714°W
History of Damages:	Although the last major dam failure occurrence for the City was the result of a flood in the 1930s, access restrictions are necessary in light of concerns for terrorism since 9/11.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Dam Failure, Terrorism
Effect on new/existing buildings:	Prevent flood damage to existing structures within the inundation area for each dam
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	TBD
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	HSEM
Target Completion Date:	2011

2015 Analysis:
***Defer Action** – Will include in 2015 Plan Update.*

City of Austin (Past Action) – 23	
Proposed Action:	**Purchase communication equipment for uniform communication capability among first responders in the event of a pipeline failure or hazardous material spill.**
BACKGROUND INFORMATION	
Site and Location:	Citywide
History of Damages:	The city does not have radio equipment that would be safe to use to communicate nearby a hazardous material release or pipeline failure. Technology is currently available for radios that would allow for communication even in a volatile environment.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Pipeline Failure, Hazardous Material Release, Terrorism
Effect on new/existing buildings:	This action enhances communicability between responders and does not directly impact new/existing buildings
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	TBD
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	HSEM
Target Completion Date:	2010-2011 with replacements as needed

2015 Analysis:
Defer Action *– Will include in 2015 Plan Update. Should consider expanding partners to assist with the implementation of this action, such as AFD HazMat and CTM Wireless.*

City of Austin (Past Action) – 24	
Proposed Action:	**Increase public awareness of the dangers of pipeline failure through the Pipeline Safety Trust, a NFP Public charity in order to promote fuel transportation safety.**
BACKGROUND INFORMATION	
Site and Location:	Citywide
History of Damages:	Pipeline failure may occur due to ruptures or terrorism.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Pipeline Failure, Terrorism
Effect on new/existing buildings:	This action does not directly affect new/existing buildings
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	HSEM
Target Completion Date:	2011

2015 Analysis:
Defer Action *– Will include in 2015 Plan Update.*

		City of Austin (Past Action) – 25
	Proposed Action:	**Develop a public awareness campaign to encourage citizens to purchase NOAA weather radios.**
	BACKGROUND INFORMATION	
	Site and Location:	Citywide
	History of Damages:	NOAA weather radios keep citizens informed in the event of a natural disaster. These radios are available for purchase at many locations throughout the city, such as HEB.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Thunderstorm, Hail, Flood, Tornado, Hurricane Wind, Winter Storm
Effect on new/existing buildings:	NOAA radios allow citizens to take measures to protect their property and existing buildings in the event of a natural disaster
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Minimal
Potential Funding Sources:	General Fund
Lead Agency/Department Responsible:	HSEM
Target Completion Date:	To be implemented annually

2015 Analysis:
Completed *– Information on NOAA weather radios is included in the publicly distributed HSEM calendar and children's workbook.*

City of Austin (Past Action) – 26	
Proposed Action:	**Conduct study to determine specific buildings and critical facilities that could be upgraded to Green Building Status.**
BACKGROUND INFORMATION	
Site and Location:	To be determined
History of Damages:	In 2007 the National Association of Home Builders (NAHB) and the International Code Council (ICC) partnered to form to establish a much-needed and nationally-recognizable standard definition of what is meant by "Green Building". This would help buildings to conserve energy, but also make critical facilities more resistant to natural hazards.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Thunderstorm, Hail, Extreme Heat, Winter Storm, Tornado, Flood
Effect on new/existing buildings:	This would increase energy savings and costs for existing buildings, but also affect the development of new buildings, as they are built to a higher standard
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	To be determined based on the study results
Potential Funding Sources:	City funds, Grants
Lead Agency/Department Responsible:	Building Services / Green Building
Target Completion Date:	Complete study by 2011

2015 Analysis:
***Delete Action*.**

City of Austin (Past Action) – 27	
Proposed Action:	**Promote the Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) through the City of Austin's Public Awareness Week.**
BACKGROUND INFORMATION	
Site and Location:	Outlying and rural areas of the City of Austin
History of Damages:	Although the City experiences little snow, it is often prone to floods and hail events, the most recent in the Spring of 2009.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Hail, Thunderstorm, Winter Storm
Effect on new/existing buildings:	This action would help for monitoring rain and hail events to better report historical occurrences; thereby identifying areas and existing buildings that are not properly protected
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Negligible
Potential Funding Sources:	General Revenue
Lead Agency/Department Responsible:	Watershed Department in conjunction with the National Weather Service
Target Completion Date:	Annually – every March

2015 Analysis:
Completed – *Along with cooperation from the National Weather Service and Texas Floodplain Managers Association, the City of Austin has promoted CoCoRaHS at outreach events such as SkyWarn, WeatherFest, and other events.*

City of Austin (Past Action) – 28	
Proposed Action:	**Install additional flashing lights at low water crossings at areas additionally annexed to the City.**
BACKGROUND INFORMATION	
Site and Location:	There have been several low water crossing areas that were recently annexed to Austin. The following locations need flashing warning lights: 10140 Old San Antonio Road, 6100 W. Slaughter, 10100 David Moore Drive, 9708 Carson Creek Boulevard, 600 block of W. Dittmar at Cooper Lane (single lane bridge crossing), Slaughter Creek Drive in the Hollow at Slaughter Creek, Bilbrook Place, E. Dessau Road, 12000 and 12100 Cameron Road, Burleson Road (south of the Bergstrom Airport), S. Brodie Lane
History of Damages:	Austin experiences torrential floods every year. More warnings are needed at low water crossings to prevent people from driving through dangerous areas.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Thunderstorm, Hail, Flood
Effect on new/existing buildings:	This would protect lives and property, but mainly vehicles rather than buildings.
Priority (High, Moderate, Low):	High
Estimated Cost:	Up to $10,000 per crossing
Potential Funding Sources:	HMGP, CDBG, PDM grants
Lead Agency/Department Responsible:	Watershed Dept.
Target Completion Date:	To be installed by 2012

2015 Analysis:
***Completed** – The flashing lights have been installed and successful in alerting drivers to the locations and flooding status of frequently flooded low water crossings.*

City of Austin (Past Action) – 29	
Proposed Action:	**Create a neighborhood and community plan, including drills and exercises to educate the public regarding the location of pipelines and actions to take in the event of a hazardous material spill.**
BACKGROUND INFORMATION	
Site and Location:	Citywide
History of Damages:	The city has experienced few man-caused events, but citizens should be aware of procedures and locations of hazardous areas.

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Pipeline Failure, Hazardous Material Release
Effect on new/existing buildings:	This action primarily concerns protecting lives instead of directly effecting buildings.
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Minimal cost as partnering opportunities are available
Potential Funding Sources:	General Revenue and grants where available
Lead Agency/Department Responsible:	Austin Fire Department; Watershed Protection and Development Services
Target Completion Date:	Ongoing

2015 Analysis:
Defer Action *– Will include in 2015 Plan Update.*

City of Austin (Past Action) – 30	
Proposed Action:	**Develop and implement shelter-in-place training for AISD schools and city buildings to mitigate against hazardous material releases.**
BACKGROUND INFORMATION	
Site and Location:	Critical infrastructure and schools throughout the city.
History of Damages:	The City has had few spill events and has not been affected by a major occurrence. However employees, students, teachers and citizens should be aware of proper procedures for shelter-in-place

MITIGATION ACTION DETAILS	
Primary Hazard Addressed:	Hazardous Material Release
Effect on new/existing buildings:	This activity would help to protect people in the event of a spill and would not negatively affect existing buildings
Priority (High, Moderate, Low):	High
Estimated Cost:	Minimal
Potential Funding Sources:	Staff time
Lead Agency/Department Responsible:	AISD, Building Services
Target Completion Date:	Ongoing

2015 Analysis:
Completed *– Through a table top functional exercise and drill in partnership with members of the pipeline safety industry the action was addressed.*

Section 24: Mitigation Actions

Summary

As discussed in Section 2, at the mitigation workshop the planning team and stakeholders met to developed mitigation actions for each of the natural and man-caused hazards included in the Plan. Each of the actions in this section were prioritized based on FEMA's STAPLEE criteria, which includes consideration of the social, technical, administrative, political, legal, economic, and environmental factors necessary for the implementation of each action. As a result of this exercise, an overall priority was assigned to each mitigation 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 all costs associated with it. As a result of this exercise, a ranking 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 prioritized for implementation 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 may not be implemented until "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.

City of Austin

City of Austin – Action #1	
Proposed Action:	**Educate FloodPro website as a tool for the public to determine if their home or property is in the 100 year floodplain. Teach communities mitigation ideas for flood-proofing their homes.**
BACKGROUND INFORMATION	
Site and Location:	City of Austin
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce risk to properties throughout City from flood, reduce risk to residents in floodplain areas.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on new/existing buildings:	This would increase situational awareness about flood risks to homes in Austin
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	TBD
Potential Funding Sources:	General Revenue, HMGP/CDBG/PDM Grants
Lead Agency/Department Responsible:	WPD
Implementation Schedule:	2016
Incorporation into Existing Plans:	Emergency Operations Plan, Floodplain Management Plan, Flood Response Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 5; Legal = 4; Economically Sound = 3; and Environmentally Sound = 5

		City of Austin – Action #2
	Proposed Action:	**Construct additional data centers to continue use of critical systems during a technological disruption.**
	BACKGROUND INFORMATION	
	Site and Location:	To be determined
	Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	The City is exposed to extended outages due to reliance on only one data center. This data center has several exposures which could result in extended outages, causing total loss of critical systems needed for public safety.
	Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Technological Disruption
Effect on new/existing buildings:	Lack of infrastructure redundancy
Priority (High, Moderate, Low):	High
Estimated Cost:	$15-$30 million
Potential Funding Sources:	HGMP, Homeland Security grants
Lead Agency/Department Responsible:	Communications & Technology Management
Implementation Schedule:	2017-2020
Incorporation into Existing Plans:	Information Technology Strategy

COMMENTS:
Possible purchase/lease and build out of a data center, or leasing space in hosting facility.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 5; Politically Acceptable = 4; Legal = 3; Economically Sound = 5; and Environmentally Sound = 4

City of Austin – Action #3	
Proposed Action:	**Move public facing services to the cloud to allow for continuity of services in the event of denial of service attacks (DOS).**
BACKGROUND INFORMATION	
Site and Location:	To be determined
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	The City is exposed to denial of service attacks (DOS). Given that the city has limited resources (network, servers), an extended DOS attack will result in unavailability of services.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Cyber, Terrorism, Technological Disruption
Effect on new/existing buildings:	Single point of attack, limited resources
Priority (High, Moderate, Low):	High
Estimated Cost:	TBD
Potential Funding Sources:	HGMP, Homeland Security grants
Lead Agency/Department Responsible:	Communications & Technology Management
Implementation Schedule:	2016-2017
Incorporation into Existing Plans:	Information Technology Strategy

COMMENTS:
Reduction of data center requirements.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5

		City of Austin – Action #4
	Proposed Action:	**Provide a Data Loss Protection System to reduce the likeliness of data loss.**
	BACKGROUND INFORMATION	
	Site and Location:	City of Austin
	Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	The City could experience high costs to remediate data loss of Personally Identifiable Information (PII).
	Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Cyber, Technological Disruption, Terrorism
Effect on new/existing buildings:	None
Priority (High, Moderate, Low):	High
Estimated Cost:	$750,000
Potential Funding Sources:	HGMP, Homeland Security grants
Lead Agency/Department Responsible:	Communications & Technology Management
Implementation Schedule:	2016-2017
Incorporation into Existing Plans:	Information Technology Strategy

COMMENTS:
Release of sensitive information.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 5; Legal = 4; Economically Sound = 3; and Environmentally Sound = 5

City of Austin – Action #5	
Proposed Action:	**Implement a Security Information and Event Management (SIEM) System.**
BACKGROUND INFORMATION	
Site and Location:	City of Austin
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	A SIEM system will provide real-time analysis of security alerts generated by network hardware and applications.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Cyber Attack, Terrorism
Effect on new/existing buildings:	None
Priority (High, Moderate, Low):	High
Estimated Cost:	$750,000
Potential Funding Sources:	HGMP, Homeland Security grants
Lead Agency/Department Responsible:	Communications & Technology Management
Implementation Schedule:	2016-2017
Incorporation into Existing Plans:	Information Technology Strategy

COMMENTS:
Security incidents.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 5; Politically Acceptable = 4; Legal = 3; Economically Sound = 5; and Environmentally Sound = 4

		City of Austin – Action #6
	Proposed Action:	**Provide a backup site for workers displaced due to a disaster.**
	BACKGROUND INFORMATION	
	Site and Location:	TBD
	Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	The City currently has very little backup sites for employees displaced due to disaster to their workspace. Contracting with a backup site vendor or providing telework options will provide the City with workspace for displaced employees.
	Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Extreme Heat, Hail, Thunderstorm, Tornado, Winter Storm, Hurricane Wind, Expansive Soils, Drought, Flood, Wildfire, Dam Failure, Hazardous Materials, Terrorism, Pipeline Failure, Infectious Disease, Cyber, Technological Disruption
Effect on new/existing buildings:	None
Priority (High, Moderate, Low):	High
Estimated Cost:	$100,000-$500,000
Potential Funding Sources:	HGMP, Homeland Security grants
Lead Agency/Department Responsible:	Communications & Technology Management
Implementation Schedule:	2016-2017
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
Security incidents.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5

City of Austin – Action #7	
Proposed Action:	**Share information about threats with other entities to provide early identification of attacks on the City's technology infrastructure.**
BACKGROUND INFORMATION	
Site and Location:	TBD
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Sharing threats with other entities will provide early identification of attacks on the City's technology infrastructure.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Cyber, Terrorism, Technological Disruption
Effect on new/existing buildings:	None
Priority (High, Moderate, Low):	High
Estimated Cost:	$100,000/yr
Potential Funding Sources:	HGMP, Homeland Security grants
Lead Agency/Department Responsible:	Communications & Technology Management
Implementation Schedule:	2016-2017
Incorporation into Existing Plans:	Information Technology Strategy

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 5; Legal = 4; Economically Sound = 3; and Environmentally Sound = 5

City of Austin – Action #8	
Proposed Action:	Conduct heat surveillance using bio-surveillance tools to plan, prioritize and mitigate risks related to climate change; guide environmental management decisions and policy changes; establish triggers for emergency alerts.
BACKGROUND INFORMATION	
Site and Location:	Data is available for Central Texas
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduces risk to public health and welfare.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Extreme Heat
Effect on new/existing buildings:	Extreme heat can compromise the habitability of buildings with little or no insulation, no radiant barrier, and/or lacking air conditioning
Priority (High, Moderate, Low):	High
Estimated Cost:	TBD
Potential Funding Sources:	US EPA
Lead Agency/Department Responsible:	Department of Health and Human Services
Implementation Schedule:	2016-2019
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 5; Politically Acceptable = 4; Legal = 3; Economically Sound = 5; and Environmentally Sound = 4

City of Austin – Action #9	
Proposed Action:	**Monitor zoonotic diseases thought to be associated with changes in weather conditions and climate change, and inform the public of any changes so they can better protect themselves.**
BACKGROUND INFORMATION	
Site and Location:	Austin/Travis County
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Prepare for potential increases in infectious diseases.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Infectious Diseases
Effect on new/existing buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	TBD
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	Department of Health and Human Services
Implementation Schedule:	2016
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5

City of Austin – Action #10	
Proposed Action:	**Have a workshop on ways to retrofit historic homes to deal with common weather related events and risks.**
BACKGROUND INFORMATION	
Site and Location:	Citywide
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Educate residents and give them resources on how to retrofit their existing home to mitigate potential effects.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Thunderstorm, Drought, Extreme Heat, Winter Storm, Tornado, Hail, Hurricane Wind, Wildfire
Effect on new/existing buildings:	Educate residents and encourage them to implement mitigation actions on their own properties
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	TBD
Potential Funding Sources:	City, Texas Historic Commission (Certified Local Government Grant), Preservation Austin
Lead Agency/Department Responsible:	Planning and Zoning, Historic Preservation
Implementation Schedule:	2015-2020
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 5; Legal = 4; Economically Sound = 3; and Environmentally Sound = 5

City of Austin – Action #11	
Proposed Action:	**Survey and map historic resources within flood prone areas.**
BACKGROUND INFORMATION	
Site and Location:	Citywide
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Help identify properties that already have historic designation, as well as those that are eligible, that are threatened by potential risks.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Thunderstorm
Effect on new/existing buildings:	Identify existing historic buildings that are threatened by flooding
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	TBD
Potential Funding Sources:	City, Texas Historic Commission (Certified Local Government Grant)
Lead Agency/Department Responsible:	Planning and Zoning, Historic Preservation
Implementation Schedule:	2015-2020
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 5; Politically Acceptable = 4; Legal = 3; Economically Sound = 5; and Environmentally Sound = 4

City of Austin – Action #12		
	Proposed Action:	**Create a grant or rebate program to encourage energy retrofitting buildings within areas that are designated as Historic to encourage energy retrofitting that is compatible to historic properties.**
	BACKGROUND INFORMATION	
	Site and Location:	Citywide
	Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	This would help with Water Conservation and Energy Conservation as well as reduce potential property damage during extreme weather events.
	Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Thunderstorm, Drought, Extreme Heat, Winter Storm, Tornado, Hail, Hurricane Wind, Expansive Soils
Effect on new/existing buildings:	Encourage retrofitting of historic buildings to reduce water and energy consumption
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	TBD
Potential Funding Sources:	City, Austin Energy
Lead Agency/Department Responsible:	Planning and Zoning, Historic Preservation
Implementation Schedule:	2015-2020
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5

		City of Austin – Action #13
	Proposed Action:	**Structurally retrofit existing City of Austin facilities including, but not limited to, libraries and recreation facilities to serve as safe rooms in the event of hazardous weather, extreme heat or winter storms.**
	BACKGROUND INFORMATION	
	Site and Location:	Citywide
	Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce loss of lives, reduce cost to repair facilities.
	Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm, Hail, Tornado, Winter Storm, Hurricane Wind, Extreme Heat
Effect on new/existing buildings:	This action would require new and existing City facilities to be strengthened to better resist extreme weather conditions
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	TBD
Potential Funding Sources:	Federal/State grants and general revenue
Lead Agency/Department Responsible:	Building Services, Parks and Recreation Department (PARD), Austin Public Libraries, HSEM
Implementation Schedule:	Ongoing
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
Submitted by R. Scott Swearengin, HSEM
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 5; Legal = 4; Economically Sound = 3; and Environmentally Sound = 5

City of Austin – Action #14	
Proposed Action:	**Structurally retrofit existing City of Austin facilities including, but not limited to, recreation facilities to serve as intermediate shelters to include the capacity to provide showers and food service.**
BACKGROUND INFORMATION	
Site and Location:	Citywide
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce loss of lives, reduce cost to repair facilities.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Local Plans & Regulations, Structure & Infrastructure Projects and Education & Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Hail, Tornado, Flood, Wildfire, Dam Failure, Hazardous Materials, Pipeline Failure
Effect on new/existing buildings:	This action would require new and existing City facilities to be designed to better serve as shelters for residents displaced by an event
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	TBD
Potential Funding Sources:	Federal/State grants and general revenue
Lead Agency/Department Responsible:	Building Services, Parks and Recreation Department (PARD), HSEM
Implementation Schedule:	Ongoing
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
Submitted by R. Scott Swearengin, HSEM
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 5; Politically Acceptable = 4; Legal = 3; Economically Sound = 5; and Environmentally Sound = 4

		City of Austin – Action #15
	Proposed Action:	**Strengthen and retrofit existing, pre-identified City of Austin facilities that serve as intermediate shelters.**
	BACKGROUND INFORMATION	
	Site and Location:	Citywide
	Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce loss of lives, reduce cost to repair facilities.
	Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure & Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Hail, Tornado, Flood, Wildfire, Dam Failure, Hazardous Materials, Pipeline Failure
Effect on new/existing buildings:	This action would require new and existing City facilities to be designed to better withstand severe weather and to include redundancies such as generators
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	TBD
Potential Funding Sources:	Federal/State grants and general revenue
Lead Agency/Department Responsible:	Building Services, Parks and Recreation Department (PARD), HSEM
Implementation Schedule:	Ongoing
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
Submitted by Billy Atkins, HSEM
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5

City of Austin – Action #16	
Proposed Action:	**Create and implement a component of the City of Austin Business Recovery Plan that will educate private business on the hazards the City is subject to and assist them with the identification of methods to mitigate the impact of those hazards on their business.**
BACKGROUND INFORMATION	
Site and Location:	Citywide
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Educate businesses to reduce loss of life and property.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Education & Awareness Programs

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Extreme Heat, Hail, Thunderstorm, Tornado, Winter Storm, Hurricane Wind, Expansive Soils, Drought, Flood, Wildfire, Dam Failure, Hazardous Materials, Terrorism, Pipeline Failure, Infectious Disease, Cyber, Technological Disruption
Effect on new/existing buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	TBD
Potential Funding Sources:	Federal/State grants and general revenue
Lead Agency/Department Responsible:	HSEM and Economic Development Department
Implementation Schedule:	Ongoing
Incorporation into Existing Plans:	Business Recovery Plan

COMMENTS:
Submitted by Aoife Longmore, HSEM
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 5; Legal = 4; Economically Sound = 3; and Environmentally Sound = 5

		City of Austin – Action #17
	Proposed Action:	**Modify the existing structure and make improvements to allow proper draining of excess rainwater away from the facility.**
	BACKGROUND INFORMATION	
	Site and Location:	EMS Station 33, 4514 James Wheat, Austin, TX
	Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Approximately $75,000 in damages from three past flooding episodes.
	Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Expansive Soils
Effect on new/existing buildings:	Modifications of the roofing and gutters to enhance drainage capabilities
Priority (High, Moderate, Low):	High
Estimated Cost:	$130,000
Potential Funding Sources:	HMGP, General Fund
Lead Agency/Department Responsible:	COA Public Works, Building Services, EMS
Implementation Schedule:	1 year from initiation
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
During heavy rain events, the facility does not have adequate guttering to direct the water away from the facility. In addition, the landscaping does not allow for excessive runoff and rainfall to drain away from the facility. More water accumulates than can drain away, and subsequently backs up into the facility. This has occurred 3 times in the recent past, damaging floors, baseboards, walls, cabinets and furniture.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 5; Politically Acceptable = 3; Legal = 5; Economically Sound = 4; and Environmentally Sound = 4

City of Austin – Action #18	
Proposed Action:	**Develop new pavement design criteria that addresses expansive soils to minimize damage to roadway structures from changes in soil moisture. Implement new criteria to ensure construction of longer lasting roadways with less environmental damage, lower maintenance costs, fewer repairs required, and less frequent reconstruction.**
BACKGROUND INFORMATION	
Site and Location:	Austin, Texas; Travis County, Texas
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Current cost is $310,000 (HVJ Associates consultant contract value). The losses avoided would be $61.5 million. (20 yr rules in use x (20 yr/ 65 yr) lost life x 0.5 on expansive clay x 50 LM/yr x $400k/LM = $61.5 Million additional reconstruction needed).
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Expansive Soils
Effect on new/existing buildings:	Cracking, distortion, roughness, structural damage
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$310,000
Potential Funding Sources:	City of Austin, Travis County, Williamson County, City of Pflugerville
Lead Agency/Department Responsible:	Austin/Travis Co/Williamson Co/Pflugerville
Implementation Schedule:	2012-2016
Incorporation into Existing Plans:	Transportation Criteria Manual

COMMENTS:
On-going engineering consultant study to develop new pavement design criteria. Criteria must be posted for adoption and approved by a rules posting process by each agency.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 5; Politically Acceptable = 3; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

	City of Austin – Action #19
Proposed Action:	**Educate and train civil and geotechnical engineers on new pavement design criteria, specifications, and design programs that address expansive soils to minimize damage to roadway structures from changes in soil moisture.**
BACKGROUND INFORMATION	
Site and Location:	Austin, Texas; Travis County, Texas
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Current cost is $11,520. (4 hrs of training x 30 hrs/hr preparation for presentation x $60/hr = $7,200 Train staff of 24 x 4 hrs training x $45/hr = $4,320 + $7,200 = $11,520). Losses avoided would be $30,750,000. (0.5 designed improperly x 20 yr rules in use x (20 yr/ 65 yr) lost life x 0.5 on expansive clay x 50 LM/yr new subdivisions x $400,000/LM = $30,750,000 additional street reconstruction needed).
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Expansive Soils
Effect on new/existing buildings:	Cracking, distortion, roughness, structural damage
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$11,520
Potential Funding Sources:	City of Austin
Lead Agency/Department Responsible:	Public Works Department
Implementation Schedule:	2016-2017
Incorporation into Existing Plans:	Capital Improvements Plan, Comprehensive Land Use Plan

COMMENTS:
On-going engineering consultant study to develop new pavement design criteria. Criteria must be posted for adoption and approved by a rules posting process by each agency.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 5; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

City of Austin – Action #20	
Proposed Action:	**Educate and train inspectors and contractors on the new specifications and pavement design criteria to ensure proper construction of roadways. New criteria will address expansive soils to minimize damage to roadway structures from changes in soil moisture. Partner with industry groups to develop and provide a formal certification program to document successful completion of this training.**
BACKGROUND INFORMATION	
Site and Location:	Austin, Texas; Travis County, Texas
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Current cost is $24,000. (4 hrs of training x 20 hrs of prep for presentation x $60/hr = $4,800 and 4 Certification programs (Asphalt, Concrete, Stabilization, Soils) x 2 weeks x 40 hr/wk x $60/hr = $19,200). Losses avoided would be $15,375,000. (0.25 constructed improperly x 20 yr rules in use x (20 yr/ 65 yr) lost life x 0.5 on expansive clay x 50 LM/yr new subdivisions x $400,000/LM = $15,375,000 additional street reconstruction needed).
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Education and Awareness Programs

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Expansive Soils
Effect on new/existing buildings:	Cracking, distortion, roughness, structural damage
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$24,000
Potential Funding Sources:	City of Austin
Lead Agency/Department Responsible:	Public Works Department
Implementation Schedule:	2016-2017
Incorporation into Existing Plans:	Capital Improvements Plan

COMMENTS:
On-going engineering consultant study to develop new pavement design criteria. Criteria must be posted for adoption and approved by a rules posting process by each agency.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 5; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

	City of Austin – Action #21
Proposed Action:	**Develop new criteria for designing structures and slabs on expansive soils to minimize damage to structures from changes in soil moisture. Implement new criteria to ensure construction of longer lasting structures with less environmental damage, lower maintenance costs, and fewer repairs required.**
BACKGROUND INFORMATION	
Site and Location:	Austin, Texas; Travis County, Texas
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Current Cost: $51,200. (SBO: 8 wks x 40 hr/wk x $60/hr = $19,200; QMD: 2 wks x 40 hr/wk x $200/hr (3.4 O/H rate) = $16,000; ESD: 2 wks x 40 hr/wk x $200/hr (3.4 O/H rate) = $16,000). Losses Avoided: $20,000,000. (10 yr / 50 yr) reduction in useful service life of structures x $100,000,000 in City of Austin facilities built on expansive clays over next 20 years = $20,000,000 serviceability loss (repairs/rehabilitation/replacement).
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Expansive Soils
Effect on new/existing buildings:	Cracking, distortion, roughness, structural damage
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$51,200
Potential Funding Sources:	City of Austin
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	2017-2018
Incorporation into Existing Plans:	Technical Criteria Manuals, Capital Improvements Plan, Comprehensive Land Use Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 5; Politically Acceptable = 3; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

City of Austin – Action #22	
Proposed Action:	**Implement an inspection program to inspect and evaluate scour potential for small bridge and culvert structures not inspected by the TxDOT BRINSAP (NBIS) program.**
BACKGROUND INFORMATION	
Site and Location:	Austin, Texas; Travis County, Texas
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Current Costs: $117,500. (~1,000 small structures (500 culverts and 500 pipes) 1000 x (1.5 hrs field (tech) x $35/hr + 1 hr office (tech) x $35/hr + 0.5 hr office (engineer) x $60/hr) = $117,500). Losses Avoided: $3,000,000. (~500 culverts x 10% need scour mitigation = 50 culverts; Estimate: $10,000 per location for scour mitigation; 50 culverts x $10,000/culvert = $500,000 (mitigation/repair); Permanent Mitigation/Repair = $500,000; Damage for lack of mitigation 3 x $500,000 = $1,500,000; Temporary emergency repairs/TCP 1 x $500,000 = $500,000; Public Inconvenience & Hazard 1 x $500,000 = $500,000).
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on new/existing buildings:	structural damage from debris and scouring
Priority (High, Moderate, Low):	High
Estimated Cost:	$117,500
Potential Funding Sources:	City of Austin
Lead Agency/Department Responsible:	Public Works Department
Implementation Schedule:	2016-2017
Incorporation into Existing Plans:	Bridge Management Information System

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 5; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

City of Austin – Action #23	
Proposed Action:	**Construct scour and erosion protection of bridges and culverts with high scour potential.**
BACKGROUND INFORMATION	
Site and Location:	Austin, Texas; Travis County, Texas
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Current Cost: $2,000,000. (465 bridges x 10%+ need scour mitigation = 50 bridges; $300,000/yr scour mitigation annually in bridge maintenance; contract for 10 major bridges = $30,000 per location for scour mitigation (major); 50 bridges x $30,000/bridge = $1,500,000 (mitigation/repair); ~500 culverts x 10% need scour mitigation = 50 culverts; Estimate: $10,000 per location for scour mitigation (minor); 50 culverts x $10,000/culvert = $500,000 (mitigation/repair)). Losses Avoided: $12,000,000. (Permanent Mitigation/Repair = $1,500,000; Damage from lack of mitigation 3 x $1,500,000 = $4,500,000; Temp. emergency repairs/TCP 1 x $1,500,000 = $1,500,000; Public Inconvenience & Hazard 1 x $1,500,000 = $1,500,000; = $9,000,000 bridges; Permanent Mitigation/Repair = $500,000; Damage from lack of mitigation 3 x $500,000 = $1,500,000; Temp. emergency repairs/TCP 1 x $500,000 = $500,000; Public Inconvenience & Hazard 1 x $500,000 = $500,000; = $3,000,000 culverts).
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on new/existing buildings:	Structural damage from scouring and loss of substructure or foundation support
Priority (High, Moderate, Low):	High
Estimated Cost:	$2,000,000
Potential Funding Sources:	City of Austin
Lead Agency/Department Responsible:	Public Works Department
Implementation Schedule:	2016-2020
Incorporation into Existing Plans:	Bridge Maintenance Programs

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 5; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

		City of Austin – Action #24
	Proposed Action:	**Establish new rural roadway design criteria with wider paved shoulders where feasible for less potential of fire caused by vehicles or motorists and better performance of roadways on expansive soils. Additional edge protection creates longer distance to fuel sources for fire and longer moisture path to travel lanes for soil stability.**
	BACKGROUND INFORMATION	
	Site and Location:	Austin, Texas; Travis County, Texas
	Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Current Cost: $36,000. (SBO: 4 weeks x 40 hr/wk x $60/hr = $9,600; AFD: 4 weeks x 40 hr/wk x $60/hr = $9,600; ATD: 2 weeks x 40 hr/wk x $60/hr = $4,800; QMD: 1 weeks x 40 hr/wk x $200/hr (3.4 O/H rate) = $8,000; ESD: 0.5 weeks x 40 hr/wk x $200/hr (3.4 O/H rate) = $4,000). Losses Avoided: no data. (There is limited data on the damages resulting from wildfires and few damaging wildfires have been identified, however the potential is generally accepted to be moderate to high).
	Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire, Expansive Soils
Effect on new/existing buildings:	Reduce number of urban wildfires and resulting damages
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$36,000
Potential Funding Sources:	City of Austin
Lead Agency/Department Responsible:	Public Works Department
Implementation Schedule:	2016-2017
Incorporation into Existing Plans:	Transportation Criteria Manual

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

City of Austin – Action #25	
Proposed Action:	**Initiate the adoption of the International Code Councils' Wildland Urban Interface Code or an equivalent regulatory framework, to mitigate the threat of wildfire in high risk areas of the city.**
BACKGROUND INFORMATION	
Site and Location:	Austin, Texas; Travis County, Texas
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce risk to residents and first responders, minimizes financial loss to residents and property.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on new/existing buildings:	Applies to new construction with the exception of major renovations
Priority (High, Moderate, Low):	High
Estimated Cost:	TBD
Potential Funding Sources:	Local Funds, Inspections, In-kind
Lead Agency/Department Responsible:	Lead: Austin Fire Department; Planning and Development, Office of Sustainability, Travis County Planning and Development
Implementation Schedule:	2018
Incorporation into Existing Plans:	City of Austin Building Code, Community Wildfire Protection Plan, Subdivision Design Manual

COMMENTS:
The City of Austin has no existing regulatory mechanism to comprehensively address the threat of wildfire. Future development absent of consideration of wildfire will result in significant loss of property and potentially human life The adoption of the Wildland Urban Interface Code would address future development in high risk areas to ensure the built environment is compatible with the local fire adapted ecosystems. According to the University of Baylor Risk report, 26% or 242,000 homes in Austin are currently at risk from wildfire. The Austin Travis County Community Wildfire Protection Plan, defined the Austin and Travis counties Wildland Urban Interface and recommends the adoption of the WUI Code.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 5; Legal = 4; Economically Sound = 3; and Environmentally Sound = 5

City of Austin – Action #26	
Proposed Action:	**Develop evacuation plan for areas without adequate collector roadways and connectivity during a wildfire or other emergency events. Plan may include the mitigation of pinch points, and high ignition corridors traffic control strategies.**
BACKGROUND INFORMATION	
Site and Location:	Austin, Texas; Travis County, Texas
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Benefits citizens and first responders' safety.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on new/existing buildings:	Potential impact on road design to include width, and right of way maintenance
Priority (High, Moderate, Low):	High
Estimated Cost:	$137,000
Potential Funding Sources:	Local Funds, Inspections, In-kind
Lead Agency/Department Responsible:	Lead: Austin Fire Department; Planning and Development, Office of Sustainability, Travis County Planning and Development.
Implementation Schedule:	2018
Incorporation into Existing Plans:	City of Austin Building Code, Community Wildfire Protection Plan, Subdivision Design Manual

COMMENTS:
The City of Austin has no existing wildfire evacuation plan. The peak burning period for wildfires correlates with peak afternoon traffic congestion, resulting in numerous areas along major routes being gridlocked at a time when wildfire based evacuations are most likely. According to the University of Baylor Risk report, 26% or 242,000 homes in Austin are currently at risk from wildfire.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 5; Politically Acceptable = 4; Legal = 3; Economically Sound = 5; and Environmentally Sound = 4

		City of Austin – Action #27
	Proposed Action:	**Utilization of goats to mitigate fire fuels in high risk areas where the use of mechanical equipment would result in environmental impacts. Establishment of contract services for grazing in designated high risk corridors.**
	BACKGROUND INFORMATION	
	Site and Location:	Austin, Texas; Travis County, Texas
	Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduced risk of loss of life and property.
	Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Natural System Protection

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on new/existing buildings:	NA
Priority (High, Moderate, Low):	High
Estimated Cost:	$117,000 annually
Potential Funding Sources:	Local Funds, Inspections, In-kind
Lead Agency/Department Responsible:	Lead: Austin Fire Department; Office of Sustainability, PARD, AWU
Implementation Schedule:	2017
Incorporation into Existing Plans:	Austin Community Wildfire Protection Plan, Austin Invasive Species Management Plan

COMMENTS:
The City of Austin has many high risk areas that, due to accessibility, traditional cost of treatment and environmental considerations cannot be mitigated with mechanical treatments. Well managed grazing animals provide a low impact high benefit fuels reduction alternative. The city currently manages 66,000 acres of open space much of which is prone to periodic wildfires. According to the University of Baylor Risk report, 26% or 242,000 homes in Austin are currently at risk from wildfire.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5

City of Austin – Action #28	
Proposed Action:	**Replacement of wooden attachments to structures and installation of ember resistive ventilations systems. This project would include the replacement of existing combustible decks and fences with ignition resistant materials as well as retrofit of ventilation systems to include ember resistive components.**
BACKGROUND INFORMATION	
Site and Location:	Austin, Texas; Travis County, Texas
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduced risk of loss of life and property.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structural and Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on new/existing buildings:	Retrofit of existing structure attachments and ventilation systems
Priority (High, Moderate, Low):	High
Estimated Cost:	$30,000,000
Potential Funding Sources:	Local Funds, Inspections, In-kind
Lead Agency/Department Responsible:	Lead: Austin Fire Department; Travis County TNR and OEM, Office of Sustainability, PDR
Implementation Schedule:	2018
Incorporation into Existing Plans:	Austin Community Wildfire Protection Plan, Austin Fire Code

COMMENTS:
There are over 15,000 homes located in at risk areas across Austin and Travis County that have highly combustible wood decking and fences. In addition ventilation systems in these areas are vulnerable to ember intrusion. According to the University of Baylor Risk report, 26% or 242,000 homes in Austin are currently at risk from wildfire.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 5; Politically Acceptable = 4; Legal = 3; Economically Sound = 5; and Environmentally Sound = 4

City of Austin – Action #29	
Proposed Action:	**Establish an alternate power supply at Austin Police Department station so law enforcement can continue to operate in an emergency that effects the city's power grid.**
BACKGROUND INFORMATION	
Site and Location:	Austin Police Department - 715 E 8th St, Austin, TX 78791
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Continue essential services to residents.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire, Tornado, Winter Storm, Extreme Heat, Cyber, Technological Disruption, Terrorism
Effect on new/existing buildings:	Continue to provide essential services
Priority (High, Moderate, Low):	High
Estimated Cost:	TBD
Potential Funding Sources:	HMGP, other grants
Lead Agency/Department Responsible:	Austin Police Department
Implementation Schedule:	2017
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
During recent flooding, parts of downtown Austin lost power. This caused the APD generator to activate. The gap or interim between the COA power and generator power caused the computer system to reboot, and Department Operations Center and the Real Time Crime Center lost internet and phones, thus losing the ability to command the flood response. Element D1 of Plan Review, Evaluation and Implementation is addressed in this issue. The COA switched, since the 2010 Hazard Mitigation Plan, to VOIP lines. The old "copper" phone lines had internal power, and loss of COA power would not affect the usage of the phones.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5

	City of Austin – Action #30
Proposed Action:	**Establish an alternate power supply at the City of Austin Public Safety Training Center (PSTC) so emergency services can continue to operate in an emergency that affects the city's power grid. This will include a generator and an Uninterrupted Power Supply (UPS).**
BACKGROUND INFORMATION	
Site and Location:	Public Safety Training Center - 4800 Shaw Ln, Austin, TX 78744
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Continue essential services to residents.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire, Tornado, Winter Storm, Extreme Heat, Cyber, Technological Disruption, Terrorism
Effect on new/existing buildings:	Continue to provide essential services
Priority (High, Moderate, Low):	High
Estimated Cost:	TBD
Potential Funding Sources:	HMGP, other grants
Lead Agency/Department Responsible:	Austin Police Department
Implementation Schedule:	2017
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
During recent flooding several emergency generators in COA buildings were activated. The gap or interim between the COA power and generator power caused computer systems to reboot. This reboot included the telephone system, resulting in the loss of communication between and within agencies. THE PSTC has been selected as a COOP site for several emergency services, but the site does not have a generator or UPS. Element D1 of Plan Review, Evaluation and Implementation is addressed in this issue. The COA switched, since the 2010 Hazard Mitigation Plan, to VOIP lines. The old "copper" phone lines had internal power, and loss of COA power would not previously affect the usage of the phones.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 5; Legal = 4; Economically Sound = 3; and Environmentally Sound = 5

City of Austin – Action #31	
Proposed Action:	**Develop a safe room program to retrofit residences in order to protect against a tornado or hurricane wind event.**
BACKGROUND INFORMATION	
Site and Location:	To be determined
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce risk of loss of life.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Tornado, Hurricane Wind
Effect on new/existing buildings:	This action would strengthen existing buildings and residences by making them more resistant to damage from tornadoes and hurricane winds
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$6,000 per safe room
Potential Funding Sources:	Federal Grants
Lead Agency/Department Responsible:	HSEM
Implementation Schedule:	To be implemented after receipt of funds
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 5; Legal = 4; Economically Sound = 3; and Environmentally Sound = 5

City of Austin – Action #32	
Proposed Action:	**Conduct public awareness campaign for realtors, insurance agents, lenders, surveyors and other professionals on benefits of flood insurance under the National Flood Insurance Program (NFIP).**
BACKGROUND INFORMATION	
Site and Location:	Citywide
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Austin experiences flooding and flash flooding which leads to damage to property and even fatalities. The NFIP benefits those who have purchased flood insurance for their homes. More training is needed regarding policies for agents, lenders and other professionals.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Thunderstorm
Effect on new/existing buildings:	This action would reduce the impact of flooding for existing and new structures
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time
Potential Funding Sources:	General Revenue
Lead Agency/Department Responsible:	Partner with other associations and groups currently providing NFIP training
Implementation Schedule:	2016
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 5; Legal = 4; Economically Sound = 3; and Environmentally Sound = 5

		City of Austin – Action #33
	Proposed Action:	**Increase public awareness regarding the National Flood Insurance Program (NFIP) and Preferred Risk Policy for residents outside of the Special Flood Hazard Area (SFHA).**
	BACKGROUND INFORMATION	
	Site and Location:	Citywide
	Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Austin experiences flooding and flash flooding which leads to damage to property and even fatalities. Flood insurance provides protection to those who have purchased flood insurance for their homes. Over 30% of NFIP claims occur outside of the SFHA.
	Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Thunderstorm
Effect on new/existing buildings:	This action would result in stronger buildings if citizens purchased flood insurance
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000 per year
Potential Funding Sources:	Grants and general revenue
Lead Agency/Department Responsible:	HSEM – partnering with organizations providing free NFIP training where available.
Implementation Schedule:	2016
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 5; Legal = 4; Economically Sound = 3; and Environmentally Sound = 5

		City of Austin – Action #34
	Proposed Action:	**Install perimeter lighting at Tom Miller, Decker and Longhorn Dams.**
	BACKGROUND INFORMATION	
	Site and Location:	Tom Miler Dam – 20.294°N, 97.786°W; Decker Dam – 30.285°N, 97.597°W; Longhorn Dam – 30.250° N, 97.714°W
	Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	The city has not experienced a major dam failure since the early 1930s. Perimeter lighting would help increase security at the above locations.
	Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Terrorism
Effect on new/existing buildings:	Prevent flood damage to existing structures within the inundation area for each dam
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	TBD
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	HSEM
Implementation Schedule:	2016
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 5; Legal = 4; Economically Sound = 3; and Environmentally Sound = 5

City of Austin – Action #35	
Proposed Action:	**Strengthen access restrictions at Tom Miller, Decker and Longhorn Dams.**
BACKGROUND INFORMATION	
Site and Location:	Tom Miler Dam – 20.294°N, 97.786°W; Decker Dam – 30.285°N, 97.597°W; Longhorn Dam – 30.250° N, 97.714°W
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Although the last major dam failure occurrence for the City was the result of a flood in the 1930s, access restrictions are necessary in light of concerns for terrorism since 9/11.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Terrorism
Effect on new/existing buildings:	Prevent flood damage to existing structures within the inundation area for each dam
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	TBD
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	HSEM
Implementation Schedule:	2016
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 5; Legal = 4; Economically Sound = 3; and Environmentally Sound = 5

City of Austin – Action #36	
Proposed Action:	**Purchase communication equipment for uniform communication capability among first responders in the event of a pipeline failure or hazardous material spill.**
BACKGROUND INFORMATION	
Site and Location:	Citywide
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	The city does not have radio equipment that would be safe to use to communicate nearby a hazardous material release or pipeline failure. Technology is currently available for radios that would allow for communication even in a volatile environment.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Pipeline Failure, Hazardous Material Release, Terrorism
Effect on new/existing buildings:	This action enhances communicability between responders and does not directly impact new/existing buildings
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	TBD
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	HSEM
Implementation Schedule:	2016-2017 with replacements as needed
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 5; Legal = 4; Economically Sound = 3; and Environmentally Sound = 5

City of Austin – Action #37	
Proposed Action:	**Increase public awareness of the dangers of pipeline failure through the Pipeline Safety Trust, a NFP Public charity in order to promote fuel transportation safety.**
BACKGROUND INFORMATION	
Site and Location:	Citywide
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce risk of loss of life and property.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Pipeline Failure, Terrorism
Effect on new/existing buildings:	This action does not directly affect new/existing buildings
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	HSEM
Implementation Schedule:	2016
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 5; Legal = 4; Economically Sound = 3; and Environmentally Sound = 5

City of Austin – Action #38	
Proposed Action:	**Create a neighborhood and community plan, including drills and exercises to educate the public regarding the location of pipelines and actions to take in the event of a hazardous material spill.**
BACKGROUND INFORMATION	
Site and Location:	Citywide
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	The city has experienced few man-caused events, but citizens should be aware of procedures and locations of hazardous areas.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Pipeline Failure, Hazardous Material Release
Effect on new/existing buildings:	This action primarily concerns protecting lives instead of directly effecting buildings
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Minimal cost as partnering opportunities are available
Potential Funding Sources:	General Revenue and grants where available
Lead Agency/Department Responsible:	Austin Fire Department; Watershed Protection and Development Services
Implementation Schedule:	2016
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 5; Legal = 4; Economically Sound = 3; and Environmentally Sound = 5

City of Austin – Action #39	
Proposed Action:	**Social Capital: For an individual, social capital is about relationships with family, friends, and colleagues. In communities, social capital can be measured by levels of trust, the cohesion of social networks, and the quality of leadership. Cities that are resilience to extreme weather events build social capital with neighborhoods and public spaces that encourage interaction and through participatory, inclusive governance. Yet, while there is growing appreciation of its importance, too little is known about how to measure, cultivate, and maintain social capital.** **Recommendation: Make an Extreme Event Recovery Plan that includes a Social Capital component. The plan would be based on expert knowledge in this area and would shares best practices with a variety of urban change makers.**
BACKGROUND INFORMATION	
Site and Location:	Austin, Texas; Travis County, Texas
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Post disaster relief to reduce long-term stressors for vulnerable communities.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Extreme Heat, Drought, Hail, Winter Storm, Hurricane Wind, Thunderstorm, Tornado, Wildfire, Hazardous Materials, Pipeline Failure, Terrorism, Expansive Soils, Cyber, Technological Disruption
Effect on new/existing buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$100,000
Potential Funding Sources:	HUD
Lead Agency/Department Responsible:	ATCHHSD
Implementation Schedule:	2016-2017
Incorporation into Existing Plans:	CHA/CHIP

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 5; Legal = 4; Economically Sound = 3; and Environmentally Sound = 5

City of Austin – Action #40		
Proposed Action:	**BRACE: In 2014, the third National Climate Assessment clearly described climate change as a threat to human health and well-being. Climate change is predicted to result in more extreme heat events, more frequent and violent weather disasters, decreased air quality and more insect-related disease. And, the Assessment states that some of the health impacts of climate change are already happening in the United States. Health effects related to climate will worsen existing health problems as well as introduce new and serious risks to the public's health. Recommendation: As the next step of the CHA/CHIP, Austin/Travis County Health and Human Services Department to explore piloting Building Resilience Against Climate Effects (BRACE), a CDC developed framework that allows public health departments put complex atmospheric science and climate projections into their planning and response activities.**	
BACKGROUND INFORMATION		
Site and Location:	Austin, Texas; Travis County, Texas	
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Health effects related to climate	
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Local Plans and Regulations	

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Extreme Heat, Drought, Hail, Winter Storm, Hurricane Wind, Thunderstorm, Tornado, Wildfire, Hazardous Materials, Pipeline Failure, Terrorism, Expansive Soils, Cyber, Technological Disruption
Effect on new/existing buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$100,000
Potential Funding Sources:	CDC
Lead Agency/Department Responsible:	ATCHHSD
Implementation Schedule:	2016-2017
Incorporation into Existing Plans:	CHA/CHIP

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 5; Legal = 4; Economically Sound = 3; and Environmentally Sound = 5

Austin ISD

		Austin Independent School District – Action #1
	Proposed Action:	**Elevate electrical transformers at AISD's House Park, located at Shoal Creek Blvd, Austin, TX 78701.**
	BACKGROUND INFORMATION	
	Site and Location:	AISD's House Park
	Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Protection of property; reduce risk to public health, safety, and welfare.
	Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Dam Failure
Effect on new/existing buildings:	Protects electrical infrastructure for existing facility
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Moderate
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Construction Management
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Facility Master Plan, Emergency Ops Plan

COMMENTS:
AISD's House Park was severely impacted by flooding that took place on Memorial Day 2015, highlighting the need to mitigate against future damage to electrical equipment there.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5

	Austin Independent School District – Action #2
Proposed Action:	**Design and construct floodwalls around flood-prone AISD properties such as House Park.**
BACKGROUND INFORMATION	
Site and Location:	AISD's House Park and other flood-prone properties
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce risk to properties throughout school district from flood; reduce risk to students and faculty from flood.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Dam Failure
Effect on new/existing buildings:	Reduces breach of floodwaters in existing facility
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$325,000
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Construction Management
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Facility Master Plan, Emergency Ops Plan

COMMENTS:
AISD's House Park was severely impacted by flooding that took place on Memorial Day 2015, highlighting the need to erect floodwalls to redirect floodwater to nearby creeks. This project is thought to cause minimal adverse impact to nearby businesses and structures.
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 4; Economically Sound = 5; and Environmentally Sound = 4

	Austin Independent School District – Action #3
Proposed Action:	**Develop and implement water monitoring system to detect leaks and monitor local water supplies to conserve water for drought seasons and use during wildfires.**
BACKGROUND INFORMATION	
Site and Location:	District-wide
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce use of water during the event of a drought.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Natural Systems Protection

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Drought, Wildfire
Effect on new/existing buildings:	Reduces water footprint of AISD
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1,000,000
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Construction Management/Service Center
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Facility Master Plan, Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5

		Austin Independent School District – Action #4
	Proposed Action:	**Develop a MOU and coordinate with the City of Austin to develop and implement a drought-related emergency operations plan.**
	BACKGROUND INFORMATION	
	Site and Location:	District-wide
	Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Ensure health and safety of residents is protected during a drought.
	Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Drought
Effect on new/existing buildings:	Reduces water footprint of AISD
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$50,000
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Police Department
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 4; Economically Sound = 5; and Environmentally Sound = 4

	Austin Independent School District – Action #5
Proposed Action:	**Develop and build AISD facility that functions as community-wide disaster safe room.**
BACKGROUND INFORMATION	
Site and Location:	District-wide
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce potential loss to students, faculty, and residents in proximity of safe room during disasters.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Flood, Hail, Hazardous Materials, Hurricane Wind, Infectious Disease, Thunderstorm, Terrorism, Tornado, Wildfire, Winter Storm
Effect on new/existing buildings:	Moderate effect on newly-built structure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$3,500,000
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Construction Management
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Facility Master Plan, Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5

		Austin Independent School District – Action #6
	Proposed Action:	**Conduct public education to promote FIREWISE practices such as xeriscaping, removing debris, and constructing fire-resistant structures.**
	BACKGROUND INFORMATION	
	Site and Location:	District-wide
	Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce risk of wildfire, fire fuels, loss of life and property.
	Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on new/existing buildings:	Extensive impact on existing and new structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$250,000
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Police Department, Risk Management
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 4; Economically Sound = 5; and Environmentally Sound = 4

		Austin Independent School District – Action #7
	Proposed Action:	**Develop and implement extreme heat awareness campaign on mitigation techniques.**
	BACKGROUND INFORMATION	
	Site and Location:	District-wide
	Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce effects on residents from extreme heat.
	Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Extreme Heat
Effect on new/existing buildings:	Extensive impact on existing and new structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$250,000
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Police Department, Risk Management
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5

		Austin Independent School District – Action #8
	Proposed Action:	**Retrofit existing AISD facilities with green roofs to reduce heat signature.**
	BACKGROUND INFORMATION	
	Site and Location:	District-wide
	Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce effects on facilities from extreme heat.
	Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Extreme Heat
Effect on new/existing buildings:	Extensive impact on existing and new structures
Priority (High, Moderate, Low):	Low
Estimated Cost:	$10,000,000
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Construction Management
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Facility Master Plan, Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 4; Economically Sound = 5; and Environmentally Sound = 4

	Austin Independent School District – Action #9
Proposed Action:	**Purchase mobile back-up generators for critical nodes around AISD such as the Service Center and the Skyline Building, both of which house network servers.**
BACKGROUND INFORMATION	
Site and Location:	District-wide
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Ensure continuation of essential services to the school district in the event of a disaster.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm, Flood, Wildfire, Extreme Heat, Hail, Tornado, Winter Storm, Hurricane Wind
Effect on new/existing buildings:	Extensive impact on existing and new structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000,000
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Facilities, Service Center
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Facility Master Plan, Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5

Austin Independent School District – Action #10	
Proposed Action:	**Retrofit AISD facilities to mitigate impact damage from hail, such as placing protective covers over existing windows and hail guards on AC units.**
BACKGROUND INFORMATION	
Site and Location:	District-wide
Risk Reduction Benefit: *(Current Cost/Losses Avoided)*	Reduce repairs and costs to facilities following a disaster event.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Hail
Effect on new/existing buildings:	Extensive impact on existing and new structures
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1,000,000
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Facilities, Service Center
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Facility Master Plan, Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 4; Economically Sound = 5; and Environmentally Sound = 4

Austin Independent School District – Action #11	
Proposed Action:	**Retrofit AISD facilities with interior safe rooms.**
BACKGROUND INFORMATION	
Site and Location:	District-wide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce potential loss to students and faculty during disasters.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Tornado
Effect on new/existing buildings:	Extensive impact on existing and new structures
Priority (High, Moderate, Low):	Low
Estimated Cost:	$5,000,000
Potential Funding Sources:	DHS,FEMA
Lead Agency/Department Responsible:	AISD – Facilities, Service Center
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Facility Master Plan, Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5

Austin Independent School District – Action #12	
Proposed Action:	**Use GIS technology to determine risks and map AISD facilities that are susceptible to expansive soils in order to implement a program with new criteria for designing structures and slabs on expansive soils to use proven engineering solutions to minimize damage to structures from changes in soil moisture.**
BACKGROUND INFORMATION	
Site and Location:	District-wide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce effects of soil expansion on properties.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Natural Systems Protection

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Expansive Soils
Effect on new/existing buildings:	Moderate impact on existing structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$40,000
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Construction Management
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Facility Master Plan, Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 4; Economically Sound = 5; and Environmentally Sound = 4

Austin Independent School District – Action #13	
Proposed Action:	**Retrofit critical AISD facilities with roadway heating system to offset impacts of ice accumulation.**
BACKGROUND INFORMATION	
Site and Location:	District-wide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to students and faculty of being trapped due to ice accumulation and being able to access critical AISD facilities in the event of a winter storm.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Winter Storm
Effect on new/existing buildings:	Moderate impact on existing structures
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1,000,000
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Construction Management
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Facility Master Plan, Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5

Austin Independent School District – Action #14	
Proposed Action:	**Retrofit AISD's network servers with enhanced Intrusion Detection Systems (IDS) and Intrusion Prevention Systems (IPS).**
BACKGROUND INFORMATION	
Site and Location:	District-wide
Risk Reduction Benefit *(Current Cost/Losses Avoided)*:	Reduce risk to network servers in the event of a cyber attack.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*:	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Cyber
Effect on new/existing buildings:	High impact on existing structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$1,000,000
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Technology
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 4; Economically Sound = 5; and Environmentally Sound = 4

Austin Independent School District – Action #15	
Proposed Action:	**Retrofit AISD's networks with Barracuda servers/firewalls to prevent network intrusion and increase reliability.**
BACKGROUND INFORMATION	
Site and Location:	District-wide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk of networks in the event of an intrusion or cyber attack.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Cyber
Effect on new/existing buildings:	High impact on existing structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$1,000,000
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Technology
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5

Austin Independent School District – Action #16	
Proposed Action:	**Implement filtration and air-cleaning programs and systems to protect buildings and occupants from infectious diseases, biological, and radiological attacks.**
BACKGROUND INFORMATION	
Site and Location:	District-wide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce the risk to students and faculty in the event of an infectious disease.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Infectious Diseases
Effect on new/existing buildings:	High impact on existing and new structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$10,000,000
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Technology
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 4; Economically Sound = 5; and Environmentally Sound = 4

Austin Independent School District – Action #17	
Proposed Action:	**Develop and build central mailing facility to prevent spread of infectious diseases and mitigate biological attacks.**
BACKGROUND INFORMATION	
Site and Location:	District-wide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to students and faculty of spreading infectious diseases.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Infectious Diseases
Effect on new/existing buildings:	High impact on existing and new structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$4,000,000
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Construction Management, Purchasing
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5

Austin Independent School District – Action #18	
Proposed Action:	**Practice FIREWISE mitigation techniques such as landscape gardens using native plants and prepare an emergency planning kit and safety plan.**
BACKGROUND INFORMATION	
Site and Location:	District-wide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Reduce risk to properties throughout school district and reduce risk to residents through education and awareness.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on new/existing buildings:	Extensive impact on existing and new structures
Priority (High, Moderate, Low):	High
Estimated Cost:	TBD
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Police Department, Risk Management
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 4; Economically Sound = 5; and Environmentally Sound = 4

Austin Independent School District – Action #19	
Proposed Action:	**Develop evacuation plan and routinely conduct evacuation exercises.**
BACKGROUND INFORMATION	
Site and Location:	District-wide
Risk Reduction Benefit *(Current Cost/Losses Avoided)*:	Increased awareness of evacuation procedures; reduce and prevent loss of life and injury.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*:	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Tornado, Hurricane Wind, Thunderstorm, Wildfire, Winter Storm
Effect on new/existing buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$25,000
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Police Department, Risk Management
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Facility Master Plan, Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5

	Austin Independent School District – Action #20	
	Proposed Action:	**Educate the public on mitigation activities that can help protect properties in the event of a flood, such as elevate AC units, elevate structures, and use of freeboard.**
	BACKGROUND INFORMATION	
	Site and Location:	District-wide
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Protection of properties; reduce risk to public health, safety and welfare.
	Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Dam Failure
Effect on new/existing buildings:	Protection of property and potential new infrastructure
Priority (High, Moderate, Low):	High
Estimated Cost:	$50,000
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Police Department, Risk Management
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 4; Economically Sound = 5; and Environmentally Sound = 4

Austin Independent School District – Action #21	
Proposed Action:	**Purchase NOAA "All Hazards" radios for early warning and event information to be placed throughout school district.**
BACKGROUND INFORMATION	
Site and Location:	District-wide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Increase warning time in the event of a disaster.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Extreme Heat, Drought, Hail, Winter Storm, Hurricane Wind, Thunderstorm, Tornado, Wildfire, Hazardous Materials, Pipeline Failure, Terrorism, Expansive Soils, Cyber, Technological Disruption
Effect on new/existing buildings:	Increase time to retrofit and protect structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$150
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Police Department, Risk Management
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5

Austin Independent School District – Action #22	
Proposed Action:	**Conduct outreach to increase public awareness by teaching students about the dangers of hail and how to take safety precautions.**
BACKGROUND INFORMATION	
Site and Location:	District-wide
Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Promote safety and increase safety to students.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Hail
Effect on new/existing buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Police Department, Risk Management
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 4; Economically Sound = 5; and Environmentally Sound = 4

Austin Independent School District – Action #23	
Proposed Action:	**Implement a public education program regarding hazard risk and evacuation, and high risk areas.**
BACKGROUND INFORMATION	
Site and Location:	District-wide
Risk Reduction Benefit *(Current Cost/Losses Avoided)*:	Promote safety and increase safety to students.
Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*:	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Extreme Heat, Drought, Hail, Winter Storm, Hurricane Wind, Thunderstorm, Tornado, Wildfire, Hazardous Materials, Pipeline Failure, Terrorism, Expansive Soils, Cyber, Technological Disruption
Effect on new/existing buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$1,000
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Police Department, Risk Management
Implementation Schedule:	By 2018
Incorporation into Existing Plans:	Emergency Ops Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 4; Economically Sound = 5; and Environmentally Sound = 4

	Austin Independent School District – Action #24	
	Proposed Action:	**Retrofit AISD facilities for wind resistance/safe room.**
	BACKGROUND INFORMATION	
	Site and Location:	Austin ISD locations and critical facilities
	Risk Reduction Benefit *(Current Cost/Losses Avoided)***:**	Austin ISD area schools housed evacuees from Hurricane Ike and also were minimally damaged from hurricane winds. Stronger windows are needed to resist hurricane winds and also damage from hail, ice or flooding during a hazard event.
	Type of Action: (*Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)***:**	Structure and Infrastructure Projects

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Hurricane Wind, Tornado, Winter Storm, Hail, Thunderstorm, Flood
Effect on new/existing buildings:	This action would strengthen current buildings by making them more resistant to hurricane and high winds
Priority (High, Moderate, Low):	High
Estimated Cost:	TBD
Potential Funding Sources:	DHS, FEMA
Lead Agency/Department Responsible:	AISD – Office of Homeland Security and Emergency Management
Implementation Schedule:	By 2020
Incorporation into Existing Plans:	Emergency Operations Plan

COMMENTS:
ADDITIONAL CONSIDERATIONS: The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 4; Economically Sound = 5; and Environmentally Sound = 4

Section 25: Plan Maintenance

Plan Maintenance Procedures

The following is an explanation of how the City of Austin, AISD, and the general public will be involved in implementing, evaluating, and enhancing the Plan over time. The sustained hazard mitigation planning process consists of three main parts:

- Incorporation
- Monitoring and Evaluation
- Continued Public Involvement

Incorporation

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

Process of Incorporation

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

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

The City of Austin and AISD will integrate implementation of their mitigation actions with other plans and policies such as construction standards and emergency management plans, and ensure that these actions, or proposed projects, are reflected in other planning efforts. Coordinating and integrating components of other plans and policies into goals and objectives of the Plan will further maximize funding and provide possible cost-sharing of key projects, thereby reducing loss of lives and property, and mitigating hazards affecting the area.

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

The City of Austin is committed to supporting the cities, communities, and AISD as they implement their mitigation actions. The City of Austin and participating 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 City will work with AISD to advance the goals of this hazard mitigation plan through its routine, ongoing, long-range planning, budgeting, and work processes.

Table 25.1 – Examples of Incorporation of the Plan

Planning Mechanism	Incorporation of Plan
Grant Applications	The Plan will be evaluated by Planning Team Members whenever grant funding is sought for mitigation projects. If a project is not in the Plan, an amendment may be necessary to include the action in the Plan.
Annual Budget Review	Various departments and key personnel that participated in the planning process 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.
Regulatory Plans	Currently, Austin has regulatory plans in place, such as Emergency Management Plans, Continuity of Operations Plans, Disaster Recovery Plans, and Economic Development and Evacuation Plans. The Plan will be consulted when City departments review or revise their current regulatory planning mechanisms, or in the development of regulatory plans that are not currently in place.
Capital Improvement Plans	Austin has a Capital Improvement Plan (CIP) in place. Prior to any revisions to the CIP, 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.

Planning Mechanism	Incorporation of Plan
Comprehensive Plans	Austin has a Comprehensive Plan 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/CRS	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 discussing the people and property at risk to flood, will be reviewed and revised when Austin updates their management plans or develops new plans. The City also plans to pursue joining the Community Rating System (CRS) and addresses this as a mitigation action item.
Emergency Operations Heat Plan	The City of Austin created an Emergency Operations Heat Plan in 2011. The Heat Plan includes stages to address the extreme heat hazard. Phase 1, the Austin/Travis County Health and Human Services Department monitors emergency visits and calls regarding heat-related illnesses, but few actions are required. In Phase II, Austin's Heat Plan calls for opening "cooling centers," air-conditioned buildings such as libraries and churches that can be used as places from which to hand out water. The actions for extreme heat, and information found in Section 8 of this Plan discussing the people and property at risk to extreme heat. The Plan will be reviewed when Austin updates their management plans or develops new plans.

Monitoring and Evaluation

Periodic revisions of the Plan are required to ensure that goals, objectives, and mitigation actions are kept current. 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 24-2 indicates the department and title of the party responsible for Plan monitoring, updating, and review of the Plan.

Table 25-2. Team Members Responsible for Plan Monitoring, Updating and Review of the Plan

DEPARTMENTS	TITLE
Office of Homeland Security & Emergency Management	Director
Office of Homeland Security & Emergency Management	Sr. Emergency Plans Officer
Office of Homeland Security & Emergency Management	Accountant
Office of Homeland Security & Emergency Management	Deputy Buildings Officer

DEPARTMENTS	TITLE
Office of Homeland Security & Emergency Management	Public Information & Marketing Program Officer
Office of Homeland Security & Emergency Management	Public Information Specialist
Office of Homeland Security & Emergency Management	Community Preparedness Program Coordinator
Office of Homeland Security & Emergency Management	Administrative Manager, Administration & Finance Programs
Office of Homeland Security & Emergency Management, Disaster Ready	Administrator, Network Systems Sr.

Monitoring

Designated Executive Planning Team (Planning Team) members are responsible for monitoring, updating, and reviewing the Plan, as shown in Table 25-2. Individuals holding the title listed in Table 25-2 will be responsible for monitoring the Plan on an annual basis. Plan monitoring, includes reviewing mitigation actions submitted and coordinating with various City departments to determine if mitigation actions need to be re-evaluated and updated. The Planning Team will develop a brief report that identifies if changes to the Plan are needed, such as recommending an action for funding. A summary of meeting notes will report the particulars involved in developing an action into a project.

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. The annual evaluation process will help to determine if any changes are necessary.

Updating

Plan Amendments

At any time, minor technical changes may be made to update the City of Austin Hazard Mitigation Plan. 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 City.

The City will review proposed amendments and vote to accept, reject, or amend the proposed change. Upon ratification, the amendment will be transmitted to TDEM.

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

- Errors or omissions made in the identification of issues or needs during the preparation of the Plan;

- New issues or needs that were not adequately addressed in the Plan; and
- Changes in information, data, or assumptions from those on which the Plan was based.

Five (5) Year Review

The Plan will be thoroughly reviewed by the Planning Team at the end of three years from the approval date, to determine whether there have been significant changes in the planning area that necessitate changes in the types of mitigation actions proposed. Factors that may affect the content of the Plan include new development in identified hazard areas, increased exposure to hazards, disaster declarations, increase or decrease in capability to address hazards, and changes to federal or state legislation.

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

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

Continued Public Involvement

Public input was an integral part of the preparation of this Plan and will continue to be essential for Plan updates. Changes or suggestions to improve or update the Plan will provide opportunities for additional public input.

The public can review the Plan on the City of Austin HSEM website and copies of the Plan will be kept in the offices of the City and ISD (http://www.austintexas.gov/department/hsem-media), where officials and the public are invited to provide ongoing feedback.

The Planning Team may also designate voluntary citizens from the City, 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 Executive Planning team is responsible for notifying stakeholders and community members on an annual basis, and maintaining the Plan as a part of their job description. Media, including local newspaper and radio stations, will be used to notify the public of any maintenance or periodic review activities. Additionally, Local News will broadcast regular updates regarding any changes or updates to the Plan, through their community public video segments. This media outlet, along with social media outlets such as Facebook and Twitter, will keep the public and stakeholders apprised of mitigation projects for which HMGP or PDM funding is made available for implementation of mitigation projects identified in the Plan.

Appendix A: Planning Team

Planning Team Members

The City of Austin Hazard Mitigation Action Plan Update, was organized using a direct representative model. An Executive Planning Team from the City of Austin Office of Homeland Security and Emergency Management, 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 City and ISD departments that participated throughout the planning process. Table A-3 is comprised of members of a “Stakeholder Working Group” that met on a monthly basis to provide Plan input. The public were also invited to participate via e-mail and throughout the planning process. Public outreach efforts and meeting documentation is provided in Appendix E.

Table A-1. Executive Planning Team

DEPARTMENTS	TITLE
Office of Homeland Security & Emergency Management	Director
Office of Homeland Security & Emergency Management	Sr. Emergency Plans Officer
Office of Homeland Security & Emergency Management	Accountant
Office of Homeland Security & Emergency Management	Deputy Buildings Officer
Office of Homeland Security & Emergency Management	Public Information & Marketing Program Officer
Office of Homeland Security & Emergency Management	Public Information Specialist
Office of Homeland Security & Emergency Management	Community Preparedness Program Coordinator
Office of Homeland Security & Emergency Management	Administrative Manager, Administration & Finance Programs
Office of Homeland Security & Emergency Management, Disaster Ready	Administrator, Network Systems Sr.

Table A-2. Advisory Planning Team

DEPARTMENTS	TITLE
Austin Fire Department	Fire Captain

DEPARTMENTS	TITLE
Austin Fire Department	Fire Adapted Communities Coordinator
Austin Health & Human Services	Chief Epidemiologist
Austin Health & Human Services	Epidemiologist
Austin Independent School District	Emergency Management Coordinator
Austin Police Department	Sergeant
Austin Travis County Emergency Management Services	Division Chief - Emergency Management
Communications & Technology Management	Security
Communications & Technology Management	Information Systems Division Manager
Geographic Information Systems	Programmer Analyst Supervisor
Historic Landmark Commission	Planning
Office of Sustainability	Environmental Program Coordinator
Planning and Development Review Department	Principal Planner
Public Works Department	City Engineer
Public Works Department	Supervising Engineer
Public Works Department	Consulting Engineer
Watershed Protection Department	Program Manager, Environmental Conservation

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; and universities. The following list of persons, by Title, were sent an email and/or contacted by phone requesting their input into the HMAP planning process, and an invitation to participate at each of the Stakeholder meetings. Many did attend and were integral to providing comments and data for the Plan. For a list of attendance at meetings, please see Appendix E[1].

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

Table A-3. Stakeholder Working Group

AGENCY	TITLE
Austin Community College (ACC)	Emergency Management Coordinator
Austin/Travis County Integral Care	Coordinator, Disaster Mental Health
Capital Area Council of Governments (CAPCOG)	Director, Homeland Security
Capital Area Council of Governments (CAPCOG)	Homeland Security Planning Coordinator
Capital Area Metropolitan Planning Organization (CAMPO)	Planner
Capital Area Metropolitan Planning Organization (CAMPO)	Air Quality Program Manager
Capital Area Trauma Regional Advisory Council (CATRAC)	Executive Director
Capital Metro	Quality Control Specialist
Red Cross	Disaster Services Chair
Travis County Medical Society	Chief Operating Officer
University of Texas	Director, Campus Security

Appendix B: Public Survey Results

Overview

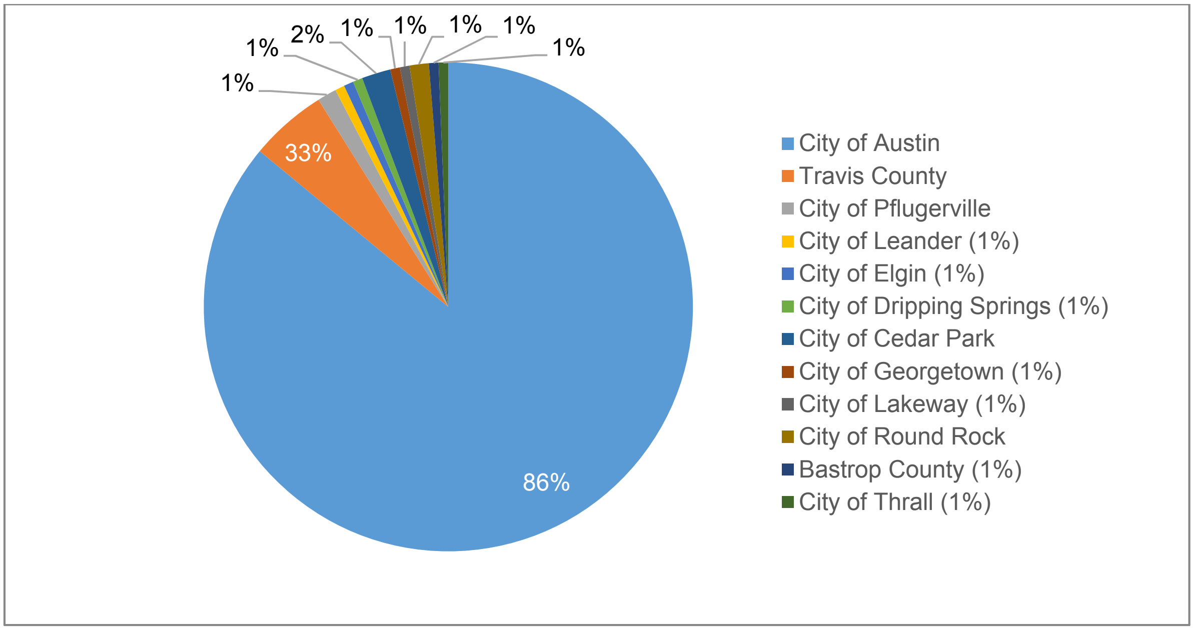
The City of Austin prepared public surveys that asked a wide range of questions concerning the opinions of the public regarding natural and man-caused hazards. The survey was made available on the City's website. This survey link was also distributed at public meetings and stakeholder events throughout the planning process.

A total of 158 surveys were collected, the results of which are analyzed in this Appendix. The purpose of the survey was twofold: 1) to solicit public input during the planning process, and 2) to help the jurisdictions identify any potential actions or problem areas.

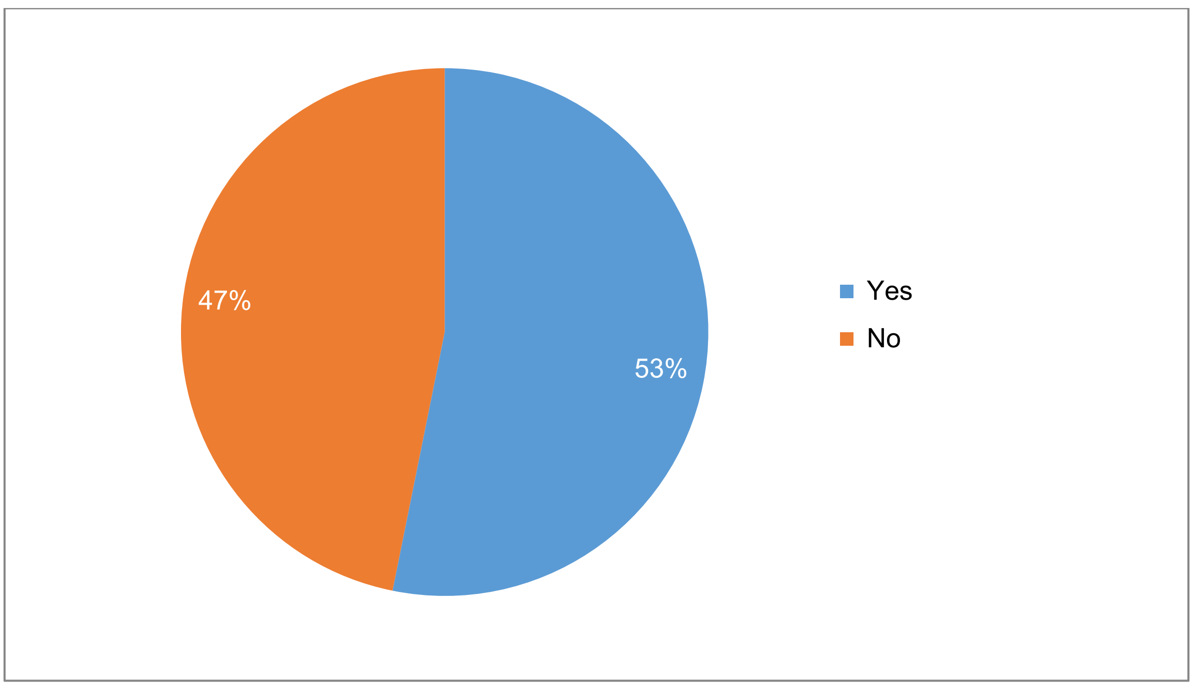
Survey results are depicted on the following pages, showing the percentage of responses for each answer. For questions that did not provide a multiple-choice answer, or that required an explanation, comments are summarized where similar.

Public Survey Results

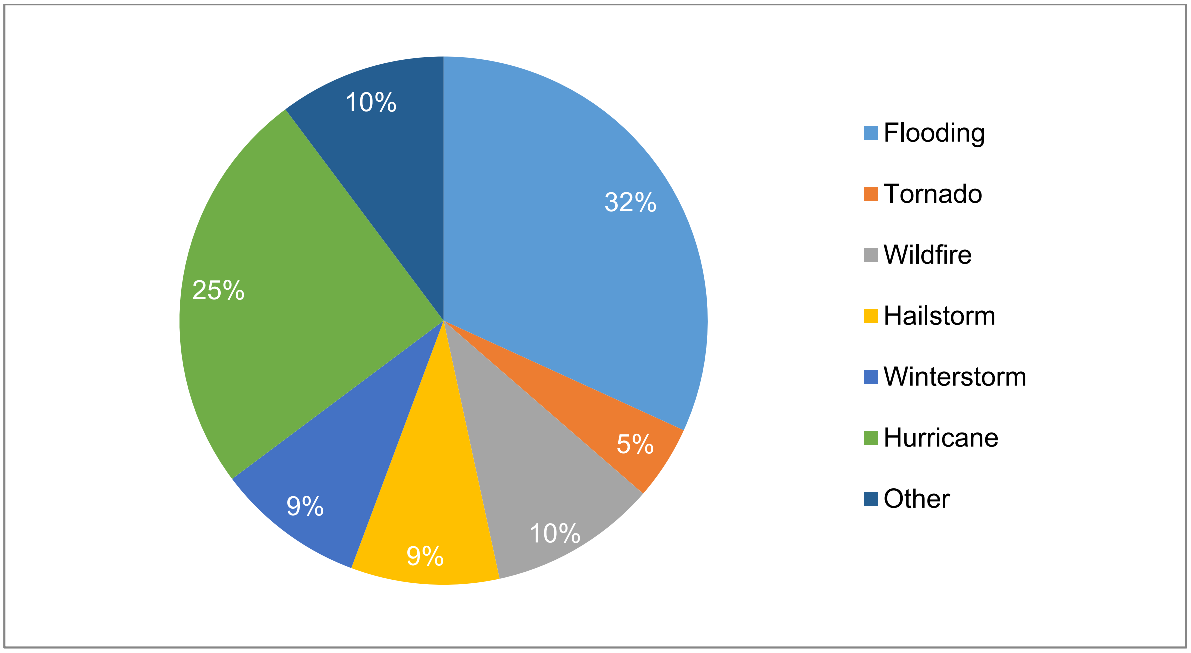
1. Please state the jurisdiction (city and community) where you reside.



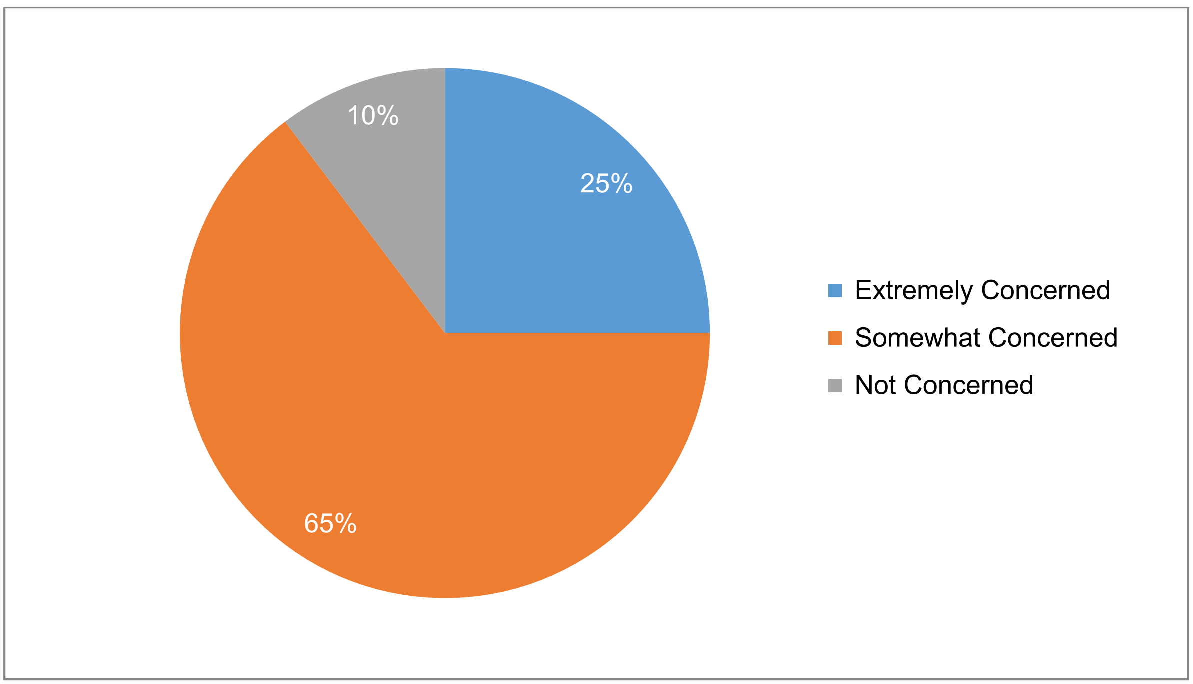
2. A. Have you ever experienced or been impacted by a disaster?



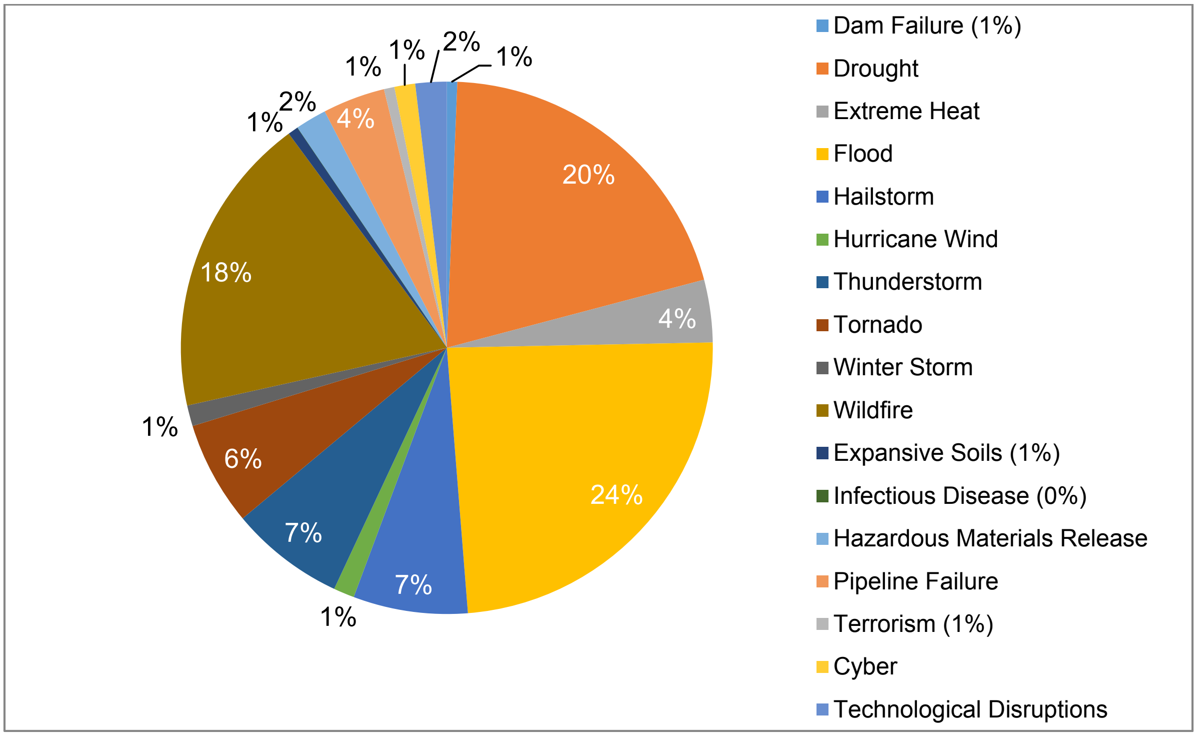
2. B. If “yes”, please explain:



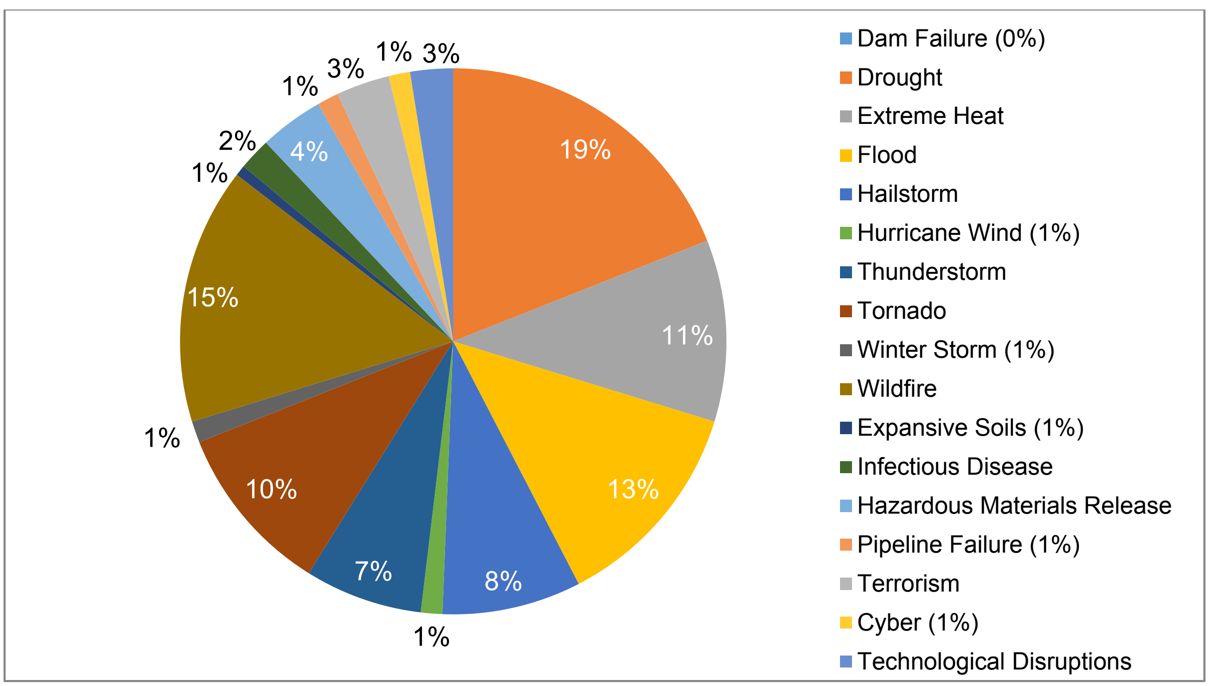
3. How concerned are you about the possibility of your community being impacted by a disaster?



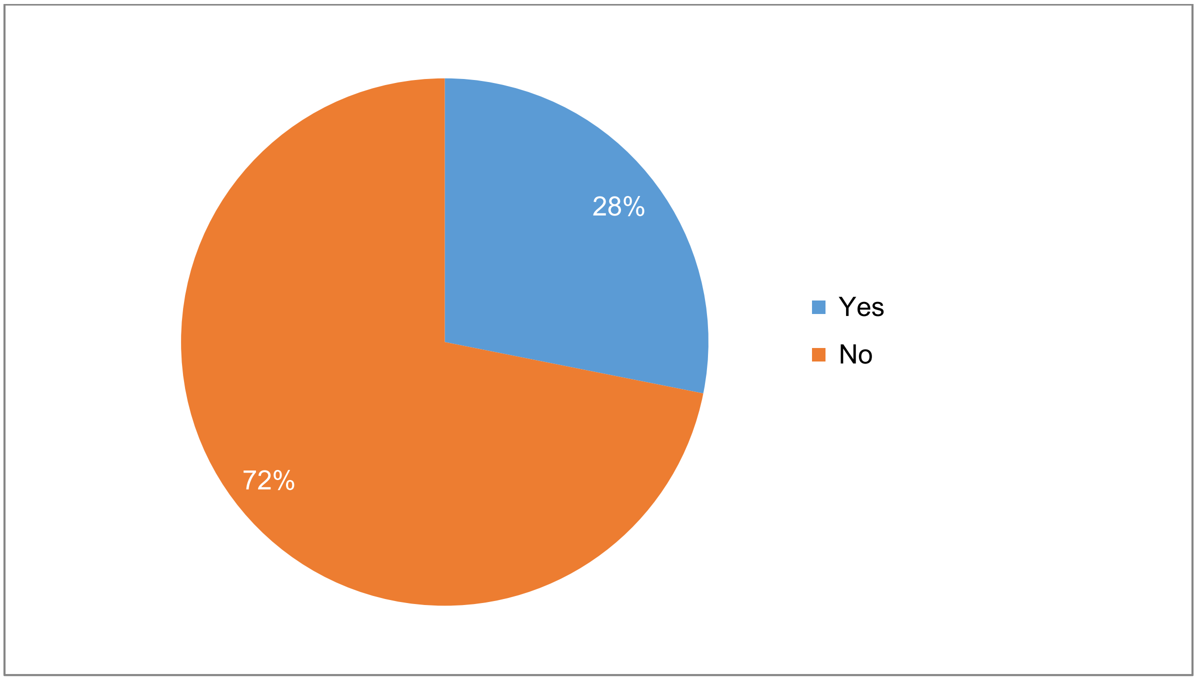
4. Please select the one hazard you think is the highest threat to your neighborhood:



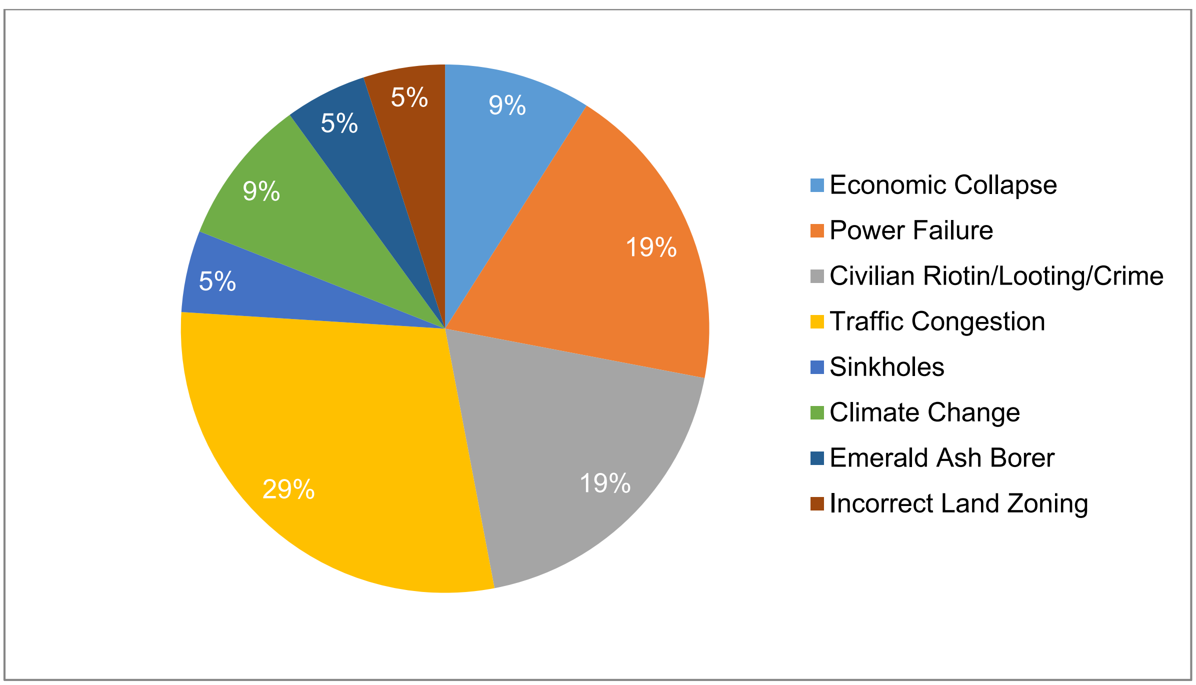
5. Please select the one hazard you think is the second highest threat to your neighborhood:



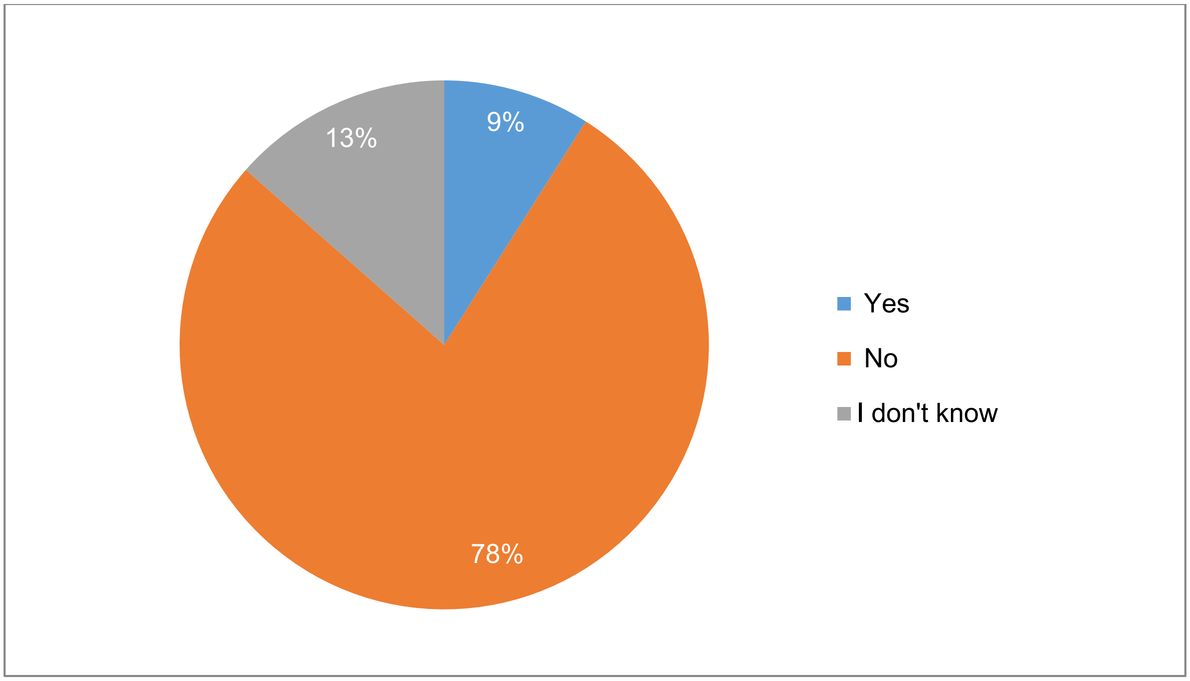
6. A. Are there hazards not listed above that you think is a wide-scale threat to your neighborhood?



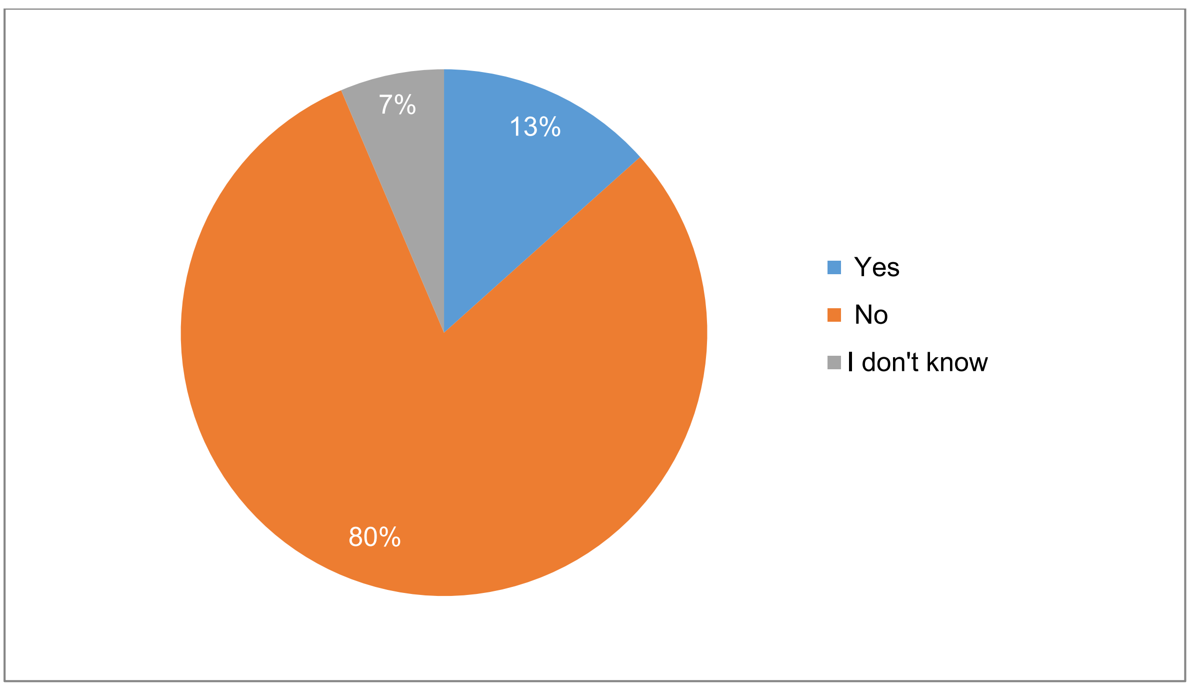
6. B. If "Yes," please explain.



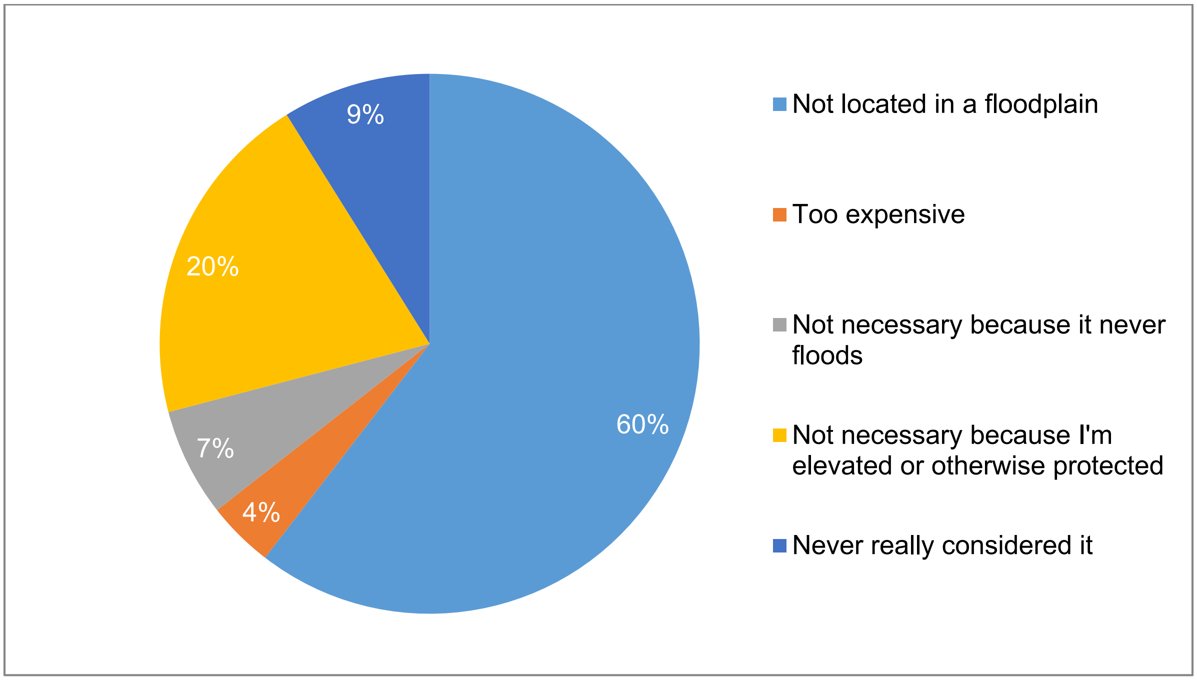
7. Is your home located in a floodplain?



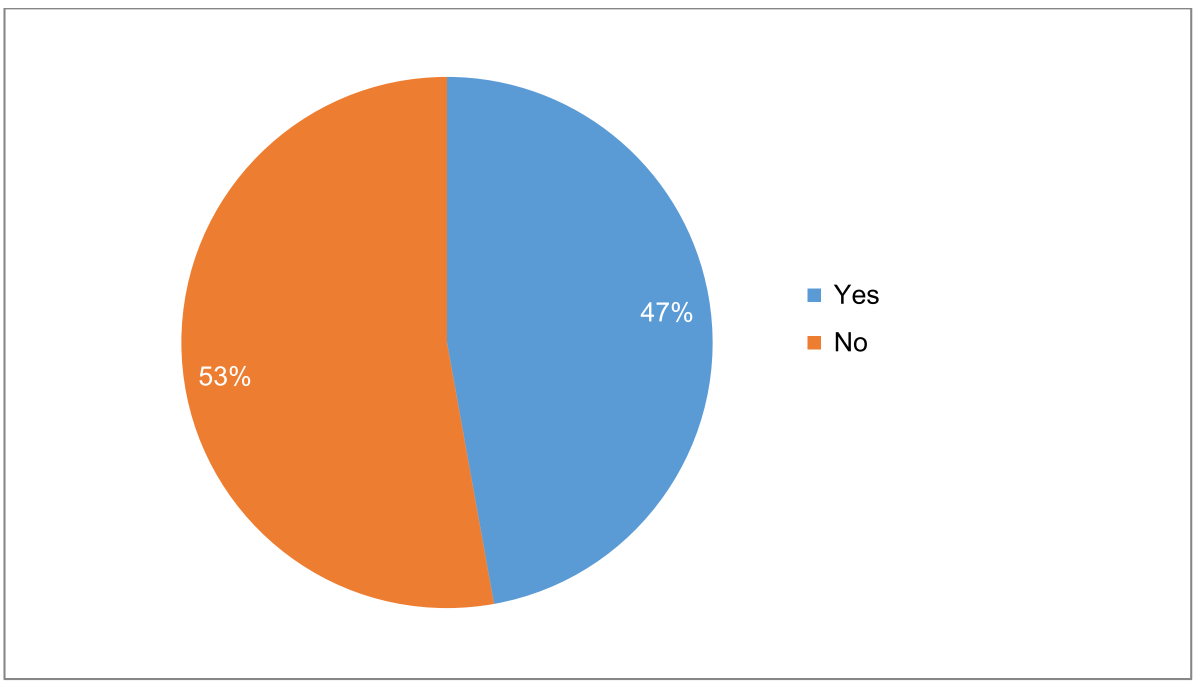
8. Do you have flood insurance?



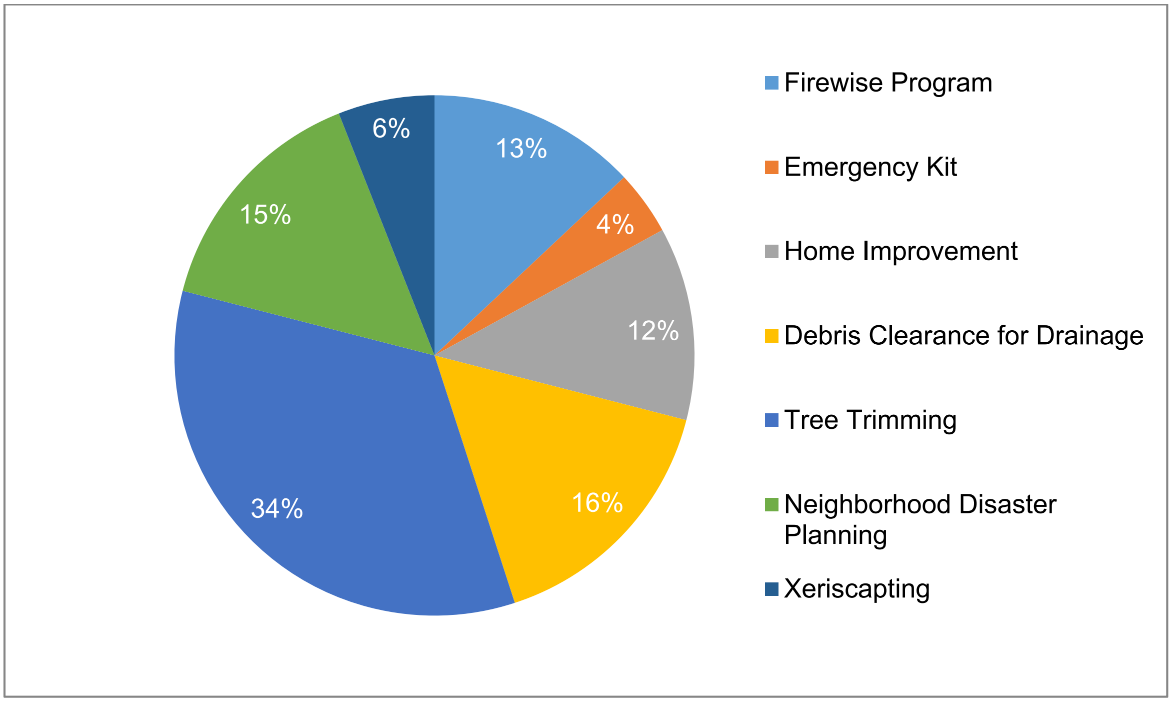
9. If you do not have flood insurance, why not?



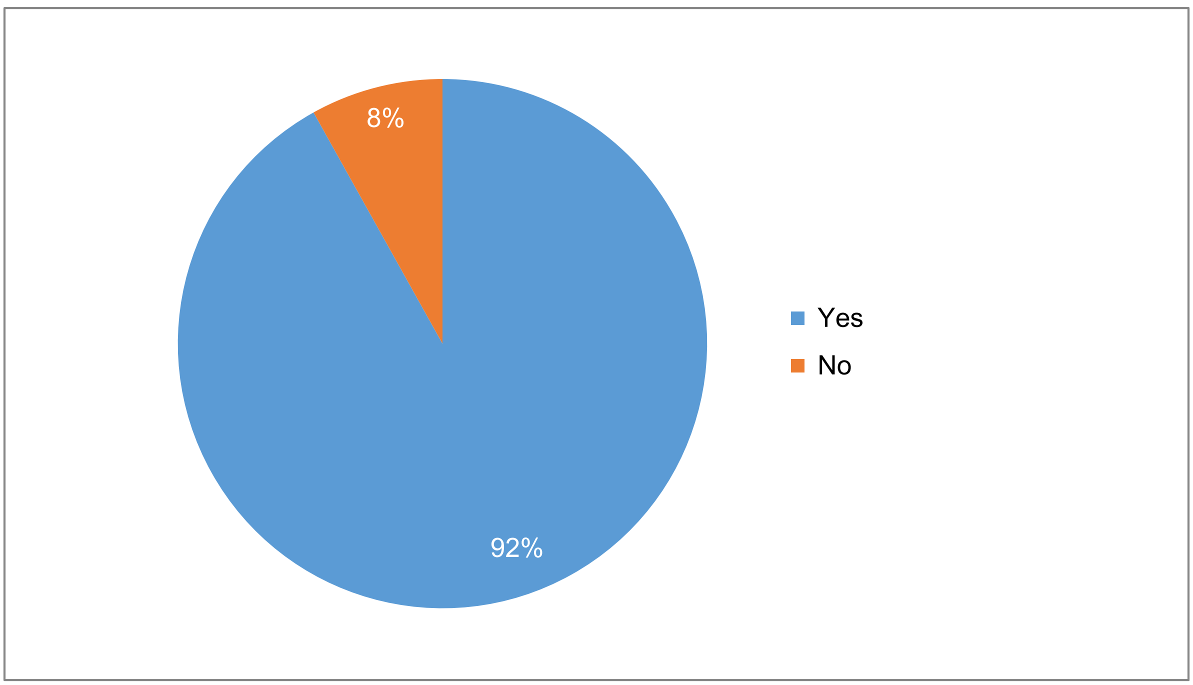
10. A. Have you taken any actions to make your home or neighborhood more resistant to hazards?



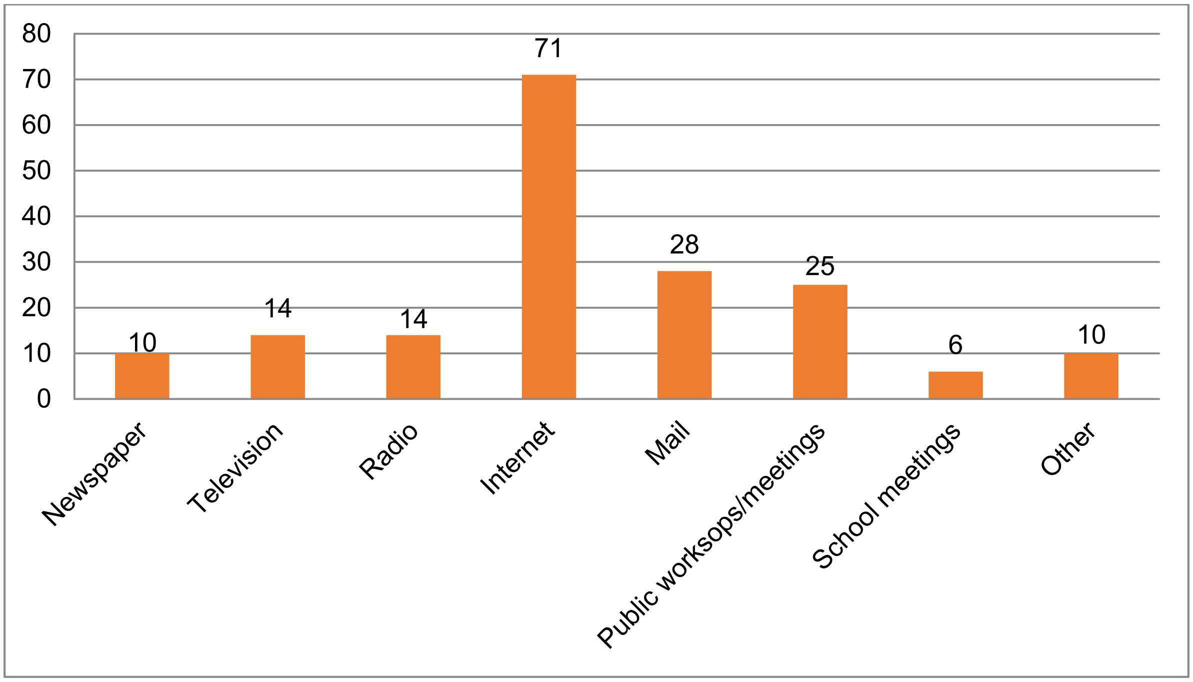
10. B. What have you done?



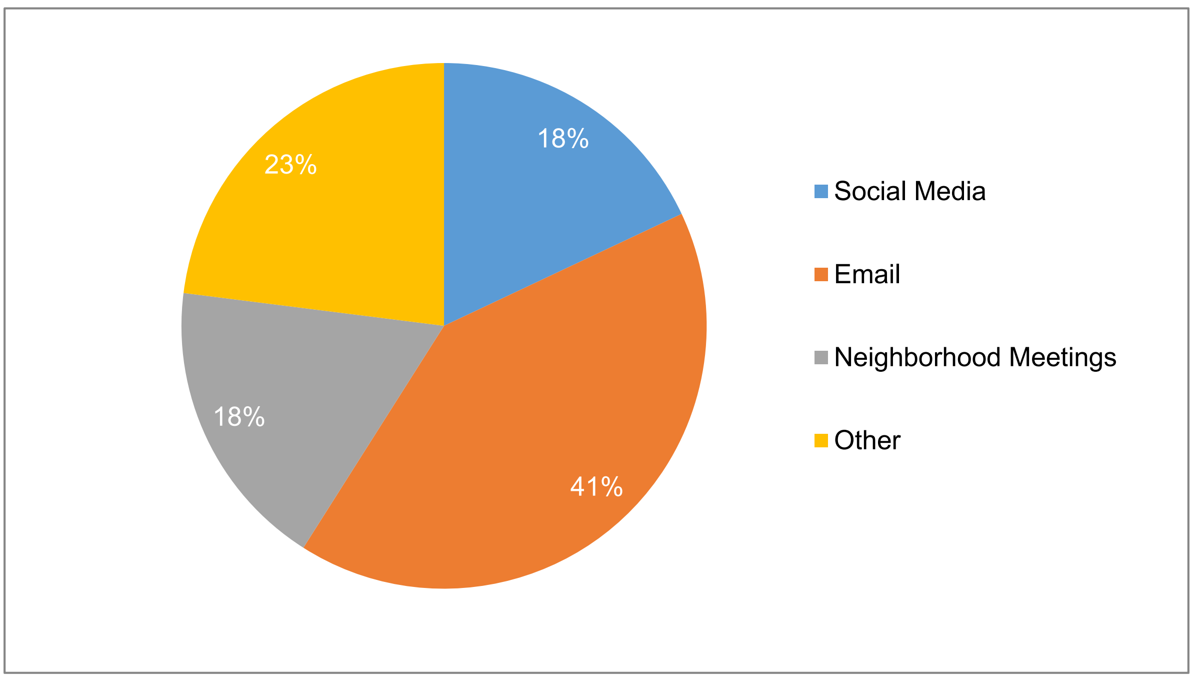
11. Are you interested in making your home or neighborhood more resistant to hazards?



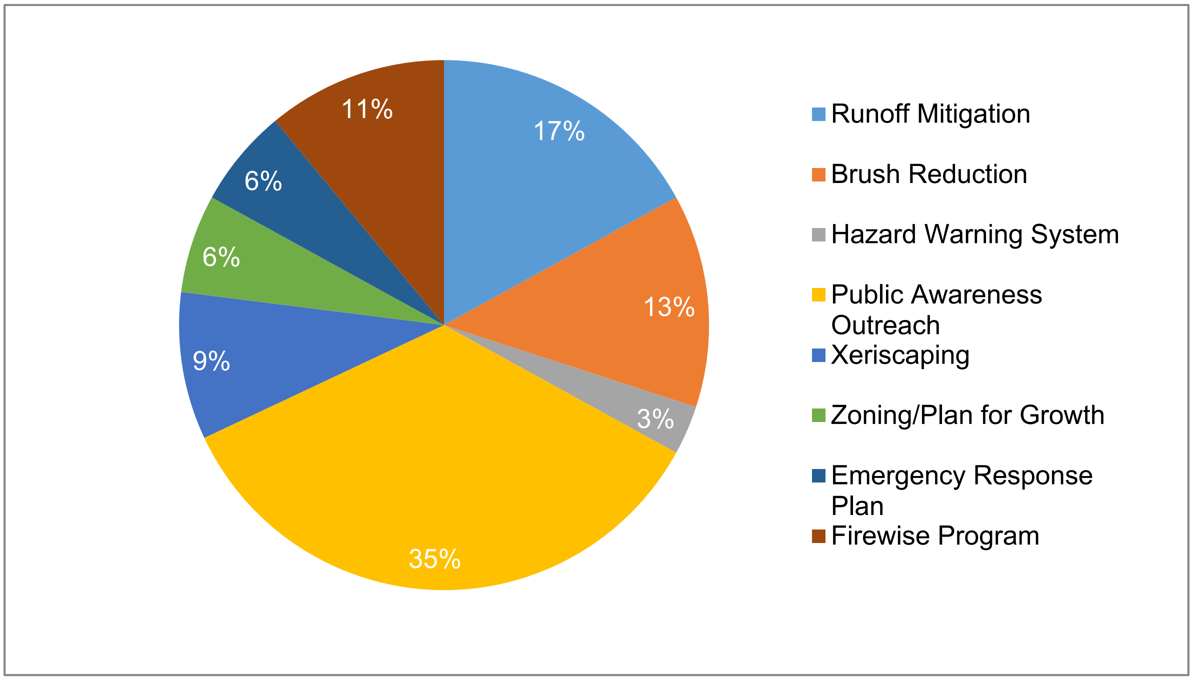
12. A. What is the most effective way for you to receive information about how to make your home and neighborhood more resistant to hazards?



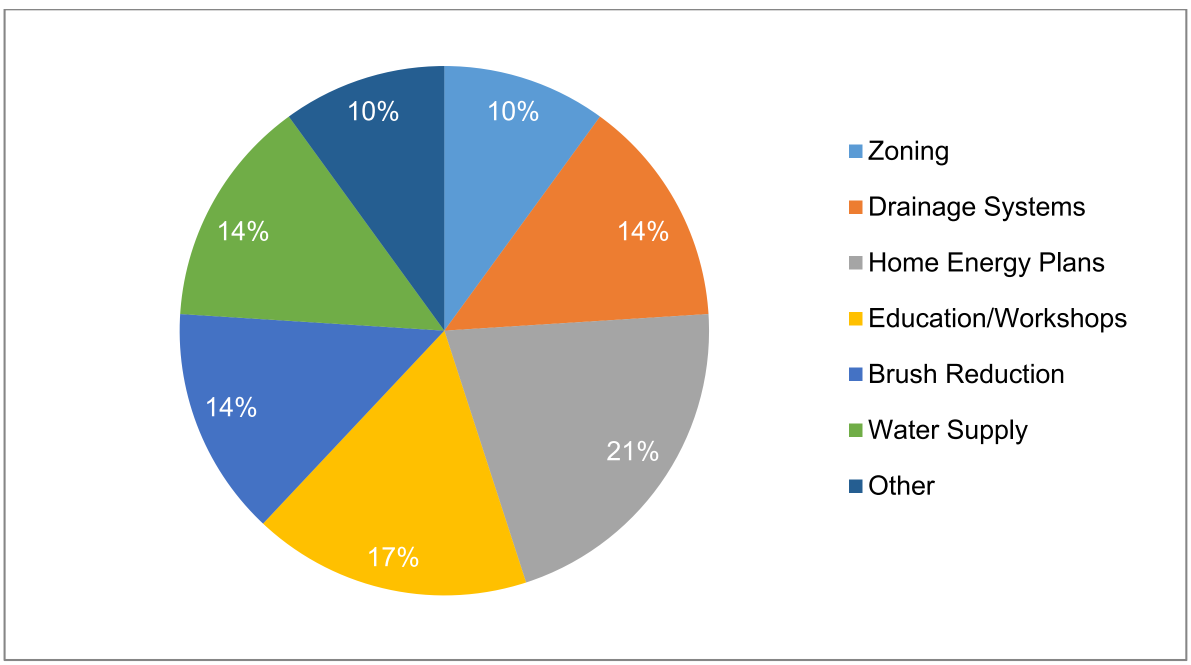
12. B. If other, please specify.



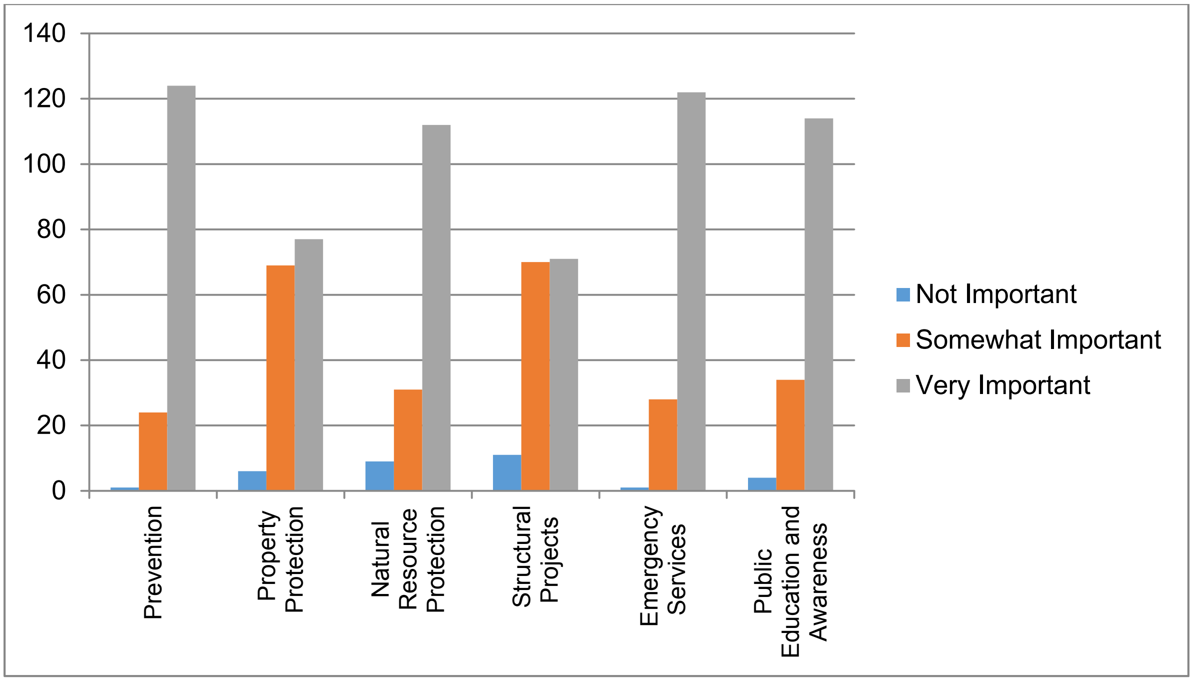
13. In your opinion, what are some steps your local government could take to reduce or eliminate the risk of future hazard damages in your neighborhood?



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



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



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.

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.

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.

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.

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.

Appendix C: Critical Facilities

This Appendix is **For Official Use Only (FOUO)** and may be exempt from public release under FOIA. Figures C-1 through C-7 locates all critical facilities that were included in the risk assessment. Mapped facilities were provided by City of Austin Planning Team members.

Figure C-1. Critical Facilities in the City of Austin

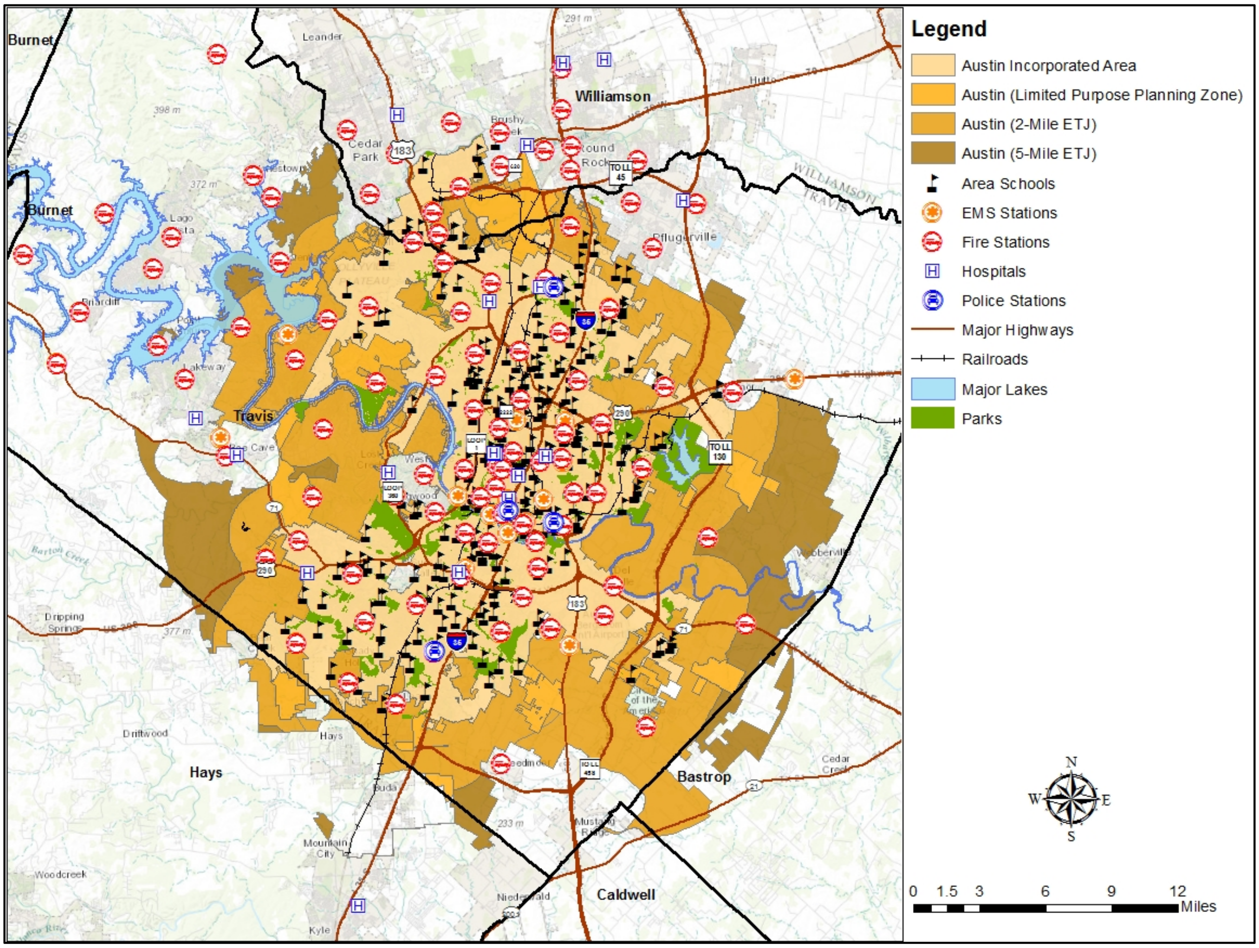


Table C-1. Critical Facilities by Type in the City of Austin

TYPE	NUMBER
Fire Stations	97
Police Stations	4
Hospitals	18
EMS Stations	46
Schools	256

Figure C-2. Fire Stations in the City of Austin

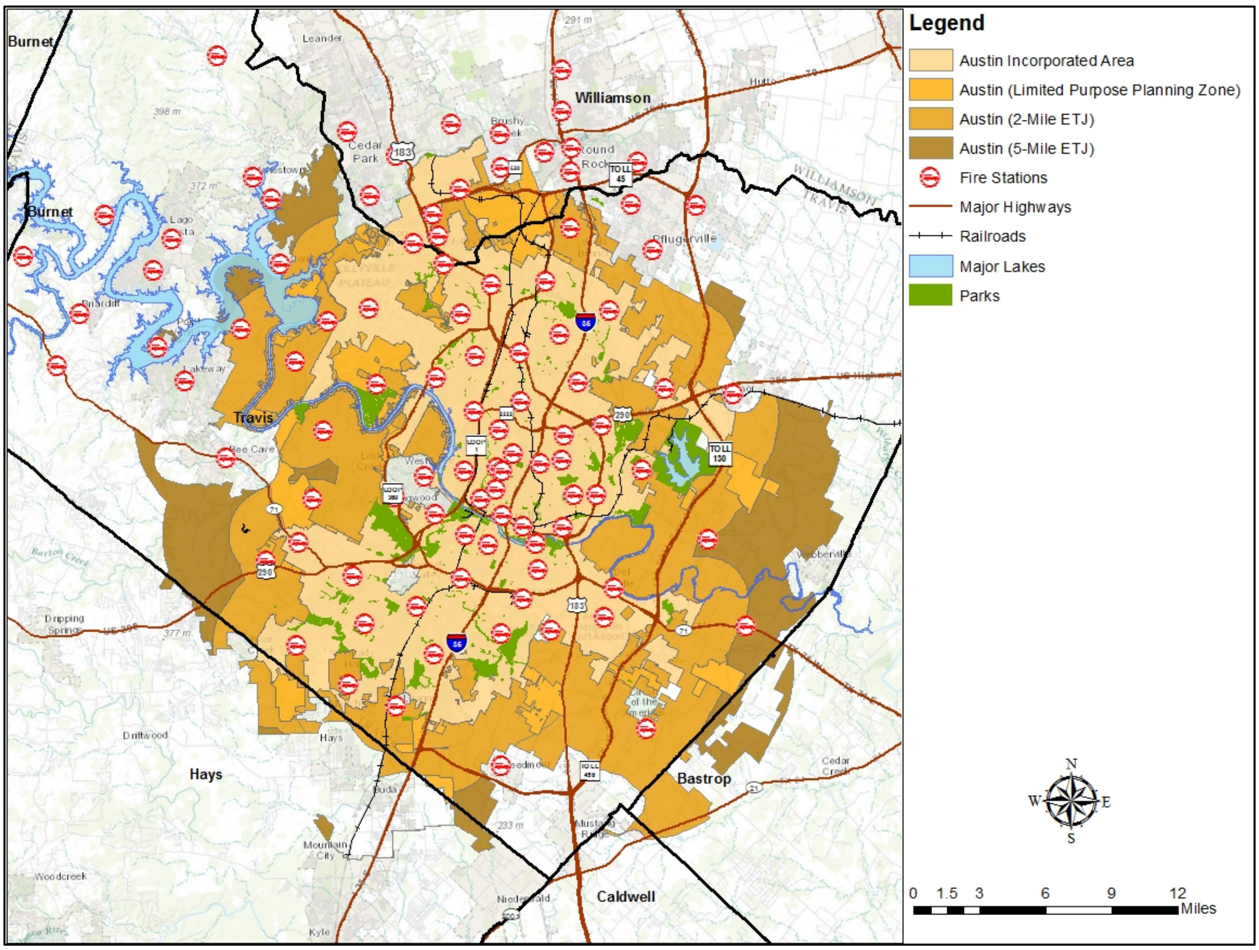


Figure C-3. Police Stations in the City of Austin

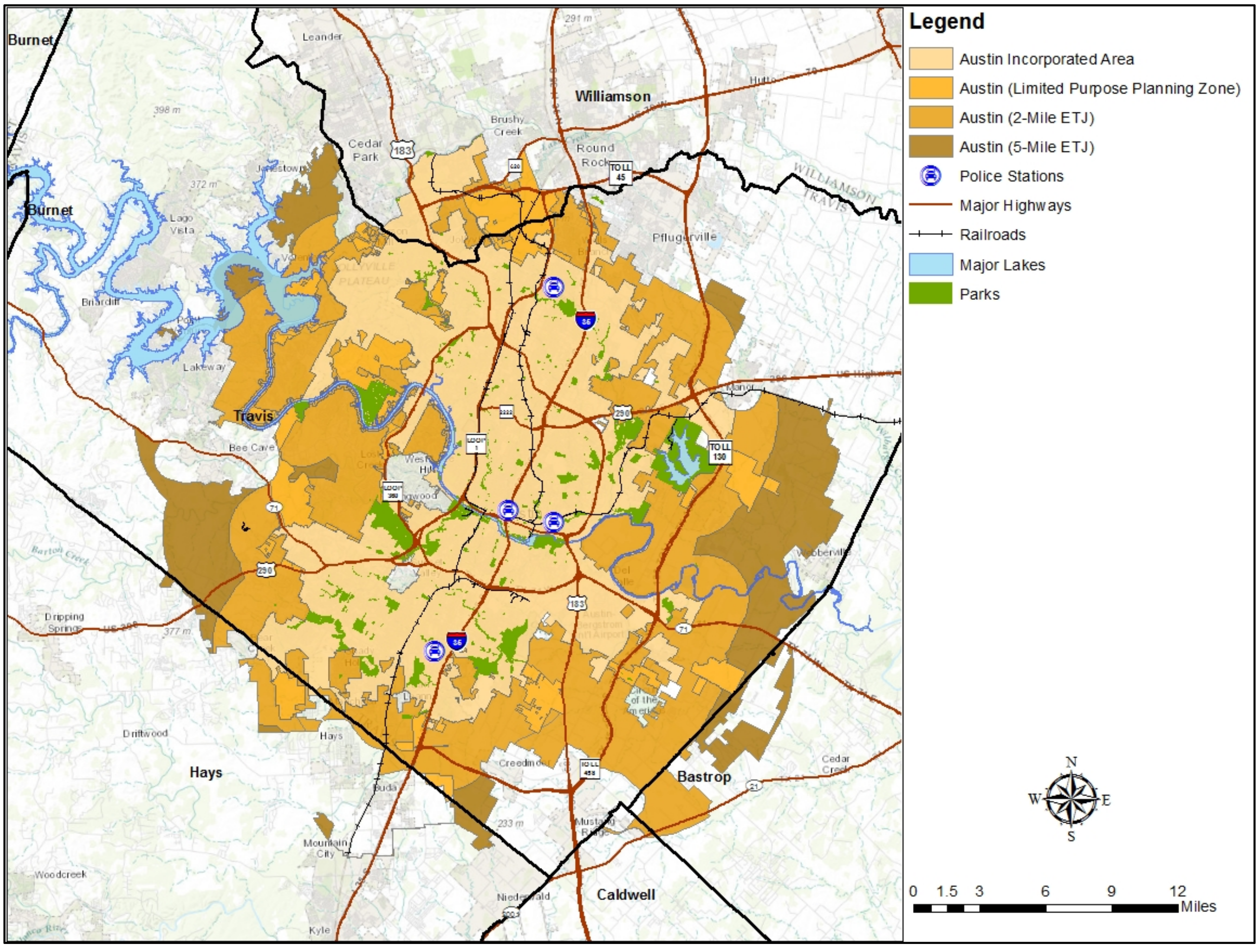


Figure C-4. Hospitals in the City of Austin

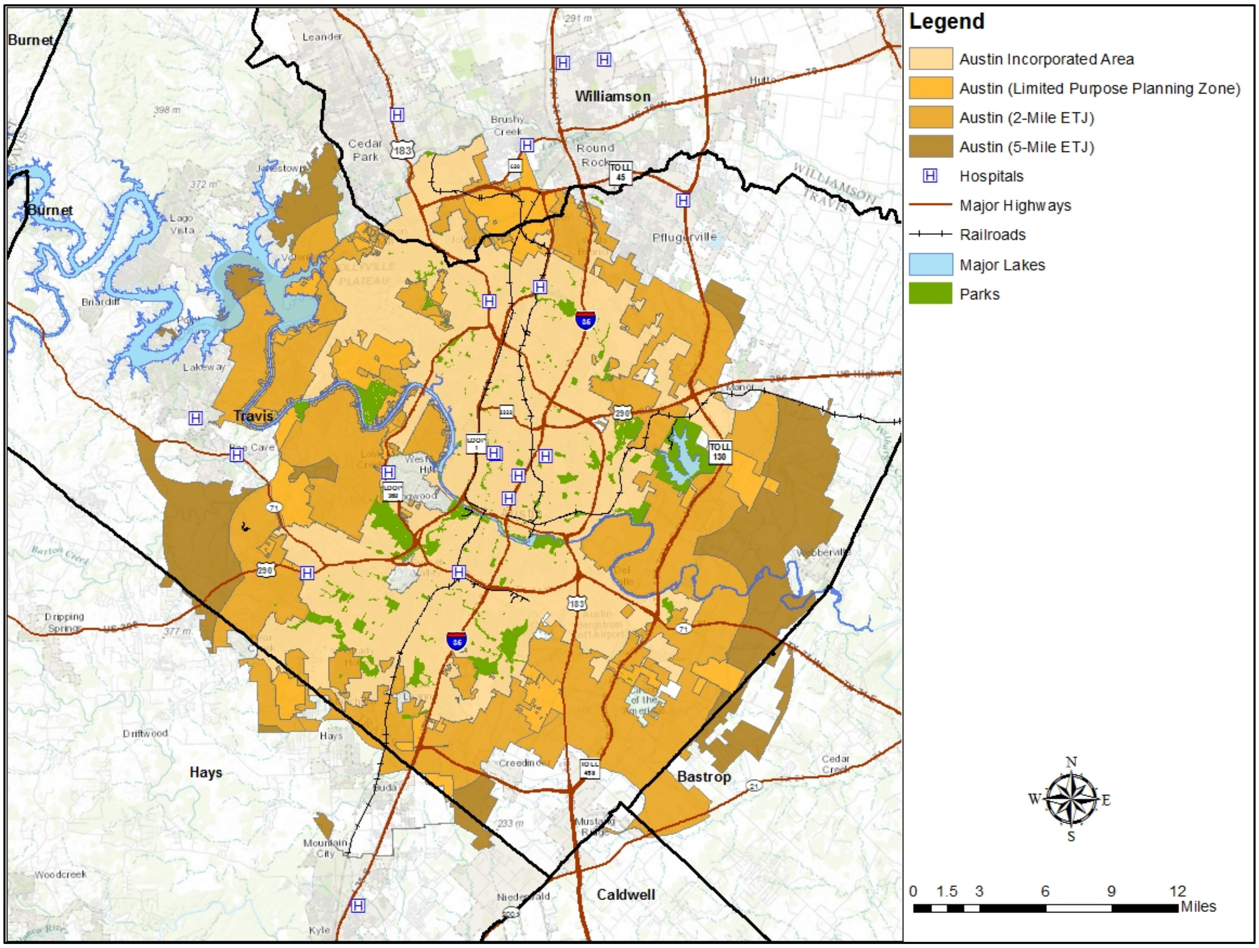


Figure C-5. EMS Stations in the City of Austin

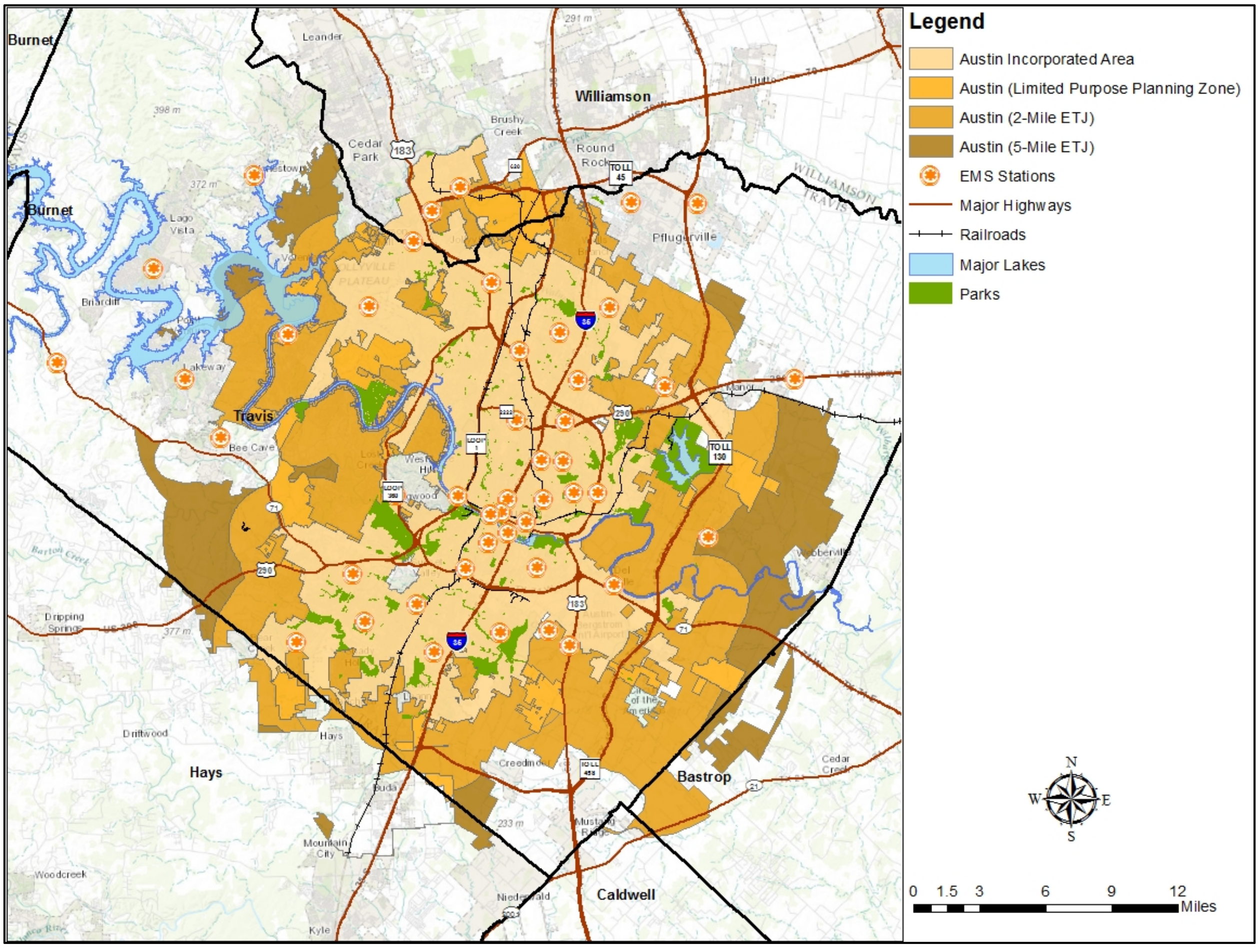


Figure C-6. Schools in the City of Austin

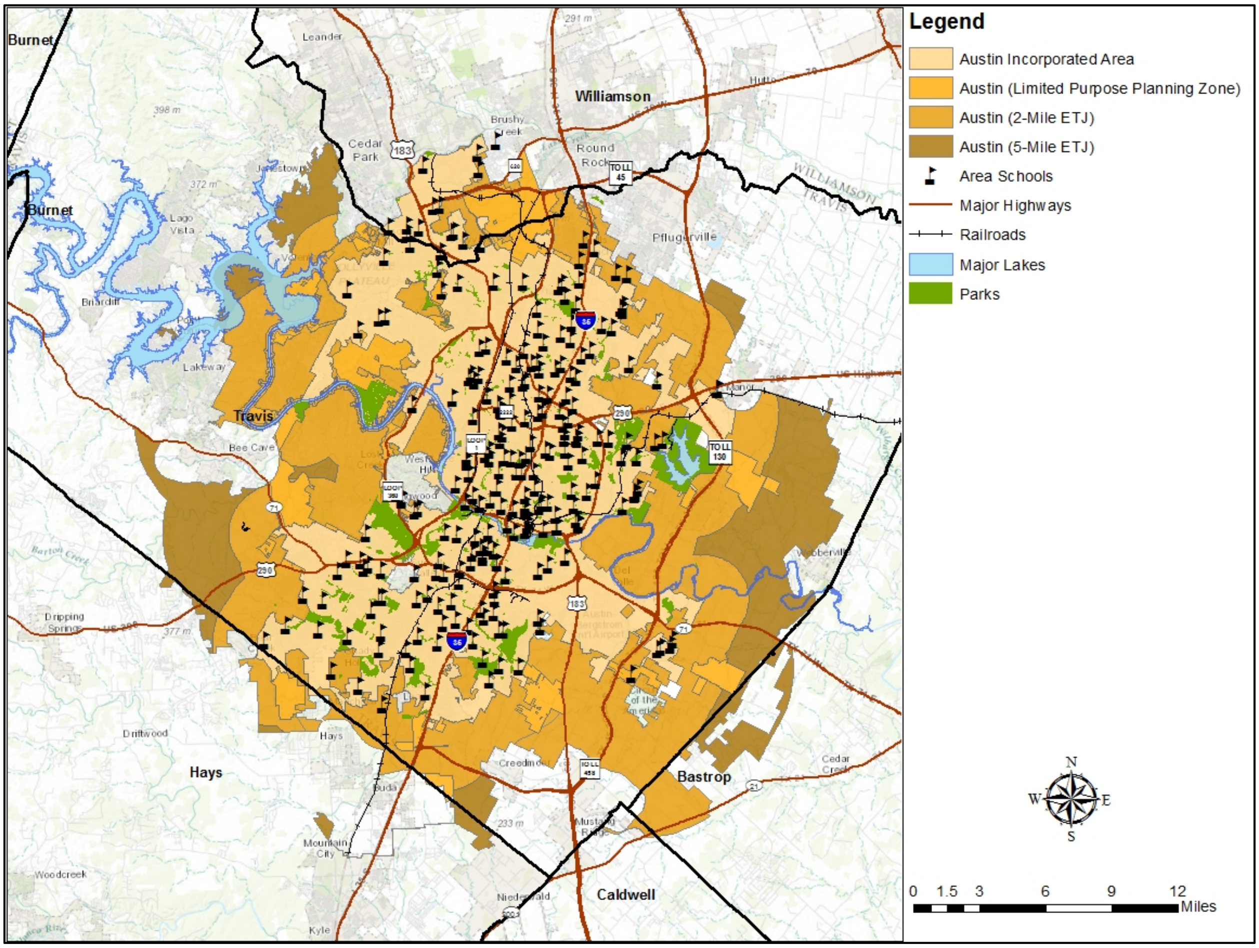


Figure C-7. Critical Facilities: Austin ISD

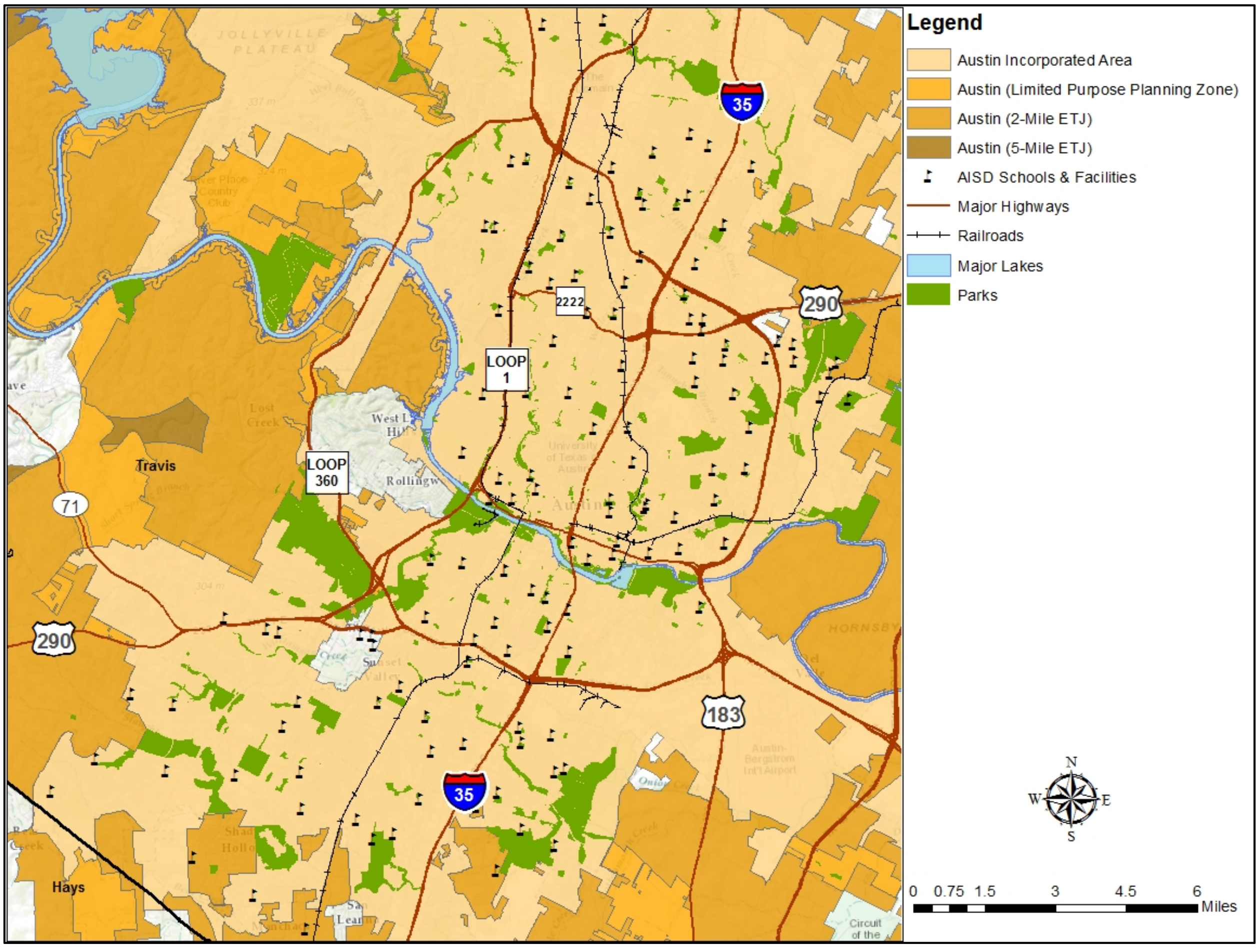


Table C-2. AISD Schools

TYPE	NUMBER
High Schools	16
Middle Schools	18
Elementary Schools	84
Other Schools	11

Appendix D: Dam Locations

Overview

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

Table D-1 below reflects all dams that are located in the City of Austin. This list includes High, Significant, and Low Hazard Dams. Section 14 of the Plan Update, profiles only "high" hazard type dams, as required by FEMA.

Dam Locations

Table D-1. Listing of Austin Dam Locations and Storage Capacities

JURISDICTION	LATITUDE	LONGITUDE	HEIGHT (Ft.)	STORAGE (Acre Feet)
Austin	30.38932	-97.7509	30	30
Austin	30.30295	-97.6937	21	150
Austin	30.40833	-97.6912	12	
Austin	30.32959	-97.6484	26	40
Austin	30.36242	-97.7781	58	50
Austin	30.28545	-97.5971	75	45,200
Austin	30.21269	-97.8544	22	300
Austin	30.4107	-97.7198	36	140
Austin	30.41186	-97.7263	28	70
Austin	30.20158	-97.8867	20	448
Austin	30.27711	-97.6927	36	
Austin	30.35131	-97.7453	24.77	64.7
Austin	30.1755	-97.8377	8	57.9
Austin	30.43446	-97.7912	42	183
Austin	30.24614	-97.8993	25	176.8
Austin	30.33484	-97.6095	9	83

Austin	30.33632	-97.6138	9	197
Austin	30.25035	-97.7135	65	6,850
Austin	30.39222	-97.9073	277	3,223,000
Austin	30.2047	-97.8519	11	43.4
Austin	30.40616	-97.6647	14	99
Austin	30.44166	-97.7267	18.3	309
Austin	30.36738	-97.7007	14	62.4
Austin	30.38342	-97.7344	7	98.2
Austin	0	0	22	225
Austin	30.42172	-97.7984	33.5	84
Austin	30.42216	-97.8104	37	506
Austin	30.40683	-97.7021	16	90.2
Austin	0	0	21	84
Austin	30.3858	-97.855	50	120
Austin	30.37134	-97.7195	12	56.6
Austin	30.19622	-97.8805	14.5	225
Austin	30.33648	-97.9269	26	
Austin	30.17558	-97.7559	17.3	50
Austin	30.17068	-97.6144	6.5	64.1
Austin	30.29406	-97.7864	85	115,404
Austin	30.38431	-97.6633	24.5	15
Austin	30.38025	-97.6057	21	100
Austin	30.27333	-97.7354	19	34.6
Austin	30.36068	-97.7498	33	60
Austin	30.33455	-97.782	16	204.3

Appendix E: Meeting Documentation

Workshop Documentation

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

The City of Austin & Austin ISD held a series of planning team workshops: a Kickoff Workshop on March 10, 2015, a Risk Assessment Workshop on April 28, 2015, and a Mitigation Workshop on August 4, 2015. At each of these workshops, planners were informed of steps in the planning process and expressed opinions and volunteered information, as necessary. The sign in sheets for each workshop are included below. Public (stakeholders) meetings followed each of the workshops and sign in documentation is included in this section as well. For more details on the workshops and planning process, see Section 2.

Figure E-1. Kickoff Workshop, 03.10.15

H_2O PARTNERS

City of Austin Hazard Mitigation Plan Update
Kickoff Workshop, Austin, TX
March 10, 2015

Name/Title	Department	Phone	Email
Stephanie Jensen	CTM	572-974-6446	stephanie.jensen@austintexas.gov
Justice Jones	APD	974 - 0199	justice.jones@austintexas.gov
Robert Andrews	APD	512-974-5793	rob.andrews@austintexas.gov
Stakeholder James Bush	CapMetro	512 369-6545	James.Bush@capmetro.org
Dan Dargevics	CAMPO	974 2748	dan.dargevics@campotexas.org
Janet Richette	HHSD	97 25486	city
Bing Chen	HSEM	512-974-0480	bing.chen@austintexas.gov
Dan Dean	BSD	4-3987	DAN.DEAN@ " " "
Marc Coudert	OOS	974-2016	marc.coudert@ " "
Angel Flores	HSEM	974-0477	"angel.flores@" "
Billy Atkins	HSEM	512-974-0463	billy.atkins@ " "

H_2O PARTNERS

City of Austin Hazard Mitigation Plan Update
Kickoff Workshop, Austin, TX
March 10, 2015

Name/Title	Department	Phone	Email
Otis J. Latin, Sr. Director	HSEM	512-974-0461	otis.latin@austintexas.gov
David Magana	PWD, City Engineer	4-7042	david.magana@
Ed Poppitt Engineer	PWD SBO	512 974 8768	ed.poppitt@austintexas.gov
Cathy Meek Mitigation Mgr	H2O	512·924·9814	cathy@h2opartnersusa.com
Denay Webb Mitigation Spec.	H2O	512 422·6607	dwebb@h2opartnersusa.com

H2O PARTNERS

City of Austin Hazard Mitigation Plan Update
Stakeholder Workshop, Austin, TX
March 10, 2015

Name/Title	Department	Phone	Email
Mike Elliott Div. Chief	Emergency Management EMS	512-972-7153	mike.elliott@austintexas
Planning Team Wendi White	CTM	5122840539	wendi.white@austintexas.gov
" Matt Porcher	WPD Network Admin Systems Sr.	512-9742844	matthew.porcher@austintexas.gov
" Sharon Cooper	COA WPD	512-974-2448	sharon.cooper@ci.austin.tx.us
Pirouz Moin	COA/PWD/CCE Supervising Eng.	512-974-8769	pirouz.moin@austintexas.gov
Carolyn Sudduth	CAPCOG	512-916-0614	csudduth@capcog.org
Kristine Eldeckin	ACC	512-223-1079	keldecki@austincc.edu
Planning Sonia Goodman	HSEM	512-974-0471	sonia.goodman@austintexas.
" [illegible]	HSEM	512-974-0468	[illegible]@ "
" John Gaeke	AISD	512-897-9922	john.gaeke@austinisdpolice.org

Figure E-2. Risk Assessment Workshop, 04.28.15

H2O PARTNERS

City of Austin Hazard Mitigation Plan Update
Planning Team & Stakeholder
Risk Assessment Workshop, Austin, TX
April 28, 2015

Name/Title	Department	Phone	Email
Robert Andrews / SGT	Austin PD	512-974-5793	rob.andrews@austintexas.gov
Matt Porcher / Network Admin	Watershed	512-974-2844	matthew.porcher@austintexas.gov
Harris Newman SEC	CTM	512 974 2456	harris.newman@austintexas.gov
Dan Dean / Deputy BSD	BSD	512 974 3987	DAN.DEAN@AUSTINTEXAS.GOV
Stephen Truesdell	Fire	974-4161	
Billy Atkins	HSEM	4-0463	billy.atkins@city
John Gaeke	AISD	512-414-1703	john.gaeke@austinisdpolice.org
Stephanie Jensen / GIS	CTM	512-974-6446	stephanie.jensen@city
Ed Poppitt / Engineer	PWD	512-974-8768	ed.poppitt@austintexas.gov
Cathy Merrell	H2O	512-924-9874	cathy@h2opartnersusa.com
Beth Johnson	Planning	512-974-7801	elizabeth.johnson@austintexas.gov
Dunaywitb	H2O	512-422-6607	
Mike Elliott	EMS	512-972-7153	mike.elliott@austintexas.gov
Janet Pichette	HHSD	25486	city

H2O PARTNERS

City of Austin Hazard Mitigation Plan Update
Planning Team & Stakeholder
Risk Assessment Workshop, Austin, TX
April 28, 2015

Name/Title	Department	Phone	Email
Judy Henry	A/TCHHSD	512-972-5045	city
Aoife Longmore	Austin HSEM	512-974-0468	city

Figure E-3. Mitigation Strategy Workshop, 08.04.15

H2O PARTNERS

City of Austin Hazard Mitigation Plan Update
Planning Team
Mitigation Strategy Workshop
August 4, 2015

Name/Title	Department	Phone	Email
Billy Atkins/Sr. Em. Planner	HSEM	4-0463	billy.atkins@city
Matt Porcher/WET Admin	COA-WPD	4-2844	matthew.porcher@city
Justice Jones	AFD	4-0199	justice.jones@city
Linda Haynie	"	4-1222	LINDA.HAYNIE@AUSTINTEXAS.COM
Harris Newman	CTM	42956	Harris.Newman@austintexas.gov
Beth Johnson	PAZ-Hist Pres	4-7801	elizabeth.johnson@austintexas.gov
Ed Poppitt	PWD-SBO	4-8768	ed.poppitt@austintexas.gov
Mike Elliott	EMS	972-7153	mike.elliott@austintexas.gov
Palmer Buck	Austin Fire	4-0111	City
Marc Coudert	OOS	4-2016	marc.coudert@austintexas.gov
[illegible]	APD	4-1703	[illegible]@austintexas.police.org
Aoife Longmore	HSEM	4-0468	aoife.longmore@austintexas.gov

City of Austin Hazard Mitigation Plan Update
Planning Team
Mitigation Strategy Workshop
August 4, 2015

H2O PARTNERS

Name/Title	Department	Phone	Email
MATT DUGAN	PAZ	4-7665	matthew.dugan@austintexas.gov
Danny Webb	H2O Partners	(512) 422-6607	dwebb@h2opartnersusa.com
Erin Capps	H2O	512-869-5783	ecapps@h2opartnersusa.com

Public Meeting Documentation

As discussed in Section 2, a series of three public meetings were held in conjunction with each of the workshops. Documentation in the form of sign in sheets for each of the meetings follows.

Figure E-4. Kickoff Workshop, Public, Pleasant Hill Branch Library, 03.10.15

H2O PARTNERS

City of Austin Hazard Mitigation Plan Update
Public Meeting, Pleasant Hill Branch Library
March 10, 2015

Name	Address	Phone	Email
ROBERT BAYLESS	8710 CHISHOLM 78748		METHYLGROUP@SBCGLOBAL.NET
Billy Atkins	HSEM		billy.atkins@austintexas.gov
Chrissie Angeletti	H2O		

Figure E-5. Kickoff Workshop, Public, Howson Branch Library, 03.12.15

H2O PARTNERS

City of Austin Hazard Mitigation Plan Update
Public Meeting, Howson Branch Library
March 12, 2015

Name	Address	Phone	Email
Billy Atkins	HSEM		billy.atkins@austintexas.gov
[illegible]	H2O Partners	512 924 9874	[illegible]@h2opartnersusa.com
Danay Webb	H2O Partners	512-422-6607	dwebb@h2opartnersusa.com
Denver Dunlap	2404 McCall Rd	512-563-0000	denver@denverdunlap.com

Figure E-6. Kickoff Workshop, Public, Spicewood Springs Branch Library, 03.12.15

H2O PARTNERS

City of Austin Hazard Mitigation Plan Update
Public Meeting, Spicewood Springs Branch Library
March 12, 2015

Name	Address	Phone	Email
Rachel Andrews	H2O Partners	512-633-8439	rachel@h2opartnersusa.com
Erin Capps	"	512-769-5483	ecapps@h2opartnersusa.com

Figure E-7. Kickoff Workshop, Public, Carver Branch Library, 03.16.15

H2O PARTNERS

City of Austin Hazard Mitigation Plan Update
Public Meeting, Carver Branch Library
March 16, 2015

Name	Address	Phone	Email
Mari CAntu	e myEXCEL.Com	512-442-4724	
Cathy Mark		512-924-9874	cathy@h2opartnersusa.com
Denay Webb		512-422-6607	dwebb@h2opartnersusa.com
STEFAN WRAY		512.983.5852	stefan@iconmedia.org
PAM THOMPSON		512-468-7607	pam@iconmedia.org
HUGH MAYFIELD			
Billy Atkins			billy.atkins@austintexas.gov
Jere Locke		416-7170	jerelocke@yahoo.com

Figure E-8. Risk Assessment Workshop, Public, Spicewood Springs Branch Library 07.13.15

H2O PARTNERS

City of Austin Hazard Mitigation Plan Update
Public Meeting, Spicewood Springs Branch Library
July 13, 2015

Name/Title	Phone	Email
Denay Webb/Mitigation Specialist	512-422-6607	dwebb@h2opartnersusa.com
Billy Atkins/HSEM	512-974-0463	billy.atkins@city
Danny Foley	512 6698845	foleyd99@gmail.com
Connie Watson	512-943-1663	cwatson@wilco.org

Figure E-9. Risk Assessment Workshop, Public, Pleasant Hill Branch Library 07.13.15

H_2O PARTNERS

City of Austin Hazard Mitigation Plan Update
Public Meeting, Pleasant Hill Branch Library
July 13, 2015

Name/Title	Phone	Email
Rachel Andrews H2O Partners	512-633-8439	rachel@h2opartnersusa.com
Geneva Kayser Del Valle ISD	512-386-3038	geneva.kayser@dvisd.net
KEN CRAIG Aide to C.M. Kitchen	512-978-2107	ken.craig@austintexas.gov

Figure E-10. Risk Assessment Workshop, Public, Carver Branch Library 07.16.15

H2O PARTNERS

City of Austin Hazard Mitigation Plan Update
Public Meeting, Carver Branch Library
July 16, 2015

Name/Title	Phone	Email
Rachel Andrews/H2O Partners	512-633-8439	rachel@h2opartnersusa.com
Scott Swearengin, Acting Director HSEM	512-974-0462	SCOTT.SWEARENGIN@AUSTINTEXAS.GOV
Annie Harton	(512) 280-1375	annieharton512@gmail.com
(TARG Travis Austin Recovery Group Board' Halloween floods)		
Iro D.	646 425 9712	irobuchi@gmail.com irobuchi@gmail.com irobuchi@gmail.com

Figure E-11. Risk Assessment Workshop, Public, Howson Branch Library 07.16.15

H2O PARTNERS

City of Austin Hazard Mitigation Plan Update
Public Meeting, Howson Branch Library
July 16, 2015

Name/Title	Phone	Email
Denny Webb/Mitigation Specialist	512-422-6601	dwebb@h2opartnersusa.com
Billy Atkins/HSEM	4-0463	billy.atkins@city
Paul Sweeney	512-499-8749	easysween@aol.com

Public Notices

Public notices to announce the City of Austin's participation in the Hazard Mitigation Plan was posted on the City of Austin OEM website and Austin ISD Twitter in conjunction with the public meetings as shown in Figures E-12 and E-15. Additionally, the City of Austin contacted the local newspaper to provide further outreach to residents regarding the Plan and public meetings as shown below in Figures E-13, E-14, and E-16.

Figure E-12. Public Notice, City of Austin Twitter Page, 03.09.15

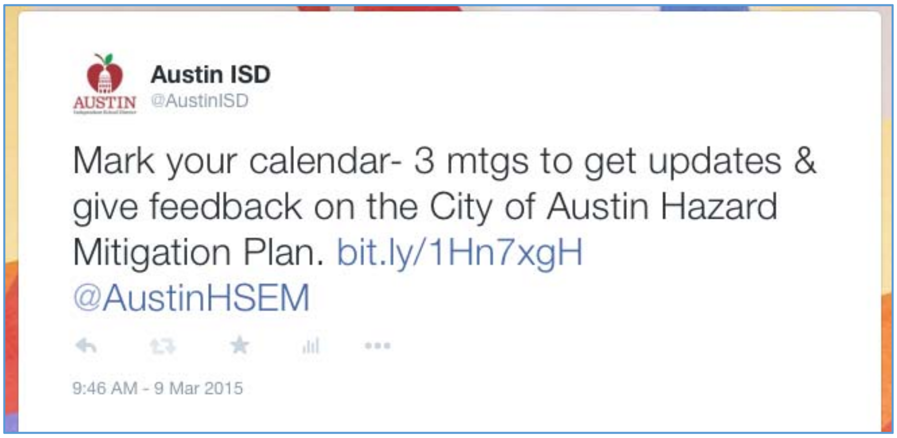
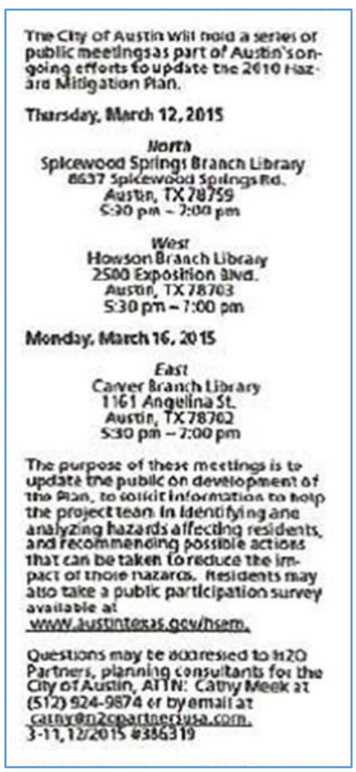


Figure E-13. Public Notice, City of Austin, Austin American Statesman Newspaper, Page D10, 03.11.15



The City of Austin will hold a series of public meetings as part of Austin's on-going efforts to update the 2010 Hazard Mitigation Plan.

Thursday, March 12, 2015

North
Spicewood Springs Branch Library
8637 Spicewood Springs Rd.
Austin, TX 78759
5:30 pm – 7:00 pm

West
Howson Branch Library
2500 Exposition Blvd.
Austin, TX 78703
5:30 pm – 7:00 pm

Monday, March 16, 2015

East
Carver Branch Library
1161 Angelina St.
Austin, TX 78702
5:30 pm – 7:00 pm

The purpose of these meetings is to update the public on development of the Plan, to solicit information to help the project team in identifying and analyzing hazards affecting residents, and recommending possible actions that can be taken to reduce the impact of those hazards. Residents may also take a public participation survey available at www.austintexas.gov/hsem.

Questions may be addressed to H2O Partners, planning consultants for the City of Austin, ATTN: Cathy Meek at (512) 924-9874 or by email at cathy@h2opartnersusa.com.
3-11,12/2015 #386319

Figure E-14. Public Notice, City of Austin, Austin American Statesman Newspaper, 07.12.15

B2 AUSTIN AMERICAN-STATESMAN | SUNDAY, JULY 12, 2015

COMMUNITY NEWS

News: communitynews@statesman.com or 512-445-3863

TRAVIS COUNTY

AUSTIN

Hazard meetings scheduled

The city of Austin will host a series of public meetings as part of ongoing efforts to update its Hazard Mitigation Plan.

Meetings will be from 5:30 to 7 p.m.:

- Monday at Pleasant Hill Branch Library, 211 E. William Cannon Drive, Room No. 1
- Monday at Spicewood Springs Branch Library, 8637 Spicewood Springs Road
- Thursday at Howson Branch Library, 2500 Exposition Blvd.
- Thursday at Carver Branch Library, 1161 Angelina St.

Input from the community is needed for the project team to identify and analyze potential hazards (such as droughts, floods, wildfires and other major disasters) and possible recommendations to reduce their damage.

The Austin school district will also be formally participating in the planning efforts.

Information about the Hazard Mitigation project is available online at austintexas.gov/hsem.

Citizens may also take part in a survey at surveymonkey.com/s/Austin_HMP.

— AMERICAN-STATESMAN STAFF

Figure E-15. Public Survey Invitation, City of Austin Website 08.12.15

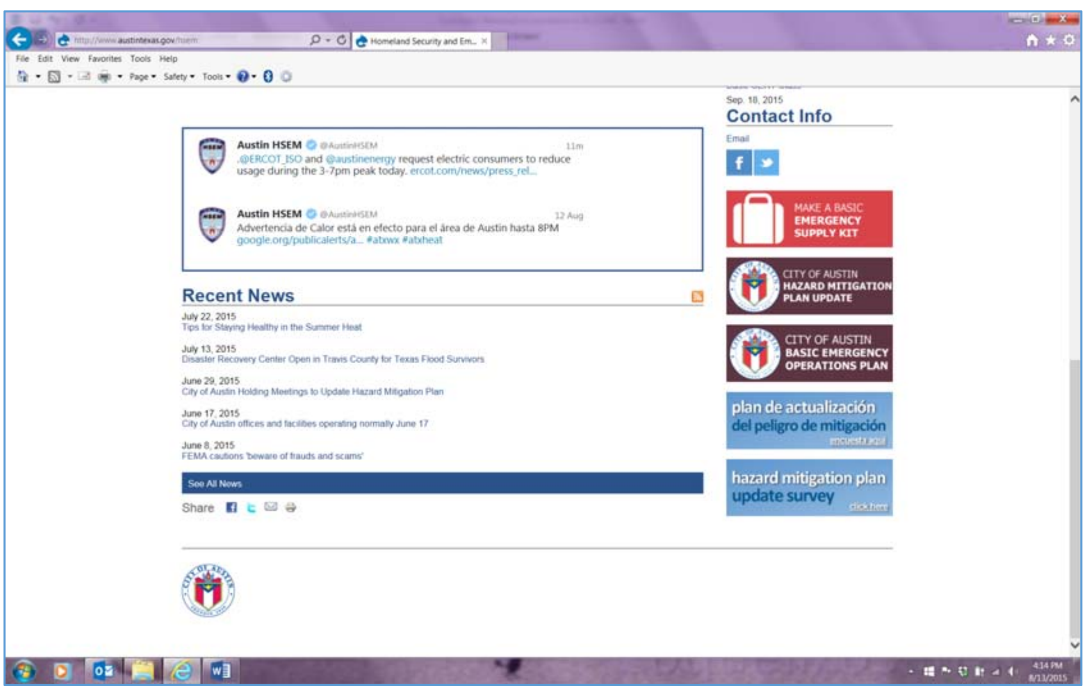


Figure E-16. Public Outreach, Community Impact Newspaper 08.26.15

CITY & COUNTY | PUBLIC SAFETY | TOP STORIES | WATER

Planning for natural disasters

Counties, city update hazard mitigation actions

By Kara Nuzback August 26, 2015

Appendix F: Capability Assessment

Overview

The Planning Team completed a Capability Assessment survey at the beginning of the Planning Process. Beginning on Page 2, a completed Capability Assessment Checklist provides information on existing policies, plans and regulations in place for the City of Austin. Austin ISD's completed Capability Assessment Checklist begins on Page 4.

A Community Capability Assessment is an integral component of the Hazard Mitigation planning process. It is an invaluable tool in assessing a community's existing planning and regulatory capabilities to support implementation of mitigation strategy objectives.

Each community has a unique set of capabilities, including authorities, policies, programs, staff, funding, and other resources available to accomplish mitigation and reduce long-term vulnerability. By reviewing existing capabilities in each jurisdiction, the planning team can identify capabilities that currently reduce disaster losses or could be used to reduce losses in the future, as well as capabilities that inadvertently increase risks in the community. This is especially useful for multi-jurisdictional plans where local capability varies widely.

The City of Austin continuously assesses the impacts of current policies, ordinances, and plans for community safety from hazard risk due to growth. The City conducts their assessment through respective planning mechanisms, such as a Capital Improvements Program, Comprehensive Long-Term Development Plan, and Flood Protection Plan, and other planning strategies. The Capability Assessment was completed considering safe growth initiative to various sectors of the City including transportation, environmental management, and land use requirements.

City of Austin Capability Assessment

COMMUNITY CAPABILITY CHECKLIST		
Planning/Regulatory Tool	**In Place**	**Under Development**
Hazard Mitigation Plan	X	
Comprehensive Land Use Plan	X	
Stormwater Management Plan/Ordinance		X
Emergency Operations Plan	X	
Capital Improvements Plan	X	
Floodplain Management Plan	X	
Flood Response Plan		X
Historic Preservation Plan		
Continuity of Operations Plan	X	
Evacuation Plan	X	
National Flood Insurance Program (NFIP)	X	
NFIP Community Rating System	X	
NFIP Floodplain Ordinance	X	
Building Code	X	
Fire Code	X	
Other Plans - CodeNEXT update to Watershed Protection and Development Ordinances		X
Administrative and Technical Capability	**Yes**	**No**
Planners	X	
Engineers	X	
Emergency Manager	X	

COMMUNITY CAPABILITY CHECKLIST		
Floodplain Manager	X	
Personnel skilled in Geographic Information Systems (GIS)	X	
Resource development staff or grant writers	X	
Financial Resources	**Yes**	**No**
Capital Improvement Programming	X	
Financial Resources	**Yes**	**No**
Community Development Block Grants (CDBG)	X	
Stormwater Utility Fees	X	
Development Impact Fees	X	
Partnering Agreements or Intergovernmental Agreements	X	
Other: Regional Stormwater Management Program	X	
Other: Public Assistance Grant DR-4159-TX 2013 October Floods: Hazard Mitigation 406	X	
Other: National Disaster Resilience Competition	X	

Austin ISD Capability Assessment

COMMUNITY CAPABILITY CHECKLIST		
Planning/Regulatory Tool	**In Place**	**Under Development**
Hazard Mitigation Plan	X	
Comprehensive Land Use Plan	X	
Stormwater Management Plan/Ordinance		
Emergency Operations Plan	X	
Capital Improvements Plan	X	
Floodplain Management Plan		
Flood Response Plan		
Historic Preservation Plan		
Continuity of Operations Plan		X
Evacuation Plan	X	
National Flood Insurance Program (NFIP)	X	
NFIP Community Rating System	X	
NFIP Floodplain Ordinance	X	
Building Code	X	
Fire Code	X	
Other Plans/Codes – ADA Compliance, National Electrical Code, Plumbing Codes, International Energy Conservation Code	X	
Administrative and Technical Capability	**Yes**	**No**
Planners	X	
Engineers	X	

COMMUNITY CAPABILITY CHECKLIST		
Emergency Manager	X	
Floodplain Manager		X
Personnel skilled in Geographic Information Systems (GIS)	X	
Resource development staff or grant writers	X	
Financial Resources	**Yes**	**No**
Capital Improvement Programming	X	
Community Development Block Grants (CDBG)	X	
Partnering Agreements or Intergovernmental Agreements	X	