City of San Marcos
Hays County Hazard Mitigation Plan Update
2017

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City of San Marcos Annex
Section 1: Organize and Review

This section contains a brief description of the City of San Marcos and its jurisdictional features. In addition, Section 1 contains the following details regarding San Marcos':

- participation in the Hays County HMP Update process,
- stakeholder engagement,
- public outreach strategy,
- incorporation efforts and
- plan maintenance procedures.

*Population :	44,805
Size of Community:	34.26 sq. mi
*Population over 65 years old	3,013
*Population under 16 years old	6,406
*Economically Disadvantaged Population ($0-$20k)	6,292

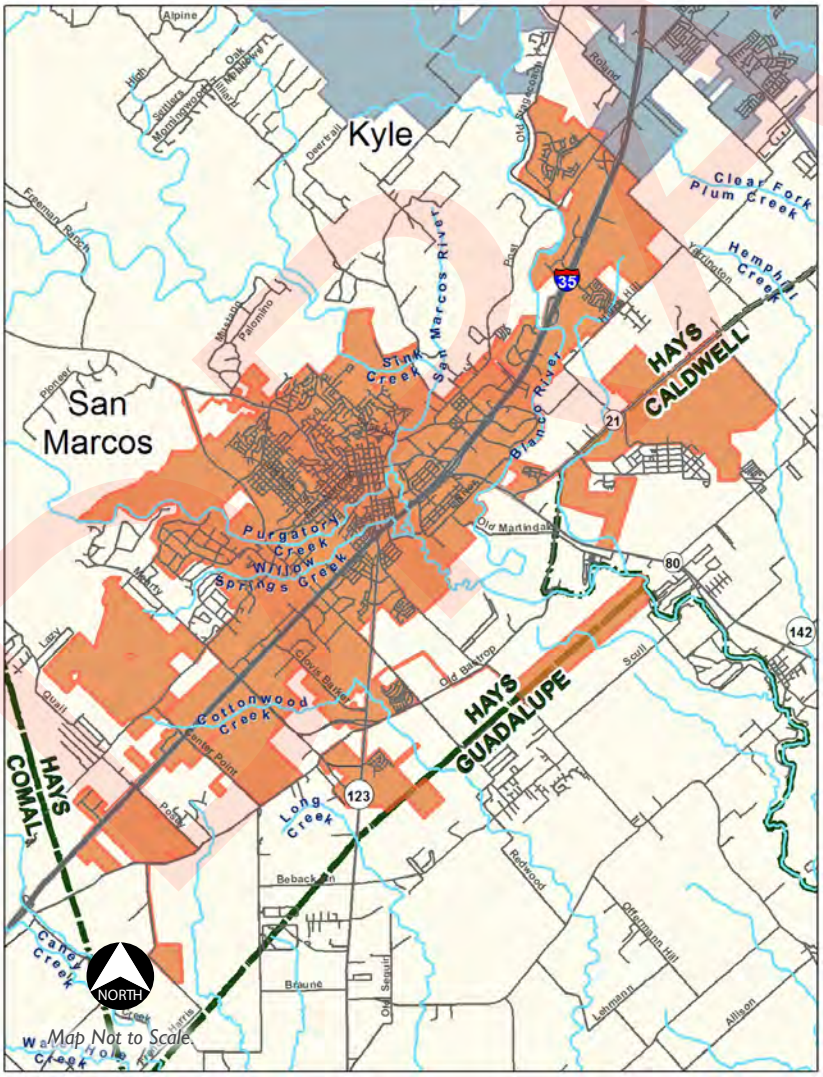
San Marcos is serviced by the following responders:

Fire/EMS - San Marcos Fire Department/San Marcos Hays County EMS

Law Enforcement - San Marcos Police Department

HAZUS-MH 3.2 Updated Census 2010 Population Estimates

Figure SM.1, City of San Marcos Planning Area



Community Description

When planning, it is important to take into account the characteristics that make a community unique. Consideration of unique needs when it comes to mitigating or recovering from natural hazards ensures that all members of the community and their needs are addressed.

San Marcos is known as the heart of Central Texas, located exactly midway between the cities of Austin and San Antonio, Texas on Interstate Highway 35 (IH-35). Located along the San Marcos River, San Marcos is the county seat for Hays County. The community has the largest population throughout the County and is home to Texas State University. Incorporated in 1877, the community follows a Council-Manager form of City Government made up of a Mayor and 6 Council Members.

The City is supported by 670 employees and known for its arts and history and is a popular tourist destination fueled by river activities, shopping and other attractions. In 2015, the City was named the fastest growing city in the United

States with a population of 50,000 residents or more, and won the designation for 3 years running. (Time, 2015)

San Marcos is served by San Marcos Consolidated ISD (SMCISD), which has 12 campuses throughout the City. There are 36,000 people enrolled at Texas State University as of 2015. In 2013, San Marcos permitted $235,940,463 in building permit values between the months of January and August. Most populated in the County, and still growing at an impressive rate, San Marcos is also home to 1,700 acres of parkland and open space.

Table SM.1 shows the City's major employers while Table SM.2 lists San Marcos main utility providers.

Table SM.1, Major Employers

Business Type	Name of Employer
Education	Texas State University
Retail	Amazon
Retail	San Marcos Premium Outlets
Retail	Tanger Factory Outlets
Education	San Marcos Consolidated Independent School District
Government	Hays County
Manufacturing	CFAN
Medical	Central Texas Medical Center (CTMC)
Retail	H-E-B Distribution Center
Government	City of San Marcos

(Greater San Marcos Partnership, 2017)

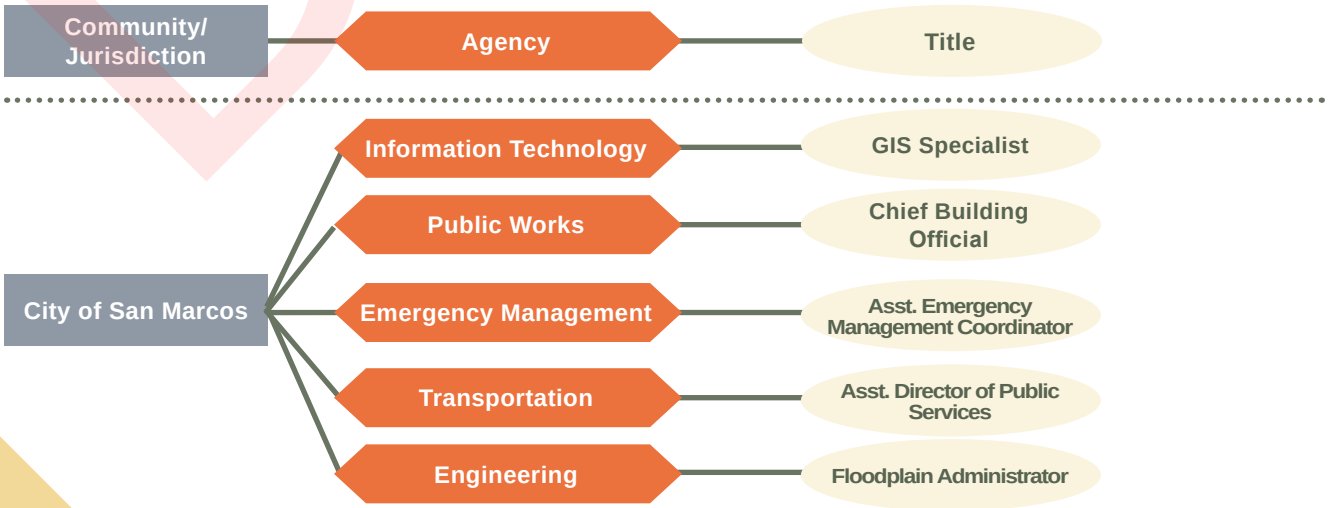
Table SM.2, Utility Providers

Type	Provider
Electric	San Marcos Electric Utility/Bluebonnet Electric/ Pedernales Electric Cooperative (PEC)
Natural Gas	CenterPoint Energy
Water	San Marcos Water-Wastewater Utility
Cable	Time Warner Cable/Centurylink

Planning Committee

Planners who represented San Marcos for the update process are collectively known as the San Marcos Mitigation Planning Committee (MPC) and are shown in Figure SM.2.

Figure SM.2, Planning Committee Membership



Community Planning Involvement

MPC planning activities for the Hays County Hazard Mitigation Plan (HMP) Update are captured in Figure SM.3, which utilizes check-marks to indicate each of the activities that were completed by the San Marcos MPC.

Figure SM.3, City of San Marcos Plan Participation

Meetings

- ✓ Kick-Off
- ✓ Risk Assessment
- ✓ Mitigation Strategy

Data Submission

- ✓ Planner's Survey Data Collection Spreadsheet/ GIS Data
- ✓ Planning Worksheets
- ✓ Phone Interview

Public Involvement

- ✓ City Council/Commissioner's Court Agenda Items
- ✓ Public Survey Posting/ Collection

Stakeholders

During the Phase 1 Kick-Off Meeting, planners were provided with a Planner/Stakeholder worksheet, referred to in Chapter 1, the Plan Process portion of the Hays County HMP Update. This document allowed planners to identify stakeholders for inclusion in the Risk Assessment and Mitigation Strategy Meetings. Table SM.3 identifies the stakeholders that were invited to participate by the following email:

Good Morning,

You or your organization has been identified by a local community planner as a stakeholder (interested/affected party) for the Hays County Hazard Mitigation Plan Update process. The planning team, made up of community officials from throughout Hays County, is working to update this plan that identifies actions for reducing and mitigating the risk from natural hazards (flood, tornado, severe winter, etc...) affecting Hays County and the communities within it. If your schedule allows, your insight would be valuable at a meeting being held on Thursday, January 12, 2017, from 1 p.m. to 4 p.m. at

Wimberley Community Center
14068 Ranch Road 12
Wimberley, TX 78676

Please register for the Hazard Mitigation Plan Update- Risk Assessment Meeting. https://www.eventbrite.com/e/hays-county-hazard-mitigation-plan-update-risk-assessment-meeting-registration-30892049953

If unable to complete registration on the Eventbrite site, please reply to this email and indicate who will attend from your organization so that the meeting facility can be prepared for the proper number of attendees.

JWSA and Halff Associates are providing coordination and facilitation support for this process for Hays County and participating communities utilizing FEMA mitigation grant funding. Any questions regarding this meeting can be directed to Paloma Alaniz at palaniz@halff.com.

Thank you.

Table SM.3, Plan Stakeholders

Jurisdiction	Agency	Title
City of San Marcos	Parks and Recreation	Assistant Director of Community Services
City of San Marcos	Administration	Mayor
City of San Marcos	GIS	GIS Enterprise Manager
City of San Marcos	Police Department	Assistant Chief
City of San Marcos	Planning & Development	Director
City of San Marcos	Administration	Assistant City Manager/CFO
City of San Marcos	Engineering	Senior Engineer
City of San Marcos	Fire Department	Assistant Fire Chief, Operations and Training
City of San Marcos	Police Department	Police Chief
City of San Marcos	Fire Department	Fire Chief
City of San Marcos	Parks and Recreation	Parks Operations Manager
City of San Marcos	Transportation	Stormwater Systems Manager
San Marcos Chamber of Commerce	Non-Profit	Administrative Assistant
San Marcos CISD	School District	Superintendent
San Marcos Council of Neighborhood Associations	Non-Profit	President
San Marcos Greenbelt Alliance	Non-Profit	President
San Marcos River Foundation	Non-Profit	Program Director
Bluebonnet Electric Cooperative	Utilities	Community Representative Manager
Spectrum (Charter)	Cable	Public Relations
Hays County	Sheriff's Office	Sheriff
Texas State Police Department	Police Department	Police Chief
Texas State University	University	Emergency Management Coordinator

Outreach Strategy

The City of San Marcos was very active in their outreach activities used to request public participation in the Hays County Hazard Mitigation Plan Update.

Public Survey Promotion

San Marcos advertised the Hays County Hazard Mitigation Plan Update Public Survey on the homepage of www.sanmarcostx.gov.

As of March 10, 2017, San Marcos had 160 residents respond to the public survey. A copy of the survey questions can be found in Appendix A of the Hays County HMP Update. Details on how the survey data was directly incorporated into the Risk Ranking process for hazards is included in Chapter 2, the Risk Assessment portion of the Hays County HMP Update.

City Council Meeting Announcement

On February 7, 2017, the City Senior Engineer presented information on the Hays County Hazard Mitigation Plan Update to the San Marcos City Council. The Council agenda and item report for this presentation are included in Appendix A of the Hays County HMP Update.

Plan Phase Newsletters

San Marcos was provided with newsletters at each phase of the planning process in order to be able to share updates on the planning process with stakeholders, elected officials, City staff and the public. Copies of the newsletters can be found in Plan Appendix A.

Plan Draft Public Review and Comment Period

The link to the draft Hays County HMP (hosted on the Hays County Office of Emergency Services page) was posted on the City of San Marcos website from July 12, 2017 until July 26, 2017. A hard copy was placed in the San Marcos City Hall. Email comments were collected by the Stormwater Management Team.

Incorporation of Sources

In addition to stakeholder and public input, the MPC also reviewed other planning resources that could provide useful information to the plan update process. Table SM.4 lists the documents reviewed and how they were considered for incorporation in the updated plan.

Table SM.4, Review/Incorporation of Sources

Name of Document	Type	How Incorporated
2013 State of Texas Hazard Mitigation Plan	Plan	Utilized hazard definitions and hazard classification names.
Flood Insurance Study	Study	Incorporated best available hydraulic and hydrologic study results for flood hazard profile.
San Marcos Code of Ordinances	Regulations	Reviewed for opportunities to enhance for mitigation (Municode, 2017) • General Ordinances Chapter 39- Flood Damage Prevention- methods for reducing flood losses • General Ordinances Chapter 86/Article 8- Drainage Utility Fee • Land Development Code Chapter 4- Zoning Regulations • Land Development Code Chapter 7- Public Facilities Standards • Land Development Code Chapter 3- Comprehensive Planning • Land Development Code Chapter 1- Development Procedures • Land Development Code Chapter 5- Environmental Regulations • General Ordinances Chapter 26- Civil Emergencies • General Ordinances Chapter 14- Buildings and Building Regulations • General Ordinances Chapter 38- Fire Prevention and Protection • General Ordinances Chapter 62- Public Safety • Land Development Code Chapter 7- Public Facilities Standards • General Ordinances Chapter 30- Emergency Services

San Marcos Flood Protection Plan 2007	Plan	Reviewed plan for possible incorporation of suggested mitigation actions from the plan
		Structural Flood Controls
		• Blanco River Watershed
		  • Channel and overbank maintenance/peak flow diversion to Bypass Creek
		• Cottonwood Creek
		  • Detention upstream of IH-35
		  • Floodplain ordinances and regulations enhanced
		• Purgatory Creek
		  • Hopkins Street culvert improvement
		  • Castle Creek Drive culvert improvement
		  • Expansion of NRCS Reservoir No. 5 flood storage volume
		• Schulle Canyon culvert improvement
		• Sessom Creek culvert improvement
		• Willow Springs Creek
		  • Downstream regional detention pond
		  • Upstream regional detention pond
		• Flood Early Warning System
		• Streamflow Gage Network
		• Various flood community initiatives
		(Espey Consultants, 2007)

Table SM.4, Review/Incorporation of Sources (cont.)

Name of Document	Type	How Incorporated
San Marcos Water Master Plan Update 2016	Plan	Reviewed for actions that were applicable for mitigation purposes. The plan ran modeling to simulate future conditions and identify the projects that would be needed to allow the City to continue to provide a safe reliable source of water for its customers. (Alan Plummer Associates, Inc., 2016)
San Marcos Transportation Master Plan	Plan	Reviewed actions that were ranked as favorable for Wetland/ Floodplain in the plan for possible incorporation • R-3 Realign Holland and Academy to provide Sessom connection to RM 12 • R-4 Widen Post Road form Aquarena Springs to northern study area limit to 4 lanes (6 lanes needed w/o Loop) • R-5 Extend LBJ northward from Bishop Street to W. Outer Loop as 2 lane section • R-7 Construct 4-lane freeway as E. Outer Loop • R-11 Extend River Ridge Parkway west as 2 lane section (IH 35 to Post Road) • R-13 Extend Beback Inn Road (Old Bastrop Hwy. to CenterPoint) as 2 lane section • R-14 Widen RM 12 from W. Outer Loop to Wimberley to 6 lanes (TxDOT) • R-15 Add U-Turn Lane for Transit Center Access • R-16 Widen River Rd. (SH 80 to new connection from Aquarena Springs) 4 lane section • R-17 Widen Comanche Street to 4 lanes (Sessom to Hopkins); improve 2-lane section (Hopkins to MLK) • R-18 Complete missing sections of University Drive (4 lane section) from Guadalupe to Comanche; long range complete section from Comanche to RM 12 • R-24 Extend Craddock South to Wonder World Drive (2 lane section) • R-25 Widen Thorpe Lane to 5 lanes from Aquarena Springs Dr - Hopkins St • R-26 Widen Hutchison to 3 lanes - CM Allen Pkwy to Moore St • R-27 Widen IH 35 overpass to 6 lanes • R-28 Widen Uhland to 3-4 lane section • R-29 Extend River Ridge Parkway from Post Road to Lime Kiln Road • R-32 Extend Stagecoach Trail (Craddock to W. Outer Loop) • R-33 Construct Purgatory Parkway between Craddock South and Stagecoach Trail western extension • R-34 Widen Charles Austin to 4 lane undivided • R-35 Widen FM 621 to 3 lanes from SH 123 to Old Bastrop Hwy. • R-38 Widen IH 35 to 8 main lanes/3-lane frontage roads throughout ETJ (Wilbur Smith Associates, 2004)

Table SM.4, Review/Incorporation of Sources (cont.)

Name of Document	Type	How Incorporated
Vision San Marcos: A River Runs Through Us- Comprehensive Plan	Plan	Reviewed community comprehensive plan for goals, objectives and actions to consider for incorporation in mitigation plan • Economic Development Goal 7/Objective- Engage appropriate partners to create a citywide strategy to better protect the area's natural resources and ecosystem's history • Environment & Resource Protection Goal 1/Objectives- Adopt watershed specific regulations based on scientific understanding of water quality impacts, Develop a regional detention and water quality strategy, • Environment & Resource Protection Goal 2/Objective- Develop a coordinated tree preservation and planting program • Environment & Resource Protection Goal 3/Objective- Develop re-claimed water infrastructure plan for activity nodes • Environment & Resource Protection Goal 4/Objectives- Adopt comprehensive floodplain development regulations, Implement an education and outreach program that identifies, and alerts citizens to, risks and responses to all hazards, in coordination with other governmental entities • Land Use Goal 3/Objectives- Implement rain water retention and storm water Best Management Practices, track and monitor pervious cover at the watershed level • Parks, Public Services & Facilities Goal 5/Objectives- Study and address homelessness issues through qualitative and/or quantitative analysis (City of San Marcos, 2013)

Continued Public Participation in Maintenance Process

The strategy for updates at the local level for the City will include opportunities for public involvement as shown in Table SM.5.

Table SM.5, Public Involvement for Updates

Activity	Public Involvement	Method Available
Monitoring	The public will be given notice when items will be reviewed and receive the opportunity to review the notes from any notable developments.	Newspaper/Social Media
Evaluation	The public will be given a means to voice their opinion on the completed actions.	SurveyMonkey/Paper Survey
Updates	Once updates are made, the changes will be recorded in a public revision history document.	Newspaper/Social Media/ Council Meeting Announcements/ SurveyMonkey

Maintenance

Table SM.6 lists the method, schedule, and responsible agent for the monitoring, evaluation, and updating of the adopted 2017 HMP within the Plan's 5-year update cycle.

Table SM.6, Hays County Hazard Mitigation Plan Maintenance Schedule, City of San Marcos

Task	Scope	Method	Schedule	Responsible Agent
Monitoring	Jurisdictional	Review of mitigation action items using Mitigation Action Progress Report Worksheets (Appendix C of the Hays County HMP Update).	Every 12 months	City of San Marcos, Marshals Office, Emergency Management Coordinator
Evaluation	Jurisdictional	Complete Online Planner Survey (using SurveyMonkey) with evaluation of plan process.	Every 12 months	City of San Marcos, Marshals Office, Emergency Management Coordinator
Updates	Jurisdictional	Perform updates to Mitigation Strategy to edit/add/omit actions identified during monitoring activities. Conduct post-disaster review of community annex in order to update for significant occurrences, construction of new critical infrastructure or facilities, changes in jurisdictional boundaries and development. Participate in MPC for 5 year HMP update process.	As needed	City of San Marcos, Marshals Office, Emergency Management Coordinator

Section 2: Risk Assessment

City of San Marcos Jurisdictional Hazards

This section contains San Marcos' hazard profiles for each natural hazard included in the Hays County HMP Update. Profiles include:

- Location - the area where the hazard is known to occur
- Previous Occurrences - a history of reported events for the hazard
- Significant Previous Occurrences (when applicable) - notable hazard events within the community
- Extent - the strength or magnitude of the hazard
- Probability - the likelihood of the hazard event occurring in the future
- Impact - the consequence or effect (or possible effect) of hazard events
- Vulnerability Summary - identification of structures, systems, populations or assets susceptible to loss or damage

Hazard descriptions and extent scales for hazard magnitudes, are found in Chapter 2, the Risk Assessment portion of the Hays County HMP Update.

When available, data specific to San Marcos was used for hazard analysis. When no instances were reported specifically for the jurisdiction for regional hazards, County level data was applied.

State and national datasets were used to determine occurrence, extent, and the respective probabilities, rather than verbal testimonies, in an effort to retain data consistency. For some hazards, the National Oceanic and Atmospheric Administration (NOAA) Storm Events Database was used as the most comprehensive data available for hazards. As a result, fatality, injury and damage amounts shown for previous hazard occurrences do not always reflect the most recent totals. The Previous Occurrences paragraphs identify instances in which this may occur. Verbal testimony, when available, was integrated into impact or vulnerability summaries, when applicable.

Hazards profiled within the Risk Assessment include:

Drought

Extreme Heat

Severe Winter Storms

Lightning

Hailstorms

Windstorms

Tornadoes

Expansive Soils

Floods

Land Subsidence

Hurricanes/Tropical Storms

Earthquakes

Dam/Levee Failure

Wildfires

Drought

Drought: Location

Drought occurs on a regional scale, therefore, all of the City of San Marcos is equally at risk as it can occur anywhere in the planning area.

Drought: Previous Occurrences

NOAA Storm Events Database documents 27 drought events for Hays County since the year 1996 (see Table SM.7). Although there were no drought events reported specifically for the City of San Marcos, the jurisdiction would have been affected by the events that were reported for the surrounding County area.

Fatality, injury and damage amounts are shown in Table SM.7, per the NOAA Storm Events Database. Community testimony indicates that these amounts do not reflect the most recent totals, however NOAA data is being used as the best source of information available for the record period.

Table SM.7, Reported Drought Occurrence, Hays County

Location	Date	Type	Fatalities	Injuries	Property Damage	Crop Damage
HAYS (ZONE)	4/1/1996	Drought	0	0	0.00	0.00
HAYS (ZONE)	5/1/1996	Drought	0	0	0.00	0.00
HAYS (ZONE)	6/1/1996	Drought	0	0	0.00	0.00
HAYS (ZONE)	7/1/1996	Drought	0	0	0.00	0.00
HAYS (ZONE)	8/1/1996	Drought	0	0	0.00	0.00
HAYS (ZONE)	7/1/2000	Drought	0	0	0.00	0.00
HAYS (ZONE)	8/1/2000	Drought	0	0	0.00	0.00
HAYS (ZONE)	9/1/2000	Drought	0	0	0.00	0.00
HAYS (ZONE)	10/1/2000	Drought	0	0	0.00	0.00
HAYS (ZONE)	5/1/2011	Drought	0	0	0.00	0.00
HAYS (ZONE)	6/1/2011	Drought	0	0	0.00	0.00
HAYS (ZONE)	7/1/2011	Drought	0	0	0.00	0.00
HAYS (ZONE)	8/1/2011	Drought	0	0	0.00	0.00
HAYS (ZONE)	9/1/2011	Drought	0	0	0.00	0.00
HAYS (ZONE)	10/1/2011	Drought	0	0	0.00	0.00
HAYS (ZONE)	11/1/2011	Drought	0	0	0.00	0.00
HAYS (ZONE)	12/1/2011	Drought	0	0	0.00	0.00
HAYS (ZONE)	1/1/2012	Drought	0	0	0.00	0.00
HAYS (ZONE)	6/1/2012	Drought	0	0	0.00	0.00
HAYS (ZONE)	12/1/2012	Drought	0	0	0.00	0.00
HAYS (ZONE)	2/1/2013	Drought	0	0	0.00	0.00
HAYS (ZONE)	3/1/2013	Drought	0	0	0.00	0.00
HAYS (ZONE)	4/1/2013	Drought	0	0	0.00	0.00
HAYS (ZONE)	6/1/2013	Drought	0	0	0.00	0.00
HAYS (ZONE)	7/1/2013	Drought	0	0	0.00	0.00
HAYS (ZONE)	8/1/2013	Drought	0	0	0.00	0.00
HAYS (ZONE)	8/1/2014	Drought	0	0	0.00	0.00
Total					$0.00	$0.00

(National Oceanic and Atmospheric Administration Storm Event Database, 2016)

Drought: Significant Past Events

Several significant regional drought events have previously impacted the City. Refer to the *Drought: Significant Past Events* paragraph within Section 2, Risk Assessment of the Hays County Annex, for narratives discussing these events.

Drought: Extent

The US Drought Monitor Drought Intensity scale classifies drought by 5 categories, D0 through D4. According to the reported previous drought occurrences in the jurisdiction, the maximum drought extent experienced is a Category D4 drought. Refer to Chapter 2, the Risk Assessment portion of the Hays County HMP Update, for a description of US Drought Monitor Drought Intensity Index.

Drought: Probability

Based on 6 years with reported drought events from the NOAA Storm Events Database within 20 years, a drought event occurs approximately once every 3 years on average in Hays County. Since drought events can happen anywhere throughout the HMP update area and occur on a regional scale, the City of San Marcos' future probability is assumed to be similar to the surrounding County areas and therefore, can expect a drought event approximately once every 3 years on average with up to a Category D4 Drought.

Number of Years with Reported Event (Drought Year)	Number of Years in Dataset	Probability
6	20	0.30

Drought: Impact

Table SM.8 and SM.9 list the impact of drought from 1996 to 2016 for Hays County as well as the City of San Marcos according to the Drought Impact Reporter (DIR). The DIR is the nation's first comprehensive database of drought impacts. This database contains information from multiple Federal agencies, such as NOAA and United States Geological Survey (USGS), related to drought impacts from a national to city level by category and extent of impact. As the effects of drought are not confined to jurisdictional boundaries and occur on a regional scale, impacts reported on the Hays County level are applicable in illustrating impact to the City of San Marcos.

Table SM.8, Reported Drought Impacts, Hays County

Hays County Drought Impacts 1996-2016	
Category	**# of Incidents Reported**
Agriculture	45
Business & Industry	3
Energy	2
Fire	24
Plants & Wildlife	33
Relief, Response & Restrictions	48
Society & Public Health	7
Tourism & Recreation	3
Water Supply & Quality	53

(University of Nebraska-Lincoln, 2016)

Table SM.9, Reported Drought Impacts, City of San Marcos

San Marcos Drought Impacts 1996-2016	
Category	**# of Incidents Reported**
Agriculture	N/A
Business & Industry	N/A
Energy	N/A
Fire	N/A
Plants & Wildlife	2
Relief, Response & Restrictions	7
Society & Public Health	2
Tourism & Recreation	N/A
Water Supply & Quality	7

(University of Nebraska-Lincoln, 2016)

Drought: Vulnerability Summary

There are wells and pumps in the City that provide the water supply, and those are vulnerable to drought. The City has a backup contract with Canyon Lake for emergency water situations, to lessen the impact of water shortage.

River levels directly impact the tourism activity of the City. When drought periods are occurring, low water levels inhibit the ability for tourists to float down the river. A decrease in visitors directly impacts tax revenue from the sales that typically come in during those seasons.

There is a power generation plant dependent on water in the City. Effluent water that has been through wastewater treatment is sold to the electrical generation plants for the purposes of cooling their engines.

Another vulnerability is the impact of drought on the small amount of farmland within the City limits. In addition, periods of drought in San Marcos can lead to cascading disaster scenarios such as wildfire due to the increase in dried vegetation.

Extreme Heat

Extreme Heat: Location

Extreme heat occurs on a regional scale; therefore, all of the City of San Marcos is equally at risk as it could occur anywhere in the planning area.

Extreme Heat: Previous Occurrences

NOAA's Online Weather Data (NOWData) provides temperature data ranging from 2000 to 2016. NOAA's National Weather Service (NWS) Heat Index (located in Chapter 2, the Risk Assessment portion of the Hays County HMP Update) indicates that temperatures meeting or exceeding 90°F are designated with an "Extreme Caution" or greater warning classification. According to Canyon Dam Station, the closest local weather data collection center with comprehensive data, the mean number of days with a daily max temperature equal or greater to 90°F is 94 days. Currently, the greatest number of days during which the jurisdiction experienced extreme heat is 119 in 2008 while the highest temperature experienced was 109°F in August 2011 (a "Danger" NWS Heat Index classification). Canyon Dam Station is the closest reporting NOWData station to the jurisdiction and applies equally to the City of San Marcos due to the regional nature of extreme heat occurrence.

Extreme Heat: Extent

Extreme heat extent is classified by temperatures as well as levels, within the NWS Heat Index. The extent of extreme heat that the City of San Marcos has experienced can be derived from the data provided from NOWData at Canyon Dam Station since the year 2000. The highest daily mean temperature experienced was 109°F in August 2011. This event is classified by the NWS Heat Index as "Danger". Refer to Chapter 2, the Risk Assessment portion of the Hays County HMP Update, for a description of heat extent scale, NOAA's NWS Heat Index.

Extreme Heat: Probability

The probability of future events can be determined by assessing historical averages. Since extreme heat events occur on a regional scale, the City of San Marcos' future probability is assumed to be similar to the area surrounding Canyon Dam Station. Based on NOWData, the City can expect, on average, approximately 94 days a year with temperatures equal or greater to 90°F, and up to a "Danger" warning classification per the NOAA NWS Heat Index. As extreme heat events have occurred every year since 2000, the probability of extreme heat affecting the community is 100% in any given year.

Extreme Heat: Impact

Extreme heat has physical impacts on the public and the infrastructure that supports them. According to the Texas Health Care Information Collection and Trauma Registry from the Texas Department of State Health Services' Injury Epidemiology & Surveillance Branch, the following number of patients were received in Hays County medical facilities for Heat Related Injuries and Trauma shown in Tables SM.10 and SM.11 (Texas Department of State Health Services - Injury Epidemiology & Surveillance Branch, 2017).

Table SM.10, Hays County Hospital Inpatient Data, Extreme Heat

Description	2010	2011	2012	2013	2014
Accidents caused by excessive heat due to weather conditions	1	3	5	0	0
Accidents due to excessive heat of unspecified origin	1	0	0	0	0

(Texas Department of State Health Services- Injury Epidemiology & Surveillance Branch, 2017)

Table SM.11, Hays County Trauma Data, Extreme Heat

Description	2010	2011	2012	2013	2014
Accidents due to excessive heat of unspecified origin	0	1	0	0	0

(Texas Department of State Health Services- Injury Epidemiology & Surveillance Branch, 2017)

In addition to the physical impacts, an excessive heat event can also be the cause of cascading incidents. Electrical outages could occur due to the high demands of electricity needed to power cooling systems. A loss of critical resources, such as power, has significant impact on the entire population, with higher impacts to those with vulnerabilities to such conditions. The following portion of the City of San Marcos' population, according to HAZUS-MH 3.2 updated Census 2010 population estimates, would be greatly impacted by the severe temperatures related to excessive heat and/or the loss of electrical energy in their dwellings.

Population over 65 years old	3,013
Population under 16 years old	6,406
Economically Disadvantaged Population ($0-$20k)	6,292

An organization called Inside Energy (http://insideenergy.org) provided a compiled database outlining 15 years of power outages across the United States from annual data available at the Department of Energy. Within the database, the following excessive heat events affected electrical availability in the areas in or near Hays County (shown in Table SM.12).

Table SM.12, Extreme Heat Affecting Electrical Availability

Event Description	Year	Start Date	Start Time	End Date	Respondent	Location	Customers Affected
Declared Energy Emergency Alert2/Heat Wave	2007	8/14/2007	2:00 p.m.	8/14/2007	American Electric Power (CSWS)	CSWS Control Area of Southwest Power Pool Parts of Oklahoma, Texas, Louisiana, Arkansas	N/A

(Wirfs-Brock, 2014)

Extreme Heat: Vulnerability Summary

San Marcos does not have a cooling station plan for the community but does have locations available in order to cool people. They have also held fan drives that provide box fans to the senior adult population in need. This project is a volunteer-run effort that utilizes some of the emergency services district stations as donation drop-off points.

In addition, San Marcos has a small homeless population that sleep outside, under bridges, and in parks and wooded areas. This population would be especially impacted by the dangerous temperatures of extreme heat events.

Severe Winter Storms

Severe Winter Storms: Location

Severe winter storms occur on a regional scale; therefore, all of the City of San Marcos is equally at risk.

Severe Winter Storms: Previous Occurrences

NOAA Storm Events Database documents 13 winter storm events for Hays County since the year 1996 (see Table SM.13). Although there were no winter storm events reported specifically for the City of San Marcos, the jurisdiction would have been affected by the events that were reported for the surrounding County area.

Fatality, injury and damage amounts are shown in Table SM.13, per the NOAA Storm Events Database. Community testimony indicates that these amounts do not reflect the most recent totals, however NOAA data is being used as the best source of information available for the record period.

Table SM.13, Winter Weather Occurrences, Hays County

Location	Date	Type	Fatalities	Injuries	Property Damage	Crop Damage
HAYS (ZONE)	2/1/1996	Winter Storm	0	0	0.00	0.00
HAYS (ZONE)	1/7/1997	Winter Storm	0	0	0.00	0.00
HAYS (ZONE)	1/11/1997	Winter Storm	0	0	0.00	0.00
HAYS (ZONE)	12/23/1998	Winter Storm	0	0	0.00	0.00
HAYS (ZONE)	12/12/2000	Winter Storm	0	0	0.00	0.00
HAYS (ZONE)	11/28/2001	Winter Storm	0	0	0.00	0.00
HAYS (ZONE)	2/24/2003	Winter Storm	0	0	0.00	0.00
HAYS (ZONE)	12/7/2005	Winter Storm	0	0	0.00	0.00
HAYS (ZONE)	1/15/2007	Winter Storm	0	0	125,000.00	0.00
HAYS (ZONE)	2/3/2011	Winter Storm	0	0	0.00	0.00
HAYS (ZONE)	11/26/2013	Winter Weather	0	0	0.00	0.00
HAYS (ZONE)	1/23/2015	Winter Weather	0	0	0.00	0.00
HAYS (ZONE)	2/16/2015	Winter Weather	0	0	0.00	0.00
Total			0	0	$125,000.00	$0.00

(National Oceanic and Atmospheric Administration Storm Event Database, 2016)

Severe Winter Storms: Significant Past Events

Regionally, there were significant winter weather events reported as Hays (Zone) that may have impacted the City, as shown in Table SM.13. Refer to the *Severe Winter Storms: Significant Past Events* section within the Hays County Annex for narratives discussing these events.

Severe Winter Storms: Extent

Ice accumulation is captured and measured with the Regional Snowfall Index (RSI) and the Sperry-Piltz Ice Accumulation (SPIA) Index, as detailed in Chapter 2, the Risk Assessment portion of the Hays County HMP Update. According to the reported previous winter weather occurrences in the jurisdiction, the maximum winter weather extent experienced is a RSI Category 1 snowfall event or SPIA Ice Index Category 2 ice event.

Severe Winter Storms: Probability

Based on 13 reported events from the NOAA Storm Events Database in 20 years, a winter weather event occurs approximately every 2 years on average in Hays County. There were no events reported specifically for the City of San Marcos. Since these events can happen anywhere throughout the HMP update area and occur on a regional scale, the City's future probability is assumed to be similar to the surrounding County area. The City can expect a winter weather event approximately once every 2 years on average in the future, with up to a RSI Category 1 snowfall event or SPIA Ice Index Category 2 ice event.

Number of Reported Events	Number of Years in Dataset	Probability
13	20	0.65

Severe Winter Storms: Impact

Severe winter weather has physical impacts upon the public and the infrastructure that supports them. According to the Texas Health Care Information Collection and Trauma Registry from the Texas Department of State Health Services' Injury Epidemiology & Surveillance Branch, the following number of patients were received in Hays County medical facilities for Cold Related Injuries and Trauma (shown in Tables SM.14 and SM.15).

Table SM.14, Hays County Hospital Inpatient Data, Severe Winter Storms

Description	2010	2011	2012	2013	2014
Accidents caused by excessive cold due to weather conditions	2	0	0	0	0
Accidents due to excessive cold of unspecified origin	1	0	0	0	1

(Texas Department of State Health Services- Injury Epidemiology & Surveillance Branch, 2017)

Table SM.15, Hays County Trauma Data, Severe Winter Storms

Description	2010	2011	2012	2013	2014
Accidents due to excessive cold due to weather conditions	1	0	0	0	0

(Texas Department of State Health Services- Injury Epidemiology & Surveillance Branch, 2017)

In addition to the physical impacts, a severe winter storm event can also be the cause of cascading incidents. Electrical outages could occur due to the high demands of electricity needed to power heating systems. A loss of critical resources, such as power, has significant impact on the entire population, with higher impacts to those with vulnerabilities to such conditions. The following portion of San Marcos' population, according to HAZUS-MH 3.2 updated Census 2010 population estimates, would be greatly impacted by the extreme temperature conditions related to severe winter storms and/or the loss of electrical energy in their dwellings.

Population over 65 years old	3,013
Population under 16 years old	6,406
Economically Disadvantaged Population ($0-$20k)	6,292

An organization called Inside Energy (http://insideenergy.org) provided a compiled database outlining 15 years of power outages across the United States from annual data available at the Department of Energy. Within the database, the following winter storm events affected electrical availability in the areas in or near Hays County (shown in Table SM.16).

Table SM.16, Severe Winter Storms Affecting Electrical Availability

Event Description	Year	Start Date	Start Time	End Date	Respondent	Location	Customers Affected
Cold Weather Event	2011	2/9/2011	4:30 PM	2/10/2011	ERCOT ISO	Texas	N/A
Public Appeal due to Severe Weather - Cold	2014	1/6/2014	7:01 AM	1/7/2014	ERCOT	Texas	N/A
Public Appeal due to Severe Weather - Cold	2014	3/2/2014	7:00 PM	3/4/2014	ERCOT	ERCOT Region Texas	N/A

**Electrical Reliability Council of Texas (ERCOT)*

(Wirfs-Brock, 2014)

In addition, severe winter storms and the icy roads that accompany them lead to dangerous driving conditions. As seen in Table SM.17, city-level data available from the Texas Department of Transportation's Crash Records Information System shows that between the years of 2010 and (May) 2017, the City of San Marcos experienced 28 crashes related to sleet/hail and snow conditions. Injuries sustained from these crash events included 2 possible injuries.

Table SM.17, Severe Winter Storms, Vehicle Accidents, City of San Marcos

City	Fatality	Incapacitating Injury	Non-Incapacitating	Possible Injury	Crash Year	Street Name	Surface Condition	Weather Condition
San Marcos	0	0	0	0	2011	W SESSOMS	Ice	Sleet/Hail
San Marcos	0	0	0	0	2011	W SESSOMS	Ice	Sleet/Hail
San Marcos	0	0	0	0	2011	IH0035	Ice	Sleet/Hail
San Marcos	0	0	0	0	2011	SH0080	Ice	Sleet/Hail
San Marcos	0	0	0	0	2011	SH0080	Ice	Sleet/Hail
San Marcos	0	0	0	0	2011	W SESSOMS	Ice	Sleet/Hail
San Marcos	0	0	0	0	2011	W SESSOMS	Ice	Sleet/Hail
San Marcos	0	0	0	0	2011	RR0012	Ice	Sleet/Hail
San Marcos	0	0	0	0	2011	RR0012	Ice	Sleet/Hail
San Marcos	0	0	0	0	2011	RR0012	Ice	Sleet/Hail
San Marcos	0	0	0	0	2011	IH0035	Ice	Snow
San Marcos	0	0	0	0	2011	IH0035	Ice	Snow
San Marcos	0	0	0	0	2014	IH0035	Slush	Sleet/Hail

Table SM.17, Severe Winter Storms, Vehicle Accidents, City of San Marcos (cont.)

City	Fatality	Incapacitating Injury	Non-Incapacitating	Possible Injury	Crash Year	Street Name	Surface Condition	Weather Condition
San Marcos	0	0	0	0	2014	IH0035	Slush	Sleet/Hail
San Marcos	0	0	0	0	2014	SL0082	Wet	Sleet/Hail
San Marcos	0	0	0	0	2014	SL0082	Wet	Sleet/Hail
San Marcos	0	0	0	0	2014	SL0082	Wet	Sleet/Hail
San Marcos	0	0	0	0	2014	SL0082	Wet	Sleet/Hail
San Marcos	0	0	0	1	2014	IH0035	Ice	Sleet/Hail
San Marcos	0	0	0	1	2014	IH0035	Ice	Sleet/Hail
San Marcos	0	0	0	0	2014	IH0035	Ice	Sleet/Hail
San Marcos	0	0	0	0	2014	IH0035	Ice	Sleet/Hail
San Marcos	0	0	0	0	2014	IH0035	Ice	Sleet/Hail
San Marcos	0	0	0	0	2014	IH0035	Ice	Snow
San Marcos	0	0	0	0	2014	IH0035	Ice	Snow
San Marcos	0	0	0	0	2016	S OLD BASTROP HWY	Wet	Sleet/Hail
San Marcos	0	0	0	0	2016	S OLD BASTROP HWY	Wet	Sleet/Hail
San Marcos	0	0	0	0	2016	S OLD BASTROP HWY	Wet	Sleet/Hail

Crash Records Information System Query for Accidents in San Marcos from 2010-2017 from non-Clear Weather Conditions (Texas Department of Transportation, 2017)

Severe Winter Storms: Vulnerability Summary

About half of San Marcos' powerlines are on poles. This poses a vulnerability due to the impact on electricity to homes and businesses during cold temperatures when an accumulation of ice and snow on branches could cause them to fall on the exposed powerlines.

Dangerous road conditions pose a threat to San Marcos due to the large number of residents and student populations that drive into the City for classes at Texas State University. The City has a dump truck that is used to drop sand onto the streets, however community officials note that this is not the most effective method for spreading sand for icy roads. School buses often have problems during icy conditions in San Marcos, as well. There are some significant roadways that have alternate routes, but the major thoroughfares for the community are Wonder World Drive, Aquarena Springs and IH-35. All state and Federal roadways are maintained by other entities and outside of the control of the City.

Lightning

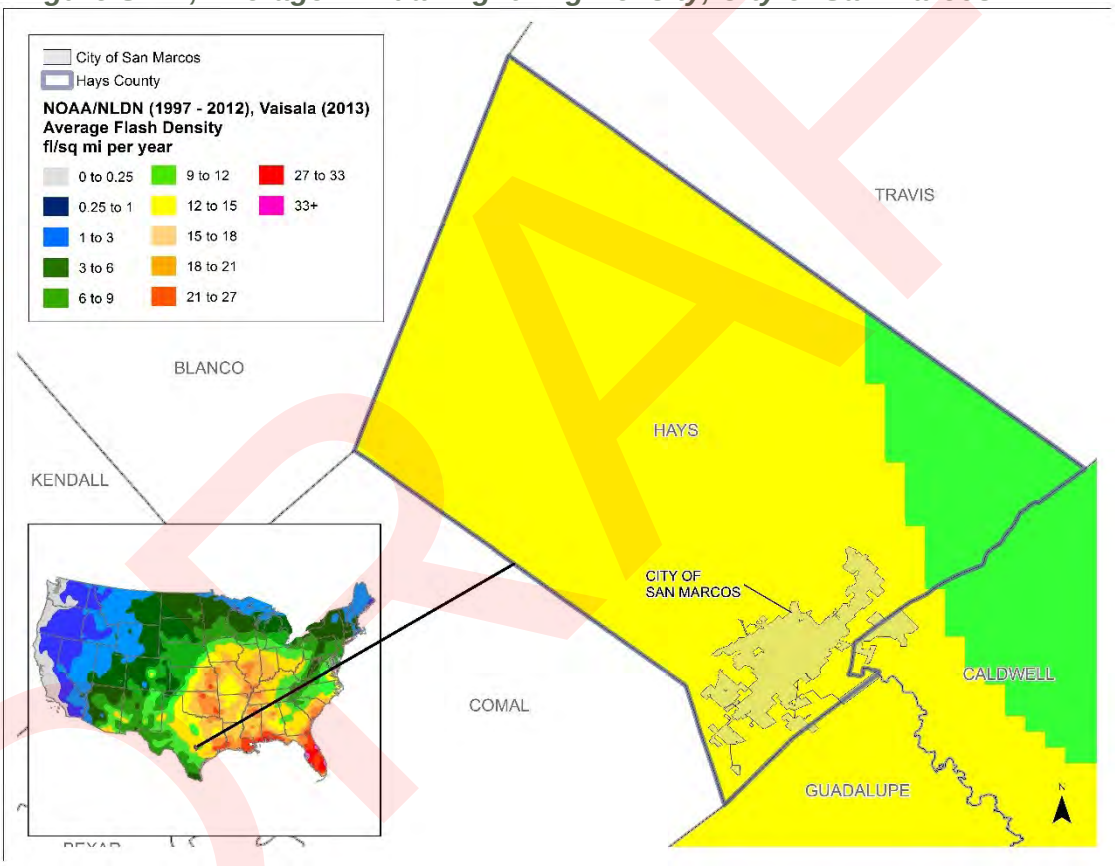
Lightning: Location

The entire extent of the City of San Marcos is exposed to some degree of lightning hazard, though exposed points of high elevation have a significantly higher frequency of occurrence. Since lightning can occur at any location, lightning events could be experienced anywhere within the planning area.

Lightning: Previous Occurrences

Figure SM.4 reflects the City of San Marcos within the area that was calculated to receive approximately 12 to 15 lightning strikes per square mile per year according to National Lightning Detection Network (NLDN) data for the years 1997 to 2012. There were no lightning events reported specifically for the jurisdiction in the NOAA Storm Events Database.

Figure SM.4, Average Annual Lightning Density, City of San Marcos



(Vaisala NLDN, 2016)

Lightning: Extent

Due to the lack of reported occurrences, there is not sufficient data to determine the maximum Lightning Activity Levels (LAL) for the planning area, refer to Chapter 2 for a description of the lightning extent scale LAL Grids. However, with the data available, the extent of lightning events that the City of San Marcos has experienced can be derived from the NOAA/NLDN data in Figure SM.4, up to 12 to 15 strikes per square mile per year where the City is approximately 34.26 square miles.

Lightning: Probability

Since lightning can occur at any location, lightning events could be experienced anywhere within the planning area. Based on the data provided in Figure SM.4, the City of San Marcos can expect future events to fall in line with NLDN data from previous years with an average occurrence of up to approximately 12 to 15 lightning strikes per square mile per year.

Lightning: Impact

The National Lightning Detection Network (NLDN) reported 217 lightning fatalities within the State between the years 1959 and 2013. According to the Texas Health Care Information Collection and Trauma Registry from the Texas Department of State Health Services' Injury Epidemiology & Surveillance Branch, the following number of patients were received in Hays County medical facilities for Lightning Related Trauma (shown in Table SM.18).

Table SM.18, Hays County Trauma Registry Data, Lightning Events

Description	2010	2011	2012	2013	2014
Accidents due to lightning	0	1	0	0	1

(Texas Department of State Health Services- Injury Epidemiology & Surveillance Branch, 2017)

In addition to the physical impacts, a lightning event can also be the cause of cascading incidents. Electrical outages could occur due to the impact that lightning strikes can have on electrical utility infrastructure. A loss of critical resources, such as power, has significant impact on the entire population, with higher impacts to those with vulnerabilities to such conditions. The following portion of the City of San Marcos' population, according to HAZUS-MH 3.2 updated Census 2010 population estimates, would be greatly impacted by the loss of electrical energy in their dwellings.

Population over 65 years old	3,013
Population under 16 years old	6,406
Economically Disadvantaged Population ($0-$20k)	6,292

An organization called Inside Energy (http://insideenergy.org) provided a compiled database outlining 15 years of power outages across the United States from annual data available at the Department of Energy. Within the database, the following thunderstorm/severe storm events affected electrical availability in the areas in or near Hays County (Table SM.19).

Table SM.19, Lightning Affecting Electrical Availability

Event Description	Year	Start Date	Start Time	End Date	Respondent	Location	Customers Affected
Severe Weather	2008	4/9/2008	4:00 p.m.	4/13/2008	Oncor Electric Delivery Company LLC	North, Central and East Texas	488,689
Severe Thunderstorms	2008	6/17/2008	9:01 a.m.	6/19/2008	Oncor Electric Delivery Company LLC	North, Central and East Texas	234,393

Table SM.19, Lightning Affecting Electrical Availability (cont.)

Event Description	Year	Start Date	Start Time	End Date	Respondent	Location	Customers Affected
Severe Thunderstorms	2008	8/3/2008	1:30 a.m.	8/3/2008	Entergy Corporation	Mississippi, Louisiana, Texas	59,500
Severe Storms	2009	6/10/2009	6:00 p.m.	6/14/2009	Oncor Electric Delivery Company, LLC	North and Central Texas	800,000
Thunderstorms	2010	6/8/2010	11:00 a.m.	6/8/2010	Centerpoint Energy	Southeastern Texas	79,741

(Wirfs-Brock, 2014)

Lightning strikes also cause wildfire ignitions. According to the National Fire Protection Association (NFPA), "during 2007-2011, U.S. local fire departments responded to an average of 22,600 fires per year that were started by lightning. These fires caused an average of 9 civilian deaths, 53 civilian injuries and $451 million in direct property damage per year." The source also cites that the fires are more common in June through August and in the late afternoon and evening.

Lightning: Vulnerability Summary

According to community testimony, there have been several lightning events in 2016. During one of these events, a lightning strike ignited a structure fire. There are also communications towers in the community that are at risk for strike within the community, however they have lightning protection equipment. In addition, the portion of the powerlines in the City that are mounted on poles are also susceptible to lightning strike, and could result in electrical outage.

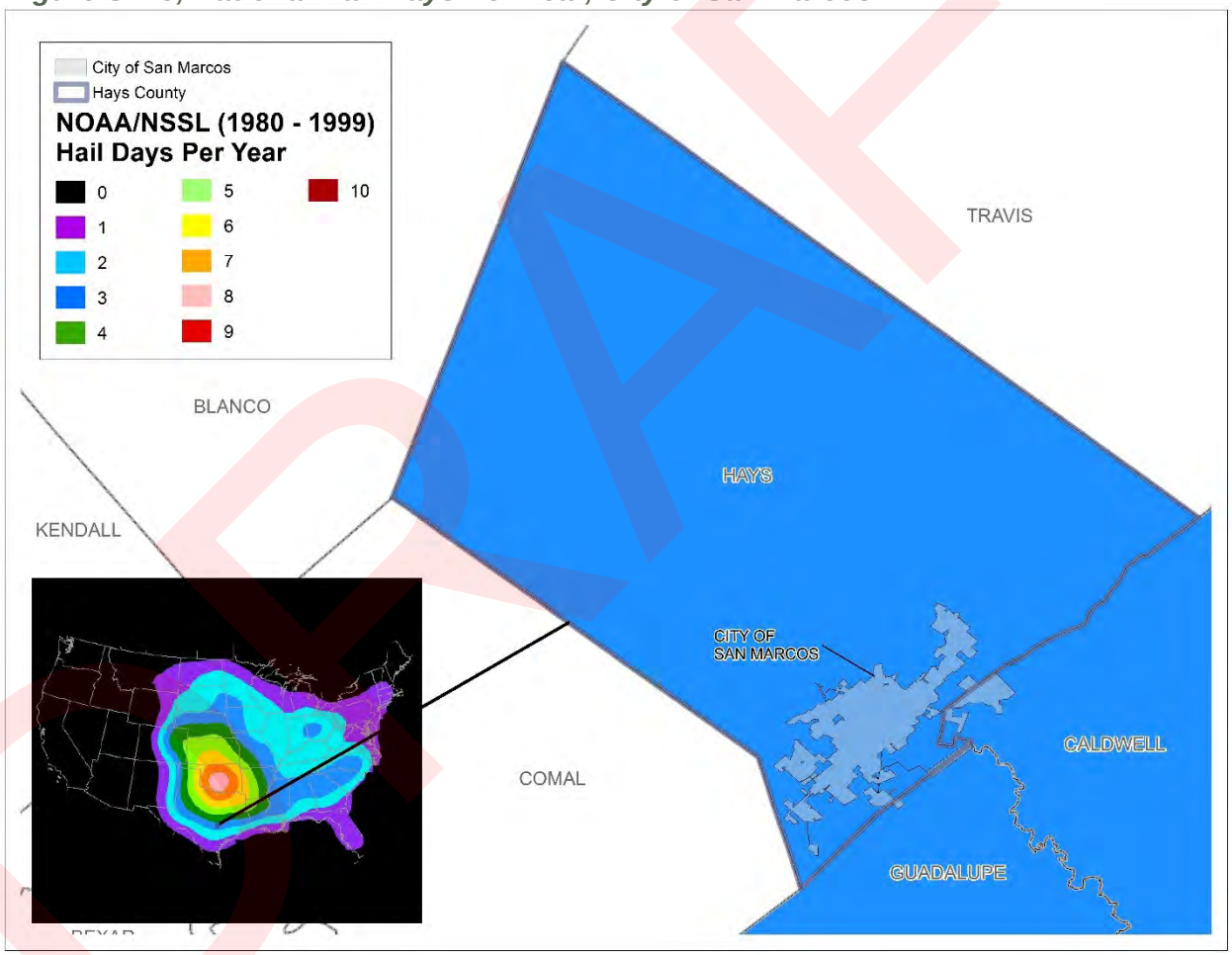
Additional community testimony indicated, that while not occurring within City Limits, there was an incident that occurred at a nearby fire training academy where 2 fire students were struck by lightning while training in an open field. The proximity and severity of this event created a concern for safety from death or injury during lightning events.

Hailstorms

Hailstorms: Location

The entire extent of the City of San Marcos is exposed to some degree of hail hazard. Since hail can occur at any location, hail events could be experienced anywhere within the planning area. NOAA's National Severe Storms Laboratory used historical data from 1980 to 1999 to estimate the daily probability of hail (of at least 0.75-inch diameter hail) occurrences across the U.S. Figure SM.5 shows the average number of hail days per year determined from this analysis and the corresponding location of the City. The density of hail days per year in the map's legend indicates the probable number of hail days for each 25-square-mile cell within the contoured zone that can be expected per year. It should be noted that the density number does not indicate the number of events that can be expected within each cell, rather the average number of days per year with 1 or more events occurring within each cell.

Figure SM.5, National Hail Days Per Year, City of San Marcos



(National Severe Storms Laboratory, 2016)

Hailstorms: Previous Occurrences

According to the NOAA Storm Events Database, there were 23 documented hail events listed for the City of San Marcos and 57 documented events listed for Hays County and its unincorporated jurisdictions from year 1967. While the NOAA Storm Events Database lists events since 1967 for the County, events were not documented per jurisdiction since the year 1993. The hail events reported for the City of Marcos are shown in the Table SM.20. Note that multiple listings for the same dates are the result of reports from different affected parts of the County for the given event.

Fatality, injury and damage amounts are shown in Table SM.20, per the NOAA Storm Events Database. Community testimony indicates that these amounts do not reflect the most recent totals, however NOAA data is being used as the best source of information available for the record period.

Table SM.20, Hail Occurrences, City of San Marcos

Location	Date	Type	Extent (mm)	Fatalities	Injuries	Property Damage	Crop Damage
San Marcos	5/9/1993	Hail	44.45	0	0	0.00	0.00
San Marcos	4/5/1994	Hail	50.80	0	0	500,000.00	500,000.00
San Marcos	11/6/1994	Hail	19.05	0	0	3,000.00	3,000.00
San Marcos	11/1/1995	Hail	44.45	0	0	0.00	0.00
San Marcos	8/14/1996	Hail	19.05	0	0	0.00	0.00
San Marcos	4/20/1997	Hail	19.05	0	0	0.00	0.00
San Marcos	5/15/1997	Hail	22.35	0	0	0.00	0.00
San Marcos	5/27/1997	Hail	19.05	0	0	0.00	0.00
San Marcos	2/26/1998	Hail	19.05	0	0	0.00	0.00
San Marcos	6/5/1998	Hail	19.05	0	0	0.00	0.00
San Marcos	3/16/2000	Hail	114.30	0	0	600,000.00	0.00
San Marcos	12/30/2002	Hail	38.10	0	0	0.00	0.00
San Marcos	3/25/2003	Hail	19.05	0	0	0.00	0.00
San Marcos	6/2/2003	Hail	19.05	0	0	0.00	0.00
San Marcos	4/20/2006	Hail	107.95	0	1	100,000,000.00	0.00
San Marcos	4/20/2006	Hail	50.80	0	0	0.00	0.00
San Marcos Lowman AR	9/29/2011	Hail	25.40	0	0	0.00	0.00
San Marcos Lowman AR	3/19/2013	Hail	25.40	0	0	0.00	0.00
San Marcos	3/19/2013	Hail	25.40	0	0	0.00	0.00
San Marcos	4/29/2013	Hail	25.40	0	0	2,000.00	0.00
San Marcos	5/9/2013	Hail	22.35	0	0	0.00	0.00
San Marcos Lowman AR	4/16/2015	Hail	22.35	0	0	0.00	0.00
San Marcos	4/16/2015	Hail	19.05	0	0	0.00	0.00
Total				0	1	$101,105,000.00	$503,000.00

(National Oceanic and Atmospheric Administration Storm Event Database, 2016)

Hailstorms: Extent

The Tornado and Storm Research Organization (TORRO) created a hail extent index to measure hail called the Hailstorm Intensity Scale. According to the reported previous hail occurrences in the planning area, the maximum hail extent experienced is hail up to 4.5 in., or 114.30 mm. in diameter, corresponding to a TORRO Hailstorm Intensity Scale classification of “Super Hailstorm.” Refer to Chapter 2, the Risk

Assessment portion of the Hays County HMP Update, for hail extent scale descriptions.

Hailstorms: Probability

Figure SM.5 reports 3 hail days per year as a result of NLDN's nationwide analysis. Since this calculation is based off of national data, a more specific calculation based on local-level NOAA reports was utilized to calculate probability. Based on 23 reported events in 23 years, the City of San Marcos can expect a hail event approximately once every year on average in the future with hail up to 4.5 in., or 114.30 mm. in diameter, corresponding to a TORRO Hailstorm Intensity Scale classification of "Super Hailstorm."

Number of Reported Events	Number of Years in Dataset	Probability
23	23	1

Hailstorms: Impact

Hail events in the area have been reported to cause up to $100,000,000 in property damages and $500,000 in crop damages as seen in the NOAA reports for the City. Additional potential impacts can be determined based on the maximum hail extent experienced (114.30 mm), where the TORRO Hailstorm Intensity Scale (found in Chapter 2, the Risk Assessment portion of the Hays County HMP Update) indicates that impact can be expected to include any of the following:

- Varying degrees of damage to vegetation and crops
- Damage to plastic structures
- Varying degrees of damage to glass
- Paint and wood scored
- Vehicle bodywork damage
- Varying degrees of roof damage
- Varying degrees of risk of injuries
- Varying degrees of aircraft damage
- Brick walls pitted
- Risk of severe or even fatal injuries to persons caught in the open

Data provided by National Weather Service resources list the highest diameter of hail to be 4.5 inches, however community testimony indicates that the hailstorm of 2003 actually produced 6 inch diameter hail. (For the purposes of consistency with analysis data sources, NOAA/NWS datasets were used to determine extent and probability for all communities, while verbal community testimony was integrated into impact and vulnerability). The damage experienced during this storm made 6 inch holes in windshields and caused significant damage to the roof at the City shopping mall.

Hailstorms: Vulnerability Summary

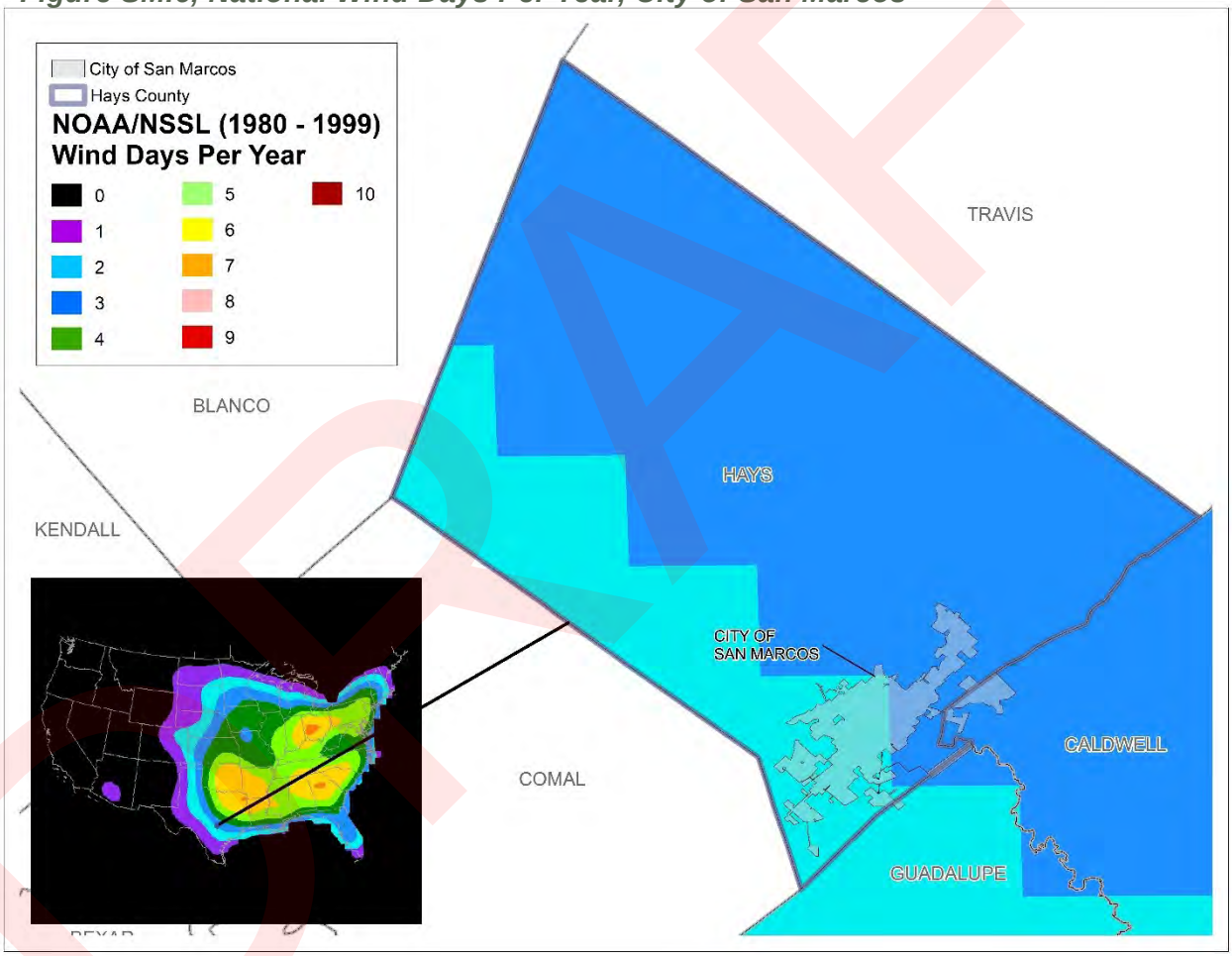
Besides the large hail event of 2003, hailstorms are not a significant concern for the community. There is not a current plan in place for protection of critical vehicles and equipment. There is a variety of roof types for the public facilities in San Marcos, to include composition, built-up, and metal roofs. These have varying levels of vulnerability to hail.

Windstorms

Windstorms: Location

The entire extent of the City of San Marcos is exposed to some degree of wind hazard. Since wind can occur at any location, wind events could be experienced anywhere within the planning area. NOAA's National Severe Storms Laboratory used historical data from 1980 - 1999 to estimate the daily probability of wind occurrences across the U.S., with gusts of at least 58 mph. Figure SM.6 shows the estimates for wind days determined from this analysis and the corresponding location of the City. The density of wind days per year in the map's legend indicates the probable number of wind days for each 25-square-mile cell within the contoured zone that can be expected per year. It should be noted that the density number does not indicate the number of events that can be expected within each cell, rather the average number of days per year with 1 or more events occurring within each cell.

Figure SM.6, National Wind Days Per Year, City of San Marcos



(National Severe Storms Laboratory, 2016)

Windstorms: Previous Occurrences

According to the NOAA Storm Events Database, there were 17 documented wind events listed for the City of San Marcos and 38 documented events listed for Hays County and its unincorporated jurisdictions from year 1974. While the NOAA Storm Events Database lists events since 1974 for the County, events were not documented per jurisdiction until 1994. The wind events reported for the City of San Marcos are shown in Table SM.21.

Fatality, injury and damage amounts are shown in Table SM.21, per the NOAA Storm Events Database. Community testimony indicates that these amounts do not reflect the most recent totals, however NOAA data is being used as the best source of information available for the record period.

Table SM.21, Reported Wind Events, City of San Marcos

Location	Date	Type	Extent (knots)	Fatalities	Injuries	Property Damage	Crop Damage
San Marcos	4/5/1994	Thunderstorm Wind	52 kts.	0	0	5,000,000.00	0.00
San Marcos	5/13/1994	Thunderstorm Wind	NA	0	0	500,000.00	50,000.00
San Marcos	5/29/1994	Thunderstorm Wind	NA	0	0	5,000.00	5,000.00
San Marcos	8/14/1996	Thunderstorm Wind	NA	0	0	20,000.00	0.00
San Marcos	8/14/1996	Thunderstorm Wind	51 kts.	0	0	0.00	0.00
San Marcos	3/7/1998	Thunderstorm Wind	NA	0	0	30,000.00	0.00
San Marcos	3/16/1998	Thunderstorm Wind	NA	0	0	30,000.00	0.00
San Marcos	7/31/2000	Thunderstorm Wind	NA	0	0	5,000.00	0.00
San Marcos Muni. Arpt.	3/19/2002	Thunderstorm Wind	50 kts. M	0	0	0.00	0.00
San Marcos	6/2/2003	Thunderstorm Wind	60 kts. EG	0	0	7,000,000.00	0.00
San Marcos	8/11/2003	Thunderstorm Wind	60 kts. EG	0	0	30,000.00	0.00
San Marcos	1/13/2007	Thunderstorm Wind	70 kts. EG	0	0	100,000.00	0.00
San Marcos	4/25/2007	Thunderstorm Wind	70 kts. EG	0	0	50,000.00	0.00
San Marcos	6/3/2007	Thunderstorm Wind	58 kts. MG	0	0	0.00	0.00
San Marcos	6/11/2009	Thunderstorm Wind	50 kts. EG	0	0	50,000.00	0.00
San Marcos Lowman AR	8/24/2010	Thunderstorm Wind	50 kts. EG	0	0	0.00	0.00
San Marcos Lowman AR	5/9/2013	Thunderstorm Wind	50 kts. EG	0	0	0.00	0.00
Total				0	0	$12,820,000.00	$55,000.00

NA - No data available
EG = Estimated Gust

(National Oceanic and Atmospheric Administration Storm Event Database, 2016)

Windstorms: Extent

Wind is measured by the Beaufort Wind Scale that relates wind speed to observed conditions on land and sea. According to the reported previous windstorm occurrences in the planning area, the maximum wind extent experienced was 70 knots (Beaufort Wind Scale Classification: Hurricane). Refer to Chapter 2, the Risk Assessment portion of the Hays County HMP Update, for a description of wind extent scales.

Windstorms: Probability

Figure SM.6 reports 2 to 3 wind days per year as a result of NLDN's nationwide analysis. Since this calculation is based on national data, a more specific calculation based on local-level NOAA reports was utilized to calculate probability. Based on 17 reported events in 22 years, the City of San Marcos can expect a wind event of up to 70 knots approximately once every year on average in the future (Beaufort Wind Scale Classification: Hurricane).

Number of Reported Events	Number of Years in Dataset	Probability
17	22	0.77

Windstorms: Impact

City level data available from the Texas Department of Transportation's Crash Records Information System shows that between the years of 2010 and 2017, the City of San Marcos experienced 2 crashes related to severe crosswind weather conditions. There were no reported injuries from these crash events (see Table SM.22).

Table SM.22, Windstorms, Vehicle Accidents, City of San Marcos

City	Fatality	Incapacitating Injury	Non-Incapacitating	Possible Injury	Crash Year	Street Name	Surface Condition	Weather Condition
San Marcos	0	0	0	0	2012	IH0035	Dry	Severe Crosswinds
San Marcos	0	0	0	0	2012	IH0035	Dry	Severe Crosswinds

(Texas Department of Transportation, 2017)

Windstorms: Vulnerability Summary

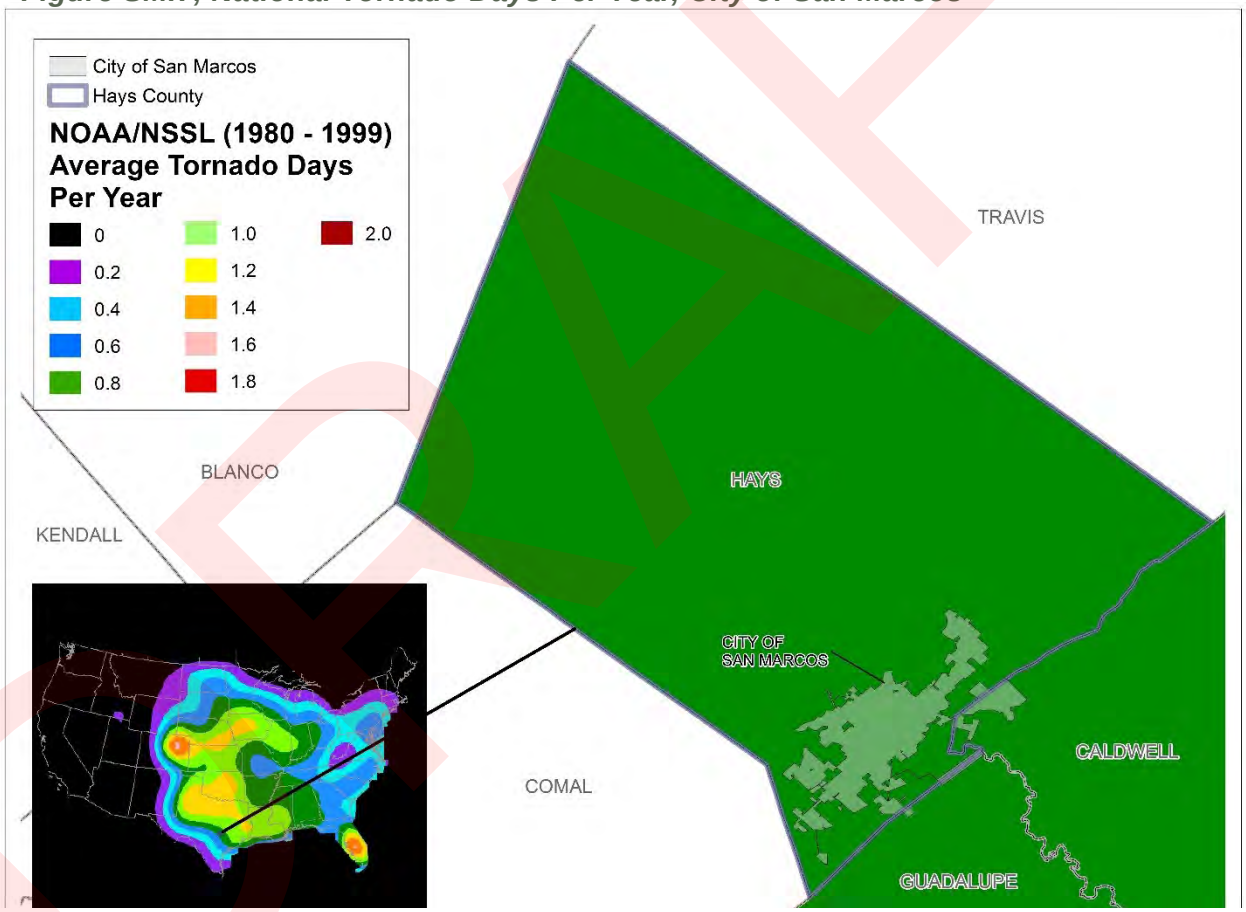
Significant wind events in San Marcos have caused structural damage in the past. According to verbal community testimony (which is integrated into impact and vulnerability as NOAA and NWS reported datasets are utilized for occurrence and extent analysis), there was a previous windstorm around 2011 that caused damage to the police department and airport. In addition, it was stated that there were several roofs blown off of community apartment complexes. The vulnerability of critical facilities within the community are a concern for the continuity of services to the public.

Tornadoes

Tornadoes: Location

The entire extent of the City of San Marcos is exposed to some degree of tornado hazard. Since tornadoes can occur at any location, tornado events can be experienced anywhere within the planning area. NOAA's National Severe Storms Laboratory used historical data from 1980 to 1999 to estimate the daily probability of tornado occurrences across the U.S., regardless of tornado magnitude. Figure SM.7 shows the average number of tornado days resulting from this analysis and the respective location of the City. The density of average tornado days per year in the map's legend indicates the probable number of tornado days for each 25-square-mile cell within the contoured zone that can be expected per year. This density number does not indicate the number of events that can be expected within each cell, rather the average number of days per year with 1 or more events occurring within each cell.

Figure SM.7, National Tornado Days Per Year, City of San Marcos



(National Severe Storms Laboratory, 2016)

Tornadoes: Previous Occurrences

According to the NOAA Storm Events Database, there were 3 documented tornado events listed for the City of San Marcos and 16 documented events listed for Hays County since the year 1953. While NOAA Storm Events Database lists events since 1953 for the County, events were not documented per jurisdiction until 1997. The tornadoes events reported for the City of San Marcos are listed in Table SM.23.

Fatality, injury and damage amounts are shown in Table SM.23, per the NOAA Storm Events Database. Community testimony indicates that these amounts do not reflect the most recent totals, however NOAA data is being used as the best source of information available for the record period.

Table SM.23: Tornado Events, City of San Marcos

Location	Date	Type	Extent	Fatalities	Injuries	Property Damage	Crop Damage
San Marcos	12/30/2002	Tornado	F0	0.00	0.00	0.00	0.00
San Marcos	1/13/2007	Tornado	F1	0.00	0.00	50000.00	0.00
San Marcos Lowman AR	10/30/2015	Tornado	EF1	0.00	0.00	0.00	0.00
Total				$0.00	$0.00	$50,000.00	$0.00

(National Oceanic and Atmospheric Administration Storm Event Database, 2016)

Tornadoes: Extent

Tornadoes are measured by severity on the Enhanced Fujita Scale, with a range from 0-6. According to the reported previous tornado occurrences in the planning area, the maximum tornado extent experienced was a category EF1. Refer to Chapter 2, the Risk Assessment portion of the Hays County HMP Update for a description of tornado extent scales, Fujita (F) Scale and Operational Enhanced Fujita (EF) Scale.

Tornadoes: Probability

Figure SM.7 reports 0.8 tornado days per year as a result of NLDN's nationwide analysis. Since this calculation is based on national data, a more specific calculation based on local-level NOAA reports was utilized to calculate probability. Based on 3 reported events in 19 years, the City of San Marcos can expect a tornado event approximately once every 6 years on average in the future, with up to an EF1 magnitude.

Number of Reported Events	Number of Years in Dataset	Probability
3	19	0.16

Tornadoes: Impact

Tornadoes in the City of San Marcos could impact roadways due to the large amount of vegetation and other objects that could become debris in the event of the high winds that accompany a funnel cloud. This debris could also cause physical harm to residents who may be outside during such an event. The wind speeds and debris caused by tornadoes can impact all residents in the community.

The City of San Marcos has experienced tornadoes at F1 levels in the past. If similar events were to happen in the future in the City, the type of impacts that the planning area could expect associated with that magnitude would include:

- Light Damage - Broken branches; shallow rooted trees pushed over; some chimney damage.
- Moderate Damage - Surface damage to roofs; mobile homes pushed off foundation; moving vehicles pushed off the road.

(Tornado Facts, 2016)

Additional impacts from tornado events could include downed utility poles, communication towers, street

signals, and debris created from residential and commercial property.

Critical infrastructure could be disrupted, resulting in periods of impact to service due to the lack of back-up utility resources. See Lightning: Impact section for more information on utility interruption.

Tornadoes: Vulnerability Summary

There are 14 outdoor warning sirens throughout the City of San Marcos. These sirens, however, do not address residents with hearing or access needs. The City is exploring a variety of alternate notification methods to supplement the audible sirens. In addition, the City uses CodeRed to conduct their emergency notifications. Because registration is voluntary, there still remains a risk that people may not receive critical safety alerts and information because officials have no way to contact them without their information being added to the database. There is also a team of trained Storm Spotters that assist with detection of tornado events. This spotter team would benefit from an increase in membership.

An additional concern is the small number of manufactured home communities and mobile home parks. These structures are more vulnerable to tornado winds than a site-built home. These types of residences make up less than 10% of the homes in San Marcos.

Expansive Soils

Expansive Soils: Location

Areas within the City of San Marcos with structures that are underlain by soils containing clays with swelling potential are most affected by expansive soils. Figure 2.4 within Chapter 2 (the Risk Assessment portion of the Hays County HMP Update) shows the location of expansive soil areas for the City.

Expansive Soils: Previous Occurrences

There was no documentation of site-specific past events for structural damage due to expansive soils from local, state, or national datasets found.

Expansive soils cannot be documented as a time-specific event, except when they lead to structural and infrastructure damage. There are no specific damage reports or historical records of events in the City, however future events can occur.

Expansive Soils: Extent

According to the USGS Expansive Soils Regions, Figure 2.4 within Chapter 2 (the Risk Assessment portion of the Hays County HMP Update), small sections of the western side of the City has less than 50% of the area underlain with soils with clayey textures that have high shrink-swell properties where as the rest of the planning area has over 50% of the area underlain with soils with abundant clays with high swelling potential, and is the area with the highest magnitude of expansive soil potential within the City.

Expansive Soils: Probability

Due to the minimal amount of swelling potential and the lack of reported events, the probability of a future event is low, (unlikely in next 10 years) for the City of San Marcos.

Expansive Soils: Impact

Areas within San Marcos that are experiencing higher amounts of development on previously undeveloped land may find a higher impact as this will offer increased opportunity for structural foundation damage in areas with high clay content. Expansion of jurisdictional boundaries and the development of more land between Austin, San Antonio and San Marcos can lead to exposure to previously unnoted areas of expansive soil.

Expansive Soils: Vulnerability Summary

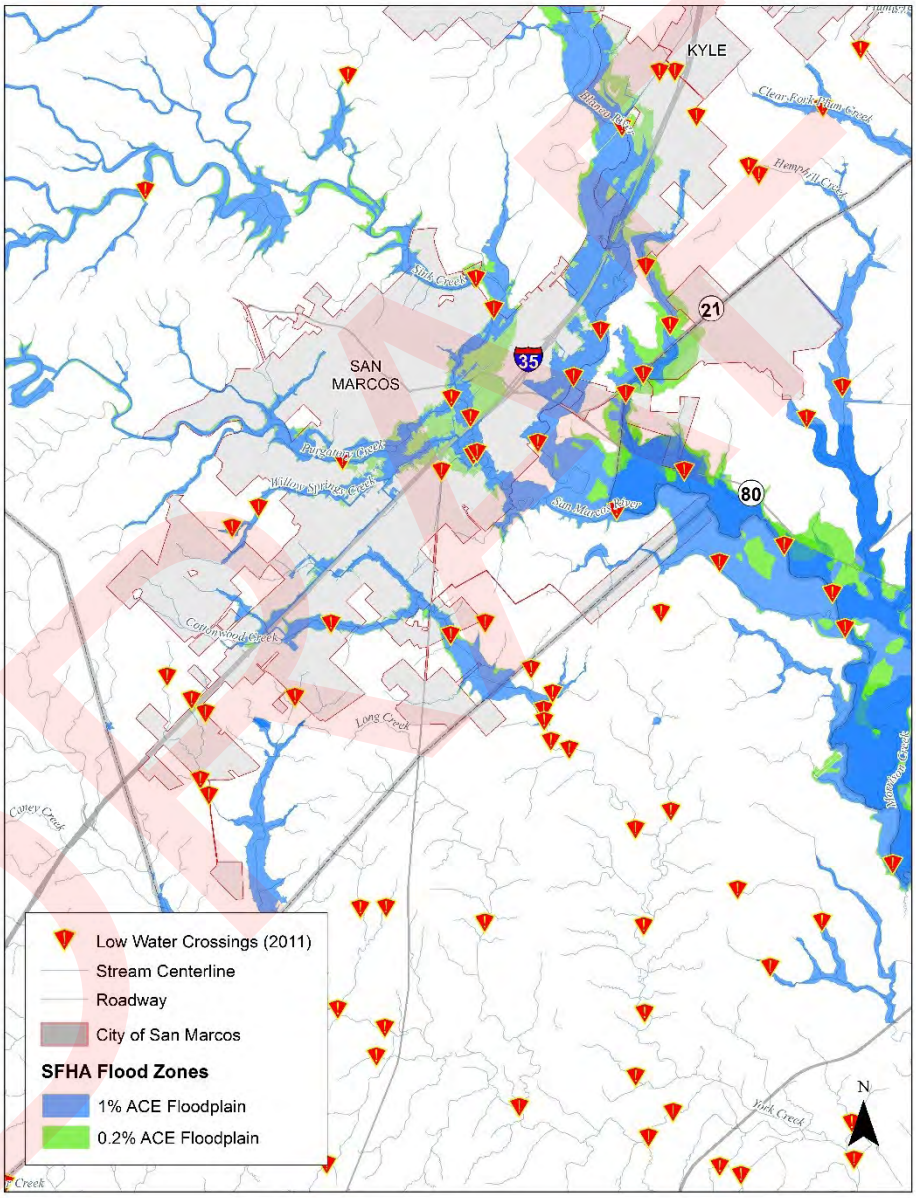
The lack of current problems from this hazard in the community leads to a lessened concern for the issue. Should parts of the community with higher concentrations of clay in the soil begin to experience development, there may be a heightened amount of vulnerability within San Marcos.

Floods

Floods: Location

The location of low water crossings as well as the 1% (100 year) and 0.2% (500 year) Annual Chance Event (ACE) floodplains for the City of San Marcos are shown in Figure SM.8 and are the locations within the planning area that are most affected by flooding. This figure is based upon newly developed hydrologic and hydraulic analysis and is the best information available to date. Table SM.24 provides the total acreage in the jurisdiction that is located in the 1% and 0.2% floodplains.

Figure SM.8, Special Flood Hazard Areas and Low Water Crossings, City of San Marcos



(Texas Natural Resources Information System, 2011)

Table SM.24, City of San Marcos Floodplain Acreage

Jurisdiction	100yr (1%) Floodplain Acres (Includes Floodway)	500yr (0.2%) Floodplain Acres (Includes 100yr)
City of San Marcos	4,250	5,938

Floods: Previous Occurrences

According to the NOAA Storm Events Database, there were 8 documented flood events listed for the City of San Marcos and 69 documented events listed for Hays County from year 1997. While NOAA Storm Events Database lists events since 1997 for the County, events were not documented per jurisdiction until 2004. The flood events reported for the City of San Marcos are shown in Table SM.25.

Fatality, injury and damage amounts are shown in Table SM.25, per the NOAA Storm Events Database. Community testimony indicates that these amounts do not reflect the most recent totals, however NOAA data is being used as the best source of information available for the record period.

Table SM.25, Flood Events, City of San Marcos

Location	Date	Type	Fatalities	Injuries	Property Damage	Crop Damage
San Marcos	11/14/2004	Flash Flood	1	0	0.00	0.00
San Marcos	9/8/2010	Flash Flood	0	0	0.00	0.00
San Marcos	5/13/2014	Flash Flood	0	0	0.00	0.00
San Marcos	5/27/2014	Flash Flood	0	0	0.00	0.00
San Marcos Lowman AR	5/30/2015	Flash Flood	0	0	5,000.00	0.00
San Marcos	6/28/2015	Flash Flood	0	0	0.00	0.00
San Marcos	5/19/2016	Flash Flood	0	0	0.00	0.00
San Marcos	9/26/2016	Flash Flood	0	0	0.00	0.00
Total			0	0	$5,000.00	$0.00

(National Oceanic and Atmospheric Administration Storm Event Database, 2016)

Floods: Significant Past Events

Although not all documented in the NOAA storm events database specifically under the City of San Marcos, the significant flood events described for October 2013, May 2015, and October 2015 in the Significant Past Events within the Hays County Annex section were events that greatly impacted the City of San Marcos. Refer to that section for details on those events.

Flood past events in San Marcos, Texas

Floods: Extent

Flood extent is described by a combination of ground elevation, river heights, 100 year Water Surface Elevations (WSE's) and HAZUS depth grids. Areas along the San Marcos River in the center of the community are exposed to some of the greatest flood extents. An example of flooding within the jurisdiction the community along the San Marcos River near Riviera Street and Riverside Drive. This area has an approximate overbank ground elevation of 572 feet with an intersecting 100 year WSE of 574 feet. For a 100 year event, water depth of approximately 2 feet can be expected within this area. A further analysis of the San Marcos River height is described below.

With the San Marcos River having an approximate normal elevation of 560 feet (per Light Detection and Ranging [LiDAR] and USGS gauge data), and an intersecting 100 year WSE of approximately of 574 feet, flood depths would be 14 feet. Such an event is categorized as a "Flood Stage." Refer to the Water Depth Extent Scale in Chapter 2 (the Risk Assessment portion of the Hays County HMP Update).

Floods: Probability

Based on 8 reported events in 12 years, the City of San Marcos can expect a flood event approximately once every 1 to 2 years on average in the future, with flood water depths in the category of "Flood Stage."

Number of Reported Events	Number of Years in Dataset	Probability
8	12	0.67

Floods: Impact

The following describes the inventory counts and building replacement values for the jurisdictional area.

San Marcos Building Counts			
Residential	Commercial	Other	Total
9,462	905	341	10,708

San Marcos Building Replacement Value		
Building ($)	Content ($)	Total ($)
3,912,662,416	2,523,636,898	6,436,299,314

Flood past events in San Marcos, Texas

A Probabilistic 100-year Return Period HAZUS-MH 3.2 analysis was run on the participating community. HAZUS results are calculated to census blocks. These blocks where then intersected with the participating community to run a weighted area analysis to get jurisdictional results. The following describes results of the 100-year Return (1% Annual Chance Event) weighted area analysis.

HAZUS-MH Results

General Building Stock Damage

HAZUS estimates that about 1,102 buildings will be at least moderately damaged in San Marcos. "At least moderately damaged" is defined by HAZUS as greater than 10% damage to a building. The majority of damage can be expected to impact residential areas (98%). The remaining damages (2%) are expected for commercial, industrial, agriculture and religious buildings.

Residential Buildings	Commercial Buildings	Other Buildings	Total Buildings
1,080	19	3	1,102

Building-Related Losses

Exposed Value is the total building and content values for structures within the community. The exposed value for the community is $6,436,299,314. The total building related losses were $381,124,000 for this scenario. This represents 5.90% of the total replacement value of the community. Loss values are divided into building and content loss dollars.

Building Loss ($)	Content Loss ($)	Total Loss ($)
176,961,000	204,163,000	381,124,000

Essential Facility Damage

HAZUS estimates 4 critical facilities and infrastructure to be out of service for 1 day each for this scenario. The scenario estimates that 100% of available hospital beds are ready for use by patients already in the hospital and those injured by an event. The estimated loss values for the area's critical facilities and infrastructure are listed below.

Critical Facilities & Infrastructure (Count)	Building Loss ($)	Content Loss ($)	Total Loss ($)
4	26,385	12,074	38,459

Debris Generation

HAZUS estimates the amount of debris that will be generated in this scenario at a total of 37,309 tons. If the building debris tonnage is converted to an estimated number of truckloads, it will require 1,493 truckloads (with 1 to 25 tons per truck) to remove the building debris generated in this scenario.

Shelter Requirements

HAZUS estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. HAZUS also estimates those people displaced that will require accommodations in temporary public shelters. The model estimates 7,503 people will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 6,858 people will seek temporary shelter in public shelters.

Floods: Vulnerability Summary

The City of San Marcos has the most Repetitive Loss payments in all of Hays County. This can obviously be attributed to the fact that the population is higher, but can also be related to proximity to the San Marcos River, the number of Pre-FIRM homes that were built before the Flood Damage Prevention Ordinance was adopted, and also the occurrences of localized flooding that occur outside of the Special Flood Hazard Area where elevation is not required.

According to community testimony, there are also a limited number of locations where mobility issues could create issues during flood events. There is a daycare at risk due to flooding and access to several group homes and other facilities where people are non-ambulatory and unable to seek higher ground on their own.

Areas with low water crossings that become overtopped are also an issue for emergency services access and the ability for residents to enter or exit their residences.

National Flood Insurance Program Repetitive Loss (RL)

The City of San Marcos is a current participant in the National Flood Insurance Program (NFIP) and has 247 tallied RL payments (as of September of 2016) with an average total (building & contents) payment of $37,560.76.

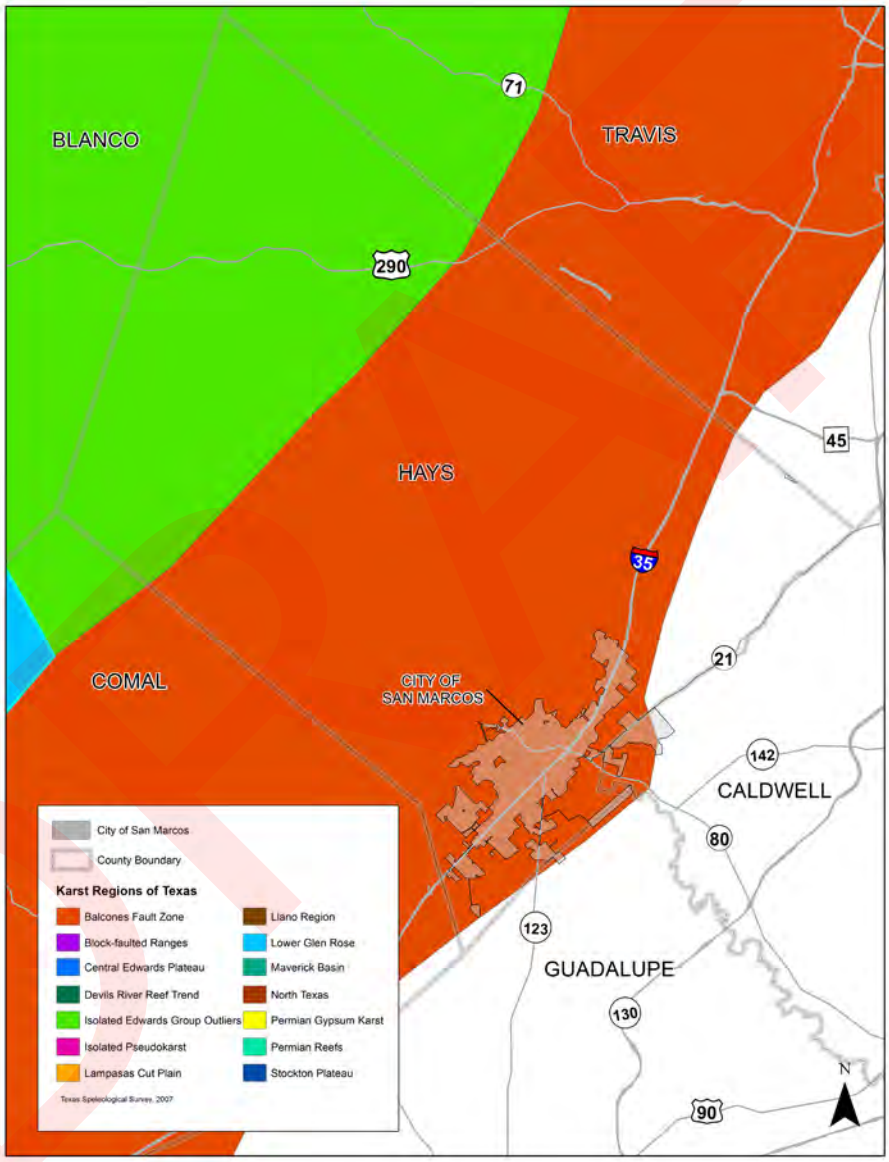
Structure Type	Number of Structures	Amount of Claims
Residential	107	$8,905,976.65
Non-Residential	3	$371,530.54

Land Subsidence

Land Subsidence: Location

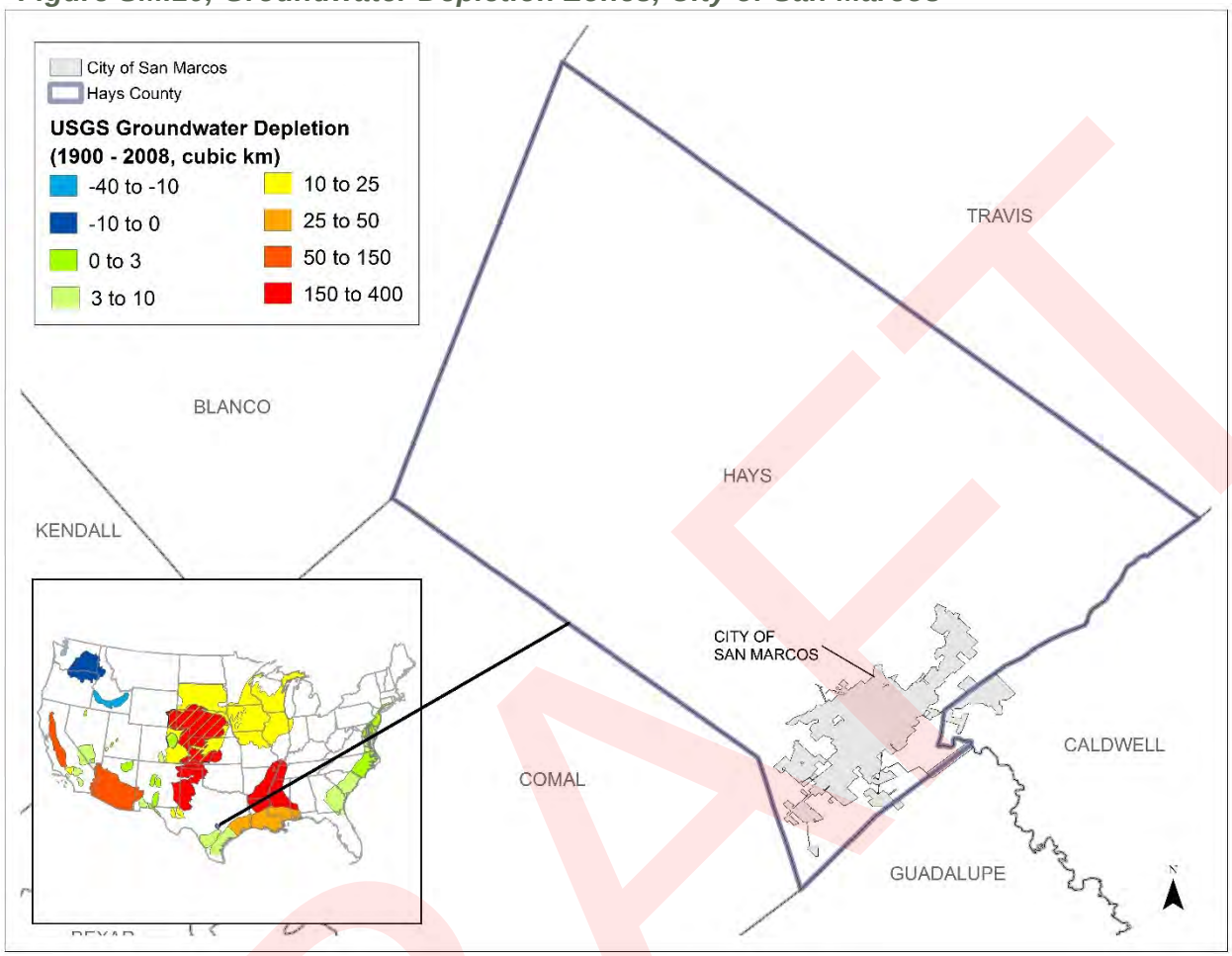
LKarst features are a landscape formed from the dissolution of soluble rocks, such as limestone, that can cause sinkholes and caves. Locations within San Marcos that are underlain by karst features or that are experiencing extensive groundwater depletion, are most at risk. Figures SM.9 and SM.10 illustrate the planning area's location in conjunction with the karst regions of Texas and USGS Groundwater Depletion Zones. According to Figure SM.9, the City is located within the Balcones Fault Zone.

Figure SM.9, Karst Regions of Texas, City of San Marcos



(Texas Speleological Survey, 2007)

Figure SM.10, Groundwater Depletion Zones, City of San Marcos



(Groundwater depletion in the United States (1900–2008), 2013)

Land Subsidence: Previous Occurrences

There were no sinkhole or land subsidence events documented specifically for the City of San Marcos. As the data displayed in Figure SM.10 illustrates, the HMP update area does not have a significant history of groundwater depletion.

Land subsidence can occur in the Central Texas Hill County Area. Recently, a small event occurred in Travis County (located ~ 23 miles north of the study area) when a 25-foot-wide and 12-foot-deep sinkhole opened up at a Costco parking lot in Austin, Texas (Mashhood, 2012). The area could potentially experience an event of similar depths, widths, and impact as the event described above, but conditions would vary depending on the location of the event. Since future events cannot be predicted, the estimated extents previously described are hypothetical.

Land Subsidence: Extent

Due to the lack of reported occurrences, there is not sufficient data to determine the maximum extent of land subsidence for the planning area. However, if a future event were to occur, it can be assumed it would be similar in extent to previous events in the region. This includes the aforementioned sinkhole in Austin, Texas measuring 25-feet wide and 12 feet deep.

Land Subsidence: Probability

The occurrence of subsidence is an ongoing process resulting from natural and human-induced causes. As seen in Figure SM.9, the majority of the City of San Marcos is located within a known karst region. However, with no documented history of subsidence, the probability of a future land subsidence event for the planning area is low (unlikely in next 10 years). If a future event were to occur, however unlikely, it can be assumed that it would be similar in extent to previous events in the region. This includes the previously mentioned sinkhole documented in Austin, Texas.

Land Subsidence: Impact

When considering the impact of land subsidence, it is important to note that many areas within the karst zone have structures and infrastructure and could be affected by a collapsed area. The possible impact of isolated incidents within the karst region could include damage to any, but not all, of the 10,740 structures located in the zone in the unlikely event of a future occurrence. All structures are cumulatively valued at approximately $6,436,298,000 based on HAZUS building and content values.

Land Subsidence: Vulnerability Summary

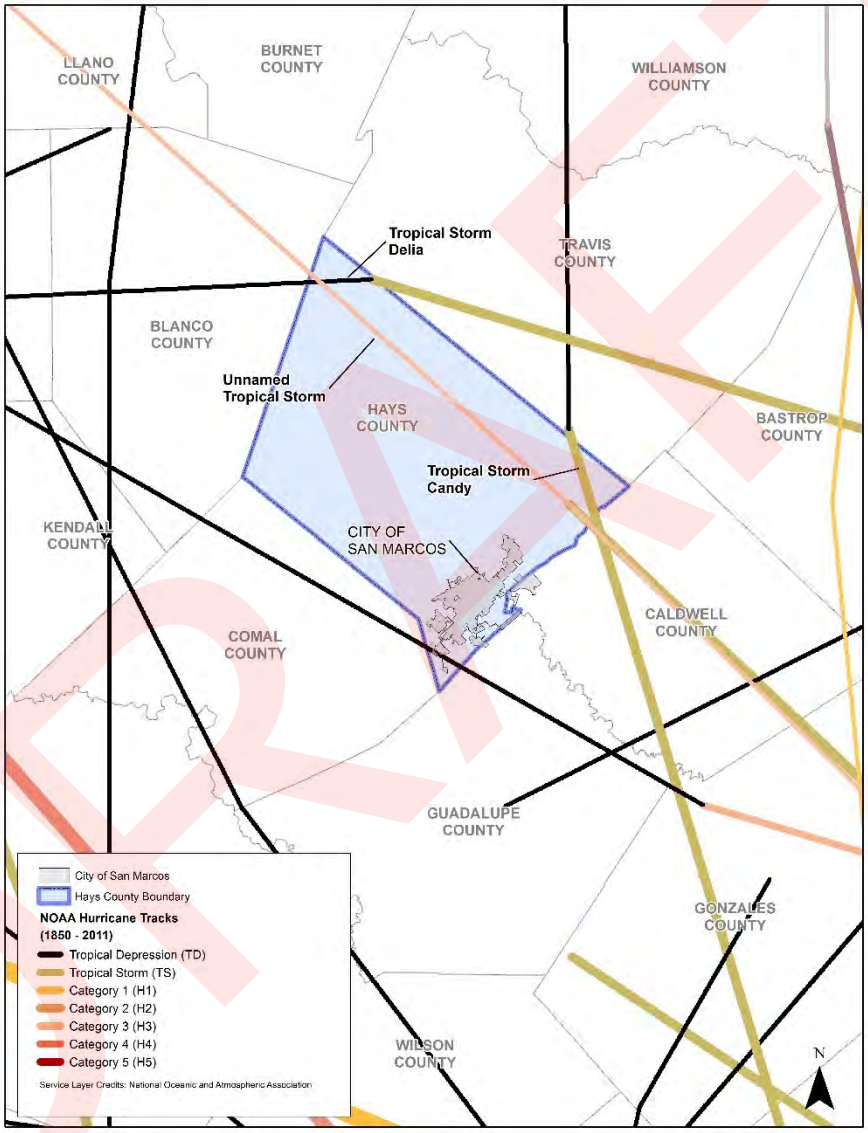
Although there have not previously been reported occurrences within the San Marcos jurisdiction, the nature of the ground and the likelihood of drought in the coming years could create circumstances where groundwater is depleted and land subsidence could occur. The continuing growth of San Marcos, named by Time Magazine as the fastest growing community in the United States for 3 years in a row (among those with over 50,000 residents), the amount of development and increase in impervious cover that impede water flow into the ground could increase risk.

Hurricanes/Tropical Storms

Hurricanes/Tropical Storms: Location

Due to the regional nature of a hurricane or tropical storm event, the entire extent of the City of San Marcos is equally exposed to a hurricane or tropical storm. Figure SM.11 illustrates the location of the planning area with historical hurricane and tropical storm paths documented by NOAA's Hurricane Tracker from 1850 to 2011.

Figure SM.11, Historical Hurricane/Tropical Storm Paths, City of San Marcos



(National Oceanic and Atmospheric Administration, 2016)

Hurricanes/Tropical Storms: Previous Occurrences

Previous events are listed below from NOAA Storm Events Database for Tropical Storm Hermine and NOAA Hurricane Tracker for all other events. By the time most hurricanes reach the County, they are tropical storms, depressions or thunderstorms. Because hurricane and tropical storm events occur on a regional scale, all events listed for Hays County have been included as they would impact the City of San Marcos.

July 13 to July 22, 1909 – An unnamed storm made landfall near Freeport, as a Category 3 Hurricane. This storm impacted Hays County and participating communities as a tropical depression with wind speeds up to 30 knots. No significant damages, injuries, or fatalities were reported for the City.

June 22 to June 26, 1968 – Tropical Storm Candy made landfall near Port Aransas. This storm impacted Hays County and participating communities as a tropical storm with wind speeds slowing to 30 knots as a tropical depression just after leaving the County. No significant damages, injuries, or fatalities were reported for the jurisdiction.

September 1 to September 7, 1973 – Tropical Storm Delia made landfall near the border of Brazoria and Matagorda Counties. This storm impacted Hays County and participating communities as a tropical storm with wind speeds slowing to 30 knots as a tropical depression just after leaving the County. No significant damages, injuries, or fatalities were reported for the jurisdiction.

September 6 to September 8, 2010 – According to the NOAA Storm Events Database, Tropical Storm Hermine made landfall near the Texas/Mexico border on the night of September 6. South Central Texas was hit very hard with widespread rains of 8 to 12 inches across much of the IH-35 corridor from Austin down to San Antonio.

Hurricanes/Tropical Storms: Extent

The Saffir-Simpson Scale measures pressure, wind speed, and storm surge in 5 categories. According to the reported previous hurricane occurrences in the jurisdiction, the maximum hurricane extent experienced was categorized as a Tropical Storm. Refer to Chapter 2, the Risk Assessment portion of the Hays County HMP Update, for a description of storm extents.

Hurricanes/Tropical Storms: Probability

Based on 4 reported events in 107 years, a hurricane or tropical storm event occurs approximately every 27 years on average in Hays County. Since hurricane and tropical storm events can happen anywhere throughout the HMP update area, the City of San Marcos' future probability is assumed to be similar to the surrounding County area. In the future, the City can expect an event approximately once every 27 years on average, of up to a magnitude of a Tropical Storm based on historical extents for the planning area.

Number of Events Reported	Number of Years in Dataset	Probability	100yr Max Wind Speed (mph)
4	107	0.04	78

Hurricanes/Tropical Storms: Impact

A Probabilistic 100-year Return Period HAZUS-MH 3.2 analysis was run on the participating community. The following describes the results of this analysis.

HAZUS-MH Results

General Building Stock Damage

The total property damage losses were $2,251,079. The majority of damage can be expected to impact residential areas (98%). The remaining damages (2%) are for commercial, industrial, agricultural and religious buildings. While some building damage is experienced, it is estimated that no buildings will be completely destroyed or experience severe damage. Exposed Value is the total building and content values for structures within the community. Loss values are divided separately for building and content loss in dollars.

Exposed Value ($) (Building + Content)	Building Loss ($)	Content Loss ($)	Total Loss ($)
6,436,299,314	2,251,079	30,222	2,281,301

Essential Facility Damage

HAZUS does not estimate any critical facilities or infrastructure to be out of service for more than 1 day on the day of the event. Additionally, the model estimates that 100% of available hospital beds are ready for use by patients already in the hospital and for those injured by the hurricane.

Debris Generation

HAZUS estimates the amount of debris that will be generated by the hurricane. The model estimates that a total of 350 tons of debris will be generated. Of the total amount, Brick/Wood comprises 100% of the total. If the building debris tonnage is converted to an estimated number of truckloads, it will require 14 truckloads (with 1 to 25 tons per truck) to remove the building debris generated by the hurricane.

Shelter Requirements

HAZUS estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates no households to be displaced due to the hurricane. While there is an estimation of over $2.2 million in property damages expected, it is aforementioned that “no buildings would be completely destroyed or experience severe damage.” Residents would likely remain in their homes as damages were repaired, therefore no temporary shelter is needed.

Hurricanes/Tropical Storms: Vulnerability Summary

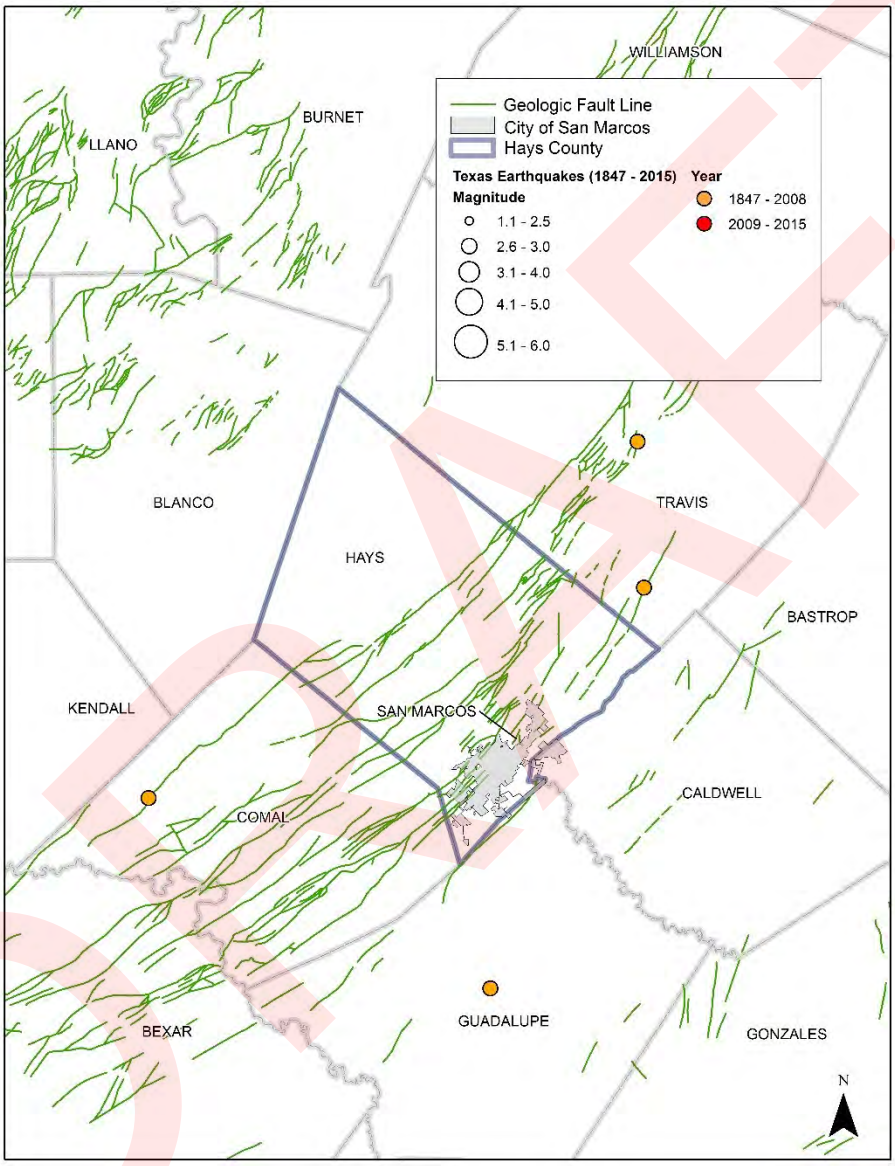
Similar to the impacts of windstorms, hailstorms, and lightning, San Marcos can expect to be impacted with debris and possible interruptions of critical infrastructure. In addition, the community’s proximity to IH-35 could lead to traffic delays caused by major evacuation efforts if the highway is used as an evacuation route for coastal residents.

Earthquakes

Earthquakes: Location

Locations within proximity to fault lines are typically the areas most at risk for earthquakes. Figure SM.12 shows USGS documented fault lines and the locations of earthquakes from 1847 to 2015 in relation to the City of San Marcos.

Figure SM.12, Texas Earthquakes, 1847 – 2015, City of San Marcos



(USGS Earthquake Hazard Program, 2015)

Earthquakes: Previous Occurrences

There have been no documented earthquake events for the City of San Marcos according to USGS 1847-2015 data as illustrated in Figure SM.12.

Earthquakes: Extent

The HAZUS Peak Ground Acceleration (PGA) for the planning area is 1.56% (see Earthquakes: Impact Section for a description of the HAZUS Analysis). This corresponds to the Modified Mercalli Scale Category IV, with light perceived shaking and no potential structure damage. HAZUS measures PGA on a census tract level. Cities within more than 1 census tract were assigned the highest PGA level to reflect the

maximum possible extent. Refer to Chapter 2 for extent scale descriptions (the Risk Assessment portion of the Hays County HMP Update).

Earthquakes: Probability

As there have been no recorded previous occurrences of earthquakes for the City of San Marcos and the PGA is less than 2% for the area, the probability of an earthquake in the City in the future is low (unlikely within the next 10 years).

Number of Events Reported	Number of Years in Dataset	500yr PGA %
0	170	1.56

Earthquakes: Impact

The FEMA How-To Guidance, Understanding Your Risks (FEMA 386-2, page 1-7), suggests the earthquake hazard should be profiled if the PGA is greater than 3%g, where PGA measures the acceleration of gravity (g). The City's PGA is less than 3%g (0.03) and there have been no recorded earthquakes in or near the jurisdiction. Therefore, only a minimum level-1 HAZUS analysis was profiled using the 500-year probability event scenario. The HAZUS analysis produced a PGA of 1.56%. HAZUS also produced $0 in building damages (Residential, Commercial, Agriculture, Religious and Government) from an event. Critical facilities and Infrastructure did not experience any loss of service. There were no critical facilities or infrastructure that experienced moderate to complete damage. No debris was generated from this event and no people or households required temporary housing. There were no moderate, extensive or completely damaged buildings by this event. HAZUS estimates no households are expected to be displaced from their homes or will require accommodations in temporary public shelters due to the earthquake. Additionally, there were no causalities or fatalities from this event.

Earthquakes: Vulnerability Summary

While the probability of an earthquake in San Marcos is low, with no significant prior events on file, there are fault lines within the community that could cause impact if there were to be an increase in seismic activity in the area. There are 13 fault lines located within the jurisdiction according to USGS data. San Marcos could expect to be impacted with debris and possible interruptions if an event were to occur in this unlikely and unprecedented scenario. If an event were to incapacitate a roadway, emergency responders would be hindered from responding, thus leaving the residents who were affected at risk.

The following thoroughfares are crossed by the USGS fault lines displayed on Figure SM.12:

LBJ, RM 12, Craddock Avenue, Nevada Street, S. Stagecoach Trail, W. Sierra Circle, Camaro Way, and Lancaster Street.

Additionally, the following critical facilities and infrastructure (according to HAZUS and community submitted critical facility data) are located within 1 mile of a fault line within the community:

Hays County Public Safety Answering Point (PSAP), Grande Communications, South Hays Fire Department, San Marcos Police Department (SMPD), Hays County Sheriff, 3 San Marcos Fire Department Locations, Primary EOC – SMPD, SMHCEMS Medics 5, 13, 11, and 12, San Marcos Treatment Center, Goodnight Middle School, Crockett Elementary, Hernandez Elementary, Miller Middle School, Travis Elementary, Blanco Vista Elementary, Mendez Elementary, San Marcos Adventist Junior Academy, San Marcos Center School, Public Safety Building/Jail, Hays County Government Center, and 2 Armed Forces Reserve Centers.

Pages 46-49, Dam/Levee Failure have been redacted from this copy of the plan.

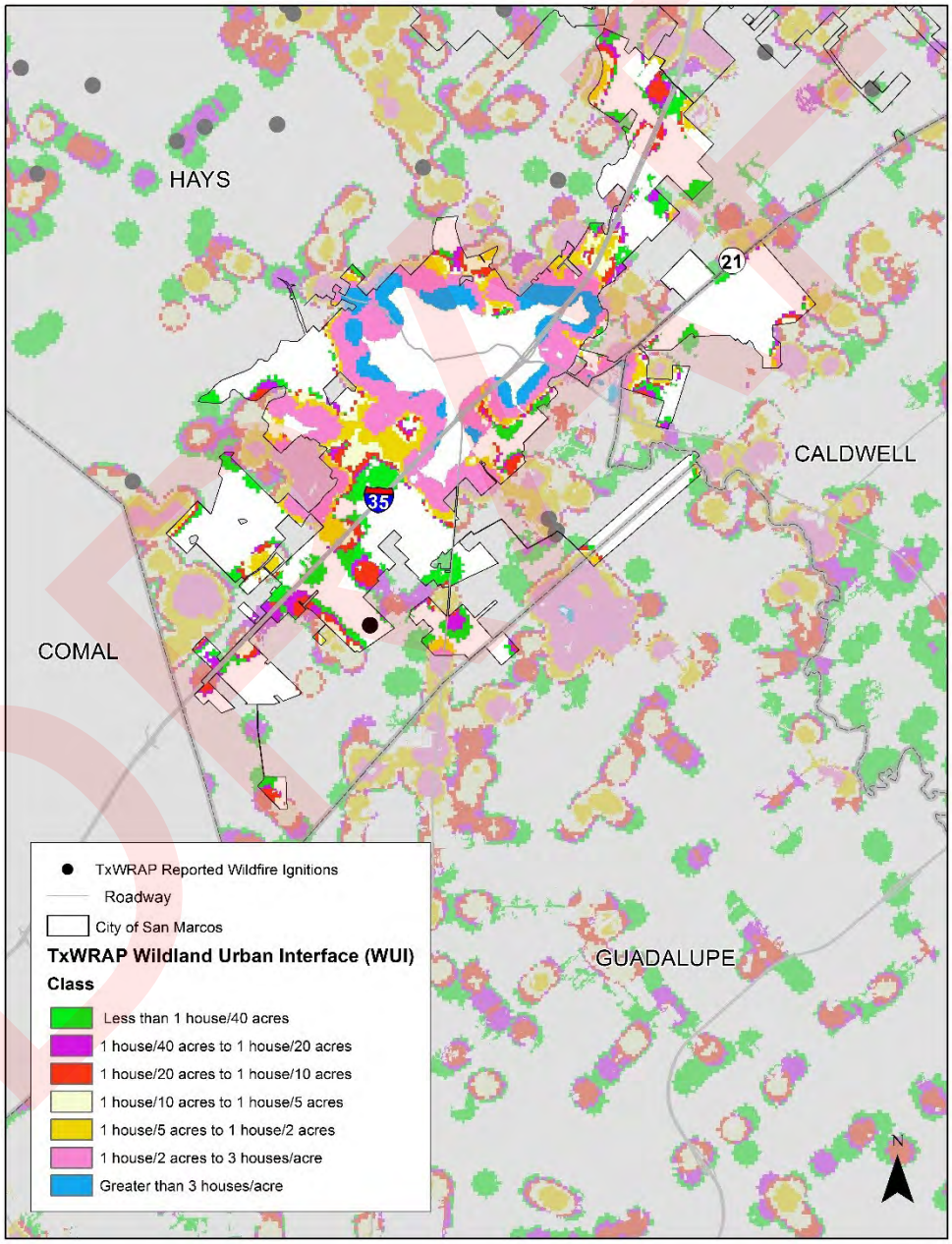
Pages 46-49, Dam/Levee Failure have been redacted from this copy of the plan.

Wildfires

Wildfires: Location

The Texas A&M Forest Service Texas Wildfire Risk Assessment Portal (TxWRAP) can be used to help communities understand their wildfire risk. Figure SM.15 below shows the location of TxWRAP's documented wildfire occurrences with Wildland Urban Interface (WUI) classifications within the City of San Marcos. The WUI illustrates areas of development that are abutting natural areas. Here, communities and the built environment have an increased vulnerability to a wildfire event. Wildfires can be ignited from a variety of sources including lightning or human activity such as campfires, smoking, arson, or equipment use.

Figure SM.15, Wildland Urban Interface (WUI) and Reported Wildfire Ignitions, City of San Marcos



(Texas A&M Forest Service, 2016)

Wildfires: Previous Occurrences

Table SM.27 shows the reported wildfire ignition within the City of San Marcos according to TxWRAP and USGS Federal Fire Occurrence data from the years 1980 to 2015.

Table SM.27, Wildfire Ignitions, City of San Marcos

FPA ID	Date	Fire Size (Acres)
SFO-TX0483-72797	1/1/2008	67

Wildfires: Extent

Table SM.28 lists the Fire Intensity Acreage for the City according to the Texas A&M Forest Service TxWRAP Community Summary Report. For a description of the Characteristic Fire Intensity Scale (FIS), refer to Chapter 2, the Risk Assessment portion of the Hays County HMP Update.

Table SM.28, TxWRAP Fire Intensity Acreage, City of San Marcos

Class	Acres	Percent
Non-Burnable	10,065	49.20%
1 (Very Low)	547	2.70%
1.5	844	4.10%
2 (Low)	216	1.10%
2.5	1,538	7.50%
3 (Moderate)	4,573	22.30%
3.5	525	2.60%
4 (High)	527	2.60%
4.5	1,631	8.00%
5 (Very High)	0	0.00%
Total	20,467	100.00%

Wildfires: Probability

Based on 1 reported event in 35 years, the City of San Marcos can expect a wildfire event approximately once every 35 years on average in the future with up to a potential fire intensity of 4.5, or “High” classification on the TxWRAP Characteristic Fire Intensity Scale.

Number of Reported Events	Number of Years in Dataset	Probability
1	35	0.03

Wildfires: Impact

Impact on the community can be measured using TxWRAP Housing Density levels within the WUI. Areas with a higher housing and population density would be affected to a greater extent than more rural areas, and especially areas near burnable fuels. Table SM.29 below lists the population, percent of total population, WUI acreage and percent of WUI acreage for the City of San Marcos, according to the Texas A&M Forest Service TxWRAP Community Summary Report. See Figure SM.15 for the location of WUI areas within the jurisdiction.

Table SM.29, WUI Acreage, City of San Marcos

Housing Density		WUI Population	Percent of WUI Population	WUI Acres	Percent of WUI Acres
	LT 1hs/40ac	30	0.10%	1,620	16.40%
	1hs/40ac to 1hs/20ac	35	0.10%	698	7.10%
	1hs/20ac to 1hs/10ac	84	0.30%	909	9.20%
	1hs/10ac to 1hs/5ac	302	1.00%	984	9.90%
	1hs/5ac to 1hs/2ac	755	2.50%	1,413	14.30%
	1hs/2ac to 3hs/1ac	11,502	38.80%	3,164	32.00%
	GT 3hs/1ac	16,929	57.10%	1,103	11.20%
Total		29,637	100.00%	9,891	100.00%

Wildfires: Vulnerability Summary

Due to the urban nature of San Marcos, community officials are not overly concerned for the WUI within the City Limits, as there are not significant numbers of structures at risk in the areas. There are not currently fire breaks in place, however this could be a potential action for the community to take in the future to lessen risk.

Although there is an ongoing program for picking up brush in the community, there may be a way to market the event in a way so that more citizens are made aware of the effort. This could decrease the amount of vegetative fuel in the community and also serve as the opportunity for an outreach campaign regarding wildfire mitigation.

Risk Ranking Result

On January 12, 2017, planning representatives from the City of San Marcos completed a questionnaire as part of the Hays County Hazard Mitigation Plan Update: Risk Assessment. The questions covered the risk associated with the hazards that affect each community based on the level of concern over each profiled hazard, the hazards' impact on health and safety as well as property damage and business continuity. The answers from this questionnaire were combined with public survey results on perception of risk, and the values from both sources were analyzed using the Halff Risk Ranking Tool (details regarding the risk ranking tool are in Chapter 2, the Risk Assessment portion of the Hays County HMP Update). The results provided a quantified ranking of risk with values ranging from 0 to 100. The results for San Marcos are shown below (hazard values shown from highest risk to lowest):

Ranking Order	Hazard	Risk Ranking Value
1	Floods	99.5
2	Drought	94.1
3	Dam/Levee Failure	91.3
4	Severe Winter Storms	72.9
5	Tornadoes	70.9
6	Extreme Heat	70.0
7	Wildfire	51.9
8	Wind Storms	51.0
9	Lightning	50.8
10	Hail Storms	44.7
11	Expansive Soils	43.2
12	Land Subsidence	39.9
13	Earthquakes	35.9
14	Hurricanes/Tropical Storms	33.8

Section 3: Mitigation Strategy

This section examines the community's ability to perform mitigation (review of existing capabilities, shown in Table SM.30) and identifies specific mitigation actions to address vulnerabilities for each hazard profiled in the Hays County HMP Update. The mitigation strategy is the application of actions into an approach for performing structural and non-structural mitigation efforts within the jurisdiction. Actions are also prioritized and considered for incorporation into other community programs, regulations, projects or plans.

Completed and canceled actions are also included in a separate section for future reference.

Table SM.30, Existing Capabilities

Capability Name	Capability Type	How it can Accomplish Mitigation
Mayor	Elected Official	Provides political support for approving and funding mitigation actions.
Council Members	Elected Officials	Supplements political support for implementation of mitigation actions.
Emergency Management Coordinator	City Staff	Coordinates MPC, implementation of mitigation actions, and monitoring/evaluation/updating HMP.
Floodplain Administrator (Sr. Engineer)	City Staff	Ensures enforcement of existing flood damage prevention ordinance, and continued compliance with NFIP requirements.
Civil Engineer	City Staff	Provides expertise and guidance for structural mitigation actions.
Chief Building Official	City Staff	Collaborates with MPC on ensuring compliance with existing mitigation-related building requirements and consideration of new building practices to increase mitigation.
Planning and Zoning	City Staff	Considers HMP-identified risk areas when consulting with community planning stakeholders.
GIS Coordinator	City Staff	Can graphically demonstrate changes in development and changes in hazard areas.
Parks and Recreation Director	City Staff	Assists in identifying opportunities for integration of mitigation activities into long-term park development plans. Can also assist with coordinating public outreach events.
Police Chief	City Staff	Assists with flood-related traffic control and evacuation planning.
Fire Chief	City Staff	Assists with wildfire-related mitigation through existing programs and efforts as well as implementation of new measures.
Sales Tax	Funding	Provides potential funding for Hazard Mitigation items
Property Tax	Funding	Provides potential funding for Hazard Mitigation items
Franchise Tax	Funding	Provides potential funding for Hazard Mitigation items
Permitting and Licensing Fees	Funding	Provides potential funding for Hazard Mitigation items
Capital Improvement Plan Funding	Funding	Budget dollars obligated to projects that involve multiple mitigation-related actions.
Chapter 211 of the Local Government Code: Zoning	Authority	Authorizes the City to regulate Zoning

Table SM.30, Existing Capabilities (cont.)

Capability Name	Capability Type	How it can Accomplish Mitigation
Chapter 213 of the Local Government Code: Municipal Comprehensive Plans	Authority	Authorizes the City to adopt a comprehensive plan for the long-range development of the City
Chapter 214 of the Local Government Code	Authority	Authorizes the City to have regulatory authority as it relates to building code (such as structural integrity and plumbing)
General Ordinances Chapter 39- Flood Damage Prevention- methods for reducing flood losses	Regulation	Power to regulate over development in the floodplain (Municode, 2017)
General Ordinances Chapter 86/Article 8- Drainage Utility Fee	Regulation	Authorizes charging fees that can be utilized for mitigation activities (Municode, 2017)
Land Development Code Chapter 4- Zoning Regulations	Regulation	Provides authority over zoning activities, enhance if used with risk assessment information to discourage development in high hazard areas (Municode, 2017)
Land Development Code Chapter 7- Public Facilities Standards	Regulation	Ability to increase standards to ensure resiliency of public facilities through mitigation practices (Municode, 2017)
Land Development Code Chapter 3- Comprehensive Planning	Regulation	Allows for the community to plan for the future and control growth and development of the community within the vision of the planners (Municode, 2017)
Land Development Code Chapter 1- Development Procedures	Regulation	Control over the way land is developed within the City (Municode, 2017)
Land Development Code Chapter 5- Environmental Regulations	Regulation	Oversight on the standards that are withheld to protect natural resources (Municode, 2017)
General Ordinances Chapter 26- Civil Emergencies	Regulation	Sets standards for the roles, responsibilities and authority granted to the City during emergencies, to include ordering evacuations and communicating disaster messaging (Municode, 2017)
General Ordinances Chapter 14- Buildings and Building Regulations	Regulation	Regulation of building standards for construction (Municode, 2017)
General Ordinances Chapter 38- Fire Prevention and Protection	Regulation	Allows community to disallow dangerous activities and encourage/require fire prevention practices (Municode, 2017)

National Flood Insurance Program Participation

The City of San Marcos participates in the National Flood Insurance Program. The community has adopted higher standards in their Flood Damage Prevention Ordinance and participates in the Community Rating System. The community administers their own program and their floodplain administrator is a Senior Engineer. The City will continue to explore options for higher standards. The community has 780 NFIP policies in force, as of January 31, 2017, which provides $167,307,000 total insurance coverage in force.

Mitigation Goals

The plan-level Mitigation Goals can be found in Chapter 3: The Mitigation Strategy portion of the Hays County Hazard Mitigation Plan. These apply to each community and were mutually decided upon as the guiding goals for the development of actions in each planning area.

Mitigation Actions

***E= Actions reducing risk to existing buildings and infrastructure**
***F= Actions reducing risk to new development and redevelopment**

Number/Title	Hazard	Item Description	Implementation Agency
1 Promote Flood Insurance in the Community (previously action 1 in 2011 plan, modified)	Floods	Placing National Flood Insurance Program information brochures in City Hall.	City of San Marcos Emergency Management, Floodplain Administration

Cost Estimate/Funding	Schedule	Status as of 2017	*Risk Focus:
Existing Staff, free brochures from FEMA	1 month	In progress	N/A

Cost and Benefit Considerations
The cost and labor required to promote the NFIP is negligible. The benefit is difficult to estimate.

Number/Title	Hazard	Item Description	Implementation Agency
2 Acquisition or Elevation of Repetitive Loss Properties (previously action 3 in 2011 plan, modified)	Floods	As of 09/2016, San Marcos has 110 repetitive loss properties that need mitigation to reduce the over $9.1 million in payments that have been made.	City of San Marcos City Council

Cost Estimate/Funding	Schedule	Status as of 2017	*Risk Focus:
The estimated acquisition cost is $100,000 per structure ($11 million total for 110 structures). The estimated cost to elevate a residential structure a total of 3 feet in a shallow flooding area is $30,000 per structure ($3.3 million total for 110 structures). Funding Sources: FEMA, TDEM, TWDB, GLO, Hays County	48 months	Delayed	E

Cost and Benefit Considerations
Cost effectiveness for these acquisitions or elevations are determined on a per structure or project basis.

Number/Title	Hazard	Item Description	Implementation Agency
3 Increase of Warning Signs and Barricades at Low Water Crossings (previously action 2 in 2011 plan, modified)	Floods	Increase number of barricades for low water crossings, as Phase 2 of the Action Item that was previously completed.	City of San Marcos City Council

Cost Estimate/Funding	Schedule	Status as of 2017	*Risk Focus:
$20,000	18 months	Ongoing	N/A

Cost and Benefit Considerations
This item would only take the amount of time/labor required to amend an ordinance within the City. The benefit would be for substantially improved or new development.

Number/Title	Hazard	Item Description	Implementation Agency
4 Attend Advanced Local Floodplain Management Courses (previously action 6 in 2011 plan, modified)	Floods	Send certified member of staff to advanced courses.	City of San Marcos Floodplain Management

Cost Estimate/Funding	Schedule	Status as of 2017	Risk Focus:
Existing Staff, cost of accommodations for FEMA training off-site	6 months	Delayed	E/F

Cost and Benefit Considerations
If attending the course at the Emergency Management Institute, the cost of the course would be very low, and only include a minimal meal ticket purchase. The benefit of an informed floodplain administrator would help both new and existing residents through guidance on how to mitigate flood damages to development.

Number/Title	Hazard	Item Description	Implementation Agency
5 Improve Flood Warning Systems (previously action 5 in 2011 plan)	Floods	Enhancing stream flow gauge network by increasing number of gauges throughout community by at least six.	City of San Marcos Emergency Management

Cost Estimate/Funding	Schedule	Status as of 2017	Risk Focus:
$120,000	Phased over 60 months	Not started	N/A

Cost and Benefit Considerations
This action promotes public safety services through enhancing the communities existing method of detecting flooding.

Number/Title	Hazard	Item Description	Implementation Agency
6 Storm Ready Designation from National Weather Service (previously action 11 in 2011 plan)	Severe Winter Weather, Lightning, Hailstorm, Windstorm, Tornadoes, Floods, Hurricanes/ Tropical Storms	Application for designation that classifies community's level of preparedness for severe weather and storms.	City of San Marcos Emergency Management

Cost Estimate/Funding	Schedule	Status as of 2017	Risk Focus:
Existing Staff	6 months	Not Started	N/A

Cost and Benefit Considerations
There is a high level of effort to complete the application, however no other cost applies. The level of increased preparedness would benefit the entire population.

Number/Title	Hazard	Item Description	Implementation Agency
7 Increase Public Awareness of Hazards (previously action 19 in 2011 plan)	All hazards	Public awareness campaign of providing natural hazard information on the City website, with links to HaysInformed.com also being included.	City of San Marcos Emergency Management

Cost Estimate/Funding	Schedule	Status as of 2017	Risk Focus:
Existing Staff	1 month	Not started	N/A

Cost and Benefit Considerations
There is minimal cost and labor required to make this enhancement to the existing San Marcos City website.

Number/Title	Hazard	Item Description	Implementation Agency
8 Adopt Wildfire Maps from Hays County Firewise project (previously action 20 in 2011 plan, modified)	Wildfires	Formally adopt the maps created through the Hays County application for Firewise designation in order to begin to control development in accordance with the avoidance of hazard areas, or development with consideration of proper mitigation.	City of San Marcos Fire Marshal's Office, in coordination with Hays County Fire Marshal's office

Cost Estimate/Funding	Schedule	Status as of 2017	Risk Focus:
Existing staff	6 months	Not started	E/F

Cost and Benefit Considerations
The benefit of mitigating against wildfire for future development as well as for instituting fire mitigation in existing areas of development greatly saves the community from the costs of potential damages.

Number/Title	Hazard	Item Description	Implementation Agency
9 Coordination of marketing Large Item Pick-up day for Wildfire Mitigation (previously action 33 in 2011 plan, modified)	Wildfire, Lightning, Windstorms, Tornadoes	Enhancement of existing large item pick-up to emphasis the wildfire mitigation benefits of cleaning brush and overgrown lots.	City of San Marcos Public Works

Cost Estimate/Funding	Schedule	Status as of 2017	Risk Focus:
Existing staff	2 months	Ongoing	N/A

Cost and Benefit Considerations
This slight change to marketing an existing event would likely lessen the risk for wildland fire for residents located within the Wildland Urban Interface.

Number/Title	Hazard	Item Description	Implementation Agency
10 Drought Monitoring Program	Drought, Land Subsidence	Provide widget on City homepage that provides the latest US Drought Monitor conditions for the day.	City of San Marcos Emergency Management Coordinator

Cost Estimate/Funding	Schedule	Status as of 2017	Risk Focus:
Existing staff	6 months	Not started	N/A

Cost and Benefit Considerations
This low cost monitoring and inclusion of drought water conservation measures will take more time than money to institute and could save the community from a water shortage. All residents that use the water source would benefit.

Number/Title	Hazard	Item Description	Implementation Agency
11 Evacuation Plans/ Alternate road consideration (previously item 27 in 2011 plan)	Hurricanes/ Tropical Storms, Floods, Dam/ Levee Failure, Wildfire	Documentation of an evacuation plan that includes multiple exits for leaving the community.	City of San Marcos Emergency Management

Cost Estimate/Funding	Schedule	Status as of 2017	Risk Focus:
Existing staff	18 months	In progress	F

Cost and Benefit Considerations
It is more cost effective to establish additional evacuation routes than other mitigation alternatives.

Number/Title	Hazard	Item Description	Implementation Agency
12 Soil Compaction Recommendation	Expansive Soils	Recommendation for soil compaction to lessen the possible effects of expansive soils to accompany existing slab requirements for manufactured and mobile homes.	City of San Marcos City Hall

Cost Estimate/Funding	Schedule	Status as of 2017	Risk Focus:
Existing staff, cost of engineer support	6 months	Not Started	F

Cost and Benefit Considerations
This recommendation would add a level of protection to future development of foundations so that they mitigate against expansive soil damage.

Number/Title	Hazard	Item Description	Implementation Agency
13 Sanding Capability Enhancements (previously action 22 in 2011 plan)	Severe Winter Weather	Research of methods and equipment that could be a benefit cost efficient method to increase sanding capability.	City of San Marcos Public Works

Cost Estimate/Funding	Schedule	Status as of 2017	Risk Focus:
Existing Staff	12 months	Not Started	N/A

Cost and Benefit Considerations
The community already has resources for spreading sand but recognizes that the extent of sanding is limited by the current equipment. The cost alternatives would have to be weighed against the recent years' events and the number of ice days that were experienced during which city roads were impassable.

Number/Title	Hazard	Item Description	Implementation Agency
14 Full hazard Assessment Reviews for New Public Facility Location Selections (previously action 24 in 2011 plan, modified)	Floods, Earthquakes, Wildfires, Land Subsidence, Expansive Soils, Dam/ Levee Failure	Ordinance update to require any public facility location be reviewed against hazard area layers in order to ensure location selections consider the safest possible locations for increased resilience against hazards.	City of San Marcos Planning in coordination with Emergency Management Coordinator

Cost Estimate/Funding	Schedule	Status as of 2017	Risk Focus:
Existing staff	6 months	Not started	F

Cost and Benefit Considerations
This enhancement to existing permitting and review processes is an action that would save the community from potential losses related to hazards that affect critical facilities and infrastructure that all citizens depend upon for services.

Number/Title	Hazard	Item Description	Implementation Agency
15 Structural Engineering reviews for New Public Facility Building Plans	Tornadoes, Windstorms, Floods, Hurricanes/ Tropical Storms, Wildfires, Earthquakes	Ordinance update to require any public facility building plan be reviewed for resiliency against hazards that affect the structural integrity.	City of San Marcos Planning

Cost Estimate/Funding	Schedule	Status as of 2017	Risk Focus:
Existing staff	6 months	Not started	F

This enhancement to existing permitting and review processes is an action that would save the community from potential losses related to hazards that affect critical facilities and infrastructure that all citizens depend upon for services.

Number/Title	Hazard	Item Description	Implementation Agency
16 Dam Safety Tabletop Exercises Program (previously action 26 in 2011 plan, modified)	Dam/Levee Failure	Coordination with dam custodians in order to exercise evacuation and emergency procedures/ Make inundation maps public.	City of San Marcos Emergency Management

Cost Estimate/Funding	Schedule	Status as of 2017	Risk Focus:
Staff resources, San Marcos and USACE	12 months	Not started	N/A

Cost and Benefit Considerations
The majority of the labor and cost for this effort would be covered by the owner of the dam. The benefit would be an increased familiarity with the evacuation procedures and expectations that will result in safer conditions for citizens and visitors.

Number/Title	Hazard	Item Description	Implementation Agency
17 Sessom Creek Improvements	Floods	Existing CIP project that would improve drainage off Sessom Creek.	City of San Marcos Engineering

Cost Estimate/Funding	Schedule	Status as of 2017	Risk Focus:
$300,000	18 months	Not started	E

Cost and Benefit Considerations
This project potentially already has funding due to its presence in the Capital Improvements Plan.

Number/Title	Hazard	Item Description	Implementation Agency
18 Vulnerability Study Adoption for Mitigation	All hazards, except Expansive Soils and Land Subsidence	Adoption of Homelessness study proposed in San Marcos Comprehensive Plan, in order to plan for mitigation measures that serve this vulnerable population.	City of San Marcos Mitigation Planning Committee

Cost Estimate/Funding	Schedule	Status as of 2017	Risk Focus:
Existing staff	6 months	Not started	N/A

Cost and Benefit Considerations
This existing effort is planned for and adopted as an action for the community. The adoption of the resulting report will not cost any funds. The benefits will be serving the vulnerable homeless population.

Number/Title	Hazard	Item Description	Implementation Agency
19 Extension of River Ridge Parkway West	Floods	Action R11 of the San Marcos Transportation Plan, this action will increase the ability to divert traffic during flooding events.	City of San Marcos Engineering

Cost Estimate/Funding	Schedule	Status as of 2017	Risk Focus:
$2,743,000	18 months	Not started	E

Cost and Benefit Considerations
This is a project from an existing community plan that likely already has dedicated funding for completion.

Number/Title	Hazard	Item Description	Implementation Agency
20 Land Conservation for Mitigation Recharge	Flooding, Drought, Land Subsidence	San Marcos has repetitive flooding and losses associated with flood events. The preservation of land in flood prone areas and in the 1% floodplain will help mitigate flooding. In addition, the preservation of upland areas that can contribute runoff to creeks and rivers may provide recharge to the Aquifer and mitigate flooding.	City of San Marcos Engineering, Floodplain Administrator and Parks Department

Cost Estimate/Funding	Schedule	Status as of 2017	Risk Focus:
Dependent upon costs per acre as land is acquired Funding sources: Local, State, Federal, Non-government and other sources	18 months	Ongoing	F

This effort would integrate benefits to not only San Marcos, but to other parts of the county and areas that are served by the Aquifer. The benefits would be significant and the natural conservation effort would receive consideration during benefit cost analysis.

Number/Title	Hazard	Item Description	Implementation Agency
21 Regional Detention/ Water Quality Strategy	Floods, Drought, Land Subsidence	Strategy design to mitigation flooding drought, flooding and land subsidence by use of regional detention.	City of San Marcos Engineering

Cost Estimate/Funding	Schedule	Status as of 2017	Risk Focus:
$200,000	18 months	Not started	F

Cost and Benefit Considerations
Existing plan item for comprehensive plan, this project is likely to receive city funding.

Capabilities Assessment

Evaluation/Prioritization of Actions

Each action added to the plan was developed using the Mitigation Action Summary Worksheet shown in Figure SM.16. Non-cost effective projects were not included in prioritization activity

Figure SM.16, Mitigation Action Summary Worksheet

Hays County Hazard Mitigation Plan Update Process

Mitigation Action Summary Worksheet

Community Name: _____

Person completing questionnaire: _____

Mitigation Action/ Project Title	
Background/ Issue	
Opportunities for Integration	
Responsible Agency	
Partners	
Strategy for Existing Structures	

Hays County Hazard Mitigation Plan Update Process

Mitigation Action Summary Worksheet

Strategy for Future Development	
Potential Funding	
Cost Estimate (Values from "Measuring Costs" fields from Benefit and Cost Review Worksheet)	
Benefits (Statements from the "Difference" fields on the Benefit and Cost Review Worksheet)	
Timeline	
Priority (Based off Priority worksheet)	

Table SM.31, Mitigation Action Prioritization (highest hazard priority to lowest)

Mitigation Action	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community	Risk Ranking Score	Total Score
28. Evacuation Plans/Alternate road consideration	1	1	1	1	1	1	1	1	1	1	100	110
20. Land Conservation for Mitigation Recharge	1	1	1	1	1	1	1	1	1	1	100	110
7. Increase Public Awareness of Hazards	1	1	1	1	0	1	1	1	0	1	100	108
2. Acquisition or elevation of Repetitive Loss Properties	1	1	1	0	1	1	0	1	1	0	100	107
20. Attend Advanced Local Floodplain Management Courses	1	1	1	1	1	1	0	1	0	0	100	107
5. Improve flood warning systems	1	0	1	1	1	0	1	1	0	1	100	107
3. Increase of Warning Signs and Barricades at Low Water Crossings	1	0	1	1	0	0	1	1	1	1	100	107
16. Dam Safety Tabletop Exercises Program	1	1	1	0	1	0	1	1	0	1	100	107
21. Regional Detention/Water Quality Strategy	0	1	1	1	0	1	1	1	0	1	100	107
3. StormReady Designation for San Marcos	1	0	1	1	0	0	1	1	0	1	100	106
15. Structural Engineering reviews for New Public Facility Building Plans	1	1	1	-1	0	1	1	1	0	1	100	106
19. Extension of River Ridge Parkway West	1	0	1	1	0	0	1	1	0	1	100	106
17. Sessom Creek Improvements	0	0	1	1	0	0	1	1	0	1	100	105
1. Promote Flood Insurance in the community	0	0	1	1	0	0	1	1	0	0	100	104
18. Vulnerability Study Adoption for Mitigation	1	0	1	-1	0	0	1	1	0	1	100	104
14. Full hazard Assessment Reviews for New Public Facility Location Selections	1	1	1	-1	0	0	0	1	0	0	100	103
10. Drought Monitoring Program	1	0	1	1	0	1	1	1	0	1	94	101
9. Coordination of marketing Large Item Pick-up day for Wildfire Mitigation	1	1	1	1	1	1	1	1	1	0	73	82
30. De-icing Capability Enhancements	1	0	1	1	1	1	1	1	0	0	73	80

Table SM.31, Mitigation Action Prioritization (highest hazard priority to lowest) (cont.)

Mitigation Action	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community	Risk Ranking Score	Total Score
8. Adopt wildfire maps from Hays County Firewise project	1	1	1	1	0	1	1	1	1	1	52	61
12. Soil Compaction Recommendation	0	1	1	-1	0	0	1	-1	0	0	43	44

Mitigation Actions by Hazard

The mitigation actions in Table SM.32 are shown with the corresponding hazards.

Table SM.32, Mitigation Action Impact, San Marcos

Action Number	Drought	Extreme Heat	Severe Winter Storms	Lightning	Hailstorms	Windstorms	Tornadoes	Expansive Soils	Floods	Land Subsidence	Hurricanes/ Tropical Storms	Earthquakes	Dam/ Levee Failure	Wildfire
1									X					
2									X					
3									X					
4									X					
5									X					
6			X	X	X	X	X		X		X			
7	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8														X
9				X		X	X							X
10	X									X				
11									X		X		X	X
12								X						
13			X											
14								X	X	X		X	X	X
15						X	X		X		X	X		X
16												X	X	
17									X					
18	X	X	X	X	X	X	X		X		X	X	X	X
19									X					
20	X								X	X				
21	X								X	X				

Integration Efforts

Table SM.33 captures ways that the Risk Assessment, Goals and Actions developed in the HMP can be integrated into other City of San Marcos documents, programs and regulations.

Table SM.33, Plan Integration Efforts, San Marcos

Name of Document	Type	Item Type	Opportunity for Integration
Haysinformed.com	Program	Action	Link to existing Hays County HaysInformed.com emergency preparedness/awareness page when creating Public Awareness Page for hazards on San Marcos website (Action 6)
City of San Marcos Budget	Document	Action	Seek obligation of funding for floodplain administrator training through available training line item
San Marcos Flood Protection Plan 2007	Plan	Actions	Seek participation of Mitigation Planning Committee member for updates of Flood Protection plan in order to ensure that existing flood projects continue on into the next plan if they are not completed by the time the next update period is conducted.
San Marcos Water Master Plan Update 2016	Plan	Goals	Participate in the plan update for the plan and seek more solutions that meet both water quality and conservation goals but also those of flood control.
San Marcos Transportation Master Plan	Plan	Actions	Participate in Transportation Master Plan Update and seek further explanation on which projects benefit the floodplain so that those can be added to the Hazard Mitigation Plan.
Vision San Marcos: A River Runs Through Us-Comprehensive Plan	Plan	Risk Assessment	Participate in the Comprehensive Plan Update in order to present hazard data for consideration when zoning and future development is considered within the City.
Hazard Mitigation Grant Program (HMGP)	Funding	Action	Identify actions that can be funded through new and existing grant awards.
Pre-Disaster Mitigation (PDM)	Funding	Action	Identify actions that can be funded through new and existing grant awards.
Flood Mitigation Assistance (FMA)	Funding	Action	Identify actions that can be funded through new and existing grant awards.
TWDB Flood Protection Planning (FPP) Grant	Funding	Action	Identify actions that can be funded through new and existing grant awards.
TWDB Clean Water State Revolving Fund (CWSRF)	Funding	Action	Identify actions that can be funded through new and existing grant awards.
Texas Water Development Fund (DFund)	Funding	Action	Identify actions that can be funded through new and existing loans.

Section 4: Finalize Plan Update (Review, Evaluation, and Implementation)

Changes in Development

The City of San Marcos has been named one of the fastest growing populations in America for 3 years within the past 5 years by Time Magazine (Time, 2015). The booming growth in this college town is not only seen in residents but also in industry. Recently, Amazon built a distribution center in the community, bringing in 3,000 employees. With higher numbers of students and employees on the road into and around San Marcos, the community has had to take measures to expand and improve roads as well.

Past Mitigation Action Progress Reports Summary - Completed and Canceled

2011 Action Number	Hazard	Item Description	Lead Department
4	Flood	Adopt "Higher Standard" Flood Damage Prevention Ordinance	City of San Marcos
Cost Estimate/Funding		**Schedule**	**Status as of 2017**
Cost and Funding: Existing staff resources, no cost		Completed	Completed in 2010.
Cost Effectiveness			
Not independently cost-effective			

2011 Action Number	Hazard	Item Description	Lead Department
7	Flood	Increase Participation in the Community Rating System (CRS) Program	City of San Marcos
Cost Estimate/Funding		**Schedule**	**Status as of 2017**
Cost and Funding: Existing staff resources		2010	Delayed. Not priority during present planning period. The community already participates in CRS.
Cost Effectiveness			
Not independently cost-effective			

2011 Action Number	Hazard	Item Description	Lead Department
9	All Hazards	Improve Emergency Communication Capabilities	City of San Marcos
Cost Estimate/Funding		**Schedule**	**Status as of 2017**
$620,000 Funding: Capital Area Planning Council of Governments (CAPCOG)		Completed	Completed.
Cost Effectiveness			
Not independently cost-effective			

2011 Action Number	Hazard	Item Description	Lead Department
10	All hazards	Development of and maintenance of countywide and individual community HAZMAP Plans	City of San Marcos
Cost Estimate/Funding		**Schedule**	**Status as of 2017**
Existing staff resources		Completed	Completed.
Cost Effectiveness			
Not independently cost-effective			

2011 Action Number	Hazard	Item Description	Lead Department
12	Extreme Heat	Reduce Impacts of Extreme Heat on Elderly, Disabled, Low-Income and Infants (Fan Distribution Program)	City of San Marcos
Cost Estimate/Funding		**Schedule**	**Status as of 2017**
$2,000 to purchase and distribute 100 box fans and $3,000 estimated cost for a/c repairs; Funding Sources: United Way, Rotary Clubs, Lion Clubs, Red Cross, Churches and charitable organizations, power companies		Completed	Completed.
Cost Effectiveness			
Not independently cost-effective			

2011 Action Number	Hazard	Item Description	Lead Department
14	Tornadoes	Encourage Construction of Tornado "Safe Rooms"	City of San Marcos- Building
Cost Estimate/Funding		**Schedule**	**Status as of 2017**
Funding: Texas DEM, CAPCOG		Completed	Completed.
Cost Effectiveness			
Not independently cost-effective			

2011 Action Number	Hazard	Item Description	Lead Department
15	Tornadoes, thunderstorms and high winds	Building Code Improvements	City of San Marcos- Building
Cost Estimate/Funding		**Schedule**	**Status as of 2017**
Funding: Texas DEM, CAPCOG		Completed	Completed.
Cost Effectiveness			
Not independently cost-effective			

2011 Action Number	Hazard	Item Description	Lead Department
16	Drought	Make San Marcos Drought Resistant	City of San Marcos Water Dept.
Cost Estimate/Funding		**Schedule**	**Status as of 2017**
$20,000 Study Cost; Funding: Texas Water Development Board		Completed	Completed.
Cost Effectiveness			
Not independently cost-effective			

2011 Action Number	Hazard	Item Description	Lead Department
17	Drought	Construct Needed Water System Improvements in Lower Colorado Region K and South Central Texas Region L	City of San Marcos Engineering
Cost Estimate/Funding		**Schedule**	**Status as of 2017**
$472 million (South Central Texas Region- 21 counties) $256 million (14 county Lower Colorado Region); Funding sources: TWDB, GBRA, LCRA		Completed	Completed. Converted water supply to San Marcos to 80% surface water and 20% aquifer
Cost Effectiveness			
Not independently cost-effective			

2011 Action Number	Hazard	Item Description	Lead Department
18	Flood	Promote Flood Insurance	City of San Marcos
Cost Estimate/Funding		**Schedule**	**Status as of 2017**
$2,000		Ongoing	Removed. Repeated in Action 1.
Cost Effectiveness			
Not independently cost-effective, but the initial step in identifying appropriate mitigation actions			

2011 Action Number	Hazard	Item Description	Lead Department
21	Extreme Heat	Evaluate Excess Heat Risks Study	City of San Marcos
Cost Estimate/Funding		**Schedule**	**Status as of 2017**
No additional cost-uses existing staff resources		TBD: Probably initiated in 2011	Canceled. Replaced with other extreme heat actions.
Cost Effectiveness			
Not independently cost-effective, but needed to develop adequate risk reduction efforts			

Changes in Priorities

As with many of the communities in Hays County, San Marcos' priorities revolve around water, the abundance and the scarcity, through flooding and drought hazards. As floods destroy structures and endanger lives, droughts threaten the availability of the necessary resources. In an effort to ensure that the supply of water is secure for their citizens, San Marcos has adopted many conservation approaches and actions. Considering and prioritizing land conservation and aquifer focused efforts, the community is making many efforts to mitigate the dangers of both hazards.

Section 5: Approval and Adoption

Approval and Adoption Procedure

Table SM.34, Municipal Jurisdiction Adoption Date

Municipality	APA Date	Adoption Date
San Marcos		

Jurisdiction Adoption Documentation Placeholder

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