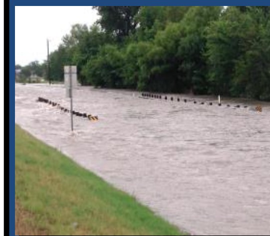
HAZARD MITIGATION PLAN

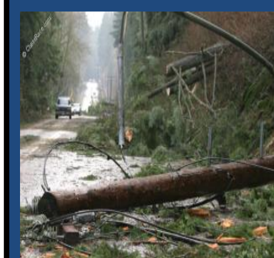
San Saba County

November 2015

DRAFT

Prepared For:
San Saba County
Office of Emergency Management
500 E. Wallace
San Saba, TX 76877





San Saba County
HAZARD MITIGATION PLAN UPDATE

DRAFT

NOVEMBER 2015

Prepared for:

San Saba County Office of Emergency Management
500 E. Wallace
San Saba, TX 76877

and

Texas Colorado River Floodplain Coalition
P.O. Box 2533
1511 Main Street
Cedar Park, TX 78613-9998

San Saba County
Hazard Mitigation Plan Update

TABLE OF CONTENTS

Executive Summary **ES-1**

PART 1 PLAN ELEMENTS AND PARTICIPATING COMMUNITIES

Chapter 1. Introduction **1-1**
1.1 Why Prepare This Plan? 1-1
1.1.1 The Big Picture 1-1
1.1.2 Local Concerns 1-1
1.1.3 Purposes for Planning 1-1
1.2 Who Will Benefit From This Plan? 1-2
1.3 Elements of This Plan 1-2

Chapter 2. Plan Update—What Has Changed **2-1**
2.1 The Previous Plan 2-1
2.2 Why Update? 2-6
2.3 The Plan—What Is Different? 2-6
2.4 Local Mitigation Plan Review Tool 2-6

Chapter 3. Plan Methodology **3-1**
3.1 Grant Funding 3-1
3.2 Establishment of the Planning Partnership 3-1
3.3 Defining the Planning Area 3-2
3.4 The Steering Committee 3-4
3.5 Coordination with Other Agencies 3-4
3.6 Review of Existing Programs 3-5
3.7 Public Involvement 3-5
3.7.1 Stakeholders and the Steering Committee 3-5
3.7.2 Survey/Questionnaire 3-6
3.7.3 Meetings 3-6
3.7.4 Press Releases/News Articles 3-7
3.7.5 Internet 3-9
3.8 Plan Development, Chronology, Milestones 3-10

Chapter 4. Guiding Principle, Goals, and Objectives **4-1**
4.1 Guiding Principle 4-1
4.2 Goals 4-1
4.3 Objectives 4-1

Chapter 5. Identified Hazards of Concern and Risk Assessment Methodology **5-1**
5.1 Identified Hazards of Concern 5-1
5.2 Climate Change 5-1
5.3 Methodology 5-2
5.4 Risk Assessment Tools 5-2
5.4.1 Dam Failure, Earthquake, Flood, and Hurricane - HAZUS-MH 5-2
5.4.2 Other Hazards of Concern 5-4
5.4.3 Limitations 5-4

Chapter 6. San Saba County Profile 6-1
6.1 Historical Overview 6-1
6.2 Major Past Hazard Events 6-2
6.3 Climate 6-3
6.4 Geology and Soils 6-9
6.5 Critical Facilities and Infrastructure 6-11
6.6 Demographics 6-17
6.6.1 Population 6-17
6.6.2 Age Distribution 6-18
6.6.3 Disabled Populations 6-19
6.6.4 Ethnic Populations 6-20
6.7 Economy 6-20
6.7.1 Income 6-21
6.7.2 Employment Trends 6-21
6.7.3 Occupations and Industries 6-22
6.8 Future Trends in Development 6-23
6.9 Laws and Ordinances 6-24
6.9.1 Federal 6-24
6.9.2 State and Regional 6-26
6.9.3 San Saba County 6-29
6.9.4 City of San Saba 6-31

Chapter 7. Hazard Mitigation Capabilities Assessment 7-1
7.1 San Saba County 7-1
7.1.1 Legal and Regulatory Capabilities 7-1
7.1.2 Administrative and Technical Capabilities 7-2
7.1.3 Financial Capabilities 7-3
7.2 City of San Saba 7-4
7.2.1 Legal and Regulatory Capabilities 7-4
7.2.2 Administrative and Technical Capabilities 7-5
7.2.3 Financial Capabilities 7-6

PART 2 RISK ASSESSMENT

Chapter 8. Coastal Erosion, Expansive Soils, and Land Subsidence 8-1
8.1 General Background 8-1
8.1.1 Coastal Erosion 8-1
8.1.2 Expansive Soils 8-1
8.1.3 Land Subsidence 8-4
8.2 Hazard Profile 8-7
8.2.1 Past Events 8-7
8.2.2 Location 8-7
8.2.3 Frequency 8-8
8.2.4 Severity 8-8
8.2.5 Warning Time 8-8
8.3 Secondary Hazards 8-9
8.4 Climate Change Impacts 8-9
8.5 Exposure 8-9
8.5.1 Population 8-9
8.5.2 Property 8-10
8.5.3 Critical Facilities and Infrastructure 8-10
8.5.4 Environment 8-10

8.6 Vulnerability 8-10
8.6.1 Population 8-10
8.6.2 Property 8-10
8.6.3 Critical Facilities and Infrastructure 8-10
8.6.4 Environment 8-11
8.7 Future Trends in Development 8-11
8.8 Scenario 8-11
8.9 Issues 8-12
Chapter 9. Dam/Levee Failure 9-1
9.1 General Background 9-1
9.1.1 Dams 9-1
9.1.2 Levees 9-3
9.1.3 Causes of Dam Failure 9-4
9.1.4 Causes of Levee Failure 9-5
9.1.5 Regulatory Oversight 9-6
9.2 Hazard Profile 9-9
9.2.1 Past Events 9-9
9.2.2 Location 9-9
9.2.3 Frequency 9-12
9.2.4 Severity 9-12
9.2.5 Warning Time 9-13
9.3 Secondary Hazards 9-13
9.4 Climate Change Impacts 9-13
9.5 Exposure and Vulnerability 9-14
9.5.1 Population 9-14
9.5.2 Property 9-14
9.5.3 Critical Facilities and Infrastructure 9-14
9.5.4 Environment 9-14
9.6 Future Trends in Development 9-14
9.7 Scenario 9-15
9.8 Issues 9-15
Chapter 10. Drought and Extreme Heat 10-1
10.1 General Background 10-1
10.1.1 Drought 10-1
10.1.2 Extreme Heat 10-2
10.2 Hazard Profile 10-2
10.2.1 Past Events 10-3
10.2.2 Location 10-9
10.2.3 Frequency 10-16
10.2.4 Severity 10-18
10.2.5 Warning Time 10-19
10.3 Secondary Hazards 10-20
10.4 Climate Change Impacts 10-20
10.5 Exposure 10-21
10.6 Vulnerability 10-23
10.6.1 Population 10-23
10.6.2 Property 10-23
10.6.3 Critical Facilities 10-24
10.6.4 Environment 10-24
10.6.5 Economic Impact 10-24

10.7 Future Trends in Development 10-24
10.8 Scenario........ 10-24
10.9 Issues........ 10-25

Chapter 11. Earthquake 11-1
11.1 General Background 11-1
11.1.1 How Earthquakes Happen........ 11-1
11.1.2 Earthquake Classifications........ 11-1
11.1.3 Ground Motion........ 11-3
11.1.4 Effect of Soil Types 11-3
11.2 Hazard Profile 11-4
11.2.1 Past Events 11-4
11.2.2 Location 11-4
11.2.3 Frequency........ 11-7
11.2.4 Severity 11-7
11.2.5 Warning Time 11-11
11.3 Secondary Hazards........ 11-11
11.4 Climate Change Impacts 11-11
11.5 Exposure 11-11
11.5.1 Population 11-11
11.5.2 Property........ 11-12
11.5.3 Critical Facilities and Infrastructure........ 11-12
11.5.4 Environment........ 11-12
11.6 Vulnerability 11-12
11.7 Future Trends in Development 11-12
11.8 Scenario........ 11-12
11.9 Issues........ 11-13

Chapter 12. Flood........ 12-1
12.1 General Background 12-1
12.1.1 Flood 12-1
12.1.2 Floodplain 12-5
12.1.3 Measuring Floods and Floodplains 12-5
12.1.4 Floodplain Ecosystems........ 12-5
12.1.5 Effects of Human Activities........ 12-5
12.2 Hazard Profile 12-6
12.2.1 Past Events 12-6
12.2.2 Location 12-8
12.2.3 Frequency........ 12-12
12.2.4 Severity 12-12
12.2.5 Warning Time 12-12
12.3 Secondary Hazards........ 12-12
12.4 Climate Change Impacts 12-12
12.5 Exposure 12-13
12.5.1 Population 12-13
12.5.2 Property........ 12-13
12.5.3 Critical Facilities and Infrastructure........ 12-16
12.5.4 Environment........ 12-18
12.6 Vulnerability 12-18
12.6.1 Population 12-18
12.6.2 Property........ 12-19
12.6.3 Critical Facilities and Infrastructure........ 12-22

12.6.4 Environment ... 12-22
12.7 Future Trends in Development ... 12-22
12.8 Scenario ... 12-22
12.9 Issues ... 12-22

Chapter 13. Hurricanes and Tropical Storms ... 13-1
13.1 General Background ... 13-1
13.1.1 Hurricanes and Tropical Storms ... 13-1
13.1.2 Hurricane and Tropical Storm Classifications ... 13-3
13.2 Hazard Profile ... 13-3
13.2.1 Past Events ... 13-3
13.2.2 Location ... 13-4
13.2.3 Frequency ... 13-6
13.2.4 Severity ... 13-6
13.2.5 Warning Time ... 13-6
13.3 Secondary Events ... 13-7
13.4 Climate Change Impacts ... 13-7
13.5 Exposure ... 13-7
13.6 Vulnerability ... 13-7
13.7 Future Trends in Development ... 13-10
13.8 Scenario ... 13-10
13.9 Issues ... 13-10

Chapter 14. Thunderstorm, Lightning, Hail, and Wind ... 14-1
14.1 General Background ... 14-1
14.1.1 Thunderstorms ... 14-1
14.1.2 Lightning ... 14-3
14.1.3 Hail ... 14-5
14.1.4 Wind ... 14-9
14.2 Hazard Profile ... 14-13
14.2.1 Past Events ... 14-13
14.2.2 Location ... 14-22
14.2.3 Frequency ... 14-25
14.2.4 Severity ... 14-25
14.2.5 Warning Time ... 14-26
14.3 Secondary Hazards ... 14-26
14.4 Climate Change Impacts ... 14-26
14.5 Exposure ... 14-26
14.5.1 Population ... 14-27
14.5.2 Property ... 14-27
14.5.3 Critical Facilities and Infrastructure ... 14-27
14.5.4 Environment ... 14-27
14.6 Vulnerability ... 14-27
14.6.1 Population ... 14-27
14.6.2 Property ... 14-28
14.6.3 Critical Facilities and Infrastructure ... 14-28
14.6.4 Environment ... 14-28
14.7 Future Trends in Development ... 14-28
14.8 Scenario ... 14-29
14.9 Issues ... 14-29

Chapter 15. Tornado ... 15-1
15.1 General Background ... 15-1
15.2 Hazard Profile ... 15-5
15.2.1 Past Events ... 15-5
15.2.2 Location ... 15-7
15.2.3 Frequency ... 15-7
15.2.4 Severity ... 15-7
15.2.5 Warning Time ... 15-7
15.3 Secondary Hazards ... 15-7
15.4 Climate Change Impacts ... 15-7
15.5 Exposure ... 15-9
15.5.1 Population ... 15-9
15.5.2 Property ... 15-9
15.5.3 Critical Facilities and Infrastructure ... 15-9
15.5.4 Environment ... 15-9
15.6 Vulnerability ... 15-9
15.6.1 Population ... 15-9
15.6.2 Property ... 15-9
15.6.3 Critical Facilities and Infrastructure ... 15-10
15.6.4 Environment ... 15-10
15.7 Future Trends in Development ... 15-10
15.8 Scenario ... 15-10
15.9 Issues ... 15-10

Chapter 16. Wildfire ... 16-1
16.1 General Background ... 16-1
16.2 Hazard Profile ... 16-4
16.2.1 Past Events ... 16-4
16.2.2 Location ... 16-8
16.2.3 Frequency ... 16-16
16.2.4 Severity ... 16-16
16.2.5 Warning Time ... 16-16
16.3 Secondary Hazards ... 16-16
16.4 Climate Change Impacts ... 16-16
16.5 Exposure ... 16-17
16.5.1 Population ... 16-17
16.5.2 Property ... 16-17
16.5.3 Critical Facilities and Infrastructure ... 16-19
16.5.4 Environment ... 16-20
16.6 Vulnerability ... 16-21
16.6.1 Population ... 16-21
16.6.2 Property ... 16-21
16.6.3 Critical Facilities and Infrastructure ... 16-22
16.6.4 Environment ... 16-22
16.7 Future Trends in Development ... 16-22
16.8 Scenario ... 16-22
16.9 Issues ... 16-23

Chapter 17. Winter Weather ... 17-1
17.1 General Background ... 17-1
17.1.1 Extreme Cold ... 17-1
17.2 Hazard Profile ... 17-3

17.2.1 Past Events 17-3
17.2.2 Location 17-3
17.2.3 Frequency 17-4
17.2.4 Severity 17-4
17.2.5 Warning Time 17-4
17.3 Secondary Hazards 17-4
17.4 Climate Change Impacts 17-4
17.5 Exposure 17-4
17.5.1 Population 17-5
17.5.2 Property 17-5
17.5.3 Critical Facilities and Infrastructure 17-5
17.5.4 Environment 17-5
17.6 Vulnerability 17-5
17.6.1 Population 17-5
17.6.2 Property 17-6
17.6.3 Critical Facilities and Infrastructure 17-6
17.6.4 Environment 17-6
17.7 Future Trends in Development 17-6
17.8 Scenario 17-7
17.9 Issues 17-7

Chapter 18. Planning Area Risk Ranking 18-1
18.1 Probability of Occurrence 18-1
18.2 Impact 18-2
18.3 Risk Rating and Ranking 18-5

PART 3 MITIGATION AND PLAN MAINTENANCE STRATEGY

Chapter 19. Area-Wide Mitigation Actions and Implementation 19-1
19.1 Recommended Mitigation Actions 19-1
19.2 Benefit/Cost Review and Prioritization 19-1

Chapter 20. Plan Adoption and Maintenance 20-1
20.1 Plan Adoption 20-1
20.2 Plan Maintenance Strategy 20-1
20.2.1 Plan Implementation 20-1
20.2.2 Steering Committee 20-2
20.2.3 Annual Progress Report 20-2
20.2.4 Plan Update 20-3
20.2.5 Continuing Public Involvement 20-3
20.2.6 Incorporation into Other Planning Mechanisms 20-3

LIST OF TABLES

No. *Title* *Page No.*

Table ES-1. Recommended Mitigation Actions ES-5
Table 2-1. Hazards Evaluated in the 2011-2016 TCRFC Multi-Jurisdictional Hazard Mitigation Plan Update 2-1
Table 2-2. San Saba County Project Implementation Worksheet (Update of 2011-2016 TCRFC Plan Projects) 2-3
Table 3-1. County and City Planning Partners 3-1
Table 3-2. Steering Committee Members 3-4
Table 3-3. Plan Development Milestones 3-10
Table 6-1. Federal Disaster Declarations in San Saba County 6-3
Table 6-2. San Saba County Temperature Summaries San Saba Station 6-4
Table 6-3. Critical Facilities in the Planning Area 6-12
Table 6-4. Critical Infrastructure in the Planning Area 6-12
Table 6-5. San Saba County Demographic and Social Characteristics (2013) 6-17
Table 6-6. San Saba County Population 6-18
Table 6-7. San Saba County Economic Characteristics 6-21
Table 6-8. Present Land Use in Planning Area 6-24
Table 7-1. San Saba County Regulatory Mitigation Capabilities Matrix 7-1
Table 7-2. San Saba County Administrative/Technical Mitigation Capabilities Matrix 7-2
Table 7-3. San Saba County Financial Mitigation Capabilities Matrix 7-3
Table 7-4. City of San Saba Regulatory Mitigation Capabilities Matrix 7-4
Table 7-5. City of San Saba Administrative/Technical Mitigation Capabilities Matrix 7-5
Table 7-6. City of San Saba Financial Mitigation Capabilities Matrix 7-6
Table 9-1. High- and Significant-Hazard Dams in San Saba County 9-10
Table 9-2. USACE Hazard Potential Classification 9-12
Table 9-3. TCEQ Hazard Potential Classification 9-13
Table 10-1. Temperature Data from San Saba Weather Station 10-9
Table 10-2. Historic Drought Events in San Saba County (1996-2014) 10-16
Table 10-3. Loss Estimates for Drought Events 10-23
Table 11-1. Mercalli Scale and Peak Ground Acceleration Comparison 11-3
Table 11-2. NEHRP Soil Classification System 11-4
Table 12-1. Historic Flood Events in San Saba County (1996-2015) 12-6
Table 12-2. Acreage in the 100-Year and 500-Year Floodplain by Jurisdiction 12-9
Table 12-3. Present Land Use in the 100-Year Floodplain 12-13
Table 12-4. Present Land Use in the 500-Year Floodplain 12-14
Table 12-5. Structures and Population in the 100-Year Floodplain 12-15
Table 12-6. Structures and Population in the 500-Year Floodplain 12-15
Table 12-7. Value of Structures in 100-Year Floodplain 12-16
Table 12-8. Value of Structures in 500-Year Floodplain 12-16
Table 12-9. Critical Facilities and Infrastructure in the 100-Year Floodplain 12-17
Table 12-10. Critical Facilities and Infrastructure in the 500-Year Floodplain 12-17
Table 12-11. Loss Estimates for the 100-Year Flood Event 12-19
Table 12-12. Loss Estimates for the 500-Year Flood Event 12-19
Table 12-13. National Flood Insurance Program Statistics 12-20
Table 13-1. Saffir-Simpson Hurricane Wind Scale 13-3
Table 13-2. Loss Estimates for Hurricane Event 13-8
Table 14-1. National Weather Service Hail Severity 14-7
Table 14-2. Historic Hail Events in San Saba County (1960-2014) 14-15
Table 14-3. Wind Power Class and Speed 14-19

Table 14-4. Historic Wind-Related Events in San Saba County (1950-2014)......14-21
Table 14-5. Loss Estimates for Thunderstorm, Lightning, Wind, and Hail Events......14-28
Table 15-1. Enhanced Fujita Scale Damage Indicators......15-2
Table 15-2. The Fujita Scale and Enhanced Fujita Scale......15-2
Table 15-3. Historic Tornado Events in San Saba County (1950-2014)......15-5
Table 15-4. Loss Estimates for Tornado Events......15-10
Table 16-1. Fire Protection Services in San Saba County......16-2
Table 16-2. Vegetation Classes in San Saba County......16-2
Table 16-3. Historic Wildfire Events in San Saba County (50+ Acres) (1980-2014)......16-4
Table 16-4. Population within Wildfire Risk Areas......16-17
Table 16-5. Exposure and Value of Structures in Very Low Wildfire Risk Areas......16-17
Table 16-6. Exposure and Value of Structures in Low Wildfire Risk Areas......16-18
Table 16-7. Exposure and Value of Structures in Moderate Wildfire Risk Areas......16-18
Table 16-8. Exposure and Value of Structures in High Wildfire Risk Areas......16-18
Table 16-9. Exposure and Value of Structures in Very HIgh Wildfire Risk Areas......16-19
Table 16-10. Wildfire Risk Areas in Present Land Coverage for San Saba County......16-19
Table 16-11. Critical Facilities and Infrastructure per Wildfire Risk Class......16-20
Table 16-12. Loss Estimates for Wildfire Events......16-21
Table 17-1. Temperature Data from the San Saba Station......17-2
Table 17-2. Historic Winter Weather Events in San Saba County (1996-2014)......17-3
Table 17-3. Loss Estimates for Winter Storm Events......17-6
Table 18-1. Hazard Probability of Occurrence......18-1
Table 18-2. Impact on People from Hazards......18-3
Table 18-3. Impact on Property from Hazards......18-3
Table 18-4. Impact on Economy from Hazards......18-4
Table 18-5. Hazard Risk Ranking Calculations......18-5
Table 18-6. Hazard Risk Summary......18-6
Table 19-1. Mitigation Actions Developed to Address Hazards......19-4
Table 19-2. Recommended Mitigation Actions......19-5

LIST OF FIGURES

No. Title *Page No.*

Figure 3-1. San Saba County Planning Area and Participating Communities 3-3
Figure 3-2. Sample Page from Questionnaire Distributed to the Public 3-6
Figure 3-3. Steering Committee Meeting March 24, 2015 3-7
Figure 3-4. TCRFC Informational Brochure 3-8
Figure 3-5. Sample Page from the TCRFC Website 3-9
Figure 6-1. Location of the San Saba County Planning Area within the State of Texas 6-1
Figure 6-2. City of San Saba Station Monthly Temperature Data (1901-2000) 6-4
Figure 6-3. Annual Average Maximum Temperature (1981-2010) 6-5
Figure 6-4. Annual Average Minimum Temperature (1981-2010) 6-6
Figure 6-5. Average Monthly Precipitation (1901-2000) 6-7
Figure 6-6. Geographic Distribution of Annual Average Precipitation (1981-2010) 6-8
Figure 6-7. Natural Regions of Texas and San Saba County 6-10
Figure 6-8. Critical Facilities in San Saba County 6-13
Figure 6-9. Critical Infrastructure in San Saba County 6-14
Figure 6-10. Critical Facilities in the City of San Saba 6-15
Figure 6-11. Critical Infrastructure in the City of San Saba 6-16
Figure 6-12. State of Texas and San Saba County Population Growth 6-18
Figure 6-13. San Saba County Age Distribution 6-19
Figure 6-14. San Saba County Ethnic Distribution 6-20
Figure 6-15. San Saba County Unemployment Rate (1990-2015) 6-22
Figure 6-16. Percent of Total Employment by Industry in San Saba County 6-23
Figure 8-1. Coastal Change/Erosion Rates for the Texas Coast 8-2
Figure 8-2. Expansive Soil Regions 8-3
Figure 8-3. Groundwater Depletion and Subsidence Rates 8-5
Figure 8-4. Karst Regions of Texas 8-6
Figure 9-1. TCEQ Dam Definition 9-2
Figure 9-2. Primary Purpose/Benefit of U.S. Dams 9-3
Figure 9-3. U.S. Levee Systems 9-4
Figure 9-4. Texas County Population Exemptions for Dams 9-8
Figure 9-5. Colorado River Water Surface Elevation and Flow During the May 2015 Precipitation Event 9-9
Figure 9-6. Locations of Dams in San Saba County 9-11
Figure 10-1. Heat Index Table 10-2
Figure 10-2. U.S. Drought Monitor, March 27, 2012 10-4
Figure 10-3. U.S. Drought Monitor, March 17, 2015 10-5
Figure 10-4. U.S. Drought Monitor, June 16, 2015 10-6
Figure 10-5. Crop Moisture Index (Week Ending March 28, 2015) 10-10
Figure 10-6. Palmer Z Index Short-Term Drought Conditions (March 2015) 10-11
Figure 10-7. Palmer Drought Severity Index (March 2015) 10-12
Figure 10-8. Palmer Drought Severity Index (May 2015) 10-13
Figure 10-9. Palmer Hydrological Drought Index Long-Term Hydrologic Conditions (March 2015) 10-14
Figure 10-10. 24-Month Standardized Precipitation Index (through February 2015) 10-15
Figure 10-11. USDA Census of Agriculture San Saba County Profile 2012 10-22
Figure 11-1. Texas Earthquakes (1847-2015) 11-5
Figure 11-2. Probabilistic Earthquake Hazard Map for the U.S. 11-6
Figure 11-3. Peak Ground Acceleration (10% Probability of Exceedance in 50-Year Map of Peak Ground Acceleration) 11-9

Figure 11-4. 500-Year Probability Event in San Saba County 11-10
Figure 12-1. Number of Flash Floods in Texas per County (1986-1999)....12-3
Figure 12-2. Number of Storm Centers by County....12-4
Figure 12-3. Special Flood Hazard Areas in San Saba County 12-10
Figure 12-4. Special Flood Hazard Areas in the City of San Saba 12-11
Figure 12-5. Repetitive Loss Properties in San Saba County 12-21
Figure 13-1. Historical Hurricane Paths Affecting San Saba County....13-2
Figure 13-2. Historical Tropical Storms and Hurricanes Affecting San Saba County 13-5
Figure 13-3. Probability of Named Tropical Storm Event....13-6
Figure 13-4. 100-Year Probabilistic Peak Wind Gusts for San Saba County....13-9
Figure 14-1. Thunderstorm Life Cycle 14-2
Figure 14-2. Average Annual National Lightning Density....14-4
Figure 14-3. National Hail Paths....14-6
Figure 14-4. National Hail Days per Year 14-8
Figure 14-5. National Wind Zones 14-10
Figure 14-6. National High Wind Paths....14-11
Figure 14-7. National Annual High Wind Days 14-12
Figure 14-8. Lightning Fatalities in the U.S. (1959-2013) 14-14
Figure 14-9. Texas Wind Power 14-20
Figure 14-10. Hail Events in San Saba County (1955-2014)....14-23
Figure 14-11. Damaging Wind Events in San Saba County (1955-2014) 14-24
Figure 14-12. Severe Weather Probabilities in Warmer Climates....14-26
Figure 15-1. Annual Average Number of Tornadoes in the U.S. (1991-2010) 15-3
Figure 15-2. Total Annual Threat of Tornado Events in the U.S. (1980-1999)....15-4
Figure 15-3. Tornado Paths in the U.S. (1950-2014)....15-6
Figure 15-4. Tornado Events in San Saba County (1950-2014) 15-8
Figure 16-1. Vegetation Types in San Saba County....16-3
Figure 16-2. Wildfires in San Saba County (1980-2014) 16-7
Figure 16-3. San Saba County Wildfire Ignitions Distribution 16-9
Figure 16-4. San Saba County Wildland Urban Interface 16-10
Figure 16-5. San Saba County Wildland Urban Interface Response Index 16-11
Figure 16-6. San Saba County Wildfire Values Response Index 16-12
Figure 16-7. San Saba County Wildfire Community Protection Zones....16-13
Figure 16-8. San Saba County Wildfire Hazard Potential 16-14
Figure 16-9. City of San Saba Wildfire Hazard Potential....16-15
Figure 17-1. National Weather Service Wind Chill Chart....17-2

LIST OF APPENDICES

Appendix A. Acronyms and Definitions
Appendix B. Local Mitigation Plan Review Tool
Appendix C. Public Outreach
Appendix D. Menu of Mitigation Alternatives
Appendix E. Worksheets for Recommended Mitigation Actions
Appendix F. Plan Adoption Resolutions from Planning Partners
Appendix G. Example Progress Report

ACKNOWLEDGMENTS AND CONTACTS

San Saba County

Ms. Marsha Hardy
Emergency Management Coordinator/Floodplain Administrator
Phone: (325) 372-8570
Email: emergencymgmt@co.san-saba.tx.us

Texas Colorado River Floodplain Coalition

Mr. Mickey Reynolds
Executive Director
Phone: (979) 533-8683
Email: TCRFC@att.net

Consultants

JSW & Associates, Jeff S. Ward

Halff Associates, Cindy J. Engelhardt

Tetra Tech, Inc., Laura D. Johnston

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The Disaster Mitigation Act of 2000 (DMA) is federal legislation that requires proactive, pre-disaster planning as a prerequisite for some funding available under the Robert T. Stafford Act. The DMA encourages state and local authorities to work together on pre-disaster planning. The planning network called for by the DMA helps local governments articulate accurate needs for mitigation, resulting in faster allocation of funding and more cost-effective risk reduction projects.

Hazard mitigation is the use of long- and short-term strategies to reduce or alleviate the loss of life, personal injury, and property damage that can result from a disaster. It involves strategies such as planning, policy changes, programs, projects, and other activities that can mitigate the impacts of hazards. It is impossible to predict exactly when and where disasters will occur or the extent to which they will impact an area. However, with careful planning and collaboration among public agencies, stakeholders, and citizens, it is possible to minimize losses that disasters can cause. The responsibility for hazard mitigation lies with many, including private property owners; business and industry; and local, state, and federal government.

San Saba County and the City of San Saba have developed and maintained a hazard mitigation plan to reduce risks from natural disasters and to comply with the DMA.

PLAN UPDATE

Federal regulations require monitoring, evaluation, and updating of hazard mitigation plans. An update provides an opportunity to reevaluate recommendations, monitor the impacts of implemented actions, and evaluate whether there is a need to change the focus of mitigation strategies. A jurisdiction covered by a hazard mitigation plan that has expired is no longer in compliance with the DMA.

San Saba County and the City of San Saba participated in previous hazard mitigation plans as part of the Texas Colorado River Floodplain Coalition (TCRFC). The TCRFC is a non-profit, 501(c)(3) organization formed in June 2001 by the cities and counties of the Lower Colorado River Authority (LCRA) in response to flood devastation requiring more coordinated damage prevention efforts. In 2004, the TCRFC developed a Hazard Mitigation Action Plan entitled *Creating a Disaster Resistant Lower Colorado River Basin*, which was approved by the Federal Emergency Management Agency (FEMA) in 2004. In 2011, TCRFC completed the *TCRFC Multi-Jurisdictional Hazard Mitigation Plan Update 2011-2016* as a regional partnership of 15 counties (including San Saba County) and 63 jurisdictions. The 2011-2016 update was completed with technical support from the LCRA and the outside consultant team of H20 Partners, Inc., and PBS&J.

In accordance with recent FEMA guidance that requires individual hazard mitigation plans for each county and Texas Division of Emergency Management's 2010 "two-county maximum" policy, this update to the *TCRFC Multi-Jurisdictional Hazard Mitigation Plan Update 2011-2016* was developed to be specific to San Saba County and the City of San Saba.

The development of this hazard mitigation plan update consisted of the following phases:

- **Phase 1: Organize and Review**—A planning team was assembled to provide technical support for the plan update, consisting of TCRFC representatives, key county and city staff, and a team of technical consultants. The first step in developing the plan update was to re-establish a planning partnership. The City of San Saba participated in the update as a planning partner. A Steering Committee was assembled to oversee the plan update, consisting of planning partner staff and community representatives from the planning area. Coordination with other county, state, and federal agencies involved in hazard mitigation occurred throughout the plan update process. This phase included a comprehensive review of the previous *TCRFC Multi-Jurisdictional Hazard Mitigation Plan Update 2011-2016*, and existing programs that may support or enhance hazard mitigation actions.

- **Phase 2: Update the Risk Assessment**—Risk assessment is the process of measuring the potential loss of life, personal injury, economic impact, and property damage resulting from natural hazards. This process assesses the vulnerability of people, buildings, and infrastructure to natural hazards. All facets of the risk assessment of the plan were re-visited by the planning team and updated with the best available data and technology. The work included the following:
    - Hazard identification and profiling
    - Assessment of the impact of hazards on physical, social, and economic assets
    - Vulnerability identification
    - Estimation of the cost of potential damage
- **Phase 3: Engage the Public**—A public involvement strategy agreed upon by the Steering Committee was implemented by the planning team. All meetings were open to the public. Meetings were held to present the risk assessment as well as the draft plan. The public was encourage to participate through a county-specific hazard mitigation survey and the county website that included information on the plan.
- **Phase 4: Assemble the Updated Plan**—The planning team and Steering Committee assembled key information into a document to meet the DMA requirements for all planning partners.
- **Phase 5: Adopt/Implement the Plan**—Once pre-adoption approval has been granted by the Texas Division of Emergency Management and FEMA Region VI, the final adoption phase will begin. Each planning partner will individually adopt the updated plan. The plan maintenance process includes a schedule for monitoring and evaluating the plan's progress annually and producing a plan revision every 5 years. Throughout the life of this plan, a representative of the original Steering Committee will be available to provide consistent guidance and oversight.

MITIGATION GUIDING PRINCIPLE, GOALS, AND OBJECTIVES

The guiding principle for the San Saba County Hazard Mitigation Plan Update is as follows:

- To reduce or eliminate the long-term risks to loss of life and property damage in San Saba County from the full range of natural disasters.

The following plan goals and objectives were determined by the Steering Committee:

- **Goal 1:** Protect public health and safety.
    - **Objective 1.1:** Advise the public about health and safety precautions to guard against injury and loss of life from hazards.
    - **Objective 1.2:** Maximize the utilization of the latest technology to provide adequate warning, communication, and mitigation of hazard events.
    - **Objective 1.3:** Reduce the danger to, and enhance protection of, dangerous areas during hazard events.
    - **Objective 1.4:** Protect critical facilities and services.
- **Goal 2:** Protect existing and new properties.
    - **Objective 2.1:** Reduce repetitive losses to the National Flood Insurance Program.
    - **Objective 2.2:** Use the most cost-effective approaches to protect existing buildings and public infrastructure from hazards.
    - **Objective 2.3:** Enact and enforce regulatory measures to ensure that development will not put people in harm's way or increase threats to existing properties.

- **Goal 3:** Increase public understanding, support and demand for hazard mitigation.
  - **Objective 3.1:** Heighten public awareness of the full range of natural hazards they face.
  - **Objective 3.2:** Educate the public on actions they can take to prevent or reduce the loss of life or property from all hazards.
  - **Objective 3.3:** Publicize and encourage the adoption of appropriate hazard mitigation measures.
- **Goal 4:** Build and support local capacity and commitment to continuously become less vulnerable to hazards.
  - **Objective 4.1:** Build and support local partnerships to continuously become less vulnerable to hazards.
  - **Objective 4.2:** Build a cadre of committed volunteers to safeguard the community before, during, and after a disaster.
  - **Objective 4.3:** Build hazard mitigation concerns into planning and budgeting processes.
- **Goal 5:** Promote growth in a sustainable manner.
  - **Objective 5.1:** Incorporate hazard mitigation into the long-range planning and development activities.
  - **Objective 5.2:** Promote beneficial uses of hazardous areas while expanding open space and recreational opportunities.
  - **Objective 5.3:** Utilize regulatory approaches to prevent creation of future hazards to life and property.
- **Goal 6:** Maximize the resources for investment in hazard mitigation.
  - **Objective 6.1:** Maximize the use of outside sources of funding.
  - **Objective 6.2:** Maximize participation of property owners in protecting their properties.
  - **Objective 6.3:** Maximize insurance coverage to provide financial protection against hazard events.
  - **Objective 6.4:** Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.

IDENTIFIED HAZARDS OF CONCERN

For this plan, the Steering Committee considered the full range of natural hazards that could impact the planning area and then listed hazards that present the greatest concern to the county. The process incorporated review of state and local hazard planning documents, as well as information on the frequency, magnitude, and costs associated with hazards that have impacted or could impact the planning area. Anecdotal information regarding natural hazards and the perceived vulnerability of the planning area's assets to hazards was also included. Based on the review, this plan addresses the following natural hazards of concern:

- Coastal Erosion
- Dam/Levee Failure
- Drought
- Expansive Soils
- Extreme Heat
- Earthquake
- Flood
- Hail

- Hurricane and Tropical Storm
- Land Subsidence
- Lightning
- Thunderstorm
- Tornado
- Wildfire
- Wind
- Winter Weather

MITIGATION ACTIONS

Mitigation actions presented in this plan update are activities designed to reduce or eliminate losses resulting from natural hazards. The update process resulted in the identification of 13 mitigation actions targeted for implementation by individual planning partners as listed in Table ES-1. The Steering Committee ranked the mitigation actions in order of priority, with 1 being the highest priority. The highest priority mitigation actions are shown in red on the table, medium priority actions are shown in yellow and low priority actions are shown in green.

TABLE ES-1.
RECOMMENDED MITIGATION ACTIONS

Action No.	Title	Description	Mitigation Action Ranking	Action Type	Applicable Goals	Applicable Objectives	Estimated Cost	Potential Funding Sources	Timeline	Benefit
SAN SABA COUNTY										
1	All-hazards education and awareness programs	Enhancing hazard awareness, for all of the counties assessed risks, of the private sector, particularly lenders, insurance agents, and realtors.	1	EAP	G1, G3, G4	1.1, 1.3, 3.1, 3.2, 3.3, 4.2	<$10,000	FEMA, USDA, General Revenue	Long Term	Medium
2	Dam brush clearance	Clear brush at each of the dam/levee spillways to allow for the proper channel flow.	4	SIP	G1, G2	1.3, 1.4, 2.2,	<$10,000	NRCS, USDA, Private Funds, General Revenue	Ongoing	Medium
3	Encourage construction of safe rooms	Encourage the construction of safe rooms in residences and public buildings in San Saba County. These would be built to FEMA standards above ground.	5	SIP EAP	G3, G4, G6	3.2, 4.1, 6.1, 6.2	<$10,000	FEMA Grants, Private Funds	Long Term	Medium
4	Reverse 911 System (CodeRED)	Develop operational procedures and protocols for the Reverse 911 system, called CodeRED, for the entire county.	2	LPR EAP	G1, G3, G4	1.2, 1.3, 3.1, 3.2, 4.3	<$10,000	Regional/ CTCOG, General Revenue	Short Term	Medium
5	Encourage drought-tolerant landscape design	Encourage drought-tolerant landscape design through incorporation of drought tolerant or xeriscape practices into landscape educational measures to reduce dependence on irrigation. Consider coordinating with NRCS group or the Texas AgriLife Extension Office.	6	EAP	G1, G2, G6	1.3, 1.4, 2.2, 6.2	<$10,000	NRCS, Texas AgriLife Extension Agency	Long Term	Medium

TABLE ES-1.
RECOMMENDED MITIGATION ACTIONS

Action No.	Title	Description	Mitigation Action Ranking	Action Type	Applicable Goals	Applicable Objectives	Estimated Cost	Potential Funding Sources	Timeline	Benefit
6	MOUs between VFDs and contiguous counties	Annually, through the Commissioners' Court, have participation between the county and the local VFDs to update MOUs.	3	LPR	G1, G2, G4	1.3, 2.3, 4.1	<$10,000	NRCS, Texas AgriLife Extension Agency	Long Term	Medium
7	Develop an engineering study of 'Hooten Holler' in the City of Richland Springs	Develop an engineering study of 'Hooten Holler' on the east side of the City of Richland Springs to help with safety and flooding issues affecting residents on both sides of the channel.	7	SIP	G1, G2, G4	1.3, 2.2, 4.1	$10,000 to $100,000	FEMA Grants, Municipal and County General Revenue	Long Term	Medium
CITY OF SAN SABA										
1	All-hazards education and awareness programs	Enhancing hazard awareness for all hazards the city is vulnerable to through articles in the weekly newspaper and on the weekly radio show hosted by the City Manager. Both of these options effectively reach most of residents of the city.	1	EAP	G1, G3	1.1, 1.3, 3.1, 3.2, 3.3	<$10,000	FEMA, USDA, General Revenue	Ongoing	Medium
2	Reverse 911 System (CodeRED)	Develop operational procedures and protocols for the Reverse 911 system, called CodeRED, for the entire county.	2	LPR EAP	G1, G3, G4	1.2, 1.3, 3.1, 3.2, 4.3	<$10,000	Regional/ CTCOG, General Revenue	Short Term	Medium
3	Encourage drought-tolerant landscape design	Encourage drought-tolerant landscape design through incorporation of drought tolerant or xeriscape practices into landscape educational measures reducing dependence on irrigation. Consider coordinating with NRCS group or the Texas AgriLife Extension Office.	4	EAP	G1, G6	1.3, 1.4, 6.2	<$10,000	NRCS, Texas AgriLife Extension Agency	Long Term	Medium

TABLE ES-1.
RECOMMENDED MITIGATION ACTIONS

Action No.	Title	Description	Mitigation Action Ranking	Action Type	Applicable Goals	Applicable Objectives	Estimated Cost	Potential Funding Sources	Timeline	Benefit
4	Encourage construction of safe rooms	Encourage the construction of safe rooms in residences and public buildings in San Saba. These would be built to FEMA standards above ground.	5	SIP EAP	G3, G4, G6	3.2, 4.1, 6.1, 6.2	<$10,000	FEMA Grants, Private Funds	Long Term	Medium
5	Reduce the number of uninhabitable and un-maintained properties in the floodplain	The city is condemning properties, paying for demolition and maintaining the lots as open space. This is an ongoing effort.	3	SIP	G2, G3, G4, G5, G6	2.1, 3.3, 4.1, 4.3, 5.1, 5.2, 5.3, 6.2, 6.3, 6.4	>$100,000	FMA, PDM, HMGP Grants	Long Term	Medium
6	National Weather Service's StormReady Program	Work to complete guidelines 1 to 6 to become a certified StormReady community.	6	LPR EAP	G3, G4	3.2, 3.3, 4.1, 4.3	<$10,000	City Funds	Long Term	Medium

CTCOG	Central Texas Council of Governments	MOU	Memorandum of Understanding
EAP	Education and Awareness Programs	NRCS	National Resource Conservation Service
FEMA	Federal Emergency Management Agency	PDM	Pre-Disaster Mitigation
FMA	Flood Mitigation Assistance	SIP	Structure and Infrastructure Project
HMGP	Hazard Mitigation Grant Program	USDA	U.S. Department of Agriculture
LPR	Local Plans and Regulations	VFD	Volunteer Fire Department

PART 1
PLAN ELEMENTS AND PARTICIPATING COMMUNITIES

CHAPTER 1.
INTRODUCTION

1.1 WHY PREPARE THIS PLAN?

1.1.1 The Big Picture

Hazard mitigation is defined as a way to alleviate the loss of life, personal injury, and property damage that can result from a disaster through long- and short-term strategies. Hazard mitigation involves strategies such as planning, policy changes, programs, projects, and other activities that can mitigate the impacts of hazards. The responsibility for hazard mitigation lies with many, including private property owners; business and industry; and local, state, and federal government.

The federal Disaster Mitigation Act of 2000 (DMA) (Public Law 106-390) required state and local governments to develop hazard mitigation plans as a condition for federal disaster grant assistance. Prior to 2000, federal disaster funding focused on disaster relief and recovery, with limited funding for hazard mitigation planning. The DMA increased the emphasis on planning for disasters before they occur.

The DMA encourages state and local authorities to work together on pre-disaster planning. It promotes "sustainable hazard mitigation," which includes the sound management of natural resources and the recognition that hazards and mitigation must be understood in the largest possible social and economic context. The planning network called for by the DMA helps local governments articulate accurate needs for mitigation, resulting in faster allocation of funding and more cost-effective risk reduction projects.

1.1.2 Local Concerns

This hazard mitigation plan considers local concerns when evaluating natural hazards and developing mitigation actions. Several factors specific to San Saba County initiated this planning effort:

- San Saba County is exposed to hazards that have caused past damage.
- Limited local resources make it difficult to be pre-emptive in reducing risk. Eligibility for federal financial assistance is paramount to promote successful hazard mitigation in the area.
- San Saba County and the City of San Saba want to be proactive in preparing for the probable impacts from natural hazards.
- San Saba County and the City of San Saba participated in previous hazard mitigation plans as part of the Texas Colorado River Floodplain Coalition (TCRFC), which included 15 counties (including San Saba) and 63 jurisdictions. In accordance with recent Federal Emergency Management Agency (FEMA) guidance individual hazard mitigation plans must be prepared for each county. In addition, the Texas Division of Emergency Management (TDEM) implemented a "two-county maximum" policy in 2010 on submittals of local plans. Therefore, this plan update was developed specifically for San Saba County and the City of San Saba.
- FEMA approval of the previous hazard mitigation plan will expire in July 2016. If this plan is not updated, San Saba County would not have a FEMA-approved mitigation plan in place, limiting county access to emergency funds after a disaster declaration.

1.1.3 Purposes for Planning

This hazard mitigation plan update identifies resources, information, and strategies for reducing risk from natural hazards. Elements and strategies in the plan were selected because they meet a program requirement and because they best meet the needs of the planning partners and their citizens. One of the benefits of multi-jurisdictional planning is the ability to pool resources and eliminate redundant activities within a planning area that has uniform risk exposure and vulnerabilities. FEMA encourages multi-jurisdictional planning under its guidance for the DMA. This plan will help guide and coordinate mitigation activities throughout the planning area.

This plan update was developed to meet the following objectives:

- Meet or exceed requirements of the DMA.
- Enable all planning partners to continue using federal grant funding to reduce risk through mitigation.
- Meet the needs of each planning partner as well as state and federal requirements.
- Create a risk assessment that focuses on San Saba County hazards of concern.
- Create a single planning document that integrates all planning partners into a framework that supports partnerships within the county, and puts all partners on the same planning cycle for future updates.
- Coordinate existing plans and programs so that high-priority actions and projects to mitigate possible disaster impacts are funded and implemented.

1.2 WHO WILL BENEFIT FROM THIS PLAN?

All citizens and businesses of San Saba County are the ultimate beneficiaries of this hazard mitigation plan update. The plan reduces risk for those who live in, work in, and visit the county. It provides a viable planning framework for all foreseeable natural hazards that may impact the county. Participation in development of the plan by key stakeholders helped ensure that outcomes will be mutually beneficial. The resources and background information in the plan are applicable countywide. The plan's goals and recommendations can lay groundwork for the development and implementation of local mitigation activities and partnerships.

1.3 ELEMENTS OF THIS PLAN

This plan includes all federally required elements of a disaster mitigation plan:

- Countywide elements:
  - A description of the planning process
  - The public involvement strategy
  - A list of goals and objectives
  - A countywide hazard risk assessment
  - Countywide mitigation actions
  - A plan maintenance strategy
- Jurisdiction-specific elements for the City of San Saba:
  - A description of the participation requirements established by the Steering Committee
  - Jurisdiction-specific mitigation actions

The following appendices include information or explanations to support the main content of the plan:

- Appendix A: A glossary of acronyms and definitions.
- Appendix B: The FEMA Local Mitigation Plan Review Tool.
- Appendix C: Public outreach information, including the hazard mitigation survey and summary, and documentation of public meetings.
- Appendix D: A menu of mitigation alternatives reviewed for this plan.
- Appendix E: Worksheets for each recommended mitigation action.

- Appendix F: Plan adoption resolutions from planning partners.
- Appendix G: A template for progress reports to be completed as this plan is implemented.

All planning partners will adopt this San Saba County Hazard Mitigation Plan Update in its entirety.

CHAPTER 2.
PLAN UPDATE—WHAT HAS CHANGED

2.1 THE PREVIOUS PLAN

San Saba County and the City of San Saba participated in previous hazard mitigation plans as part of the TCRFC. The TCRFC is a non-profit, 501(c)(3) organization formed in June 2001 by the cities and counties of the Lower Colorado River Authority (LCRA) in response to flood devastation requiring more coordinated damage prevention efforts. In 2004, the TCRFC developed a Hazard Mitigation Action Plan entitled *Creating a Disaster Resistant Lower Colorado River Basin*, which was approved by FEMA in 2004. In 2011, TCRFC completed the *Multi-Jurisdictional Hazard Mitigation Plan Update 2011-2016* as a regional partnership of 15 counties (including San Saba) and 63 jurisdictions. The 2011-2016 update was completed with technical support from the LCRA and the outside consultant team of H20 Partners, Inc., and PBS&J.

The 2011-2016 update ranked 13 hazards from high (H) to very low (VL), or not applicable (N/A) for San Saba County and the City of San Saba. Table 2-1 lists the hazards and their ranking. These 13 hazards were evaluated in the TCRFC plan. These hazards included 3 human-caused hazards: hazardous materials (HAZMAT), pipeline failure, and terrorism. Although the previous plan profiled human-caused hazards, only natural hazards are evaluated in this plan update. Drought, extreme heat, and flood were the natural hazards ranked high for San Saba County. Drought, extreme heat, thunderstorms, tornadoes, and wildfire ranked high for the City of San Saba.

TABLE 2-1.
HAZARDS EVALUATED IN THE 2011-2016 TCRFC MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN UPDATE

Jurisdiction	Dam Failure	Drought	Extreme Heat	Flood	Hail	HAZMAT	Hurricane / Tropical Storm	Pipeline Failure	Terrorism	Thunderstorm	Tornado	Wildfire	Winter Storm
San Saba County	**L**	**H**	**H**	**H**	**M**	**M**	**N/A**	**L**	**L**	**M**	**L**	**M**	**M**
City of San Saba	VL	H	H	M	M	VL	L	L	L	H	H	H	L

The *TCRFC Multi-Jurisdictional Hazard Mitigation Plan Update 2011-2016* identified goals, objectives, and mitigation actions for these hazards. The overall goal of the 2011-2016 TCRFC plan was:

- To reduce or eliminate the long-term risks to loss of life and property damage in the Lower Colorado River Basin from the full range of disasters.

Six goals were identified for mitigating the hazards, with one or more objectives defined for each goal. These goals and their associated objectives are as follows:

- **Goal 1:** Protect public health and safety.
  - **Objective 1.1:** Advise the public about health and safety precautions to guard against injury and loss of life from hazards.
  - **Objective 1.2:** Maximize the utilization of the latest technology to provide adequate warning, communication, and mitigation of hazard events.
  - **Objective 1.3:** Reduce the damage to, and enhance protection of, dangerous areas during hazard events.

- **Objective 1.4:** Protect critical facilities and services.

- **Goal 2:** Protect existing and new properties.
  - **Objective 2.1:** Reduce repetitive losses to the National Flood Insurance Program.
  - **Objective 2.2:** Use the most cost-effective approaches to protect existing buildings and public infrastructure from hazards.
  - **Objective 2.3:** Enact and enforce regulatory measures to ensure that development will not put people in harm's way or increase threats to existing properties.
- **Goal 3:** Increase public understanding, support and demand for hazard mitigation.
  - **Objective 3.1:** Heighten public awareness of the full range of natural and man-made hazards they face.
  - **Objective 3.2:** Educate the public on actions they can take to prevent or reduce the loss of life or property from all hazards.
  - **Objective 3.3:** Publicize and encourage the adoption of appropriate hazard mitigation measures.
- **Goal 4:** Build and support local capacity and commitment to continuously become less vulnerable to hazards.
  - **Objective 4.1:** Build and support local partnerships to continuously become less vulnerable to hazards.
  - **Objective 4.2:** Build a cadre of committed volunteers to safeguard the community before, during, and after a disaster.
  - **Objective 4.3:** Build hazard mitigation concerns into planning and budgeting processes.
- **Goal 5:** Promote growth in a sustainable manner.
  - **Objective 5.1:** Incorporate hazard mitigation into the long-range planning and development activities.
  - **Objective 5.2:** Promote beneficial uses of hazardous areas while expanding open space and recreational opportunities.
  - **Objective 5.3:** Utilize regulatory approaches to prevent creation of future hazards to life and property.
- **Goal 6:** Maximize the resources for investment in hazard mitigation.
  - **Objective 6.1:** Maximize the use of outside sources of funding.
  - **Objective 6.2:** Maximize participation of property owners in protecting their properties.
  - **Objective 6.3:** Maximize insurance coverage to provide financial protection against hazard events.
  - **Objective 6.4:** Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.

The *TCRFC Multi-Jurisdictional Hazard Mitigation Plan Update 2011-2016* then identified one or more mitigation action to accomplish each objective. The current status of each of these actions identified in the plan is shown in Table 2-2. Actions designated as "(Past)" were carried forward from the 2004 TCRFC Plan.

TABLE 2-2.
SAN SABA COUNTY PROJECT IMPLEMENTATION WORKSHEET
(UPDATE OF 2011-2016 TCRFC PLAN PROJECTS)

Action No.	Action	Project Status: Ongoing	Project Status: Delayed	Project Status: Completed	Project Status: Deleted	Funding: Budgeted	Funding: Apply for Grant	Funding: Grant Received	Funding: Target Completion	Comments
SAN SABA COUNTY										
1 (Past)	Undertake a review of the county's floodplain management ordinance.			X						
1	Place emergency management/floodplain issue pamphlets and flyers at the San Saba County Library and City of San Saba Chamber of Commerce office.			X						
2	Work with San Angelo's National Weather Service office to facilitate SkyWarn classes for all first responders, city/county employees and independent school district employees.			X						
3	Introduce CoCoRaHS to citizens and encourage them to become official observers.			X						
4	Become a National Weather Service StormReady community.				X					
5	Develop an engineering study of 'Hooten Holler' in the City of Richland Springs to determine a way to control the severe flooding and washout issues.		X							Budgeting Issues. Incorporated into Mitigation Action 7.
6	Add at least four more warning sirens to the City of San Saba.				X					Budgeting Issues
7	Install a new warning siren for the City of Richland Springs.				X					Budgeting Issues
8	Install a new warning siren for the Town of Cherokee.				X					Budgeting Issues

TABLE 2-2.
SAN SABA COUNTY PROJECT IMPLEMENTATION WORKSHEET
(UPDATE OF 2011-2016 TCRFC PLAN PROJECTS)

Action No.	Action	Project Status				Funding				Comments
		Ongoing	Delayed	Completed	Deleted	Budgeted	Apply for Grant	Grant Received	Target Completion	
9	Place metal burn ban signs at all roads leading into San Saba County (from contiguous counties and out of incorporated cities) and magnetic burn ban signs on county, emergency response, and law enforcement vehicles.				X					
CITY OF SAN SABA										
1 (Past)	Review floodplain management ordinance to ensure that it meets the mandatory minimum criteria under state law and the National Flood Insurance Program for development in the regulatory floodplain, and that all FEMA minimum requirements and criteria are met.			X						
2 (Past)	Undertake a comprehensive flood insurance policy survey for the City of San Saba.				X					
3 (Past)	Develop a comprehensive list of structures and their value located in the floodplain.			X						
4 (Past)	Reduce the number of uninhabitable and un-maintained properties in the floodplain.	X								Incorporated into Mitigation Action 5.
5 (Past)	Establish a pre-disaster debris management plan.			X						
1	Become a National Weather Service StormReady community.	X								Incorporated into Mitigation Action 6.

TABLE 2-2.
SAN SABA COUNTY PROJECT IMPLEMENTATION WORKSHEET
(UPDATE OF 2011-2016 TCRFC PLAN PROJECTS)

Action No.	Action	Project Status				Funding				Comments
		Ongoing	Delayed	Completed	Deleted	Budgeted	Apply for Grant	Grant Received	Target Completion	
2	Implement plans to straighten and widen Mill Pond Creek bed.				X					City is conducting mitigation measures for the Mill Pond Creek but it is cost prohibitive to straighten and widen when it flows under a highway and a railroad line near the creek.
3	Replace tin horns on 5th Street to reduce damages from flooding.			X						
4	Clean out ditches and culverts, and divert drains to reduce the impact from floods.			X						

"(Past)" in the action number column indicates that the action was first identified in the *2004 TCRFC Hazard Mitigation Plan* and was carried forward into the *2011-2016 TCRFC Hazard Mitigation Plan Update*.

CoCoRaHS Community Collaborative Rain, Hail and Snow Network
FEMA Federal Emergency Management Agency

2.2 WHY UPDATE?

Title 44 of the Code of Federal Regulations (44 CFR) stipulates that hazard mitigation plans must present a schedule for monitoring, evaluating, and updating the plan. As mentioned previously, San Saba County participated in a mitigation planning process in 2011 as part of the TCRFC. This plan included 15 counties and will expire in 2016. Regional plans are no longer acceptable by FEMA. This update process provides an opportunity to reevaluate recommendations, monitor the impacts of actions that have been accomplished, and evaluate whether there is a need to change the focus of mitigation strategies. A jurisdiction covered by a plan that has expired is not able to pursue elements of federal funding under the Robert T. Stafford Act for which a current hazard mitigation plan is a prerequisite.

2.3 THE PLAN—WHAT IS DIFFERENT?

The previous regional TCRFC plan has been improved to focus on San Saba County and the City of San Saba using the best and most current data and technology available. The county and the city were fully involved in the preparation of this plan update. The updated plan includes a more robust hazard analysis. Mitigation actions were reviewed and amended to include only those that would move the community towards a higher degree of resiliency while being feasible, practical, and implementable given current finances. Federal and state funds for projects have become difficult to obtain. The update recommends 13 mitigation actions: 7 countywide actions and 6 actions specifically for the City of San Saba.

Actions from the previous plan were carried forward into the mitigation actions if they were identified as delayed or in progress. These actions are indicated on Table 2-2.

2.4 LOCAL MITIGATION PLAN REVIEW TOOL

The Local Mitigation Plan Review Tool demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers states and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-Jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of each element of the plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference the *Local Mitigation Plan Review Guide* when completing the Local Mitigation Plan Review Tool. The Local Mitigation Plan Review Tool is included in this hazard mitigation plan as Appendix B.

CHAPTER 3.
PLAN METHODOLOGY

3.1 GRANT FUNDING

The current TCRFC Hazard Mitigation Plan will expire in 2016. Therefore, TCRFC initiated steps to begin the next update in 2013. The TCRFC Board selected the JSWA Team to assist with development and implementation of the plan update. The JSWA Team consists of JSW & Associates, Tetra Tech, Inc., and Halff Associates. TCRFC worked with the JSWA Team to apply for hazard mitigation funding through FEMA's Pre-Disaster Mitigation Grant Program. The JSWA Team was successful in obtaining grants for San Saba County and the City of San Saba. Each participating member contributed both monetarily and through in-kind contributions.

3.2 ESTABLISHMENT OF THE PLANNING PARTNERSHIP

San Saba County opened this planning effort to all eligible local governments in the county. The planning partners covered under this plan are shown in Table 3-1.

TABLE 3-1.
COUNTY AND CITY PLANNING PARTNERS

Jurisdiction	Point of Contact	Title
San Saba County	Marsha Hardy	Emergency Management Coordinator/Floodplain Administrator
City of San Saba	Al Hamrick	Floodplain Administrator

Each jurisdiction wishing to join the planning partnership was asked to commit to the process and have a clear understanding of expectations. These include:

- Each partner will support and participate in the Steering Committee meetings overseeing the development of the plan update. Support includes making decisions regarding plan development and scope on behalf of the partnership.
- Each partner will provide support as needed for the public involvement strategy developed by the Steering Committee in the form of mailing lists, possible meeting space, and media outreach such as newsletters, newspapers, or direct-mailed brochures.
- Each partner will participate in plan update development activities such as:
  - Steering Committee meetings
  - Public meetings or open houses
  - Workshops and planning partner training sessions
  - Public review and comment periods prior to adoption

  Attendance will be tracked at these activities, and attendance records will document participation for each planning partner. All participating communities are expected to attend and actively participate in all meetings and activities.
- Each partner will be expected to review the risk assessment and identify hazards and vulnerabilities specific to its jurisdiction. Contract resources will provide jurisdiction-specific mapping and technical consultation to aid in this task, but the determination of risk and vulnerability ranking will be up to each partner.

- Each partner will be expected to review the mitigation recommendations chosen for the overall county and evaluate whether they will meet the needs of its jurisdiction. Projects within each jurisdiction consistent with the overall plan recommendations will need to be identified, prioritized, and reviewed to identify their benefits and costs.
- Each partner will be required to sponsor at least one public meeting to present the draft plan at least two weeks prior to adoption.
- Each partner will be required to formally adopt the plan.
- Each partner will agree to the plan implementation and maintenance protocol.

Failure to meet these criteria may result in a partner being dropped from the partnership by the Steering Committee, and thus losing eligibility under the scope of this plan.

3.3 DEFINING THE PLANNING AREA

The planning area was defined to consist of all of San Saba County, including planning partner the City of San Saba (Figure 3-1). The county and the city have jurisdictional authority within this planning area.

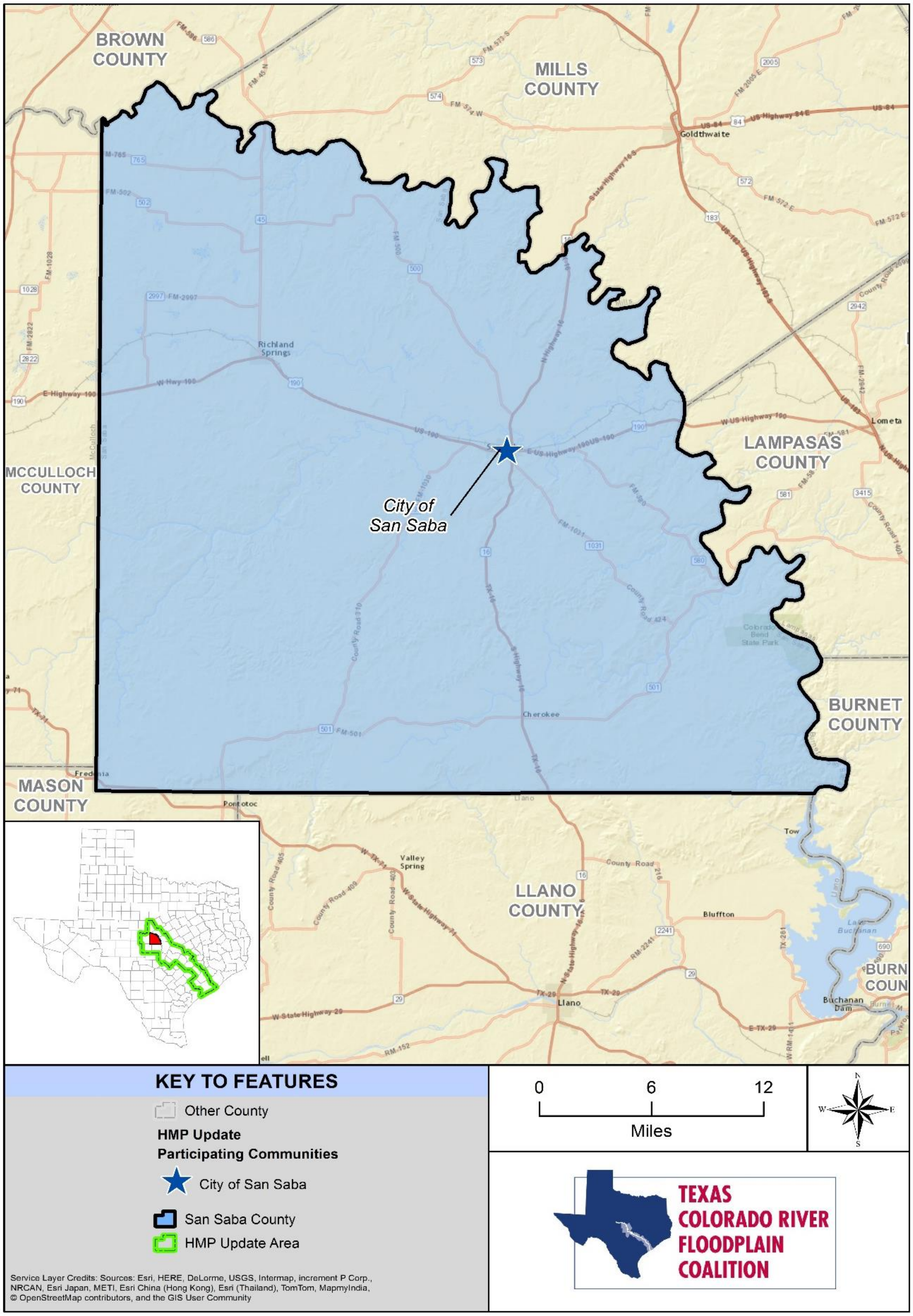


Figure 3-1. San Saba County Planning Area and Participating Communities

3.4 THE STEERING COMMITTEE

Hazard mitigation planning enhances collaboration and support among diverse parties whose interests can be affected by hazard losses. A Steering Committee was formed to oversee all phases of the plan update. The members of this committee included key planning partner staff, citizens, and other stakeholders from the planning area. Table 3-2 lists the committee members.

**TABLE 3-2.
STEERING COMMITTEE MEMBERS**

Name	Jurisdiction
Marsha Hardy	San Saba County
Byron Theodosis	San Saba County
Al Hamrick	City of San Saba
Misty Maldonado	City of San Saba

The Steering Committee agreed to meet a minimum of three times or as needed throughout the course of the plan's development. The JSWA Team and the TCRFC Executive Director facilitated each Steering Committee meeting, which addressed a set of objectives based on the work plan established for the plan update. The Steering Committee met three times from March 2015 through September 2015. Meeting agendas, notes, and attendance logs can be found in Appendix C of this document.

The planning team made a presentation at a Steering Committee meeting on March 24, 2015, to introduce the mitigation planning process. The Steering Committee, planning partners, and the public were encouraged to participate in the plan update process. Key meeting objectives at the March meeting were as follows:

- Steering Committee purposes and responsibilities
- Plan partners and signators responsibilities
- Purpose and goals of the update process
- Review and amend mitigation goals and objectives
- Review previous mitigation actions from 2011 plan
- Critical facilities discussion
- Next steps (including the capabilities assessment, hazard analysis review, and community participation)

3.5 COORDINATION WITH OTHER AGENCIES

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and non-profit interests (44 CFR, Section 201.6(b)(2)). This task was accomplished by the planning team as follows:

- **Steering Committee Involvement**—Agency representatives were invited to participate on the Steering Committee.
- **Agency Notification**—The Texas Division of Emergency Management (TDEM) was invited to participate in the plan development process from the beginning and was kept apprised of plan development milestones. TDEM received meeting announcements, meeting agendas, and meeting

minutes by e-mail throughout the plan development process. TDEM supported the effort by attending meetings or providing feedback on issues.

- **Pre-Adoption Review**—Agency representatives on the Steering Committee and TDEM were provided an opportunity to review and comment on this plan, primarily through the hazard mitigation plan website (see Section 3.7). Each agency was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to TDEM for a pre-adoption review to ensure program compliance.

3.6 REVIEW OF EXISTING PROGRAMS

Hazard mitigation planning must include review and incorporation, if appropriate, of existing plans, studies, reports and technical information (44 CFR, Section 201.6(b)(3)). Chapter 6 of this plan provides a review of laws and ordinances in effect within the planning area that can affect hazard mitigation actions. In addition, the following programs can affect mitigation within the planning area:

- San Saba County
  - Subdivision Regulations
  - Flood Damage Prevention Order
  - Floodplain Map
  - Basic Emergency Operations Plan
- City of San Saba
  - Comprehensive Plan
  - Code of Ordinances
  - Planning and Zoning Commission
  - Economic Corporation
  - Emergency Operations Plan

An assessment of all planning partners' regulatory, technical, and financial capabilities to implement hazard mitigation actions is presented in Chapter 7. Many of these relevant plans, studies, and regulations are cited in the capability assessment.

3.7 PUBLIC INVOLVEMENT

Broad public participation in the planning process helps ensure that diverse points of view about the planning area's needs are considered and addressed. The public must have opportunities to comment on disaster mitigation plans during the drafting stages and prior to plan approval (44 CFR, Section 201.6(b)(1)). The strategy for involving the public in this plan emphasized the following elements:

- Include members of the public on the Steering Committee
- Use a community survey/questionnaire to evaluate whether the public's perception of risk and support of hazard mitigation has changed since the initial planning process
- Attempt to reach as many planning area citizens as possible using multiple media
- Identify and involve planning area stakeholders

3.7.1 Stakeholders and the Steering Committee

Stakeholders are the individuals, agencies, and jurisdictions that have a vested interest in the recommendations of the hazard mitigation plan, including planning partners. The effort to include stakeholders in this process included stakeholder participation on the Steering Committee. Stakeholders were encouraged to attend and participate in all committee meetings.

3.7.2 Survey/Questionnaire

A hazard mitigation plan questionnaire (see Figure 3-2) was developed to gauge household preparedness for natural hazards; the level of knowledge of tools and techniques that assist in reducing risk and loss from natural hazards; and the perceived impact of natural hazards on San Saba County residents and businesses. This on-line questionnaire was designed to help identify areas vulnerable to one or more natural hazards. The answers to these 35 questions helped guide the Steering Committee in prioritizing hazards of impact and in selecting goals, objectives, and mitigation strategies. A total of 8 questionnaires were completed during the course of this planning process. The complete questionnaire and a summary of its findings can be found in Appendix C.

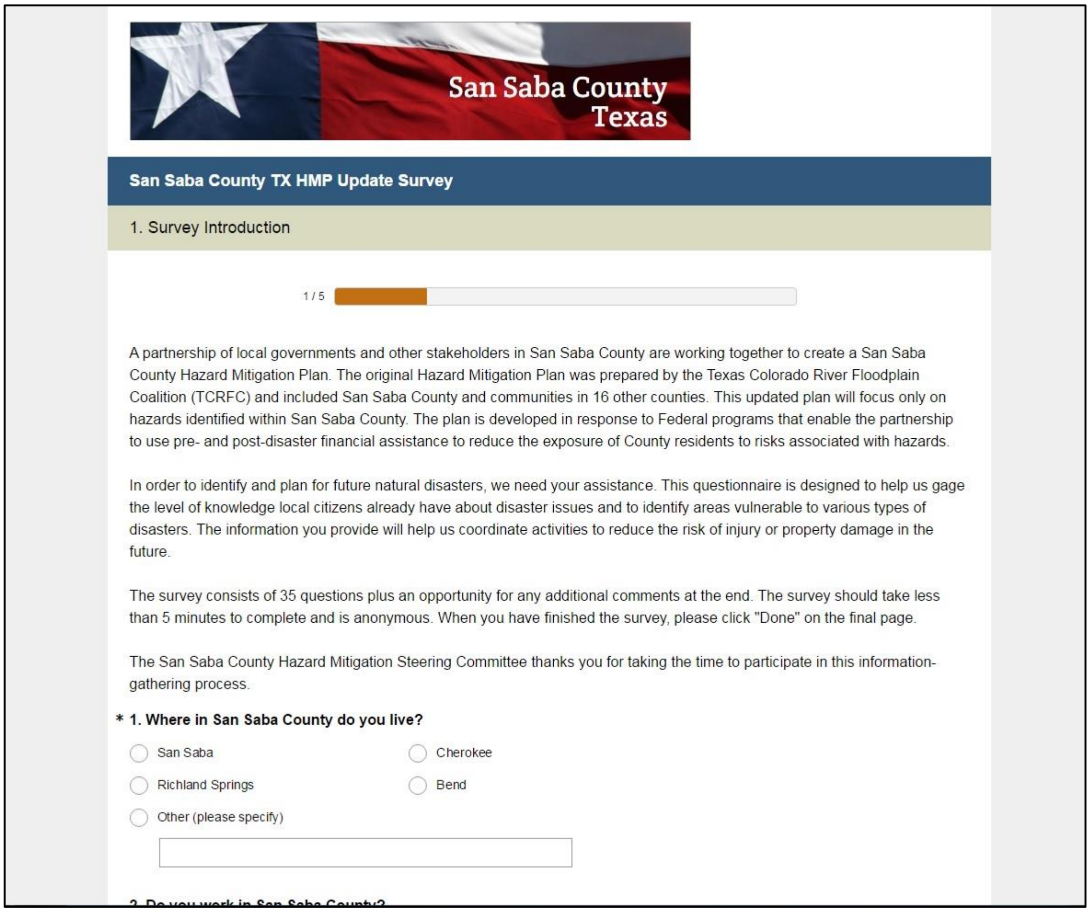


Figure 3-2. Sample Page from Questionnaire Distributed to the Public

3.7.3 Meetings

Three Steering Committee meetings, as well as one meeting before the San Saba County Commissioners' Court were held during the planning process. Meetings were held in the City of San Saba on March 24, 2015, June 30, 2015, and September 8, 2015, along with representatives from Mason, Mills, and Lampasas Counties and the Cities of Brady and Brownwood (see Figure 3-3). The draft plan was then presented and reviewed before the San Saba County Commissioners' Court on XXX XX, 2015. The meeting format allowed attendees to access to handouts, maps, and other resources and have direct conversations with project staff. Reasons for planning and information generated for the risk assessment were shared with attendees via a PowerPoint presentation. Planning partners and the planning team were present to answer questions.

Figure 3-3. Steering Committee Meeting March 24, 2015

3.7.4 Press Releases/News Articles

Press releases were distributed over the course of the plan's development as key milestones were achieved and prior to each public meeting. The planning effort received press coverage as shown in Figure 3-4.

TEXAS COLORADO RIVER FLOODPLAIN COALITION

Hazard Mitigation Plan Update Community Participation

"To Build More Resilient Communities"

What is Hazard Mitigation?

Hazard mitigation planning is a **proactive** effort to identify actions that can be taken to reduce the dangers to life and property from hazard events. These long-term strategies include planning, policy, and regulation changes, education programs, infrastructure projects, and other activities. The Federal Disaster Mitigation Act of 2000 **requires all jurisdictions** that wish to be **eligible to receive FEMA funding** for hazard mitigation grants to **adopt a local multi-hazard mitigation plan** and keep the plan current by **reviewing it annually and updating it at least every five years.**

Why You MUST Attend?

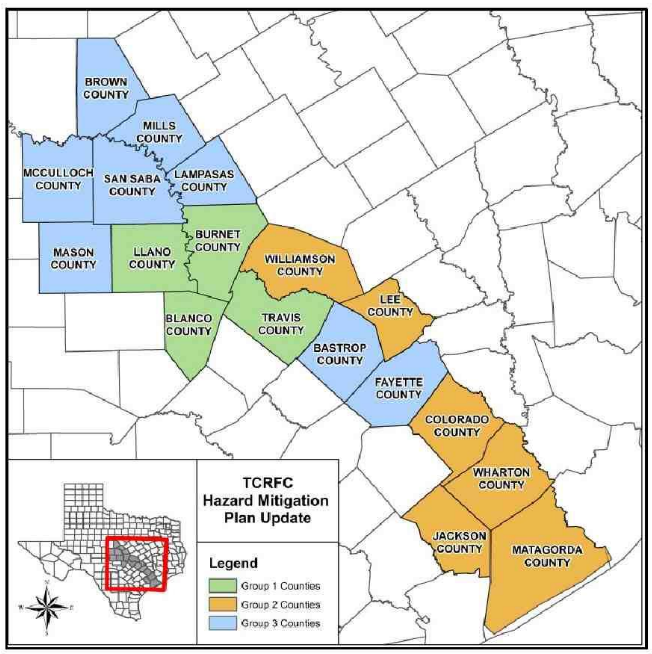
To be included in the Hazard Mitigation Plan Update (ensuring **eligibility** for FEMA Hazard Funding) active participation and involvement is necessary. Attendance from a least one participating community representative is mandatory to **ALL** three Planning Meetings. FEMA-compliant active participation is documented using sign-in sheets at the planning meetings. Someone from your community **MUST** sign in to each meeting.

Who Should Attend?

Participating members include but are not limited to emergency managers, police and fire officials, floodplain managers, city engineers, public works managers, city and community planners, city leadership as well as major city employers such as school districts, hospitals, etc.

TCRFC Hazard Mitigation History

The current TCRFC Hazard Mitigation Plan will expire in 2016, therefore TCRFC has initiated steps to begin the next update. In late 2013, the TCRFC Board selected the JSWA Team to prepare our Hazard Mitigation Plan Update. The JSWA Team consists of Jeff Ward (JSW & Associates), Tetra Tech, and Halff Associates. TCRFC has worked with the JSWA Team to apply for hazard mitigation funding through FEMA's Pre-Disaster Mitigation (PDM) Grant Program. The Team has been successful in obtaining three PDM Grants as displayed below. Planning meetings for these grants will be conducted over the course of 2015. Additional meeting information is provided on the back of this page.



Texas Colorado River Floodplain Coalition • phone 512-260-1366 • www.tcrfc.org

Figure 3-4. TCRFC Informational Brochure

3.7.5 Internet

At the beginning of the plan development process, the TCRFC posted information regarding the update process, a link to the community survey, and a link to the mitigation plan on the TCRFC website (http://www.tcrfc.org/; see Figure 3-5). The TCRFC website keeps the public informed on plan development milestones and to solicit relevant input. Information on the plan development process, the Steering Committee, the questionnaire, and phased drafts of the plan were available to the public on the site throughout the process. After the plan's completion, the TCRFC website will keep the public informed about successful mitigation projects and future plan updates.

Figure 3-5. Sample Page from the TCRFC Website

3.8 PLAN DEVELOPMENT, CHRONOLOGY, MILESTONES

Table 3-3 summarizes important milestones in the development of the plan update.

TABLE 3-3. PLAN DEVELOPMENT MILESTONES

Date	Event	Description	Attendance
2013			
9/16	Submit grant application	Seek funding for plan development process	N/A
8/5	Initiate consultant procurement	Seek a planning expert to facilitate the process	N/A
10/1	Select JSWA Team to facilitate plan development	Facilitation contractor secured	N/A
2015			
2/25	Notified grant funding secured	Funding secured	N/A
2/25	Contract signed	Notice to proceed given to Tetra Tech, Inc.	N/A
2/26	Identify Steering Committee	Formation of the Steering Committee	N/A
3/24	Steering Committee/ Stakeholder Meeting #1	Presentation on plan process given, participation, review of goals and objectives	San Saba County; City of San Saba
6/30	Steering Committee Meeting #2	Review community survey, review hazard identification and risk assessment, review and update plan goals and objectives	San Saba County; City of San Saba
9/8	Steering Committee Meeting #3	Mitigation actions presentation and project development	San Saba County; City of San Saba
Ongoing	Public Outreach	News articles and website posting	N/A
11/13	Draft Plan	Internal review draft provided to Steering Committee	N/A
11/13	Public Comment Period	Initial public comment period of draft plan opens. Draft plan posted on plan website with press release notifying public of plan availability	N/A
X/X	Plan Review	Final draft plan submitted to Texas Division of Emergency Management for review	N/A
X/X	Public Outreach	Final public meeting on draft plan	N/A
X/X	Plan Approval Pending Adoption	Plan approval pending adoption by FEMA	N/A
X/X	Adoption	Adoption window of final plan opens	N/A
X/X	Plan Approval	Final plan approved by FEMA	N/A

FEMA — Federal Emergency Management Agency
JSWA Team — JSW & Associates, Tetra Tech, Inc., and Halff Associates
N/A — Not Applicable

CHAPTER 4.
GUIDING PRINCIPLE, GOALS, AND OBJECTIVES

Hazard mitigation plans must identify goals for reducing long-term vulnerabilities to identified hazards (44 CFR Section 201.6(c)(3)(i)). The Steering Committee established a guiding principle, a set of goals, and measurable objectives for this plan, based on data from the preliminary risk assessment and the results of the public involvement strategy. The guiding principle, goals, objectives, and actions in this plan all support each other. Goals were selected to support the guiding principle. Objectives were selected that met multiple goals. Actions were prioritized based on the action meeting multiple objectives.

4.1 GUIDING PRINCIPLE

A guiding principle focuses the range of objectives and actions to be considered. This is not a goal because it does not describe a hazard mitigation outcome, and it is broader than a hazard-specific objective. The guiding principle for the San Saba County Hazard Mitigation Plan Update is as follows:

- To reduce or eliminate the long-term risks to loss of life and property damage in San Saba County from the full range of natural disasters.

4.2 GOALS

The following are the mitigation goals for this plan:

- **Goal 1:** Protect public health and safety.
- **Goal 2:** Protect existing and new properties.
- **Goal 3:** Increase public understanding, support and demand for hazard mitigation.
- **Goal 4:** Build and support local capacity and commitment to continuously become less vulnerable to hazards.
- **Goal 5:** Promote growth in a sustainable manner.
- **Goal 6:** Maximize the resources for investment in hazard mitigation.

4.3 OBJECTIVES

The objectives are used to help establish priorities and support the agreed upon goals. The objectives are as follows:

- Objectives in support of Goal 1:
  - **Objective 1.1:** Advise the public about health and safety precautions to guard against injury and loss of life from hazards.
  - **Objective 1.2:** Maximize the utilization of the latest technology to provide adequate warning, communication, and mitigation of hazard events.
  - **Objective 1.3:** Reduce the danger to, and enhance protection of, dangerous areas during hazard events.
  - **Objective 1.4:** Protect critical facilities and services.
- Objectives in support of Goal 2:
  - **Objective 2.1:** Reduce repetitive losses to the National Flood Insurance Program.
  - **Objective 2.2:** Use the most cost-effective approaches to protect existing buildings and public infrastructure from hazards.

  - **Objective 2.3:** Enact and enforce regulatory measures to ensure that development will not put people in harm's way or increase threats to existing properties.
- Objectives in support of Goal 3:
  - **Objective 3.1:** Heighten public awareness of the full range of natural hazards they face.
  - **Objective 3.2:** Educate the public on actions they can take to prevent or reduce the loss of life or property from all hazards.
  - **Objective 3.3:** Publicize and encourage the adoption of appropriate hazard mitigation measures.
- Objectives in support of Goal 4:
  - **Objective 4.1:** Build and support local partnerships to continuously become less vulnerable to hazards.
  - **Objective 4.2:** Build a cadre of committed volunteers to safeguard the community before, during, and after a disaster.
  - **Objective 4.3:** Build hazard mitigation concerns into planning and budgeting processes.
- Objective in support of Goal 5:
  - **Objective 5.1:** Incorporate hazard mitigation into the long-range planning and development activities.
  - **Objective 5.2:** Promote beneficial uses of hazardous areas while expanding open space and recreational opportunities.
  - **Objective 5.3:** Utilize regulatory approaches to prevent creation of future hazards to life and property.
- Objective in support of Goal 6:
  - **Objective 6.1:** Maximize the use of outside sources of funding.
  - **Objective 6.2:** Maximize participation of property owners in protecting their properties.
  - **Objective 6.3:** Maximize insurance coverage to provide financial protection against hazard events.
  - **Objective 6.4:** Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.

CHAPTER 5.
IDENTIFIED HAZARDS OF CONCERN AND RISK ASSESSMENT METHODOLOGY

Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards. It allows emergency management personnel to establish early response priorities by identifying potential hazards and vulnerable assets. The process focuses on the following elements:

- **Hazard identification -** Use all available information to determine what types of disasters may affect a jurisdiction, how often they can occur, and their potential severity.
- **Vulnerability identification -** Determine the impact of natural hazard events on the people, property, environment, economy, and lands of the region.
- **Cost evaluation -** Estimate the cost of potential damage or cost that can be avoided by mitigation.

The risk assessment for this hazard mitigation plan update evaluates the risk of natural hazards prevalent in the planning area and meets requirements of the DMA (44 CFR, Section 201.6(c)(2)).

5.1 IDENTIFIED HAZARDS OF CONCERN

For this plan, the Steering Committee considered the full range of natural hazards that could impact the planning area and then listed hazards that present the greatest concern. The process incorporated review of state and local hazard planning documents, as well as information on the frequency, magnitude, and costs associated with hazards that have impacted or could impact the planning area. Anecdotal information regarding natural hazards and the perceived vulnerability of the planning area's assets to them was also used. Table 2-1 lists the hazards identified in the previous *2011-2016 TCRFC Plan* and the hazard ranking. Based on the review, this plan addresses the following hazards of concern:

- Coastal Erosion
- Dam/Levee Failure
- Drought
- Expansive Soils
- Extreme Heat
- Earthquake
- Flood
- Hail
- Hurricane and Tropical Storm
- Land Subsidence
- Lightning
- Thunderstorm
- Tornado
- Wildfire
- Wind
- Winter Weather

Several of these hazards were profiled together because of their common occurrence or damage assessments, such as drought and extreme heat, and thunderstorms, lightning, hail, and wind.

5.2 CLIMATE CHANGE

Climate includes patterns of temperature, precipitation, humidity, wind, and seasons. Climate plays a fundamental role in shaping natural ecosystems, and the human economies and cultures that depend on them. The term "climate change" refers to changes over a long period of time. It is generally perceived that climate change will have a measurable impact on the occurrence and severity of natural hazards around the world. Impacts include the following:

- Snow cover losses will continue, and declining snowpack will affect snow-dependent water supplies and stream flow levels around the world.

- The risk of drought and the frequency, intensity, and duration of heat waves are expected to increase.
- More extreme precipitation is likely, increasing the risk of flooding.
- The world's average temperature is expected to increase.

Climate change will affect communities in a variety of ways. Impacts could include an increased risk for extreme events such as drought, storms, flooding, and wildfires; more heat-related stress; and the spread of existing or new vector-born disease into a community. In many cases, communities are already facing these problems to some degree. Climate change influences the frequency, intensity, extent, or magnitude of the problems.

This hazard mitigation plan update addresses climate change as a secondary impact for each identified hazard of concern. Each chapter addressing one of the hazards of concern includes a section with a qualitative discussion on the probable impacts of climate change for that hazard. While many models are being developed to assess the potential impacts of climate change, none are currently available to support hazard mitigation planning. As these models are developed in the future, this risk assessment may be enhanced to better measure these impacts.

5.3 METHODOLOGY

The risk assessments in Chapter 8 through Chapter 17 describe the risks associated with each identified hazard of concern. Each chapter describes the hazard, the planning area's vulnerabilities, and probable event scenarios. The following steps were used to define the risk of each hazard:

- **Identify and profile each hazard -** The following information is given for each hazard:
  - Geographic areas most affected by the hazard
  - Event frequency estimates
  - Severity estimates
  - Warning time likely to be available for response
- **Determine exposure to each hazard -** Exposure was evaluated by overlaying hazard maps, when available, with an inventory of structures, facilities, and systems to identify which of them would be exposed to each hazard. When hazard mapping was not available, a more qualitative discussion of exposure is presented.
- **Assess the vulnerability of exposed facilities -** Vulnerability of exposed structures and infrastructure was evaluated by interpreting the probability of occurrence of each event and assessing structures, facilities, and systems that are exposed to each hazard. Tools such as geographic information system (GIS) and FEMA's hazard modeling program called Hazards, United States – Multi-Hazard, or HAZUS-MH, were used to perform this assessment for the dam/levee failure, earthquake, flood, and hurricane hazards. Outputs similar to those from HAZUS were generated for other hazards, using maps generated by the HAZUS program.

5.4 RISK ASSESSMENT TOOLS

5.4.1 Dam Failure, Earthquake, Flood, and Hurricane - HAZUS-MH

Overview

In 1997, FEMA developed the standardized HAZUS model to estimate losses caused by earthquakes and identify areas that face the highest risk and potential for loss. HAZUS was later expanded into a multi-hazard methodology, HAZUS-MH, with new models for estimating potential losses from dam failures, hurricanes, and floods.

HAZUS-MH is a GIS-based software program used to support risk assessments, mitigation planning, and emergency planning and response. It provides a wide range of inventory data, such as demographics, building stock, critical facility, transportation, and utility lifeline, and multiple models to estimate potential losses from natural disasters. The program maps and displays hazard data and the results of damage and economic loss estimates for buildings and infrastructure. Its advantages include the following:

- Provides a consistent methodology for assessing risk across geographic and political entities.
- Provides a way to save data so that it can readily be updated as population, inventory, and other factors change, and as mitigation planning efforts evolve.
- Facilitates the review of mitigation plans because it helps to ensure that FEMA methodologies are incorporated.
- Supports grant applications by calculating benefits using FEMA definitions and terminology.
- Produces hazard data and loss estimates that can be used when communicating with local stakeholders.
- Is administered by the local government and can be used to manage and update a hazard mitigation plan throughout its implementation.

Levels of Detail for Evaluation

HAZUS-MH provides default data for inventory, vulnerability, and hazards; this default data can be supplemented with local data to provide a more refined analysis. The model can carry out three levels of analysis, depending on the format and level of detail of information about the planning area:

- **Level 1** – All of the information needed to produce an estimate of losses is included in the software’s default data. These data are derived from national databases and describe in general terms the characteristic parameters of the planning area.
- **Level 2** – More accurate estimates of losses require more detailed information about the planning area. To produce Level 2 estimates of losses, detailed information is required about local geology, hydrology, hydraulics, and building inventory, as well as data about utilities and critical facilities. This information is needed in a GIS format.
- **Level 3** – This level of analysis generates the most accurate estimate of losses. It requires detailed engineering and geotechnical information to customize it for the planning area.

Application for This Plan

This risk assessment was conducted using HAZUS and GIS-based analysis methodology. The default HAZUS inventory database for San Saba County was updated with the updated with 2010 U.S. Census data and 2014 RS Means Square Foot Costs. This enabled a HAZUS Level 2 analysis to be performed on some of the profiled hazards.

The following methods were used to assess specific hazards for this plan:

- **Dam/Levee Failure -** Dam failure inundation mapping for the planning area was not available in a format usable with HAZUS. Therefore, dam failure inundation maps were not used for performing HAZUS risk analysis.
- **Earthquake -** A Level 2 analysis is typically performed to assess earthquake risk and exposure for counties with a peak ground acceleration (PGA) greater than 3%g (percentage of gravity) (*FEMA How-To Guidance, Understanding Your Risks*, FEMA 386-2, p. 1-7). No earthquake

scenarios were selected for this plan since an earthquake event for the planning area is rare according to the *2013 State of Texas Hazard Mitigation Plan.* Only a minimum Level 1 HAZUS analysis was profiled using the 500-Year Probability Event scenario.

- **Flood -** A Level 2 flood analysis was performed using HAZUS.
- **Hurricane -** A HAZUS Level 2 analysis was performed to assess hurricane and tropical storm risk and exposure for coastal and near coastal communities. The probabilistic option in the HAZUS hurricane module was used for analysis of this hazard.

5.4.2 Other Hazards of Concern

For hazards of concern that are not directly modeled in HAZUS, annualized losses were estimated using GIS-based analysis, historical data analysis, and statistical risk assessment methodology. Event frequency, severity indicators, expert opinions, and historical knowledge of the region was used for this assessment. The primary data source was the updated HAZUS inventory data updated with 2010 U.S. Census data and 2014 RS Means Square Foot Costs and augmented with state and federal data sets. Additional data sources for specific hazards were as follows:

- **Drought -** National Drought Mitigation Center, Census of Agriculture.
- **Extreme Heat -** Western Regional Climate Center.
- **Hail, Lightning, Thunderstorm, Tornado, Wind, and Winter Weather -** Data provided by National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center Storm Events Database.
- **Wildfire -** Information on wildfire hazards areas was provided by the Texas A&M Forest Service Wildfire Risk Assessment Portal (TxWRAP), U.S. Geological Survey (USGS) Federal Wildfire History, Fire Program Analysis Fire-Occurrence Database (FPA-FOD), and the U.S. Department of Agriculture (USDA) Wildfire Hazard Potential (WHP) data.

5.4.3 Limitations

Loss estimates, exposure assessments, and hazard-specific vulnerability evaluations rely on the best available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from the following:

- Approximations and simplifications necessary to conduct a study
- Incomplete or outdated inventory, demographic, or economic parameter data
- The unique nature, geographic extent, and severity of each hazard
- Mitigation measures already employed
- The amount of advance notice residents have to prepare for a specific hazard event

These factors can affect loss estimates by a factor of two or more. Therefore, potential exposure and loss estimates are approximate and not deterministic. The results do not predict precise results and should be used only to understand relative risk for planning purposes and not engineering. Over the long term, San Saba County and its planning partners will collect additional data to assist in estimating potential losses associated with other hazards.

CHAPTER 6.
SAN SABA COUNTY PROFILE

San Saba County covers 1,138 square miles of which all is land except for 3 square miles of water. It is located on the Edwards Plateau in the central part of Texas (Figure 6-1). The San Saba River bisects the county from southwest to northeast and joins the Colorado River on the eastern border. The San Saba River is a typical Hill Country river consisting of clear water that flows through limestone bluffs and hills. Primary streams include Richland, Wallace, Simpson, Rough, Wilbarger, Brady, and Cherokee Creeks. The City of San Saba is the largest city and holds the county seat for San Saba County. As of the 2010 U.S. Census, San Saba County had a population of 6,131. The county does not have any hospitals.

Figure 6-1. Location of the San Saba County Planning Area within the State of Texas

The major livestock are beef cattle, sheep, and goats. Many ranchers lease their ranches for deer hunting. The main crops are grain sorghum, small grains, and improved pasture. Pecans are produced in native groves mostly along the Colorado and San Saba Rivers. Soil and water are important natural resources in the county. Most people earn their living from the land and the Colorado and San Saba Rivers provide water for livestock and irrigation.

Limestone, sand, and gravel are other natural resources in the county. Limestone is used as building material and some is crushed for roadbed material.

6.1 HISTORICAL OVERVIEW

San Saba County was organized from Bexar County in 1856 and the majority of this section was summarized from the *Handbook of Texas Online* (Kleiner 2010). The county was named for the San Saba

River. The Tonkawa, Apache, Caddoan, and Comanche Indian tribes inhabited the area at different times. Comanche and Lipan Apaches continued to live in the San Saba County area into the eighteenth and nineteenth centuries, often coming into conflict with Spanish missionaries, United States military forces, and Anglo-American settlers. The original surveys of present San Saba County indicate that the first land grants of a league each along the San Saba River were given to Spanish grantees. The earliest known record of Anglo-Americans in San Saba County was in December 1828 with a group from Austin's colony. A part of the county was included in one of the grants ceded to Stephen F. Austin under the Mexican empresario system. Early permanent settlers settled at Wallace, Richland, and Cherokee Creeks in the fall of 1854. The present site of the City of San Saba was selected for the county seat. Chappel, settled during the 1850s, was San Saba County's first town. During the Civil War, the citizens of San Saba County supported the Confederacy.

The years between 1860 and 1920 marked a period of growth for San Saba County. During the 1880s, lawlessness became a problem, and the county experienced a period of "mob rule." In response, citizens formed an anti-mob organization. However, factions developed within the organization, and by 1896, the competing groups were conducting what amounted to open warfare. After a number of men were killed, the Texas Rangers were dispatched to the area, and order was eventually restored. By 1920, the population was 10,045. During this period, agriculture in San Saba County flourished. The number of farms, cattle, and sheep grew. Wheat and oats originally emerged as primary crops and peaches were produced in significant numbers after 1900. Pecans, already in natural abundance, also emerged as an important crop, largely because of the work of Edmund E. Riesen. Riesen is credited for laying the groundwork for the pecan industry that led San Saba County to proclaim itself Pecan Capital of the World.

Difficult agricultural conditions in the 1920s, followed by the Great Depression, affected farming in the county. Although the number of farms increased, the overall value decreased, when half of the county farms were worked by tenants. The record-breaking flood of the San Saba River in July 1938 caused destruction throughout the county. A prolonged drought from 1953 to 1956 did extensive harm to the agricultural economy. Between 1950 and 1959 the number of farms decreased to only 784.

The first newspaper in West Texas was the San Saba County News, which was founded on January 1, 1873. The paper continued operating into the twentieth century, and in 1960 it merged with the San Saba Star. It was still being published as the San Saba News and Star into the late 1980s.

In 1886, the Santa Fe Railroad completed a line that came within 21 miles of the Town of San Saba, but it was 25 years before railroad officials were convinced that San Saba's level of agricultural production merited the extension of the line to the county seat. Not until 1911 was the Lometa-Eden branch of the Santa Fe build across the county. The county's progress in the area of highway construction was equally slow; it was the last county in Texas to have its roads paved. In 1982, San Saba had one railroad branch line used for freight; 755 miles of public roads; and one airport, the San Saba County Municipal Airport.

The economy of San Saba County became more diversified in the late 1980s. The manufacturing base remained small, constituting only seven percent of the business sector. Sixteen percent of the labor force was employed in wholesale and retail trade, and almost twenty-five percent in agribusiness, forestry, fishing, or mining. The industries with the most employment were agribusiness, stone quarrying, and tourism. Tourism showed the highest rate of growth. The county has a variety of recreational opportunities and is a popular deer hunting area.

6.2 MAJOR PAST HAZARD EVENTS

Federal disaster declarations are typically issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government. However, no specific dollar loss threshold has been established for these declarations. A federal disaster declaration puts federal recovery programs into motion to help disaster victims, businesses, and public entities. Some of the programs are matched by state programs. The planning area has experienced 15 events since 1993 for which federal disaster declarations were issued. These events are listed in Table 6-1.

Review of these events helps identify targets for risk reduction and ways to increase a community's capability to avoid large-scale events in the future. Still, many natural hazard events do not trigger federal disaster declaration protocol but have significant impacts on their communities. These events are also important to consider in establishing recurrence intervals for hazards of concern. More detailed event tables can be found in the individual hazard profile sections.

**TABLE 6-1.
FEDERAL DISASTER DECLARATIONS IN SAN SABA COUNTY**

Disaster Declaration[a]	Description	Incident Date
DR-1999	Wildfires	4/6/2011 - 8/29/2011
EM-3284	Wildfires	3/14/2008 - 9/1/2008
DR-1709	Severe Storms, Tornadoes, and Flooding	6/16/2007 - 8/3/2007
DR-1624	Extreme Wildfire Threat	11/27/2005 - 5/14/2006
DR-1606	Hurricane Rita	9/23/2005 - 10/14/2005
EM-3261	Hurricane Rita	9/20/2005 - 10/14/2005
EM-3216	Hurricane Katrina Evacuation	8/29/2005 - 10/1/2005
DR-1425	Severe Storms And Flooding	6/29/2002 - 7/31/2002
FS-2335	Deep Creek Fire	9/8/2000 - 9/13/2000
FS-2282	Williams Ranch Fire	9/19/1999 - 9/28/1999
EM-3142	Extreme Fire Hazards	8/1/1999 - 12/10/1999
DR-1239	Tropical Storm Charley	8/22/1998 - 8/31/1998
DR-1179	Severe Storms And Flooding	6/21/1997 - 7/15/1997
EM-3117	Extreme Fire Hazard	2/23/1996 - 9/19/1996
EM-3113	Extreme Fire Hazard	8/30/1993 - 11/15/1993

a. Federal disaster declarations are coded as follows: DR = Major Disaster Declaration; EM = Emergency Declaration

Source: FEMA Disaster Declarations Summary - Open Government Dataset (http://www.fema.gov/media-library/assets/documents/28318?id=6292)

6.3 CLIMATE

San Saba County is hot in summer but cool in winter when an occasional surge of cold air causes a sharp drop in otherwise mild temperatures. Average temperatures range from 94.4 degrees Fahrenheit (°F) in the summer to 35.2°F in the winter. The Western Regional Climate Center reports data from the City of San Saba weather station in San Saba County. Table 6-2 contains temperature summaries for the station. Figure 6-2 graphs the daily temperature averages and extremes from January 1, 1901, through February 29, 2012. Figure 6-4 and Figure 6-5 show the geographic distribution of annual average minimum and annual average maximum temperatures in San Saba County compared to the State of Texas from 1981 to 2010.

TABLE 6-2.
SAN SABA COUNTY TEMPERATURE SUMMARIES SAN SABA STATION

Period of record	1901-2000
Winter[a] Average Minimum Temperature[b]	35.2°F
Winter[a] Mean Temperature[b]	48.1°F
Summer[a] Average Maximum Temperature[b]	94.4°F
Summer[a] Mean Temperature[b]	81.9ºF
Maximum Temperature (and Date)	112°F; July 17, 1978
Minimum Temperature (and Date)	-1°F; December 23, 1989
Average Annual Number of Days >90°F	106.8
Average Annual Number of Days <32°F	48.3

a. Winter: December, January, February; Summer: June, July, August
b. Temperatures are in degrees Fahrenheit
Source: Western Regional Climate Center, http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?tx6750

Source: Western Regional Climate Center, http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?tx7992

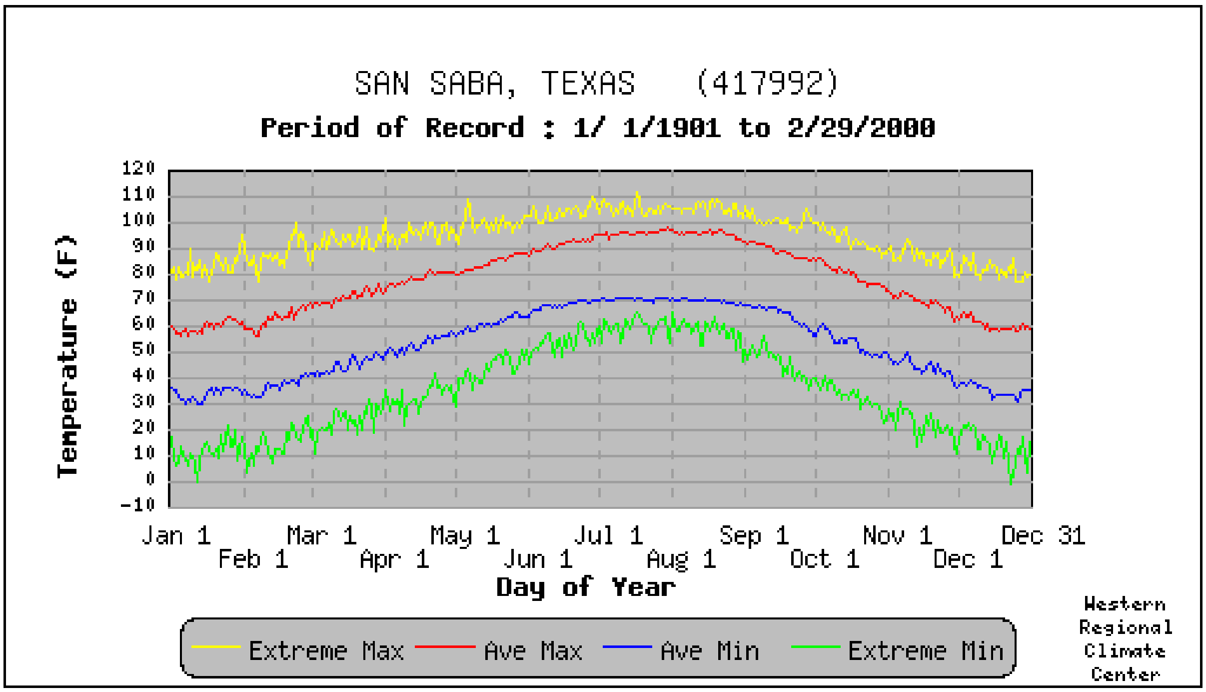


Figure 6-2. City of San Saba Station Monthly Temperature Data (1901-2000)

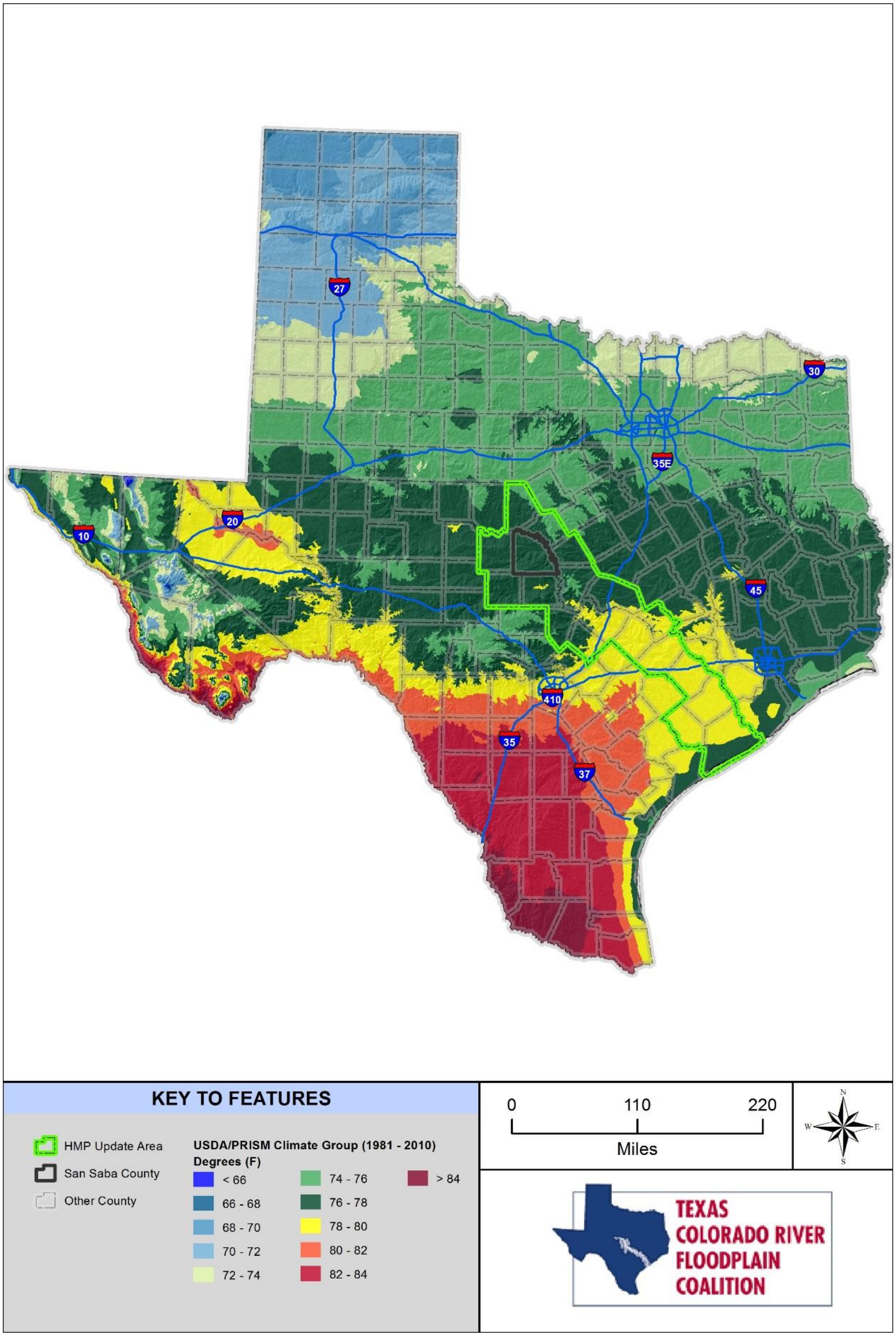


Figure 6-3. Annual Average Maximum Temperature (1981-2010)

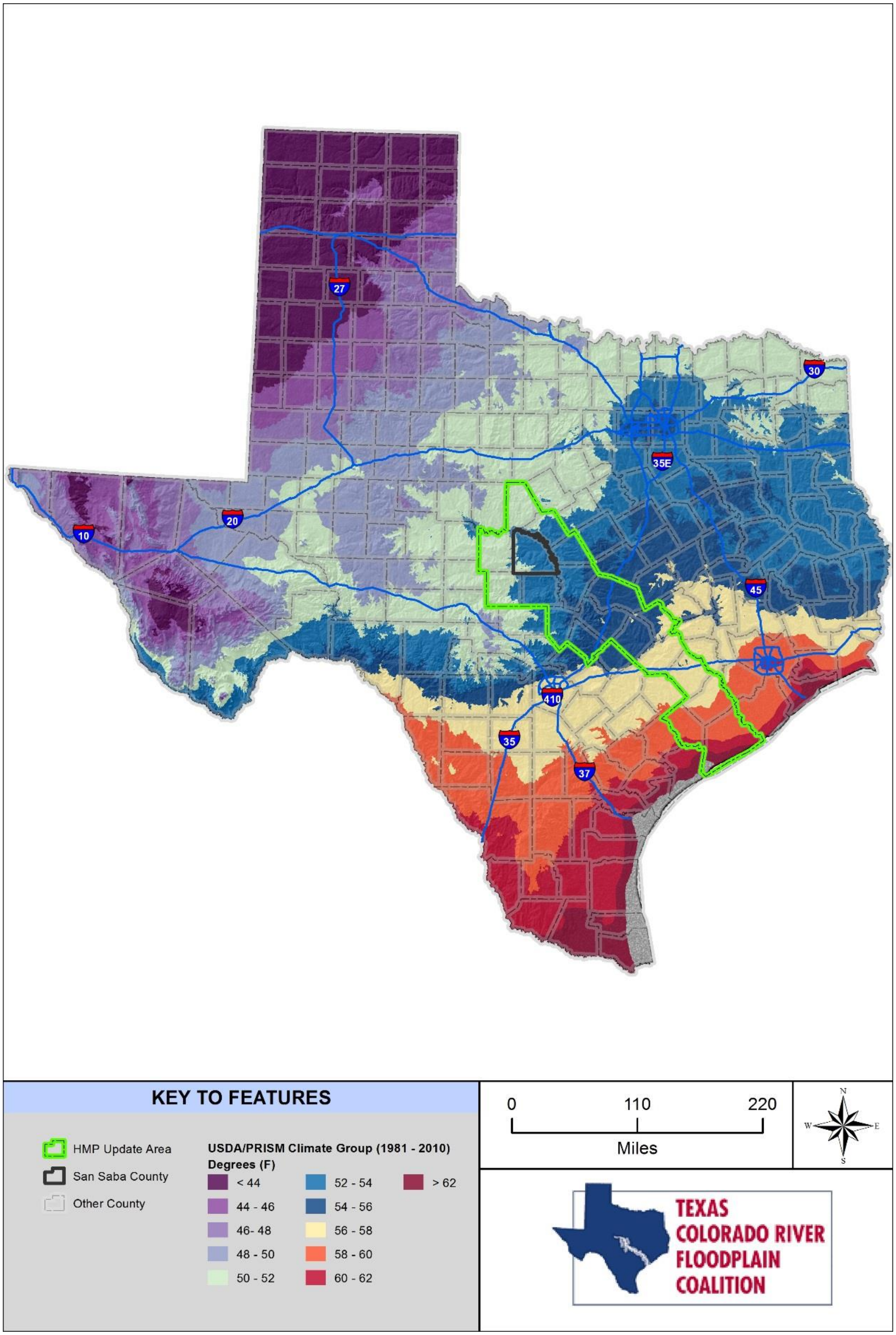


Figure 6-4. Annual Average Minimum Temperature (1981-2010)

Rainfall is uniformly distributed throughout the year, reaching a slight peak in spring. Snowfalls are infrequent. Precipitation is highest in May. The average annual precipitation is 26.92 inches. Severe thunderstorm occur mostly in the spring. Based on information measured by the National Lightning Detection Network, the State of Texas is ranked 17th in the nation for cloud-to-ground lightning flashes per square mile from 1997 to 2010. The average flashes during this timeframe was 11.3 per square mile. Figure 6-5 shows the average monthly precipitation in San Saba County. Figure 6-6 shows geographic distribution of annual average precipitation in San Saba County compared to the State of Texas.

Source: http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?tx7992

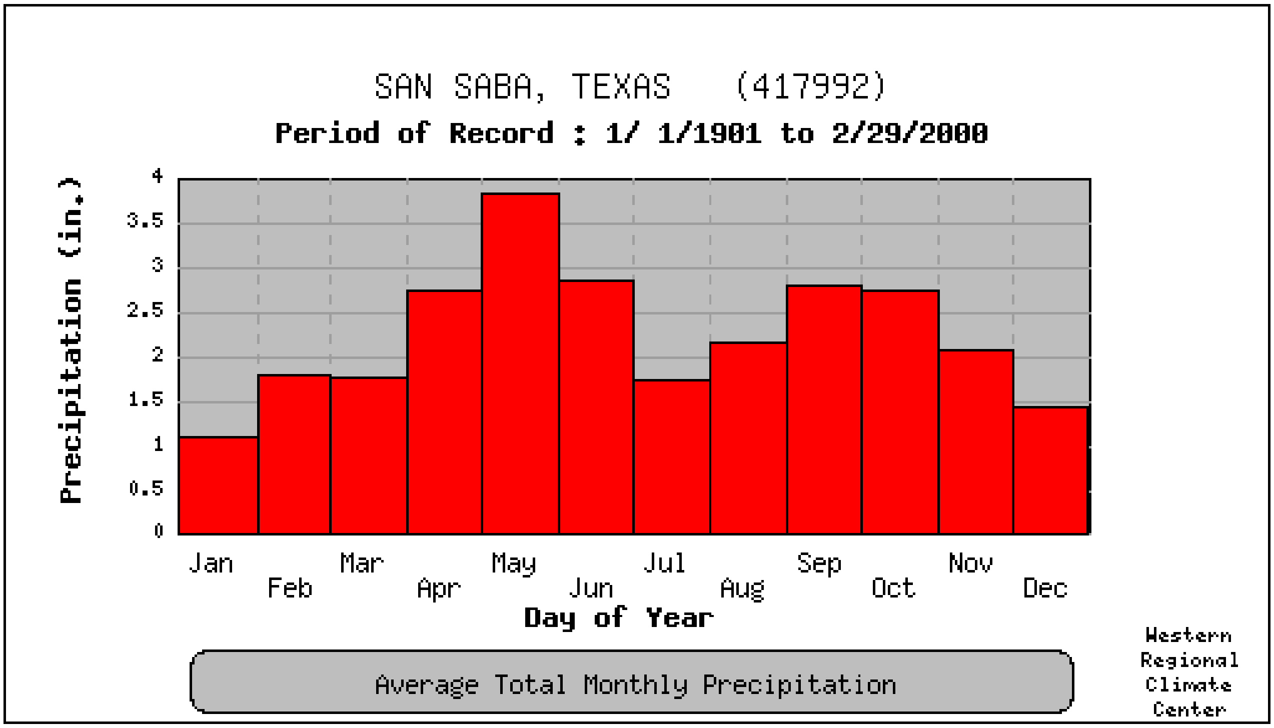


Figure 6-5. Average Monthly Precipitation (1901-2000)

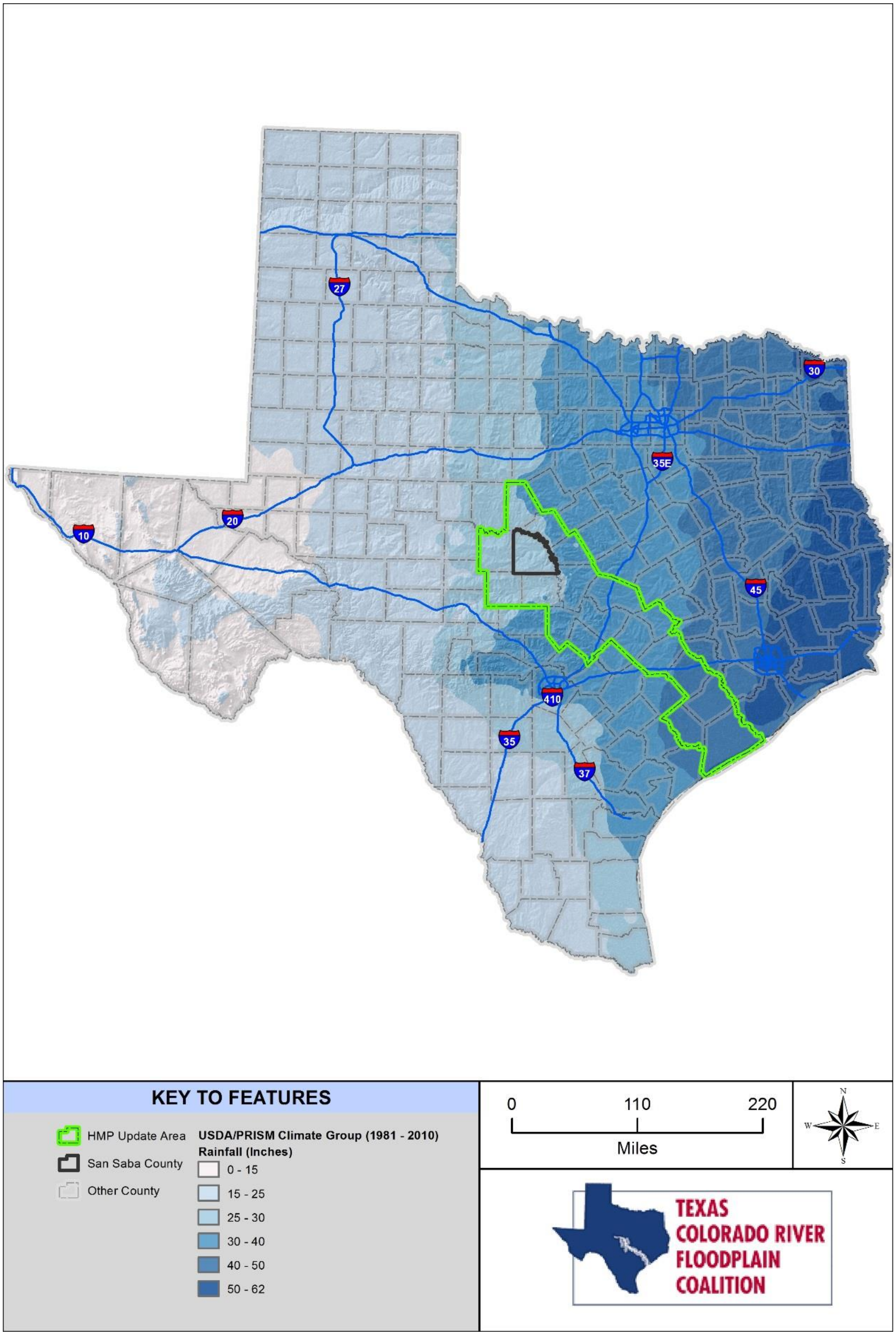


Figure 6-6. Geographic Distribution of Annual Average Precipitation (1981-2010)

6.4 GEOLOGY AND SOILS

Texas is broadly divided into four regions by physical geography features such as landforms, climate, and vegetation. San Saba County is in central Texas. It lies in two major land resource areas. The majority of the county is within the Llano Basin of the Great Plains Natural Region while a small portion is within the Rolling Plains of the North Central Plains. Figure 6-7 shows the Texas natural regions with San Saba County highlighted.

The county is roughly triangular. In most areas, the topography is undulating to hilly and generally slopes to the southeast. The elevation ranges from 1,100 to 1,800 feet above sea level.

San Saba County has sandy and loamy soils that formed under post oak savannah and are mostly light in color. The clayey and loamy soils that formed under grass and post oak savannah are mostly dark. The soils are mostly used as rangeland.

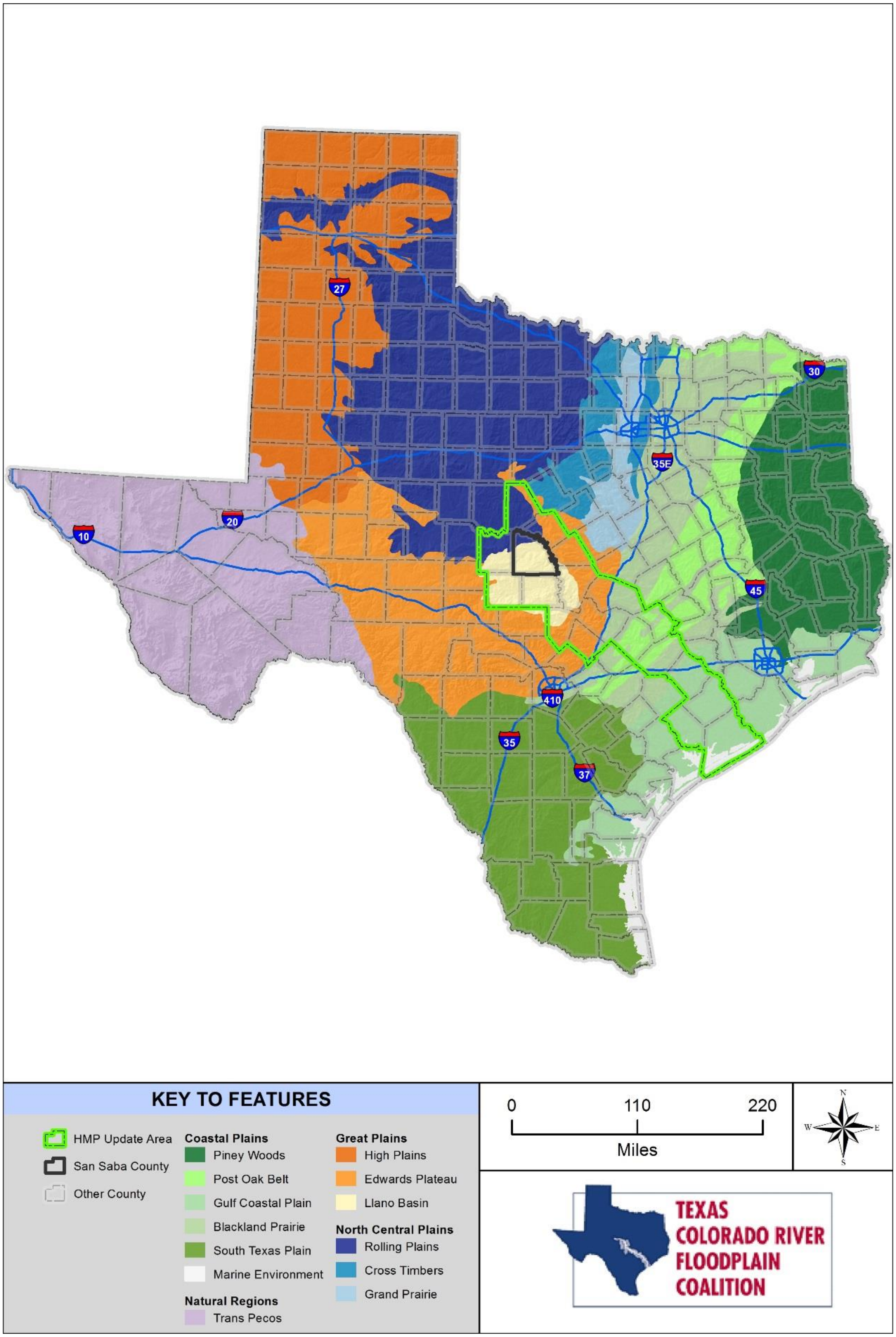


Figure 6-7. Natural Regions of Texas and San Saba County

6.5 CRITICAL FACILITIES AND INFRASTRUCTURE

Critical facilities and infrastructure are essential to the health and welfare of the population. These assets become especially important after a hazard event. As defined for this hazard mitigation plan update, critical facilities include but are not limited to the following:

- Essential services facilities:
  - Public safety facilities (police stations, fire and rescue stations, emergency vehicle and equipment storage, and, emergency operation centers)
  - Emergency medical facilities (hospitals, ambulance service centers, urgent care centers having emergency treatment functions, and non-ambulatory surgical structures but excluding clinics, doctors' offices, and non-urgent care medical structures that do not provide these functions)
  - Designated emergency shelters
  - Communications (main hubs for telephone, broadcasting equipment for cable systems, satellite dish systems, cellular systems, television, radio, and other emergency warning systems, but excluding towers, poles, lines, cables, and conduits)
  - Public utility plant facilities for generation and distribution (hubs, treatment plants, substations and pumping stations for water, power and gas, but not including towers, poles, power lines, buried pipelines, transmission lines, distribution lines, and service lines)
  - Air transportation lifelines (airports [municipal and larger], helicopter pads and structures serving emergency functions, and associated infrastructure [aviation control towers, air traffic control centers, and emergency equipment aircraft hangars])
- Hazardous materials facilities:
  - Chemical and pharmaceutical plants
  - Laboratories containing highly volatile, flammable, explosive, toxic, or water-reactive materials
  - Refineries
  - Hazardous waste storage and disposal sites
  - Aboveground gasoline or propane storage or sales centers
- At-risk population facilities:
  - Elder care centers (nursing homes)
  - Congregate care serving 12 or more individuals (day care and assisted living)
  - Public and private schools (pre-schools, K-12 schools, before-school and after-school care serving 12 or more children)
- Facilities vital to restoring normal services:
  - Essential government operations (public records, courts, jails, building permitting and inspection services, community administration and management, maintenance and equipment centers)
  - Essential structures for public colleges and universities (dormitories, offices, and classrooms only)

Table 6-3 and Table 6-4 summarize the critical facilities and infrastructure in each municipality and unincorporated county areas. This information was obtained from HAZUS-MH, county assessor data, or from community personnel.

TABLE 6-3.
CRITICAL FACILITIES IN THE PLANNING AREA

Facility Type	City of San Saba	Unincorporated or Other	**San Saba County Total**
Fire Stations	1	3	**4**
Police Stations	1	0	**1**
Medical and Health	0	0	**0**
Emergency Operations Center	0	0	**0**
School	4	3	**7**
Hazardous Materials	6	0	**6**
Government Functions	2	0	**2**
Total	**14**	**6**	**20**

TABLE 6-4.
CRITICAL INFRASTRUCTURE IN THE PLANNING AREA

Facility Type	City of San Saba	Unincorporated or Other	**San Saba County Total**
Communication	2	0	**2**
Power Facility	2	0	**2**
Potable Water/ Wastewater Facility	0	2	**2**
Dam Location	0	46	**46**
Airport Facility	1	0	**1**
Airport Runway	1	0	**1**
Other Transportation	0	0	**0**
Bridge	1	84	**85**
Total	**7**	**132**	**139**

Figure 6-8 through Figure 6-11 show the location of critical facilities and infrastructure in the county. Due to the sensitivity of this information, a detailed list of facilities is not provided. The list is on file with each planning partner. Critical facilities and infrastructure were analyzed in HAZUS to help rank risk and identify mitigation actions. The risk assessment for each hazard discusses critical facilities and infrastructure with regard to that hazard.

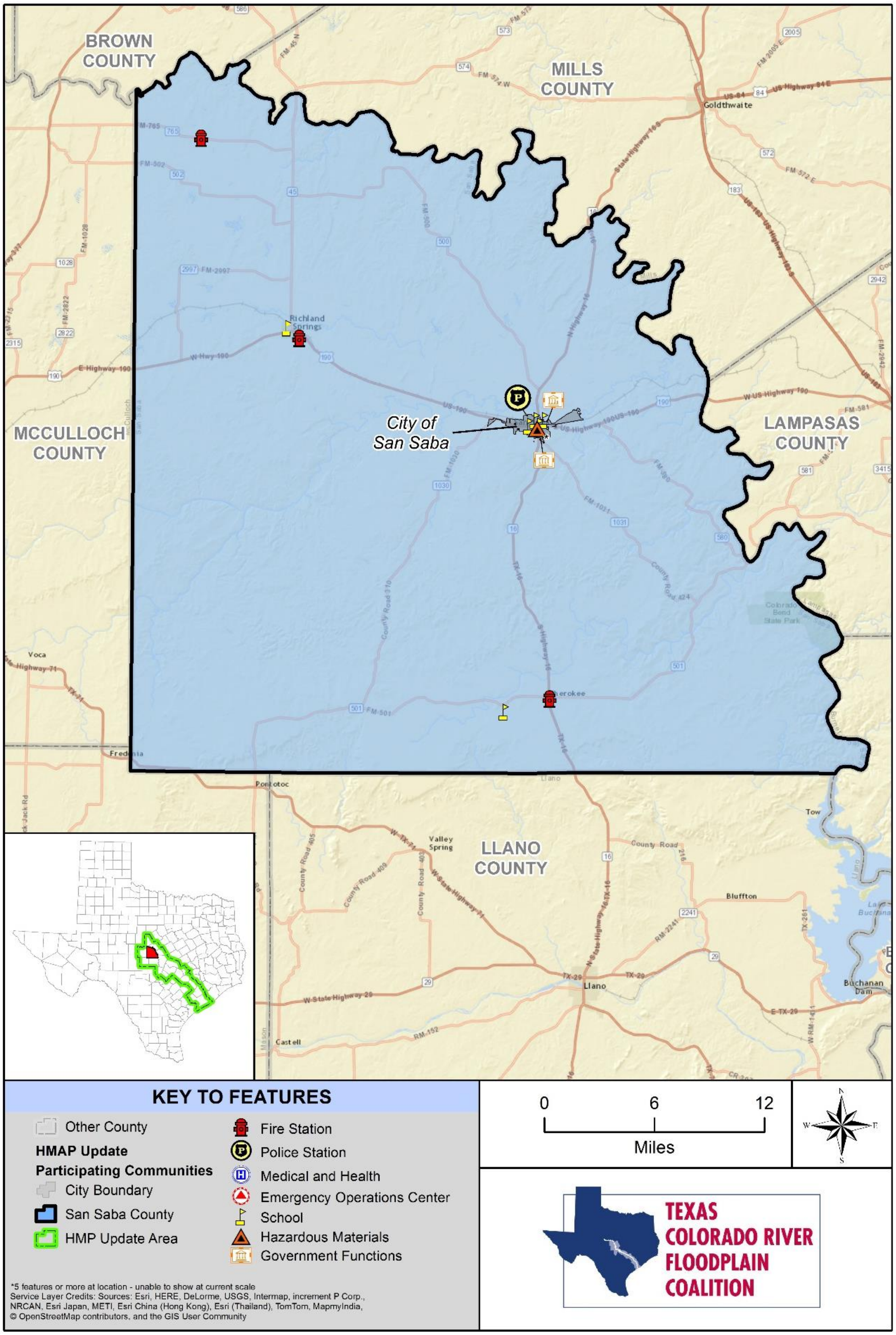


Figure 6-8. Critical Facilities in San Saba County

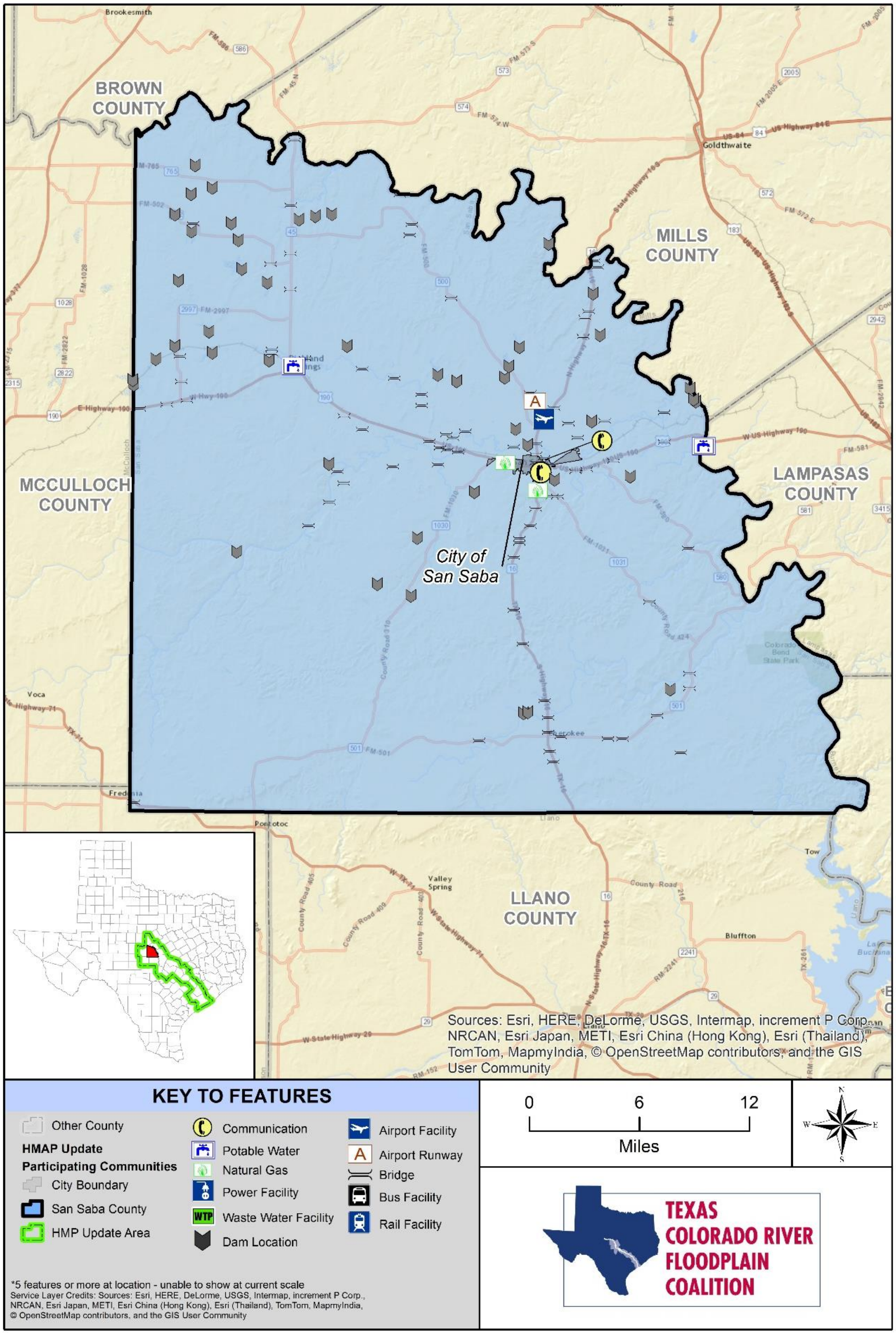


Figure 6-9. Critical Infrastructure in San Saba County

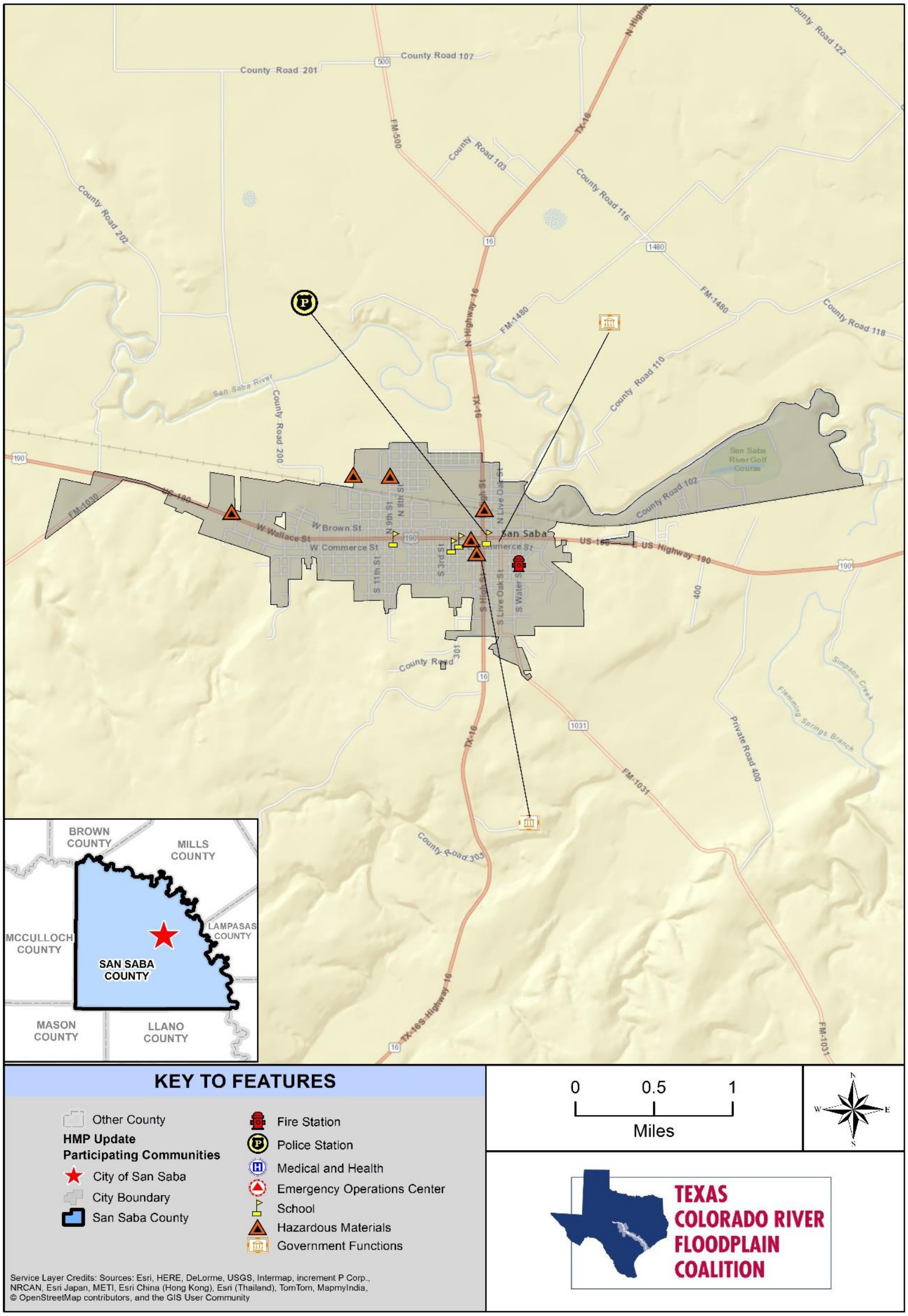


Figure 6-10. Critical Facilities in the City of San Saba

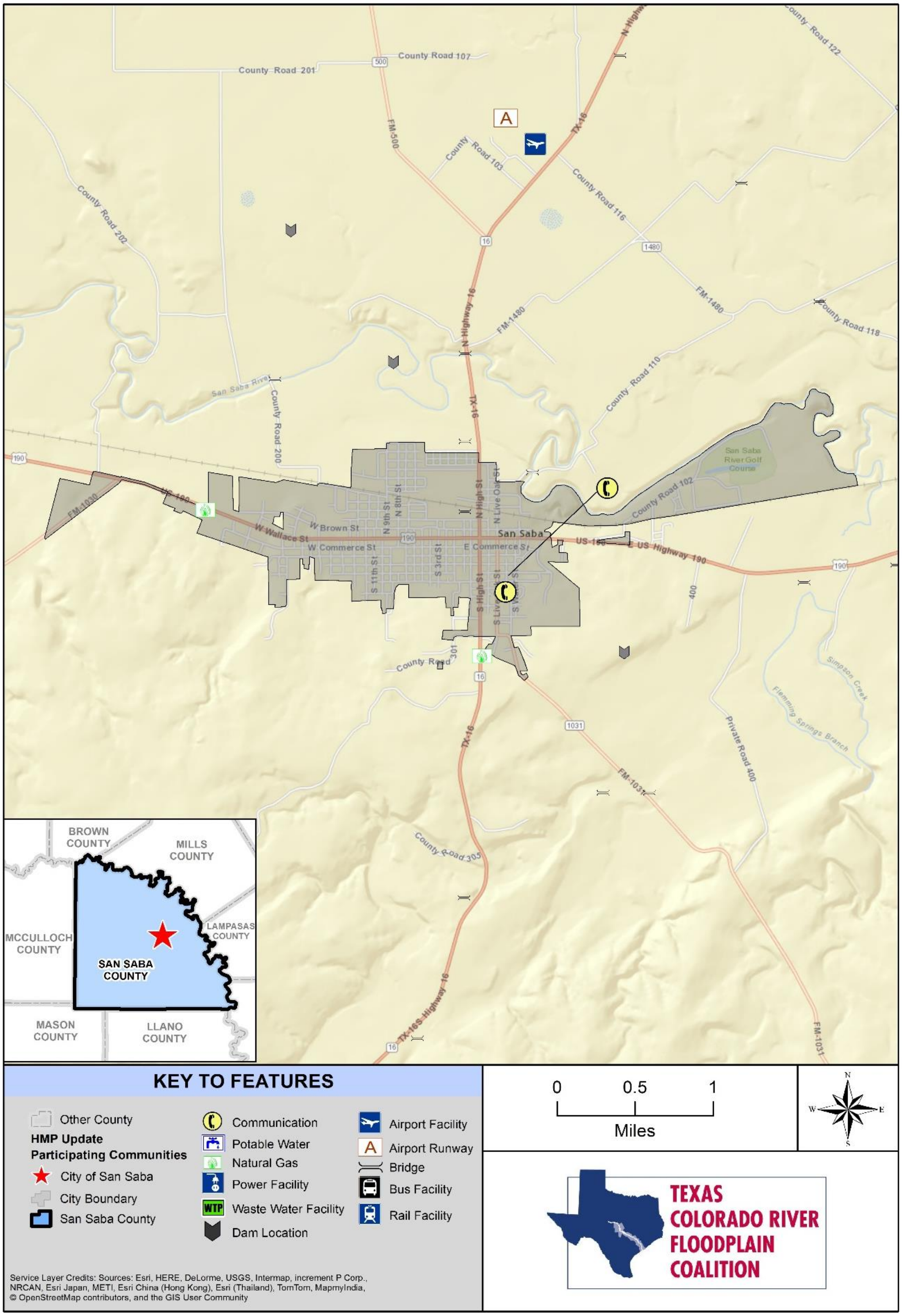


Figure 6-11. Critical Infrastructure in the City of San Saba

6.6 DEMOGRAPHICS

Information on current and historic population levels and future population projections is needed for making informed decisions about future planning. Population directly relates to land needs such as housing, industry, stores, public facilities and services, and transportation. Population changes are useful socio-economic indicators, as a growing population generally indicates a growing economy, and a decreasing population signifies economic decline.

Some populations are at greater risk from hazard events because of decreased resources or physical abilities. Elderly people, for example, may be more likely to require additional assistance. Research has shown that people living near or below the poverty line, the elderly (especially older single men), the disabled, women, children, ethnic minorities and renters all experience, to some degree, more severe effects from disasters than the general population. These vulnerable populations may vary from the general population in risk perception; living conditions; access to information before, during and after a hazard event; capabilities during an event; and access to resources for post-disaster recovery. Indicators of vulnerability—such as disability, age, poverty, and minority race and ethnicity—often overlap spatially and often in the geographically most vulnerable locations. Detailed spatial analysis to locate areas where there are higher concentrations of vulnerable community members would assist the county in extending focused public outreach and education to these most vulnerable citizens. Select U.S. Census demographic and social characteristics for San Saba County are shown in Table 6-5.

TABLE 6-5.
SAN SABA COUNTY DEMOGRAPHIC AND SOCIAL CHARACTERISTICS (2013)

	San Saba County	City of San Saba
Gender/Age (% of Total Population)		
Male	54.1	50.4
Female	45.9	49.6
Under 5 years	5.4	6.1
65 years and over	21.2	19.2
Race/Ethnicity (% of Total Population)		
White	93.4	90.0
American Indian/Alaska Native	1.3	0.0
Asian	0.3	0.3
Black or African American	3.6	2.4
More Than One Race	1.4	1.4
Hispanic or Latino (of any race)[1]	29.0	4.32
Education		
High School Graduate or Higher (% of Total Population, 25+ years)	81.0%	75.6

Source: U.S. Census Bureau, factfinder.census.gov

[1]The U.S. Census Bureau considers the Hispanic/Latino designation an ethnicity, not a race. The population self-identified as “Hispanic/Latino” is also represented within the categories in the “Race” demographic.

6.6.1 Population

The U.S. Census Bureau estimated a population of 6,050 for San Saba County as of July 2013. Table 6-6 shows planning area population data from 1990 through 2013. The San Saba County population has increased 14.5% from 1990 to 2000, but decreased 2.1% from 2000 to 2013. The City of San Saba is the county's principal population center. The population in the City of San Saba and the county have grown since 1990.

**TABLE 6-6.
SAN SABA COUNTY POPULATION**

	Total Population			
	1990	2000	2010	2013[a]
City of San Saba	2,626	2,637	3,099	3,110
Unincorporated Areas and Other[b]	2,775	3,549	3,032	2,940
San Saba County Total	**5,401**	**6,186**	**6,131**	**6,050**

Source: Texas State Library and Archives Commission and Texas Association of Counties
https://www.tsl.texas.gov/ref/abouttx/population.html
http://www.county.org/about-texas-counties/county-data/Documents/towns.html[1]

a. Data from Texas Association of Counties
b. Includes non-participating communities

Figure 6-12 shows 5-year population changes in San Saba County and the State of Texas from 1990 to 2010, and the 3-year change from 2010 to 2013. Between 1990 and 2013, the State of Texas' population grew by 53% (about 2.3% per year) while San Saba County's population increased by 12% (0.5% per year).

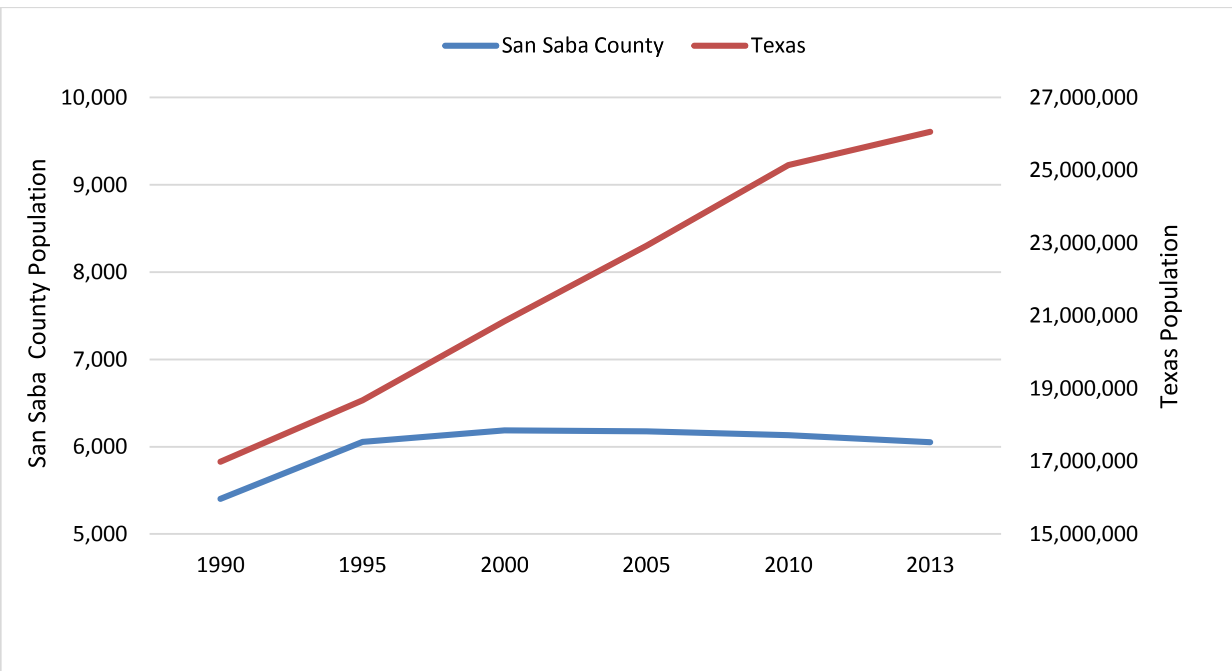


Figure 6-12. State of Texas and San Saba County Population Growth

6.6.2 Age Distribution

As a group, the elderly are more apt to lack the physical and economic resources necessary for response to hazard events and are more likely to suffer health-related consequences making recovery slower. They are more likely to be vision, hearing, or mobility impaired, and more likely to experience mental impairment or dementia. Additionally, the elderly are more likely to live in assisted-living facilities where emergency preparedness occurs at the discretion of facility operators. These facilities are typically identified as “critical facilities” by emergency managers because they require extra notice to implement evacuation. Elderly residents living in their own homes may have more difficulty evacuating their homes and could be stranded in dangerous situations. This population group is more likely to need special medical attention, which may not be readily available during natural disasters due to isolation caused by the event. Specific planning attention for the elderly is an important consideration given the current aging of the national population.

Children under 14 are particularly vulnerable to disaster events because of their young age and dependence on others for basic necessities. Very young children may additionally be vulnerable to injury or sickness; this vulnerability can be worsened during a natural disaster because they may not understand the measures that need to be taken to protect themselves from hazards.

The overall age distribution for the planning area is illustrated in Figure 6-13. Based on U.S. Census data estimates, 21.2% of the planning area’s population is 65 or older. U.S. Census data does not provide information regarding disabilities in the planning area’s over-65 population. U.S. Census estimates for 2013 indicate that 10.3% of San Saba County families have children under 18 and are below the poverty line.

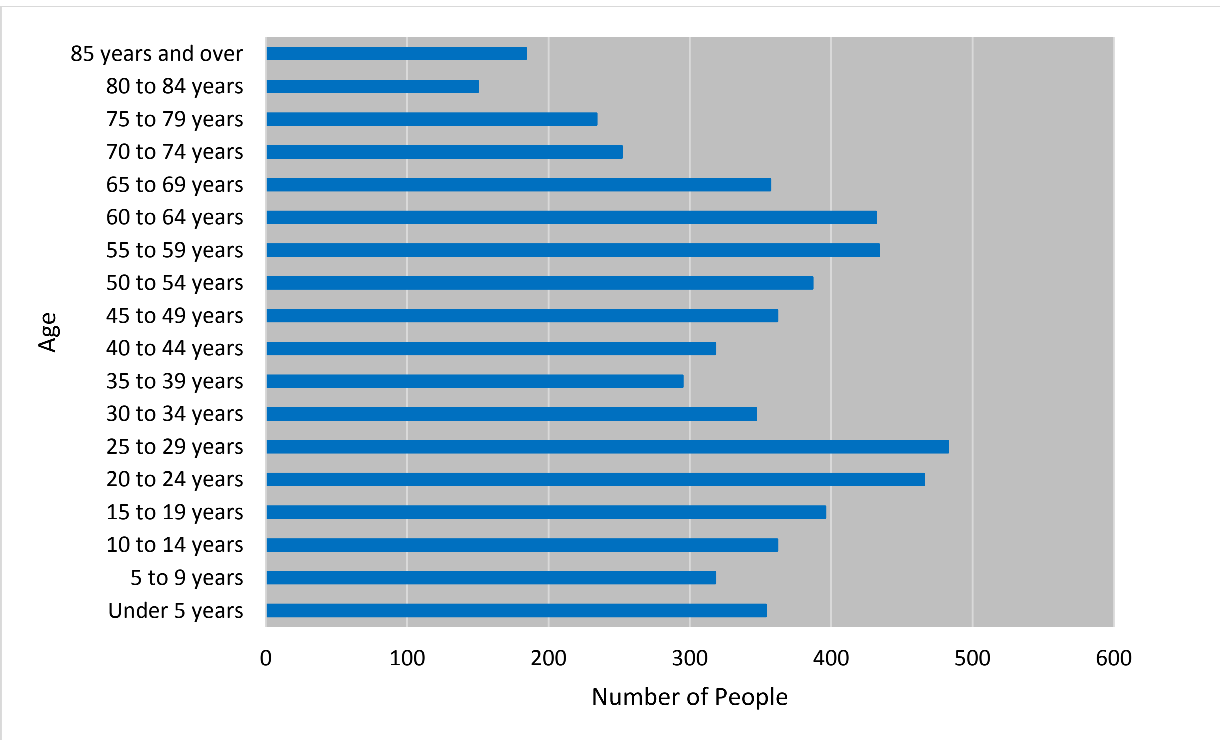


Figure 6-13. San Saba County Age Distribution

6.6.3 Disabled Populations

The 2010 U.S. Census estimated that 57 million non-institutionalized Americans with disabilities live in the U.S. This equates to about one-in-five persons. People with disabilities are more likely to have difficulty responding to a hazard event than the general population. Local government is the first level of response to assist these individuals, and coordination of efforts to meet their access and functional needs is paramount to life safety efforts. It is important for emergency managers to distinguish between functional and medical needs in order to plan for incidents that require evacuation and sheltering. Knowing the percentage of population with a disability will allow emergency management personnel and first responders to have personnel available who can provide services needed by those with access and functional needs. According to the 2010 U.S. Census, 12.2% of the population in the planning area lives with some form of disability.

6.6.4 Ethnic Populations

Research shows that minorities are less likely to be involved in pre-disaster planning and experience higher mortality rates during a disaster event. Post-disaster recovery can be less effective for ethnic populations and is often characterized by cultural insensitivity. Since higher proportions of ethnic minorities live below the poverty line than the majority white population, poverty can compound vulnerability. According to 2013 data from the U.S. Census Bureau, the ethnic composition of San Saba County is predominantly white, at about 93.4%. The largest minority population is Hispanic or Latino at 29%. Figure 6-14 shows the population distribution by race and ethnicity in San Saba County. The values shown on Figure 6-14 exceed 100% because according to the U.S. Census, Hispanic or Latino is listed as an ethnicity, not a race. Therefore, the Hispanic or Latino designation encompasses several races.

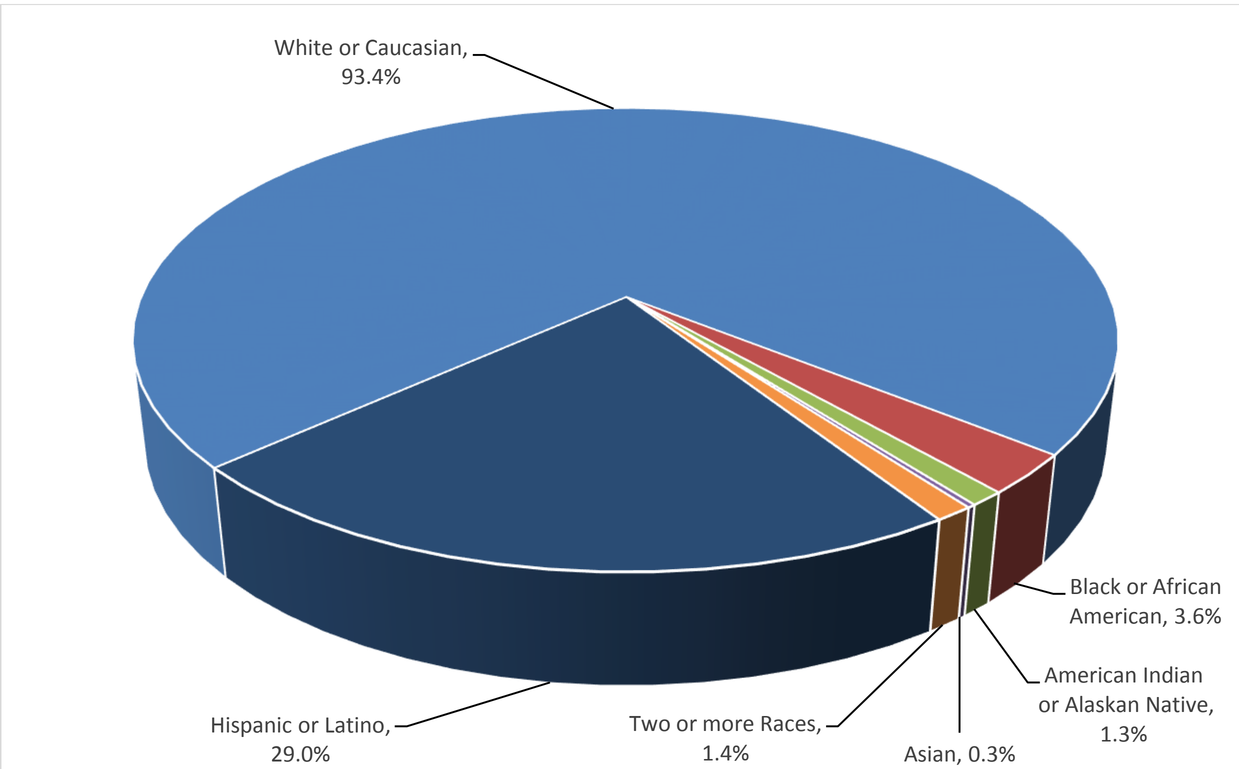


Figure 6-14. San Saba County Ethnic Distribution

San Saba County has a 7.4% foreign-born population. Other than English, the most commonly spoken language in San Saba County is Spanish. The U.S. Census estimates 7.6% of the residents speak English “less than very well.”

6.7 ECONOMY

Select 2013 economic characteristics estimated for San Saba County by the U.S. Census Bureau are shown in Table 6-7.

**TABLE 6-7.
SAN SABA COUNTY ECONOMIC CHARACTERISTICS**

	San Saba County	City of San Saba
Families Below Poverty Level	10.3%	16.1%
Individuals Below Poverty Level	21.1%	19.0%
Median Home Value	$71,300	$61,572
Median Household Income	$37,743	$30,750
Per Capita Income	$18,009	$15,461
Population >16 Years Old in Labor Force	51.6%	54.1%
Population Employed	48.2%	51.1%

Source: factfinder.census.gov; www.city-data.com

6.7.1 Income

In the United States, individual households are expected to use private resources to some extent to prepare for, respond to, and recover from disasters. This means that households living in poverty are automatically disadvantaged when confronting hazards. Additionally, the poor typically occupy more poorly built and inadequately maintained housing. Mobile or modular homes, for example, are more susceptible to damage in earthquakes and floods than other types of housing. In urban areas, the poor often live in older houses and apartment complexes, which are more likely to be made of un-reinforced masonry, a building type that is particularly susceptible to damage during earthquakes. Furthermore, residents below the poverty level are less likely to have insurance to compensate for losses incurred from natural disasters. This means that residents below the poverty level have a great deal to lose during an event and are the least prepared to deal with potential losses. The events following Hurricane Katrina in 2005 illustrated that personal household economics significantly impact people’s decisions on evacuation. Individuals who cannot afford gas for their cars will likely decide not to evacuate.

Based on U.S. Census Bureau estimates, per capita income in the planning area in 2013 was $18,009 and the median household income was $37,743. It is estimated that 4.8% of households receive an income between $100,000 and $149,999 per year and 0.9% are above $150,000 annually. Families with incomes below the poverty level in 2013 made up 10.3% of all families and 21.1 % of the total population in San Saba County.

6.7.2 Employment Trends

According to the U.S. Bureau of Labor Statistics, San Saba County’s unemployment rate as of March 1, 2015, was 2.9%, compared to a statewide rate of 4.2%. Figure 6-15 shows San Saba County’s unemployment trends from 1990 through March 1, 2015. San Saba County’s unemployment rate was lowest 1995 at 2.0% and peaked in 1992 at 9.4%.

Source: U.S. Bureau of Labor Statistics, 2015, http://m.research.stlouisfed.org/fred/

Note: Shaded areas indicate U.S. recessions

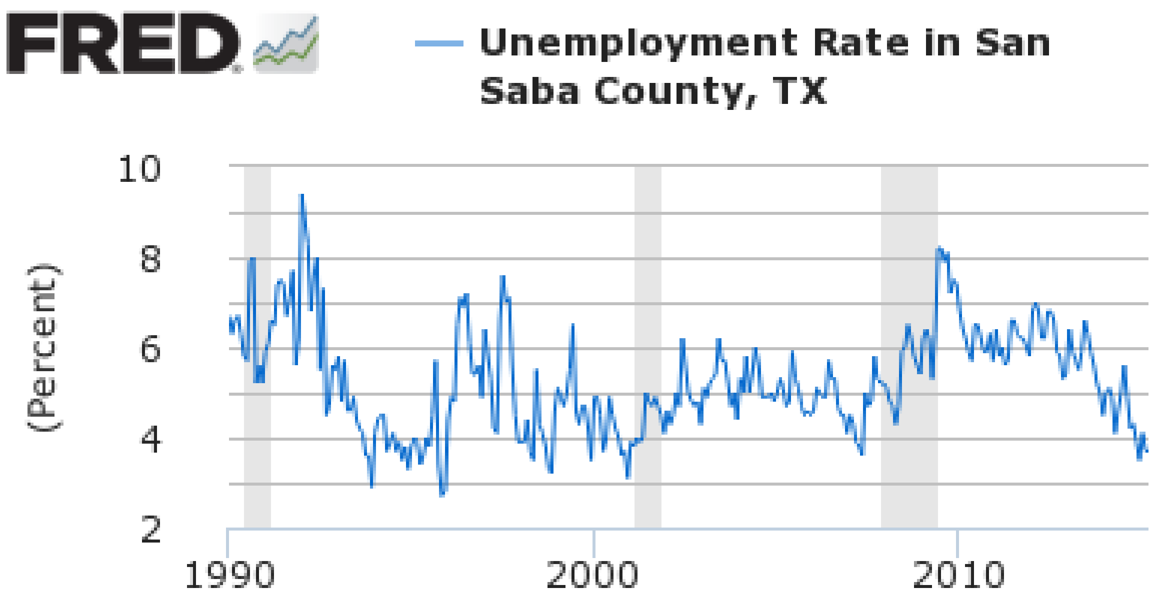


Figure 6-15. San Saba County Unemployment Rate (1990-2015)

According to 2013 data from the U.S. Census Bureau, 51.6% of San Saba County's population 16 years and older is in the labor force, including 45% of women and 55% of men.

6.7.3 Occupations and Industries

According to 2013 data from the U.S. Census Bureau, the planning area's economy is strongly based in the education, health care and social assistance industries (19.9% of total employment), followed by the retail trade (14.9%), agriculture, forestry, fishing and hunting, and mining (9.4%), and manufacturing (7.7%). Figure 6-16 shows the distribution of industry types in San Saba County, based on share of total employment.

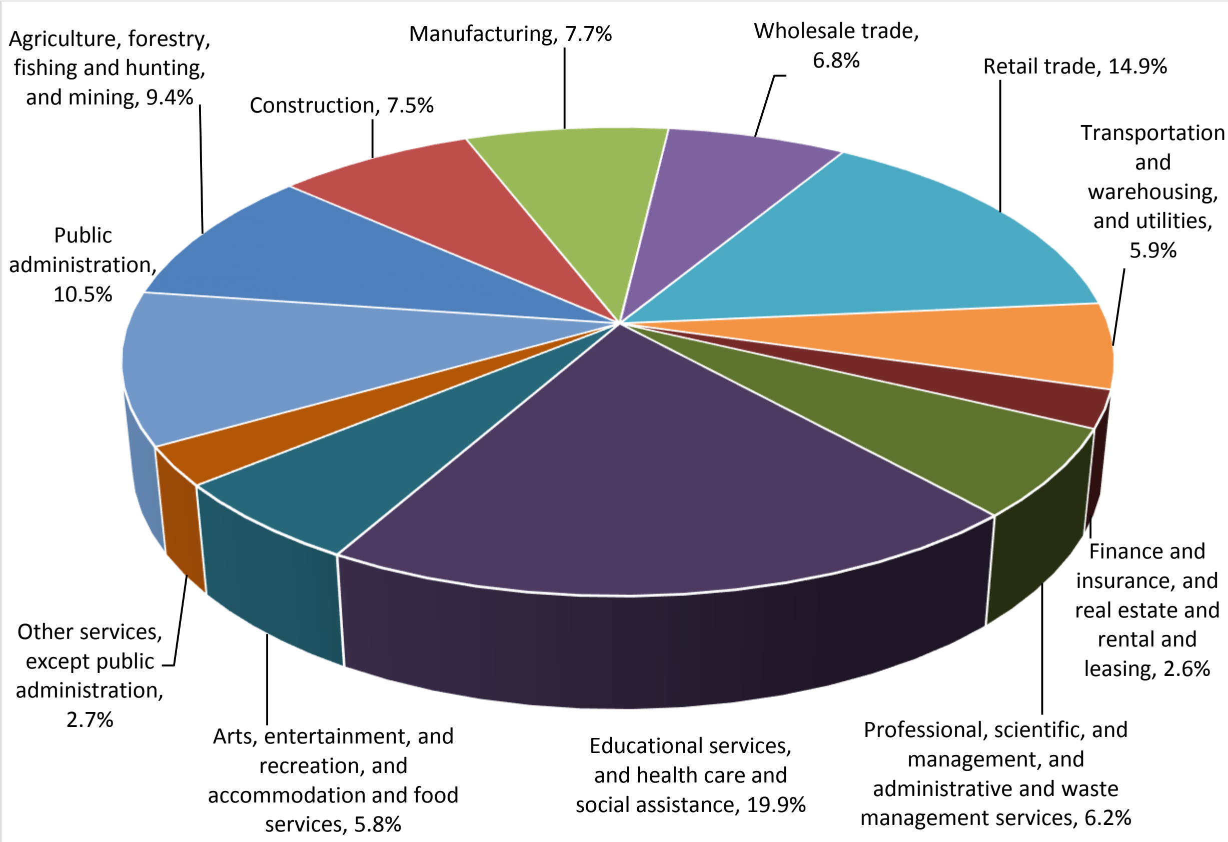


Figure 6-16. Percent of Total Employment by Industry in San Saba County

6.8 FUTURE TRENDS IN DEVELOPMENT

The municipal planning partners have adopted plans that govern land use decision and policy making in their jurisdictions. Decisions on land use will be governed by these programs. This plan will work together with these programs to support wise land use in the future by providing vital information on the risk associated with natural hazards in the planning area.

It is the goal that all municipal planning partners will incorporate this hazard mitigation plan update in their comprehensive plans (if applicable) by reference. This will help ensure that future development trends can be established with the benefits of the information on risk and vulnerability to natural hazards identified in this plan. Table 6-8 lists the present land use in San Saba County. San Saba County consists primarily of agricultural land, forest land, and grassland/prairie.

TABLE 6-8.
PRESENT LAND USE IN PLANNING AREA

Present Use Classification	Area (acres)	% of Total Land Area
Agriculture	35,742	4.9
Developed, Open Space	23,629	3.2
Developed, High Intensity	83	<0.1
Developed, Medium Intensity	186	<0.1
Developed, Low Intensity	477	<0.1
Forest Land	162,714	22.3
Grassland/Prairie	501,934	68.9
Water/Wetland	3,342	0.5
Total	**728,107**	**100.0**

Note: Acreage covers only mapped parcels and thus excludes many rights of way and major water features.

6.9 LAWS AND ORDINANCES

Existing laws, ordinances, and plans at the federal, state, and local level can support or impact hazard mitigation actions identified in this plan. Hazard mitigation plans are required to include review and incorporation, if appropriate, of existing plans, studies, reports, and technical information as part of the planning process (44 CFR, Section 201.6(b)(3)). Pertinent federal, state, and local laws are described below.

6.9.1 Federal

Disaster Mitigation Act

The DMA is the current federal legislation addressing hazard mitigation planning. It emphasizes planning for disasters before they occur. It specifically addresses planning at the local level, requiring plans to be in place before Hazard Mitigation Grant Program (HMGP) funds are available to communities. This plan is designed to meet the requirements of DMA, improving the planning partners' eligibility for future hazard mitigation funds.

Endangered Species Act

The federal Endangered Species Act (ESA) was enacted in 1973 to conserve species facing depletion or extinction and the ecosystems that support them. The act sets forth a process for determining which species are threatened and endangered and requires the conservation of the critical habitat in which those species live. The ESA provides broad protection for species of fish, wildlife, and plants that are listed as threatened or endangered. Provisions are made for listing species, as well as for recovery plans and the designation of critical habitat for listed species. The ESA outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species and contains exceptions and exemptions. It is the enabling legislation for the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Criminal and civil penalties are provided for violations of the ESA and the Convention.

Federal agencies must seek to conserve endangered and threatened species and use their authorities in furtherance of the ESA's purposes. The ESA defines three fundamental terms:

- **Endangered** means that a species of fish, animal, or plant is "in danger of extinction throughout all or a significant portion of its range." For salmon and other vertebrate species, this may include subspecies and distinct population segments.
- **Threatened** means that a species "is likely to become endangered within the foreseeable future." Regulations may be less restrictive for threatened species than for endangered species.
- **Critical habitat** means "specific geographical areas that are…essential for the conservation and management of a listed species, whether occupied by the species or not."

Five sections of the ESA are of critical importance to understanding the act:

- **Section 4: Listing of a Species**—NOAA's Fisheries Service is responsible for listing marine species; the U.S. Fish and Wildlife Service is responsible for listing terrestrial and freshwater aquatic species. The agencies may initiate reviews for listings, or citizens may petition for them. A listing must be made "solely on the basis of the best scientific and commercial data available." After a listing has been proposed, agencies receive comment and conduct further scientific reviews for 12 to 18 months, after which they must decide if the listing is warranted. Economic impacts cannot be considered in this decision, but it may include an evaluation of the adequacy of local and state protections. Critical habitat for the species may be designated at the time of listing.
- **Section 7: Consultation**—Federal agencies must ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed or proposed species or adversely modify its critical habitat. This includes private and public actions that require a federal permit. Once a final listing is made, non-federal actions are subject to the same review, termed a "consultation." If the listing agency finds that an action will "take" a species, it must propose mitigations or "reasonable and prudent" alternatives to the action; if the proponent rejects these, the action cannot proceed.
- **Section 9: Prohibition of Take**—It is unlawful to "take" an endangered species, including killing or injuring it or modifying its habitat in a way that interferes with essential behavioral patterns, including breeding, feeding, or sheltering.
- **Section 10: Permitted Take**—Through voluntary agreements with the federal government that provide protections to an endangered species, a non-federal applicant may commit a take that would otherwise be prohibited as long as it is incidental to an otherwise lawful activity (such as developing land or building a road). These agreements often take the form of a "Habitat Conservation Plan."
- **Section 11: Citizen Lawsuits**—Civil actions initiated by any citizen can require the listing agency to enforce the ESA's prohibition of taking or to meet the requirements of the consultation process.

Clean Water Act

The federal Clean Water Act (CWA) employs regulatory and non-regulatory tools to reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's surface waters so that they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water."

Evolution of CWA programs over the last decade has included a shift from a program-by-program, source-by-source, and pollutant-by-pollutant approach to more holistic watershed-based strategies. Under the watershed approach, equal emphasis is placed on protecting healthy waters and restoring impaired ones. A full array of issues are addressed, not just those subject to CWA regulatory authority. Involvement of stakeholder groups in the development and implementation of strategies for achieving and maintaining water quality and other environmental goals is a hallmark of this approach.

National Flood Insurance Program

The National Flood Insurance Program (NFIP) provides federally backed flood insurance in exchange for communities enacting floodplain regulations. Participation and good standing under NFIP are prerequisites to grant funding eligibility under the Robert T. Stafford Act. San Saba County and the City of San Saba participate in the NFIP and have adopted regulations that meet the NFIP requirements. At the time of the preparation of this plan, San Saba County and the City of San Saba were in good standing with NFIP requirements.

6.9.2 State and Regional

Texas Division of Emergency Management

The TDEM is a division within the Texas Department of Public Safety and has its roots in the civil defense programs established during World War II. It became a separate organization through the Texas Civil Protection Act of 1951, which established the Division of Defense and Disaster Relief in the Governor's Office to handle civil defense and disaster response programs. The division was collocated with the Department of Public Safety (DPS) in 1963. The division was renamed the Division of Disaster Emergency Services in 1973. After several more name changes, it was designated an operating division of the Texas Department of Public Safety in 2005. Legislation passed during the 81st session of the Texas Legislature in 2009 formally changed the name to TDEM. TDEM operates according to the Texas Disaster Act of 1975 (Chapter 418 of the Texas Government Code).

TDEM's is "charged with carrying out a comprehensive all-hazard emergency management program for the state and for assisting cities, counties, and state agencies in planning and implementing their emergency management programs. A comprehensive emergency management program includes pre- and post-disaster mitigation of known hazards to reduce their impact; preparedness activities, such as emergency planning, training, and exercises; provisions for effective response to emergency situations; and recovery programs for major disasters."

Texas Water Development Board

The Texas Water Development Board (TWDB) was created in 1957 but its history dates back to a 1904 constitutional amendment authorizing the first public development of water resources. The TWDB mission is "to provide leadership, information, education, and support for planning, financial assistance, and outreach for the conservation and responsible development of water for Texas." TWDB provides water planning, data collection and dissemination, financial assistance, and technical assistance services.

TWDB financial assistance programs are funded through state-backed bonds, a combination of state bond proceeds and federal grant funds, or limited appropriated funds. Since 1957, the Texas State Legislature and voters approved constitutional amendments authorizing TWDB to issue up to $10.93 billion in Texas Water Development Bonds. To date, TWDB has sold nearly $3.95 billion of these bonds to finance the construction of water- and wastewater-related projects. In 1987, TWDB added the Clean Water State Revolving Fund (CWSRF) to its portfolio of financial assistance programs. Low-interest loans from the CWSRF finance costs associated with the planning, design, construction, expansion, or improvement of wastewater treatment facilities, wastewater recycling and reuse facilities, collection systems, stormwater pollution control projects, and nonpoint source pollution control projects. Funded in part by federal grant money, CWSRF provides loans at interest rates lower than the market can offer to any eligible applicant. CWSRF offers 20-year loans using either a traditional long-term, fixed-rate or a short-term, variable-rate construction period loan that converts to a long-term, fixed-rate loan on project completion.

Texas Soil and Water Conservation Board

The Texas State Soil and Water Conservation Board (TSSWCB) is the state agency that administers Texas' soil and water conservation law and coordinates conservation and nonpoint source water pollution abatement programs. The TSSWCB was created in 1939 by the Texas Legislature to organize the state into 216 soil and water conservation districts (SWCD) and to serve as a centralized agency for communicating with the Texas Legislature as well as other state and federal entities. The TSSWCB is the lead state agency for the planning, management, and abatement of agricultural and silvicultural (forestry) nonpoint source water pollution, and administers the Water Supply Enhancement Program. Each SWCD is an independent political subdivision of state government. Local SWCDs are actively involved throughout the state in soil and water conservation activities such as operation and maintenance of flood control structures.

Texas Bureau of Economic Geology

The University of Texas at Austin, Bureau of Economic Geology serves as the State Geological Survey of Texas. The bureau conducts research focusing on the intersection of energy, environment, and economy. The bureau partners with federal, state, and local agencies, academic institutions, industry, nonprofit organizations, and foundations to conduct high-quality research and to disseminate the results to the scientific and engineering communities as well as to the broad public. The Geophysical Log Facility (GLF) is the official well log repository for the Railroad Commission of Texas, which by law receives a copy of geophysical logs from every new, deepened, or plugged well drilled in Texas since September 1985.

Texas Forest Service

Texas Forest Service (TFS) was created in 1915 by the 34th Legislature as an integral part of the Texas A&M University System. It is mandated by law to assume direction of all forest interests and all matters pertaining to forestry within the jurisdiction of the state. TFS administers the Community Wildfire Protection Plan (CWPP) to reduce related risks to life, property, and the environment. Its Fire Control Department provides leadership in wildland fire protection for state and private lands in Texas and reduces wildfire-related loss of life, property, and critical resources.

The intention of the TFS CWPP is to reduce the risk of wildfire and promote ecosystem health. The plan also is intended to reduce home losses and provide for the safety of residents and firefighters during wildfires. It has the following goals and objectives.

Goals:

- Provide for the safety of residents and emergency personnel
- Limit the number of homes destroyed by wildfire
- Promote and maintain healthy ecosystems
- Educate citizens about wildfire prevention

Objectives:

- Complete wildfire risk assessments
- Identify strategic fuels reduction projects
- Address treatment of structural ignitability
- Identify local capacity building and training needs
- Promote wildfire awareness programs

CWPPs are developed to mitigate losses from wildfires. By developing a CWPP, a community is outlining a strategic plan to mitigate, prepare, respond, and recover.

Texas Department of State Health Services

The mission of the Department of State Health Services is to protect and preserve the health of the citizens of Texas. Public health nurses provide a variety of services including immunizations, preventive assessments of children and the elderly, and a full range of services designed to assist individuals and groups to attain and maintain good health and to cope with illnesses.

Texas Colorado River Floodplain Coalition

The TCRFC is a partnership of cities and counties in the Colorado River Basin and surrounding areas seeking better ways to reduce and mitigate flood damage. The coalition was formed in response to a combination of rapid growth, a greatly expanded number of homes and businesses in the floodplain, and devastating floods that have reoccurred in the basin. TCRFC's mission statement is to "Encourage comprehensive consistent management of the floodplain along the Colorado River and its tributaries; provide a forum for data exchange; and facilitate a structured approach to managing the complex issues related to floodplain management." TCRFC is the sponsoring agency for the development of this hazard mitigation plan to address all natural hazards that could potentially affect communities.

Central Texas Council of Governments

The Central Texas Council of Governments (CTCOG) helps local communities work cooperatively to improve the conditions and well-being of Central Texans. The CTCOG includes the following counties: Bell, Coryell, Hamilton, Lampasas, Milam, Mills, and San Saba. The CTCOG serves more than 385,000 residents in the Central Texas area and help local communities work cooperatively to improve the conditions and well-being of Central Texans. Services and programs include 911 emergency communications, air quality, homeland security, hazard mitigation, resource conservation, transportation planning, and criminal justice training.

CTCOG's 911 Rural Addressing Department serves all rural sections of the region. The emergency communications program provides public safety mapping and call-handling equipment for emergency telecommunications. The staff assigns rural addresses for the area and works with municipalities to ensure consistent standards are met across the region. The education program helps members of the public understand how they can make sure emergency responders can reach them as quickly as possible.

The CTCOG GIS department is responsible for tracking development, statistics, environmental, and infrastructure data throughout the seven county region. The GIS program is also tasked with development of solutions for member entities involving GIS and various forms of technology.

CTCOG Homeland Security Division is tasked with the administration of the federal Homeland Security Grant Program for the Central Texas Region. The division works closely with state and local emergency management coordinators, federal, state, county and municipal governments, law enforcement agencies, fire departments, emergency medical services, and emergency communications organizations. Planning efforts include:

- Emergency communications (including radio and dispatch equipment)
- Hazard mitigation
- Homeland security
- Criminal justice
- Emergency management
- Public education
- Managing other federal grants

The Homeland Security Division develops and maintains the Regional Interoperable Communications Plan, the Region Emergency Response Plan, and the Hazard Mitigation Plan. The division also includes the CodeRED system, which provides regional emergency management agencies the ability to quickly deliver messages to targeted areas, entire communities, selected groups, or the entire region. The CodeRED system was selected in order to provide individuals and businesses the ability to add their own phone numbers directly into the database.

6.9.3 San Saba County

The San Saba County government is made up of the following offices and departments:

- Commissioners' Court
- County Attorney
- County Clerk
- Treasurer
- Assessor/Collector
- Sheriff's Office
- Justice of the Peace
- Municipal Court
- District Attorney
- District Clerk
- Emergency Management
- Indigent Health Care
- Extension Office
- Elections
- Community Supervision and Corrections
- Veteran Services
- Floodplain Management
- Sewage

Excerpts from applicable policies, regulations, and plans and program descriptions follow to provide more detail on existing mitigation capabilities.

San Saba County Subdivision Regulations, 2007 (as amended)

The San Saba County Subdivision Regulations established rules, regulations, and standards governing the subdivision of land within the unincorporated areas of San Saba County. On April 23, 2007, acting pursuant to Section 232 and 233, Texas Local Government Code, the San Saba County Subdivision Regulations established the legal provisions, bond requirements, platting procedures, design standards, and water regulations for dividing property within the county.

San Saba County's Flood Damage Prevention Order, 2004

The Flood Damage Prevention Order, 2004-1, established the San Saba County Commissioners' Court as the governing body to administer the National Flood Insurance Act and Texas Flood Control and Insurance Act. The purpose of the order and attached regulations is to promote the public health, safety, and general welfare and to minimize public and private losses due to flood conditions in specific areas by regulations designed to: (1) protect human life and health; (2) minimize the expenditure of public money for costly flood control projects; (3) minimize the need for rescue and relief efforts associated with flooding and usually undertaken at public expense; (4) minimize prolonged business interruptions; (5) minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, and streets and bridges located in or near floodplains; (6) help maintain a stable tax base by providing for the sound use and development of flood-prone areas in such a manner as to minimize future flood blight areas; and (7) to provide that developers are notified that property is in an area of special flood hazard, and (8) to ensure that these occupy the area of special flood hazard assume responsibility for their actions.

The order will be implemented through methods authorized by federal and state law to: (1) restrict or prohibit uses that are dangerous to health, safety, or property in times of flood, or uses that cause excessive increases in flood heights or velocities; (2) require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction; (3) control the alteration of natural floodplains, stream channels, watercourses, and natural protective barriers which are involved in the accommodation of flood waters; (4) control filling, grading, dredging, and other development which may increase flood damage; and (5) prevent or regulate the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards to other lands.

The responsibilities of the Commissioners' Court are to: (1) fulfill an obligation mandated by federal and state law; (2) regulate construction in an area designated under law as a floodplain; (3) regulate sewer and on-site sewage/sewer facilities (OSSF); (4) prevent waste; (5) protect the rights of owners of interests in groundwater; (6) prevent subsidence; (7) provide a response to a real and substantial threat to public health and safety, said response being designed to significantly advance the public purposes herein described and not to impose a greater burden than is necessary to achieve said purposes; and (8) prevent the imminent destruction of property or injury to persons from flooding within a floodplain established by a federal flood control program and enacted to prevent the flooding of buildings intended for public occupancy.

San Saba County Floodplain Map

The current floodplain maps from FEMA are in use for issuing permits and went into effect on July 2, 1991.

San Saba County Basic Emergency Operations Plan, 2014

The purpose of the San Saba County Basic Emergency Operations Plan (EOP) (including a base plan and 22 functional annexes) is to:

- Identify the roles, responsibilities and actions required of county departments and other agencies in preparing for and responding to major emergencies and disasters
- Provide a framework for coordinating, integrating, and administering the EOPs and related programs of local, state, and federal governments
- Provide for the integration and coordination of volunteer agencies and private organizations involved in emergency response and relief efforts

The EOP covers the county and City of San Saba.

San Saba County Office of Emergency Management

The Office of Emergency Management (OEM) assists San Saba County in preparing for, responding to, and recovering from disasters. The OEM works year-round with city departments, regional emergency management and public safety officials, and elected officials to develop a plan to lessen the impact of disasters on county residents. In addition, communication is maintained with state and federal agencies for coordination in the event of large disasters, natural or manmade.

San Saba County Volunteer Fire Department

The San Saba Volunteer Fire Department provides fire and rescue services for both the City and County of San Saba. The San Saba Fire Department is first out on all structure fires and rescue calls within the county. Richland Springs, Cherokee, and Elm Grove Fire Departments are also located within San Saba County and are primarily set up for fighting grass fires. The San Saba Fire Department provides not only fire suppression and extrication, but also water rescue, high angle rescue, severe weather spotting, and fire prevention.

San Saba County Emergency Medical Services

San Saba County recently contracted Capital Emergency Medical Services to provide pre-hospital emergency care for both the City of San Saba and the County of San Saba. Capital Emergency Medical Services is a locally owned company that has provided emergency and non-emergency ambulance services in Central Texas since 2002. Capital Emergency Medical Services operates a fleet of 22 vehicles and employs over 120 personnel. The company is based in Lampasas, Texas.

San Saba County Commissioners' Court

The San Saba County Commissioners' Court consist of the County Judge and four Commissioners. The court is responsible for approving platting and enforcing the subdivision rules.

6.9.4 City of San Saba

The City of San Saba government is made up of the following offices and departments:

- City Manager
- City Secretary
- Finance
- Public Works
- Economic Development and Tourism
- Electric
- Golf
- Police
- Code Enforcement
- Animal Control

The City of San Saba has multiple plans and functions in place that guide growth and development within the community. The City of San Saba Boards and Commissions include:

- Airport Advisory Board
- Economic Development and Tourism
- Keep San Saba Beautiful
- Parks
- Planning and Zoning
- Utilities and Streets.

Excerpts from applicable policies, regulations, and plans and program descriptions follow to provide more detail on existing mitigation capabilities.

San Saba Comprehensive Plan, 2014

The *City of San Saba Comprehensive Plan* was created in 2014. The plan serves as a long-range planning tool for municipal staff, decision-makers, and citizens to direct the growth and physical development of a community. The city's leaders initiated the creation of this plan to establish a vision for San Saba based on input directly from the community. This vision has guided the plan's recommendations and will continue to shape the future of San Saba through the review of future development proposals, attracting future businesses, allocating capital improvements funding, planning for public services and facilities, and many other applications.

City of San Saba Code of Ordinances

Some of the chapters in the San Saba Code of Ordinances have provisions related, directly or indirectly, to hazard mitigation. These provisions are discussed below:

- **Chapter 1 - General Provisions**

  Provisions under this chapter include:

  - Adoption of National Incident Management System (Ordinance 2005-12 adopted 9/13/05)

  - Establishment of the City of San Saba Emergency Management Organization (Ordinance 1996-2, sec. 1, adopted 2/13/96)
  - Identification of the powers, duties, and responsibilities of the Emergency Management Director (Ordinance 1996-2, sec. 2, adopted 2/13/96)
  - Creation of an emergency operations plan (Ordinance 1996-2, sec. 3, adopted 2/13/96)

- **Chapter 3 - Buildings and Building Regulations**

  Provisions under this chapter include:

  - Building permit requirements
  - Adoption of the International Building Code, 2005 edition (Ordinance 2010-02, sec. 1, adopted 2/19/10). Note: The council just passed an ordinance to update to the 2015 code but it has not been published to date.
  - Description of enforcement, authorization, and purpose of the Standard for Floodplain Management (Ordinance 1991-3, art. 1, adopted 5/14/91)
  - Methods of reducing flood losses (Ordinance 1991-3, art. 1, adopted 5/14/91)
  - Basis for establishing the areas of special flood hazard and permitting requirements (Ordinance 1991-3, art. 4, adopted 5/14/91)
  - Designation, duties, and responsibilities of the floodplain administrator (Ordinance 1991-3, art. 4, adopted 5/14/91)
  - Permit and variance procedures for a floodplain development permit (Ordinance 1991-3, art. 4, adopted 5/14/91)
  - Construction standards for new construction and substantial improvements to minimize flood damage (Ordinance 1991-3, art. 5, adopted 5/14/91)
  - Review of proposed subdivisions and land use areas to minimize flood damage (Ordinance 1991-3, art. 5, adopted 5/14/91)

- **Chapter 5 – Fire Prevention and Protection**

  Provisions under this chapter include:

  - Adoption of the International Fire Code, 2006 edition (Ordinance 2010-02, sec. 1, adopted 2/19/10).
  - Regulations on the use, possession, and sale of fireworks (Ordinance adopted 1/10/55, sec. 1)

- **Chapter 10 – Subdivision Regulations**

  Provisions under this chapter include:

  - Establishes general and prohibited land use (Ordinance 1991-2)
  - Established rules, regulations, and standards governing the subdivision of land (Ordinance 1991-2)
  - Defines the process and permits required (Ordinance 1991-2)
  - Provide for the implementation of the comprehensive plan, including the future land use plan, transportation master plan and compliance with comprehensive zoning (Ordinance 1991-2)

- It established standards and specifications for construction of roads and drainage (Ordinance 1991-2)

- **Chapter 11 – Zoning**

  Provisions under this chapter include:

  - Created a city-county joint zoning board to manage the airport (Ordinance 1974-3, secs. 1, 2, adopted 7/31/74)11/7/91)
  - Creates the Planning and Zoning Commission and the Board of Adjustments procedures, variances, and review process for approval of construction projects within the city (Ordinance 1991-13 adopted 11/7/91)
  - Establishes zoning districts within San Saba (Ordinance 1991-13 adopted 11/7/91)

City of San Saba Planning and Zoning Commission

The Planning and Zoning Commission serves as a review body to make recommendations to the City Council regarding land use issues, including zoning requests, subdivision plats, changes to the Zoning Ordinance, amendment to and update of the Comprehensive Master Plan and other items included in the physical development of the City of San Saba.

City of San Saba Economic Corporation

The City of San Saba's Economic Development Corporation is a 4B Economic Development Corporation. The corporation administers a city half cent sales tax. The goal is to enhance the quality of life in the City of San Saba, by providing appropriate infrastructure and by promoting and assisting the kind of economic development which will provide the people of San Saba meaningful and rewarding employment opportunities and greater access to desirable goods and services. The corporation also manages the city's tourism efforts.

City of San Saba Emergency Operations Plan, 1991

The City of San Saba EOP has a base plan and 22 functional annexes. The plan is designed to:

- Identify the roles, responsibilities and actions required of county departments and other agencies in preparing for and responding to major emergencies and disasters
- Provide a framework for coordinating, integrating, and administering the EOPs and related programs of local, state, and federal governments
- Provide for the integration and coordination of volunteer agencies and private organizations involved in emergency response and relief efforts

CHAPTER 7.
HAZARD MITIGATION CAPABILITIES ASSESSMENT

The planning team performed an inventory and analysis of existing authorities and capabilities called a "capability assessment." A capability assessment creates an inventory of an agency's mission, programs and policies, and evaluates its capacity to carry them out.

7.1 SAN SABA COUNTY

7.1.1 Legal and Regulatory Capabilities

Table 7-1 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in San Saba County.

TABLE 7-1.
SAN SABA COUNTY REGULATORY MITIGATION CAPABILITIES MATRIX

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
General plan	No	
Zoning ordinance	No	
Subdivision ordinance	Yes	San Saba County Subdivision Ordinance, 2007, established rules, regulations and standards governing the subdivision of land within the unincorporated areas of San Saba County.
Growth management	Yes	Growth management is accomplished through compliance with the San Saba County Subdivision Ordinance.
Floodplain ordinance	Yes	Flood Damage Prevention Order was originally signed in 1987 and updates were made in 1999 and 2004.
Other special purpose ordinance (stormwater, steep slope, wildfire)	No	
Building code	No	
Erosion or sediment control program	No	
Stormwater management	No	
Site plan review requirements	Yes	Site plan reviews are limited to septic tank and floodplain ordinance compliance.
Capital improvement plan	Yes	Capital improvement is managed through the annual budget cycle.
Economic development plan	No	
Local emergency operations plan	Yes	San Saba County Basic Emergency Operations Plan covers the county and local municipalities.
Other special plans	No	

TABLE 7-1.
SAN SABA COUNTY REGULATORY MITIGATION CAPABILITIES MATRIX

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
Flood insurance study or other engineering study for streams	Yes	The Floodplain Administrator is the local repository for the FEMA FIRM for the unincorporated areas of the county and makes the maps available for public review. The Floodplain Administrator maintains flood insurance rate maps in conjunction with the NFIP. The current maps are dated 1991.
Elevation certificates	Yes	The Floodplain Administration works in conjunction with FEMA and keeps a copy of the flood elevation certificates on file in its office.

Notes:
FEMA Federal Emergency Management Agency
FIRM Flood Insurance Rate Map
NFIP National Flood Insurance Program

7.1.2 Administrative and Technical Capabilities

Table 7-2 identifies the county personnel responsible for activities related to mitigation and loss prevention in San Saba County.

TABLE 7-2.
SAN SABA COUNTY ADMINISTRATIVE/TECHNICAL MITIGATION CAPABILITIES MATRIX

Personnel Resources	Yes/No	Department/Position
Planner/engineer with knowledge of land development/land management practices	No	Engineering support is only outsourced if required for FEMA grant requirements.
Engineer/professional trained in construction practices related to buildings or infrastructure	No	
Planner/engineer/scientist with an understanding of natural hazards	No	
Personnel skilled in GIS	No	
Full-time building official	No	
Floodplain manager	Yes	Floodplain Administrator
Emergency manager	Yes	Office of Emergency Management
Grant writer	Yes	Department specific and outsourced as needed
Other personnel	No	
GIS data: Hazard areas	No	
GIS data: Critical facilities	No	
GIS data: Building footprints	No	
GIS data: Land use	No	
GIS data: Links to Assessor’s data	No	

TABLE 7-2. SAN SABA COUNTY ADMINISTRATIVE/TECHNICAL MITIGATION CAPABILITIES MATRIX		
Personnel Resources	Yes/No	Department/Position
Warning systems/services (Reverse 911 callback, cable override, outdoor warning signals)	Yes	Warning sirens are located in the municipalities where population density is the highest.
Other	No	Engineering support is only outsourced if required for FEMA grant requirements.

Notes:
FEMA Federal Emergency Management Agency
GIS Geographic Information System

7.1.3 Financial Capabilities

Table 7-3 identifies financial tools or resources that San Saba County could use to help fund mitigation activities.

TABLE 7-3. SAN SABA COUNTY FINANCIAL MITIGATION CAPABILITIES MATRIX	
Financial Resources	Accessible/Eligible to Use (Yes/No)
Community Development Block Grants	Yes
Capital improvements project funding	Yes
Authority to levy taxes for specific purposes	Yes
Fees for water, sewer, gas, or electric services	No
Impact fees for new development	Yes
Incur debt through general obligation bonds	Yes
Incur debt through special tax bonds	Yes
Incur debt through private activities	No
Withhold spending in hazard prone areas	No
Other	No

7.2 CITY OF SAN SABA

7.2.1 Legal and Regulatory Capabilities

Table 7-4 lists regulatory and planning tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the City of San Saba.

**TABLE 7-4.
CITY OF SAN SABA REGULATORY MITIGATION CAPABILITIES MATRIX**

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
General plan	Yes	*City of San Saba Comprehensive Plan* was created in 2014 to help the city prepare for and manage growth.
Zoning ordinance	Yes	Zoning regulations are included in Chapter 14, Ordinance 1991-13
Subdivision ordinance	Yes	Subdivision regulations are included in Chapter 10, Ordinance 1991-2
Growth management	Yes	Growth management is managed through the combination of the Comprehensive Plan, zoning ordinances, and subdivision ordinances.
Floodplain ordinance	Yes	Part of Chapter 3 - Buildings and Building Regulations (1991)
Other special purpose ordinance (stormwater, steep slope, wildfire)	No	A community wildfire plan is under development.
Building code	Yes	San Saba adopted the International Building Code and International Residential Code (2015 editions)
Erosion or sediment control program	Yes	The responsibility is primarily managed by the Public Works Department.
Stormwater management	Yes	The responsibility is primarily managed by the Public Works Department.
Site plan review requirements	Yes	The responsibility is primarily managed by the Code Enforcement Officer.
Capital improvements plan	Yes	Capital improvement is managed through the annual budget cycle.
Economic development plan	Yes	Economic Development Commission
Local emergency operations plan	Yes	The City of San Saba maintains a local EOP and is covered under the county EOP.
Other special plans	Yes	The city maintains a Fire Marshal Plan for the city and county.
Flood insurance study or other engineering study for streams	Yes	FEMA floodplain maps indicate flood insurance is necessary along the San Saba River and Mill Creek.
Elevation certificates	Yes	The Code Enforcement Officer keeps records of flood elevation certificates on file in its office.

Notes:

EOP Emergency Operations Plan

FEMA Federal Emergency Management Agency

7.2.2 Administrative and Technical Capabilities

Table 7-5 identifies the city personnel responsible for activities related to mitigation and loss prevention in the City of San Saba.

TABLE 7-5.
CITY OF SAN SABA ADMINISTRATIVE/TECHNICAL MITIGATION CAPABILITIES MATRIX

Personnel Resources	Yes/No	Department/Position
Planner/engineer with knowledge of land development/land management practices	No	Outsourced to Jacobs and Martin Engineering Services (Abilene)
Engineer/professional trained in construction practices related to buildings or infrastructure	No	Outsourced to Jacobs and Martin Engineering Services (Abilene)
Planner/engineer/scientist with an understanding of natural hazards	No	Outsourced to Jacobs and Martin Engineering Services (Abilene)
Personnel skilled in GIS	No	
Full-time building official	Yes	Code Enforcement
Floodplain manager	Yes	Code Enforcement
Emergency manager	Yes	
Grant writer	No	Outsourced to a local grant writer as needed
Other personnel	No	
GIS data: Hazard areas	No	
GIS data: Critical facilities	No	
GIS data: Building footprints	No	
GIS data: Land use	No	
GIS data: Links to Assessor’s data	No	
Warning systems/services (Reverse 911 callback, cable override, outdoor warning signals)	Yes	The city currently operates outdoor warning sirens and is in the process of acquiring a Reverse 911 system.
Other	Yes	The city has access to the local AM/FM radio station.

Notes:
GIS Geographic Information System

7.2.3 Financial Capabilities

Table 7-6 identifies financial tools or resources that the City of San Saba could use to help fund mitigation activities.

TABLE 7-6.
CITY OF SAN SABA FINANCIAL MITIGATION CAPABILITIES MATRIX

Financial Resources	Accessible/Eligible to Use (Yes/No)
Community Development Block Grants	Yes
Capital improvements project funding	Yes
Authority to levy taxes for specific purposes	Yes
Fees for water, sewer, gas, or electric services	Yes (water, sewer, and electric)
Impact fees for new development	No
Incur debt through general obligation bonds	Yes
Incur debt through special tax bonds	Yes
Incur debt through private activities	No
Withhold spending in hazard prone areas	No
Other	No

PART 2
RISK ASSESSMENT

CHAPTER 8. COASTAL EROSION, EXPANSIVE SOILS, AND LAND SUBSIDENCE

COASTAL EROSION, EXPANSIVE SOILS, AND LAND SUBSIDENCE RANKING			
Jurisdiction	**Coastal Erosion**	**Expansive Soils**	**Land Subsidence**
San Saba County	No Exposure	Medium	Low
City of San Saba	No Exposure	Low	Low

DEFINITIONS

Ground Subsidence — Ground subsidence is the sinking of land over human-caused or natural underground voids and the settlement of native low density soils.

Soil Erosion — Soil erosion is the removal and simultaneous transportation of earth materials from one location to another by water, wind, waves, or moving ice.

Deposition — Deposition is the placing of eroded material in a new location.

8.1 GENERAL BACKGROUND

8.1.1 Coastal Erosion

The General Land Office (GLO) of Texas defines coastal erosion as "the loss of shoreline, beach and/or dune sediments and is caused by the lack of sediment delivered to the coast to balance the impacts ranging from man-made actions such as the damming of rivers, land subsidence from groundwater withdrawal, construction of seawalls, groins and jetties, diversion of rivers and streams, fast-moving motor craft and ship-generated wakes and many other factors to natural processes such as wave action from storms, tidal surges, wind, and loss of wetlands."

The Texas Coastline stretches approximately 367 miles along the Gulf of Mexico. This coastline will lose, on average, 2.3 feet per year of beaches due to coastal erosion. Furthermore, according to the GLO, 64% of the Texas Coast is eroding at a higher rate of approximately 6 feet per year, with some locations losing over 30 feet per year. The specific erosion rates for the Texas Coast are shown in Figure 8-1. This figure shows the shoreline change rates due to erosion in feet per year from 1950 to 2012.

8.1.2 Expansive Soils

Expansive and collapsible soils are some of the most widely distributed and costly geologic hazards. Collapsible soils are a group of soils that can rapidly settle or collapse the ground. They are also known as metastable soils and are unsaturated soils that undergo changes in volume and settlement in response to wetting and drying, often resulting in severe damage to structures. The sudden and usually large volume change could cause considerable structural damage. Expansive soil and rock are characterized by clayey material that shrinks as it dries or swells as it becomes wet. In addition, trees and shrubs placed closely to a structure can lead to soil drying and subsequent shrinkage. The parent (source) rock most associated with expansive soils is shale. Figure 8-2 shows expansive soil distribution in the U.S. Collapsible soils consist of loose, dry, low-density materials that collapse and compact under the addition of water or excessive loading. Soil collapse occurs when the land surface is saturated at depths greater than those reached by typical rain events. This saturation eliminates the clay bonds holding the soil grains together. Similar to expansive soils, collapsible soils result in structural damage such as cracking of the foundation, floors, and walls in response to settlement. Swelling soils cause cracked foundations, as well as damage to upper floors of a building when the motion in the structure is significant. Shrinkage as result of dried soils can remove support from buildings or other structures and result in damaging subsidence. Fissures in the soil can also develop. These fissures can facilitate the deep penetration of water when moist conditions or runoff occurs.

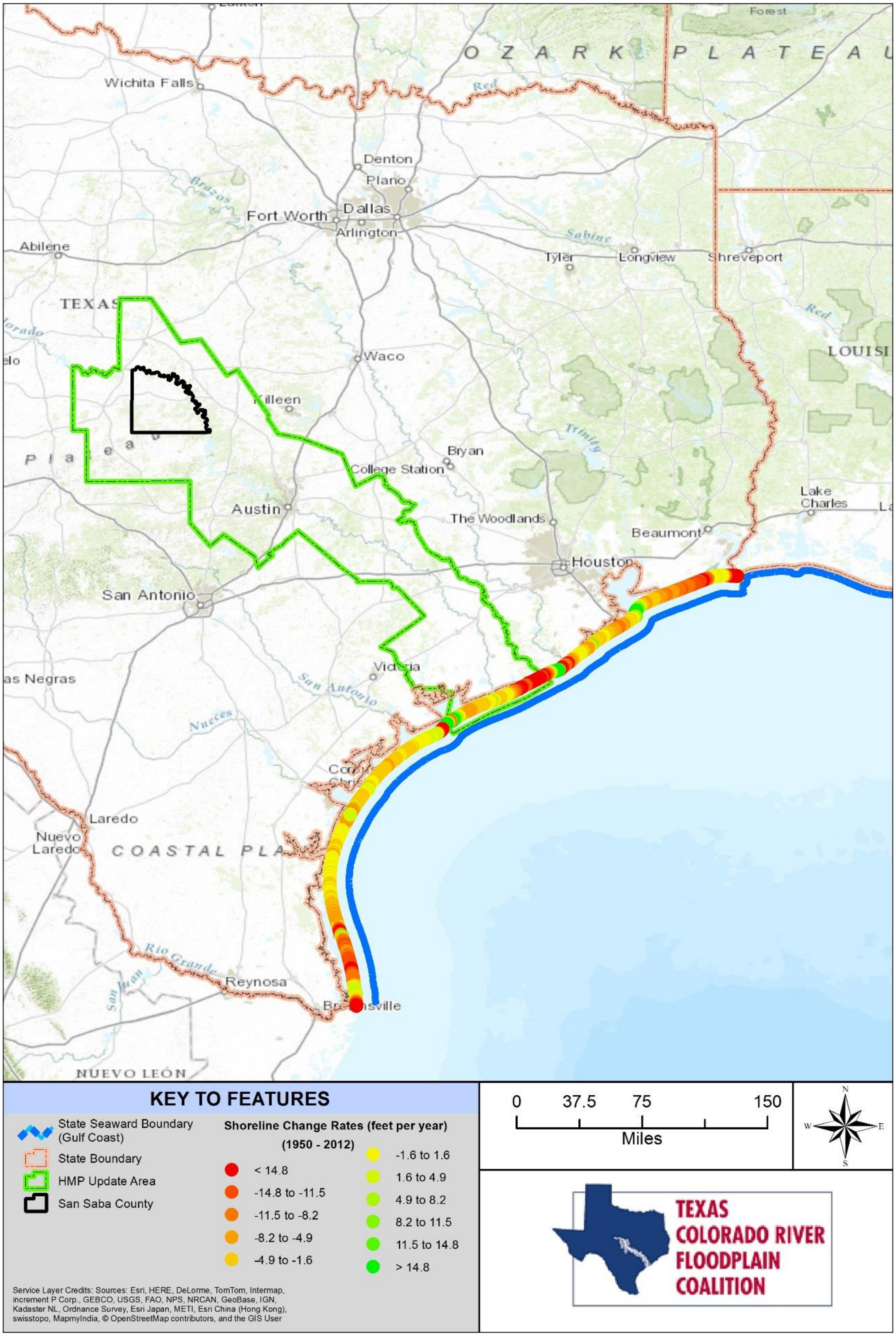


Figure 8-1. Coastal Change/Erosion Rates for the Texas Coast

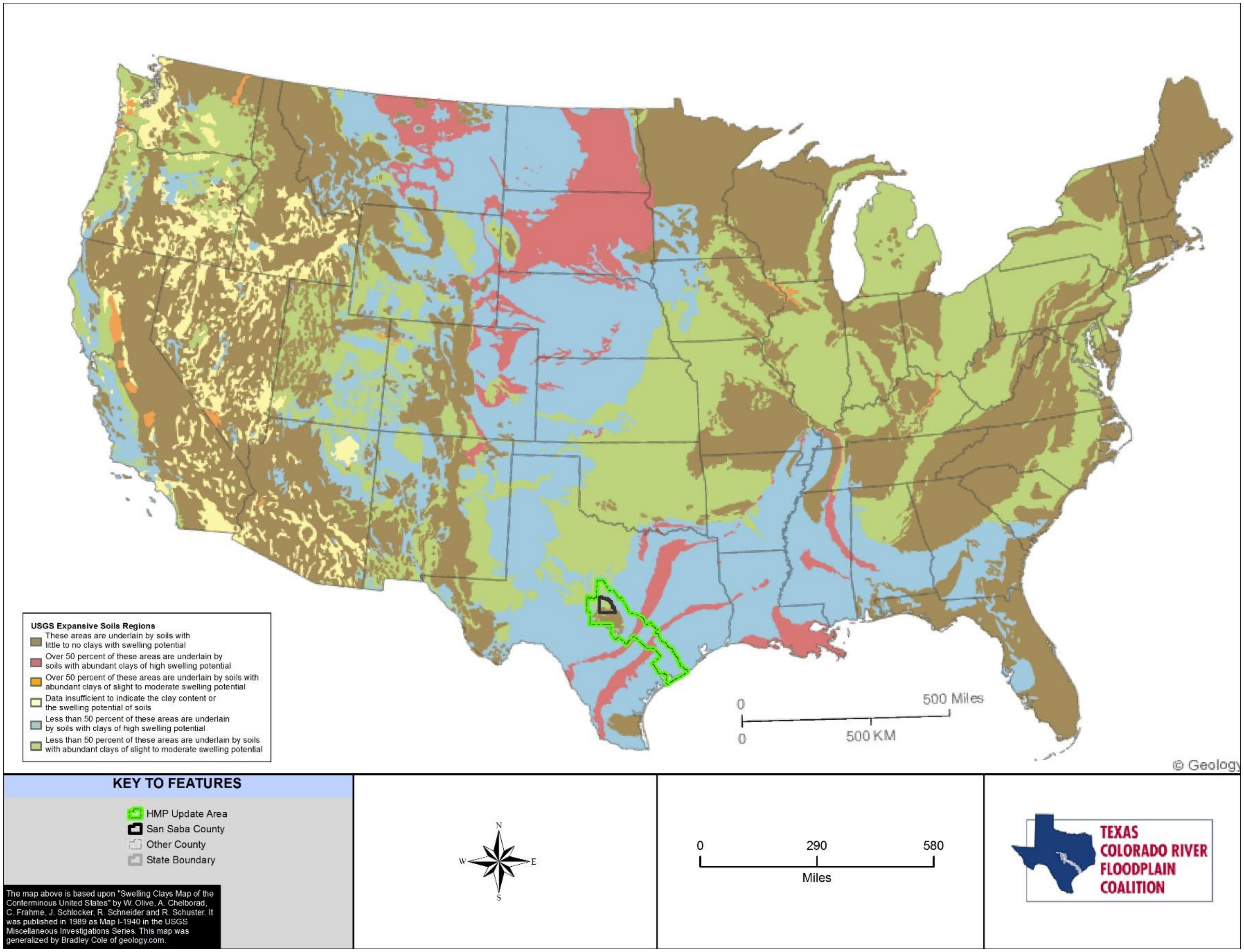


Figure 8-2. Expansive Soil Regions

8.1.3 Land Subsidence

According to the *2013 State of Texas Hazard Mitigation Plan*, "Land subsidence is defined as the loss of surface elevation due to the removal of subsurface support. It can range from broad, regional lowering of the land surface to localized, full-blown collapses. Land subsidence occurs in different areas for different reasons" (Texas Division of Emergency Management [TDEM] 2013). Subsidence can occur gradually over time or virtually instantaneously. There are many different types of subsidence; however, in Texas, there are three types of subsidence that warrant the most concern: groundwater depletion, sinkholes in karst areas, and erosion and deposition.

Groundwater Depletion

Over drafting of aquifers is the major cause of subsidence in the southwestern United States, and as groundwater pumping increases, land subsidence also will increase. In many aquifers, groundwater is pumped from pore spaces between grains of sand and gravel. If an aquifer has beds of clay or silt within or next to it, the lowered water pressure in the sand and gravel causes slow drainage of water from the clay and silt beds. The reduced water pressure is a loss of support for the clay and silt beds. Because these beds are compressible, they compact (become thinner), and the effects are seen as a lowering of the land surface. The lowering of land surface elevation from this process is permanent. For example, if lowered groundwater levels caused land subsidence, recharging the aquifer until groundwater returned to the original levels would not result in an appreciable recovery of the land-surface elevation. Figure 8-3 shows the areas in the hazard mitigation plan update area susceptible to subsidence due to groundwater depletion.

Sinkholes in Karst Areas

A sinkhole is a natural depression that is formed when subsurface limestone, salt or gypsum is slowly eroded away by groundwater. As surface water infiltrates the soil, it percolates downward and moves deeper into the soil. Over time, the water eats away at the rock layer until voids, or caves, form in the rock. As these voids grow, ultimately the spaces between the rocks become too big and the weight of the earth on top of the rock causes the chamber to collapse. Natural sinkholes most commonly form in the karst regions of Texas (Figure 8-4). Karst is an area of irregular limestone in which erosion has produced fissures, sinkholes, underground streams, and caverns. Subsidence can be caused by natural processes but most problems involving subsidence are caused by human activities. Sinkholes on the other hand are natural hazards caused by erosion underground. It is possible, however, for unnatural sinkholes to form. In urban areas, water main breaks can erode the subsoil and cause the earth above to cleave.

Erosion and Deposition

Both erosion and deposition are continually occurring phenomenon, although the rate of erosion and deposition varies tremendously and can be affected by a variety of factors including rate of scour, type of material being eroded, and the presence or absence of vegetation. In Texas, these processes of erosion and deposition have formed a variety of landforms (beaches, plateaus, mountains, and canyons) as well as soil types (fertile soil, clay rich soil, and sandy soil). Wind, rain, and rivers are the main weathering, erosion, and deposition agents in Texas. When waves along coastlines deposit sediment, they extend beaches; when they wash sediment away, the waves erode beaches.

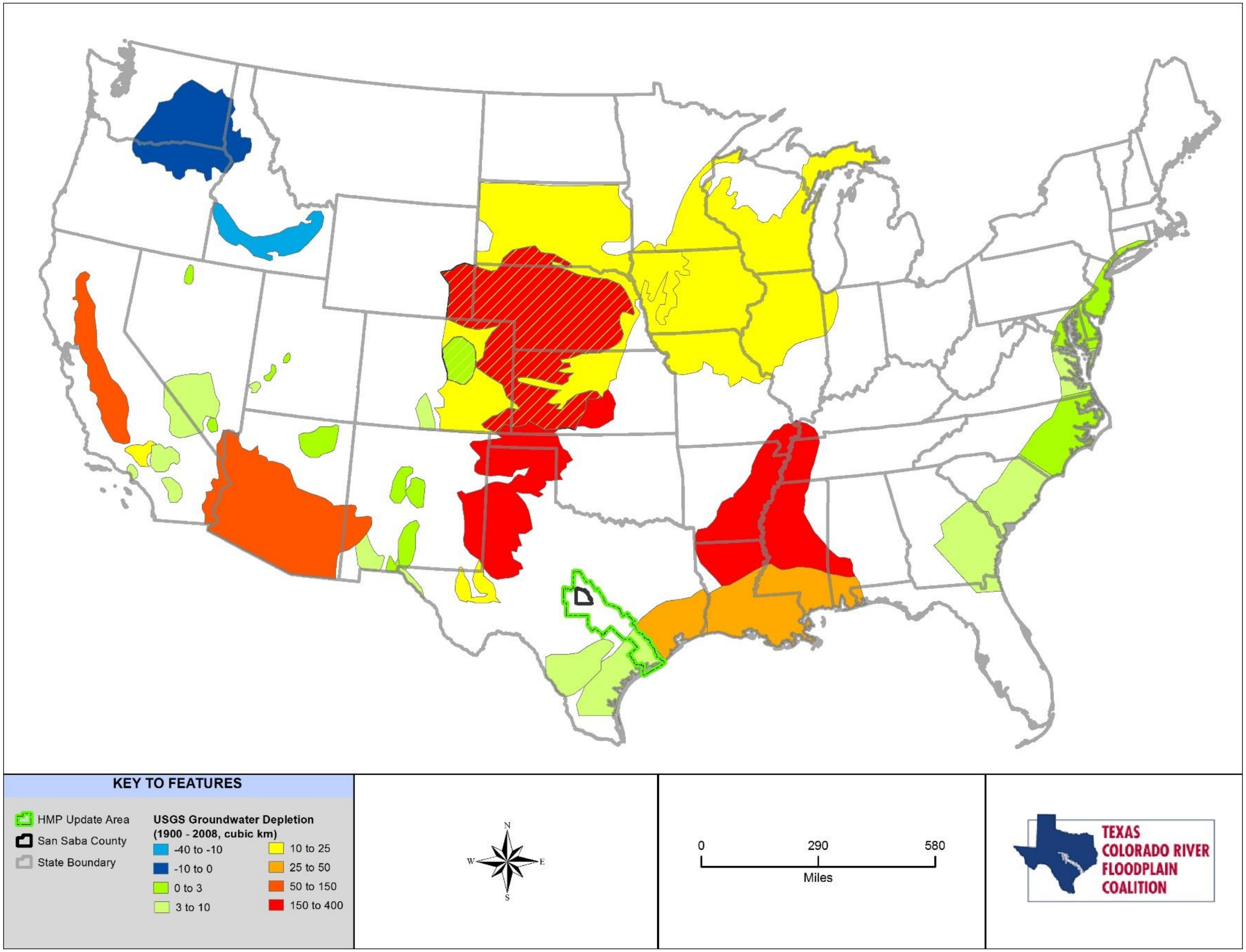


Figure 8-3. Groundwater Depletion and Subsidence Rates

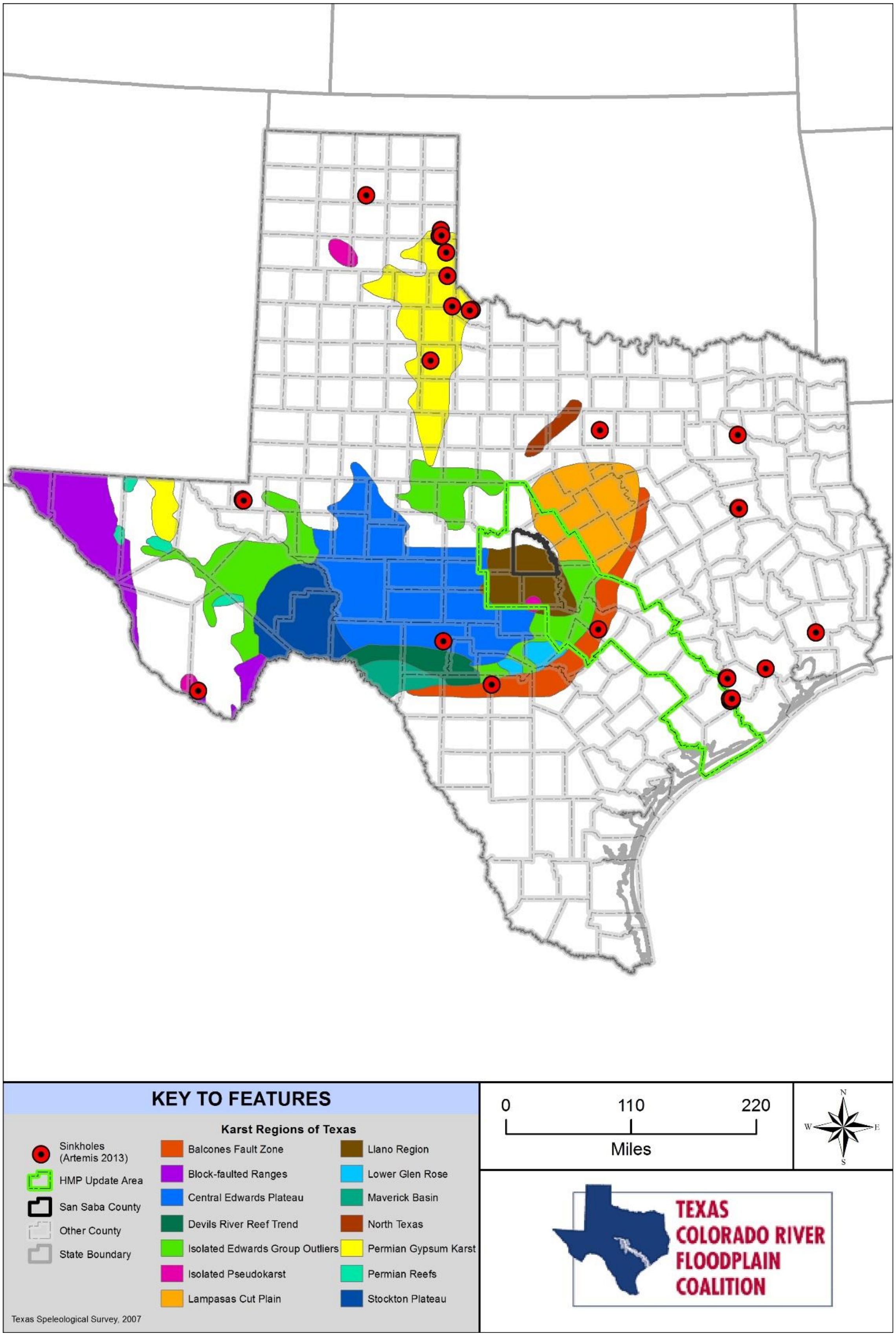


Figure 8-4. Karst Regions of Texas

8.2 HAZARD PROFILE

8.2.1 Past Events

Coastal Erosion

Coastal erosion is a problem along the Texas Coast. However, because of San Saba County's interior location (approximately 250 miles inland), San Saba County is not exposed to coastal erosion.

Expansive Soils

San Saba County is mostly underlain by soils with little to no clays with swelling potential. Expansive soils can cause structural damage, and even though structural foundation issues occur in the county, there is little documentation of past events.

Land Subsidence

The occurrence of subsidence is an ongoing process resulting from natural and human-induced causes. San Saba County does not have a history of sinkholes as Figure 8-4 illustrates. San Saba County does not have a history of groundwater depletion and there is no known database of specific groundwater depletion events for San Saba County. As Figure 8-3 illustrates, San Saba County is not in a known or documented groundwater depletion zone.

Soil erosion and deposition are also ongoing events that can be affected by both natural and human-induced processes. Dust storms are a common occurrence in West Texas where large portions of loose topsoil are transported over large distances into parts of the Midwest. The Dust Bowl of the 1930s was not an isolated, one-time event; soil erosion and deposition events are continually occurring throughout the county.

8.2.2 Location

Coastal Erosion

Coastal erosion is located primarily along the Texas Coast (Gulf of Mexico). Coastal erosion issues will affect both the Gulf and Bay side of barrier islands along the coast. San Saba County is not affected by coastal erosion because of its inland geography. However, natural and human activities cause seasonal soil erosion and deposition throughout the county.

Expansive Soils

Structural foundation issues are a known occurrence through this region of Central Texas. The potential vertical rise of the clay soil in the area can be as high as several inches over a drought cycle. Structural foundations in the county are thus subject to cyclical perimeter lifting and lowering from seasonal changes in soil moisture content because of the semi-arid conditions that persist in the area.

Land Subsidence

Sinkholes occur over much of the United States. Subsidence and sinkholes strongly correlate to the distribution of carbonic rock. However, not all areas underlain by carbonate bedrock, such as limestone, are at risk. In Texas, high concentrations of karst rock occur in the soluble limestone areas of the Hill Country and the gypsum-rich Rolling Plains of northwest Texas. In Texas, however, most sinkholes go unnoticed. In areas where they are likely to form, people may pass by them and never know they exist. Perhaps the most heralded human-caused Texas sinkhole occurred in 1980 near the West Texas town of Wink. On June 3, residents woke to find a 370-foot-wide, 110-foot-deep hole had formed 2 ½ miles north of town. Geologists suspect the sinkhole, also known as the Wink Sink, formed as a result of historic oil production practices in the Permian Basin that pumped saltwater from below the surface, leaving a void beneath. In May 2002, a second sinkhole opened up nearby. The new sinkhole dwarfed the first one, at 900 feet wide and more than 300 feet deep. The most prominent natural sinkhole in Texas is the Devil's Sinkhole in Rocksprings. It is 351 feet deep. Another major Texas sinkhole is the May 7, 2008, sinkhole occurrence in Daisetta, Texas. It's approximately 900 feet wide and 260 feet deep. Land subsidence, especially on the Texas Gulf Coast area, has been a major concern and resulted in the creation of the Houston-Galveston Subsidence District in 1975.

8.2.3 Frequency

In Central Texas, it can take five or more years for an initial moisture dome to stabilize in a foundation. The establishment of the initial moisture dome usually causes the worst of the damage from foundation deflection. Afterward, the foundation is subject to cyclic perimeter lifting and lowering from seasonal changes in soil moisture content. For example, most homeowners with moving foundations find that cracks widen in the summer and close in the winter because San Saba County normally gets most of its annual rainfall in May and October, summers can be quite dry, and evapotranspiration is less in the winter.

Land subsidence and dissolution of evaporites underground, which provides the potential for sinkholes, is a continuous occurrence throughout the county. Large precipitation events as well as human activity may influence the frequency of these events within the county. Although there are currently no significant sinkholes or land subsidence events documented in San Saba County, it is possible for either to occur as a result of oil exploration or groundwater activities.

A large increase in development between Austin and San Saba County could lead to an increase in land subsidence events. More structures, residents, and people could cause a strain on previously undeveloped areas of land and resources. This could increase the probability of an event occurring.

8.2.4 Severity

The severity of subsidence, sinkholes, soil erosion, and expansive soils are largely related to the extent and location of areas that are impacted. Such events can cause property damage as well as loss of life; however, events may also occur in remote areas of the county where there is little to no impact to people or property.

Subsidence is typically not dangerous but it does cause major economic problems in the form of damage to structures, pipelines, drainage systems, and sewer systems. Property exposed to subsidence and erosion can sustain minor damages or can result in complete destruction. Land subsidence can lead to many problems, including changes in elevation; damage to structures such as storm drains, sanitary sewers, roads, railroads, canals, levees and bridges; structural damage to public and private buildings; and damage to wells. FEMA estimates that there are over $125 million in losses in the U.S. annually as a result of subsidence. While groundwater withdrawals have been restricted over the last forty years in the coastal area, subsidence may continue to develop from other types of below ground withdrawals or from natural forces.

Expansive soil is the hidden force behind basement and foundation problems. The U.S. Department of Agriculture (USDA) claims that expansive soils are responsible for more home damage every year than floods, tornadoes and hurricanes combined. The USDA estimates 50% of all homes in the U.S. are built on expansive soils. Each year in the U.S., expansive soils cause $2.3 billion in structural damage. Structures may be condemned as a result of this damage resulting in large losses.

Structures exposed to erosion hazard areas may be undermined, resulting in damages. This may also result in the condemnation of a structure. Additionally, physical loss land area may occur as a result of erosion.

8.2.5 Warning Time

Subsidence can happen suddenly and without warning or can occur gradually over time. Soil erosion and deposition generally occurs gradually over time; however, these processes may be intensified as a result of natural or human-induced activities.

8.3 SECONDARY HAZARDS

Events that cause damage to improved areas can result in secondary hazards, such as explosions from natural gas lines, loss of utilities such as water and sewer due to shifting infrastructure, and potential failures of reservoir dams. Additionally, these events may occur simultaneously with other natural hazards such as flooding. Erosion can cause undercutting that can result in an increase in landslide or rockfall hazards. Additionally erosion can result in the loss of topsoil, which can affect agricultural production in the area. Deposition can have impacts that aggravate flooding, bury crops, or reduce capacities of water reservoirs.

8.4 CLIMATE CHANGE IMPACTS

In areas where climate change results in less precipitation and reduced surface-water supplies, communities will pump more groundwater. Changes in precipitation events and the hydrological cycle may result in changes in the rate of subsidence and soil erosion. According to a 2003 paper published by the Soil and Water Conservation Society (Soil and Water Conservation 2003):

> *The potential for climate change – as expressed in changed precipitation regimes – to increase the risk of soil erosion, surface runoff, and related environmental consequences is clear. The actual damage that would result from such a change is unclear. Regional, seasonal, and temporal variability in precipitation is large both in simulated climate regimes and in the existing climate record. Different landscapes vary greatly in their vulnerability to soil erosion and runoff. Timing of agricultural production practices creates even greater vulnerabilities to soil erosion and runoff during certain seasons. The effect of a particular storm event depends on the moisture content of the soil before the storm starts. These interactions between precipitation, landscape, and management mean the actual outcomes of any particular change in precipitation regime will be complex.*

8.5 EXPOSURE

Coastal Erosion

San Saba County does not have coastal erosion exposure due to its inland location (approximately 250 miles inland).

Expansive Soils

While all structures and foundations are exposed to expansive soils, San Saba County's minimal clay soil composition decreases the likelihood and severity of the seasonal swelling and contraction of soils.

Land Subsidence

San Saba County does not have a history of groundwater depletion and there is no known database of specific groundwater depletion events for this area. However, current growth trends could cause more county residents to be exposed to this hazard. The exposure of people, property, critical facilities, and the environment is described below. Soil erosion and deposition events are continually occurring throughout the county.

8.5.1 Population

The entire planning area is exposed to some extent to subsidence, expansive soils, and erosion events. Certain areas are more exposed due to geographic location and local weather patterns. Populations living at higher elevations and on hilly slopes may be more susceptible to seasonal erosion and deposition. Populations in agricultural areas are at risk for possible subsidence especially in areas groundwater has been pumped for irrigation.

In the future, increasing population may result in subsidence problems in metropolitan areas where damage from subsidence will be great. These events may damage infrastructure and result in loss of life. Current growth trends could cause more county residents to be exposed to erosion and expansive soils. Increased population will increase demands on groundwater supplies, causing more land subsidence in areas already subsiding and new subsidence in areas where subsidence has not yet occurred.

8.5.2 Property

According to the San Saba County HAZUS 2.2 inventory data (updated with 2010 U.S. Census data and 2014 RS Means Square Foot Costs), there are 3,162 buildings within the San Saba County with an asset replaceable value of more than $635 million (excluding contents). About 99% of these buildings (and 84% of the building value) are associated with residential housing. Within the participating communities, there are 2,951 buildings (residential, commercial, and other) with a total asset inventory value of over $587 million (excluding contents). Other types of buildings in this report include agricultural, education, religious, and governmental structures. Structures and other improvements located in areas prone to subsidence or soil erosion are exposed to risk from these hazards. Additionally, deposition may result in damage to structures and property.

8.5.3 Critical Facilities and Infrastructure

Any critical facilities or infrastructure that are located on or near areas prone to subsidence, expansive soils, and soil erosion are exposed to risk from the hazard. Deposition may result in additional exposure.

8.5.4 Environment

Subsidence, expansive soils, erosion and deposition are all naturally occurring processes, but can still cause damage to the natural environment. These processes and events can alter the natural environment where they occur.

8.6 VULNERABILITY

8.6.1 Population

The risk of injury or fatalities as a result of these hazards are limited, but possible. Spontaneous collapse and opening of voids are rare, but still may occur resulting in death or injury to any people in the area at the time. It is likely that any such injuries would be highly localized to the area directly impacted by an event. Erosion can adversely impact populations who have respiratory issues by reducing air quality, so those with existing respiratory issues are likely to be more vulnerable.

8.6.2 Property

Property exposed to subsidence and erosion can sustain minor damages or can result in complete destruction. According to several studies, an inch of differential subsidence beneath a residential structure can cause several thousand dollars of damage. Structures may be condemned as a result of this damage resulting in large losses. FEMA estimates that there are over $125 million in losses in the U.S. annually as a result of subsidence. Structures exposed to erosion hazard areas may be undermined, resulting in damages. This may also result in the condemnation of a structure. Additionally, physical loss land area may occur as a result of erosion.

8.6.3 Critical Facilities and Infrastructure

Subsidence can result in serious structural damage to critical facilities and infrastructure such as roads, irrigation ditches, underground utilities, and pipelines. Large ground displacements caused by collapsing soils can totally destroy roads and structures and alter surface drainage. Minor cracking and distress may result as the improvements respond to small adjustments in the ground beneath them. Erosion can also impact structures such as bridges and roads by undermining their foundations. Structures and underground utilities found in areas prone to subsidence or soil erosion can suffer from distress.

Even though expansive soils cause enormous amounts of damage, the effects can occur slowly and may not be attributed to a specific event. The damage done by expansive soils is then attributed to poor construction practices or a misconception that all buildings experience this type of damage as they age. Cracked foundations, floors, and basement walls, as well damage to the upper floors of the building when the motion in the structure is significant are typical types of damage done by swelling soils. Shrinkage can remove support from buildings or other structures and result in damaging subsidence.

8.6.4 Environment

Ecosystems that are exposed to increased sedimentation as a result of erosion and deposition degrades habitat. However, some erosion and disposition is required for healthful ecosystem functioning. Ecosystems that are already exposed to other pressures, such as encroaching development, may be more vulnerable to impacts from these hazards.

8.7 FUTURE TRENDS IN DEVELOPMENT

According to the *2013 State of Texas Hazard Mitigation Plan* (TDEM 2013):

> *Because of climate change, the Texas Coast is becoming exposed to increasing risk of inundation and coastal erosion over the coming decades. Sea level rise measured by Texas Coastal Ocean Observation Network tide gauges in the Galveston area measured a current rise of about 6 millimeters per year. At this current rate of rise, local sea levels in the Galveston area can be projected to be 0.6 meters (approximately 2 feet) by the year 2100. With current rates of coastal subsidence and with the majority of the Texas Gulf Coast being characterized by low-lying topography, in addition to a broad gently sloping outer continental shelf, this anticipated rise in sea level is important. A small rise in sea level along the Texas Coast can result in a significant shoreline retreat and an increased risk of inundation of wetlands, marshes, private property, and public infrastructure. Relative sea level rise increases the vulnerability of barrier islands and peninsulas along the Texas Coast to inundation from storm surge, even from smaller storms and coastal weather systems.*

As steward of the Texas coast, the Texas GLO is leading the fight against coastal erosion by:

- Implementing coastal erosion response projects and related studies through the Coastal Erosion Planning and Response Act (CEPRA) program and other grant programs at the GLO.
- Maximizing federal, state, and local resources. The GLO works with all coastal stakeholders to fight erosion where it makes economic sense to do so.

Jurisdictions in the planning area should ensure that known hazard areas are regulated under their planning and zoning programs. In areas where hazards may be present, permitting processes should require geotechnical investigations to access risk and vulnerability to hazard areas. Erosion issues generally do not impact land use except along river channels. Issues pertaining to land use in these areas are likely addressed through jurisdictional floodplain ordinances and regulations.

8.8 SCENARIO

A worst case scenario would occur if a rapidly occurring sinkhole opened up beneath a structure where many individuals lived or worked. This situation could result in a number of injuries or fatalities and would cause extensive damage to the area directly impacted.

8.9 ISSUES

The major issues for subsidence, sinkholes, erosion, and deposition are the following:

- Onset of actual or observed subsidence in many cases is related to changes in land use. Land uses permitted in known hazard areas should be carefully evaluated.
- Knowledge of hydrologic factors is critical for evaluating most types of ground subsidence.
- Abandoned mine information is incomplete. There may be hazards in unknown locations in addition to known locations.
- Some housing developments have had subsidence hazard investigations completed before development. This practice should be reviewed and expanded as needed.
- Many older sinkholes have been covered with recent soil infilling and are completely concealed at the surface.
- Human activities greatly influence the rate and extent of erosion and deposition. Activities should be evaluated before proceeding.
- Riverine erosion can reduce water quality and impact aquatic habitat as well as impact private property and critical infrastructure.
- More detailed analysis should be conducted for critical facilities and infrastructure exposed to hazard areas. This analysis should address how potential structural issues were addressed in facility design and construction.
- Evaluate how Texas should address sea level rise and it causal effect on coastal subsidence and coastal erosion.
- Texas is one of the leading consumers of water in the nation and also uses extensive irrigation agriculture. Alternates source of water should be researched.
- The increased (potential and existing) use of groundwater and its effects land subsidence should be addressed.

CHAPTER 9.
DAM/LEVEE FAILURE

DAM/LEVEE FAILURE RANKING	
San Saba County	Medium
City of San Saba	No Exposure

9.1 GENERAL BACKGROUND

9.1.1 Dams

Water is an essential natural resource and one of the most efficient ways to manage and control water resources is through dam construction. A dam is defined in the Texas Water Code as a barrier, including one for flood detention, designed to impound liquid volumes and which has a height of dam greater than six feet" (Texas Administrative Code, Ch. 299, 1986).

The Texas Commission on Environmental Quality (TCEQ) has jurisdiction over rule changes to dams as 99% of dams are under state regulatory authority. Those regulations are implemented by the TCEQ Dam Safety Program, which monitors and regulates both private and public dams in Texas. The program periodically inspects dams that pose a high or significant hazard and makes recommendations and reports to dam owners to help them maintain safe facilities. The primary goal of the state's Dam Safety Program is to reduce the risk to lives and property from the consequences of dam failure.

In 2008, TCEQ proposed several rule changes including the definition of dams and dam classifications. According to the new definition, a dam in Texas is a barrier with a "height greater than or equal to 25 feet and a maximum storage (top of dam) capacity of 15 acre-feet; a height greater than 6 feet and a maximum storage capacity greater than or equal to 50 acre-feet; or one that poses a threat to human life or property in the event of failure, regardless of height or maximum storage capacity." Figure 9-1 shows the specifications required for a dam to be regulated by TCEQ.

DEFINITIONS

Breach — An opening through which floodwaters may pass after part of a levee has given way.

Dam Failure — An uncontrolled release of impounded water due to structural deficiencies in a dam.

Emergency Action Plan — A document that identifies potential emergency conditions at a dam and specifies actions to be followed to minimize property damage and loss of life. The plan specifies actions the dam owner should take to alleviate problems at a dam. It contains procedures and information to assist the dam owner in issuing early warning and notification messages to responsible downstream emergency management authorities of the emergency situation. It also contains inundation maps to show emergency management authorities the critical areas for action in case of an emergency. (FEMA 64)

High-Hazard Dam — Dams where failure or operational error will probably cause loss of human life. (FEMA 333)

Significant-Hazard Dam — Dams where failure or operational error will result in no probable loss of human life but can cause economic loss, environmental damage, or disruption of lifeline facilities, or can impact other concerns. Significant hazard dams are often located in rural or agricultural areas but could be located in areas with population and significant infrastructure. (FEMA 333)

Accredited Levee — A levee that is shown on a Flood Insurance Rate Map (FIRM) as providing protection from the 1% annual chance or greater flood. A **non-accredited or de-accredited levee** is a levee that is not shown on a FIRM as providing protection from the 1% annual chance or greater flood. A **provisionally accredited levee** is a previously accredited levee that has been de-accredited for which data and/or documentation is pending that will show the levee is compliant with National Flood Insurance Program (NFIP) regulations.

Source: DamSafetyAction.Org, Texas

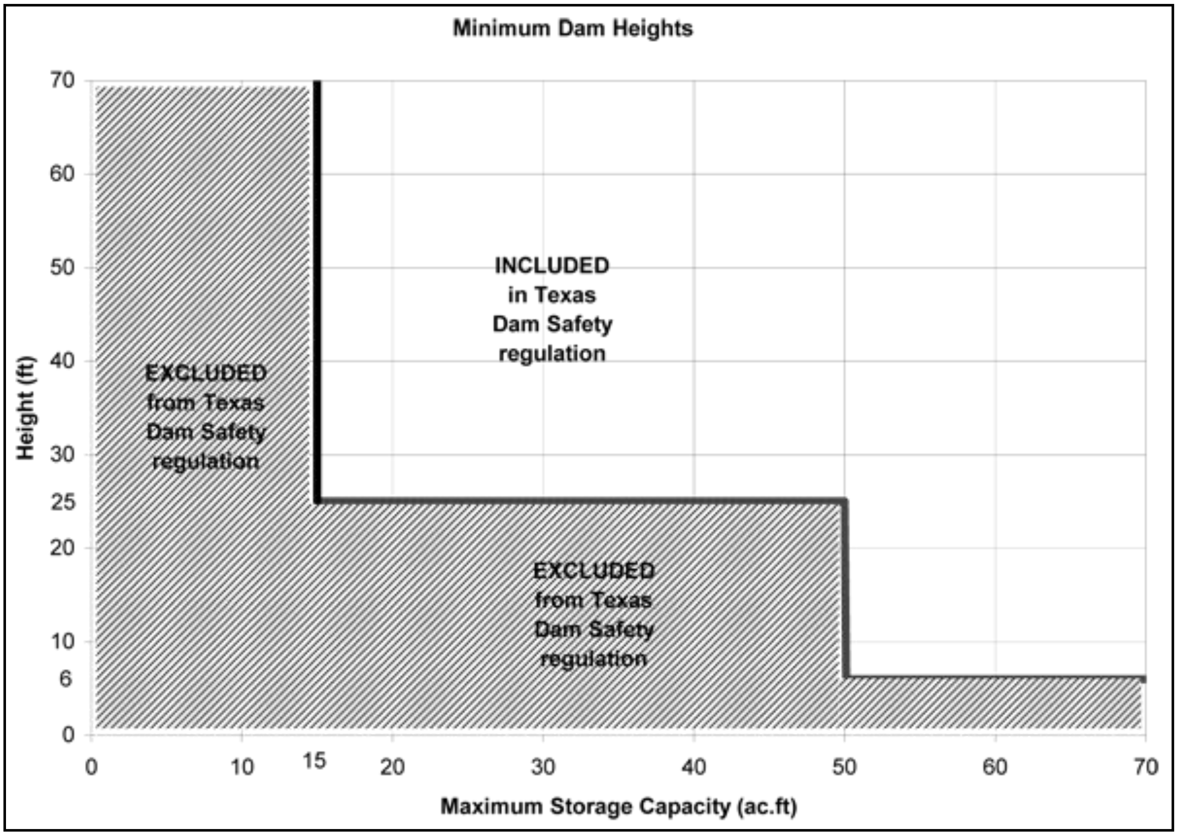


Figure 9-1. TCEQ Dam Definition

The majority of dams and lakes in Texas are used for water supply. Dams also provide benefits such as irrigation for agriculture, hydropower, flood control, maintenance of lake levels, and recreation. The primary purposes and benefits of dams are shown on Figure 9-2. However, despite the benefits and importance of dams to our public works infrastructure, many safety issues exist for dams as with any complex infrastructure; the most serious threat is dam failure. Approximately 59% of the dams in San Saba County are owned by either the local government or local government agency. The remaining 41% are privately owned.

Source: FEMA, Dams

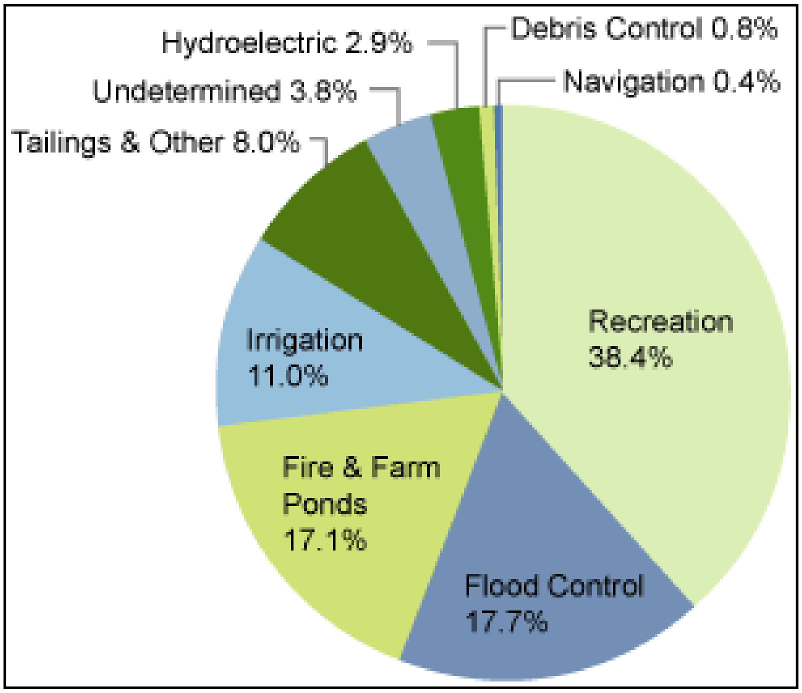


Figure 9-2. Primary Purpose/Benefit of U.S. Dams

9.1.2 Levees

The Federal Emergency Management Agency (FEMA) defines a levee as a "man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding." The terms dike and levee are sometimes used interchangeably. A few examples of levee systems are the Texas City Hurricane Protection Structure, Freeport Hurricane Protection Structure, the Port Arthur Hurricane Protection Structure in the Houston area, and the Trinity Floodway Levees in the Dallas area. Levees reduce the risk of flooding but no levee system can eliminate all flood risk. There is always a chance that a flood will exceed the capacity of a levee, no matter how well built. Levees can work to provide critical time for local emergency management officials to safely evacuate residents during flooding events. The possibility exists that levees can be overtopped or breached by large floods; however, levees sometimes fail even when a flood is small.

Although there are levees in all 50 states, there is no single agency responsible for levee construction and maintenance. It is a common misperception that U.S. Army Corps of Engineers (USACE) manages all levees in the nation. In reality, the levees included in the USACE Levee Safety Program represent only about 10% of the nation's levees (as estimated by the National Committee on Levee Safety). Some estimates indicate that over 100,000 miles of levees exist across the nation. Of that number, the USACE designed and constructed over 14,000 miles of levees with another 14,000 to 16,000 miles operated by other federal agencies, such as the U.S. Bureau of Reclamation. The majority of the nation's levees were constructed by private and non-federal interests and are not federally operated or maintained. However, more than 10 million people live or work behind USACE program levees. For this reason, USACE considers its role in assessing, communicating, and managing risk to be a top priority. Figure 9-3 shows USACE program levees versus other levee programs.

Flooding can happen anywhere, but certain areas are especially prone to serious flooding. To help communities understand their risk behind levee structures, FEMA uses levee accreditation on flood insurance rate maps (FIRM) to show the locations with reduced risks from the base flood. Conditions in, near, or under levees can change due to environmental factors. The FIRMs take these factors into consideration. If the risk level for a property changes, so may the requirement to carry flood insurance.

Levee accreditation is FEMA's recognition that a levee is reasonably certain to contain the base (1% annual chance exceedance, sometimes referred to as the 100-year flood) regulatory flood. In order to be accredited, levee owners must certify to FEMA that the levee will provide protection from the base flood. Certification is a technical finding by a professional engineer based on data, drawings, and analyses that the levee system meets the minimum acceptable standards. FEMA's accreditation is not a guarantee of performance; it is intended to provide updated information for insurance and floodplain development.

Source: USACE

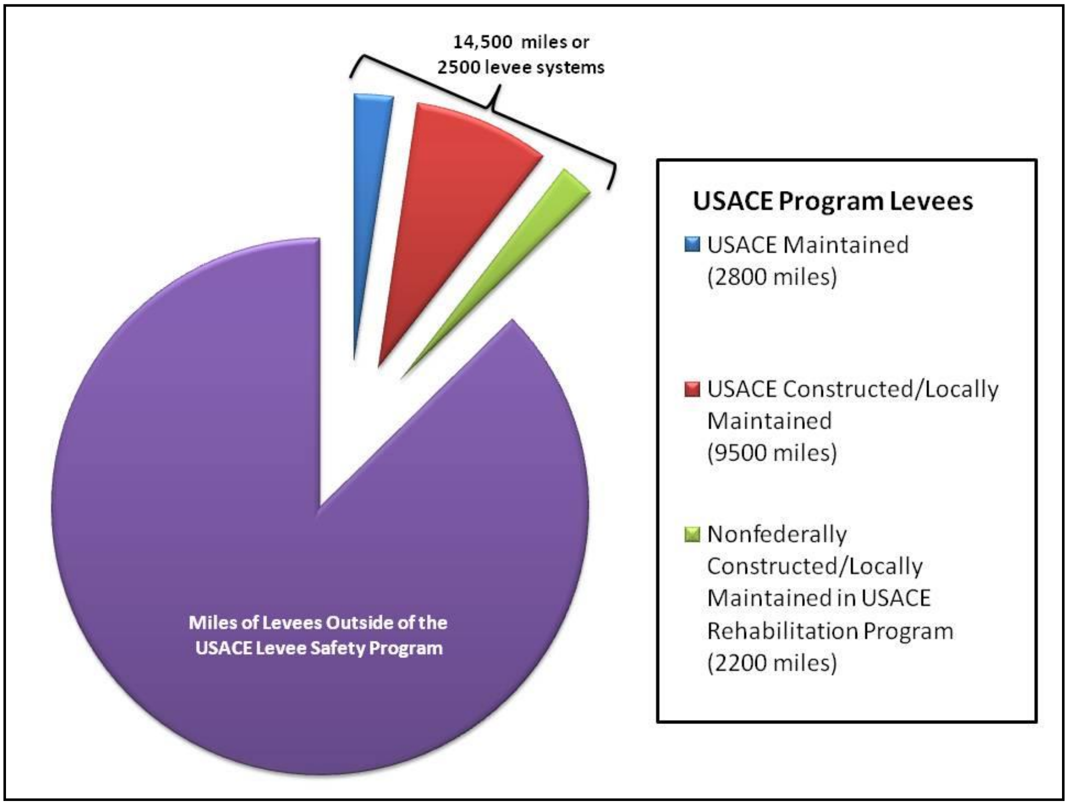


Figure 9-3. U.S. Levee Systems

9.1.3 Causes of Dam Failure

Dam failure is a collapse or breach in a dam. While most dams have storage volumes small enough that failures have little or no repercussions, dams with large storage amounts can cause significant downstream flooding. Dam failures in the United States typically occur from any one or combination of the following:

- Overtopping of the primary dam structure, which accounts for 34% of all dam failures, can occur due to inadequate spillway design, settlement of the dam crest, blockage of spillways, and other factors.
- Foundation defects due to differential settlement, slides, slope instability, uplift pressures, and foundation seepage can also cause dam failure. These account for 30% of all dam failures.
- Failure due to piping and seepage accounts for 20% of all failures. These are caused by internal erosion due to piping and seepage, erosion along hydraulic structures such as spillways, erosion due to animal burrows, and cracks in the dam structure.

- Failure due to problems with conduits and valves, typically caused by the piping of embankment material into conduits through joints or cracks, constitutes 10% of all failures.

The remaining 6% of U.S. dam failures are due to miscellaneous causes. Many dam failures in the United States have been secondary results from other disasters. The prominent causes are earthquakes, landslides, extreme storms, massive snowmelt, equipment malfunction, structural damage, foundation failures, and sabotage.

Poor construction, lack of maintenance and repair, and deficient operational procedures are preventable or correctable by a program of regular inspections. Terrorism and vandalism are serious concerns that all operators of public facilities must plan for; these threats are under continuous review by public safety agencies.

9.1.4 Causes of Levee Failure

Levee data used in this report is from the FEMA Midterm Levee Inventory (MLI) and the Hazards, United States-Multi Hazard (HAZUS-MH) database. The FEMA MLI captures all levee data (USACE and non-USACE), with a primary focus on levees that provide protection from the base (1% annual chance) flood. Levees providing less than base flood protection will also be included, but only for those levees with data readily available. The HAZUS-MH database and the FEMA MLI database did not list any levees in San Saba County. However, it is possible that there are private levees located within the county that are not listed in these databases.

A levee breach occurs when part of a levee gives way, creating an opening through which floodwaters may pass. A breach may occur gradually or suddenly. The most dangerous breaches happen quickly during periods of high water. The resulting torrent can quickly swamp a large area behind the failed levee with little or no warning.

Earthen levees can be damaged in several ways. For instance, strong river currents and waves can erode the surface. Debris and ice carried by floodwaters—and even large objects such as boats or barges—can collide with and gouge the levee. Trees growing on a levee can blow over, leaving a hole where the root wad and soil used to be. Burrowing animals can create holes that enable water to pass through a levee. If severe enough, any of these situations can lead to a zone of weakness that could cause a levee breach. In seismically active areas, earthquakes and ground shaking can cause a loss of soil strength, weakening a levee and possibly resulting in failure. Seismic activity can also cause levees to slide or slump, both of which can lead to failure. Unfortunately, in the rare occurrence when a levee system fails or is overtopped, severe flooding can occur due to increased elevation differences associated with levees and the increased water velocity that is created.

It is also important to remember that no levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure. In some cases, flooding may not be directly attributable to a river, stream, or lake overflowing its banks. Rather, it may simply be the combination of excessive rainfall or snowmelt, saturated ground, and inadequate drainage. With no place to go, the water will find the lowest elevations—areas that are often not in a floodplain. This type of flooding, often referred to as sheet flooding, is becoming increasingly prevalent as development outstrips the ability of the drainage infrastructure to properly carry and disburse the water flow. Flooding also occurs due to combined storm and sanitary sewers that cannot handle the amount of water.

The complicated nature of levee protection was made evident by events such as Hurricane Katrina. Flooding can be exacerbated by levees that are breached or overtopped. As a result, FEMA and USACE are re-evaluating their policies regarding enforcement of levee maintenance and post-flood rebuilding. Both agencies are also conducting stricter inspections to determine how much protection individual levees actually provide. The Texas Water Development Board's (TWDB) mission is to provide leadership, information, education, and support for planning, financial assistance, and outreach for the conservation and responsible development of water for Texas. TWDB will assist qualifying entities who are in good standing with the National Flood Insurance Program (NFIP) through technical and financial assistance. TWDB assistance may include grant funding, participation in levee inspections, assistance in developing Maintenance Deficiency Correction Plans, site visits, and participation in public hearings. In addition, the TWDB will also discourage the construction of new levees to protect new developments, and instead encourage other types of flood mitigation projects.

9.1.5 Regulatory Oversight

The potential for catastrophic flooding due to dam failures led to passage of the National Dam Safety Act (Public Law 92-367). The National Dam Safety Program requires a periodic engineering analysis of every major dam in the country. The goal of this FEMA-monitored effort is to identify and mitigate the risk of dam failure so as to protect the lives and property of the public.

Texas Rules and Regulations for Dam Safety and Dam Construction

Effective September 1, 2013, dams are exempt from safety requirements if they are located on private property, have a maximum impoundment capacity of less than 500 acre-feet, are classified as low or significant hazard, are located in a county with a population of less than 350,000 (as per 2010 U.S. Census), and are not located within the corporate limits of a municipality. Dam owners will still have to comply with maintenance and operation requirements. There is no exemption expiration date. Figure 9-4 shows counties in Texas that fall under this exemption criteria. Thirty of the dams in San Saba County are non-exempt while the others are exempt per 30 TAC 299.

To help the State Dam Safety Program achieve its goal, the state’s dam safety regulations now include the requirement for emergency action plans on all non-exempt Significant-Hazard and High-Hazard Potential dams (Title 30, Texas Administrative Code, Ch. 299, 299.61b).

U.S. Army Corps of Engineers Dam Safety Program

USACE is responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. USACE has inventoried dams; surveyed each state and federal agency’s capabilities, practices, and regulations regarding design, construction, operation and maintenance of the dams; and developed guidelines for inspection and evaluation of dam safety (USACE 1997).

Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) cooperates with a large number of federal and state agencies to ensure and promote dam safety. More than 3,000 dams are part of regulated hydroelectric projects in the FERC program. Two-thirds of these are more than 50 years old. As dams age, concern about their safety and integrity grows, so oversight and regular inspection are important. FERC inspects hydroelectric projects on an unscheduled basis to investigate the following:

- Potential dam safety problems
- Complaints about constructing and operating a project
- Safety concerns related to natural disasters
- Issues concerning compliance with the terms and conditions of a license

Every 5 years, an independent engineer approved by the FERC must inspect and evaluate projects with dams higher than 32.8 feet (10 meters) or with a total storage capacity of more than 2,000 acre-feet.

FERC monitors and evaluates seismic research and applies it in investigating and performing structural analyses of hydroelectric projects. FERC also evaluates the effects of potential and actual large floods on the safety of dams. During and following floods, FERC visits dams and licensed projects, determines the extent of damage, if any, and directs any necessary studies or remedial measures the licensee must undertake. The FERC publication *Engineering Guidelines for the Evaluation of Hydropower Projects* guides the FERC engineering staff and licensees in evaluating dam safety. The publication is frequently revised to reflect current information and methodologies.

FERC requires licensees to prepare emergency action plans and conducts training sessions on how to develop and test these plans. The plans outline an early warning system if there is an actual or potential sudden release of water from a dam due to failure. The plans include operational procedures that may be used, such as reducing reservoir levels and reducing downstream flows, as well as procedures for notifying affected residents and agencies responsible for emergency management. These plans are frequently updated and tested to ensure that everyone knows what to do in emergency situations.

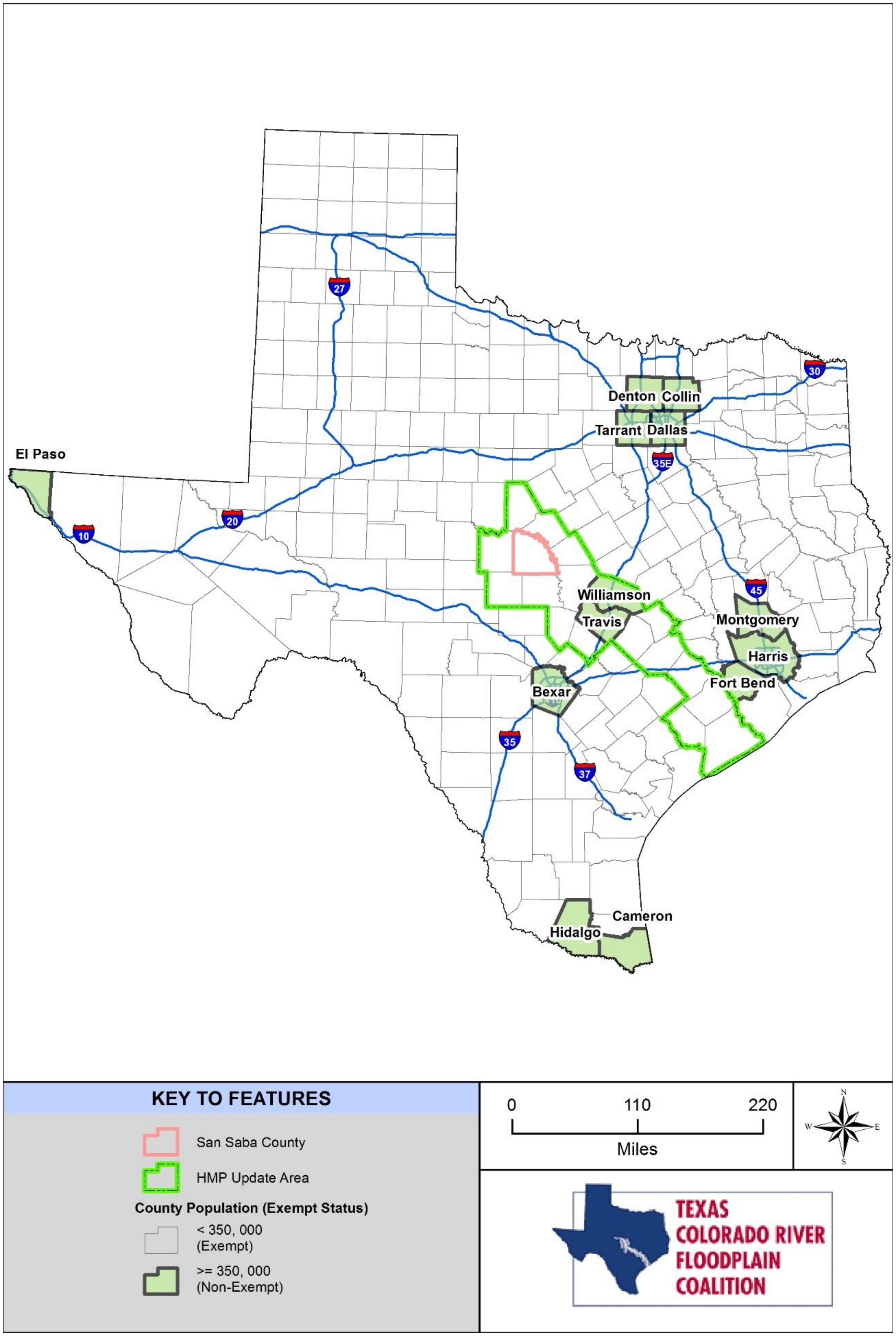


Figure 9-4. Texas County Population Exemptions for Dams

9.2 HAZARD PROFILE

9.2.1 Past Events

There are approximately 7,290 dams in the inventory of dams in Texas. Only two major dam failures have occurred in the entire Texas Colorado River Floodplain Coalition (TCRFC) planning region. Both occurred in the City of Austin, which is not a participating jurisdiction in this effort. The last failure for the city was in 1915.

After a series of high-profile failures throughout the United States during the 1960s and early 1970s, the U.S. Congress enacted legislation mandating inspections and strict safety requirements for all governmental and privately operated dams. Stricter state and federal dam safety regulations were adopted in the 1970s and 1980s as a direct response to numerous dam failures across the country. These standards require that dams be able to withstand the most severe flood imaginable, the Probable Maximum Flood (PMF). This flood is so severe and statistically remote that its probability of occurrence in any given year cannot be measured. Since that time the number of failures and deaths has dramatically decreased.

LCRA conducted a Dam Modernization Program between 1994 and 2004 to strengthen the dams in its jurisdiction and ensure their safety for years to come. This program addressed a common problem with the stability of the “gravity” sections of the dams. Since gravity sections derive strength from their size and weight, post-tensioned anchors were added to improve stability. The dam modernization program helps ensure that LCRA’s dams meet required design safety standards to resist the water load and pressure of the PMF.

An extreme precipitation event occurred May 23 through 25, 2015 (this event is further outlined in Chapter 12, Flood) causing a rise in the rivers and lakes in the county, including the Colorado River at San Saba (Figure 9-5); however no releases occurred from LCRA.

Source: LCRA

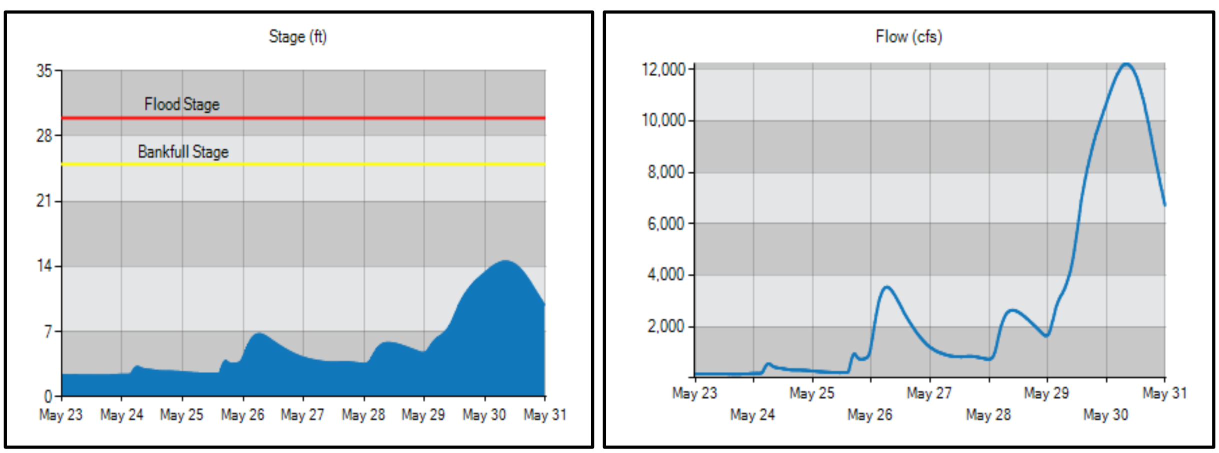


Figure 9-5. Colorado River Water Surface Elevation and Flow During the May 2015 Precipitation Event

9.2.2 Location

TWDB provided a database of dams based on the National Inventory of Dams. This database lists 46 dams in San Saba County and classifies dams based on the potential hazard to the downstream area resulting from failure or mis-operation of the dam or facilities:

- High-Hazard Potential—Probable loss of life (one or more persons)
- Significant-Hazard Potential—No probable loss of human life but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns; often located in

predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure

- Low-Hazard Potential—No probable loss of human life and low economic or environmental losses; losses are principally limited to the owner's property

Based on these classifications, there are nine high-hazard and three significant-hazard dams in San Saba County. The high-and significant-hazard dams in the participating communities and in the unincorporated county are listed on Table 9-1. Figure 9-6 shows locations of the high-hazard and significant hazard dams in the county.

TABLE 9-1.
HIGH- AND SIGNIFICANT-HAZARD DAMS IN SAN SABA COUNTY

Name	Near City [a]	Max Storage (Acre-Feet)	Hazard Class
Lower San Saba River WS SCS Site 14A Dam	San Saba County Unincorporated Area	4,185	High
Lower San Saba River WS SCS Site 8 Dam	San Saba County Unincorporated Area	696	High
Lower San Saba River WS SCS Site 7 Dam	San Saba County Unincorporated Area	2,393	High
Lower San Saba River WS SCS Site 2 Dam	San Saba County Unincorporated Area	4,846	High
Lower San Saba River WS SCS Site 3 Dam	San Saba County Unincorporated Area	2,106	High
Lower San Saba River WS SCS Site 4 Dam	San Saba County Unincorporated Area	2,319	High
Lower San Saba River WS SCS Site 5 Dam	San Saba County Unincorporated Area	1,099	High
Lower San Saba River WS SCS Site 6 Dam	San Saba County Unincorporated Area	1,107	High
Lower San Saba River WS SCS Site 13A Dam	San Saba County Unincorporated Area	4,269	High
Southeast Laterals WS SCS Site 8A-1 Dam	San Saba County Unincorporated Area	2,020	Significant
Lake Margery Dam	San Saba County Unincorporated Area	1,215	Significant
Childress Lake Dam	City of San Saba	314	Significant

a . Data shown in this table is for dams in participating communities only.
Source: Texas Water Development Board

There are an uncounted number of 'non-jurisdictional' dams on public and private lands in the county. These are small dams that normally do not store water but may impound water during heavy precipitation events. Because they are not monitored or maintained, there is potential for them to overtop or fail and cause flooding and property damage during a significant rainfall event. The extent and risk associated with these dams is not known.

The areas of the county most likely to be impacted by a dam failure are the downstream areas of the City of San Saba along the San Saba River and the Richland Springs Creek Community along Richland Springs Creek. San Saba County could be impacted by several high-hazard dams that are located outside of the county. If a failure of one of these high-hazard dams occurred, it could result in loss of life. Other high-hazard dams are located outside of the county and their drainages enter San Saba County either by direct drainage through parts of the county or by inflow into the San Saba River or Richland Springs Creek upstream from McCulloch County.

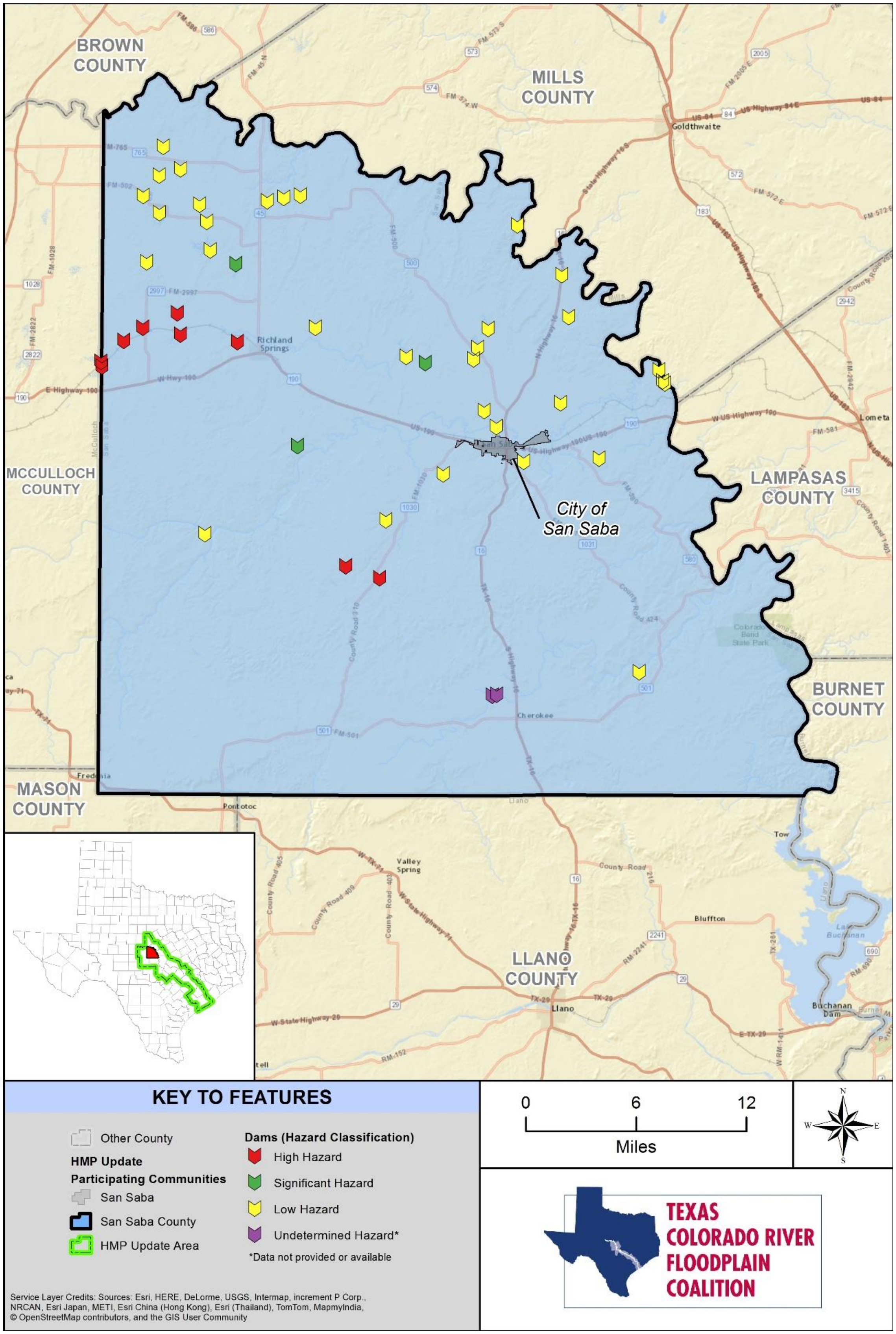


Figure 9-6. Locations of Dams in San Saba County

9.2.3 Frequency

There have been no occurrences of dam failure in the past 100 years in San Saba County. Overall, the probability of a dam failure somewhere in San Saba County is considered rare.

9.2.4 Severity

USACE and TCEQ developed the classification system shown in Table 9-2 and Table 9-3 for the hazard potential of dam failures. The hazard rating systems are both based only on the potential consequences of a dam failure; neither system takes into account the probability of such failures.

**TABLE 9-2.
USACE HAZARD POTENTIAL CLASSIFICATION**

Hazard Category [a]	Direct Loss of Life [b]	Lifeline Losses [c]	Property Losses [d]	Environmental Losses [e]
Low	None (rural location, no permanent structures for human habitation)	No disruption of services (cosmetic or rapidly repairable damage)	Private agricultural lands, equipment, and isolated buildings	Minimal incremental damage
Significant	Possible (rural location, only transient or day-use facilities)	Disruption of essential facilities and access	Major public and private facilities	Major mitigation required
High	Certain (one or more persons; extensive residential, commercial, or industrial development)	Disruption of essential facilities and access	Extensive public and private facilities	Extensive mitigation cost or impossible to mitigate

a. Categories are assigned to overall projects, not individual structures at a project.

b. Loss of life potential based on inundation mapping of area downstream of the project. Analyses of loss of life potential should take into account the population at risk, time of flood wave travel, and warning time.

c. Indirect threats to life caused by the interruption of lifeline services due to project failure or operational disruption; for example, loss of critical medical facilities or access to them.

d. Damage to project facilities and downstream property and indirect impact due to loss of project services, such as impact due to loss of a dam and navigation pool, or impact due to loss of water or power supply.

e. Environmental impact downstream caused by the incremental flood wave produced by the project failure, beyond what would normally be expected for the magnitude flood event under which the failure occurs.

Source: U.S. Army Corps of Engineers 1995

TABLE 9-3.
TCEQ HAZARD POTENTIAL CLASSIFICATION

Hazard Category	Human Impact	Economic Impact
Low	No loss of life expected (no lives or permanent habitable structures in the inundation area)	Minimal economic loss (failure may cause damage to occasional farms, agricultural improvements, and minor highways)
Significant	Loss of life is possible (1 to 6 lives or 1 to 2 permanent habitable structures in the inundation area)	Appreciable economic loss (failure may cause damage to isolated homes, secondary highways, minor railroads, or cause interruption of public services)
High	Loss of life is expected (7 or more lives or 3 or more permanent habitable structures in the inundation area)	Excessive economic losses (failure may cause damage to public, agricultural, industrial, or commercial facilities or utilities, and main highways or railroads)

Source: Texas Commission on Environmental Quality, http://www.tceq.texas.gov/field/damsafetyprog.html

9.2.5 Warning Time

Warning time for dam failure varies depending on the cause of the failure. In events of extreme precipitation or massive snowmelt, evacuations can be planned with sufficient time. In the event of a structural failure due to earthquake, there may be no warning time. A dam’s structural type also affects warning time. Earthen dams do not tend to fail completely or instantaneously. Once a breach is initiated, discharging water erodes the breach until either the reservoir water is depleted or the breach resists further erosion. Concrete gravity dams also tend to have a partial breach as one or more monolith sections are forced apart by escaping water. The time of breach formation ranges from a few minutes to a few hours (USACE 1997).

Emergency action plans for all high-hazard dams that would affect San Saba County are on file with TCEQ. Additionally, possible evacuation routes in the event of a failure have been identified.

9.3 SECONDARY HAZARDS

Dam failure can cause severe downstream flooding, depending on the magnitude of the failure. Other potential secondary hazards of dam failure are landslides around the reservoir perimeter, bank erosion on the rivers, and destruction of downstream habitat.

9.4 CLIMATE CHANGE IMPACTS

Dams are designed partly based on assumptions about a river’s flow behavior, expressed as hydrographs. Changes in weather patterns can have significant effects on the hydrograph used for the design of a dam. If the hygrograph changes, it is conceivable that the dam can lose some or all of its designed margin of safety, also known as freeboard. If freeboard is reduced, dam operators may be forced to release increased volumes earlier in a storm cycle in order to maintain the required margins of safety. Such early releases of increased volumes can increase flood potential downstream.

Dams are constructed with safety features known as “spillways.” Spillways are put in place on dams as a safety measure in the event of the reservoir filling too quickly. Spillway overflow events, often referred to as “design failures,” result in increased discharges downstream and increased flooding potential. Although climate change will not increase the probability of catastrophic dam failure, it may increase the probability of design failures.

9.5 EXPOSURE AND VULNERABILITY

Dam and levee failure inundation mapping for the planning area was not available to allow HAZUS loss estimations. Historical records, exposures, and vulnerability are described in general in this chapter.

Overall, dam failure impacts would likely be rare and limited in San Saba County, largely affecting the downstream areas during a failure event. Roads closed due to dam failure floods could result in serious transportation disruptions due to the limited number of roads in the county.

9.5.1 Population

Vulnerable populations are all populations downstream from dam failures that are incapable of escaping the area within the allowable time frame. This population includes the elderly and young who may be unable to get themselves out of the inundation area. The vulnerable population also includes those who would not have adequate warning from a television or radio emergency warning system.

9.5.2 Property

Vulnerable properties are those closest to the dam inundation area. These properties would experience the largest, most destructive surge of water. Low-lying areas are also vulnerable since they are where the dam waters would collect. Transportation routes are vulnerable to dam inundation and have the potential to be wiped out, creating isolation issues. This includes all roads, railroads, and bridges in the path of the dam inundation. Those that are most vulnerable are those that are already in poor condition and would not be able to withstand a large water surge. Utilities such as overhead power lines, cable and phone lines could also be vulnerable. Loss of these utilities could create additional isolation issues for the inundation areas.

9.5.3 Critical Facilities and Infrastructure

Any critical facilities or infrastructure that are located within the dam inundation area are exposed to risk from the hazard. Dam or levee failure can result in serious structural damage to critical facilities and infrastructure, in particular roads, bridges, underground utilities, and pipelines.

9.5.4 Environment

Reservoirs held behind dams affect many ecological aspects of a river. River topography and dynamics depend on a wide range of flows, but rivers below dams often experience long periods of very stable flow conditions or saw-tooth flow patterns caused by releases followed by no releases. Water releases from dams usually contain very little suspended sediment; this can lead to scouring of river beds and banks.

The environment would be vulnerable to a number of risks in the event of dam failure. The inundation could introduce many foreign elements into local waterways. This could result in destruction of downstream habitat and could have detrimental effects on many species of animals.

9.6 FUTURE TRENDS IN DEVELOPMENT

Land use in the planning area will be directed by general plans. The safety elements of the general plans establish standards and plans for the protection of the community from hazards. Dam failure is not typically addressed as a standalone hazard in the safety elements, but flooding is. The planning partners have established plans and policies regarding sound land use in identified flood hazard areas. Most of the areas vulnerable to the more severe impacts from dam failure are likely to intersect the mapped flood hazard areas. Flood-related policies in the general plans will help to reduce the risk associated with the dam failure hazard for all future development in the planning area.

9.7 SCENARIO

An earthquake in the region (although rare) could lead to liquefaction of soils around a dam or levee. This could occur without warning during any time of the day. A human-caused failure such as a terrorist attack also could trigger a catastrophic failure of a dam or levee that impacts the planning area. While the probability of dam or levee failure is very low, the probability of flooding associated with changes to dam operational parameters in response to climate change is higher. Dam and levee designs and operations are developed based on hydrographs with historical record. If these hydrographs experience significant changes over time due to the impacts of climate change, the design and operations may no longer be valid for the changed condition. This could have significant impacts on dams and levees that provide flood control. Specified release rates and impound thresholds may have to be changed. This would result in increased discharges downstream of these facilities, thus increasing the probability and severity of flooding.

9.8 ISSUES

The most significant issue associated with dam and levee failure involves the properties and populations in the inundation zones. Flooding as a result of a dam failure would significantly impact these areas. There is often limited warning time for dam failure. These events are frequently associated with other natural hazard events such as earthquakes, landslides, or severe weather, which limits their predictability and compounds the hazard. Important issues associated with dam failure hazards include the following:

- Federally regulated dams have an adequate level of oversight and sophistication in the development of emergency action plans for public notification in the unlikely event of failure. However, the protocol for notification of downstream citizens of imminent failure needs to be tied to local emergency response planning.
- Mapping for federally regulated dams is already required and available; however, mapping for non-federally regulated dams that estimates inundation depths is needed to better assess the risk associated with dam failure from these facilities.
- Most dam failure mapping required at federal levels requires determination of the PMF. While the PMF represents a worst-case scenario, it is generally the event with the lowest probability of occurrence. For non-federally regulated dams, mapping of dam failure scenarios that are less extreme than the PMF but have a higher probability of occurrence can be valuable to emergency managers and community officials downstream of these facilities. This type of mapping can illustrate areas potentially impacted by more frequent events to support emergency response and preparedness.
- The concept of residual risk associated with structural flood control projects should be considered in the design of capital projects and the application of land use regulations.
- Security concerns should be addressed and the need to inform the public of the risk associated with dam failure is a challenge for public officials.

CHAPTER 10.
DROUGHT AND EXTREME HEAT

DROUGHT AND EXTREME HEAT RANKING		
Jurisdiction	**Drought**	**Extreme Heat**
San Saba County	High	High
City of San Saba	Low	High

DEFINITIONS

Drought — The cumulative impacts of several dry years on water users. It can include deficiencies in surface and subsurface water supplies and generally impacts health, well-being, and quality of life.

Extreme Heat — Summertime weather that is substantially hotter or more humid than average for a location at that time of year.

10.1 GENERAL BACKGROUND

10.1.1 Drought

Drought is a normal phase in the climatic cycle of most geographical areas. According to the National Drought Mitigation Center, drought originates from a deficiency of precipitation over an extended period, usually a season or more. This results in a water shortage for some activity, group, or environmental sector. Drought is the result of a significant decrease in water supply relative to what is "normal" in a given location. Unlike most disasters, droughts normally occur slowly but last a long time. There are four generally accepted operational definitions of drought (Wilhite and Glantz 1985):

- **Meteorological drought** is an expression of precipitation's departure from normal over some period of time. Meteorological measurements are the first indicators of drought. Definitions are usually region-specific, and based on an understanding of regional climatology. A definition of drought developed in one part of the world may not apply to another, given the wide range of meteorological definitions.
- **Agricultural drought** occurs when there is not enough soil moisture to meet the needs of a particular crop at a particular time. Agricultural drought happens after meteorological drought but before hydrological drought. Agriculture is usually the first economic sector to be affected by drought.
- **Hydrological drought** refers to deficiencies in surface and subsurface water supplies. It is measured as stream flow and as lake, reservoir, and groundwater levels. There is a time lag between lack of rain and the volume of water in streams, rivers, lakes, and reservoirs, so hydrological measurements are not the earliest indicators of drought. After precipitation has been reduced or deficient over an extended period of time, this shortage is reflected in declining surface and subsurface water levels. Water supply is controlled not only by precipitation, but also by other factors, including evaporation (which is increased by higher than normal heat and winds), transpiration (the use of water by plants), and human use.
- **Socioeconomic drought** occurs when a physical water shortage starts to affect people, individually and collectively. Most socioeconomic definitions of drought associate it with the supply and demand of an economic good.

Defining when drought begins is a function of the impacts of drought on water users, and includes consideration of the supplies available to local water users as well as the stored water they may have available in surface reservoirs or groundwater basins. Different local water agencies have different criteria for defining drought conditions in their jurisdictions. Some agencies issue drought watch or drought warning announcements to their customers. Determinations of regional or statewide drought conditions are usually based on a combination of hydrologic and water supply factors.

10.1.2 Extreme Heat

Excessive heat events are defined by the U.S. Environmental Protection Agency (EPA) as "summertime weather that is substantially hotter or more humid than average for a location at that time of year" (EPA 2006). Criteria that define an excessive heat event may differ among jurisdictions and in the same jurisdiction depending on the time of year. Excessive heat events are often a result of more than just ambient air temperature. Heat index tables (see Figure 10-1) are commonly used to provide information about how hot it feels, which is based on the interactions between several meteorological conditions. Since heat index values were devised for shady, light wind conditions, exposure to full sunshine can increase heat index values by up to 15 degrees Fahrenheit (°F). Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.

Source: NOAA National Weather Service

NOAA's National Weather Service

Heat Index

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution Extreme Caution Danger Extreme Danger

Classification	Heat Index	Effect on the body
Caution	80°F - 90°F	Fatigue possible with prolonged exposure and/or physical activity
Extreme Caution	90°F - 103°F	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity
Danger	103°F - 124°F	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity
Extreme Danger	125°F or higher	Heat stroke highly likely

Figure 10-1. Heat Index Table

10.2 HAZARD PROFILE

Droughts originate from a deficiency of precipitation resulting from an unusual weather pattern. If the weather pattern lasts a short time (a few weeks or a couple months), the drought is considered short-term. If the weather pattern becomes entrenched and the precipitation deficits last for several months or years, the drought is considered to be long-term. It is possible for a region to experience a long-term circulation pattern that produces drought, and to have short-term changes in this long-term pattern that result in short-term wet spells. Likewise, it is possible for a long-term wet circulation pattern to be interrupted by short-term weather spells that result in short-term drought.

Precipitation into the area lakes and dams is the main source of Texas' water supply. Precipitation is the only naturally reoccurring/renewable water supply for San Saba County. Annual precipitation in the populated areas of the planning area is approximately 25 to 40 inches per year. There are various streams and tributaries contributing to water supply in the area. This supply is stored in four forms throughout the state: streamflow, reservoir water, soil moisture, and groundwater.

The summer months in Texas are frequently affected by severe heat hazards. Persistent domes of high pressure establish themselves, which set up hot and dry conditions. This high pressure prevents other weather features such as cool fronts or rain events from moving into the area and providing necessary relief. Daily high temperatures range into the upper 90s and low 100s. When combined with moderate to high relative humidity levels, the heat index moves into dangerous levels, and a heat index of 105°F is considered the level where many people begin to experience extreme discomfort or physical distress.

10.2.1 Past Events

Drought

Texas officially experienced the driest nine-month period in the state's history between October 2010 and June 2011 according to the National Weather Service (NWS) in Fort Worth. This beat the previous record of June 1917 to February 1918. The substantial dry period has led to widespread extreme to exceptional drought conditions throughout the state. The 2010-2011 drought neared record levels, ranking as the third worst in Texas history. The worst of the 2010-2011 drought was found in central and western Texas where precipitation deficits during the 10 months exceeded 20 inches in some areas.

Based on previous occurrences, drought conditions in Central Texas counties, such as San Saba County, are usually drastic, typically with periods of abnormal dryness, moderate, and severe drought. These drought conditions are shown as D0, D1, and D2 drought intensity in Figure 10-2 and Figure 10-3. These figures show the severity of drought conditions in Texas in spring 2012 and spring 2015. As of March 2015, portions of San Saba County was still experiencing severe drought conditions. However, the drought conditions changed in May 2015 with heavy spring rains falling over the Texas region. San Saba County, like much of Texas, saw its wettest May on record. Texas received a statewide average of 8.81 inches of rain in May 2015, exceeding the previous record wet month of June 2004 during which a statewide average of 6.66 inches of rain fell, according to the Office of the State Climatologist at Texas A&M University. The Texas region received more rain in the first 5 months of 2015 than in all of 2011.

Figure 10-4 shows the drought conditions as of June 2015. For the first time in 3 years, none of the state falls within the U.S. Drought Monitor's most severe classification. Most of San Saba County is still experiencing abnormally dry conditions but area reservoirs experienced large capacity gains during the spring and early summer of 2015.

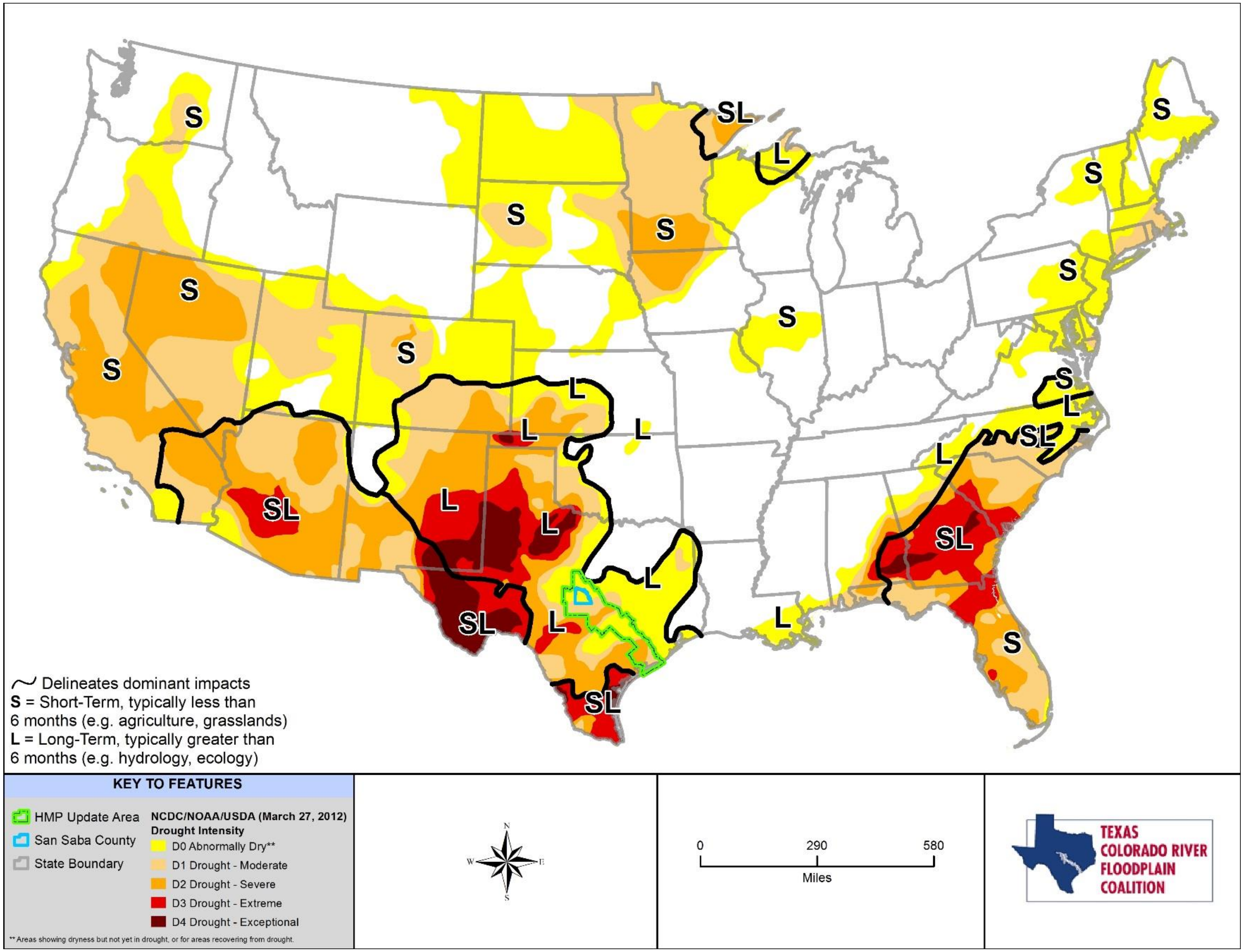


Figure 10-2. U.S. Drought Monitor, March 27, 2012

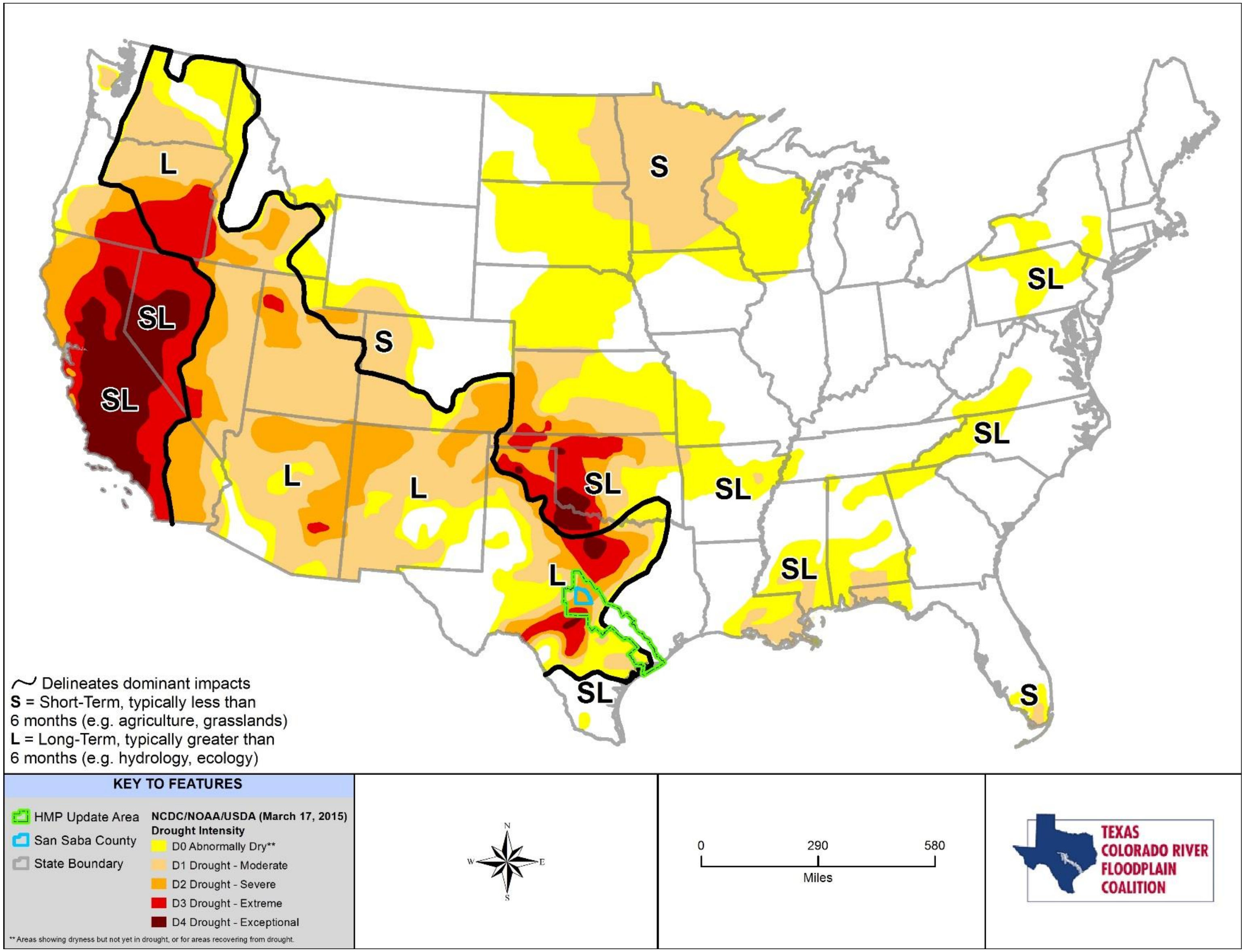


Figure 10-3. U.S. Drought Monitor, March 17, 2015

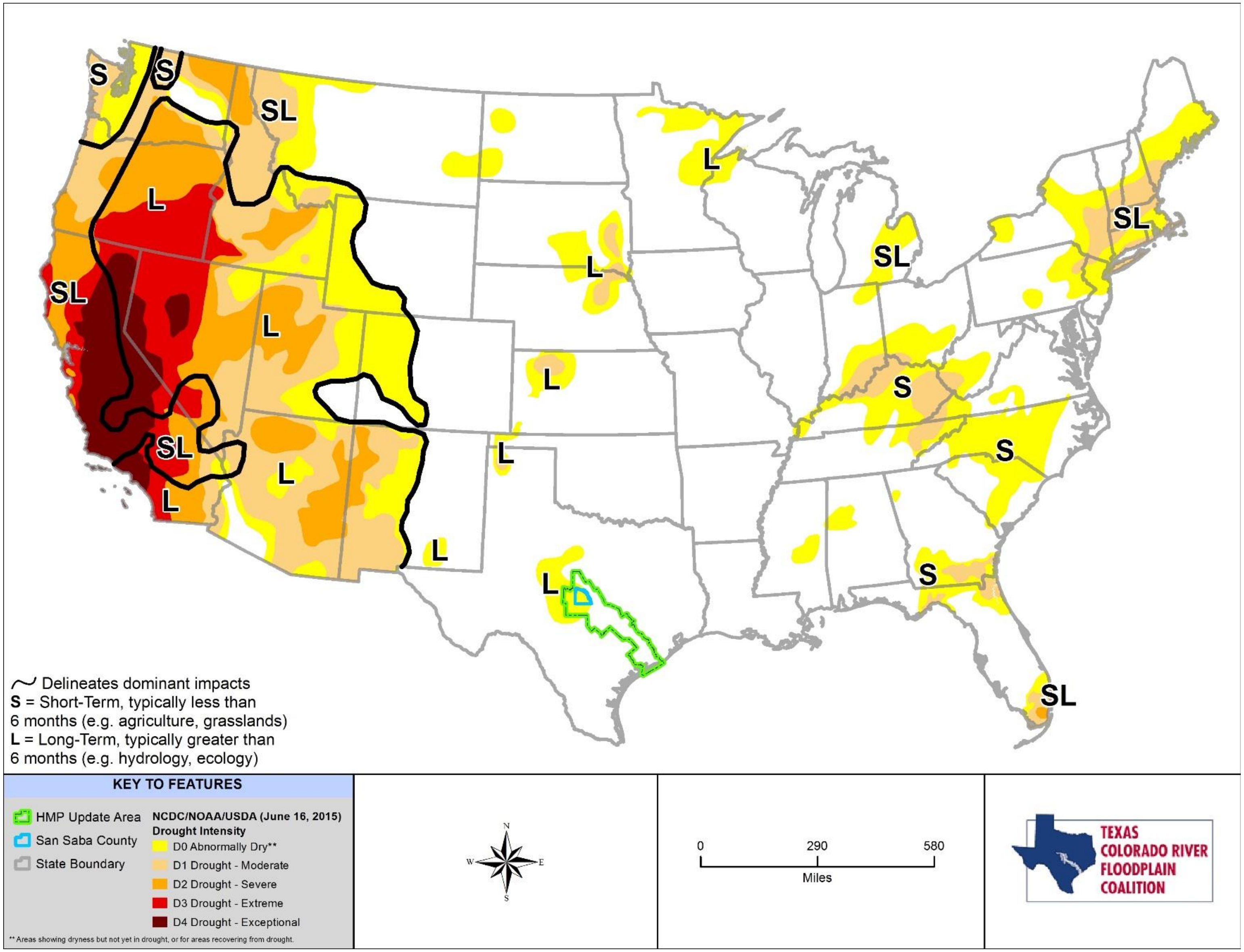


Figure 10-4. U.S. Drought Monitor, June 16, 2015

The National Drought Mitigation Center developed the Drought Impact Reporter in response to the need for a national drought impact database for the United States. Information comes from a variety of sources: on-line drought-related news stories and scientific publications, members of the public who visit the website and submit a drought-related impact for their region, members of the media and members of relevant government agencies. The database is being populated beginning with the most recent impacts and working backward in time.

The Drought Impact Reporter contains information on impacts from droughts that affected San Saba County between January 2005 and April 2015. Most of the impacts were classified as “agriculture” (264). Other impacts include “society and public health” (73), “fire” (118), “tourism and recreation” (7), “water supply and quality” (72), “energy” (11), “business and industry” (28), “plants and wildlife” (75), and “relief, response, and restrictions” (136). These categories are described as follows:

- **Agriculture –** Drought effects associated with agriculture, farming, aquaculture, horticulture, forestry, or ranching. Examples of drought-induced agricultural impacts include damage to crop quality; income loss for farmers due to reduced crop yields; reduced productivity of cropland; insect infestation; plant disease; increased irrigation costs; cost of new or supplemental water resource development (wells, dams, pipelines) for agriculture; reduced productivity of rangeland; forced reduction of foundation stock; closure/limitation of public lands to grazing; high cost or unavailability of water for livestock, Christmas tree farms, forestry, raising domesticated horses, bees, fish, shellfish, or horticulture.
- **Society and Public Health –** Drought effects associated with human, public, and social health include health-related problems related to reduced water quantity or quality, such as increased concentration of contaminants; loss of human life (e.g., from heat stress, suicide); increased respiratory ailments; increased disease caused by wildlife concentrations; increased human disease caused by changes in insect carrier populations; population migration (rural to urban areas, migrants into the United States); loss of aesthetic values; change in daily activities (non-recreational, like putting a bucket in the shower to catch water); elevated stress levels; meetings to discuss drought; communities creating drought plans; lawmakers altering penalties for violation of water restrictions; demand for higher water rates; cultural/historical discoveries from low water levels; cancellation of fundraising events; cancellation/alteration of festivals or holiday traditions; stockpiling water; public service announcements and drought information websites; protests; and conflicts within the community due to competition for water.
- **Fire –** Drought often contributes to forest, range, rural, or urban fires, fire danger, and burning restrictions. Specific impacts include enacting or increasing burning restrictions; fireworks bans; increased fire risk; occurrence of fire (number of acres burned, number of wildfires compared to average, people displaced, etc.); state of emergency during periods of high fire danger; closure of roads or land due to fire occurrence or risk; and expenses to state and county governments of paying firefighters overtime and paying equipment (helicopter) costs.
- **Tourism and Recreation –** Drought effects associated with recreational activities and tourism include closure of state hiking trails and hunting areas due to fire danger; water access or navigation problems for recreation; bans on recreational activities; reduced license, permit, or ticket sales (e.g., hunting, fishing, ski lifts, etc.); losses related to curtailed activities (e.g., bird watching, hunting and fishing, boating, etc.); reduced park visitation; and cancellation or postponement of sporting events.
- **Water Supply and Quality –** Drought effects associated with water supply and water quality include dry wells; voluntary and mandatory water restrictions; changes in water rates; increasing water restrictions; increases in requests for new well permits; changes in water use due to water restrictions; greater water demand; decreases in water allocation or allotments; installation or alteration of water pumps or water intakes; changes to allowable water contaminants; water line

damage or repairs due to drought stress; drinking water turbidity; change in water color or odor; declaration of drought watches or warnings; and mitigation activities.

- **Energy –** Drought effects on power production, rates and revenue include production changes for both hydropower and non-hydropower providers; changes in electricity rates; revenue shortfalls and/or windfall profits; and purchase of electricity when hydropower generation is down.
- **Business and Industry –** Drought effects on non-agriculture and non-tourism businesses, such as lawn care; recreational vehicles or gear dealers; and plant nurseries. Typical impacts include reduction or loss of demand for goods or services; reduction in employment; variation in number of calls for service; late opening or early closure for the season; bankruptcy; permanent store closure; and other economic impacts.
- **Plants and Wildlife –** Drought effects associated with unmanaged plants and wildlife, both aquatic and terrestrial, include loss of biodiversity of plants or wildlife; loss of trees from rural or urban landscapes, shelterbelts, or wooded conservation areas; reduction and degradation of fish and wildlife habitat; lack of feed and drinking water; greater mortality due to increased contact with agricultural producers as animals seek food from farms and producers are less tolerant of the intrusion; disease; increased vulnerability to predation (from species concentrated near water); migration and concentration (loss of wildlife in some areas and too much wildlife in others); increased stress on endangered species; salinity levels affecting wildlife; wildlife encroaching into urban areas; and loss of wetlands.
- **Relief, Response, and Restrictions –** Drought effects associated with disaster declarations, aid programs, requests for disaster declaration or aid, water restrictions, or fire restrictions. Examples include disaster declarations; aid programs; USDA Secretarial disaster declarations; Small Business Association disaster declarations; government relief and response programs; state-level water shortage or water emergency declarations; county-level declarations; a declared "state of emergency;" requests for declarations or aid; non-profit organization-based relief; water restrictions; fire restrictions; NWS Red Flag warnings; and declaration of drought watches or warnings.

Extreme Heat

According a 2014 EPA study, a total of nearly 8,000 Americans suffered heat-related deaths between 1979 and 2010. The 2012 Natural Resource Defense Council study of 40 major U.S. cities showed that the historic average mortality per summer was 1,332 between 1975 and 2004. This reveals that annually more people in the U.S. die from severe summer heat than from hurricanes, lightning, tornadoes, floods, and earthquakes combined.

According to the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center, a strong heat wave affected Texas in the summers of 1999, 2000, and 2011. During these heat waves, multiple counties suffered in terms of injuries and deaths, mostly to the elderly. During these periods, some Texas counties also experienced extreme heat events. Table 10-1 contains temperature summaries temperature summaries related to extreme heat for the City of San Saba weather station.

TABLE 10-1.
TEMPERATURE DATA FROM SAN SABA WEATHER STATION

Statistic	Years	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
High Annual Maximum	1964-1999	90	100	96	102	109	110	112	109	106	100	96	88
Low Annual Maximum	1964-1999	69	70	76	84	89	94	95	95	91	87	77	72
Average Annual Maximum	1964-1999	79.2	82.2	87.2	93.1	96.0	100.0	102.5	102.3	98.4	92.8	85.6	79.6
Average Days Annually with a Maximum Above 90	1901-2000	0.0	0.2	1.1	2.3	7.3	21.1	27.6	27.0	16.4	3.7	0.2	0.0

Source: www.wrcc.dri.edu
Temperatures are in degrees Fahrenheit

10.2.2 Location

Drought

The National Oceanic and Atmospheric Administration (NOAA) has developed several indices to measure drought impacts and severity and to map their extent and locations:

- The Palmer Crop Moisture Index measures short-term drought on a weekly scale and is used to quantify drought's impacts on agriculture during the growing season. Figure 10-5 shows this index for the week ending in March 28, 2015.
- The Palmer Z Index measures short-term drought on a monthly scale. Figure 10-6 shows this index for March 2015.
- The Palmer Drought Index (PDI) measures the duration and intensity of long-term drought-inducing circulation patterns. Long-term drought is cumulative, so the intensity of drought during a given month is dependent on the current weather patterns plus the cumulative patterns of previous months. Weather patterns can change quickly from a long-term drought pattern to a long-term wet pattern, and the PDI can respond fairly rapidly. Figure 10-7 and Figure 10-8 show this index for March 2015 and May 2015 to show the change in PDI after the May 2015 rain.
- The hydrological impacts of drought (e.g., reservoir levels, groundwater levels, etc.) take longer to develop and it takes longer to recover from them. The Palmer Hydrological Drought Index (PHDI), another long-term index, was developed to quantify hydrological effects. The PHDI responds more slowly to changing conditions than the PDI. Figure 10-9 shows this index for March 2015.
- While the Palmer indices consider precipitation, evapotranspiration and runoff, the Standardized Precipitation Index (SPI) considers only precipitation. In the SPI, an index of zero indicates the median precipitation amount; the index is negative for drought and positive for wet conditions. The SPI is computed for time scales ranging from 1 month to 24 months. Figure 10-10 shows the 24-month SPI map through the end of February 2015.

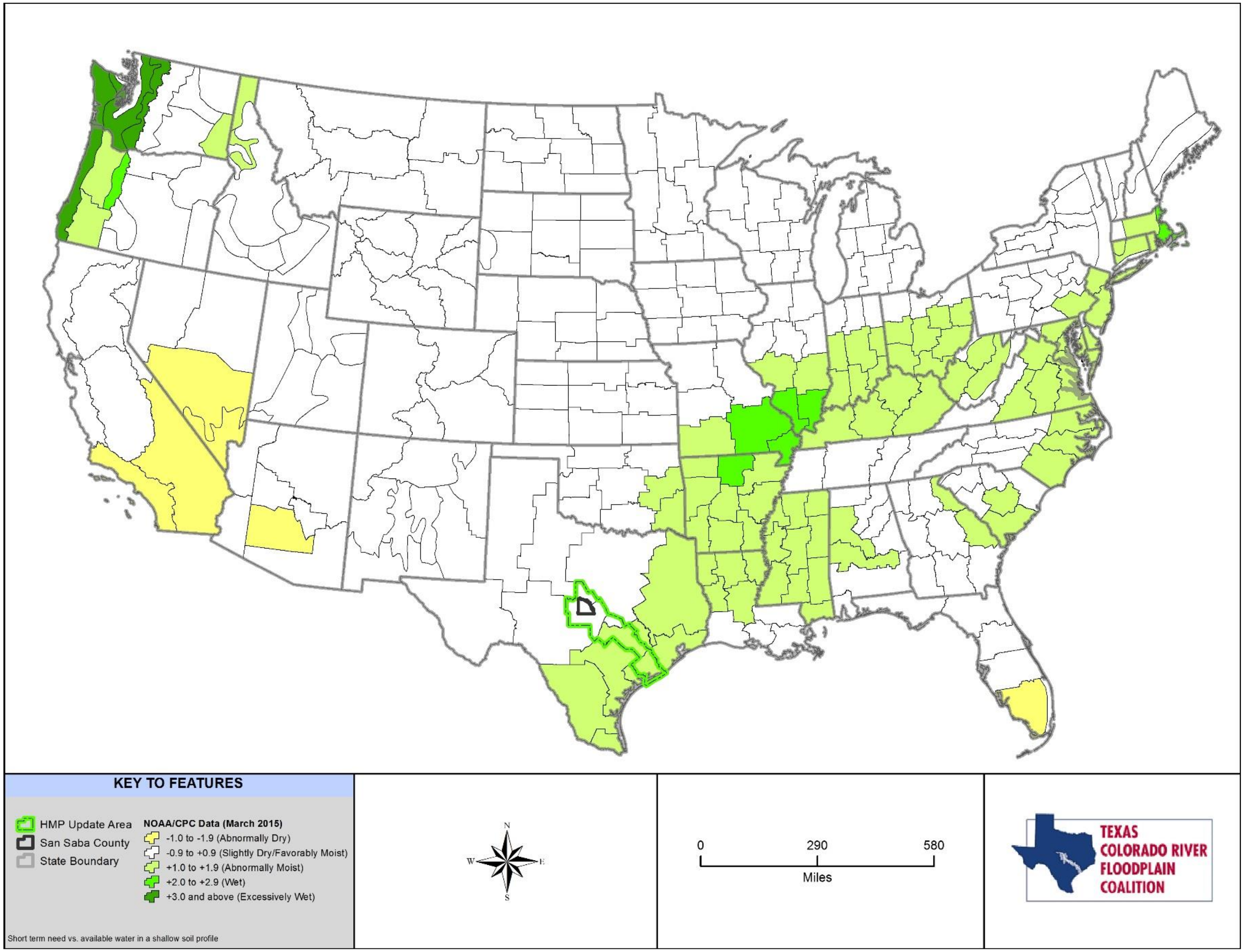


Figure 10-5. Crop Moisture Index (Week Ending March 28, 2015)

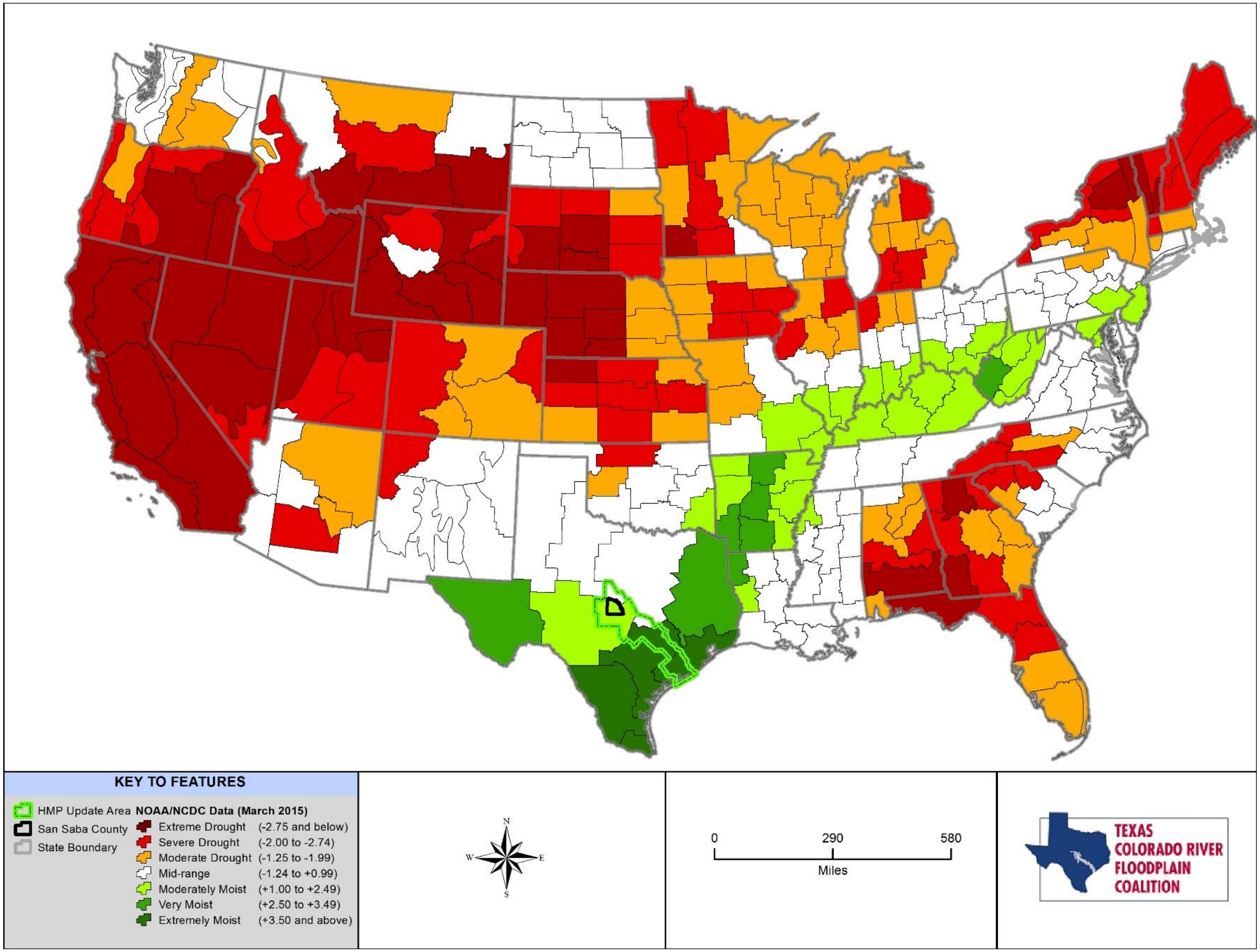


Figure 10-6. Palmer Z Index Short-Term Drought Conditions (March 2015)

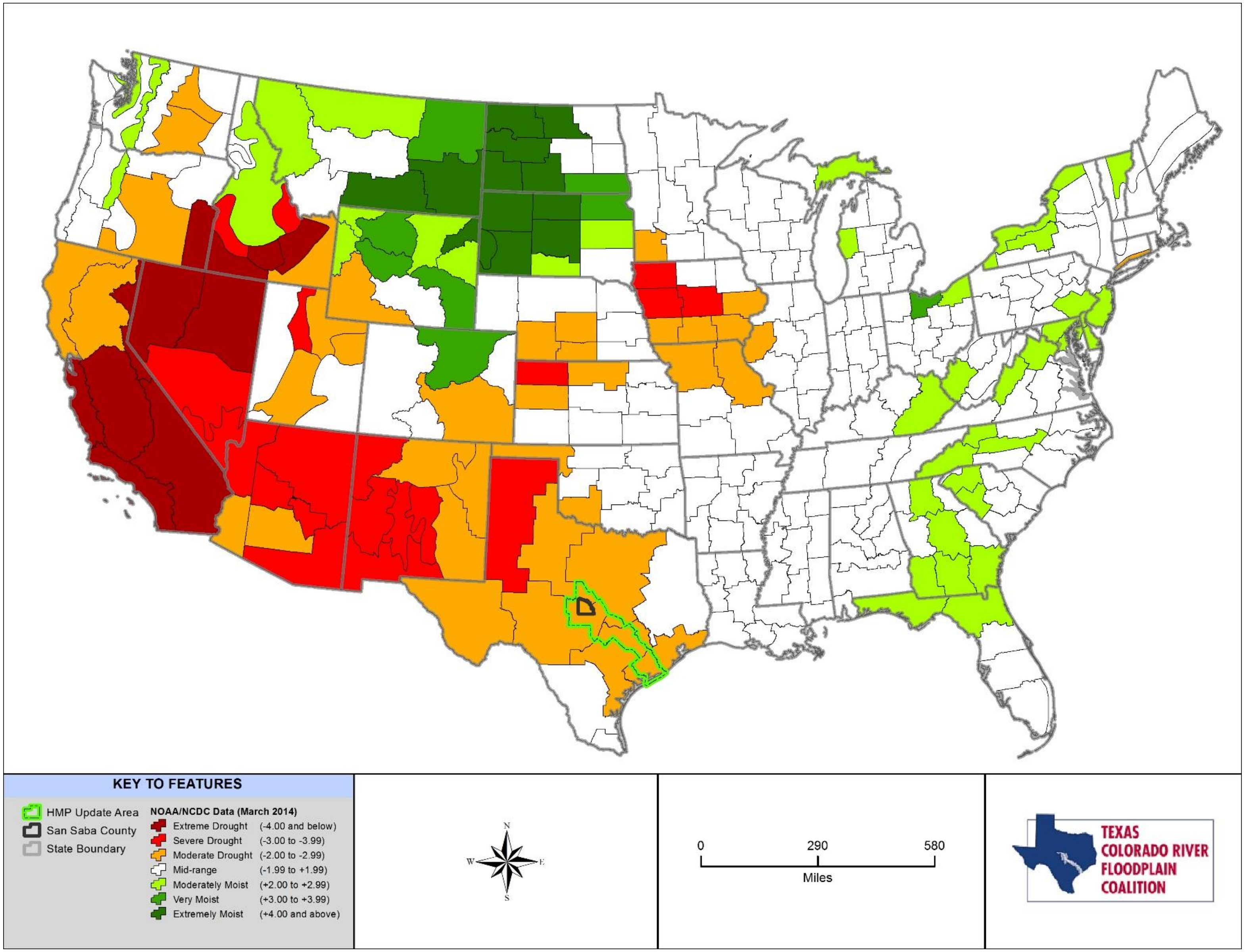


Figure 10-7. Palmer Drought Severity Index (March 2015)

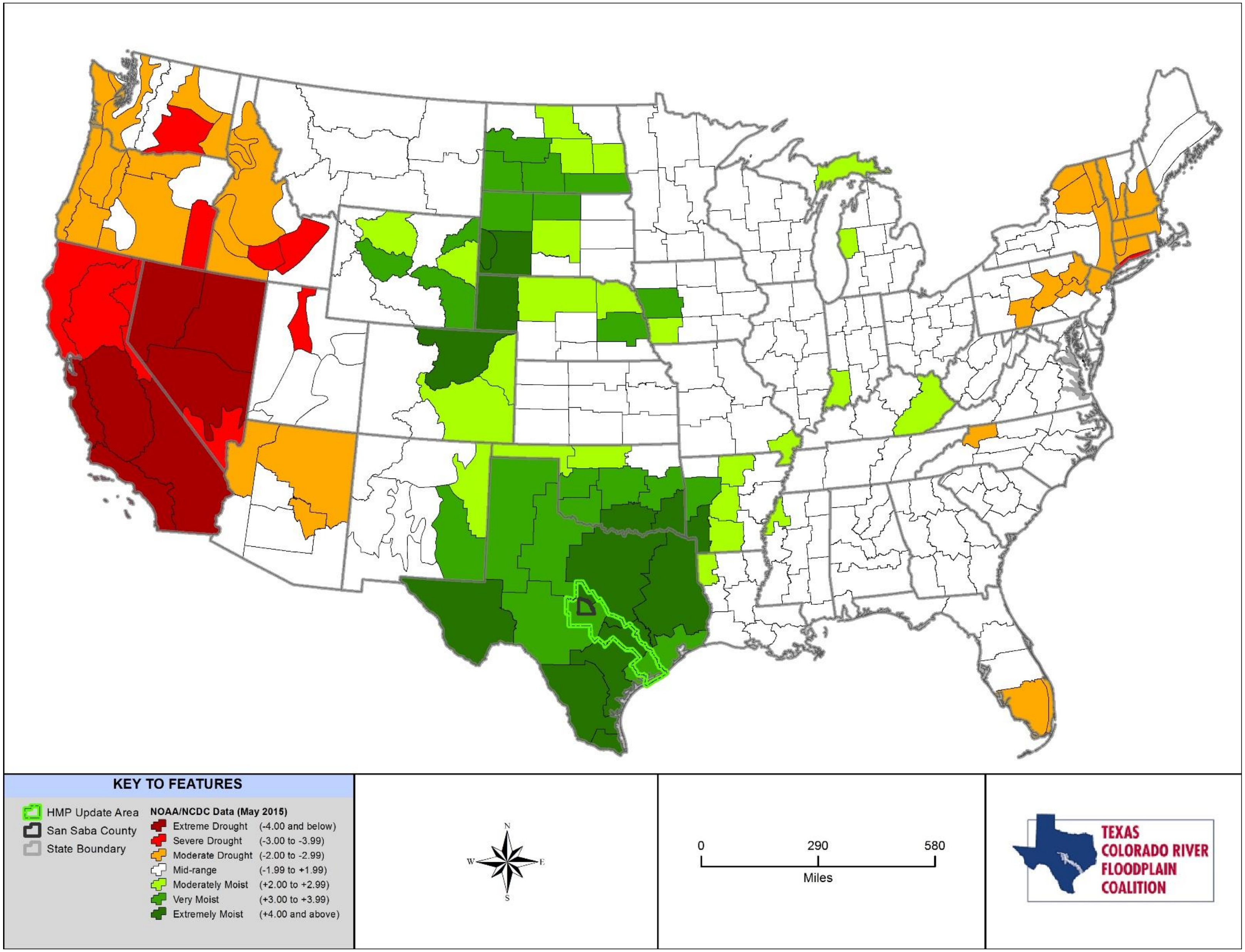


Figure 10-8. Palmer Drought Severity Index (May 2015)

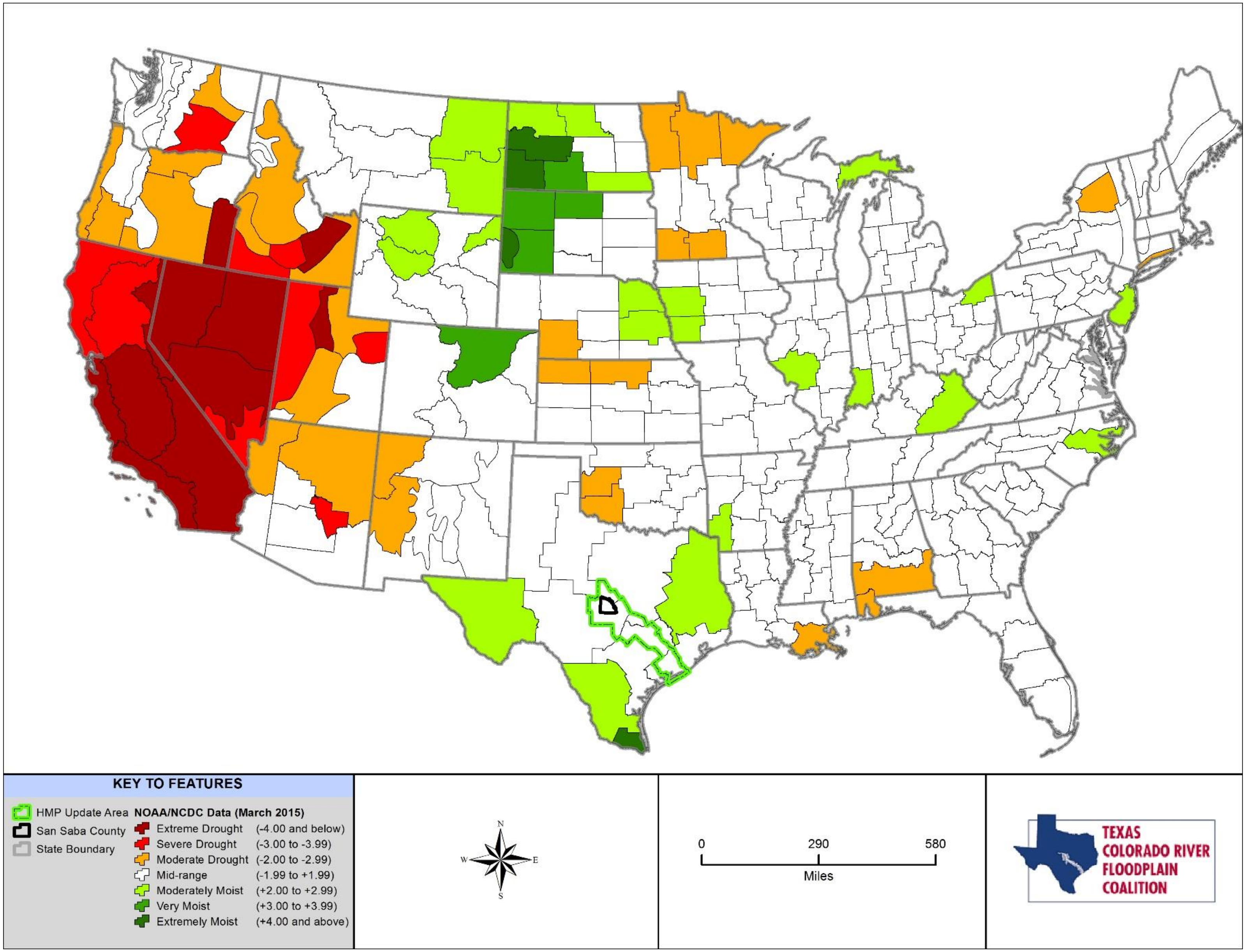


Figure 10-9. Palmer Hydrological Drought Index Long-Term Hydrologic Conditions (March 2015)

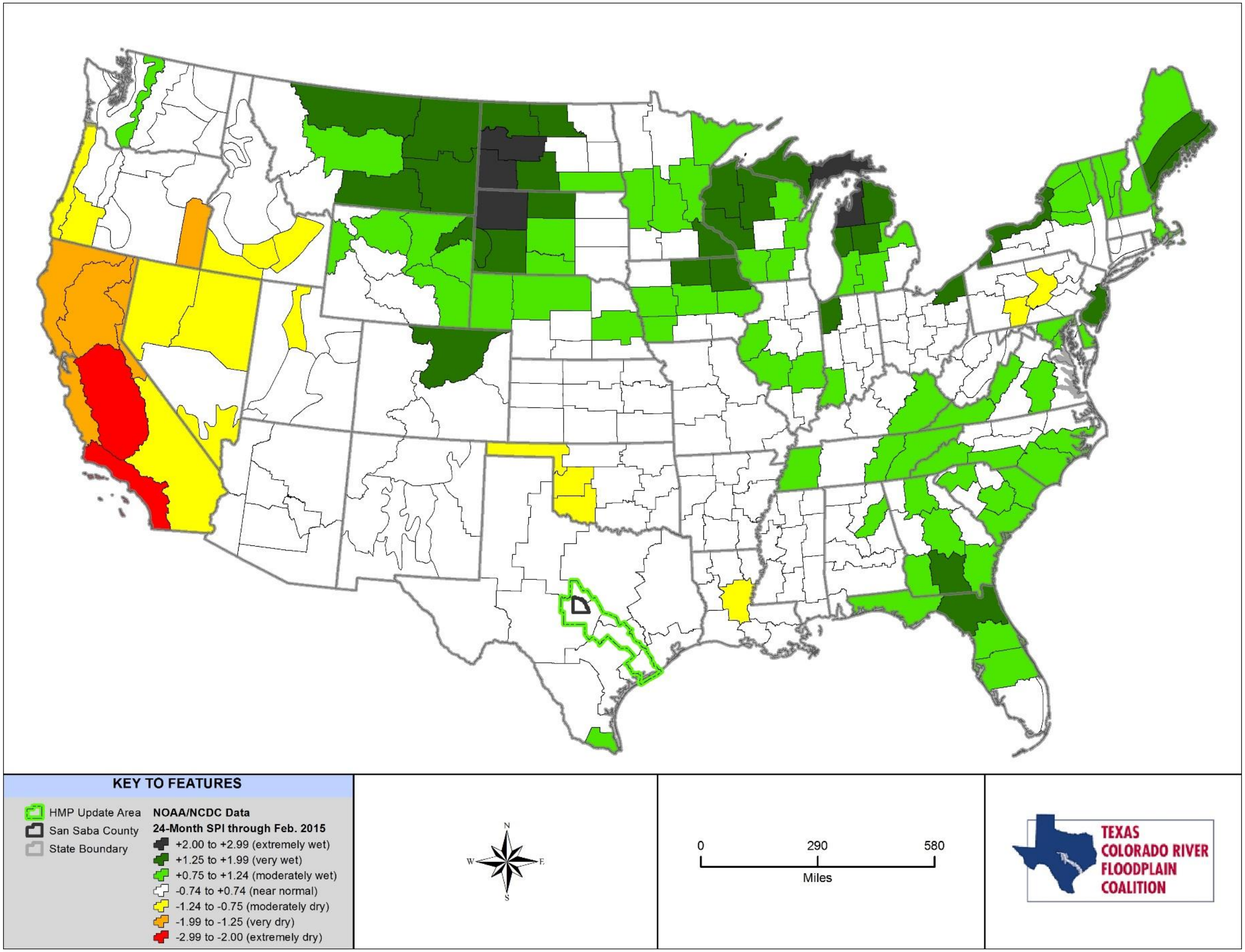


Figure 10-10. 24-Month Standardized Precipitation Index (through February 2015)

Because of Texas's humid sub-tropical to semi-arid conditions, drought is a regular but unpredictable occurrence in the state. However, because of natural variations in climate and precipitation sources, it is rare for all of Texas to be deficient in moisture at the same time. Single season droughts over some portion of the state are quite common. From 1950 to 1957, Texas experienced the most severe drought in recorded history. By the time the drought ended, 244 of Texas' 254 counties had been declared federal disaster areas. In 2011, Texas experienced its most intense single-year drought in recorded history.

Droughts occur regularly in Central Texas and are a normal condition. However, they can vary greatly in their intensity and duration. The entire county is at risk to drought conditions. Drought is one of the few hazards that has the potential to directly or indirectly impact every person in the county as well as adversely affect the local economy.

Extreme Heat

The entire county is at risk to extreme heat events; however, these events may be exacerbated in urban areas, where reduced air flow, reduced vegetation, and increased generation of waste heat can contribute to temperatures that are several degrees higher than in surrounding rural or less urbanized areas. This phenomenon is known as urban heat island effect. The record highs for Texas occurs during May through October. San Saba County experiences an average of 17 days with temperatures 100°F or above during these months, according to data recorded by the National Weather Service between 1900 and 2014. During 2011, Texas experienced the hottest summer in U.S. history with an average temperature of 86.8°F. San Saba County area experienced more than 77 days with temperatures 100°F and above in 2011. Figure 6-3 shows the annual average maximum temperature distribution in Texas.

10.2.3 Frequency

Drought

The probability of a future drought in San Saba County is likely, with between 10% and 100% chance of occurrence in any given year, or a recurrence interval of 10 years or less. According to information from the NOAA National Climatic Data Center, San Saba County had 11 documented drought years between 1996 and 2014. Based on this historical information, the probability of a drought occurring in any given year over 60%. Short duration droughts occur much more frequently. Various studies indicate that drought occurrence in Texas is expected to increase in frequency and will continue be an inevitable factor in the climate of Texas. Table 10-2 lists historic drought events.

TABLE 10-2.
HISTORIC DROUGHT EVENTS IN SAN SABA COUNTY (1996-2014)

Date	Estimated Damage Cost		Injuries	Deaths
	Property	Crops		
June 1998	$0	$0	0	0
May 2000	$0	$3,473,975	0	0
August 2000	$0	$0	0	0
December 2005	$8,093,347	$0	0	0
November 2006	$0	$0	0	0
December 2006	$0	$0	0	0
January 2007	$0	$0	0	0
February 2007	$0	$0	0	0
March 2007	$0	$0	0	0

TABLE 10-2.
HISTORIC DROUGHT EVENTS IN SAN SABA COUNTY (1996-2014)

Date	Estimated Damage Cost		Injuries	Deaths
	Property	Crops		
January 2009	$0	$0	0	0
January 2009	$0	$0	0	0
February 2009	$0	$0	0	0
March 2009	$0	$0	0	0
December 2010	$0	$0	0	0
January 2011	$0	$0	0	0
February 2011	$0	$0	0	0
March 2011	$0	$0	0	0
April 2011	$0	$0	0	0
May 2011	$0	$0	0	0
June 2011	$0	$0	0	0
July 2011	$0	$0	0	0
August 2011	$0	$0	0	0
September 2011	$0	$0	0	0
October 2011	$0	$0	0	0
November 2011	$0	$0	0	0
December 2011	$0	$0	0	0
January 2012	$0	$0	0	0
February 2012	$0	$0	0	0
September 2012	$0	$0	0	0
November 2012	$0	$0	0	0
December 2012	$0	$0	0	0
January 2013	$0	$0	0	0
February 2013	$0	$0	0	0
March 2013	$0	$0	0	0
April 2013	$0	$0	0	0
May 2013	$0	$0	0	0
June 2013	$0	$0	0	0
August 2013	$0	$0	0	0
October 2013	$0	$0	0	0
November 2013	$0	$0	0	0
December 2013	$0	$0	0	0
January 2013	$0	$0	0	0

**TABLE 10-2.
HISTORIC DROUGHT EVENTS IN SAN SABA COUNTY (1996-2014)**

Date	Estimated Damage Cost		Injuries	Deaths
	Property	Crops		
February 2014	$0	$0	0	0
March 2014	$0	$0	0	0
April 2014	$0	$0	0	0
May 2014	$0	$0	0	0
June 2014	$0	$0	0	0

Extreme Heat

On average, there are 106 days per year where temperatures exceed 90°F so the frequency of extreme heat events is expected to be very likely in any given year. There are not recorded extreme heat events for San Saba County in the NOAA National Climatic Data Center's Storm Events Database.

10.2.4 Severity

Drought

Drought impacts are wide-reaching and may be economic, environmental, or societal. The most significant impacts associated with drought in Texas are those related to water intensive activities such as agriculture, wildfire protection, municipal usage, commerce, tourism, recreation, and wildlife preservation. An ongoing drought may leave an area more prone to wildfires. Drought conditions can also cause soil to compact, increasing an area's susceptibility to flooding, and reduce vegetation cover, which exposes soil to wind and erosion. A reduction of electric power generation and water quality deterioration are also potential problems. Drought impacts increase with the length of a drought, as carry-over supplies in reservoirs are depleted and water levels in streams and groundwater decline.

According to the information in this hazard profile, drought impacts on San Saba County could be considered moderate. Moderate drought typically means less than 25% to 50% of property (mainly agricultural) is severely damaged; injuries/illnesses are treatable or do not result in permanent disability; crop fields become withered; and cattle herds are thinned. Due to the low probability of severe drought, the overall significance is considered moderate with significant potential impact. Drought can have a widespread impact on the environment and the economy, depending upon its severity, although it typically does not result in loss of life or damage to property, as do other natural disasters. The National Drought Mitigation Center uses three categories to describe likely drought impacts:

- **Agricultural** – Drought threatens crops that rely on natural precipitation.
- **Water supply** – Drought threatens supplies of water for irrigated crops and for communities.
- **Fire hazard** – Drought increases the threat of wildfires from dry conditions in forest and rangelands.

On average, the nationwide annual impacts of drought are greater than the impacts of any other natural hazard. They are estimated to be between $6 billion and $8 billion annually in the United States and occur primarily in the agriculture, transportation, recreation and tourism, forestry, and energy sectors. Social and environmental impacts are also significant, although it is difficult to put a precise cost on these impacts.

The severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts. Droughts are not usually associated with direct impacts on people or property, but they can have significant impacts on agriculture, which can impact people indirectly.

When measuring the severity of droughts, analysts typically look at economic impacts on a planning area. A drought directly or indirectly impacts all people in affected areas. All people could pay more for water if utilities increase their rates due to shortages. Agricultural impacts can result in loss of work for farm workers and those in related food processing jobs. Other water- or electricity-dependent industries are commonly forced to shut down all or a portion of their facilities, resulting in further layoffs. A drought can harm recreational companies that use water (e.g., swimming pools, water parks, and river rafting companies) as well as landscape and nursery businesses because people will not invest in new plants if water is not available to sustain them.

Drought generally does not affect groundwater sources as quickly as surface water supplies, but groundwater supplies generally take longer to recover. Reduced precipitation during a drought means that groundwater supplies are not replenished at a normal rate. This can lead to a reduction in groundwater levels and problems such as reduced pumping capacity or wells going dry. Shallow wells are more susceptible than deep wells. Reduced replenishment of groundwater affects streams. Much of the flow in streams comes from groundwater, especially during the summer when there is less precipitation and after snowmelt ends. Reduced groundwater levels mean that even less water will enter streams when steam flows are lowest.

Additionally, there is increased danger of wildfires associated with most droughts. Millions of board feet of timber have been lost due to drought, and in many cases erosion has occurred, which caused serious damage to aquatic life, irrigation, and power production by heavy silting of streams, reservoirs, and rivers.

Extreme Heat

Drought also is often accompanied by extreme heat. When temperatures reach 90ºF and above, people are vulnerable to heat cramps, heat exhaustion, and heat stroke. Pets and livestock are also vulnerable to heat-related injuries. Crops can be vulnerable as well.

Based on the information in this hazard profile, the magnitude/severity of extreme temperatures is considered moderate. This is defined as less than 25 to 50% of property (mainly agricultural) is severely damaged, or injuries/illnesses are treatable or do not result in permanent disability. Due to the expansive nature of soils in this area, extreme heat could pose foundation issues. Overall significance is considered minimal: moderate potential impact.

10.2.5 Warning Time

Drought

Droughts are climatic patterns that occur over long periods of time. Only generalized warnings can take place due to the numerous variables that scientists have not pieced together well enough to make accurate and precise predictions. Empirical studies conducted over the past century have shown that meteorological drought is never the result of a single cause. It is the result of many causes, often synergistic in nature.

Scientists at this time do not know how to predict drought more than a month in advance for most locations. Predicting drought depends on the ability to forecast precipitation and temperature. Anomalies of precipitation and temperature may last from several months to several decades. How long these anomalies last depends on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of weather systems on the global scale.

Texas is semi-arid to humid sub-tropical, thus, drought is a regular and natural occurrence in the state. The main source of water supply in the state is precipitation and much of this occurs in the spring and fall. Some snowfall does occur in the wintertime. Although drought conditions are difficult to predict, low levels of spring precipitation may act as an indicator that drought conditions are occurring.

Extreme Heat

NOAA issues watch, warning, and advisory information for extreme heat. Extreme heat is a regular and natural occurrence in the state.

10.3 SECONDARY HAZARDS

Drought

The secondary hazard most commonly associated with drought is wildfire. A prolonged lack of precipitation dries out vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends. According to the *State of Texas 2014 Emergency Management Plan* (Drought Annex), economic impacts may also occur for industries that are water intensive such as agriculture, wildfire protection, municipal usage, commerce, tourism, recreation and wildfire preservation. Additionally, a reduction of electric power generation and water quality deterioration are also potential effects. Drought conditions can also cause soil to compact, decreasing its ability to absorb water, making an area more susceptible to flash flooding and erosion. A drought may also increase the speed at which dead and fallen trees dry out and become more potent fuel sources for wildfires. Drought may also weaken trees in areas already affected by insect infestations, causing more extensive damage to trees and increasing wildfire risk, at least temporarily. An ongoing drought that severely inhibits natural plant growth cycles may impact critical wildlife habitats. Drought impacts increase with the length of a drought, as carry-over supplies in reservoirs are depleted and water levels in groundwater basins decline.

Extreme Heat

Excessive heat events can cause failure of motorized systems such as ventilation systems used to control temperatures inside buildings. The lack of air conditioning in businesses and homes can exacerbate existing health conditions, particularly in senior citizens.

10.4 CLIMATE CHANGE IMPACTS

The long-term effects of climate change on regional water resources are unknown, but global water resources are already experiencing the following stresses without climate change:

- Growing populations
- Increased competition for available water
- Poor water quality
- Environmental claims
- Uncertain reserved water rights
- Groundwater overdraft
- Aging urban water infrastructure

With a warmer climate, droughts could become more frequent, more severe, and longer-lasting. From 1987 to 1989, losses from drought in the U.S. totaled $39 billion (Congressional Office of Technology Assessment [OTA] 1993). More frequent extreme events such as droughts could end up being more cause for concern than the long-term change in temperature and precipitation averages.

The best advice to water resource managers regarding climate change is to start addressing current stresses on water supplies and build flexibility and robustness into any system. Flexibility helps to ensure a quick response to changing conditions, and robustness helps people prepare for and survive the worst conditions. With this approach to planning, water system managers will be better able to adapt to the impacts of climate change.

10.5 EXPOSURE

Because droughts cannot be directly modeled in HAZUS, annualized losses were estimated using geographic information system- (GIS) based analysis, historical data (frequency and damage) analysis, and statistical risk assessment methodology. Event frequency, severity indicators, expert opinions, and historical knowledge of the region were used for this assessment. The primary data source was the HAZUS 2.2 data inventory (updated 2010 U.S. Census data and 2014 RS Means Square Foot Costs), and 2012 USDA Census of Agriculture augmented with state and federal datasets as well as the National Drought Mitigation Center reports.

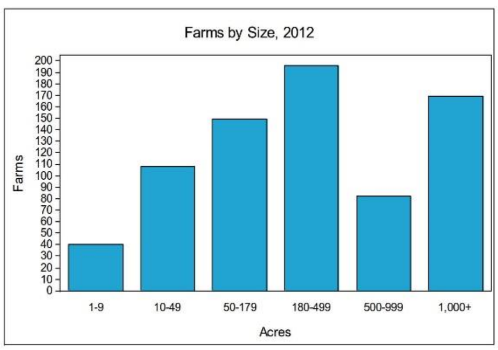
All people, property, and environments in the planning area would be exposed to some degree to the impacts of moderate to extreme drought conditions and extreme heat. Populations living in densely populated urban areas are likely to be more exposed to extreme heat events. Furthermore, farms and agriculture will be greatly impacted by drought and extreme temperature. Figure 10-11 (USDA's 2012 Census of Agriculture) profiles the county's agriculture use. By applying historical averages on losses and events (probability) to current economic totals (HAZUS structure inventory) and agricultural values (also from HAZUS), the exposure rate for the entire county is approximately $39 million. Although most farmlands are usually outside the city limits, drought can still economically impact local communities.

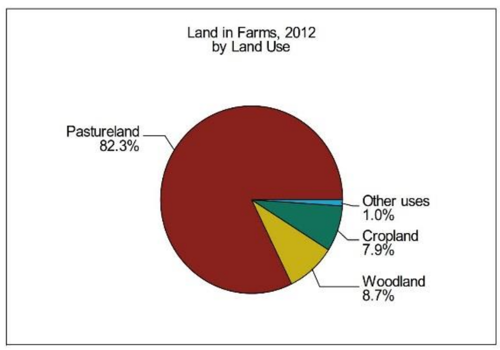
2012 CENSUS OF AGRICULTURE

COUNTY PROFILE

San Saba County
Texas

	2012	2007	% change
Number of Farms	744	725	+ 3
Land in Farms	671,092 acres	717,799 acres	- 7
Average Size of Farm	902 acres	990 acres	- 9
Market Value of Products Sold	$30,021,000	$28,581,000	+ 5
Crop Sales $9,349,000 (31 percent) Livestock Sales $20,672,000 (69 percent)			
Average Per Farm	$40,351	$39,422	+ 2
Government Payments	$1,166,000	$523,000	+ 123
Average Per Farm Receiving Payments	$8,330	$4,283	+ 94





USDA

US Department of Agriculture
National Agricultural Statistics Service

www.agcensus.usda.gov

Figure 10-11. USDA Census of Agriculture San Saba County Profile 2012

10.6 VULNERABILITY

Drought produces a complex web of impacts that spans many sectors of the economy and reaches well beyond the area experiencing physical drought. This complexity exists because water is integral to the ability to produce goods and provide services. Drought can affect a wide range of economic, environmental, and social activities. The vulnerability of an activity to the effects of drought usually depends on its water demand, how the demand is met, and what water supplies are available to meet the demand. Extreme heat can exacerbate the effects of drought.

10.6.1 Population

Drought

The planning partnership has the ability to minimize any impacts on residents and water consumers in the county should several consecutive dry years occur. No significant life or health impacts are anticipated as a result of drought within the planning area

Extreme Heat

According to the EPA, the individuals with the following characteristics are typically at greater risk to the adverse effects of excessive heat events: individuals with physical or mobility constraints, cognitive impairments, economic constraints, and social isolation.

10.6.2 Property

Drought

No structures will be directly affected by drought conditions, though some structures may become vulnerable to wildfires, which are more likely following years of drought. Droughts can also have significant impacts on landscapes, which could cause a financial burden to property owners. However, these impacts are not considered critical in planning for impacts from the drought hazard.

Loss estimations for drought are not based on damage functions, because no such damage functions have been generated. Instead, loss estimates were developed representing projected damages (annualized loss) on historical events, statistical analysis, and probability factors. These were applied to the exposed agriculture values of the participating communities to create an annualized loss (Table 10-3).

TABLE 10-3.
LOSS ESTIMATES FOR DROUGHT EVENTS

Jurisdiction	Exposed Value ($)	Annualized Loss ($)	Annualized Loss (%)
City of San Saba	15,516,731	5,566	0.04
Unincorporated Areas	23,861,264	3,645,814	15.28
Planning Area Total	**39,377,995**	**3,651,380**	**9.27**

Extreme Heat

Typically the only impact extreme heat has on general building stock is increased demand on air conditioning equipment, which in turn may cause strain on electrical systems. Due to the expansive nature of soils in this area, extreme heat also could pose foundation issues.

10.6.3 Critical Facilities

Drought

Critical facilities as defined for this plan will continue to be operational during a drought. Critical facility elements such as landscaping may not be maintained due to limited resources, but the risk to the planning area's critical facilities inventory will be largely aesthetic. For example, when water conservation measures are in place, landscaped areas will not be watered and may die. These aesthetic impacts are not considered significant.

Extreme Heat

Power outages may occur as a result of extreme heat events. Additionally, transportation systems may experience disruption in services. It is common in Texas for concrete pavements to experience "blowouts or heaves" both on local highway and the higher volume parkway and interstate systems. Blowouts occur when pavements expand and cannot function properly within their allotted spaces. Pavement sections may rise up several inches during such events. These conditions can cause motor vehicle accidents in their initial stages and can shut down traffic lanes or roadways entirely until such times as the conditions are mitigated.

10.6.4 Environment

Environmental losses from drought are associated with damage to plants, animals, wildlife habitat, and air and water quality; forest and range fires; degradation of landscape quality; loss of biodiversity; and soil erosion. Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes, and vegetation. However, many species will eventually recover from this temporary aberration. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity. Although environmental losses are difficult to quantify, growing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects.

10.6.5 Economic Impact

Economic impact will be largely associated with industries that use water or depend on water for their business. For example, landscaping businesses were affected in the droughts of the past as the demand for service significantly declined because landscaping was not watered. Agricultural industries will be impacted if water usage is restricted for irrigation. The tourism sector may also be impacted.

10.7 FUTURE TRENDS IN DEVELOPMENT

Each municipal planning partner in this effort has an established comprehensive plan or policies directing land use and dealing with issues of water supply and the protection of water resources. These plans provide the capability at the local municipal level to protect future development from the impacts of drought. All planning partners reviewed their plans under the capability assessments performed for this effort. Deficiencies identified by these reviews can be identified as mitigation initiatives to increase the capability to deal with future trends in development. Vulnerability to drought will increase as population growth increases, putting more demands on existing water supplies. Future water use planning should consider increases in population as well as potential impacts of climate change.

10.8 SCENARIO

An extreme multi-year drought could impact the region with little warning. Combinations of low precipitation and unusually high temperatures could occur over several consecutive years. Intensified by such conditions, extreme wildfires could break out throughout the planning area, increasing the need for water. Surrounding communities, also in drought conditions, could increase their demand for water supplies relied upon by the planning partnership, causing social and political conflicts. If such conditions persisted for several years, the economy of San Saba County could experience setbacks, especially in water dependent industries.

10.9 ISSUES

The following are extreme heat and drought-related issues:

- Identification and development of alternative water supplies.
- Utilization of groundwater recharge techniques to stabilize the groundwater supply.
- The probability of increased drought frequencies and durations due to climate change.
- The promotion of active water conservation even during non-drought periods.
- Increasing vulnerability to drought over time as demand for water from different sectors increases.
- The effects of climate change may result in an increase in frequency of extreme heat events.
- The effects of recent droughts have exposed the vulnerability of the planning areas economy to drought events.
- Environmental and erosion control impact analysis for transportation projects.
- Wildlife habitat management for landowners.
- Human health impacts from droughts and extreme heat.
- Monitoring and evaluating risks to power supply and water rights.
- Development of mitigation- or response-based state drought plans.

CHAPTER 11.
EARTHQUAKE

EARTHQUAKE RANKING	
San Saba County	Low
City of San Saba	Low

DEFINITIONS

Earthquake — The shaking of the ground caused by an abrupt shift of rock along a fracture in the earth or a contact zone between tectonic plates.

Epicenter — The point on the earth's surface directly above the hypocenter of an earthquake. The location of an earthquake is commonly described by the geographic position of its epicenter and by its focal depth.

Fault — A fracture in the earth's crust along which two blocks of the crust have slipped with respect to each other.

Focal Depth — The depth from the earth's surface to the hypocenter.

Hypocenter — The region underground where an earthquake's energy originates.

Liquefaction — Loosely packed, water-logged sediments losing their strength in response to strong shaking, causing major damage during earthquakes.

11.1 GENERAL BACKGROUND

11.1.1 How Earthquakes Happen

An earthquake is a sudden release of energy from the earth's crust that creates seismic waves. Tectonic plates become stuck, putting a strain on the ground. When the strain becomes so great that rocks give way, fault lines occur. At the Earth's surface, earthquakes may manifest themselves by a shaking or displacement of the ground, which may lead to loss of life and destruction of property. Size of an earthquake is expressed quantitatively as magnitude and local strength of shaking as intensity. The inherent size of an earthquake is commonly expressed using a magnitude. For a more detailed description of seismic/earthquake hazards visit FEMA's web site on hazards, http://www.fema.gov/hazard.

Earthquakes tend to reoccur along faults, which are zones of weakness in the crust. Even if a fault zone has recently experienced an earthquake, there is no guarantee that all the stress has been relieved. Another earthquake could still occur.

Geologists classify faults by their relative hazards. Active faults, which represent the highest hazard, are those that have ruptured to the ground surface during the Holocene period (about the last 11,000 years). Potentially active faults are those that displaced layers of rock from the Quaternary period (the last 1,800,000 years). Determining if a fault is "active" or "potentially active" depends on geologic evidence, which may not be available for every fault. Although there are probably still some unrecognized active faults, nearly all the movement between the two plates, and therefore the majority of the seismic hazards, are on the well-known active faults.

Faults are more likely to have earthquakes on them if they have more rapid rates of movement, have had recent earthquakes along them, experience greater total displacements, and are aligned so that movement can relieve accumulating tectonic stresses. A direct relationship exists between a fault's length and location and its ability to generate damaging ground motion at a given site. In some areas, smaller, local faults produce lower magnitude quakes, but ground shaking can be strong, and damage can be significant as a result of the fault's proximity to the area. In contrast, large regional faults can generate great magnitudes but, because of their distance and depth, may result in only moderate shaking in the area.

11.1.2 Earthquake Classifications

Earthquakes are typically classified in one of two ways: by the amount of energy released, measured as **magnitude**; or by the impact on people and structures, measured as **intensity**.

Magnitude

Currently the most commonly used magnitude scale is the moment magnitude (M_w) scale, with the follow classifications of magnitude:

- Great $M_w > 8$
- Major $M_w = 7.0 - 7.9$
- Strong $M_w = 6.0 - 6.9$
- Moderate $M_w = 5.0 - 5.9$
- Light $M_w = 4.0 - 4.9$
- Minor $M_w = 3.0 - 3.9$
- Micro $M_w < 3$

Estimates of moment magnitude roughly match the local magnitude scale (ML) commonly called the Richter scale. One advantage of the M_w scale is that, unlike other magnitude scales, it does not saturate at the upper end. That is, there is no value beyond which all large earthquakes have about the same magnitude. For this reason, M_w scale is now the most often used estimate of large earthquake magnitudes.

Intensity

Currently the most commonly used intensity scale is the modified Mercalli intensity scale, with ratings defined as follows (U.S. Geological Survey [USGS] 1989):

- I. Not felt except by a very few under especially favorable conditions.
- II. Felt only by a few persons at rest, especially on upper floors of buildings.
- III. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it is an earthquake. Standing cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
- IV. Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like a heavy truck striking building. Standing cars rocked noticeably.
- V. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
- VI. Felt by all; many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
- VII. Damage negligible in buildings of good design and construction; slight in well-built ordinary structures; considerable in poorly built or badly designed structures. Some chimneys broken.
- VIII. Damage slight in specially designed structures; considerable damage in ordinary buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
- IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
- X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
- XI. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
- XII. Damage total. Lines of sight and level are distorted. Objects thrown into the air.

11.1.3 Ground Motion

Earthquake hazard assessment is also based on expected ground motion. This involves determining the annual probability that certain ground motion accelerations will be exceeded, then summing the annual probabilities over the time period of interest. The most commonly mapped ground motion parameters are the horizontal and vertical peak ground accelerations (PGA) for a given soil or rock type. Instruments called accelerographs record levels of ground motion due to earthquakes at stations throughout a region. These readings are recorded by state and federal agencies that monitor and predict seismic activity.

Maps of PGA values form the basis of seismic zone maps that are included in building codes such as the International Building Code. Building codes that include seismic provisions specify the horizontal force due to lateral acceleration that a building should be able to withstand during an earthquake. PGA values are directly related to these lateral forces that could damage "short-period structures" (e.g., single-family dwellings). Longer-period response components create the lateral forces that damage larger structures with longer natural periods (apartment buildings, factories, high-rises, bridges). Table 11-1 lists damage potential and perceived shaking by PGA factors, compared to the Mercalli scale.

TABLE 11-1.
MERCALLI SCALE AND PEAK GROUND ACCELERATION COMPARISON

Modified Mercalli Scale	Perceived Shaking	Potential Structure Damage		Estimated PGA[a] (%g)
		Resistant Buildings	Vulnerable Buildings	
I	Not Felt	None	None	<0.17%
II to III	Weak	None	None	0.17% - 1.4%
IV	Light	None	None	1.4% - 3.9%
V	Moderate	Very Light	Light	3.9% - 9.2%
VI	Strong	Light	Moderate	9.2% - 18%
VII	Very Strong	Moderate	Moderate/Heavy	18% - 34%
VIII	Severe	Moderate/Heavy	Heavy	34% - 65%
IX	Violent	Heavy	Very Heavy	65% - 124%
X to XII	Extreme	Very Heavy	Very Heavy	>124%

a. PGA measured in percent of g, where g is the acceleration of gravity
Sources: USGS 2008, 2010

11.1.4 Effect of Soil Types

The impact of an earthquake on structures and infrastructure is largely a function of ground shaking, distance from the source of the quake, and liquefaction. Liquefaction is a secondary effect of an earthquake in which soils lose their shear strength and flow or behave as liquid, thereby damaging structures that derive their support from the soil. Liquefaction generally occurs in soft, unconsolidated sedimentary soils. A program called the National Earthquake Hazard Reduction Program (NEHRP) creates maps based on soil characteristics to help identify locations subject to liquefaction. Table 11-2 summarizes NEHRP soil classifications. NEHRP Soils B and C typically can sustain ground shaking without much effect, dependent on the earthquake magnitude. The areas that are commonly most affected by ground shaking have NEHRP Soils D, E, and F. In general, these areas are also most susceptible to liquefaction.

TABLE 11-2.
NEHRP SOIL CLASSIFICATION SYSTEM

NEHRP Soil Type	Description	Mean Shear Velocity to 30 meters (meters per second)
A	Hard Rock	1,500
B	Firm to Hard Rock	760-1,500
C	Dense Soil/Soft Rock	360-760
D	Stiff Soil	180-360
E	Soft Clays	< 180
F	Special Study Soils (liquefiable soils, sensitive clays, organic soils, soft clays >36 meters thick)	

11.2 HAZARD PROFILE

Earthquakes can last from a few seconds to over five minutes; they may also occur as a series of tremors over several days. The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Casualties generally result from falling objects and debris, because the shocks shake, damage, or demolish buildings and other structures. Disruption of communications, electrical power supplies and gas, sewer and water lines should be expected. Earthquakes may trigger fires, dam failures, landslides, or releases of hazardous material, compounding their disastrous effects.

Small, local faults produce lower magnitude quakes, but ground shaking can be strong and damage can be significant in areas close to the fault. In contrast, large regional faults can generate earthquakes of great magnitudes but, because of their distance and depth, they may result in only moderate shaking in an area.

The severity of earthquakes is influenced by several factors, including the depth of the quake, the geology in the area, and the soils. The severity of soil liquefaction is dependent on the soils grain size, thickness, compaction, and degree of saturation.

11.2.1 Past Events

Most past earthquakes in Texas have been of low magnitude and have mainly occurred in west Texas, or the Panhandle area. As shown in Figure 11-1 below, the probability of a severe earthquake in the area is low. According to the *2013 State of Texas Hazard Mitigation Plan*, the probability of an earthquake in the Central Region of Texas is considered rare. Although a small event is possible, it would pose little to no risk for the area. According to the USGS Earthquake Hazard Program, no earthquake have been recorded in San Saba County since 1847 (the earliest date data are available).

11.2.2 Location

While Texas does face some earthquake hazard, this hazard is very small in comparison to many other states. The biggest threat appears to be from the New Madrid fault system in Missouri, a system powerful enough to pose a risk to the north Texas area. Two regions, near El Paso and in the Panhandle, should expect earthquakes with magnitudes of approximately 5.5 to 6.0 to occur every 50 to 100 years, with even larger earthquakes possible. In Central Texas, the hazard is generally low, but residents should be aware that small earthquakes can occur, including some that are theoretically triggered by oil or gas production. Elsewhere in Texas, earthquakes are exceedingly rare. However, the hazard level is not zero anywhere in Texas; small earthquakes are possible almost anywhere, and all regions face possible ill effects from very large, distant earthquakes. Figure 11-2 shows earthquake hazard threats in the U.S.

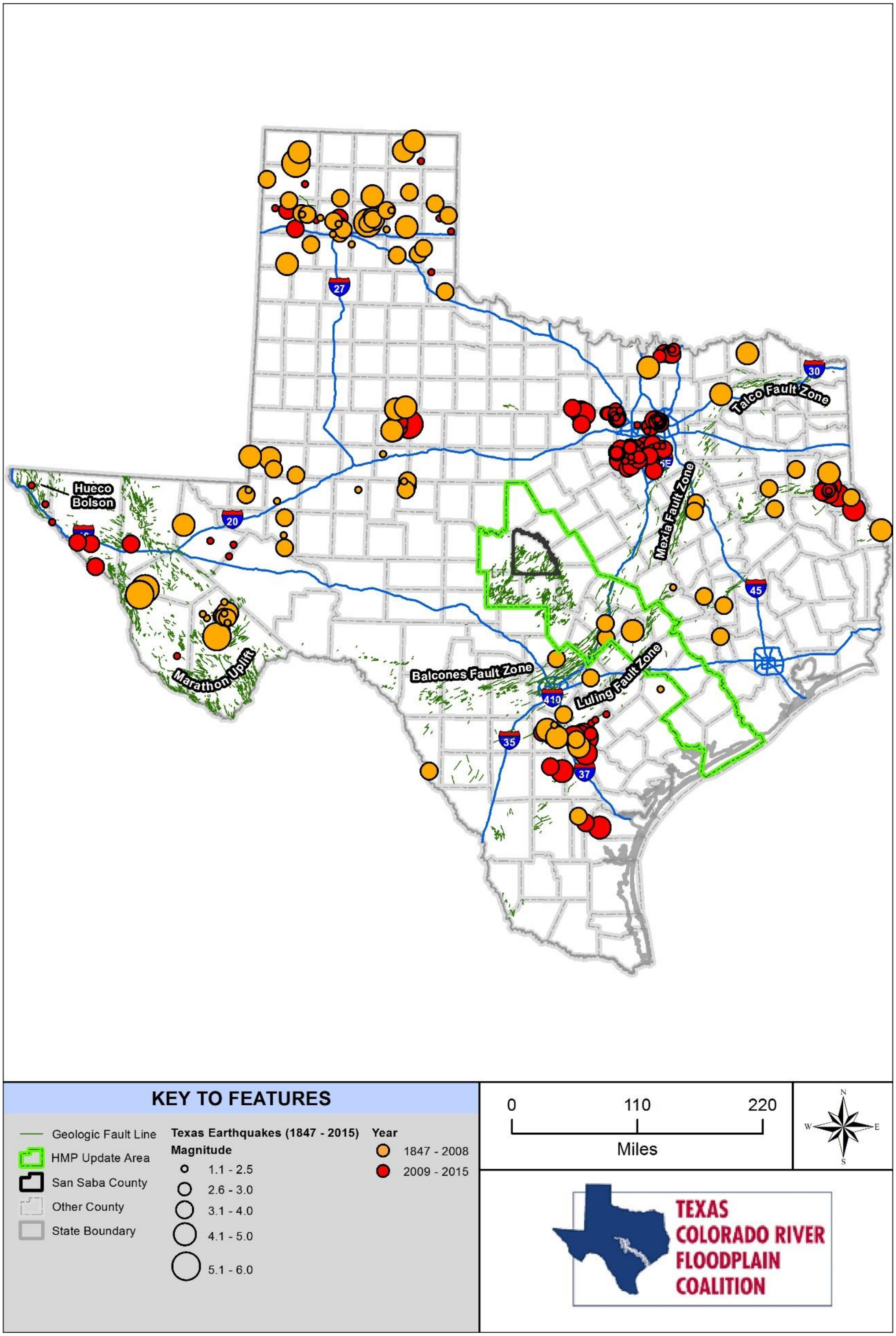


Figure 11-1. Texas Earthquakes (1847-2015)

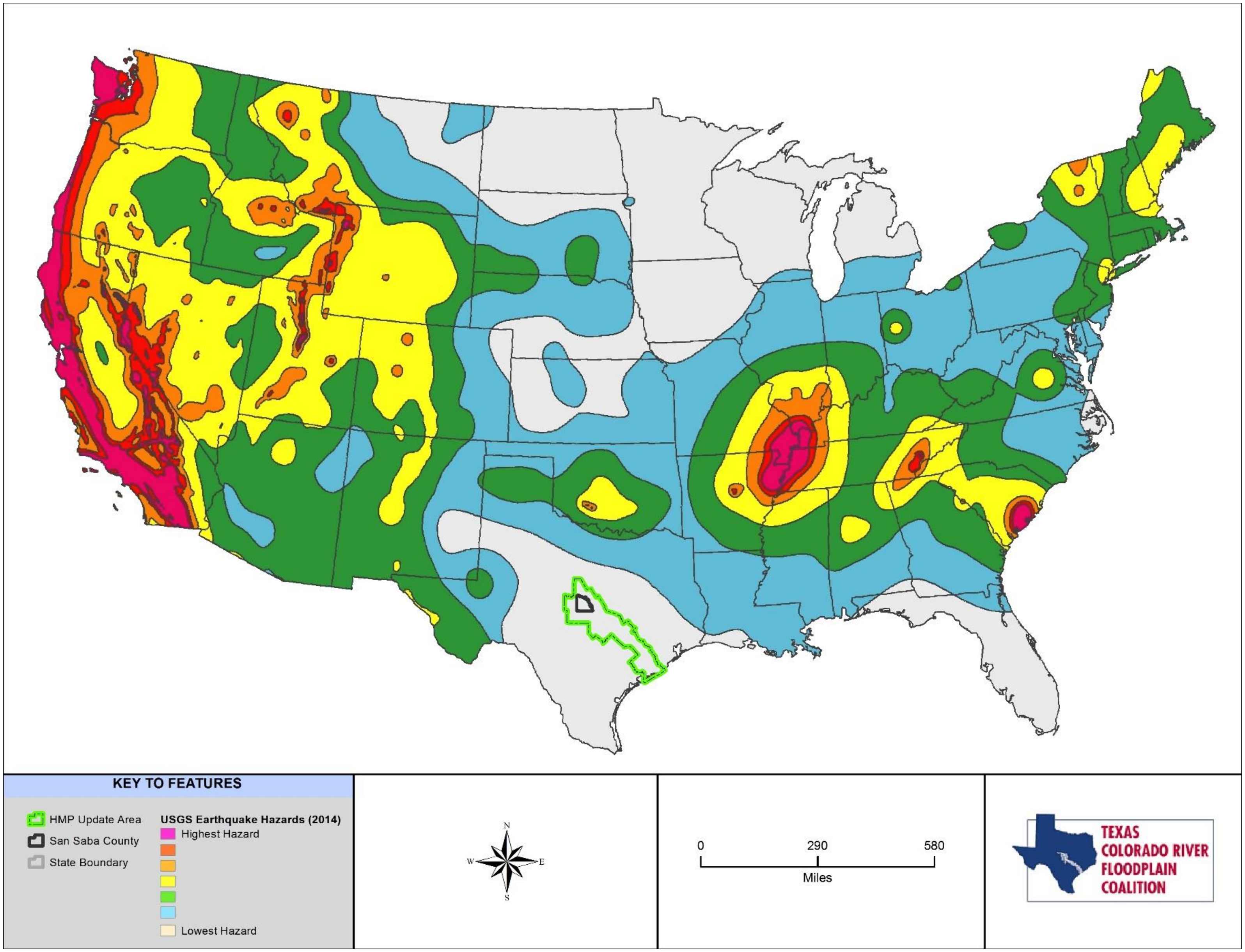


Figure 11-2. Probabilistic Earthquake Hazard Map for the U.S.

Faults have been classified based on the geologic time frame of their latest suspected movement (in order of activity occurrence, most recent is listed first):

- H Holocene (within past 15,000 years)
- LQ Late Quaternary (15,000 to 130,000 years ago)
- MLQ Middle to Late Quaternary (130,000 to 750,000 years ago)
- Q Quaternary (approximately past 2 million years)
- LC Late Cenozoic (approximately past 23.7 million years)

Known named faults in Texas are the Balcones Fault Zone, Mexia Fault Zone, Luling Fault Zone, Hueco Bolson, Marathon Uplift, and Talco Fault Zone.

The impact of an earthquake is largely a function of the following components:

- Ground shaking (ground motion accelerations)
- Liquefaction (soil instability)
- Distance from the source (both horizontally and vertically)

No earthquake scenarios were selected for this plan because an earthquake event for the planning area is rare, according to the *2013 State of Texas Hazard Mitigation Plan*.

11.2.3 Frequency

According to the USGS, the probability that a magnitude 5 or greater earthquake will occur in the planning area in the next few years is unlikely. The USGS Earthquake Probability Mapping application estimates that the probability that a magnitude 5 or greater earthquake will occur in the next 500 years in San Saba County is 2% or less. Overall, the probability of a damaging earthquake somewhere in San Saba County is considered rare. Small earthquakes that cause no or little damage are more likely.

11.2.4 Severity

Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks, such as water, power, communication, and transportation lines. Damage and life loss can be particularly devastating in communities where buildings were not designed to withstand seismic forces (e.g., historic structures). Other damage-causing effects of earthquakes include surface rupture, fissuring, settlement, and permanent horizontal and vertical shifting of the ground. Secondary impacts can include landslides, rock falls, liquefaction, fires, dam failure, and hazardous materials incidents.

There are no known deaths or injuries from earthquakes in San Saba County. Some of the past earthquake events in Texas were severe enough to cause minor property damage such as broken windows or contents falling from shelves. The very low probability of an event suggests that potential for these impacts is minimal.

The severity of an earthquake can be expressed in terms of intensity or magnitude. Intensity represents the observed effects of ground shaking on people, buildings, and natural features. The USGS has created ground motion maps based on current information about several fault zones. These maps show the PGA that has a certain probability (2% or 10%) of being exceeded in a 50-year period, as shown on Figure 11-3. The PGA is measured in numbers of g's (the acceleration associated with gravity). The 500-Year HAZUS-MH Probabilistic Event scenario for San Saba County produced a PGA of 0.0133, which is lower than the FEMA PGA minimum requirement (3%g) for earthquake analysis profiling. Figure 11-4 shows the 500-Year Probability Event, which produces only a weak ground shaking and is likely to cause no damage. This means that during an event of such magnitude, shaking might not be felt or felt indoors by a few persons, especially on upper floors, or by sensitive or nervous individuals. Hanging objects or doors may swing and trees, structures, or bodies of water may sway. Dizziness or nausea can also be experienced.

Magnitude is related to the amount of seismic energy released at the hypocenter of an earthquake. It is calculated based on the amplitude of the earthquake waves recorded on instruments. Whereas intensity varies depending on location with respect to the earthquake epicenter, magnitude is represented by a single, instrumentally measured value for each earthquake event.

In simplistic terms, the severity of an earthquake event can be measured in the following terms:

- How hard did the ground shake?
- How did the ground move? (horizontally or vertically)
- How stable was the soil?
- What is the fragility of the built environment in the area of impact?

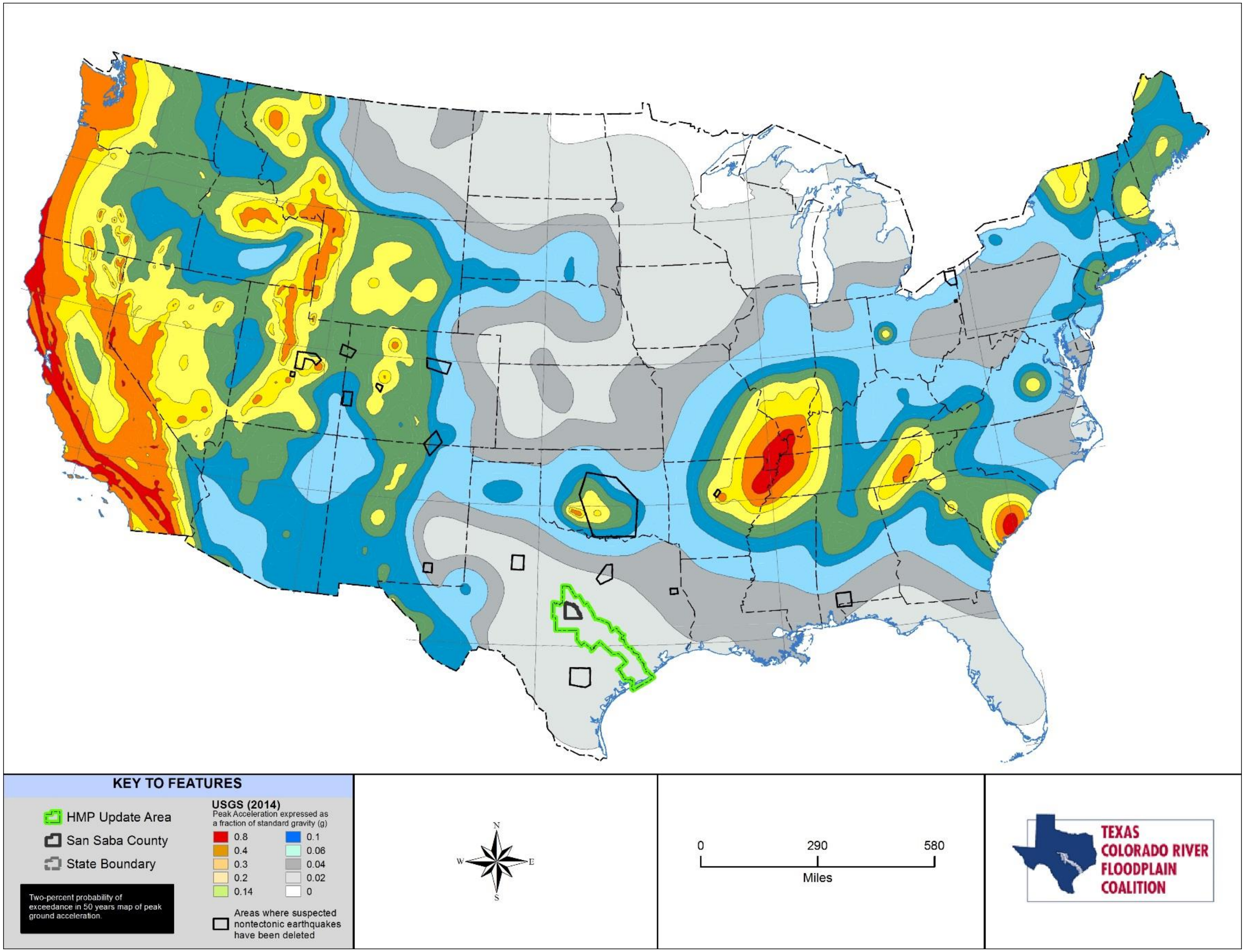
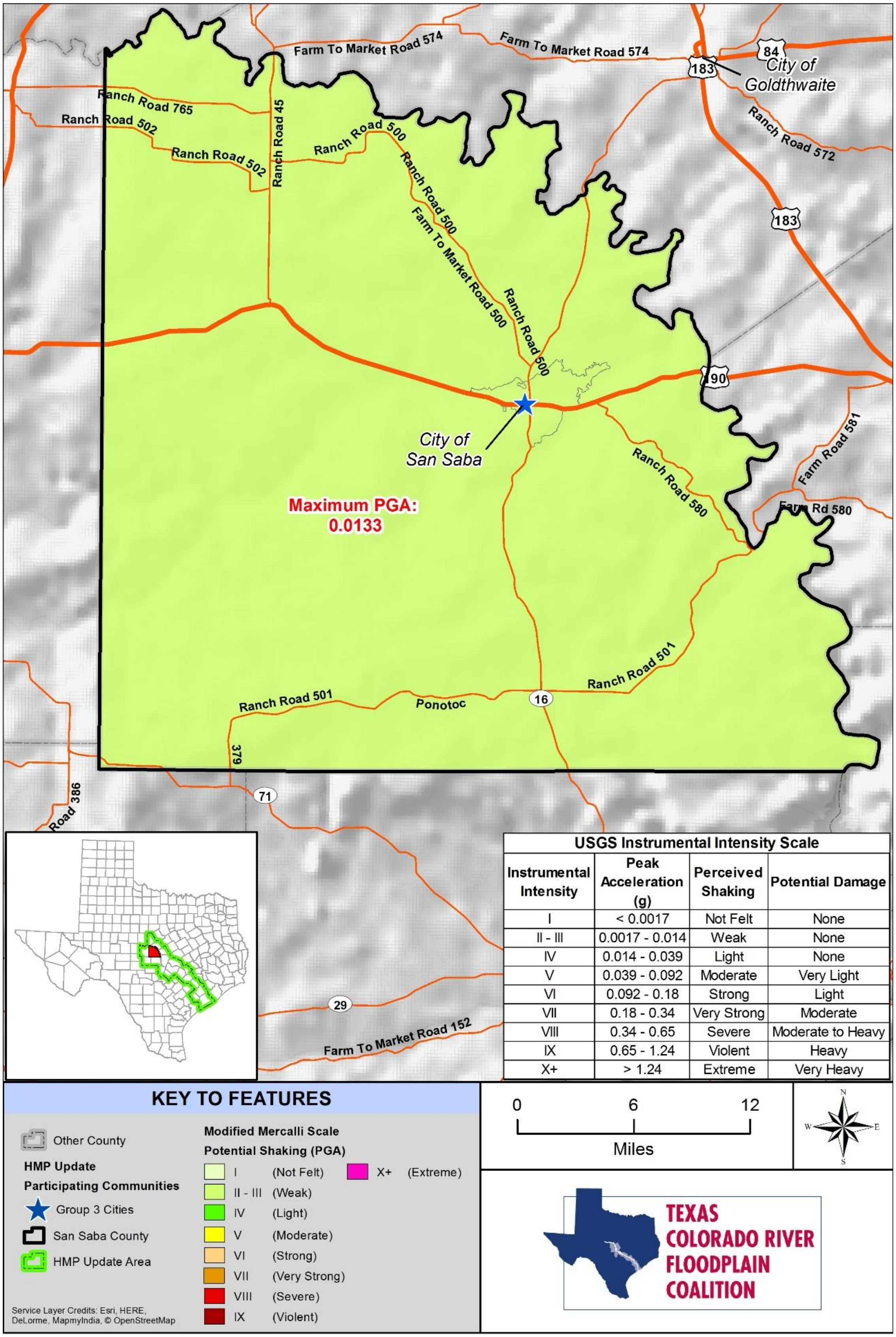


Figure 11-3. Peak Ground Acceleration (10% Probability of Exceedance in 50-Year Map of Peak Ground Acceleration)



USGS Instrumental Intensity Scale

Instrumental Intensity	Peak Acceleration (g)	Perceived Shaking	Potential Damage
I	< 0.0017	Not Felt	None
II - III	0.0017 - 0.014	Weak	None
IV	0.014 - 0.039	Light	None
V	0.039 - 0.092	Moderate	Very Light
VI	0.092 - 0.18	Strong	Light
VII	0.18 - 0.34	Very Strong	Moderate
VIII	0.34 - 0.65	Severe	Moderate to Heavy
IX	0.65 - 1.24	Violent	Heavy
X+	> 1.24	Extreme	Very Heavy

Figure 11-4. 500-Year Probability Event in San Saba County

11.2.5 Warning Time

Part of what makes earthquakes so destructive is that they generally occur without warning. The main shock of an earthquake can usually be measured in seconds, and rarely lasts for more than a minute. Aftershocks can occur within the days, weeks, and even months following a major earthquake.

By studying the geologic characteristics of faults, geoscientists can often estimate when the fault last moved and estimate the magnitude of the earthquake that produced the last movement. Because the occurrence of earthquakes is relatively low to none in the county and the historical earthquake record is short, accurate estimations of magnitude, timing, or location of future dangerous earthquakes in San Saba County are difficult to estimate.

There is currently no reliable way to predict the day or month that an earthquake will occur at any given location. Research is being done with warning systems that use the low energy waves that precede major earthquakes. These potential warning systems give approximately 40 seconds notice that a major earthquake is about to occur. The warning time is very short but it could allow for someone to get under a desk, step away from a hazardous material they are working with, or shut down sensitive equipment.

11.3 SECONDARY HAZARDS

Earthquakes can cause large and sometimes disastrous landslides and mudslides. River valleys are vulnerable to slope failure, often as a result of loss of cohesion in clay-rich soils. Soil liquefaction occurs when water-saturated sands, silts, or gravelly soils are shaken so violently that the individual grains lose contact with one another and float freely in the water, turning the ground into a pudding-like liquid. Building and road foundations lose load-bearing strength and may sink into what was previously solid ground. Unless properly secured, hazardous materials can be released, causing significant damage to the environment and people. Earthen dams and levees are highly susceptible to seismic events and the impacts of their eventual failures can be considered secondary risks for earthquakes.

11.4 CLIMATE CHANGE IMPACTS

The impacts of global climate change on earthquake probability are unknown. Some scientists say that melting glaciers could induce tectonic activity. As ice melts and water runs off, tremendous amounts of weight are shifted on the earth's crust. As newly freed crust returns to its original, pre-glacier shape, it could cause seismic plates to slip and stimulate volcanic activity according to research into prehistoric earthquakes and volcanic activity. National Aeronautics and Space Administration (NASA) and USGS scientists found that retreating glaciers in southern Alaska may be opening the way for future earthquakes (NASA 2004).

Secondary impacts of earthquakes could be magnified by climate change. Soils saturated by repetitive storms could experience liquefaction during seismic activity due to the increased saturation. Dams storing increased volumes of water due to changes in the hydrograph could fail during seismic events. There are currently no models available to estimate these impacts.

11.5 EXPOSURE

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. San Saba County's PGA is less than 3%g (0.03) and there have been no recorded earthquakes in or near San Saba County. Therefore, only a minimum Level 1 HAZUS analysis was profiled using the 500-Year Probability Event scenario.

11.5.1 Population

The entire population of San Saba County is potentially exposed to direct and indirect impacts from earthquakes. The degree of exposure is dependent on many factors, including the age and construction type of the structures people live in, the soil type their homes are constructed on, their proximity to fault location, and other factors. Whether impacted directly or indirectly, the entire population will have to deal with the consequences of earthquakes to some degree. Business interruption could keep people from working, road closures could isolate populations, and functional loss of utilities could impact populations that suffered no direct damage from an event itself.

11.5.2 Property

According to the San Saba County HAZUS 2.2 inventory data (updated with 2010 U.S. Census data and 2014 RS Means Square Foot Costs), there are 3,162 buildings within the San Saba County with an asset replaceable value of more than $635 million (excluding contents). About 99% of these buildings (and 84% of the building value) are associated with residential housing. Within the participating communities, there are 2,951 buildings (residential, commercial, and other) with a total asset inventory value of over $587 million (excluding contents). Other types of buildings in this report include agricultural, education, religious, and governmental structures. Since all structures in the planning area are susceptible to earthquake impacts to varying degrees, this represents the total planning area property exposure to seismic events.

11.5.3 Critical Facilities and Infrastructure

All critical facilities and infrastructure in the planning area are exposed to the earthquake hazard. Table 6-3 and Table 6-4 list the number of each type of facility by jurisdiction. Hazardous material releases can occur during an earthquake from fixed facilities or transportation-related incidents. Transportation corridors can be disrupted during an earthquake, leading to the release of materials to the surrounding environment. Facilities holding hazardous materials are of particular concern because of possible isolation of neighborhoods surrounding them. During an earthquake, structures storing these materials could rupture and leak into the surrounding area or an adjacent waterway, having a disastrous effect on the environment.

11.5.4 Environment

Secondary hazards associated with earthquakes will likely have some of the most damaging effects on the environment. Earthquake-induced landslides can significantly impact surrounding habitat. It is also possible for streams to be rerouted after an earthquake. This can change the water quality, possibly damaging habitat and feeding areas. There is a possibility of streams fed by groundwater drying up because of changes in underlying geology.

11.6 VULNERABILITY

All structures, people, and infrastructure within the county are vulnerable to earthquake damage. However due to the low risk of occurrence, only a minimum Level 1 HAZUS 500-Year Probabilistic Event analysis was conducted. San Saba County's PGA is less than 2%g, which is lower than the FEMA PGA minimum requirement (3%g) for earthquake analysis profiling.

11.7 FUTURE TRENDS IN DEVELOPMENT

Land use in the planning area will be directed by master plans adopted by the county and its planning partners as well as local permitting departments and zoning maps. The information in this plan provides the participating partners a tool to ensure that there is no increase in exposure in areas of high seismic risk. Development in the planning area will be regulated through building standards and performance measures so that the degree of risk will be reduced. The International Building Code also establishes provisions to address seismic risk.

11.8 SCENARIO

An earthquake does not have to occur within the planning area to have a significant impact on the people, property and economy of the county. However, any seismic activity of 6.0 or greater on faults within the planning area would have significant impacts throughout the county. Earthquakes of this magnitude or higher would lead to massive structural failure of property on highly liquefiable soils. Levees and revetments built on these poor soils would likely fail, representing a loss of critical infrastructure. These events could cause secondary hazards, including landslides and mudslides that would further damage structures. River valley hydraulic-fill sediment areas are also vulnerable to slope failure, often as a result of loss of cohesion in clay-rich soils.

11.9 ISSUES

Important issues associated with an earthquake include but are not limited to the following:

- Many structures within the planning area were built prior to 1994, when seismic provisions became uniformly applied through building code applications.
- Critical facility owners should be encouraged to create or enhance continuity of operations plans using the information on risk and vulnerability contained in this plan.
- Geotechnical standards should be established that take into account the probable impacts from earthquakes in the design and construction of new or enhanced facilities.
- Earthquakes could trigger other natural hazard events such as dam failures and landslides, which could severely impact the county.
- A worst-case scenario would be the occurrence of a large seismic event during a flood or high-water event. Failures could happen at multiple locations, increasing the impacts of the individual events.
- The cost of retrofitting buildings to meet earthquake seismicity standards may be cost-prohibitive.
- Dams located in the county may not have been engineered to withstand probable seismic events.
- Information regarding liquefaction susceptibility of soils in the planning area is lacking.

CHAPTER 12.
FLOOD

FLOOD RANKING	
San Saba County	Medium
City of San Saba	Low

DEFINITIONS

Flood — The inundation of normally dry land resulting from the rising and overflowing of a body of water.

Floodplain — The land area along the sides of a river that becomes inundated with water during a flood.

100-Year Floodplain — The area flooded by a flood that has a 1% chance of being equaled or exceeded each year. This is a statistical average only; a 100-year flood can occur more than once in a short period of time. The 1% annual chance flood is the standard used by most federal and state agencies.

Riparian Zone — The area along the banks of a natural watercourse.

12.1 GENERAL BACKGROUND

12.1.1 Flood

The following description of flooding is an excerpt from the *2013 State of Texas Flood Mitigation Plan*.

A flood is a general and temporary condition of partial or complete inundation of normally dry land areas from:

- The overflow of stream banks
- The unusual and rapid accumulation of runoff of surface waters from any source
- Mudflows or the sudden collapse of shoreline land

Flooding results when the flow of water is greater than the normal carrying capacity of the stream channel. Rate of rise, magnitude (or peak discharge), duration, and frequency of floods are a function of specific physiographic characteristics. Generally, the rise in water surface elevation is quite rapid on small (and steep gradient) streams and slow in large (and flat sloped) streams.

The causes of floods relate directly to the accumulation of water from precipitation, or the failure of man-made structures, such as dams or levees. Floods caused by precipitation are further classified as coming from: rain in a general storm system, rain in a localized intense thunderstorm, melting snow and ice, and hurricanes and tropical storms. Floods may also be caused by structural or hydrologic failures of dams or levees. A hydrologic failure occurs when the volume of water behind the dam or levee exceeds the structure‘s capacity resulting in overtopping. Structural failure arises when the physical stability of the dam or levee is compromised due to age, poor construction and maintenance, seismic activity, rodent tunneling, or myriad other causes. For more information on floods resulting from dam and levee failure refer to Chapter 9 of this plan.

General Rain Floods

General rain floods can result from moderate to heavy rainfall occurring over a wide geographic area lasting several days. They are characterized by a slow steady rise in stream stage and a peak flood of long duration. As various minor streams empty into larger and larger channels, the peak discharge on the mainstream channel may progress upstream or downstream (or remain stationary) over a considerable length of river. General rain floods can result in considerably large volumes of water. Because the rate of rise is slow and the time available for warning is great, few lives are usually lost, but millions of dollars in valuable public and private property are at risk.

Thunderstorm Floods

Damaging thunderstorm floods are caused by intense rain over basins of relatively small area. They are characterized by a sudden rise in stream level, short duration, and a relatively small volume of runoff. Because there is little or no warning time, the term “flash flood” is often used to describe thunderstorm floods. Parts of Texas are located in the “Flash Flood Alley” and the area along the Balcones Escarpment (from Austin south to San Antonio, then west to Del Rio) is one of the nation's three most flash flood-prone regions. Figure 12-1 and Figure 12-2 show the number of flash floods and storm centers in each county. San Saba County lies north of the “Flash Flood Alley.”

Thunderstorm floods occur in every month of the year in Texas but are most common in the spring and summer. The mean annual number of thunderstorm flood days varies from 40 in eastern Texas to 60 in western Texas. Most flash flooding is caused by slow-moving thunderstorms, thunderstorms repeatedly moving over the same area, or heavy rains from hurricanes and tropical storms.

Flash floods can occur within a few minutes or after hours of excessive rainfall. Flash floods can roll boulders, tear out trees, destroy buildings and bridges, and carve out new channels. Rapidly rising water can reach heights of thirty feet or more. Flash flood-producing rains can also trigger catastrophic mudslides. Often there is no warning that flash floods are coming. Hill Country flash floods devastated the river basin and are a major reason why the LCRA located Mansfield Dam and Lake Travis (the flood control components of the Highland Lake chain) upstream of Austin. Flash flooding poses a deadly danger to residents of the Lower Colorado River Basin. A number of roads run through low-lying areas that are prone to sudden and frequent flooding during heavy rains. Motorists often attempt to drive through barricaded or flooded roadways. It takes only 18 to 24 inches of water moving across a roadway to carry away most vehicles. Floating cars easily get swept downstream, making rescues difficult and dangerous.

Rain on Snowmelt Floods

Winter is the driest time of the year in Texas. Snowfall occurs at least once every winter in the northern half of Texas, although accumulations rarely are substantial except in the High Plains. Snow is not uncommon in the mountainous areas of the Trans-Pecos, though heavy snows (five inches or more) come only once every two or three winters. More often than not, snow falling in the southern half of the state melts and does not stick to the surface; snow stays on the ground only once or twice in every decade. Snowfall rarely is observed before early November and hardly ever occurs after mid-April. Where it is not uncommon, snow is almost always heaviest in either January or February. Mean seasonal snowfall is 15 to 18 inches in the Texas Panhandle and 4 to 8 inches elsewhere in the High and Low Rolling Plains.

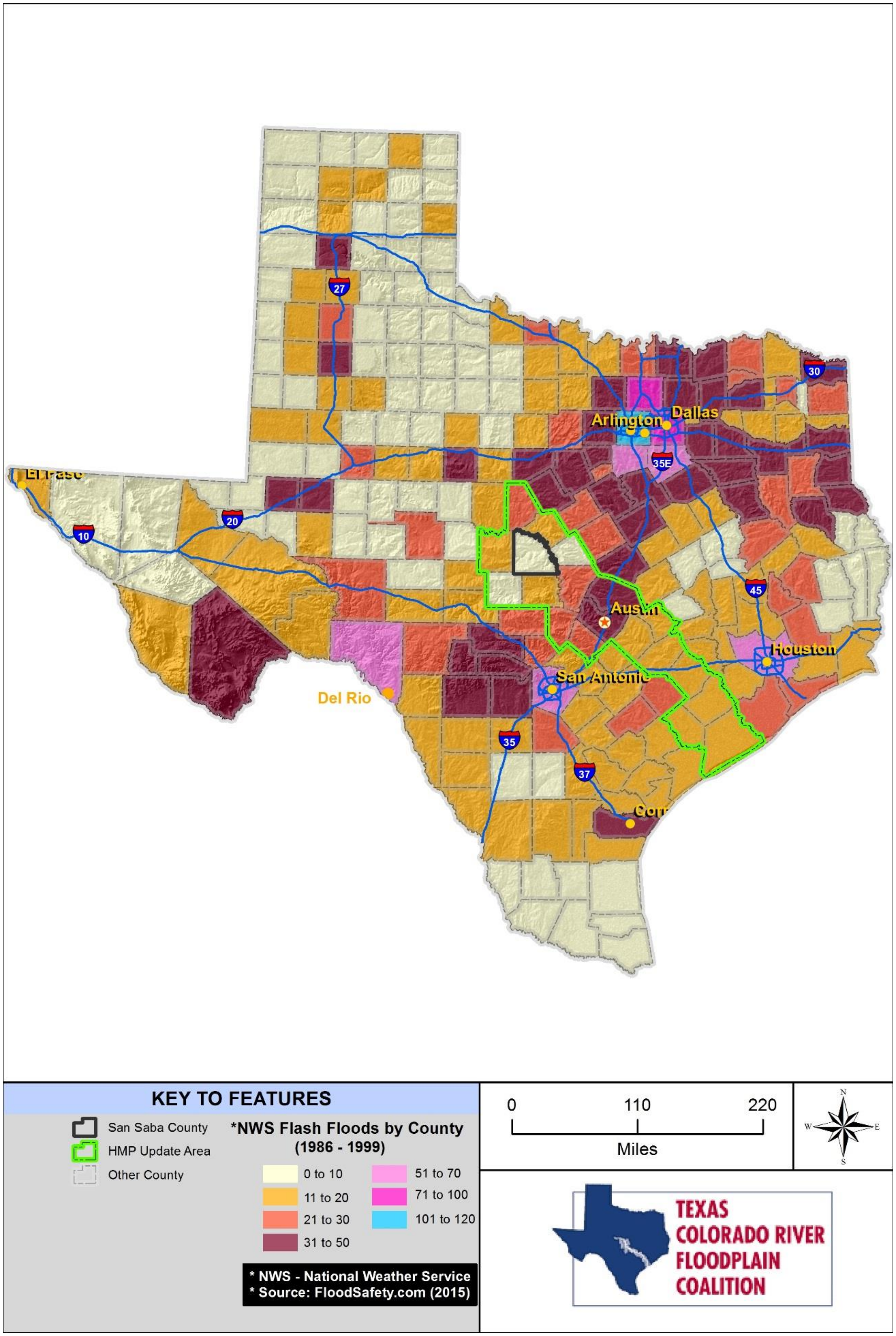


Figure 12-1. Number of Flash Floods in Texas per County (1986-1999)

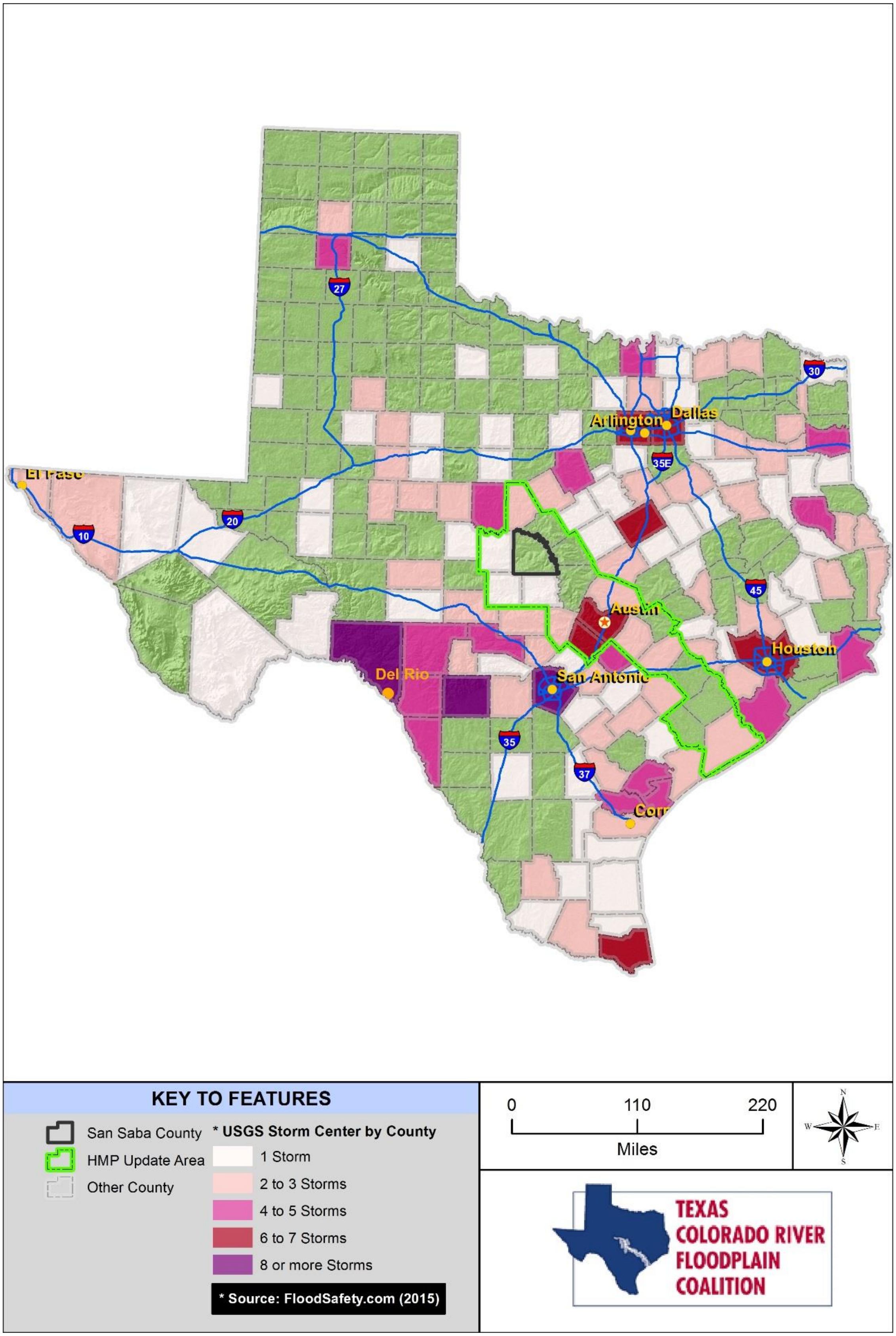


Figure 12-2. Number of Storm Centers by County

12.1.2 Floodplain

A floodplain is the area adjacent to a river, creek, or lake that becomes inundated during a flood. Floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined in a canyon.

When floodwaters recede after a flood event, they leave behind layers of rock and mud. These gradually build up to create a new floor of the floodplain. Floodplains generally contain unconsolidated sediments (accumulations of sand, gravel, loam, silt, or clay), often extending below the bed of the stream. These sediments provide a natural filtering system, with water percolating back into the ground and replenishing groundwater. These are often important aquifers, the water drawn from them being filtered compared to the water in the stream. Fertile, flat reclaimed floodplain lands are commonly used for agriculture, commerce, and residential development.

Connections between a river and its floodplain are most apparent during and after major flood events. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. When a river is separated from its floodplain with levees and other flood control facilities, natural, built-in benefits can be lost, altered, or significantly reduced.

12.1.3 Measuring Floods and Floodplains

The frequency and severity of flooding are measured using a discharge probability, which is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to estimate the probability of occurrence for the different discharge levels. The flood frequency equals 100 divided by the discharge probability. For example, the 100-year discharge has a 1% chance of being equaled or exceeded in any given year. These measurements reflect statistical averages only; it is possible for two or more floods with a 100-year or higher recurrence interval to occur in a short time period. The same flood can have different recurrence intervals at different points on a river.

The extent of flooding associated with a 1% annual probability of occurrence (the base flood or 100-year flood) is used as the regulatory boundary by FEMA and many agencies. Also referred to as the special flood hazard area (SFHA), this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water surface elevations describe the elevation of water that will result from a given discharge level, which is one of the most important factors used in estimating flood damage.

12.1.4 Floodplain Ecosystems

Floodplains can support ecosystems that are rich in plant and animal species. A floodplain can contain 100 or even 1,000 times as many species as a river. Wetting of the floodplain soil releases an immediate surge of nutrients: those left over from the last flood, and those that result from the rapid decomposition of organic matter that has accumulated since then. Microscopic organisms thrive and larger species enter a rapid breeding cycle. Opportunistic feeders (particularly birds) move in to take advantage. The production of nutrients peaks and falls away quickly, but the surge of new growth endures for some time. This makes floodplains valuable for agriculture. Species growing in floodplains are markedly different from those that grow outside floodplains. For instance, riparian trees (trees that grow in floodplains) tend to be very tolerant of root disturbance and very quick-growing compared to non-riparian trees.

12.1.5 Effects of Human Activities

Because they border water bodies, floodplains have historically been popular sites to establish settlements. Human activities tend to concentrate in floodplains for a number of reasons: water is readily available; land is fertile and suitable for farming; transportation by water is easily accessible; and land is flatter and easier to develop. However, human activity in floodplains frequently interferes with the natural function of floodplains. It can affect the distribution and timing of drainage, thereby increasing flood problems. Human development can create local flooding problems by altering or confining drainage channels. This increases flood potential in two ways: it reduces the stream's capacity to contain flows, and it increases flow rates or velocities downstream during all stages of a flood event. Human activities can interface effectively with a floodplain as long as steps are taken to mitigate the activities' adverse impacts on floodplain functions.

12.2 HAZARD PROFILE

Texas has the most flash flood deaths of any state in the country. Although San Saba County is north of the "Flash Flood Alley" area of Texas, it is still susceptible to flash flood events every year. The terrain is punctuated by a large number of limestone or granite rocks and boulders and a thin layer of topsoil, which makes the region very dry and prone to flash flooding. Other factors contributing to flash floods in the area include its location between the Rocky Mountains and the moisture laden Gulf of Mexico. As weather systems stall and dissipate over Texas, and they drop intense rains over small areas. In the past, San Saba County has had significant seasonal floods along the Colorado River, San Saba River, and Richland Springs Creek; however, these floods have been greatly reduced by the construction of large reservoirs. This has also helped to reduce the impacts of seasonal floods in the planning area.

Flooding in the county is mostly caused by slow-moving thunderstorms, thunderstorms repeatedly moving over the same area, or heavy rains from hurricanes and tropical storms. Flash floods can occur within a few minutes or after hours of excessive rainfall. These rain events are most often microbursts, which produce a large amount of rainfall in a short amount of time. Flash floods, by their nature, occur suddenly but usually dissipate within hours. Despite their sudden nature, the NWS is usually able to issue advisories, watches, and warnings in advance of a flood.

The potential for flooding can change and increase through various land use changes and changes to land surface. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining watersheds or natural drainage channels. These changes are commonly created by human activities (e.g., development). These changes can also be created by other events such as wildfires. Wildfires create hydrophobic soils, a hardening or "glazing" of the earth's surface that prevents rainfall from being absorbed into the ground, thereby increasing runoff, erosion, and downstream sedimentation of channels.

Potential flood impacts include loss of life, injuries, and property damage. Floods can also affect infrastructure (water, gas, sewer, and power utilities), transportation, jobs, tourism, the environment, and ultimately local and regional economies.

12.2.1 Past Events

The NOAA National Climatic Data Center's Storm Events Database includes flood events that occurred in San Saba County between 1996 and 2015, as listed in Table 12-1. No injuries or deaths have been reported.

**TABLE 12-1.
HISTORIC FLOOD EVENTS IN SAN SABA COUNTY (1996-2015)**

Location	Date	Estimated Damage Cost		Injuries	Deaths
		Property	Crops		
San Saba	6/7/1996	$0	$0	0	0
San Saba	7/15/1996	$0	$0	0	0
San Saba	2/20/1997	$0	$0	0	0
San Saba (Zone)	2/20/1997	$50,000	$50,000	0	0
Cherokee	5/30/1997	$0	$0	0	0
Richland Springs	6/6/1997	$800,000	$400,000	0	0
San Saba (Zone)	6/21/1997	$0	$0	0	0

**TABLE 12-1.
HISTORIC FLOOD EVENTS IN SAN SABA COUNTY (1996-2015)**

Location	Date	Estimated Damage Cost		Injuries	Deaths
		Property	Crops		
Cherokee	6/22/1997	$150,000	$75,000	0	0
San Saba	5/11/1999	$0	$0	0	0
Northwest Portion	10/23/2000	$5,000	$0	0	0
Countywide	11/3/2000	$25,000	$0	0	0
San Saba (Zone)	11/3/2000	$10,000	$0	0	0
San Saba (Zone)	11/4/2000	$0	$0	0	0
San Saba (Zone)	11/6/2000	$0	$0	0	0
San Saba (Zone)	11/15/2001	$0	$0	0	0
Countywide	7/3/2002	$5,000	$0	0	0
Northeast Portion	7/5/2002	$5,000	$0	0	0
Countywide	7/14/2002	$0	$0	0	0
Countywide	6/5/2003	$0	$0	0	0
Northwest Portion	9/14/2003	$0	$0	0	0
Countywide	6/9/2004	$800,000	$0	0	0
San Saba	8/21/2004	$0	$0	0	0
San Saba	8/21/2004	$0	$0	0	0
San Saba (Zone)	11/18/2004	$6,000	$0	0	0
San Saba	6/1/2007	$0	$0	0	0
San Saba County Municipal Airport	10/8/2011	$0	$0	0	0
San Saba	5/25/2014	$0	$0	0	0
San Saba	7/15/2014	$0	$0	0	0

Source: http://www.ncdc.noaa.gov

Notable incidents from the Storm Events Database in San Saba County are described below:

- February 20, 1997 – River flooding occurred on the San Saba River at San Saba, cresting at 28.65 feet. Flood stage is 24 feet. No injuries or fatalities were recorded. The county sustained property and crop damage of $50,000 each.
- June 6, 1997 – Very heavy rains fell over San Saba County, with the northwest portion receiving the most precipitation. Elk Grove reported 10 inches of rain, and Richland Springs reported 8 inches. The City of San Saba reported 6.5 inches of rain, and many residents were stranded in the floodwaters. No injuries or fatalities resulted from the storm. However, property and crop damages totaled $800,000 and $400,000, respectively.
- June 23, 1997 – Heavy rains yielded up to 6.5 inches and caused widespread flooding throughout the county. Highway 71 was closed due to high water. While no injuries or fatalities were attributed to this event, the county sustained property damages of $150,000 and crop damages of $75,000.
- October 23, 2000 – Thunderstorms dropped 3 to 5 inches of rain across the northwest sections of San Saba County. Several roads were reported flooded and water entered a house in Richland

Springs. Property damage amounted to $5,000, but no injuries or fatalities were associated with the event.

- November 3, 2000 – Heavy rainfall of 6 to 10 inches across several counties, including San Saba, caused the San Saba River to climb out of its banks. Many roads throughout the county were closed, as low water crossings along both the San Saba River and its smaller tributaries became flooded and impassable. No injuries or fatalities were recorded. The flood caused $35,000 in property damage.
- July 3, 2002 – A slow moving tropical wave started to produce heavy rains over portions of west central Texas in the early morning hours of July 3. The first short-lived round of flooding was confined to mainly the Heartland and northwest Hill Country. The damage from this first round of flooding was due to road washouts. Law enforcement reported significant street flooding in the San Saba area. Creeks and streams also overflowed their banks along State Highway 16. Property damage amounted to $5,000, and no injuries or fatalities were reported.
- July 5, 2002 – Heavy rains of up to 8 inches produced widespread flooding, and closed several roads within the San Saba County, especially in the northeast portion. No injuries or fatalities resulted from this event, and the property damage was $5,000.
- June 9, 2004 – Heavy rains produced rainfall rates of 1 to 2 inches per hour for several hours. Total rainfall amounts upwards of 10 inches were reported over a 6 mile wide area from southwest San Saba County across the City of San Saba and into the northeastern portions of the county. The City of San Saba received the most damage with homes and businesses becoming inundated with water. Also several streets were scoured due to the fast movement of the water. The heavy rains also caused minor flooding on the San Saba River at San Saba and the Colorado River near San Saba. No injuries or fatalities were associated with this event, although property damages totaled $800,000.
- November 18, 2004 – Flooding occurred throughout the county and caused one car to be swept from the road. A water rescue was performed, and no injuries or fatalities were reported. Property damage amounted to $6,000.
- May 23 to 25, 2015 – An extreme precipitation event occurred throughout the Central and South Texas regions over Memorial Day weekend. A large volume of precipitation fell within a relatively short period of time, resulting in damaging flood waters throughout the region. According to NWS, observed rainfalls in Comal, Guadalupe, Hays, Comal, Travis, and Kerr Counties exceeded 6 inches within a 48-hour period. Areas within Blanco, Comal, and Kendall Counties received at least 8 inches within 48 hours, and a Blanco County rain gauge managed by LCRA recorded 9.41 inches of rain over the same time period. San Saba County received an average of 2.61 inches of rainfall throughout the county, according to NWS. On May 27, the San Saba River reached a peak flow of approximately 12,000 cubic feet per second and reached an elevation of about 14 feet. No flood damages were reported for San Saba County at this time. There were no injuries or fatalities in San Saba County.

12.2.2 Location

San Saba County lies completely within the Colorado River basin. The Colorado River runs west to southeast in this area along the north and east boundary of the county. Some local waterbodies include the San Saba River, as well as Antelope, Simpson, Richland Springs, Wallace, and Wilbarger Creeks. These streams normally flow year round, although they may dry up during unusually dry years. Additionally, large irrigation canals (not mapped) also contribute to local flooding.

Run off is captured to fill several lakes and reservoirs in San Saba County. The San Saba soil and water conservation districts (SWCD) operates several dams within the county. Some with the highest storage volumes include the Lower San Saba River WS Site 2, 7, and 15 Dams. These dams are used to manage floodwaters with the overall goal of reducing downstream flooding.

In addition to the riverine flooding, San Saba County may experience urban flooding caused by urbanization which can increase the runoff potential of an area. Coastal flooding is typically a result of storm surge, wind-driven waves and heavy rainfall produced by hurricanes, tropical storms, and other large coastal storms that migrate northward from the Gulf of Mexico. Coastal flooding does not apply to San Saba County because of its inland geography.

The floodplain boundary extents for the creeks, streams, rivers, and lakes have been mapped by FEMA in most areas of the county. The resulting FIRMs provide an official depiction of flood hazard risks and risk premium zones for each community and for properties located within it. The published FIRMs within San Saba County became effective on July 02, 1991. However, areas in the southeast corner as well as the north central border have not yet had the flood map boundaries printed. The FIRMs mapped for San Saba County have not yet been remapped as part of the FEMA Map Modernization Program providing Digital Flood Insurance Rate Maps, or DFIRMs.

San Saba County has 41,541 acres in the 100-year floodplain, and 45,606 acres in the 500-year floodplain. Table 12-2 shows the distribution of the acreage across just the participating jurisdictions in the planning area.

TABLE 12-2.
ACREAGE IN THE 100-YEAR AND 500-YEAR FLOODPLAIN BY JURISDICTION

Jurisdiction	Area (acres)	
	100-Year	500-Year
City of San Saba	687	689
Unincorporated Area	40,568	44,635
Planning Area Total	**41,255**	**45,324**

Figure 12-3 shows the SFHAs in San Saba County. Figure 12-4 shows the SFHAs for the City of San Saba.

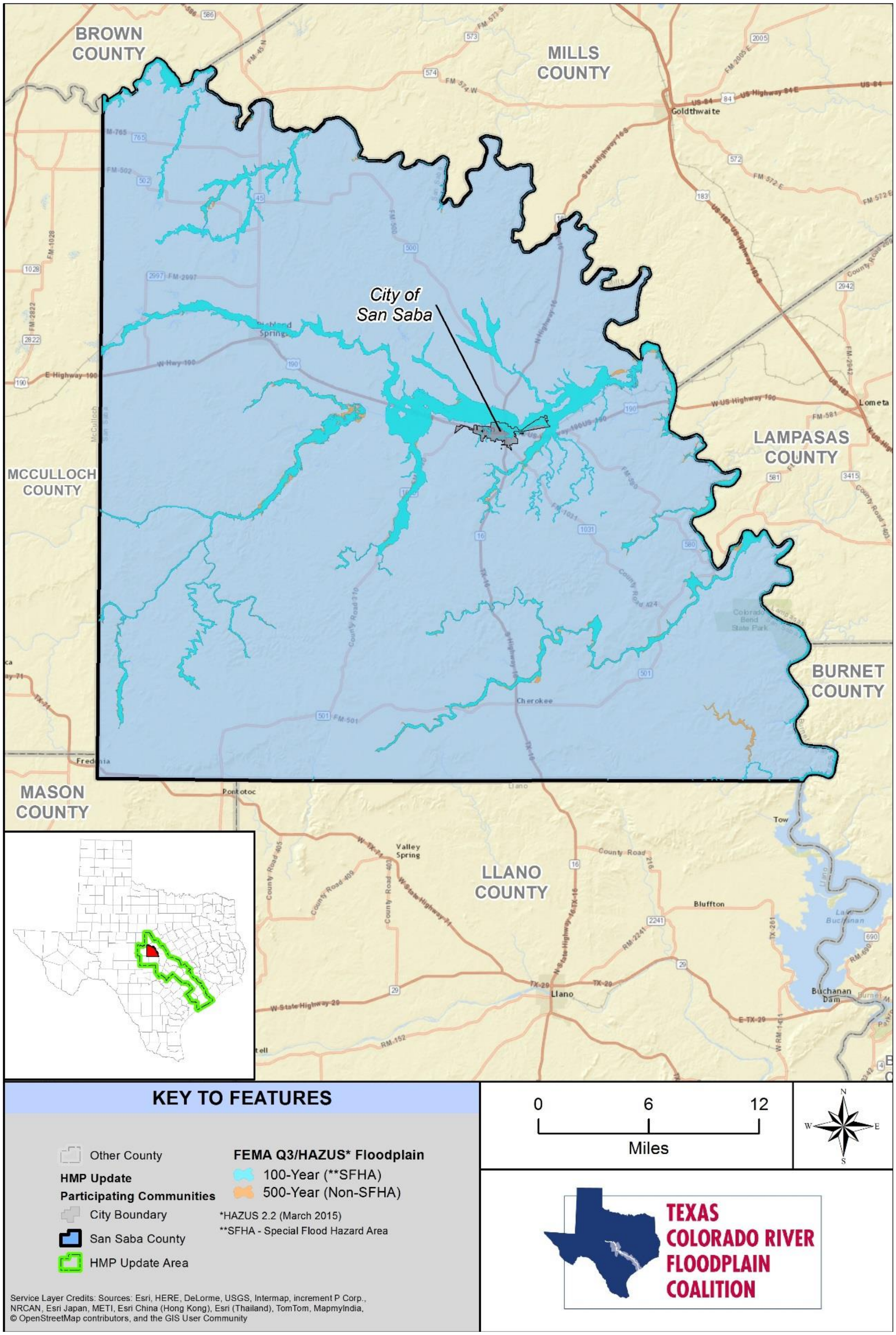


Figure 12-3. Special Flood Hazard Areas in San Saba County

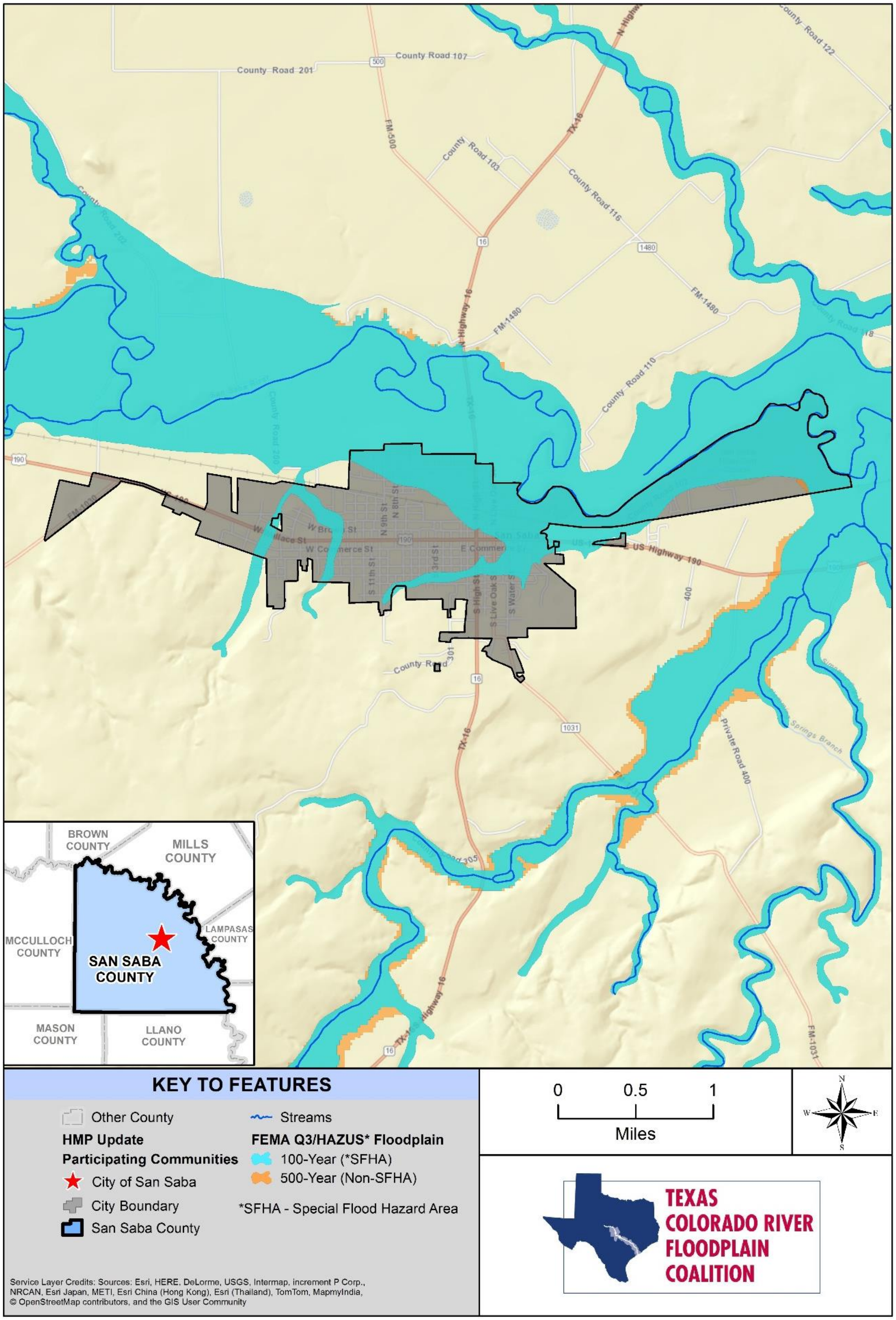


Figure 12-4. Special Flood Hazard Areas in the City of San Saba

12.2.3 Frequency

Seasonal flooding on the Colorado River, Richland Springs Creek, and the numerous creeks in the county have increased over time due to increase rainfall events and weather patterns. Flash floods are still considered to be highly likely to occur in any given year.

12.2.4 Severity

Based on the 100-Year HAZUS-MH Probabilistic Event scenario for San Saba County, the magnitude/severity of flooding is medium. Countywide, approximately 33% of structures will be moderately (11 to 25%) damaged, and over 1,200 tons of debris will be generated requiring more than 50 truckloads (at 25 tons/truck) to remove the debris generated by the flood. The 100-Year HAZUS-MH Probabilistic Event scenario estimates approximately 64 households will be displaced and may seek temporary lodging in public shelters. Overall significance is considered moderate.

12.2.5 Warning Time

Due to the sequential pattern of meteorological conditions needed to cause serious flooding, it is unusual for a flood to occur without warning. Warning times for floods can be between 24 and 48 hours. Flash flooding can be less predictable, but potential hazard areas can be warned in advanced of potential flash flooding danger.

12.3 SECONDARY HAZARDS

The most problematic secondary hazard for flooding is bank erosion, which in some cases can be more harmful than actual flooding. This is especially true in the upper courses of rivers with steep gradients, where floodwaters may pass quickly and without much damage, but scour the banks, edging properties closer to the floodplain or causing them to fall in. Flooding is also responsible for hazards such as landslides when high flows over-saturate soils on steep slopes, causing them to fail. Hazardous materials spills are also a secondary hazard of flooding if storage tanks rupture and spill into streams, rivers, or storm sewers.

12.4 CLIMATE CHANGE IMPACTS

Use of historical hydrologic data has long been the standard of practice for designing and operating water supply and flood protection projects. For example, historical data are used for flood forecasting models. This method of forecasting assumes that the climate of the future will be similar to that of the period of historical record. However, the hydrologic record cannot be used to predict changes in frequency and severity of extreme climate events such as floods. Going forward, model calibration or statistical relation development must happen more frequently, new forecast-based tools must be developed, and a standard of practice that explicitly considers climate change must be adopted. Climate change is already impacting water resources, and resource managers have observed the following:

- Historical hydrologic patterns can no longer be solely relied upon to forecast the water future.
- Precipitation and runoff patterns are changing, increasing the uncertainty for water supply and quality, flood management, and ecosystem functions.
- Extreme climatic events will become more frequent, necessitating improvement in flood protection, drought preparedness, and emergency response.

High frequency flood events (e.g., 10-year floods) in particular will likely increase with a changing climate. Along with reductions in the amount of the snowpack and accelerated snowmelt, scientists project greater storm intensity, resulting in more direct runoff and flooding. Changes in watershed vegetation and soil moisture conditions will likewise change runoff and recharge patterns. As stream flows and velocities change, erosion patterns will also change, altering channel shapes and depths, possibly increasing sedimentation behind dams, and affecting habitat and water quality. With potential increases in the frequency and intensity of wildfires due to climate change, there is potential for more floods following fire, which increase sediment loads and water quality impacts.

As hydrology changes, what is currently considered a 100-year flood may strike more often, leaving many communities at greater risk. Planners will need to factor a new level of safety into the design, operation, and regulation of flood protection facilities such as dams, floodways, bypass channels, and levees, as well as the design of local sewers and storm drains.

12.5 EXPOSURE

The Level 2 HAZUS-MH protocol was used to assess the risk and vulnerability to flooding in the planning area. The model used U.S. Census data at the block level and calculated floodplain data, which has a level of accuracy acceptable for planning purposes. Where possible, the generated HAZUS-MH flood depth data was enhanced using revised FEMA flood depth grids for the area. The HAZUS 2.2 default inventory (updated with 2010 U.S. Census data and 2014 RS Means Square Foot Costs) data was used.

12.5.1 Population

Population counts of those living in the floodplain in the planning area were generated by census block demographic data (2010 U.S. Census data) that intersect with the 100-year and 500-year floodplains identified on FIRMs. The methodology used to generate population estimates intersected census block demographic data with the identified floodplains and then aggregating the resulting data to the community boundaries. Using this approach, it was estimated that the exposed population for the planning area within the 100-year floodplain or SFHA is 913 (14.9% of the total county population). In the 500-year floodplain it is estimated that 934 people countywide live within the mapped non-SFHA areas (15.2% of the total county population).

12.5.2 Property

Present Land Use

Table 12-3 and Table 12-4 show the present land uses in the 100-year and 500-year floodplains for the entire planning area.

TABLE 12-3.
PRESENT LAND USE IN THE 100-YEAR FLOODPLAIN

Present Use Classification	Area (acres)			% of Total
	City of San Saba	Unincorporated Area	**San Saba County Total**	
Barren Land (Rock/Sand/Clay)	0	0	**0**	0.00
Cultivated Crops	0	3,259	**3,259**	7.90
Deciduous Forest	15	1,550	**1,565**	3.79
Developed High Intensity	10	0	**10**	0.02
Developed, Low Intensity	57	15	**72**	0.18
Developed, Medium Intensity	31	3	**34**	0.08
Developed, Open Space	258	1,637	**1,895**	4.59

TABLE 12-3.
PRESENT LAND USE IN THE 100-YEAR FLOODPLAIN

Present Use Classification	Area (acres)			% of Total
	City of San Saba	Unincorporated Area	**San Saba County Total**	
Evergreen Forest	0	3	**3**	0.01
Emergent Wetlands	69	7,205	**7,274**	17.63
Grassland/Herbaceous	144	11,926	**12,070**	29.26
Mixed Forest	0	4	**4**	0.01
Open Water	5	1,643	**1,648**	3.99
Pasture/Hay	31	2,579	**2,610**	6.33
Shrub/Scrub	54	10,526	**10,580**	25.64
Woody Wetlands	14	219	**233**	0.56
Planning Area Total	**688**	**40,569**	**41,257**	**100**

TABLE 12-4.
PRESENT LAND USE IN THE 500-YEAR FLOODPLAIN

Present Use Classification	Area (acres)			% of Total
	City of San Saba	Unincorporated Area	**San Saba County Total**	
Barren Land (Rock/Sand/Clay)	0	0	**0**	0.00
Cultivated Crops	0	3,422	**3,422**	7.55
Deciduous Forest	15	1,734	**1,749**	3.86
Developed High Intensity	10	0	**10**	0.02
Developed, Low Intensity	57	16	**73**	0.16
Developed, Medium Intensity	31	3	**34**	0.08
Developed, Open Space	258	1,799	**2,057**	4.54
Evergreen Forest	0	3	**3**	0.01
Emergent Wetlands	69	8,051	**8,120**	17.92
Grassland/Herbaceous	145	12,986	**13,131**	28.97
Mixed Forest	0	5	**5**	0.01

TABLE 12-4. PRESENT LAND USE IN THE 500-YEAR FLOODPLAIN				
	Area (acres)			
Present Use Classification	City of San Saba	Unincorporated Area	**San Saba County Total**	% of Total
Open Water	5	1,739	**1,744**	3.85
Pasture/Hay	32	2,800	**2,832**	6.25
Shrub/Scrub	55	11,854	**11,909**	26.27
Woody Wetlands	14	225	**239**	0.53
Planning Area Total	**691**	**44,637**	**45,328**	**100**

Structures in the Floodplain

Table 12-5 and Table 12-6 summarize the total area and number of structures in the floodplain by municipality. The updated HAZUS-MH model inventory data estimated that for the planning area there are 446 structures within the 100-year floodplain and 460 structures within the 500-year floodplain. In the 100-year floodplain, 66% of these structures are in unincorporated areas and 99% are residential.

TABLE 12-5. STRUCTURES AND POPULATION IN THE 100-YEAR FLOODPLAIN					
	Structures and Population Affected				
	Residential	Commercial	Other*	**Total Structures Affected**	**Total Population Affected**
City of San Saba	263	4	1	**268**	**600**
Unincorporated Area	177	0	0	**177**	**313**
Planning Area Total	**440**	**4**	**1**	**445**	**913**

*Other includes industrial, agricultural, religious, governmental, and educational classifications.

TABLE 12-6. STRUCTURES AND POPULATION IN THE 500-YEAR FLOODPLAIN					
	Structures and Population Affected				
	Residential	Commercial	Other*	**Total Structures Affected**	**Total Population Affected**
City of San Saba	263	4	1	268	600
Unincorporated Area	192	0	0	192	334
Planning Area Total	**455**	**4**	**1**	**460**	**934**

*Other includes industrial, agricultural, religious, governmental, and educational classifications.

Exposed Value

Table 12-7 and Table 12-8 summarize the estimated value of exposed buildings in the planning area in the 100-year and 500-year floodplains. The updated HAZUS-MH model inventory data estimated $143 million worth of building and contents exposure to the 100-year flood. This represents 15% of the total assessed value of the planning area. Approximately $148 million worth of building-and-contents exposure was estimated to be exposed to the 500-year flood. This represents 16% of the total assessed value of the planning area.

TABLE 12-7.
VALUE OF STRUCTURES IN 100-YEAR FLOODPLAIN

	Value Exposed ($)				
	Structure	Contents	**Total**	Total Assessed Value ($)	% of Total Assessed Value
City of San Saba	55,558,565	35,197,582	**90,756,147**	428,225,383	21.19
Unincorporated Area	34,158,841	18,036,081	**52,194,922**	502,972,374	10.38
Planning Area Total	**89,717,406**	**53,233,663**	**142,951,069**	**931,197,757**	**15.35**

TABLE 12-8.
VALUE OF STRUCTURES IN 500-YEAR FLOODPLAIN

	Value Exposed ($)				
	Structure	Contents	**Total**	Total Assessed Value ($)	% of Total Assessed Value
City of San Saba	55,579,740	35,209,327	**90,789,067**	428,225,383	21.20
Unincorporated Area	37,205,546	19,703,189	**56,908,735**	502,972,374	11.31
Planning Area Total	**92,785,286**	**54,912,516**	**147,697,802**	**931,197,757**	**15.86**

12.5.3 Critical Facilities and Infrastructure

Table 12-9 and Table 12-10 summarize the critical facilities and infrastructure in the 100-year and 500-year floodplains of the planning area. Details are provided in the following sections.

**TABLE 12-9.
CRITICAL FACILITIES AND INFRASTRUCTURE IN THE 100-YEAR FLOODPLAIN**

	City of San Saba	Unincorporated Area	**Planning Area Total**
Medical and Health	0	0	**0**
Government Functions	0	0	**0**
Protective Functions	0	0	**0**
Schools	0	0	**0**
Hazardous Materials	0	0	**0**
Bridges	0	23	**23**
Water Storage	0	0	**0**
Wastewater	0	0	**0**
Power	0	0	**0**
Communications	0	0	**0**
Transportation	0	0	**0**
Dams	0	7	**7**

**TABLE 12-10.
CRITICAL FACILITIES AND INFRASTRUCTURE IN THE 500-YEAR FLOODPLAIN**

	City of San Saba	Unincorporated Area	**Planning Area Total**
Medical and Health	0	0	**0**
Government Functions	0	0	**0**
Protective Functions	0	0	**0**
Schools	0	0	**0**
Hazardous Materials	0	0	**0**
Bridges	0	28	**28**
Water Storage	0	0	**0**
Wastewater	0	0	**0**
Power	0	0	**0**
Communications	0	0	**0**
Transportation	0	0	**0**
Dams	0	9	**9**

Utilities and Infrastructure

It is important to identify who may be at risk if infrastructure is damaged by flooding. Roads or railroads that are blocked or damaged can isolate residents and can prevent access throughout the county, including emergency service providers needing to get to vulnerable populations or to make repairs. Bridges washed out or blocked by floods or debris also can cause isolation. Water and sewer systems can be flooded or backed up, causing health problems. Underground utilities can be damaged. Levees can fail or be overtopped, inundating the land that they protect. The following sections describe specific types of critical infrastructure.

Roads

The major roads in the planning area that pass through the 100-year floodplain and thus are exposed to flooding are U.S. Highway 190, and State Highways 16, 501, and 580. In severe flood events, these roads can be blocked or damaged, preventing access to some areas.

Bridges

Flooding events can significantly impact road bridges. These are important because often they provide the only ingress and egress to some neighborhoods. Countywide, there are more than 84 bridges that are in or cross over the 100-year floodplain. Within just the participating jurisdictions, there are more than 20 bridges that cross over the 100-year floodplain.

Water and Sewer Infrastructure

Water and sewer systems can be affected by flooding. Floodwaters can back up drainage systems, causing localized flooding. Culverts can be blocked by debris from flood events, also causing localized urban flooding. Floodwaters can get into drinking water supplies, causing contamination. Sewer systems can be backed up, causing wastewater to spill into homes, neighborhoods, rivers, and streams.

12.5.4 Environment

Flooding is a natural event, and floodplains provide many natural and beneficial functions. Nonetheless, with human development factored in, flooding can impact the environment in negative ways. Migrating fish can wash into roads or over levees into flooded fields, with no possibility of escape. Pollution from roads, such as oil, and hazardous materials can wash into rivers and streams. During floods, these can settle onto normally dry soils, polluting them for agricultural uses. Human development such as bridge abutments and levees, and logjams from timber harvesting can increase stream bank erosion, causing rivers and streams to migrate into non-natural courses.

12.6 VULNERABILITY

Many of the areas exposed to flooding may not experience serious flooding or flood damage. This section describes vulnerabilities in terms of population, property, infrastructure, and environment. The vulnerability analysis was performed at the census-block level. This methodology is likely to overestimate impacts from both the modeled 100-year and 500-year flood events as it is assumed that both structures and the population are evenly spread throughout census blocks.

12.6.1 Population

A geographic analysis of demographics (countywide) using the default HAZUS-MH model inventory identified populations vulnerable to the flood hazard as follows. These numbers are calculated assuming that the population/households are evenly distributed over the census blocks.

- Economically Disadvantaged Populations—It is estimated that approximately 7% of the population within the 100-year floodplain are economically disadvantaged. Economically disadvantaged is defined as having household incomes of $20,000 or less.

- Population over 65 Years Old—It is estimated that approximately 20% of the population in the 100-year floodplain are over 65 years old.
- Population under 16 Years Old—It is estimated that approximately 15% of the population in the 100-year floodplain are under 16 years of age.

The following impacts on persons and households in San Saba County were estimated for the 100-year and 500-year flood events through the Level 2 HAZUS-MH analysis:

- During an 100-year flood event
  - Displaced population = 64
  - Persons requiring short-term shelter = 39
- During a 500-year flood event
  - Displaced population = 89
  - Persons requiring short-term shelter = 62

12.6.2 Property

HAZUS-MH calculates losses to structures from flooding by looking at depth of flooding and type of structure. Using historical flood insurance claim data, HAZUS-MH estimates the percentage of damage to structures and their contents by applying established damage functions to an inventory. For this analysis, the default inventory data provided with HAZUS-MH was used. The analysis is summarized in Table 12-11 for the 100-year flood event. It is estimated that there would be up to $9.5 million of flood loss from a 100-year flood event in the planning area. This represents 6.6% of the total exposure to the 100-year flood and 1.4% of the exposed replacement value for the county. Losses are estimated to be $14 million from a 500-year flood event, representing 9.5% of the total exposure to the 500-year flood (Table 12-12).

TABLE 12-11.
LOSS ESTIMATES FOR THE 100-YEAR FLOOD EVENT

	Loss ($)			Exposed Value ($)	% of Total Exposed Value
	Structure	Contents	**Total**		
City of San Saba	624,551	521,994	**1,146,545**	90,756,147	1.26
Unincorporated Area	4,705,427	3,624,989	**8,330,416**	52,194,923	15.96
Planning Area Total	**5,329,978**	**4,146,983**	**9,476,961**	**142,951,070**	**6.63**

TABLE 12-12.
LOSS ESTIMATES FOR THE 500-YEAR FLOOD EVENT

	Loss ($)			Exposed Value ($)	% of Total Exposed Value
	Structure	Contents	**Total**		
City of San Saba	1,269,259	1,173,936	**2,443,195**	90789066.7	2.69
Unincorporated Area	6,573,692	4,937,030	**11,510,722**	56908735.84	20.23
Planning Area Total	**7,842,951**	**6,110,966**	**13,953,917**	**147,697,803**	**9.45**

National Flood Insurance Program

Table 12-13 lists flood insurance statistics that help identify vulnerability in the planning area. San Saba County and the City of San Saba participate in the NFIP.

**TABLE 12-13.
NATIONAL FLOOD INSURANCE PROGRAM STATISTICS**

Facility Type	Initial FIRM Effective Date	Claims	Value of Claims Paid ($)
City of San Saba	6/1/1988	9	82,267
Unincorporated Area	5/1/1987	5	44,271
Total	**7/02/1991** *	**14**	**126,538**

Notes:
FIRM Flood Insurance Rate Map
* Effective date of initial countywide Flood Insurance Study
Source: http://bsa.nfipstat.fema.gov/

Properties constructed after a FIRM has been adopted are eligible for reduced flood insurance rates. Such structures are less vulnerable to flooding since they were constructed after regulations and codes were adopted to decrease vulnerability. Properties built before a FIRM is adopted are more vulnerable to flooding because they do not meet code or are located in hazardous areas. The first FIRM for the county was in 1991; the countywide FIRM has not been updated.

The following information from flood insurance statistics is relevant to reducing flood risk:

- The use of flood insurance in the planning area is less than the national average
- The average claim paid in San Saba County (1978 to June 2015) is approximately $9,038, well below the national average

Repetitive Loss

A repetitive loss property is defined by FEMA as an NFIP-insured property that has experienced any of the following since 1978, regardless of any changes in ownership:

- Four or more paid losses in excess of $1,000
- Two paid losses in excess of $1,000 within any rolling 10-year period
- Three or more paid losses that equal or exceed the current value of the insured property

Repetitive loss properties make up only 1% to 2% of flood insurance policies in force nationally, yet they account for 40% of the nation’s flood insurance claim payments. In 1998, FEMA reported that the NFIP’s 75,000 repetitive loss structures have already cost $2.8 billion in flood insurance payments and that numerous other flood-prone structures remain in the floodplain at high risk. The government has instituted programs encouraging communities to identify and mitigate the causes of repetitive losses. A recent report on repetitive losses by the National Wildlife Federation found that 20% of these properties are outside any mapped 100-year floodplain. The key identifiers for repetitive loss properties are the existence of flood insurance policies and claims paid by the policies.

FEMA-sponsored programs, require participating communities to identify repetitive loss areas. A repetitive loss area is the portion of a floodplain holding structures that FEMA has identified as meeting the definition of repetitive loss. Identifying repetitive loss areas helps to identify structures that are at risk but are not on FEMA’s list of repetitive loss structures because no flood insurance policy was in force at the time of loss. Figure 12-5 shows the location of repetitive loss properties in San Saba County.

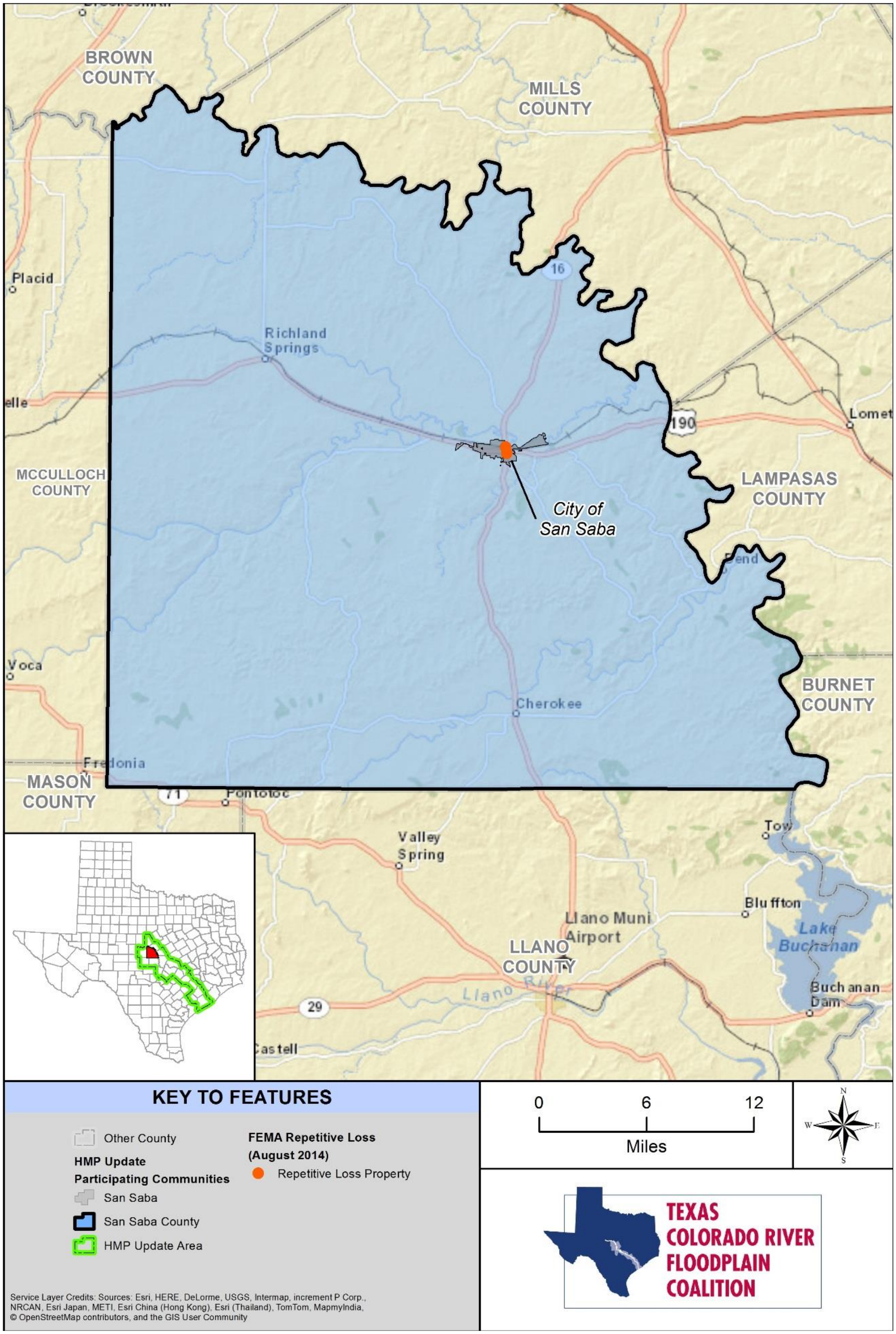


Figure 12-5. Repetitive Loss Properties in San Saba County

12.6.3 Critical Facilities and Infrastructure

HAZUS-MH was used to estimate the flood loss potential to critical facilities exposed to the flood risk. Using depth/damage function curves to estimate the percent of damage to the building and contents of critical facilities, HAZUS-MH correlates these estimates into an estimate of functional down-time (the estimated time it will take to restore a facility to 100% of its functionality). This helps to gauge how long the planning area could have limited usage of facilities deemed critical to flood response and recovery.

The HAZUS critical facility analysis found that critical facilities would receive negligible damage to structure and contents during a 100-year or 500-year flood event. No significant loss of facility functionality would be lost during a 100-year or 500-year event.

12.6.4 Environment

The environment vulnerable to flood hazard is the same as the environment exposed to the hazard. Loss estimation platforms such as HAZUS-MH are not currently equipped to measure environmental impacts of flood hazards. The best gauge of vulnerability of the environment would be a review of damage from past flood events. Loss data that segregates damage to the environment was not available at the time of this plan. Capturing this data from future events could be beneficial in measuring the vulnerability of the environment for future updates.

12.7 FUTURE TRENDS IN DEVELOPMENT

San Saba County and the City of San Saba are equipped to handle future growth within flood hazard areas. The city and county have plans and policies that address frequently flooded areas. The city and county have committed to linking their plans to this hazard mitigation plan update. This will create an opportunity for sound watershed-wide land use decisions and floodplain management practices as future growth impacts flood hazard areas.

Additionally, San Saba County and the City of San Saba are participants in the NFIP and have adopted flood damage prevention ordinances in response to its requirements. All municipal planning partners have committed to maintaining their good standing under the NFIP through initiatives identified in this plan.

Urban flooding issues that contribute to flash floods are also a concern in more highly developed areas in San Saba County. Jurisdictions in the county are required to develop a stormwater permitting program as mandated by the National Pollutant Discharge Elimination System. This program will help jurisdictions apply effective mitigation measures for stormwater runoff.

The recent dam modernization program on LCRA’s dams meet required design safety standards to resist the water load and pressure of the PMF is a step in the right direction. There is, however, always some residual risk and it is expected that the emergency action plans for the dams will be maintained so the appropriate responses can be exercised in case of a dam failure.

12.8 SCENARIO

An intense, short-duration storm could move slowly across the planning area creating significant flash floods with little or no warning. Injuries or fatalities may result if residents are caught off guard by the flood event. Stormwater systems could be overwhelmed and significant flooding could impact a substantial portion of structures within the planning area. Transportation routes could be cut off due to floodwaters, isolating portions of the planning area. These impacts may last after the floodwater recedes as flash floods in the area have been known to cause extensive damage to roadway infrastructure. Areas that have recently experienced wildfires would contribute to the extent of flooding impacts.

12.9 ISSUES

The major issues for flooding are the following:

- Flash flooding that occurs with little or no warning will continue to impact the planning area.

- The duration and intensity of storms contributing to flooding issues may increase due to climate change.
- Flooding may be exacerbated by other hazards, such as wildfires.
- Damages resulting from flood may impact tourism, which may have significant impacts on the local economy.
- The promotion of flood insurance as a means of protecting private property owners from the economic impacts of frequent flood events should continue.

CHAPTER 13.
HURRICANES AND TROPICAL STORMS

HURRICANE AND TROPICAL STORM RANKING	
San Saba County	Low
City of San Saba	Low

DEFINITIONS

Hurricane — A tropical cyclone with maximum sustained surface winds (using the U.S. 1-minute average) of 64 knot (kt) (74 miles per hour [mph]) or more.

Tropical Storm — A tropical cyclone with maximum sustained surface wind speed (using the U.S. 1-minute average) ranges from 34 kt (39 mph) to 63 kt (73 mph).

Tropical Depression — A tropical cyclone with maximum sustained surface wind speed (using the U.S. 1-minute average) ranges from 4 kt (39 mph) to 63 kt (73 mph).

13.1 GENERAL BACKGROUND

13.1.1 Hurricanes and Tropical Storms

The following description of hurricanes and tropical storms was summarized from the *2013 State of Texas Hazard Mitigation Plan*.

According to NOAA, tropical cyclones are classified into three main categories (per intensity): hurricanes, tropical storms, and tropical depressions.

The term hurricane is used for Northern Hemisphere tropical cyclones east of the International Dateline to the Greenwich Meridian. Hurricanes are any closed circulation developed around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) and whose diameter averages 10 to 30 miles across. A tropical cyclone refers to any such circulation that develops over tropical waters. The key energy source for a tropical cyclone is the release of latent heat from the condensation of warm water. Their formation requires a low-pressure disturbance, warm sea surface temperature, rotational force from the spinning of the earth, and the absence of wind shear in the lowest 50,000 feet of the atmosphere.

Hurricanes are areas of disturbed weather in the tropics with closed isobars and strong and very pronounced rotary circulation. An area of clear weather called an “eye” is present in the center of the circulation. To qualify as a hurricane, the wind speed is 74 miles per hour (mph) or more. Hurricanes are classified into categories based on wind speed and the potential damage they cause. Thunderstorm rain resulting in urban flooding, battering wave action, intense sea level rise, localized coastal erosion, and significant winds are associated with hurricanes.

A tropical storm is a tropical cyclone in which the maximum sustained surface wind speeds range from 39 to 73 mph. At this time the tropical cyclone is assigned a name. During this time, the storm itself becomes more organized and begins to become more circular in shape, resembling a hurricane. Figure 13-1 illustrates historical hurricane paths affecting the entire study area.

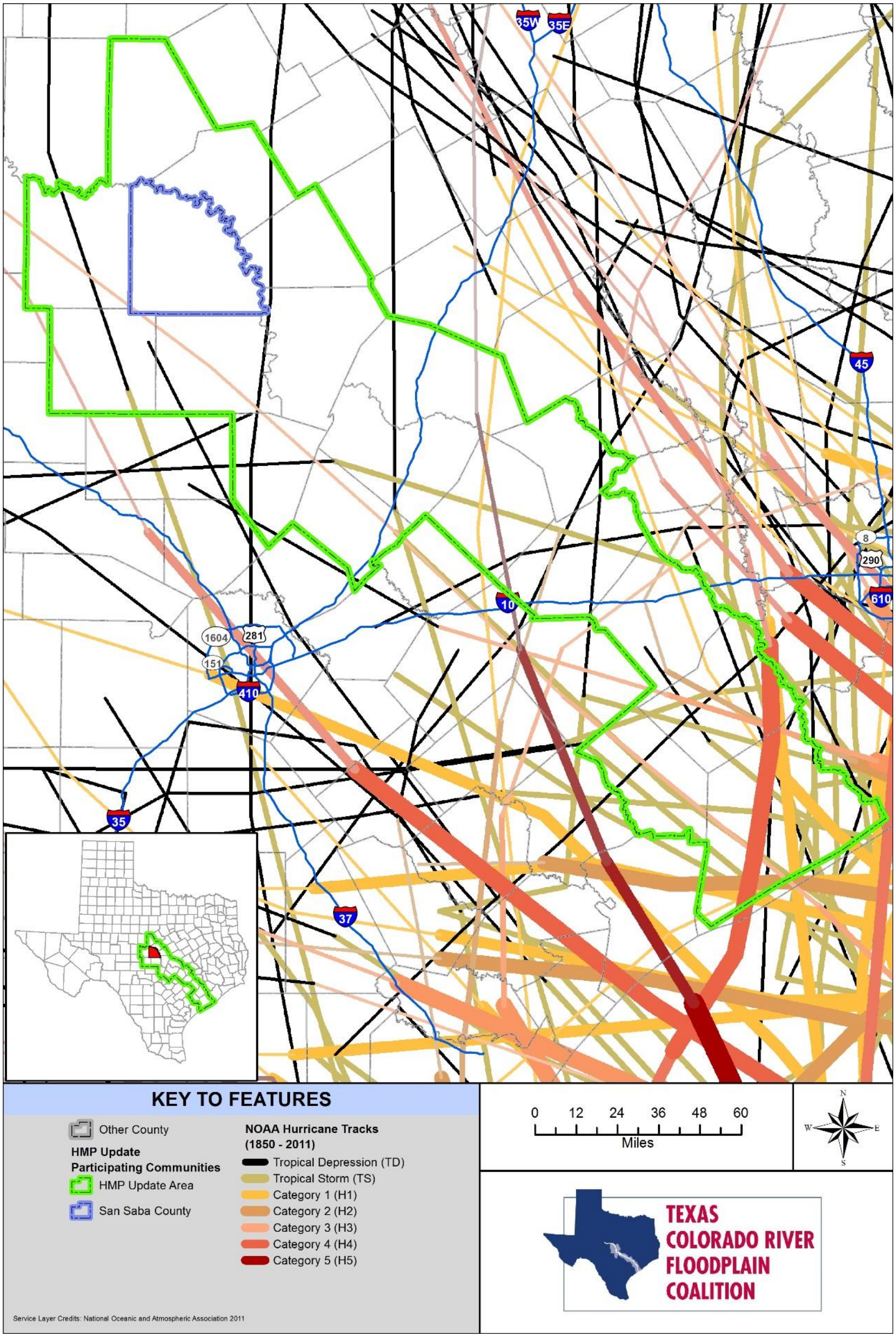


Figure 13-1. Historical Hurricane Paths Affecting San Saba County

13.1.2 Hurricane and Tropical Storm Classifications

Hurricanes are classified according to the Saffir-Simpson Hurricane Wind Scale from a Category 1 to Category 5 by sustained wind intensity. Table 13-1 lists a description of each category.

TABLE 13-1.
SAFFIR-SIMPSON HURRICANE WIND SCALE

Category	Sustained Winds (miles per hour)	Types of Damage Due to Hurricane Winds
1	74-95	Very dangerous winds will produce some damage: Well-constructed frame homes could have damage to roof, shingles, vinyl siding, and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110	Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (Major)	111-129	Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (Major)	130-156	Catastrophic damage will occur: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (Major)	157 or higher	Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Other non-hurricane classifications are tropical storms (39-73 miles per hour) and tropical depressions (0-38 miles per hour)

Source: http://www.nhc.noaa.gov/aboutsshws.php

13.2 HAZARD PROFILE

While hurricanes pose the greatest threat to life and property, tropical storms and depressions also can be devastating. Floods from heavy rains and severe weather, such as tornadoes, can cause extensive damage and loss of life. For example, Tropical Storm Allison produced over 40 inches of rain in the Houston area in 2001, causing approximately $5 billion in damage and multiple fatalities.

13.2.1 Past Events

Due to San Saba County's interior location (approximately 250 miles inland), it is not exposed directly to hurricanes. The hurricanes usually fade and downgrade to tropical storms or tropical depressions as they move away from the coast. According to NOAA, San Saba County has been impacted by two Atlantic Hurricanes-related events between 1851 and 2011. A count of the seven hurricane categories within this time period shows two tropical storms. Notable hurricane, tropical storm, and depression landfalls documented by NOAA between 1851 and 2015 for San Saba County are described below:

- August 31, 1942 – An unnamed tropical storm started as a Category 3 hurricane from the Gulf of Mexico but was downgraded to a tropical storm when it reached San Saba County. Maximum wind speeds were between 40 and 50 mph.
- June 16 to 17, 2015 – Tropical Storm Bill made landfall on Matagorda Island, Matagorda County, Texas at 11:45 am. Its maximum sustained wind speed at landfall was 60 mph. Tropical Storm Bill moved inland and was downgraded to a tropical depression at 1:00 am on June 17. After spending three days over land as a tropical depression, Bill finally transitioned into a post-tropical cyclone on the afternoon of June 20 over eastern Kentucky. Although Bill brought coastal flooding and gusty winds to the Texas Coast at landfall, its primary impact was rainfall flooding. Peak rainfall totals from Bill were: 13.28 inches near El Campo, Texas; 12.53 inches near Healdton, Oklahoma; and 11.77 inches near Ganado, Texas. A Flash Flood Watch was issued for San Saba County, but no serious flooding occurred. Rainfall totals for the San Saba County area during this event ranged from approximately 0.25 to 1 inch.

13.2.2 Location

A recorded event can occur anywhere in the county, moving inland from the Gulf of Mexico. Figure 13-2 illustrates historical hurricane paths effecting San Saba County. These hurricane events become tropical depressions or tropical storms by the time they reach San Saba County.

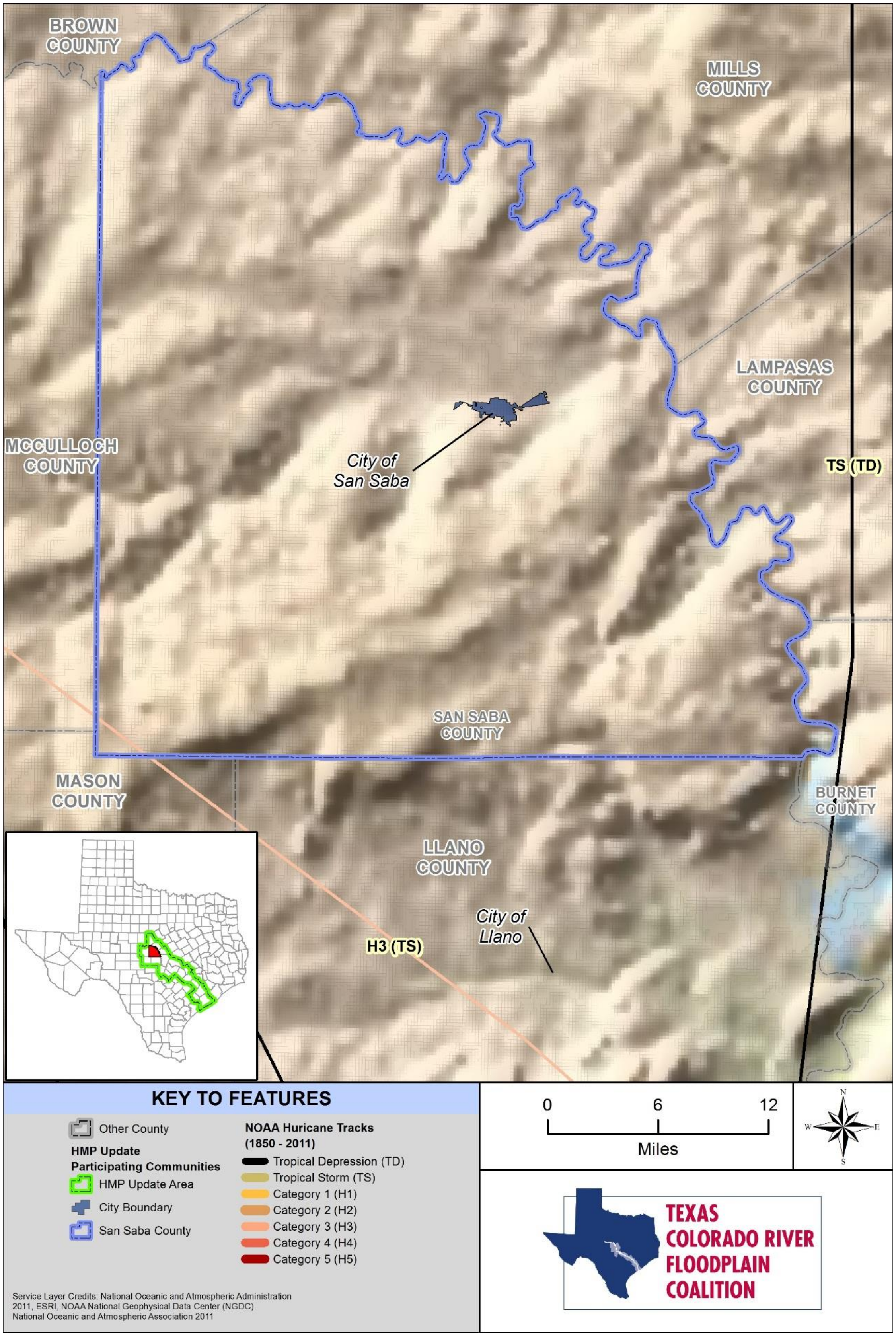


Figure 13-2. Historical Tropical Storms and Hurricanes Affecting San Saba County

13.2.3 Frequency

Tropical storms are an annual event occurring from May through November in either the Gulf of Mexico or the Atlantic Ocean. The peak of the Atlantic hurricane season is in early- to mid-September. On average, approximately six storms reach hurricane intensity each year. Hurricanes appear to be less frequent during La Niña periods and more prevalent during strong El Niño periods. El Niño, and La Niña, its counterpart, refer to climate conditions in the Pacific Ocean that influence weather patterns in Texas. El Niño is associated with warmer sea surface temperatures and high air pressure systems, while La Niña is associated with cooler ocean temperatures and low air pressure systems. These changes in water temperature and air pressure systems occur in somewhat regular intervals, with El Niño periods having longer durations. Figure 13-3 illustrates the probability of a named tropical storm event throughout the U.S.

Source: http://www.prh.noaa.gov/cphc/pages/FAQ/Climatology.php

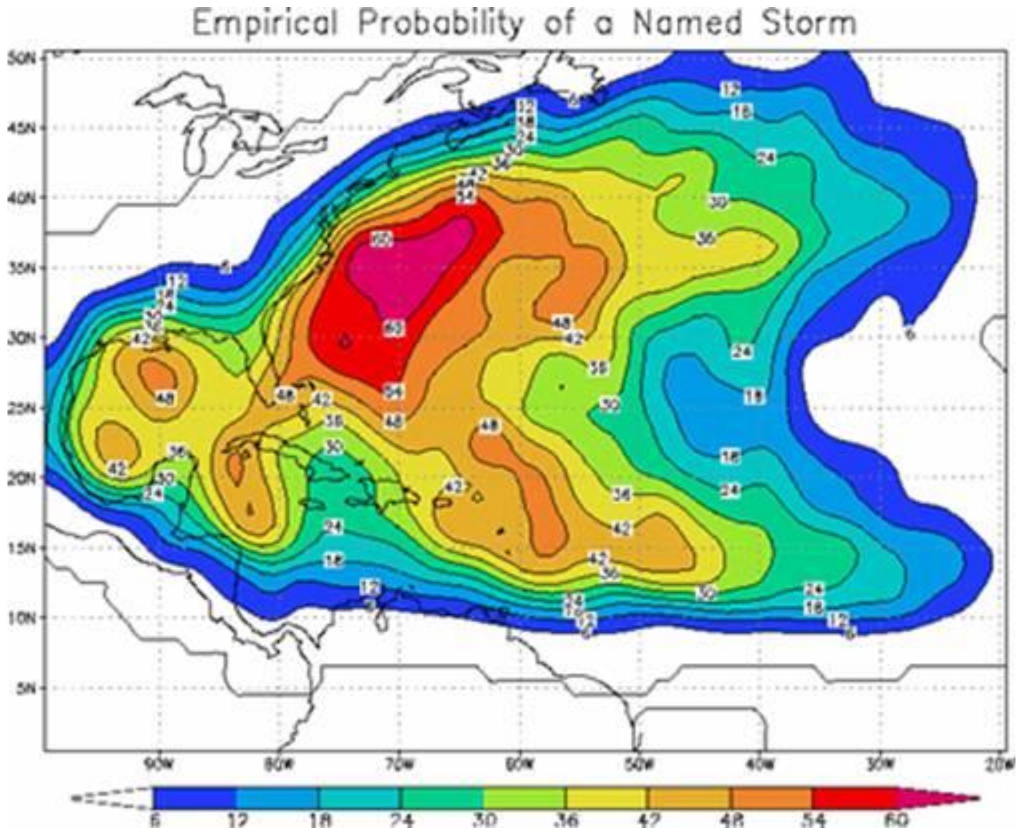


Figure 13-3. Probability of Named Tropical Storm Event

13.2.4 Severity

Historic events indicate that a hurricane will affect San Saba County as a thunderstorm, tropical depression, or related weather event (high winds, hail). These hazards are discussed in more detail in Chapter 14.

13.2.5 Warning Time

Meteorologists can often predict the likelihood and path of a hurricane or tropical storm. Meteorologists can give several days of warning before a storm. However, meteorologists cannot predict the exact time of onset or severity of the storm. At times, warning for the onset of severe weather may be limited. People generally rely on weather forecasts from the City of San Saba.

13.3 SECONDARY EVENTS

Secondary events associated with a hurricane reaching San Saba County are similar to that of a thunderstorm. Even after the high winds subside, floods brought on by the heavy rainfalls can be dangerous. As a hurricane or tropical storm moves inland and begins to break up, the storm remnants can drop 6 to 12 or more inches of rain, resulting in extensive damage and loss of life. The most significant secondary hazards associated with severe local storms are floods, falling and downed trees, and downed power lines. Landslides occur when the soil on slopes becomes oversaturated and fails. Fires can occur as a result of lightning strikes. High winds from the storm can turn debris into flying projectiles. Debris carried by high winds can also result in injury or damage to property. The lack of proper management of trees may exacerbate damage from high winds. The damage to the infrastructure and land of San Saba County may impact tourism as San Saba County has many lakes, parks, scenic parks, wild flower trails, deer hunting, and historic sites. Known as the ‘Pecan Capital of the world’, the county holds the ‘Cow Camp Cookoff’ annually in early summer.

13.4 CLIMATE CHANGE IMPACTS

It’s unclear whether climate change will increase or decrease the frequency of hurricanes and tropical storms, but warmer ocean surface temperatures and higher sea levels are expected to intensify their impacts. Hurricanes are subject to various climate change-related influences. Warmer sea surface temperatures could intensify tropical storms wind speeds, potentially delivering more damage if they make landfall. Based on sophisticated computer modeling, scientists expect a 2 to 11% increase in average maximum wind speed, with increased frequency of intense storms. Rainfall rates during these storms are also projected to increase by approximately 20%.

In addition, sea level rise is likely to make future coastal storms, including hurricanes, more damaging. Globally averaged, sea level is expected to rise by 1 to 4 feet during the next century, which will amplify coastal storm surge. For example, sea level rise intensified the impact of Hurricane Sandy, which caused an estimated $65 billion in damages in New York, New Jersey, and Connecticut in 2012. Much of this damage was related to coastal flooding (Center for Climate and Energy Solutions no date).

13.5 EXPOSURE

Population, structures, aboveground infrastructure, critical facilities, and natural environments are all exposed to hurricanes and tropical storms. The entire population of the planning area would be affected by the tropical storm or tropical depression to some degree. Business interruption could keep people from working, road closures could isolate populations, and loss of functions of utilities could impact populations that suffered no direct damage form an event.

13.6 VULNERABILITY

The Level 1 HAZUS-MH protocol was used to assess the exposure of the planning area to hurricanes and tropical storms. The model used U.S. Census data at the tract level and modeled storms initiated in the Atlantic Ocean, Caribbean Sea, Gulf of Mexico, and eastern and central Pacific Ocean. The HAZUS-MH default data (updated with 2010 U.S. Census data and 2014 RS Means Square Foot Costs) were used.

HAZUS-MH calculates losses to structures from hurricanes by looking at wind speeds, winds tracks, and amount of precipitation. Using historical storm data, HAZUS-MH estimates probabilistic storm scenarios. The historic storm database contains precomputed wind fields and storm track for Category 3, 4, and 5 land falling hurricanes from 1900 to 2010. For this analysis, a probabilistic HAZUS-MH hurricane scenario was selected. Peak gust wind speeds for the 100-Year Probabilistic scenario are between 56 mph to 57 mph (Figure 13-4). Less than 1% of the buildings (mostly residential) are expected to sustain moderate damages for this scenario. Countywide, the economic loss estimated for this probabilistic hurricane scenario is approximately $19,000, which represents less than 0.01% of the total replacement value of the planning area's buildings. Table 13-2 lists annualized loss estimates for the 100-year probabilistic event scenario.

**TABLE 13-2.
LOSS ESTIMATES FOR HURRICANE EVENT**

	Annualized Loss ($)			Exposed Value ($)	% of Total Exposed Value
	Structure	Contents	Total		
City of San Saba	453	15	**468**	428,225,383	<0.01
Unincorporated Area	1,863	82	**1,945**	502,972,374	<0.01
Planning Area Total	**2,316**	**97**	**2,413**	**931,197,757**	**<0.01**

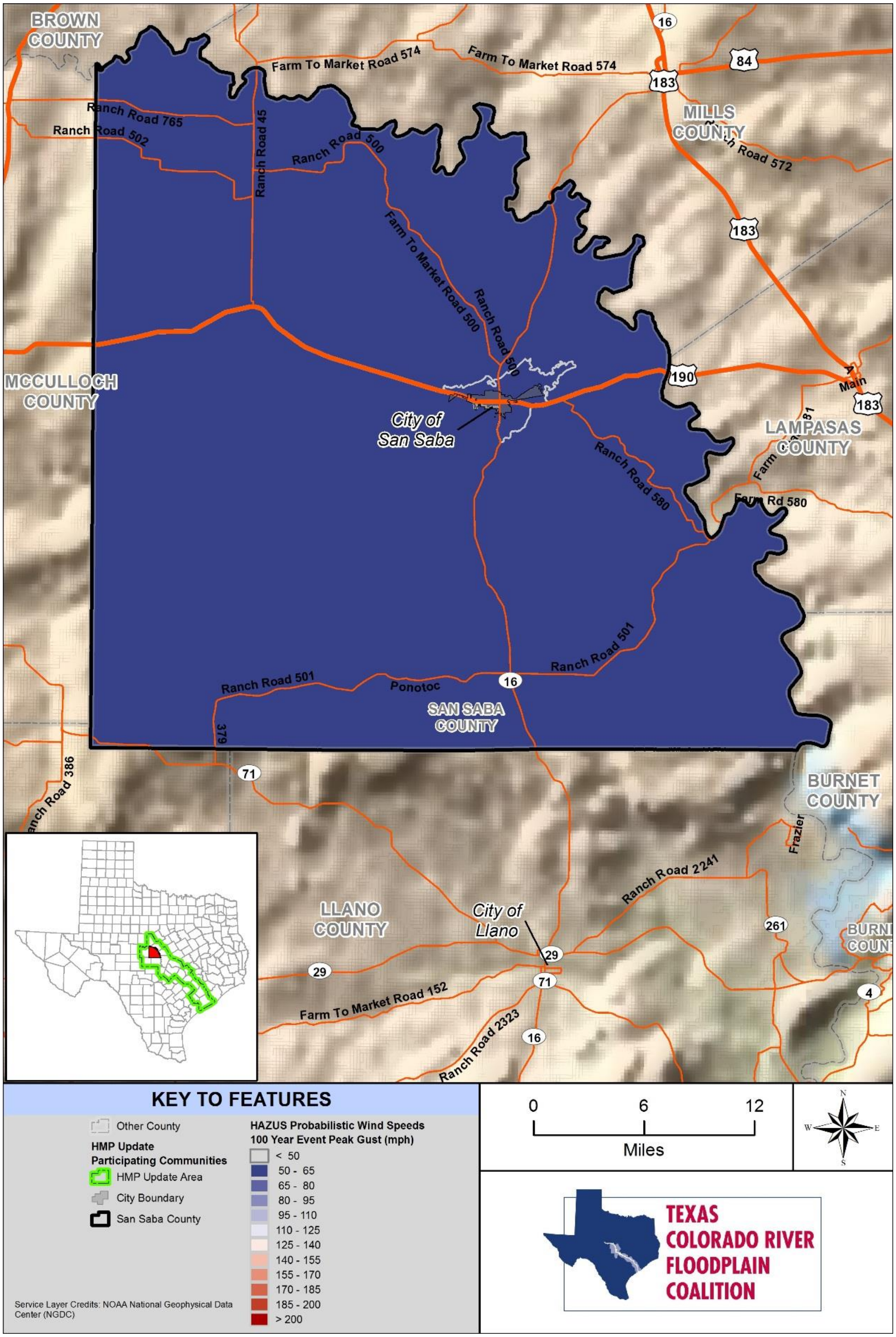


Figure 13-4. 100-Year Probabilistic Peak Wind Gusts for San Saba County

13.7 FUTURE TRENDS IN DEVELOPMENT

The threat of tropical storms is constant in Texas. From the Gulf of Mexico coastline to Central Texas, the adverse effects of tropical storms and hurricanes will be felt. Tropical storms and hurricanes may cause billions of dollars in damages. Hurricane trends change yearly and with the unclear effects of climate change on tropical developments, future trends are difficult to predict. NOAA's 2015 hurricane season outlook predicted that a below-normal Atlantic hurricane season is likely. This outlook called for a 70% chance of a below-normal season, a 25% chance of a near-normal season, and only a 5% chance of an above-normal season. However, Global Weather Oscillations Inc., a leading hurricane cycle prediction company, says "The 2015 Atlantic Basin hurricane season will be the most active and dangerous in at least 3 years, and the next 3 seasons will be the most dangerous in 10 years." Therefore it is important for communities and community leaders to remain alert and informed of seasonal predictions and developments.

13.8 SCENARIO

A worst case scenario would be for a very large and severe hurricane to make landfall along the Texas coastline and move inland through San Saba County. Such a powerful storm at landfall may still have significant impacts in San Saba County and beyond. This storm could cause severe flooding, tornadoes, and wind damage to infrastructure throughout the county. This could significantly slow emergency response time and cause public utilities to be offline for weeks. A large of a storm would leave a large path of damage across south and central Texas, straining resources throughout the county and state. However, this event is unlikely and San Saba County's inland location will mitigate the possibility of extensive damage from hurricanes and tropical storms.

13.9 ISSUES

Important issues associated with a tropical storm in San Saba County include the following:

- Older building stock in the planning area is built to low code standards or none at all. These structures could be highly vulnerable to severe weather events such as hurricanes and tropical storms.
- Redundancy of power supply must be evaluated.
- The potential for isolation after a severe storm event is high.
- Flash flooding that occurs with little or no warning will continue to impact the planning area.
- The promotion of flood insurance as a means of protecting private property owners from the economic impacts of frequent flood events should continue.
- Roads and bridges blocked by debris or otherwise damaged might isolate populations.
- Warning time may not be adequate for residents to seek appropriate shelter or such shelter may not be widespread throughout the planning area.
- The impacts of climate change on the frequency and severity of hurricanes and tropical storms are not well understood.

CHAPTER 14.
THUNDERSTORM, LIGHTNING, HAIL, AND WIND

THUNDERSTORM, LIGHTNING, HAIL, AND WIND RANKING				
	Thunderstorm	**Lightning**	**Hail**	**Wind**
San Saba County	High	Medium	Medium	Medium
City of San Saba	High	Medium	Medium	High

14.1 GENERAL BACKGROUND

14.1.1 Thunderstorms

A thunderstorm is a rain event that includes thunder and lightning. A thunderstorm is classified as "severe" when it contains one or more of the following: hail with a diameter of three-quarter inch or greater, winds gusting in excess of 50 knots (kt) (57.5 mph), or tornadoes.

Three factors cause thunderstorms to form: moisture, rising unstable air (air that keeps rising when disturbed), and a lifting mechanism to provide the disturbance. The sun heats the surface of the earth, which warms the air above it. If this warm surface air is forced to rise (hills or mountains can cause rising motion, as can the interaction of warm air and cold air or wet air and dry air) it will continue to rise as long as it weighs less and stays warmer than the air around it. As the air rises, it transfers heat from the surface of the earth to the upper levels of the atmosphere (the process of convection). The water vapor it contains begins to cool and it condenses into a cloud. The cloud eventually grows upward into areas where the temperature is below freezing. Some of the water vapor turns to ice and some of it turns into water droplets. Both have electrical charges. Ice particles usually have positive charges, and rain droplets usually have negative charges. When the charges build up enough, they are discharged in a bolt of lightning, which causes the sound waves we hear as thunder. Thunderstorms have three stages (see Figure 14-1):

- The **developing stage** of a thunderstorm is marked by a cumulus cloud that is being pushed upward by a rising column of air (updraft). The cumulus cloud soon looks like a tower (called towering cumulus) as the updraft continues to develop. There is little to no rain during this stage but occasional lightning. The developing stage lasts about 10 minutes.
- The thunderstorm enters the **mature stage** when the updraft continues to feed the storm, but precipitation begins to fall out of the storm, and a downdraft begins (a column of air pushing downward). When the downdraft and rain-cooled air spread out along the ground, they form a gust front, or a line of gusty winds. The mature stage is the most likely time for hail, heavy rain, frequent lightning, strong winds, and tornadoes. The storm occasionally has a black or dark green appearance.

DEFINITIONS

Severe Local Storm — Small-scale atmospheric systems, including tornadoes, thunderstorms, windstorms, ice storms, and snowstorms. These storms may cause a great deal of destruction and even death, but their impact is generally confined to a small area. Typical impacts are on transportation infrastructure and utilities.

Thunderstorm — A storm featuring heavy rains, strong winds, thunder and lightning, typically about 15 miles in diameter and lasting about 30 minutes. Hail and tornadoes are also dangers associated with thunderstorms. Lightning is a serious threat to human life. Heavy rains over a small area in a short time can lead to flash flooding.

Windstorm — A storm featuring violent winds. Windstorms tend to damage ridgelines that face into the wind.

- Eventually, a large amount of precipitation is produced and the updraft is overcome by the downdraft beginning the **dissipating stage**. At the ground, the gust front moves out a long distance from the storm and cuts off the warm moist air that was feeding the thunderstorm. Rainfall decreases in intensity, but lightning remains a danger.

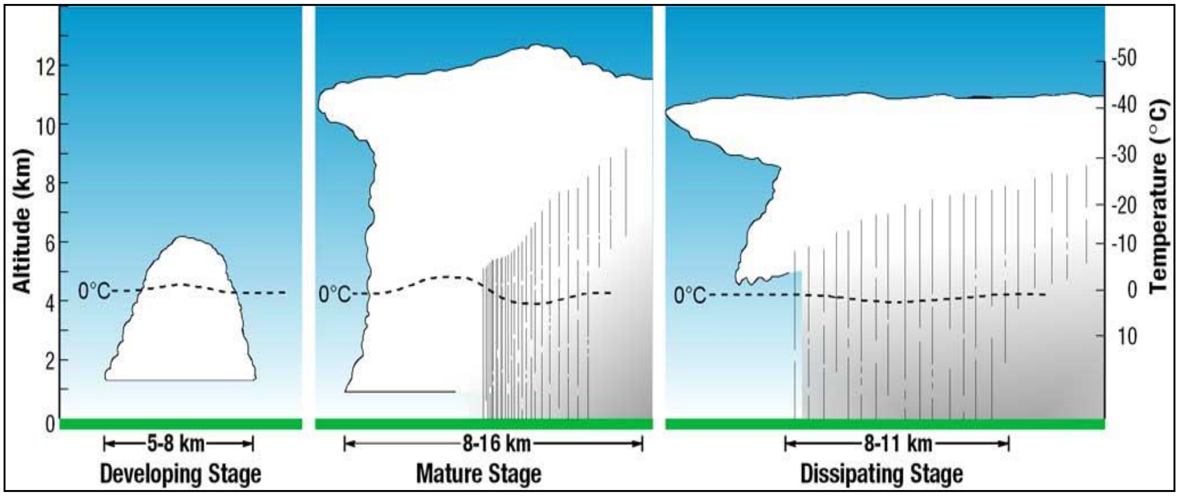


Figure 14-1. Thunderstorm Life Cycle

There are four types of thunderstorms:

- **Single-Cell Thunderstorms**—Single-cell thunderstorms usually last 20 to 30 minutes. A true single-cell storm is rare, because the gust front of one cell often triggers the growth of another. Most single-cell storms are not usually severe, but a single-cell storm can produce a brief severe weather event. When this happens, it is called a pulse severe storm.
- **Multi-Cell Cluster Storm**—A multi-cell cluster is the most common type of thunderstorm. The multi-cell cluster consists of a group of cells, moving as one unit, with each cell in a different phase of the thunderstorm life cycle. Mature cells are usually found at the center of the cluster and dissipating cells at the downwind edge. Multi-cell cluster storms can produce moderate-size hail, flash floods, and weak tornadoes. Each cell in a multi-cell cluster lasts only about 20 minutes; the multi-cell cluster itself may persist for several hours. This type of storm is usually more intense than a single cell storm.
- **Multi-Cell Squall Line**—A multi-cell line storm, or squall line, consists of a long line of storms with a continuous well-developed gust front at the leading edge. The line of storms can be solid, or there can be gaps and breaks in the line. Squall lines can produce hail up to golf-ball size, heavy rainfall, and weak tornadoes, but they are best known as the producers of strong downdrafts. Occasionally, a strong downburst will accelerate a portion of the squall line ahead of the rest of the line. This produces what is called a bow echo. Bow echoes can develop with isolated cells as well as squall lines. Bow echoes are easily detected on radar but are difficult to observe visually.
- **Super-Cell Storm**—A super-cell is a highly organized thunderstorm that poses a high threat to life and property. It is similar to a single-cell storm in that it has one main updraft, but the updraft is extremely strong, reaching speeds of 150 to 175 mph. Super-cells are rare. The main characteristic that sets them apart from other thunderstorms is the presence of rotation. The rotating updraft of a super-cell (called a mesocyclone when visible on radar) helps the super-cell to produce extreme weather events, such as giant hail (more than 2 inches in diameter), strong downbursts of 80 mph or more, and strong to violent tornadoes.

14.1.2 Lightning

Lightning is an electrical discharge between positive and negative regions of a thunderstorm. A lightning flash is composed of a series of strokes with an average of about four. The length and duration of each lightning stroke vary, but typically average about 30 microseconds.

Lightning is one of the more dangerous and unpredictable weather hazards in the United States and in Texas. Each year, lightning is responsible for deaths, injuries, and millions of dollars in property damage, including damage to buildings, communications systems, power lines and electrical systems. Lightning also causes forest and brush fires as well as deaths and injuries to livestock and other animals. According to the National Lightning Safety Institute, lightning strikes the U.S about 25 million times each year and causes more than 26,000 fires nationwide each year. The institute estimates property damage, increased operating costs, production delays, and lost revenue from lightning and secondary effects to be in excess of $6 billion per year. Impacts can be direct or indirect. People or objects can be directly struck, or damage can occur indirectly when the current passes through or near it.

Intra-cloud lightning is the most common type of discharge. This occurs between oppositely charged centers within the same cloud. Usually it takes place inside the cloud and looks from the outside of the cloud like a diffuse brightening that flickers. However, the flash may exit the boundary of the cloud, and a bright channel can be visible for many miles.

Although not as common, cloud-to-ground lightning is the most damaging and dangerous form of lightning. Most flashes originate near the lower-negative charge center and deliver negative charge to earth. However, a minority of flashes carry positive charge to earth. These positive flashes often occur during the dissipating stage of a thunderstorm's life. Positive flashes are also more common as a percentage of total ground strikes during the winter months. This type of lightning is particularly dangerous for several reasons. It frequently strikes away from the rain core, either ahead or behind the thunderstorm. It can strike as far as 5 or 10 miles from the storm in areas that most people do not consider to be a threat. Positive lightning also has a longer duration, so fires are more easily ignited. And, when positive lightning strikes, it usually carries a high peak electrical current, potentially resulting in greater damage.

The ratio of cloud-to-ground and intra-cloud lightning can vary significantly from storm to storm. Depending upon cloud height above ground and changes in electric field strength between cloud and earth, the discharge stays within the cloud or makes direct contact with the earth. If the field strength is highest in the lower regions of the cloud, a downward flash may occur from cloud to earth. Using a network of lightning detection systems, NOAA monitors a yearly average of 25 million strokes of lightning from the cloud-to-ground. Figure 14-2 shows the lightning flash density for the nation.

U.S. lightning statistics compiled by NOAA between 1959 and 1994 indicate that most lightning incidents occur during the summer months of June, July, and August, and during the afternoon hours from between 2 and 6 p.m.

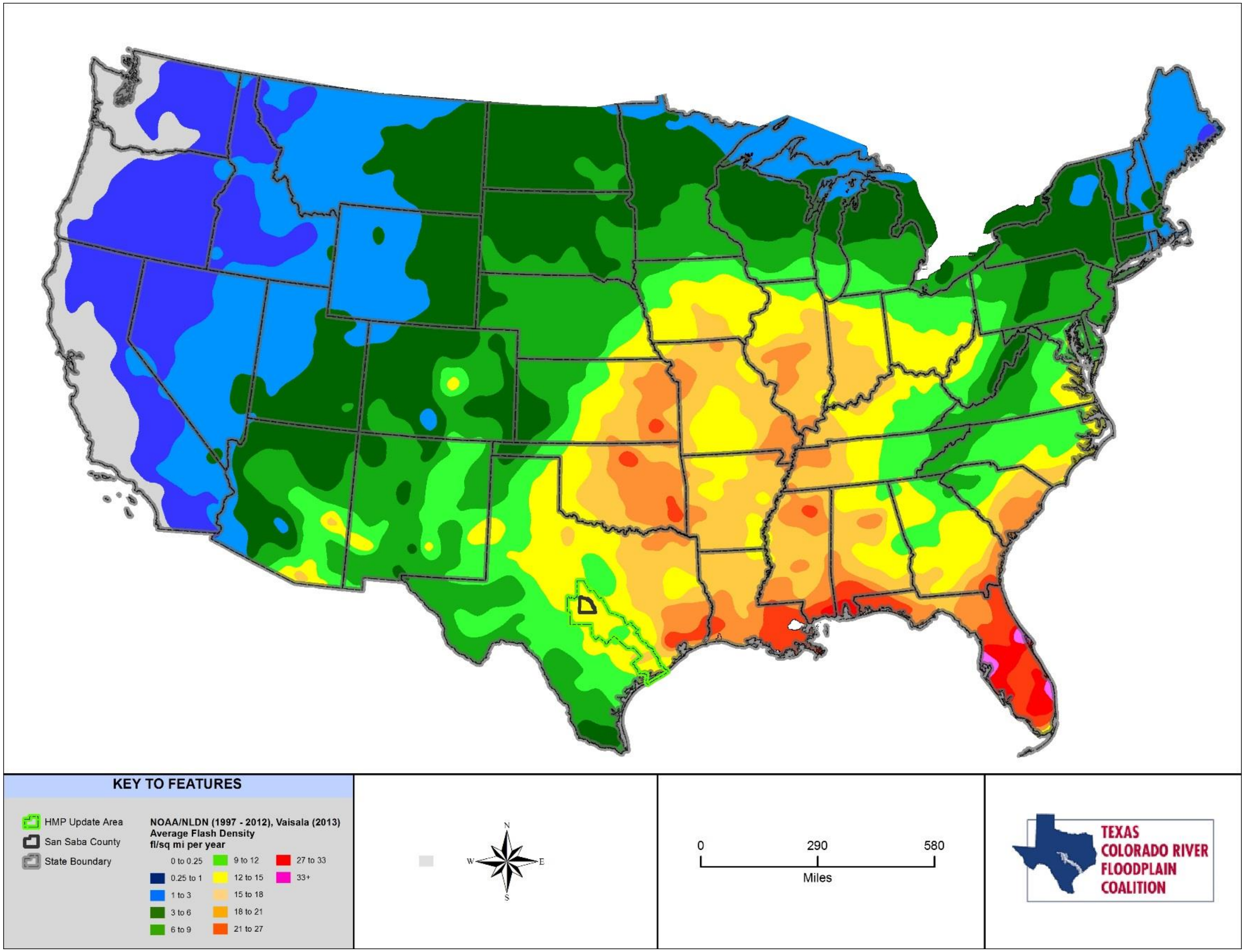


Figure 14-2. Average Annual National Lightning Density

14.1.3 Hail

Hail occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where they freeze into ice. Figure 14-3 shows the hail path across the nation. Recent studies suggest that super-cooled water may accumulate on frozen particles near the back-side of a storm as they are pushed forward across and above the updraft by the prevailing winds near the top of the storm. Eventually, the hailstones encounter downdraft air and fall to the ground.

Hailstones grow two ways: by wet growth or dry growth. In wet growth, a tiny piece of ice is in an area where the air temperature is below freezing, but not super cold. When the tiny piece of ice collides with a super-cooled drop, the water does not freeze on the ice immediately. Instead, liquid water spreads across tumbling hailstones and slowly freezes. Since the process is slow, air bubbles can escape, resulting in a layer of clear ice. Dry growth hailstones grow when the air temperature is well below freezing and the water droplet freezes immediately as it collides with the ice particle. The air bubbles are “frozen” in place, leaving cloudy ice.

Hailstones can have layers like an onion if they travel up and down in an updraft, or they can have few or no layers if they are “balanced” in an updraft. One can tell how many times a hailstone traveled to the top of the storm by counting its layers. Hailstones can begin to melt and then re-freeze together, forming large and very irregularly shaped hail. NWS classifies hail as non-severe and severe based on hail diameter size. Descriptions and diameter sizes are provided in Table 14-1.

Source: NOAA's NWS Storm Prediction Center Severe Report Database 1950 – 2013

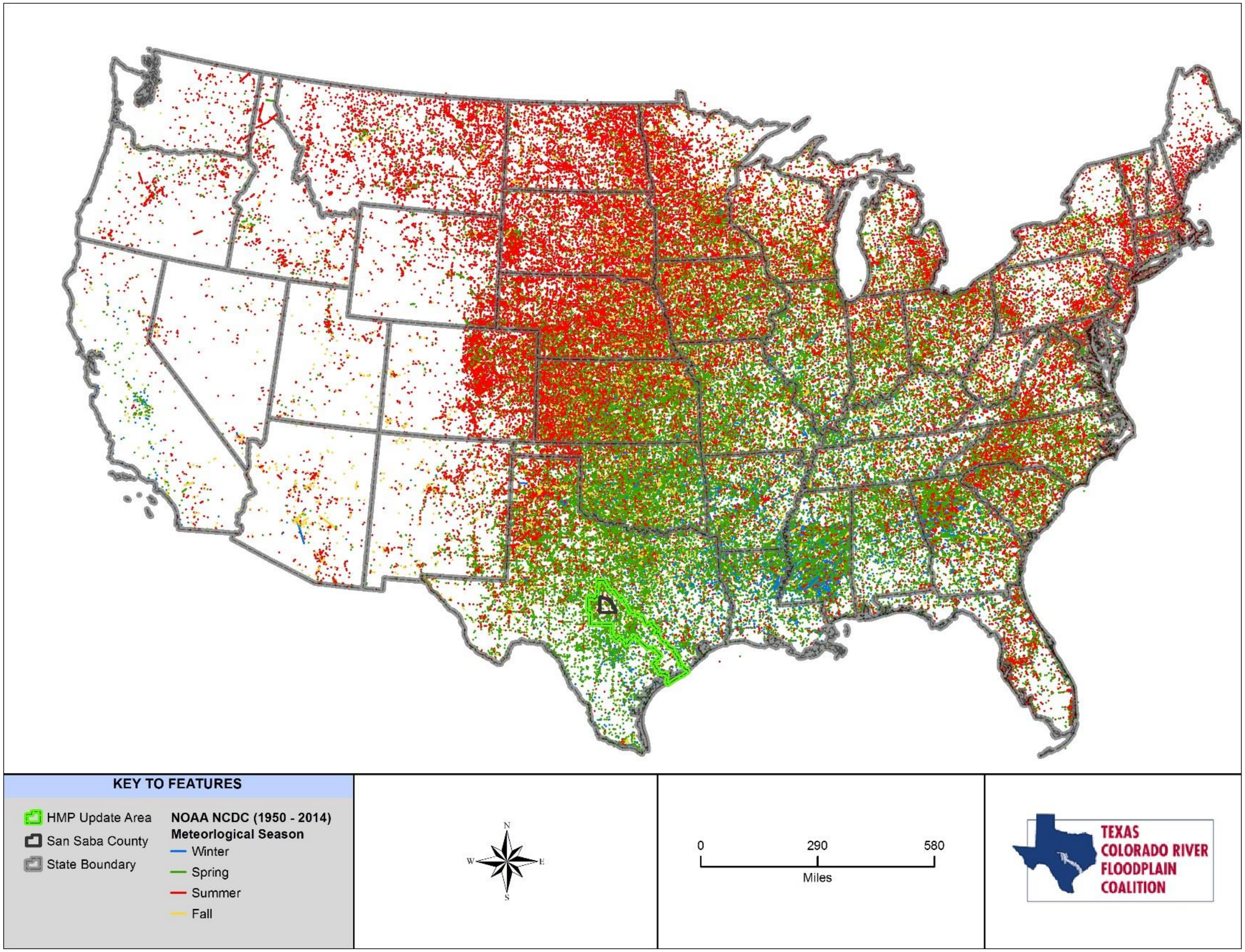


Figure 14-3. National Hail Paths

TABLE 14-1.
NATIONAL WEATHER SERVICE HAIL SEVERITY

Severity	Description	Hail Diameter Size (in inches)
Non-Severe Hail Does not typically cause damage and does not warrant severe thunderstorm warning from National Weather Service.	Pea	1/4"
	Plain M&M Candy	1/2"
	Penny	3/4"
	Nickel	7/8"
Severe Hail Research has shown that damage occurs after hail reaches around one inch in diameter and larger. Hail of this size will trigger a severe thunderstorm warning from National Weather Service.	Quarter	1" (severe)
	Half Dollar	1 1/4"
	Walnut/Ping Pong Ball	1 1/2"
	Golf Ball	1 3/4"
	Hen Egg/Lime	2"
	Tennis Ball	2 1/2"
	Baseball	2 3/4"
	Teacup/Large Apple	3"
	Grapefruit	4"
	Softball	4 1/2"
	Computer CD-DVD	4 3/4"- 5"

NOAA's National Severe Storms Laboratory used historical data to estimate the daily probability of hail occurrences across the U.S., regardless of storm magnitude. Figure 14-4 shows the average number of hail days per year. The density per 25 square miles 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 over a similar period of record. It should be noted that the density number does NOT indicate the number of events that can be expected across the entire zone on the map.

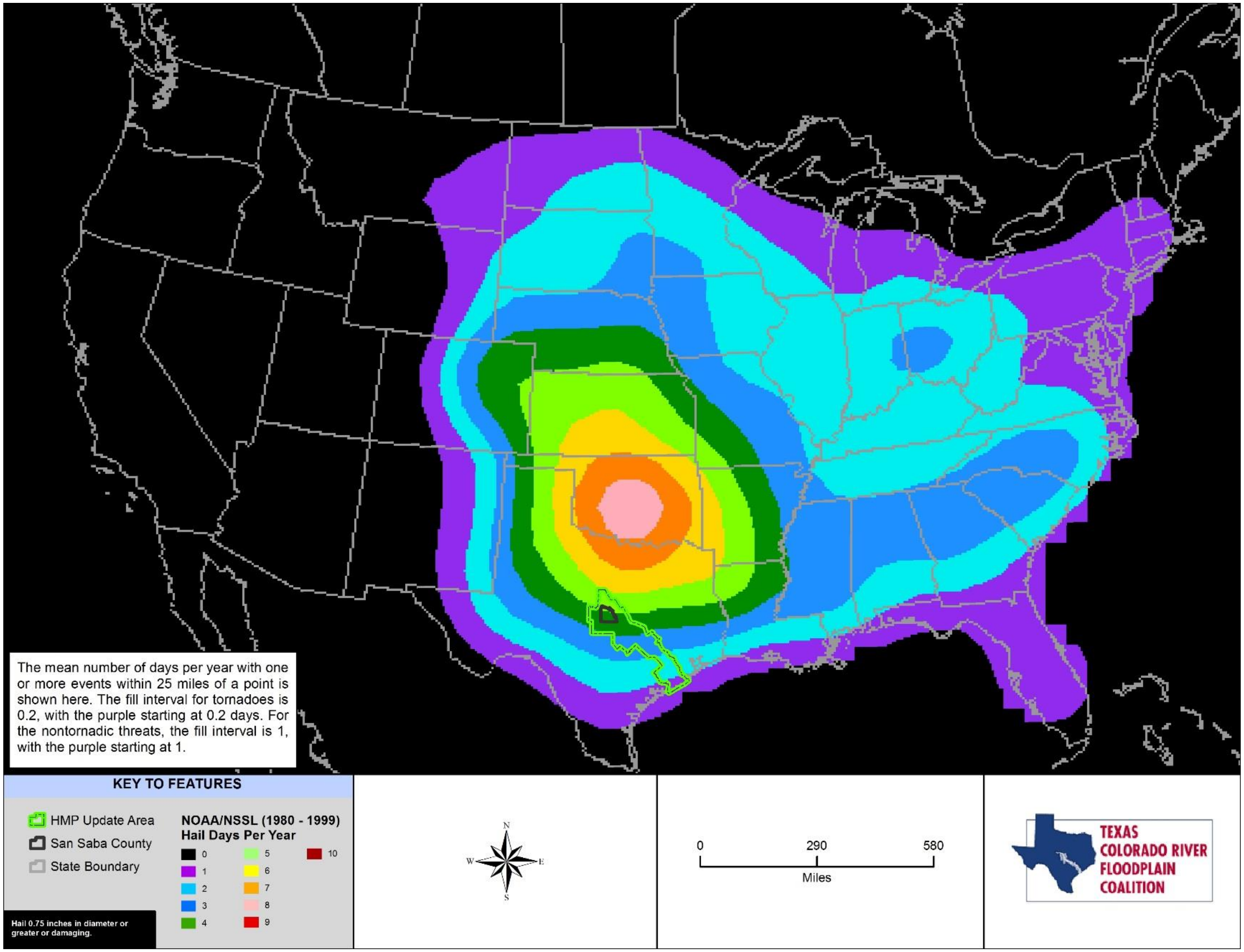


Figure 14-4. National Hail Days per Year

14.1.4 Wind

Damaging winds are classified as those exceeding 60 mph. Figure 14-5 shows the wind zones in the nation. NOAA's NWS Storm Prediction Center Severe Report Database has wind inventory from 1955 to 2014. Figure 14-6 shows the thunderstorm wind paths. Damage from such winds accounts for half of all severe weather reports in the lower 48 states and is more common than damage from tornadoes. Wind speeds can reach up to 100 mph and can produce a damage path extending for hundreds of miles. There are seven types of damaging winds:

- **Straight-line winds—**Any thunderstorm wind that is not associated with rotation; this term is used mainly to differentiate from tornado winds. Most thunderstorms produce some straight-line winds as a result of outflow generated by the thunderstorm downdraft.
- **Downdrafts—**A small-scale column of air that rapidly sinks toward the ground.
- **Downbursts**—A strong downdraft with horizontal dimensions larger than 2.5 miles resulting in an outward burst or damaging winds on or near the ground. Downburst winds may begin as a microburst and spread out over a wider area, sometimes producing damage similar to a strong tornado. Although usually associated with thunderstorms, downbursts can occur with showers too weak to produce thunder.
- **Microbursts**—A small concentrated downburst that produces an outward burst of damaging winds at the surface. Microbursts are generally less than 2.5 miles across and short-lived, lasting only 5 to 10 minutes, with maximum wind speeds up to 168 mph. There are two kinds of microbursts: wet and dry. A wet microburst is accompanied by heavy precipitation at the surface. Dry microbursts, common in places like the high plains and the intermountain west, occur with little or no precipitation reaching the ground.
- **Gust front**—A gust front is the leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. Gust fronts are characterized by a wind shift, temperature drop, and gusty winds out ahead of a thunderstorm. Sometimes the winds push up air above them, forming a shelf cloud or detached roll cloud.
- **Derecho**—A derecho is a widespread thunderstorm wind caused when new thunderstorms form along the leading edge of an outflow boundary (the boundary formed by horizontal spreading of thunderstorm-cooled air). The word "derecho" is of Spanish origin and means "straight ahead." Thunderstorms feed on the boundary and continue to reproduce. Derechos typically occur in summer when complexes of thunderstorms form over plains, producing heavy rain and severe wind. The damaging winds can last a long time and cover a large area.
- **Bow Echo**—A bow echo is a linear wind front bent outward in a bow shape. Damaging straight-line winds often occur near the center of a bow echo. Bow echoes can be 200 miles long, last for several hours, and produce extensive wind damage at the ground.

NOAA's National Severe Storms Laboratory used historical data to estimate the daily probability of wind occurrences across the U.S., regardless of storm magnitude. Figure 14-7 shows the estimates for damaging winds with 50 kts or greater. The density per 25 square miles in the map's legend indicates the probable number of wind for each 25 square mile cell within the contoured zone that can be expected over a similar period of record. It should be noted that the density number does NOT indicate the number of events that can be expected across the entire zone on the map.

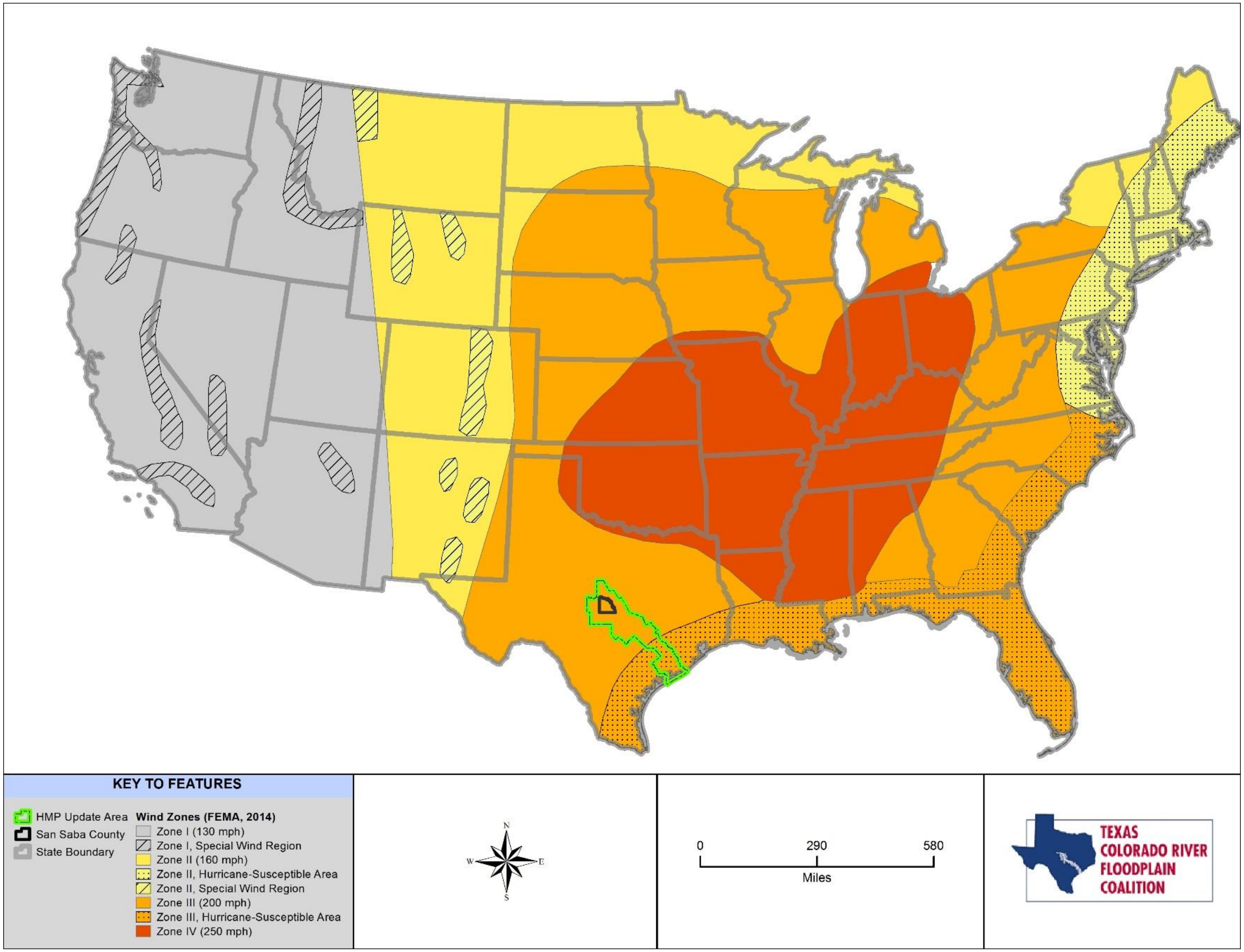


Figure 14-5. National Wind Zones

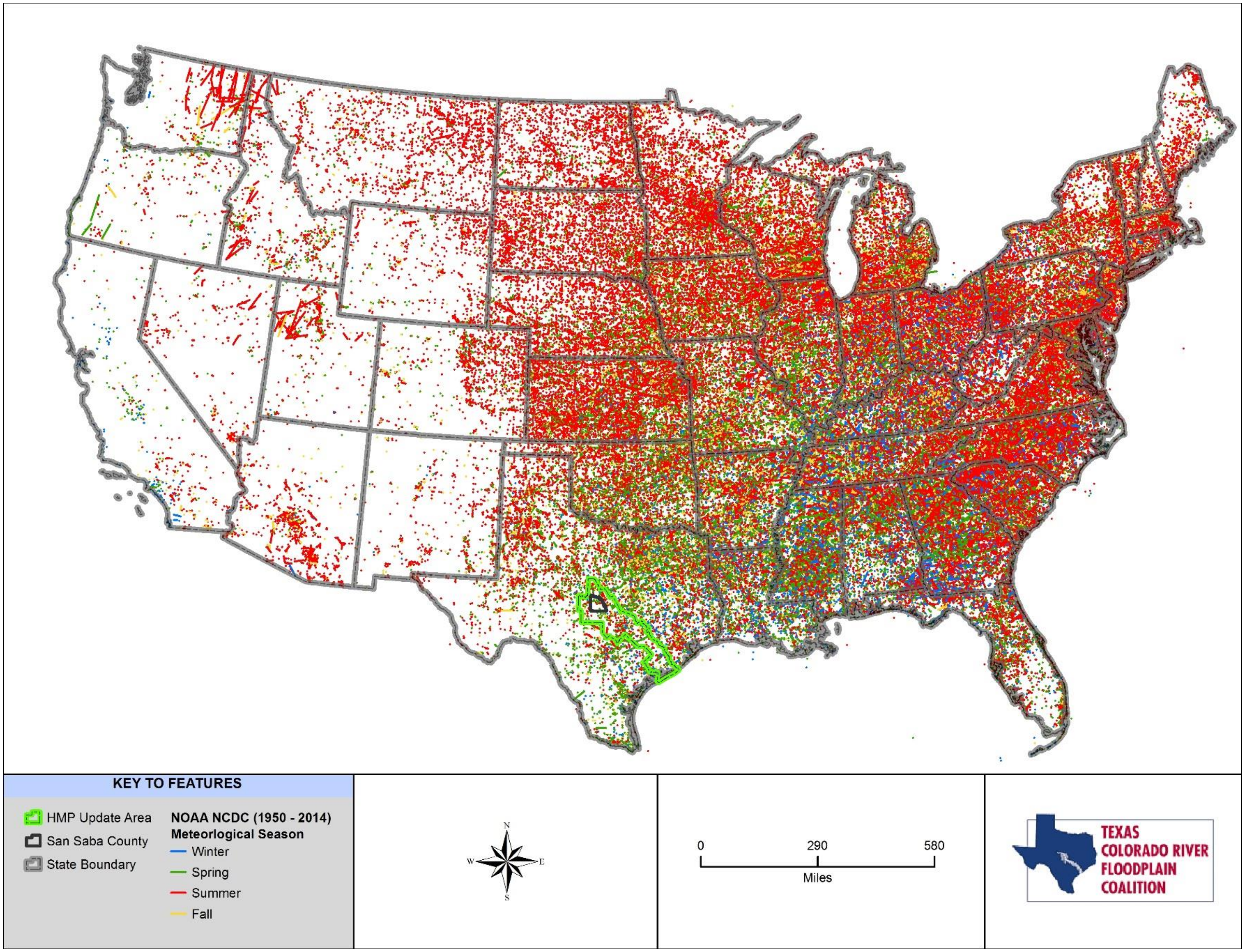


Figure 14-6. National High Wind Paths

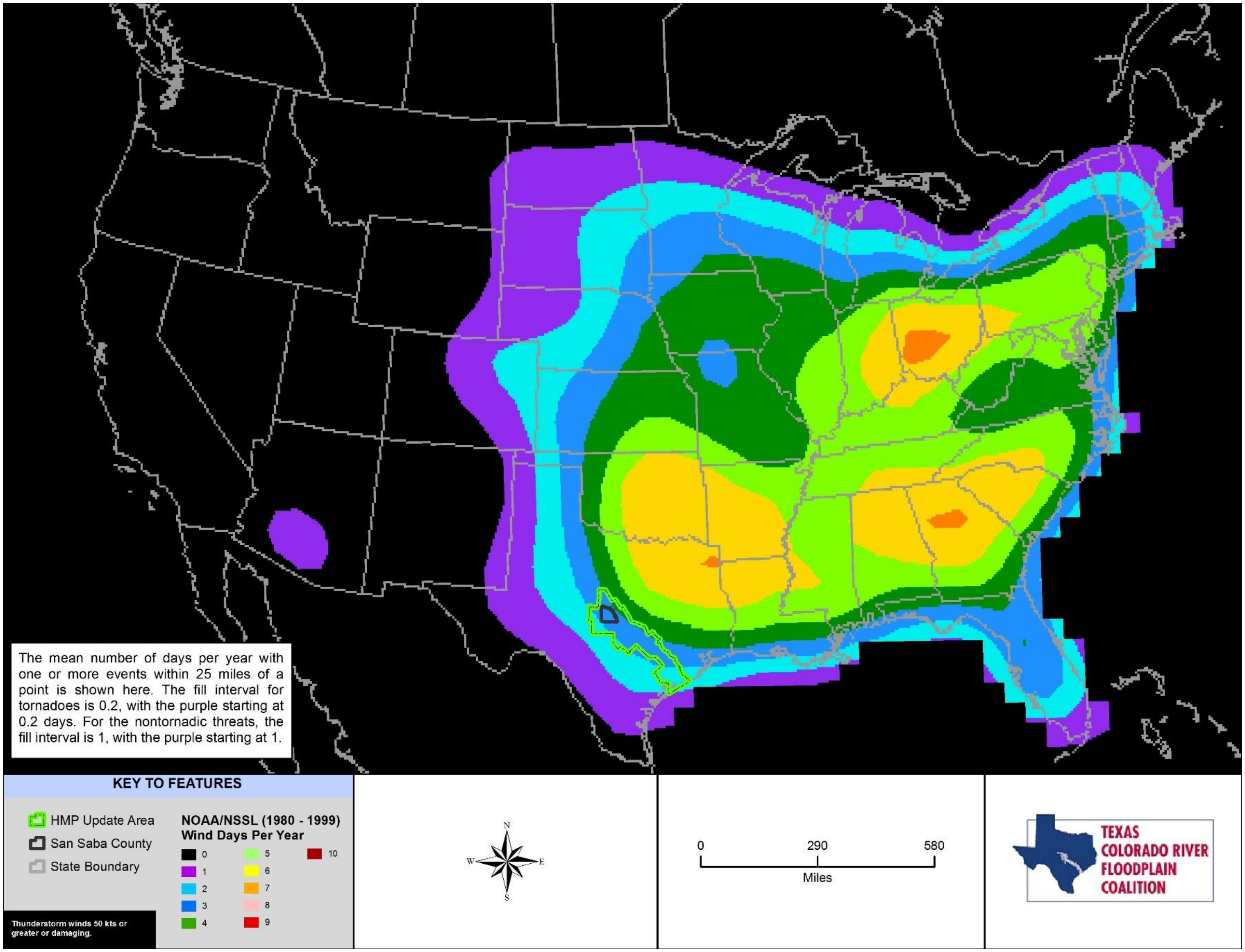


Figure 14-7. National Annual High Wind Days

14.2 HAZARD PROFILE

14.2.1 Past Events

Thunderstorms and Lightning

Data from the National Lightning Detection Network ranks Texas second in the nation (excluding Alaska and Hawaii) with respect to the number of cloud-to-ground lightning flashes. On average, Texas has more than 2,892,486 cloud-to-ground lightning strikes per year with higher lightning frequency in the western part of the state. San Saba County has an average of 12 to 15 lightning flashes per square mile per year as shown in Figure 14-2. The NOAA National Climatic Data Center's Severe Weather Data Inventory documents that 298,321 cloud-to-ground lightning flashes have been reported in San Saba County from 1986 to 2013.

Figure 14-8 shows state-by-state lightning deaths between 1959 and 2013. Texas ranks second for the number of deaths at 217. Only Florida, with 471 deaths, had more. Texas has a 0.25 death rate per million people from lightning strikes according to 1959 to 2013 data published by NWS.

According to the NOAA National Climatic Data Center's Storm Events Database, there were no casualty reports from lightning in San Saba County between 1950 and December 2014.

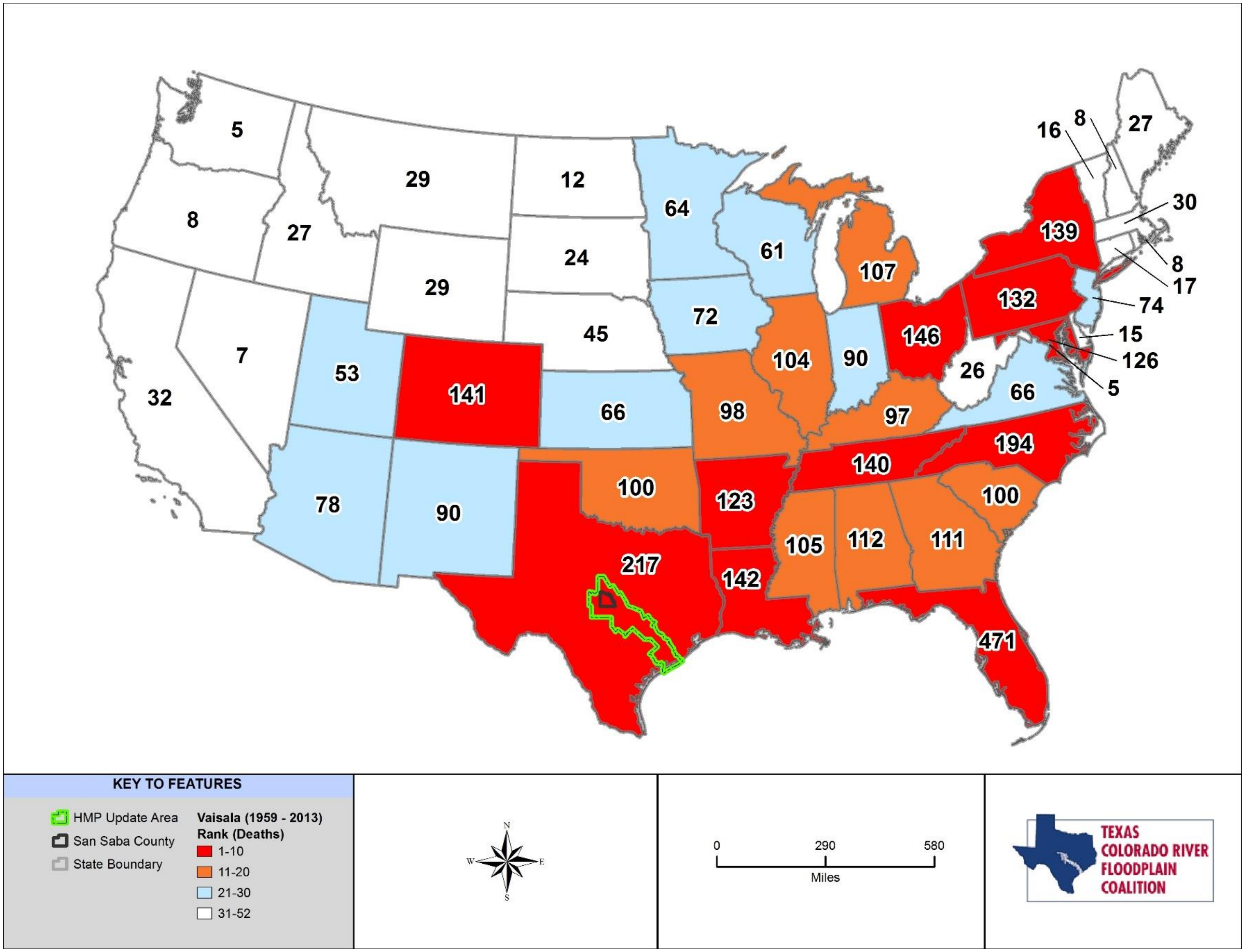


Figure 14-8. Lightning Fatalities in the U.S. (1959-2013)

Hail

The NOAA National Climatic Data Center's Storm Events Database lists hail events in San Saba County between 1960 and 2014. These events are noted in Table 14-2. None of these events resulted in injuries or deaths.

TABLE 14-2.
HISTORIC HAIL EVENTS IN SAN SABA COUNTY (1960-2014)

Location	Date	Hail Size (inches)	Estimated Damage Cost	
			Property	Crops
San Saba County	04/30/1967	1.5	$0	$0
San Saba County	03/07/1969	0.75	$0	$0
San Saba County	04/29/1975	1.75	$0	$0
San Saba County	05/05/1975	2.75	$0	$0
San Saba County	06/09/1975	2.75	$0	$0
San Saba County	05/25/1976	1.5	$0	$0
San Saba County	05/31/1976	2.75	$0	$0
San Saba County	05/01/1978	1.75	$0	$0
San Saba County	06/26/1982	1.75	$0	$0
San Saba County	03/25/1983	1.5	$0	$0
San Saba County	06/28/1983	1.75	$0	$0
San Saba County	05/17/1986	1	$0	$0
San Saba County	05/17/1986	1	$0	$0
San Saba County	05/13/1989	1.75	$0	$0
San Saba County	05/27/1990	1.75	$0	$0
San Saba County	06/01/1992	1.5	$0	$0
San Saba County	06/28/1992	1.75	$0	$0
San Saba County	06/28/1992	1.75	$0	$0
San Saba County	04/19/1993	1	$0	$0
Richland Springs	04/19/1993	0.75	$0	$0
Richland Springs	04/19/1993	0.75	$0	$0
Richland Springs	04/19/1993	0.75	$0	$0
San Saba	04/19/1993	1	$0	$0
San Saba	04/19/1993	1	$0	$0
San Saba	04/19/1993	0.75	$0	$0
San Saba	04/19/1993	0.75	$0	$0
Sloan	04/19/1993	1	$0	$0
Colorado Bend State Park	10/13/1993	0.75	$0	$0
Richland Springs	10/18/1993	1.75	$500,000	$0
Richland Springs	10/18/1993	1.75	$50,000	$0
Richland Springs	10/18/1993	1.75	$0	$0

TABLE 14-2.
HISTORIC HAIL EVENTS IN SAN SABA COUNTY (1960-2014)

Location	Date	Hail Size (inches)	Estimated Damage Cost	
			Property	Crops
Richland Springs	10/18/1993	1.75	$0	$0
Richland Springs	10/18/1993	1.75	$0	$0
Richland Springs	10/18/1993	1.75	$0	$0
San Saba	10/18/1993	1	$0	$0
San Saba	10/18/1993	1	$0	$0
San Saba	05/14/1994	1.75	$0	$0
San Saba	05/14/1994	1.5	$0	$0
Southern San Saba	05/14/1994	1.75	$0	$0
Richland Springs	05/26/1994	1	$0	$0
San Saba	05/26/1994	1.75	$50,000	$0
Richland Springs	05/29/1994	2.75	$0	$0
Cherokee	10/24/1994	0.75	$0	$0
San Saba	04/17/1995	1.75	$0	$0
Rosewood	05/31/1995	1	$0	$0
Cherokee	03/24/1996	0.75	$0	$0
San Saba	03/01/1997	1	$0	$0
Richland Springs	03/25/1997	0.75	$0	$0
Bend	04/20/1997	1.75	$0	$0
San Saba	04/20/1997	2	$0	$0
San Saba	04/20/1997	1.25	$0	$0
San Saba	01/05/1998	1.75	$0	$0
San Saba	04/26/1998	0.75	$0	$0
San Saba	06/04/1998	1.75	$0	$0
San Saba	06/04/1998	0.88	$0	$0
San Saba	06/12/1998	0.88	$0	$0
Cherokee	03/12/1999	0.75	$0	$0
San Saba	03/12/1999	0.75	$0	$0
San Saba	03/12/1999	1.75	$0	$0
Richland Springs	05/24/1999	1.5	$0	$0
Cherokee	03/25/2000	0.75	$0	$0
San Saba	04/01/2000	0.75	$0	$0
Cherokee	05/12/2000	0.75	$0	$0
San Saba	05/05/2001	1.75	$0	$0
Chappel	05/06/2001	1.25	$0	$0
San Saba	03/30/2002	1.75	$0	$0
San Saba	05/04/2002	1.75	$0	$0

TABLE 14-2.
HISTORIC HAIL EVENTS IN SAN SABA COUNTY (1960-2014)

Location	Date	Hail Size (inches)	Estimated Damage Cost	
			Property	Crops
San Saba	05/04/2002	2	$0	$0
San Saba	05/27/2002	1	$0	$0
Algerita	12/30/2002	0.88	$0	$0
Algerita	05/02/2003	1	$0	$0
Algerita	06/05/2003	0.75	$0	$0
San Saba	04/10/2004	0.75	$0	$0
Algerita	05/08/2005	0.88	$0	$0
Richland Springs	10/31/2005	1	$0	$0
San Saba	03/19/2006	0.75	$0	$0
Cherokee	04/18/2006	0.88	$0	$0
San Saba	04/18/2006	0.75	$0	$0
Cherokee	04/20/2006	0.88	$0	$0
Sellman	05/01/2007	1.75	$4,000	$0
San Saba	06/04/2007	1	$0	$0
San Saba	06/14/2007	0.75	$0	$0
Algerita	04/17/2008	1	$0	$0
Harkeyville	05/14/2008	0.75	$0	$0
Cherokee	04/17/2009	1	$0	$0
Cherokee	06/11/2009	1.75	$0	$0
Harkeyville	06/12/2009	1	$0	$0
San Saba	06/12/2009	1	$0	$0
Sellman	06/12/2009	1	$0	$0
Skeeterville	06/12/2009	0.75	$0	$0
Cherokee	06/02/2010	1.75	$0	$0
Cherokee	06/02/2010	2.75	$0	$0
Skeeterville	04/10/2011	1	$0	$0
Elm Grove	06/21/2011	1.5	$0	$0
Bend	03/19/2012	1	$0	$0
Cherokee	03/19/2012	1.75	$0	$0
San Saba	05/07/2012	1	$0	$0
San Saba County Municipal Airport	03/09/2013	1	$0	$0
San Saba	05/10/2013	1	$0	$0
Bend	04/21/2014	1.5	$0	$0
Bend	04/21/2014	1.5	$0	$0
Bend	04/21/2014	1.5	$0	$0

TABLE 14-2.
HISTORIC HAIL EVENTS IN SAN SABA COUNTY (1960-2014)

Location	Date	Hail Size (inches)	Estimated Damage Cost	
			Property	Crops
San Saba County Municipal Airport	05/27/2014	2.75	$0	$0
San Saba County Municipal Airport	05/27/2014	1.75	$0	$0
San Saba County Municipal Airport	05/27/2014	1.75	$0	$0
Sellman	06/12/2014	0.88	$0	$0

Source: http://www.ncdc.noaa.gov/

Winds

High winds occur year round in San Saba County. In the spring and summer, which are generally warm and humid in Texas, high winds often accompany severe thunderstorms. The varying topography in the area has the potential for continuous and sudden high wind gusts. The northern winds are a fairly common wintertime phenomena in Southern Texas. These winds develop in well-defined areas and can be quite strong with resulting drastic drop in air temperatures. Atmospheric conditions are expected to continue unchanged with windstorms remaining a perennial occurrence. Winds of 0 to near 200 mph are possible in the planning area.

Although these high winds may not be life-threatening, they can disrupt daily activities, cause damage to building and structures, and increase the potential damage of other hazards. Wind resource information is shown in Figure 14-9 as a proxy for typical wind speeds. Wind resource information is estimated by the National Renewable Energy Laboratory (NREL) to identify areas that are suitable for wind energy applications. The wind resource is expressed in terms of wind power classes, ranging from Class 1 (lowest) to Class 7 (highest). Each class represents a range of mean wind power density or approximate mean wind speed at specified heights above the ground (in this case, 50 meters above the ground surface). Table 14-3 identifies the mean wind power density and speed associated with each classification. Figure 14-9 shows the wind power class potential density for San Saba County classified as “Poor.”

TABLE 14-3.
WIND POWER CLASS AND SPEED

Rank	Wind Power Class	Wind Power Density at 50 meters (W/m^2)	Wind Speed at 50 meters (mph)
Poor	1	0-200	0-12.5
Marginal	2	200-300	12.5-14.3
Fair	3	300-400	14.3-15.7
Good	4	400-500	15.7-16.8
Excellent	5	500-600	16.8-17.9
Outstanding	6	600-800	17.9-19.7
Superb	7	800-2000	19.7-26.6

Source: National Renewable Energy Laboratory Wind Energy Resource Atlas of the United States
mph Miles per hour
W/m^2 Watts per square meter

Historical severe weather data from the NOAA National Climatic Data Center's Storm Events Database lists thunderstorm wind events in San Saba County between 1955 and December 2014, as shown in Table 14-4.

The NOAA National Climatic Data Center's database lists no dust devil or dust storm events for the county. There were several documented tornadoes in San Saba County in the 1950 to 2014 time period. These tornadoes are discussed in Chapter 15.

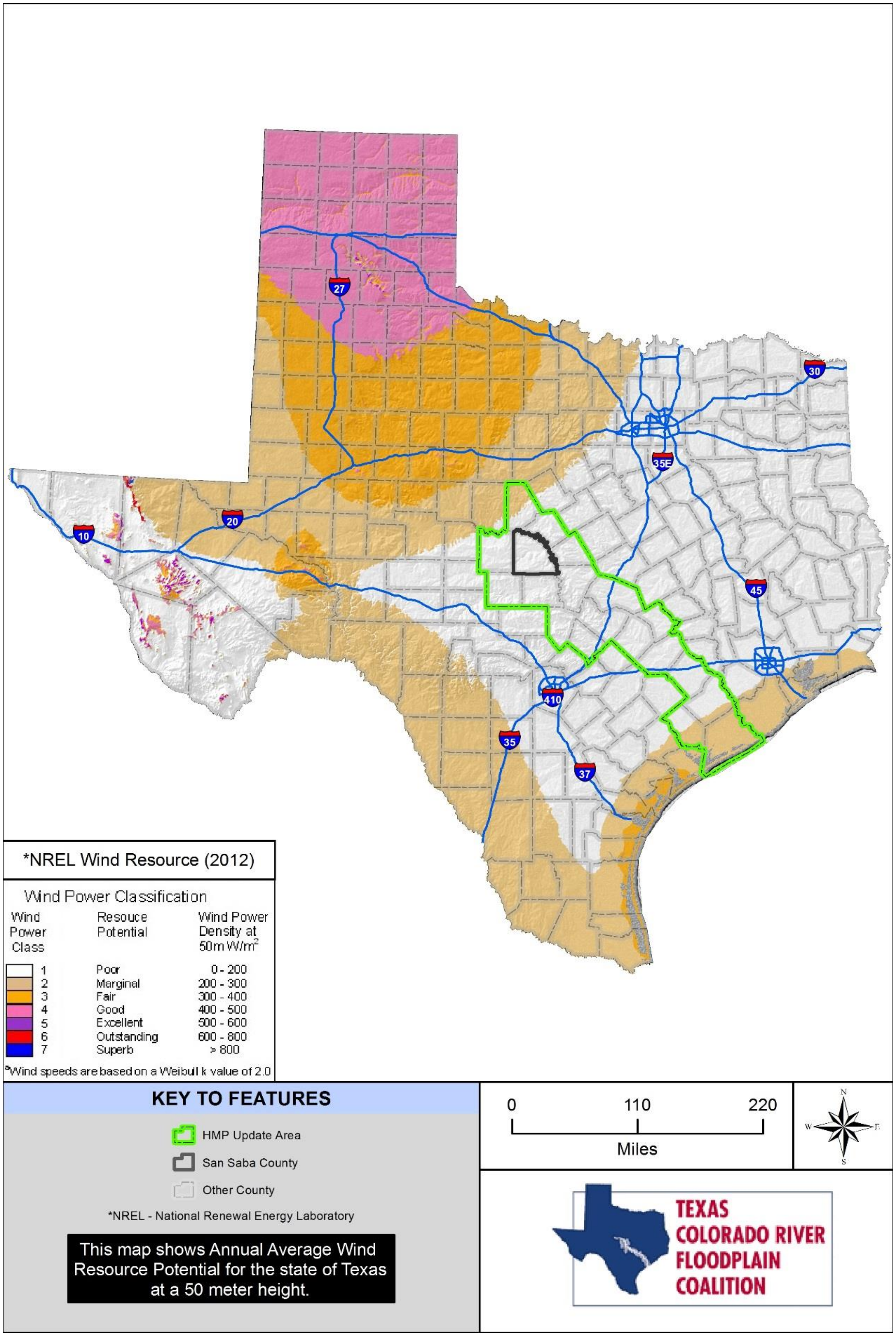


Figure 14-9. Texas Wind Power

TABLE 14-4.
HISTORIC WIND-RELATED EVENTS IN SAN SABA COUNTY (1950-2014)

Location	Date	Peak Wind Speed (knots)	Estimated Damage Cost		Injuries	Deaths
			Property	Crops		
San Saba County	06/02/1988	0	$0	$0	0	0
San Saba County	06/28/1992	0	$0	$0	0	0
San Saba County	06/28/1992	0	$0	$0	0	0
Richland Springs	04/19/1993	52	$0	$0	0	0
Richland Springs	04/19/1993	52	$0	$500	0	0
Colorado Bend State Park	10/13/1993	0	$5,000	$0	0	0
San Saba	05/26/1994	61	$50,000	$0	0	0
San Saba	05/29/1994	0	$50,000	$5,000	1	0
San Saba	05/29/1994	0	$5,000	$0	0	0
San Saba	11/04/1994	52	$5,000	$0	0	0
San Saba	05/31/1995	0	$5,000	$0	0	0
Willow Park	05/31/1995	57	$0	$0	0	0
Richland Springs	03/25/1997	52	$0	$0	0	0
Cherokee	05/30/1997	52	$0	$0	0	0
Cherokee	02/18/1998	52	$0	$0	0	0
San Saba	06/04/1998	N/A	$2,000	$0	0	0
San Saba	07/17/1998	N/A	$500	$0	0	0
San Saba	07/18/1998	N/A	$5,000	$0	0	0
San Saba	07/18/1998	N/A	$2,000	$0	0	0
Richland Springs	03/19/2002	N/A	$2,000	$0	0	0
San Saba	05/27/2002	52	$0	$0	0	0
San Saba	06/03/2003	61	$0	$0	0	0
Algerita	06/05/2003	61	$0	$0	0	0
Countywide	06/05/2003	70	$0	$0	0	0
San Saba	06/05/2003	70	$11,000	$0	0	0
San Saba	03/04/2004	60.83	$15,000	$0	0	0
Countywide	06/01/2004	69.52	$900,000	$0	0	0
Countywide	06/04/2004	52.14	$50,000	$0	0	0
Cherokee	05/28/2005	52.17	$0	$0	0	0
Richland Springs	05/08/2009	70	$0	$0	0	0
Harkeyville	05/11/2011	60	$0	$0	0	0

TABLE 14-4.
HISTORIC WIND-RELATED EVENTS IN SAN SABA COUNTY (1950-2014)

Location	Date	Peak Wind Speed (knots)	Estimated Damage Cost		Injuries	Deaths
			Property	Crops		
Algerita	05/15/2013	52	$0	$0	0	0
Harkeyville	05/15/2013	52	$0	$0	0	0
San Saba	05/15/2013	52	$0	$0	0	0
San Saba County Municipal Airport	05/15/2013	52	$0	$0	0	0
Richland Springs	05/17/2013	52	$0	$0	0	0
San Saba	08/15/2013	52	$0	$0	0	0
San Saba	08/15/2013	52	$0	$0	0	0
Sellman	08/15/2013	52	$0	$0	0	0
Cherokee	05/12/2014	56	$0	$0	0	0
Sellman	06/12/2014	52	$0	$0	0	0
Sellman	06/12/2014	52	$0	$0	0	0
Bend	10/13/2014	61	$0	$0	0	0

Source: http://www.ncdc.noaa.gov
N/A Not Available

14.2.2 Location

Severe weather events have the potential to happen anywhere in the planning area. Figure 6-6 shows the distribution of average precipitation over the planning area.

Thunderstorms and Lightning

The entire extent of San Saba County is exposed to some degree of lightning hazard, though exposed points of high elevation have significantly higher frequency of occurrence. There were no recorded lightning damage events documented by the NOAA National Climatic Data Center from 1993 to 2014 in San Saba County.

Hail

The entire extent of San Saba County is exposed to the hailstorm hazard. Previous instances of hail events in the county are shown in Figure 14-10.

Winds

Windstorms could occur anywhere in San Saba County. They have the ability to cause damage over 100 miles from the center of storm activity. Wind events are most damaging to areas that are heavily wooded. Winds impacting walls, doors, windows, and roofs, may cause structural components to fail. Previous occurrences of damaging high winds and the locations that they occurred are shown in Figure 14-11.

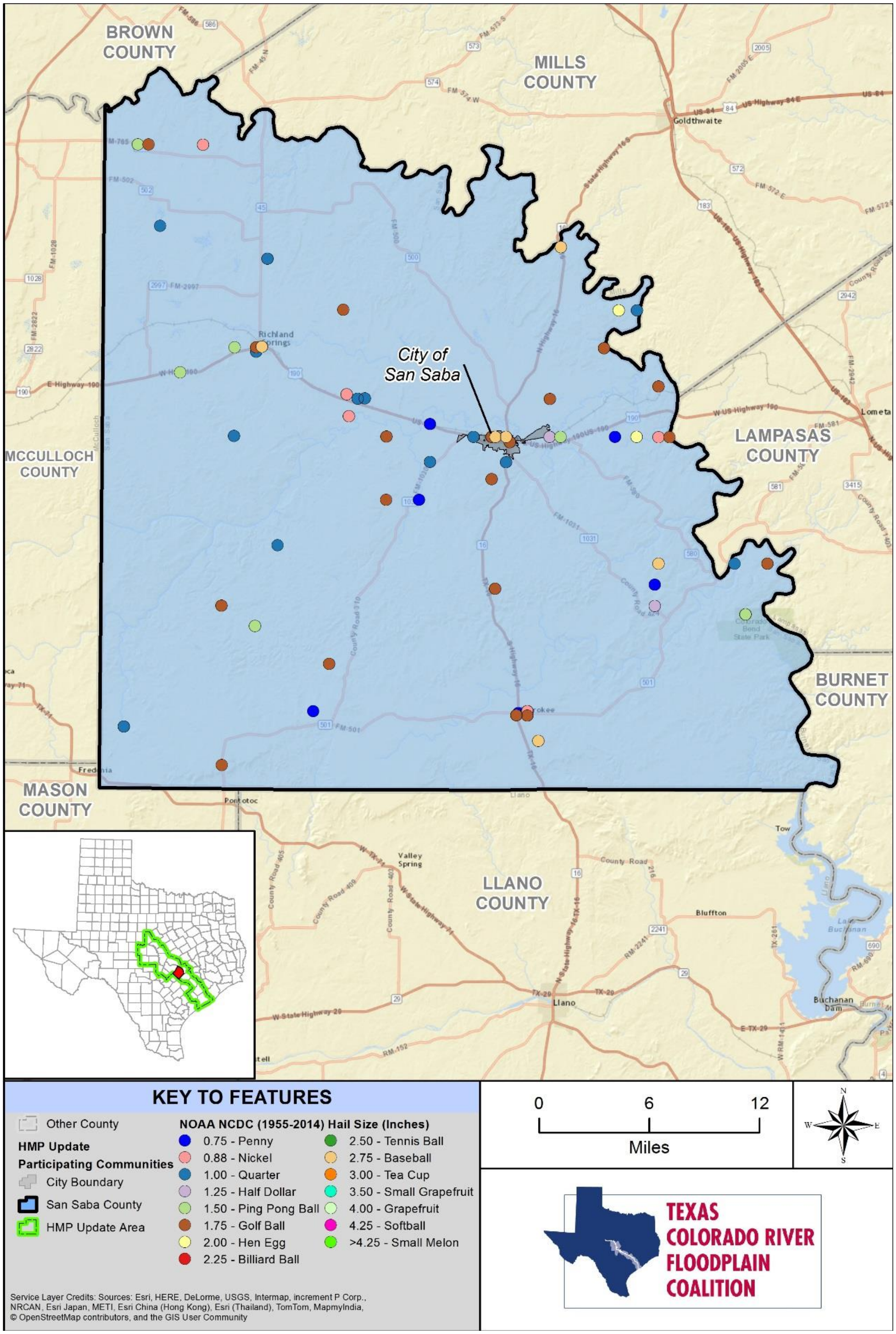


Figure 14-10. Hail Events in San Saba County (1955-2014)

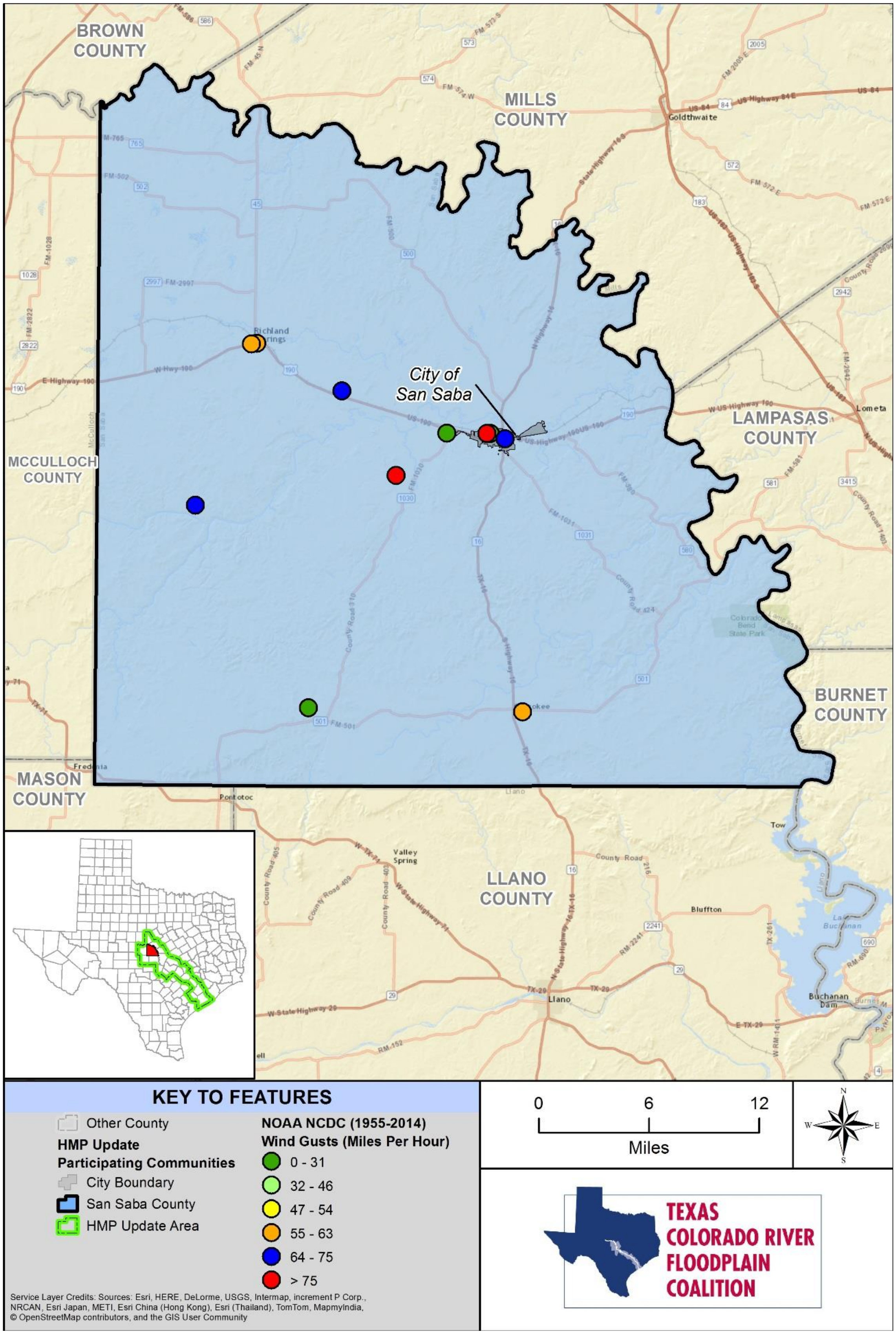


Figure 14-11. Damaging Wind Events in San Saba County (1955-2014)

14.2.3 Frequency

Thunderstorms and Lightning

To date, there have been no reported lightning strikes resulting in property damage, injury, or death in San Saba County. Texas ranks as one of the highest in lightning fatalities in the nation. San Saba County has approximately 12 to 15 lightning flashes per square mile per year and a thunderstorm lightning event is considered likely, with a recurrence interval of 10 years or more.

Hail

Based on a record of 106 hailstorm events over a 54-year period, significant hail occurs approximately twice per year on average and is considered likely.

Winds

Based on 43 events in 64 years, a damaging high-wind event occurs approximately every year to every other year on average in San Saba County and is considered likely.

14.2.4 Severity

Thunderstorms and Lightning

Based on the information in this hazard profile, the risk of a damaging lightning event in San Saba County is limited and the magnitude/severity of thunderstorms is low. The number of reported injuries from lightning is likely to be low, and county infrastructure losses are expected to be limited each year.

Hail

Severe hailstorms can be quite destructive. In recent years within the United States, hail causes more than $1.3 billion in damage to property and crops each year representing between 1 and 2% of the annual crop value.

Insurance claims resulting from hailstorm damage increased 84% nationwide in 2012 from their 2010 level according to the National Insurance Crime Bureau. In 2010, there were 467,602 hail damage claims filed in the U.S. That number increased to 689,267 in 2011 and 861,597 in 2012. The property damage can be as minimal as a few broken shingles to the total destruction of buildings.

Over 2 million hail damage claims were processed from January 1, 2010, to December 31, 2012, with Texas ranking first in overall claims. The top five states generating hail damage claims were Texas (320,823 claims); Missouri (138,857 claims); Kansas (126,490 claims); Colorado (118,118 claims) and Oklahoma (114,168 claims). Much of the damage inflicted by hail is to crops. Even relatively small hail can shred plants to ribbons in a matter of minutes. Vehicles, roofs of buildings and homes, and landscaping are the other things most commonly damaged by hail. Hail has been known to cause injury to humans and occasionally has been fatal.

A typical significant event occurred on October 18, 1993. Hail as large as golf balls damaged several vehicles and windows of buildings within the City of Richland Springs causing over $500,000 in property damages.

Based on the information in this hazard profile, the severity of hail storms is limited and the overall significance is low.

High Winds

High winds, often accompanying severe thunderstorms, can cause significant property and crop damage, threaten public safety, and have adverse economic impacts from business closures and power loss. Wind storms in San Saba County are rarely life threatening, but do disrupt daily activities, cause damage to buildings, and structures, and increase the potential for other hazards, such as wildfires. Winter winds can result in damage and close highways due to ice and blowing snow. Winds can also cause trees to fall, particularly those killed by insects or wildfire, creating a hazard to property or those outdoors.

Based on the information in this hazard profile, the magnitude/severity of high winds is considered limited. The overall significance of the hazard is considered low, with minimal potential impact.

14.2.5 Warning Time

Meteorologists can often predict the likelihood of a severe storm. This can give several days of warning time. However, meteorologists cannot predict the exact time of onset or severity of the storm. Some storms may come on more quickly and have only a few hours of warning time. Weather forecasts for the planning area are reliable. However, at times, the warning for the onset of severe weather may be limited.

14.3 SECONDARY HAZARDS

The most significant secondary hazards associated with severe local storms are floods, falling and downed trees, landslides, and downed power lines. Rapidly melting snow combined with heavy rain can overwhelm both natural and man-made drainage systems, causing overflow and property destruction. Erosion can occur when the soil on slopes becomes oversaturated and fails. Fires can occur as a result of lightning strikes. Many locations in the region have minimal vegetative ground cover and the high winds can create a large dust storm, which becomes a hazard for travelers and a disruption for local services. High winds in the winter can turn small amount of snow into a complete whiteout and create drifts in roadways. Debris carried by high winds can also result in injury or damage to property. A wildland fire can be accelerated and rendered unpredictable by high winds, which creates a dangerous environment for firefighters.

14.4 CLIMATE CHANGE IMPACTS

Climate change presents a significant challenge for risk management associated with severe weather. The frequency of severe weather events has increased steadily over the last century. The number of weather-related disasters during the 1990s was four times that of the 1950s, and cost 14 times as much in economic losses. Historical data shows that the probability for severe weather events increases in a warmer climate (see Figure 14-12). The changing hydrograph caused by climate change could have a significant impact on the intensity, duration, and frequency of storm events. All of these impacts could have significant economic consequences.

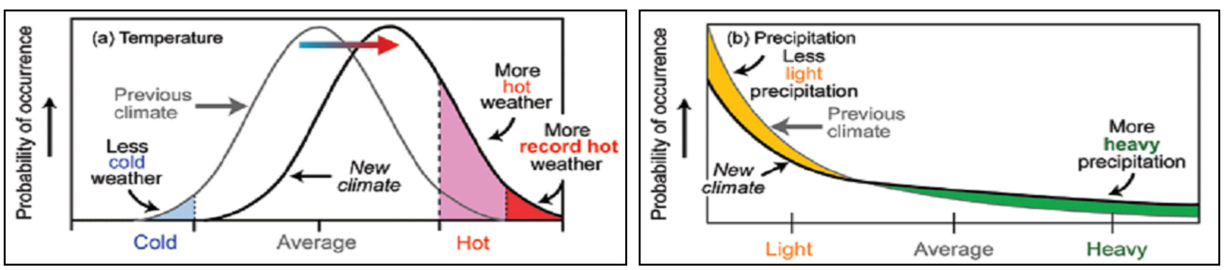


Figure 14-12. Severe Weather Probabilities in Warmer Climates

14.5 EXPOSURE

Because thunderstorms, lightning, hail, and wind cannot be directly modeled in HAZUS, annualized losses were estimated using GIS-based analysis, historical data analysis, and statistical risk assessment methodology. Event frequency, severity indicators, expert opinions, and historical knowledge of the region were used for this assessment. The primary data source was the updated HAZUS inventory data (2010 U.S. Census data and 2014 RS Means Square Foot Costs) using the augmented with state and federal data sets as well as the NOAA National Climatic Data Center’s Storm Event Database.

14.5.1 Population

It can be assumed that the entire planning area is exposed to some extent to thunderstorm, lightning, high wind, and hail events. Certain areas are more exposed due to geographic location and local weather patterns. Populations with large stands of trees or overhead power lines may be more susceptible to wind damage and black out, while populations in low-lying areas are at risk for possible flooding. It is not uncommon for residents living in more remote areas of the county to be isolated after such events.

14.5.2 Property

According to the San Saba County HAZUS 2.2 inventory data (updated with 2010 U.S. Census data and 2014 RS Means Square Foot Costs), there are 3,162 buildings within the San Saba County with an asset replaceable value of more than $635 million (excluding contents). About 99% of these buildings (and 84% of the building value) are associated with residential housing. Within the participating communities, there are 2,951 buildings (residential, commercial, and other) with a total asset inventory value of over $587 million (excluding contents). Other types of buildings in this report include agricultural, education, religious, and governmental structures.

It is estimated that most of the residential structures were built without the influence of a structure building code with provisions for wind loads. Wind pressure can create a direct and frontal assault on a structure, pushing walls, doors, and windows inward. Conversely, passing currents can create lift and suction forces that act to pull building components and surfaces outward. The effects of winds are magnified in the upper levels of multi-story structures. As positive and negative forces impact the building’s protective envelope (doors, windows, and walls), the result can be roof or building component failures and considerable structural damage.

All of these buildings are considered to be exposed to the thunderstorm, lightning, wind, and hail hazards, but structures in poor condition or in particularly vulnerable locations (located on hilltops or exposed open areas) may risk the most damage. The frequency and degree of damage will depend on specific locations.

14.5.3 Critical Facilities and Infrastructure

All critical facilities within the planning area are exposed to thunderstorms, lightning, high winds, and hail. Those facilities within the floodplain (Chapter 12) are exposed to flooding associated with thunderstorms. Additional facilities on higher ground may be particularly exposed to wind damage, lightning, or damage from falling trees. The most common problems associated with these weather events are loss of utilities. Downed power lines can cause blackouts, leaving large areas isolated. Phone, water, and sewer systems may not function. Roads may become impassable due to secondary hazards such as flooding.

14.5.4 Environment

The environment is highly exposed to thunderstorms, lightning, high winds, and hail. Natural habitats such as streams and trees risk major damage and destruction. Prolonged rains can saturate soils and lead to slope failure. Flooding events can produce river channel migration or damage riparian habitat. Lightning can start wildfires, particularly during a drought.

14.6 VULNERABILITY

14.6.1 Population

Vulnerable populations are the elderly, low income or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Power outages can be life threatening to those dependent on electricity for life support. Isolation of these populations is a significant concern. These populations face isolation and exposure during thunderstorm, wind, and hail events and could suffer more secondary effects of the hazard. Outdoor recreational users in the area may also be more vulnerable to severe weather events.

14.6.2 Property

All property is vulnerable during thunderstorm, lightning, wind, and hail events, but properties in poor condition or in particularly vulnerable locations may risk the most damage. Generally, damage is minimal and goes unreported. Those on hillsides and ridges may be more prone to wind damage. Those that are located under or near overhead lines or near large trees may be damaged in the event of a collapse.

Loss estimations for the thunderstorm, lightning, wind, and hail hazards are not based on damage functions, because no such damage functions have been generated. Instead, loss estimates were developed representing projected damages (annualized loss) on reported damages and exposed values. Historical events, statistical analysis and probability factors were applied to the county's and communities reported damages and exposed values to create an annualized loss. Table 14-5 lists the loss estimates.

TABLE 14-5.
LOSS ESTIMATES FOR THUNDERSTORM, LIGHTNING, WIND, AND HAIL EVENTS

	Exposed Value ($)	Annualized Loss ($)	Annualized Loss Percentage (%)
City of San Saba	$428,225,383	$1,418	<0.01%
Unincorporated Area	$502,972,374	$709,616	0.14%
Planning Area Total	**$931,197,757**	**$711,034**	**0.08%**

14.6.3 Critical Facilities and Infrastructure

Incapacity and loss of roads are the primary transportation failures resulting from thunderstorms, lightning, wind, and hail and are mostly associated with secondary hazards. Erosion caused by heavy prolonged rains can block roads. High winds can cause significant damage to trees and power lines, blocking roads with debris, incapacitating transportation, isolating population, and disrupting ingress and egress. Of particular concern are roads providing access to isolated areas and to the elderly. Prolonged obstruction of major routes due to debris or floodwaters can disrupt the shipment of goods and other commerce. Large, prolonged storms can have negative economic impacts for an entire region. Severe windstorms and downed trees can create serious impacts on power and above-ground communication lines. Loss of electricity and phone connection would leave certain populations isolated because residents would be unable to call for assistance. Lightning events in the county can have destructive effects on power and information systems. Failure of these systems would have cascading effects throughout the county and could possible disrupt critical facility functions.

14.6.4 Environment

The vulnerability of the environment to severe weather is the same as the exposure, discussed in Section 14.5.4

14.7 FUTURE TRENDS IN DEVELOPMENT

All future development will be affected by severe storms. The ability to withstand impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction. The City of

San Saba has adopted the International Building Code for construction within this region. This code is equipped to deal with the impacts of severe weather events. Land use policies identified in master plans and enforced through zoning code and the permitting process also address many of the secondary impacts of the severe weather hazard. With these tools, the planning partnership is well equipped to deal with future growth and the associated impacts of severe weather.

14.8 SCENARIO

Although severe local storms are infrequent, impacts can be significant, particularly when secondary hazards of flood and erosion occur. A worst-case event would involve prolonged high winds during a thunderstorm. Such an event would have both short-term and longer-term effects. Initially, schools and roads would be closed due to power outages caused by high winds and downed tree obstructions. In more rural areas, some subdivisions could experience limited ingress and egress. Prolonged rain could produce flooding, overtopped culverts with ponded water on roads and landslides on steep slopes. Flooding could further obstruct roads and bridges, further isolating residents.

14.9 ISSUES

Important issues associated with a severe weather in the planning area include the following:

- Older building stock in the planning area is built to low code standards or none at all. These structures could be highly vulnerable to severe weather events such as windstorms.
- Redundancy of power supply must be evaluated.
- The capacity for backup power generation is limited.
- The potential for isolation after a severe storm event is high.
- There is limited information available for local weather forecasts.
- The lack of proper management of trees may exacerbate damage from high winds.

CHAPTER 15.
TORNADO

TORNADO RANKING	
San Saba County	Low
City of San Saba	Low

DEFINITIONS

Tornado — Funnel clouds that generate winds up to 500 mph. They can affect an area up to three-quarters of a mile wide, with a path of varying length. Tornadoes can come from lines of cumulonimbus clouds or from a single storm cloud. They are measured using the Fujita Scale (ranging from F0 to F5), or the Enhanced Fujita Scale.

15.1 GENERAL BACKGROUND

A tornado is a narrow, violently rotating column of air that extends from the base of a cumulonimbus cloud to the ground. The visible sign of a tornado is the dust and debris that is caught in the rotating column made up of water droplets. Tornadoes are the most violent of all atmospheric storms. Tornadoes can be induced by hurricanes. The following are common ingredients for tornado formation:

- Very strong winds in the mid and upper levels of the atmosphere
- Clockwise turning of the wind with height (i.e., from southeast at the surface to west aloft)
- Increasing wind speed in the lowest 10,000 feet of the atmosphere (i.e., 20 mph at the surface and 50 mph at 7,000 feet)
- Very warm, moist air near the ground with unusually cooler air aloft
- A forcing mechanism such as a cold front or leftover weather boundary from previous shower or thunderstorm activity

Tornadoes can form from individual cells within severe thunderstorm squall lines. They also can form from an isolated super-cell thunderstorm. Weak tornadoes can sometimes occur from air that is converging and spinning upward, with little more than a rain shower occurring in the vicinity.

In 2007, NWS began rating tornadoes using the Enhanced Fujita Scale (EF-scale). The EF-scale is a set of wind estimates (not measurements) based on damage. It uses 3-second gusts estimated at the point of damage based on a judgment of 8 levels of damage to the 28 indicators listed in Table 15-1. These estimates vary with height and exposure. Standard measurements are taken by weather stations in openly exposed area. Table 15-2 describes the EF-scale ratings (NOAA 2007).

The U.S. experiences more tornadoes than any other country. In a typical year, approximately 1,000 tornadoes affect the U.S. The peak of the tornado season is April through June, with the highest concentration of tornadoes in the central U.S. Figure 15-1 shows the annual average number of tornadoes between 1991 and 2010. Texas experienced an average of 155 tornado events annually in that period. Texas ranks first among the 50 states in both the frequency of tornadoes and the number of lethal tornadoes. When these statistics are compared to other states by the frequency per 10,000 square miles, Texas ranks tenth in the U.S. "Tornado Alley" is a nickname given to an area in the southern plains of the central United States that consistently experiences a high frequency of tornadoes each year. Tornadoes in this region typically happen in late spring and occasionally the early fall. The Gulf Coast area has a separate tornado region nicknamed "Dixie Alley" with a relatively high frequency of tornadoes occurring in the late fall (October through December).

NOAA's National Severe Storms Laboratory used historical data to estimate the daily probability of tornado occurrences across the U.S., regardless of tornado magnitude. Figure 15-2 shows the estimates. The density per 25 square miles in the map's legend indicates the probable number of tornadoes for each 25 square mile cell within the contoured zone that can be expected over a similar period of record. This density number does NOT indicate the number of events that can be expected across the entire zone on the map.

**TABLE 15-1.
ENHANCED FUJITA SCALE DAMAGE INDICATORS**

No.	Damage Indicator	No.	Damage Indicator
1	Small barns, farm outbuildings	15	School – one-story elementary (interior or exterior halls)
2	One or two-family residences	16	School – junior or senior high school
3	Single-wide mobile home	17	Low-rise (1-4 story) building
4	Double-wide mobile home	18	Mid-rise (5-20) building
5	Apartment, condo, townhouse (3 stories or less)	19	High-rise (over 20 stories) building
6	Motel	20	Institutional building (hospital, government, or university)
7	Masonry apartment or motel	21	Metal building system
8	Small retail building (fast food)	22	Service station canopy
9	Small professional (doctor office, bank)	23	Warehouse (tilt-up walls or heavy timber)
10	Strip mall	24	Transmission line tower
11	Large shopping mall	25	Free-standing tower
12	Large, isolated (big box) retail building	26	Free standing pole (light, flag, luminary)
13	Automobile showroom	27	Tree – hardwood
14	Automobile service building	28	Tree – softwood

**TABLE 15-2.
THE FUJITA SCALE AND ENHANCED FUJITA SCALE**

Fujita (F) Scale			Derived		Operational Enhanced Fujita (EF) Scale	
F Number	Fastest ¼ mile (mph)	3-second gust (mph)	EF Number	3-second gust (mph)	EF Number	3-second gusts (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

Notes:
mph Miles per Hour

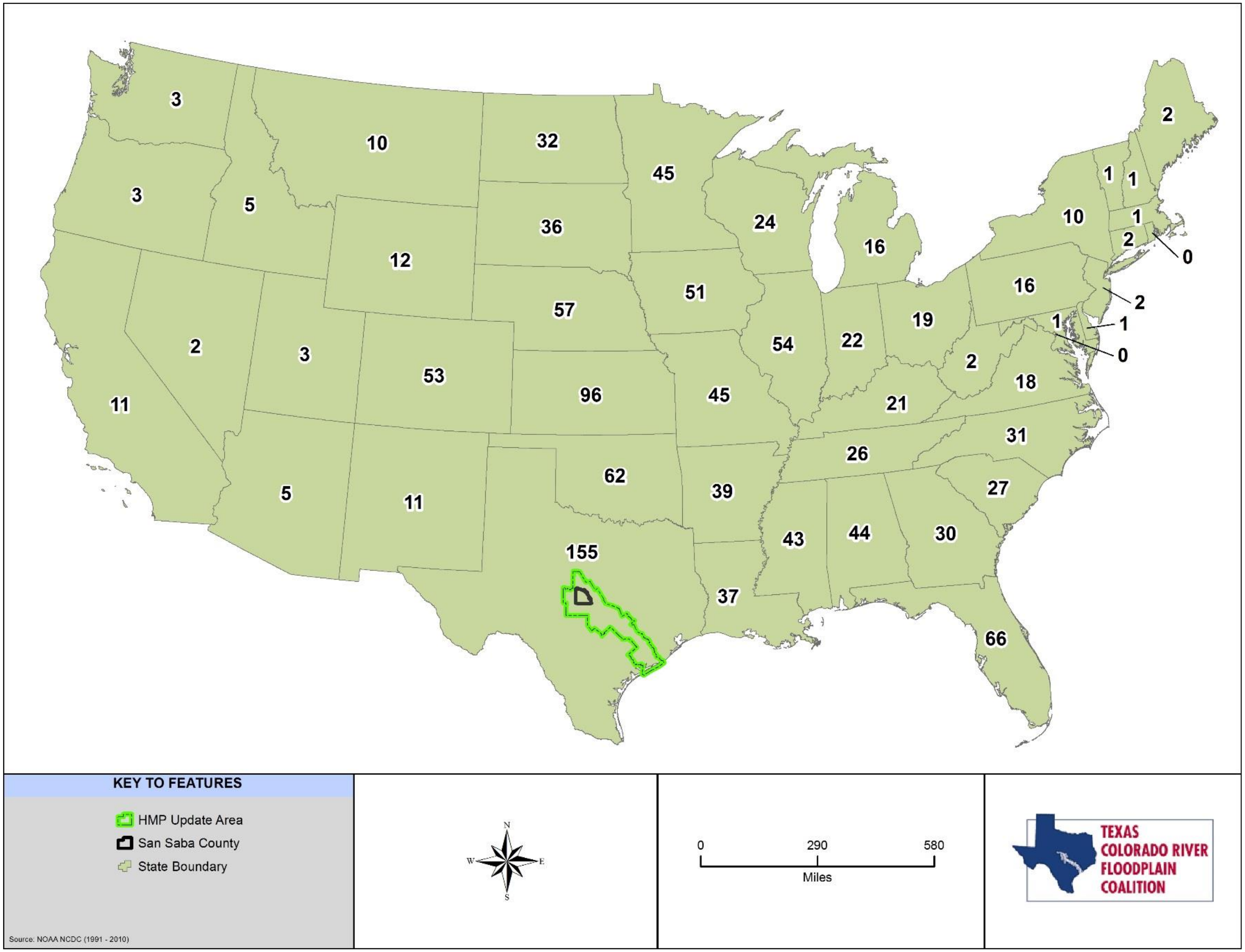


Figure 15-1. Annual Average Number of Tornadoes in the U.S. (1991-2010)

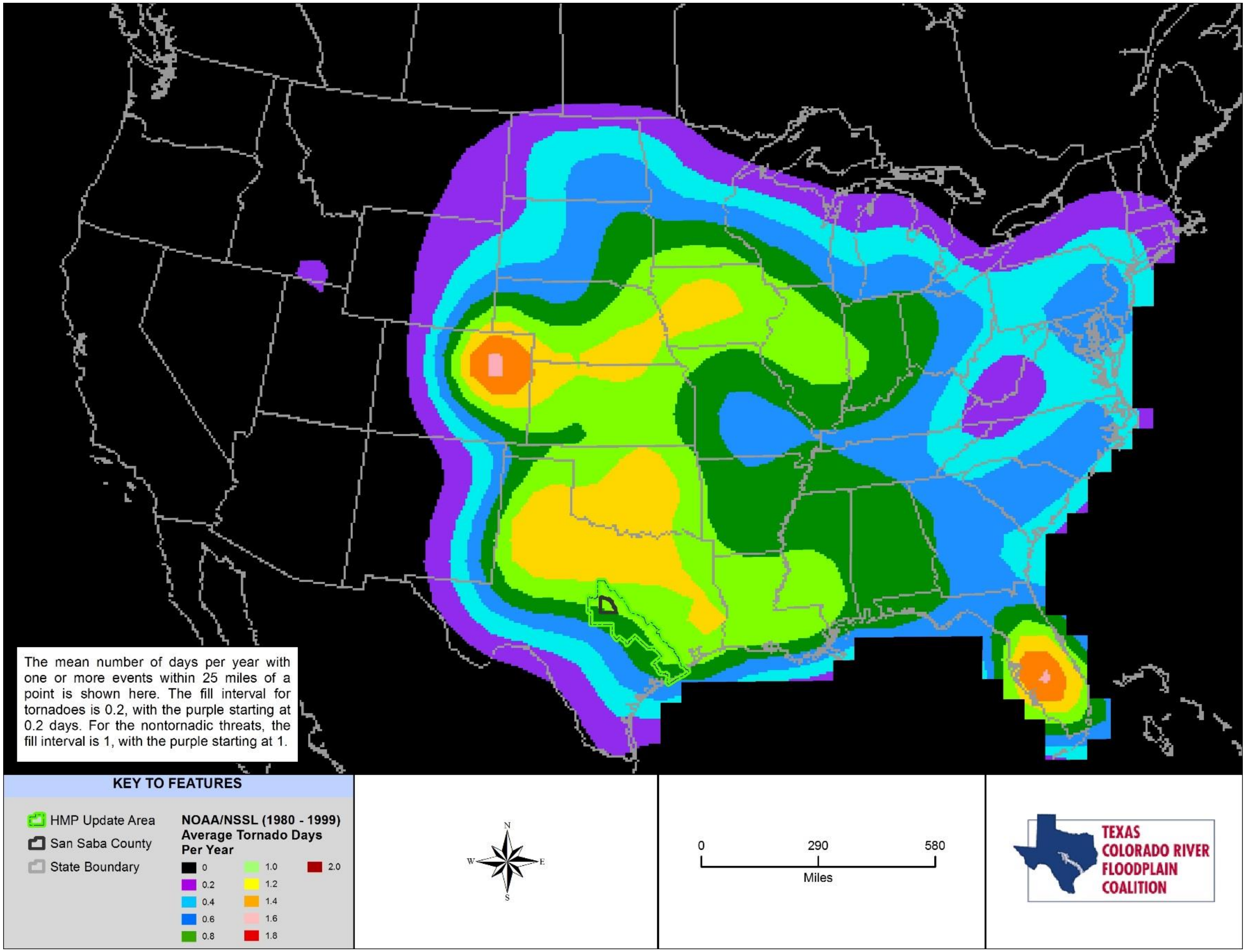


Figure 15-2. Total Annual Threat of Tornado Events in the U.S. (1980-1999)

15.2 HAZARD PROFILE

15.2.1 Past Events

Table 15-3 lists tornadoes in San Saba County recorded by the NOAA Storm Event Center from 1950 to 2014. Of the 19 recorded tornadoes, 9 tornadoes caused property damage. In addition, there were 4 reported injuries, but no fatalities. Seven of the tornadoes were rated F1 or above. Figure 15-3 shows the location of NOAA-documented tornado paths between 1950 and 2014. Most tornadoes occur in the spring and early summer, with a few in the fall.

TABLE 15-3.
HISTORIC TORNADO EVENTS IN SAN SABA COUNTY (1950-2014)

			Estimated Damage Cost			
Location	**Date**	**Category**	**Property**	**Crops**	**Injuries**	**Deaths**
San Saba County	7/20/1956	F1	$2,500	$0	3	0
San Saba County	1/20/1973	F1	$2,500	$0	0	0
San Saba County	4/30/1978	F1	$2,500	$0	1	0
San Saba County	5/15/1981	F2	$0	$0	0	0
San Saba County	6/15/1982	F0	$2,500	$0	0	0
San Saba County	5/19/1987	F0	$25,000	$0	0	0
San Saba County	6/28/1992	F1	$25,000	$0	0	0
Hall Valley	4/19/1993	F0	$0	$500	0	0
Hall Valley	4/19/1993	F0	$0	$0	0	0
San Saba	1/5/1998	F0	$1,000	$0	0	0
Richland Springs	3/12/1999	F2	$300,000	$0	0	0
Elm Grove	5/11/1999	F0	$0	$0	0	0
San Saba	5/11/1999	F0	$0	$0	0	0
Elm Grove	6/21/2004	F0	$0	$0	0	0
Cherokee	6/12/2009	EF0	$0	$0	0	0
Cherokee	6/12/2009	EF0	$0	$0	0	0
Richland Springs	6/12/2009	EF1	$0	$0	0	0
Chappel	5/27/2014	NA	$0	$0	0	0
San Saba County Municipal Airport	5/27/2014	NA	$0	$0	0	0

Source: http://www.ncdc.noaa.gov
NA Not Available

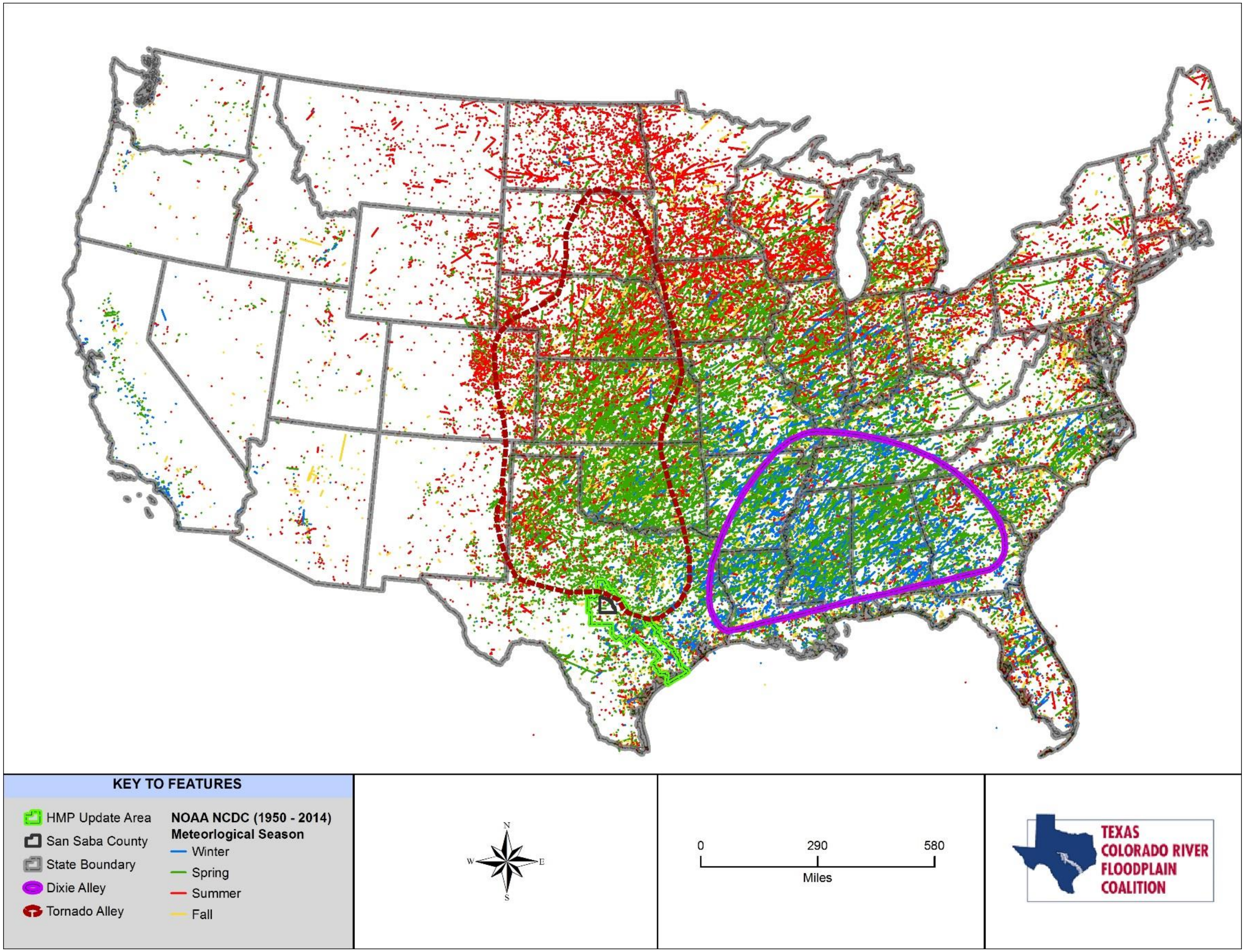


Figure 15-3. Tornado Paths in the U.S. (1950-2014)

15.2.2 Location

Recorded tornadoes in the planning area are typically average size and short-lived. They can occur anywhere in the county. Figure 15-4 the location of previous tornado events in the county.

15.2.3 Frequency

Tornadoes may occur in any month and at any hour of the day, but they occur with the greatest frequency during the late spring and early summer months, and between the hours of 4:00 pm and 8:00 pm. In the period of 1951 to 2011, nearly 62.7% of all Texas tornadoes occurred within the three-month period of April, May, and June, with almost one-third of the total tornadoes occurring in May.

Table 15-3 lists 7 recorded tornadoes rated F1 or higher between 1950 and 2014. Therefore, on average, a significant tornado occurs in the county once every 10 years.

15.2.4 Severity

Tornadoes are potentially the most dangerous of local storms. If a major tornado were to strike within the populated areas of San Saba County, damage could be widespread. Businesses could be forced to close for an extended period or permanently, fatalities could be high, many people could be homeless for an extended period, and routine services such as telephone or power could be disrupted. Buildings may be damaged or destroyed. Historically, tornadoes have not typically been severe or caused damage in the planning area.

15.2.5 Warning Time

The NOAA Storm Prediction Center issues tornado watches and warnings for San Saba County. Watches and warnings are described below:

- Tornado Watch - Tornadoes are possible. Remain alert for approaching storms. Watch the sky and stay tuned to NOAA all hazards weather radio, commercial radio, or television for information.
- Tornado Warning - A tornado has been sighted or indicated by weather radar. Take shelter immediately.

Once a warning has been issued, residents may have only a matter of seconds or minutes to seek shelter.

15.3 SECONDARY HAZARDS

Tornadoes may cause loss of power if utility service is disrupted. Additionally, fires may result from damages to natural gas infrastructure. Hazardous materials may be released if a structure is damaged that houses such materials or if such a material is in transport.

15.4 CLIMATE CHANGE IMPACTS

Climate change impacts on the frequency and severity of tornadoes are unclear. According to the Center for Climate Change and Energy Solutions, “Researchers are working to better understand how the building blocks for tornadoes – atmospheric instability and wind shear – will respond to global warming. It is likely that a warmer, moister world would allow for more frequent instability. However, it is also likely that a warmer world would lessen chances for wind shear. Recent trends for these quantities in the Midwest during the spring are inconclusive. It is also possible that these changes could shift the timing of tornadoes or regions that are most likely to be hit” (Center for Climate and Energy Solutions no date).

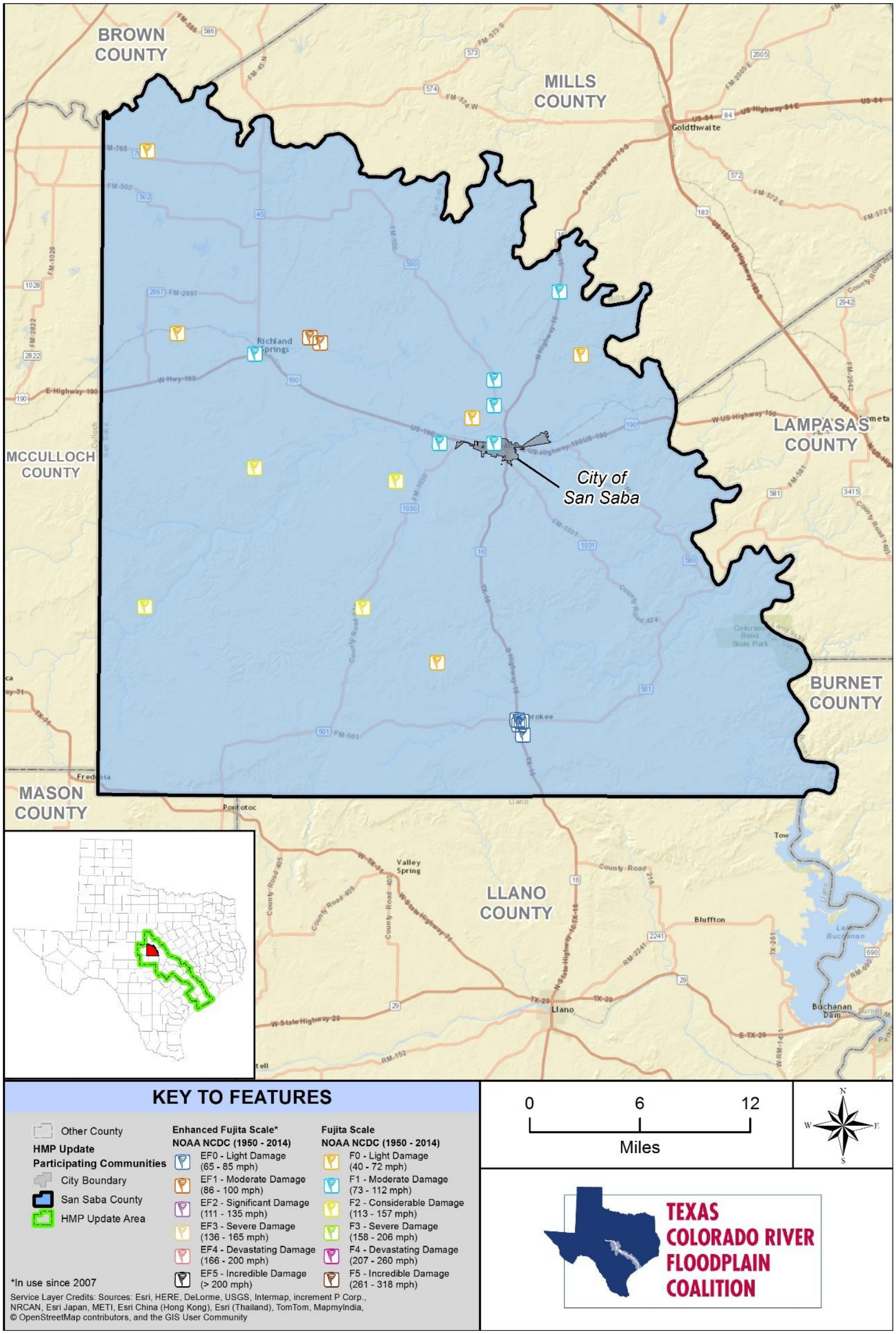


Figure 15-4. Tornado Events in San Saba County (1950-2014)

15.5 EXPOSURE

Because tornadoes cannot be directly modeled in HAZUS, annualized losses were estimated using GIS-based analysis, historical data analysis, and statistical risk assessment methodology. Event frequency, severity indicators, expert opinions, and historical knowledge of the region were used for this assessment. The primary data source was the updated HAZUS inventory data (updated with 2010 U.S. Census data and 2014 RS Means Square Foot Costs) augmented with state and federal data sets as well as the NOAA National Climatic Data Center's Storm Event Database.

15.5.1 Population

It can be assumed that the entire planning area is exposed to tornadoes to some extent. Certain areas are more exposed due to geographic location and local weather patterns.

15.5.2 Property

According to the San Saba County HAZUS 2.2 inventory data (updated with 2010 U.S. Census data and 2014 RS Means Square Foot Costs), there are 3,162 buildings within the San Saba County with an asset replaceable value of more than $635 million (excluding contents). About 99% of these buildings (and 84% of the building value) are associated with residential housing. Within the participating communities, there are 2,951 buildings (residential, commercial, and other) with a total asset inventory value of over $587 million (excluding contents). Other types of buildings in this report include agricultural, education, religious, and governmental structures.

15.5.3 Critical Facilities and Infrastructure

All critical facilities (see Figure 6-8 and Figure 6-9) are likely vulnerable to tornadoes. The most common problems associated with this hazard are utility losses. Downed power lines can cause blackouts, leaving large areas isolated. Phone, water, and sewer systems may not function. Roads may become impassable due to downed trees or other debris.

15.5.4 Environment

Environmental features are exposed to tornado risk, although damages are generally localized to the path of the tornado.

15.6 VULNERABILITY

15.6.1 Population

Vulnerable populations are the elderly, low income, or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Power outages can be life threatening to those dependent on electricity for life support. Isolation of these populations is a significant concern. These populations face isolation and exposure after tornado events and could suffer more secondary effects of the hazard.

Individuals caught in the path of a tornado who are unable to seek appropriate shelter are especially vulnerable. This may include individuals who are out in the open, in cars, or who do not have access to basements, cellars, or safe rooms.

15.6.2 Property

All property is vulnerable during tornado events, but properties in poor condition or in particularly vulnerable locations may risk the most damage.

Loss estimations for tornadoes are not based on damage functions, because no such damage functions have been generated. Instead, loss estimates were developed representing projected damages (annualized loss) on historical events, statistical analysis, and probability factors. These were applied to the exposed value of the county and communities to create an annualized loss. Table 15-4 lists the loss estimates.

TABLE 15-4.
LOSS ESTIMATES FOR TORNADO EVENTS

Jurisdiction	Exposed Value	Annualized Loss	Annualized Loss Percentage
City of San Saba	$428,225,383	$91	< 0.01%
Unincorporated Area	$502,972,374	$45,515	< 0.01%
Planning Area Total	**$931,197,757**	**$45,606**	**< 0.01%**

15.6.3 Critical Facilities and Infrastructure

Tornadoes can cause significant damage to trees and power lines, block roads with debris, incapacitate transportation, isolate populations, and disrupt ingress and egress. Of particular concern are roads providing access to isolated areas and to the elderly. Any facility that is in the path of a tornado is likely to sustain damage.

15.6.4 Environment

Environmental vulnerability will typically be the same as exposure (discussed in Section 15.5.4); however, if tornadoes impact facilities that store hazardous material, areas impacted by material releases may be especially vulnerable.

15.7 FUTURE TRENDS IN DEVELOPMENT

All future development will be affected by tornadoes, particularly development that occurs at lower elevations. Development regulations that require safe rooms, basements, or other structures that reduce risk to people would decrease vulnerability. Tornadoes that cause damage are uncommon in the county, so mandatory regulations may not be cost-effective.

15.8 SCENARIO

If an F3 or higher tornado were to hit populated areas of the county, substantial damage to property and loss of life could result. Likelihood of injuries and fatalities would increase if warning time was limited before the event or if residents were unable to find adequate shelter. Damage to critical facilities and infrastructure would likely include loss of power, water, sewer, gas and communications. Roads and bridges could be blocked by debris or otherwise damaged. The most serious damage would be seen in the direct path of the tornado, but secondary effects could impact the rest of the county through loss of government services and interruptions in the transportation network. Debris from the tornado would need to be collected and properly disposed. Such an event would likely have substantial negative effects on the local economy.

15.9 ISSUES

Important issues associated with a tornado in the planning area include the following:

- Older building stock in the planning area is built to low code standards or none at all. These structures could be highly vulnerable to tornadoes.

- Redundancy of power supply must be evaluated.
- The capacity for backup power generation is limited.
- Roads and bridges blocked by debris or otherwise damaged might isolate populations.
- Warning time may not be adequate for residents to seek appropriate shelter or such shelter may not be widespread throughout the planning area.
- The impacts of climate change on the frequency and severity of tornadoes are not well understood.
- Building codes may need to be updated so buildings can withstand strong wind loads or provisions may be added for tornado shelters in high risk areas.

CHAPTER 16.
WILDFIRE

WILDFIRE RANKING	
San Saba County	Medium
City of San Saba	Low

DEFINITIONS

Conflagration — A fire that grows beyond its original source area to engulf adjoining regions. Wind, extremely dry or hazardous weather conditions, excessive fuel buildup, and explosions are usually the elements behind a wildfire conflagration.

Interface Area — An area susceptible to wildfires and where wildland vegetation and urban or suburban development occur together. An example would be smaller urban areas and dispersed rural housing in forested areas.

Wildfire — Fires that result in uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property in non-urban areas. Because of their distance from firefighting resources, they can be difficult to contain and can cause a great deal of destruction.

16.1 GENERAL BACKGROUND

According to the *2000 National Fire Plan*, the wildland fire risk is now considered by authorities as "the most significant fire service problem of the Century."

A wildfire is any uncontrolled fire occurring on undeveloped land that requires fire suppression. Wildfires can be ignited by lightning or by human activity such as smoking, campfires, equipment use, and arson.

Fire hazards present a considerable risk to vegetation and wildlife habitats. Short-term loss caused by a wildfire can include the destruction of timber, wildlife habitat, scenic vistas, and watersheds. Long-term effects include smaller timber harvests, reduced access to affected recreational areas, and destruction of cultural and economic resources and community infrastructure. Vulnerability to flooding increases due to the destruction of watersheds. The potential for significant damage to life and property exists in areas designated as wildland urban interface (WUI) areas, where development is adjacent to densely vegetated areas.

Texas has seen a huge increase in the number of wildfires in the past 30 years. From January 2005 to mid-September 2006, the Texas Forest Service (TFS) responded to 4,370 wildfires that burned 1.6 million acres. More and more people are placing their homes in woodland settings in or near forests, rural areas, or remote mountain sites. Many of these homes are nestled along ridgelines, cliff-edges, and other classic fire-interface hazard zones. There, homeowners enjoy the beauty of the environment but they also face the very real danger of wildfire.

Years of fire suppression has significantly disturbed natural fire occurrences—nature's renewal process. The result has been the gradual accumulation of understory and canopy fuels to levels of density that can feed high-energy, intense wildfires and further increase hazards from and exposure to interface problems.

Fire Protection in San Saba County

Fire protection in San Saba County is divided between volunteer fire departments, TFS, Bureau of Land Management, the U.S. Forest Service (USFS), and other fire protection services. More information about these divisions is provided in Table 16-1. The TFS administers the *Community Wildfire Protection Plan* (CWPP) to reduce related risks to life, property, and the environment. Its Fire Control Department provides leadership in wildland fire protection for state and private lands in Texas.

TABLE 16-1.
FIRE PROTECTION SERVICES IN SAN SABA COUNTY

Fire Protection Service	Unincorporated Area	City of San Saba
Local Volunteer Fire Department	Yes	Yes
National Park Service	Yes	No
Bureau of Land Management	Yes	No
Texas Commission on Environmental Quality	Yes	Yes
Texas Forest Service	Yes	Yes
AgriLife	Yes	Yes
Texas Parks and Wildlife Department	Yes	Yes
Texas Interagency Coordination Center	Yes	Yes
U.S. Fish and Wildlife Service	Yes	No
U.S. Forest Service	Yes	No

Vegetation Classes in San Saba County

General vegetation for San Saba County is described in Table 16-2 and Figure 16-1. The most common vegetation classes in the county is grassland (comprising approximately 74% of the acreage in the county).

TABLE 16-2.
VEGETATION CLASSES IN SAN SABA COUNTY

Class	Acres	% of Area
Barren Land (Rock/Sand/Clay)	30	0.00
Deciduous Forest	29,592	4.06
Developed Land	23,767	3.26
Evergreen Forest	135,740	18.63
Grassland	536,303	73.62
Marshland	319	0.04
Mixed Forest	120	0.02
Water	2,620	0.36
Total	**728,491**	**100**

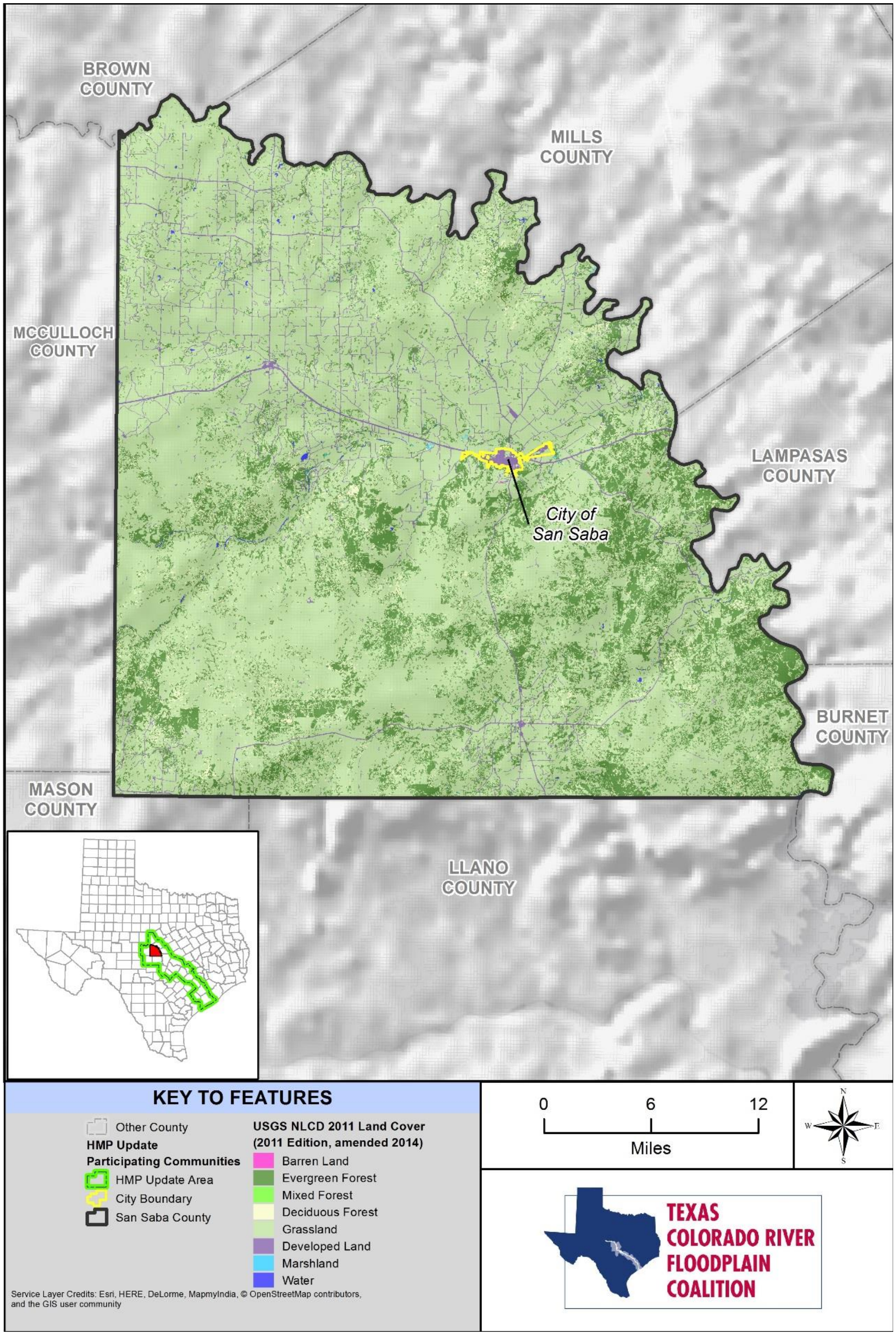


Figure 16-1. Vegetation Types in San Saba County

16.2 HAZARD PROFILE

16.2.1 Past Events

Recent fires larger than fifty acres are listed in Table 16-3. No detailed descriptions of the wildfire events in San Saba County were available. Figure 16-2 shows the locations of federally reported wildfires in San Saba County, documented by federal and state agencies from 1980 through 2013.

TABLE 16-3.
HISTORIC WILDFIRE EVENTS IN SAN SABA COUNTY (50+ ACRES) (1980-2014)

Fire ID	Name	Cause	Start Date	Acres
201752825	N/A	Missing/Not Specified	8/15/1993	12,892
201752818	N/A	Missing/Not Specified	10/19/1999	6,213
15001462	N/A	Lightning	9/6/2000	5,205
871	Grass Fire	Debris burning	1/26/2005	100
4021	CR 105-2	Miscellaneous	6/30/2005	50
12020	Gossett	Debris burning	10/25/2005	100
14275	Bob McLean	Equipment use	12/5/2005	100
40499	CR 258	Miscellaneous	3/9/2006	100
34226	Cap Rock	Miscellaneous	3/9/2006	100
49280	Wade Cottrell	Debris burning	4/25/2006	65
131507	Wade Cottrell	Equipment use	4/26/2006	50
52282	Weatherby	Debris burning	5/16/2006	300
1277	Los Valles	Equipment use	7/18/2006	250
1371	Kirk Ranch	Miscellaneous	7/26/2006	1,935
131711	Connord Appleton	Equipment use	10/13/2007	100
131714	Andrews and Keeter	Miscellaneous	10/20/2007	150
131721	Mike Harllow	Debris burning	12/20/2007	50
113116	Harlow 1	Debris burning	12/20/2007	60
131723	Christmas Present	Debris burning	12/25/2007	150
113138	Shannon 1	Debris burning	12/25/2007	500
113321	Kenney	Miscellaneous	12/26/2007	150
113323	Ponotoc	Miscellaneous	12/27/2007	75
113450	Baxter Lively	Debris burning	12/28/2007	60
116793	Los Valles	Equipment use	1/11/2008	116
131356	Spiral Horn Ranch	Debris burning	1/16/2008	60
126769	Alvin	Equipment use	2/12/2008	100
131359	Mike Simmons	Debris burning	3/16/2008	150

TABLE 16-3.
HISTORIC WILDFIRE EVENTS IN SAN SABA COUNTY (50+ ACRES) (1980-2014)

Fire ID	Name	Cause	Start Date	Acres
130968	Simmons	Debris burning	3/16/2008	151
73346	Haverlah Fire	Debris burning	3/26/2008	800
134300	Heathererley Ranch	Debris burning	3/30/2008	1,800
138664	JG Ranch	Debris burning	4/26/2008	100
138671	Brindley	Debris burning	5/7/2008	50
138676	Brister	Debris burning	5/9/2008	200
140826	Wallace Creek	Debris burning	5/27/2008	300
143741	CR270	Equipment use	6/6/2008	100
141345	Riemer	Equipment use	6/6/2008	150
143750	Hill 2	Debris burning	6/19/2008	250
151785	Pool Ranch	Lightning	7/31/2008	50
151784	Nord Ranch	Lightning	7/31/2008	100
148859	Pool	Lightning	7/31/2008	150
151786	Nored Ranch 2	Lightning	8/2/2008	100
149028	Nord	Lightning	8/2/2008	100
149029	Barnes Keith	Lightning	8/2/2008	150
151783	Gibbons Ranch	Equipment use	8/15/2008	100
155180	Chappel	Miscellaneous	9/18/2008	300
159415	Bill Kirkpatrick	Equipment use	9/18/2008	500
159366	Leonard Ranch 1	Debris burning	9/25/2008	300
156564	Mask	Equipment use	9/27/2008	100
159365	Leonard Ranch	Debris burning	10/2/2008	250
159363	Holt	Smoking	10/3/2008	60
168985	Pool	Miscellaneous	10/3/2008	150
169082	Flying V	Lightning	10/4/2008	125
704644	N/A	Debris Burning	10/4/2008	250
169088	Flying V`	Debris burning	10/5/2008	200
74879	Cook Fire	Debris burning	3/17/2009	250
190588	Henry J Warne	Debris burning	3/20/2009	300
201388362	N/A	Debris Burning	3/20/2009	300
75073	Cook II	Debris burning	4/9/2009	425
218646	Gibbins	Debris burning	8/21/2009	1,200
231825	Tommy Lee	Lightning	8/23/2009	100
218254	Edmondson	Miscellaneous	8/27/2009	75

TABLE 16-3.
HISTORIC WILDFIRE EVENTS IN SAN SABA COUNTY (50+ ACRES) (1980-2014)

Fire ID	Name	Cause	Start Date	Acres
201397139	N/A	Debris Burning	2/17/2010	200
201397460	N/A	Debris Burning	3/3/2010	75
201398359	N/A	Debris Burning	4/3/2010	80
201401171	N/A	Lightning	8/18/2010	1,200
201401708	N/A	Debris Burning	8/31/2010	150
201401881	N/A	Lightning	9/5/2010	350
201406646	N/A	Debris Burning	1/30/2011	50
201407605	N/A	Debris Burning	2/14/2011	200
201409234	N/A	Debris Burning	3/11/2011	50
201409232	N/A	Debris Burning	3/11/2011	100
201410805	N/A	Equipment Use	4/8/2011	65
201338713	N/A	Equipment Use	7/23/2011	285
201341394	N/A	Equipment Use	9/4/2011	50
201700322	N/A	Equipment Use	7/4/2012	98
201700377	N/A	Equipment Use	7/28/2012	617
201705502	N/A	Debris Burning	8/5/2012	100
201705986	N/A	Equipment Use	8/16/2012	50

Source: TxWRAP (https://www.texaswildfirerisk.com/), USGS (http://wildfire.cr.usgs.gov/firehistory/data.html), USDA (http://www.fs.usda.gov/rds/archive/Product/RDS-2013-0009.2/)

N/A Not Applicable

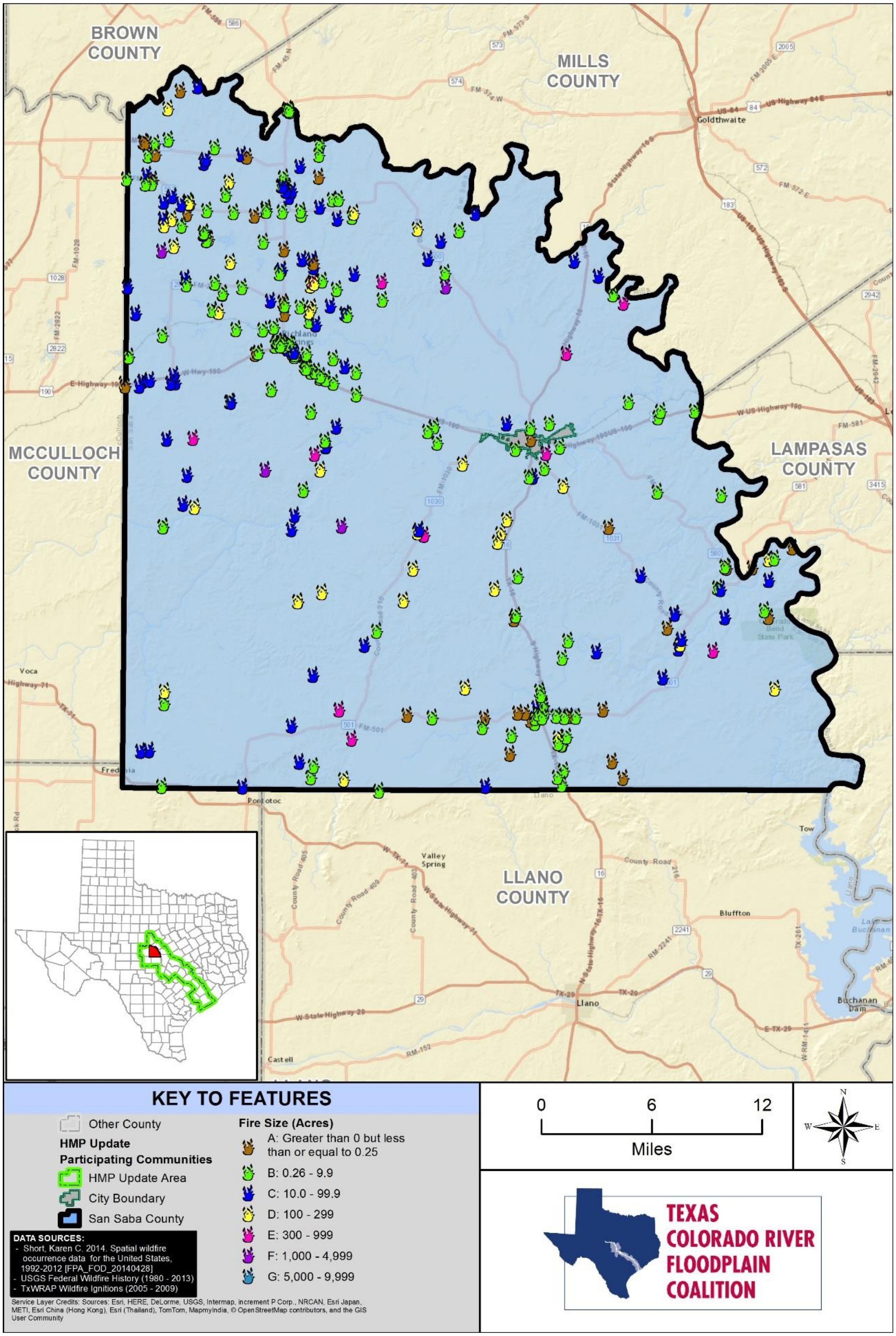


Figure 16-2. Wildfires in San Saba County (1980-2014)

16.2.2 Location

According to the TFS CWPP, nearly 85% of wildfires in Texas occur within two miles of a community. These wildfires pose a threat to life and property. There are approximately 14,000 communities in Texas that have been identified as “at risk” for potentially devastating fires. Figure 16-3 shows the distribution of wildfire ignitions in the county.

Texas is one of the fastest growing states in the nation. Much of this growth is occurring in the WUI area, where structures and other human improvements meet and mix with undeveloped wildland or vegetative fuels. Population growth within the WUI substantially increases the risk from wildfires. For San Saba County, the Texas A&M Forest Service Wildfire Risk Assessment Portal (TxWRAP) estimated that 5,699 people or 97% of the total county population (5,865) live within the WUI. The WUI layer reflects housing density depicting where humans and their structures meet or intermix with wildland fuels. Figure 16-4 shows the San Saba County housing density within the WUI.

The TxWRAP report for San Saba County maps the WUI Response Index, which is a rating of the potential impact of a wildfire on people and their homes. The key input, WUI, reflects housing density (houses per acre) consistent with Federal Register National standards (Figure 16-4). The TxWRAP report states that the location of people living in the WUI and rural areas is essential for defining potential wildfire impacts to people and homes. Figure 16-5 shows the WUI Response Index for San Saba County.

According to the TxWRAP report for San Saba County, Wildfire Values Response Index (VRI) layer reflects a rating of the potential impact of a wildfire on values or assets. The VRI is an overall rating that combines the impact ratings for WUI (housing density) and Pine Plantations (pine age) into a single measure. VRI combines the likelihood of a fire occurring (threat) with those areas of most concern that are adversely impacted by fire to derive a single overall measure of wildfire risk. Figure 16-6 shows the VRI for San Saba County.

The TxWRAP report for San Saba County maps the Community Protection Zones (CPZ), which represent those areas considered highest priority for mitigation planning activities. CPZs are based on an analysis of the “Where People Live” housing density data and surrounding fire behavior potential. “Rate of Spread” data is used to determine the areas of concern around populated areas that are within a 2-hour fire spread distance. Figure 16-7 shows the demarcation of CPZs in San Saba County.

Finally, wildfire threat or Wildfire Hazard Potential (WHP) is the likelihood of a wildfire occurring or burning into an area. Threat is calculated by combining multiple landscape characteristics including surface and canopy fuels, fire behavior, historical fire occurrences, weather observations, terrain conditions, and other factors. Figure 16-8 and Figure 16-9 maps the WHP for San Saba County and the City of San Saba as identified in the 2014 USDA Forest Service, Fire Modeling Institute WHP using data from 1992 to 2012. On its own, WHP is not an explicit map of wildfire threat or risk, but when paired with spatial data depicting highly valued resources and assets such as structures or power lines, it can approximate relative wildfire risk to those specific resources and assets. WHP is also not a forecast or wildfire outlook for any particular season, as it does not include any information on current or forecasted weather or fuel moisture conditions. It is instead intended for long-term strategic fuels management and appropriate for regional, county, or local protection mitigation or prevention planning.

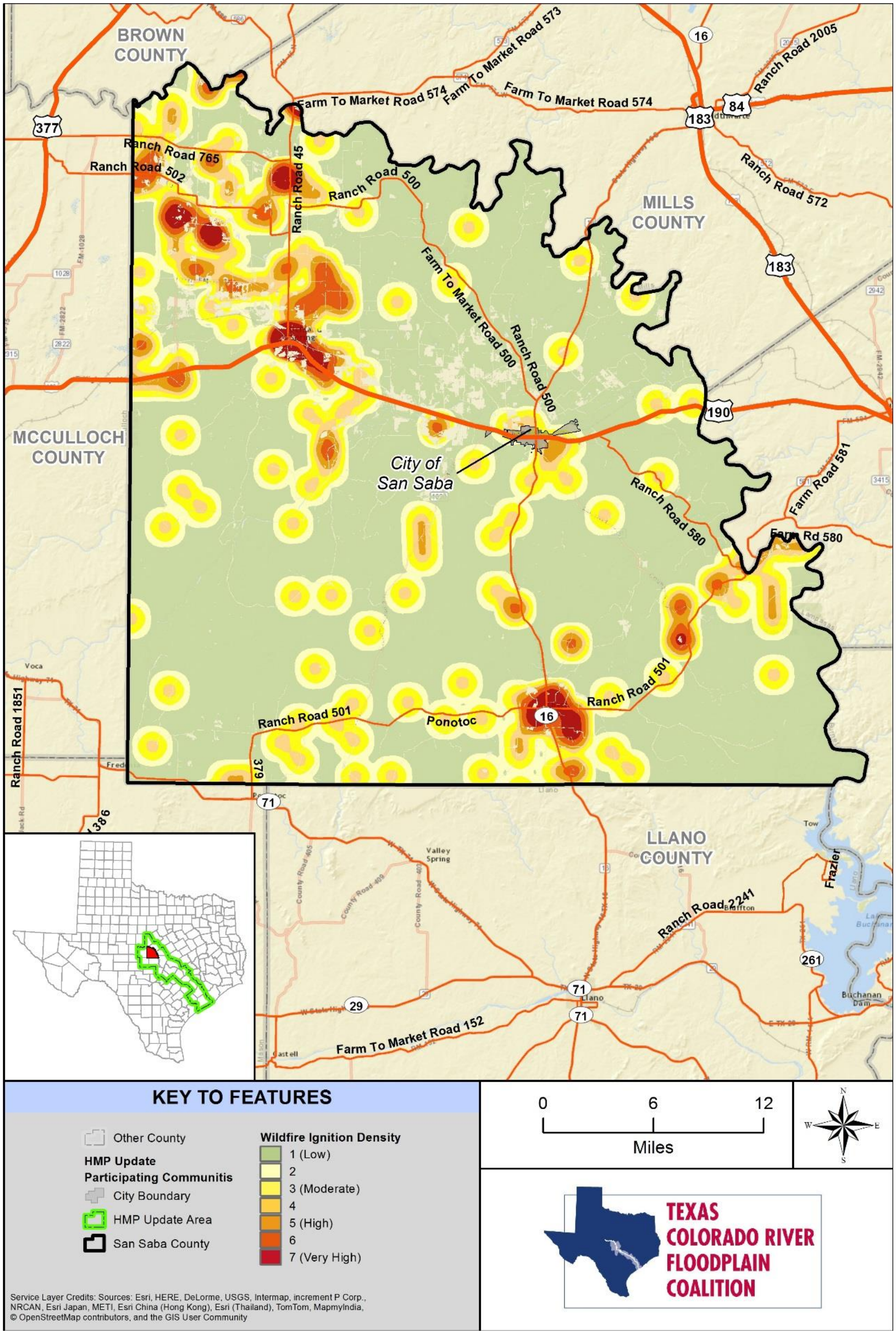


Figure 16-3. San Saba County Wildfire Ignitions Distribution

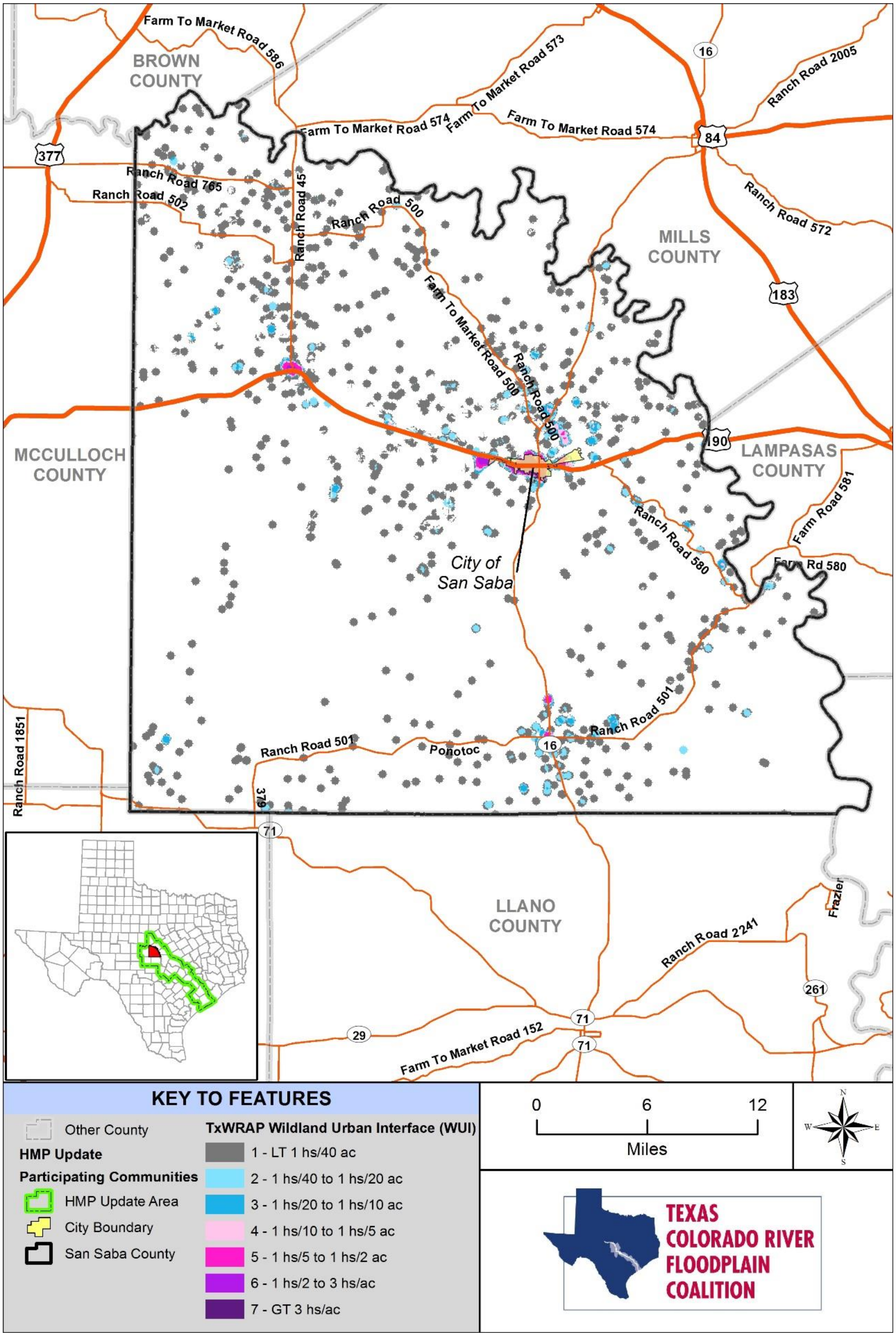


Figure 16-4. San Saba County Wildland Urban Interface

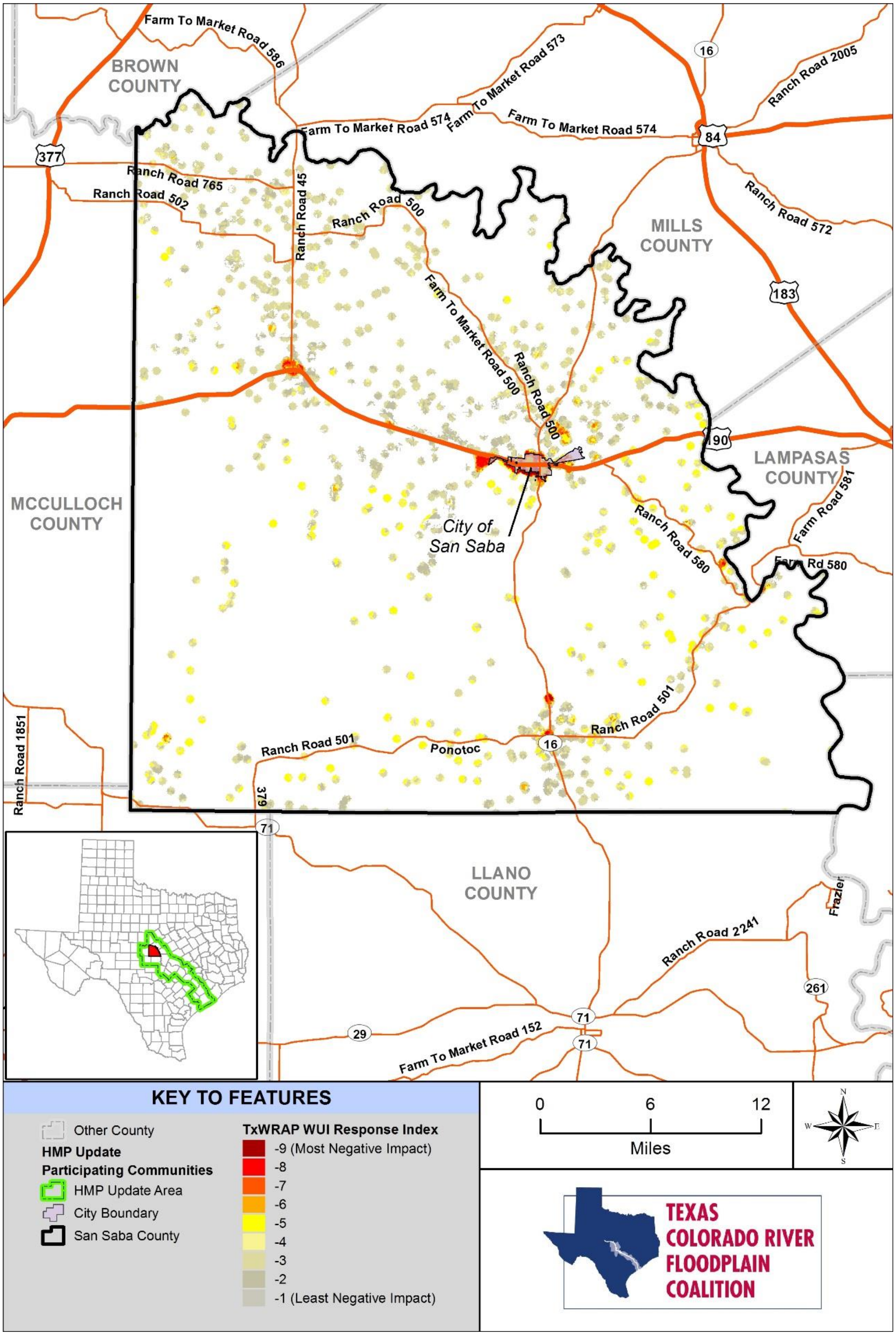


Figure 16-5. San Saba County Wildland Urban Interface Response Index

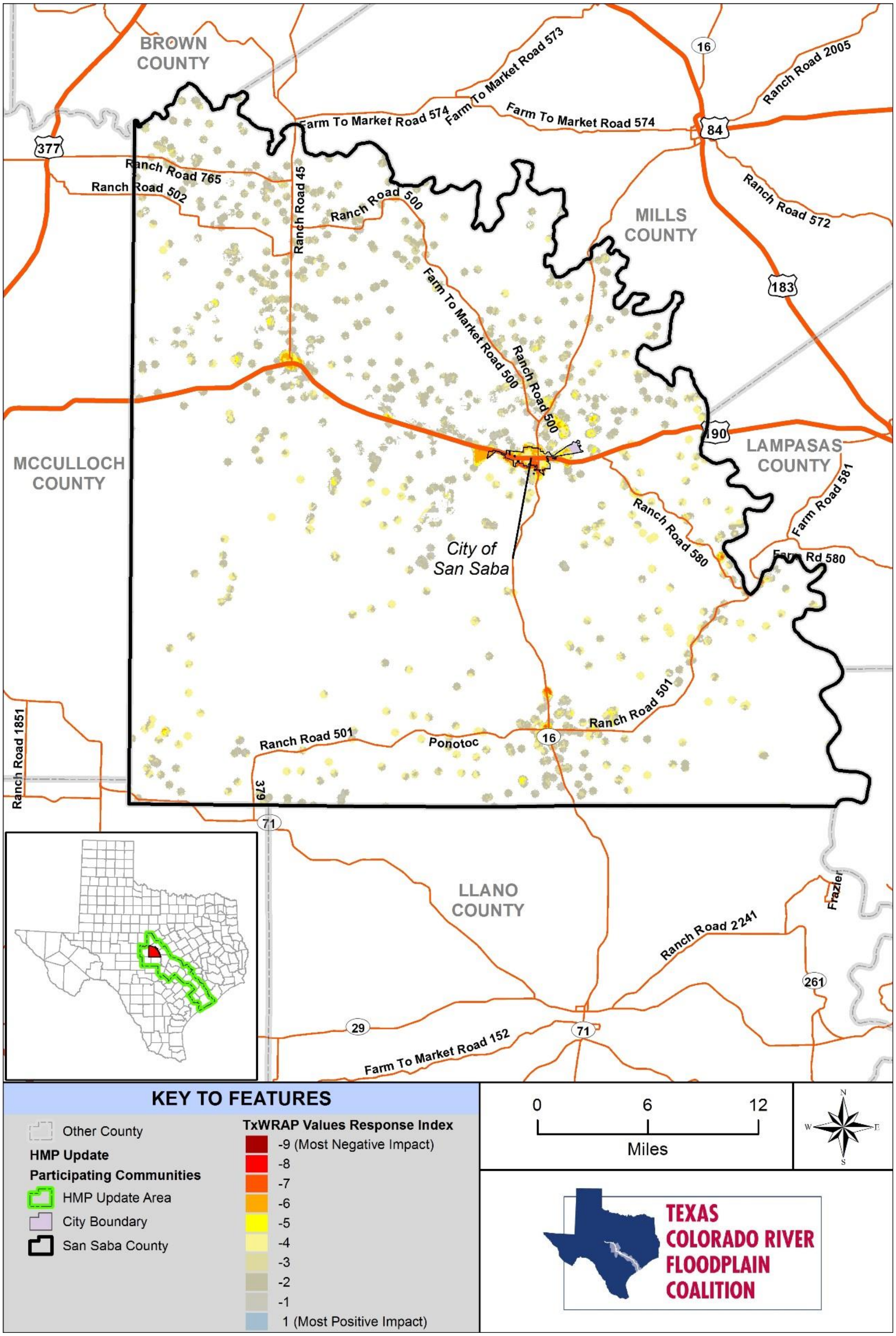


Figure 16-6. San Saba County Wildfire Values Response Index

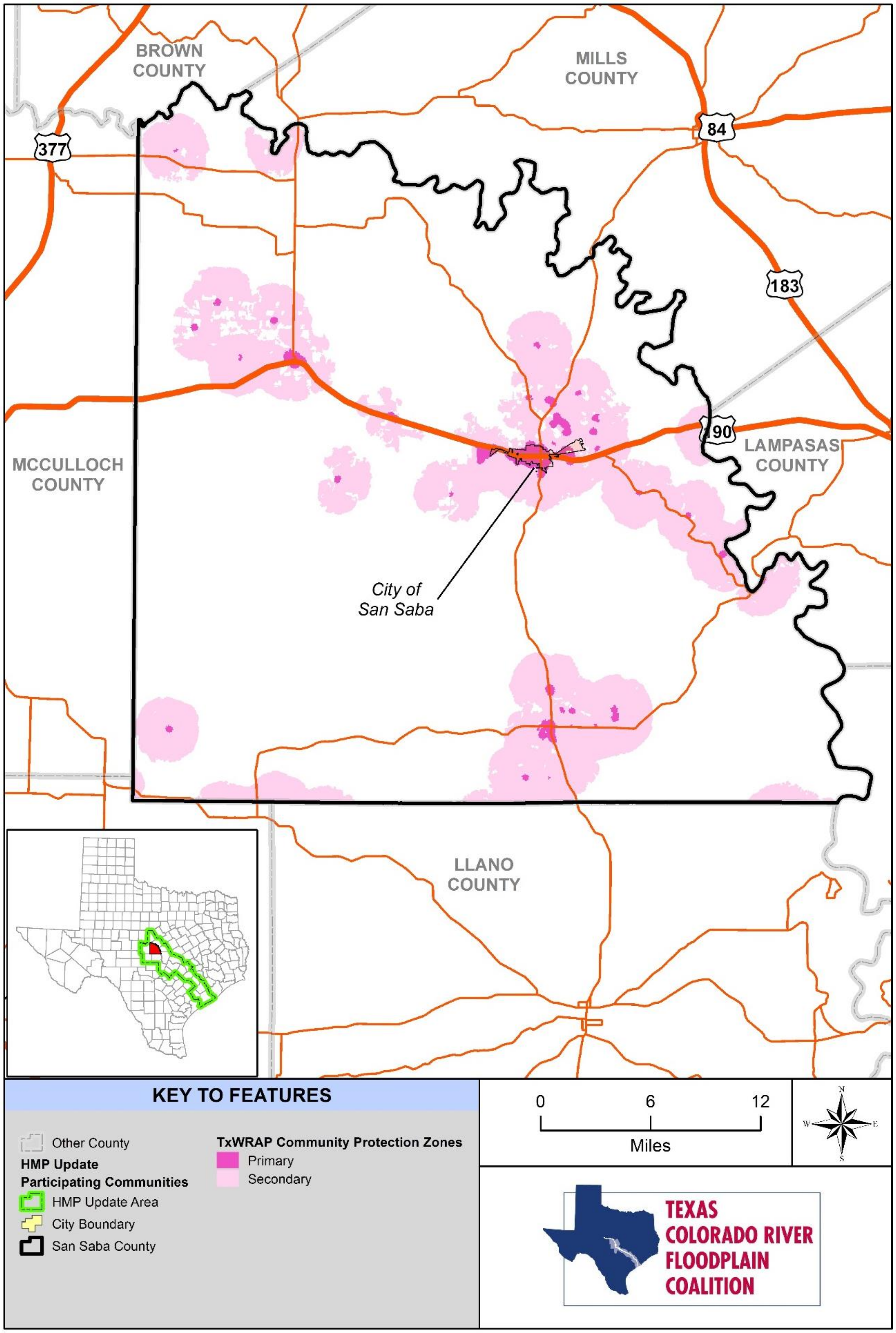


Figure 16-7. San Saba County Wildfire Community Protection Zones

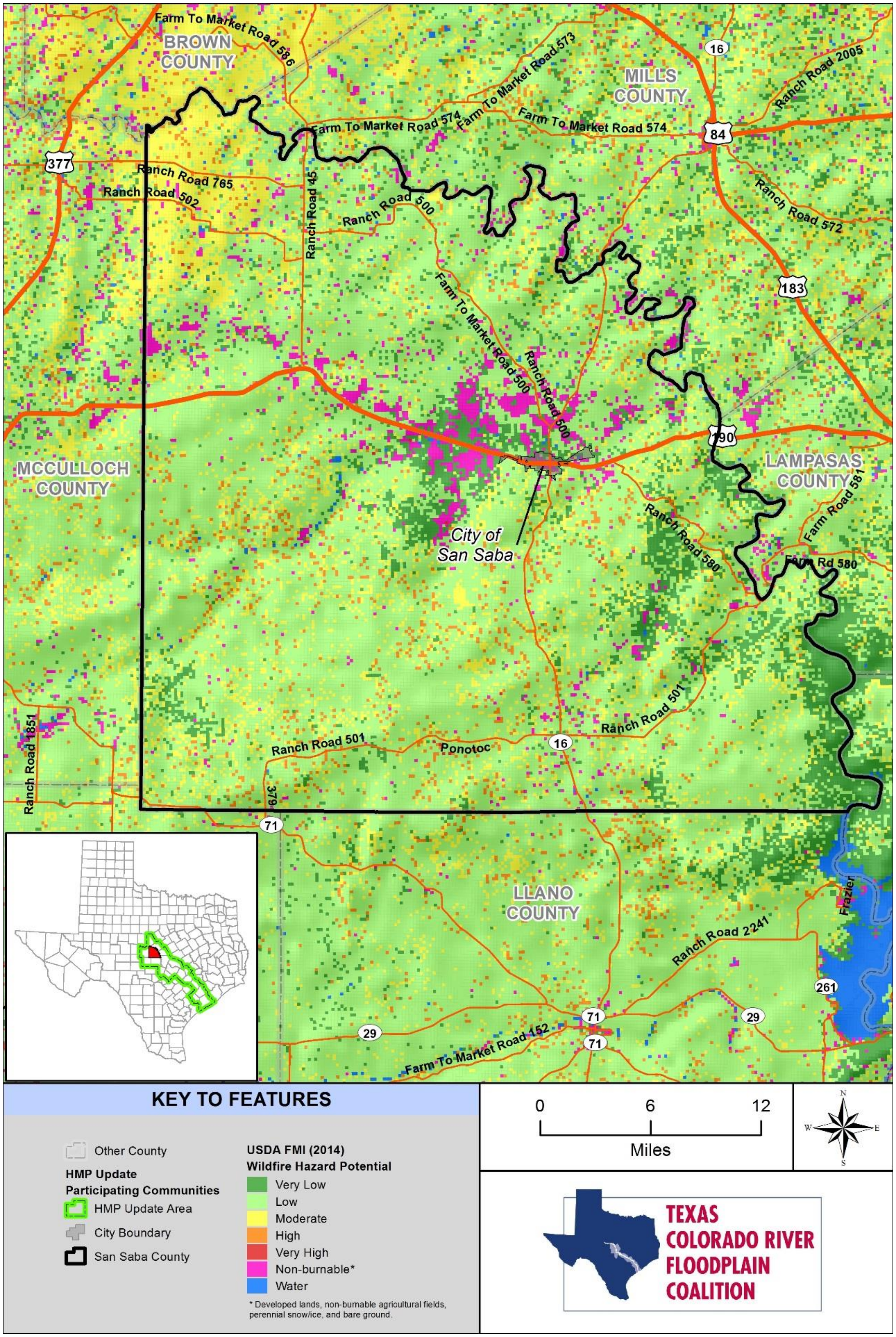


Figure 16-8. San Saba County Wildfire Hazard Potential

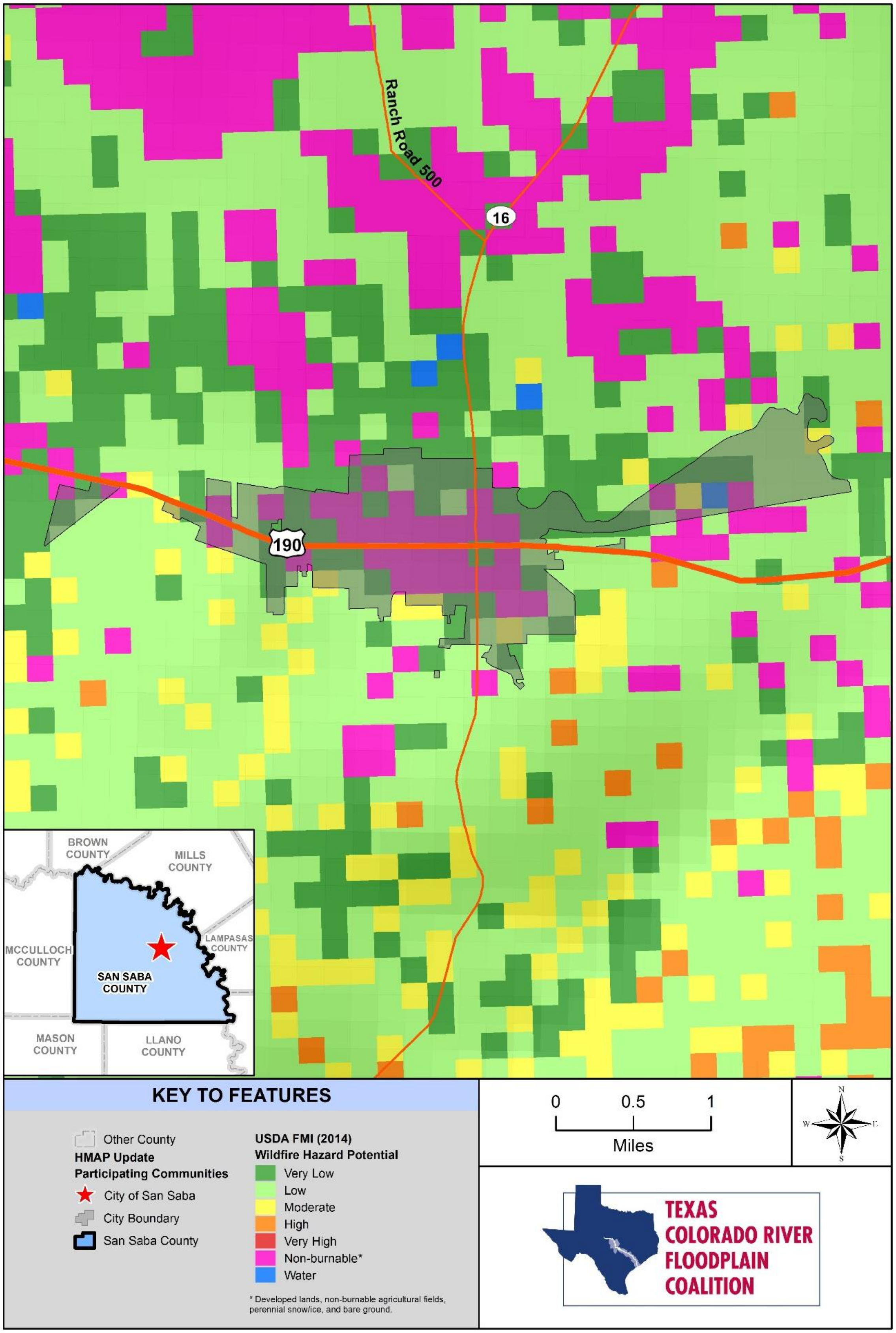


Figure 16-9. City of San Saba Wildfire Hazard Potential

16.2.3 Frequency

According to the TFS, there is a 100% chance that at least one wildfire will occur each year in San Saba County. Wildfires occur throughout the year and these fires are expected to be greater than 50 acres in size.

16.2.4 Severity

Based on the information in this hazard profile, and the widespread impacts, the magnitude/severity of severe wildfires is considered moderate. Moderate impact indicates there are few deaths or injuries; limited property damage; interruption of essential facilities and services; or economic impact. The overall significance of the hazard is considered medium.

16.2.5 Warning Time

Wildfires are often caused by humans, intentionally or accidentally. There is no way to predict when one might break out. Because fireworks often cause brush fires, extra diligence is warranted around the Fourth of July when the use of fireworks is highest. Dry seasons and droughts are factors that greatly increase fire likelihood. Dry lightning may trigger wildfires. Severe weather can be predicted, so special attention can be paid during weather events that may include lightning. Reliable NWS lightning warnings are available on average 24 to 48 hours before a significant electrical storm.

If a fire does break out and spreads rapidly, residents may need to evacuate within days or hours. A fire’s peak burning period generally is between 1:00 p.m. and 6:00 p.m. Once a fire has started, fire alerting is reasonably rapid in most cases. The rapid spread of cellular and two-way radio communications in recent years has further contributed to a significant improvement in warning time.

16.3 SECONDARY HAZARDS

Wildfires can generate a range of secondary effects, which in some cases may cause more widespread and prolonged damage than the fire itself. Fires can cause direct economic losses in the reduction of harvestable timber and indirect economic losses in reduced tourism. Wildfires cause the contamination of reservoirs, destroy transmission lines, and contribute to flooding. They strip slopes of vegetation, exposing them to greater amounts of runoff. This in turn can weaken soils and cause failures on slopes. Major landslides can occur several years after a wildfire. Most wildfires burn hot and for long durations that can bake soils, especially those high in clay content, increasing the imperviousness of the ground. This increases the runoff generated by storm events, thus increasing the chance of flooding.

16.4 CLIMATE CHANGE IMPACTS

Fire in western ecosystems is affected by climate variability, local topography, and human intervention. Climate change has the potential to affect multiple elements of the wildfire system: fire behavior, ignitions, fire management, and vegetation fuels. Hot, dry spells create the highest fire risk. Increased temperatures may intensify wildfire danger by warming and drying out vegetation. When climate alters fuel loads and fuel moisture, forest susceptibility to wildfires changes. Climate change also may increase winds that spread fires. Faster fires are harder to contain, and thus are more likely to expand into residential neighborhoods.

Historically, drought patterns in the West and Midwest are related to large-scale climate patterns in the Pacific and Atlantic Oceans. The El Niño–Southern Oscillation in the Pacific varies on a 5- to 7-year cycle, the Pacific Decadal Oscillation varies on a 20- to 30-year cycle, and the Atlantic Multidecadal Oscillation varies on a 65- to 80-year cycle. As these large-scale ocean climate patterns vary in relation to each other, drought conditions in the U.S. shift from region to region.

Climate scenarios project summer temperature increases between 2 and 5 degrees Celsius (35.6 to 41°F) and precipitation decreases of up to 15% by 2100. Such conditions would exacerbate summer drought and further promote wildfires, releasing stores of carbon and further contributing to the buildup of greenhouse gases. Forest response to increased atmospheric carbon dioxide – the so-called “fertilization effect” – could also contribute to more tree growth and thus more fuel for fires, but the effects of carbon dioxide on mature forests are still largely unknown. High carbon dioxide levels should enhance tree recovery after fire and young forest regrowth, as long as sufficient nutrients and soil moisture are available, although the latter is in question for many parts of the western United States because of climate change.

16.5 EXPOSURE

Since wildfire cannot be directly modeled in HAZUS, annualized losses were estimated using GIS-based analysis, historical data analysis, and statistical risk assessment methodology. Event frequency, severity indicators, expert opinions, and historical knowledge of the region were used for this assessment. The primary data source was the updated HAZUS inventory data (updated with 2010 U.S. Census data and 2014 RS Means Square Foot Costs) augmented with state and federal data sets as well as TxWRAP, USGS Federal Wildfire History, Fire Program Analysis Fire-Occurrence Database (FPA-FOD), CWPP, and the USDA WHP data. Information for the exposure analyses provided in the sections below was based on these sources.

16.5.1 Population

Population estimates within the WHP areas are shown in Table 16-4.

TABLE 16-4.
POPULATION WITHIN WILDFIRE RISK AREAS

	Non-Burnable*	Very Low	Low	Moderate	High	Very High	**Total**
City of San Saba	1,446	1,278	353	96	0	0	**3,173**
Unincorporated Area	303	340	1,567	331	62	1	**2,604**
Planning Area Total	**1,749**	**1,618**	**1,920**	**427**	**62**	**1**	**5,777**

* Non-Burnable classification includes developed lands, non-burnable agricultural fields, perennial snow or ice, bare ground, and permanent water areas.

16.5.2 Property

Property damage from wildfires can be severe and can significantly alter entire communities. Table 16-5 through Table 16-9 display the number of structures in the various wildfire hazard zones within the planning area and their values. For all tables, property data are from the HAZUS 2014 data inventory (updated with 2010 U.S. Census data and 2014 RS Means Square Foot Costs).

TABLE 16-5.
EXPOSURE AND VALUE OF STRUCTURES IN VERY LOW WILDFIRE RISK AREAS

	Exposed Buildings	Value Exposed ($)			% of Total Assessed Value
		Structure	Contents	**Total**	
City of San Saba	430	87,638,591	51,555,625	**139,194,216**	32.50
Unincorporated Area	203	36,551,920	19,119,485	**55,671,405**	11.07
Planning Area Total	**633**	**124,190,511**	**70,675,110**	**194,865,621**	**20.93**

TABLE 16-6.
EXPOSURE AND VALUE OF STRUCTURES IN LOW WILDFIRE RISK AREAS

	Exposed Buildings	Value Exposed ($)			% of Total Assessed Value
		Structure	Contents	**Total**	
City of San Saba	147	27,869,278	16,047,364	**43,916,642**	10.26
Unincorporated Area	1,079	203,837,870	113,296,339	**317,134,209**	63.05
Planning Area Total	**1,226**	**231,707,148**	**129,343,703**	**361,050,851**	**38.77**

TABLE 16-7.
EXPOSURE AND VALUE OF STRUCTURES IN MODERATE WILDFIRE RISK AREAS

	Exposed Buildings	Value Exposed ($)			% of Total Assessed Value
		Structure	Contents	**Total**	
City of San Saba	43	7,764,613	4,055,414	**11,820,027**	2.76
Unincorporated Area	244	45,415,691	24,238,169	**69,653,860**	13.85
Planning Area Total	**287**	**53,180,304**	**28,293,583**	**81,473,887**	**8.75**

TABLE 16-8.
EXPOSURE AND VALUE OF STRUCTURES IN HIGH WILDFIRE RISK AREAS

	Exposed Buildings	Value Exposed ($)			% of Total Assessed Value
		Structure	Contents	**Total**	
City of San Saba	0	0	0	**0**	0.00
Unincorporated Area	48	8,890,209	4,799,796	**13,690,005**	2.72
Planning Area Total	**48**	**8,890,209**	**4,799,796**	**13,690,005**	**1.47**

TABLE 16-9.
EXPOSURE AND VALUE OF STRUCTURES IN VERY HIGH WILDFIRE RISK AREAS

	Exposed Buildings	Value Exposed ($)			% of Total Assessed Value
		Structure	Contents	**Total**	
City of San Saba	0	0	0	**0**	0.00
Unincorporated Area	1	70,424	35,460	**105,884**	0.02
Planning Area Total	**1**	**70,424**	**35,460**	**105,884**	**0.01**

Present Land Use

Present land use for each wildfire risk area is described in Table 16-10.

TABLE 16-10.
WILDFIRE RISK AREAS IN PRESENT LAND COVERAGE FOR SAN SABA COUNTY

	Wildfire Risk Class and Area (acres)				
Present Land Cover Class	Very Low	Low	Moderate	High	Very High
Barren Land (Rock/Sand/Clay)	3	12	1	0	0
Deciduous Forest	3,852	16,095	6,439	2,857	20
Developed Land	2,673	14,594	3,449	472	0
Evergreen Forest	23,250	74,207	26,983	9,766	63
Grassland	40,937	378,205	73,515	14,388	168
Marshland	156	102	19	7	0
Mixed Forest	7	78	24	11	0
Open Water	364	827	360	146	0

16.5.3 Critical Facilities and Infrastructure

Table 16-11 identifies critical facilities exposed to the wildfire hazard in the county.

TABLE 16-11.
CRITICAL FACILITIES AND INFRASTRUCTURE PER WILDFIRE RISK CLASS

	Critical Facilities and Infrastructure per Wildfire Risk Class				
	Very Low	Low	Moderate	High	Very High
Medical and Health	0	0	0	0	0
Government Functions	0	0	0	0	0
Protective Functions	0	0	0	0	0
Schools	0	2	0	0	0
Hazardous Materials	0	0	0	0	0
Bridges	15	52	8	0	0
Water Storage	0	0	0	0	0
Wastewater	0	0	0	0	0
Power	0	0	0	0	0
Communications	0	0	0	0	0
Transportation	8	25	8	1	0
Dams	0	0	0	0	0

16.5.4 Environment

Fire is a natural and critical ecosystem process in most terrestrial ecosystems, dictating in part the types, structure, and spatial extent of native vegetation. However, wildfires can cause severe environmental impacts:

- **Soil Erosion** – The protective covering provided by foliage and dead organic matter is removed, leaving the soil fully exposed to wind and water erosion. Accelerated soil erosion occurs, causing landslides and threatening aquatic habitats.
- **Spread of Invasive Plant Species** – Non-native woody plant species frequently invade burned areas. When weeds become established, they can dominate the plant cover over broad landscapes, and become difficult and costly to control.
- **Disease and Insect Infestations** – Unless diseased or insect-infested trees are swiftly removed, infestations and disease can spread to healthy forests and private lands. Timely active management actions are needed to remove diseased or infested trees.
- **Destroyed Endangered Species Habitat** – Catastrophic fires can have devastating consequences for endangered species.
- **Soil Sterilization** – Topsoil exposed to extreme heat can become water repellant, and soil nutrients may be lost. It can take decades or even centuries for ecosystems to recover from a fire. Some fires burn so hot that they can sterilize the soil.

Many ecosystems are adapted to historical patterns of fire occurrence. These patterns, called "fire regimes," include temporal attributes (e.g., frequency and seasonality), spatial attributes (e.g., size and spatial complexity), and magnitude attributes (e.g., intensity and severity), each of which have ranges of natural variability. Ecosystem stability is threatened when any of the attributes for a given fire regime diverge from its range of natural variability.

16.6 VULNERABILITY

Structures, aboveground infrastructure, critical facilities, agricultural area (crops and structures), and natural environments are all vulnerable to the wildfire hazard. There is currently no validated damage function available to support wildfire mitigation planning. Except as discussed in this section, vulnerable populations, property, infrastructure, and environment are assumed to be the same as described in the section on exposure.

16.6.1 Population

Smoke and air pollution from wildfires can be a severe health hazard, especially for sensitive populations, including children, the elderly, and those with respiratory and cardiovascular diseases. Smoke generated by wildfire consists of visible and invisible emissions that contain particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide, carbon dioxide, nitrogen oxides), and toxics (formaldehyde, benzene). Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather. Public health impacts associated with wildfire include difficulty in breathing, odor, and reduction in visibility.

Wildfire may also threaten the health and safety of those fighting the fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke.

The increasing demand for outdoor recreation places more people outside and in higher wildfire risk areas during holidays, weekends, and vacation periods.

16.6.2 Property

Loss estimations for wildfire hazard are not based on damage functions, because no such damage functions have been generated. Instead, loss estimates were developed representing projected damages (annualized loss) on historical events, statistical analysis and probability factors. These were applied to the exposed values of the participating communities to create an annualized loss. Table 16-12 lists the loss estimates for the general building stock for jurisdictions that have an exposure to a wildfire risk category.

TABLE 16-12.
LOSS ESTIMATES FOR WILDFIRE EVENTS

Jurisdiction	Exposed Value	Annualized Loss	Annualized Loss Percentage
City of San Saba	$9,719,676	Negligible	Negligible
Unincorporated Area	$62,380,498	Negligible	Negligible
Planning Area Total	**$72,100,174**	**Negligible**	**Negligible**

16.6.3 Critical Facilities and Infrastructure

Critical facilities of wood frame construction are especially vulnerable during wildfire events. In the event of wildfire, there would likely be little damage to most infrastructure. Most roads and railroads would be without damage except in the worst scenarios. Power lines are the most at risk from wildfire because most poles are made of wood and susceptible to burning. Fires can create conditions that block or prevent access and can isolate residents and emergency service providers. Wildfire typically does not have a major direct impact on bridges, but it can create conditions in which bridges are obstructed. Many bridges in areas of high to moderate fire risk are important because they provide the only ingress and egress to large areas and in some cases to isolated neighborhoods.

16.6.4 Environment

Environmental vulnerability will typically be the same as exposure (as discussed in Section 16.5).

16.7 FUTURE TRENDS IN DEVELOPMENT

The threat of wildfire is a constant in Texas. From the East Texas Piney Woods to the Davis Mountains of West Texas, wildfires burn thousands, if not millions, of acres each year. Wildfires become especially dangerous when wildland vegetation begins to intermix with homes.

With more and more people living in the WUI, it is increasingly important for local officials to plan and prepare for wildfires. CWPPs are a proven strategy for reducing the risk of catastrophic wildfires and protecting lives and property.

TFS encourages Texas counties and communities to develop and adopt CWPPs to better prepare their region and citizens for wildfires. Planning for wildfires should take place long before a community is threatened. Once a wildfire ignites, the only option available to firefighters is to attempt to suppress the fire before it reaches a community. A CWPP is unique in that it empowers communities to share the responsibility of determining the best strategies for protection against wildfire.

The Texas CWPP calls for communities to:

- Know their environment (WUI), assets at risk, fire occurrence and behavior, and overall wildfire risks
- Adopt mitigation strategies from wildfire preventions to fuels reduction to capacity building
- Create and adopt recovery plan strategies

16.8 SCENARIO

A major conflagration in the planning area might begin with a wet spring, adding to fuels already present on the forest floor. Flash fuels would build throughout the spring. The summer could see the onset of insect infestation. A dry summer could follow the wet spring, exacerbated by dry hot winds. Carelessness with combustible materials or a tossed lit cigarette, or a sudden lightning storm could trigger a multitude of small isolated fires.

The embers from these smaller fires could be carried miles by hot, dry winds. The deposition zone for these embers would be deep in the forests and interface zones. Fires that start in flat areas move slower, but wind still pushes them. It is not unusual for a wildfire pushed by wind to burn the ground fuel and later climb into the crown and reverse its track. This is one of many ways that fires can escape containment, typically during periods when response capabilities are overwhelmed. These new small fires would most likely merge. Suppression resources would be redirected from protecting the natural resources to saving more remote subdivisions.

The worst-case scenario would include an active fire season throughout Texas, spreading resources thin. Firefighting teams would be exhausted or unavailable. Many federal assets would be responding to other fires that started earlier in the season. While local fire districts would be extremely useful in the urban interface areas, they have limited wildfire capabilities or experience, and they would have a difficult time responding to the ignition zones. Even though the existence and spread of the fire is known, it may not be possible to respond to it adequately, so an initially manageable fire can become out of control before resources are dispatched.

To further complicate the problem, heavy rains could follow, causing flooding and landslides, and releasing tons of sediment into the San Saba River, Colorado River, and other streams and creeks. This in turn could permanently change floodplains and damage sensitive habitat and riparian areas. Such a fire followed by rain could release millions of cubic yards of sediment into streams for years, creating new floodplains and changing existing ones. With the forests removed from the watershed, stream flows could easily double. Floods that could be expected every 50 years may occur every couple of years. With the streambeds unable to carry the increased discharge because of increased sediment, the floodplains and floodplain elevations would increase.

16.9 ISSUES

The major issues for wildfire are the following:

- Public education and outreach to people living in or near the fire hazard zones should include information about and assistance with mitigation activities such as defensible space, and advance identification of evacuation routes and safe zones.
- Wildfires could cause landslides as a secondary natural hazard.
- Climate change could affect the wildfire hazard.
- Future growth into interface areas should continue to be managed.
- Area fire districts need to continue to train on WUI events.
- Vegetation management activities should be enhanced.
- Regional consistency of higher building code standards should be adopted such as residential sprinkler requirements and prohibitive combustible roof standards.
- Fire department water supply in high risk wildfire areas.
- Expand certifications and qualifications for fire department personnel. Ensure that all firefighters are trained in basic wildfire behavior, basic fire weather, and that all company officers and chief level officers are trained in the wildland command and strike team leader level.
- Both the natural and man-made conditions that contribute to the wildland fire hazard are tending to exacerbate through time.
- Conservative forestry management practices have resulted in congested forests prone to fire and disease.
- The continued migration of inhabitants to remote areas of the county increases the probability of human-caused ignitions from vehicles, grills, campfires, and electrical devices.

CHAPTER 17.
WINTER WEATHER

WINTER WEATHER RANKING	
San Saba County	Medium
City of San Saba	High

DEFINITIONS

Freezing Rain — The result of rain occurring when the temperature is below the freezing point. The rain freezes on impact, resulting in a layer of glaze ice up to an inch thick. In a severe ice storm, an evergreen tree 60 feet high and 30 feet wide can be burdened with up to 6 tons of ice, creating a threat to power and telephone lines and transportation routes.

Severe Local Storm — Small-scale atmospheric systems, including tornadoes, thunderstorms, windstorms, ice storms, and snowstorms. These storms may cause a great deal of destruction and even death, but their impact is generally confined to a small area. Typical impacts are on transportation infrastructure and utilities.

Winter Storm — A storm having significant snowfall, ice, or freezing rain; the quantity of precipitation varies by elevation.

17.1 GENERAL BACKGROUND

Winter storms can include heavy snow, ice, and blizzard conditions. Heavy snow can immobilize a region, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse roofs and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. The cost of snow removal, damage repair, and business losses can have a tremendous impact on cities and towns.

Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days until damage can be repaired. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians.

Some winter storms are accompanied by strong winds, creating blizzard conditions with blinding wind-driven snow, severe drifting, and dangerous wind chills. Strong winds with these intense storms and cold fronts can knock down trees, utility poles, and power lines. Blowing snow can reduce visibilities to only a few feet in areas where there are no trees or buildings. Serious vehicle accidents can result in injuries and deaths.

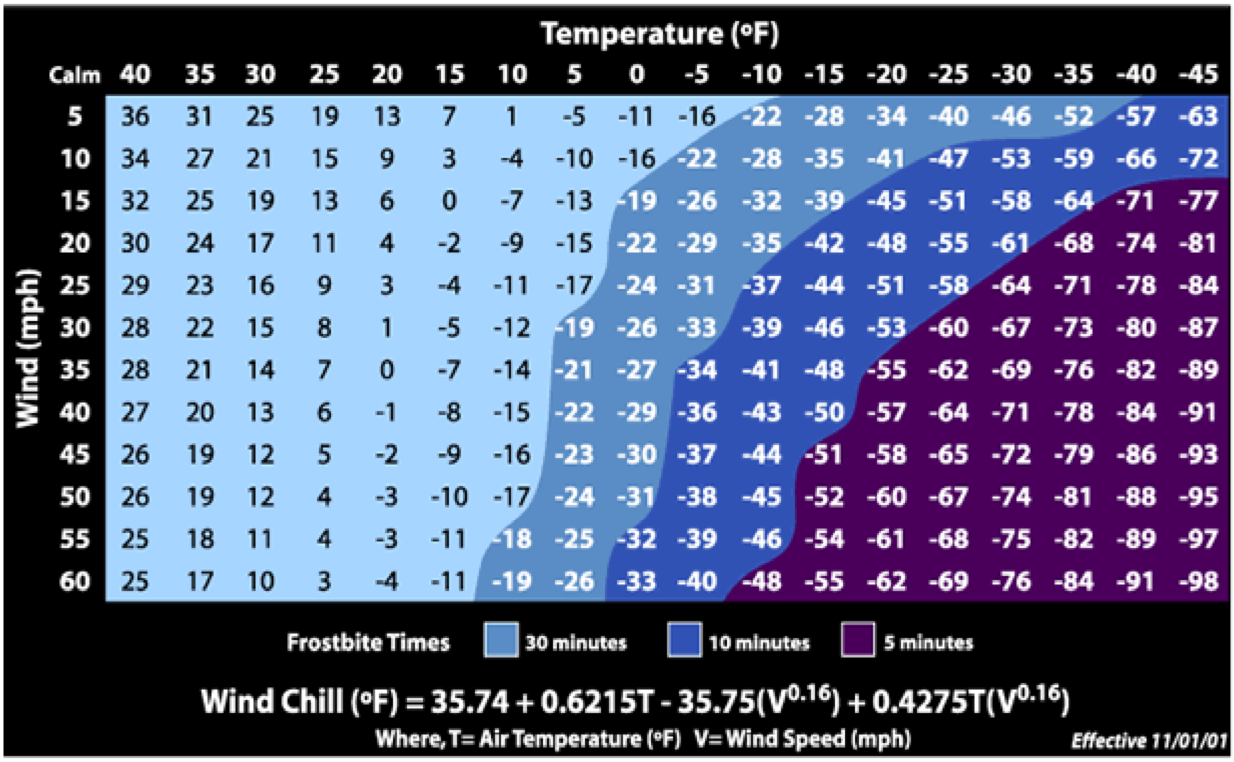
Winter storms in San Saba County, including strong winds and ice conditions, can result in property damage, localized power and phone outages and closures of streets, highways, schools, businesses, and nonessential government operations. People can also become isolated from essential services in their homes and vehicles. A winter storm can escalate, creating life threatening situations when emergency response is limited by severe winter conditions. Other issues associated with severe winter weather include hypothermia and the threat of physical overexertion that may lead to heart attacks or strokes. Snow and ice prevention as well as removal costs can impact budgets significantly.

17.1.1 Extreme Cold

Extreme cold often accompanies a winter storm or is left in its wake. It is most likely to occur in the winter months of December, January, and February. Prolonged exposure to the cold can cause frostbite or hypothermia and can become life-threatening. Infants and the elderly are most susceptible. Pipes may freeze and burst in homes or buildings that are poorly insulated or without heat. Extreme cold can disrupt or impair communications facilities.

In 2001, the NWS implemented an updated wind chill temperature index (see Figure 17-1). This index describes the relative discomfort or danger resulting from the combination of wind and temperature. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature.

Source: NOAA, NWS



Temperature (°F)

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

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

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

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

Effective 11/01/01

Figure 17-1. National Weather Service Wind Chill Chart

A wind chill watch is issued by the NWS when wind chill warning criteria are possible in the next 12 to 36 hours. A wind chill warning is issued for wind chills of at least -25°F on plains and -35°F in mountains and foothills. Table 17-1 contains a summary of temperature data related to extreme cold for the City of San Saba weather station.

TABLE 17-1.
TEMPERATURE DATA FROM THE SAN SABA STATION

Statistic	Years	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
High Annual Minimum	1964-1999	27	29	34	50	56	66	70	68	63	43	38	30
Low Annual Minimum	1964-1999	0	4	11	25	38	47	54	51	39	23	13	-1
Average Annual Minimum	1964-1999	16.8	20.5	26.6	34.9	46.3	57.7	63.6	62.4	48.4	36.0	25.3	18.9
Average Days Annually with Minimum Below 32	1923-2012	15.2	10.1	4.1	0.6	0.0	0.0	0.0	0.0	0.0	0.5	4.9	12.9

Note: All temperatures are in degrees Fahrenheit.

Few areas of Texas escape freezing weather in any winter. San Saba County receives little to no snow accumulations. More often than not, snow falling in the southern half of the state melts and does not stick to the surface; snow stays on the ground only once or twice every decade. Snowfall occurs at least once every winter in the northern half of Texas.

17.2 HAZARD PROFILE

17.2.1 Past Events

The NOAA National Climatic Data Center lists 17 winter weather events that impacted San Saba County between 1996 and 2014. These events and estimated damage costs are outlined in Table 17-2. San Saba County does not experience severe winter weather events consistently, but winter storms can affect San Saba County.

TABLE 17-2.
HISTORIC WINTER WEATHER EVENTS IN SAN SABA COUNTY (1996-2014)

Location	Date	Event Type	Estimated Damage Cost			
			Property	Crops	Injuries	Deaths
San Saba (Zone)	02/01/1996	Ice Storm	$0	$0	0	0
San Saba (Zone)	01/12/1997	Winter Storm	$0	$0	0	0
San Saba (Zone)	12/23/1998	Ice Storm	$0	$0	0	0
San Saba (Zone)	02/24/2003	Winter Storm	$29,630	$0	0	0
San Saba (Zone)	01/13/2007	Ice Storm	$15,693	$0	0	0
San Saba (Zone)	01/16/2007	Winter Weather	$2,496	$0	0	0
San Saba (Zone)	04/06/2007	Cold/Wind Chill	$5,795	$9,644	0	0
San Saba (Zone)	04/07/2007	Winter Storm	$5,795	$9,644	0	0
San Saba (Zone)	01/27/2009	Ice Storm	$0	$0	0	0
San Saba (Zone)	03/29/2009	Frost/Freeze	$0	$0	0	0
San Saba (Zone)	04/07/2009	Frost/Freeze	$0	$0	0	0
San Saba (Zone)	01/09/2010	Extreme Cold/ Wind Chill	$0	$0	0	0
San Saba (Zone)	02/23/2010	Heavy Snow	$0	$0	0	0
San Saba (Zone)	01/03/2013	Winter Weather	$0	$0	0	0
San Saba (Zone)	12/05/2013	Winter Storm	$0	$0	0	0
San Saba (Zone)	01/23/2014	Winter Weather	$0	$0	0	0
San Saba (Zone)	04/15/2014	Frost/Freeze	$0	$0	0	0

Source: http://www.ncdc.noaa.gov/

17.2.2 Location

The record lows for Texas occur during October through March. According to data recorded by NWS between 1893 and 2014, the planning area experiences an average of 56 freezing days. The average first freeze in San Saba County usually occurs late November to early December and the last freeze occurs in late February to early March. In January 1940, the San Saba County area experienced the coldest month on record with mean temperature of 38.1°F. The coldest recorded winter for the area was in 1978, with a mean temperature of about 43.1°F. Figure 6-4 shows the annual average minimum temperature distribution in Texas.

The entire county is susceptible to severe winter storms; although severe winter weather or blizzard conditions are primarily in the form of freezing rain, sleet, or ice. Ice accumulation becomes a hazard by creating dangerous travel conditions. U.S. Highway 190 and State Highways 16, 501, and 580 are important corridors to move people, supplies, and equipment into the region and to reach medical facilities outside of the counties. An accident on these roads can cause a major disruption in the flow of goods and services to the area.

17.2.3 Frequency

Table 17-2 lists 17 winter weather events from 1996 to 2014. Therefore, on average a winter storm occurs in the county once every 1 to 2 years. In this region, the first autumn freeze ordinarily occurs in mid-December, and the last freeze in spring takes place in mid-February. There is an average of 20 to 25 days of freezes in Central Texas.

17.2.4 Severity

The magnitude and severity of severe winter weather in San Saba County is low, resulting in minor injuries and illnesses; minimal property damage that does not severely threaten structural stability; or interruption of essential facilities and services for less than 48 hours.

17.2.5 Warning Time

Meteorologists can often predict the likelihood of a severe winter storm. When forecasts are available, they can give several days of warning time. However, meteorologists cannot predict the exact time of onset or severity of the storm. Some storms may come on more quickly and have only a few hours of warning time.

17.3 SECONDARY HAZARDS

The most significant secondary hazards associated with severe local storms are falling and downed trees, landslides, and downed power lines. Heavy rain and icy conditions can overwhelm both natural and man-made drainage systems, causing overflow and property destruction. Landslides occur when the soil on slopes becomes oversaturated and fails. Additionally, the storms may result in closed highways and blocked roads. It is not unusual for motorists and residents to become stranded. Annually, icy conditions and frozen pipes cause damage to residences and businesses. Late season winter events will typically cause some plant and crop damage.

17.4 CLIMATE CHANGE IMPACTS

Climate change presents a significant challenge for risk management associated with severe weather. The frequency of severe weather events has increased steadily over the last century. Nationally, the number of weather-related disasters during the 1990s was four times that of the 1950s, and cost 14 times as much in economic losses. Historical data shows that the probability for severe weather events increases in a warmer climate (see Figure 14-12). The changing hydrograph caused by climate change could have a significant impact on the intensity, duration and frequency of storm events. All of these impacts could have significant economic consequences.

17.5 EXPOSURE

Because winter weather cannot be directly modeled in HAZUS, annualized losses were estimated using GIS-based analysis, historical data analysis, and statistical risk assessment methodology. Event frequency, severity indicators, expert opinions, and historical knowledge of the region were used for this assessment.

The primary data source was the updated HAZUS inventory data (updated with 2010 U.S. Census data and 2014 RS Means Square Foot Costs) augmented with state and federal data sets as well as the NOAA National Climatic Data Center's Storm Event Database.

17.5.1 Population

It can be assumed that the entire planning area is exposed to severe winter weather events to some extent. Certain areas are more exposed due to geographic location and local weather patterns.

17.5.2 Property

According to the San Saba County HAZUS 2.2 inventory data (updated with 2010 U.S. Census data and 2014 RS Means Square Foot Costs), there are 3,162 buildings within the San Saba County with an asset replaceable value of more than $635 million (excluding contents). About 99% of these buildings (and 84% of the building value) are associated with residential housing. Within the participating communities, there are 2,951 buildings (residential, commercial, and other) with a total asset inventory value of over $587 million (excluding contents). Other types of buildings in this report include agricultural, education, religious, and governmental structures.

Residents within a city or municipality are governed by building codes and ordinances. Buildings and land in unincorporated areas of the county are not governed by building codes. Because of the less stringent regulations, all of these buildings are considered to be exposed to severe winter weather, but structures in poor condition or in particularly vulnerable locations (located on hilltops or exposed open areas) may risk the most damage. The frequency and degree of damage to a building will depend on specific locations.

17.5.3 Critical Facilities and Infrastructure

All critical facilities are likely exposed to winter weather events. The most common problems associated with this hazard are utility losses. Downed power lines can cause blackouts, leaving large areas isolated. Phone, water, and sewer systems may not function. Roads may become impassable due to ice or snow. Ice accumulation on roadways can create dangerous driving conditions. There are several county roads that are available to move people and supplies throughout the region.

17.5.4 Environment

The environment is highly exposed to severe weather events. Natural habitats such as streams and trees risk major damage and destruction. Flooding events caused by snowmelt can produce river channel migration or damage riparian habitat.

17.6 VULNERABILITY

17.6.1 Population

Vulnerable populations are the elderly, low income, linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Power outages can be life threatening to those dependent on electricity for life support. Isolation of these populations is a significant concern. These populations face isolation and exposure during severe winter weather events and could suffer more secondary effects of the hazard. Commuters who are caught in storms may be particularly vulnerable. Stranded commuters may be vulnerable to carbon monoxide poisoning or hypothermia. Additionally, individuals engaged in outdoor recreation during a severe winter event may be difficult to locate and rescue.

17.6.2 Property

All property is vulnerable during severe winter weather events, but properties in poor condition or in particularly vulnerable locations may risk the most damage. Those that are located under or near overhead lines or near large trees may be vulnerable to falling ice or may be damaged in the event of a collapse.

Loss estimations for severe winter weather are not based on damage functions, because no such damage functions have been generated. Instead, loss estimates were developed representing projected damages (annualized loss) on historical events, statistical analysis, and probability factors. These were applied to the exposed value of the county and communities to create an annualized loss. The annualized loss estimated for winter storm events is shown in Table 17-3.

TABLE 17-3.
LOSS ESTIMATES FOR WINTER STORM EVENTS

	Exposed Value	Annualized Loss	Annualized Loss Percentage
City of San Saba	$428,225,383	Negligible	Negligible
Unincorporated Area	$502,972,374	$17,497	<0.01%
Planning Area Total	**$931,197,757**	**$17,497**	**<0.01%**

17.6.3 Critical Facilities and Infrastructure

Incapacity and loss of roads are the primary transportation failures resulting from winter weather, mostly associated with secondary hazards. Snowstorms can significantly impact the transportation system and the availability of public safety services. Of particular concern are roads providing access to isolated areas and to the elderly. Prolonged obstruction of major routes can disrupt the shipment of goods and other commerce. Large, prolonged storms can have negative economic impacts for an entire region.

Severe windstorms, downed trees, and ice can create serious impacts on power and above-ground communication lines. Freezing of power and communication lines can cause them to break, disrupting electricity and communication. Loss of electricity and phone connection would leave certain populations isolated because residents would be unable to call for assistance.

17.6.4 Environment

The vulnerability of the environment to winter weather is the same as the exposure, discussed in Section 17.5.4.

17.7 FUTURE TRENDS IN DEVELOPMENT

All future development will be affected by winter storms. The vulnerability of community assets to severe winter storms is increasing through time as more people enter the planning area. The ability to withstand impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction. The City of San Saba adopted the International Building Code. This code is equipped to deal with the impacts of severe weather events. Land use policies identified in general plans within the planning area also address many of the secondary impacts (flood and landslide) of the severe weather hazard. With these tools, the planning partnership is well equipped to deal with future growth and the associated impacts of severe weather.

17.8 SCENARIO

Although severe local storms are infrequent, impacts can be significant, particularly when secondary hazards, such as flood or erosion occur. A worst-case event would involve prolonged high winds during a winter storm accompanied by thunderstorms. Such an event would have both short-term and longer-term effects. Initially, schools and roads would be closed due to power outages caused by high winds and downed tree obstructions. In more rural areas, some subdivisions could experience limited ingress and egress. Prolonged rain could produce flooding, overtopped culverts with ponded water on roads, and erosion on steep slopes. Flooding and landslides could further obstruct roads and bridges, further isolating residents.

17.9 ISSUES

Important issues associated with a winter storm in the planning area include the following:

- Older building stock in the planning area is built to low code standards or none at all. These structures could be highly vulnerable to winter weather, particularly freezing temperatures, high winds, and ice.
- Redundancy of power supply must be evaluated.
- The capacity for backup power generation is limited.
- Future efforts should be made to identify populations at risk and determine special needs during winter storm event.

CHAPTER 18.
PLANNING AREA RISK RANKING

A risk ranking was performed for the hazards of concern described in this plan. This risk ranking assesses the probability of each hazard's occurrence as well as its likely impact on the people, property, and economy of the planning area. The risk ranking was conducted by the Steering Committee based on the hazard risk assessment presented during the second Steering Committee meeting, community survey results, and personal and professional experience with hazards in the planning area. Estimates of risk were generated with data from HAZUS-MH using methodologies promoted by FEMA. The results are used in establishing mitigation priorities. The hazard rankings were used in establishing mitigation action priorities.

18.1 PROBABILITY OF OCCURRENCE

The probability of occurrence of a hazard is indicated by a probability factor based on likelihood of annual occurrence:

- High – Hazard event is likely to occur within 25 years (Probability Factor = 3)
- Medium – Hazard event is likely to occur within 100 years (Probability Factor = 2)
- Low – Hazard event is not likely to occur within 100 years (Probability Factor = 1)
- No exposure – There is no probability of occurrence (Probability Factor = 0)

The assessment of hazard frequency is generally based on past hazard events in the planning area. The Steering Committee assigned the probabilities of occurrence for each hazard, as shown on Table 18-1.

TABLE 18-1.
HAZARD PROBABILITY OF OCCURRENCE

	San Saba County		City of San Saba	
Hazard	High/Med/ Low/No	Probability Factor	High/Med/ Low/No	Probability Factor
Coastal Erosion	No	0	No	0
Dam/Levee Failure	Medium	2	No	0
Drought	High	3	High	3
Earthquake	Low	1	Low	1
Expansive Soils	Medium	2	Low	1
Extreme Heat	High	3	High	3
Flood	Medium	2	Low	1
Hail	Medium	2	Medium	2
Hurricane/Tropical Storm	Low	1	Low	1
Land Subsidence	Low	1	Low	1
Lightning	Medium	2	Medium	2
Thunderstorm	High	3	High	3
Tornado	Medium	2	Medium	2
Wildfire	High	3	Low	1

**TABLE 18-1.
HAZARD PROBABILITY OF OCCURRENCE**

	San Saba County		City of San Saba	
Hazard	High/Med/ Low/No	Probability Factor	High/Med/ Low/No	Probability Factor
Wind	High	3	High	3
Winter Weather	High	3	High	3

18.2 IMPACT

Hazard impacts were assessed in three categories, impacts on: people, property, and the local economy. Numerical impact factors were assigned as follows:

- **People** – Values were assigned based on the percentage of the total ***population exposed*** to the hazard event. The degree of impact on individuals will vary and is not measurable, so the calculation assumes for simplicity and consistency that all people who live in a hazard zone will be equally impacted when a hazard event occurs. It should be noted that planners can use an element of subjectivity when assigning values for impacts on people. Impact factors were assigned as follows:
  - High – 50% or more of the population is exposed to a hazard (Impact Factor = 3)
  - Medium – 25% to 49% of the population is exposed to a hazard (Impact Factor = 2)
  - Low – 24% or less of the population is exposed to the hazard (Impact Factor = 1)
  - No impact – None of the population is exposed to a hazard (Impact Factor = 0)
- **Property** – Values were assigned based on the percentage of the total ***assessed property value*** exposed to the hazard event:
  - High – 30% or more of the total assessed property value is exposed to a hazard (Impact Factor = 3)
  - Medium – 15% to 29% of the total assessed property value is exposed to a hazard (Impact Factor = 2)
  - Low – 14% or less of the total assessed property value is exposed to the hazard (Impact Factor = 1)
  - No impact – None of the total assessed property value is exposed to a hazard (Impact Factor = 0)
- **Economy** – Values were assigned based on total impact to the economy from the hazard event and activities conducted after the event to restore the community to previous functions. Values were assigned based on the number of days the hazard impacts the community, including impacts on tourism, businesses, road closures, or government response agencies.
  - High – Community impacted for more than 7 days (Impact Factor = 3)
  - Medium – Community impacted for 1 to 7 days (Impact Factor = 2)
  - Low – Community impacted for less than 1 day (Impact Factor = 1)
  - No impact – No community impacts estimated from the hazard event (Impact Factor = 0)

The impacts of each hazard category were assigned a weighting factor to reflect the significance of the impact. These weighting factors are consistent with those typically used for measuring the benefits of hazard mitigation actions: impact on people was given a weighting factor of 3; impact on property was given a weighting factor of 2; and impact on the economy was given a weighting factor of 1. The impacts for each hazard are summarized in Table 18-2 through Table 18-4. The total impact factor shown on the tables equals the impact factor multiplied by the weighting factor.

**TABLE 18-2.
IMPACT ON PEOPLE FROM HAZARDS**

	San Saba County		City of San Saba	
Hazard	High/Med/ Low/No	Total Impact Factor	High/Med/ Low/No	Total Impact Factor
Coastal Erosion	No	0	No	0
Dam/Levee Failure	Medium	6	No	0
Drought	High	9	Low	3
Earthquake	Low	3	Low	3
Expansive Soils	Medium	6	Low	3
Extreme Heat	High	9	High	9
Flood	Medium	6	Low	3
Hail	Medium	6	Medium	6
Hurricane/Tropical Storm	Low	3	Low	3
Land Subsidence	Low	3	Low	3
Lightning	Medium	6	Medium	6
Thunderstorm	High	9	High	9
Tornado	Low	3	Low	3
Wildfire	Low	3	Low	3
Wind	Low	3	High	9
Winter Weather	Medium	6	High	9

**TABLE 18-3.
IMPACT ON PROPERTY FROM HAZARDS**

	San Saba County		City of San Saba	
Hazard	High/Med/ Low/No	Total Impact Factor	High/Med/ Low/No	Total Impact Factor
Coastal Erosion	No	0	No	0
Dam/Levee Failure	Medium	4	No	0
Drought	High	6	Low	2
Earthquake	Low	2	Low	2

TABLE 18-3.
IMPACT ON PROPERTY FROM HAZARDS

	San Saba County		City of San Saba	
Hazard	High/Med/ Low/No	Total Impact Factor	High/Med/ Low/No	Total Impact Factor
Expansive Soils	Medium	4	Low	2
Extreme Heat	High	6	Medium	4
Flood	Medium	4	Low	2
Hail	Medium	4	Medium	4
Hurricane/Tropical Storm	Low	2	Low	2
Land Subsidence	Low	2	Low	2
Lightning	Medium	4	Medium	4
Thunderstorm	High	6	Medium	4
Tornado	Medium	4	Medium	4
Wildfire	High	6	Low	2
Wind	Medium	4	High	6
Winter Weather	Medium	4	High	6

TABLE 18-4.
IMPACT ON ECONOMY FROM HAZARDS

	San Saba County		City of San Saba	
Hazard	High/Med/ Low/No	Total Impact Factor	High/Med/ Low/No	Total Impact Factor
Coastal Erosion	No	0	No	0
Dam/Levee Failure	Medium	2	No	0
Drought	High	3	Low	1
Earthquake	Low	1	Low	1
Expansive Soils	Medium	2	Low	1
Extreme Heat	High	3	High	3
Flood	Medium	2	Low	1
Hail	Medium	2	Medium	2
Hurricane/Tropical Storm	Low	1	Low	1
Land Subsidence	Low	1	Low	1
Lightning	Medium	2	Medium	2

TABLE 18-4.
IMPACT ON ECONOMY FROM HAZARDS

	San Saba County		City of San Saba	
Hazard	High/Med/ Low/No	Total Impact Factor	High/Med/ Low/No	Total Impact Factor
Thunderstorm	High	3	Medium	2
Tornado	Low	1	Medium	2
Wildfire	Medium	2	Low	1
Wind	High	3	Low	1
Winter Weather	Medium	2	Medium	2

18.3 RISK RATING AND RANKING

The risk rating for each hazard was calculated by multiplying the probability factor by the sum of the weighted impact factors for people, property, and operations, as summarized in Table 18-5. Based on these ratings, a priority of high, medium, or low was assigned to each hazard. The hazards ranked as being of highest concern vary by jurisdiction but generally include extreme heat and thunderstorms. Table 18-6 summarizes the hazard risk ranking.

TABLE 18-5.
HAZARD RISK RANKING CALCULATIONS

	San Saba County			City of San Saba		
Hazard	Probability Factor	Impact Weighted Sum	Total	Probability Factor	Impact Weighted Sum	Total
Coastal Erosion	0	0	0	0	0	0
Dam/Levee Failure	2	12	24	0	0	0
Drought	3	18	54	3	6	18
Earthquake	1	6	6	1	6	6
Expansive Soils	2	12	24	1	6	6
Extreme Heat	3	18	54	3	16	48
Flood	2	12	24	1	6	6
Hail	2	12	24	2	12	24
Hurricane/ Tropical Storm	1	6	6	1	6	6
Land Subsidence	1	6	6	1	6	6
Lightning	2	12	24	2	12	24
Thunderstorm	3	18	54	3	15	45

TABLE 18-5.
HAZARD RISK RANKING CALCULATIONS

	San Saba County			City of San Saba		
Hazard	Probability Factor	Impact Weighted Sum	Total	Probability Factor	Impact Weighted Sum	Total
Tornado	2	8	16	2	9	18
Wildfire	3	11	33	1	6	6
Wind	3	10	30	3	16	48
Winter Weather	3	12	36	3	17	51

Notes:
Impact Weighted Sum=Total Impact Factor People+ Total Impact Factor Property + Total Impact Factor Economy
Total = Probability x Impact Weighted Sum

TABLE 18-6.
HAZARD RISK SUMMARY

Hazard	San Saba County	City of San Saba
Coastal Erosion	No Exposure	No Exposure
Dam/Levee Failure	Medium	No Exposure
Drought	High	Low
Earthquake	Low	Low
Expansive Soils	Medium	Low
Extreme Heat	High	High
Flood	Medium	Low
Hail	Medium	Medium
Hurricane/Tropical Storm	Low	Low
Land Subsidence	Low	Low
Lightning	Medium	Medium
Thunderstorm	High	High
Tornado	Low	Low
Wildfire	Medium	Low
Wind	Medium	High
Winter Weather	Medium	High

PART 3
MITIGATION AND PLAN MAINTENANCE STRATEGY

CHAPTER 19.
AREA-WIDE MITIGATION ACTIONS AND IMPLEMENTATION

The Steering Committee reviewed a menu of hazard mitigation alternatives that present a broad range of alternatives to be considered for use in the planning area, in compliance with Title 44 Code of Federal Regulations (44 CFR) (Section 201.6(c)(3)(ii)). The menu reviewed for this plan is presented in Appendix D. The menu provided a baseline of mitigation alternatives that are backed by a planning process, are consistent with the planning partners' goals and objectives, and are within the capabilities of the partners to implement. The Steering Committee reviewed the full range of actions as well as the county's ability to implement the variety of mitigation actions. Hazard mitigation actions recommended in this plan were selected from among the alternatives presented in the menu as well as other projects known to be necessary.

19.1 RECOMMENDED MITIGATION ACTIONS

The planning partners and the Steering Committee identified actions that could be implemented to provide hazard mitigation benefits. Table 19-1 lists the recommended mitigation actions and the hazards addressed by the action. All of the hazards profiled in this plan are addressed by more than one mitigation action. Individual worksheets for each recommended action are provided in Appendix E.

Table 19-2 provides more details on the mitigation actions, including the mitigation action description, action type, estimated cost, potential funding sources, timeline, and benefit to the community (high, medium or low). Mitigation types used for this categorization are as follows:

- Local Plans and Regulations (LPR) – These actions include government authorities, policies, or codes that influence the way land and buildings are being developed and built.
- Structure and Infrastructure Projects (SIP) – These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards.
- Natural Systems Protection (NSP) – These are actions that minimize damage and losses, and also preserve or restore the functions of natural systems.
- Education and Awareness Programs (EAP) – These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These initiatives may also include participation in national programs, such as StormReady and FireWise Communities.

The parameters for the timeline are as follows:

- Short-Term – To be completed in 1 to 5 years
- Long-Term – To be completed in greater than 5 years
- Ongoing – Currently being funded and implemented under existing programs

19.2 BENEFIT/COST REVIEW AND PRIORITIZATION

The action plan must be prioritized according to a benefit/cost analysis of the proposed projects and their associated costs (44 CFR, Section 201.6(c)(3)(iii)). The benefits of proposed projects were weighed against estimated costs as part of the project prioritization process. The benefit/cost analysis was not of the detailed variety required by FEMA for project grant eligibility under the Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) Grant Program. A less formal approach was used because some projects may not be implemented for up to 10 years, and associated costs and benefits could change dramatically in that time. Therefore, a review of the apparent benefits versus the apparent cost of each project was performed. Parameters were established for assigning subjective ratings (high, medium, and low) to the costs and benefits of these projects.

Fourteen criteria were used to assist in evaluating and prioritizing the mitigation initiatives. For each mitigation action, a numeric rank (0, 1, 2, 3, 4) was assigned for each of the 14 evaluation criteria defined as follows:

- Definitely Yes - 4
- Maybe Yes - 3
- Unknown/Neutral - 2
- Probably No - 1
- Definitely No - 0

The 14 evaluation/prioritization criteria are:

1. Life Safety – How effective will the action be at protecting lives and preventing injuries? The numeric rank for this criterion is multiplied by 2 to emphasize the importance of life safety when evaluating the benefit of the action.
2. Property Protection – How significant will the action be at eliminating or reducing damage to structures and infrastructure? The numeric rank for this criterion is multiplied by 2 to emphasize the importance of property protection when evaluating the benefit of the action.
3. Cost-Effectiveness – Will the future benefits achieved by implementing the action, exceed the cost to implement the action?
4. Technical – Is the mitigation action technically feasible? Will it solve the problem independently and is it a long-term solution? Eliminate actions that, from a technical standpoint, will not meet the goals.
5. Political – Is there overall public support for the mitigation action? Is there the political will to support it?
6. Legal – Does the jurisdiction have the authority to implement the action?
7. Fiscal – Can the project be funded under existing program budgets (i.e., is this action currently budgeted for)? Or would it require a new budget authorization or funding from another source such as grants?
8. Environmental – What are the potential environmental impacts of the action? Will it comply with environmental regulations?
9. Social – Will the proposed action adversely affect one segment of the population? Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?
10. Administrative – Does the jurisdiction have the personnel and administrative capabilities to implement the action and maintain it or will outside help be necessary?
11. Multi-hazard – Does the action reduce the risk to multiple hazards?
12. Timeline - Can the action be completed in less than 5 years (within our planning horizon)?
13. Local Champion – Is there a strong advocate for the action or project among the jurisdiction's staff, governing body, or committees that will support the action's implementation?

14. Other Local Objectives – Does the action advance other local objectives, such as capital improvements, economic development, environmental quality, or open space preservation? Does it support the policies of other plans and programs?

The numeric results of this exercise are shown on the mitigation action worksheets in Appendix E. These results were used to identify the benefit of the action to the community as low, medium, or high priority. Table 19-2 shows the benefit of each mitigation action.

The Steering Committee used the results of the benefit/cost review and prioritization exercise to rank the mitigation actions in order of priority, with 1 being the highest priority. The highest priority mitigation actions are shown in red on Table 19-2, medium priority actions are shown in yellow and low priority actions are shown in green.

TABLE 19-1.
MITIGATION ACTIONS DEVELOPED TO ADDRESS HAZARDS

Action No.	Title	Coastal Erosion	Dam/Levee Failure	Drought	Earthquake	Expansive Soil	Extreme Heat	Flood	Hail	Hurricane/ Tropical Storms	Land Subsidence	Lightning	Thunderstorm	Tornado	Wildfire	Wind	Winter Weather
SAN SABA COUNTY																	
1	All-hazards education and awareness programs	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	Dam brush clearance	N/A	X														
3	Encourage construction of safe rooms	N/A			X								X	X		X	
4	Reverse 911 System (CodeRED)	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	Encourage drought-tolerant landscape design	N/A		X													
6	MOUs between VFDs and contiguous counties	N/A													X		
7	Develop an engineering study of 'Hooten Holler' in the City of Richland Springs	N/A						X									
CITY OF SAN SABA																	
1	All-hazards education and awareness programs	N/A	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	Reverse 911 System (CodeRED)	N/A	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	Encourage drought-tolerant landscape design	N/A	N/A	X			X										
4	Encourage construction of safe rooms	N/A	N/A		X								X	X		X	
5	Reduce the number of uninhabitable and un-maintained properties in the floodplain	N/A	N/A					X									
6	National Weather Service's StormReady Program	N/A	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Notes:
MOU Memorandum of Understanding
N/A Not applicable
VFD Volunteer Fire Department

TABLE 19-2.
RECOMMENDED MITIGATION ACTIONS

Action No.	Title	Description	Mitigation Action Ranking	Action Type	Applicable Goals	Applicable Objectives	Estimated Cost	Potential Funding Sources	Timeline	Benefit
SAN SABA COUNTY										
1	All-hazards education and awareness programs	Enhancing hazard awareness, for all of the counties assessed risks, of the private sector, particularly lenders, insurance agents and realtors.	1	EAP	G1, G3, G4	1.1, 1.3, 3.1, 3.2, 3.3, 4.2	<$10,000	FEMA, USDA, General Revenue	Long Term	Medium
2	Dam brush clearance	Clear brush at each of the dam/levee spillways to allow for the proper channel flow.	4	SIP	G1, G2	1.3, 1.4, 2.2,	<$10,000	NRCS, USDA, Private Funds, General Revenue	Ongoing	Medium
3	Encourage construction of safe rooms	Encourage the construction of safe rooms in residences and public buildings in San Saba County. These would be built to FEMA standards above ground.	5	SIP EAP	G3, G4, G6	3.2, 4.1, 6.1, 6.2	<$10,000	FEMA Grants, Private Funds	Long Term	Medium
4	Reverse 911 system (CodeRED)	Develop operational procedures and protocols for the Reverse 911 system, called CodeRED, for the entire county.	2	LPR EAP	G1, G3, G4	1.2, 1.3, 3.1, 3.2, 4.3	<$10,000	Regional/ CTCOG, General Revenue	Short Term	Medium
5	Encourage drought-tolerant landscape design	Encourage drought-tolerant landscape design through incorporation of drought tolerant or xeriscape practices into landscape educational measures to reduce dependence on irrigation. Consider coordinating with NRCS group or the Texas AgriLife Extension Office.	6	EAP	G1, G2, G6	1.3, 1.4, 2.2, 6.2	<$10,000	NRCS, Texas AgriLife Extension Agency	Long Term	Medium
6	MOUs between VFDs and contiguous counties	Annually, through the Commissioners' Court, have participation between the county and the local VFDs to update MOUs.	3	LPR	G1, G2, G4	1.3, 2.3, 4.1	<$10,000	NRCS, Texas AgriLife Extension Agency	Long Term	Medium

**TABLE 19-2.
RECOMMENDED MITIGATION ACTIONS**

Action No.	Title	Description	Mitigation Action Ranking	Action Type	Applicable Goals	Applicable Objectives	Estimated Cost	Potential Funding Sources	Timeline	Benefit
7	Develop an engineering study of 'Hooten Holler' in the City of Richland Springs	Develop an engineering study of 'Hooten Holler' on the east side of the City of Richland Springs to help with safety and flooding issues affecting residents on both sides of the channel.	7	SIP	G1, G2, G4	1.3, 2.2, 4.1	$10,000 to $100,000	FEMA Grants, Municipal and County General Revenue	Long Term	Medium
CITY OF SAN SABA										
1	All-hazards education and awareness programs	Enhancing hazard awareness for all hazards the city is vulnerable to through articles in the weekly newspaper and on the weekly radio show hosted by the City Manager. Both of these options effectively reach most of residents of the city.	1	EAP	G1, G3	1.1, 1.3, 3.1, 3.2, 3.3	<$10,000	FEMA, USDA, General Revenue	Ongoing	Medium
2	Reverse 911 system (CodeRED)	Develop operational procedures and protocols for the Reverse 911 system, called CodeRED, for the entire county.	2	LPR EAP	G1, G3, G4	1.2, 1.3, 3.1, 3.2, 4.3	<$10,000	Regional/ CTCOG, General Revenue	Short Term	Medium
3	Encourage drought-tolerant landscape design	Encourage drought-tolerant landscape design through incorporation of drought tolerant or xeriscape practices into landscape educational measures reducing dependence on irrigation. Consider coordinating with NRCS group or the Texas AgriLife Extension Office.	4	EAP	G1, G6	1.3, 1.4, 6.2	<$10,000	NRCS, Texas AgriLife Extension Agency	Long Term	Medium
4	Encourage construction of safe rooms	Encourage the construction of safe rooms in residences and public buildings in San Saba. These would be built to FEMA standards above ground.	5	SIP EAP	G3, G4, G6	3.2, 4.1, 6.1, 6.2	<$10,000	FEMA Grants, Private Funds	Long Term	Medium

TABLE 19-2.
RECOMMENDED MITIGATION ACTIONS

Action No.	Title	Description	Mitigation Action Ranking	Action Type	Applicable Goals	Applicable Objectives	Estimated Cost	Potential Funding Sources	Timeline	Benefit
5	Reduce the number of uninhabitable and un-maintained properties in the floodplain	The city is condemning properties, paying for demolition and maintaining the lots as open space. This is an ongoing effort.	3	SIP	G2, G3, G4, G5, G6	2.1, 3.3, 4.1, 4.3, 5.1, 5.2, 5.3, 6.2, 6.3, 6.4	>$100,000	FMA, PDM, HMGP Grants	Long Term	Medium
6	National Weather Service's StormReady Program	Work to complete guidelines 1 to 6 to become a certified StormReady community.	6	LPR EAP	G3, G4	3.2, 3.3, 4.1, 4.3	<$10,000	City Funds	Long Term	Medium

CTCOG	Central Texas Council of Governments	MOU	Memorandum of Understanding
EAP	Education and Awareness Programs	NRCS	National Resource Conservation Service
FEMA	Federal Emergency Management Agency	PDM	Pre-Disaster Mitigation
FMA	Flood Mitigation Assistance	SIP	Structure and Infrastructure Project
HMGP	Hazard Mitigation Grant Program	USDA	U.S. Department of Agriculture
LPR	Local Plans and Regulations	VFD	Volunteer Fire Department

CHAPTER 20.
PLAN ADOPTION AND MAINTENANCE

20.1 PLAN ADOPTION

A hazard mitigation plan must document that it has been formally adopted by the governing body of the jurisdiction requesting federal approval of the plan (44 CFR Section 201.6(c)(5)). For multi-jurisdictional plans, each jurisdiction requesting approval must document that is has been formally adopted. All planning partners fully met the participation requirements specified by the Steering Committee and will seek Disaster Mitigation Act of 2000 (DMA) compliance under this plan. The plan will be submitted for review to the Texas Division of Emergency Management (TDEM) and then to the Federal Emergency Management Agency (FEMA) Region VI for review and pre-adoption approval. Once pre-adoption approval has been provided, all planning partners will formally adopt the plan. All partners understand that DMA compliance and its benefits cannot be achieved until the plan is adopted. Copies of the resolutions adopting this plan for all planning partners can be found in Appendix F.

20.2 PLAN MAINTENANCE STRATEGY

A hazard mitigation plan must present a plan maintenance process that includes the following (44 CFR Section 201.6(c)(4)):

- A section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan over a 5-year cycle
- A process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate
- A discussion on how the community will continue public participation in the plan maintenance process.

This chapter details the formal process that will ensure that the San Saba County Hazard Mitigation Plan remains an active and relevant document and that the planning partners maintain their eligibility for applicable funding sources. The plan maintenance process includes a schedule for monitoring and evaluating the plan annually and producing an updated plan every 5 years. This chapter also describes how public participation will be integrated throughout the plan maintenance and implementation process. It also explains how the mitigation strategies outlined in this plan will be incorporated into existing planning mechanisms and programs, such as comprehensive land-use planning processes, capital improvement planning, and building code enforcement and implementation. The plan’s format allows sections to be reviewed and updated when new data become available, resulting in a plan that will remain current and relevant.

20.2.1 Plan Implementation

The effectiveness of the hazard mitigation plan depends on its implementation and incorporation of its action items into partner jurisdictions’ existing plans, policies, and programs. Together, the action items in the plan provide a framework for activities that the partnership can implement over the next 5 years. The planning team and the Steering Committee have established goals and objectives and have prioritized mitigation actions that will be implemented through existing plans, policies, and programs.

The San Saba County Office of Emergency Management (OEM) will have lead responsibility for overseeing the plan implementation and maintenance strategy. Plan implementation and evaluation will be a shared responsibility among all planning partnership members and agencies identified as lead agencies in the mitigation action plans.

20.2.2 Steering Committee

The Steering Committee is a total volunteer body that oversaw the development of the plan and made recommendations on key elements of the plan, including the maintenance strategy. It was the Steering Committee's position that an implementation committee with representation similar to the initial Steering Committee should have an active role in the plan maintenance strategy. Therefore, it is recommended that a Steering Committee remain a viable body involved in key elements of the plan maintenance strategy. The new Steering Committee should strive to include representation from the planning partners, as well as other stakeholders in the planning area.

The principal role of the new implementation committee in this plan maintenance strategy will be to review the annual progress report and provide input to the San Saba County Emergency Management Coordinator on possible enhancements to be considered at the next update. Future plan updates will be overseen by a Steering Committee similar to the one that participated in this plan development process, so keeping an interim Steering Committee intact will provide a head start on future updates. Completion of the progress report is the responsibility of each planning partner, not the responsibility of the Steering Committee. It will simply be the Steering Committee's role to review the progress report in an effort to identify issues needing to be addressed by future plan updates.

20.2.3 Annual Progress Report

The minimum task of each planning partner will be the evaluation of the progress of its individual action plan during a 12-month performance period. This review will include the following:

- Summary of any hazard events that occurred during the performance period and the impact these events had on the planning area
- Review of mitigation success stories
- Review of continuing public involvement
- Brief discussion about why targeted strategies were not completed
- Re-evaluation of the action plan to evaluate whether the timeline for identified projects needs to be amended (such as changing a long-term project to a short-term one because of new funding)
- Recommendations for new projects
- Changes in or potential for new funding options (grant opportunities)
- Impact of any other planning programs or initiatives that involve hazard mitigation

The planning team has created a template to guide the planning partners in preparing a progress report (see Appendix G). The plan maintenance Steering Committee will provide feedback to the planning team on items included in the template. The planning team will then prepare a formal annual report on the progress of the plan. This report should be used to:

- Post on the San Saba County OEM website dedicated to the hazard mitigation plan
- Provide information for a press release that will be issued to the local media
- Inform planning partner governing bodies of the progress of actions implemented during the reporting period

Uses of the progress report will be at the discretion of each planning partner. Annual progress reporting is not a requirement specified under 44 CFR. However, it may enhance the planning partnership's opportunities for funding. While failure to implement this component of the plan maintenance strategy will not jeopardize a planning partner's compliance under the DMA, it may jeopardize its opportunity to partner and leverage funding opportunities with the other partners.

20.2.4 Plan Update

Local hazard mitigation plans must be reviewed, revised if appropriate, and resubmitted for approval in order to remain eligible for benefits under the DMA (44 CFR, Section 201.6(d)(3)). The San Saba County partnership intends to update the hazard mitigation plan on a 5-year cycle from the date of initial plan adoption. This cycle may be accelerated to less than 5 years based on the following triggers:

- A Presidential Disaster Declaration that impacts the planning area
- A hazard event that causes loss of life
- A comprehensive update of the county or participating city's comprehensive plan

It will not be the intent of future updates to develop a complete new hazard mitigation plan for the planning area. The update will, at a minimum, include the following elements:

- The update process will be convened through a Steering Committee
- The hazard risk assessment will be reviewed and, if necessary, updated using best available information and technologies
- The action plans will be reviewed and revised to account for any actions completed, dropped, or changed and to account for changes in the risk assessment or new partnership policies identified under other planning mechanisms (such as the comprehensive plan)
- The draft update will be sent to appropriate agencies and organizations for comment
- The public will be given an opportunity to comment on the update prior to adoption
- The partnership governing bodies will adopt their respective portions of the updated plan

20.2.5 Continuing Public Involvement

The public will continue to be apprised of the plan's progress through the TCRFC and San Saba County OEM's websites and other methods as appropriate. This site will not only house the final plan, it will become the one-stop shop for information regarding the plan, the partnership and plan implementation. Copies of the plan will be distributed to the public library system in San Saba County Library. Upon initiation of future update processes, a new public involvement strategy will be initiated based on guidance from a new Steering Committee. This strategy will be based on the needs and capabilities of the planning partnership at the time of the update. At a minimum, this strategy will include the use of local media outlets within the planning area.

20.2.6 Incorporation into Other Planning Mechanisms

The information on hazard, risk, vulnerability, and mitigation contained in this plan is based on the best science and technology available at the time this plan was prepared. The existing San Saba County regulations, ordinances, and plans (including the *San Saba County Basic Emergency Operations Plan*), and the comprehensive plan of the City of San Saba are considered to be integral parts of this plan. The county and city, through adoption of comprehensive plans and zoning ordinances, have planned for the impact of natural hazards. The plan development process provided the county and the city with the opportunity to review and expand on policies contained within these planning mechanisms. The planning partners used their comprehensive plans (where applicable) and the hazard mitigation plan as complementary documents that work together to achieve the goal of reducing risk exposure to the citizens of the planning area. An update to a comprehensive plan may trigger an update to the hazard mitigation plan.

All municipal planning partners are committed to creating a linkage between the hazard mitigation plan and their individual comprehensive plans. Other planning processes and programs to be coordinated with the recommendations of the hazard mitigation plan include the following:

- Partners' emergency response plans
- Capital improvement programs
- Municipal codes
- Community design guidelines
- Water-efficient landscape design guidelines
- Stormwater management programs
- Water system vulnerability assessments
- Community wildfire protection plans

Some action items do not need to be implemented through regulation. Instead, these items can be implemented through the creation of new educational programs, continued interagency coordination, or improved public participation. As information becomes available from other planning mechanisms that can enhance this plan, that information will be incorporated via the update process.

REFERENCES

Center for Climate and Energy Solutions. No date. Accessed at http://www.c2es.org/science-impacts/basics/faqs/tornadoes. Accessed April 2014.

Congressional Office of Technology Assessment (OTA). 1993. Preparing for an Uncertain Climate, Vol. I. OTA–O–567. U.S. Government Printing Office, Washington, D.C.

Federal Emergency Management Agency (FEMA). 2001. Understanding Your Risks; Identifying Hazards and Determining your Risks. FEMA (386-2). August 2001.

FEMA. 2002. Getting Started; Building Support for Mitigation Planning; FEMA (386-1). September.

FEMA. 2003. Developing the Mitigation Plan; Identifying Mitigation Actions and Implementing Strategies. FEMA (386-3). April.

FEMA. 2004. Using HAZUS-MH for Risk Assessment, How to Guide, FEMA (433). August.

FEMA. 2007. FEMA, National Flood Insurance Program, Community Rating System; CRS Coordinator's Manual FIA-15/2007 OMB No. 1660-0022

FEMA 2010. http://www.fema.gov . Website accessed 2009, 2010, 2011.

Federal Reserve Economic Data (FRED), unemployment data, http://m.research.stlouisfed.org/fred/, accessed May11, 2015.

International Strategy for Disaster Reduction. 2008. "Disaster Risk Reduction Strategies and Risk Management Practices: Critical Elements for Adaptation to Climate Change." November 11.

Kleiner, Diana J. 2010. "San Saba County," Handbook of Texas Online. (https://tshaonline.org/handbook/online/articles/hcf05), accessed May 20, 2015. Uploaded on June 15, 2010. Published by the Texas State Historical Association.

National Aeronautics and Space Administration (NASA). 2004. http://earthobservatory.nasa.gov/Newsroom/view.php?id=25145 NASA Earth Observatory News Web Site Item, dated August 2.

National Lightning Detection Network, owned and operated by Vaisala, "Cloud-To-Ground Lightning Flashes". (http://www.lightningsafety.noaa.gov/stats/97-10cloud_to_ground-state-list.pdf), accessed May 7, 2015. Updated July 2011. Published by the National Oceanic and Atmospheric Administration.

National Oceanic and Atmospheric Administration (NOAA). 2007. Storm Prediction Center. http://www.spc.noaa.gov/faq/tornado/ef-scale.html

NOAA. 2010. National Climatic Data Center website. Accessed at: http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms.

Ressel, Dennis D. and Brown, Samuel E. Jr. "Soil Survey of San Saba County, Texas" (http://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/texas/TX411/0/San Saba.pdf), accessed May 20, 2015. Uploaded 2004. Published by the USDA Natural Resources Conservation Services.

Soil and Water Conservation Society. 2003. Conservation Implications of Climate Change: Soil Erosion and Runoff from Cropland. Ankeny, IA: Soil and Water Conservation Society. Available on-line at http://www.swcs.org/en/publications/conservation_implications_of_climate_change/.

Texas Division of Emergency Management. 2013. State of Texas Mitigation Plan Update. October 15.

U.S. Army Corps of Engineers (USACE). 1997. Hydrologic Engineering Requirements for Reservoirs, Engineer Manual. EM 1110-2-1420. October 31.

U.S. Census Bureau. 2010. Data from 2010 U.S. Census. http://factfinder.census.gov/.

U.S. Environmental Protection Agency (EPA). 2006. Excessive Heat Events Guidebook. EPA 430-B-06-005. Available online at http://www.epa.gov/heatisld/about/pdf/EHEguide_final.pdf.

U.S. Geological Survey (USGS). 1989. The Severity of an Earthquake. U.S. Government Printing Office: 1989-288-913. Accessed at: http://pubs.usgs.gov/gip/earthq4/severity_text.html

USGS. 2008. An Atlas of ShakeMaps for Selected Global Earthquakes. U.S. Geological Survey Open-File Report 2008-1236. Prepared by Allen, T.I., Wald, D.J., Hotovec, A.J., Lin, K., Earle, P.S. and Marano, K.D.

USGS. 2010. PAGER—Rapid Assessment of an Earthquake's Impact. U.S. Geological Survey Fact Sheet 2010-3036. September.

Wilhite, D.A, and M.H. Glantz. 1985. Understanding the Drought Phenomenon: The Role of Definitions. Water International. 10 (3): 111-120.

APPENDIX A.
ACRONYMS AND DEFINITIONS

APPENDIX A.
ACRONYMS AND DEFINITIONS

ACRONYMS

Note: Acronyms are defined the first time they are used in each part of this plan.

°F	Degrees Fahrenheit
°C	Degrees Celsius
%g	Percentage of gravity
44 CFR	Title 44 Code of Federal Regulations
CEPRA	Coastal Erosion Planning and Response Act
CPZ	Community Protection Zone
CTCOG	Central Texas Council of Governments
CWA	Clean Water Act
CWPP	Community Wildfire Protection Plan
CWSRF	Clean Water State Revolving Fund
DFIRM	Digital Flood Insurance Rate Maps
DMA	Disaster Mitigation Act of 2000
DPS	Department of Public Safety
EAP	Education and Awareness Program
EF	Enhanced Fujita
EMT	Emergency Medical Technicians
EOP	Emergency Operations Plan
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FIRM	Flood Insurance Rate Map
FPA-FOD	Fire Program Analysis-Fire-Occurrence Database
GIS	Geographic Information System
GLF	Geophysical Log Facility
GLO	General Land Office
HAZMAT	Hazardous Materials
HAZUS-MH	Hazards, United States-Multi Hazard
HMGP	Hazard Mitigation Grant Program
KT	Knot

LCRA	Lower Colorado River Authority
LPR	Local Plans and Regulations
MLI	Midterm Levee Inventory
ML	Local Magnitude Scale
mph	Miles per Hour
M_W	Moment Magnitude
NEHRP	National Earthquake Hazards Reduction Program
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NREL	National Renewable Energy Laboratory
NSP	Natural Systems Protection
NWS	National Weather Service
OEM	Office of Emergency Management
OSSF	On-site Sewage/Sewer Facilities
OTA	Congressional Office of Technology Assessment
PDM	Pre-Disaster Mitigation Grant Program
PDI	Palmer Drought Index
PGA	Peak Ground Acceleration
PHDI	Palmer Hydrological Drought Index
PMF	Probable Maximum Flood
SIP	Structure and Infrastructure Project
SFHA	Special Flood Hazard Area
SPI	Standardized Precipitation Index
SWCD	Soil and Water Conservation District
TCEQ	Texas Commission on Environmental Quality
TCRFC	Texas Colorado River Floodplain Coalition
TDEM	Texas Division of Emergency Management
TFS	Texas Forest Service
TSSWCB	Texas State Soil and Water Conservation Board
TWDB	Texas Water Development Board
TxWRAP	Texas A&M Forest Service Wildfire Risk Assessment Portal
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USGS	U.S. Geological Survey

VRI	Values Response Index
WHP	Wildfire Hazard Potential
WUI	Wildland Urban Interface

DEFINITIONS

100-Year Flood: The term "100-year flood" can be misleading. The 100-year flood does not necessarily occur once every 100 years. Rather, it is the flood that has a 1% chance of being equaled or exceeded in any given year. Thus, the 100-year flood could occur more than once in a relatively short period of time. The Federal Emergency Management Agency (FEMA) defines it as the 1% annual chance flood, which is now the standard definition used by most federal and state agencies and by the National Flood Insurance Program (NFIP).

Accredited Levee: A levee that is shown on a FIRM as providing protection from the 1% annual chance or greater flood. A **non-accredited or de-accredited levee** is a levee that is not shown on a FIRM as providing protection from the 1% annual chance or greater flood. A **provisionally accredited levee** is a previously accredited levee that has been de-accredited for which data and/or documentation is pending that will show the levee is compliant with NFIP regulations.

Acre-Foot: An acre-foot is the amount of water it takes to cover 1 acre to a depth of 1 foot. This measure is used to describe the quantity of storage in a water reservoir. An acre-foot is a unit of volume. One acre foot equals 7,758 barrels; 325,829 gallons; or 43,560 cubic feet. An average household of four will use approximately 1 acre-foot of water per year.

Asset: An asset is any man-made or natural feature that has value, including, but not limited to, people; buildings; infrastructure, such as bridges, roads, sewers, and water systems; lifelines, such as electricity and communication resources; and environmental, cultural, or recreational features such as parks, wetlands, and landmarks.

Base Flood: The flood having a 1% chance of being equaled or exceeded in any given year, also known as the "100-year" or "1% chance" flood. The base flood is a statistical concept used to ensure that all properties subject to the NFIP are protected to the same degree against flooding.

Basin: A basin is the area within which all surface water, whether from rainfall, snowmelt, springs, or other sources, flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains, and ridges. Basins are also referred to as "watersheds" and "drainage basins."

Benefit: A benefit is a net project outcome and is usually defined in monetary terms. Benefits may include direct and indirect effects. For the purposes of benefit-cost analysis of proposed mitigation measures, benefits are limited to specific, measurable risk reduction factors, including reduction in expected property losses (buildings, contents, and functions) and protection of human life.

Benefit/Cost Analysis: A benefit/cost analysis is a systematic, quantitative method of comparing projected benefits to projected costs of a project or policy. It is used as a measure of cost effectiveness.

Breach: An opening through which floodwaters may pass after part of a levee has given way.

Building: A building is defined as a structure that is walled and roofed, principally aboveground, and permanently fixed to a site. The term includes manufactured homes on permanent foundations on which the wheels and axles carry no weight.

Capability Assessment: A capability assessment provides a description and analysis of a community's current capacity to address threats associated with hazards. The assessment includes two components: an inventory of an agency's mission, programs, and policies, and an analysis of its capacity to carry them out. A capability assessment is an integral part of the planning process in which a community's actions to reduce losses are identified, reviewed, and analyzed, and the framework for implementation is identified. The following capabilities were reviewed under this assessment:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability

Collapsible soils: Collapsible soils consist of loose, dry, low-density materials that collapse and compact under the addition of water or excessive loading. Soil collapse occurs when the land surface is saturated at depths greater than those reached by typical rain events. This saturation eliminates the clay bonds holding the soil grains together. Similar to expansive soils, collapsible soils result in structural damage such as cracking of the foundation, floors, and walls in response to settlement.

Community Protection Zones (CPZ): CPZs are based on an analysis of the "Where People Live" housing density data and surrounding fire behavior potential and represent those areas considered highest priority for wildfire mitigation planning activities. "Rate of Spread" data is used to determine the areas of concern around populated areas that are within a 2-hour fire spread distance.

Conflagration: A fire that grows beyond its original source area to engulf adjoining regions. Wind, extremely dry or hazardous weather conditions, excessive fuel buildup, and explosions are usually the elements behind a wildfire conflagration.

Critical Area: An area defined by state or local regulations as deserving special protection because of unique natural features or its value as habitat for a wide range of species of flora and fauna. A sensitive/critical area is usually subject to more restrictive development regulations.

Critical Facility: Facilities and infrastructure that are critical to the health and welfare of the population. These become especially important after any hazard event occurs. For the purposes of this plan, critical facilities include:

- Structures or facilities that produce, use, or store highly volatile, flammable, explosive, toxic or water reactive materials.
- Hospitals, nursing homes, and housing likely to contain occupants who may not be sufficiently mobile to avoid death or injury during a hazard event.
- Police stations, fire stations, vehicle and equipment storage facilities, and emergency operations centers that are needed for disaster response before, during, and after hazard events.
- Public and private utilities, facilities and infrastructure that are vital to maintaining or restoring normal services to areas damaged by hazard events.
- Government facilities.

Dam: A barrier, including one for flood detention, designed to impound liquid volumes and which has a height of dam greater than six feet (Texas Administrative Code, Ch. 299, 1986).

Dam Failure: Dam failure refers to a partial or complete breach in a dam (or levee) that impacts its integrity. Dam failures occur for a number of reasons, such as flash flooding, inadequate spillway size, mechanical failure of valves or other equipment, freezing and thawing cycles, earthquakes, and intentional destruction.

Debris Flow: Dense mixtures of water-saturated debris that move down-valley; looking and behaving much like flowing concrete. They form when loose masses of unconsolidated material are saturated, become unstable, and move down slope. The source of water varies but includes rainfall, melting snow or ice, and glacial outburst floods.

Deposition: Deposition is the placing of eroded material in a new location.

Disaster Mitigation Act of 2000 (DMA): The DMA is Public Law 106-390 and is the latest federal legislation enacted to encourage and promote proactive, pre-disaster planning as a condition of receiving financial assistance under the Robert T. Stafford Act. The DMA emphasizes planning for disasters before they occur. Under the DMA, a pre-disaster hazard mitigation program and new requirements for the national post-disaster hazard mitigation grant program (HMGP) were established.

Drainage Basin: A basin is the area within which all surface water, whether from rainfall, snowmelt, springs or other sources, flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains and ridges. Drainage basins are also referred to as **watersheds** or **basins**.

Drought: Drought is a period of time without substantial rainfall or snowfall from one year to the next. Drought can also be defined as the cumulative impacts of several dry years or a deficiency of precipitation over an extended period of time, which in turn results in water shortages for some activity, group, or environmental function. A hydrological drought is caused by deficiencies in surface and subsurface water supplies. A socioeconomic drought impacts the health, well-being, and quality of life or starts to have an adverse impact on a region. Drought is a normal, recurrent feature of climate and occurs almost everywhere.

Earthquake: An earthquake is defined as a sudden slip on a fault, volcanic or magmatic activity, and sudden stress changes in the earth that result in ground shaking and radiated seismic energy. Earthquakes can last from a few seconds to over 5 minutes, and have been known to occur as a series of tremors over a period of several days. The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Casualties may result from falling objects and debris as shocks shake, damage, or demolish buildings and other structures.

Emergency Action Plan: A document that identifies potential emergency conditions at a dam and specifies actions to be followed to minimize property damage and loss of life. The plan specifies actions the dam owner should take to alleviate problems at a dam. It contains procedures and information to assist the dam owner in issuing early warning and notification messages to responsible downstream emergency management authorities of the emergency situation. It also contains inundation maps to show emergency management authorities the critical areas for action in case of an emergency. (FEMA 64)

Enhanced Fujita Scale (EF-scale): The EF-scale is a set of wind estimates (not measurements) based on damage. It uses 3-second gusts estimated at the point of damage based on a judgment of 8 levels of damage to the 28 indicators. These estimates vary with height and exposure. Standard measurements are taken by weather stations in openly exposed area.

Epicenter: The point on the earth's surface directly above the hypocenter of an earthquake. The location of an earthquake is commonly described by the geographic position of its epicenter and by its focal depth.

Expansive Soil: Expansive soil and rock are characterized by clayey material that shrinks as it dries or swells as it becomes wet.

Exposure: Exposure is defined as the number and dollar value of assets considered to be at risk during the occurrence of a specific hazard.

Extent: The extent is the size of an area affected by a hazard.

Extreme Heat: Summertime weather that is substantially hotter or more humid than average for a location at that time of year.

Fault: A fracture in the earth's crust along which two blocks of the crust have slipped with respect to each other.

Fire Behavior: Fire behavior refers to the physical characteristics of a fire and is a function of the interaction between the fuel characteristics (such as type of vegetation and structures that could burn), topography, and weather. Variables that affect fire behavior include the rate of spread, intensity, fuel consumption, and fire type (such as underbrush versus crown fire).

Fire Frequency: Fire frequency is the broad measure of the rate of fire occurrence in a particular area. An estimate of the areas most likely to burn is based on past fire history or fire rotation in the area, fuel conditions, weather, ignition sources (such as human or lightning), fire suppression response, and other factors.

Flash Flood: A flash flood occurs with little or no warning when water levels rise at an extremely fast rate.

Flood: The inundation of normally dry land resulting from the rising and overflowing of a body of water.

Flood Insurance Rate Map (FIRM): FIRMs are the official maps on which the Federal Emergency Management Agency (FEMA) has delineated the Special Flood Hazard Area (SFHA).

Flood Insurance Study: A report published by the Federal Insurance and Mitigation Administration for a community in conjunction with the community’s FIRM. The study contains such background data as the base flood discharges and water surface elevations that were used to prepare the FIRM. In most cases, a community FIRM with detailed mapping will have a corresponding flood insurance study.

Floodplain: Any land area susceptible to being inundated by flood waters from any source. A FIRM identifies most, but not necessarily all, of a community’s floodplain as the SFHA.

Floodway: Floodways are areas within a floodplain that are reserved for the purpose of conveying flood discharge without increasing the base flood elevation more than one foot. Generally speaking, no development is allowed in floodways, as any structures located there would block the flow of floodwaters.

Focal Depth: The depth from the earth’s surface to the hypocenter.

Freeboard: Freeboard is the margin of safety added to the base flood elevation.

Freezing Rain: The result of rain occurring when the temperature is below the freezing point. The rain freezes on impact, resulting in a layer of glaze ice up to an inch thick. In a severe ice storm, an evergreen tree 60 feet high and 30 feet wide can be burdened with up to 6 tons of ice, creating a threat to power and telephone lines and transportation routes.

Frequency: For the purposes of this plan, frequency refers to how often a hazard of specific magnitude, duration, or extent is expected to occur on average. Statistically, a hazard with a 100-year frequency is expected to occur about once every 100 years on average and has a 1% chance of occurring any given year. Frequency reliability varies depending on the type of hazard considered.

Fujita Scale of Tornado Intensity: Tornado wind speeds are sometimes estimated on the basis of wind speed and damage sustained using the Fujita Scale. The scale rates the intensity or severity of tornado events using numeric values from F0 to F5 based on tornado wind speed and damage. An F0 tornado (wind speed less than 73 miles per hour [mph]) indicates minimal damage (such as broken tree limbs), and an F5 tornado (wind speeds of 261 to 318 mph) indicates severe damage.

Goal: A goal is a general guideline that explains what is to be achieved. Goals are usually broad-based, long-term, policy-type statements and represent global visions. Goals help define the benefits that a plan is trying to achieve. The success of a hazard mitigation plan is measured by the degree to which its goals have been met (that is, by the actual benefits in terms of actual hazard mitigation).

Geographic Information System (GIS): GIS is a computer software application that relates data regarding physical and other features on the earth to a database for mapping and analysis.

Ground Subsidence: Ground subsidence is the sinking of land over human-caused or natural underground voids and the settlement of native low density soils.

Groundwater Depletion: Groundwater depletion occurs when groundwater is pumped from pore spaces between grains of sand and gravel. If an aquifer has beds of clay or silt within or next to it, the lowered water pressure in the sand and gravel causes slow drainage of water from the clay and silt beds. The reduced water pressure is a loss of support for the clay and silt beds. Because these beds are compressible, they compact (become thinner), and the effects are seen as a lowering of the land surface.

Hazard: A hazard is a source of potential danger or adverse condition that could harm people or cause property damage.

Hazard Mitigation Grant Program (HMGP): Authorized under Section 202 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, the HMGP is administered by FEMA and provides grants to states, tribes, and local governments to implement hazard mitigation actions after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to disasters and to enable mitigation activities to be implemented as a community recovers from a disaster.

Hazards U.S. Multi-Hazard (HAZUS-MH) Loss Estimation Program: HAZUS-MH is a GIS-based program used to support the development of risk assessments as required under the DMA. The HAZUS-MH software program assesses risk in a quantitative manner to estimate damages and losses associated with natural hazards. HAZUS-MH is FEMA's nationally applicable, standardized methodology and software program and contains modules for estimating potential losses from earthquakes, floods, and wind hazards. HAZUS-MH has also been used to assess vulnerability (exposure) for other hazards.

High Hazard Dam — Dams where failure or operational error will probably cause loss of human life. (FEMA 333)

Hurricane: A tropical cyclone with maximum sustained surface winds (using the U.S. 1-minute average) of 64 knot (kt) (74 miles per hour [mph]) or more.

Hydraulics: Hydraulics is the branch of science or engineering that addresses fluids (especially water) in motion in rivers or canals, works and machinery for conducting or raising water, the use of water as a prime mover, and other fluid-related areas.

Hydrology: Hydrology is the analysis of waters of the earth. For example, a flood discharge estimate is developed by conducting a hydrologic study.

Hypocenter: The region underground where an earthquake's energy originates.

Intensity: For the purposes of this plan, intensity refers to the measure of the effects of a hazard.

Interface Area: An area susceptible to wildfires and where wildland vegetation and urban or suburban development occur together. An example would be smaller urban areas and dispersed rural housing in forested areas.

Inventory: The assets identified in a study region comprise an inventory. Inventories include assets that could be lost when a disaster occurs and community resources are at risk. Assets include people, buildings, transportation, and other valued community resources.

Land Subsidence: Land subsidence is the loss of surface elevation due to the removal of subsurface support. In Texas there are three types of subsidence that warrant the most concern: groundwater depletion, sinkholes in karst areas, and erosion.

Landslide: Landslides can be described as the sliding movement of masses of loosened rock and soil down a hillside or slope. Fundamentally, slope failures occur when the strength of the soils forming the slope exceeds the pressure, such as weight or saturation, acting upon them.

Levee: A man-made structure, usually an earthen embankment or concrete floodwall, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide reasonable assurance of excluding temporary flooding from the leveed area.

Lightning: Lightning is an electrical discharge resulting from the buildup of positive and negative charges within a thunderstorm. When the buildup becomes strong enough, lightning appears as a "bolt," usually within or between clouds and the ground. A bolt of lightning instantaneously reaches temperatures approaching 50,000ºF. The rapid heating and cooling of air near lightning causes thunder. Lightning is a major threat during thunderstorms. In the United States, 75 to 100 people are struck and killed by lightning each year (see http://www.fema.gov/hazard/thunderstorms/thunder.shtm).

Liquefaction: Liquefaction is the complete failure of soils, occurring when soils lose shear strength and flow horizontally. It is most likely to occur in fine grain sands and silts, which behave like viscous fluids when liquefaction occurs. This situation is extremely hazardous to development on the soils that liquefy, and generally results in extreme property damage and threats to life and safety.

Local Government: Any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under state law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity.

Magnitude: Magnitude is the measure of the strength of an earthquake, and is typically measured by the Richter scale. As an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

Mitigation: A preventive action that can be taken in advance of an event that will reduce or eliminate the risk to life or property.

Mitigation Actions: Mitigation actions are specific actions to achieve goals and objectives that minimize the effects from a disaster and reduce the loss of life and property.

National Flood Insurance Program (NFIP): The NFIP provides federally backed flood insurance in exchange for communities enacting floodplain regulations.

Objective: For the purposes of this plan, an objective is defined as a short-term aim that, when combined with other objectives, forms a strategy or course of action to meet a goal.

Peak Ground Acceleration: Peak Ground Acceleration is a measure of the highest amplitude of ground shaking that accompanies an earthquake, based on a percentage of the force of gravity.

Preparedness: Preparedness refers to actions that strengthen the capability of government, citizens, and communities to respond to disasters.

Presidential Disaster Declaration: These declarations are typically made for events that cause more damage than state and local governments and resources can handle without federal government assistance. Generally, no specific dollar loss threshold has been established for such declarations. A Presidential Disaster Declaration puts into motion long-term federal recovery programs, some of which are matched by state programs, designed to help disaster victims, businesses, and public entities.

Probability of Occurrence: The probability of occurrence is a statistical measure or estimate of the likelihood that a hazard will occur. This probability is generally based on past hazard events in the area and a forecast of events that could occur in the future. A probability factor based on yearly values of occurrence is used to estimate probability of occurrence.

Repetitive Loss Property: Any NFIP-insured property that, since 1978 and regardless of any changes of ownership during that period, has experienced:

- Four or more paid flood losses in excess of $1,000; or
- Two paid flood losses in excess of $1,000 within any 10-year period since 1978; or

- Three or more paid losses that equal or exceed the current value of the insured property.

Riparian Zone: The area along the banks of a natural watercourse.

Riverine: Of or produced by a river. Riverine floodplains have readily identifiable channels. Floodway maps can only be prepared for riverine floodplains.

Risk: Risk is the estimated impact that a hazard would have on people, services, facilities, and structures in a community. Risk measures the likelihood of a hazard occurring and resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to occurrence of a specific type of hazard. Risk also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Risk Assessment: Risk assessment is the process of measuring potential loss of life, personal injury, economic injury, and property damage resulting from hazards. This process assesses the vulnerability of people, buildings, and infrastructure to hazards and focuses on (1) hazard identification; (2) impacts of hazards on physical, social, and economic assets; (3) vulnerability identification; and (4) estimates of the cost of damage or costs that could be avoided through mitigation.

Risk Ranking: This ranking serves two purposes, first to describe the probability that a hazard will occur, and second to describe the impact a hazard will have on people, property, and the economy. Risk estimates for the jurisdiction are based on the methodology that the jurisdiction used to prepare the risk assessment for this plan. The following equation shows the risk ranking calculation:

Risk Ranking = Probability + Impact (people + property + economy)

Robert T. Stafford Act: The Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 100-107, was signed into law on November 23, 1988. This law amended the Disaster Relief Act of 1974, Public Law 93-288. The Stafford Act is the statutory authority for most federal disaster response activities, especially as they pertain to FEMA and its programs.

Severe Local Storm: Small-scale atmospheric systems, including tornadoes, thunderstorms, windstorms, ice storms, and snowstorms. These storms may cause a great deal of destruction and even death, but their impact is generally confined to a small area. Typical impacts are on transportation infrastructure and utilities.

Significant Hazard Dam: Dams where failure or operational error will result in no probable loss of human life but can cause economic loss, environmental damage, or disruption of lifeline facilities, or can impact other concerns. Significant hazard dams are often located in rural or agricultural areas but could be located in areas with population and significant infrastructure. (FEMA 333)

Sinkhole: A collapse depression in the ground with no visible outlet. Its drainage is subterranean. It is commonly vertical-sided or funnel-shaped.

Soil Erosion: Soil erosion is the removal and simultaneous transportation of earth materials from one location to another by water, wind, waves, or moving ice.

Special Flood Hazard Area: The base floodplain delineated on a FIRM. The SFHA is mapped as a Zone A in riverine situations. The SFHA may or may not encompass all of a community's flood problems.

Stakeholder: Business leaders, civic groups, academia, non-profit organizations, major employers, managers of critical facilities, farmers, developers, special purpose districts, and others whose actions could impact hazard mitigation.

Stream Bank Erosion: Stream bank erosion is common along rivers, streams, and drains where banks have been eroded, sloughed, or undercut. However, it is important to remember that a stream is a dynamic and constantly changing system. It is natural for a stream to want to meander, so not all eroding banks are "bad" and in need of repair. Generally, stream bank erosion becomes a problem where development has limited the meandering nature of streams, where streams have been channelized, or where stream bank structures (like bridges, culverts, etc.) are located in places where they can actually cause damage to downstream areas. Stabilizing these areas can help protect watercourses from continued sedimentation, damage to adjacent land uses, control unwanted meander, and improvement of habitat for fish and wildlife.

Steep Slope: Different communities and agencies define it differently, depending on what it is being applied to, but generally a steep slope is a slope in which the percent slope equals or exceeds 25%. For this study, steep slope is defined as slopes greater than 33%.

Sustainable Hazard Mitigation: This concept includes the sound management of natural resources, local economic and social resiliency, and the recognition that hazards and mitigation must be understood in the largest possible social and economic context.

Thunderstorm: A thunderstorm is a storm with lightning and thunder produced by cumulonimbus clouds. Thunderstorms usually produce gusty winds, heavy rains, and sometimes hail. Thunderstorms are usually short in duration (seldom more than 2 hours). Heavy rains associated with thunderstorms can lead to flash flooding during the wet or dry seasons.

Tornado: A tornado is a violently rotating column of air extending between and in contact with a cloud and the surface of the earth. Tornadoes are often (but not always) visible as funnel clouds. On a local scale, tornadoes are the most intense of all atmospheric circulations, and winds can reach destructive speeds of more than 300 mph. A tornado's vortex is typically a few hundred meters in diameter, and damage paths can be up to 1 mile wide and 50 miles long.

Tropical Storm: A tropical cyclone with maximum sustained surface wind speed (using the U.S. 1-minute average) ranges from 34 kt (39 mph) to 63 kt (73 mph).

Tropical Depression: A tropical cyclone with maximum sustained surface wind speed (using the U.S. 1-minute average) ranges from 4 kt (39 mph) to 63 kt (73 mph).

Values Response Index (VRI): The wildfire VRI reflects a rating of the potential impact of a wildfire on values or assets. The VRI is an overall rating that combines the impact ratings for WUI (housing density) and Pine Plantations (pine age) into a single measure. VRI combines the likelihood of a fire occurring (threat) with those areas of most concern that are adversely impacted by fire to derive a single overall measure of wildfire risk.

Vulnerability: Vulnerability describes how exposed or susceptible an asset is to damage. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power. Flooding of an electric substation would affect not only the substation itself but businesses as well. Often, indirect effects can be much more widespread and damaging than direct effects.

Watershed: A watershed is an area that drains downgradient from areas of higher land to areas of lower land to the lowest point, a common drainage basin.

Wildfire: Wildfire refers to any uncontrolled fire occurring on undeveloped land that requires fire suppression. The potential for wildfire is influenced by three factors: the presence of fuel, topography, and air mass. Fuel can include living and dead vegetation on the ground, along the surface as brush and small trees, and in the air such as tree canopies. Topography includes both slope and elevation. Air mass includes temperature, relative humidity, wind speed and direction, cloud cover, precipitation amount, duration, and the stability of the atmosphere at the time of the fire. Wildfires can be ignited by lightning and, most frequently, by human activity including smoking, campfires, equipment use, and arson.

Wildfire Hazard Potential (WHP): The wildfire threat or WHP is the likelihood of a wildfire occurring or burning into an area. Threat is calculated by combining multiple landscape characteristics including surface and canopy fuels, fire behavior, historical fire occurrences, weather observations, terrain conditions, and other factors.

Windstorm: Windstorms are generally short-duration events involving straight-line winds or gusts exceeding 50 mph. These gusts can produce winds of sufficient strength to cause property damage. Windstorms are especially dangerous in areas with significant tree stands, exposed property, poorly constructed buildings, mobile homes (manufactured housing units), major infrastructure, and aboveground utility lines. A windstorm can topple trees and power lines; cause damage to residential, commercial, critical facilities; and leave tons of debris in its wake.

Winter Storm: A storm having significant snowfall, ice, or freezing rain; the quantity of precipitation varies by elevation.

Zoning Ordinance: The zoning ordinance designates allowable land use and intensities for a local jurisdiction. Zoning ordinances consist of two components: a zoning text and a zoning map.

APPENDIX B.
LOCAL MITIGATION PLAN REVIEW TOOL

APPENDIX B.
LOCAL MITIGATION PLAN REVIEW TOOL

This appendix presents the local mitigation action review tool for the San Saba County Hazard Mitigation Plan. The review tool demonstrates how the plan meets federal regulations and offers state and FEMA planners an opportunity to provide feedback on the plan to the community.

LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of the each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: San Saba County, Texas	**Title of Plan:** San Saba County Hazard Mitigation Plan Update	**Date of Plan:** December 2015
Local Point of Contact: Ms. Marsha Hardy	**Address:** 500 E. Wallace San Saba, TX 76877	
Title: Emergency Management Coordinator		
Agency: San Saba County Office of Emergency Management		
Phone Number: (325) 372-8570	**E-Mail:** emergencymgmt@co.san-saba.tx.us	

State Reviewer:	**Title:**	**Date:**

FEMA Reviewer:	**Title:**	**Date:**
Date Received in FEMA Region VIII		
Plan Not Approved		
Plan Approvable Pending Adoption		
Plan Approved		

SECTION 1:
MULTI-JURISDICTION SUMMARY SHEET

MULTI-JURISDICTION SUMMARY SHEET									
#	Jurisdiction Name	Jurisdiction Type	Jurisdiction Contact	Email	Requirements Met (Y/N)				
					A. Planning Process	B. HIRA	C. Mitigation Strategy	D. Update Rqtms.	E. Adoption Resolution
1	San Saba County	County	Marsha Hardy	emergencymgmt@co.san-saba.tx.us					
2	City of San Saba	Incorporated City	Al Hamrick	sansaba@centex.net					
3									
4									

SECTION 2:
REGULATION CHECKLIST

REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** (section and/or page number)	**Met**	**Not Met**
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Part 1 in its entirety		
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Part 1, Chapter 3, Section 3.2-3.7		
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Part 1, Chapter 3, Section 3.7		
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Part 1, Chapter 3, Section 3.7, Chapters 6 and 7		
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Part 3, Chapter 20.2.5		
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Part 3, Chapter 20, Section 20.2		
ELEMENT A: REQUIRED REVISIONS			
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Part 2 in its entirety		
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Part 1, Chapter 6, Section 6.2 and Part 2 in its entirety		

REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Part 2, Subsections 2 and 6 of each Chapter		
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Part 1, Chapter 6, and Part 2, Chapter 12		
ELEMENT B: REQUIRED REVISIONS			
ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Part 1, Chapter 6, Section 6.9 and Chapter 7		
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Part 1, Chapters 6 and 7; Part 2, Chapter 12		
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Part 1, Chapter 4		
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Part 3, Chapter 19		
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Part 3, Chapter 19, Section 19.2		
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Part 3, Chapter 20, Section 20.2.6		

REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT C: REQUIRED REVISIONS			
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Part 2, Chapters 8 through 17, Subsection 7 of each Chapter		
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Part 1, Chapter 2		
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Part 1, Chapters 1 and 2		
ELEMENT D: REQUIRED REVISIONS			
ELEMENT E. PLAN ADOPTION			
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	Pre-adoption review. Documentation to be provided upon issuance of pre-adoption approval by TDEM and FEMA Region VI		
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	Pre-adoption review. Documentation to be provided upon issuance of pre-adoption approval by TDEM and FEMA Region VI		
ELEMENT E: REQUIRED REVISIONS			
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)			
F1.			
F2.			
ELEMENT F: REQUIRED REVISIONS			

SECTION 3:
PLAN ASSESSMENT

A. Plan Strengths and Opportunities for Improvement

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Element A: Planning Process

Element B: Hazard Identification and Risk Assessment

Element C: Mitigation Strategy

Element D: Plan Review, Evaluation, and Implementation (Plan Updates Only)

B. Resources for Implementing Your Approved Plan

APPENDIX C.
PUBLIC OUTREACH

APPENDIX C.
PUBLIC OUTREACH

This appendix includes the agenda, sign-in sheets, and meeting notes from each of the three Steering Committee Meetings. This appendix also include the results of the San Saba County Hazard Mitigation Plan questionnaire, as described in Section 3.7.2. The press releases announcing the update of the San Saba County Hazard Mitigation Plan are shown in Section 3.7.4.

Hazard Mitigation Plan Updates

for Lampasas, Mason, Mills, and San Saba Counties

and the Cities of Brady and Brownwood

Steering Committee Kickoff Meeting

Tuesday, March 24, 2015

9:00 AM

Agenda

1. Welcome and Introductions
2. Steering Committee Purpose and Responsibilities
3. Plan Partners and Signators
4. Purpose and Goals of the Update Process
5. Review and Amend Mitigation Goals and Objectives (in packet)
6. Review Mitigation Actions from TCRFC Hazard Mitigation Plan (in packet)
7. Critical Facilities Discussion
8. Next Steps
    a. Capabilities Assessment
    b. Hazard Analysis Review
    c. Community Participation and Survey (in packet)
9. Next meeting date - ???
10. Adjournment

TEXAS COLORADO RIVER FLOODPLAIN COALITION

TCRFC Hazard Mitigation Plan Update - Kickoff Meeting - Group 3A

March 23, 2015

LAST NAME	FIRST NAME	COUNTY	COMMUNITY	Email	SIGN - IN
Mosier	Joe	McCulloch	City of Brady	crtisfld@centex.net;	
Neal	Danny	McCulloch	City of Brady		
Minor	James	McCulloch	City of Brady	bradyco@bradytx.us;	
GROVES	ANTHONY	McCulloch	"	agroves@bradytx.us	AW Groves
Lamont	Peter	McCulloch	City of Brady	plamont@bradytx.us	[illegible]
Haynes	Stephen	Brown	City of Brownwood	shaynes@haynesfirm.com;	
Hatcher, P.E.	Donald	Brown	City of Brownwood	dhatcher@ci.brownwood.tx.us;	Donald R Hatcher
Kelly	Jodie	Brown	City of Brownwood	jkelly@ci.brownwood.tx.us;	Jodie Kelly
Albright	Del	Brown	City of Brownwood	dalbright@ci.brownwood.tx.us	[illegible]
Bouse	Lynn	Mills	City of Goldthwaite		
Lindsey	Robert	Mills	City of Goldthwaite	citymgr@centex.net;	
McMahan	Mike	Mills	City of Goldthwaite		
Cagle	Ronald	Mills	City of Goldthwaite	city@centex.net;	
Rountree	Bobby	Mills	City of Goldthwaite	bobbyr@centex.net;	

TCRFC Hazard Mitigation Plan Update - Kickoff Meeting - Group 3A
March 23, 2015

LAST NAME	FIRST NAME	COUNTY	COMMUNITY	Email	SIGN - IN
Bearden	Jerry	Mason	Mason County	county.judge@co.mason.tx.us;	
Toeppich	Stanley	Mason	Mason County		
Starks	Tommy	Mason	Mason County	tstarks@tstar.net;	
Martin	Clyde	Mason	Mason County	masonvfdtx@hotmail.com	Clyde Martin
Fulk	Kirkland	Mills	Mills County	kirkland.fulk@co.mills.tx.us	
Dibrell	Shawn	Mills	Mills County		
Hammonds	Clint	Mills	Mills County	sheriffhammonds@centex.net	
Lusty	Rickey	San Saba	San Saba County	rickey_lusty@yahoo.com;	
Theodosis	Byron	San Saba	San Saba County	judge@co.san-saba.tx.us;	[illegible]
Hardy	Marsha	San Saba	San Saba County	emergencymgmt@co.san-saba.tx.us;	M B Hardy
Maultsby	Sabrina	San Saba	San Saba County	sansaba@centex.net;	

TCRFC Hazard Mitigation Plan Update - Kickoff Meeting - Group 3A
March 23, 2015

LAST NAME	FIRST NAME	COUNTY	COMMUNITY	Email	SIGN - IN
Cook	Paul	Lampasas	City of Kempner		
Davis	Trudy	Lampasas	City of Kempner	citysec@embarqmail.com	
Grayson	Jerry	Lampasas	City of Lampasas	jerry@cityoflampasas.com	
Bierschwale	Wanda	Lampasas	City of Lampasas	wanda@cityoflampasas.com	
deGraffenried	Finley	Lampasas	City of Lampasas	finley@cityoflampasas.com;	
Bunting	Jerry	Lampasas	City of Lampasas	jerryb@cityoflampasas.com;	
Kirby	Cynthia	Lampasas	City of Lometa	cityoflometa@yahoo.com;	
Taylor	Vicki	Lampasas	City of Lometa	cityoflometa@yahoo.com;	

TCRFC Hazard Mitigation Plan Update - Kickoff Meeting - Group 3A
March 23, 2015

LAST NAME	FIRST NAME	COUNTY	COMMUNITY	Email	SIGN - IN
Hinckley	Brent	Mason	City of Mason	brent.hinckley@cityofmason.us;	
Palacio	John	Mason	City of Mason	john.palacio@cityofmason.us;	
Yarbrough	Wayne	San Saba	City of San Saba	sansaba@centex.net;	
Hamrick	Al	San Saba	City of San Saba	sansaba@centex.net;	
Weik	Stan	San Saba	City of San Saba	weik@sbcglobal.net;	
Jordan	Ken	San Saba	City of San Saba	ken@jordancattle.com	
Maldonado	Misty	San Saba	City of San Saba	mistymaldonadopd12@yahoo.com	M Maldonado
~~Boultinghouse~~	Wayne OK	Lampasas	Lampasas County	wayne.boultinghouse@co.lampasas.tx.us;	Wayne L. Boultinghouse
Wittenburg	Alex	Lampasas	Lampasas County		
Cox	Jack	Lampasas	Lampasas County		
Rainwater	Angela	Lampasas	Lampasas County	angela.rainwater@co.lampasas.tx.us	

TEXAS COLORADO RIVER FLOODPLAIN COALITION

Lampasas, Mason, Mills, and San Saba Counties and Cities of Brady and Brownwood, TX

Hazard Mitigation Plan Updates
Kickoff Meeting – Meeting Notes

San Saba Counsel Chamber
9:00am – 11:00am
Tuesday, March 24, 2015

- Welcome and Introductions – Mickey Reynolds (Texas Colorado River Floodplain Coalition [TCRFC]) welcomed everyone and introduced Cindy Engelhardt (Halff Associates).
    1. Cindy stated that the consultant team consists of JSW, Halff Associates, and Tetra Tech, then provided the group with an overview of the Hazard Mitigation Plan (HMP) Update process. The TCRFC Basin and Planning Group was funded under a Pre-Disaster Mitigation Grant, which was awarded in fall 2014 to update the 2011 HMP. Cindy referred to the fact sheet distributed by TCRFC that explains why each community needs to participate in the update process. Each participating community needs to sign in at the steering committee meetings to be recognized by FEMA as participating.
    2. Cindy stated that she will distribute a spreadsheet and instructions to attendees to document their time for these meetings for the in-kind 25% soft match.
    3. Cindy encouraged Steering Committee members to invite other community groups, such as school districts and hospitals, and major city employers, to attend these meetings and participate in the plan development so they are eligible for additional FEMA grants.
    4. Cindy introduced Brian McNamara with Halff, and Laura Johnston and Krista Jack from Tetra Tech.
    5. Laura explained that while the previous 2011 plan included many counties in the region, FEMA now requires that each county create their own plan. The TCRFC counties were separated into three groups. The counties and cities in today's meeting are a part of Group 3. The other counties and groups are shown on the TCRFC fact sheet.
    6. Laura explained the roles and responsibilities of JSW, Halff, and Tetra Tech. Halff will complete the hazard risk assessment and the GIS mapping of hazards. Tetra Tech will complete the planning portions, including leading the steering committee meetings, and write the plan.
    7. Laura provided an overview of the mitigation plan process, FEMA requirements, and the benefits to the counties and participating communities. Laura stated that a partnership with FEMA and the state is important to the planning and implementation of the HMP.

Representatives from FEMA Region VI and the State of Texas were invited to the meeting but could not attend.

8. Laura requested introductions of each of the attendees and the organization or municipality they represent. Attendees present were from Lampasas, Mason, and San Saba Counties, and the Cities of Brownwood, Brady, and San Saba. There was no representative present from Mills County. (See sign in sheet for a complete list of attendees.)
9. Laura asked if anyone in the meeting participated in the development of the previous 2011 HMP. Three attendees indicated that they were involved in the previous plan (Marsha Hardy [San Saba County], Al Hamrick [City of San Saba], and Wayne Boultinghouse [Lampasas County]) and that others in the meeting were also indirectly involved.

- Each attendee was provided a folder, tailored to their specific community and county, with handouts, a copy of the presentation slides, and contact information for the planning team.
- Laura reviewed the purpose of hazard mitigation. She noted that a community must have a current and approved HMP to be eligible for certain FEMA funds; however, our team focuses on developing plans that identify practical, implementable, politically viable, and fundable mitigation actions. Laura stated that the hazard mitigation actions from the current plan are robust. Plans need to be updated every 5 years and reviewed annually. Laura also stated that the HMP updates will focus only on natural hazards and will not include human-caused hazards.
- Laura reviewed the purpose and responsibilities of the Steering Committee. Steering Committee members:
    1. Are leaders involved in the development of the plan
    2. Provide guidance on their specific community
    3. Carry information from the meetings to their community
    4. Represent all community stakeholders (residents and businesses)
    5. Attend and actively participate in all three committee meetings (including this one)
- Laura discussed Planning Partners and Signators. Each Planning Partner must actively participate in the Steering Committee meetings and formally adopt the plan. The sign-in sheets will be attached to the plan to demonstrate participation.
- Laura presented a list of participating communities within each plan. Marsha said they are still reaching out to participants to encourage their participation and attendance.
- Laura presented the goals for each meeting of the Steering Committee:
    1. The goal of the kick-off meeting is to review the goals and objectives, briefly discuss past mitigation actions, discuss critical facilities, and review the natural hazards as ranked in the current plan;
    2. The goal of the second meeting is to present the results of the hazard risk assessment and to complete the hazard ranking process; and
    3. The goal of the third meeting is to identify actions that mitigate the identified hazards and to rank those hazards.
- Laura discussed the project schedule.
- Laura reviewed the distinction between goals, objectives, and mitigation actions.

    1. Laura asked that if there are mitigation actions that the counties want to include, the attendees should make a note of those as they go through this multi-month process because these actions will be presented and discussed in the third meeting.
- Laura reviewed the goals and objectives from the current regional HMP and stated the updated plan would only address natural hazards. Objective 3.1 would be modified to remove the reference to "man-made" hazards. Laura read through each goal and objective and asked for comments. She asked if any of the actions are not applicable to their communities.
    1. All counties in attendance participate in National Flood Insurance Program (NFIP). None of the counties or cities in attendance participate in the Community Rating System (CRS).
    2. Laura emphasized that Objective 3.2 is important to educate the public on self-responsibility and self-resiliency.
    3. Wayne (Lampasas) noted that his experience with FEMA has brought up concerns about Goal 2. Laura explained that the purpose of developing this plan is to protect the communities and help the communities prepare for natural disasters and be able to benefit from resources, as needed, if and when disasters strike. Byron Theodosis (San Saba County) noted that when the 2013 floods hit the region, they did received federal resources to recover from the flood. He noted that it is important to position the communities to be eligible to receive federal funding in case a natural disaster strikes.
    4. Clyde Martin (Mason County) asked if a wildfire is started by humans, then it is considered a man-made event and not eligible for federal funding. Laura confirmed this is true.
    5. Laura said typically if you don't have a HMP in place before the release of funding from a natural disaster, then the jurisdiction won't get the federal funding.
    6. Objective 5.2 – Anthony Groves (City of Brady) asked Laura to explain this objective. Laura said this is typically in reference to floodways. These areas, once acquired by the counties or communities, can't be developed; this land has to remain in open space in perpetuity. Peter Lamont (City of Brady) added that no permanent structures can be built but things such as soccer goals can be installed.
    7. A representative from the each county will send a marked-up version of the goals and objectives based on input from other representatives within their county and participating communities. They will send their final version to Laura and Cindy for inclusion in the plan. Laura asked that *any changes or suggestions for goals and objectives should be submitted to the planning team by Monday, April 6, 2015*. Cindy will send out an email reminder. The identified representatives were:
        - Marsha Hardy (San Saba County)
        - Rob Lindsey (Mills County) (Rob was not in attendance but will be informed of his nomination and responsibilities)
        - Clyde Martin and Byron Theodosis (Mason County)
        - Wayne Boultinghouse (Lampasas County)
    8. Laura encouraged attendees after the meeting to review the handout containing sample mitigation goals, objectives, and actions as well as the Mitigation Ideas document from FEMA.

- Laura explained the handout entitled Project Implementation Worksheet, which documents mitigation actions prioritized in the current plan.
    1. Marsha asked about the designation of "PAST". Laura clarified that these actions were carried over from the 2004 plan into the 2011 plan.
    2. Don Hatcher (City of Brownwood) asked if an action stays on the list after it has been completed. Laura explained once completed, the action drops off the list; maintenance is not a mitigation action (for example, cleaning out brush or dredging a river are not mitigation actions).
    3. Laura requested that attendees update the mitigation action status spreadsheet provided in the packet. This includes updating the project status and funding. There is no punitive action from FEMA for "incomplete" or "no longer applicable" mitigation actions update. Going forward, we want only practical, fundable, and implementable mitigation actions for the HMP update. More information on the previous mitigation actions is in the 2011 TCRFC HMP, which is available on the TCRFC website. The Steering Committee members will send their updates to the same points of contact as the goals/objectives update, who will send the complete list to Cindy and Laura for incorporation into the plan. Laura asked that the *updates to the mitigation action table are returned to the team by Monday April 6, 2015.*
- Laura explained that FEMA requires a minimum of two mitigation actions for each hazard profiled in the plan and that they must be unique to each participating community.
    1. There will be community-specific and county-wide mitigation actions. The local jurisdiction prioritizes the community-specific mitigation actions. County-wide mitigation actions will be ranked by all those representing entities within the County.
    2. Mitigation actions must be supported by at least one goal/objective. However, mitigation actions can fall under multiple goals and objectives. Mitigation actions are more likely to be funded if under more than one goal/objective.
    3. These plans are living documents and can be updated as needed. Updated plan needs to be updated formally according to the communities' laws and regulations.
    4. Wayne asked whether each community would have its own plan. Laura explained how the communities and counties are organized under the plan as well as how the mitigation actions need to be updated by each community and county.
- Laura reviewed the critical facilities analysis.
    1. There was a brief discussion on the definition of "Critical Facilities." Laura shared the CRS definition of Critical Facilities because there is no definition of critical facilities in the current regional HMP nor the State of Texas HMP.
    2. Laura explained that she obtained a draft list of critical facilities from FEMA's HAZUS defaults but this list needs to be updated. Laura provided two copies of the lists of critical facilities for each of the participating counties. Laura stated that the counties may have a more complete list of facilities and to add these facilities to the list as necessary. Cindy will send these critical facilities lists out to the contacts via email. Laura asked that the committee *review/update the list and return to Laura in the next six weeks, by May 6, 2015.* The following contacts took copies of the critical facilities lists for their respective counties:

        - Peter Lamont and Anthony Groves for McCullough County (City of Brady)
        - Wayne Boultinghouse for Lampasas County
        - Jodie Kelly and Del Albright for Brown County (City of Brownwood)
        - Clyde Martin for Mason County
        - Marsha Hardy and Al Hamrick for San Saba County.
        - Jodie and Del took the copies of the critical facilities list for Mills County and will give it to Rob Lindsey to revise for Mills County
    3. Laura stated that this updated information is needed to map the critical facilities for each jurisdiction to determine if these facilities are located in high risk areas and how they overlap with hazards. FEMA requires the identification of critical facilities in the HMP. Cindy will provide the mapped information to the counties once completed as this detailed list of critical facilities will not be included in the HMP.
- Laura reviewed the next steps: (1) capabilities assessment; (2) hazard analysis; and (3) community participation and survey.
    1. Laura provided an overview of the capabilities assessment. Jeremy Kaufman is Tetra Tech's lead for this portion of the plan. He will be contacting each of the participating jurisdictions. Tetra Tech will initiate online research and then contact the local communities to further document and verify the current resources of each county/community. This is used to determine the strengths and opportunities related to the community's ability to implement the future mitigation actions.
    2. Halff Associates will conduct the hazards analysis in the next few months. During the next (second) meeting, the results of the hazards analysis will be presented and the attendees will rank these hazards during the meeting. Laura reviewed the ranking of high/medium/low and how there can be discrepancies of ranking between nearby communities. Marsha asked whether the man-made hazards currently on the hazards analysis list would be excluded in the new list. Laura confirmed that man-made hazards ("pipeline" and "HAZMAT") would not be included in the future plan. Jodie asked why critical facilities with hazardous materials are on the critical facilities list if HAZMAT is a man-made concern. Laura explained that if a natural hazard could affect a critical facility then it needs to be included on the critical facilities list. Don asked about the opportunity to correct the hazard ranking list. Laura confirmed this list will be updated before the second meeting, and reviewed during the meeting.
    3. Laura discussed how community participation (including the online survey) is an integral part of this HMP update process. Laura discussed the benefits of full community participation in order to produce a true community plan.
        - The online surveys are already live and consists of 35 questions. There are separate surveys for each county. The survey were set up for community input; the links to the surveys were provided in the handout packets.
        - Need to get the word out into the communities. Suggest to put on local websites, TCRFC's website, mention in meetings, post announcement, word of mouth, etc.
        - Jodie asked if they can provide paper copies of the completed survey. Laura said yes paper copies of the survey can be filled out and sent to her.
        - Laura passed out copies of the online survey.

        - The surveys will be active for several months.
- Laura reviewed the action items for the Steering Committee members, including:
    1. Review/update goals and objectives by April 6, 2015
    2. Update mitigation action table with current status of actions by April 6, 2015
    3. Publicize community survey link to community through website posting and other media
    4. Community points of contact will review and update as necessary the list of critical facilities and return to Laura in 6 weeks, by May 6, 2015
- The date for the next (second) meeting of the Steering Committee has not been determined but is anticipated to be in early June. The third meeting will be in the early fall. Meeting details will be forthcoming.
- Adjournment

Lampasas, Mason, Mills, and San Saba Counties

and the Cities of Brady and Brownwood

Hazard Mitigation Plan Updates

Steering Committee 2nd Meeting

Tuesday, June 30, 2015

<u>Agenda</u>

1. Welcome and Introductions
2. Reminder: What is Hazard Mitigation and Why?
3. Reminder: Steering Committee Purpose and Responsibilities
4. Review of Completed Items
    a. Final Goals and Objectives (in packet)
    b. Updated Mitigation Actions (in packet)
    c. Capabilities Assessment
5. Hazard Analysis
    a. Community Participation and Survey Results (in packet)
    b. Hazard Analysis Review
    c. Hazard Ranking Exercise (in packet)
6. Mitigation Action Worksheet (in packet)
7. Next Meeting Date- September 8, 2015
8. Adjournment

TEXAS COLORADO RIVER FLOODPLAIN COALITION

Hazard Mitigation Group	Last Name	First Name	County	Organization	Title	Sign In	Date
3A	Groves	Anthony	McCulloch	City of Brady			6/30/2015
3A	Lamont	Peter	McCulloch	City of Brady	Director of Community Services	[illegible]	6/30/2015
3A	Minor	James	McCulloch	City of Brady	City Manager		6/30/2015
3A	Mosier	Joe	McCulloch	City of Brady	Airport Manager/ FPA		6/30/2015
3A	Neal	Danny	McCulloch	City of Brady	Judge		6/30/2015
	DANIEL	Lyle	McCulloch	City of Brady	Fire/EMS/EM	Lyle Daniel	6/30/2015
							6/30/2015
							6/30/2015
3A	Albright	Del	Brown	City of Brownwood			6/30/2015
3A	Hatcher, P.E.	Donald	Brown	City of Brownwood	Division Director of Public Works/City Engineer	Donald R Hatcher	6/30/2015
3A	Haynes	Stephen	Brown	City of Brownwood	Mayor		6/30/2015
3A	Kelly	Jodie	Brown	City of Brownwood	Engineering Asst/ GIS Coord.	Jodie Kelly	6/30/2015
							6/30/2015
							6/30/2015
							6/30/2015
3A	Bouse	Lynn	Mills	City of Goldthwaite	Alderman		6/30/2015
3A	Cagle	Ronald	Mills	City of Goldthwaite	Operations Manager		6/30/2015
3A	Lindsey	Robert	Mills	City of Goldthwaite	City Manager	[illegible]	6/30/2015
3A	McMahan	Mike	Mills	City of Goldthwaite	Mayor		6/30/2015
3A	Rountree	Bobby	Mills	City of Goldthwaite	City Manager		6/30/2015

Hazard Mitigation Group	Last Name	First Name	County	Organization	Title	Sign In	Date
							6/30/2015
							6/30/2015
3A	Cook	Paul	Lampasas	City of Kempner	Mayor		6/30/2015
3A	Davis	Trudy	Lampasas	City of Kempner	City Secretary		6/30/2015
3A	Bierschwale	Wanda	Lampasas	City of Lampasas	Mayor Pro-tem		6/30/2015
3A	Ellis ~~Bunting~~	Bryan ~~Jerry~~	Lampasas	City of Lampasas	Building Official ~~Inspector~~	Bryan Ellis	6/30/2015
3A	deGraffenried	Finley	Lampasas	City of Lampasas	City Manager		6/30/2015
3A	Grayson	Jerry	Lampasas	City of Lampasas	Mayor		6/30/2015
3A	Oestreich Oestrich	Reece	Lampasas	City of Lampasas	~~Interim~~ Fire Chief	[illegible]	6/30/2015
3A	Kirby	Cynthia	Lampasas	City of Lometa	Mayor		6/30/2015
3A	Taylor	Vicki	Lampasas	City of Lometa	City Secretary		6/30/2015
							6/30/2015
							6/30/2015
							6/30/2015
3A	Collins	Lindsey	Mason	City of Mason	Judge	Lindsey Collins	6/30/2015
3A	Hinckley	Brent	Mason	City of Mason	Mayor		6/30/2015
3A	Palacio	John	Mason	City of Mason	City Manager		6/30/2015
	STARKS	Thomas	Mason	~~Flood~~ Mason Co	Flood Plain		6/30/2015
	Kothman	Keyla	Mason	City of Mason	Intern of City managment	Keyla Kothman	6/30/2015
							6/30/2015

Hazard Mitigation Group	Last Name	First Name	County	Organization	Title	Sign In	Date
3A	Hamrick	Al	San Saba	City of San Saba	Floodplain Administrator	[illegible]	6/30/2015
3A	Jordan	Ken	San Saba	City of San Saba	Mayor		6/30/2015
3A	Maultsby	Sabrina	San Saba	City of San Saba	City Secretary		6/30/2015
3A	Weik	Stan	San Saba	City of San Saba	City Manager		6/30/2015
3A	Yarbrough	Wayne	San Saba	City of San Saba	Water Superintendent		6/30/2015
	Maldonado	Misty	San Saba	City of San Saba	Sgt. San Saba PD	Misty Maldonado	6/30/2015
							6/30/2015
							6/30/2015
3A	Boultinghouse	Wayne	Lampasas	Lampasas County	Judge		6/30/2015
3A	Rainwater	Angela	Lampasas	Lampasas County	Emergency Management Coordinator	Angela Rainwater	6/30/2015
							6/30/2015
							6/30/2015
							6/30/2015
3A	Bearden	Jerry	Mason	Mason County	County Judge		6/30/2015
3A	Martin	Clyde	Mason	Mason County	Emerg Mgmt	Clyde Martin	6/30/2015
3A	Starks	Tommy	Mason	Mason County	Floodplain Administrator	[illegible]	6/30/2015
3A	Toeppich	Stanley	Mason	Mason County	Commissioner		6/30/2015
							6/30/2015
							6/30/2015
							6/30/2015

Hazard Mitigation Group	Last Name	First Name	County	Organization	Title	Sign In	Date
3A	Dibrell	Shawn	Mills	Mills County	EMC/FPA		6/30/2015
3A	Fulk	Kirkland	Mills	Mills County	Judge		6/30/2015
3A	Hammonds	Clint	Mills	Mills County	EMC/FPA		6/30/2015
3A	Lewis	Shaye	Mills	Mills County	Coordinator		6/30/2015
							6/30/2015
							6/30/2015
							6/30/2015
3A	Hardy	Marsha	San Saba	San Saba County	EMC/FPA		6/30/2015
3A	Lusty	Rickey	San Saba	San Saba County	Commissioner		6/30/2015
3A	Theodosis	Byron	San Saba	San Saba County	County Judge		6/30/2015
	Maldonado	Misty	San Saba	City			

Lampasas, Mason, Mills, and San Saba Counties and Cities of Brady and Brownwood, TX

Hazard Mitigation Plan Update
Steering Committee Meeting – Meeting Notes
Tuesday, June 30, 2015

- Welcome and Introductions – Mickey Reynolds (Texas Colorado River Floodplain Coalition [TCRFC]) welcomed everyone and introduced Laura Johnston (Tetra Tech). Each member of the Committee was provided a folder with handouts and a copy of the presentation slides.
    - TCRFC Annual Meeting is July 31.
    - Laura distributed a spreadsheet and instructions to attendees to document their time for these meetings for the in-kind 25% soft match. She explained what time should be included.
    - Laura introduced the rest of the team present today from Halff Associates and Tetra Tech.
    - All attendees introduced themselves.
- Ms. Johnston reviewed the purpose of the mitigation plan update, FEMA requirements, and the benefits to the counties and participating municipalities.
    - Ms. Johnston stated that the plan needed to be reviewed annually and updated every 5 years to remain compliant with the Federal Disaster Mitigation Act.
    - Laura provided an overview of the mitigation plan process, FEMA requirements, and the benefits to the counties and participating communities. Laura stated that a partnership with FEMA and the state is important to the planning and implementation of the HMP.
    - Laura explained that while the previous 2011 plan included many counties in the region, FEMA now requires that each county create their own plan. The TCRFC counties were separated into three groups. The counties and cities in today's meeting are a part of Group 2. The other counties and groups are shown on the TCRFC fact sheet.
- Ms. Johnston reviewed the purpose and responsibilities of the Steering Committee, Planning Partners, and Signators. Each Planning Partner must formally adopt the plan.
- Ms. Johnston directed the attendees to look at the handout with the mitigation goals and objectives that were identified during the kick-off meeting and finalized by after receiving input from the Steering Committee.
- Ms. Johnston directed attendees to the mitigation actions handout. She said if the jurisdiction's information is missing then the consultants didn't receive information from the jurisdiction. She asked attendees from those communities to fill out the sheet today during the meeting and give to Ms. Johnston by the end of today's meeting. There are no punitive repercussions if the actions are marked as no longer needed, delayed, or no action. Mason County, City of Brady, and San Saba County need to complete the worksheet today during the meeting. Ms. Johnston stated that each mitigation action identified in the plan would need to directly relate to one or more of the objectives.

- Capability Assessment – Ms. Johnston said this is required element per FEMA. Most jurisdictions should have received a call from Tetra Tech asking questions for this assessment. Jeremy Kaufman (Tetra Tech) still needs to reach some jurisdictions. Ms. Johnston asked attendees to please respond to Mr. Kaufman if he contacts them.
- Ms. Johnston reviewed the hazard analysis including: community participation survey results (included in the packet); hazard analysis review; hazard ranking exercise (included in the packet); and the anticipated outcome for each jurisdiction.
    - The survey will be open for approximately another month since some jurisdictions did not have any survey results.
    - Ms. Johnston read out loud some of the survey feedback. She passed out feedback results to the City of Lampasas, Mason County, San Saba County, and City of Brownwood. She encouraged attendees to review the results and look at what hazards are highlighted by the citizens.
- Cindy Engelhardt (Halff Associates) presented a summary of the hazard identification and risk assessment that will be included in the plan. The hazard assessments include identification of areas at risk from the hazard, historical occurrences, damage projections, and historical damages. More detailed information for each jurisdiction are provided in the packets.
- Two sources were used to help with the hazard profile and risk assessment:
    - HAZUS was used to run profiles for the jurisdiction for each hazard.
    - Historical records and information (mostly from NOAA) was used to estimate risk from various hazards
- For each hazard exposed value, estimated loss value and annualized percentage of loss are included for each hazard.
- **Floods** - Ms. Engelhardt reviewed the flood hazard. Floodplain maps (digitized information) were used as available. She presented the 1% annual-chance floodplain and 0.2% annual-chance floodplain information for each community. She presented the structure count inside the floodplains. However the structure count may be inaccurate since it is from HAZUS. The structures are categorized by residential, commercial and other. "Other" includes schools, agricultural structures, churches, government buildings, and other structures. She presented tables listing estimated risk in total percentage of assessed value in the floodplain and estimated losses (exposed value).
- **Hurricanes and Tropical Storms** – HAZUS has information on the paths of these storms for over 100 years. The HMPs will include in the text portion of the plan information from recent events. Loss estimates for exposed values have been compiled for the communities.
- **Dams and Levees** – USACE National Dam Inventory data was used for this hazard analysis. Ms. Engelhardt and Ms. Johnston encouraged attendees if they know of dams not listed to provide that information so this can be included and updated for the plan. The National Dam Inventory is not a complete listing of dams in the U.S.
- **Drought and Extreme Temperatures** – Ms. Engelhardt showed how drought map for Texas has changed significantly since March 2012 (one of the worst droughts in recent history). She cautioned that because Texas is out of drought, the state is still at risk of drought. Agricultural losses due to drought are the largest consideration for this hazard.
- **Severe Weather – Hail, Winds, Thunderstorm** - This hazard was analyzed using NOAA historical records. Because the risks are being calculated off of historic information and based on documented insurance claims and reported damages, this must be considered going forward. Because some people don't report damages from these hazards, the reported losses may be underrepresented.
- **Tornado** – Two scales (Fujita and Enhanced Fujita Scales) are used. Angela Rainwater (Lampasas County) said there was no record of tornado in City of Lampasas but it is listed in the packet. Ms. Engelhardt said the information was from NOAA and was from decades ago and was probably considered high wind event.
- **Wildfire** - Data from TXWRAP, CWP and other sources were used for wildfire hazard analysis. This is based on last 35 years of record. Tables based on TXWRAP list and ranks the population at risk to wildfire. Because many people don't report damage from fires, this estimated exposed value, this is likely underestimated.
- **Earthquake** – There are fault lines running through this area.
- **Winter Weather** – Information is taken from NOAA and is based on damages from snow and ice.

- **Summary of Hazards** – Ms. Engelhardt reviewed the hazard summary matrix including the values within each hazard.
- Ms. Johnston explained the hazard ranking exercise. This needs to be filled out for each community/jurisdiction. Ms. Johnston explained that FEMA and the State of Texas requires that all hazards must be profiled. She encouraged careful consideration for ranking. For example, thunderstorms have a high probability for occurring but the impact and dollar value loss may not be considered high.
    - The attendees spent approximately 15 minutes ranking the hazards for their community.
    - Marsha asked if an attendee represents more than one jurisdiction, should the ranking be combined into one form. Ms. Johnston explained she needs one sheet for each jurisdiction so they cannot be combined.
    - Ms. Johnston explained that need to assess all hazards and consider the cyclical nature of these hazards over a 5-year period, despite the current conditions.
- Mitigation Action Worksheet – Ms. Johnston reviewed the mitigation action worksheet that Bryan McNamara (Halff Associates) will send via email. Ms. Johnston clarified the process and the information necessary for each proposed action. Two mitigation actions are required for each hazard. If you rank a hazard as "not applicable" then actions are not necessary but the State of Texas can refute this ranking. This needs to be filled out and sent back to Ms. Johnston by July 31, 2015.
    - Some mitigation action may cover multiple hazards. For example, education and outreach on emergency management (aka what to do when a siren goes off), or obtain funding to build a new EOP would apply to many or all hazards.
    - Three potential alternatives are required by FEMA. Potential alternatives don't have to be pre-engineered, researched, etc. One alternative can be "no action."
    - Mitigation actions should be "actionable" actions which are practical, implementable, discrete actions.
    - Mitigation actions have to be specific to the individual community.
    - Mitigation actions are to reduce the exposed to hazards. Maintenance is not a mitigation action. However, wording or phrasing can shift a maintenance or preparedness action into a mitigation action.
    - In-progress mitigation actions can be included in this worksheet.
    - Ms. Johnston reviewed the FEMA-required prioritization worksheet.
    - Ms. Johnston stated that the Steering Committee will review each mitigation action at the next meeting. The mitigation actions will be ranked. The representatives of each municipality will rank only their own actions.
    - Jodie Kelly asked if it is best to start with the previous mitigation actions, existing projects.
    - Marcia Hardy (San Saba County) asked if the mitigation actions correlate with the hazard ranking. Ms. Johnston said she will be sending the information on the hazard rankings back to the jurisdictions. However, she explained that two mitigation actions must be developed for all hazards profiled for this plan regardless of the hazard ranking for the community.
    - Ms. Johnston encouraged communities to develop more than two mitigation actions, especially with high ranked hazards.
- Ms. Johnston collected all completed timesheets that have been filled out.
- Ms. Johnston discussed action items for the committee to complete and return to her before the next Steering Committee meeting. Ms. Engelhardt will provide the necessary documents and forms to meeting participants by email after the meeting. Action items include:
    - Capabilities assessment (please be responsive to Jeremy Kaufman if he contacts you)

    - List of mitigation actions for each community or municipality (completed and returned to Ms. Johnston by July 31, 2015)
- The date for the next meeting of the Steering Committee is set for September 8, 2015, from 9:00 to 11:00 AM.
- Adjournment

Lampasas, Mason, Mills, and San Saba Counties

and the Cities of Brady and Brownwood

Hazard Mitigation Plan Update

Steering Committee Meeting 3

Tuesday, September 8, 2015

9:00 AM

Agenda

- Welcome and Introductions
- Review and Reminders
  - What is Hazard Mitigation?
  - Steering Committee Purpose and Responsibilities
  - Capabilities Assessment
  - Mitigation Goals and Objectives (In Packet)
  - Final Hazard Ranking (In Packet)
- Review of Survey Results (Handouts)
  - Question #24 Results
- Mitigation Actions
  - General Guidelines and Requirements
  - Summary Table (In Packet)
- Review Goals and Objectives – Any Changes Needed?
- Ranking of Mitigation Actions
- Next Steps
- Adjournment

TEXAS COLORADO RIVER FLOODPLAIN COALITION

Group 3A Round 3 Sign-In Sheet

Hazard Mitigation Group	Last Name	First Name	County	Organization	Title	Signature	Date
3A	Albright	Del	Brown	City of Brownwood			9/8/2015
3A	Hatcher, P.E.	Donald	Brown	City of Brownwood	~~Division Director of Public Works/~~City Engineer	Donald R Hatcher	9/8/2015
3A	Haynes	Stephen	Brown	City of Brownwood	Mayor		9/8/2015
3A	Kelly	Jodie	Brown	City of Brownwood	Floodplain Administrator Engineering Asst/ GIS Coord.	Jodie Kelly	9/8/2015
							9/8/2015
							9/8/2015
							9/8/2015
3A	~~Cook~~	~~Paul~~	Lampasas	City of Kempner	Mayor		9/8/2015
3A	Davis	Trudy	Lampasas	City of Kempner	City Secretary		9/8/2015
				City of Kempner	Kempner EMC	Angela Rainwater	9/8/2015
							9/8/2015
3A	Bierschwale	Wanda	Lampasas	City of Lampasas	Mayor Pro-tem		9/8/2015
3A	Bunting	Jerry	Lampasas	City of Lampasas	Building Inspector		9/8/2015
3A	deGraffenried	Finley	Lampasas	City of Lampasas	City Manager		9/8/2015
3A	Grayson	Jerry	Lampasas	City of Lampasas	Mayor		9/8/2015
3A	Oestrich	Reece	Lampasas	City of Lampasas	~~Interim~~ Fire Chief		9/8/2015
				City of Lampasas	Lampasas EMC	Angela Rainwater	9/8/2015
							9/8/2015
							9/8/2015

Group 3A Round 3 Sign-In Sheet

Hazard Mitigation Group	Last Name	First Name	County	Organization	Title	Signature	Date
3A	Daniel	Lyle	McCulloch	City of Brady	Emergency Mgmt	Lyle Daniel	9/8/2015
3A	Groves	Anthony	McCulloch	City of Brady			9/8/2015
3A	Lamont	Peter	McCulloch	City of Brady	Planning Mgmt	[illegible]	9/8/2015
3A	Minor	James	McCulloch	City of Brady	City Manager		9/8/2015
3A	Mosier	Joe	McCulloch	City of Brady	Airport Manager/ FPA		9/8/2015
3A	Neal	Danny	McCulloch	City of Brady	Judge		9/8/2015
3A	Slaughter	Crystal	McCulloch	City of Brady	Asst EM		9/8/2015
							9/8/2015
							9/8/2015
							9/8/2015
3A	Bouse	Lynn	Mills	City of Goldthwaite	Alderman		9/8/2015
3A	Cagle	Ronald	Mills	City of Goldthwaite	Operations Manager		9/8/2015
3A	Lindsey	Robert	Mills	City of Goldthwaite	City Manager	[illegible]	9/8/2015
3A	McMahan	Mike	Mills	City of Goldthwaite	Mayor		9/8/2015
3A	Rountree	Bobby	Mills	City of Goldthwaite	City Manager		9/8/2015
							9/8/2015
							9/8/2015
3A	Dibrell	Shawn	Mills	Mills County	EMC/FPA		9/8/2015
3A	Fulk	Kirkland	Mills	Mills County	Judge		9/8/2015

Group 3A Round 3 Sign-In Sheet

Hazard Mitigation Group	Last Name	First Name	County	Organization	Title	Signature	Date
3A	Kirby	Cynthia	Lampasas	City of Lometa	Mayor		9/8/2015
3A	Taylor	Vicki	Lampasas	City of Lometa	City Secretary		9/8/2015
				City of Lometa	Lometa EMC	Angela Rainwater	9/8/2015
							9/8/2015
3A	Boultinghouse	Wayne	Lampasas	Lampasas County	Judge		9/8/2015
3A	Rainwater	Angela	Lampasas	Lampasas County	Emergency Management Coordinator	Angela Rainwater	9/8/2015
							9/8/2015
							9/8/2015
							9/8/2015
3A	Collins	Lindsey	Mason	City of Mason	Judge	Lindsay Collins	9/8/2015
3A	Hinckley	Brent	Mason	City of Mason	Mayor		9/8/2015
3A	Palacio	John	Mason	City of Mason	City Manager		9/8/2015
							9/8/2015
							9/8/2015
3A	Bearden	Jerry	Mason	Mason County	County Judge		9/8/2015
3A	Martin	Clyde	Mason	Mason County	EMC	Clyde Martin	9/8/2015
3A	Starks	Tommy	Mason	Mason County	Floodplain Administrator	[illegible]	9/8/2015
3A	Toeppich	Stanley	Mason	Mason County	Commissioner		9/8/2015
							9/8/2015

Group 3A Round 3 Sign-In Sheet

Hazard Mitigation Group	Last Name	First Name	County	Organization	Title	Signature	Date
3A	Hammonds	Clint	Mills	Mills County	EMC/FPA	Clint Hammonds	9/8/2015
3A	Lewis	Shaye	Mills	Mills County	Coordinator		9/8/2015
							9/8/2015
							9/8/2015
							9/8/2015
3A	Hamrick	Al	San Saba	City of San Saba	Floodplain Administrator	Al [illegible]	9/8/2015
3A	Jordan	Ken	San Saba	City of San Saba	Mayor		9/8/2015
3A	Maultsby	Sabrina	San Saba	City of San Saba	City Secretary		9/8/2015
3A	Weik	Stan	San Saba	City of San Saba	City Manager		9/8/2015
3A	Yarbrough	Wayne	San Saba	City of San Saba	Water Superintendent		9/8/2015
							9/8/2015
							9/8/2015
							9/8/2015
3A	Hardy	Marsha	San Saba	San Saba County	EMC/FPA	MB Hardy	9/8/2015
3A	Lusty	Rickey	San Saba	San Saba County	Commissioner		9/8/2015
3A	Theodosis	Byron	San Saba	San Saba County	County Judge		9/8/2015
							9/8/2015
							9/8/2015
							9/8/2015

Lampasas, Mason, Mills, and San Saba Counties and
Cities of Brady and Brownwood, TX

Hazard Mitigation Plan Update
Steering Committee Meeting – Meeting Notes
Tuesday, September 8, 2015

- Welcome and Introductions – Mickey Reynolds (Texas Colorado River Floodplain Coalition [TCRFC]) welcomed everyone and introduced the planning team: Cindy Engelhardt (Halff Associates), Laura Johnston (Tetra Tech), and Krista Jack (Tetra Tech). See sign in sheet for a complete list of attendees.
    - Sign-in sheet and timesheets are required and necessary part of getting credit for participating (in-kind) in this project. Cindy handed out the timesheets and Laura requested everyone sign in for today's meeting.
    - Each attendee was provided a folder, tailored to their specific community and county, with handouts, a copy of the presentation slides, and contact information for the planning team.
    - There are more hard copies of the survey if attendees want a copy.
    - This is the last of three meetings. After these series of meetings, the draft plan will be finalized and will be submitted to the State of Texas and subsequently submitted to FEMA. All 16 plans are planned to be submitted to the State of Texas by January 2016.
- Laura reviewed what hazard mitigation is and why this is important; the steering committee purpose and responsibilities; the final mitigation goals and objectives; and the final hazard rankings. Ranking is different than in other states because in Texas you have to develop two mitigation actions regardless of whether a hazard is ranked high, medium, or low. Only "Non Applicable" (NA) ranking is not required to have two mitigation actions. However, if there are too many NA rankings, you will need to defend these rankings to the State of Texas and FEMA reviewers.
    - Marsha Hardy (San Saba County) noted that she was appreciative of Carrie Valentine's (Tetra Tech) efforts to help the jurisdictions through the process.
    - Angela Rainwater (City of Kempner) said that "Dams/Levees" needs to be removed from their spreadsheet since there are no dams or levees present in that jurisdiction. Laura will have this change made.
    - Laura passed out sheets to Mills County (Clint Hammonds) and City of Lometa (Angela Rainwater) that have items that need to be confirmed and sent back to Jeremy Kaufman (Tetra Tech). This information needs to be finalized by the end of the week.

- There were several differences in hazard rankings between the cities and counties. Laura asked the attendees about this and confirmed these differences are accurate since FEMA will likely notice these differences and known justifications are important.
- Don Hatcher (City of Brownwood) noted that distance between the jurisdictions and different counties.

- Laura reviewed the number of responses for each jurisdiction. There were no survey responses for Mills County. Laura encouraged the attendees to review the special comments and read some of the responses, encouraging attendees to review them for possible recommendations for mitigation actions.
- One question from the survey was reviewed in particular: "What types of projects do you believe the county, state, and federal government agencies should be doing in order to reduce damage and disruption from hazard events within your community? Please rank each option as a high, medium, or low priority." Laura reviewed the slides for each jurisdiction and the patterns and anomalies from the various communities. Retrofit infrastructure, and retrofit and strengthen critical facilities are often top priorities.
- Key point from these surveys is to keep in mind what your citizens felt were most important. This will be important when the jurisdictions are prioritizing the mitigation actions later on during this meeting.
- Mitigation Actions – you need a minimum of two actions per ranked hazard (this is a requirement). You can have more than two actions. Mitigation actions can cover multiple hazards. This is encouraged especially on medium and high ranked hazards. Carrie Valentine has been working to get these mitigation actions ready for this meeting. All jurisdictions in this group had mitigation actions to cover all goals and objectives.
- The Mitigation Action Spreadsheet is in the individual folders for each jurisdiction. This lists the projects which attendees will rank during today's meeting. Laura reviewed the significance of each column on the spreadsheet. The action number is simply a reference number, not a ranking number. The mitigation actions from the existing plan were handed out at the first meeting. The jurisdictions had previously marked whether mitigation actions would be carried forward and any actions carried forward are included in this spreadsheet. The priority column is per the mitigation action worksheet scoring that each jurisdiction prepared previously. Each jurisdiction may or may not rank these similar today, based in part on public feedback from survey. If actions are shaded in gray, the action is either integrated, duplicate, or not typically a mitigation action. The estimated cost column is a ballpark figure. FEMA likes to see a combination of short-, medium-, and long-term projects. The responsible party should be a department or agency instead of an individual.
- Laura explained that one mitigation action can cover several hazards. Sometimes Tetra Tech combined several mitigation actions to make them a clearer, actionable action. Laura said if these modifications are not accurate to let Laura know. She reminded the attendees they can update the mitigation action list anytime up until submittal and can also modify the plan at any point after the plan is adopted.
- Mitigation Actions – Ranking Process. Laura instructed the attendees how to rank the mitigation actions with 1 as the highest. Laura asked the jurisdictions to rank numerically all the mitigation actions. Laura asked that each jurisdiction return only one sheet to her at the end of this process.

    - For ranking: Only community representatives can vote for the mitigation actions for that community. For the county, either only the county representatives can vote, or the communities and county representatives can vote. This decision is up to each county.
    - Marsha Hardy asked if they are required to implement the mitigation actions in the order they are ranking them now. Laura said that FEMA requires that mitigation actions are ranked. However, this ranking and order of implementation can change in the future based on changing conditions (funding sources, current disasters, etc.). There is no punitive action if the jurisdiction ends up implementing action #15 before #1 (for example).
    - The attendees broke into small groups. Afterwards, Laura collected all the ranked spreadsheets and said this data would be compiled.
- Next Steps in the Plan Development
    - Between November 13 and December 4 a draft plan will be submitted to the counties for their review. The counties will have two weeks to review and should get comments back to Tetra Tech within that period. Yellow highlighted areas mean there is an information gap that will be filled in. The tight turn-around time was dictated by a schedule set by the lapsing of the existing plan and grant delays. The schedule was not dictated by the TCRFC planning team. Laura reviewed the specific dates the plans will be given to each county.
    - Laura alerted the attendees to watch for an email with a link to an FTP site to download the draft plan.
    - The draft plan will be approximately 350 pages and is based on FEMA requirements. All State of Texas and FEMA requirements must be met in the plan.
    - The State of Texas may ask for clarification or additional questions once reviewed. Therefore, the time it takes for the state to review is outside of the planning team's control.
    - Laura said once the plan is accepted by the State of Texas, it is sent to FEMA for review and approval. Once FEMA approves the plan, the plan is granted an Approval Pending Adoption (APA) status. This letter usually comes from FEMA to the State, and then the State sends the letter to the county top elected official. Once this APA status is granted, there is a 6-month period during which the jurisdiction has to officially review, approve, and adopt the plan. According to current regulations, each participating jurisdiction has to officially adopt the plan. This adoption documentation must be submitted to FEMA within that 6-month period.
    - Marsha Hardy asked about requirements for notification about the approval process. Laura said it is solely based on the local requirements. Peter Lamont (City of Brady) asked if a public meeting or public hearing needs to be conducted. Laura said she would check to see if there was a specific requirement regarding a public hearing versus a public meeting.
    - Don Hatcher asked if the team can possibly get the drafts before that time period due to the Thanksgiving holiday. Laura said if possible to get to the jurisdictions earlier they would.
- Laura thanked all the attendees for coming to these meetings and all the work that the jurisdictions have done during this process. This is the last of three meetings.
- Adjournment

San Saba County Communities, Hazard Mitigation Plan

Public Involvement/Participation

A partnership of local governments and other stakeholders in San Saba County are working together to create a San Saba County Hazard Mitigation Plan. Community input and involvement is instrumental in the development of a mitigation plan update that truly reflects the perceptions and needs of San Saba County residents.

We have developed a community survey and would like as much input from San Saba County residents, businesses, and interested citizens as possible. Please take a few minutes to fill out this survey so that your ideas may become a part of the plan to make San Saba County a safer and more resilient county!

Community Survey Link:

https://www.surveymonkey.com/s/SanSabaCountyHMPCommunitySurvey

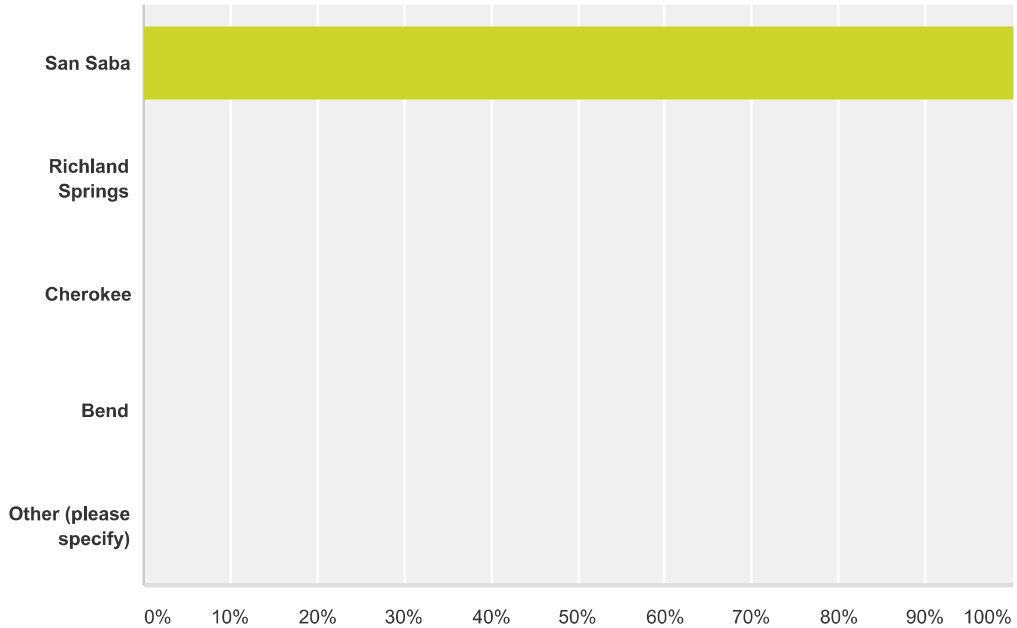
If you have any questions, please don't hesitate to contact:

Laura Johnston at laura.johnston@tetratech.com or 303-312-8807

TEXAS COLORADO RIVER FLOODPLAIN COALITION

Q1 Where in San Saba County do you live?

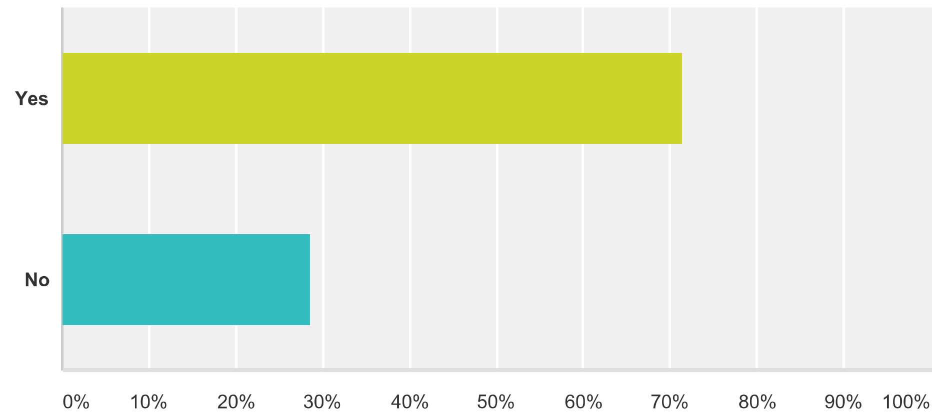
Answered: 8   Skipped: 0



Answer Choices	Responses	
San Saba	**100.00%**	8
Richland Springs	**0.00%**	0
Cherokee	**0.00%**	0
Bend	**0.00%**	0
Other (please specify)	**0.00%**	0
Total		**8**

Q2 Do you work in San Saba County?

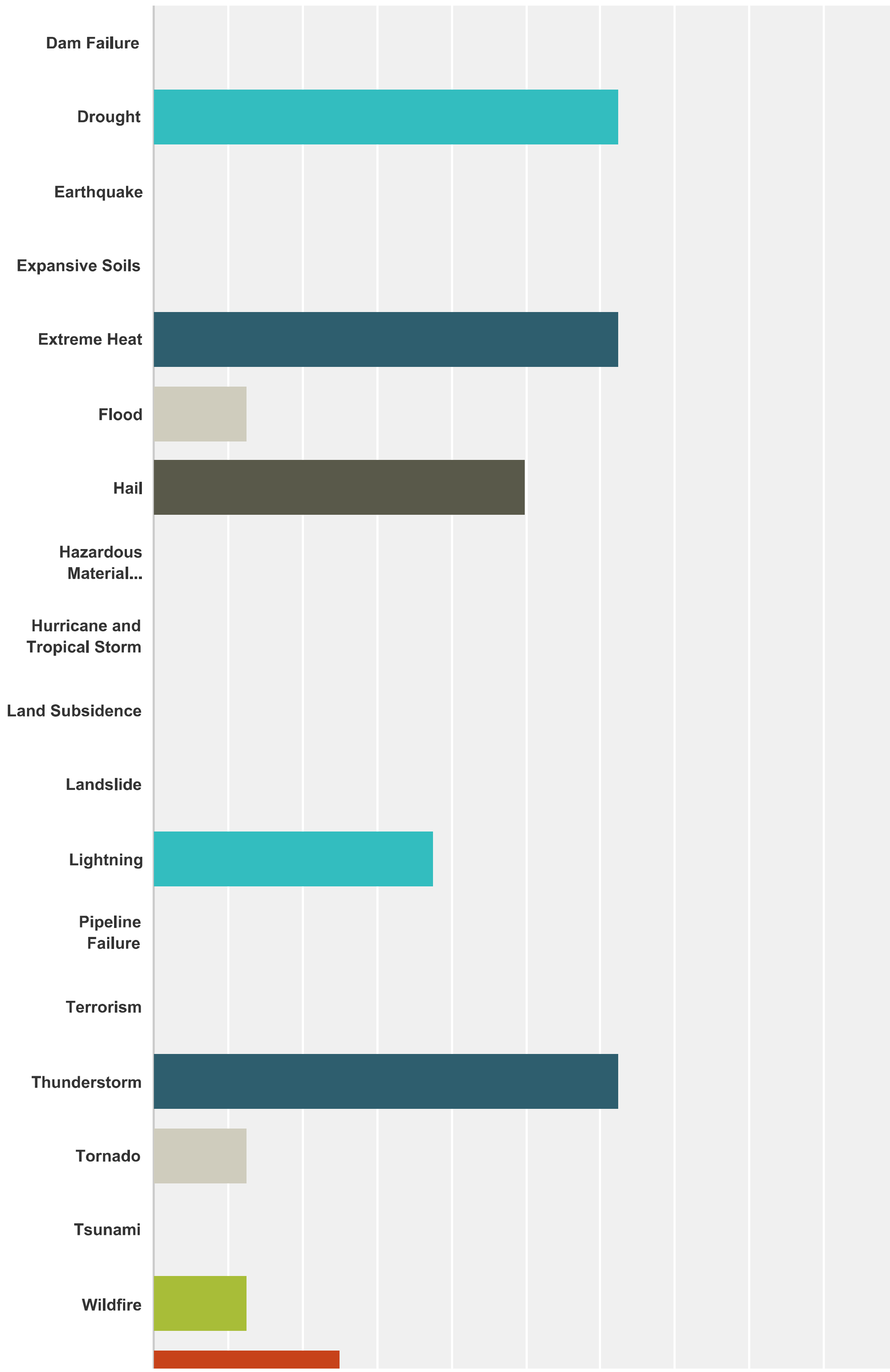
Answered: 7   Skipped: 1

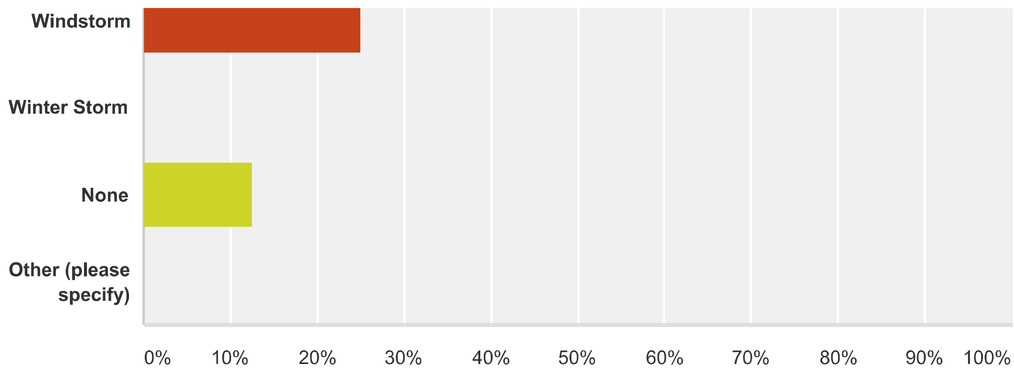


Answer Choices	Responses	
Yes	**71.43%**	5
No	**28.57%**	2
Total		**7**

Q3 Which of the following hazard events have you or has anyone in your household experienced in the past 20 years within San Saba County? (Check all that apply)

Answered: 8 Skipped: 0

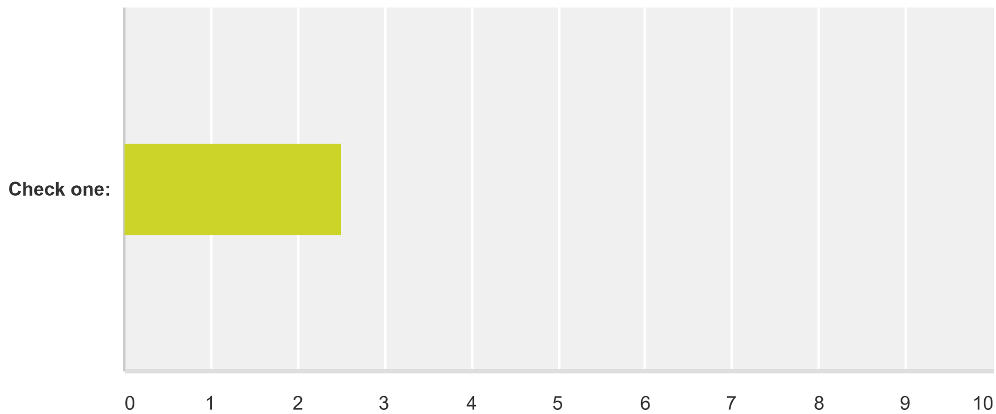




Answer Choices	Responses	
Dam Failure	0.00%	0
Drought	62.50%	5
Earthquake	0.00%	0
Expansive Soils	0.00%	0
Extreme Heat	62.50%	5
Flood	12.50%	1
Hail	50.00%	4
Hazardous Material Release	0.00%	0
Hurricane and Tropical Storm	0.00%	0
Land Subsidence	0.00%	0
Landslide	0.00%	0
Lightning	37.50%	3
Pipeline Failure	0.00%	0
Terrorism	0.00%	0
Thunderstorm	62.50%	5
Tornado	12.50%	1
Tsunami	0.00%	0
Wildfire	12.50%	1
Windstorm	25.00%	2
Winter Storm	0.00%	0
None	12.50%	1
Other (please specify)	0.00%	0
Total Respondents: 8		

Q4 How prepared is your household to deal with a natural hazard event?

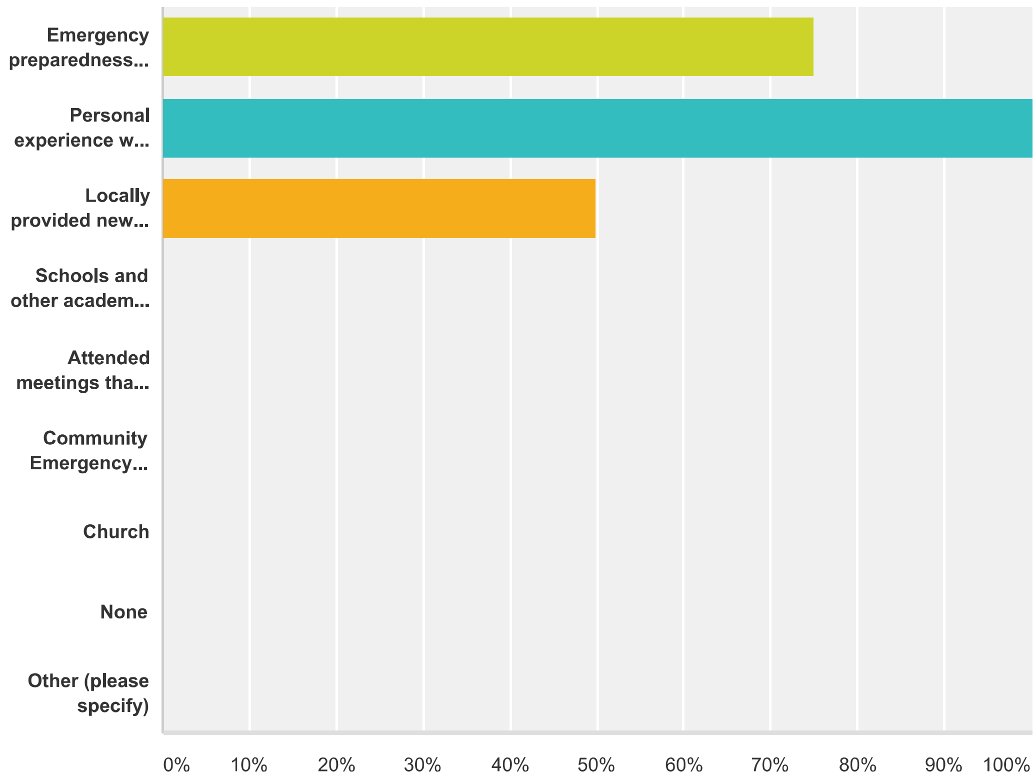
Answered: 4 Skipped: 4



	Not at all prepared	Somewhat prepared	Adequately prepared	Well prepared	Very well prepared	Total	Weighted Average
Check one:	**25.00%** 1	**50.00%** 2	**0.00%** 0	**0.00%** 0	**25.00%** 1	4	2.50

Q5 Which of the following have provided you with useful information to help you be prepared for a natural hazard event? (Check all that apply)

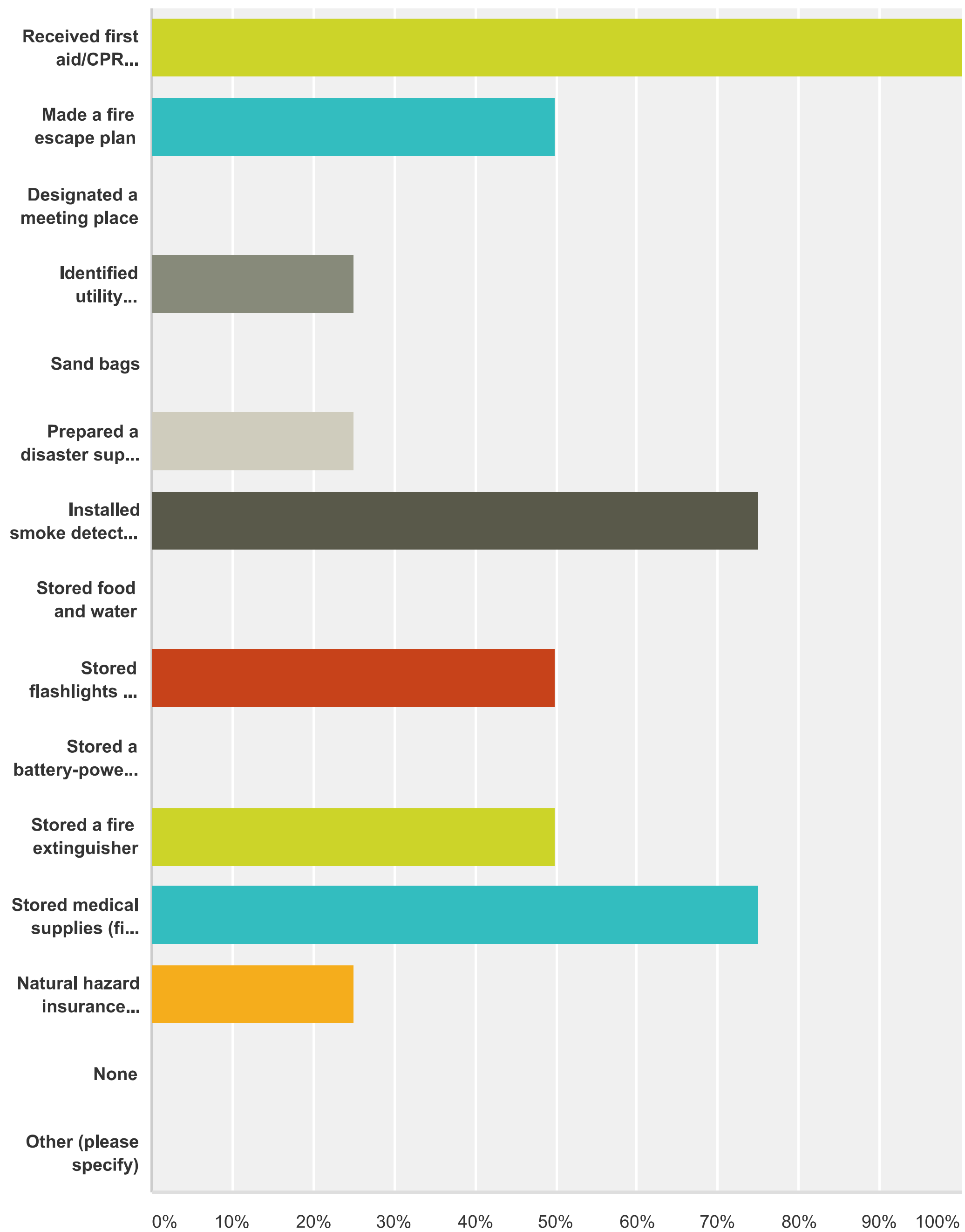
Answered: 4   Skipped: 4



Answer Choices	Responses	
Emergency preparedness information from a government source (e.g., federal, state, or local emergency management)	**75.00%**	3
Personal experience with one or more natural hazards/disasters	**100.00%**	4
Locally provided news or other media information	**50.00%**	2
Schools and other academic institutions	**0.00%**	0
Attended meetings that have dealt with disaster preparedness	**0.00%**	0
Community Emergency Response Training (CERT)	**0.00%**	0
Church	**0.00%**	0
None	**0.00%**	0
Other (please specify)	**0.00%**	0
Total Respondents: 4		

Q6 Which of the following steps has your household taken to prepare for a natural hazard event? (Check all that apply)

Answered: 4 Skipped: 4

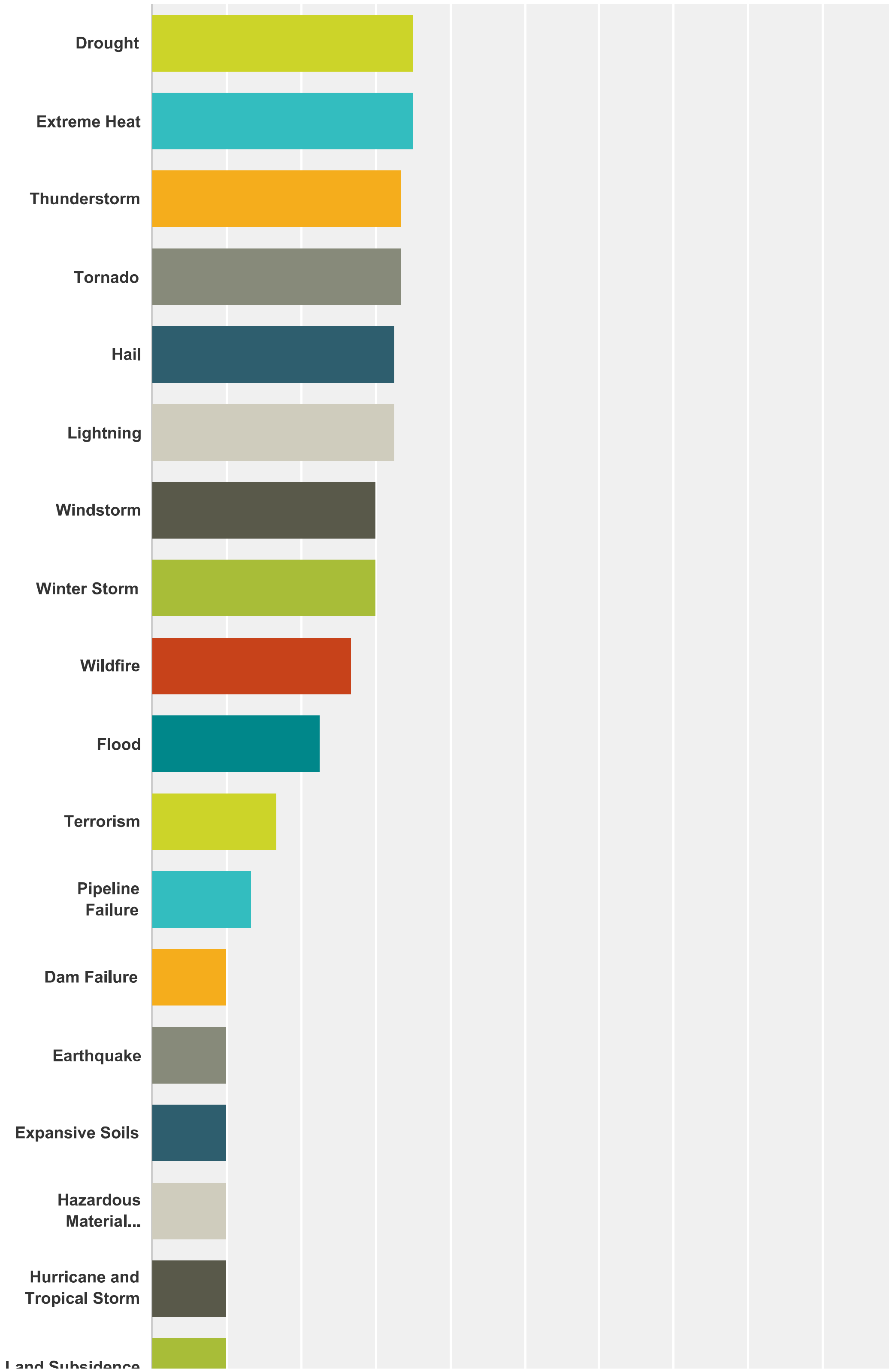


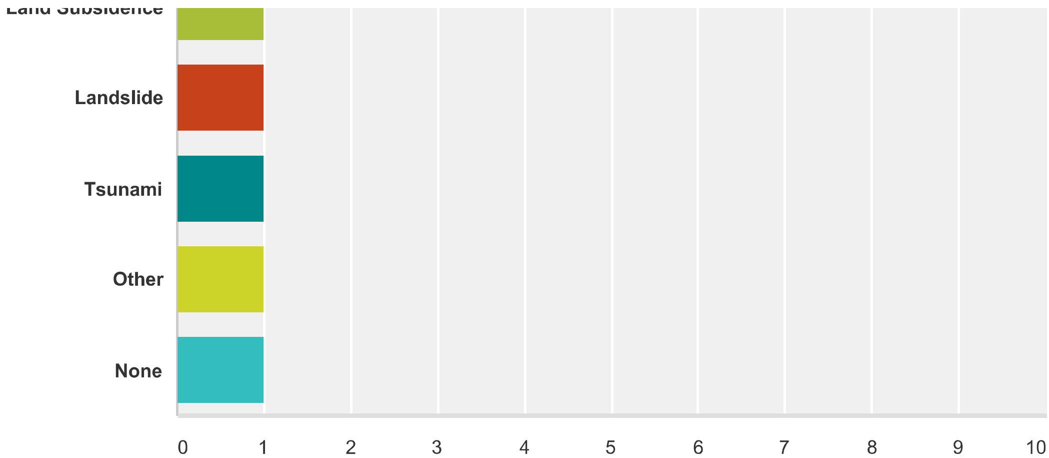
Answer Choices	Responses	
Received first aid/CPR training	100.00%	4
Made a fire escape plan	50.00%	2
Designated a meeting place	0.00%	0

Identified utility shutoffs	**25.00%**	1
Sand bags	**0.00%**	0
Prepared a disaster supply kit	**25.00%**	1
Installed smoke detectors on each level of the house	**75.00%**	3
Stored food and water	**0.00%**	0
Stored flashlights and batteries	**50.00%**	2
Stored a battery-powered radio	**0.00%**	0
Stored a fire extinguisher	**50.00%**	2
Stored medical supplies (first aid kit, medications)	**75.00%**	3
Natural hazard insurance (Flood, Earthquake, Wildfire)	**25.00%**	1
None	**0.00%**	0
Other (please specify)	**0.00%**	0
Total Respondents: 4		

Q7 How concerned are you about the following natural hazards in San Saba County? (Check one response for each hazard)

Answered: 4 Skipped: 4



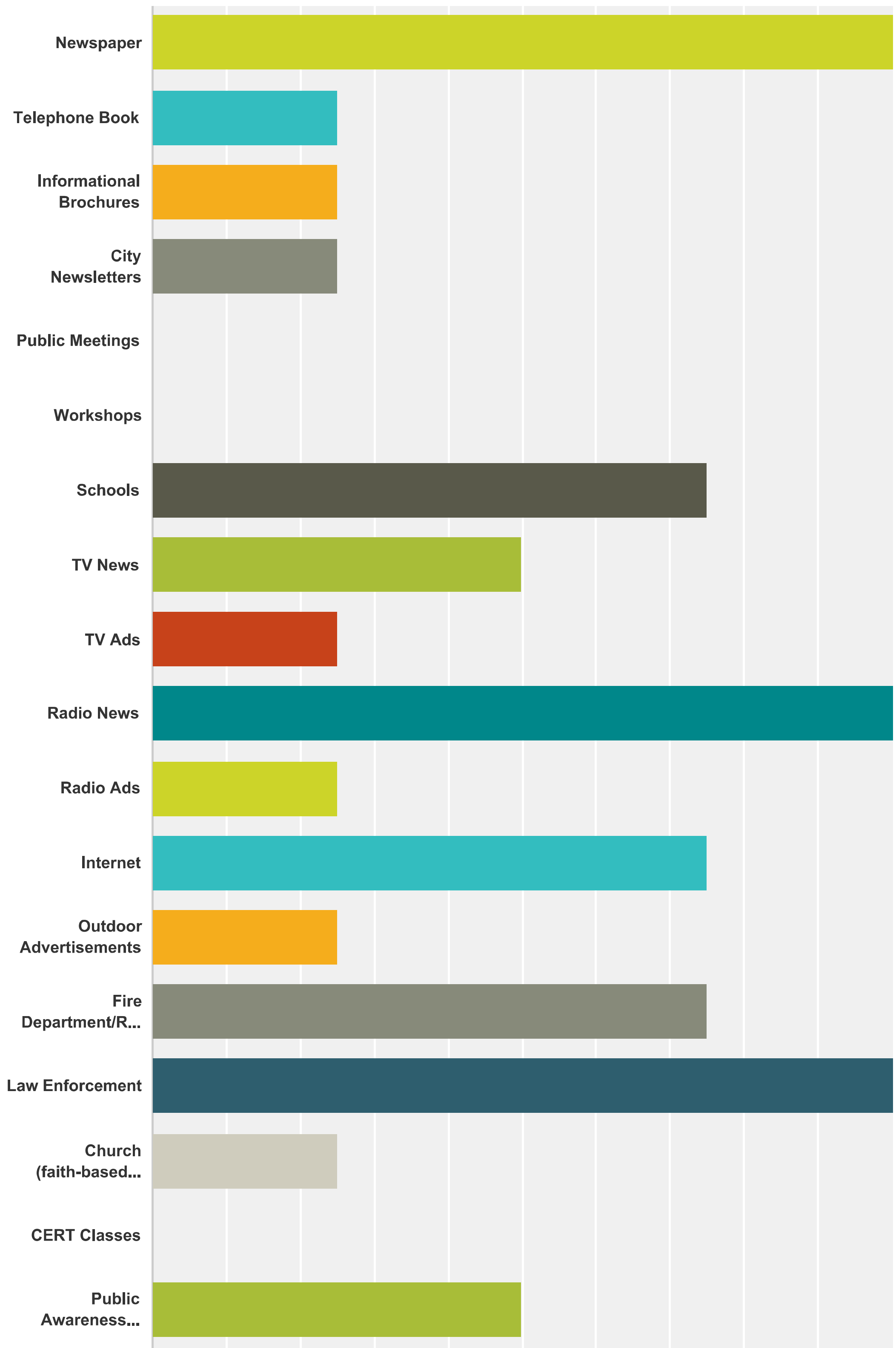


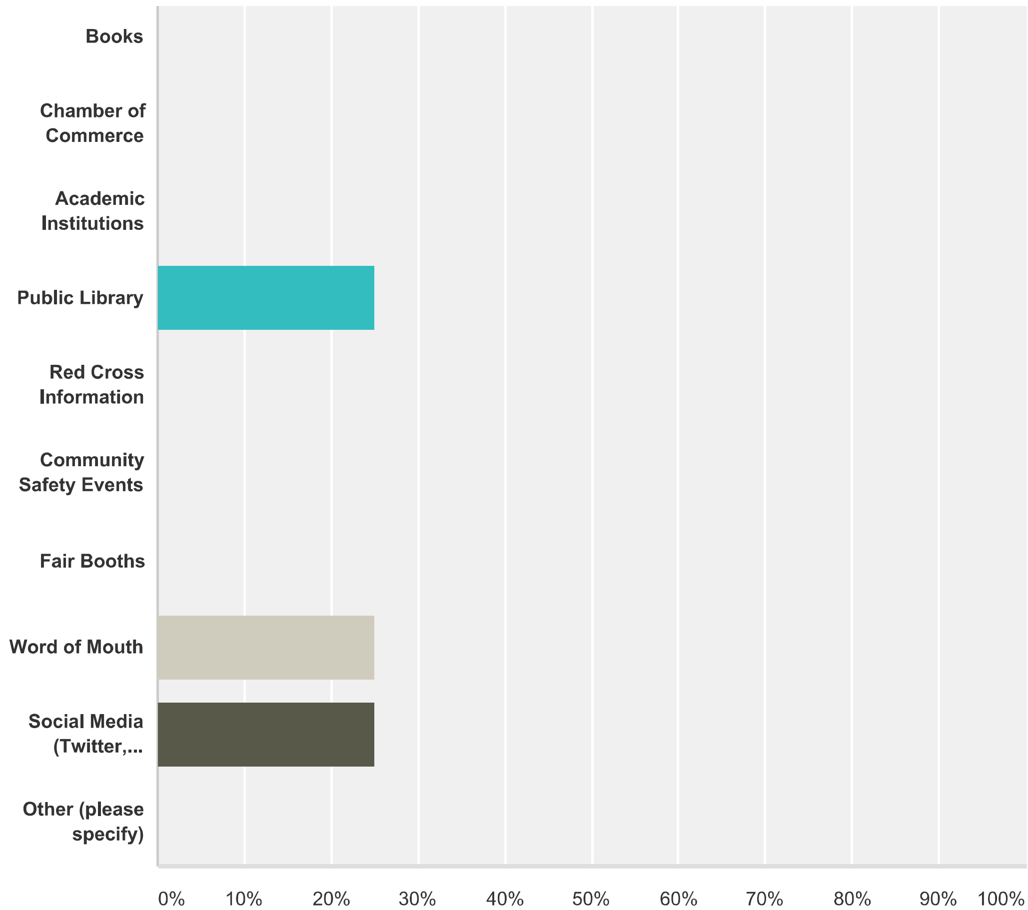
	Not Concerned	Somewhat Concerned	Concerned	Very Concerned	Extremely Concerned	Total	Weighted Average
Drought	**0.00%** 0	**25.00%** 1	**25.00%** 1	**25.00%** 1	**25.00%** 1	4	3.50
Extreme Heat	**25.00%** 1	**0.00%** 0	**0.00%** 0	**50.00%** 2	**25.00%** 1	4	3.50
Thunderstorm	**0.00%** 0	**33.33%** 1	**33.33%** 1	**0.00%** 0	**33.33%** 1	3	3.33
Tornado	**0.00%** 0	**33.33%** 1	**33.33%** 1	**0.00%** 0	**33.33%** 1	3	3.33
Hail	**0.00%** 0	**50.00%** 2	**0.00%** 0	**25.00%** 1	**25.00%** 1	4	3.25
Lightning	**0.00%** 0	**50.00%** 2	**0.00%** 0	**25.00%** 1	**25.00%** 1	4	3.25
Windstorm	**0.00%** 0	**66.67%** 2	**0.00%** 0	**0.00%** 0	**33.33%** 1	3	3.00
Winter Storm	**0.00%** 0	**66.67%** 2	**0.00%** 0	**0.00%** 0	**33.33%** 1	3	3.00
Wildfire	**33.33%** 1	**33.33%** 1	**0.00%** 0	**0.00%** 0	**33.33%** 1	3	2.67
Flood	**25.00%** 1	**50.00%** 2	**0.00%** 0	**25.00%** 1	**0.00%** 0	4	2.25
Terrorism	**66.67%** 2	**0.00%** 0	**33.33%** 1	**0.00%** 0	**0.00%** 0	3	1.67
Pipeline Failure	**66.67%** 2	**33.33%** 1	**0.00%** 0	**0.00%** 0	**0.00%** 0	3	1.33
Dam Failure	**100.00%** 3	**0.00%** 0	**0.00%** 0	**0.00%** 0	**0.00%** 0	3	1.00
Earthquake	**100.00%** 3	**0.00%** 0	**0.00%** 0	**0.00%** 0	**0.00%** 0	3	1.00
Expansive Soils	**100.00%** 3	**0.00%** 0	**0.00%** 0	**0.00%** 0	**0.00%** 0	3	1.00
Hazardous Material Release	**100.00%** 3	**0.00%** 0	**0.00%** 0	**0.00%** 0	**0.00%** 0	3	1.00

Hurricane and Tropical Storm	**100.00%** 3	**0.00%** 0	**0.00%** 0	**0.00%** 0	**0.00%** 0	3	1.00
Land Subsidence	**100.00%** 3	**0.00%** 0	**0.00%** 0	**0.00%** 0	**0.00%** 0	3	1.00
Landslide	**100.00%** 3	**0.00%** 0	**0.00%** 0	**0.00%** 0	**0.00%** 0	3	1.00
Tsunami	**100.00%** 3	**0.00%** 0	**0.00%** 0	**0.00%** 0	**0.00%** 0	3	1.00
Other	**100.00%** 2	**0.00%** 0	**0.00%** 0	**0.00%** 0	**0.00%** 0	2	1.00
None	**100.00%** 1	**0.00%** 0	**0.00%** 0	**0.00%** 0	**0.00%** 0	1	1.00

Q8 Which of the following methods do you think are most effective for providing hazard and disaster information? (Check all that apply)

Answered: 4 Skipped: 4



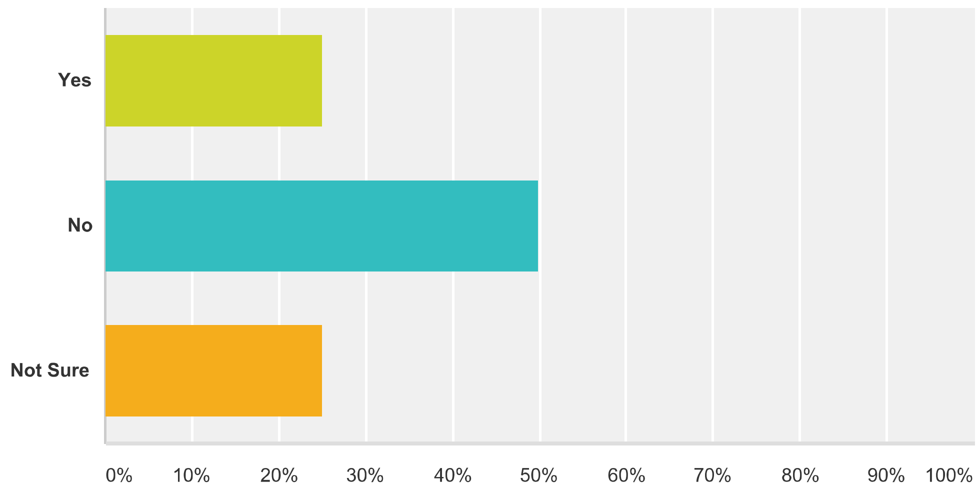


Answer Choices	Responses	
Newspaper	**100.00%**	4
Telephone Book	**25.00%**	1
Informational Brochures	**25.00%**	1
City Newsletters	**25.00%**	1
Public Meetings	**0.00%**	0
Workshops	**0.00%**	0
Schools	**75.00%**	3
TV News	**50.00%**	2
TV Ads	**25.00%**	1
Radio News	**100.00%**	4
Radio Ads	**25.00%**	1
Internet	**75.00%**	3
Outdoor Advertisements	**25.00%**	1
Fire Department/Rescue	**75.00%**	3
Law Enforcement	**100.00%**	4

Church (faith-based institutions)	**25.00%**	1
CERT Classes	**0.00%**	0
Public Awareness Campaign (e.g., Flood Awareness Week, Winter Storm Preparedness Month)	**50.00%**	2
Books	**0.00%**	0
Chamber of Commerce	**0.00%**	0
Academic Institutions	**0.00%**	0
Public Library	**25.00%**	1
Red Cross Information	**0.00%**	0
Community Safety Events	**0.00%**	0
Fair Booths	**0.00%**	0
Word of Mouth	**25.00%**	1
Social Media (Twitter, Facebook, Linkdin)	**25.00%**	1
Other (please specify)	**0.00%**	0
Total Respondents: 4		

Q9 Is your property located in or near a FEMA designated floodplain?

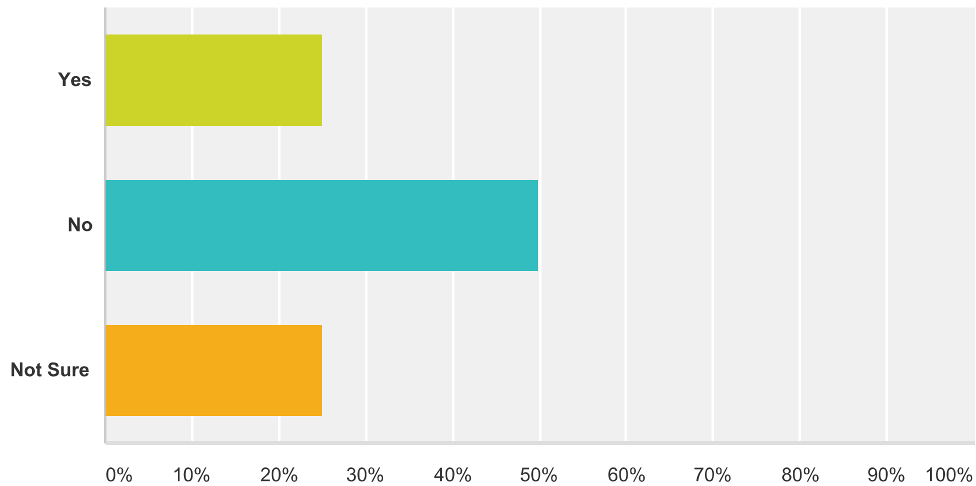
Answered: 4 Skipped: 4



Answer Choices	Responses	
Yes	**25.00%**	1
No	**50.00%**	2
Not Sure	**25.00%**	1
Total		**4**

Q10 Do you have flood insurance?

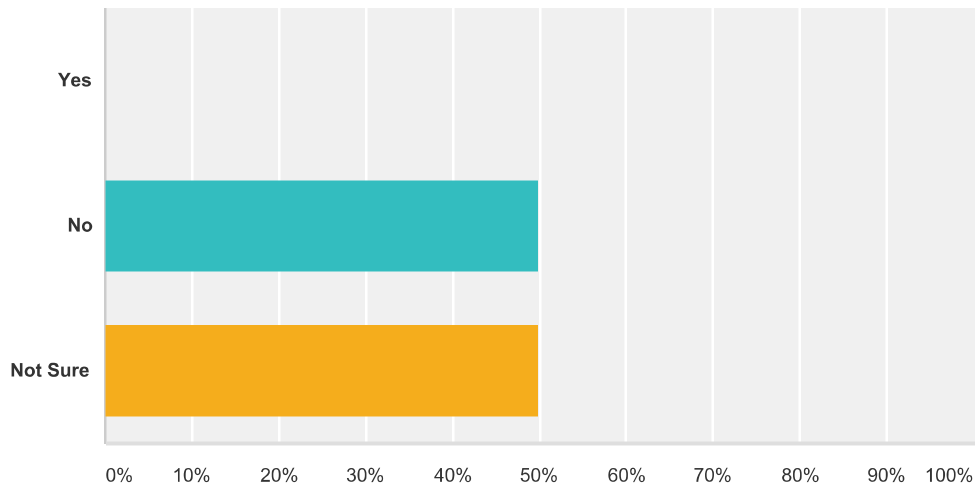
Answered: 4 Skipped: 4



Answer Choices	Responses	
Yes	**25.00%**	1
No	**50.00%**	2
Not Sure	**25.00%**	1
Total		**4**

Q11 Is your property located near an earthquake fault?

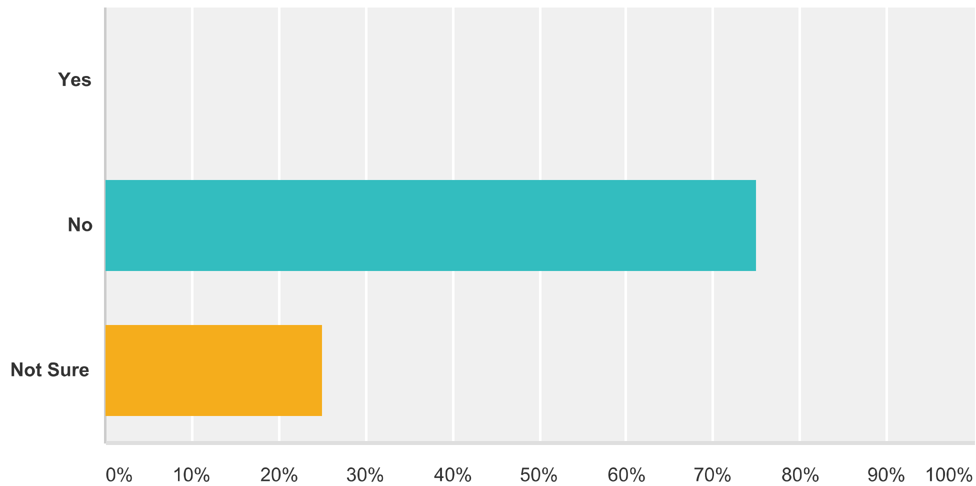
Answered: 4 Skipped: 4



Answer Choices	Responses	
Yes	**0.00%**	0
No	**50.00%**	2
Not Sure	**50.00%**	2
Total		**4**

Q12 Do you have earthquake insurance?

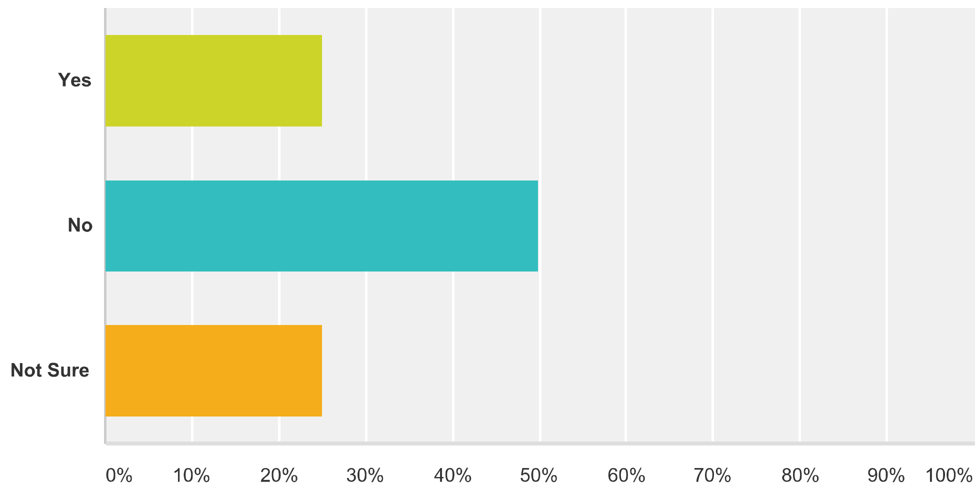
Answered: 4 Skipped: 4



Answer Choices	Responses	
Yes	**0.00%**	0
No	**75.00%**	3
Not Sure	**25.00%**	1
Total		**4**

Q13 Is your property located in an area at risk for wildfires?

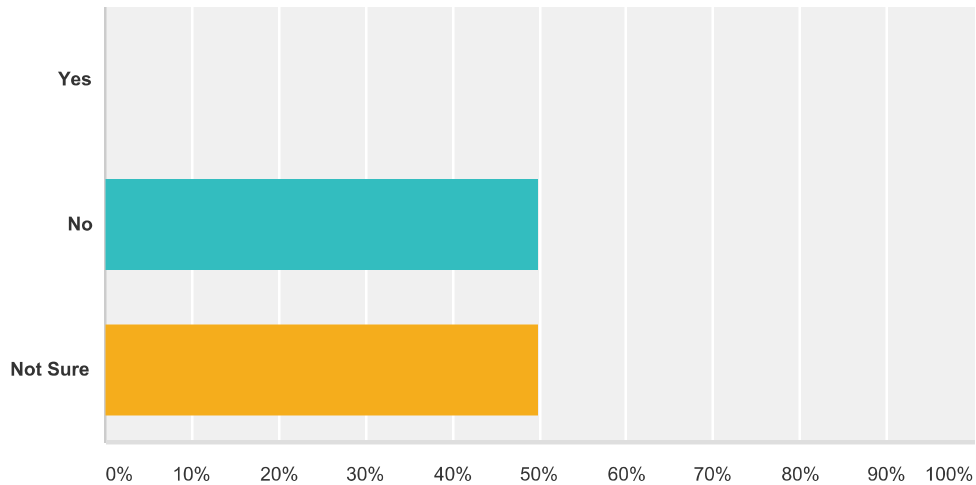
Answered: 4 Skipped: 4



Answer Choices	Responses	
Yes	**25.00%**	1
No	**50.00%**	2
Not Sure	**25.00%**	1
Total		**4**

Q14 Have you ever had problems getting homeowners or renters insurance due to risks from natural hazards?

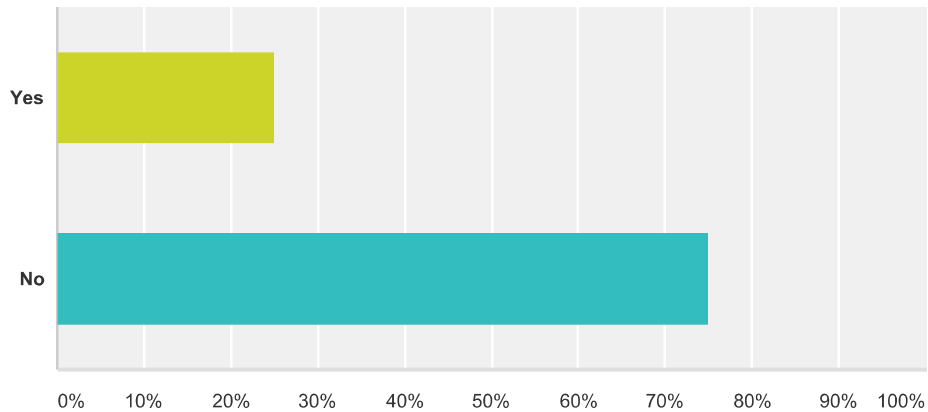
Answered: 4 Skipped: 4



Answer Choices	Responses	
Yes	**0.00%**	0
No	**50.00%**	2
Not Sure	**50.00%**	2
Total		**4**

Q15 Do you have any special access or functional needs within your household that would require early warning or specialized response during disasters?

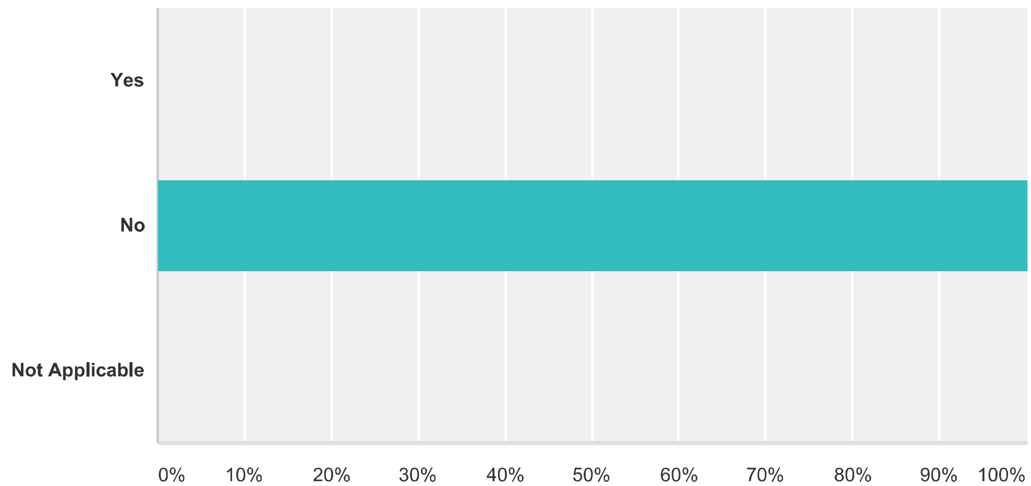
Answered: 4 Skipped: 4



Answer Choices	Responses	
Yes	**25.00%**	1
No	**75.00%**	3
Total		**4**

Q16 If the answer to question # 15 was yes, would you like County Emergency Management personnel to contact you regarding your access and functional needs? If yes, please enter your contact information in the following text box.

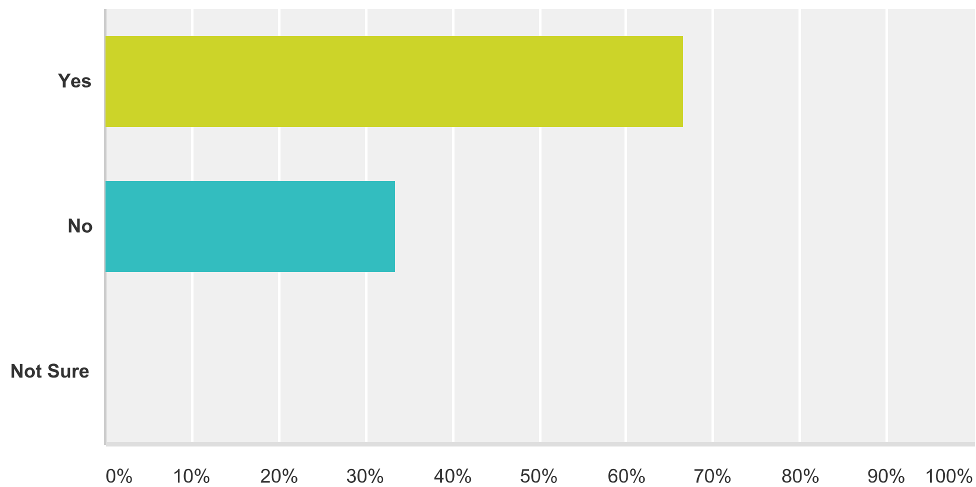
Answered: 2 Skipped: 6



Answer Choices	Responses	
Yes	**0.00%**	0
No	**100.00%**	2
Not Applicable	**0.00%**	0
Total		**2**

Q17 When you moved into your home, did you consider the impact a natural disaster could have on your home?

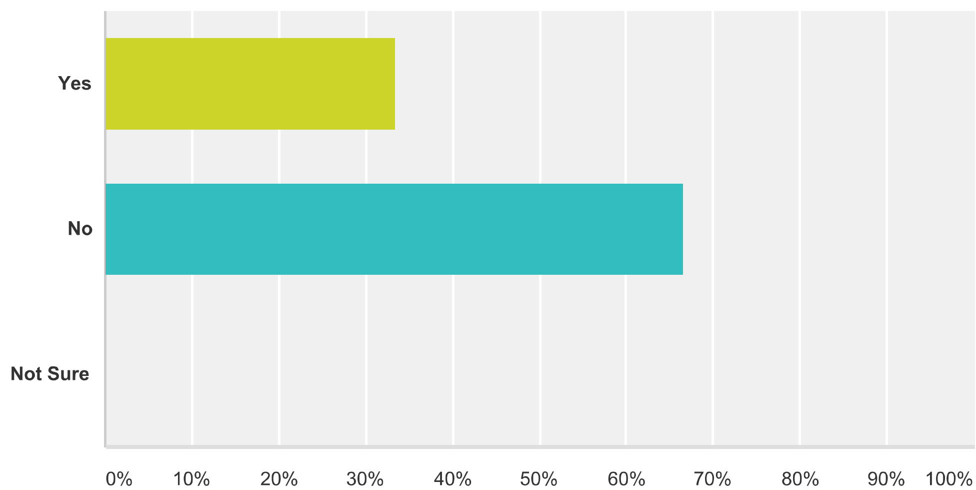
Answered: 3 Skipped: 5



Answer Choices	Responses	
Yes	**66.67%**	2
No	**33.33%**	1
Not Sure	**0.00%**	0
Total		**3**

Q18 Was the presence of a natural hazard risk zone (e.g., dam failure zone, flood zone, landslide hazard area, high fire risk area) disclosed to you by a real estate agent, seller, or landlord before you purchased or moved into your home?

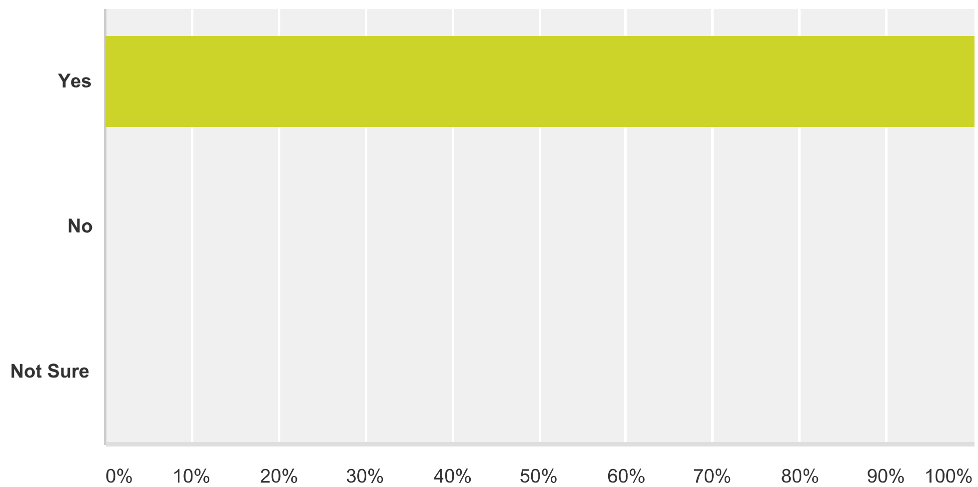
Answered: 3 Skipped: 5



Answer Choices	Responses	
Yes	**33.33%**	1
No	**66.67%**	2
Not Sure	**0.00%**	0
Total		**3**

Q19 Would the disclosure of this type of natural hazard risk information influence your decision to buy or rent a home?

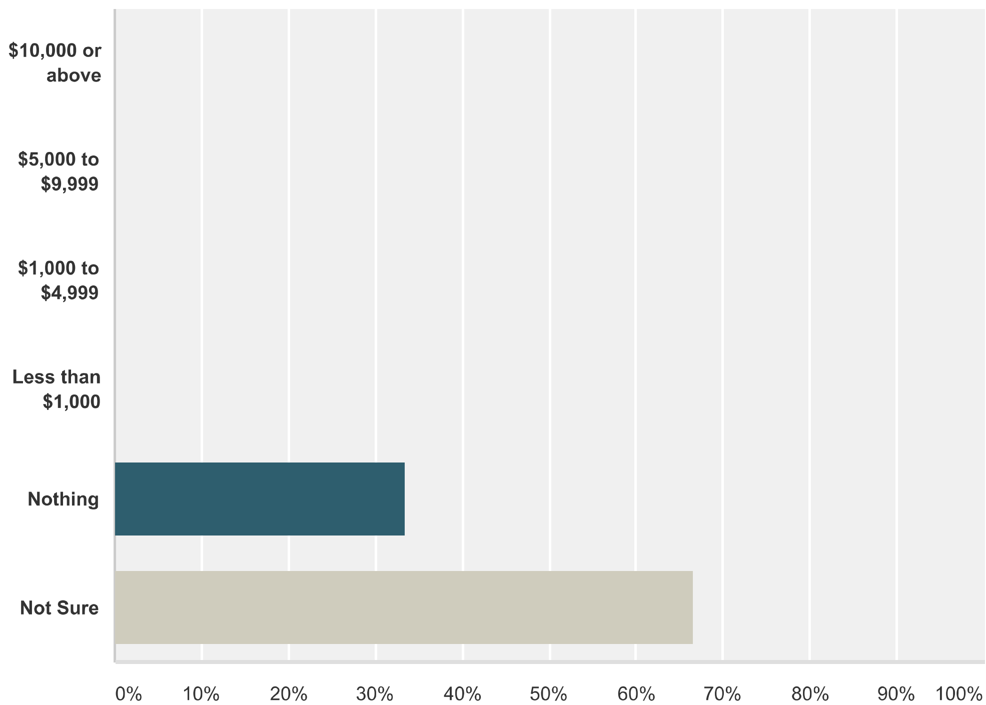
Answered: 3 Skipped: 5



Answer Choices	Responses	
Yes	**100.00%**	3
No	**0.00%**	0
Not Sure	**0.00%**	0
Total		**3**

Q20 How much money would you be willing to spend to retrofit your home to reduce risks associated with natural disasters? (for example, by clearing brush and plant materials from around your home to create a "defensible space" for wildfire, performing seismic upgrades, or replacing a combustible roof with non-combustible roofing)

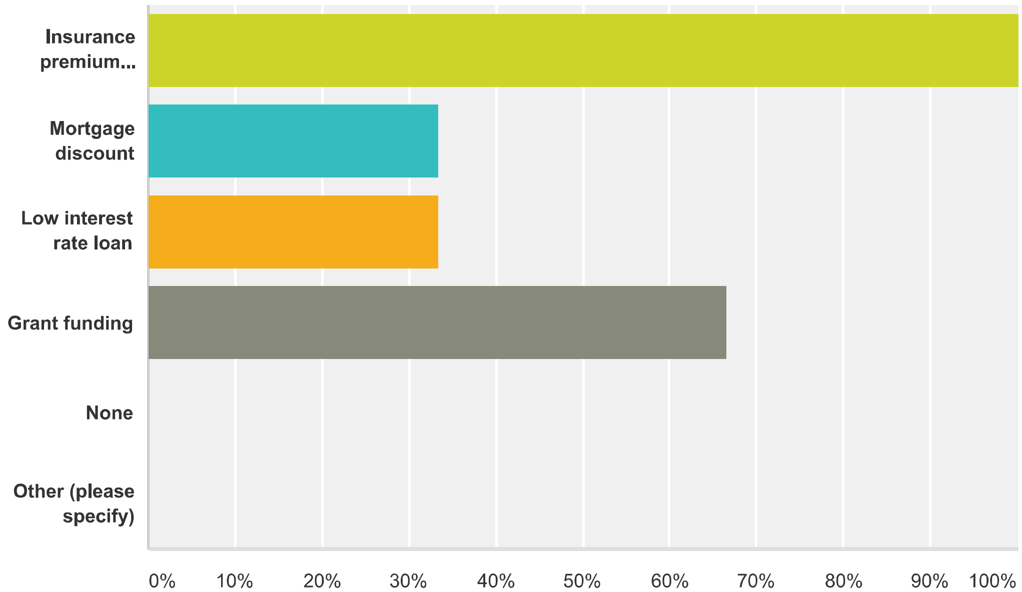
Answered: 3 Skipped: 5



Answer Choices	Responses	
$10,000 or above	**0.00%**	0
$5,000 to $9,999	**0.00%**	0
$1,000 to $4,999	**0.00%**	0
Less than $1,000	**0.00%**	0
Nothing	**33.33%**	1
Not Sure	**66.67%**	2
Total		**3**

Q21 Which of the following incentives would encourage you to spend money to retrofit your home to protect against natural disasters? (Check all that apply)

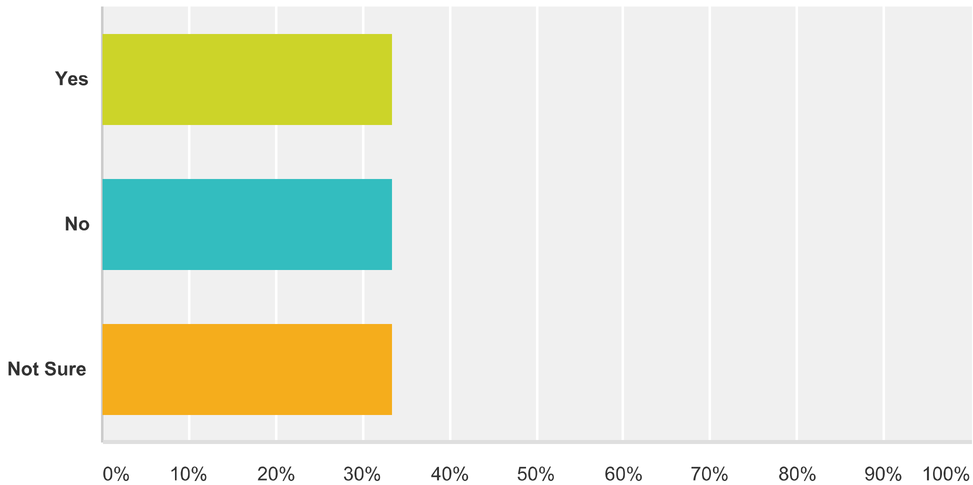
Answered: 3 Skipped: 5



Answer Choices	Responses	
Insurance premium discount	**100.00%**	3
Mortgage discount	**33.33%**	1
Low interest rate loan	**33.33%**	1
Grant funding	**66.67%**	2
None	**0.00%**	0
Other (please specify)	**0.00%**	0
Total Respondents: 3		

Q22 If your property were located in a designated “high hazard” area or had received repetitive damages from a natural hazard event, would you consider a ”buyout” offered by a public agency?

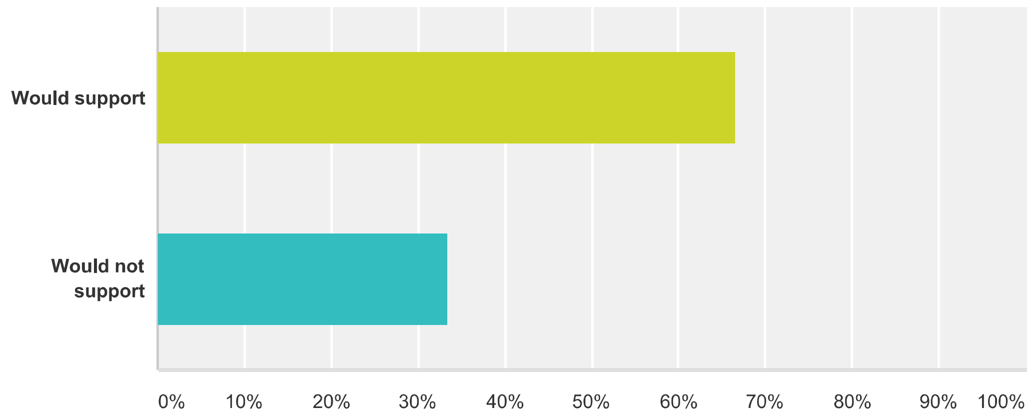
Answered: 3 Skipped: 5



Answer Choices	Responses	
Yes	**33.33%**	1
No	**33.33%**	1
Not Sure	**33.33%**	1
Total		**3**

Q23 Would you support the regulation (restriction) of land uses within known high hazard areas?

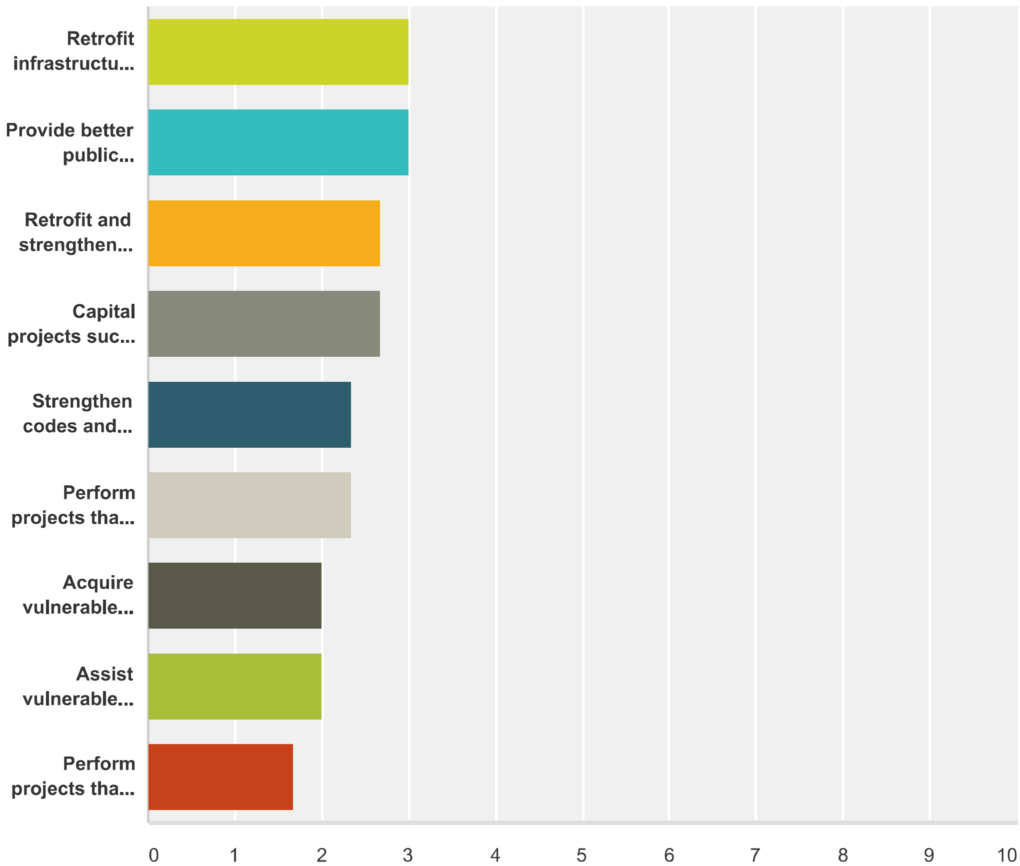
Answered: 3 Skipped: 5



Answer Choices	Responses	
Would support	**66.67%**	2
Would not support	**33.33%**	1
Total		**3**

Q24 What types of projects do you believe the County, State or Federal government agencies should be doing in order to reduce damage and disruption from hazard events within San Saba County? Please rank each option as a high, medium or low priority.

Answered: 3 Skipped: 5

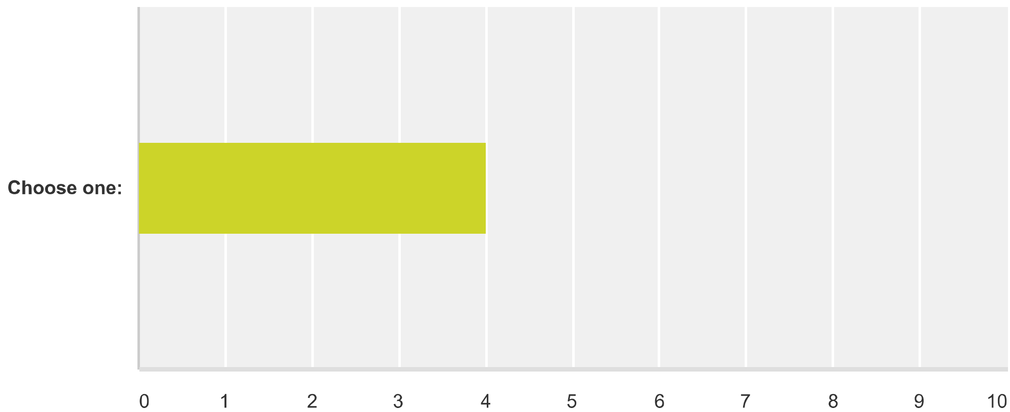


	High	Medium	Low	Total	Weighted Average
Retrofit infrastructure such as roads, bridges, drainage facilities, levees, water supply, waste water and power supply facilities.	100.00% 3	0.00% 0	0.00% 0	3	3.00
Provide better public information about risk, and the exposure to hazards within the operational area.	100.00% 3	0.00% 0	0.00% 0	3	3.00
Retrofit and strengthen essential facilities such as police, fire, schools and hospitals.	66.67% 2	33.33% 1	0.00% 0	3	2.67
Capital projects such as dams, levees, flood walls, drainage improvements and bank stabilization projects.	66.67% 2	33.33% 1	0.00% 0	3	2.67
Strengthen codes and regulations to include higher regulatory standards in hazard areas.	33.33% 1	66.67% 2	0.00% 0	3	2.33
Perform projects that restore the natural environments capacity to absorb the impacts from natural hazards.	33.33% 1	66.67% 2	0.00% 0	3	2.33

Acquire vulnerable properties and maintain as open space.	**0.00%** 0	**100.00%** 3	**0.00%** 0	3	2.00
Assist vulnerable property owners with securing funding for mitigation.	**0.00%** 0	**100.00%** 3	**0.00%** 0	3	2.00
Perform projects that mitigate the potential impacts from climate change.	**0.00%** 0	**66.67%** 2	**33.33%** 1	3	1.67

Q25 Please indicate how you feel about the following statement:It is the responsibility of government (local, state and federal) to provide education and programs that promote citizen actions that will reduce exposure to the risks associated with natural hazards.

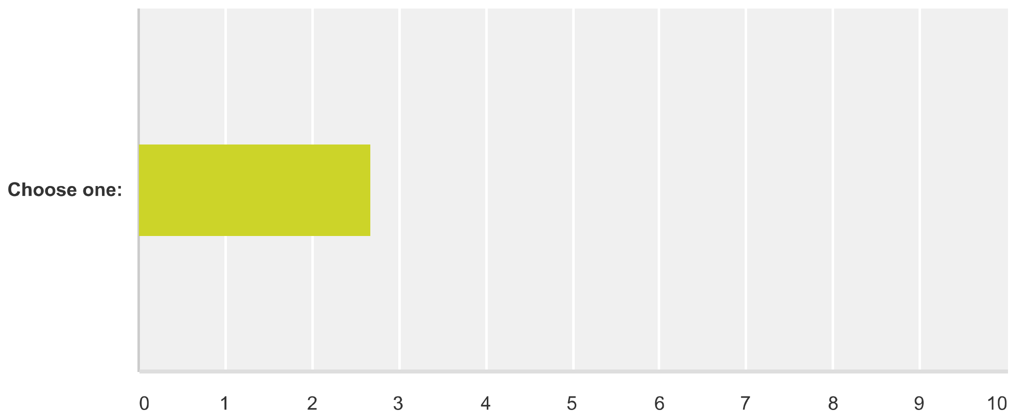
Answered: 3 Skipped: 5



	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	Total	Weighted Average
Choose one:	**0.00%** 0	**0.00%** 0	**33.33%** 1	**33.33%** 1	**33.33%** 1	3	4.00

Q26 Please indicate how you feel about the following statement:It is my responsibility to educate myself and take actions that will reduce my exposure to the risks associated with natural hazards.

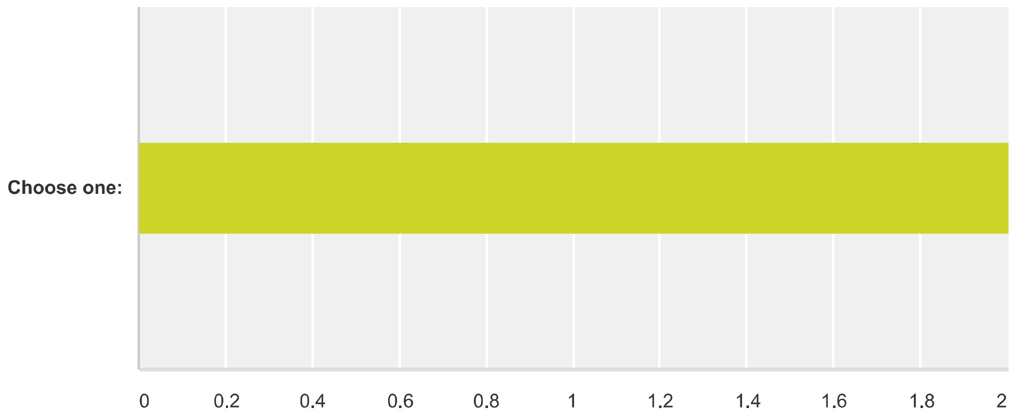
Answered: 3 Skipped: 5



	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	Total	Weighted Average
Choose one:	**33.33%** 1	**0.00%** 0	**33.33%** 1	**33.33%** 1	**0.00%** 0	3	2.67

Q27 Please indicate how you feel about the following statement:Information about the risks associated with natural hazards is readily available and easy to locate.

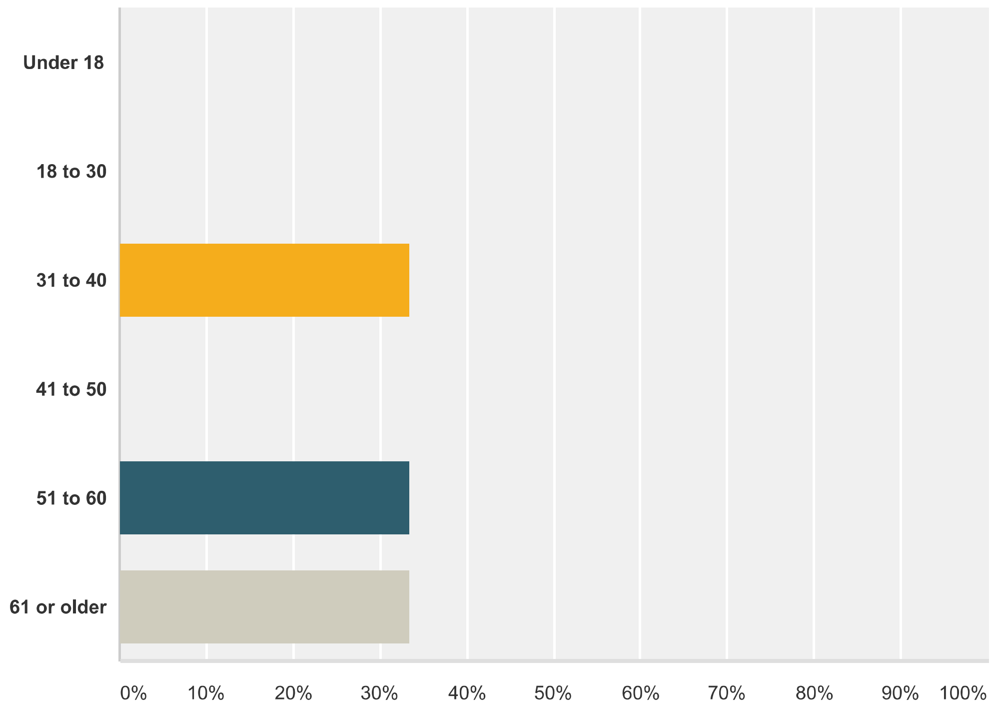
Answered: 3 Skipped: 5



	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	Total	Weighted Average
Choose one:	**0.00%** 0	**100.00%** 3	**0.00%** 0	**0.00%** 0	**0.00%** 0	3	2.00

Q28 Please indicate your age range:

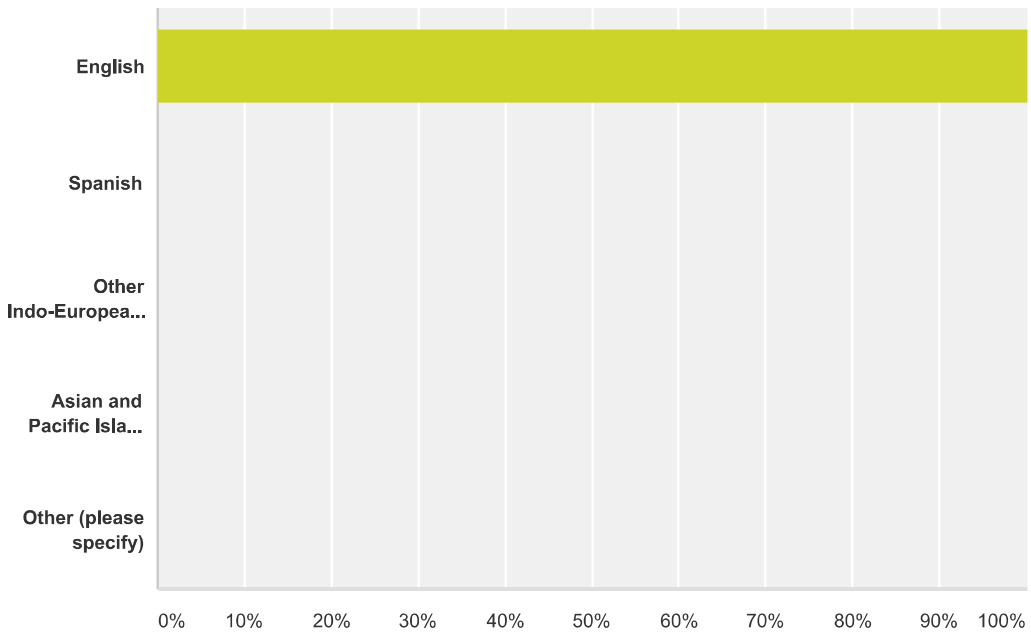
Answered: 3 Skipped: 5



Answer Choices	Responses	
Under 18	**0.00%**	0
18 to 30	**0.00%**	0
31 to 40	**33.33%**	1
41 to 50	**0.00%**	0
51 to 60	**33.33%**	1
61 or older	**33.33%**	1
Total		**3**

Q29 Please indicate the primary language spoken in your household.

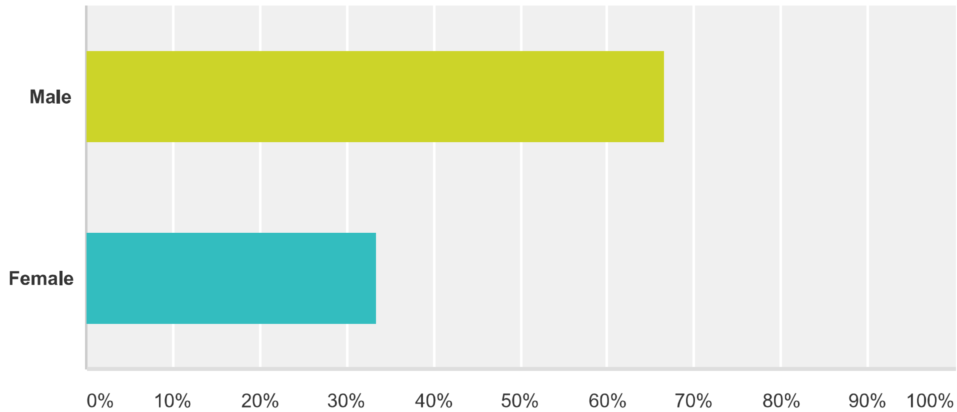
Answered: 3 Skipped: 5



Answer Choices	Responses	
English	**100.00%**	3
Spanish	**0.00%**	0
Other Indo-European Languages	**0.00%**	0
Asian and Pacific Island Languages	**0.00%**	0
Other (please specify)	**0.00%**	0
Total		**3**

Q30 Please indicate your gender:

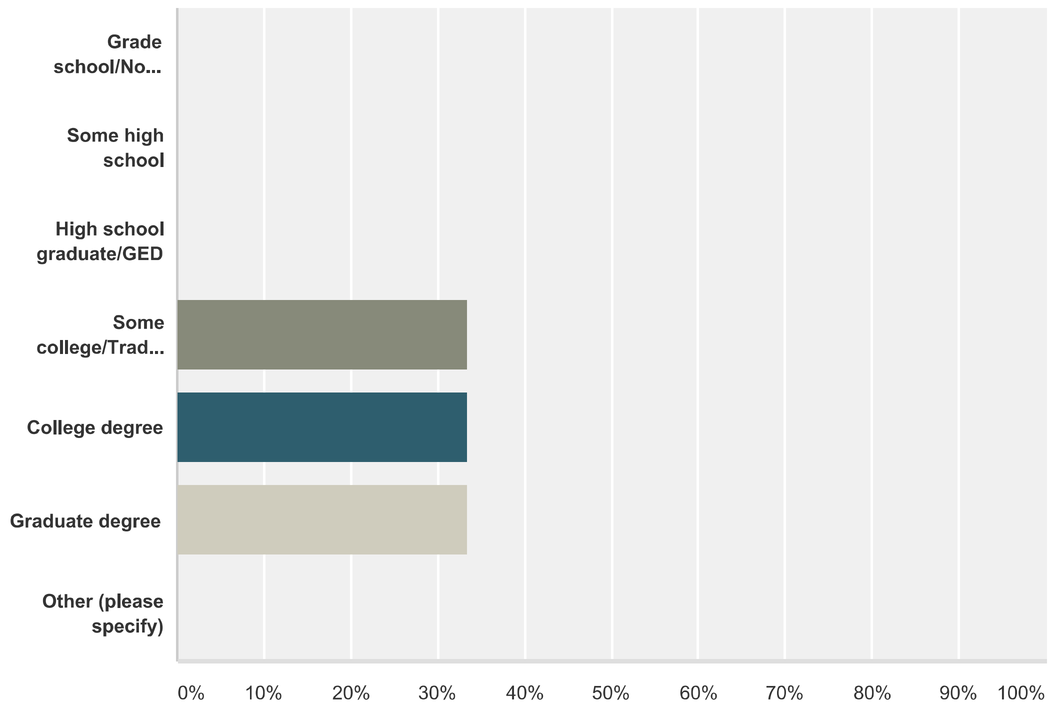
Answered: 3 Skipped: 5



Answer Choices	Responses	
Male	**66.67%**	2
Female	**33.33%**	1
Total		**3**

Q31 Please indicate your highest level of education.

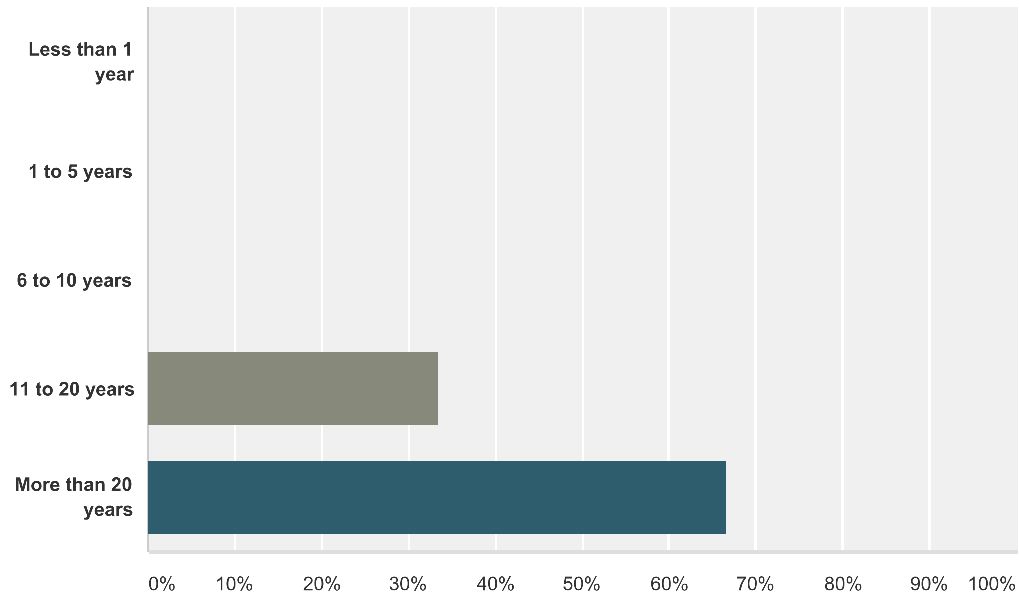
Answered: 3 Skipped: 5



Answer Choices	Responses	
Grade school/No schooling	**0.00%**	0
Some high school	**0.00%**	0
High school graduate/GED	**0.00%**	0
Some college/Trade school	**33.33%**	1
College degree	**33.33%**	1
Graduate degree	**33.33%**	1
Other (please specify)	**0.00%**	0
Total		**3**

Q32 How long have you lived in San Saba County?

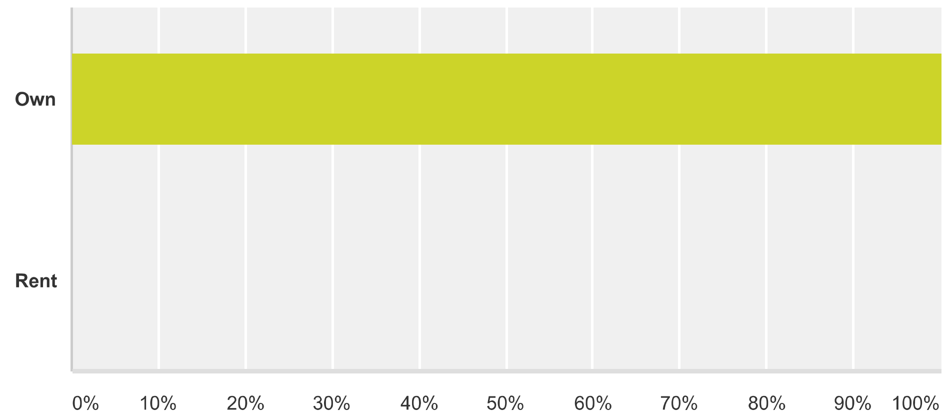
Answered: 3 Skipped: 5



Answer Choices	Responses	
Less than 1 year	**0.00%**	0
1 to 5 years	**0.00%**	0
6 to 10 years	**0.00%**	0
11 to 20 years	**33.33%**	1
More than 20 years	**66.67%**	2
Total		**3**

Q33 Do you own or rent your place of residence?

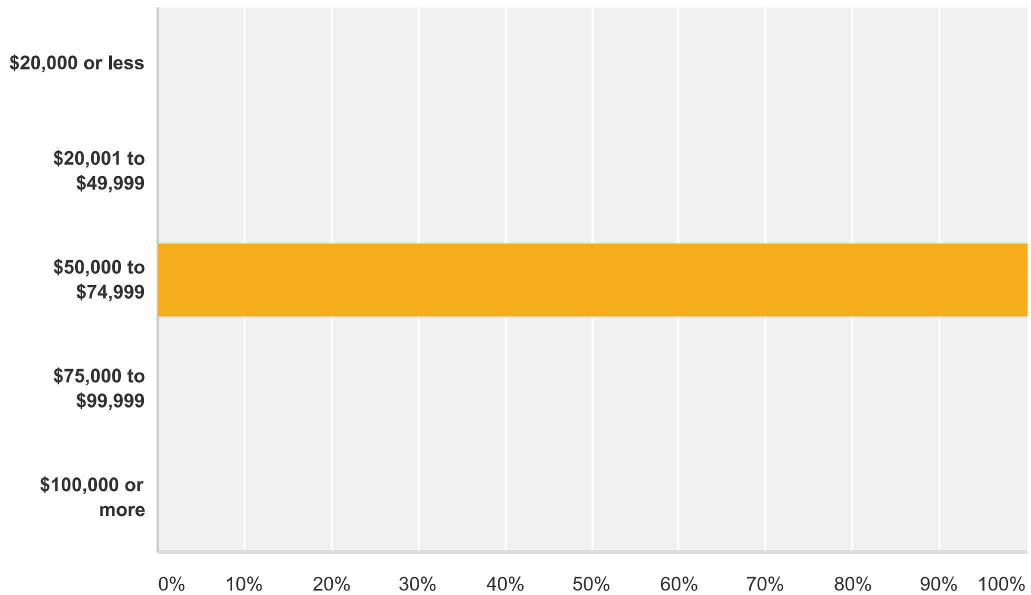
Answered: 3 Skipped: 5



Answer Choices	Responses	
Own	**100.00%**	3
Rent	**0.00%**	0
Total		**3**

Q34 How much is your gross household income?

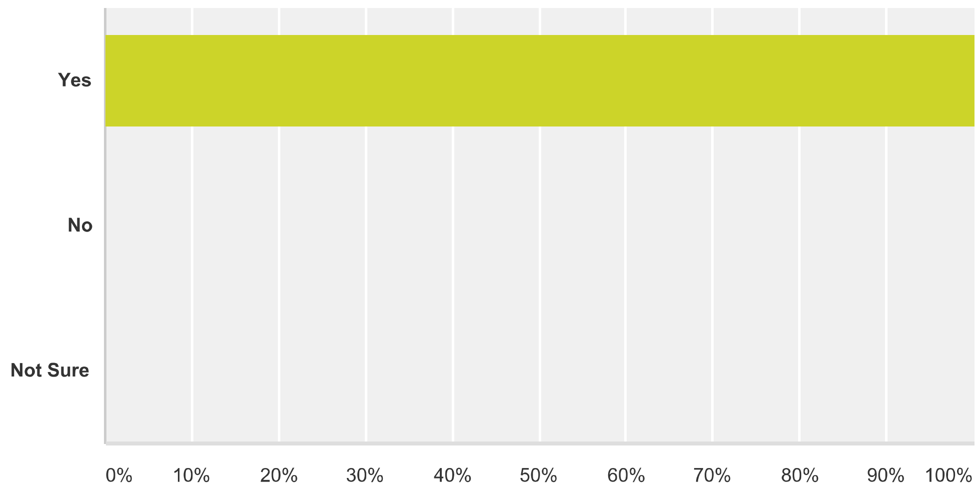
Answered: 3 Skipped: 5



Answer Choices	Responses	
$20,000 or less	**0.00%**	0
$20,001 to $49,999	**0.00%**	0
$50,000 to $74,999	**100.00%**	3
$75,000 to $99,999	**0.00%**	0
$100,000 or more	**0.00%**	0
Total		**3**

Q35 Do you have regular access to the Internet?

Answered: 3 Skipped: 5



Answer Choices	Responses	
Yes	**100.00%**	3
No	**0.00%**	0
Not Sure	**0.00%**	0
Total		**3**

Q36 Comments

Answered: 1 Skipped: 7

APPENDIX D. MENU OF MITIGATION ALTERNATIVES

APPENDIX D.
MENU OF MITIGATION ALTERNATIVES

Mitigation Categories

The measures that communities and individuals can use to protect themselves from, or mitigate the impacts of, natural and man-made hazards fall into six categories:

1. Public Information and Education
2. Preventive Measures
3. Structural Projects
4. Property Protection
5. Emergency Services
6. Natural Resources Protection

SAMPLE MITIGATION ACTIONS:

Hazard: All Hazards

- Incorporate an Emergency Telephone Notification System into the County/Community Emergency Communications Center.
- Construct a new Emergency Operations Center.
- Develop a Master Generator Plan for the County.
- Develop a Public Education and Information Program.
- Develop a Special Needs registry through the 911 databases to assist with educating, alerting, evacuating, or responding to vulnerable populations during disaster.
- Provide for back-up power sources for county essential services facilities to avoid water shortages during extended power outages.
- Provide backup power generators to fueling facilities.
- Develop enhanced Emergency Planning for Special Needs populations in the County/Community Emergency Operations Plan and other planning documents.
- Work with county businesses to develop a Disaster Resistant Business Program.
- Develop a comprehensive public education program on the dangers of carbon monoxide during extended power outages.
- Develop multi-lingual disaster education public service announcements and educational videos.
- Develop a separate “public safety” information area in all public libraries and public recreation facilities to disseminate disaster safety information appropriate to the area and the season.
- Train/educate builders, developers, architects and engineers in techniques of disaster-resistant homebuilding.
- Develop and begin to implement a systematic process to evaluate and upgrade aging infrastructure such as transportation, drainage, utilities, and others that could be affected during a major natural disaster.
- Collaborate with other stakeholders (public, businesses, non-profit organizations, government and regulatory agencies, and others) for public outreach efforts.
- Continue the public outreach strategy to share responsibilities amongst the citizens, federal, state, and local governments.
- Develop and maintain the County’s Office of Emergency Management natural hazards website.
- Continue to pursue additional grants to implement risk reduction projects.
- Develop preparedness guides for county/community residents and businesses.
- Continue to improve the communication of severe weather warnings, flood warning, and related information.

- Distribute NOAA all hazards weather radios to residents that are most vulnerable to severe weather.
- Identify which critical facilities currently have weather radios and feasibility of hard-wiring.
- Develop an improved critical facilities dataset to use in emergency planning efforts and in the 2018 mitigation plan update.
- Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement, to meet or exceed building code standards, upgrade of electrical panels to accept generators, etc.
- Pursue StormReady designation.
- Adopt Continuity of Operations Plans for all applicable hazards.
- Enforce or initiate triggers guiding improvements to structures (such as < 50% substantial damage/improvements).
- Provide redundancy for critical facilities.

Hazard: Floods, Dam/Levee Failure

- Evaluate repetitive loss properties and potential solutions to mitigate existing conditions.
- Acquire and remove repetitive loss properties and repeatedly flooded properties where the county's repetitive loss and master drainage plans identify acquisition to be the most cost effective and desirable mitigation measure.
- Implement structural and non-structural flood mitigation measures for flood-prone properties, as recommended in the basin-wide master drainage plans.
- Develop a Dam/Levee Public Education and Evacuation Plan for targeted areas of the community.
- Continue to update and revise basin-wide master drainage plans where changed conditions warrant.
- Develop an outreach program aimed at identifying and assisting private dam owners with repairing or decommissioning at risk dams.
- Provide stricter floodplain regulations along the Colorado River corridor.
- Consider establishing an administrative procedure or change in county/city codes for requiring builders to develop a site drainage plan ensuring "no adverse impact" when they apply for permits for new residential construction.
- Complete GIS and other automated inventories for stormwater, problem drainage areas, digital flood insurance rate maps, and other city assets.
- Review compliance with the National Flood Insurance Program with an annual review of the floodplain ordinances and any newly permitted activities in the 100-year floodplain.

Hazard: Tornadoes, High Winds

- Develop a model SafeRoom project for a mobile home park in the county.
- Develop a SafeRoom plan for county/community facilities.
- Participate in the individual SafeRoom rebate program.
- Educate residents, building professionals, and SafeRoom vendors on the ICC/NSSA *Standard for the Design and Construction of Storm Shelters* and consider incorporating into current regulatory measures.
- Develop a program which encourages residents to trim or remove trees that could affect power lines.
- Develop a program which encourages residents to obtain a NOAA all hazards weather radio.
- Secure emergency generators (or alternative power sources) for all critical and vital facilities.
- Develop a program which encourages residents to be prepared including generators, 72-hour self-sufficiency kits, NOAA all hazards radios, etc.
- Support programs such as "Tree Watch" that proactively manage problem areas by use of selective removal of hazardous trees, tree replacement, etc.
- Establish and enforce building codes that require all roofs to withstand high wind loads.

- Modify land use and environmental regulations to support vegetation management activities that improve reliability in utility corridors.
- Modify landscape and other ordinances to encourage appropriate planting near overhead power, cable, and phone lines.

Hazard: Lightning

- Install lightning warning and alert systems in public recreation areas.
- Install lightning rods on public structures.

Hazard: Expansive Soils

- Research the applicability of establishing an administrative procedure or change in county codes for requiring builders to check for expansive soils when they apply for permits for new residential construction and for using foundations that mitigate expansive soil damages when in a moderate or high-risk area.

Hazard: Extreme Heat

- Review the safety of playground materials during extreme heat events.

Hazard: Wildfire

- Implement a FireWise Community Education and Information Program.
- Research the availability of use of possible weapons of mass destruction funds available to enhance fire capability in high risk areas.
- Create and maintain defensible space around structures and infrastructure.
- Update building codes to require the use of fire-retardant building materials in high fire hazard areas.
- Require higher regulatory standards - such as a prohibition on combustible roof materials.
- Continue to develop partnerships with other organizations to implement wildfire mitigation plans and other hazard reduction programs.
- Complete and maintain a Community Wildfire Protection Plan including the assessment of parcels identified in the Wildland Urban Interface.
- Work with Texas Forest Service and Department of Natural Resources to review zoning and ordinances to identify areas to include wildfire mitigation principles.
- Investigate the status of and need to create additional emergency vehicle access in high hazard areas.
- Seek alternative water supplies in Wildland Urban Interface areas.

***Hazard:* Earthquake**

- Incorporate earthquakes in the Office of Emergency Management public outreach strategy.
- Work with USGS to continue the study and analyze earthquakes related to appropriate levels of seismic safety in building codes and practices.
- Further enhance seismic risk assessment to target high hazard buildings for mitigation opportunities.
- Develop a post disaster action plan that includes a grant funding and debris removal components.

Hazard: **Avalanche**

- Ensure hazard maps are current and updated on a regular basis.
- Enact tools to help manage development in hazard areas: better land controls, tax incentives, information.
- Develop strategy to take advantage of post-disaster opportunities as they arise.
- Continue to educate the public on the avalanche hazard and appropriate risk reduction alternatives.

Hazard: **Drought**

- Develop a public education on drought resistance.
- Identify alternative water supplies for time of drought. Develop mutual aid agreements with alternative suppliers.
- Consider providing incentives to property owners that utilize drought resistant landscapes in the design of their homes.
- Develop standards that require drought resistant landscapes on county and community owned facilities.
- Implement stormwater retention in regions ideally suited for groundwater recharges.
- Develop a residential and local business program to modify plumbing systems - i.e., water saving kits.

APPENDIX E.
WORKSHEETS FOR RECOMMENDED MITIGATION ACTIONS

APPENDIX E.
WORKSHEETS FOR RECOMMENDED MITIGATION ACTIONS

The planning partners and the Steering Committee determined that some actions could be implemented to provide hazard mitigation benefits. The individual worksheets for each recommended action are provided in this appendix.

Mitigation Action Worksheet

Please complete one worksheet per action with as much detail as possible, using the instructions beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: San Saba County **Mitigation Action #:** 1

Mitigation Action Title: All Hazards Education and Awareness Programs

Assessing the Risk	
Hazard(s) addressed: (check all that apply)	X All Hazards ☐Coastal Erosion ☐Dam/Levee Failure ☐Drought ☐Earthquake ☐Expansive Soils ☐Extreme Heat ☐Flood ☐Hail ☐Hurricanes/Tropical Storms ☐Land Subsidence ☐Lightning ☐Thunderstorm ☐Tornado ☐Wildfire ☐Wind ☐Winter Weather
Specific problem being Mitigated (describe why action is needed)	**All Hazards Education and Awareness Programs**
Evaluation of Potential Alternatives	
Alternatives Considered (name of project and reason for not selecting)	1. Have brochures and pamphlets available at annual Health Fair
	2. Encourage residents to educate themselves via internet sites
	3.No action
Action/Project Intended for Implementation	
Describe how action will be implemented (main steps involved)	Enhancing hazard awareness, for all of the counties assessed risks, of the private sector, particularly lenders, insurance agents and realtors
Action/Project Type	☐Local Plans and Regulations ☐Structure and Infrastructure Project ☐Natural Systems Protection X Education and Awareness Programs
Applicable Goals/Objectives (refer to list of goals/objectives)	X Goal #1 ☐Goal #2 X☐Goal #3 xGoal #4 ☐Goal #5 ☐Goal #6 Objective: 1.1, 1.3, 3.1, 3.2, 3.3, 4.2
Applies to existing or future development	☐ Existing Development ☐Future Development X Both Existing and Future Development ☐Not Applicable
Describe benefits (losses avoided)	X Life Safety X Damage Reduction ☐Other Describe:
Estimated Cost	X < \$10,000; ☐\$10,000 to \$100,000; ☐>\$100,000 Other Amount: \$
Plan for Implementation	
Responsible Department	Office of Emergency Management
Local Planning Mechanism (check all that apply)	☐Capital Improvement Plan X Comprehensive Plan ☐Building Code ☐Ordinance X Other: Education and Awareness
Potential Funding Sources	FEMA, USDA, General Revenue
Timeline for Completion	☐ Short Term (1-5 yrs.) X Long Term (>5 yrs.) ☐ Ongoing
Reporting on Progress	
Status/Comment	☐Not Started ☐In-progress ☐Delayed ☐Completed ☐No Longer Required Comment:
Completed by: (name, title, phone #)	**Marsha Hardy, EMC/CFM, 325-372-8570 Date: 7-23-15**

Prioritization Worksheet

Mitigation Action #: 1

Mitigation Action Title: All Hazards Education and Awareness Programs

Criteria	Numeric Rank: Definitely Yes = 4, Maybe Yes = 3, Unknown/Neutral = 2, Probably No = 1, Definitely No = 0		Provide brief rationale for numeric rank when appropriate
1. Will the action result in Life Safety?	4	x 2 = 8	
2. Will the action result in Property Protection?	3	x 2 = 6	
3. Will the action be Cost-Effective? (future benefits exceed cost)	2		
4. Is the action Technically feasible	4		
5. Is the action Politically acceptable?	4		
6. Does the jurisdiction have the Legal authority to implement?	3		
7. Is Funding available for the action?	1		
8. Will the action have a positive impact on the natural Environment?	3		
9. Is the action Socially acceptable?	2		
10. Does the jurisdiction have the Administrative capability to execute the action?	2		
11. Will the action reduce risk to more than one hazard (Multi-Hazard)?	3		
12. Can the action be implemented Quickly?	2		
13. Is there an Agency/Department Champion for the action?	3		
14. Will the action meet other Community Objectives?	3		
Total	46		
Priority: Low = <35, Medium = 35-49, High = >50	☐Low X Medium ☐High		

Mitigation Action Worksheet

Please complete one worksheet per action with as much detail as possible, using the instructions beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: San Saba County **Mitigation Action #:** 2

Mitigation Action Title: Dam Brush Clearance

Assessing the Risk	
Hazard(s) addressed: (check all that apply)	☐All Hazards ☐Coastal Erosion X Dam/Levee Failure ☐Drought ☐Earthquake ☐Expansive Soils ☐Extreme Heat ☐Flood ☐Hail ☐Hurricanes/Tropical Storms ☐Land Subsidence ☐Lightning ☐Thunderstorm ☐Tornado ☐Wildfire ☐Wind ☐Winter Weather
Specific problem being Mitigated (describe why action is needed)	San Saba County has around 22 total Dam/Levees with 9 being classified as High Hazard and 3 as Significant Hazards.
Evaluation of Potential Alternatives	
Alternatives Considered (name of project and reason for not selecting)	1. Allow the NRCS county committee to handle any potential dangers.
	2. No action
	3.
Action/Project Intended for Implementation	
Describe how action will be implemented (main steps involved)	There needs to be a Brush Clearance at each of the Dam/Levee spillways to allow for the proper channel flow allotted.
Action/Project Type	☐Local Plans and Regulations X Structure and Infrastructure Project ☐Natural Systems Protection ☐Education and Awareness Programs
Applicable Goals/Objectives (refer to list of goals/objectives)	X☐Goal #1 X Goal #2 ☐Goal #3 ☐Goal #4 ☐Goal #5 ☐Goal #6 Objective: 1.3, 1.4, 2.2,
Applies to existing or future development	☐ Existing Development ☐Future Development X Both Existing and Future Development ☐Not Applicable
Describe benefits (losses avoided)	X Life X Damage Reduction ☐Other Describe:
Estimated Cost	X < $10,000; ☐$10,000 to $100,000; ☐>$100,000 Other Amount: $
Plan for Implementation	
Responsible Department	Natural Resource Conservation Services and Office of Emergency Management
Local Planning Mechanism (check all that apply)	☐Capital Improvement Plan X Comprehensive Plan ☐Building Code ☐Ordinance ☐Other:
Potential Funding Sources	NRCS, USDA, Private Funds, General Revenue
Timeline for Completion	☐ Short Term (1-5 yrs.) ☐ Long Term (>5 yrs.) X Ongoing
Reporting on Progress	
Status/Comment	☐Not Started ☐In-progress ☐Delayed ☐Completed ☐No Longer Required Comment:
Completed by: (name, title, phone #)	**Marsha Hardy, EMC/CFM, 325-372-8570 Date: 7-23-15**

Prioritization Worksheet

Mitigation Action #: 2

Mitigation Action Title: Dam/Levee Failure Program

Criteria	Numeric Rank: Definitely Yes = 4 Maybe Yes = 3 Unknown/Neutral = 2 Probably No = 1 Definitely No = 0		Provide brief rationale for numeric rank when appropriate
1. Will the action result in <u>Life Safety</u>?	4	x 2 = 8	
2. Will the action result in <u>Property Protection</u>?	3	x 2 = 6	
3. Will the action be <u>Cost-Effective</u>? (future benefits exceed cost)	3		
4. Is the action <u>Technically</u> feasible	2		
5. Is the action <u>Politically</u> acceptable?	2		
6. Does the jurisdiction have the <u>Legal</u> authority to implement?	1		
7. Is <u>Funding</u> available for the action?	1		
8. Will the action have a positive impact on the natural <u>Environment</u>?	4		
9. Is the action <u>Socially</u> acceptable?	2		
10. Does the jurisdiction have the <u>Administrative</u> capability to execute the action?	2		
11. Will the action reduce risk to more than one hazard (<u>Multi-Hazard</u>)?	3		
12. Can the action be implemented <u>Quickly</u>?	1		
13. Is there an Agency/Department <u>Champion</u> for the action?	2		
14. Will the action meet other <u>Community Objectives</u>?	2		
Total	39		
Priority: **Low = <35** **Medium = 35-49** **High = >50**	☐Low X Medium ☐High		

Mitigation Action Worksheet

Please complete one worksheet per action with as much detail as possible, using the instructions beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: San Saba County **Mitigation Action #:** 3

Mitigation Action Title: Encourage construction of safe rooms

Assessing the Risk	
Hazard(s) addressed: (check all that apply)	☐All Hazards ☐Coastal Erosion ☐Dam/Levee Failure ☐Drought X Earthquake ☐Expansive Soils ☐Extreme Heat ☐Flood ☐Hail ☐Hurricanes/Tropical Storms ☐Land Subsidence ☐Lightning X Thunderstorm X Tornado ☐Wildfire X Wind ☐Winter Weather
Specific problem being Mitigated (describe why action is needed)	**Encourage construction of safe rooms in county**
Evaluation of Potential Alternatives	
Alternatives Considered (name of project and reason for not selecting)	1. Develop a local grant program to assist homeowners who wish to construct a safe room [budget
	2. No action
	3.
Action/Project Intended for Implementation	
Describe how action will be implemented (main steps involved)	Encourage the construction of safe rooms in residential homes and public buildings in San Saba County. These would be built to FEMA standards above ground.
Action/Project Type	☐Local Plans and Regulations X Structure and Infrastructure Project ☐Natural Systems Protection X Education and Awareness Programs
Applicable Goals/Objectives (refer to list of goals/objectives)	☐Goal #1 ☐Goal #2 X Goal #3 X☐Goal #4 ☐Goal #5 X☐Goal #6 Objective: 3.2, 4.1, 6.1, 6.2
Applies to existing or future development	☐ Existing Development X Future Development ☐ Both Existing and Future Development ☐Not Applicable
Describe benefits (losses avoided)	X Life Safety ☐Damage Reduction ☐Other Describe:
Estimated Cost	X < $10,000; ☐$10,000 to $100,000; ☐>$100,000 Other Amount: $
Plan for Implementation	
Responsible Department	Office of Emergency Management
Local Planning Mechanism (check all that apply)	☐Capital Improvement Plan X Comprehensive Plan ☐Building Code ☐Ordinance ☐Other:
Potential Funding Sources	FEMA Grants, Private Funds
Timeline for Completion	☐ Short Term (1-5 yrs.) X Long Term (>5 yrs.) ☐ Ongoing
Reporting on Progress	
Status/Comment	☐Not Started ☐In-progress ☐Delayed ☐Completed ☐No Longer Required Comment:
Completed by: (name, title, phone #)	**Marsha Hardy, EMC/CFM, 325-372-8570 Date: 7-27-15**

Prioritization Worksheet

Mitigation Action #: 3

Mitigation Action Title: Encourage construction of safe rooms

Criteria	Numeric Rank: Definitely Yes = 4, Maybe Yes = 3, Unknown/Neutral = 2, Probably No = 1, Definitely No = 0		Provide brief rationale for numeric rank when appropriate
1. Will the action result in Life Safety?	4	x 2 = 8	
2. Will the action result in Property Protection?	3	x 2 = 6	
3. Will the action be Cost-Effective? (future benefits exceed cost)	2		
4. Is the action Technically feasible	2		
5. Is the action Politically acceptable?	2		
6. Does the jurisdiction have the Legal authority to implement?	2		
7. Is Funding available for the action?	1		
8. Will the action have a positive impact on the natural Environment?	2		
9. Is the action Socially acceptable?	2		
10. Does the jurisdiction have the Administrative capability to execute the action?	2		
11. Will the action reduce risk to more than one hazard (Multi-Hazard)?	4		
12. Can the action be implemented Quickly?	2		
13. Is there an Agency/Department Champion for the action?	2		
14. Will the action meet other Community Objectives?	2		
Total	39		
Priority: Low = <35, Medium = 35-49, High = >50	☐Low X Medium ☐High		

Mitigation Action Worksheet

Please complete one worksheet per action with as much detail as possible, using the instructions beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: San Saba County **Mitigation Action #:** 4

Mitigation Action Title: Reverse 9-1-1 System [Code Red]

Assessing the Risk	
Hazard(s) addressed: (check all that apply)	X All Hazards ☐Coastal Erosion ☐Dam/Levee Failure ☐Drought ☐Earthquake ☐Expansive Soils ☐Extreme Heat ☐Flood ☐Hail ☐Hurricanes/Tropical Storms ☐Land Subsidence ☐Lightning ☐Thunderstorm ☐Tornado ☐Wildfire ☐Wind ☐Winter Weather
Specific problem being Mitigated (describe why action is needed)	**All Hazards that need fast dissemination**
Evaluation of Potential Alternatives	
Alternatives Considered (name of project and reason for not selecting)	1. Promote NOAA Weather Radios
	2. Use outdoor warning sirens
	3.No action
Action/Project Intended for Implementation	
Describe how action will be implemented (main steps involved)	Develop operational procedures and protocols for the 'Reverse 9-1-1' system called Code Red for the entire county.
Action/Project Type	X Local Plans and Regulations ☐Structure and Infrastructure Project ☐Natural Systems Protection X Education and Awareness Programs
Applicable Goals/Objectives (refer to list of goals/objectives)	XGoal #1 ☐Goal #2 X Goal #3 X ☐Goal #4 ☐Goal #5 ☐Goal #6 Objective: 1.2, 1.3, 3.1, 3.2, 4.3
Applies to existing or future development	☐ Existing Development ☐Future Development X Both Existing and Future Development ☐Not Applicable
Describe benefits (losses avoided)	☐Life Safety ☐Damage Reduction ☐Other Describe: Possibly all of the above
Estimated Cost	X < $10,000; ☐$10,000 to $100,000; ☐>$100,000 Other Amount: $
Plan for Implementation	
Responsible Department	Office of Emergency Management working with all first responders
Local Planning Mechanism (check all that apply)	☐Capital Improvement Plan X Comprehensive Plan ☐Building Code ☐Ordinance ☐Other:
Potential Funding Sources	Regional/CTCOG, General Revenue
Timeline for Completion	X Short Term (1-5 yrs.) ☐ Long Term (>5 yrs.) ☐ Ongoing
Reporting on Progress	
Status/Comment	☐Not Started ☐In-progress ☐Delayed ☐Completed ☐No Longer Required Comment:
Completed by: (name, title, phone #)	**Marsha Hardy, EMC/CFM, 325-372-8570 Date: 7-27-15**

Prioritization Worksheet

Mitigation Action #: 4 _______________

Mitigation Action Title: Reverse 9-1-1 System [Code Red]

Criteria	**Numeric Rank:** **Definitely Yes = 4** **Maybe Yes = 3** **Unknown/Neutral = 2** **Probably No = 1** **Definitely No = 0**		**Provide brief rationale for numeric rank when appropriate**
1. Will the action result in <u>Life Safety</u>?	4	x 2 = 8	
2. Will the action result in <u>Property Protection</u>?	3	x 2 = 6	
3. Will the action be <u>Cost-Effective</u>? (future benefits exceed cost)	4		
4. Is the action <u>Technically</u> feasible	4		
5. Is the action <u>Politically</u> acceptable?	3		
6. Does the jurisdiction have the <u>Legal</u> authority to implement?	3		
7. Is <u>Funding</u> available for the action?	3		
8. Will the action have a positive impact on the natural <u>Environment</u>?	2		
9. Is the action <u>Socially</u> acceptable?	3		
10. Does the jurisdiction have the <u>Administrative</u> capability to execute the action?	2		
11. Will the action reduce risk to more than one hazard (<u>Multi-Hazard</u>)?	4		
12. Can the action be implemented <u>Quickly</u>?	2		
13. Is there an Agency/Department <u>Champion</u> for the action?	3		
14. Will the action meet other <u>Community Objectives</u>?	2		
Total	49		
Priority: **Low = <35** **Medium = 35-49** **High = >50**	☐Low X Medium ☐High		

Mitigation Action Worksheet

Please complete one worksheet per action with as much detail as possible, using the instructions beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: San Saba County **Mitigation Action #:** 5

Mitigation Action Title: Encourage Drought-Tolerant landscape design

Assessing the Risk	
Hazard(s) addressed: (check all that apply)	☐All Hazards ☐Coastal Erosion ☐Dam/Levee Failure X Drought ☐Earthquake ☐Expansive Soils ☐Extreme Heat ☐Flood ☐Hail ☐Hurricanes/Tropical Storms ☐Land Subsidence ☐Lightning ☐Thunderstorm ☐Tornado ☐Wildfire ☐Wind ☐Winter Weather
Specific problem being Mitigated (describe why action is needed)	Encourage Drought-Tolerant landscape design through incorporating drought tolerant or xeriscape practices into landscape educational measures to reduce dependence on irrigation.
Evaluation of Potential Alternatives	
Alternatives Considered (name of project and reason for not selecting)	1. Provide incentives for xeriscaping.
	2. No action
	3.
Action/Project Intended for Implementation	
Describe how action will be implemented (main steps involved)	Encourage Drought-Tolerant landscape design through incorporating drought tolerant or xeriscape practices into landscape educational measures to reduce dependence on irrigation, as with the NRCS group or the Texas Agri-Life Extension Office.
Action/Project Type	☐Local Plans and Regulations ☐Structure and Infrastructure Project ☐Natural Systems Protection X Education and Awareness Programs
Applicable Goals/Objectives (refer to list of goals/objectives)	X☐Goal #1 X Goal #2 ☐Goal #3 ☐Goal #4 ☐Goal #5 X ☐Goal #6 Objective: 1.3, 1.4, 2.2, 6.2
Applies to existing or future development	☐ Existing Development X Future Development ☐ Both Existing and Future Development ☐Not Applicable
Describe benefits (losses avoided)	☐Life Safety X Damage Reduction ☐Other Describe:
Estimated Cost	X < $10,000; ☐$10,000 to $100,000; ☐>$100,000 Other Amount: $
Plan for Implementation	
Responsible Department	Natural Resource Conservation Service, Texas Agri-Life Extension Agency
Local Planning Mechanism (check all that apply)	☐Capital Improvement Plan ☐Comprehensive Plan ☐Building Code ☐Ordinance ☐Other:
Potential Funding Sources	Natural Resource Conservation Service, Texas Agri-Life Extension Agency
Timeline for Completion	☐ Short Term (1-5 yrs.) X Long Term (>5 yrs.) ☐ Ongoing
Reporting on Progress	
Status/Comment	☐Not Started ☐In-progress ☐Delayed ☐Completed ☐No Longer Required Comment:
Completed by: (name, title, phone #)	**Marsha Hardy, EMC/CFM, 325-372-8570 Date: 7-23-15**

Prioritization Worksheet

Mitigation Action #: 5 ______________

Mitigation Action Title: Encourage Drought-Tolerant landscape design

Criteria	Numeric Rank: Definitely Yes = 4, Maybe Yes = 3, Unknown/Neutral = 2, Probably No = 1, Definitely No = 0		Provide brief rationale for numeric rank when appropriate
1. Will the action result in Life Safety?	2	x 2 = 4	
2. Will the action result in Property Protection?	3	x 2 = 6	
3. Will the action be Cost-Effective? (future benefits exceed cost)	2		
4. Is the action Technically feasible	3		
5. Is the action Politically acceptable?	3		
6. Does the jurisdiction have the Legal authority to implement?	1		
7. Is Funding available for the action?	1		
8. Will the action have a positive impact on the natural Environment?	4		
9. Is the action Socially acceptable?	3		
10. Does the jurisdiction have the Administrative capability to execute the action?	2		
11. Will the action reduce risk to more than one hazard (Multi-Hazard)?	2		
12. Can the action be implemented Quickly?	1		
13. Is there an Agency/Department Champion for the action?	1		
14. Will the action meet other Community Objectives?	2		
Total	35		
Priority: Low = <35, Medium = 35-49, High = >50	☐Low X Medium ☐High		

Mitigation Action Worksheet

Please complete one worksheet per action with as much detail as possible, using the instructions beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: San Saba County **Mitigation Action #:** 6

Mitigation Action Title: MOUs between VFDs and Contiguous Counties

Assessing the Risk	
Hazard(s) addressed: (check all that apply)	☐All Hazards ☐Coastal Erosion ☐Dam/Levee Failure ☐Drought ☐Earthquake ☐Expansive Soils ☐Extreme Heat ☐Flood ☐Hail ☐Hurricanes/Tropical Storms ☐Land Subsidence ☐Lightning ☐Thunderstorm ☐Tornado X Wildfire ☐Wind ☐Winter Weather
Specific problem being Mitigated (describe why action is needed)	Wildfire/Urban Interface
Evaluation of Potential Alternatives	
Alternatives Considered (name of project and reason for not selecting)	1. Check with TFS for listings
	2. No action
	3.
Action/Project Intended for Implementation	
Describe how action will be implemented (main steps involved)	Annually, through the Commissioner's Court, have participation between the County and the local VFDs, to update MOUs.
Action/Project Type	X Local Plans and Regulations ☐Structure and Infrastructure Project ☐Natural Systems Protection ☐Education and Awareness Programs
Applicable Goals/Objectives (refer to list of goals/objectives)	X Goal #1 X☐Goal #2 ☐Goal #3 X☐Goal #4 ☐Goal #5 ☐Goal #6 Objective: 1.3, 2.3, 4.1
Applies to existing or future development	☐ Existing Development ☐Future Development X Both Existing and Future Development ☐Not Applicable
Describe benefits (losses avoided)	X Life Safety X Damage Reduction ☐Other Describe:
Estimated Cost	X < $10,000; ☐$10,000 to $100,000; ☐>$100,000 Other Amount: $
Plan for Implementation	
Responsible Department	Office of Emergency Management/Local VFDs
Local Planning Mechanism (check all that apply)	☐Capital Improvement Plan X Comprehensive Plan ☐Building Code ☐Ordinance ☐Other:
Potential Funding Sources	N/A
Timeline for Completion	☐ Short Term (1-5 yrs.) ☐ Long Term (>5 yrs.) X Ongoing
Reporting on Progress	
Status/Comment	☐Not Started ☐In-progress ☐Delayed ☐Completed ☐No Longer Required Comment:
Completed by: (name, title, phone #)	**Marsha Hardy, EMC/CFM, 325-372-8570 Date: 7-28-15**

Prioritization Worksheet

Mitigation Action #: 6 ______________

Mitigation Action Title: MOUs between VFDs and Contiguous Counties

Criteria	Numeric Rank: Definitely Yes = 4 Maybe Yes = 3 Unknown/Neutral = 2 Probably No = 1 Definitely No = 0		Provide brief rationale for numeric rank when appropriate
1. Will the action result in Life Safety?	4	x 2 = 8	
2. Will the action result in Property Protection?	4	x 2 = 8	
3. Will the action be Cost-Effective? (future benefits exceed cost)	3		
4. Is the action Technically feasible	3		
5. Is the action Politically acceptable?	2		
6. Does the jurisdiction have the Legal authority to implement?	2		
7. Is Funding available for the action?	2		
8. Will the action have a positive impact on the natural Environment?	3		
9. Is the action Socially acceptable?	3		
10. Does the jurisdiction have the Administrative capability to execute the action?	2		
11. Will the action reduce risk to more than one hazard (Multi-Hazard)?	2		
12. Can the action be implemented Quickly?	1		
13. Is there an Agency/Department Champion for the action?	2		
14. Will the action meet other Community Objectives?	2		
Total	43		
Priority: Low = <35 Medium = 35-49 High = >50	☐Low X Medium ☐High		

Mitigation Action Worksheet

Please complete one worksheet per action with as much detail as possible, using the instructions beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: San Saba County **Mitigation Action #:** 7 (5-Past2011)

Mitigation Action Title: Develop a study of the area known as 'Hooten Holler' in the city of Richland Springs

Assessing the Risk	
Hazard(s) addressed: (check all that apply)	☐All Hazards ☐Coastal Erosion ☐Dam/Levee Failure ☐Drought ☐Earthquake ☐Expansive Soils ☐Extreme Heat X Flood ☐Hail ☐Hurricanes/Tropical Storms ☐Land Subsidence ☐Lightning ☐Thunderstorm ☐Tornado ☐Wildfire ☐Wind ☐Winter Weather
Specific problem being Mitigated (describe why action is needed)	To determine how to control flooding and washout issues involved with the Holler
Evaluation of Potential Alternatives	
Alternatives Considered (name of project and reason for not selecting)	1. Rechannel floodplain [not feasible]
	2. Install culverts and bridges [budgetary issues]
	3. No action
Action/Project Intended for Implementation	
Describe how action will be implemented (main steps involved)	Develop a study of the area known as 'Hooten Holler', on the east side of the city of Richland Springs to help with safety and flooding issues to the residents on both sides of the channel.
Action/Project Type	☐Local Plans and Regulations X Structure and Infrastructure Project ☐Natural Systems Protection ☐Education and Awareness Programs
Applicable Goals/Objectives (refer to list of goals/objectives)	X Goal #1 X☐Goal #2 ☐Goal #3 X☐Goal #4 ☐Goal #5 ☐Goal #6 Objective: 1.3, 2.2, 4.1
Applies to existing or future development	☐ Existing Development ☐Future Development X Both Existing and Future Development ☐Not Applicable
Describe benefits (losses avoided)	X Life Safety X Damage Reduction ☐Other Describe:
Estimated Cost	☐ < $10,000; X $10,000 to $100,000; ☐>$100,000 Other Amount: $
Plan for Implementation	
Responsible Department	City of Richland Springs and County of San Saba
Local Planning Mechanism (check all that apply)	☐Capital Improvement Plan ☐Comprehensive Plan ☐Building Code ☐Ordinance ☐Other:
Potential Funding Sources	FEMA Grants, Municipal and County General Revenue
Timeline for Completion	☐ Short Term (1-5 yrs.) X Long Term (>5 yrs.) ☐ Ongoing
Reporting on Progress	
Status/Comment	☐Not Started ☐In-progress ☐Delayed ☐Completed ☐No Longer Required Comment:
Completed by: (name, title, phone #)	**Marsha Hardy, EMC/DFM, 325-372-8570 Date: 7-27-15**

Prioritization Worksheet

Mitigation Action #: 7 (5-Past2011)

Mitigation Action Title: Develop a study of the area known as 'Hooten Holler'

Criteria	Numeric Rank: Definitely Yes = 4, Maybe Yes = 3, Unknown/Neutral = 2, Probably No = 1, Definitely No = 0		Provide brief rationale for numeric rank when appropriate
1. Will the action result in Life Safety?	3	x 2 = 6	
2. Will the action result in Property Protection?	3	x 2 = 6	
3. Will the action be Cost-Effective? (future benefits exceed cost)	3		
4. Is the action Technically feasible	2		
5. Is the action Politically acceptable?	2		
6. Does the jurisdiction have the Legal authority to implement?	2		
7. Is Funding available for the action?	2		
8. Will the action have a positive impact on the natural Environment?	4		
9. Is the action Socially acceptable?	2		
10. Does the jurisdiction have the Administrative capability to execute the action?	2		
11. Will the action reduce risk to more than one hazard (Multi-Hazard)?	1		
12. Can the action be implemented Quickly?	1		
13. Is there an Agency/Department Champion for the action?	2		
14. Will the action meet other Community Objectives?	2		
Total	37		
Priority: Low = <35 Medium = 35-49 High = >50	☐Low X Medium ☐High		

Mitigation Action Worksheet

Please complete one worksheet per action with as much detail as possible, using the instructions beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: City of San Saba **Mitigation Action #:** 1

Mitigation Action Title: All Hazards Education and Awareness Programs

Assessing the Risk	
Hazard(s) addressed: (check all that apply)	X All Hazards ☐Coastal Erosion ☐Dam/Levee Failure ☐Drought ☐Earthquake ☐Expansive Soils ☐Extreme Heat ☐Flood ☐Hail ☐Hurricanes/Tropical Storms ☐Land Subsidence ☐Lightning ☐Thunderstorm ☐Tornado ☐Wildfire ☐Wind ☐Winter Weather
Specific problem being Mitigated (describe why action is needed)	**All Hazards Education and Awareness Programs**
Evaluation of Potential Alternatives	
Alternatives Considered (name of project and reason for not selecting)	1. Encourage residents to educate themselves via internet sites
	2. Use City website to post educational links
	3.No action
Action/Project Intended for Implementation	
Describe how action will be implemented (main steps involved)	Enhancing hazard awareness for all the hazards the City is exposed to through articles in the weekly newspaper and on the weekly radio show hosted by the City Manager. Both of these options are effective to reach most of residents of the City.
Action/Project Type	☐Local Plans and Regulations ☐Structure and Infrastructure Project ☐Natural Systems Protection X Education and Awareness Programs
Applicable Goals/Objectives (refer to list of goals/objectives)	X Goal #1 ☐Goal #2 ☐XGoal #3 ☐Goal #4 ☐Goal #5 ☐Goal #6 Objective:1.1, 1.3, 3.1, 3.2, 3.3
Applies to existing or future development	☐ Existing Development ☐Future Development X Both Existing and Future Development ☐Not Applicable
Describe benefits (losses avoided)	X Life Safety X Damage Reduction ☐Other Describe:
Estimated Cost	X < $10,000; ☐$10,000 to $100,000; ☐>$100,000 Other Amount: $
Plan for Implementation	
Responsible Department	Code Enforcement
Local Planning Mechanism (check all that apply)	☐Capital Improvement Plan X Comprehensive Plan ☐Building Code ☐Ordinance X Other: Education and Awareness
Potential Funding Sources	FEMA, USDA, General Revenue
Timeline for Completion	☐ Short Term (1-5 yrs.) Long Term (>5 yrs.) ☐X Ongoing
Reporting on Progress	
Status/Comment	☐Not Started ☐In-progress ☐Delayed ☐Completed ☐No Longer Required Comment:
Completed by: (name, title, phone #)	**Al Hamrick, Code Enforcement Director, 325-372-5144 Date: 8-27-15**

Prioritization Worksheet

Mitigation Action #: 1 ______________

Mitigation Action Title: All Hazards Education and Awareness Programs

Criteria	Numeric Rank: Definitely Yes = 4, Maybe Yes = 3, Unknown/Neutral = 2, Probably No = 1, Definitely No = 0		Provide brief rationale for numeric rank when appropriate
1. Will the action result in Life Safety?	4	x 2 = 8	
2. Will the action result in Property Protection?	3	x 2 = 6	
3. Will the action be Cost-Effective? (future benefits exceed cost)	2		
4. Is the action Technically feasible	4		
5. Is the action Politically acceptable?	4		
6. Does the jurisdiction have the Legal authority to implement?	3		
7. Is Funding available for the action?	1		
8. Will the action have a positive impact on the natural Environment?	3		
9. Is the action Socially acceptable?	2		
10. Does the jurisdiction have the Administrative capability to execute the action?	2		
11. Will the action reduce risk to more than one hazard (Multi-Hazard)?	3		
12. Can the action be implemented Quickly?	2		
13. Is there an Agency/Department Champion for the action?	3		
14. Will the action meet other Community Objectives?	3		
Total	46		
Priority: Low = <35, Medium = 35-49, High = >50	☐Low X Medium ☐High		

Mitigation Action Worksheet

Please complete one worksheet per action with as much detail as possible, using the instructions beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: City of San Saba **Mitigation Action #:** 2

Mitigation Action Title: Reverse 9-1-1 System [Code Red]

Assessing the Risk	
Hazard(s) addressed: (check all that apply)	X All Hazards ☐Coastal Erosion ☐Dam/Levee Failure ☐Drought ☐Earthquake ☐Expansive Soils ☐Extreme Heat ☐Flood ☐Hail ☐Hurricanes/Tropical Storms ☐Land Subsidence ☐Lightning ☐Thunderstorm ☐Tornado ☐Wildfire ☐Wind ☐Winter Weather
Specific problem being Mitigated (describe why action is needed)	**All Hazards that need fast dissemination**
Evaluation of Potential Alternatives	
Alternatives Considered (name of project and reason for not selecting)	1. Use NOAA Weather Radios
	2. Use outdoor warning sirens
	3. No action
Action/Project Intended for Implementation	
Describe how action will be implemented (main steps involved)	Develop operational procedures and protocols for the 'Reverse 9-1-1' system called Code Red for the entire county.
Action/Project Type	X Local Plans and Regulations ☐Structure and Infrastructure Project ☐Natural Systems Protection X Education and Awareness Programs
Applicable Goals/Objectives (refer to list of goals/objectives)	X☐Goal #1 ☐Goal #2 X Goal #3 X☐Goal #4 ☐Goal #5 ☐Goal #6 Objective: 1.2, 1.3, 3.1, 3.2, 4.3
Applies to existing or future development	☐ Existing Development ☐Future Development X Both Existing and Future Development ☐Not Applicable
Describe benefits (losses avoided)	☐Life Safety ☐Damage Reduction ☐Other Describe: Possibly all of the above
Estimated Cost	X < $10,000; ☐$10,000 to $100,000; ☐>$100,000 Other Amount: $
Plan for Implementation	
Responsible Department	Code Enforcement
Local Planning Mechanism (check all that apply)	☐Capital Improvement Plan X Comprehensive Plan ☐Building Code ☐Ordinance ☐Other:
Potential Funding Sources	Regional/CTCOG, General Revenue
Timeline for Completion	X Short Term (1-5 yrs.) ☐ Long Term (>5 yrs.) ☐ Ongoing
Reporting on Progress	
Status/Comment	☐Not Started ☐In-progress ☐Delayed ☐Completed ☐No Longer Required Comment:
Completed by: (name, title, phone #)	**Al Hamrick, Code Enforcement Director, 325-372-5144 Date: 8-27-15**

Prioritization Worksheet

Mitigation Action #: 2 ______________

Mitigation Action Title: Reverse 9-1-1 System [Code Red]

Criteria	Numeric Rank: Definitely Yes = 4, Maybe Yes = 3, Unknown/Neutral = 2, Probably No = 1, Definitely No = 0		Provide brief rationale for numeric rank when appropriate
1. Will the action result in <u>Life Safety</u>?	4	x 2 = 8	
2. Will the action result in <u>Property Protection</u>?	3	x 2 = 6	
3. Will the action be <u>Cost-Effective</u>? (future benefits exceed cost)	4		
4. Is the action <u>Technically</u> feasible	4		
5. Is the action <u>Politically</u> acceptable?	3		
6. Does the jurisdiction have the <u>Legal</u> authority to implement?	3		
7. Is <u>Funding</u> available for the action?	3		
8. Will the action have a positive impact on the natural <u>Environment</u>?	2		
9. Is the action <u>Socially</u> acceptable?	3		
10. Does the jurisdiction have the <u>Administrative</u> capability to execute the action?	2		
11. Will the action reduce risk to more than one hazard (<u>Multi-Hazard</u>)?	4		
12. Can the action be implemented <u>Quickly</u>?	2		
13. Is there an Agency/Department <u>Champion</u> for the action?	3		
14. Will the action meet other <u>Community Objectives</u>?	2		
Total	49		
Priority: **Low = <35** **Medium = 35-49** **High = >50**	☐Low X Medium ☐High		

Mitigation Action Worksheet

Please complete one worksheet per action with as much detail as possible, using the instructions beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: City of San Saba **Mitigation Action #:** 3

Mitigation Action Title: Encourage Drought-Tolerant landscape design

Assessing the Risk	
Hazard(s) addressed: (check all that apply)	☐All Hazards ☐Coastal Erosion ☐Dam/Levee Failure X Drought ☐Earthquake ☐Expansive Soils X☐Extreme Heat ☐Flood ☐Hail ☐Hurricanes/Tropical Storms ☐Land Subsidence ☐Lightning ☐Thunderstorm ☐Tornado ☐Wildfire ☐Wind ☐Winter Weather
Specific problem being Mitigated (describe why action is needed)	Encourage Drought-Tolerant landscape design through incorporating drought tolerant or xeriscape practices into landscape educational measures to reduce dependence on irrigation.
Evaluation of Potential Alternatives	
Alternatives Considered (name of project and reason for not selecting)	1. Provide incentives for xeriscaping.
	2. No action
	3.
Action/Project Intended for Implementation	
Describe how action will be implemented (main steps involved)	Encourage Drought-Tolerant landscape design through incorporating drought tolerant or xeriscape practices into landscape educational measures to reduce dependence on irrigation, as with the NRCS group or the Texas Agri-Life Extension Office.
Action/Project Type	☐Local Plans and Regulations ☐Structure and Infrastructure Project ☐Natural Systems Protection X Education and Awareness Programs
Applicable Goals/Objectives (refer to list of goals/objectives)	X☐Goal #1 X Goal #2 ☐Goal #3 ☐Goal #4 ☐Goal #5 XGoal #6 Objective: 1.3, 1.4, 2.2, 6.2
Applies to existing or future development	☐ Existing Development X Future Development ☐ Both Existing and Future Development ☐Not Applicable
Describe benefits (losses avoided)	☐Life Safety X Damage Reduction ☐Other Describe:
Estimated Cost	X < $10,000; ☐$10,000 to $100,000; ☐>$100,000 Other Amount: $
Plan for Implementation	
Responsible Department	Code Enforcement, Natural Resource Conservation Service, Texas Agri-Life Extension Agency
Local Planning Mechanism (check all that apply)	☐Capital Improvement Plan ☐Comprehensive Plan ☐Building Code ☐Ordinance ☐Other:
Potential Funding Sources	Natural Resource Conservation Service, Texas Agri-Life Extension Agency
Timeline for Completion	☐ Short Term (1-5 yrs.) X Long Term (>5 yrs.) ☐ Ongoing
Reporting on Progress	
Status/Comment	☐Not Started ☐In-progress ☐Delayed ☐Completed ☐No Longer Required Comment:
Completed by: (name, title, phone #)	**Al Hamrick, Code Enforcement Director, 325-372-5144 Date: 8-27-15**

Prioritization Worksheet

Mitigation Action #: 3 ______________

Mitigation Action Title: Encourage Drought-Tolerant landscape design

Criteria	Numeric Rank: Definitely Yes = 4, Maybe Yes = 3, Unknown/Neutral = 2, Probably No = 1, Definitely No = 0		Provide brief rationale for numeric rank when appropriate
1. Will the action result in Life Safety?	2	x 2 = 4	
2. Will the action result in Property Protection?	3	x 2 = 6	
3. Will the action be Cost-Effective? (future benefits exceed cost)	2		
4. Is the action Technically feasible	3		
5. Is the action Politically acceptable?	3		
6. Does the jurisdiction have the Legal authority to implement?	1		
7. Is Funding available for the action?	1		
8. Will the action have a positive impact on the natural Environment?	4		
9. Is the action Socially acceptable?	3		
10. Does the jurisdiction have the Administrative capability to execute the action?	2		
11. Will the action reduce risk to more than one hazard (Multi-Hazard)?	2		
12. Can the action be implemented Quickly?	1		
13. Is there an Agency/Department Champion for the action?	1		
14. Will the action meet other Community Objectives?	2		
Total	35		
Priority: Low = <35, Medium = 35-49, High = >50	☐Low X Medium ☐High		

Mitigation Action Worksheet

Please complete one worksheet per action with as much detail as possible, using the instructions beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: City of San Saba **Mitigation Action #:** 4

Mitigation Action Title: Encourage construction of safe rooms

Assessing the Risk	
Hazard(s) addressed: (check all that apply)	☐All Hazards ☐Coastal Erosion ☐Dam/Levee Failure ☐Drought X Earthquake ☐Expansive Soils ☐Extreme Heat ☐Flood ☐Hail ☐Hurricanes/Tropical Storms ☐Land Subsidence ☐Lightning X Thunderstorm X Tornado ☐Wildfire X Wind ☐Winter Weather
Specific problem being Mitigated (describe why action is needed)	**Encourage construction of safe rooms**
Evaluation of Potential Alternatives	
Alternatives Considered (name of project and reason for not selecting)	1. Develop a local grant program to assist homeowners who wish to construct a safe room [budget
	2. Retrofit public buildings with safe rooms
	3.No action
Action/Project Intended for Implementation	
Describe how action will be implemented (main steps involved)	Encourage the construction of safe rooms in residential homes and public buildings in San Saba. These would be built to FEMA standards above ground.
Action/Project Type	☐Local Plans and Regulations X Structure and Infrastructure Project ☐Natural Systems Protection X Education and Awareness Programs
Applicable Goals/Objectives (refer to list of goals/objectives)	☐Goal #1 ☐Goal #2 X Goal #3 X☐Goal #4 ☐Goal #5 ☐Goal #6 Objective: 3.2, 4.1, 6.1, 6.2
Applies to existing or future development	☐ Existing Development X Future Development ☐ Both Existing and Future Development ☐Not Applicable
Describe benefits (losses avoided)	X Life Safety ☐Damage Reduction ☐Other Describe:
Estimated Cost	X < $10,000; ☐$10,000 to $100,000; ☐>$100,000 Other Amount: $
Plan for Implementation	
Responsible Department	Code Enforcement
Local Planning Mechanism (check all that apply)	☐Capital Improvement Plan X Comprehensive Plan ☐Building Code ☐Ordinance ☐Other:
Potential Funding Sources	FEMA Grants, Private Funds
Timeline for Completion	☐ Short Term (1-5 yrs.) X Long Term (>5 yrs.) ☐ Ongoing
Reporting on Progress	
Status/Comment	☐Not Started ☐In-progress ☐Delayed ☐Completed ☐No Longer Required Comment:
Completed by: (name, title, phone #)	**Al Hamrick, Code Enforcement Director, 325-372-5144 Date: 8-27-15**

Prioritization Worksheet

Mitigation Action #: 4 ______________

Mitigation Action Title: Encourage construction of safe rooms

Criteria	Numeric Rank: Definitely Yes = 4 Maybe Yes = 3 Unknown/Neutral = 2 Probably No = 1 Definitely No = 0		Provide brief rationale for numeric rank when appropriate
1. Will the action result in Life Safety?	4	x 2 = 8	
2. Will the action result in Property Protection?	3	x 2 = 6	
3. Will the action be Cost-Effective? (future benefits exceed cost)	2		
4. Is the action Technically feasible	2		
5. Is the action Politically acceptable?	2		
6. Does the jurisdiction have the Legal authority to implement?	2		
7. Is Funding available for the action?	1		
8. Will the action have a positive impact on the natural Environment?	2		
9. Is the action Socially acceptable?	2		
10. Does the jurisdiction have the Administrative capability to execute the action?	2		
11. Will the action reduce risk to more than one hazard (Multi-Hazard)?	4		
12. Can the action be implemented Quickly?	2		
13. Is there an Agency/Department Champion for the action?	2		
14. Will the action meet other Community Objectives?	2		
Total	39		
Priority: Low = <35 Medium = 35-49 High = >50	☐Low X Medium ☐High		

Mitigation Action Worksheet

Please complete one worksheet per action with as much detail as possible, using the instructions beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: City of San Saba **Mitigation Action #:** 5 (4-Past2004)

Mitigation Action Title: Reduce the number of uninhabitable and un-maintained properties in the floodplain.

Assessing the Risk	
Hazard(s) addressed: (check all that apply)	☐All Hazards ☐Coastal Erosion ☐Dam/Levee Failure ☐Drought Earthquake ☐Expansive Soils ☐Extreme Heat X ☐Flood ☐Hail ☐Hurricanes/Tropical Storms ☐Land Subsidence ☐Lightning Thunderstorm Tornado ☐Wildfire Wind ☐ Winter Weather
Specific problem being Mitigated (describe why action is needed)	**One-fourth of the City is in the 100-year floodplain. Reducing the number of un-maintained properties in the floodplains is an ongoing effort**
Evaluation of Potential Alternatives	
Alternatives Considered (name of project and reason for not selecting)	1. buyout properties
	2. Elevate properties
	3.No action
Action/Project Intended for Implementation	
Describe how action will be implemented (main steps involved)	The City is condemning properties, paying for demolition and maintaining the lots as open space. This is an ongoing effort.
Action/Project Type	☐Local Plans and Regulations X Structure and Infrastructure Project ☐XNatural Systems Protection Education and Awareness Programs
Applicable Goals/Objectives (refer to list of goals/objectives)	☐Goal #1 X☐Goal #2 X Goal #3 X☐Goal #4 X ☐Goal #5 X☐Goal #6 Objective: 2.1, 3.3, 4.1, 4.3, 5.1, 5.2, 5.3, 6.2
Applies to existing or future development	☐X Existing Development Future Development ☐ Both Existing and Future Development ☐Not Applicable
Describe benefits (losses avoided)	X Life Safety X☐Damage Reduction ☐Other Describe:
Estimated Cost	< $10,000; ☐$10,000 to $100,000; X☐>$100,000 Other Amount: $
Plan for Implementation	
Responsible Department	Code Enforcement
Local Planning Mechanism (check all that apply)	☐Capital Improvement Plan X Comprehensive Plan ☐Building Code ☐Ordinance ☐Other:
Potential Funding Sources	FMA, PDM, HMGP grants
Timeline for Completion	☐ Short Term (1-5 yrs.) X Long Term (>5 yrs.) ☐ Ongoing
Reporting on Progress	
Status/Comment	☐Not Started ☐In-progress ☐Delayed ☐Completed ☐No Longer Required Comment:
Completed by: (name, title, phone #)	**Al Hamrick, Code Enforcement Director, 325-372-5144 Date: 8-27-15**

Prioritization Worksheet

Mitigation Action #: 5 (4-Past2004)

Mitigation Action Title: Reduce the number of uninhabitable and un-maintained properties in the floodplain.

Criteria	Numeric Rank: Definitely Yes = 4 Maybe Yes = 3 Unknown/Neutral = 2 Probably No = 1 Definitely No = 0		Provide brief rationale for numeric rank when appropriate
1. Will the action result in Life Safety?	4	x 2 = 8	
2. Will the action result in Property Protection?	2	x 2 = 4	
3. Will the action be Cost-Effective? (future benefits exceed cost)	2		
4. Is the action Technically feasible	2		
5. Is the action Politically acceptable?	2		
6. Does the jurisdiction have the Legal authority to implement?	2		
7. Is Funding available for the action?	2		
8. Will the action have a positive impact on the natural Environment?	3		
9. Is the action Socially acceptable?	1		
10. Does the jurisdiction have the Administrative capability to execute the action?	2		
11. Will the action reduce risk to more than one hazard (Multi-Hazard)?	0		
12. Can the action be implemented Quickly?	2		
13. Is there an Agency/Department Champion for the action?	2		
14. Will the action meet other Community Objectives?	2		
Total	34		
Priority: Low = <35 Medium = 35-49 High = >50	X☐Low Medium ☐High		

Mitigation Action Worksheet

Please complete one worksheet per action with as much detail as possible, using the instructions beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: City of San Saba **Mitigation Action #:** 6 (1-Past2011)

Mitigation Action Title: National Weather Service's StormReady program

Assessing the Risk	
Hazard(s) addressed: (check all that apply)	☒All Hazards ☐Coastal Erosion ☐Dam/Levee Failure ☐Drought ☐Earthquake ☐Expansive Soils ☐Extreme Heat ☐Flood ☐Hail ☐Hurricanes/Tropical Storms ☐Land Subsidence ☐Lightning ☐Thunderstorm ☐Tornado ☐Wildfire ☐Wind ☐Winter Weather
Specific problem being Mitigated (describe why action is needed)	**San Saba experiences natural hazards. A storm ready status would help ensure storm information to all citizens.**
Evaluation of Potential Alternatives	
Alternatives Considered (name of project and reason for not selecting)	1. Create storm proof community 2. Complete our own list of community safety priorities and actions 3. No action
Action/Project Intended for Implementation	
Describe how action will be implemented (main steps involved)	Work to complete guidelines 1-6 to become a certified StormReady community.
Action/Project Type	☒Local Plans and Regulations ☐Structure and Infrastructure Project ☐Natural Systems Protection ☒Education and Awareness Programs
Applicable Goals/Objectives (refer to list of goals/objectives)	☐Goal #1 ☐Goal #2 ☒Goal #3 ☒Goal #4 ☐Goal #5 ☐Goal #6 Objective: 3.2, 3.3, 4.1, 4.3
Applies to existing or future development	☐ Existing Development ☐Future Development ☒ Both Existing and Future Development ☐Not Applicable
Describe benefits (losses avoided)	☒Life Safety ☒Damage Reduction ☐Other Describe:
Estimated Cost	☒ < $10,000; ☐$10,000 to $100,000; ☐>$100,000 Other Amount: $
Plan for Implementation	
Responsible Department	Code Enforcement
Local Planning Mechanism (check all that apply)	☐Capital Improvement Plan ☐Comprehensive Plan ☒Building Code ☒Ordinance ☐Other: Education Plan
Potential Funding Sources	City Funds
Timeline for Completion	☐ Short Term (1-5 yrs.) ☒ Long Term (>5 yrs.) ☐ Ongoing
Reporting on Progress	
Status/Comment	☐Not Started ☐In-progress ☐Delayed ☐Completed ☐No Longer Required Comment:
Completed by: (name, title, phone #)	**Al Hamrick, Code Enforcement Director, 325-372-5144 Date: 8-27-15**

Prioritization Worksheet

Mitigation Action #: 6 (1-Past2011)

Mitigation Action Title: National Weather Service's StormReady program

Criteria	Numeric Rank: Definitely Yes = 4, Maybe Yes = 3, Unknown/Neutral = 2, Probably No = 1, Definitely No = 0		Provide brief rationale for numeric rank when appropriate
1. Will the action result in <u>Life Safety</u>?	4	x 2 = 8	
2. Will the action result in <u>Property Protection</u>?	4	x 2 = 8	
3. Will the action be <u>Cost-Effective</u>? (future benefits exceed cost)	3		
4. Is the action <u>Technically</u> feasible	2		
5. Is the action <u>Politically</u> acceptable?	2		
6. Does the jurisdiction have the <u>Legal</u> authority to implement?	3		
7. Is <u>Funding</u> available for the action?	2		
8. Will the action have a positive impact on the natural <u>Environment</u>?	4		
9. Is the action <u>Socially</u> acceptable?	3		
10. Does the jurisdiction have the <u>Administrative</u> capability to execute the action?	3		
11. Will the action reduce risk to more than one hazard (<u>Multi-Hazard</u>)?	4		
12. Can the action be implemented <u>Quickly</u>?	2		
13. Is there an Agency/Department <u>Champion</u> for the action?	3		
14. Will the action meet other <u>Community Objectives</u>?	2		
Total	49		
Priority: Low = <35, Medium = 35-49, High = >50	☐Low ☒Medium ☐High		

APPENDIX F. PLAN ADOPTION RESOLUTIONS FROM PLANNING PARTNERS

APPENDIX F.
PLAN ADOPTION RESOLUTIONS FROM PLANNING PARTNERS

To Be Provided With Final Release

APPENDIX G.
EXAMPLE PROGRESS REPORT

APPENDIX G.
EXAMPLE PROGRESS REPORT

San Saba County
Hazard Mitigation Plan Update
Annual Progress Report

Reporting Period: 2016-2020

Background: San Saba County and the City of San Saba developed a hazard mitigation plan to reduce risk from all hazards by identifying resources, information, and strategies for risk reduction. The federal Disaster Mitigation Act of 2000 requires state and local governments to develop hazard mitigation plans as a condition for federal disaster grant assistance. To prepare the plan, the participating partners organized resources, assessed risks from natural hazards within the planning area, developed planning goals and objectives, reviewed mitigation alternatives, and developed an action plan to address probable impacts from natural hazards. By completing this process, these jurisdictions maintained compliance with the Disaster Mitigation Act, achieving eligibility for mitigation grant funding opportunities afforded under FEMA's Hazard Mitigation Assistance grants. The plan can be viewed on-line at:

http://www.co.san-saba.tx.us/

Summary Overview of the Plan's Progress: The performance period for the Hazard Mitigation Plan became effective on ____, 2016, with the final approval of the plan by FEMA. The initial performance period for this plan will be 5 years, with an anticipated update to the plan to occur before ______, 2020. As of this reporting period, the performance period for this plan is considered to be __% complete. The Hazard Mitigation Plan has targeted 13 hazard mitigation actions to be pursued during the 5-year performance period. As of the reporting period, the following overall progress can be reported:

- __ out of __ actions (__%) reported ongoing action toward completion
- __ out of __ actions (__%) were reported as being complete
- __ out of __ actions (___%) reported no action taken

Purpose: The purpose of this report is to provide an annual update on the implementation of the action plan identified in the San Saba County Hazard Mitigation Plan Update. The objective is to ensure that there is a continuing and responsive planning process that will keep the Hazard Mitigation Plan dynamic and responsive to the needs and capabilities of the partner jurisdictions. This report discusses the following:

- Natural hazard events that have occurred within the last year
- Changes in risk exposure within the planning area (all of San Saba County)
- Mitigation success stories
- Review of the action plan
- Changes in capabilities that could impact plan implementation
- Recommendations for changes/enhancement.

The Hazard Mitigation Plan Steering Committee: The Hazard Mitigation Plan Steering Committee, made up of planning partners and stakeholders within the planning area, reviewed and approved this progress report at its annual meeting held on _____, 201_. It was determined through the plan's development process that a Steering Committee would remain in service to oversee maintenance of the plan. At a minimum, the Steering Committee will provide technical review and oversight on the development of the annual progress report. It is anticipated that there will be turnover in the membership annually, which will be documented in the progress reports. For this reporting period, the Steering Committee membership is as indicated in Table 1.

TABLE 1.
STEERING COMMITTEE MEMBERS

Name	Title	Jurisdiction/Agency

Natural Hazard Events within the Planning Area: During the reporting period, there were __ natural hazard events in the planning area that had a measurable impact on people or property. A summary of these events is as follows:

- ______________________________
- ______________________________
- ______________________________
- ______________________________

Changes in Risk Exposure in the Planning Area: *(Insert brief overview of any natural hazard event in the planning area that changed the probability of occurrence or ranking of risk for the hazards addressed in the hazard mitigation plan)*

Mitigation Success Stories: *(Insert brief overview of mitigation accomplishments during the reporting period)*

Review of the Action Plan: Table 2 reviews the action plan, reporting the status of each action. Reviewers of this report should refer to the Hazard Mitigation Plan for more detailed descriptions of each action and the prioritization process.

Address the following in the "status" column of the following table:

- Was any element of the action carried out during the reporting period?
- If no action was completed, why?
- Is the timeline for implementation for the action still appropriate?

If the action was completed, does it need to be changed or removed from the action plan?

TABLE 2.
ACTION PLAN MATRIX

Action No.	Title	Action Taken? (Yes or No)	Timeline	Priority	Status	Status (√, O, X)
SAN SABA COUNTY						
1	All-hazards education and awareness programs					
2	Dam brush clearance					
3	Encourage construction of safe rooms					
4	Reverse 911 system (CodeRED)					
5	Encourage drought-tolerant landscape design					
6	MOUs between VFDs and contiguous counties					
7	Develop an engineering study of 'Hooten Holler' in the City of Richland Springs					
CITY OF SAN SABA						
1	All-hazards education and awareness programs					
2	Reverse 911 system (CodeRED)					
3	Encourage drought-tolerant landscape design					
4	Encourage construction of safe rooms					
5	Reduce the number of uninhabitable and un-maintained properties in the floodplain					
6	National Weather Service's StormReady Program					

Completion status legend:

✓= Project Completed

O = Action ongoing toward completion

X = No progress at this time

Changes That May Impact Implementation of the Plan: (*Insert brief overview of any significant changes in the planning area that would have a profound impact on the implementation of the plan. Specify any changes in technical, regulatory and financial capabilities identified during the plan's development)*

Recommendations for Changes or Enhancements: Based on the review of this report by the Hazard Mitigation Plan Steering Committee, the following recommendations will be noted for future updates or revisions to the plan:

- ____________________________
- ____________________________
- ____________________________
- ____________________________
- ____________________________

Public review notice: *The contents of this report are considered to be public knowledge and have been prepared for total public disclosure. Copies of the report have been provided to the governing boards of all planning partners and to local media outlets and the report is posted on the San Saba County Hazard Mitigation Plan website. Any questions or comments regarding the contents of this report should be directed to:*

Insert Contact Info Here