

**Cover Page**





**Lampasas County**  
**HAZARD MITIGATION PLAN UPDATE**

**DRAFT**

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*Prepared for:*

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# Lampasas County Hazard Mitigation Plan Update

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## **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.

Lampasas County and a partnership of local governments within the county 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.

Lampasas County and its communities 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 Lampasas County) and 63 jurisdictions. The 2011-2016 update was completed with technical support from the LCRA and the outside consultant team of H2O 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 Lampasas County and its participating communities: the Cities of Kempner, Lampasas, and Lometa.

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. Planning partners participating in the update were the Cities of Kempner, Lampasas, and Lometa. 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 Lampasas County Hazard Mitigation Plan Update is as follows:

- To reduce or eliminate the long-term risks to loss of life and property damage in Lampasas 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 71 mitigation actions targeted for implementation by individual planning partners as listed in Table ES-1-1. 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-1-1.  
RECOMMENDED MITIGATION ACTIONS**

Action No.	Title	Description	Mitigation Action Ranking	Action Type	Applicable Goals	Applicable Objectives	Estimated Cost	Potential Funding Sources	Timeline	Benefit
<b>LAMPASAS COUNTY</b>										
1	Dam/levee education	Encourage public awareness on local dam/levee structures and potential failures.	14	EAP	G1, G4, G6	1.1, 1.2, 1.3, 4.1, 4.3, 6.1, 6.4	<\$10,000	Grant Funding, General Revenue	Ongoing	Low
2	Dam/levee monitoring	Establish annual review of dam/levee conditions.	13	LPR	G1, G2, G4, G5, G6	1.2, 1.3, 2.3, 4.1, 5.1, 6.1	<\$10,000	Grant Funding, Donations	Ongoing	Low
3	Water saving techniques	Encourage residents to adopt water saving measures.	4	EAP	G3, G6	3.1, 3.2, 6.1, 6.2	<\$10,000	General Revenue, Grant Funding	Short Term	Medium
4	Drought vulnerability	Gathering and analyzing water and climate data to gain better understanding of local climate and drought history.	7	LPR NSP	G1, G4, G6	1.2, 1.4, 4.1, 6.1, 6.2, 6.4	<\$10,000	General Revenue, Grant Funding	Long Term	Medium
5	Monitor risk areas	Monitor at-risk areas.	9	LPR	G1, G5, G6	1.1, 1.2, 5.2, 5.3, 6.1	>\$100,000	Grant Funding	Long Term	Low
6	Education for earthquakes/land subsidence and expansive soils	Encourage residents to participate in information sessions on risks to homes, businesses, and schools.	18	EAP	G1, G3, G4	1.1, 3.1, 3.2, 4.1	<\$10,000	Grant Funding	Long Term	Low
7	Extreme weather awareness	Encourage public education through local presentations and literature.	12	EAP	G1, G3, G6	1.1, 3.2, 6.1	<\$10,000	General Revenue, Grant Funding	Short Term	High

**TABLE ES-1-1.  
RECOMMENDED MITIGATION ACTIONS**

Action No.	Title	Description	Mitigation Action Ranking	Action Type	Applicable Goals	Applicable Objectives	Estimated Cost	Potential Funding Sources	Timeline	Benefit
8	Heat vulnerable populations	Prevent loss of life among the at-risk population located throughout the county.	8	LPR EAP	G1, G3, G4, G6	1.1, 3.1, 4.1, 4.2, 6.1	\$10,000 to \$100,000	General Revenue, Grant Funding, Donations	Ongoing	Low
9	Drainage issue on CR 1139	Survey drainage site and get cost estimate for replacement for larger capacity drainage.	2	NSP	G1, G4, G6	1.3, 4.3, 6.4	<\$10,000	General Revenue	Short Term	High
10	Drainage/flooding issue on CR 4450	Survey drainage site and get cost estimate for replacement for larger capacity drainage to prevent future flooding.	1	NSP	G1, G4, G6	1.3, 4.3, 6.4	<\$10,000	General Revenue	Short Term	High
11	Hazardous weather awareness	Increase public awareness of severe weather by encouraging participation in National Weather Service's SKYWARN training and providing take home materials.	11	EAP	G1, G3, G6	1.1, 1.2, 3.1, 3.2, 6.1	<\$10,000	General Revenue and Grants	Short Term	High
12	Hurricane community risk	Obtain weather information from local sources and the State Operations Center and determine local impact.	17	LPR	G1, G3, G5, G6	1.1, 1.2, 3.1, 5.1, 6.2	<\$10,000	N/A	Ongoing	Low
13	Protecting critical facilities from lightning	Protect critical facilities and equipment from lightning damage.	5	SIP	G4, G6	4.1, 4.3, 6.1	\$10,000 to \$100,000	General Revenue	Ongoing	Low
14	Safe room	Encourage residents to construct safe rooms inside and outside homes. Also require mobile home parks to provide safe storm shelters.	16	LPR	G4, G5, G6	4.1, 5.1, 6.1, 6.2, 6.4	>\$100,000	Private Funding, Grant Funding	Long Term	Medium

**TABLE ES-1-1.  
RECOMMENDED MITIGATION ACTIONS**

Action No.	Title	Description	Mitigation Action Ranking	Action Type	Applicable Goals	Applicable Objectives	Estimated Cost	Potential Funding Sources	Timeline	Benefit
15	Reduce roadway impact/winter weather	County Commissioners will acquire cost to purchase sanding equipment and storage sites for sand.	15	LPR	G1, G4, G5, G6	1.3, 4.3, 5.1, 6.4	>\$100,000	General Revenue	Short Term	Low
16	Adopt routine fire hydrant maintenance	Maintenance program is a risk reduction measure that combines prevention and mitigation strategies. A routine hydrant maintenance program will have a direct effect on the safety of firefighters.	6	SIP	G1	1.3, 1.4	<\$10,000	Fire Department Funding	Ongoing	High
17	County burn ban	County Fire Marshall will assess the conditions and advise the Commissioners' Court on appropriate action needed. This also includes establishing and implementing burning standards in the community.	10	LPR EAP	G1, G3, G4, G6	1.1, 3.1, 3.1, 4.1, 6.1	<\$10,000	N/A	Ongoing	Medium
18	Ensure that area firefighters are properly trained in current firefighting techniques, covering both urban and wildland fires	Training will be routinely offered to firefighters.	3	LPR	G1, G4	1.4, 4.1	< \$10,000	County Funds, Grants	Ongoing	Medium
19	Mandate and inspect to ensure standard tie-down of mobile homes	Pass an ordinance that all mobile homes in the county must be tied-down and have annual inspections.	19	LPR SIP	G1, G4, G5, G6	1.3, 4.1, 4.3, 5.1, 6.2, 6.3, 6.4	<\$10,000	None Needed	Long Term	High

**TABLE ES-1-1.  
RECOMMENDED MITIGATION ACTIONS**

Action No.	Title	Description	Mitigation Action Ranking	Action Type	Applicable Goals	Applicable Objectives	Estimated Cost	Potential Funding Sources	Timeline	Benefit
<b>CITY OF KEMPNER</b>										
1	Wildfire assistance	Increase city's response to prevent further loss during wildfires.	9	LPR	G1, G4, G6	1.3, 1.4, 4.1, 6.1	Other	N/A	Long Term	High
2	Water saving techniques	Encourage residents to adopt water saving measures.	13	EAP	G3, G6	3.1, 3.2, 6.1, 6.2	<\$10,000	Grant Funding, Donations	Short Term	Medium
3	Monitor water supply	Provide early warning for a water shortage. Allows city officials to be proactive.	4	NSP	G1, G4, G6	1.2, 1.4, 4.1, 6.1, 6.2, 6.4	Other	General Revenue, Grant Funding	Ongoing	Medium
4	Education for earthquakes/land subsidence and expansive soils	Encourage residents to participate in information sessions on risks to homes, businesses, and schools.	17	LPR	G1, G3, G4	1.1, 3.1, 3.2, 4.1	<\$10,000	Grant Funding	Long Term	Low
5	Monitor risk areas	Monitor at-risk areas.	7	LPR	G1, G5, G6	1.1, 1.2, 5.2, 5.3, 6.1	Other	Grant Funding	Long Term	Low
6	Extreme weather awareness	Encourage public education through local presentations and literature. Develop a pamphlet and public awareness campaign including radio messages.	8	EAP	G1, G3, G6	1.1, 3.2, 6.1	<\$10,000	General Revenue, Grant Funding	Short Term	High
7	Heat vulnerable populations	Prevent loss of life among the at-risk population.	12	LPR	G1, G3, G4, G6	1.1, 3.1, 4.1, 4.2, 6.1	<\$10,000	General Revenue, Grant Funds, Donations	Ongoing	Low

**TABLE ES-1-1.  
RECOMMENDED MITIGATION ACTIONS**

Action No.	Title	Description	Mitigation Action Ranking	Action Type	Applicable Goals	Applicable Objectives	Estimated Cost	Potential Funding Sources	Timeline	Benefit
8	Curbing and drainage	City will assess the cost and engineering designs for future plans to install these infrastructure items.	1	SIP	G1, G2, G5, G6	1.3, 1.4, 2.1, 5.1, 6.1	>\$100,000	General Revenue, TXDOT Funding	Long Term	High
9	Flood Insurance Program	Reduce economic impact of floods. Meeting NFIP requirements will reduce the threat to life and property.	5	LPR	G1, G2, G4, G6	1.3, 1.4, 2.1, 4.1, 6.4	Other	General Revenue	Long Term	High
10	Hazardous weather awareness	Increase public awareness of severe weather by encouraging participation in National Weather Service's SKYWARN training and providing take home materials.	6	EAP	G1, G3, G6	1.1, 1.2, 3.1, 3.2, 6.1	<\$10,000	General Revenue and Grants	Short Term	High
11	Hurricane community risk	Obtain weather information from local sources and the State Operations Center and determine local impact.	16	LPR	G1, G3, G5, G6	1.1, 1.2, 3.1, 5.1, 6.2	Other	General Revenue	Long Term	Low
12	Protect critical facilities	Prevent city from losing critical facilities, for example, water plant.	2	SIP	G1, G4, G6	1.4, 4.1, 6.1	Other	Grant Funding	Long Term	Low
13	Safe room	Encourage residents to construct safe rooms inside and outside homes.	11	LPR	G4, G5, G6	4.1, 5.1, 6.1, 6.2, 6.4	\$10,000 to \$100,000	Private Funding, Grant Funding	Long Term	Medium

**TABLE ES-1-1.  
RECOMMENDED MITIGATION ACTIONS**

Action No.	Title	Description	Mitigation Action Ranking	Action Type	Applicable Goals	Applicable Objectives	Estimated Cost	Potential Funding Sources	Timeline	Benefit
14	Wildfire education	Local volunteer fire department will conduct education programs in communities and schools.	15	EAP	G1, G3, G4, G6	1.1, 3.1, 4.1, 6.1	<\$10,000	Grant Funding and General Revenue	Ongoing	Low
15	Develop a mass debris removal plan	Develop a mass debris removal plan in advance of a disaster event.	10	LPR	G1, G4, G5	1.3, 1.4, 4.3, 5.1	\$10,000 to \$100,000	Grant Funding	Short Term	Medium
16	National Weather Service's StormReady Program	Work to complete guidelines 1 to 6 to become a certified StormReady community	14	LPR EAP	G3, G4	3.3, 4.1	<\$10,000	City Funds	Short Term	High
17	Outdoor warning sirens	Purchase and determine coverage area for placement of sirens. Install and test sirens.	3	SIP	G1, G3	1.1, 1.2, 1.3, 3.1	\$10,000 to \$100,000	City Funds, Grants	Short Term	High
<b>CITY OF LAMPASAS</b>										
1	Dam/levee education	Encourage public awareness on local dam/levee structures and potential failures. Have Power Point presentations at city meetings.	11	EAP	G1, G4, G6	1.1, 1.2, 1.3, 4.1, 4.3, 6.1, 6.4	<\$10,000	General Revenue	Short Term	High
2	Revise levee standards	Revise how the City of Lampasas maintains levee improvements. Work closely with the USACE to ensure maintenance and documentation is maintained.	5	EAP	G1, G4, G6	1.1, 1.3, 1.4, 4.1, 6.2	\$10,000 to \$100,000	General Revenue	Ongoing	High

**TABLE ES-1-1.  
RECOMMENDED MITIGATION ACTIONS**

Action No.	Title	Description	Mitigation Action Ranking	Action Type	Applicable Goals	Applicable Objectives	Estimated Cost	Potential Funding Sources	Timeline	Benefit
3	Drought education	Encourage residents to adopt water saving measures.	12	EAP	G3, G6	3.1, 3.2, 6.1, 6.2	<\$10,000	General Revenue	Long Term	High
4	Drought monitoring	Monitor drought conditions and use water stages to restrict water usages as needed.	13	LPR NSP	G1, G4, G6	1.2, 1.4, 4.1, 6.1, 6.2, 6.4	<\$10,000	General Revenue	Long Term	High
5	Natural hazards education	The city will use meetings and publications to educate the public about natural hazard events, promote life safety measures and how to minimize property damages.	10	EAP	G1, G3, G6	1.1, 1.3, 3.1, 3.2, 6.1, 6.2	<\$10,000	General Revenue	Long Term	Medium
6	Enforcement of building codes	Through the enforcement of building codes, drainage issues and GEO Tech services have to be completed for commercial properties to test soil content for expansive soils possibilities.	1	LPR	G1, G2	1.3, 2.3	\$10,000 to \$100,000	City Budget	Long Term	High
7	Create areas of refuge	Create areas of refuge including at public parks.	15	NSP	G1, G2	1.3, 2.2	<\$10,000	City Budget	Long Term	Medium

**TABLE ES-1-1.  
RECOMMENDED MITIGATION ACTIONS**

Action No.	Title	Description	Mitigation Action Ranking	Action Type	Applicable Goals	Applicable Objectives	Estimated Cost	Potential Funding Sources	Timeline	Benefit
8	Low water crossing	Signs at low water crossings and drainage improvements would help with flooded roads.	3	SIP	G1, G2	1.3, 1.4, 2.2	\$10,000 to \$100,000	City Revenue, Grants	Ongoing	Medium
9	Community Emergency Response Team (CERT)	The city would like to initiate a countywide CERT capable of responding and assisting during all natural hazard events.	6	LPR EAP	G1, G3, G4, G6	1.3, 1.4, 3.1, 3.2, 3.3, 4.1, 4.2, 6.2	<\$10,000	City Revenue, Non-Profit Organizations	Short Term	High
10	Adopt routine fire hydrant maintenance	Maintenance program is a risk reduction measure that combines prevention and mitigation strategies. A routine hydrant maintenance program will have a direct effect on the safety of firefighters.	2	SIP	G1	1.3, 1.4	<\$10,000	Fire Department Funding	Ongoing	High
11	Implement burning standards	This includes burn bans, code enforcement of clearing property, and burn permits.	9	LPR EAP	G1, G3, G4, G5, G6	1.1, 1.3, 1.4, 2.2, 2.3, 3.1, 3.2, 3.3, 4.1, 5.1, 6.2	<\$10,000	N/A	Ongoing	Medium
12	Ensure that area firefighters are properly trained in current firefighting techniques, covering both urban and wildland fires	Training will be routinely offered to firefighters.	4	LPR	G1, G4	1.4, 4.1	<\$10,000	County Funds, Grants	Ongoing	Medium

**TABLE ES-1-1.  
RECOMMENDED MITIGATION ACTIONS**

Action No.	Title	Description	Mitigation Action Ranking	Action Type	Applicable Goals	Applicable Objectives	Estimated Cost	Potential Funding Sources	Timeline	Benefit
13	Mandate and inspect to ensure standard tie-down of mobile homes	Pass an ordinance that all mobile homes in the city must be tied-down and have annual inspections.	7	LPR SIP	G1, G4, G5, G6	1.3, 4.1, 4.3, 5.1, 6.2, 6.3, 6.4	<\$10,000	Not Needed	Long Term	High
14	Secure traffic lights and traffic controls from high winds	Secure traffic lights and traffic controls from high winds.	8	SIP	G1, G2	1.4, 2.2	>\$100,000	City Funds	Long Term	Medium
15	National Weather Service's StormReady Program	Work to complete guidelines 1 to 6 to become a certified StormReady community.	14	LPR EAP	G3, G4	3.3, 4.1, 4.3	<\$10,000	City Funds	Short Term	High
<b>CITY OF LOMETA</b>										
1	Water saving techniques	Encourage residents to adopt water saving measures.	9	EAP	G3, G6	3.1, 3.2, 6.1, 6.2	<\$10,000	AgriLife Extension, General Revenue, Grant Funding	Short Term	Medium
2	Monitor water supply	Provide early warning for a water shortage. Allows city officials to be proactive.	3	NSP	G1, G4, G6	1.2, 1.4, 4.1, 6.1, 6.2, 6.4	Other	General Revenue, Grant Funding	Long Term	Medium

**TABLE ES-1-1.  
RECOMMENDED MITIGATION ACTIONS**

Action No.	Title	Description	Mitigation Action Ranking	Action Type	Applicable Goals	Applicable Objectives	Estimated Cost	Potential Funding Sources	Timeline	Benefit
3	Education for earthquakes/land subsidence and expansive soils	Encourage residents to participate in information sessions on risks to homes, businesses, and schools.	20	LPR	G1, G3, G4	1.1, 3.1, 3.2, 4.1	<\$10,000	Grant Funding	Long Term	Low
4	Monitor risk areas	Monitor at-risk areas.	4	LPR	G1, G5, G6	1.1, 1.2, 5.2, 5.3, 6.1	>\$100,000	Grant Funding	Long Term	Low
5	Extreme weather awareness	Encourage public education through local presentations and literature.	8	EAP	G1, G3, G6	1.1, 3.2, 6.1	<\$10,000	General Revenue, Grant Funding	Short Term	High
6	Heat vulnerable populations	Prevent loss of life among the at-risk population.	5	LPR	G1, G3, G4, G6	1.1, 3.1, 4.1, 4.2, 6.1	<\$10,000	General Revenue, Grant Funds, Donations	Short Term	Low
7	Curbing and drainage	City will assess the cost and engineering designs for future plans.	1	SIP	G1, G2, G5, G6	1.3, 1.4, 2.1, 5.1, 6.1	>\$100,000	General Revenue, TXDOT Funding and Grants	Long Term	High
8	National Flood Insurance Program	Reduce economic impact of floods. Meeting NFIP requirements will reduce the threat to life and property.	6	LPR	G1, G2, G4, G6	1.3, 1.4, 2.1, 4.1, 6.4	Other	General Revenue, Grants	Long Term	High

**TABLE ES-1-1.  
RECOMMENDED MITIGATION ACTIONS**

Action No.	Title	Description	Mitigation Action Ranking	Action Type	Applicable Goals	Applicable Objectives	Estimated Cost	Potential Funding Sources	Timeline	Benefit
9	Hazardous weather awareness	Increase public awareness of severe weather by encouraging participation in National Weather Service's SKYWARN training and providing take home materials.	11	EAP	G1, G3, G6	1.1, 1.2, 3.1, 3.2, 6.1	<\$10,000	General Revenue, Grants	Short Term	Medium
10	Hurricane community risk	Obtain weather information from local sources and the State Operations Center and determine local impact.	19	LPR	G1, G3, G5, G6	1.1, 1.2, 3.1, 5.1, 6.2	<\$10,000	General Revenue	Long Term	Low
11	Safe room	Encourage residents to construct safe rooms inside and outside homes.	10	LPR	G1, G4, G5, G6	1.3, 4.1, 5.1, 6.1, 6.2, 6.4	>\$100,000	Private Funding, Grant Funding	Long Term	Medium
12	Wildfire education	Local volunteer fire department will conduct education programs in communities and schools on fire risks as well as wildland fire mitigation.	15	EAP	G1, G3, G4, G6	1.1, 3.1, 4.1, 6.1	<\$10,000	Grant Funding and General Revenue	Ongoing	Low
13	Wildfire assistance MOUs	Increase city's response to prevent further loss during wildfires with MOUs already established.	14	LPR	G1, G4, G6	1.3, 1.4, 4.1, 6.1	<\$10,000	N/A	Ongoing	High
14	Protect power lines	Create ordinance with allowable easements to prevent loss due to overhanging trees on power lines.	12	LPR	G1, G2, G4, G5, G6	1.3, 1.4, 2.2, 2.3, 4.1, 5.3, 6.1	<\$10,000	Hamilton Electric Coop., General Revenue	Ongoing	High
15	Develop a mass debris removal plan	Develop a mass debris removal plan in advance of a disaster event.	7	LPR	G1, G4, G5	1.3, 1.4, 4.3, 5.1	\$10,000 to \$100,000	Grant Funding	Short Term	Medium

**TABLE ES-1-1.  
RECOMMENDED MITIGATION ACTIONS**

Action No.	Title	Description	Mitigation Action Ranking	Action Type	Applicable Goals	Applicable Objectives	Estimated Cost	Potential Funding Sources	Timeline	Benefit
16	National Weather Service's StormReady Program	Work to complete guidelines 1 to 6 to become a certified StormReady community.	13	LPR EAP	G3, G4	3.3, 4.1, 4.3	<\$10,000	City Funds	Short Term	High
17	Outdoor warning sirens	Purchase and determine coverage area for placement of sirens. Install and test sirens.	2	SIP	G1, G3	1.1, 1.2, 1.3, 3.1	\$10,000 to \$100,000	City Funds, Grants	Short Term	High
18	Develop evacuation plans, policies and procedures	Develop main route evacuation plan with policies and procedures.	16	LPR	G1, G3	1.3, 3.3	<\$10,000	City Funds, Grants	Short Term	Medium
19	CERT	Create a countywide CERT with volunteers from the City of Lometa to train and provide support in safeguarding the city before, during, and after any disaster.	17	LPR EAP	G1, G3, G4	1.3, 3.2, 4.1, 4.2	<\$10,000	City and County Funds, Grants	Long Term	Medium
20	Xeriscape planting	Encourage xeriscape planting for drought/extreme heat-resistant landscaping.	18	EAP	G3	3.1, 3.2	<\$10,000	City Funds	Ongoing	Medium
CERT	Community Emergency Response Team		NFIP	National Flood Insurance Program						
EAP	Education and Awareness Programs		NSP	Natural Systems Protection						
LPR	Local Plans and Regulations		SIP	Structure and Infrastructure Project						
MOU	Memorandum of Understanding		TXDOT	Texas Department of Transportation						
N/A	Not Applicable		USACE	U.S. Army Corps of Engineers						

**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 Lampasas County initiated this planning effort:

- Lampasas 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.
- Lampasas County and its partners participating in this plan want to be proactive in preparing for the probable impacts from natural hazards.
- Lampasas County and its communities participated in previous hazard mitigation plans as part of the Texas Colorado River Floodplain Coalition (TCRFC), which included 15 counties (including Lampasas) 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 Lampasas County and its participating communities: the Cities of Kempner, Lampasas, and Lometa.
- FEMA approval of the previous hazard mitigation plan will expire in July 2016. If this plan is not updated, Lampasas 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 Lampasas 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 Lampasas 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 each participating jurisdiction:
  - 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 Lampasas County Hazard Mitigation Plan Update in its entirety.



# CHAPTER 2. PLAN UPDATE—WHAT HAS CHANGED

## 2.1 THE PREVIOUS PLAN

Lampasas County and its communities 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 Lampasas) and 63 jurisdictions. The 2011-2016 update was completed with technical support from the LCRA and the outside consultant team of H2O 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 Lampasas County and the participating Cities of Kempner, Lampasas, and Lometa. 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 was the only hazard ranked high for Lampasas County.

<b>TABLE 2-1. HAZARDS EVALUATED IN THE 2011-2016 TCRFC MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN UPDATE</b>													
Jurisdiction	Dam Failure	Drought	Extreme Heat	Flood	Hail	HAZMAT	Hurricane / Tropical Storm	Pipeline Failure	Terrorism	Thunderstorm	Tornado	Wildfire	Winter Storm
<b>Lampasas County</b>	<b>L</b>	<b>H</b>	<b>L</b>	<b>M</b>	<b>L</b>	<b>M</b>	<b>VL</b>	<b>VL</b>	<b>L</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>L</b>
City of Kempner	N/A	M	H	H	M	H	L	VL	H	M	M	VL	H
City of Lampasas	M	H	M	M	M	H	VL	L	M	H	L	H	VL
City of Lometa	N/A	H	L	L	M	VL	M	M	L	H	M	M	H

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.  
LAMPASAS 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	
<b>LAMPASAS COUNTY</b>										
1 (Past)	Adopt routine fire hydrant maintenance.	X								Incorporated into Mitigation Action 16.
2 (Past)	Establish and implement burning standards in community.	X								Incorporated into Mitigation Action 17.
3 (Past)	Ensure that area firefighters are properly trained in current firefighting techniques, covering both urban and wildland fires.	X								Incorporated into Mitigation Action 18.
4 (Past)	Promote the use of new technologies for detecting and fighting fires.	X								Incorporated into Mitigation Action 18.
5 (Past)	Educate the public about the risks they face and steps that can be taken to reduce their risk. - Educate citizens about hazardous materials and household hazardous waste. - Educate individuals and businesses regarding actions to take in preparation for possible terrorist events (emergency preparedness kits).				X					Only natural hazards were profiled in this plan update.
6 (Past)	Increase security where appropriate.				X					Only natural hazards were profiled in this plan update.

**TABLE 2-2.  
LAMPASAS 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	
7 (Past)	Require mobile home parks to provide safe storm shelters.		X							Incorporated into Mitigation Action 14.
8 (Past)	Mandate and inspect to ensure standard tie-downs of mobile homes.		X							Incorporated into Mitigation Action 19.
9 (Past)	Secure traffic lights and traffic controls from high wind damage.				X					
1	Rebuild low water crossing on CR 3372.			X				X		Project Completed
2	Conduct surface milling and install side walls at low water crossing at CR 2699.			X				X		Project Completed
3	Replace low water crossing on CR 2207.			X				X		Project Completed
<b>CITY OF KEMPNER</b>										
1 (Past)	Digitize hardcopies of public records and store them in hazard-free offsite locations.	X								Incorporated into Mitigation Action 5.
2 (Past)	Develop a mass debris removal plan.	X								No plan has been developed. Incorporated into Mitigation Action 15.

**TABLE 2-2.  
LAMPASAS 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	
3 (Past)	Employ consulting engineers to assess the adequacy of the city’s drainage and culverts.		X							Incorporated into Mitigation Action 8.
4 (Past)	Encourage the installation of safe rooms in new and existing homes and businesses.	X								Incorporated into Mitigation Action 13.
5 (Past)	Bring the city into compliance with the requirements of the National Weather Service’s StormReady Program.	X								Incorporated into Mitigation Action 16.
6 (Past)	Determine feasibility of installing outdoor warning sirens (investigate equipment available; determine types of sirens available; determine installation, operating, and maintenance costs; interview system owners to determine level of satisfaction and problems encountered).	X								Incorporated into Mitigation Action 17.
1	Develop a pamphlet and public awareness campaign including radio messages to educate the public about the dangers of extreme heat.	X								Plan to add link to city's website. Incorporated into Mitigation Action 6.
2	Adopt routine maintenance and cleaning of stormwater drains.				X					City does not have a public works department.

**TABLE 2-2.  
LAMPASAS 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	
3	Provide training for EMS in conjunction with railway companies to prepare for a derailment that involves a hazardous material release.				X					City of Kempner Volunteer Fire Department provides local training on a limited budget. Only natural hazards were profiled in this plan update.
4	Implement an annual tree trimming program to clear stray branches and limbs from the right-of-way.				X					No public works department.
<b>CITY OF LAMPASAS</b>										
1 (Past)	Adopt routine fire hydrant maintenance.	X								Incorporated into Mitigation Action 10.
2 (Past)	Establish and implement burning standards in community.	X								Incorporated into Mitigation Action 11.
3 (Past)	Ensure that area firefighters are properly trained in current firefighting techniques, covering both urban and wildland fires.	X								Incorporated into Mitigation Action 12.
4 (Past)	Promote the use of new technologies for detecting and fighting fires.	X								Incorporated into Mitigation Action 12.

**TABLE 2-2.  
LAMPASAS 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	
5 (Past)	Educate the public about the risks they face and steps that can be taken to reduce their risk. -Educate citizens about hazardous materials and household hazardous waste. - Educate individuals and businesses regarding actions to take in preparation for possible terrorist events (emergency preparedness kits).				X					Only natural hazards were profiled in this plan update.
6 (Past)	Increase security where appropriate.				X					Only natural hazards were profiled in this plan update.
7 (Past)	Require mobile home parks to provide safe storm shelters.	X								Incorporated into Mitigation Action 7.
8 (Past)	Mandate and inspect to ensure standard tie-downs of mobile homes.	X								Incorporated into Mitigation Action 13.
9 (Past)	Secure traffic lights and traffic controls from high wind damage.	X								Incorporated into Mitigation Action 14.
1	Bring the city into compliance with the National Weather Service’s StormReady Program.	X								Incorporated into Mitigation Action 15.
2	Undertake Sulphur Creek Drainage Project.			X						Work Completed.

**TABLE 2-2.  
LAMPASAS 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	
3	Implement Sulphur Creek Bank Stabilization Project, installing rock gabions to reduce erosion of the creek bank.			X						Received grant; project completed.
<b>CITY OF LOMETA</b>										
1 (Past)	Develop a mass debris removal plan.		X							No plan has been developed. Incorporated into Mitigation Action 15.
2 (Past)	Employ consulting engineers to assess the adequacy of the city's drainage ditches and culverts.		X							Lack of funding. Incorporated into Mitigation Action 7.
3 (Past)	Digitize hardcopies of public records and store them in hazard-free offsite locations.		X							Incorporated into Mitigation Action 4.
4 (Past)	Bring the city into compliance with the requirements of the National Weather Service's StormReady Program.		X							Incorporated into Mitigation Action 16.
5 (Past)	Investigate the equipment available for outdoor warning systems. Determine the type of sirens recommended, their placement, and installation costs. Investigate operating and maintenance costs. Interview existing system owners to determine level of satisfaction and problems encountered.		X							No funding. Incorporated into Mitigation Action 17.
6 (Past)	Complete the City of Lometa Emergency Plan.			X						City of Lometa's Emergency Plan is under Lampasas County's Emergency Plan.

**TABLE 2-2.  
LAMPASAS 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	
7 (Past)	Define safe zones in public buildings, schools, day care centers, and senior citizen facilities.		X							Incorporated into Mitigation Actions 5, 9, 11, and 18.
8 (Past)	Encourage the installation of safe rooms in new and existing homes and businesses.	X								Incorporated into Mitigation Action 11.
9 (Past)	Develop evacuation plans, policies, and procedures.	X								Incorporated into Mitigation Action 18.
10 (Past)	Recruit and train volunteers to provide support in safeguarding the city before, during, and after any disaster.		X							Incorporated into Mitigation Action 19.
1	Conduct public education program on fire risks as well as wildland fire mitigation, with the assistance of the Texas Forest Service.	X								Incorporated into Mitigation Action 12.
2	Offer free classes to the public on tree trimming and pruning to reduce debris buildup.	X								Funding issue. Incorporated into Mitigation Actions 5 and 9.
3	Educate residents about xeriscape planting.	X								Funding issue. Incorporated into Mitigation Action 20.
<p>“(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.</p> <p>EMS                      Emergency Medical Services</p>										

## 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, Lampasas 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 Lampasas County and its participating communities using the best and most current data and technology available. All participating municipalities 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 71 mitigation actions:

- 19 countywide actions
- 17 actions specifically for the City of Kempner
- 15 actions specifically for the City of Lampasas
- 20 actions specifically for the City of Lometa

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 Half 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 Lampasas County and the participating communities of the Cities of Kempner, Lampasas, and Lometa. Each participating member contributed both monetarily and through in-kind contributions.

### 3.2 ESTABLISHMENT OF THE PLANNING PARTNERSHIP

Lampasas 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.

<b>TABLE 3-1. COUNTY AND CITY PLANNING PARTNERS</b>		
<b>Jurisdiction</b>	<b>Point of Contact</b>	<b>Title</b>
Lampasas County	Angela Rainwater	Emergency Management Coordinator
City of Kempner	Trudy Davis	City Secretary
City of Lampasas	Reece Oestrich	Fire Chief
City of Lometa	Angela Rainwater	County Emergency Management Coordinator

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 Lampasas County. All partners to this plan have jurisdictional authority within this planning area. Planning partners include the Cities of Kempner, Lampasas, and Lometa (Figure 3-1).

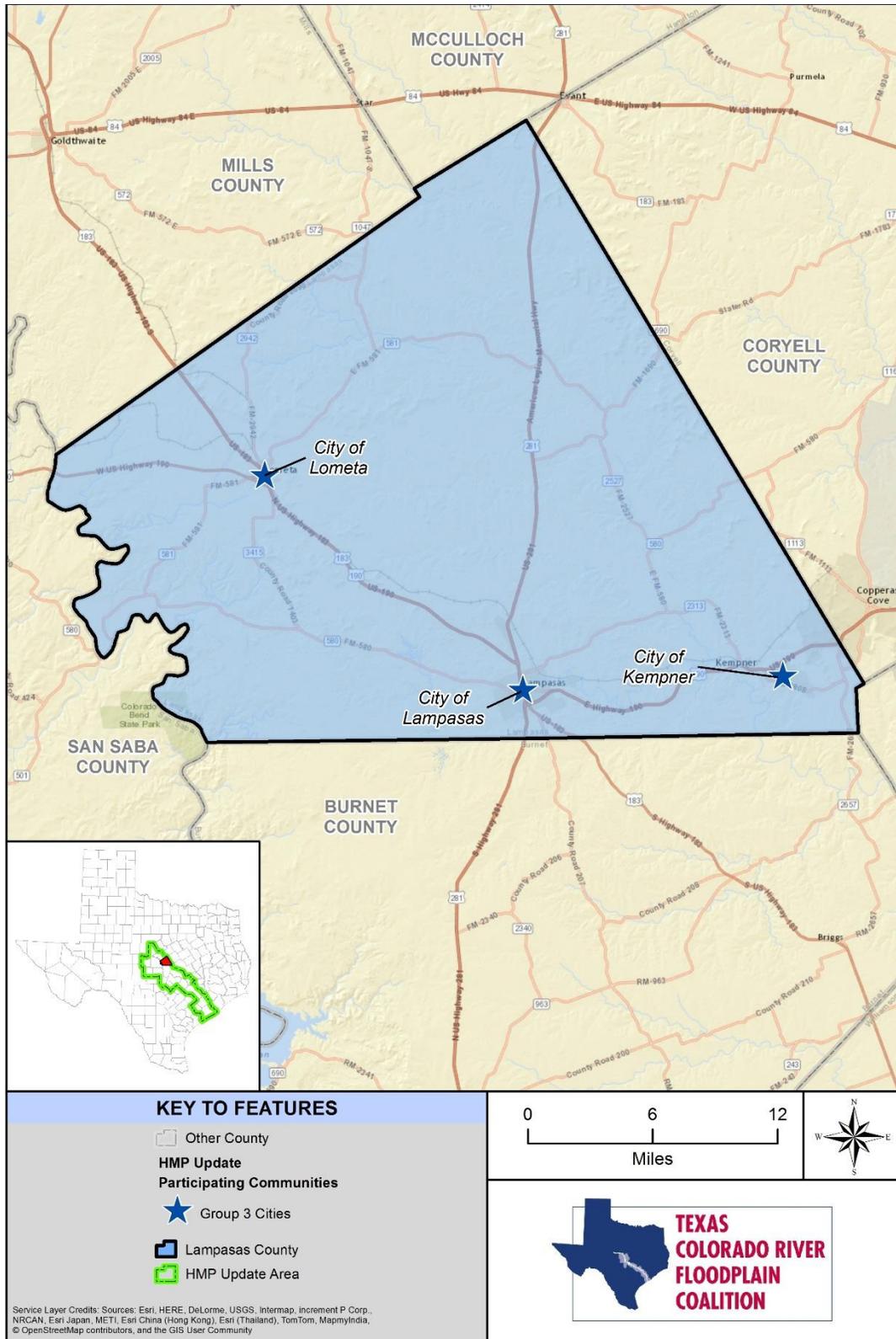


Figure 3-1. Lampasas County Planning Area and Participating Communities

### 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.

Name	Title	Jurisdiction
Angela Rainwater	Emergency Management Coordinator	Lampasas County and City of Lometa
Wayne Boultinghouse	County Judge	Lampasas County
Trudy Davis	City Secretary	City of Kempner
Reece Oestreich	Fire Chief and Building Inspector	City of Lampasas
Bryan Ellis	Building Official	City of Lampasas
Jerry Bunting	Building Official (Former)	City of Lampasas
Finley DeGraffenried	City Manager	City of Lampasas

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.

This update process was initiated by TCRFC, a regional partnership of cities and counties in the Colorado River basin and the surrounding areas. The process was initiated by and was under the direction of Mr. Mickey Reynolds, Executive Director of TCRFC. Although separate plans were prepared for each county, 15 counties and 46 cities and towns in TCRFC updated their hazard mitigation plans simultaneously. Steering Committee meetings were held with adjacent counties so neighboring communities were aware of the planning process and could share ideas and information throughout the region. Steering Committee meetings for Lampasas County were held along with San Saba, Mason, and Mills Counties and the City of San Saba in San Saba County, the Cities of Mason in Mason County, the City of Goldthwaite in Mills County, the City of Brady in McCulloch County, and the City of Brownwood in Brown County. The full list of attendees from other neighboring communities at each Steering Committee meeting is included in Appendix C. In addition, the planning team presented the plan update process at the TCRFC annual meeting on July 31, 2015. Other regional organizations, such as the Lower Colorado River Authority, were made aware of the update process but chose not to actively contribute.

Communication with TDEM was primarily through Ms. Johnna Cantrell, State Coordinator Mitigation and Standards (former). Ms. Cantrell responded to planning questions and attended Steering Committee meetings when possible. Pre-adoption review of the plan was coordinated with Ms. Hildy Soper.

### 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:

- Lampasas County
  - Subdivision Regulations
  - Floodplain Damage Prevention Order
  - Floodplain Map
  - Emergency Operations Plan
- City of Kempner
  - Code of Ordinances
- City of Lampasas
  - Comprehensive Plan
  - Code of Ordinances
  - Capital Improvements Program Committee

- Construction Board of Adjustments
- Economic Development Corporation
- Planning and Zoning Commission
- Zoning Board of Adjustments
- City of Lometa
  - 2033 Comprehensive Plan
  - Code of Ordinances

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.

The review of existing programs and the assessment of capabilities identify the plans, regulations, personnel, and funding mechanisms available to the county and planning partners to impact and mitigate the effects of natural hazards. The review also helps identify opportunities for the planning partners to strengthen their abilities to proactively mitigate natural hazards in the community through the expansion of existing departments and programs; completion of applicable plans; adoption of necessary regulations or ordinances; creation and hiring of new departments and staff; or mutual aid agreements and memorandums of understanding with neighboring communities. The planning partners reviewed the findings of the capabilities assessment during the second Steering Committee meeting and used this information to identify mitigation action.

### **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 Lampasas 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 12 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.

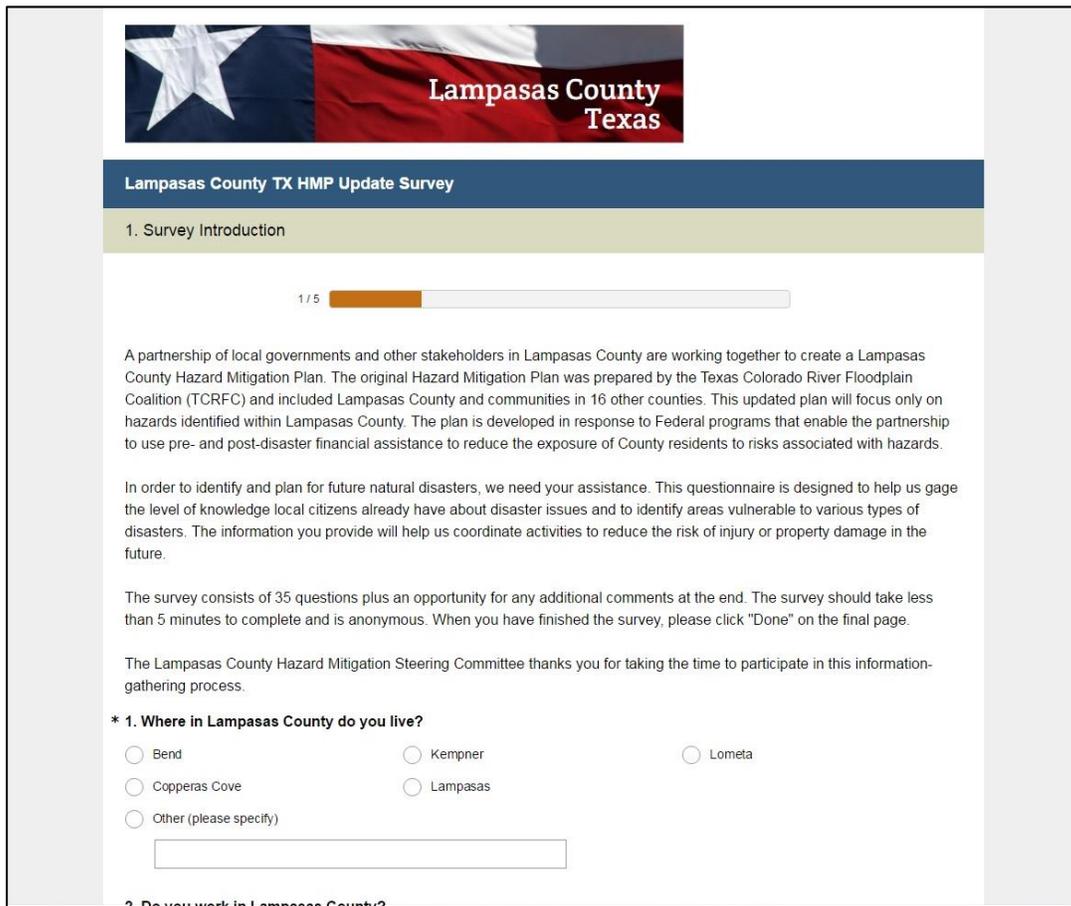


Figure 3-2. Sample Page from Questionnaire Distributed to the Public

### 3.7.3 Meetings

Three Steering Committee meetings, as well as one meeting before the Lampasas 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 San Saba Counties, and the Cities of Brady and Brownwood (see Figure 3-3). The meeting format allowed attendees to access handouts, maps, and other resources and ask questions during the meetings. Additionally, project staff and county personnel remained after the meeting to have direct conversations with interested attendees. Details regarding the 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.

Lampasas County and the planning partners held a public meeting on XXX XX, 2016 to present the draft plan and solicit public comments. The draft plan was available for review in hard copy at the county offices as well as at XXXXX for review by interested parties. In addition, the draft was posted on the Lampasas County website from XX to XX 2016. The draft plan was presented and reviewed in a public meeting before the Lampasas County Commissioners Court on XXX XX, 2016.



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?

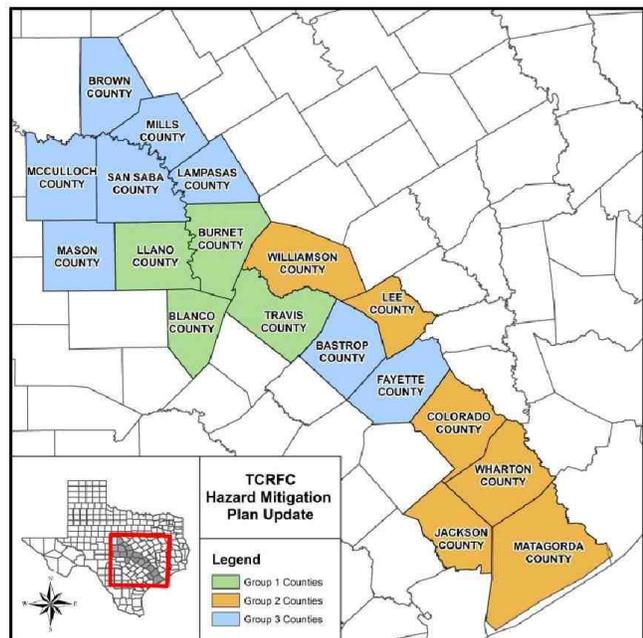
To be included in the Hazard Mitigation Plan Update (ensuring **eligibility** for FEMA Hazard Funding) active participation and involvement is necessary. Attendance from a least one participating community representative is mandatory to **ALL** three Planning Meetings. FEMA-compliant active participation 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 Half 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.

The draft plan was posted on the Lampasas County website from **XX to XX 2016** to allow the public to review the plan before the public meeting on **XXX XX 2016**. Additionally, hard copies were available for review at the county courthouse and **XXXXXXXXXX**.



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.

<b>TABLE 3-3. PLAN DEVELOPMENT MILESTONES</b>			
Date	Event	Description	Attendance
<b>2013</b>			
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
<b>2015</b>			
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	Lampasas County; Cities of Lampasas and Lometa
6/30	Steering Committee Meeting #2	Review community survey, review hazard identification and risk assessment, review and update plan goals and objectives	Lampasas County; Cities of Lampasas and Lometa
9/8	Steering Committee Meeting #3	Mitigation actions presentation and project development	Lampasas County; Cities of Kempner, Lampasas, and Lometa
Ongoing	Public Outreach	News articles and website posting	N/A
11/30	Draft Plan	Internal review draft provided to Steering Committee	N/A
11/30	Public Comment Period	Initial public comment period of draft plan opens. Draft plan posted on plan website and in hard copy at the courthouse and XXXX 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 Lampasas County Hazard Mitigation Plan Update is as follows:

- To reduce or eliminate the long-term risks to loss of life and property damage in Lampasas 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-borne 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 Lampasas 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, Lampasas County and its planning partners will collect additional data to assist in estimating potential losses associated with other hazards.

## CHAPTER 6. LAMPASAS COUNTY PROFILE

Lamparas County covers 714 square miles. It is located within the Grand Prairies region in central Texas and is characterized by high rolling prairie with steep slopes and limestone benches that give a stairstep appearance to the landscape (Figure 6-1). The majority of Lamparas County is drained by the Lamparas River, which runs north to south in the eastern portion of the county. The remainder of the county is drained by the Colorado River, which forms the county's western border. There are a number of spring-fed creeks throughout the county. Four reservoirs are located near the City of Lamparas in the southwestern corner of the county, as well as various mineral springs along Sulphur and Burleson Creeks. Lamparas County water is usually hard and somewhat mineralized. The county also overlies the Trinity Group Aquifer, with some sections overlying the Ellenburger-San Saba, Hickory Sandstone, and Marble Falls Limestone Aquifers. The City of Lamparas is the largest city and holds the county seat for Lamparas County. As of the 2010 U.S. Census, Lamparas County had a population of 19,677. The county has one hospital, Rollins Brook Community Hospital, located in the City of Lamparas.



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

Wheat, oats, and forage sorghum are the principal cultivated crops. Small amounts of grain sorghum and peanuts are also grown. Peaches and pecans are grown commercially on a limited scale. Livestock products are beef cattle, sheep, and goats. Many ranchers also engage in the commercial leasing of their ranches for deer and turkey hunting. The county has a few dairy and hog farms. The majority of the land is used as rangeland, then cropland and pasture.

### 6.1 HISTORICAL OVERVIEW

Lamparas County was created 1856 from parts of Bell, Travis, and Coryell Counties. The majority of this section was summarized from the *Handbook of Texas Online* (Kleiner 2010). For centuries, the Apache and Comanche Indian tribes occupied the territory and were attracted by the large herds of buffalo, the streams,

and the various mineral springs on Burlison and Sulphur Creeks, which were noted for their healing properties. Settlers permanently stayed in the early 1850s. The settlers sought the curative powers of the sulphur springs, and many stayed in the area because of the abundant water supply. These early settlers encountered Indian raids, bears, wild horses, and stampeding herds of buffalo.

In 1856, Lampasas County was created in response to a petition signed by 135 Lampasas County citizens, the Sixth Texas Legislature formed Lampasas County, named after the Lampasas River. The young county had no resources to build a courthouse and county records were kept in a small frame building for a number of years.

During the 1850s and 1860s, settlers in Lampasas County suffered from Comanche raids and outlawry. The Lampasas Guards were organized in Lampasas on July 1, 1859, to ward off Indian attacks, but aside from this and an occasional Texas Ranger passing through, there was little law and order until well after the Civil War. As white hunters began to kill off the buffalo for profit and sport, the Indians began to resent encroachment on their hunting grounds and increased their raids on the settlements. Herds were still plentiful through the 1860s, but had largely disappeared by 1875.

With the passing of the buffalo and the growth of the cattle market following the Civil War, Lampasas County became a center of the cattle industry. During the 1870s, it was on the direct route of many of the major cattle trails to Kansas, Colorado, and other states.

The frontier era gave way to the railroad boom with the coming of the Santa Fe railroad in 1882. The railroad came from Temple, moving west to Brownwood. Trains brought loads of newcomers eager to take part in the economic boom and to buy land. As the railroad boom moved westward, the county stabilized. The ranchers and farmers began producing livestock, grain, and forage crops, as they do today. In 1903, a second railroad, a branch of the Houston and Texas Central, was built from Burnet to Lampasas; it was abandoned in 1951.

The county weathered the Great Depression fairly well; business waned slightly, but no bank or business failures occurred. Overgrazing and overplanting became a concern in the 1930s, prompting an interest in soil management. The Hill Country Soil Conservation District, a federal service, established a program of soil and water conservation. A trend toward mechanization began on the farms, and the population started to shift from the rural areas to the towns. By the 1930s, Lampasas County was connected to the rest of the state by a network of federal and state highways and ranch roads.

The establishment of nearby Camp Hood (now Fort Hood) during World War II increased business as military personnel enlarged the consumer market, and the fort soon became a permanent part of the area's economy. After the war, a housing shortage caused growth in the already strong construction industry throughout the late 1940s. Although the number of manufacturing establishments did not increase, the number of people employed in them did.

The Lampasas County economy grew steadily over the years; the county has generally been considered prosperous, chiefly due to its diversity. The top industry continues to be agribusiness, followed by construction and the manufacture of food products and plastics. Nearby military installations continue to be important in the economy.

## **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 13 events since 1991 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 LAMPASAS COUNTY**

Disaster Declaration <sup>a</sup>	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
FS-2333	Texas - Mesquite Creek Fire	9/6/2000 - 9/8/2000
EM-3142	Extreme Fire Hazards	8/1/1999 - 12/10/1999
FS-2272	Topeka Fire	8/26/1999 - 8/29/1999
DR-1239	Tropical Storm Charley	8/22/1998 - 8/31/1998
EM-3113	Extreme Fire Hazard	8/30/1993 - 1/15/1993
DR-930	Severe Thunderstorms	12/20/1991 - 1/14/1992

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

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

## 6.3 CLIMATE

Lampasas 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 94.6 degrees Fahrenheit (°F) in the summer to 34.3°F in the winter. The Western Regional Climate Center reports data from the City of Lampasas weather station in Lampasas County. Table 6-2 contains temperature summaries for the station. Figure 6-2 graphs the daily temperature averages and extremes from January 1, 1897, through November 30, 2012. Figure 6-4 and Figure 6-5 show the geographic distribution of annual average minimum and annual average maximum temperatures in Lampasas County compared to the State of Texas from 1981 to 2010.

<b>TABLE 6-2. LAMPASAS COUNTY TEMPERATURE SUMMARIES LAMPASAS STATION</b>	
Period of record	1897-2012
Winter <sup>a</sup> Average Minimum Temperature <sup>b</sup>	34.3°F
Winter <sup>a</sup> Mean Temperature <sup>b</sup>	47.7°F
Summer <sup>a</sup> Average Maximum Temperature <sup>b</sup>	94.6°F
Summer <sup>a</sup> Mean Temperature <sup>b</sup>	81.9°F
Maximum Temperature (and Date)	112°F; August 18, 1909
Minimum Temperature (and Date)	-12°F; January 31, 1949
Average Annual Number of Days >90°F	110.6
Average Annual Number of Days <32°F	58.2
a. Winter: December, January, February; Summer: June, July, August b. Temperatures are in degrees Fahrenheit Source: Western Regional Climate Center, <a href="http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?tx6750">http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?tx6750</a>	

Source: Western Regional Climate Center, <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?tx2820>

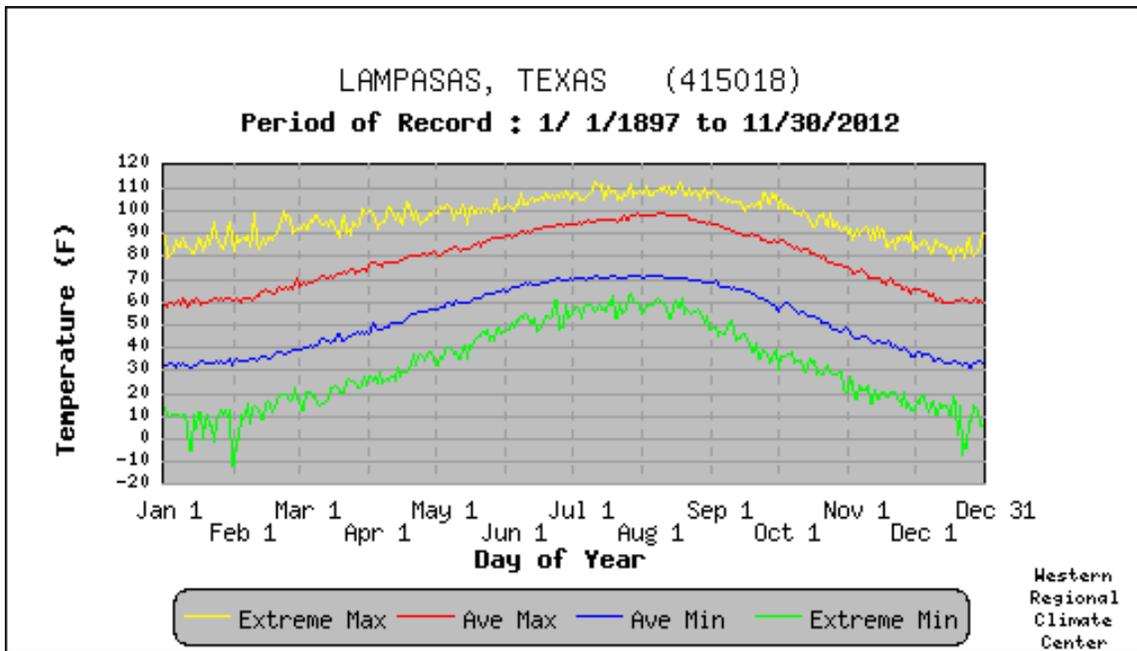


Figure 6-2. City of Lampasas Station Monthly Temperature Data (1897-2012)

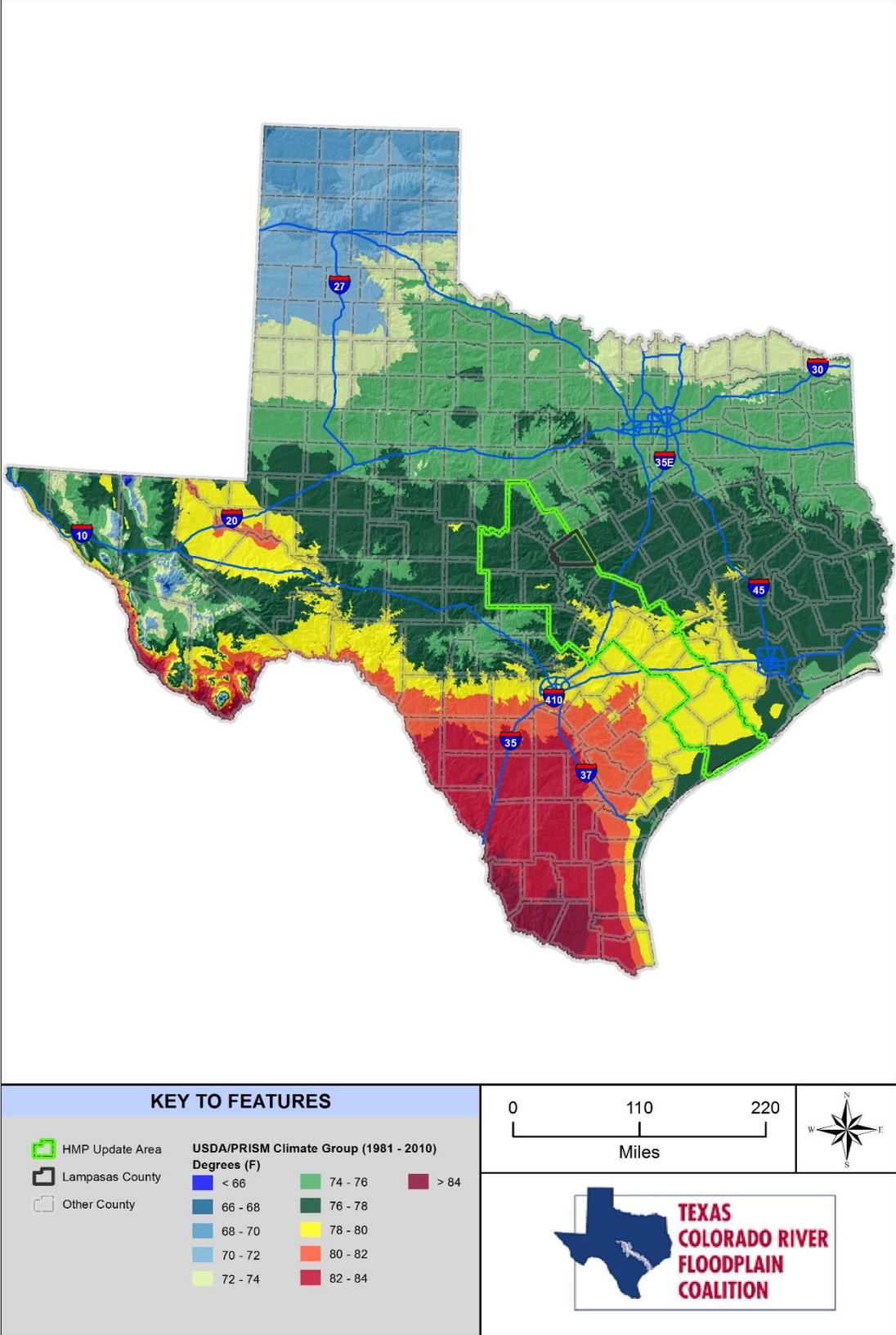


Figure 6-3. Annual Average Maximum Temperature (1981-2010)

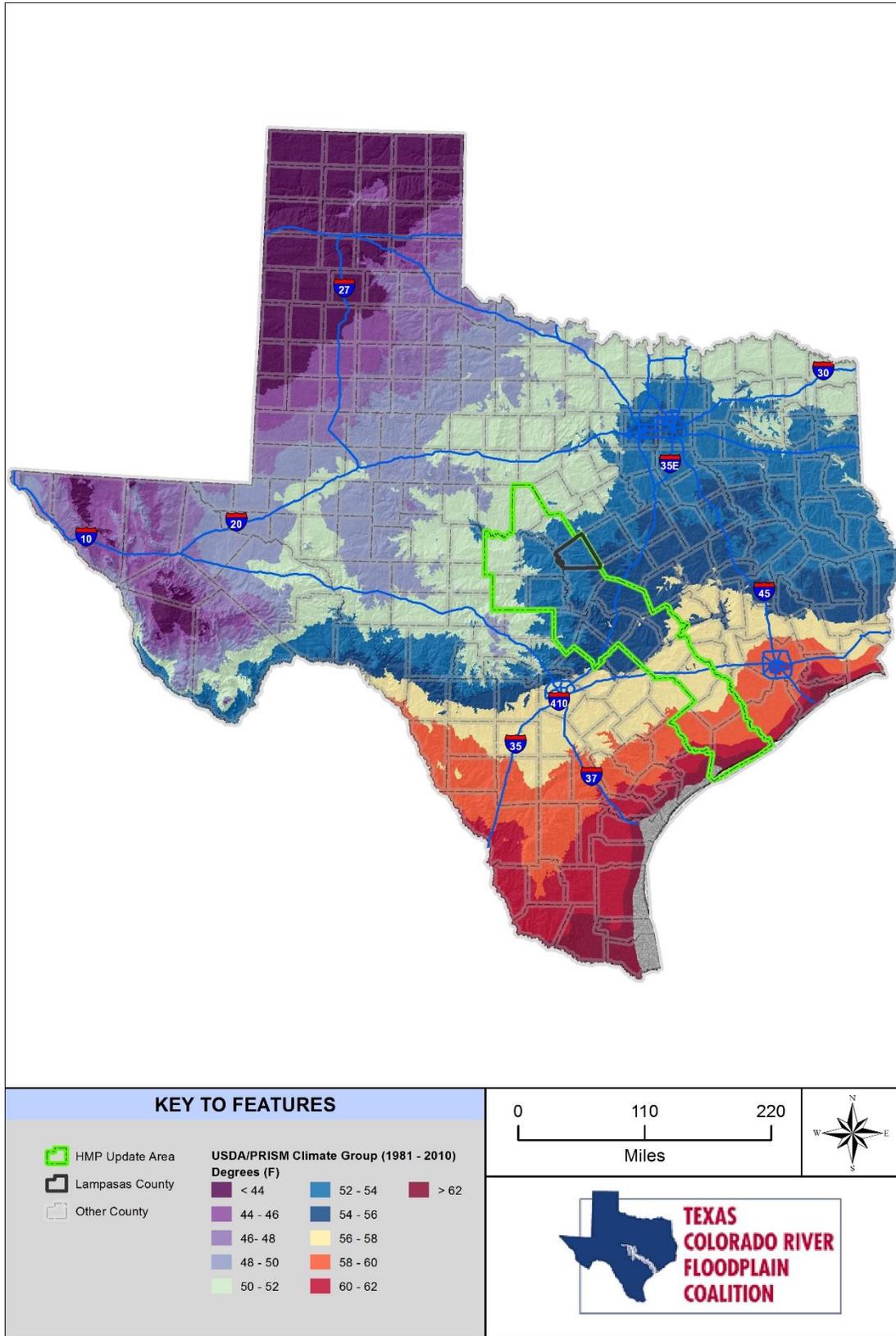


Figure 6-4. Annual Average Minimum Temperature (1981-2010)

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 30.08 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 Lampasas County. Figure 6-6 shows geographic distribution of annual average precipitation in Lampasas County compared to the State of Texas.

Source: <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?tx5018>

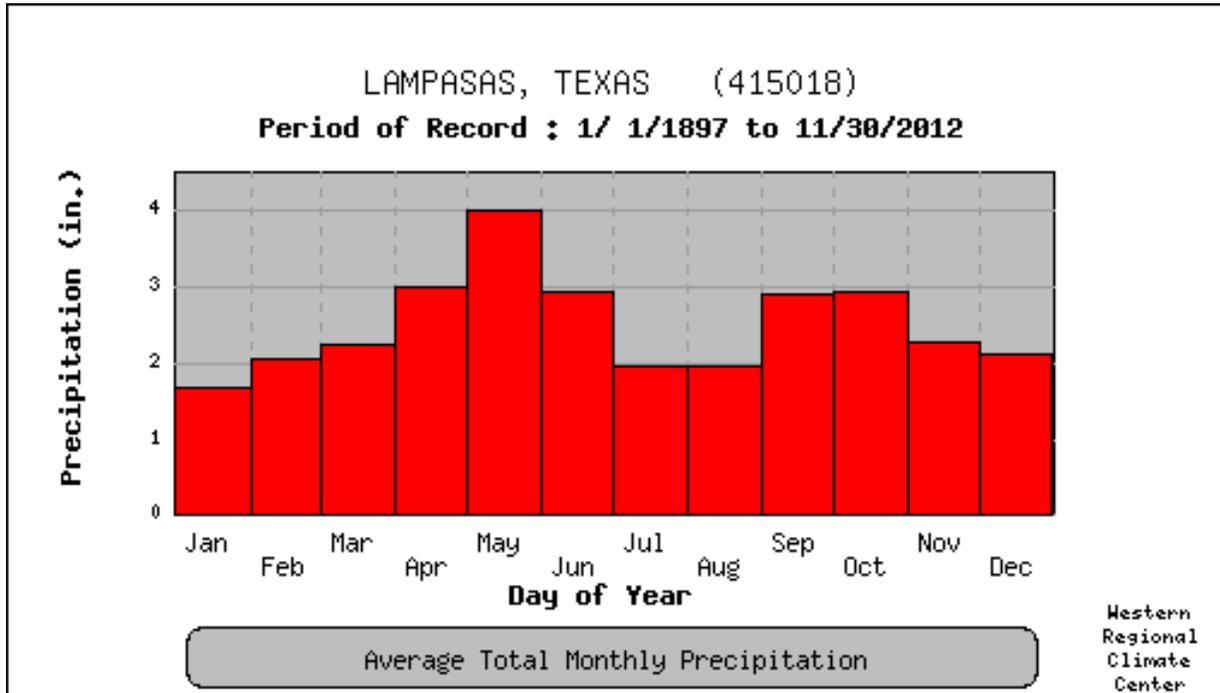


Figure 6-5. Average Monthly Precipitation (1897-2012)

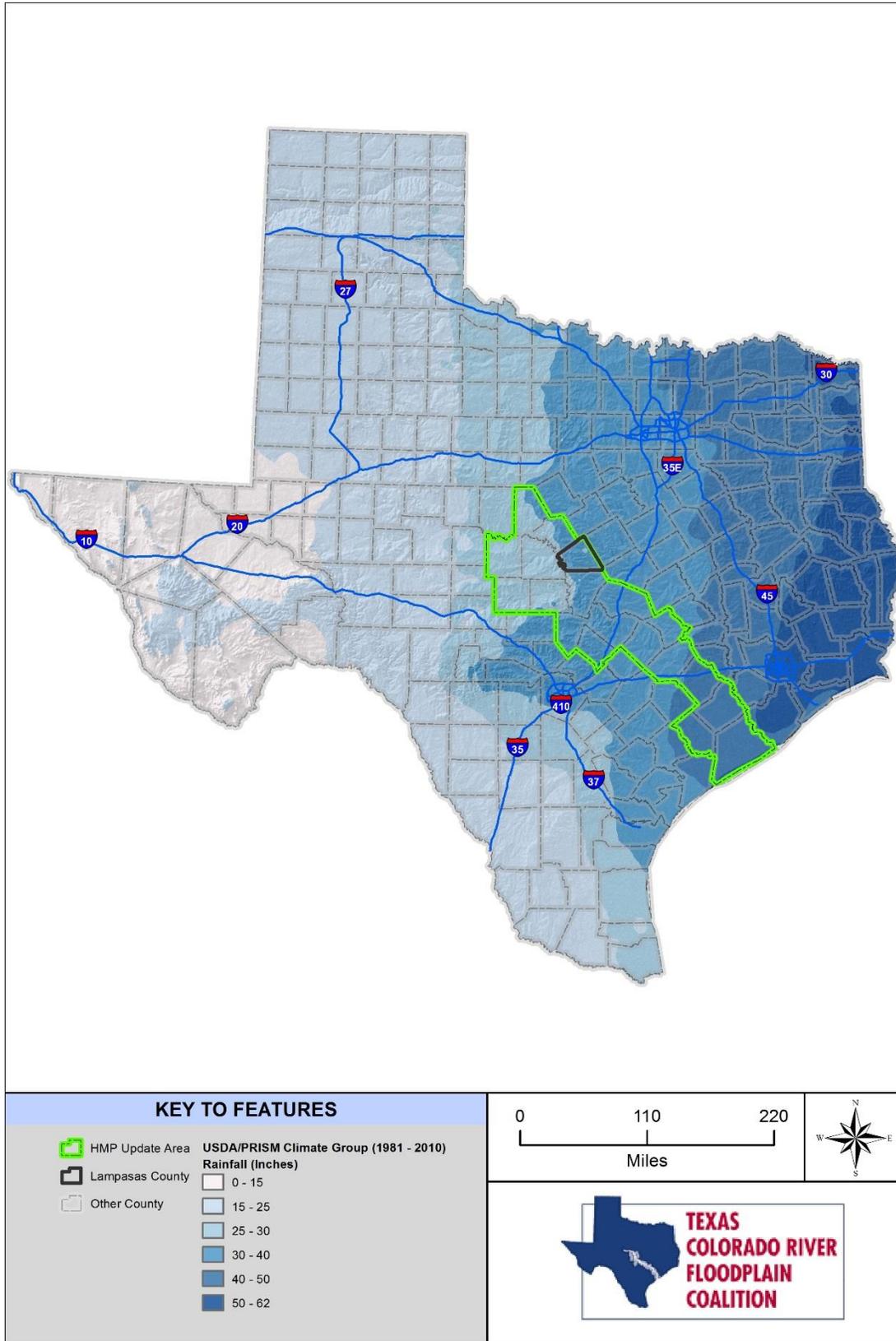


Figure 6-6. Geographic Distribution of Annual Average Precipitation (1981-2010)

## 6.4 GEOLOGY AND SOILS

Texas is broadly divided into four regions by physical geography features such as landforms, climate, and vegetation. Lampasas County is in central Texas. It lies in the Edwards Plateau Land Resource Area of the Great Plains Natural Region. Figure 6-7 shows the Texas natural regions with Lampasas County highlighted.

Lampasas County's surface soil is approximately 13 inches thick and is slightly alkaline, dark reddish brown gravelly clay in the upper part, and very gravelly clay in the lower part. The underlying material, from a depth of 13 to 60 inches, is fragmental limestone.

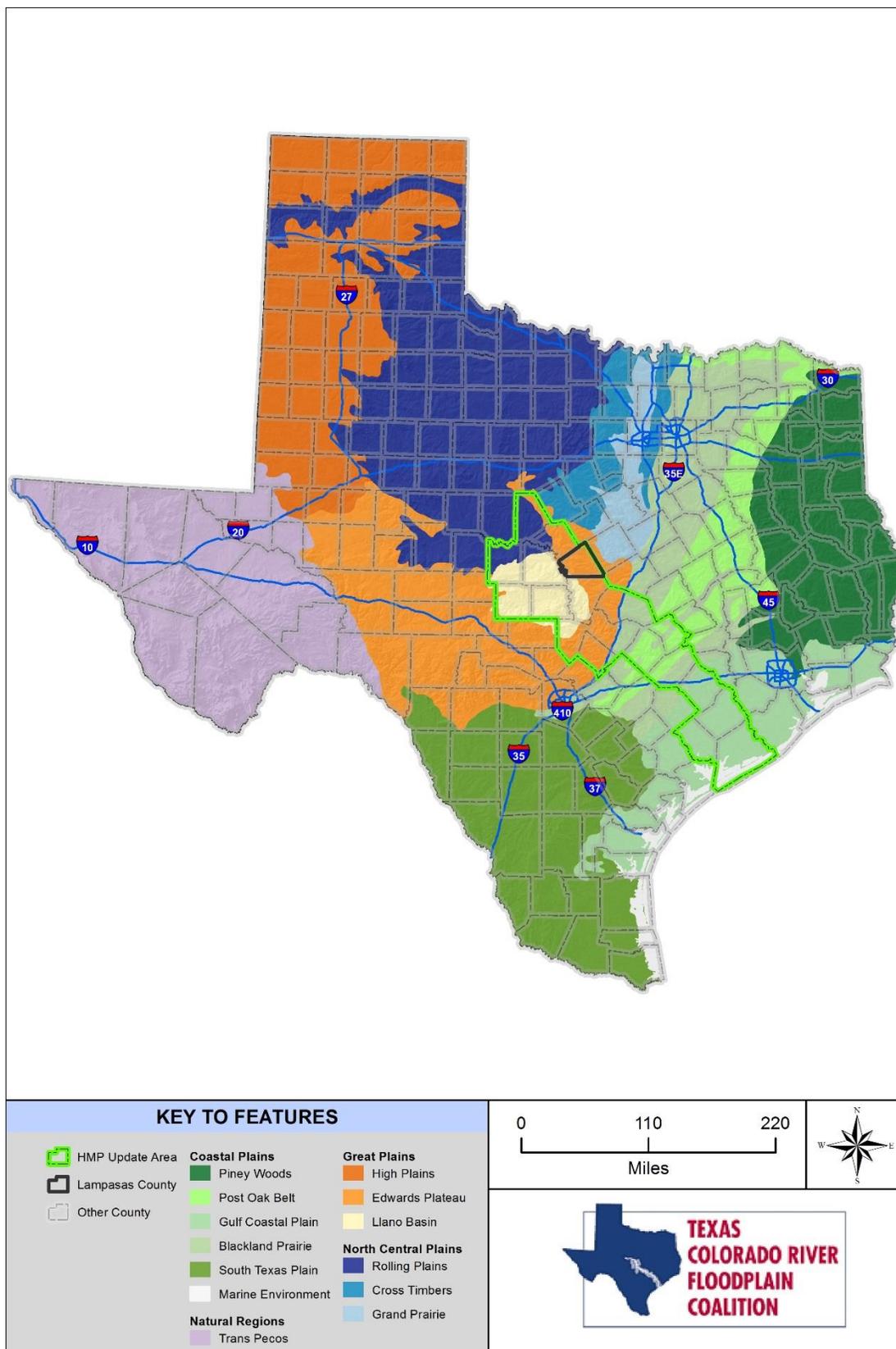


Figure 6-7. Natural Regions of Texas and Lampasas County

## 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.

<b>TABLE 6-3. CRITICAL FACILITIES IN THE PLANNING AREA</b>					
<b>Facility Type</b>	<b>City of Kempner</b>	<b>City of Lampasas</b>	<b>City of Lometa</b>	<b>Unincorporated or Other</b>	<b>Lampasas County Total</b>
Fire Stations	0	2	1	0	<b>3</b>
Police Stations	0	2	0	0	<b>2</b>
Medical and Health	0	1	0	0	<b>1</b>
Emergency Operations Center	0	0	0	0	<b>0</b>
School	0	5	2	0	<b>7</b>
Hazardous Materials	0	2	0	0	<b>2</b>
Government Functions	1	2	1	0	<b>4</b>
<b>Total</b>	<b>1</b>	<b>14</b>	<b>4</b>	<b>0</b>	<b>19</b>

<b>TABLE 6-4. CRITICAL INFRASTRUCTURE IN THE PLANNING AREA</b>					
<b>Facility Type</b>	<b>City of Kempner</b>	<b>City of Lampasas</b>	<b>City of Lometa</b>	<b>Unincorporated or Other</b>	<b>Lampasas County Total</b>
Communication	0	1	0	2	<b>3</b>
Power Facility	0	0	0	0	<b>0</b>
Potable Water/ Wastewater Facility	0	0	0	0	<b>0</b>
Dam Location	0	4	0	10	<b>14</b>
Airport Facility	0	1	0	0	<b>1</b>
Airport Runway	0	1	0	0	<b>1</b>
Other Transportation	0	0	0	0	<b>0</b>
Bridge	1	12	0	65	<b>78</b>
<b>Total</b>	<b>1</b>	<b>19</b>	<b>0</b>	<b>77</b>	<b>97</b>

Figure 6-8 through Figure 6-15 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.

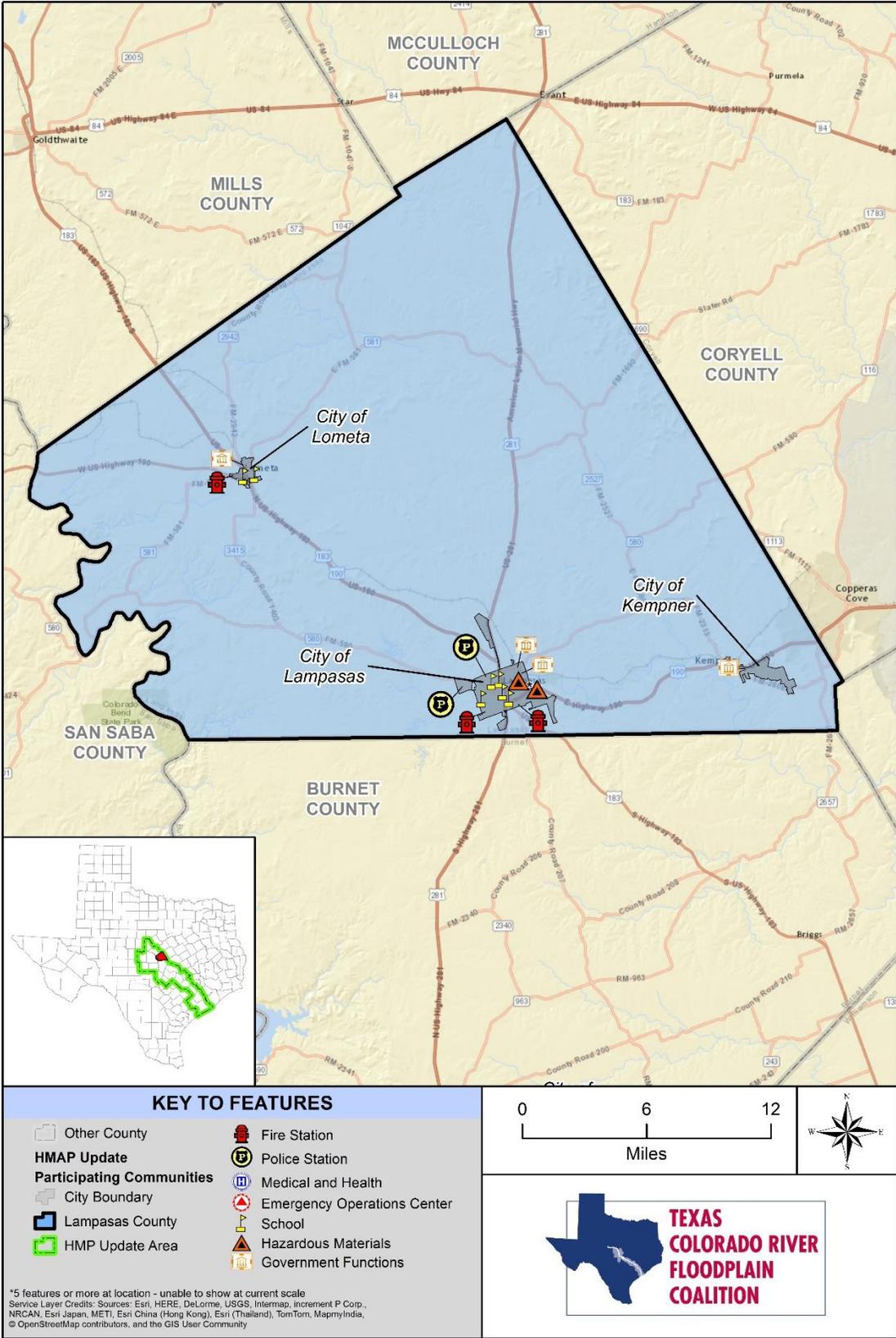


Figure 6-8. Critical Facilities in Lampasas County

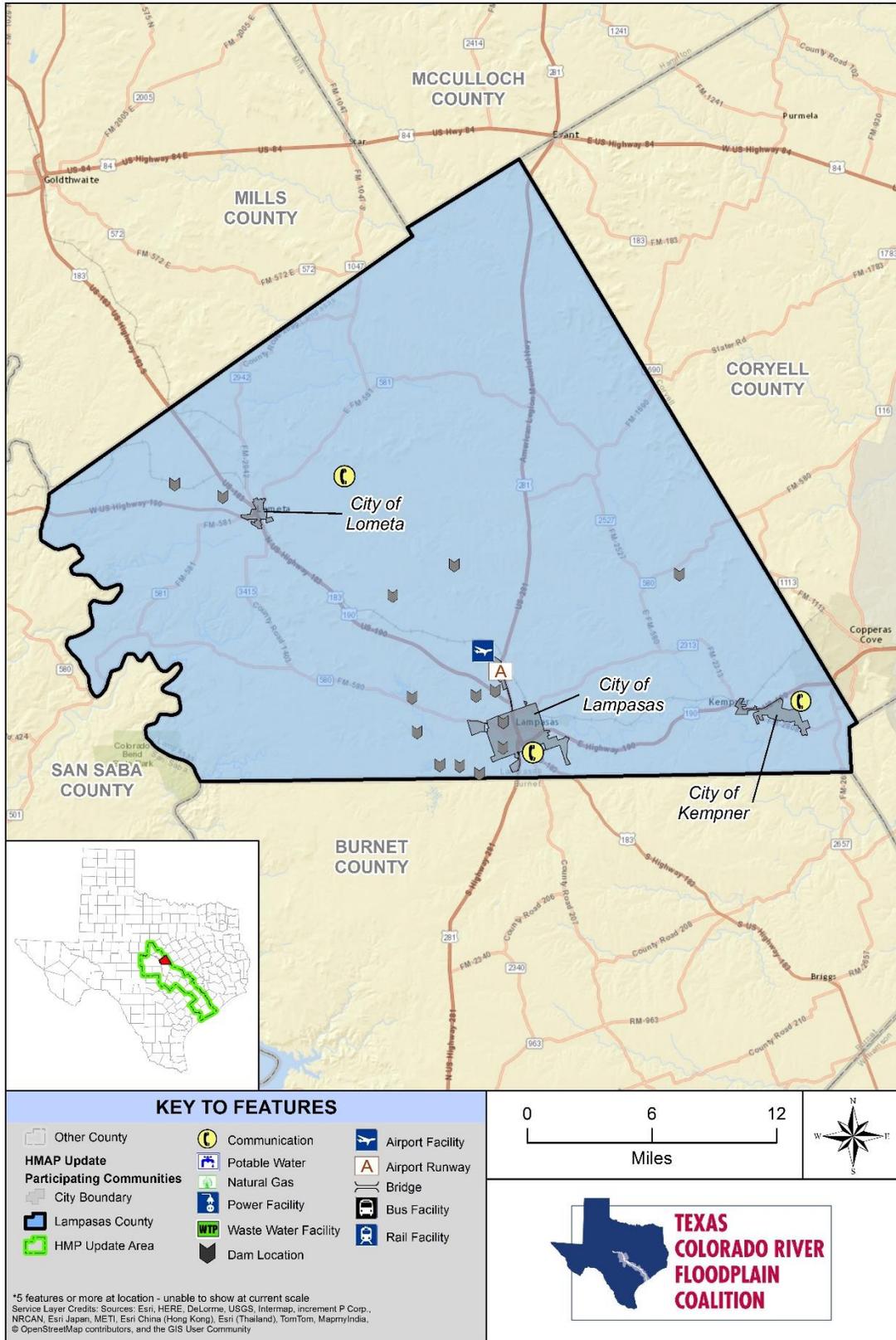


Figure 6-9. Critical Infrastructure in Lampasas County

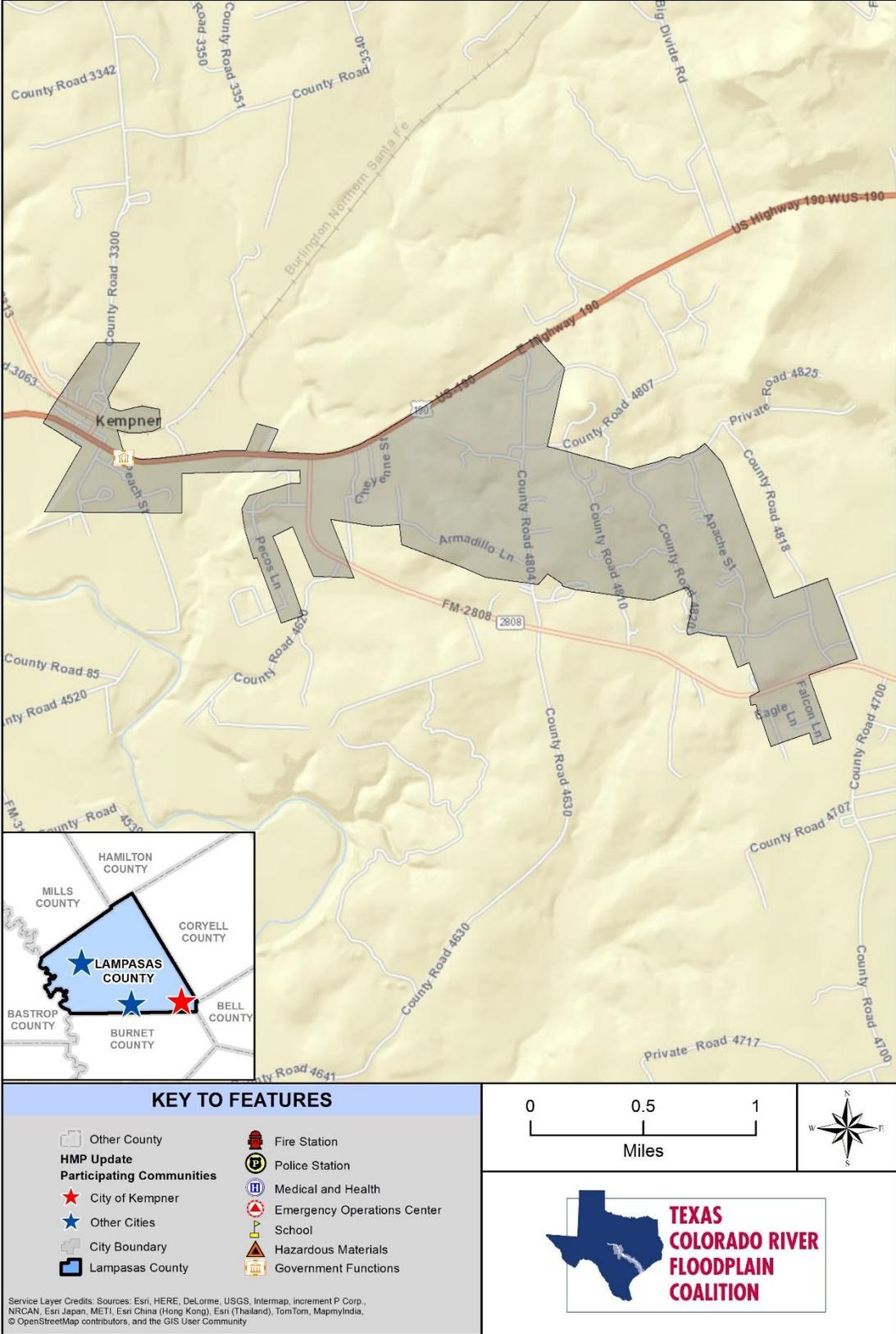


Figure 6-10. Critical Facilities in the City of Kempner

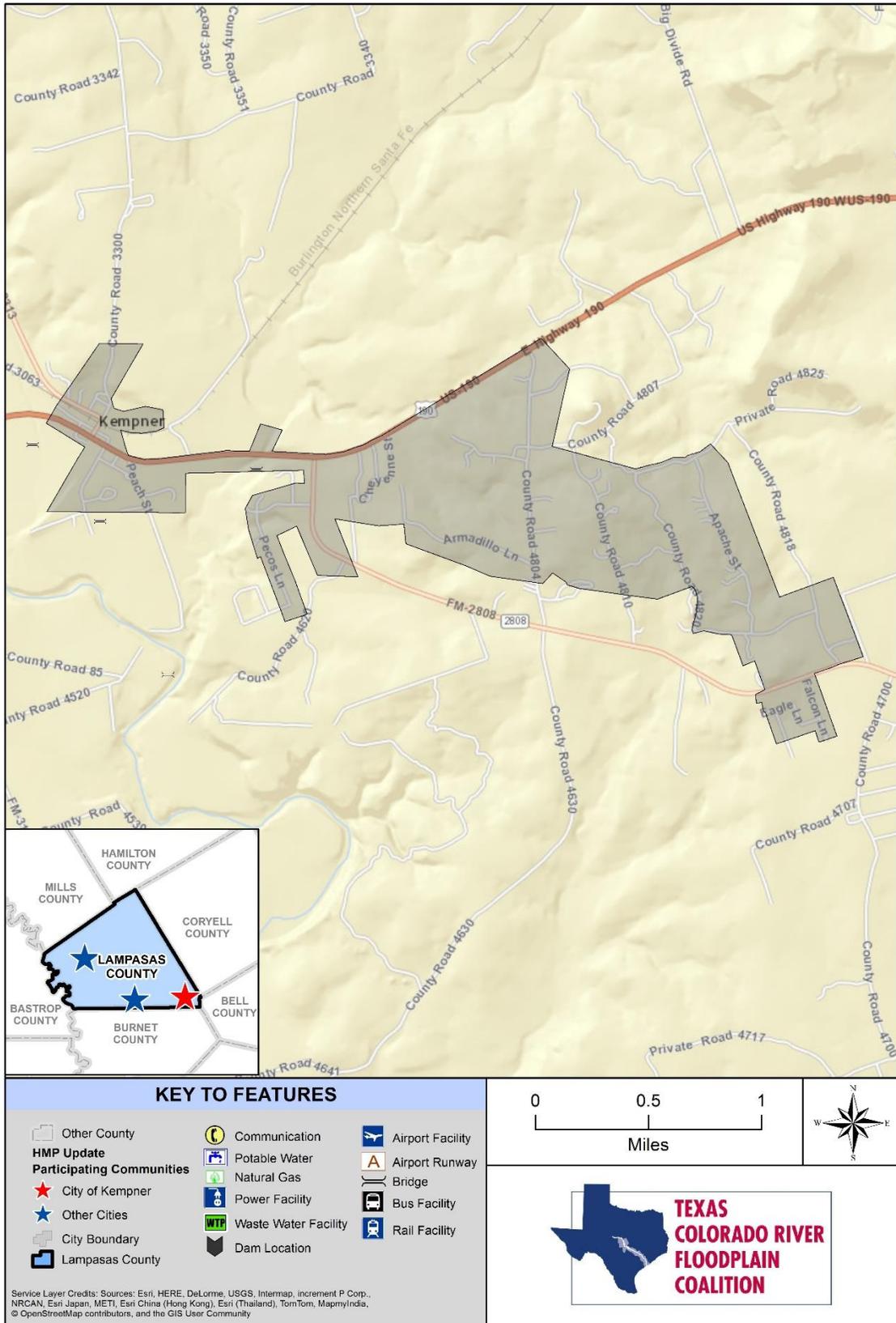


Figure 6-11. Critical Infrastructure in the City of Kempner

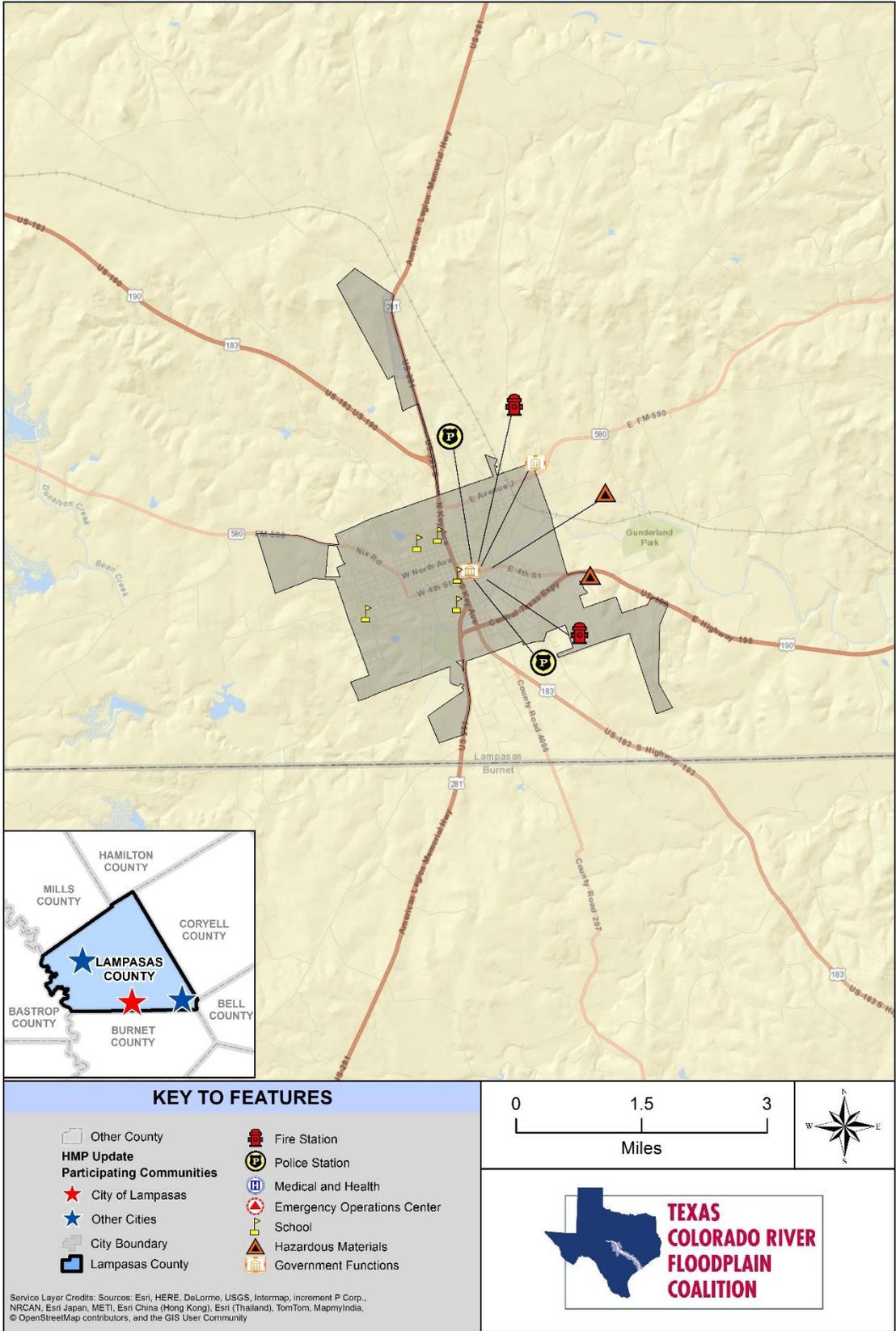


Figure 6-12. Critical Facilities in the City of Lampasas

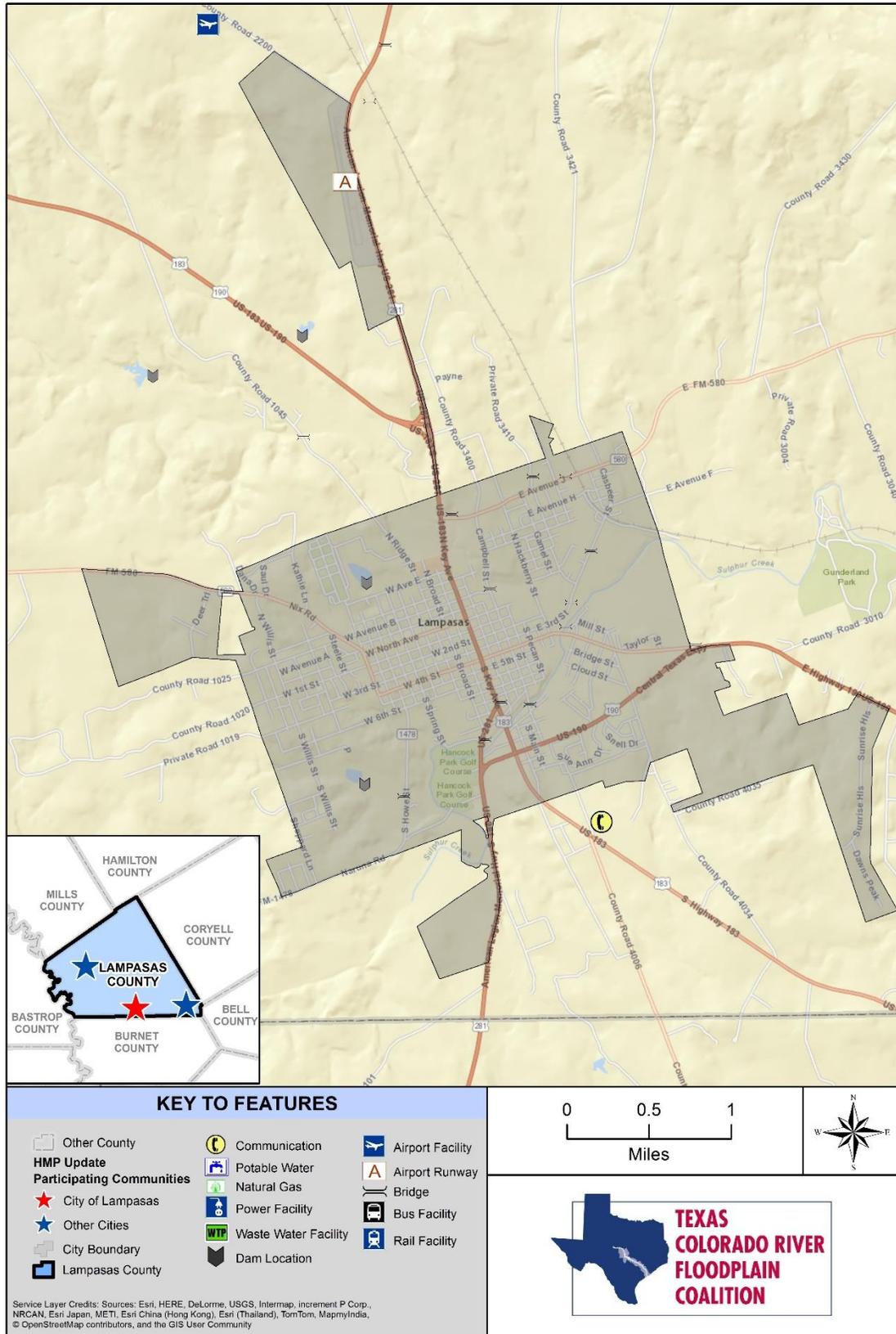


Figure 6-13. Critical Infrastructure in the City of Lampasas

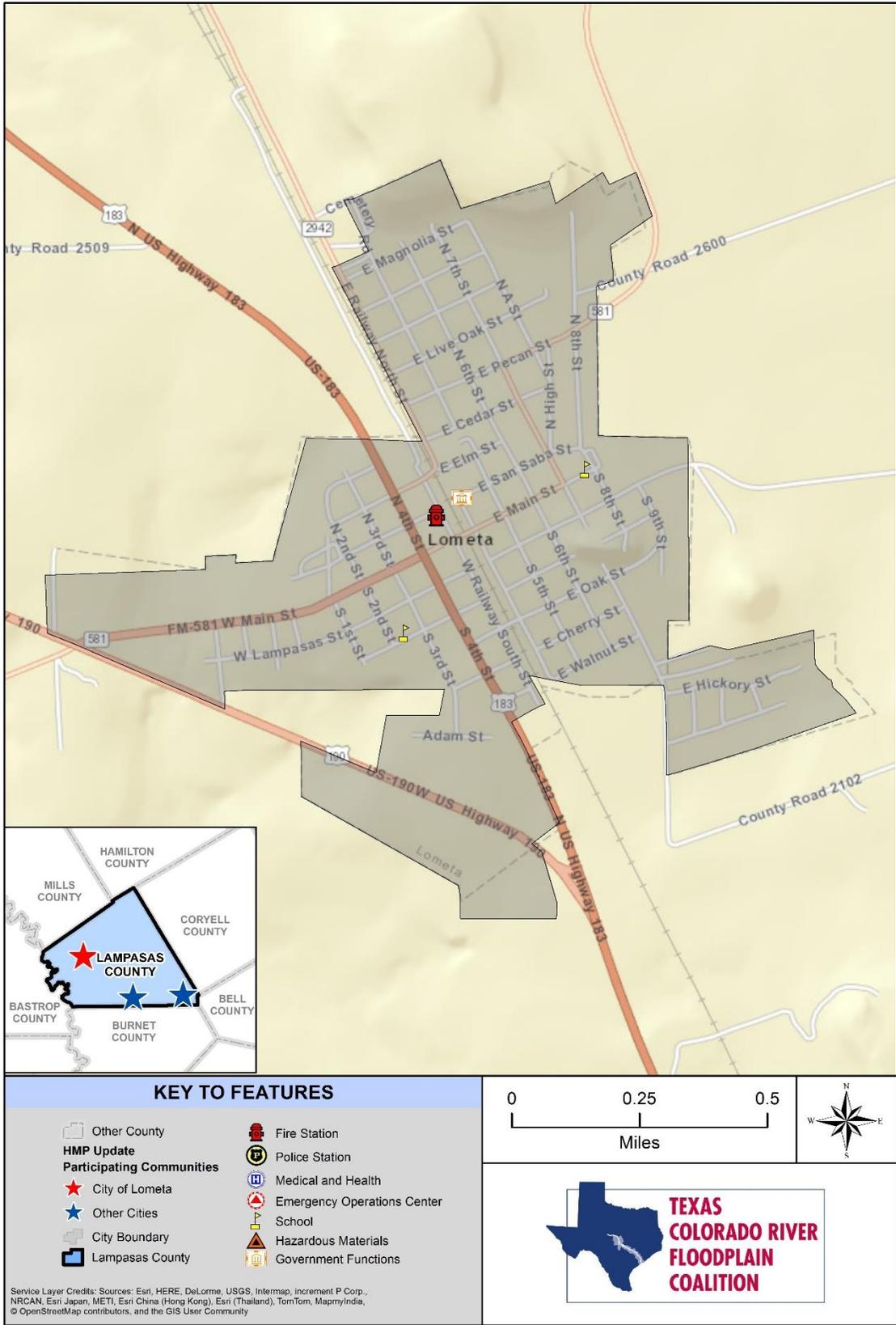


Figure 6-14. Critical Facilities in the City of Lometa

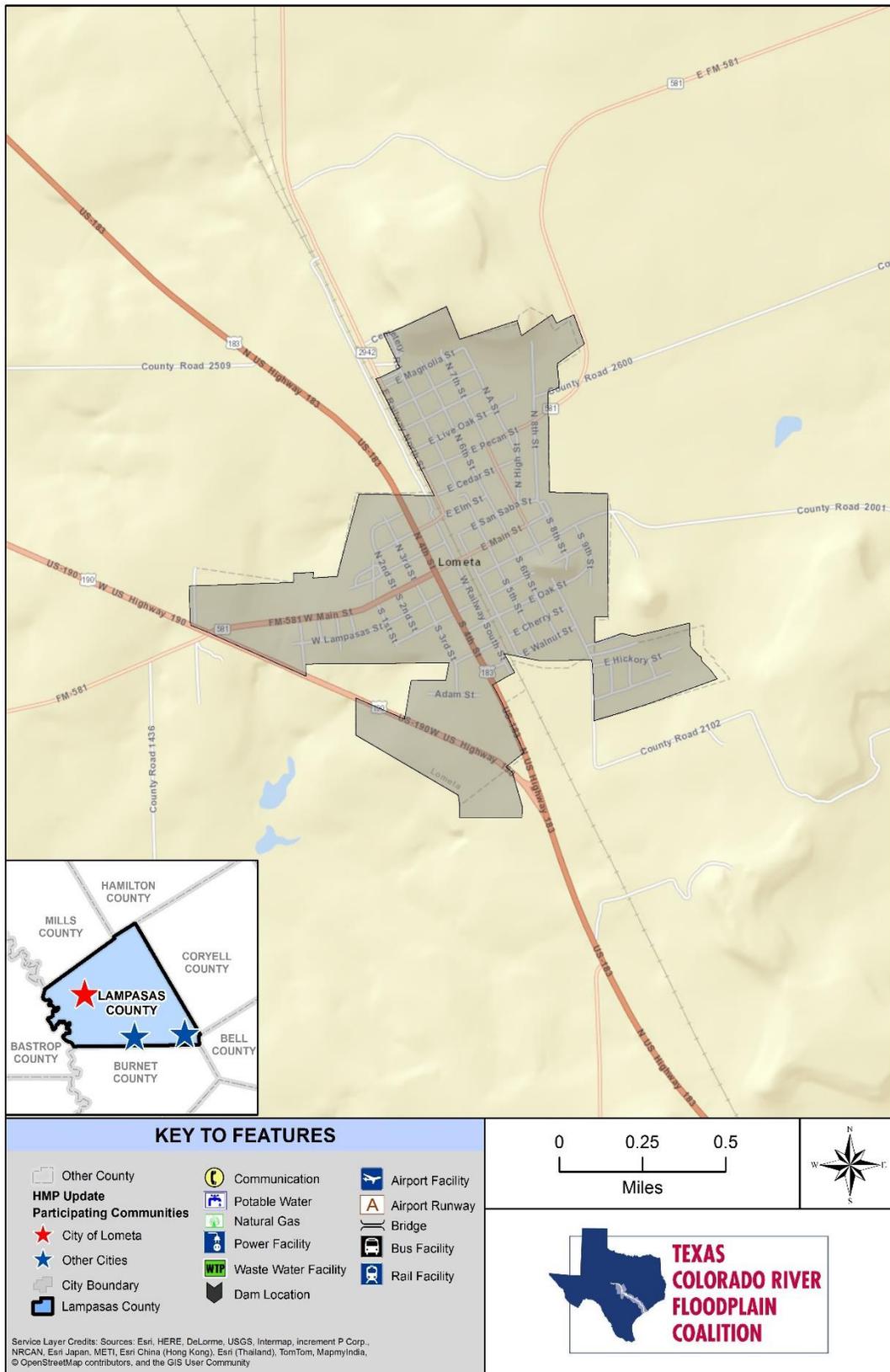


Figure 6-15. Critical Infrastructure in the City of Lometa

## 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 Lampasas County are shown in Table 6-5.

	Lampasas County	City of Kempner	City of Lampasas	City of Lometa
<b>Gender/Age</b> (% of Total Population)				
Male	49.7	50.0	50.0	50.7
Female	50.3	50.0	50.0	49.3
Under 5 years	6.2	5.1	7.4	9.1
65 years and over	16.6	8.9	19.2	10.0
<b>Race/Ethnicity</b> (% of Total Population)				
White	88.4	87.1	86.0	86.6
American Indian/Alaska Native	1.3	0.0	2.9	0.9
Asian	0.9	0.8	0.7	0.0
Black or African American	4.8	3.2	5.3	7.4
More Than One Race	2.1	8.5	2.6	2.7
Hispanic or Latino (of any race) <sup>1</sup>	18.0	16.1	26.2	42.0
<b>Education</b>				
High School Graduate or Higher (% of Total Population, 25+ years)	84.6	85.7	72.2	74.7
Source: U.S. Census Bureau, factfinder.census.gov				
<sup>1</sup> 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 20,222 for Lampasas County as of July 2013. Table 6-6 shows planning area population data from 1990 through 2013. The Lampasas County population has

increased 31.3% from 1990 to 2000 and increased another 2.7% from 2000 to 2013. The City of Lampasas is the county’s principal population center.

<b>TABLE 6-6. LAMPASAS COUNTY POPULATION</b>				
	Total Population			
	1990	2000	2010	2013 <sup>a</sup>
City of Kempner	495	1,004	1,089	1,313
City of Lampasas	6,382	6,786	6,681	6,822
City of Lometa	625	782	856	781
Unincorporated Areas and Other <sup>b</sup>	6,019	9,190	11,051	11,306
<b>Lampasas County Total</b>	<b>13,521</b>	<b>17,762</b>	<b>19,677</b>	<b>20,222</b>

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><sup>1</sup>

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

Figure 6-16 shows 5-year population changes in Lampasas 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 Lampasas County’s population increased by 33.1% (1.4% per year).

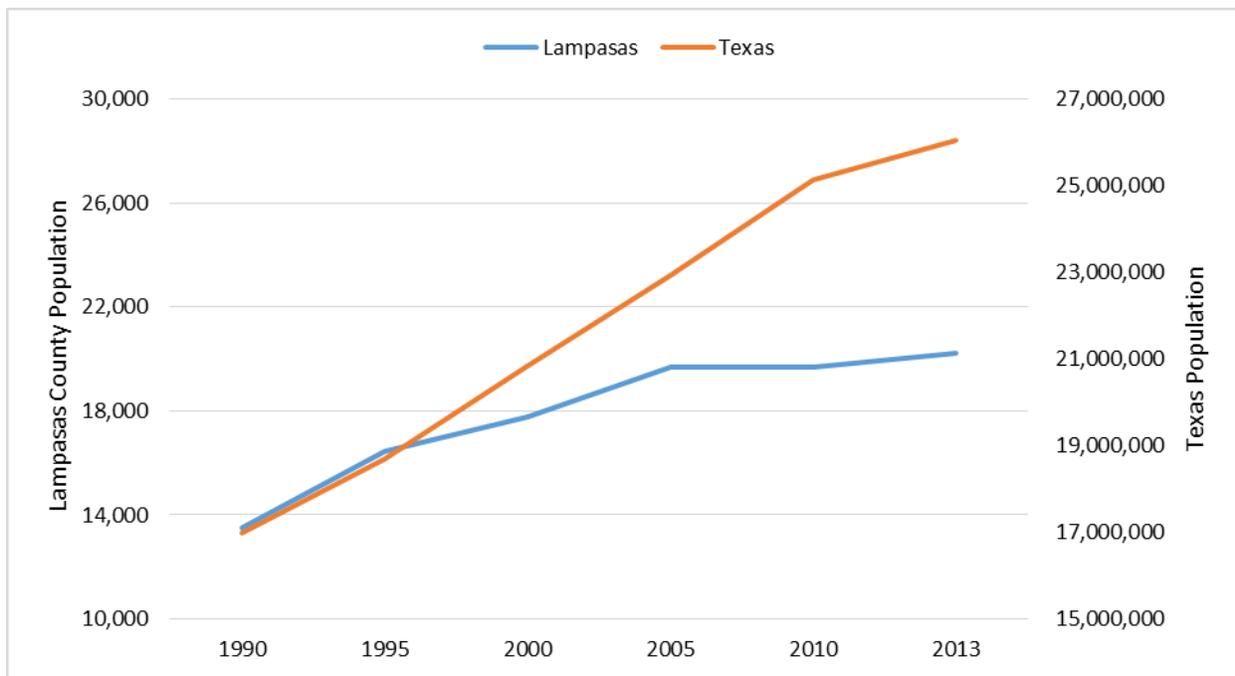


Figure 6-16. State of Texas and Lampasas County Population Growth

## 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 6-17. Based on U.S. Census data estimates, 16.6% 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 11.1% of Lampasas County families have children under 18 and are below the poverty line.

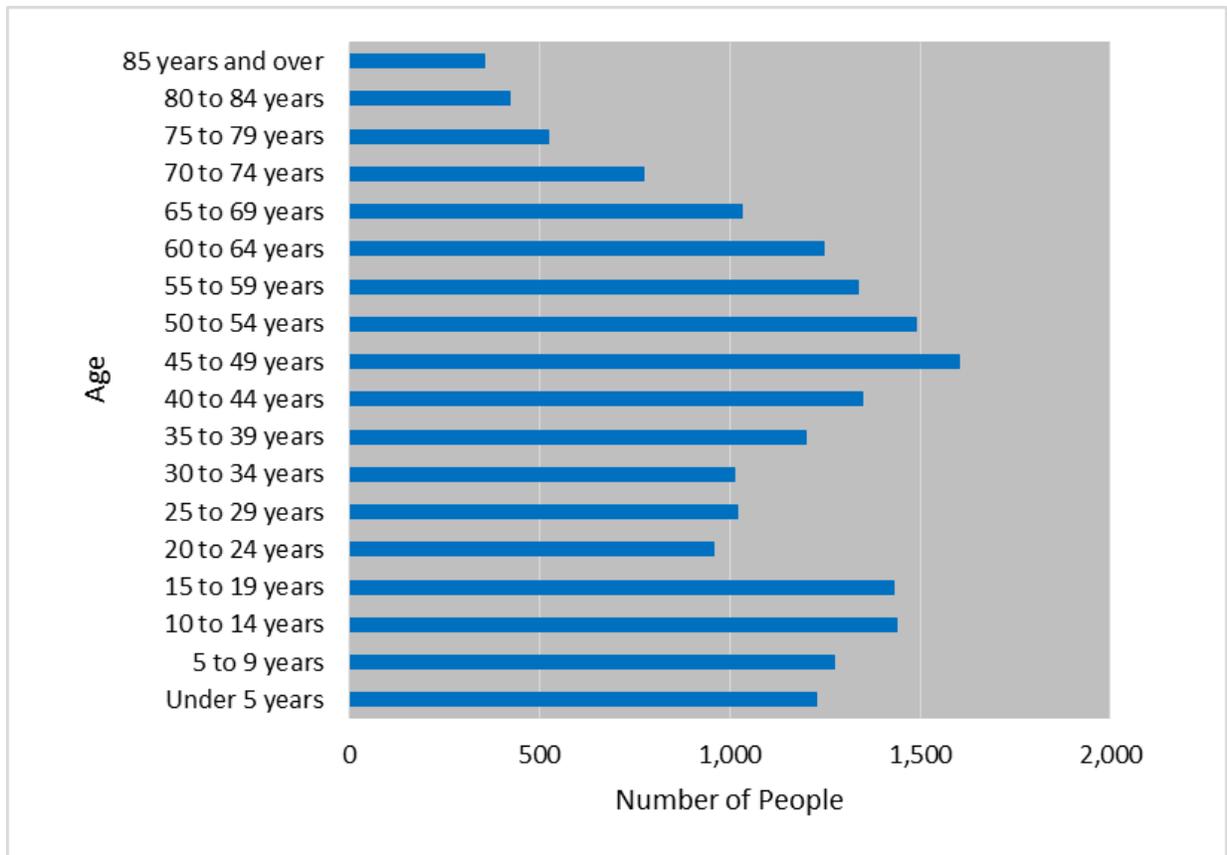


Figure 6-17. Lampasas County Age Distribution

### 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, 18.9% 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 U.S. Census Bureau estimates for 2013, the ethnic composition of Lampasas County is predominantly white, at about 90.4%. The largest minority population is Hispanic or Latino at 18.7%. Figure 6-18 shows the population distribution by race and ethnicity in Lampasas County. The values shown on Figure 6-18 exceed 100% because according to the U.S. Census Bureau, Hispanic or Latino is listed as an ethnicity, not a race. Therefore, the Hispanic or Latino designation encompasses several races.

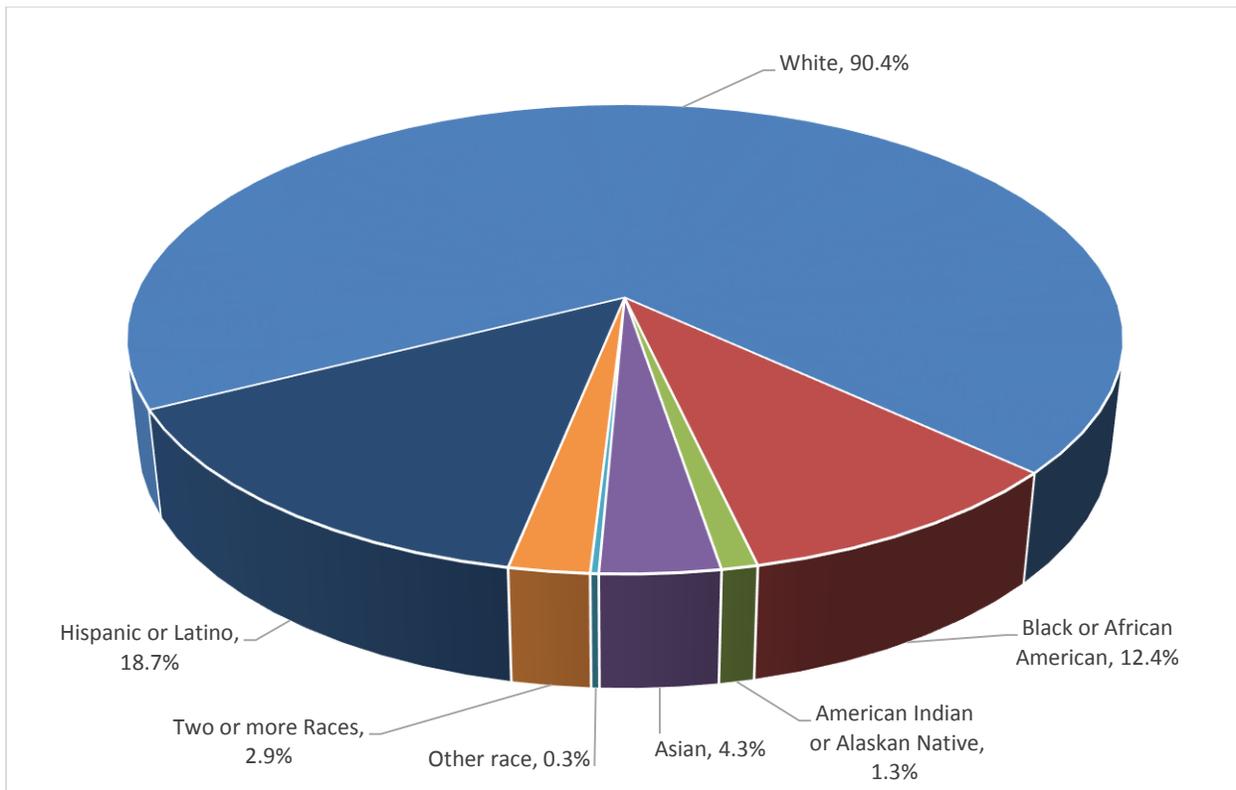


Figure 6-18. Lampasas County Ethnic Distribution

Lampasas County has a 7.1% foreign-born population. Other than English, the most commonly spoken language in Lampasas County is Spanish. The U.S. Census estimates 5.5% of the residents speak English “less than very well.”

## 6.7 ECONOMY

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

	Lampasas County	City of Kempner	City of Lampasas	City of Lometa
Families Below Poverty Level	11.1%	12.2%	21.4%	30.2%
Individuals Below Poverty Level	16.9%	14.1%	30.7%	38.6%
Median Home Value	\$86,501	\$78,630	\$86,503	\$71,060
Median Household Income	\$49,277	\$37,292	\$33,457	\$27,188
Per Capita Income	\$23,423	\$19,316	\$18,313	\$14,103
Population >16 Years Old in Labor Force	59.5%	66.6%	56.2%	71.2%
Population Employed	52.7%	56.7%	50.0%	68.1%

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 \$23,423 and the median household income was \$49,277. It is estimated that 11.2% of households receive an income between \$100,000 and \$149,999 per year and 6.4% are above \$150,000 annually. Families with incomes below the poverty level in 2013 made up 11.1% of all families and 16.9% of the total population in Lampasas County.

### 6.7.2 Employment Trends

According to the U.S. Bureau of Labor Statistics, Lampasas County’s unemployment rate as of March 1, 2015, was 4.4%, compared to a statewide rate of 4.2%. Figure 6-19 shows Lampasas County’s

unemployment trends from 1990 through March 1, 2015. Lampasas County's unemployment rate was lowest 1999 at 2.7% and peaked in 1991 at 8.3%.

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

Note: Shaded areas indicate U.S. recessions



Figure 6-19. Lampasas County Unemployment Rate (1990-2015)

According to the 2013 U.S. Census Bureau estimates, 59.5% of Lampasas County's population 16 years and older is in the labor force, including 53% of women and 47% of men.

### 6.7.3 Occupations and Industries

According to 2013 U.S. Census Bureau estimates, the planning area's economy is strongly based in the education, health care and social assistance industries (19.6% of total employment), followed by the construction (14.4%), retail trade (11.9%), and public administration (11.3%). Figure 6-20 shows the distribution of industry types in Lampasas County, based on share of total employment.

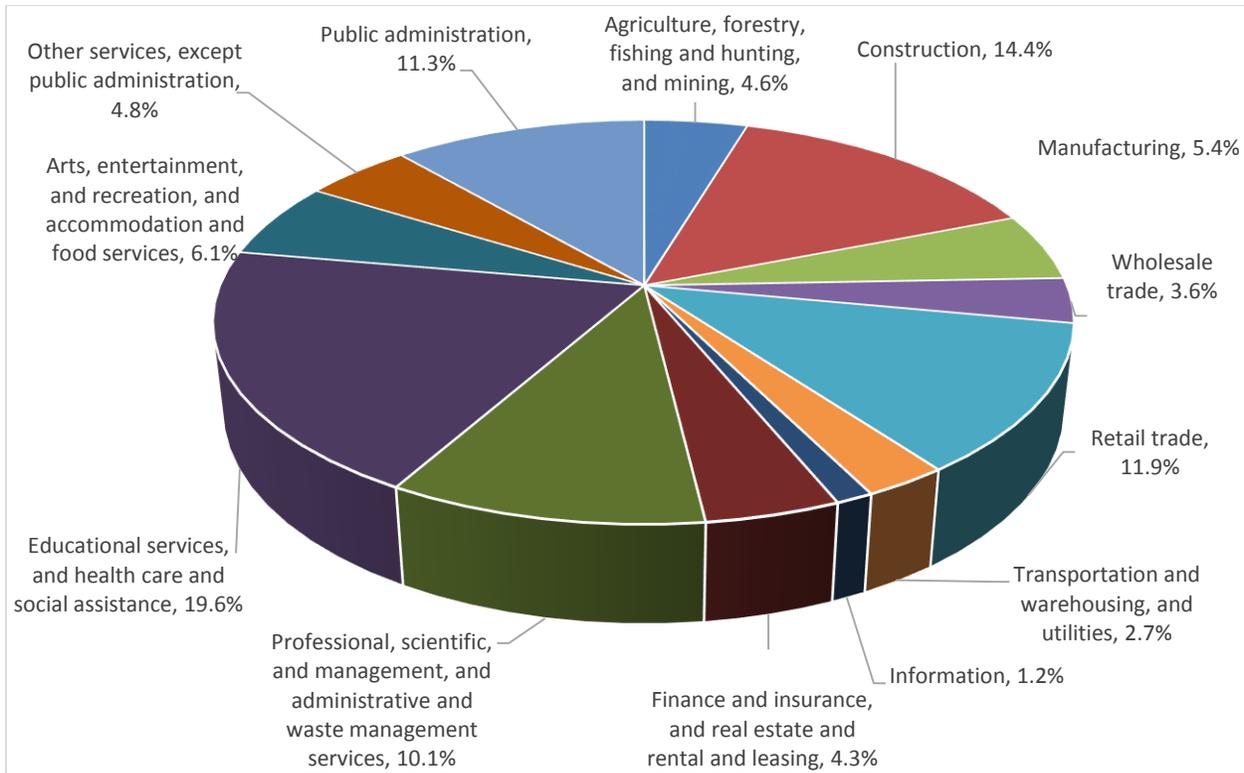


Figure 6-20. Percent of Total Employment by Industry in Lampasas County

## 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 Lampasas County. Lampasas County consists primarily of grassland/prairie and forest land.

**TABLE 6-8.  
PRESENT LAND USE IN PLANNING AREA**

Present Use Classification	Area (acres)	% of Total Land Area
Agriculture	7,859	1.7
Developed, Open Space	14,531	3.2
Developed, High Intensity	247	<0.1
Developed, Medium Intensity	869	0.2
Developed, Low Intensity	2,121	0.5
Forest Land	96,922	21.2
Grassland/Prairie	331,938	72.6
Water/Wetland	2,301	0.5
<b>Total</b>	<b>456,788</b>	<b>100</b>

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. These laws, programs, documents, and departments were reviewed to identify the plans, regulations, personnel, and funding mechanisms available to the county and planning partners to impact and mitigate the effects of natural hazards. The review also helps identify opportunities for the planning partners to strengthen their abilities to proactively mitigation natural hazards in the community.

### 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. Lampasas County and the Cities of Kempner and Lampasas participate in the NFIP and have adopted regulations that meet the NFIP requirements. At the time of the preparation of this plan, Lampasas County and the Cities of Kempner and Lampasas were in good standing with NFIP requirements. The City of Lometa is not listed as a participant in the NFIP database.

## **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 Lampasas County

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

- County Judge
- Commissioners' Court
- County Attorney
- County Clerk
- County Treasure
- County Tax Assessor/Collector
- Constable
- County Auditor
- Sheriff
- Justice of the Peace
- County Court Collections
- Emergency Management
- Human Resources
- Elections Administration
- District Judge
- District Clerk
- District Attorney

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

#### ***Lampasas County Subdivision Regulations, 2012 (as amended)***

The Lampasas County Subdivision Regulations, dated August 11, 2008, established rules, regulations, and standards governing the subdivision of land within the unincorporated areas of Lampasas County. The initial Subdivision Regulations were adopted January 30, 1984. It established standards and specifications for platting, bond requirements, utilities, construction of roads and drainage. The Subdivision Regulations were designed and enacted for the purpose of promoting the health, safety, and general welfare of the public and to establish standards of subdivision design, which will encourage the development of sound, economical, stable neighborhoods and create a healthy environment for present and future inhabitants of Lampasas County by:

1. Detailing preliminary and final platting requirements, lot sizes, and setbacks
2. Detailing requirements and design standards, for water, wastewater, street design and maintenance, and utilities
3. Detailing acceptable impacts and drainage requirements
4. Detailing administrative responsibilities including enforcement and variances

#### ***Lampasas County's Floodplain Damage Prevention Order, 1997***

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) ensure that potential buyers are notified that property is in a flood area.”

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 ordinance will be administered by the County Building Official whose responsibilities include reviewing and approving permit applications in according with the ordinance and required permitting practices. The ordinance also addressed development requirements, variances procedures, planning requirements for subdivisions, shallow areas, and severity.

### ***Lampasas County Floodplain Map***

The current floodplain maps are dated January 2, 1991.

### ***Lampasas County Commissioners’ Court***

The Commissioners’ Court and Drainage Districts are responsible for the maintenance and construction of those roadway and drainage structure assets maintained through the direct and indirect efforts of Lampasas County.

### ***Lampasas County Emergency Management***

The Emergency Management Coordinator assists Lampasas County in preparing for, responding to, and recovering from disasters in the unincorporated areas of the county and the Cities of Kempner and Lometa. The Emergency Management Coordinator works with 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.

### ***Lampasas County Emergency Operations Plan***

The *Lampasas County Emergency Operations Plan* outlines the countywide approach to emergency operations, and is applicable to Lampasas County and the Cities of Kempner, Lampasas, and Lometa. It provides general guidance for emergency management activities and an overview of the methods of mitigation, preparedness, response, and recovery. The plan describes the emergency response organization and assigns responsibilities for various emergency tasks. The plan is intended to provide a framework for more specific functional annexes that describe in more detail who does what, when, and how. It applies to all chief elected official and other elected officials, the emergency management staff, department and agency heads and their senior staff members, leaders of local volunteer organizations that support emergency operations, and others who may participate in our mitigation, preparedness, response, and recovery efforts.

## **6.9.4 City of Kempner**

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

- City Administration
- Fire
- Police
- Parks
- Water Supply Corporation

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

### ***City of Kempner Code of Ordinances***

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

- **Buildings Code Ordinance** 2002-02-12-001, Section 2

Provisions under this chapter include:

- Adoption of the International Building Code, 2003 edition

- **Buildings Code Ordinance** 2010-03-09-02 (Amendment of 2005-07-26-002)

Provisions under this chapter include:

- Building permit requirements
- Land development and division restrictions
- Permit and variance procedures for subdivisions

- **Burn Ordinance** 2006-10-24-002 (Revision of 2004-04-27-003)

Provisions under this chapter include:

- Prohibits outdoor burning within the city

- **Fireworks Ordinance** 2006-06-13-001

Provisions under this chapter include:

- Prohibits manufacture, assembly, storage, transport, and ignition of fireworks

- **Flood Damage Prevention Ordinance** (2002-01-22-001)

Provisions under this chapter include:

- Description of enforcement, authorization, and purpose of the Standard for Floodplain Management
- Methods of reducing flood losses
- Basis for establishing the areas of special flood hazard and permitting requirements
- Designation, duties, and responsibilities of the floodplain administrator
- Permit and variance procedures for a floodplain development permit
- Construction standards for new construction and substantial improvements to minimize flood damage
- Standards for subdivision

- **Subdivisions Ordinance** 2001-11-20-002 (Revision of 1999-02-23-001)

Provisions under this chapter include:

- Manage the orderly, safe and healthful development to promote the health, safety and general welfare of the community
- Minimum construction standards
- Land development and division restrictions

### **6.9.5 City of Lampasas**

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

- Airport
- Animal Shelter
- Building & Planning
- Cemetery
- City Attorney
- City Manager
- City Secretary
- Economic Development
- Finance
- Fire
- Golf Course
- Human Resources
- Information Systems
- Library
- Municipal Court
- Parks & Recreation
- Police
- Public Utilities
- Public Works
- Swimming Pool

The city also has the following boards and commissions:

- Airport Advisory Board
- Capital Improvements Program Committee
- Cemetery Association
- Construction Board of Adjustments
- Economic Development Corporation
- Golf Course Advisory Board
- Library Board
- Parks and Recreation Advisory Board
- Planning and Zoning Commission
- Zoning Board of Adjustments

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

#### ***City of Lampasas Comprehensive Planning, under development***

The City of Lampasas is currently developing a comprehensive plan and anticipates it will be adopted in late 2015. A previous plan was created but never adopted by the City Council. The plan is intended to serve as a policy guide for city elected officials and staff on decisions affecting the physical development of the community. It will provide a vision for what the community wants to achieve over the next ten years and it provides a clear direction on growth, quality of life, and economic prosperity. The plan will include

guidance regarding land use, economic development, transportation, and utility infrastructure (water, wastewater, and electricity).

### **City of Lampasas Code of Ordinances**

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

- **Chapter 18 - Buildings and Building Regulations**

Provisions under this chapter include:

- Adoption of the International Building Code, 2006 edition (Ord. No. 743, §§ 1—3, 9-25-95; Ord. No. 1307, § 1, 1-10-2011)
- Building permit requirements, including the application requirements, authority, and process (Ord. No. 1003, § 1, 10-28-2002)
- Designation of the building inspections processes (Ord. No. 743, §§ 1—3, 9-25-95; Ord. No. 1307, § 1, 1-10-2011)

- **Chapter 30 – Civil Emergencies**

Provisions under this chapter include:

- Establishment of the City of Lampasas Emergency Management Organization (Ord. No. 541, § 1, 4-14-86)
- Identification of the powers, duties, and responsibilities of the Emergency Management Director (Ord. No. 541, § 2, 4-14-86)

- **Chapter 38 – Fire Prevention and Protection**

Provisions under this chapter include:

- Creation of the Office of the Fire Marshall including authorities and responsibilities (Ord. No. 1340, Part 1b, 3-26-2012)
- Adoption of the Standard Fire Prevention Code, 1994 edition (Ord. No. 743, §§ 1—3, 9-25-95)
- Regulations on the use, possession, and sale of fireworks (Ord. No. 744, § I, 10-23-95; Ord. No. 887, § 1, 12-13-99)

- **Chapter 42 – Floods**

Provisions under this chapter include:

- Description of enforcement, authorization, and purpose of the Standard for Floodplain Management (Ord. No. 573, art. 1, § C, 3-30-87)
- Methods of reducing flood losses (Ord. No. 573, art. 1, § D, 3-30-87)
- Basis for establishing the areas of special flood hazard and permitting requirements (Ord. No. 573, art. 3, § B, 3-30-87)
- Designation, duties, and responsibilities of the floodplain administrator (Ord. No. 573, art. 4, § A, 3-30-87)
- Permit and variance procedures for a floodplain development permit (Ord. No. 573, art. 3, § C, 3-30-87)

- Construction standards for new construction and substantial improvements to minimize flood damage (Ord. No. 573, art. 5, § A, 3-30-87)
- Standards for subdivision (Ord. No. 573, art. 5, § C, 3-30-87)
- **Chapter 70 – Subdivision**

Provisions under this chapter include:

  - Manage the orderly, safe and healthful development to promote the health, safety and general welfare of the community (Ord. No. 726, § 3.01, 3-13-95)
  - Minimum Construction Standards (Ord. No. 726, § 5.12(1)-(3), 3-13-95)
  - Land development and division restrictions (Ord. No. 726, § 4.05, 3-13-95; Ord. No. 1317, § 1, 4-25-2011; Ord. No. 1423, § 1, 8-25-2014)
- **Chapter 90 – Zoning, Codified by 878**

Provisions under this chapter include:

  - Establishes zoning regulations and establishes zoning types within the City of Lampasas. (Ord. No. 878, adopted June 14, 1999)
  - Restrictions on the types of businesses that can operate (Ord. No. 878, adopted June 14, 1999)
  - Creates the Planning and Zoning Commission procedures, variances, and review process for approval of construction projects within the city (Ord. No. 878, adopted June 14, 1999)
  - Creates the Board of Adjustments procedures, variances, and review process for approval of construction projects within the city (Ord. No. 878, adopted June 14, 1999)

### ***Airport Advisory Board***

The Airport Advisory Board studies and makes recommendations to the City Council regarding operations and facility improvements of the municipal airport. The board ensures that the municipal airport is efficiently and adequately meeting the needs of the city and the air transportation industry.

### ***Capital Improvements Program Committee***

The Capital Improvements Program Committee recommends approval of capital purchases to the City of Lampasas City Council. A capital purchase is considered \$5,000 or higher and includes, but not limited to, types of purchases such as large equipment, vehicles, office equipment, and funding for large projects. For example, the replacement of the retaining wall at WM Brook Park and street reconstruction are considered capital purchases.

### ***Construction Board of Adjustments***

The Construction Board of Adjustments and Appeals Board hears appeals of decisions and interpretations of the Building Official; considers variances and special exceptions of the technical codes; reviews building regulations; reviews the adopted building, gas, mechanical, plumbing, energy, maintenance and residential codes; and makes recommendations to the City Council.

### ***Economic Development Corporation***

The City of Lampasas Economic Development Corporation is responsible for promoting the economic development of the community through the coordinated actions of the city and the Chamber of Commerce.

***Golf Course Advisory Board***

The Golf Course Advisory Board advises and makes recommendations to the city regarding matters pertaining to the Golf Course.

***Parks and Recreation Advisory Board***

The Parks and Recreation Advisory Board aids and assists the city administration in procuring financial and other assistance for the improvement of public parks and recreation facilities from state and federal government and their agencies. This board considers other parks and recreation policies and capital issues as assigned by the City Council.

***Planning and Zoning Commission***

The Planning and Zoning Commission considers issues regarding developments of property within the city limits, and makes recommendations to the City Council.

***Zoning Board of Adjustments***

The Zoning Board of Adjustments makes decisions on appeals from determinations made by the Building Official, and regarding special exceptions and specific variances.

***City of Lampasas Fire Department***

The Lampasas Fire Department protects 25,000 people living in Lampasas County. The fire department is a public department that operates out of one station whose members are a combination of paid and volunteer status. The Lampasas Fire Department provides:

- Emergency medical assists
- Extrication services within Lampasas County
- Fire suppression services
- Fire safety education
- Technical HAZMAT response
- Search and rescue services

**6.9.6 City of Lometa**

The City of Lometa government is made up of city administration and the fire department. Excerpts from applicable policies, regulations, and plans and program descriptions follow to provide more detail on existing mitigation capabilities.

***City of Lometa 2033 Comprehensive Plan, 2013***

The City of Lometa developed a comprehensive plan in 2013 to serve as a policy guide for city elected officials and staff on decisions affecting the physical development of the community. The plan provides a vision for what the community wants to achieve in over the next 30 years and it provides a clear direction on how some of that vision can be realized regarding growth, quality of life, and economic prosperity. The plan include content regarding goals and objectives, population analysis, housing study, land use, utility infrastructure (water, wastewater, electricity), economic development, recreation and open space, capital improvement, and content regarding future zoning and subdivision ordinances.

***City of Lometa Code of Ordinances***

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

- **Flood Damage Prevention Ordinance**

Provisions under this chapter include:

- Methods of reducing flood losses (Ord. 06022003)
- Basis for establishing the areas of special flood hazard and permitting requirements (Ord. 06022003)
- Permit and variance procedures for a floodplain development permit (Ord. 06022003)
- Standards for subdivision (Ord. 06022003)
- Permit required for development activities increasing flooding or drainage problems (Ord. 06022003)

## 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. The county and the planning partners used this capabilities assessment to identify mitigation actions to strengthen their ability to mitigate the effects of a natural hazard.

### 7.1 LAMPASAS 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 Lampasas County.

<b>TABLE 7-1. LAMPASAS COUNTY REGULATORY MITIGATION CAPABILITIES MATRIX</b>		
Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
General plan	No	
Zoning ordinance	No	
Subdivision ordinance	Yes	The Lampasas County Subdivision Regulations (2012, as amended) established rules, regulations and standards governing the subdivision of land within the unincorporated areas of Lampasas County.
Growth management	Yes	Growth management is accomplished through compliance with the Lampasas County Subdivision Ordinance.
Floodplain ordinance	Yes	Signed May 15, 1997 (as amended).
Other special purpose ordinance (stormwater, steep slope, wildfire)	No	
Building code	No	
Erosion or sediment control program	No	
Stormwater management	No	The county works with Texas Water Development Board but does not manage other initiatives.
Site plan review requirements	Yes	The Commissioners’ Court administers a platting review process in accordance with the subdivision ordinance.
Capital improvement plan	Yes	Capital improvement planning is completed through the annual budget cycle.
Economic development plan	No	
Local emergency operations plan	Yes	The <i>Lampasas County Basic Emergency Operations Plan</i> covers the county and the Cities of Kempner, Lampasas, and Lometa.
Other special plans	No	

<b>TABLE 7-1. LAMPASAS COUNTY REGULATORY MITIGATION CAPABILITIES MATRIX</b>		
Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
Flood insurance study or other engineering study for streams	Yes	The County Judge is the local repository for the FEMA FIRMs for the unincorporated areas of the county and makes the maps available for public review. The department maintains flood insurance rate maps in conjunction with the NFIP. The maps are dated January 2, 1991.
Elevation certificates	Yes	The Lampasas County Judge keeps records of 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 Lampasas County.

<b>TABLE 7-2. LAMPASAS COUNTY ADMINISTRATIVE/TECHNICAL MITIGATION CAPABILITIES MATRIX</b>		
Personnel Resources	Yes/No	Department/Position
Planner/engineer with knowledge of land development/land management practices	No	
Engineer/professional trained in construction practices related to buildings or infrastructure	No	
Planner/engineer/scientist with an understanding of natural hazards	No	Emergency Management Coordinator
Personnel skilled in GIS	No	
Full-time building official	No	
Floodplain manager	Yes	County Judge
Emergency manager	Yes	Emergency Management Coordinator
Grant writer	Yes	The county uses a variety of means to develop grant applications. Some grants are generated by county departments. Other are supported by Central Texas Council of Governments or outsourced to Grant Works.
Other personnel	No	
GIS data: Hazard areas	No	
GIS data: Critical facilities	No	
GIS data: Building footprints	No	
GIS data: Land use	No	

Personnel Resources	Yes/No	Department/Position
GIS data: Links to Assessor's data	No	
Warning systems/services (Reverse 911 callback, cable override, outdoor warning signals)	Yes	The county participates in the CodeRED notification system.
Other	No	
Notes: GIS Geographic Information System		

### 7.1.3 Financial Capabilities

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

Financial Resources	Accessible/Eligible to Use (Yes/No)
Community Development Block Grants	Yes
Capital improvements project funding	No
Authority to levy taxes for specific purposes	Yes
Fees for water, sewer, gas, or electric services	No
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

## 7.2 CITY OF KEMPNER

### 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 Kempner.

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

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
General plan	No	
Zoning ordinance	No	
Subdivision ordinance	Yes	The City of Kempner Subdivisions Ordinance (2001-11-20)
Growth management	No	
Floodplain ordinance	Yes	Flood Damage Prevention Ordinance (2002-01-22-001)
Other special purpose ordinance (stormwater, steep slope, wildfire)	No	
Building code	Yes	The City of Kempner adopted the International Building Code (2012 editions).
Erosion or sediment control program	No	
Stormwater management	No	
Site plan review requirements	No	
Capital improvements plan	No	
Economic development plan	No	
Local emergency operations plan	No	
Other special plans	No	
Flood insurance study or other engineering study for streams	Yes	FEMA floodplain maps indicate flood insurance is necessary along Lampasas River and Taylor Creek.
Elevation certificates	No	The Lampasas Commissioners' Court keeps records of flood elevation certificates on file in its office.
Notes:		
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 Kempner.

<b>TABLE 7-5. CITY OF KEMPNER ADMINISTRATIVE/TECHNICAL MITIGATION CAPABILITIES MATRIX</b>		
<b>Personnel Resources</b>	<b>Yes/No</b>	<b>Department/Position</b>
Planner/engineer with knowledge of land development/land management practices	No	The role of the City Engineer is outsourced to Mitchel and Associates.
Engineer/professional trained in construction practices related to buildings or infrastructure	No	The role of the City Engineer is outsourced to Mitchel and Associates.
Planner/engineer/scientist with an understanding of natural hazards	No	The role of the City Engineer is outsourced to Mitchel and Associates.
Personnel skilled in GIS	No	GIS services are provided to the region by the Central Texas Council of Governments.
Full-time building official	No	The city has a Building Standards Commission for dilapidated buildings.
Floodplain manager	No	
Emergency manager	No	The City of Kempner also works in conjunction with the Lampasas County Emergency Manager.
Grant writer	Yes	Outsourced to Grant Works.
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	Lampasas County Central Appraisal District website
Warning systems/services (Reverse 911 callback, cable override, outdoor warning signals)	No	
Other	No	
Notes: GIS                      Geographic Information System		

### 7.2.3 Financial Capabilities

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

<b>TABLE 7-6. CITY OF KEMPNER FINANCIAL MITIGATION CAPABILITIES MATRIX</b>	
<b>Financial Resources</b>	<b>Accessible/Eligible to Use (Yes/No)</b>
Community Development Block Grants	No
Capital improvements project funding	Yes
Authority to levy taxes for specific purposes	Yes

Financial Resources	Accessible/Eligible to Use (Yes/No)
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	No
Incur debt through private activities	No
Withhold spending in hazard prone areas	No
Other	No

### 7.3 CITY OF LAMPASAS

#### 7.3.1 Legal and Regulatory Capabilities

Table 7-7 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the City of Lampasas.

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
General plan	No	<i>Lampasas Comprehensive Planning and Capacity Study, 2009-2029</i>
Zoning ordinance	Yes	Lampasas Consolidated Zoning Ordinance, Ord. No. 878
Subdivision ordinance	Yes	Chapter 70, Subdivisions
Growth management	Yes	Growth management is accomplished through compliance with the subdivision and zoning regulations.
Floodplain ordinance	Yes	Part of Chapter 10, Flooding (Ord. No. 573)
Other special purpose ordinance (stormwater, steep slope, wildfire)	No	
Building code	Yes	The city adopted the 2006 editions of the International Building Code.
Erosion or sediment control program	Yes	The city follows and administers the erosion and sediment control program developed by the City of Austin.
Stormwater management	No	The city follows and administers the stormwater management program developed by the City of Austin.
Site plan review requirements	Yes	The City Building Official reviews site plans for all new development.
Capital improvements plan	Yes	The city maintains an ongoing 5-year <i>Capital Improvement Plan</i> for budgeting.
Economic development plan	Yes	

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
Local emergency operations plan	No	
Other special plans	No	
Flood insurance study or other engineering study for streams	Yes	FEMA floodplain maps indicate flood insurance is necessary along Sulphur Creek and Cemetery Creek.
Elevation certificates	Yes	The City Building Official maintains flood elevation certificates for new development.
Notes:		
FEMA Federal Emergency Management Agency		

### 7.3.2 Administrative and Technical Capabilities

Table 7-8 identifies the City of Lampasas personnel responsible for activities related to mitigation and loss prevention.

Personnel Resources	Yes/No	Department/Position
Planner/engineer with knowledge of land development/land management practices	Yes	Engineering services are outsourced primarily to Eckermann Engineering, Inc.
Engineer/professional trained in construction practices related to buildings or infrastructure	Yes	Engineering services are outsourced primarily to Eckermann Engineering, Inc.
Planner/engineer/scientist with an understanding of natural hazards	Yes	Engineering services are outsourced primarily to Eckermann Engineering, Inc.
Personnel skilled in GIS	Yes	Information systems and other departments
Full-time building official	Yes	Building Official
Floodplain manager	Yes	Building Official with support from TCRFC
Emergency manager	Yes	The City of Lampasas works in conjunction with the Lampasas County Emergency Manager. The city has an Emergency Management Coordinator.
Grant writer	Yes	The city develops some grants applications internally; others are outsourced based on complexity.
Other personnel	No	
GIS data: Hazard areas	Yes	
GIS data: Critical facilities	No	

**TABLE 7-8.  
CITY OF LAMPASAS ADMINISTRATIVE/TECHNICAL MITIGATION CAPABILITIES MATRIX**

Personnel Resources	Yes/No	Department/Position
GIS data: Building footprints	Yes	
GIS data: Land use	Yes	
GIS data: Links to Assessor's data	Yes	
Warning systems/services (Reverse 911 callback, cable override, outdoor warning signals)	Yes	The city maintains outdoor warning sirens and the CodeRED notification system
Other	No	
Notes: GIS Geographic Information System TCRFC Texas Colorado River Floodplain Coalition		

### 7.3.3 Financial Capabilities

Table 7-9 identifies financial tools or resources that City of Lampasas could use to help fund mitigation activities.

**TABLE 7-9.  
CITY OF LAMPASAS 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	No
Incur debt through private activities	Yes
Withhold spending in hazard prone areas	Yes
Other	No

## 7.4 CITY OF LOMETA

### 7.4.1 Legal and Regulatory Capabilities

Table 7-10 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the City of Lometa.

**TABLE 7-10.  
CITY OF LOMETA REGULATORY MITIGATION CAPABILITIES MATRIX**

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
General plan	Yes	<i>Lometa Comprehensive Plan, 2013</i>
Zoning ordinance	No	
Subdivision ordinance	No	
Growth management	No	
Floodplain ordinance	Yes	Flood Damage Prevention Ordinance, Ordinance 06022003
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	No	
Capital improvements plan	No	
Economic development plan	No	
Local emergency operations plan	No	The city operates under the <i>Lampasas County Emergency Operation Plan</i> .
Other special plans	No	
Flood insurance study or other engineering study for streams	No	FEMA floodplain maps indicate flood insurance is not required within the city due to the lack of tributaries.
Elevation certificates	No	
Notes:		
FEMA Federal Emergency Management Agency		

### 7.4.2 Administrative and Technical Capabilities

Table 7-11 identifies the City of Lometa personnel responsible for activities related to mitigation and loss prevention.

**TABLE 7-11.  
CITY OF LOMETA ADMINISTRATIVE/TECHNICAL MITIGATION CAPABILITIES MATRIX**

Personnel Resources	Yes/No	Department/Position
Planner/engineer with knowledge of land development/land management practices	No	

TABLE 7-11. CITY OF LOMETA ADMINISTRATIVE/TECHNICAL MITIGATION CAPABILITIES MATRIX		
Personnel Resources	Yes/No	Department/Position
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	No	
Emergency manager	No	The City of Lometa works in conjunction with the Lampasas County Emergency Manager.
Grant writer	No	The city outsources grant writing to Grant Works.
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 has a warning system at City Hall for fires.
Other	No	
Notes: GIS      Geographic Information System		

### 7.4.3 Financial Capabilities

Table 7-12 identifies financial tools or resources that City of Lometa could use to help fund mitigation activities.

TABLE 7-12. CITY OF LOMETA FINANCIAL MITIGATION CAPABILITIES MATRIX	
Financial Resources	Accessible/Eligible to Use (Yes/No)
Community Development Block Grants	Yes
Capital improvements project funding	No
Authority to levy taxes for specific purposes	No
Fees for water, sewer, gas, or electric services	No
Impact fees for new development	No

**TABLE 7-12.  
CITY OF LOMETA FINANCIAL MITIGATION CAPABILITIES MATRIX**

Financial Resources	Accessible/Eligible to Use (Yes/No)
Incur debt through general obligation bonds	No
Incur debt through special tax bonds	No
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

<b>COASTAL EROSION, EXPANSIVE SOILS, AND LAND SUBSIDENCE RANKING</b>			
<b>Jurisdiction</b>	<b>Coastal Erosion</b>	<b>Expansive Soils</b>	<b>Land Subsidence</b>
Lampasas County	No Exposure	Low	Low
City of Kempner	No Exposure	Low	Low
City of Lampasas	No Exposure	Low	Low
City of Lometa	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.

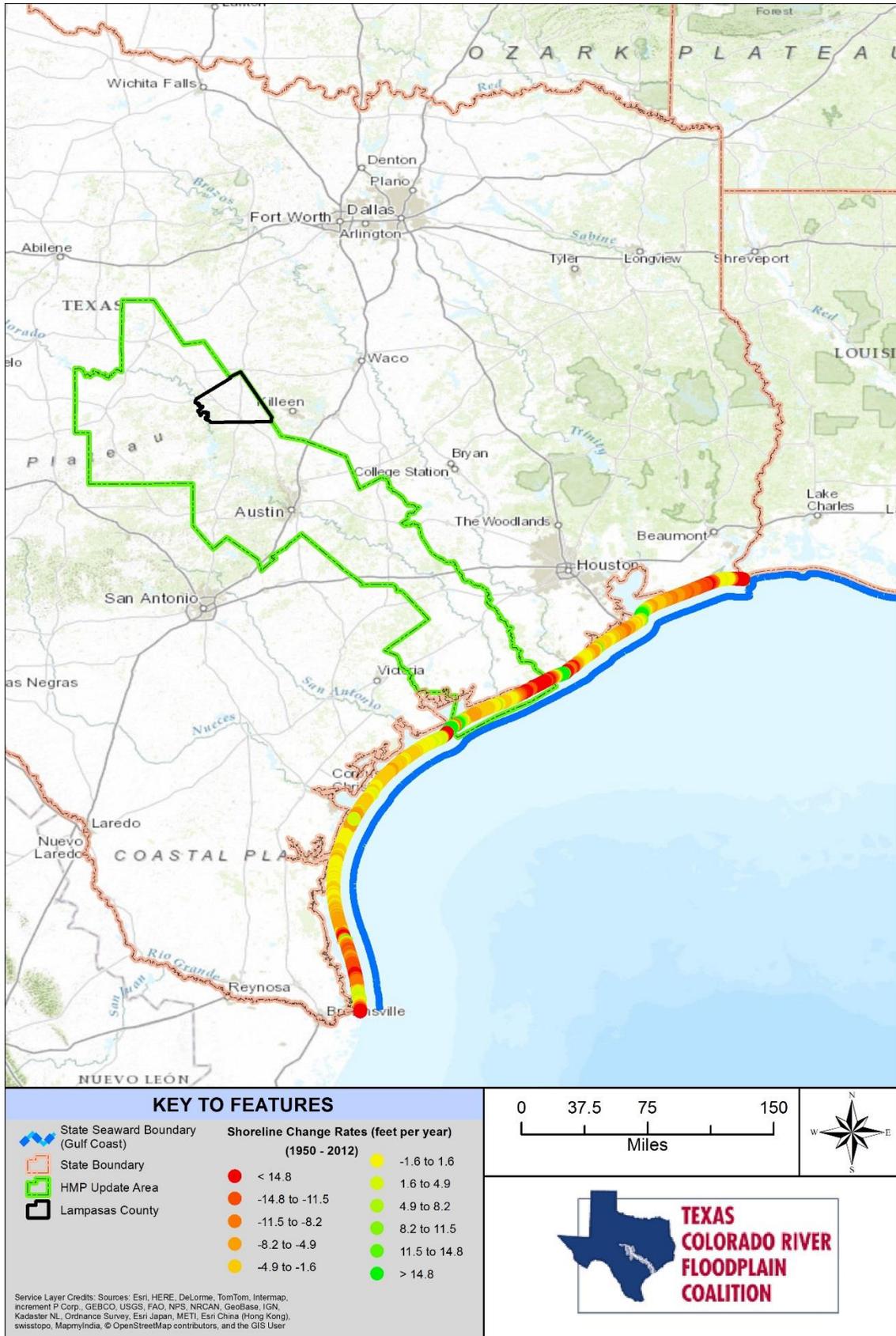


Figure 8-1. Coastal Change/Erosion Rates for the Texas Coast

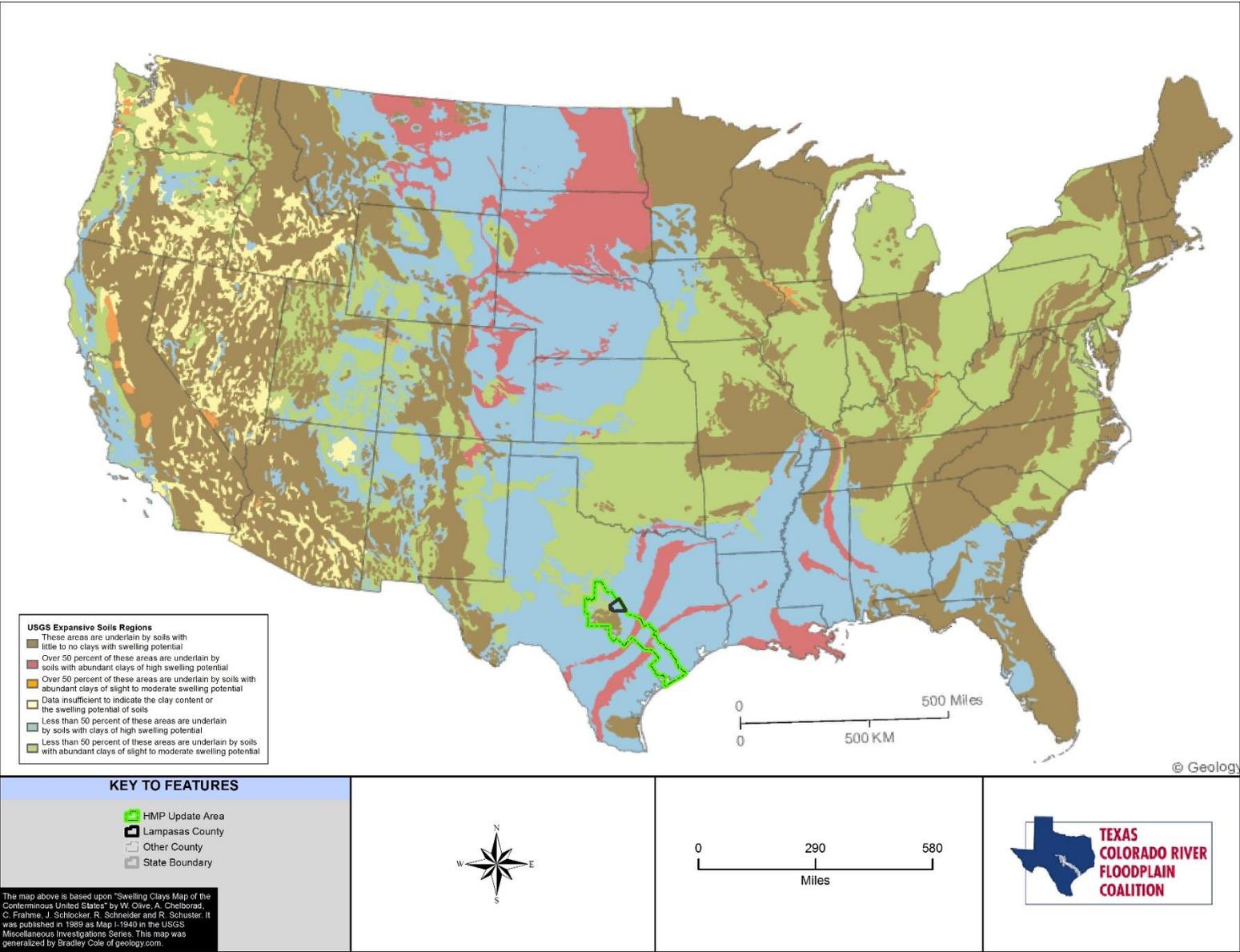


Figure 8-2. Expansive Soil Regions

### **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.

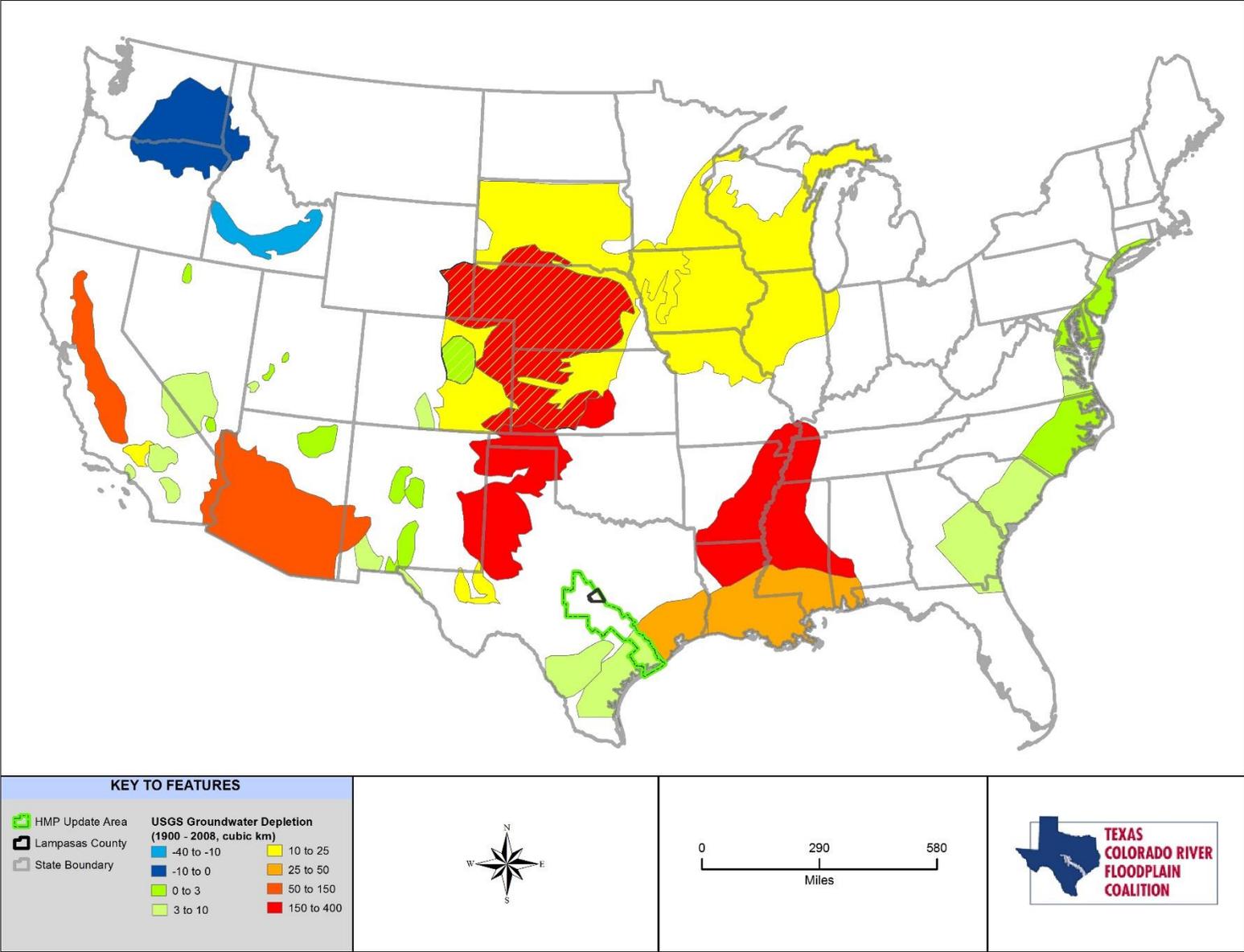


Figure 8-3. Groundwater Depletion and Subsidence Rates

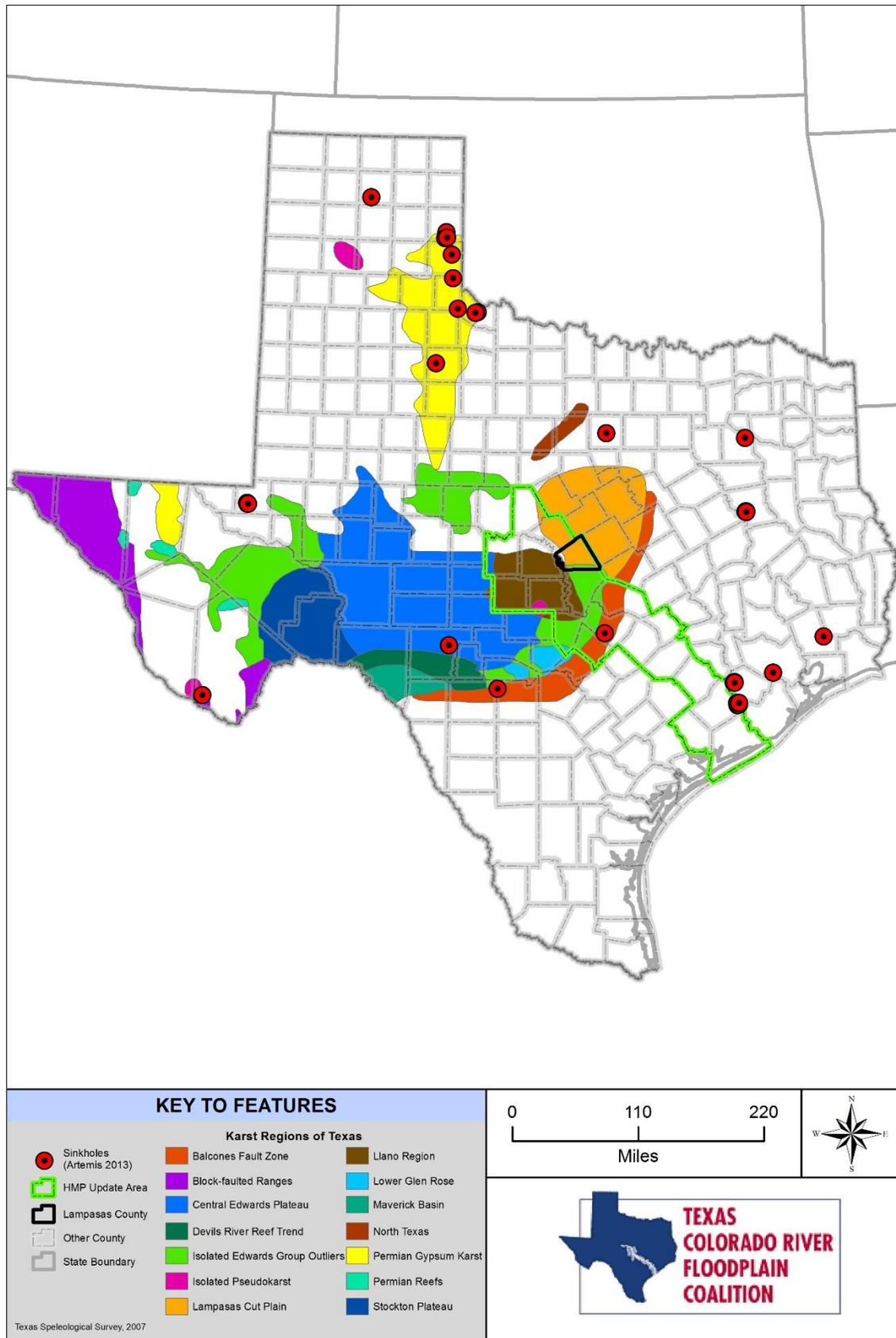


Figure 8-4. Karst Regions of Texas

## 8.2 HAZARD PROFILE

### 8.2.1 Past Events

#### ***Coastal Erosion***

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

#### ***Expansive Soils***

Lampasas 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. Lampasas County does not have a history of sinkholes as Figure 8-4 illustrates. Lampasas County does not have a history of groundwater depletion and there is no known database of specific groundwater depletion events for Lampasas County. As Figure 8-3 illustrates, Lampasas 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. Lampasas 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 Lampasas 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 Lampasas County, it is possible for either to occur as a result of oil exploration or groundwater activities.

The large increase in development between the greater metropolitan Austin area and Lampasas 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***

Lampasas 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, Lampasas County's minimal clay soil composition decreases the likelihood and severity of the seasonal swelling and contraction of soils.

### ***Land Subsidence***

Lampasas 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 Lampasas County HAZUS 2.2 inventory data (updated with 2010 U.S. Census data and 2014 RS Means Square Foot Costs), there are 8,457 buildings within the Lampasas County with an asset replaceable value of approximately \$1.8 billion (excluding contents). About 99% of these buildings (and 86% of the building value) are associated with residential housing. Within the participating communities, there are 7,771 buildings (residential, commercial, and other) with a total asset inventory value of over \$1.7 billion (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 assess 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 its 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	
Lampasas County	Low
City of Kempner	No Exposure
City of Lampasas	Medium
City of Lometa	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

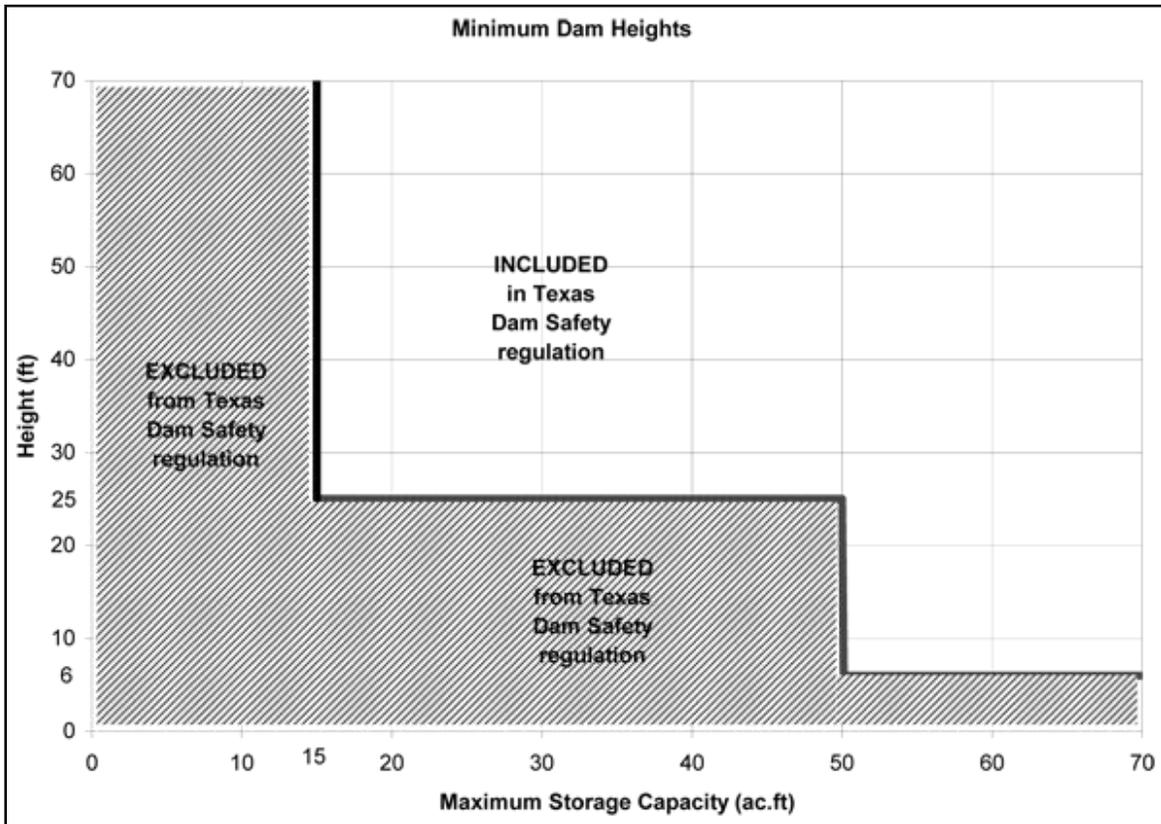


Figure 9-1. TCEQ Dam Definition

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 64% of the dams in Lampasas County are owned by either the local government or local government agency. The remaining 36% are privately owned.

Source: FEMA, Dams

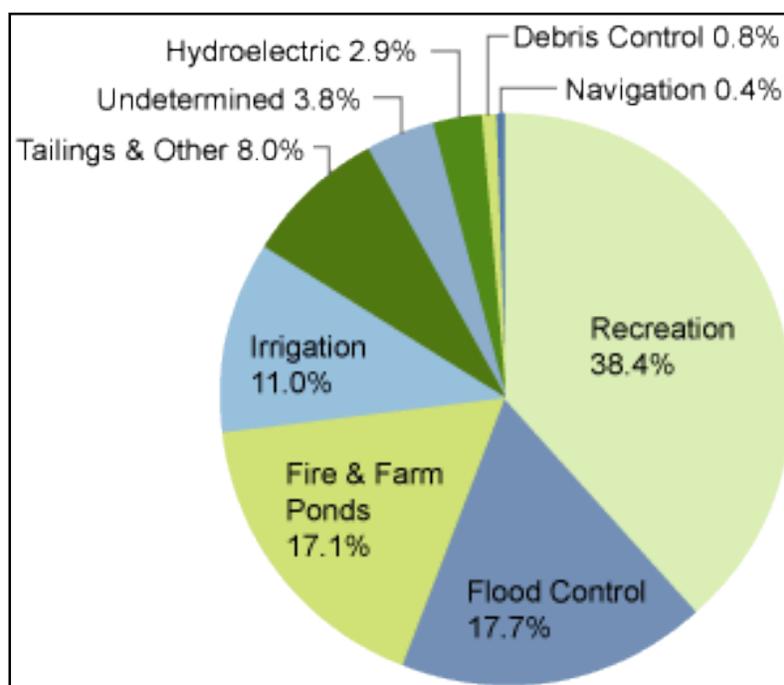


Figure 9-2. Primary Purpose/Benefit of U.S. Dams

## 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

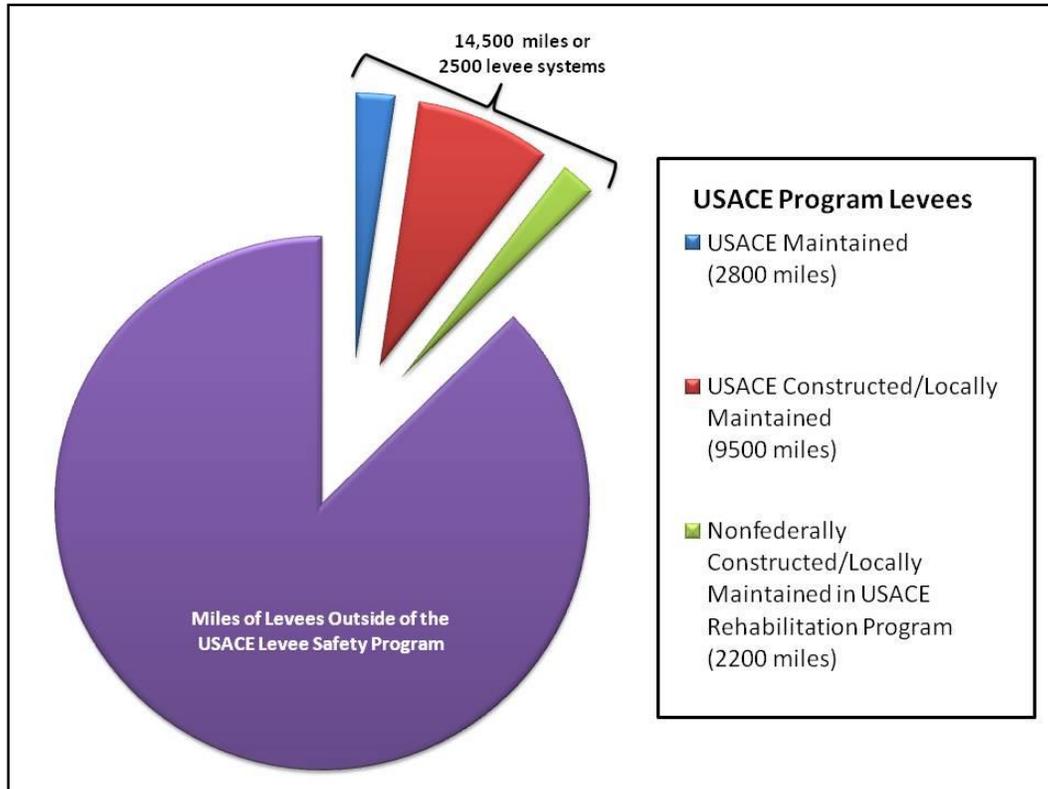


Figure 9-3. U.S. Levee Systems

### 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 did not list any levees in Lampasas County. However, the FEMA MLI database contained information about levees in Lampasas County. It is also 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. Eleven of the dams in Lampasas 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.

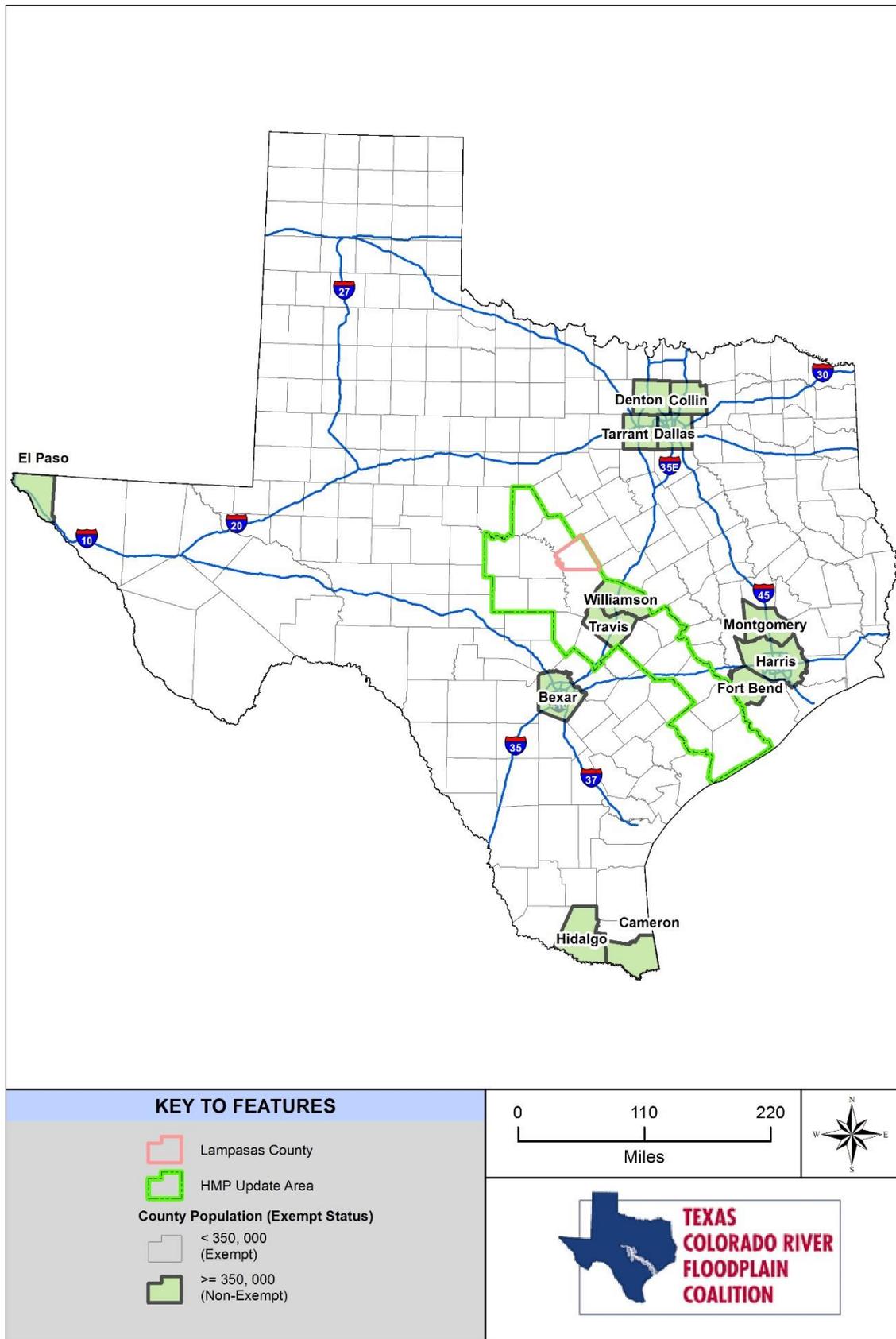


Figure 9-4. Texas County Population Exemptions for Dams

## 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.

The Lower Colorado River Authority (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 Bend (Figure 9-5); however no releases occurred from LCRA.

Source: LCRA

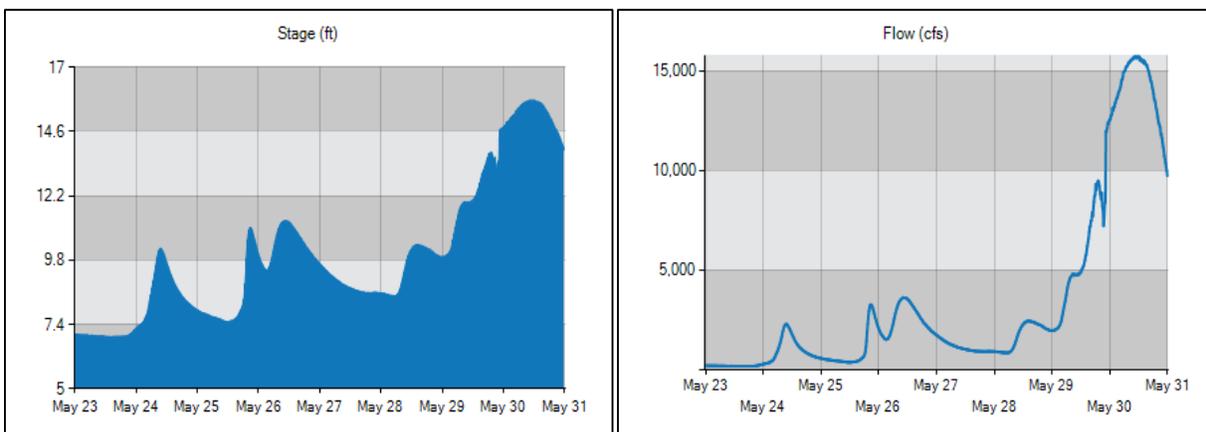


Figure 9-5. Colorado River Water Surface Elevation and Flow During the May 2015 Precipitation Event

### 9.2.2 Location

TWDB provided a database of dams based on the National Inventory of Dams. This database lists 14 dams in Lampasas 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 ten high-hazard and no significant-hazard dams in Lampasas County. The high-hazard dams in the participating communities and in the unincorporated county are listed on Table 9-1. Figure 9-6 shows locations of these dams in the county.

**TABLE 9-1.  
HIGH- AND SIGNIFICANT-HAZARD DAMS IN LAMPASAS COUNTY**

Name	Near City <sup>a</sup>	Max Storage (Acre-Feet)	Hazard Class
Sulphur Creek Ws Scs Site 9 Dam	City of Lampasas	270	High
Sulphur Creek Ws Scs Site 7 Dam	City of Lampasas	1,687	High
Sulphur Creek Ws Scs Site 5 Dam	City of Lampasas	2,237	High
Sulphur Creek Ws Scs Site 6 Dam	City of Lampasas	9,252	High
Sulphur Creek Ws Scs Site 3 Dam	City of Lampasas	4,154	High
Sulphur Creek Ws Scs Site 2 Dam	City of Lampasas	3,895	High
Sulphur Creek Ws Scs Site 1 Dam	City of Lampasas	8,206	High
Lometa Reservoir Dam	City of Lometa	2,016	High
Sulphur Creek Ws Scs Site 8 Dam	City of Lampasas	1,902	High
Jones Lake Dam	City of Lampasas	325	High

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 FEMA MLI data provided a listing of levee locations in Texas. Figure 9-7 shows the counties with levee in Texas and Figure 9-8 shows levee locations in Lampasas County. These levees have not been certified as providing protection from the 100-year flood event.

The areas of Lampasas County most likely to be impacted by a dam or levee failure are the areas in and around the City of Lampasas and, to a lesser extent, the City of Lometa. Lampasas County could also be impacted by several high-hazard dams that are located outside of the county. If a failure at 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 Lampasas County either by direct drainage through parts of the county or by inflow into the Colorado River upstream of Lampasas County.

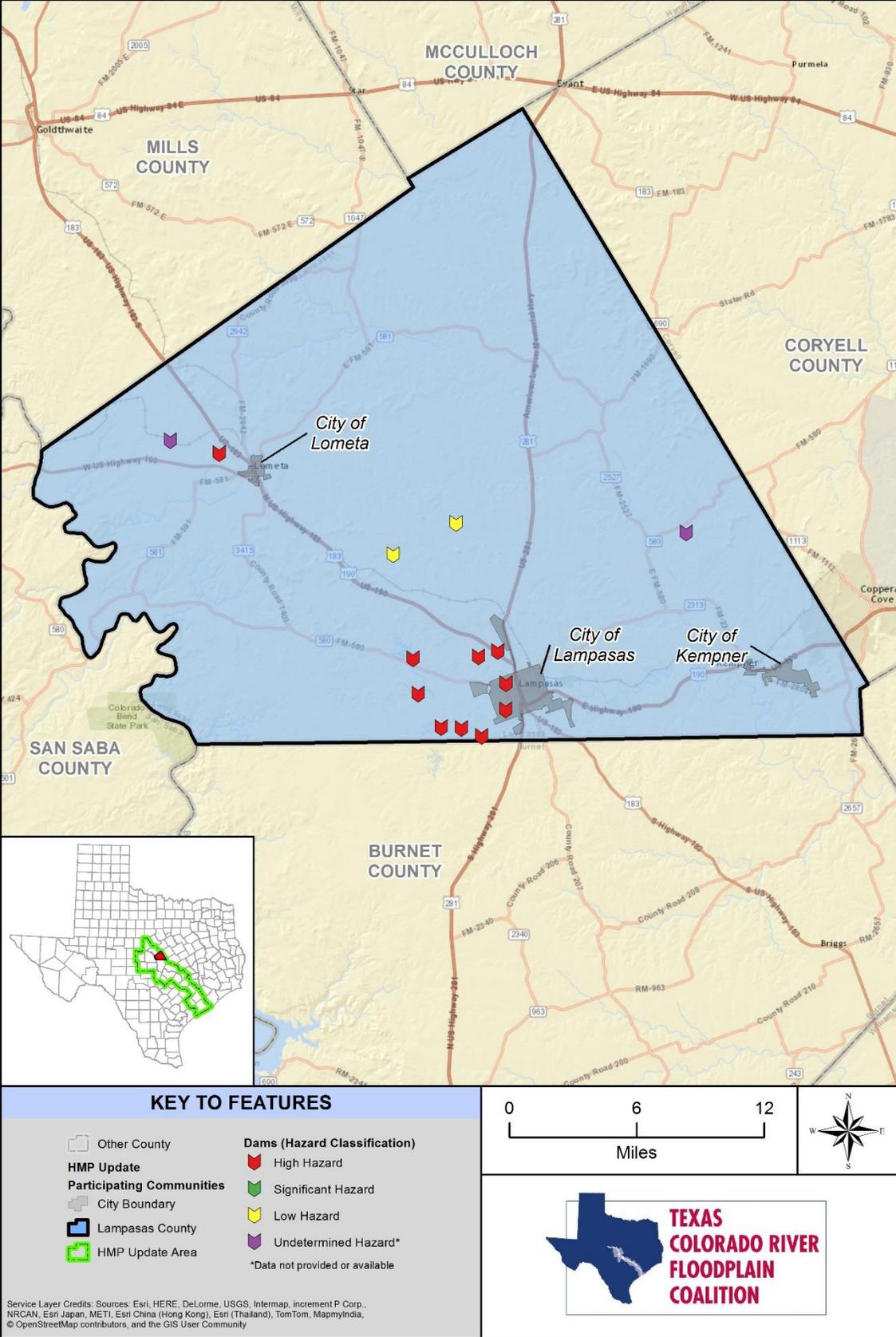


Figure 9-6. Locations of Dams in Lampasas County

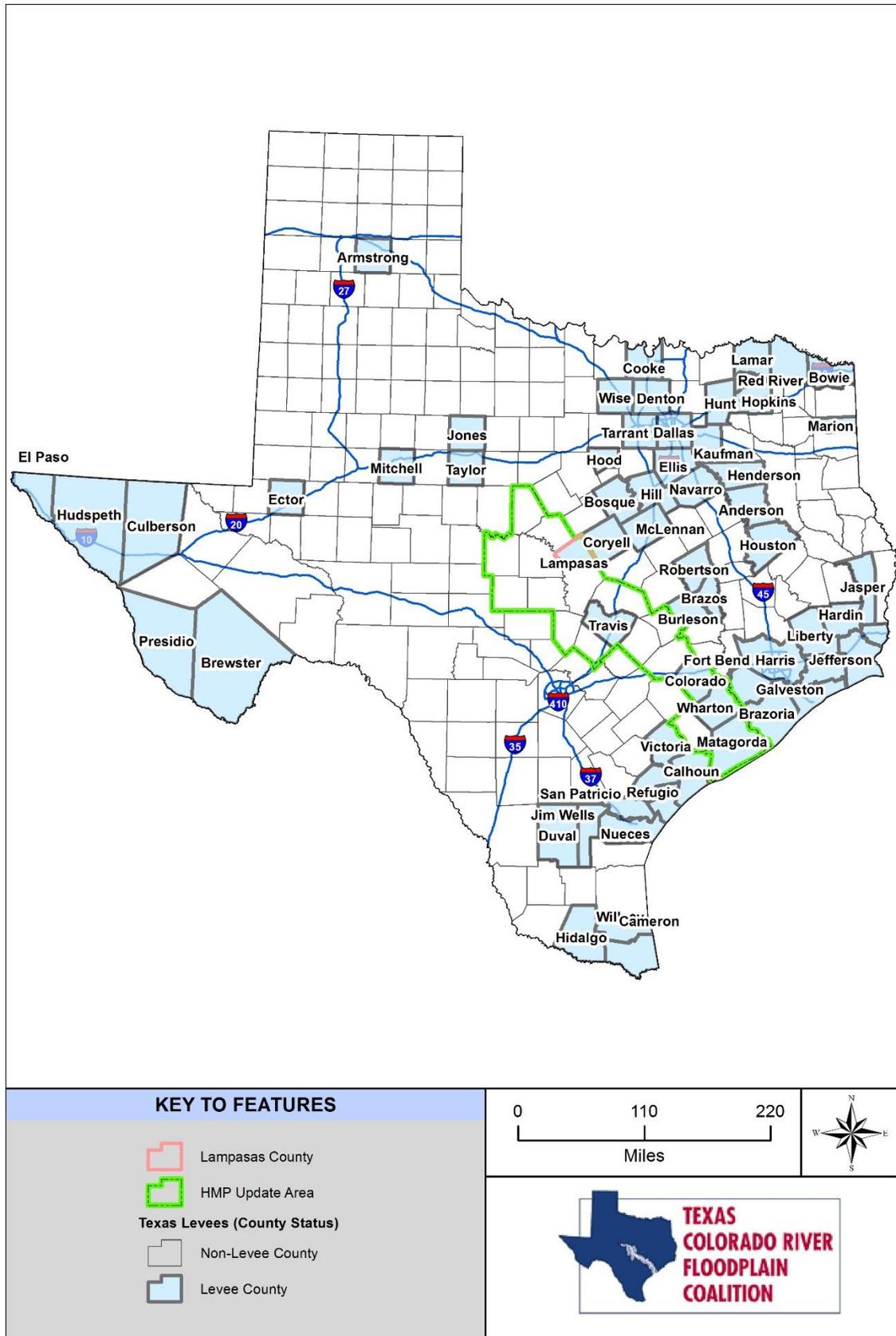


Figure 9-7. Counties in Texas with Levees

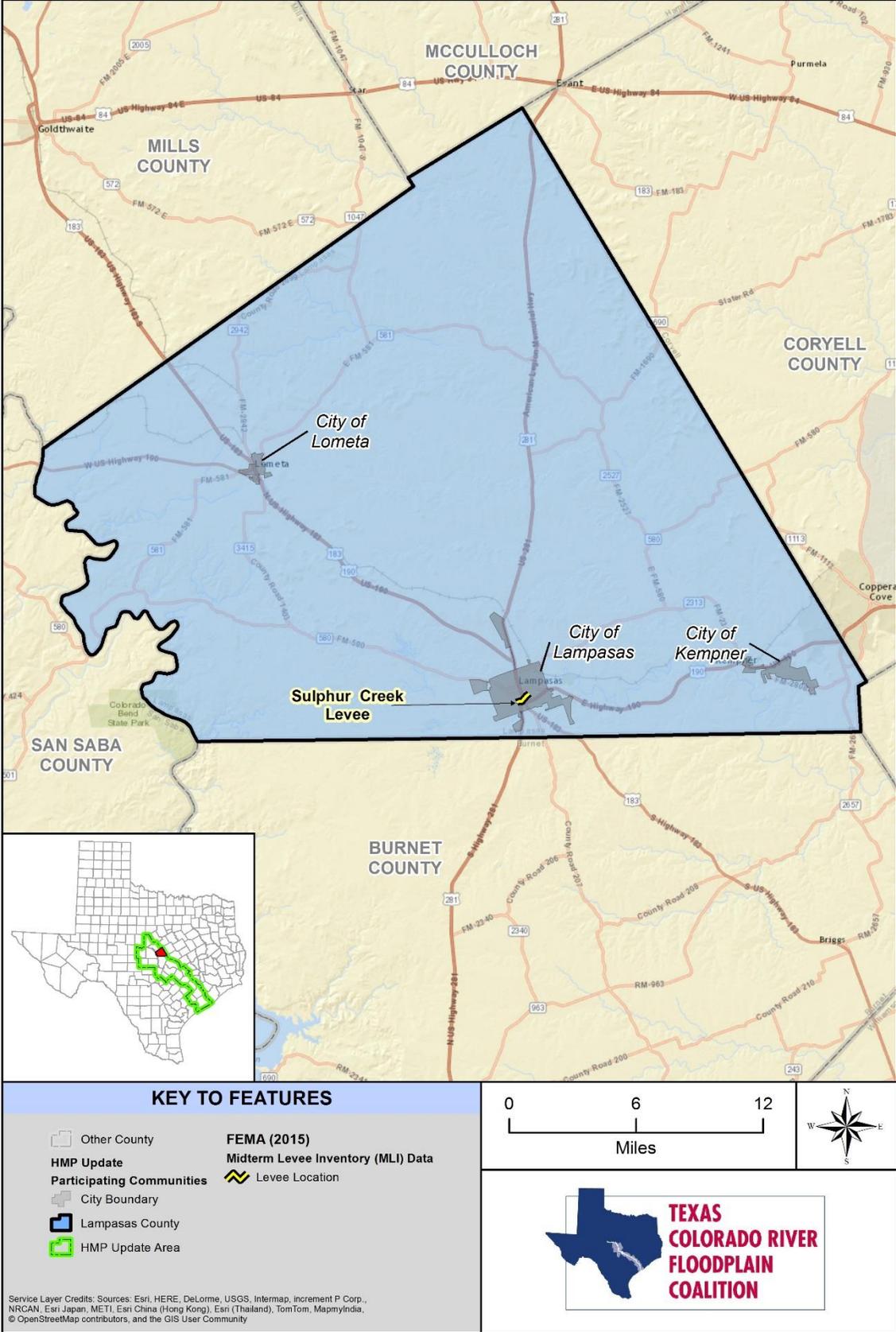


Figure 9-8. Locations of Levees in Lampasas County

### 9.2.3 Frequency

There have been no occurrences of dam failure in the past 100 years in Lampasas County. Overall, the probability of a dam failure somewhere in Lampasas 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.

<b>TABLE 9-2. USACE HAZARD POTENTIAL CLASSIFICATION</b>				
Hazard Category <sup>a</sup>	Direct Loss of Life <sup>b</sup>	Lifeline Losses <sup>c</sup>	Property Losses <sup>d</sup>	Environmental Losses <sup>e</sup>
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
<p>a. Categories are assigned to overall projects, not individual structures at a project.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>Source: U.S. Army Corps of Engineers 1995</p>				

**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, <a href="http://www.tceq.texas.gov/field/damsafetyprog.html">http://www.tceq.texas.gov/field/damsafetyprog.html</a>		

### 9.2.5 Warning Time

Warning time for dam or levee 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 Lampasas County are on file with TCEQ. Additionally, possible evacuation routes in the event of a failure have been identified.

### 9.3 SECONDARY HAZARDS

Dam or levee 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 hydrograph 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 or levee failure impacts would likely be rare and limited in Lampasas 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 or levee failure 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 or levee 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 or levee 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 or levee 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.
- Maintain accreditation of levees in the county.



# CHAPTER 10. DROUGHT AND EXTREME HEAT

DROUGHT AND EXTREME HEAT RANKING		
Jurisdiction	Drought	Extreme Heat
Lampasas County	Medium	High
City of Kempner	Medium	High
City of Lampasas	Medium	High
City of Lometa	Medium	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

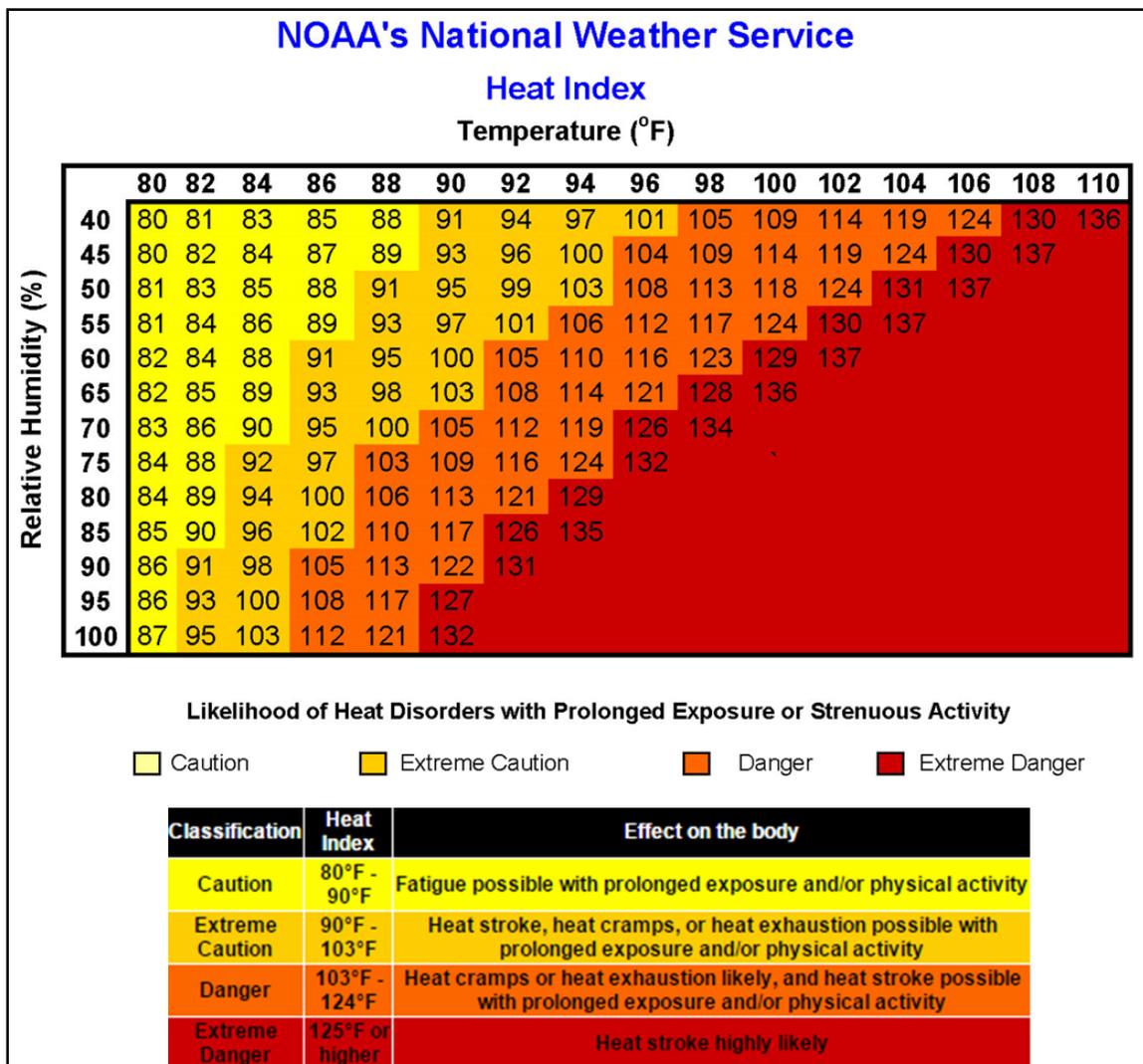


Figure 10-1. Heat Index Table

## 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 Lampasas 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 Lampasas 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 Lampasas County was experiencing D1 and D2 drought. However, the drought conditions changed in May 2015 with heavy spring rains falling over the Texas region. Lampasas 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 Lampasas County is now no longer experiencing drought and area reservoirs are 100% full or experienced large capacity gains during the spring and early summer of 2015.

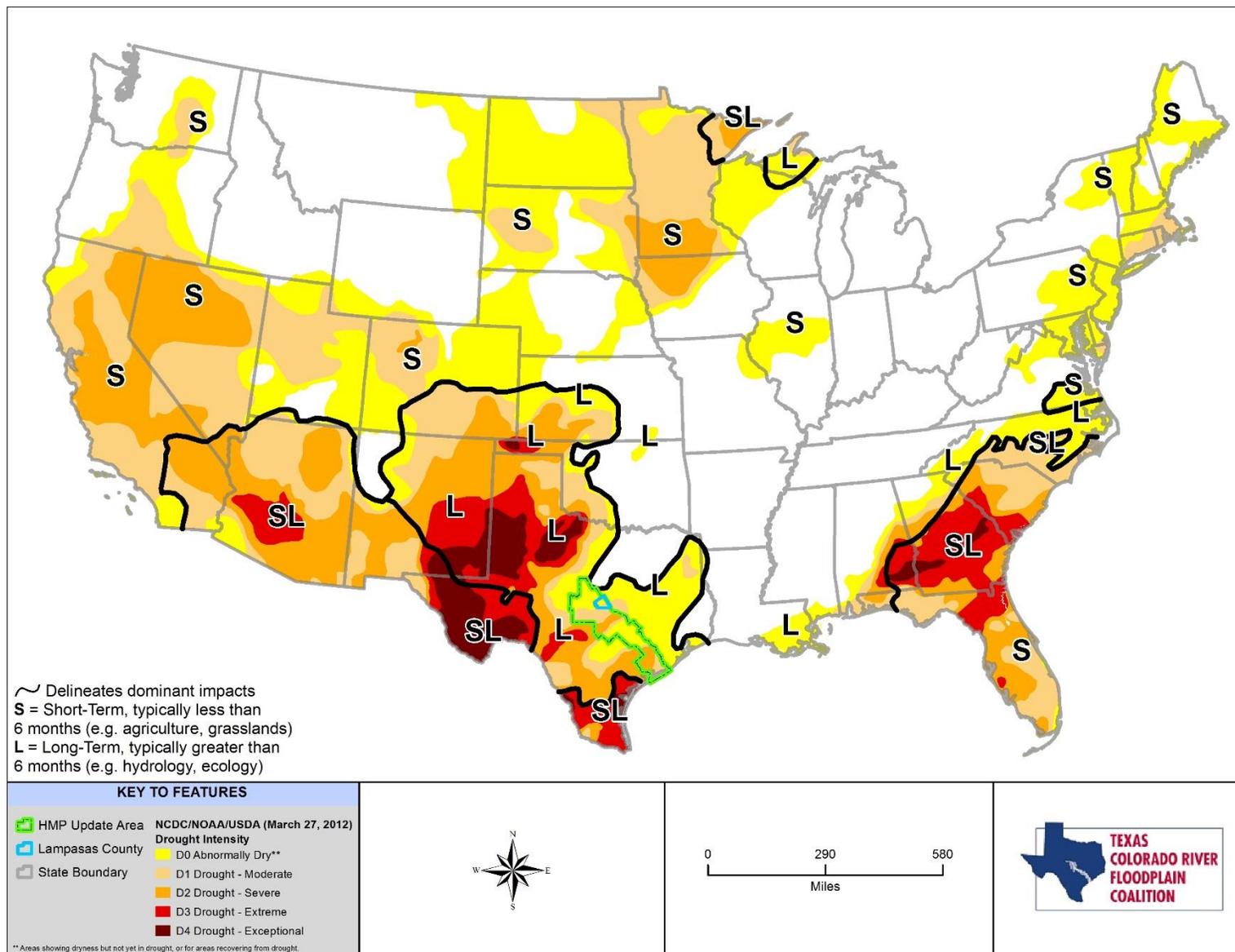


Figure 10-2. U.S. Drought Monitor, March 27, 2012

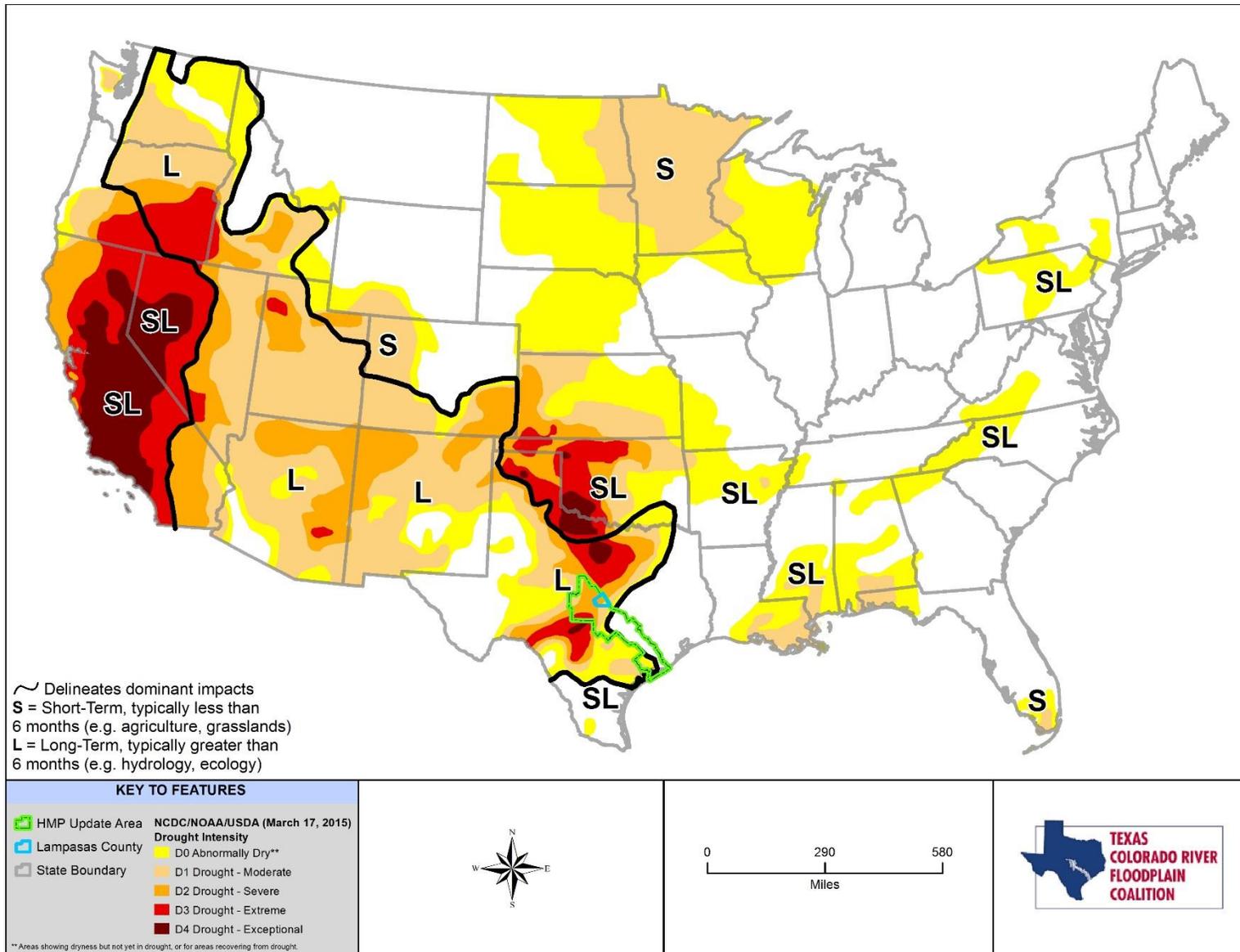


Figure 10-3. U.S. Drought Monitor, March 17, 2015

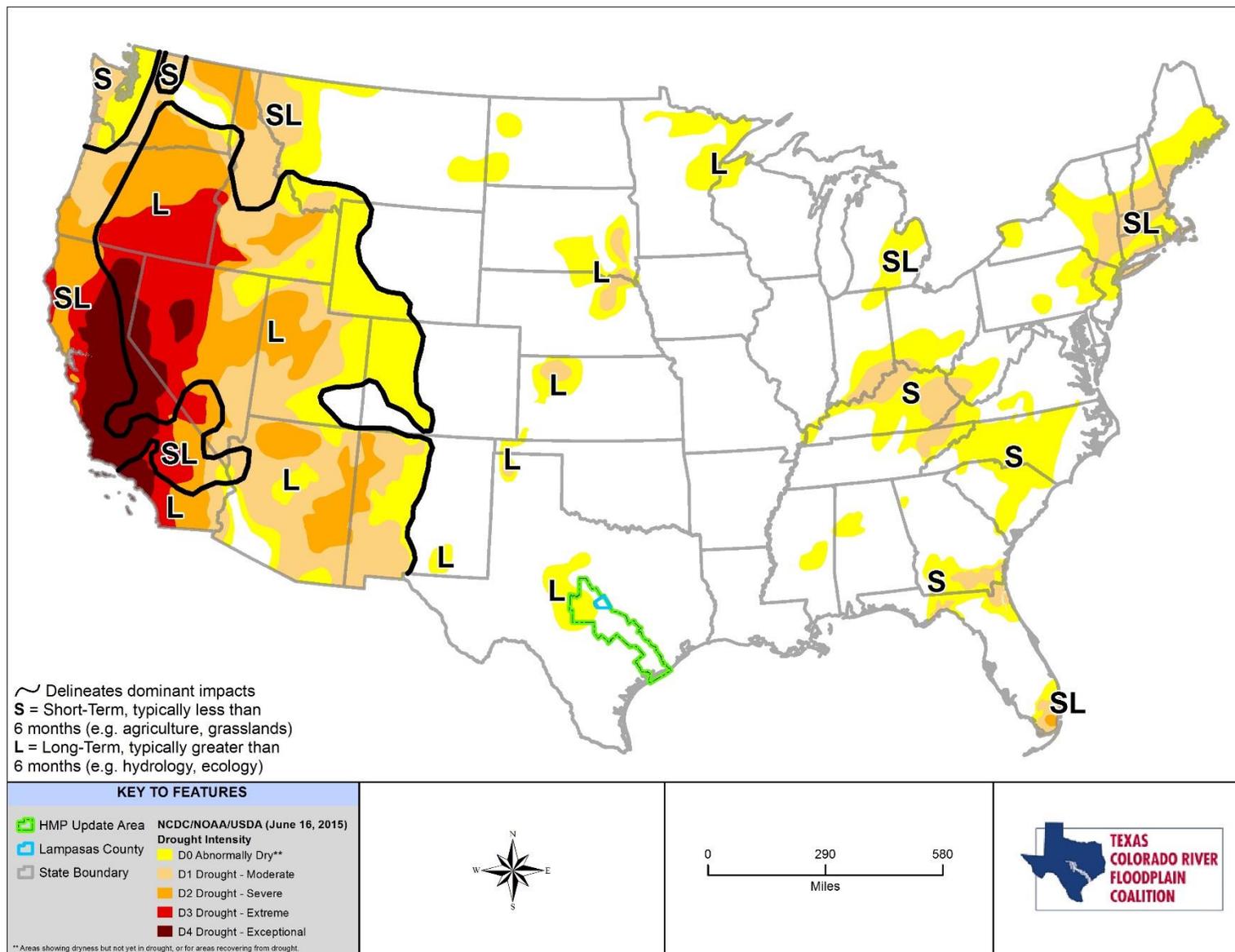


Figure 10-4. U.S. Drought Monitor, June 16, 2015

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 Lampasas County between January 2005 and April 2015. Most of the impacts were classified as “agriculture” (265). Other impacts include “society and public health” (73), “fire” (119), “tourism and recreation” (7), “water supply and quality” (74), “energy” (11), “business and industry” (28), “plants and wildlife” (77), and “relief, response, and restrictions” (141). 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 Lampasas weather station.

**TABLE 10-1.  
TEMPERATURE DATA FROM LAMPASAS WEATHER STATION**

Statistic	Years	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
High Annual Maximum	1965-2014	88	97	94	97	100	106	105	110	111	100	90	85
Low Annual Maximum	1965-2014	70	71	77	83	87	91	92	95	91	86	79	72
Average Annual Maximum	1965-2014	77.9	80.4	85.0	88.5	92.0	96.5	99.1	100.3	97.6	91.5	84.4	79.1
Average Days Annually with a Maximum Above 90	1948-2012	0.0	0.1	0.2	1.2	6.0	19.4	27.4	27.9	16.5	3.4	0.0	0.0

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

## 10.2.2 Location

### *Drought*

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.

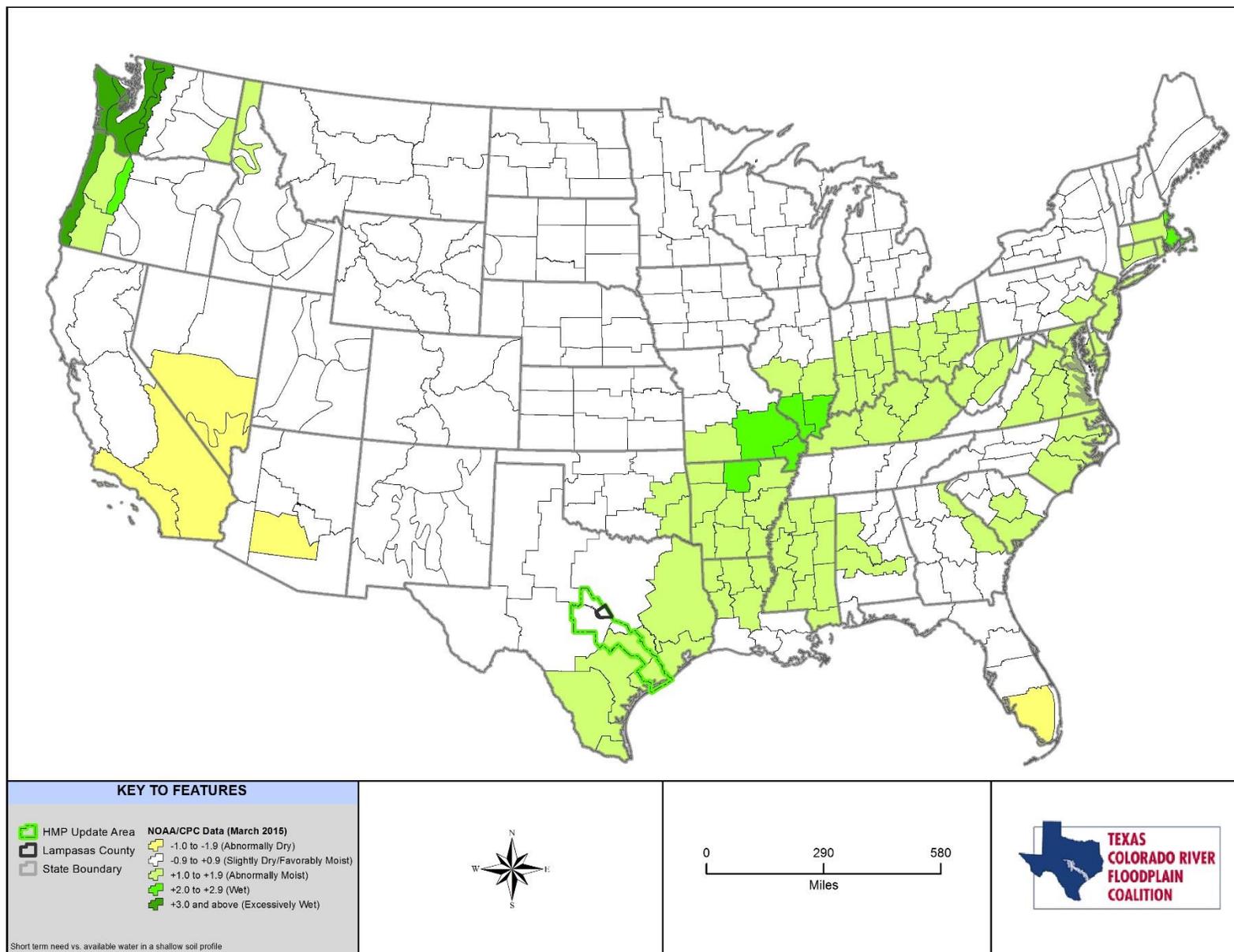
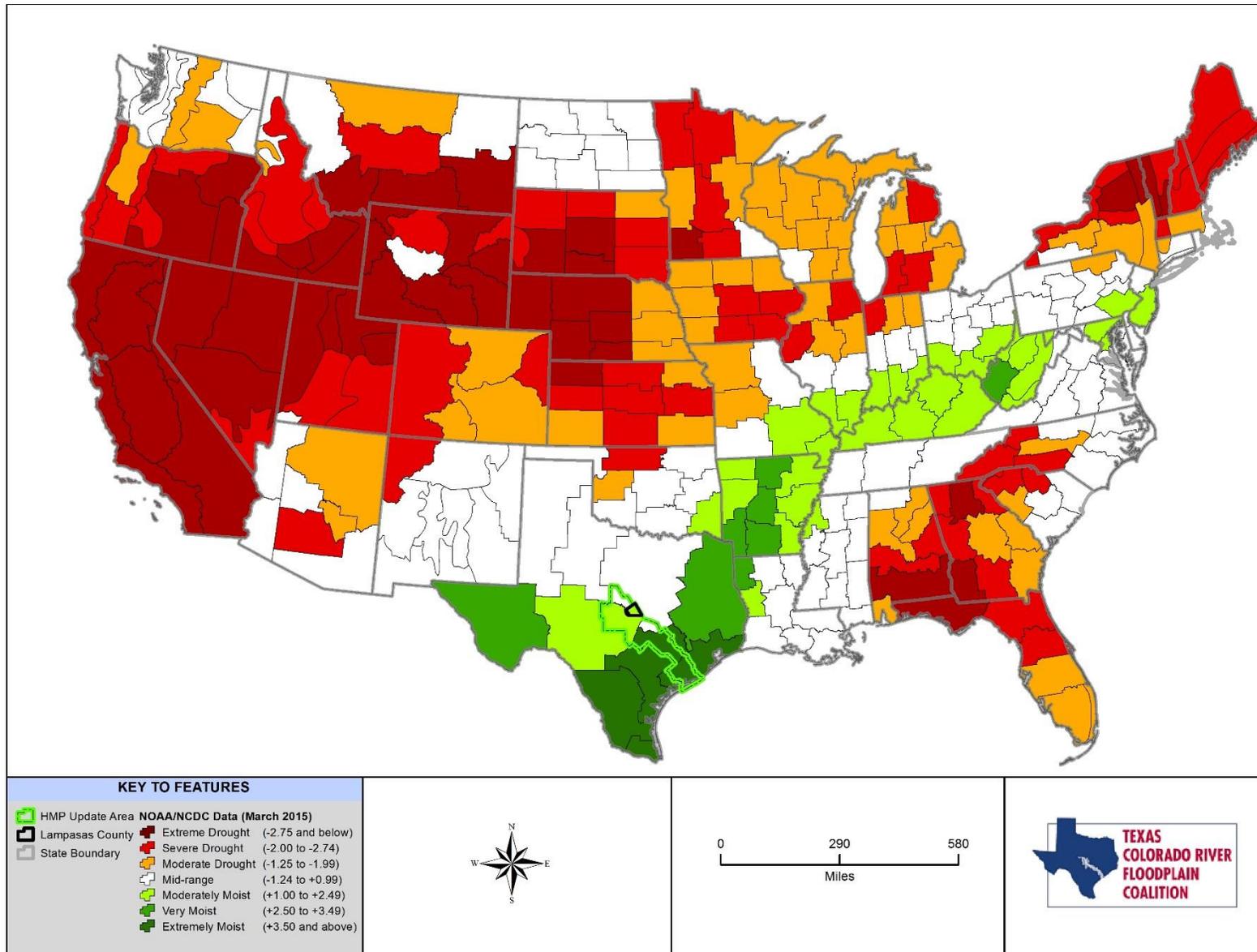


Figure 10-5. Crop Moisture Index (Week Ending March 28, 2015)



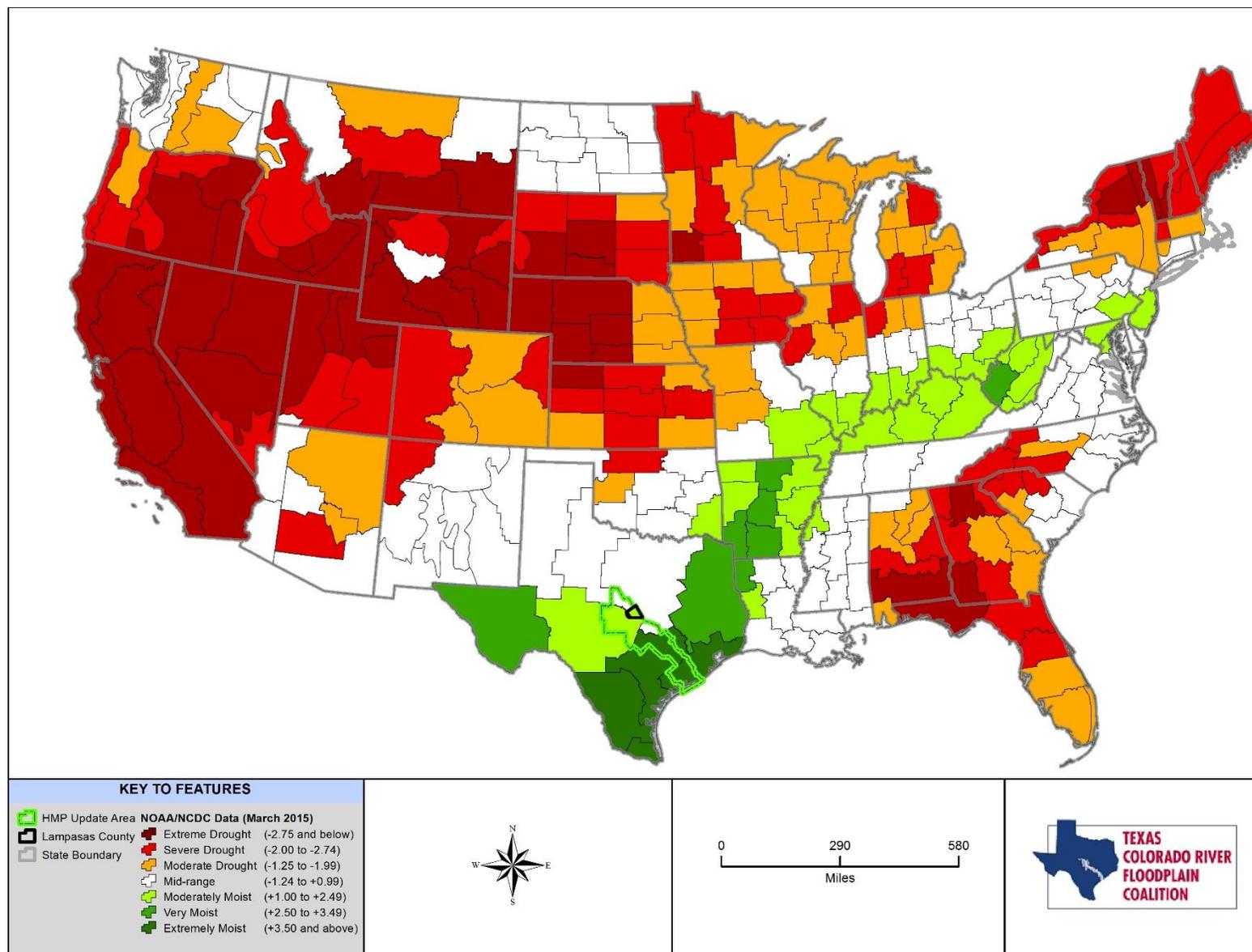


Figure 10-6. Palmer Z Index Short-Term Drought Conditions (March 2015)

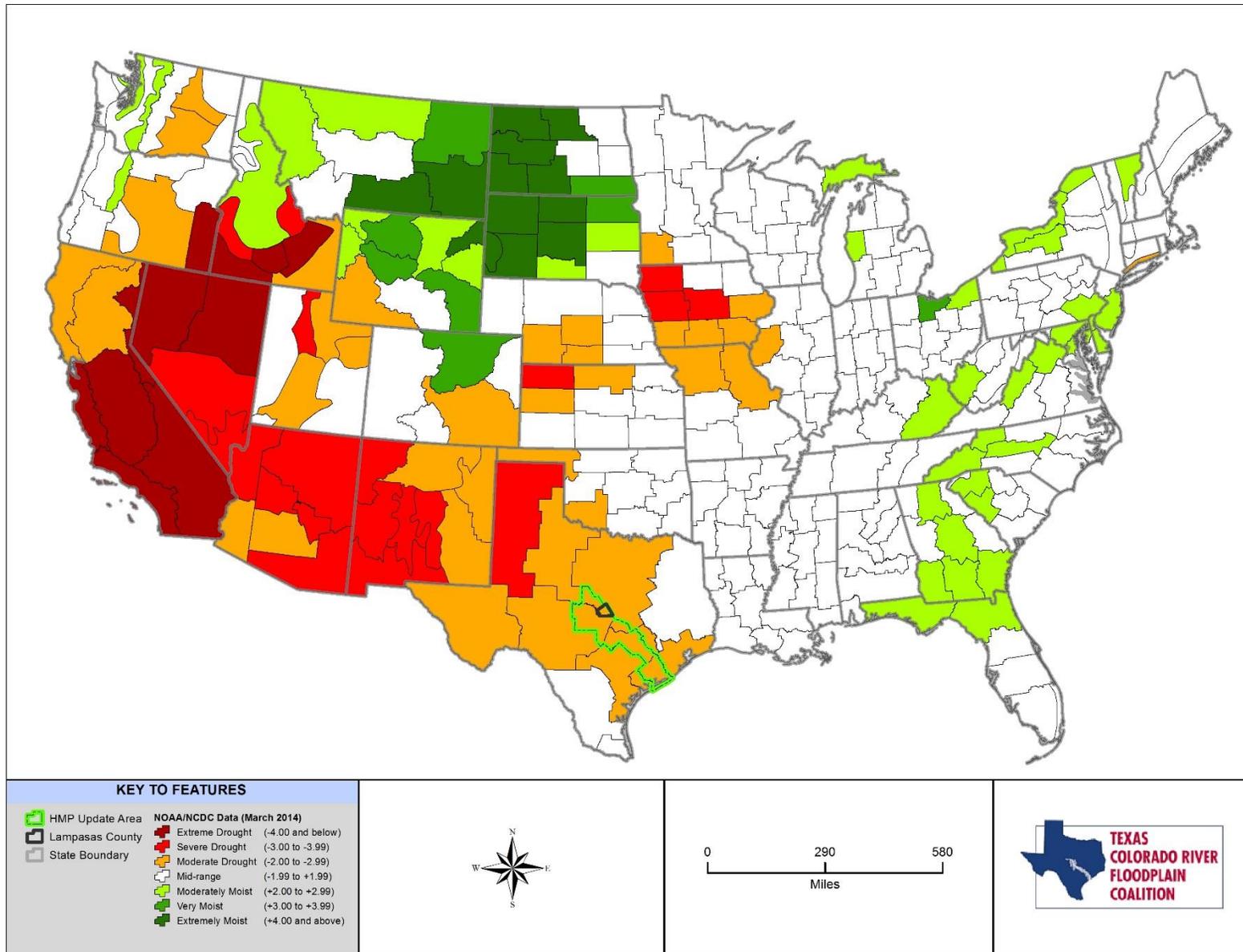


Figure 10-7. Palmer Drought Severity Index (March 2015)

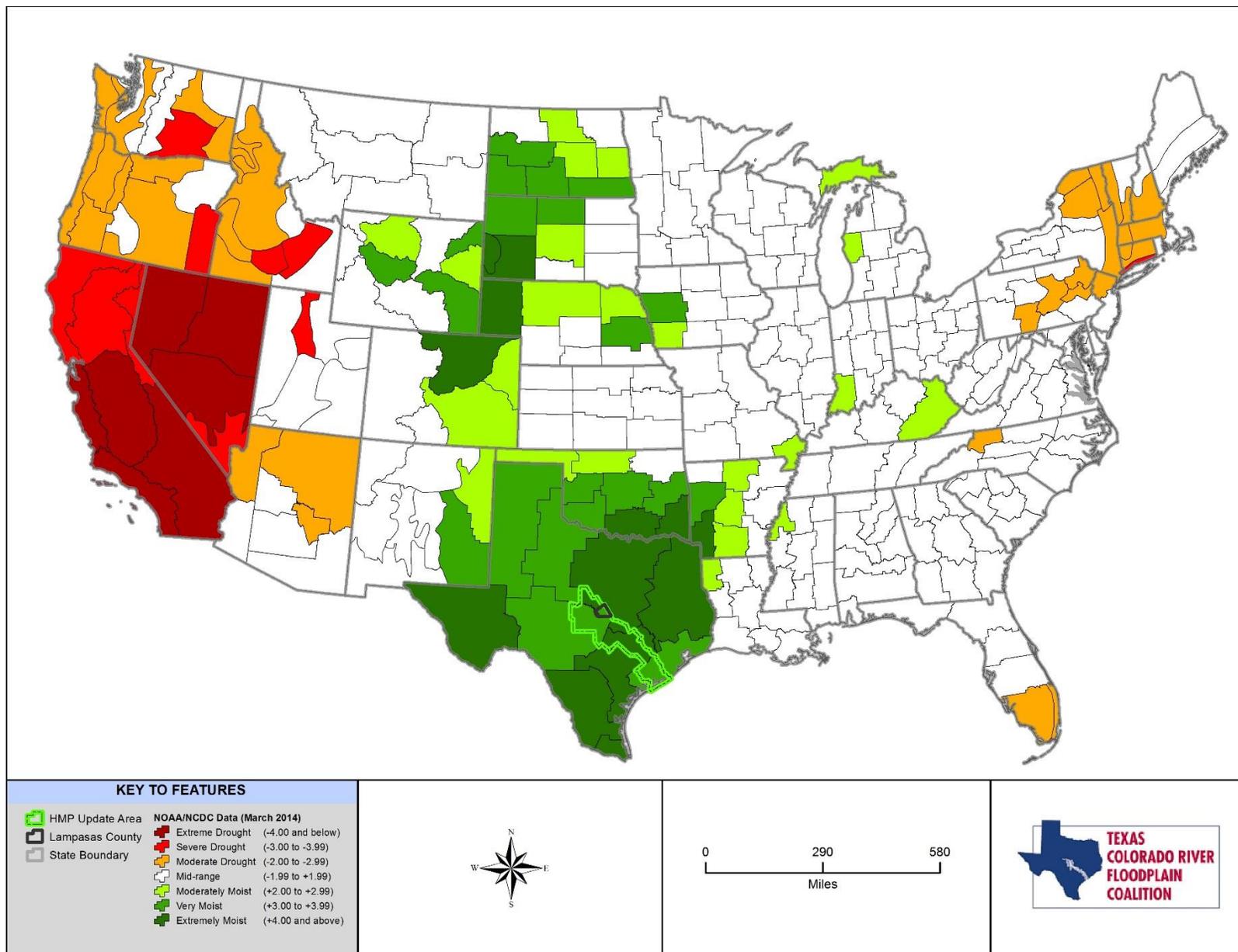


Figure 10-8. Palmer Drought Severity Index (May 2015)

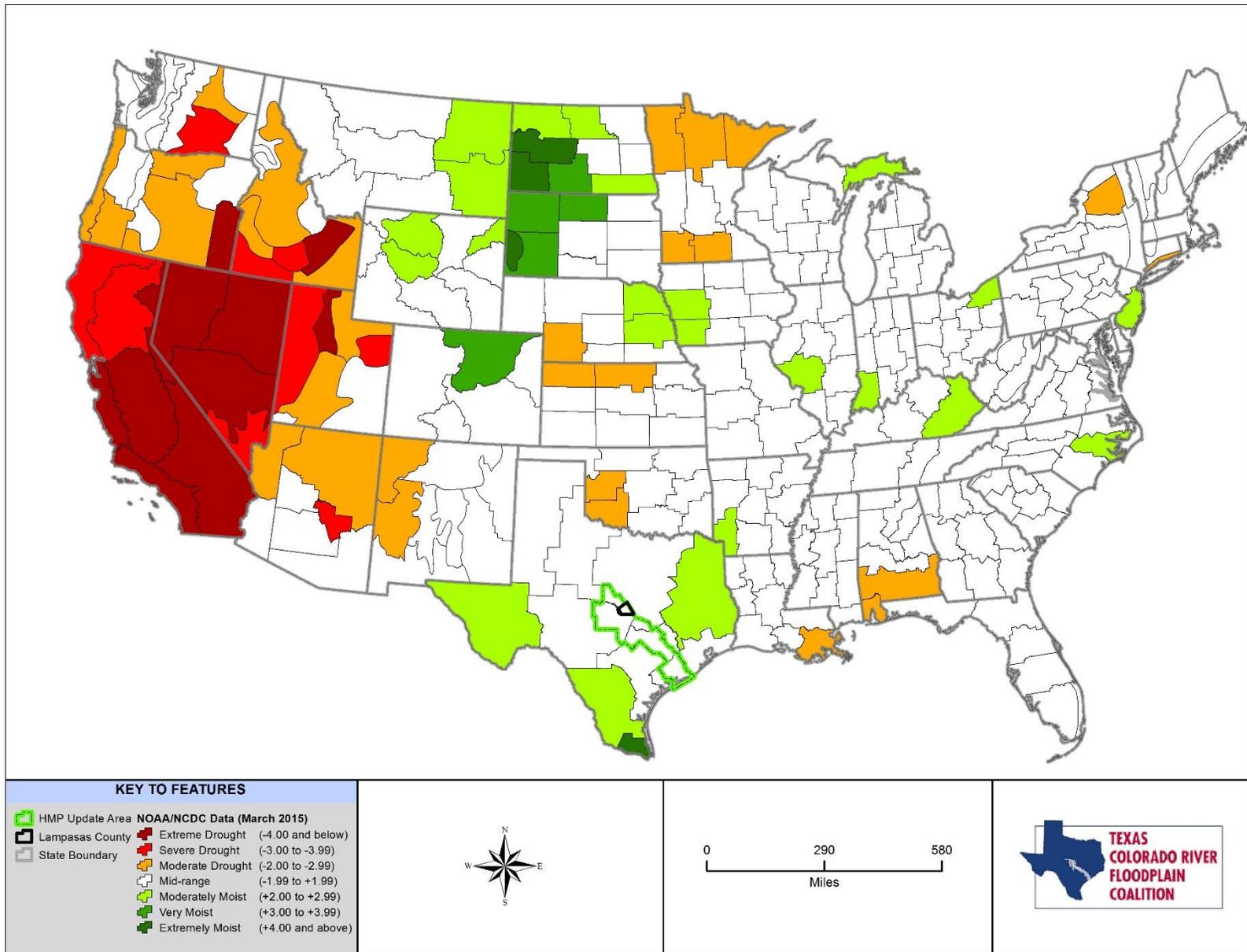


Figure 10-9. Palmer Hydrological Drought Index Long-Term Hydrologic Conditions (March 2015)

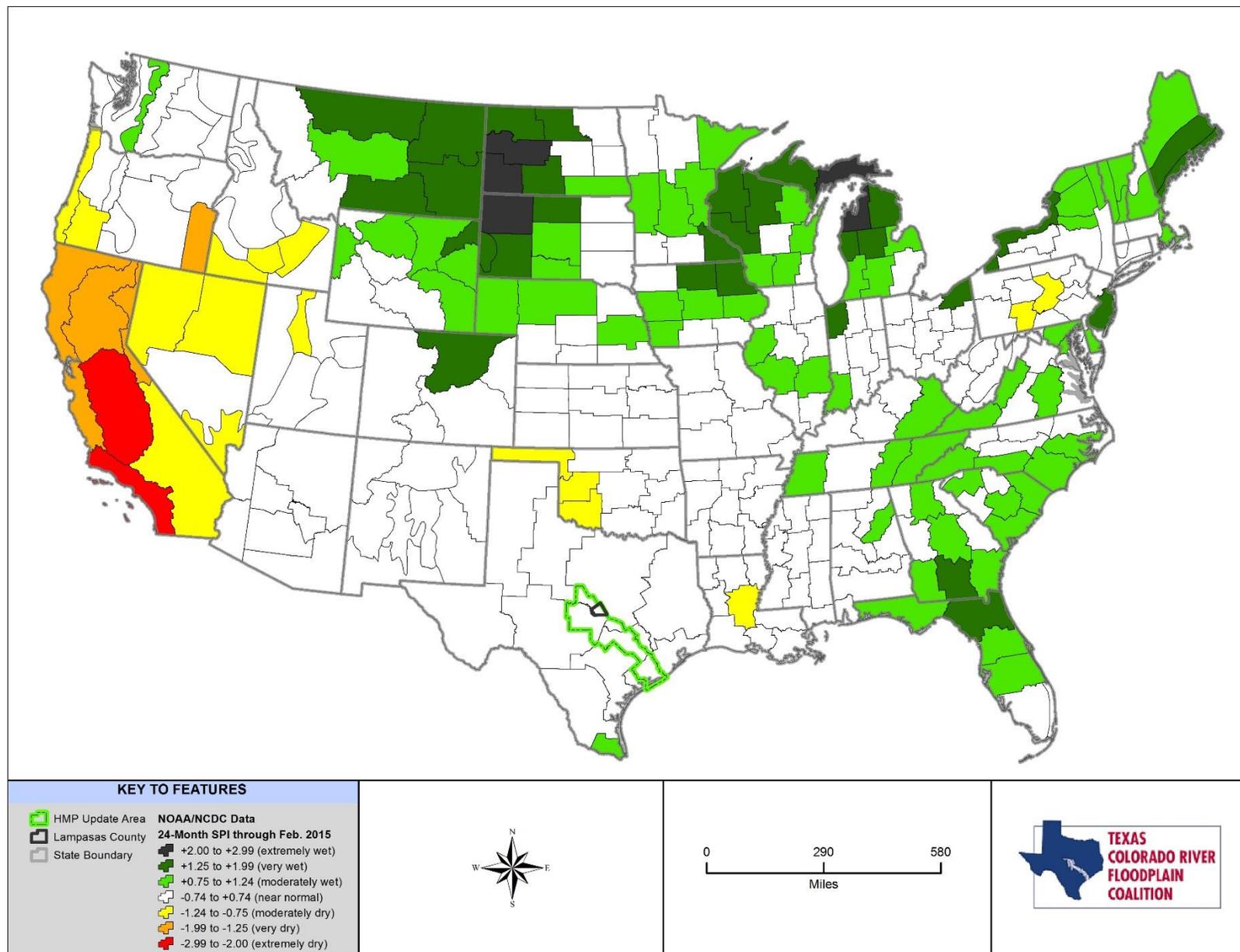


Figure 10-10. 24-Month Standardized Precipitation Index (through February 2015)

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 occur during May through October. The Lampasas County area experiences an average of 17 days with temperatures at or above 100°F, according to data from 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. The Lampasas County area experienced more than 77 days with temperatures at or above 100°F 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 Lampasas 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, Lampasas County had 13 documented drought years between 1996 and 2014. Based on this historical information, the probability of a drought occurring in any given year is 68%. Short duration droughts occur much more frequently. Various studies indicate that drought occurrence in Texas is expected to increase in frequency and will continue to be an inevitable factor in the climate of Texas. Table 10-2 lists historic drought events.

<b>Date</b>	<b>Estimated Damage Cost</b>			
	<b>Property</b>	<b>Crops</b>	<b>Injuries</b>	<b>Deaths</b>
August 1996	\$0	\$0	0	0
July 1998	\$0	\$0	0	0
August 2000	\$0	\$0	0	0
September 2000	\$0	\$0	0	0
November 2005	\$0	\$2,171,664	0	0
December 2005	\$0	\$2,186,046	0	0
January 2006	\$0	\$18,097,199	0	0
February 2006	\$0	\$5,429,160	0	0
March 2006	\$0	\$3,534,964	0	0

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

Date	Estimated Damage Cost		Injuries	Deaths
	Property	Crops		
April 2006	\$2,572,858	\$0	0	0
May 2006	\$0	\$2,572,858	0	0
July 2006	\$0	\$1,809,720	0	0
September 2006	\$0	\$1,447,776	0	0
November 2006	\$0	\$14,802	0	0
December 2006	\$4,094	\$4,094	0	0
January 2007	\$0	\$4,913	0	0
February 2007	\$0	\$6,591	0	0
July 2008	\$0	\$10,078	0	0
August 2008	\$0	\$349	0	0
February 2009	\$0	\$0	0	0
March 2009	\$0	\$0	0	0
April 2009	\$0	\$0	0	0
December 2010	\$0	\$0	0	0
January 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
March 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

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

Date	Estimated Damage Cost			
	Property	Crops	Injuries	Deaths
April 2013	\$0	\$0	0	0
May 2013	\$0	\$0	0	0
June 2013	\$0	\$0	0	0
July 2013	\$0	\$0	0	0
August 2013	\$0	\$0	0	0
September 2013	\$0	\$0	0	0
January 2014	\$0	\$0	0	0
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
July 2014	\$0	\$0	0	0

### ***Extreme Heat***

On average, there are 110 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 five recorded extreme heat events for Lampasas County in the NOAA National Climatic Data Center's Storm Events Database. These events caused fatalities in other areas near Lampasas County, but no fatalities were reported within the county.

## **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 Lampasas 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 likely 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 stream 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 90°F 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 medium with 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.

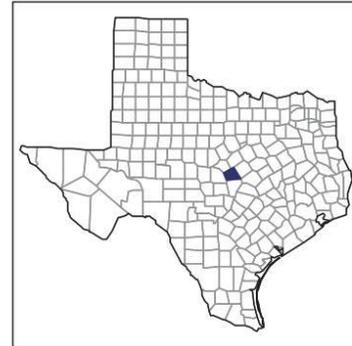
The best advice to water resource managers regarding climate change is to start addressing current stresses on water supplies and build flexibility and robustness into any system. Flexibility helps to ensure a quick response to changing conditions, and robustness helps people prepare for and survive 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 \$97 million. Although most farmlands are usually outside the city limits, drought can still economically impact local communities.

**2012 CENSUS OF AGRICULTURE**  
**COUNTY PROFILE**



**Lampasas County  
 Texas**

	2012	2007	% change
<b>Number of Farms</b>	1,017	966	+ 5
<b>Land in Farms</b>	444,755 acres	416,018 acres	+ 7
<b>Average Size of Farm</b>	437 acres	431 acres	+ 1
<b>Market Value of Products Sold</b>			
	\$16,137,000	\$13,972,000	+ 15
Crop Sales \$2,924,000 (18 percent)			
Livestock Sales \$13,214,000 (82 percent)			
<b>Average Per Farm</b>	\$15,868	\$14,464	+ 10
<b>Government Payments</b>			
	\$530,000	\$208,000	+ 155
<b>Average Per Farm Receiving Payments</b>	\$4,694	\$2,541	+ 85

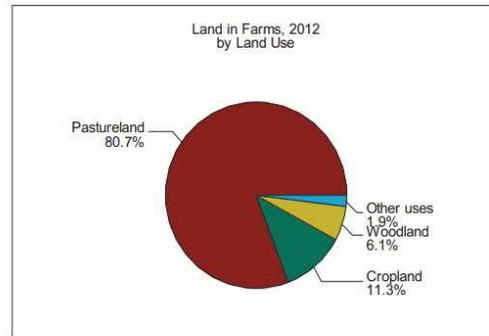
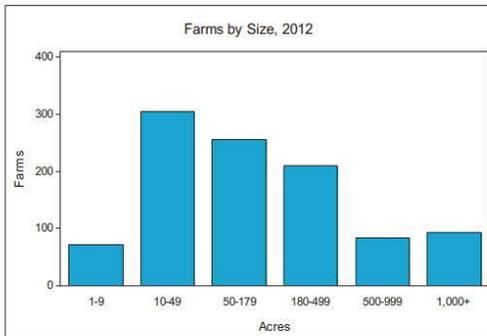


Figure 10-11. USDA Census of Agriculture Lampasas County Profile 2012

## 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).

<b>TABLE 10-3. LOSS ESTIMATES FOR DROUGHT EVENTS</b>			
Jurisdiction	Exposed Value (\$)	Annualized Loss (\$)	Annualized Loss (%)
City of Kempner	6,579,330	4,596	0.07
City of Lampasas	39,653,331	99,950	0.25
City of Lometa	4,329,590	1,376	0.03
Unincorporated Areas	46,543,363	11,307,096	24.29
<b>Planning Area Total</b>	<b>97,105,614</b>	<b>11,413,018</b>	<b>11.75</b>

### ***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 Lampasas 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	
Lampasas County	Low
City of Kempner	Low
City of Lampasas	Low
City of Lometa	Low

## 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.

### 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.

## 11.1.2 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 following 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.

Modified Mercalli Scale	Perceived Shaking	Potential Structure Damage		Estimated PGA <sup>a</sup> (% 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.

<b>TABLE 11-2. NEHRP SOIL CLASSIFICATION SYSTEM</b>		
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 Lampasas 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.

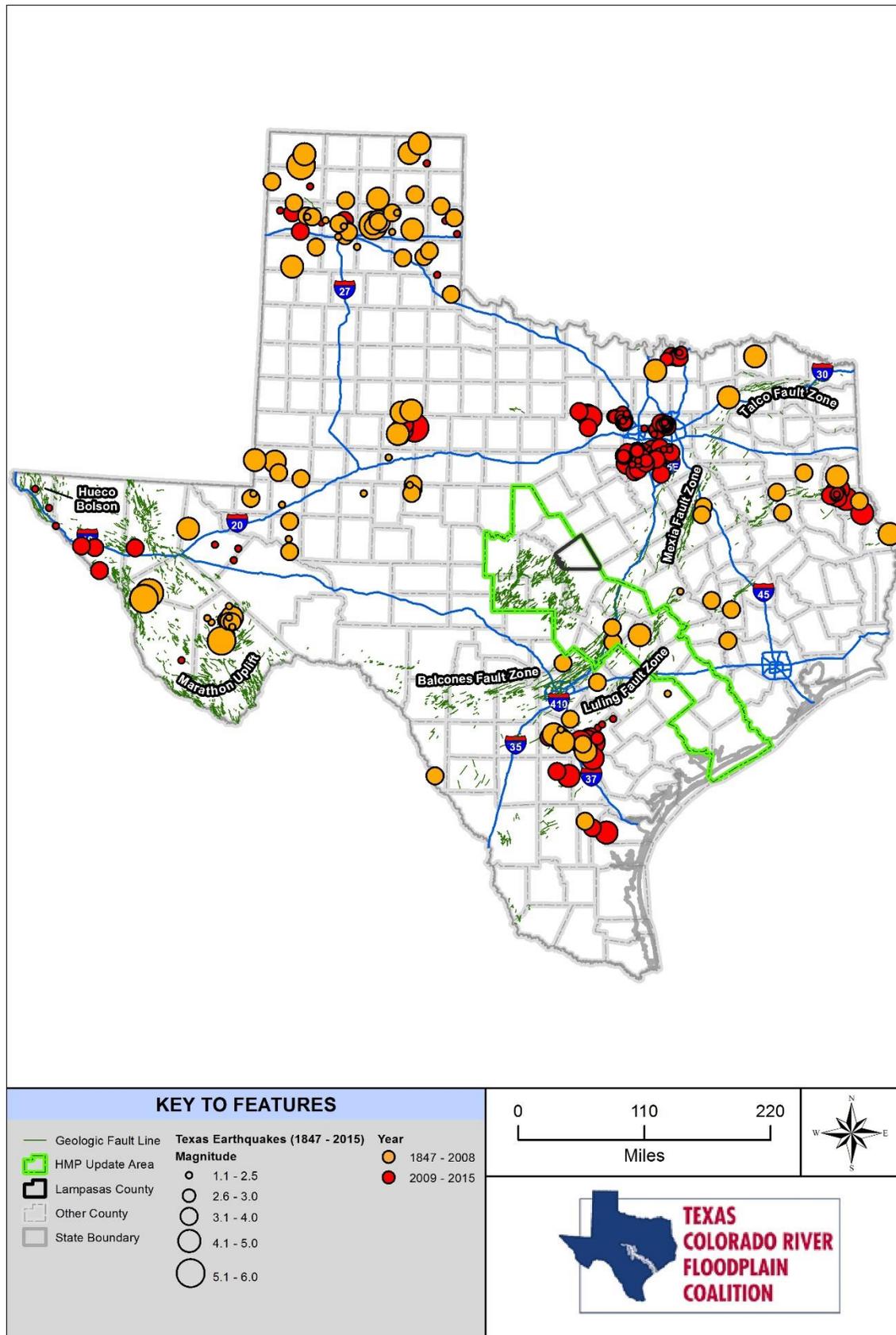


Figure 11-1. Texas Earthquakes (1847-2015)

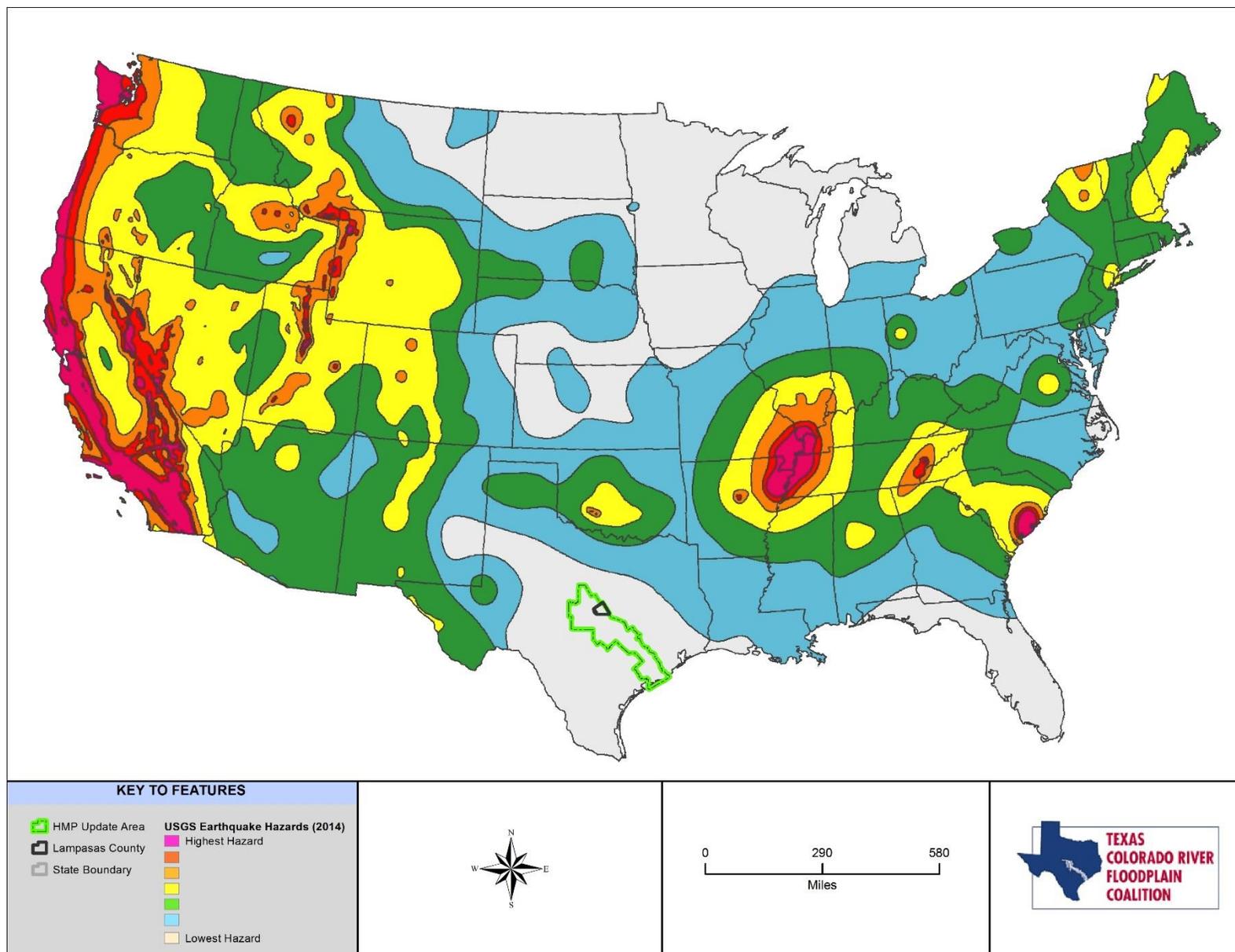


Figure 11-2. Probabilistic Earthquake Hazard Map for the U.S.

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 Lampasas County is 2% or less. Overall, the probability of a damaging earthquake somewhere in Lampasas 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 (HAZMAT) incidents.

There are no known deaths or injuries from earthquakes in Lampasas 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 Lampasas County produced a PGA of 0.0145, 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 light ground shaking and is likely to cause no damage. Vibrations feel like those of a heavy truck passing by. This means that during an event of such magnitude,

dishes, windows, and doors rattle; walls and frames of structures creak; liquids in open vessels are slightly disturbed; and standing vehicles rock noticeably.

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?

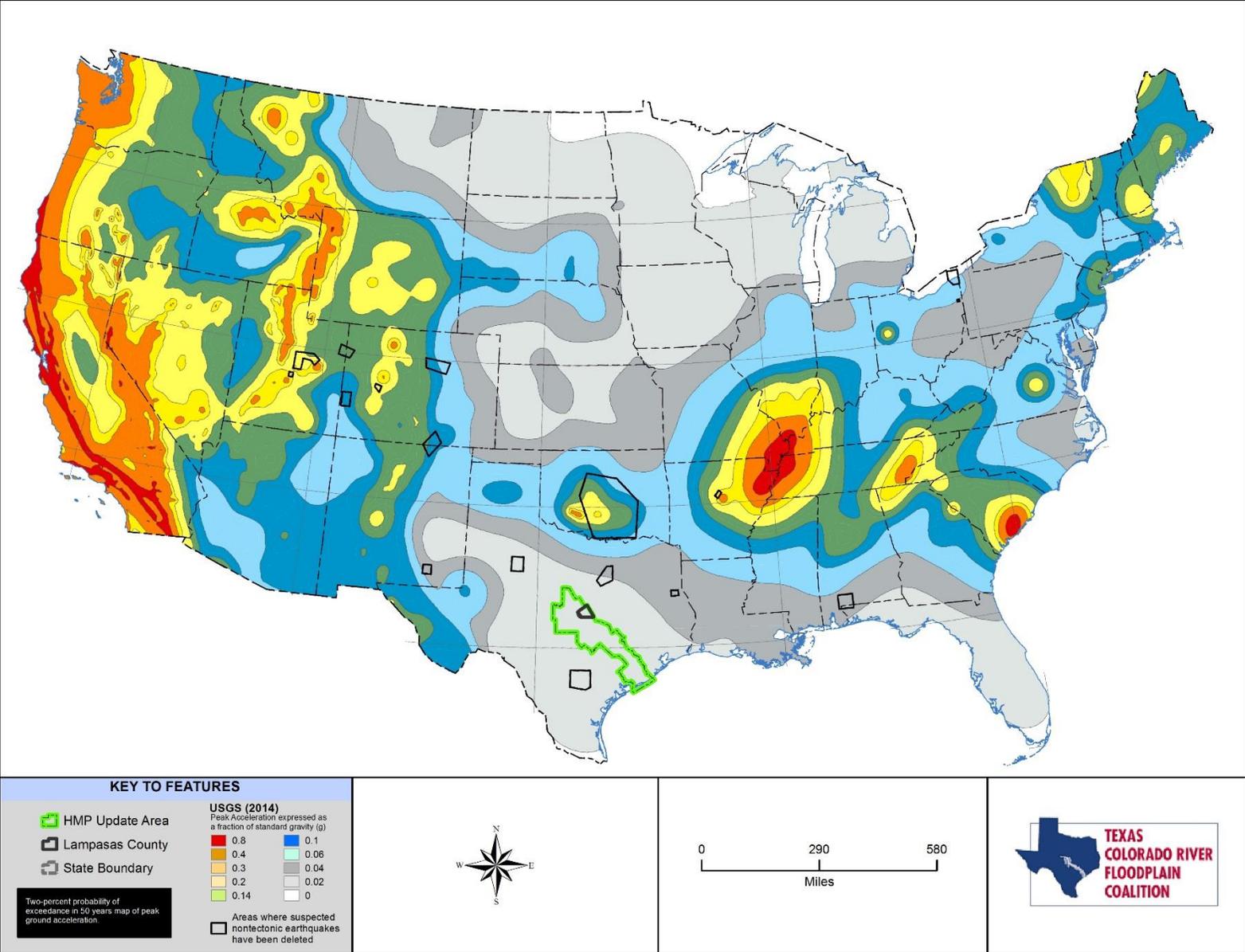


Figure 11-3. Peak Ground Acceleration (10% Probability of Exceedance in 50-Year Map of Peak Ground Acceleration)

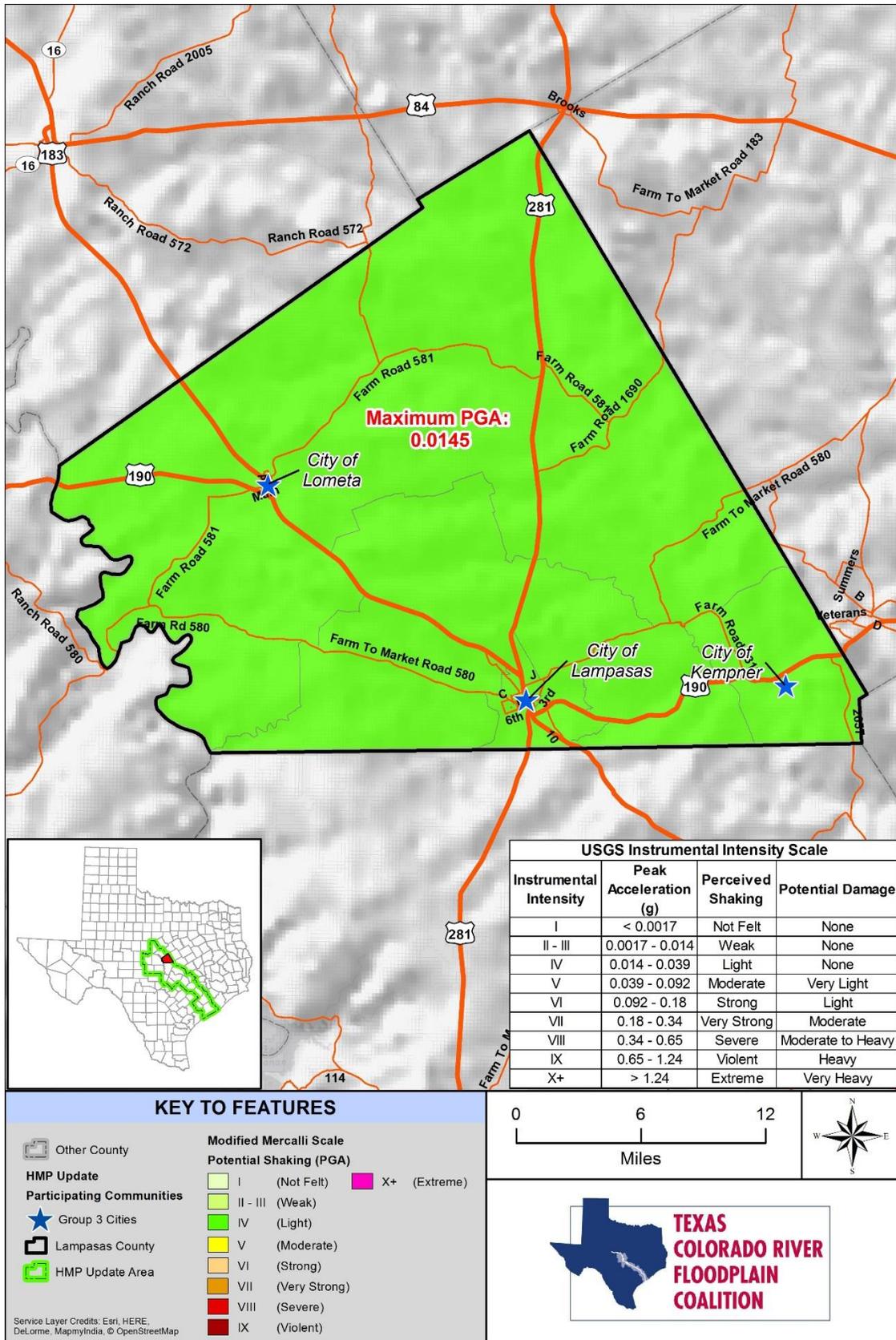


Figure 11-4. 500-Year Probability Event in Lampasas County

### 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 Lampasas 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, HAZMAT 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. Lampasas County's PGA is less than 3%g (0.03) and there have been no recorded earthquakes in or near Lampasas 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 Lampasas 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 Lampasas County HAZUS 2.2 inventory data (updated with 2010 U.S. Census data and 2014 RS Means Square Foot Costs), there are 8,457 buildings within the Lampasas County with an asset replaceable value of approximately \$1.8 billion (excluding contents). About 99% of these buildings (and 86% of the building value) are associated with residential housing. Within the participating communities, there are 7,771 buildings (residential, commercial, and other) with a total asset inventory value of over \$1.7 billion (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 HAZMAT 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. Lampasas 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	
Lampasas County	High
City of Kempner	High
City of Lampasas	High
City of Lometa	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. Lampasas 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.

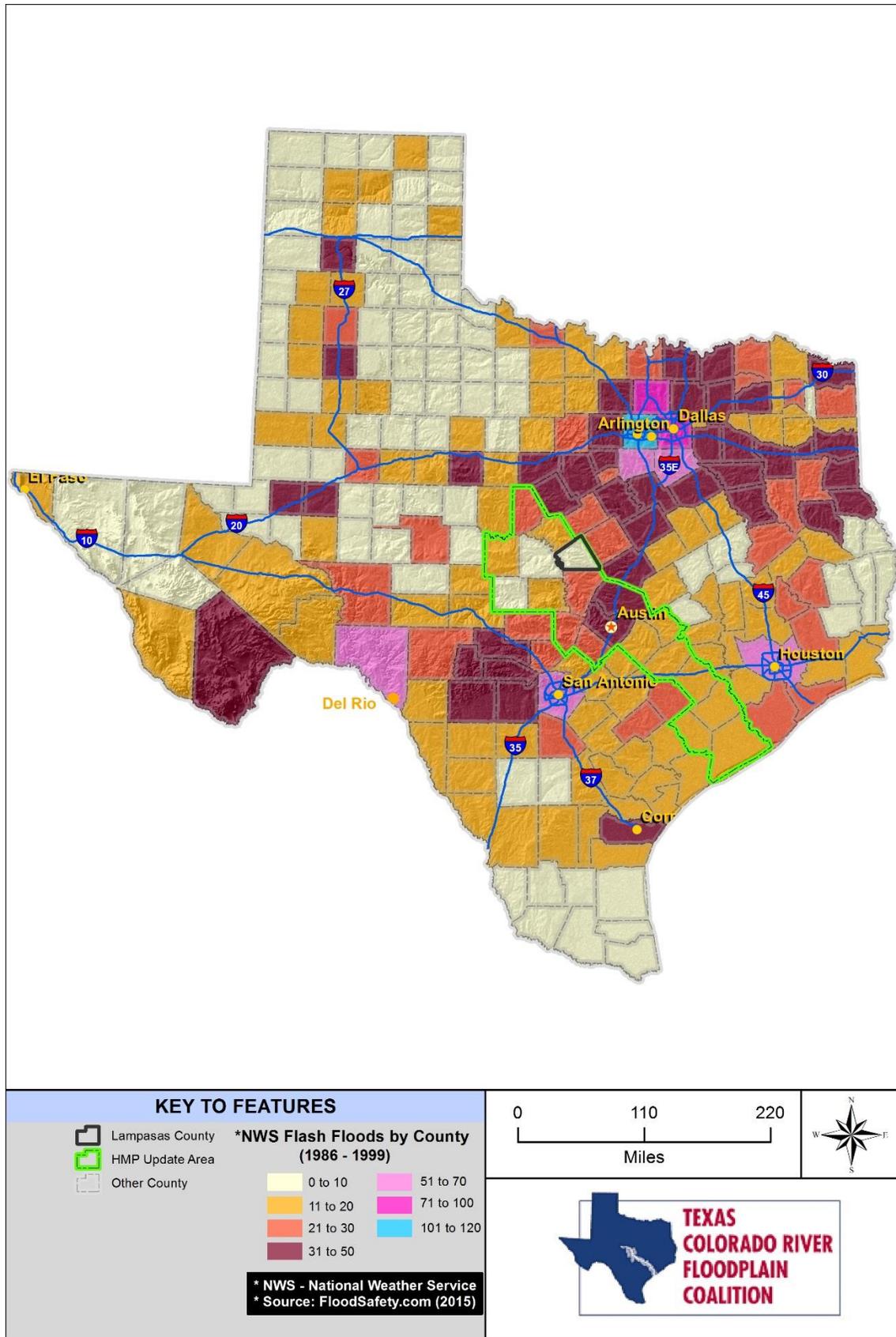


Figure 12-1. Number of Flash Floods in Texas per County (1986-1999)

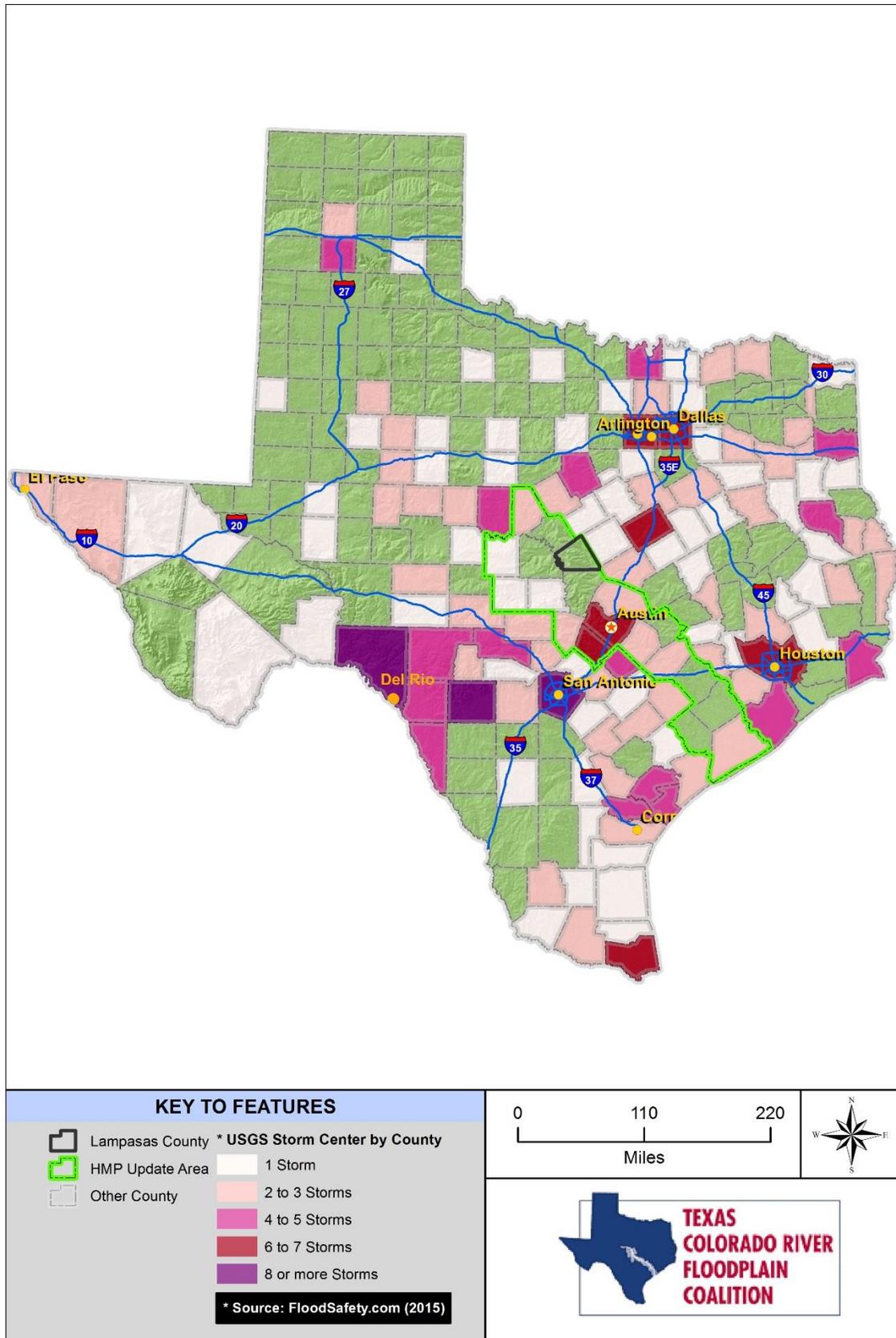


Figure 12-2. Number of Storm Centers by County

## 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 Lampasas 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 limestone or granite rocks, 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, Lampasas County has had significant seasonal floods along the Colorado and Lampasas Rivers, Sulphur Creek, Simms Creek, Lucy Creek, Burleson Creek, and others; 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 Lampasas County between 1996 and 2015, as listed in Table 12-1. These flood events have caused 15 injuries and one fatality.

Location	Date	Estimated Damage Cost			
		Property	Crops	Injuries	Deaths
Lampasas (Zone)	02/12/1997	\$0	\$0	0	0
Lampasas (Zone)	02/19/1997	\$0	\$0	0	0
Lometa	02/20/1997	\$0	\$0	0	0
Lampasas	02/20/1997	\$0	\$0	0	0
Lampasas	03/02/1997	\$0	\$0	0	0
Lampasas (Zone)	01/04/1998	\$0	\$0	0	0

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

Location	Date	Estimated Damage Cost			
		Property	Crops	Injuries	Deaths
Lampasas (Zone)	01/05/1998	\$0	\$0	0	0
Countywide	03/16/1998	\$0	\$0	0	0
Countywide	03/16/1998	\$0	\$0	0	0
Kempner	11/05/2000	\$0	\$0	0	0
Lampasas	06/09/2004	\$0	\$0	0	0
Kempner	08/20/2004	\$5,000	\$0	0	0
Lampasas	11/17/2004	\$0	\$0	0	0
Lampasas	07/29/2005	\$0	\$0	0	0
Adamsville	08/08/2005	\$0	\$0	0	0
Lampasas	03/30/2007	\$50,000	\$0	0	0
Lampasas	03/30/2007	\$0	\$0	0	0
Lampasas	05/22/2007	\$300,000	\$0	0	0
Lampasas	05/24/2007	\$5,000	\$0	0	0
Lometa	05/31/2007	\$0	\$0	0	0
Kempner	06/17/2007	\$0	\$0	0	0
Kempner	06/26/2007	\$0	\$0	0	0
Adamsville	06/28/2007	\$0	\$0	0	0
Lampasas	06/28/2007	\$0	\$0	0	0
Lometa	07/03/2007	\$0	\$0	0	0
Lampasas Airport	04/27/2009	\$50,000	\$0	0	0
Lampasas Airport	04/27/2009	\$0	\$0	0	0
Lampasas	06/11/2009	\$2,000	\$0	0	0
Lampasas Airport	10/22/2009	\$1,000	\$0	0	0
Lampasas	01/28/2010	\$0	\$0	0	0
Moline	01/28/2010	\$0	\$0	0	0
Izoro	05/22/2011	\$0	\$0	0	0

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

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

- August 20, 2004 – Flash flooding caused numerous county roads to be closed around Kempner, with one road completely washed out. Rainfall ranged from 3 inches in the City of Lampasas to 7.4 inches in Adamsville. Total property damage amounted to \$5,000.
- March 30, 2007 – Severe thunderstorms caused widespread flooding and wind damage throughout the county. Numerous roads, including State Highway 190, were closed due to high water. A swift water rescue rescued a woman and two young children trapped in a flooded home. No injuries or fatalities resulted from this event. The property damage total was \$50,000.
- May 22, 2007 – A series of training thunderstorms (repeating thunderstorm cells) caused flash flooding throughout the county. Flooding was reported along Highways 183 and 190 near the city. Flood waters reached four feet on Highway 183. Evacuations were required near Mesquite Creek.

Numerous low water crossings were barricaded. About 20 apartments and several homes were damaged by high water and deemed uninhabitable. Many of the residents lost most of their possessions. In addition, the School Creek Bridge was washed away, with the road closed indefinitely. The county sustained \$300,000 in property damages, but no injuries or fatalities resulted from this event.

- May 24, 2007 – A cold front stalled in the area, providing focus for afternoon thunderstorms. There were several reports of hail and flash flooding. The fire department reported cars stranded downtown due to high water. No injuries or fatalities were associated with the event, and property damages amounted to \$5,000.
- April 27, 2009 – A slow moving squall line produced copious amounts of rainfall and severe weather in the area. Numerous roads across the northern half of the county were closed due to water over the road. The water was several inches to a foot deep in some areas. The resulting property damages totaled \$50,000. No injuries or fatalities were recorded.
- June 11, 2009 – Severe thunderstorms merged into a large high pressure supercell that moved southeast from Comanche County through Lampasas County. Winds up to 70 miles per hour (mph) and hail up to baseball size were common with this supercell. A home in Lampasas County sustained significant damage. Roads throughout the City of Lampasas were barricaded due to high waters. Property damage amounted to \$2,000, but no injuries or fatalities resulted from this event.
- October 22, 2009 – Widespread rain fell on very saturated grounds throughout the area, causing several streets to be closed in the City of Lampasas. No injuries or fatalities resulted from this event, and property damage totaled \$1,000.
- 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. Lampasas County received an average of 2 to 3 inches of rainfall throughout the county, according to NWS. On May 27, the Colorado River reached a peak flow of approximately 15,000 cubic feet per second and reached an elevation of about 15 feet (Figure 9-5). There were no injuries or fatalities reported for Lampasas County.

### **12.2.2 Location**

The majority of Lampasas County lies within the Lampasas Watershed. A sizeable portion of the western section of the county is covered by the Buchanan-Lyndon B Watershed. The Colorado River runs north to south in this area along the western boundary of the county. The Cowhouse Watershed crosses a small slender section of the eastern side of the county. Some local waterbodies include the Lampasas River, Sulphur Creek, Lucy Creek, Burleson Creek, and Simms Creek. 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 Lampasas County. The Lampasas County Water Control and Improvement District operates several dams within the county. Some with the highest storage volumes include Sulphur Creek WS SCS Site 1, 2, and 6 Dams. These dams are used to manage floodwaters with the overall goal of reducing downstream flooding.

In addition to the riverine flooding, Lampasas 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 Lampasas County because of its inland geography.

The floodplain boundary extents for most of the creeks, streams, rivers, and lakes in Lampasas County have been mapped by FEMA. Most of the published FIRMs within the county became effective on January 2, 1991, with one south of the Lampasas Airport with an effective date of June 15, 1982. The Lampasas County FIRMs have not yet been remapped as part of the FEMA Map Modernization Program providing countywide digital flood insurance rate maps, or DFIRMs. While the FEMA digital flood data is recognized as best available data for planning purposes, it does not always reflect the most accurate and up-to-date flood risk. Riverine flooding, stormwater flooding, and flood-related losses often do occur outside of delineated SFHAs.

The participating communities have 36,622 acres in the 100-year floodplain, and 37,542 acres in the 500-year floodplain. Table 12-2 shows the distribution of the acreage across just the participating jurisdictions in the planning area.

<b>TABLE 12-2.</b>		
<b>ACREAGE IN THE 100-YEAR AND 500-YEAR FLOODPLAIN BY JURISDICTION</b>		
Jurisdiction	Area (acres)	
	100-Year	500-Year
City of Kempner	52	53
City of Lampasas	702	816
City of Lometa	18	19
Unincorporated Area	35,850	36,654
<b>Planning Area Total</b>	<b>36,622</b>	<b>37,542</b>

Figure 12-3 shows the SFHAs in Lampasas County. Figure 12-4 through Figure 12-6 show the SFHAs for each planning partner.

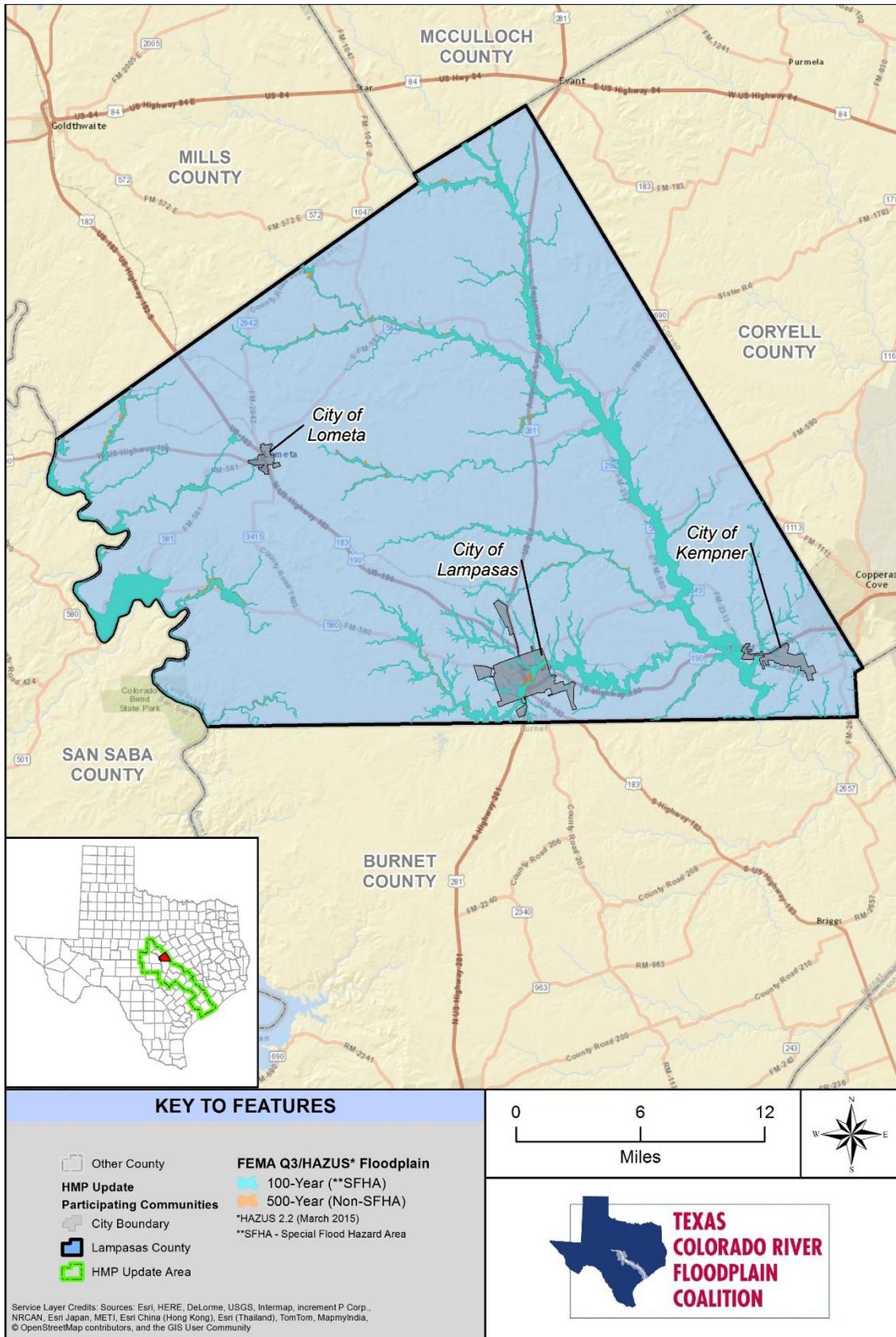


Figure 12-3. Special Flood Hazard Areas in Lampasas County

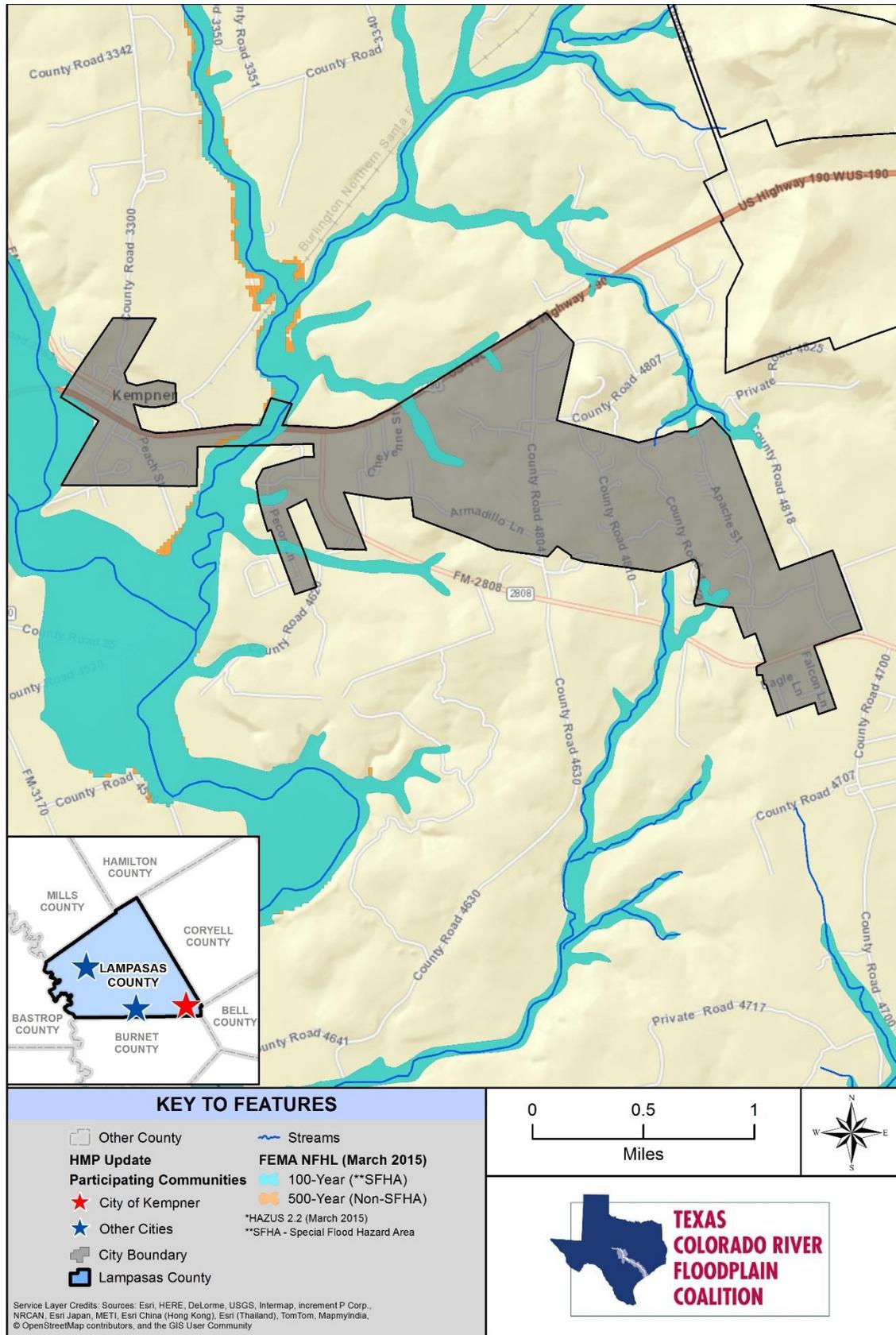


Figure 12-4. Special Flood Hazard Areas in the City of Kempner

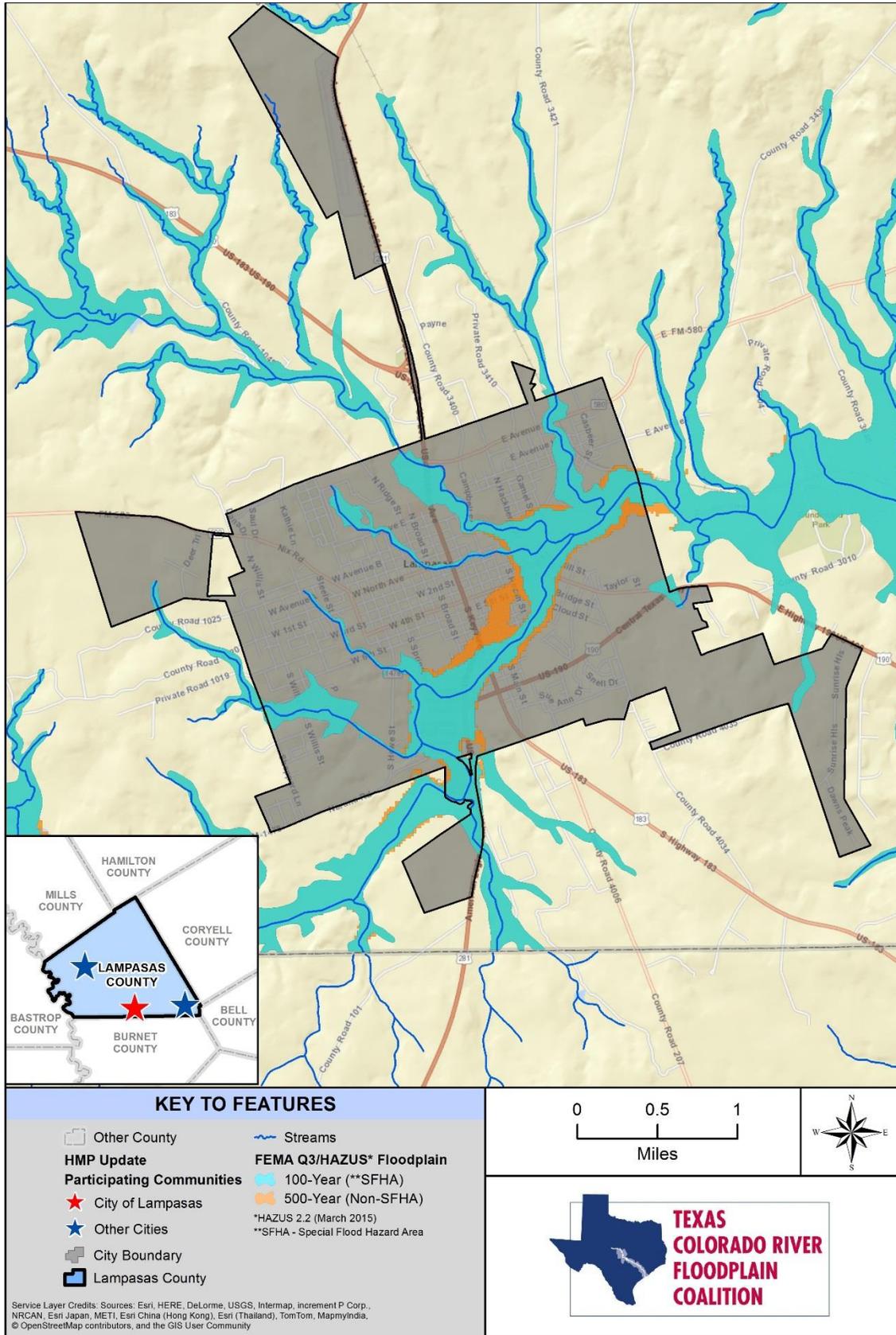


Figure 12-5. Special Flood Hazard Areas in the City of Lampasas

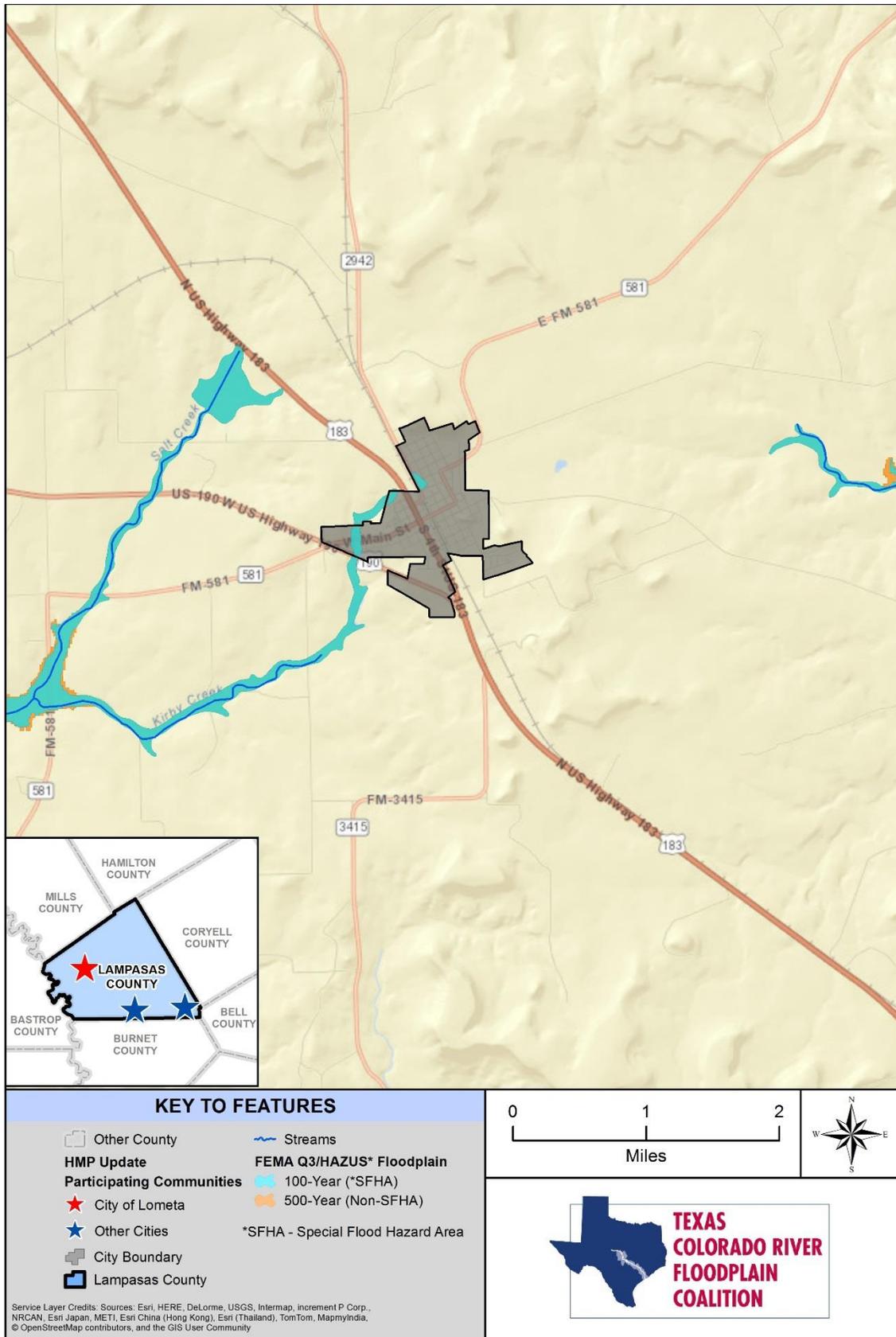


Figure 12-6. Special Flood Hazard Areas in the City of Lometa

### **12.2.3 Frequency**

Seasonal flooding on the Colorado River, Lampasas River, Sulphur Creek, and 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 Lampasas County, the magnitude/severity of flooding is medium. Countywide, approximately 54% of structures will be moderately (11 to 25%) damaged; 4 structures will be completely destroyed (51 to 100%); and over 1,960 tons of debris will be generated requiring more than 78 truckloads (at 25 tons/truck) to remove the debris generated by the flood. The 100-Year HAZUS-MH Probabilistic Event scenario estimates approximately 146 households will be displaced and will seek temporary lodging in public shelters. Overall significance is considered severe.

### **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. HAZMAT 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 1,491 (7.6% of the total county population). In the 500-year floodplain it is estimated that 1,772 people countywide live within the mapped non-SFHA areas (9% 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 Kempner	City of Lampasas	City of Lometa	Unincorporated Area	Lampasas County Total	
Barren Land (Rock/Sand/Clay)	0	0	0	36	<b>36</b>	0.10
Cultivated Crops	0	0	0	1,978	<b>1,978</b>	5.52
Deciduous Forest	11	72	1	4,272	<b>4,356</b>	12.15
Developed High Intensity	0	34	0	1	<b>35</b>	0.10
Developed, Low Intensity	5	65	0	57	<b>127</b>	0.36
Developed, Medium Intensity	2	44	1	25	<b>72</b>	0.20
Developed, Open Space	9	229	10	1,062	<b>1,310</b>	3.65

<b>TABLE 12-3. PRESENT LAND USE IN THE 100-YEAR FLOODPLAIN</b>						
Present Use Classification	Area (acres)					% of Total
	City of Kempner	City of Lampasas	City of Lometa	Unincorporated Area	Lampasas County Total	
Evergreen Forest	0	0	0	0	<b>0</b>	0.00
Emergent Wetlands	13	60	1	4,737	<b>4,811</b>	13.42
Grassland/Herbaceous	5	115	3	13,474	<b>13,597</b>	37.93
Mixed Forest	0	0	0	0	<b>0</b>	0.00
Open Water	0	17	0	870	<b>887</b>	2.47
Pasture/Hay	0	0	0	859	<b>859</b>	2.40
Shrub/Scrub	5	30	2	6,606	<b>6,643</b>	18.53
Woody Wetlands	1	36	0	1,100	<b>1,137</b>	3.17
<b>Planning Area Total</b>	<b>51</b>	<b>702</b>	<b>18</b>	<b>35,077</b>	<b>35,848</b>	<b>100</b>

<b>TABLE 12-4. PRESENT LAND USE IN THE 500-YEAR FLOODPLAIN</b>						
Present Use Classification	Area (acres)					% of Total
	City of Kempner	City of Lampasas	City of Lometa	Unincorporated Area	Lampasas County Total	
Barren Land (Rock/Sand/Clay)	0	0	0	36	<b>36</b>	0.10
Cultivated Crops	0	0	0	2,037	<b>2,037</b>	5.42
Deciduous Forest	12	74	1	4,404	<b>4,491</b>	11.96
Developed High Intensity	0	54	0	1	<b>55</b>	0.15
Developed, Low Intensity	5	90	0	59	<b>154</b>	0.41
Developed, Medium Intensity	2	66	1	25	<b>94</b>	0.25
Developed, Open Space	9	251	10	1,092	<b>1,362</b>	3.63
Evergreen Forest	0	0	0	0	<b>0</b>	0.00
Emergent Wetlands	13	60	1	5,008	<b>5,082</b>	13.54
Grassland/Herbaceous	6	136	3	14,092	<b>14,237</b>	37.92
Mixed Forest	0	0	0	0	<b>0</b>	0.00

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

Present Use Classification	Area (acres)					% of Total
	City of Kempner	City of Lampasas	City of Lometa	Unincorporated Area	Lampasas County Total	
Open Water	0	17	0	881	<b>898</b>	2.39
Pasture/Hay	0	0	0	889	<b>889</b>	2.37
Shrub/Scrub	5	33	2	7,015	<b>7,055</b>	18.79
Woody Wetlands	1	36	0	1,116	<b>1,153</b>	3.07
<b>Planning Area Total</b>	<b>53</b>	<b>817</b>	<b>18</b>	<b>36,655</b>	<b>37,543</b>	<b>100</b>

### ***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 680 structures within the 100-year floodplain and 772 structures within the 500-year floodplain. In the 100-year floodplain, 64% 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 Kempner	14	1	0	<b>15</b>	35
City of Lampasas	212	9	4	<b>225</b>	480
City of Lometa	5	0	0	<b>5</b>	15
Unincorporated Area	433	1	1	<b>435</b>	961
<b>Planning Area Total</b>	<b>664</b>	<b>11</b>	<b>5</b>	<b>680</b>	<b>1,491</b>

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

<b>TABLE 12-6. STRUCTURES AND POPULATION IN THE 500-YEAR FLOODPLAIN</b>					
	Structures and Population Affected				<b>Total Population Affected</b>
	Residential	Commercial	Other*	<b>Total Structures Affected</b>	
City of Kempner	14	1	0	<b>15</b>	36
City of Lampasas	284	14	8	<b>306</b>	738
City of Lometa	5	0	0	<b>5</b>	15
Unincorporated Area	444	1	1	<b>446</b>	983
<b>Planning Area Total</b>	<b>747</b>	<b>16</b>	<b>9</b>	<b>772</b>	<b>1,772</b>

\*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 \$245 million worth of building and contents exposure to the 100-year flood. This represents 9% of the total assessed value of the planning area. Approximately \$306 million worth of building-and-contents exposure was estimated to be exposed to the 500-year flood. This represents 11% of the total assessed value of the planning area.

<b>TABLE 12-7. VALUE OF STRUCTURES IN 100-YEAR FLOODPLAIN</b>					
	Value Exposed (\$)			Total Assessed Value (\$)	% of Total Assessed Value
	Structure	Contents	<b>Total</b>		
City of Kempner	4,748,616	3,485,480	<b>8,234,096</b>	158,651,717	5.19
City of Lampasas	66,966,234	46,511,275	<b>113,477,509</b>	1,183,059,355	9.59
City of Lometa	641,714	321,932	<b>963,646</b>	89,375,627	1.08
Unincorporated Area	79,839,075	42,273,737	<b>122,112,812</b>	1,372,828,808	8.89
<b>Planning Area Total</b>	<b>152,195,639</b>	<b>92,592,424</b>	<b>244,788,063</b>	<b>2,803,915,507</b>	<b>8.73</b>

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

	Value Exposed (\$)			Total Assessed Value (\$)	% of Total Assessed Value
	Structure	Contents	Total		
City of Kempner	4,788,904	3,507,726	<b>8,296,630</b>	158,651,717	5.23
City of Lampasas	98,983,832	72,972,180	<b>171,956,012</b>	1,183,059,355	14.53
City of Lometa	641,714	321,932	<b>963,646</b>	89,375,627	1.08
Unincorporated Area	81,771,610	43,282,470	<b>125,054,080</b>	1,372,828,808	9.11
<b>Planning Area Total</b>	<b>186,186,060</b>	<b>120,084,308</b>	<b>306,270,368</b>	<b>2,803,915,507</b>	<b>10.92</b>

### 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 Kempner	City of Lampasas	City of Lometa	Unincorporated Area	<b>Planning Area Total</b>
Medical and Health	0	0	0	0	<b>0</b>
Government Functions	0	0	0	0	<b>0</b>
Protective Functions	0	0	0	0	<b>0</b>
Schools	0	0	0	0	<b>0</b>
Hazardous Materials	0	0	0	0	<b>0</b>
Bridges	0	4	0	12	<b>16</b>
Water Storage	0	0	0	0	<b>0</b>
Wastewater	0	0	0	0	<b>0</b>
Power	0	0	0	0	<b>0</b>
Communications	0	0	0	0	<b>0</b>
Transportation	0	0	0	0	<b>0</b>
Dams	0	0	0	2	<b>2</b>

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

	City of Kempner	City of Lampasas	City of Lometa	Unincorporated Area	Planning Area Total
Medical and Health	0	0	0	0	0
Government Functions	0	0	0	0	0
Protective Functions	0	0	0	0	0
Schools	0	0	0	0	0
Hazardous Materials	0	1	0	0	1
Bridges	0	6	0	16	22
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	0	0	0	0	0
Dams	0	0	0	4	4

***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. Highways 183, 190, and 281, and FM 580, FM 2313, and FM 2527. 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. Within the participating communities, there are 16 bridges that are in or 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 HAZMAT 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 0.5% 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 1.7% of the population in the 100-year floodplain are over 65 years old.
- Population under 16 Years Old—It is estimated that approximately 2.8% of the population in the 100-year floodplain are under 16 years of age.

The following impacts on persons and households in Lampasas 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 = 146 households
  - Persons requiring short-term shelter = 186 people
- During a 500-year flood event
  - Displaced population = 267 households
  - Persons requiring short-term shelter = 374 people

### 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 \$28 million of flood loss from a 100-year flood event in the planning area. This represents 11% of the total exposure to the 100-year flood and

9% of the exposed replacement value for the county. Losses are estimated to be \$48 million from a 500-year flood event, representing 16% of the total exposure to the 500-year flood (Table 12-12).

<b>TABLE 12-11. LOSS ESTIMATES FOR THE 100-YEAR FLOOD EVENT</b>					
	Loss (\$)			Exposed Value (\$)	% of Total Exposed Value
	Structure	Contents	Total		
City of Kempner	131,918	329,596	<b>461,514</b>	8,234,095	5.60
City of Lampasas	6,973,998	10,147,423	<b>17,121,421</b>	113,477,509	15.09
City of Lometa	84,000	47,000	<b>131,000</b>	963,646	13.59
Unincorporated Area	6,012,870	4,246,837	<b>10,259,707</b>	122,112,812	8.40
<b>Planning Area Total</b>	<b>13,202,786</b>	<b>14,770,856</b>	<b>27,973,642</b>	<b>244,788,062</b>	<b>11.43</b>

<b>TABLE 12-12. LOSS ESTIMATES FOR THE 500-YEAR FLOOD EVENT</b>					
	Loss (\$)			Exposed Value (\$)	% of Total Exposed Value
	Structure	Contents	Total		
City of Kempner	280,788	668,162	<b>948,950</b>	8,296,629	11.44
City of Lampasas	12,589,511	19,406,400	<b>31,995,911</b>	171,956,012	18.61
City of Lometa	84,000	47,000	<b>131,000</b>	963,646	13.59
Unincorporated Area	9,045,393	6,271,223	<b>15,316,616</b>	125,054,080	12.25
<b>Planning Area Total</b>	<b>21,999,692</b>	<b>26,392,785</b>	<b>48,392,477</b>	<b>306,270,367</b>	<b>15.80</b>

**National Flood Insurance Program**

Table 12-13 lists flood insurance statistics that help identify vulnerability in the planning area. Lampasas County and the Cities of Kempner and Lampasas, participate in the NFIP. The City of Lometa is not listed as a participant in the NFIP.

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

Facility Type	Initial FIRM Effective Date	Claims	Value of Claims Paid (\$)
City of Kempner	1/2/1991	0	0
City of Lampasas	6/15/1982	7	84,359
City of Lometa	1/2/1991*	0	0
Unincorporated Area	1/2/1991	15	99,553
<b>Total</b>	<b>--</b>	<b>22</b>	<b>183,912</b>

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 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 Lampasas County (1978 to June 2015) is approximately \$8,360, less than 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 12-7 shows the location of repetitive loss properties in Lampasas County.

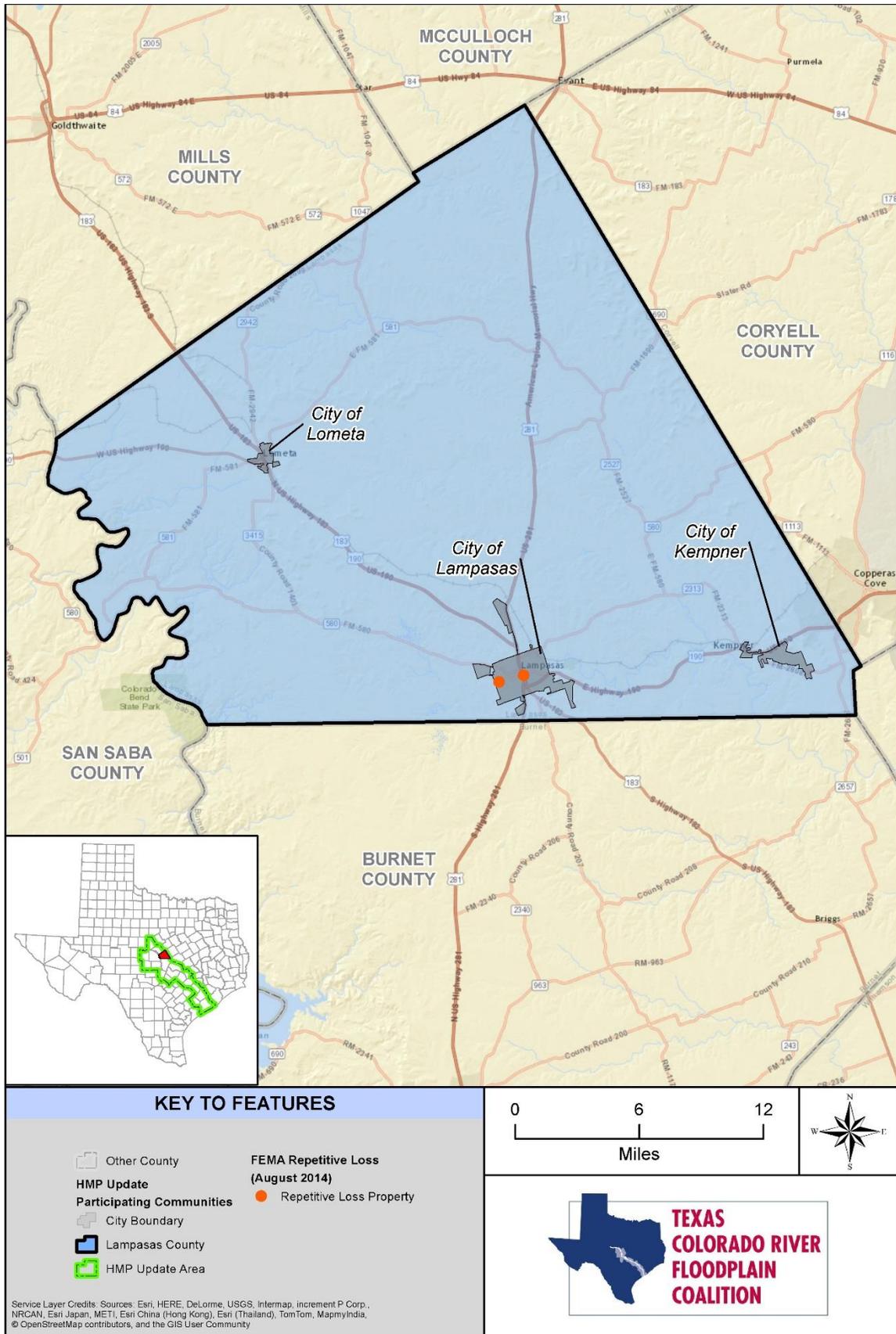


Figure 12-7. Repetitive Loss Properties in Lampasas County

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### **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 and 500-year flood events. No significant loss of facility functionality would be lost during these events.

### **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**

Lampasas County and its planning partners are equipped to handle future growth within flood hazard areas. All municipal planning partners have plans and policies that address frequently flooded areas. All partners 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, Lampasas County and the Cities of Kempner and Lampasas 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 Lampasas 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	
Lampasas County	Low
City of Kempner	Low
City of Lampasas	Low
City of Lometa	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 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 study area.

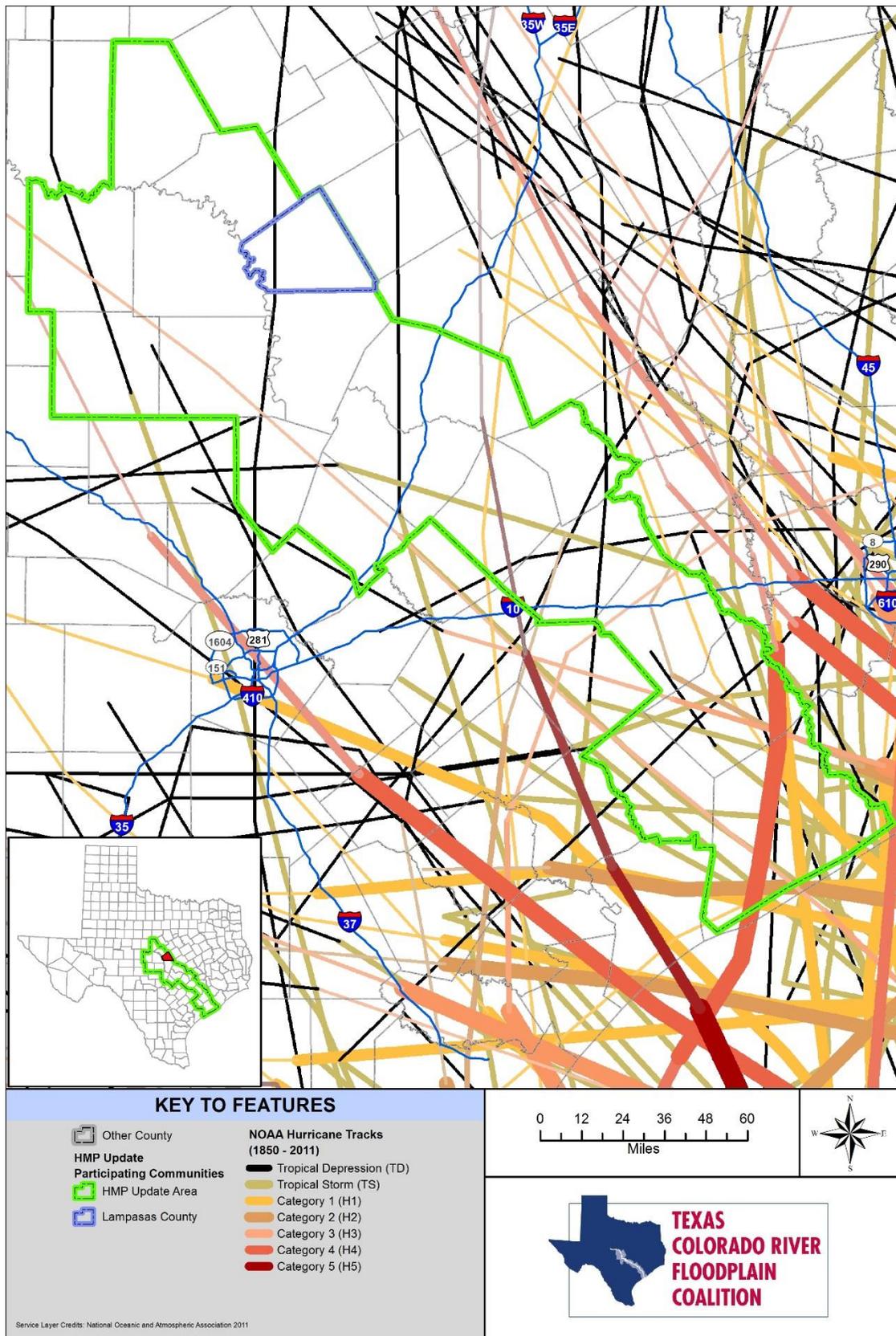


Figure 13-1. Historical Hurricane Paths Affecting Lampasas County

### 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: <a href="http://www.nhc.noaa.gov/aboutsshws.php">http://www.nhc.noaa.gov/aboutsshws.php</a>		

## 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 Lampasas 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, Lampasas County has been impacted by one Atlantic Hurricane between 1851 and 2011. A count of the seven hurricane categories within this time period shows one tropical depression. Notable hurricane, tropical storm, and depression landfalls documented by NOAA between 1851 and 2015 for Lampasas County are described below:

- September 7, 1874 – An unnamed tropical depression that started as a tropical storm reached Lampasas County with maximum wind speeds of 35 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 Lampasas County, but no serious flooding occurred. Rainfall totals for the Lampasas County area during this event ranged from less than 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 Lampasas County. These hurricane events can become tropical depressions or tropical storms by the time they reach Lampasas County.

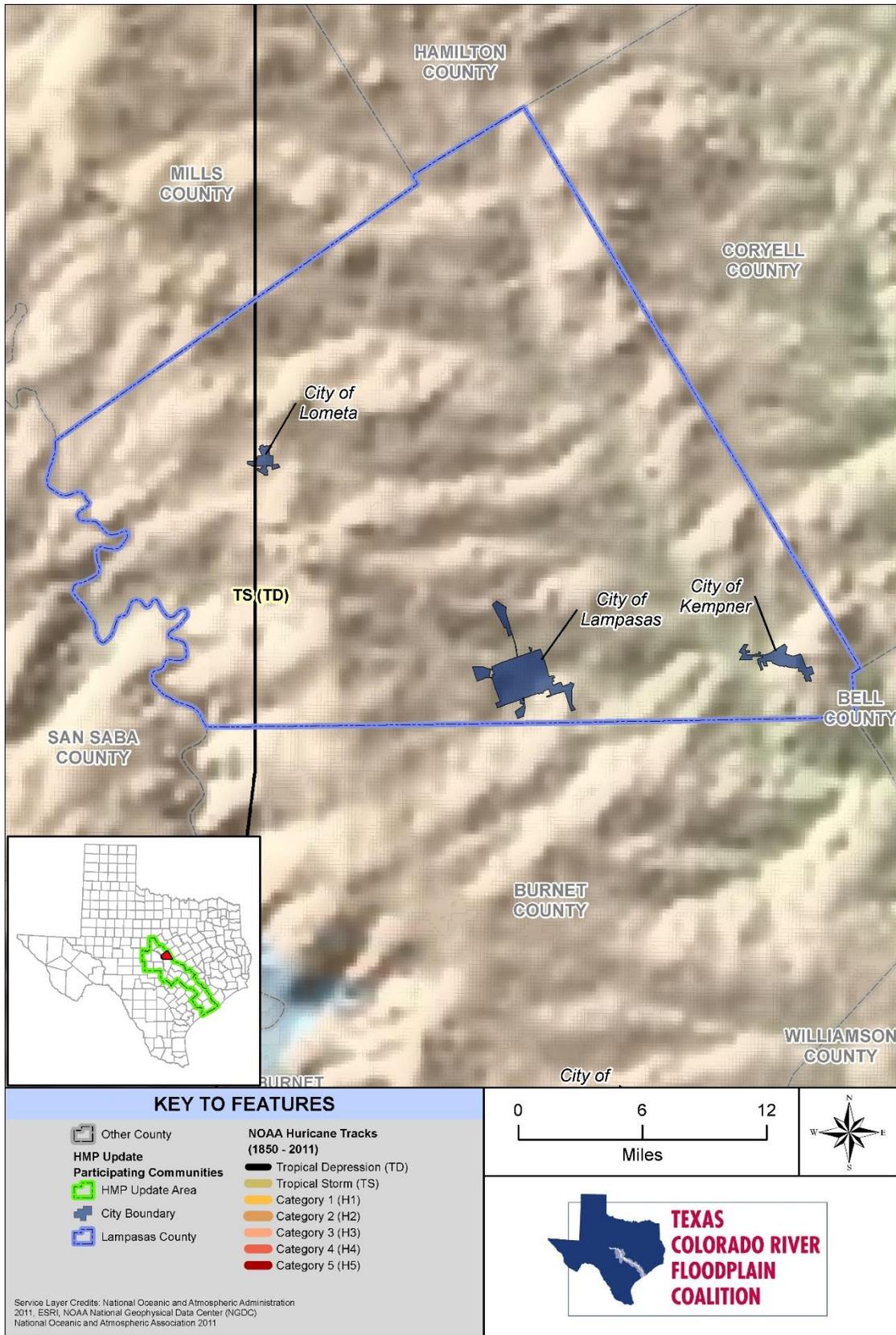


Figure 13-2. Historical Tropical Storms and Hurricanes Affecting Lampasas County

### 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>

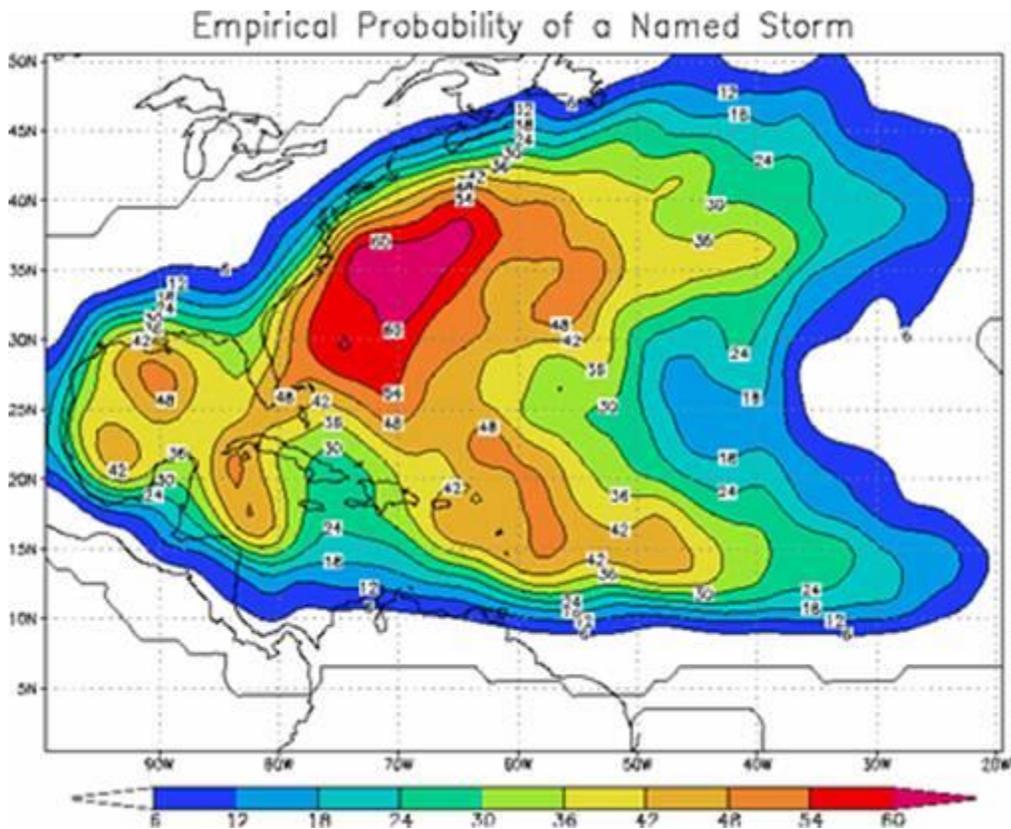


Figure 13-3. Probability of Named Tropical Storm Event

### 13.2.4 Severity

Historic events indicate that a hurricane will affect Lampasas 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 Lampasas.

### **13.3 SECONDARY EVENTS**

Secondary events associated with a hurricane reaching Lampasas 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 Lampasas County may impact tourism, as Lampasas County has scenic drives, state parks, and deer hunting. The county holds the Spring Ho Festival in July and the Diamondback Jubilee and Rodeo in March.

### **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 from 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. Table 13-2 lists annualized loss estimates for the 100-year probabilistic event scenario. Peak gust wind speeds for the 100-Year Probabilistic scenario are between 58 mph to 63 mph (Figure 13-4). Less than 1% of the buildings (mostly residential) are expected to sustain moderate damages for this scenario. The annualized economic loss estimated for this probabilistic hurricane scenario is approximately \$400,000, which represents less than 0.01% of the total replacement value of the planning area's buildings.

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

	Annualized Loss (\$)			Exposed Value (\$)	% of Total Exposed Value
	Structure	Contents	Total		
City of Kempner	506	17	<b>523</b>	158,651,717	<0.01
City of Lampasas	4,284	146	<b>4,430</b>	1,183,059,355	<0.01
City of Lometa	Negligible	Negligible	<b>Negligible</b>	89,375,627	<0.01
Unincorporated Area	26,259	1,022	<b>27,281</b>	1,372,828,808	<0.01
<b>Planning Area Total</b>	<b>31,049</b>	<b>1,185</b>	<b>32,234</b>	<b>2,803,915,507</b>	<b>&lt;0.01</b>

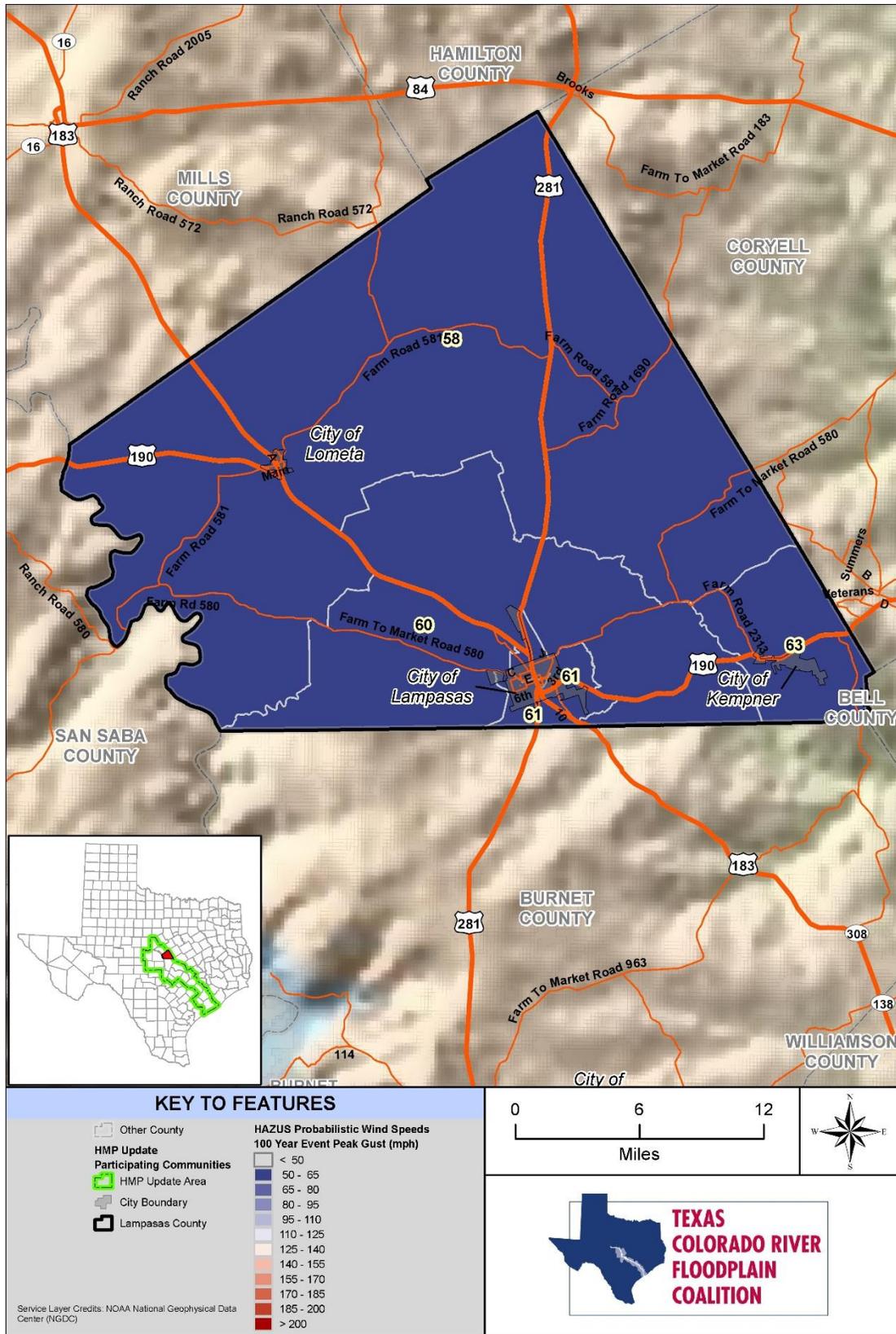


Figure 13-4. 100-Year Probabilistic Peak Wind Gusts for Lampasas County

## **13.7 FUTURE TRENDS IN DEVELOPMENT**

The threat of tropical storms is constant in Texas. From the Gulf of Mexico coastline to South 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 central Texas Gulf Coast and move inland toward Lampasas County. Such a powerful storm at landfall may still have significant impacts in Lampasas 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 storm would leave a large path of damage across central Texas, straining resources throughout the county and state. However, this event is unlikely and Lampasas 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 Lampasas 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
Lampasas County	Low	Low	Medium	Medium
City of Kempner	Low	Low	Medium	Low
City of Lampasas	Low	Low	Medium	Medium
City of Lometa	Medium	Low	Medium	Medium

## 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,

#### 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.

frequent lightning, strong winds, and tornadoes. The storm occasionally has a black or dark green appearance.

- 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.

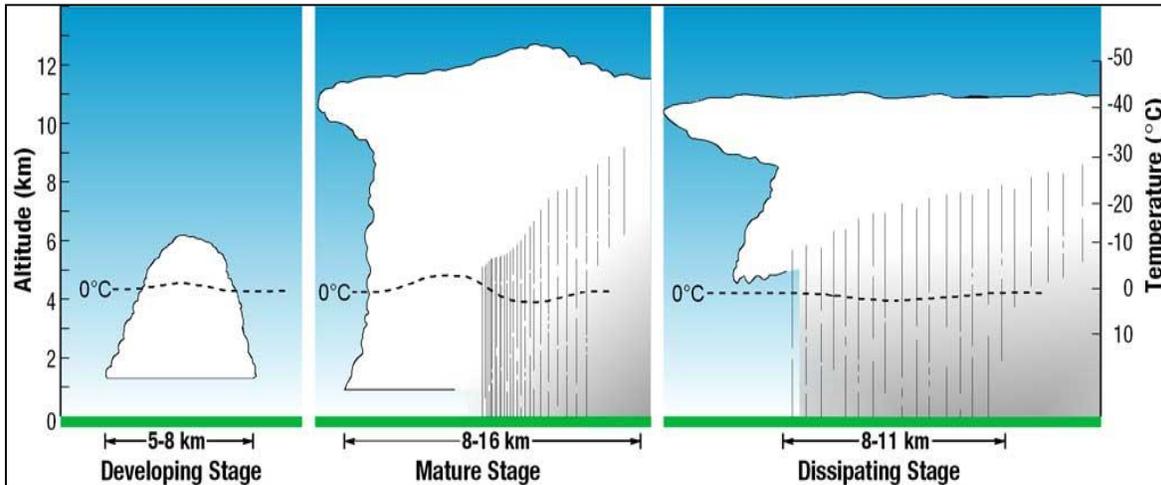


Figure 14-1. Thunderstorm Life Cycle

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.

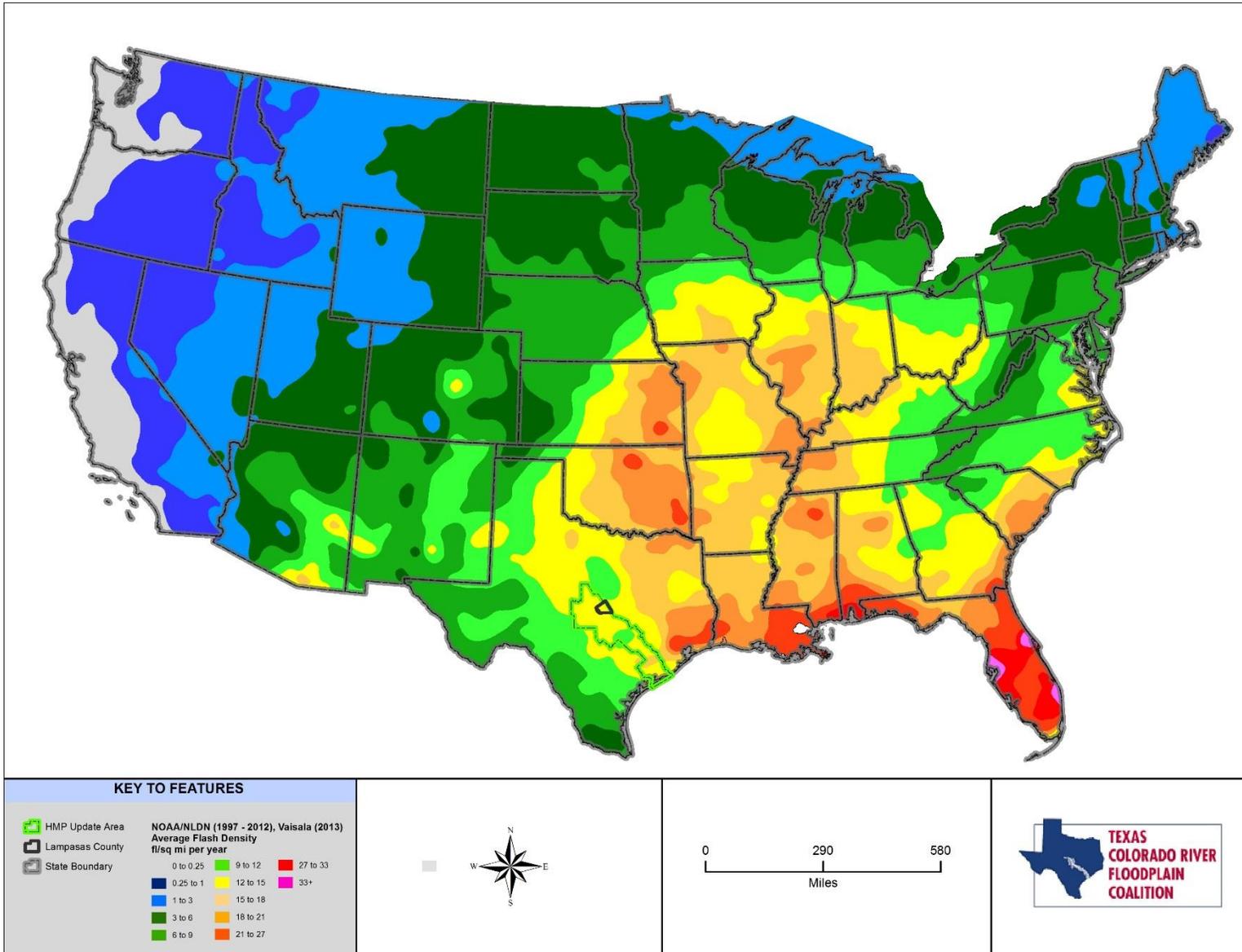


Figure 14-2. Average Annual National Lightning Density

### 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

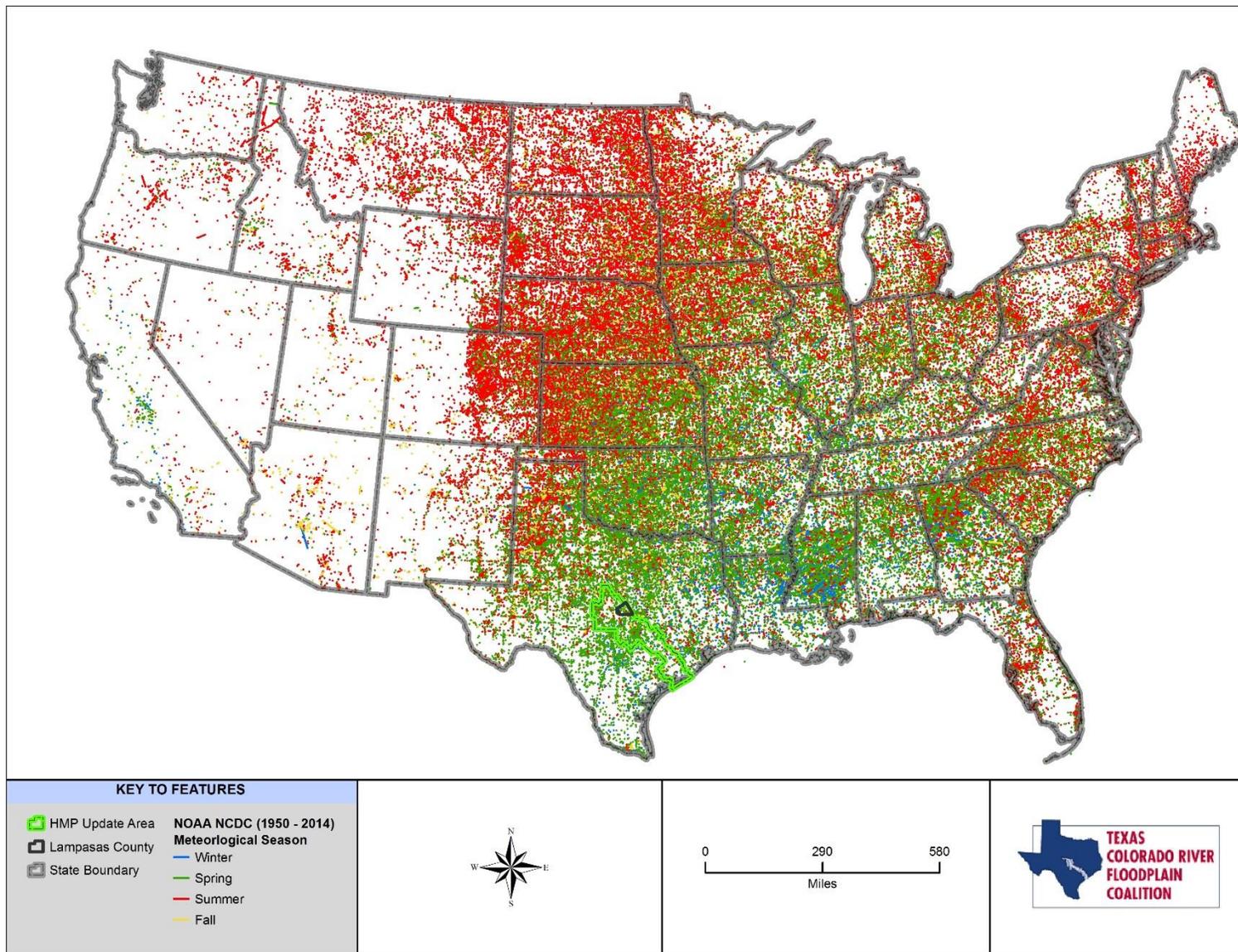


Figure 14-3. National Hail Paths

<b>TABLE 14-1.                      NATIONAL WEATHER SERVICE HAIL SEVERITY</b>		
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.

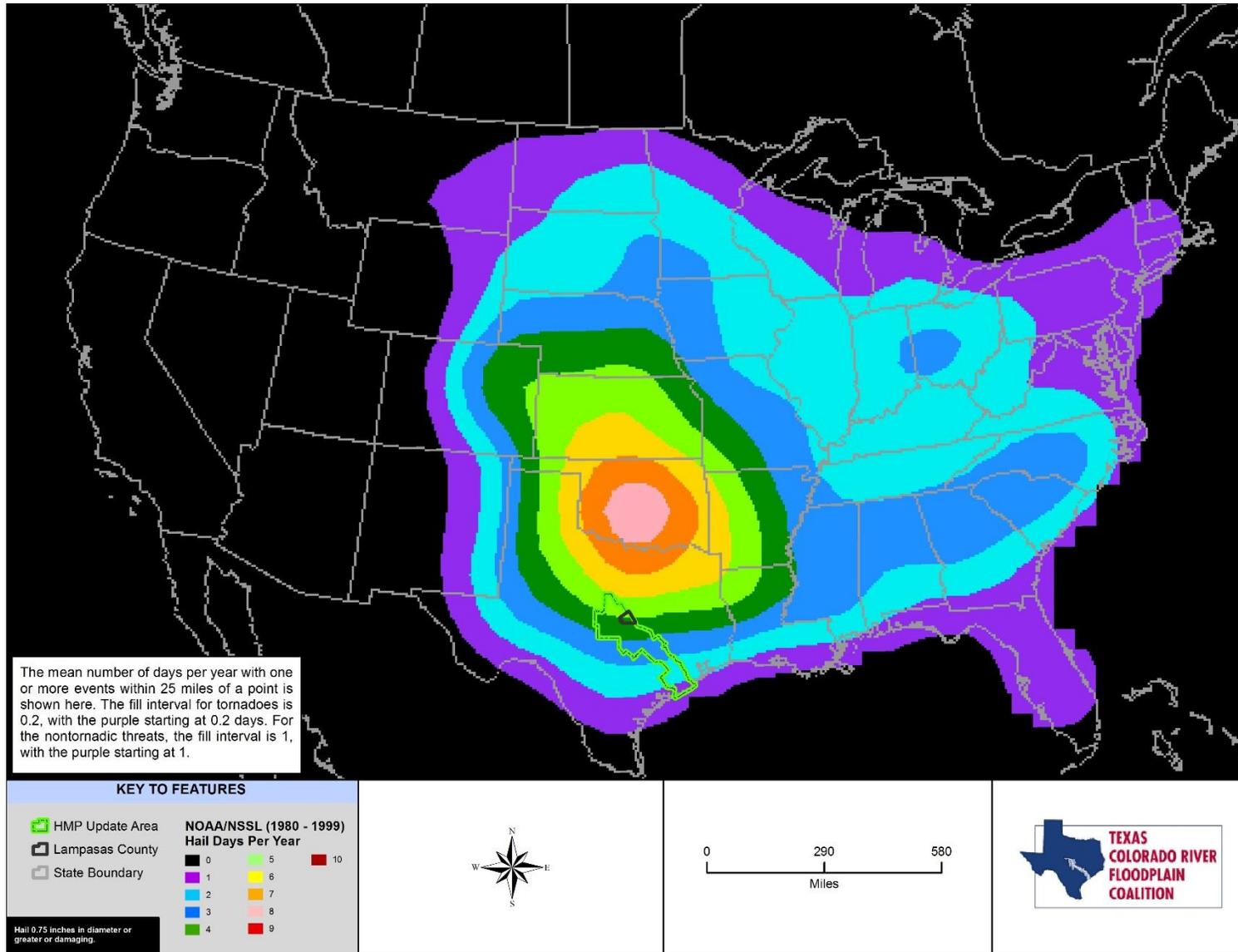


Figure 14-4. National Hail Days per Year

### 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.

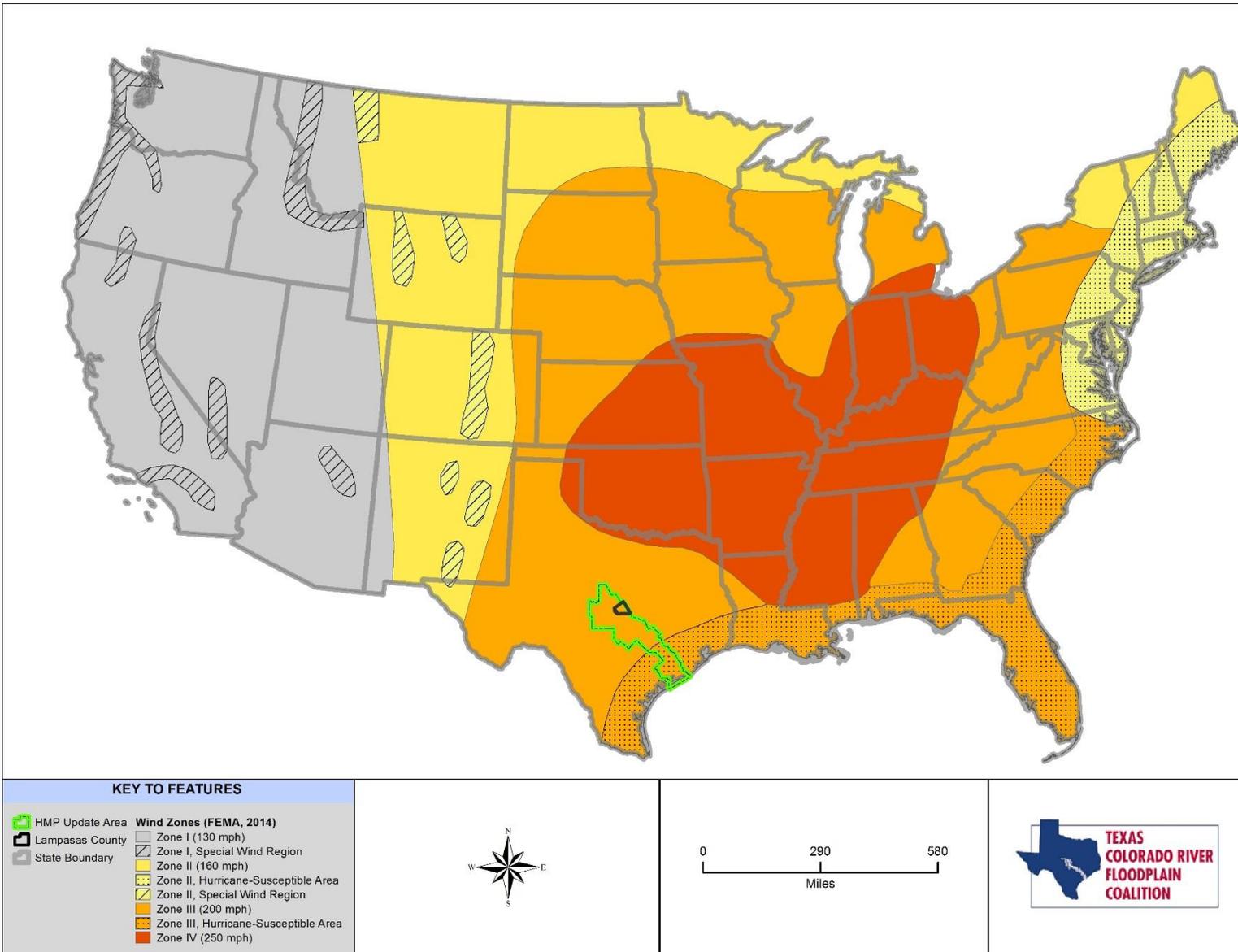


Figure 14-5. National Wind Zones

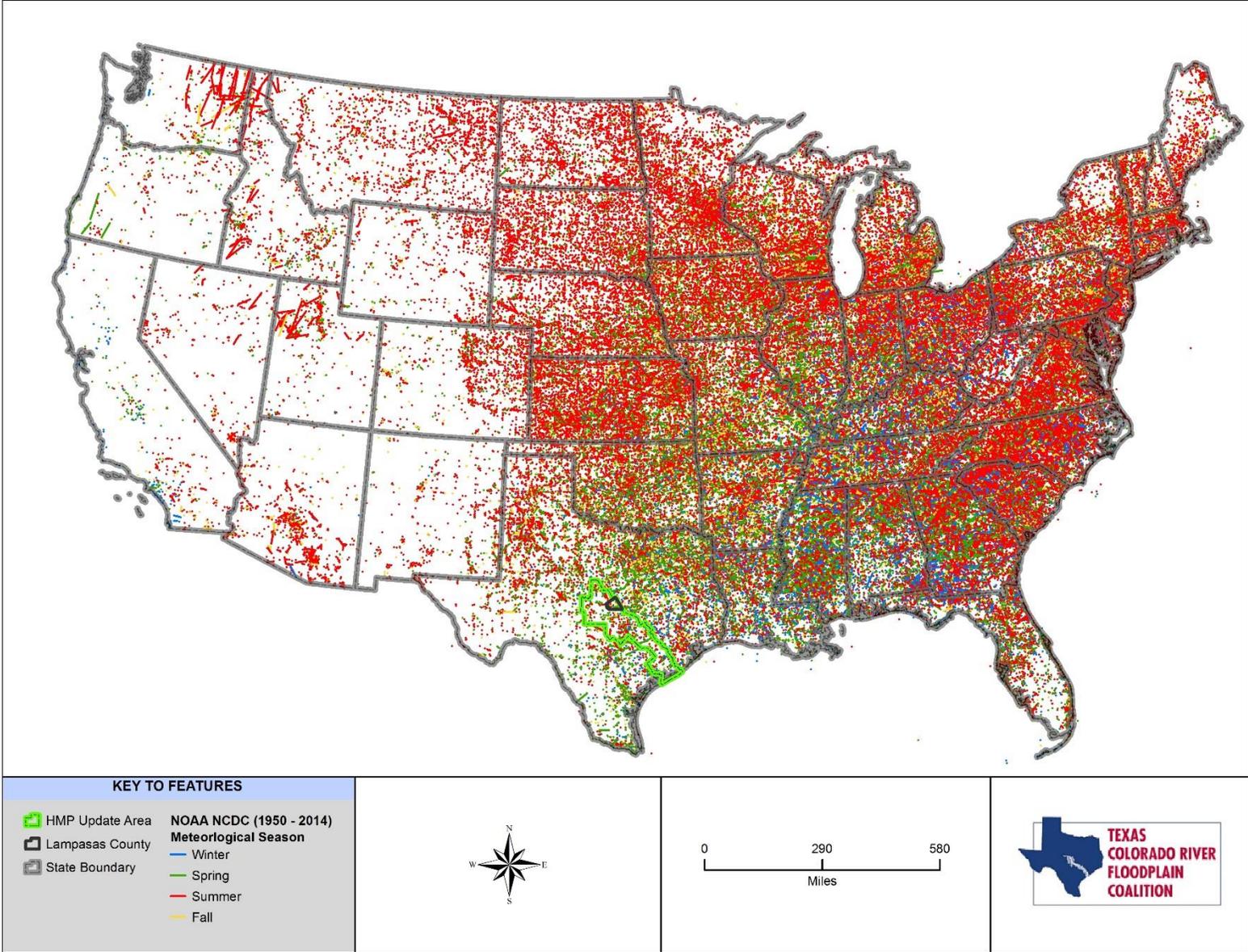


Figure 14-6. National High Wind Paths

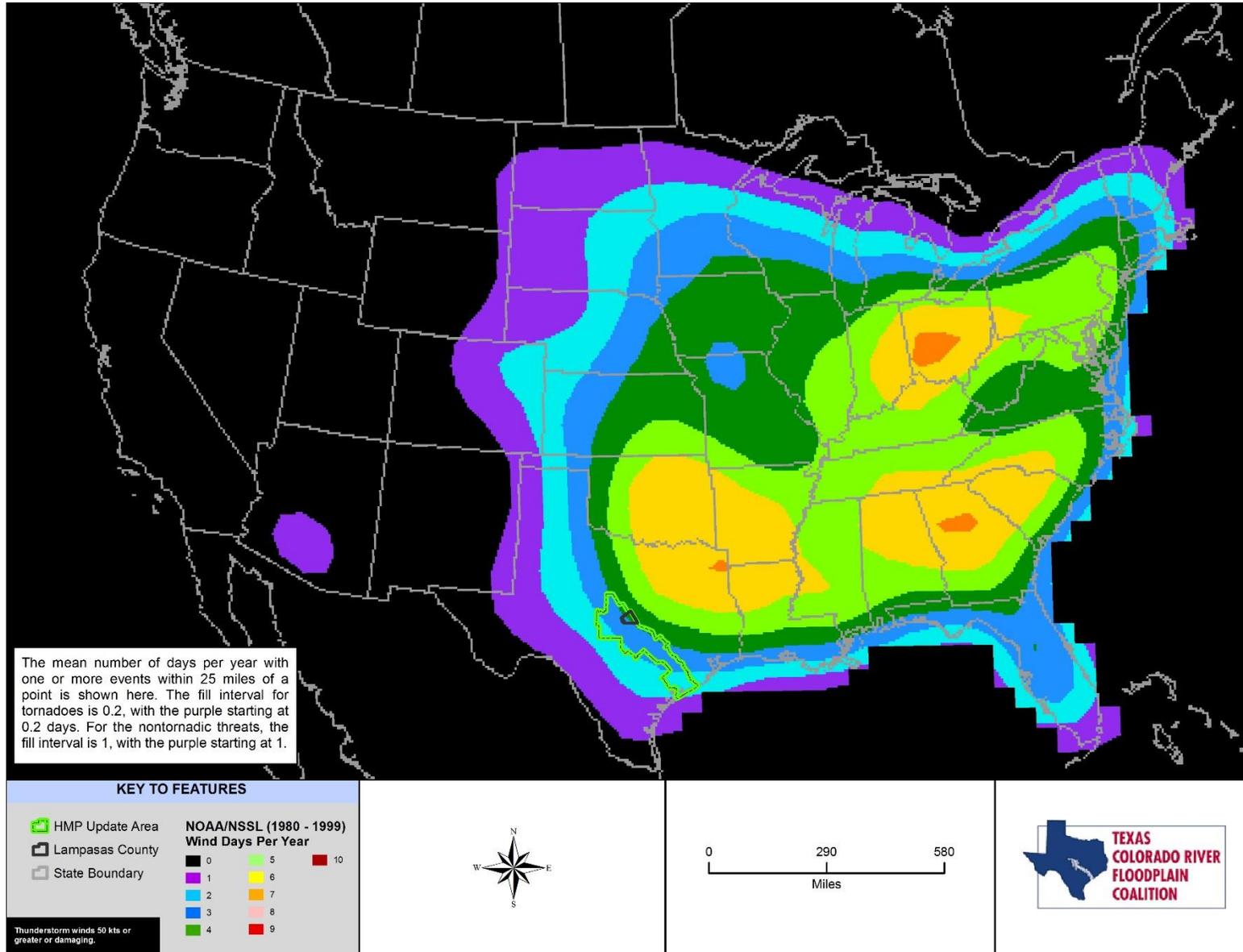


Figure 14-7. National Annual High Wind Days

## 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. Lampasas 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 191,060 cloud-to-ground lightning flashes have been reported in Lampasas 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 was one documented lightning event in Lampasas County between 1950 and December 2014. Lightning struck an oak tree in a driveway on July 14, 2008, busting some of the concrete and exposing steel rebar, causing approximately \$5,000 in damages.

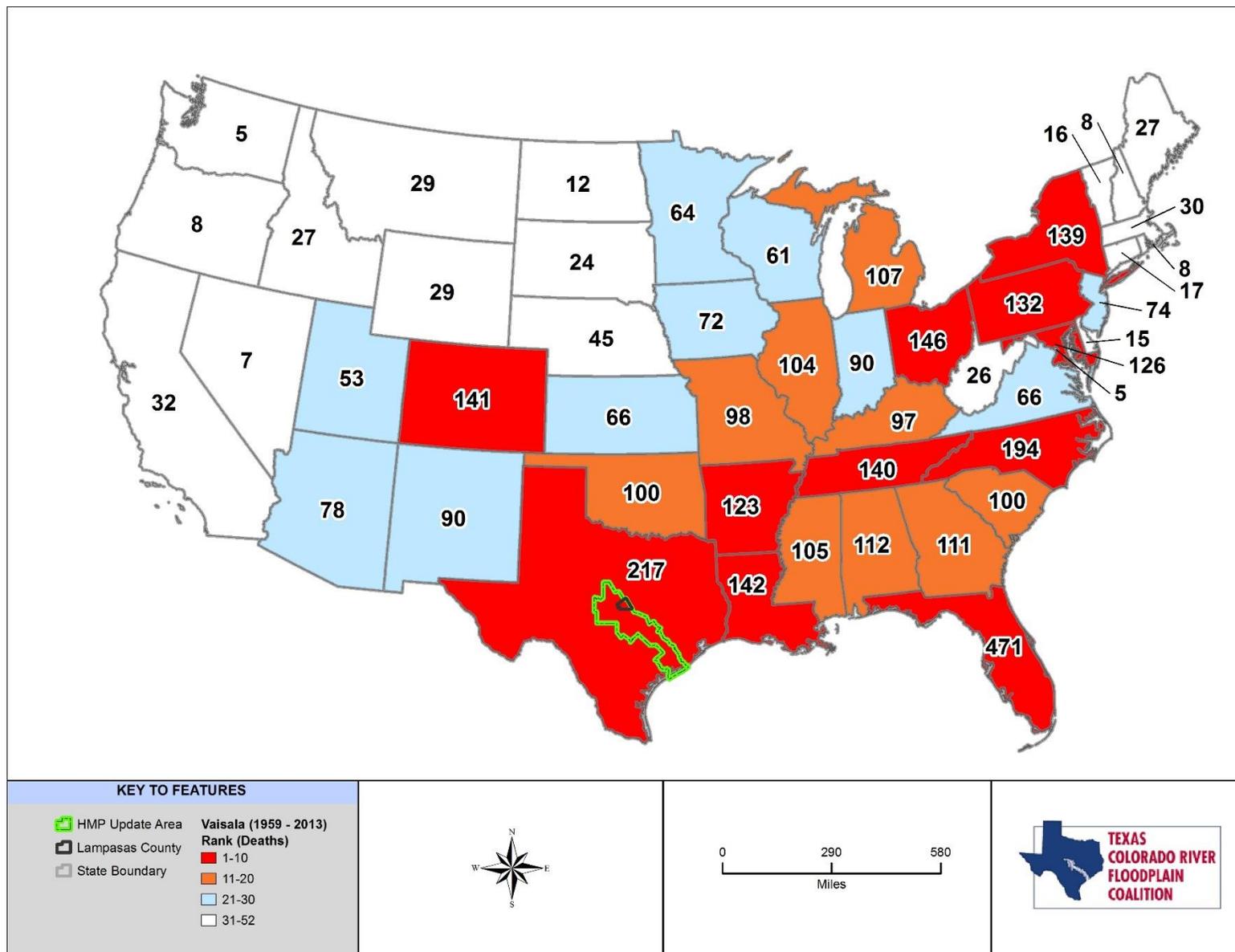


Figure 14-8. Lightning Fatalities in the U.S. (1959-2013)

**Hail**

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

<b>TABLE 14-2. HISTORIC HAIL EVENTS IN LAMPASAS COUNTY (1960-2014)</b>				
Location	Date	Hail Size (inches)	Estimated Damage Cost	
			Property	Crops
Lampasas County	05/25/1957	1.75	\$0	\$0
Lampasas County	03/12/1971	2.25	\$0	\$0
Lampasas County	05/24/1973	1.75	\$0	\$0
Lampasas County	06/07/1974	2.5	\$0	\$0
Lampasas County	05/04/1975	1.75	\$0	\$0
Lampasas County	04/07/1976	0.75	\$0	\$0
Lampasas County	05/26/1976	1.75	\$0	\$0
Lampasas County	04/30/1978	1.75	\$0	\$0
Lampasas County	04/30/1978	2	\$0	\$0
Lampasas County	04/19/1982	1.75	\$0	\$0
Lampasas County	04/19/1982	4	\$0	\$0
Lampasas County	04/19/1982	4	\$0	\$0
Lampasas County	06/22/1982	1.75	\$0	\$0
Lampasas County	06/28/1983	2.75	\$0	\$0
Lampasas County	06/28/1983	2.75	\$0	\$0
Lampasas County	04/05/1990	1.5	\$0	\$0
Lampasas County	05/27/1990	1.75	\$0	\$0
Lampasas County	05/11/1992	2	\$0	\$0
Lampasas County	05/11/1992	2	\$0	\$0
Adamsville	05/09/1993	1	\$0	\$0
Lampasas	05/09/1993	1	\$0	\$0
Lometa	05/26/1994	2.75	\$500,000	\$500,000
Lampasas	01/12/1995	1	\$0	\$0
Lampasas	04/19/1995	0.75	\$0	\$0
Lampasas	06/28/1995	1	\$0	\$0
Lometa	06/28/1995	0.75	\$0	\$0
Lampasas	05/29/1996	0.75	\$0	\$0
Lometa	04/20/1997	1.75	\$0	\$0
Nix	04/20/1997	1.75	\$0	\$0
Nix	04/20/1997	1.75	\$0	\$0
Lampasas	01/06/1998	0.75	\$0	\$0
Lampasas	03/12/1999	0.75	\$0	\$0

**TABLE 14-2.  
HISTORIC HAIL EVENTS IN LAMPASAS COUNTY (1960-2014)**

Location	Date	Hail Size (inches)	Estimated Damage Cost	
			Property	Crops
Lampasas	03/12/1999	2	\$0	\$0
Lampasas	03/12/1999	0.75	\$0	\$0
Lometa	03/12/1999	0.75	\$0	\$0
Lampasas	05/10/1999	1.75	\$0	\$0
Lampasas	03/28/2000	1.75	\$0	\$0
Lometa	05/12/2000	1	\$0	\$0
Lometa	05/12/2000	1.75	\$0	\$0
Kempner	05/06/2001	1.75	\$0	\$0
Kempner	05/06/2001	2.75	\$0	\$0
Kempner	05/24/2001	1	\$0	\$0
Lampasas	05/04/2002	1.75	\$0	\$0
Lometa	05/04/2002	0.75	\$0	\$0
Lometa	05/04/2002	3	\$0	\$0
Lometa	06/03/2003	0.75	\$0	\$0
Lampasas	06/03/2005	1.75	\$0	\$0
Lometa	04/18/2006	0.88	\$0	\$0
Lampasas	04/20/2006	0.88	\$0	\$0
Lampasas	04/20/2006	1.75	\$5,000	\$0
Lampasas	04/28/2006	0.75	\$0	\$0
Adamsville	05/04/2006	1	\$0	\$0
Lampasas	05/05/2006	1.75	\$5,000	\$0
Lometa	05/06/2006	4	\$20,000	\$0
Lampasas	05/09/2006	1	\$0	\$0
Lometa	04/03/2007	1.75	\$5,000	\$0
Lometa	04/03/2007	1	\$0	\$0
Lampasas	05/02/2007	0.88	\$0	\$0
Lometa	06/14/2007	1	\$0	\$0
Lometa	03/31/2008	1	\$0	\$0
Lampasas Airport	03/31/2008	1	\$0	\$0
Ogles	03/31/2008	1	\$0	\$0
Adamsville	04/08/2008	0.88	\$0	\$0
Adamsville	04/08/2008	1.75	\$5,000	\$0
Lampasas	05/09/2008	1.75	\$10,000	\$0
Kempner	06/11/2009	2.5	\$5,000	\$0
Lampasas	06/11/2009	2.75	\$10,000	\$0
Lampasas	06/11/2009	2.75	\$10,000	\$0

**TABLE 14-2.  
HISTORIC HAIL EVENTS IN LAMPASAS COUNTY (1960-2014)**

Location	Date	Hail Size (inches)	Estimated Damage Cost	
			Property	Crops
Kempner	04/23/2010	1.75	\$5,000	\$0
Rumley	05/21/2011	4	\$20,000	\$0
Rumley	05/21/2011	1	\$0	\$0
Rumley	05/21/2011	1.75	\$1,000	\$0
Lampasas Airport	03/19/2012	1	\$0	\$0
Lometa	05/06/2012	1	\$0	\$0
Lampasas Airport	05/10/2013	1	\$0	\$0
Lampasas	03/28/2014	1	\$0	\$0
Lometa	03/28/2014	0.88	\$0	\$0
Lometa	03/28/2014	1.75	\$10,000	\$0
Adamsville	04/13/2014	1.5	\$40,000	\$0
Lampasas	04/21/2014	1	\$0	\$0
Lampasas Airport	05/08/2014	0.75	\$0	\$0
Kempner	06/12/2014	1.75	\$5,000	\$0
Kempner	06/12/2014	2	\$25,000	\$0
Lampasas Airport	06/12/2014	2	\$3,000	\$0

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

### **Winds**

High winds occur year round in Lampasas 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 Lampasas County classified as “Poor.”

<b>TABLE 14-3. WIND POWER CLASS AND SPEED</b>			
Rank	Wind Power Class	Wind Power Density at 50 meters (W/m <sup>2</sup> )	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<sup>2</sup> Watts per square meter

Historical severe weather data from the NOAA National Climatic Data Center’s Storm Events Database lists thunderstorm wind events in Lampasas 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 Lampasas County during the 1950 to 2014 time period. These tornadoes are discussed in Chapter 15.

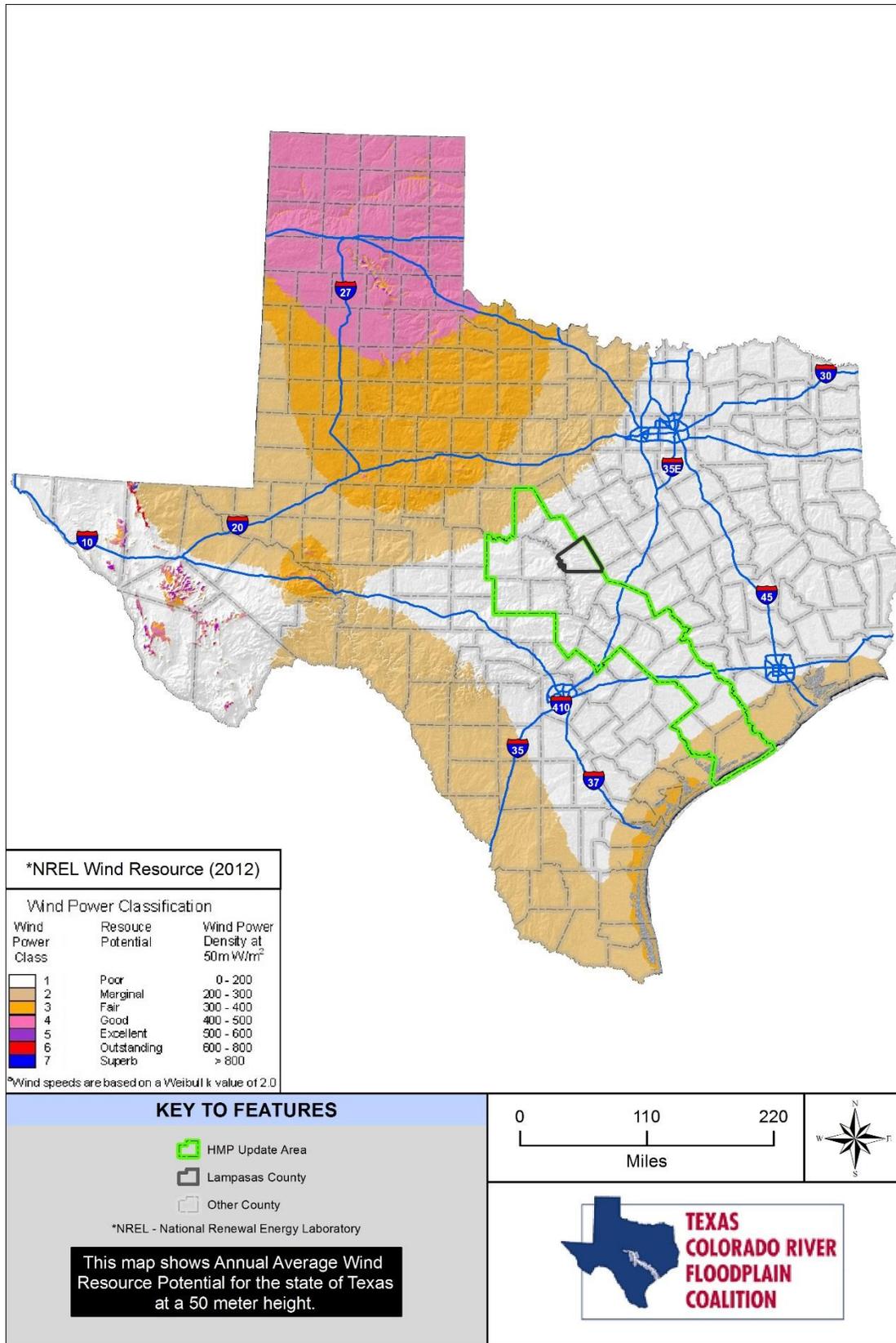


Figure 14-9. Texas Wind Power

<b>TABLE 14-4.                      HISTORIC WIND-RELATED EVENTS IN LAMPASAS COUNTY (1950-2014)</b>						
Location	Date	Peak Wind Speed (knots)	Estimated Damage Cost		Injuries	Deaths
			Property	Crops		
Lampasas County	05/25/1957	55	\$0	\$0	0	0
Lampasas County	03/27/1975	0	\$0	\$0	0	0
Lampasas County	04/07/1976	65	\$0	\$0	0	0
Lampasas County	09/13/1977	0	\$0	\$0	0	0
Lampasas County	05/15/1980	0	\$0	\$0	0	0
Lampasas County	02/21/1981	0	\$0	\$0	0	0
Lampasas County	09/01/1981	52	\$0	\$0	0	0
Lampasas County	10/17/1981	52	\$0	\$0	0	0
Lampasas County	06/02/1988	0	\$0	\$0	0	0
Lampasas County	05/28/1990	0	\$0	\$0	0	0
Lampasas County	08/22/1990	0	\$0	\$0	0	0
Lampasas County	09/01/1990	0	\$0	\$0	0	0
Lampasas County	08/10/1991	0	\$0	\$0	0	0
Lampasas County	10/12/1993	0	\$0	\$5,000	0	0
Lampasas County	10/12/1993	0	\$5,000	\$0	0	0
Lampasas County	05/26/1994	0	\$50,000	\$0	0	0
Lampasas County	05/26/1994	0	\$5,000,000	\$0	6	0
Lampasas County	11/04/1994	56	\$0	\$0	0	0
Lampasas County	06/28/1995	52	\$0	\$0	0	0
Lampasas County	06/04/1996	N/A	\$5,000	\$0	0	0
Lampasas County	06/04/1996	N/A	\$0	\$0	0	0
Lampasas County	10/21/1996	52	\$0	\$0	0	0
Lampasas County	04/20/1997	N/A	\$2,000	\$0	0	0
Lampasas County	04/20/1997	N/A	\$2,000	\$0	0	0
Lampasas County	04/20/1997	N/A	\$2,000	\$0	0	0
Lampasas County	04/20/1997	N/A	\$2,000	\$0	0	0
Lampasas County	02/25/1998	N/A	\$15,000	\$0	0	0
Lampasas County	04/26/1998	N/A	\$1,000	\$0	0	0
Lampasas County	06/04/1998	N/A	\$0	\$0	0	0
Lampasas County	08/29/1998	N/A	\$50,000	\$0	0	0
Lampasas County	05/11/1999	61	\$0	\$0	0	0
Lampasas County	04/11/2000	52	\$0	\$0	0	0

**TABLE 14-4.  
HISTORIC WIND-RELATED EVENTS IN LAMPASAS COUNTY (1950-2014)**

Location	Date	Peak Wind Speed (knots)	Estimated Damage Cost		Injuries	Deaths
			Property	Crops		
Lampasas County	05/27/2000	58	\$0	\$0	0	0
Lampasas County	11/05/2000	N/A	\$2,000	\$0	0	0
Lampasas County	03/19/2002	60	\$0	\$0	0	0
Lampasas County	06/16/2002	57	\$2,000	\$0	0	0
Lampasas County	06/05/2003	52	\$2,000	\$0	0	0
Lampasas County	03/04/2004	52	\$10,000	\$0	0	0
Lampasas County	03/04/2004	50	\$25,000	\$0	0	0
Lampasas County	06/01/2004	61	\$5,000	\$0	0	0
Lampasas County	06/01/2004	61	\$5,000	\$0	0	0
Lampasas County	06/04/2004	52	\$10,000	\$0	0	0
Lampasas County	06/04/2004	52	\$30,000	\$0	0	0
Lampasas County	05/08/2005	52	\$1,000	\$0	0	0
Lampasas County	04/20/2006	50	\$0	\$0	0	0
Lampasas County	04/28/2006	52	\$0	\$0	0	0
Lampasas County	02/24/2007	50	\$60,000	\$0	0	0
Lampasas County	05/31/2007	56	\$0	\$0	0	0
Lampasas County	08/30/2007	50	\$20,000	\$0	0	0
Lampasas County	05/14/2008	61	\$0	\$0	0	0
Lampasas County	05/14/2008	61	\$75,000	\$0	0	0
Lampasas County	07/14/2008	N/A	\$5,000	\$0	0	0
Lampasas County	02/10/2009	60	\$2,000	\$0	0	0
Lampasas County	04/27/2009	70	\$10,000	\$0	0	0
Lampasas County	05/31/2009	50	\$1,000	\$0	0	0
Lampasas County	06/11/2009	65	\$25,000	\$0	0	0
Lampasas County	06/11/2009	61	\$15,000	\$0	0	0
Lampasas County	06/11/2009	61	\$2,000	\$0	0	0
Lampasas County	10/01/2009	52	\$0	\$0	0	0
Lampasas County	03/20/2010	65	\$75,000	\$0	0	0
Lampasas County	03/20/2010	65	\$175,000	\$0	0	0
Lampasas County	04/23/2010	52	\$2,000	\$0	0	0
Lampasas County	05/12/2011	50	\$2,000	\$0	0	0
Lampasas County	03/19/2013	52	\$0	\$0	0	0

<b>TABLE 14-4.                      HISTORIC WIND-RELATED EVENTS IN LAMPASAS COUNTY (1950-2014)</b>						
Location	Date	Peak Wind Speed (knots)	Estimated Damage Cost		Injuries	Deaths
			Property	Crops		
Lampasas County	05/08/2014	61	\$30,000	\$0	0	0
Lampasas County	05/08/2014	50	\$5,000	\$0	0	0
Lampasas County	10/13/2014	50	\$5,000	\$0	0	0
Source: <a href="http://www.ncdc.noaa.gov">http://www.ncdc.noaa.gov</a>						
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 Lampasas County is exposed to some degree of lightning hazard, though exposed points of high elevation have significantly higher frequency of occurrence. There was only one lightning damage events recorded by the NOAA National Climatic Data Center from 1993 to 2014 in Lampasas County, located near the City of Lampasas (Figure 14-10).

#### **Hail**

The entire extent of Lampasas County is exposed to the hailstorm hazard. Previous instances of hail events in the county from 1955 to 2014 are shown in Figure 14-11.

#### **Winds**

Windstorms could occur anywhere in Lampasas 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 in the county from 1955 to 2014 are shown in Figure 14-12.

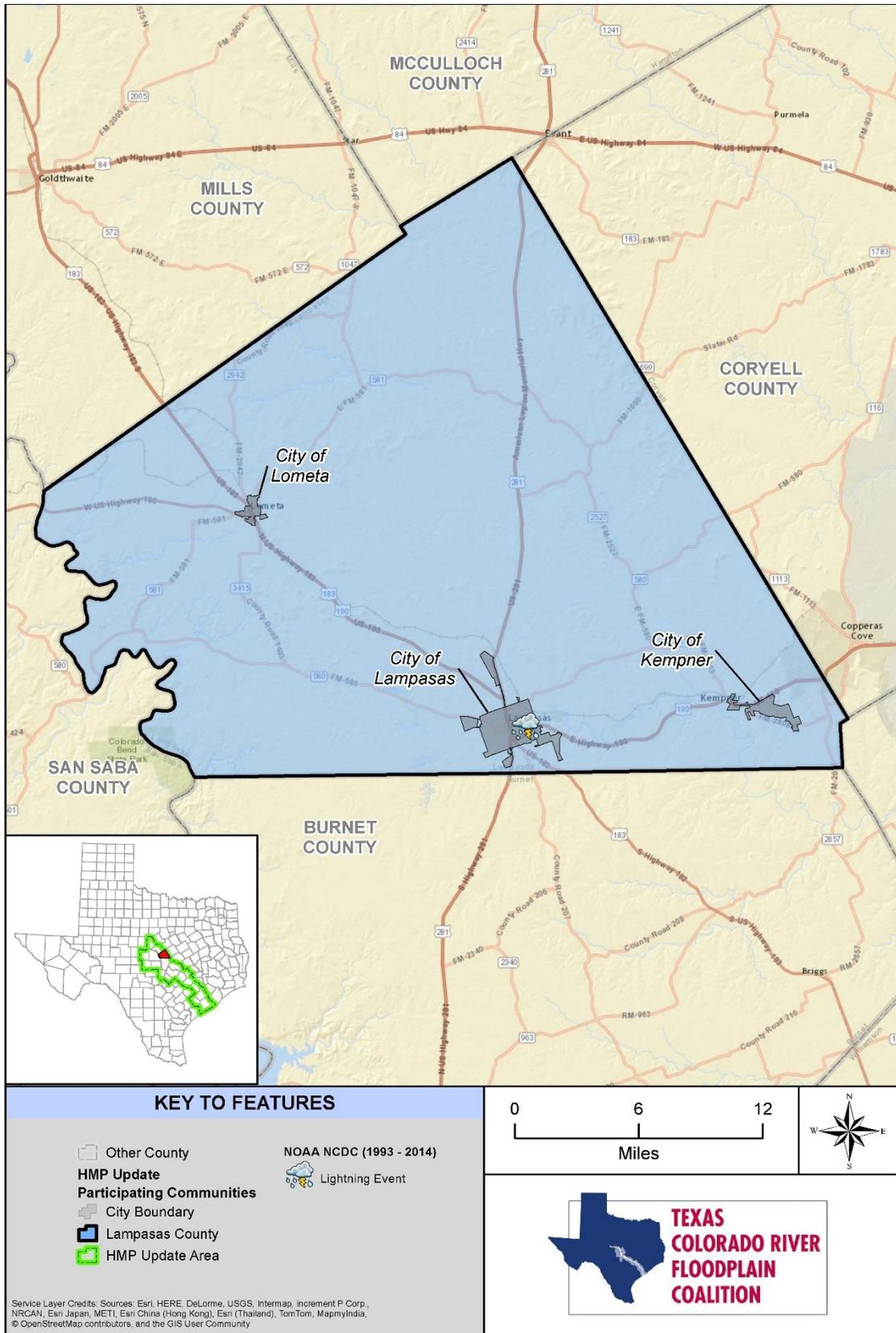


Figure 14-10. Lightning Events in Lampasas County (1993-2014)

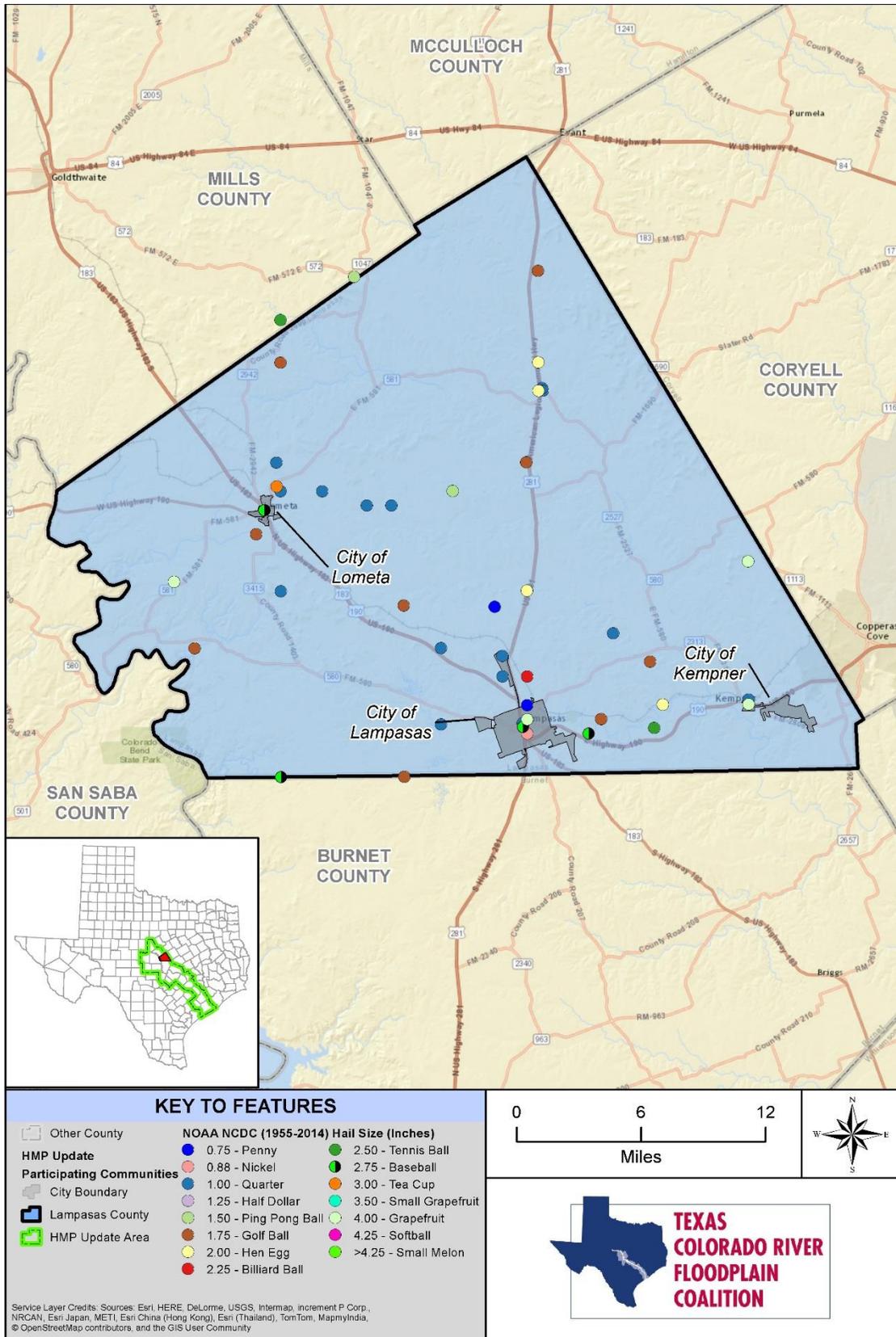


Figure 14-11. Hail Events in Lampasas County (1955-2014)

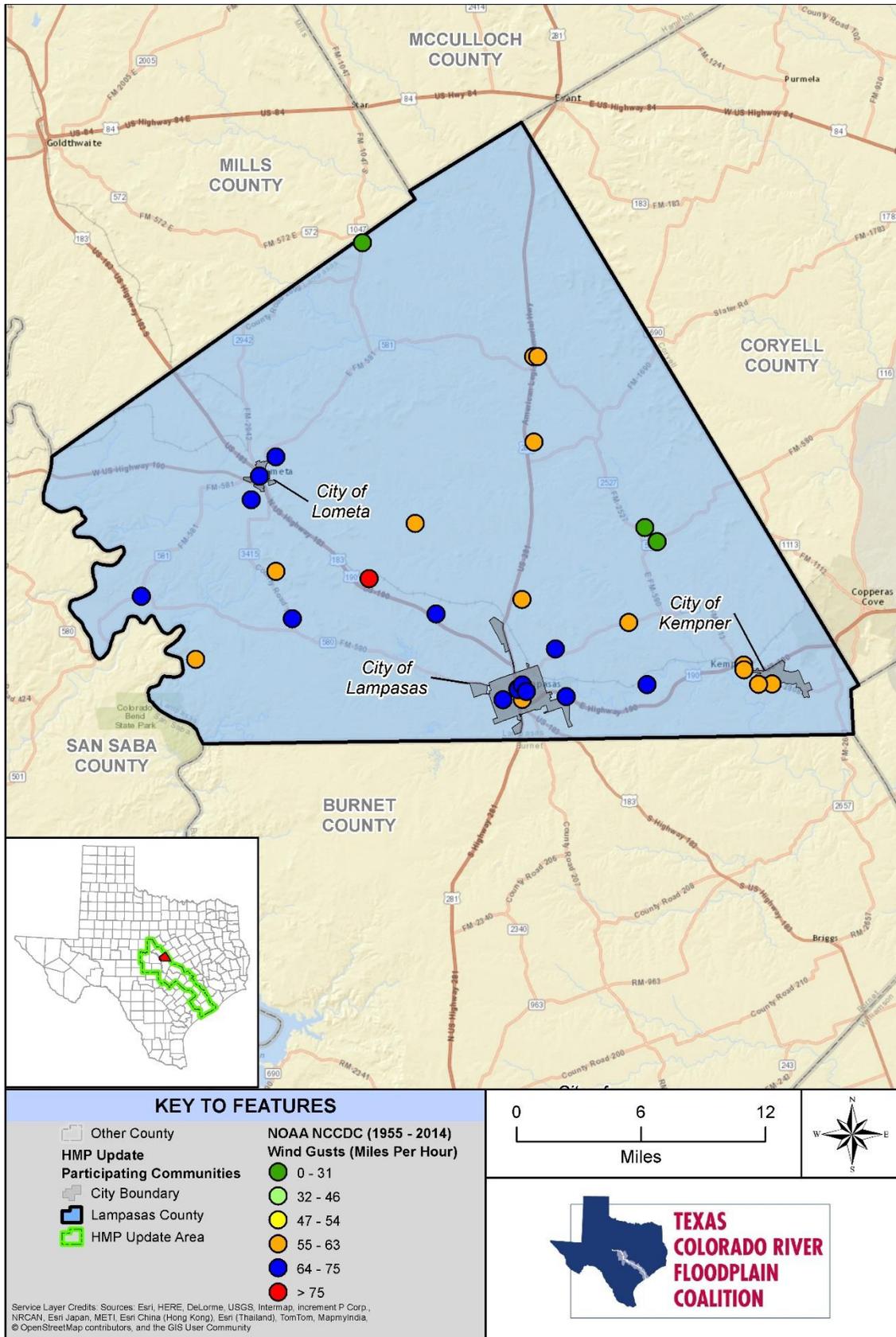


Figure 14-12. Damaging Wind Events in Lampasas County (1955-2014)

### **14.2.3 Frequency**

#### ***Thunderstorms and Lightning***

To date, there has been only one reported lightning strike resulting in property damage in Lampasas County. Texas ranks as one of the highest in lightning fatalities in the nation. Lampasas 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 84 hailstorm events over a 54-year period, significant hail occurs more than once per year on average and is considered highly likely.

#### ***Winds***

Based on 67 events in 64 years, a damaging high-wind event occurs approximately every year to every other year on average in Lampasas County and is considered highly likely.

### **14.2.4 Severity**

#### ***Thunderstorms and Lightning***

Based on the information in this hazard profile, the risk of a damaging lightning event in Lampasas 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 significant event occurred on May 26, 1994. A severe thunderstorm that struck the City of Lometa was accompanied by wind-driven golf ball- to baseball-sized hail. Considerable damage was reported on the north side of structures, with penetration of roofs and even steel siding in one instance. Crops in the area of the wind-driven hail were destroyed. Estimated damages were over \$500,000.

Based on the information in this hazard profile, the severity of hail storms is limited (less than 10% of property damaged) and the overall significance is medium with moderate potential impact.

#### ***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 Lampasas 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 14-13). 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.

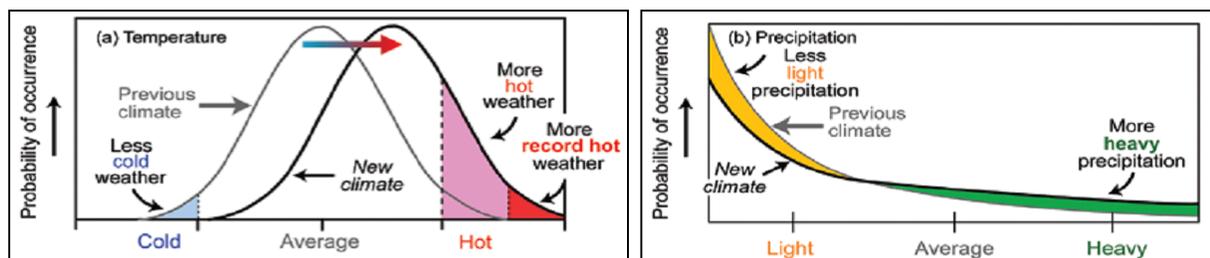


Figure 14-13. Severe Weather Probabilities in Warmer Climates

## 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 Lampasas County HAZUS 2.2 inventory data (updated with 2010 U.S. Census data and 2014 RS Means Square Foot Costs), there are 8,457 buildings within the Lampasas County with an asset replaceable value of approximately \$1.8 billion (excluding contents). About 99% of these buildings (and 86% of the building value) are associated with residential housing. Within the participating communities, there are 7,771 buildings (residential, commercial, and other) with a total asset inventory value of over \$1.7 billion (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 building code 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.

	Exposed Value	Annualized Loss	Annualized Loss Percentage
City of Kempner	\$158,651,717	\$840	<0.01%
City of Lampasas	\$1,183,059,355	\$22,606	<0.01%
City of Lometa	\$89,375,627	\$215	<0.01%
Unincorporated Area	\$1,372,828,808	\$2,528,636	0.18%
<b>Planning Area Total</b>	<b>\$2,803,915,507</b>	<b>\$2,552,297</b>	<b>0.09%</b>

### 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 possibly 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 planning partners have already 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	
Lampasas County	High
City of Kempner	Medium
City of Lampasas	Medium
City of Lometa	High

## 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.

<b>TABLE 15-1. ENHANCED FUJITA SCALE DAMAGE INDICATORS</b>			
<b>No.</b>	<b>Damage Indicator</b>	<b>No.</b>	<b>Damage Indicator</b>
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

<b>TABLE 15-2. THE FUJITA SCALE AND ENHANCED FUJITA SCALE</b>						
<b>Fujita (F) Scale</b>			<b>Derived</b>		<b>Operational Enhanced Fujita (EF) Scale</b>	
<b>F Number</b>	<b>Fastest ¼ mile (mph)</b>	<b>3-second gust (mph)</b>	<b>EF Number</b>	<b>3-second gust (mph)</b>	<b>EF Number</b>	<b>3-second gusts (mph)</b>
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

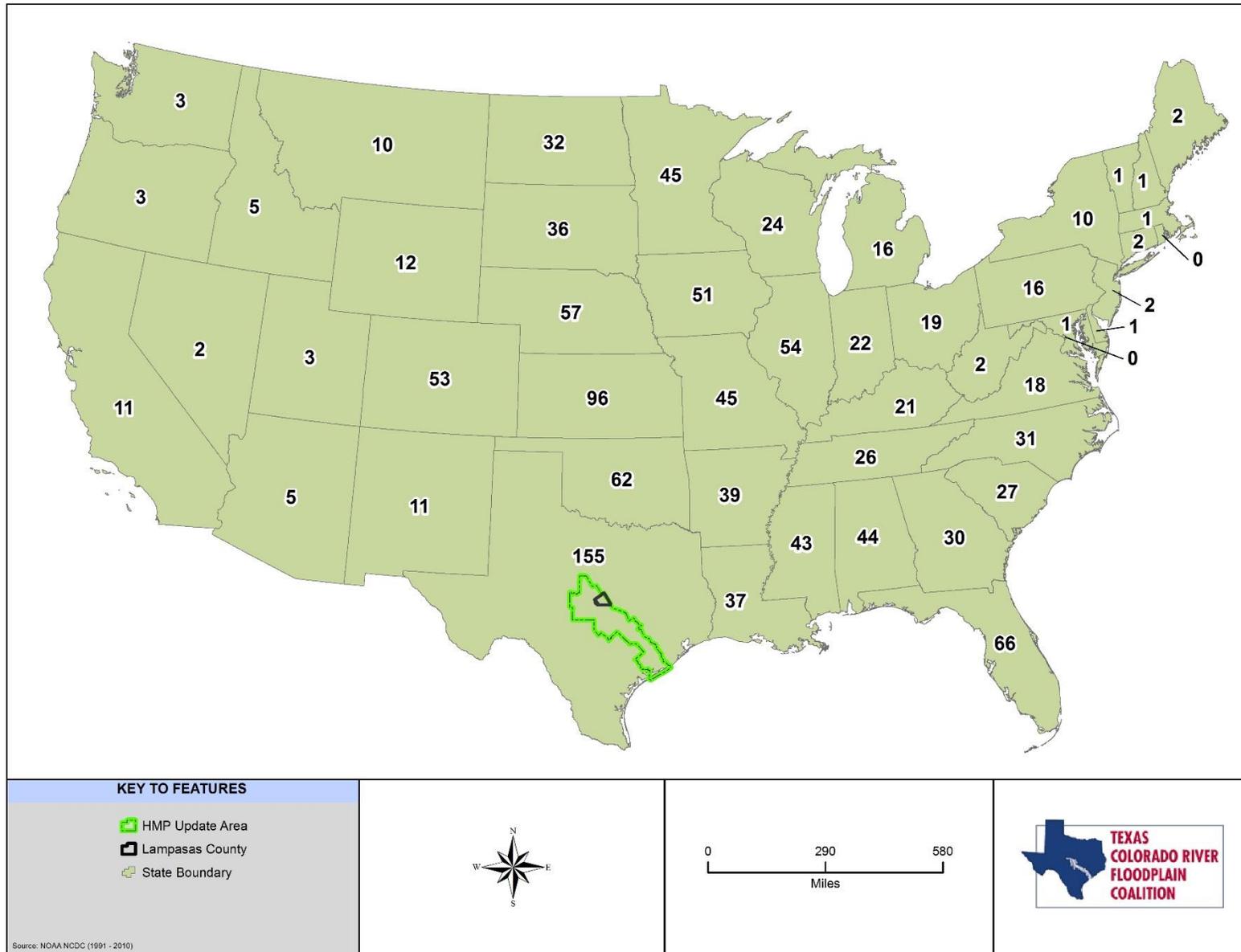


Figure 15-1. Annual Average Number of Tornadoes in the U.S. (1991-2010)

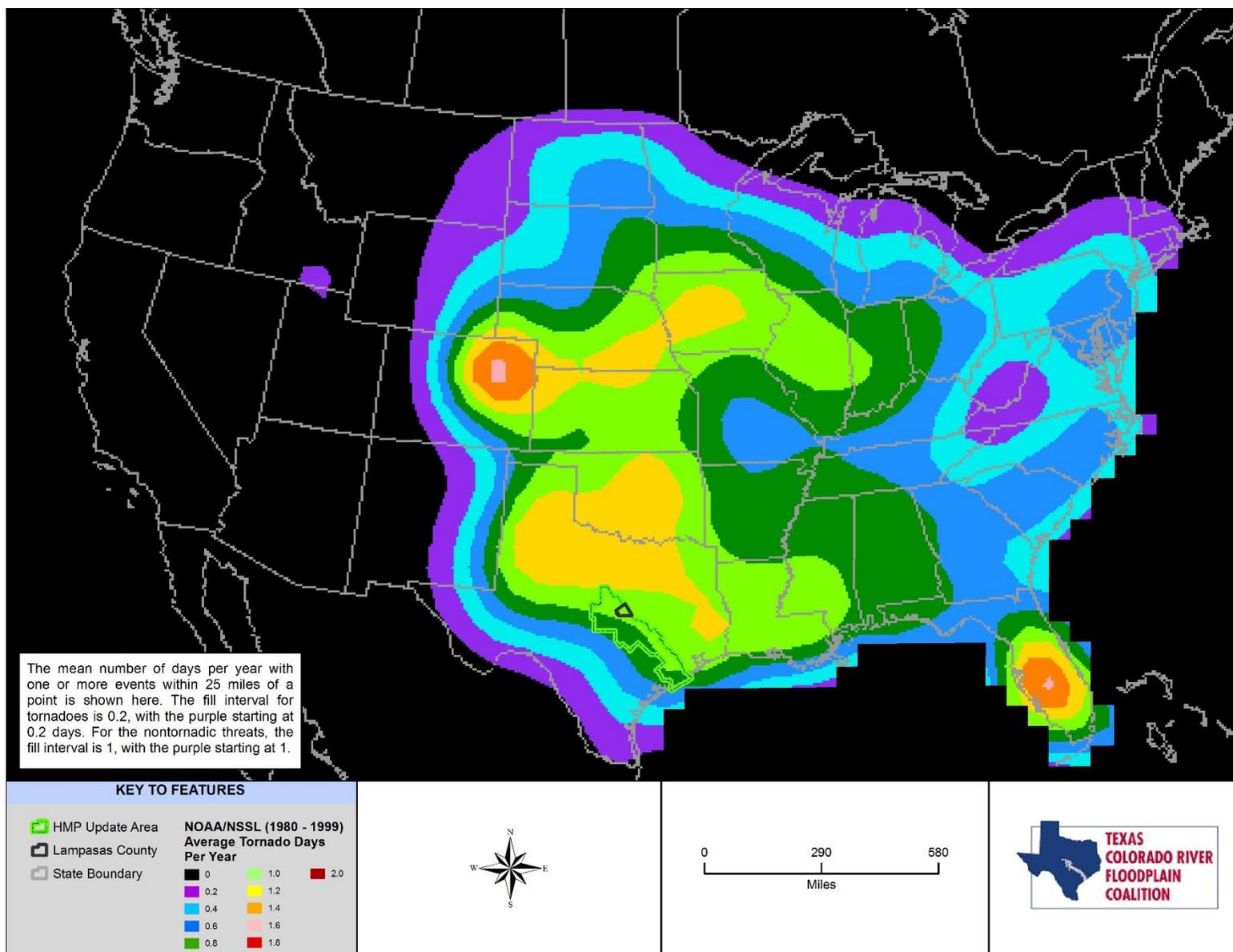


Figure 15-2. Total Annual Threat of Tornado Events in the U.S. (1980-1999)

## 15.2 HAZARD PROFILE

### 15.2.1 Past Events

Table 15-3 lists tornadoes in Lampasas County recorded by the NOAA Storm Event Center from 1950 to 2014. Of the 12 recorded tornadoes, 5 tornadoes caused property damage. In addition, there was one reported injury, but no fatalities. Six 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.

Location	Date	Category	Estimated Damage Cost			
			Property	Crops	Injuries	Deaths
Lampasas County	5/1/1956	F1	\$25,000	\$0	0	0
Lampasas County	5/25/1957	F1	\$250	\$0	0	0
Lampasas County	1/18/1968	F1	\$2,500	\$0	0	0
Lampasas County	5/24/1973	F2	\$25,000	\$0	0	0
Lampasas County	5/5/1976	F1	\$0	\$0	0	0
Lampasas County	5/15/1981	F1	\$0	\$0	0	0
Lampasas	10/18/1993	F0	\$0	\$0	0	0
Lometa	10/18/1993	F0	\$0	\$0	0	0
Kempner	5/26/1994	F0	\$0	\$0	0	0
Lampasas	2/22/2000	F0	\$0	\$0	0	0
Kempner	4/28/2006	F0	\$0	\$0	0	0
Kempner	6/17/2007	EF0	\$100,000	\$0	1	0

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

### 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.

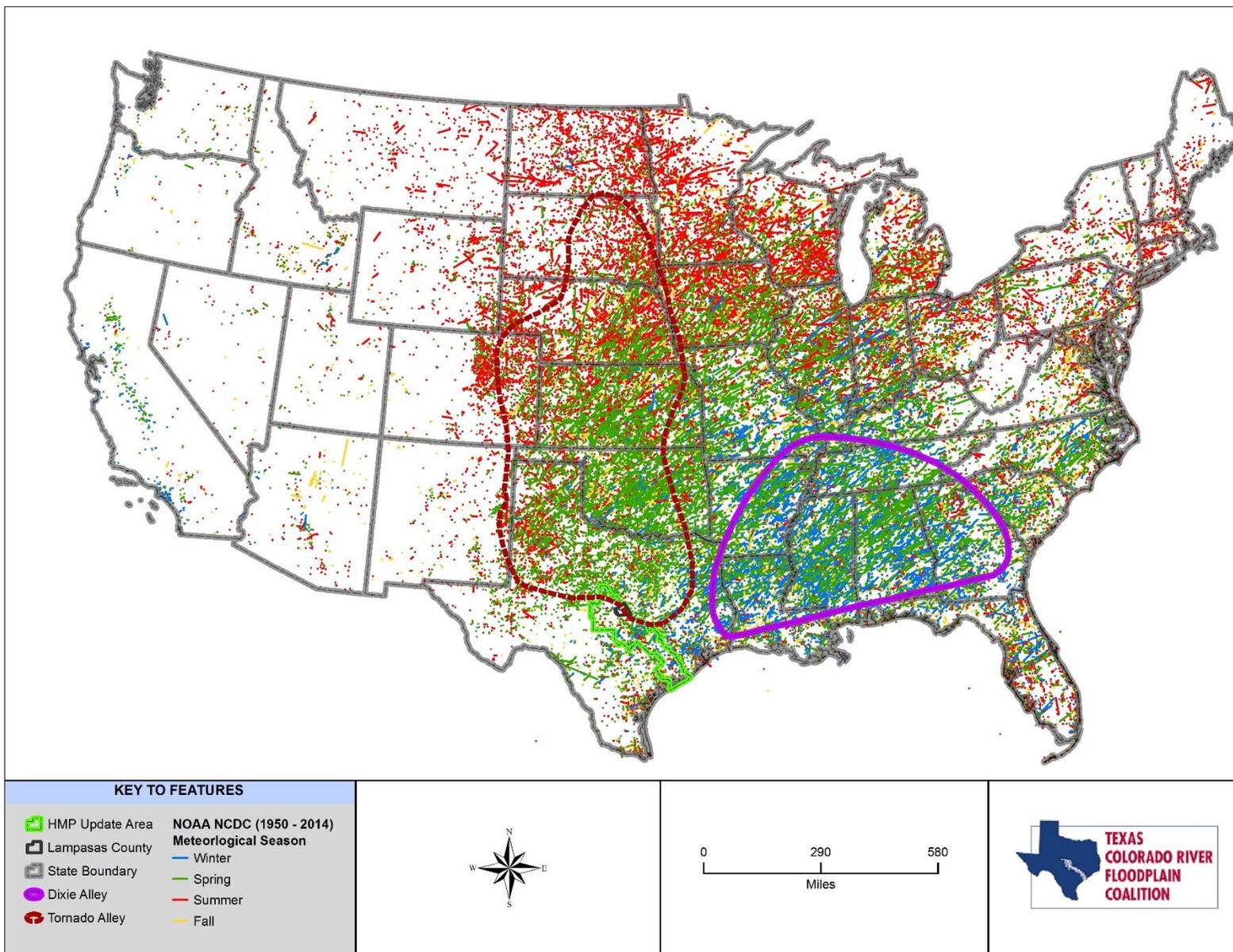


Figure 15-3. Tornado Paths in the U.S. (1950-2014)

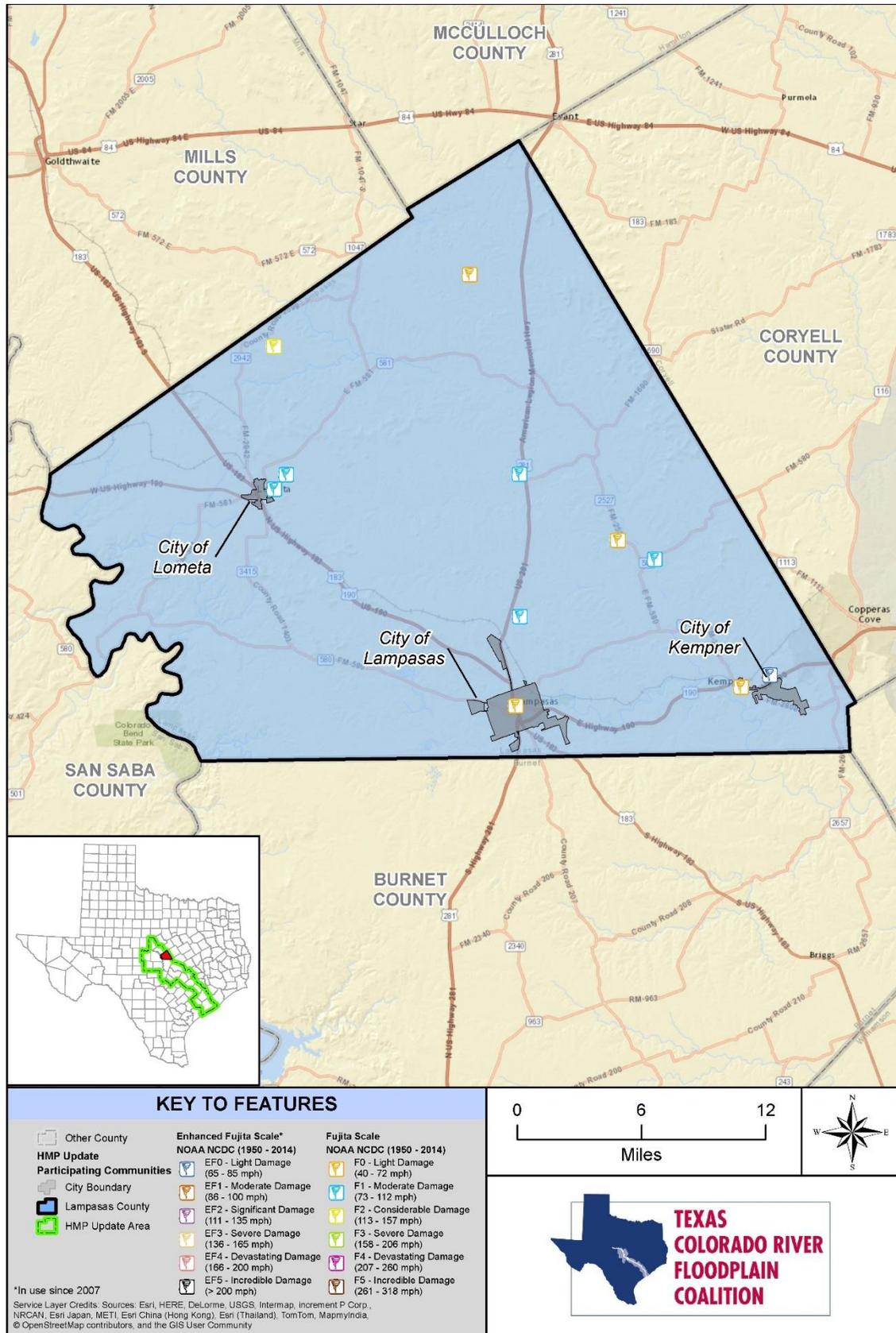


Figure 15-4. Tornado Events in Lampasas County (1950-2014)

### **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 6 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 Lampasas 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 Lampasas 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 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. HAZMAT 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).

## **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 Lampasas County HAZUS 2.2 inventory data (updated with 2010 U.S. Census data and 2014 RS Means Square Foot Costs), there are 8,457 buildings within the Lampasas County with an asset replaceable value of approximately \$1.8 billion (excluding contents). About 99% of these buildings (and 86% of the building value) are associated with residential housing. Within the participating communities, there are 7,771 buildings (residential, commercial, and other) with a total asset inventory value of over \$1.7 billion (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.

<b>TABLE 15-4. LOSS ESTIMATES FOR TORNADO EVENTS</b>			
Jurisdiction	Exposed Value	Annualized Loss	Annualized Loss Percentage
City of Kempner	\$158,651,717	Negligible	<0.01%
City of Lampasas	\$1,183,059,355	\$108	<0.01%
City of Lometa	\$89,375,627	Negligible	<0.01%
Unincorporated Area	\$1,372,828,808	\$12,106	<0.01%
<b>Planning Area Total</b>	<b>\$2,803,915,507</b>	<b>\$12,214</b>	<b>&lt;0.01%</b>

### 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	
Lampasas County	Medium
City of Kempner	Medium
City of Lampasas	Medium
City of Lometa	High

## 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 Lampasas County***

Fire protection in Lampasas 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.

<b>TABLE 16-1. FIRE PROTECTION SERVICES IN LAMPASAS COUNTY</b>				
Fire Protection Service	Unincorporated Area	City of Kempner	City of Lampasas	City of Lometa
Local Volunteer Fire Department	Yes	Yes	Yes	Yes
National Park Service	Yes	No	No	No
Bureau of Land Management	Yes	No	No	No
Texas Commission on Environmental Quality	Yes	Yes	Yes	Yes
Texas Forest Service	Yes	Yes	Yes	Yes
AgriLife	Yes	Yes	Yes	Yes
Texas Parks and Wildlife Department	Yes	Yes	Yes	Yes
Texas Interagency Coordination Center	Yes	Yes	Yes	Yes
U.S. Fish and Wildlife Service	Yes	No	No	No
U.S. Forest Service	Yes	No	No	No

***Vegetation Classes in Lampasas County***

General vegetation for Lampasas 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).

<b>TABLE 16-2. VEGETATION CLASSES IN LAMPASAS COUNTY</b>		
Class	Acres	% of Area
Barren Land (Rock/Sand/Clay)	494	0.11
Deciduous Forest	33,333	7.32
Developed Land	17,340	3.81
Evergreen Forest	63,887	14.03
Grassland	337,751	74.18
Marshland	1,384	0.30
Mixed Forest	14	0.00
Water	1,131	0.25
<b>Total</b>	<b>455,334</b>	<b>100</b>

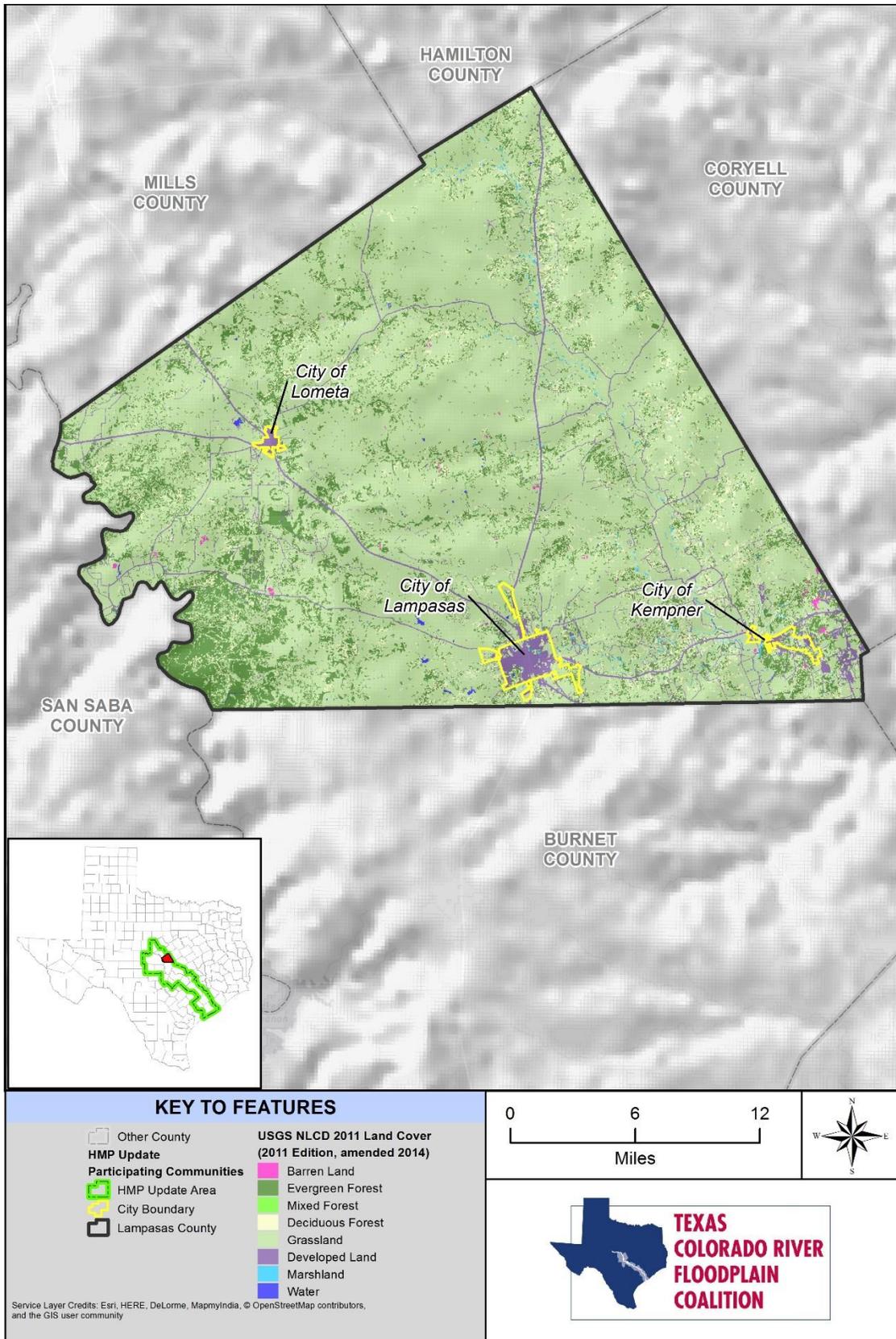


Figure 16-1. Vegetation Types in Lampasas County

## 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 Lampasas County were available. Figure 16-2 shows the locations of federally reported wildfires in Lampasas County, documented by federal and state agencies from 1980 through 2013.

<b>TABLE 16-3. HISTORIC WILDFIRE EVENTS IN LAMPASAS COUNTY (50+ ACRES) (1980-2014)</b>				
Fire ID	Name	Cause	Start Date	Acres
71130	Oak Valley	Debris burning	7/5/2005	300
40425	1255 & 1281 nix area	Miscellaneous	12/28/2005	100
40449	CR 1377	Debris burning	1/1/2006	150
40465	CR 1415	Debris burning	1/8/2006	100
40494	CR 2400 & 2579	Railroads	1/28/2006	120
21873	CR 2579	Railroads	1/29/2006	75
679040	N/A	Miscellaneous	3/2/2006	50
15001151	N/A	Missing/Not Specified	3/2/2006	125
556	CR 419 Fire	Miscellaneous	3/20/2006	100
38445	CR 1415	Debris burning	3/20/2006	125
46461	CR 3500	Debris burning	4/22/2006	75
71819	1202 CR 1403	Miscellaneous	8/5/2006	50
1452	Monaham Fire	Miscellaneous	8/8/2006	1250
184734	CR 4700	Miscellaneous	6/7/2008	50
184736	Harmon Rd & FM 580	Miscellaneous	6/11/2008	50
73825	Spivey	Miscellaneous	7/22/2008	214
73937	Stiffemire	Miscellaneous	8/3/2008	100
74460	Cedar Creek Fire	Miscellaneous	1/19/2009	60
197703	CR 1415	Debris burning	4/21/2009	80
217869	CR 2275	Lightning	8/23/2009	75
201396825	N/A	Debris Burning	1/25/2010	200
201405969	N/A	Debris Burning	1/22/2011	600
201406410	N/A	Equipment Use	1/28/2011	150
201337461	N/A	Debris Burning	3/24/2011	180
201414400	N/A	Railroad	6/16/2011	50
201338688	N/A	Miscellaneous	7/20/2011	202
201338848	N/A	Miscellaneous	8/3/2011	60

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

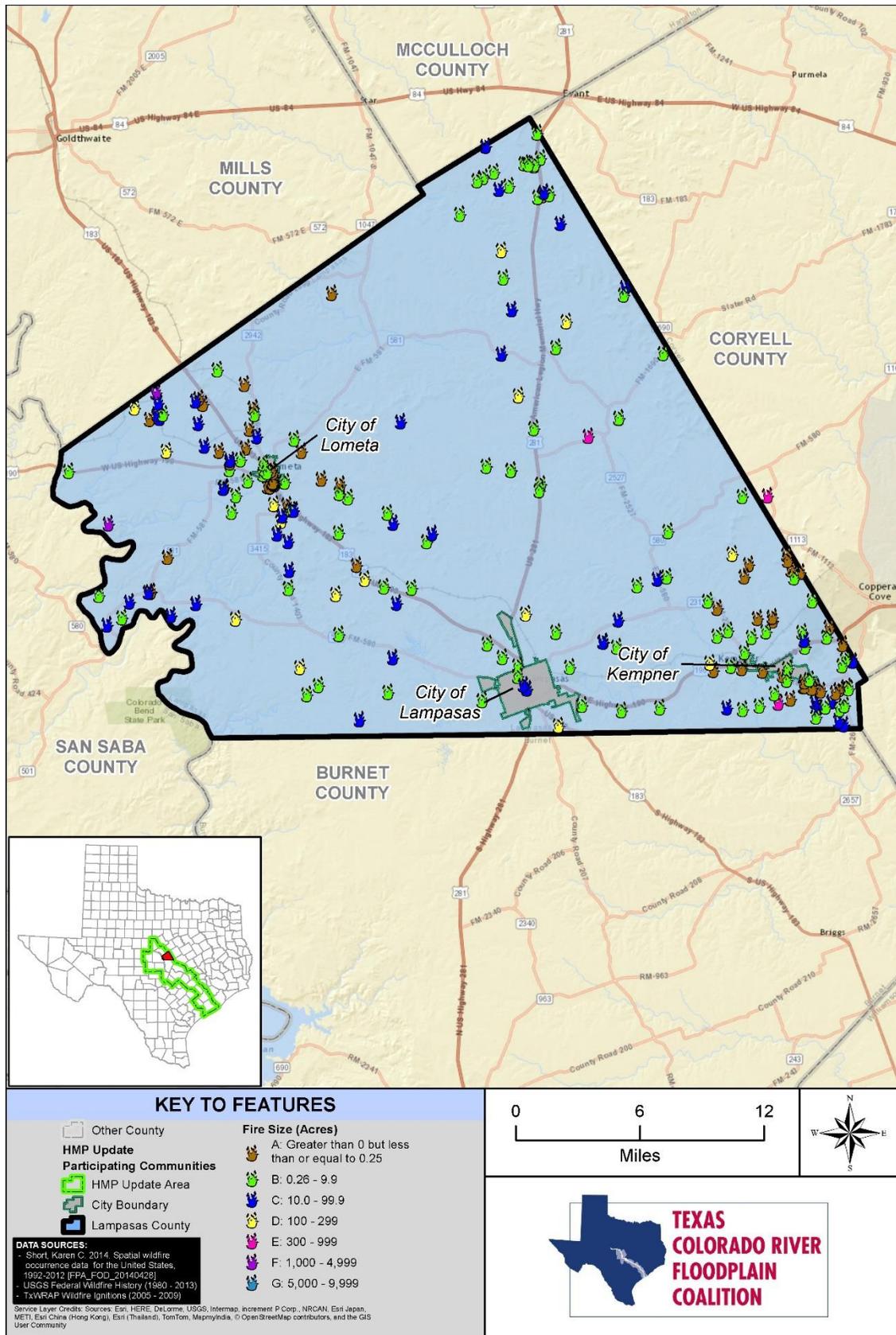


Figure 16-2. Wildfires in Lampasas County (1980-2014)

## 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 Lampasas County, the Texas A&M Forest Service Wildfire Risk Assessment Portal (TxWRAP) estimated that 17,547 people or 84% of the total county population (20,901) 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 Lampasas County housing density within the WUI.

The TxWRAP report for Lampasas 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 Lampasas County.

According to the TxWRAP report for Lampasas 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 Lampasas County.

The TxWRAP report for Lampasas 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 Lampasas 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 through Figure 16-11 maps the WHP for Lampasas County and each partner community 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.

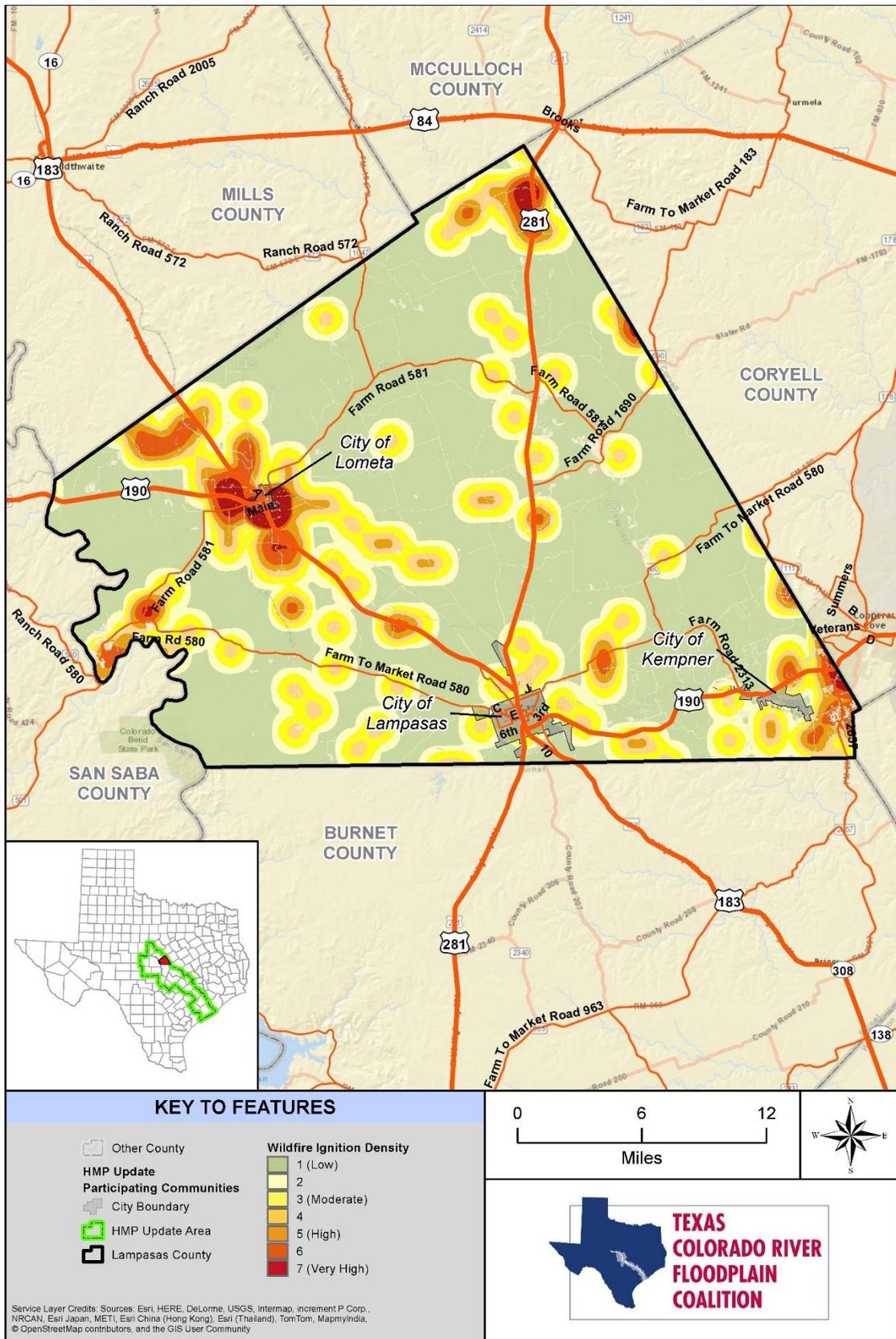


Figure 16-3. Lampasas County Wildfire Ignitions Distribution

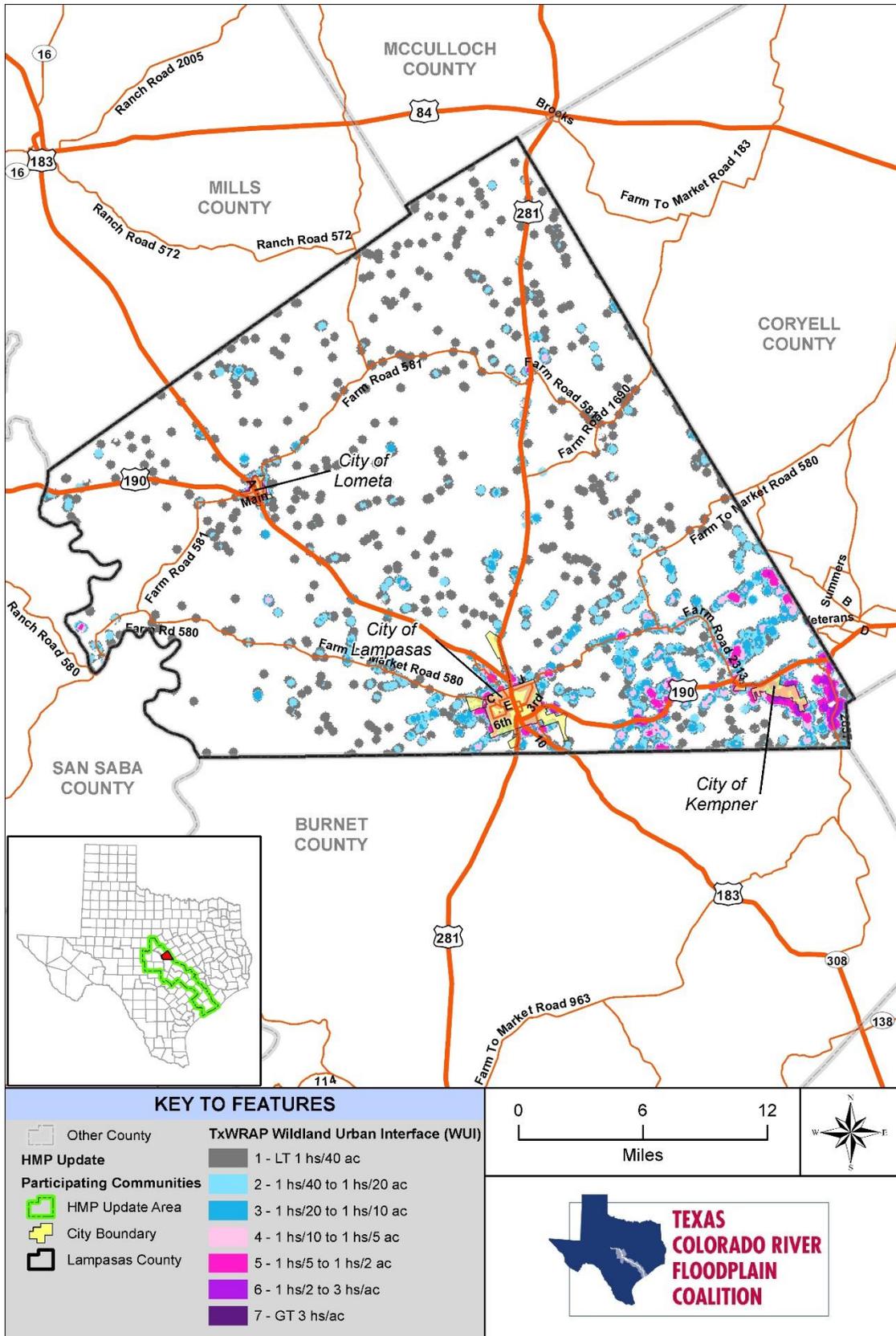


Figure 16-4. Lampasas County Wildland Urban Interface

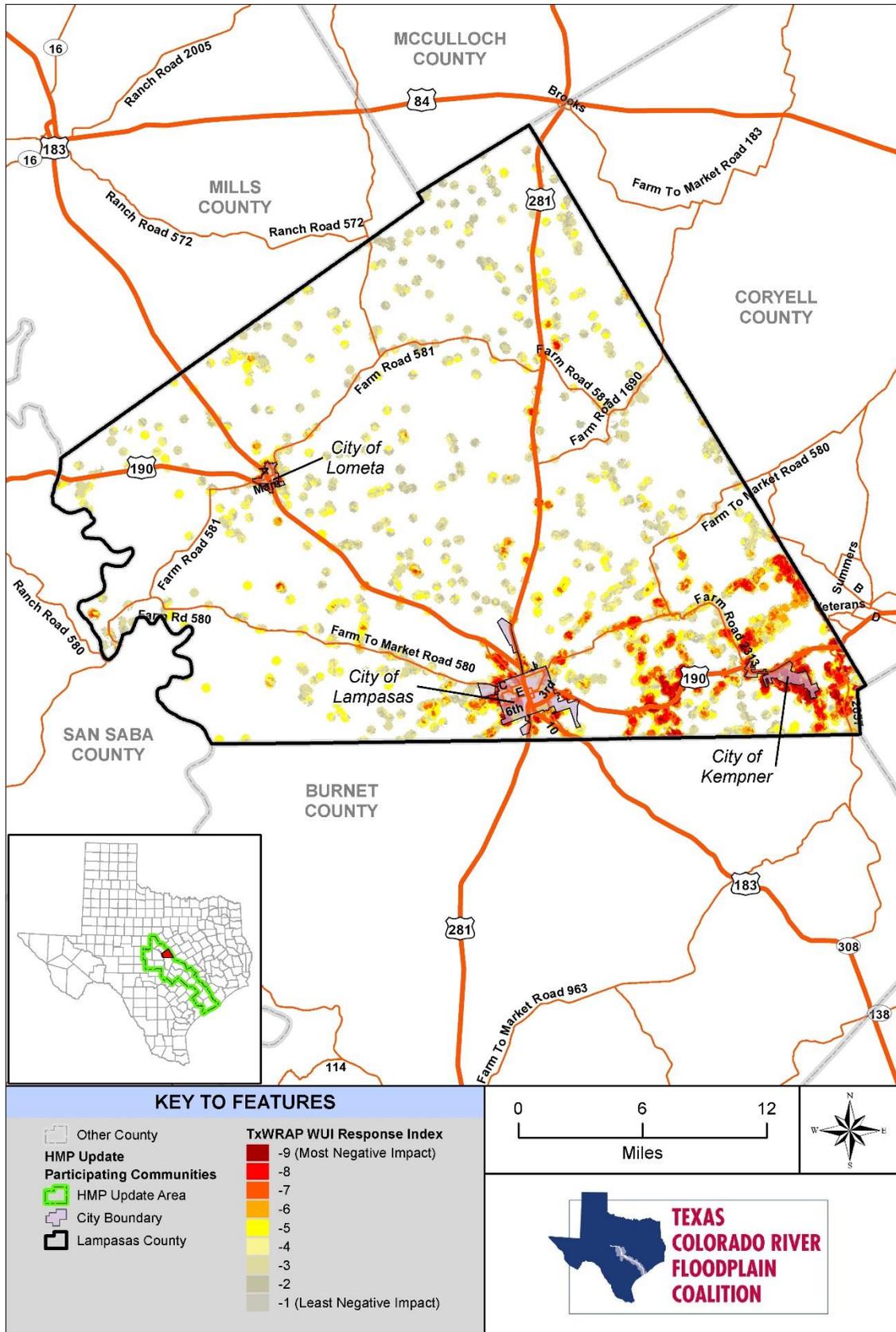


Figure 16-5. Lampasas County Wildland Urban Interface Response Index

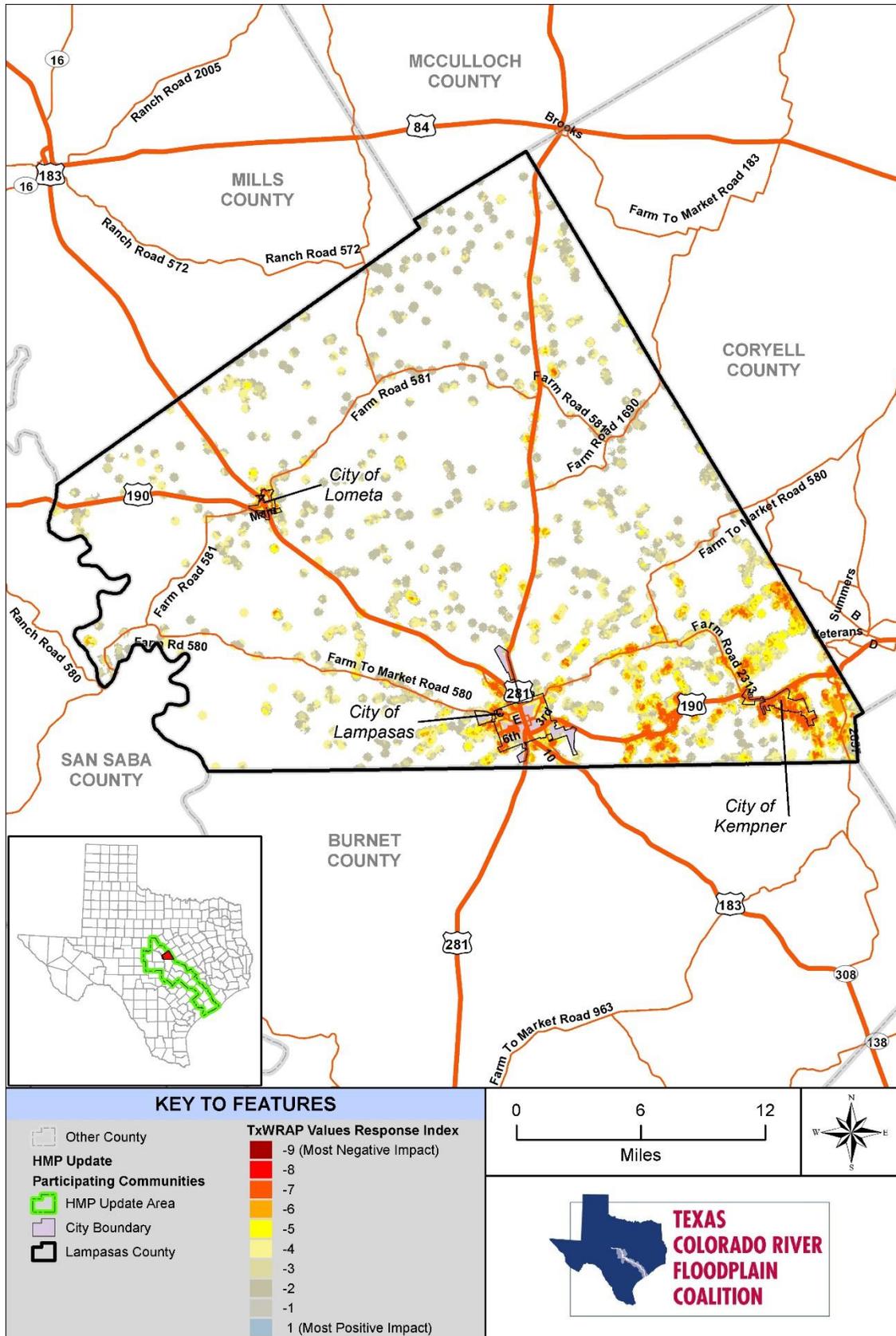


Figure 16-6. Lampasas County Wildfire Values Response Index

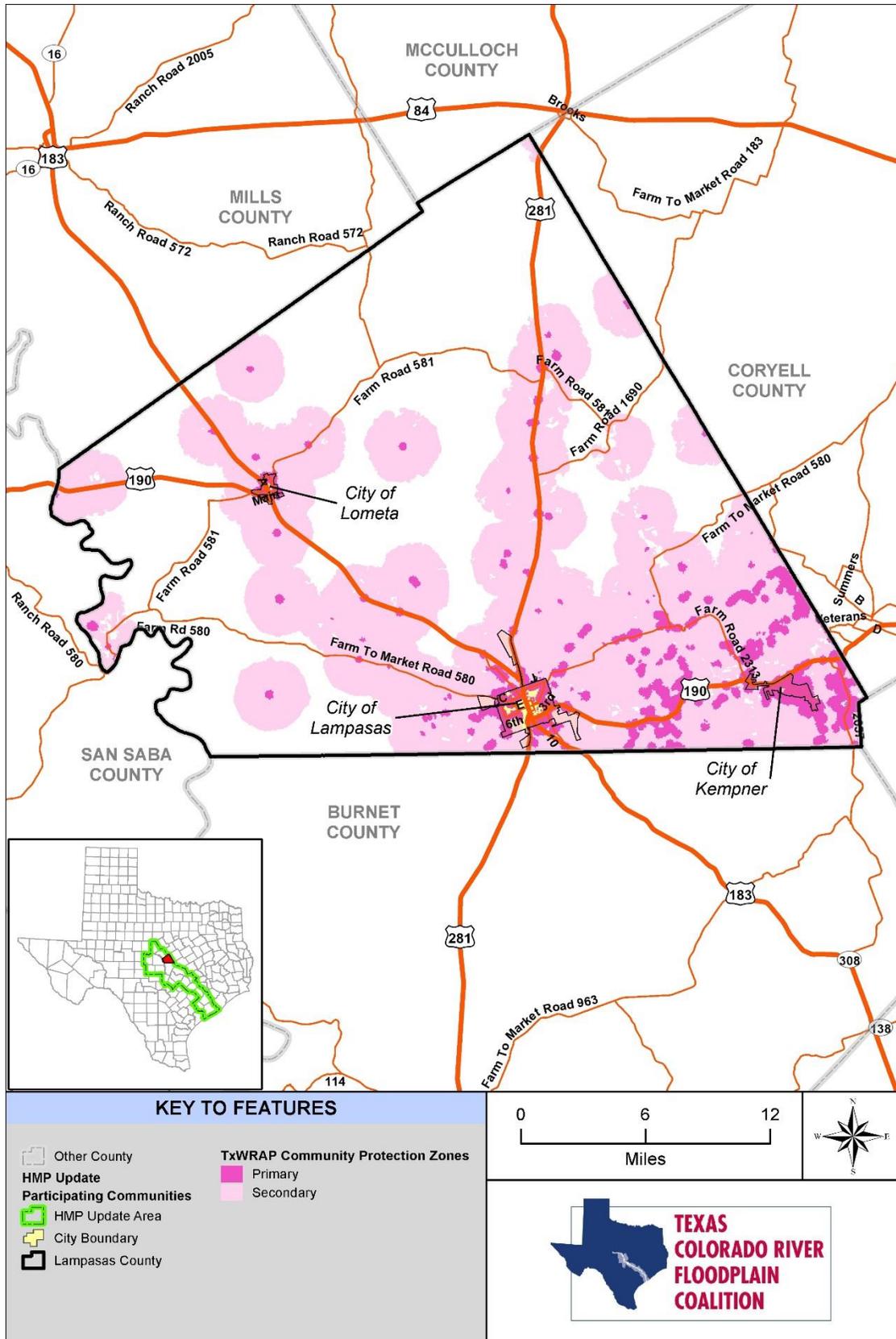


Figure 16-7. Lampasas County Wildfire Community Protection Zones

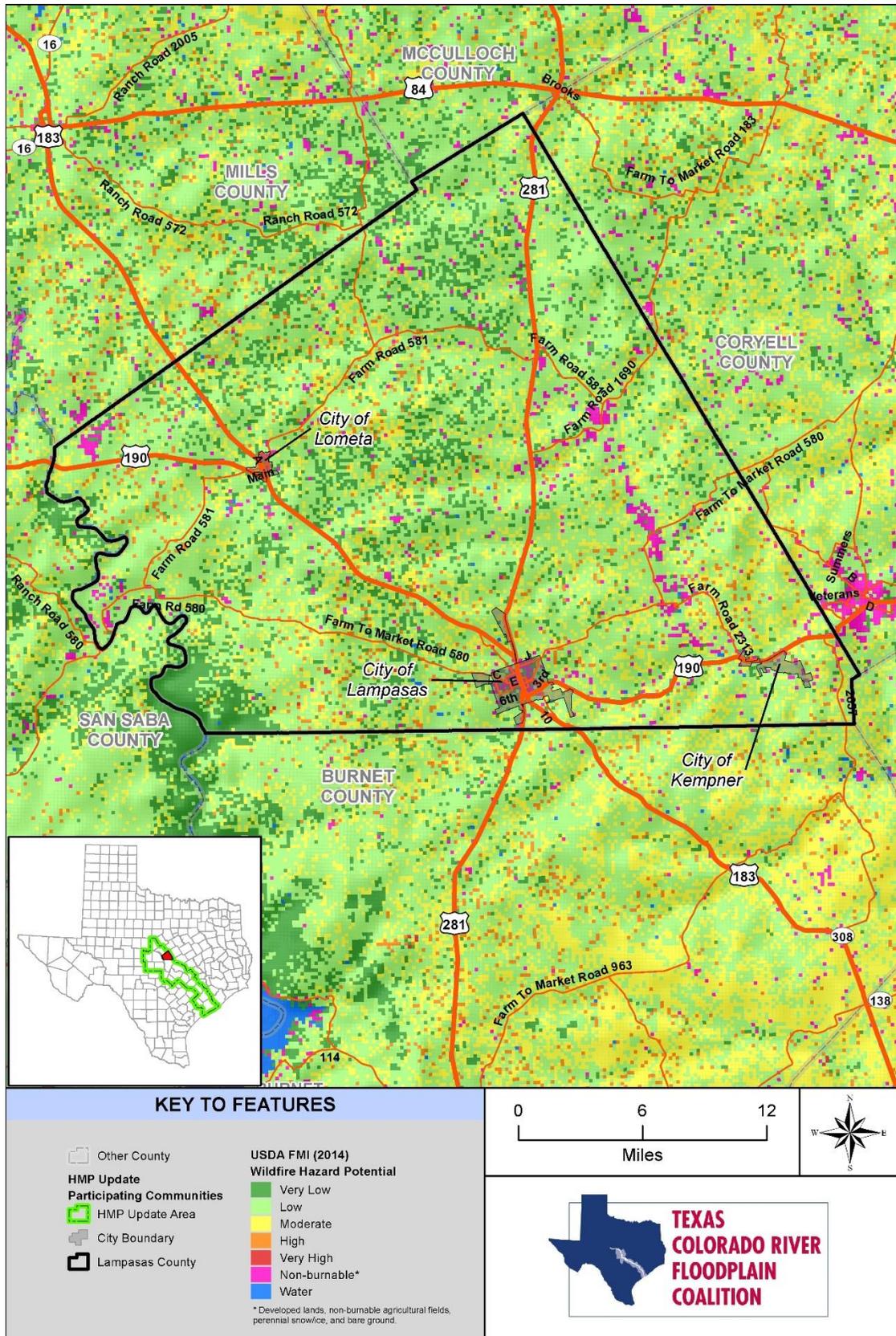


Figure 16-8. Lampasas County Wildfire Hazard Potential

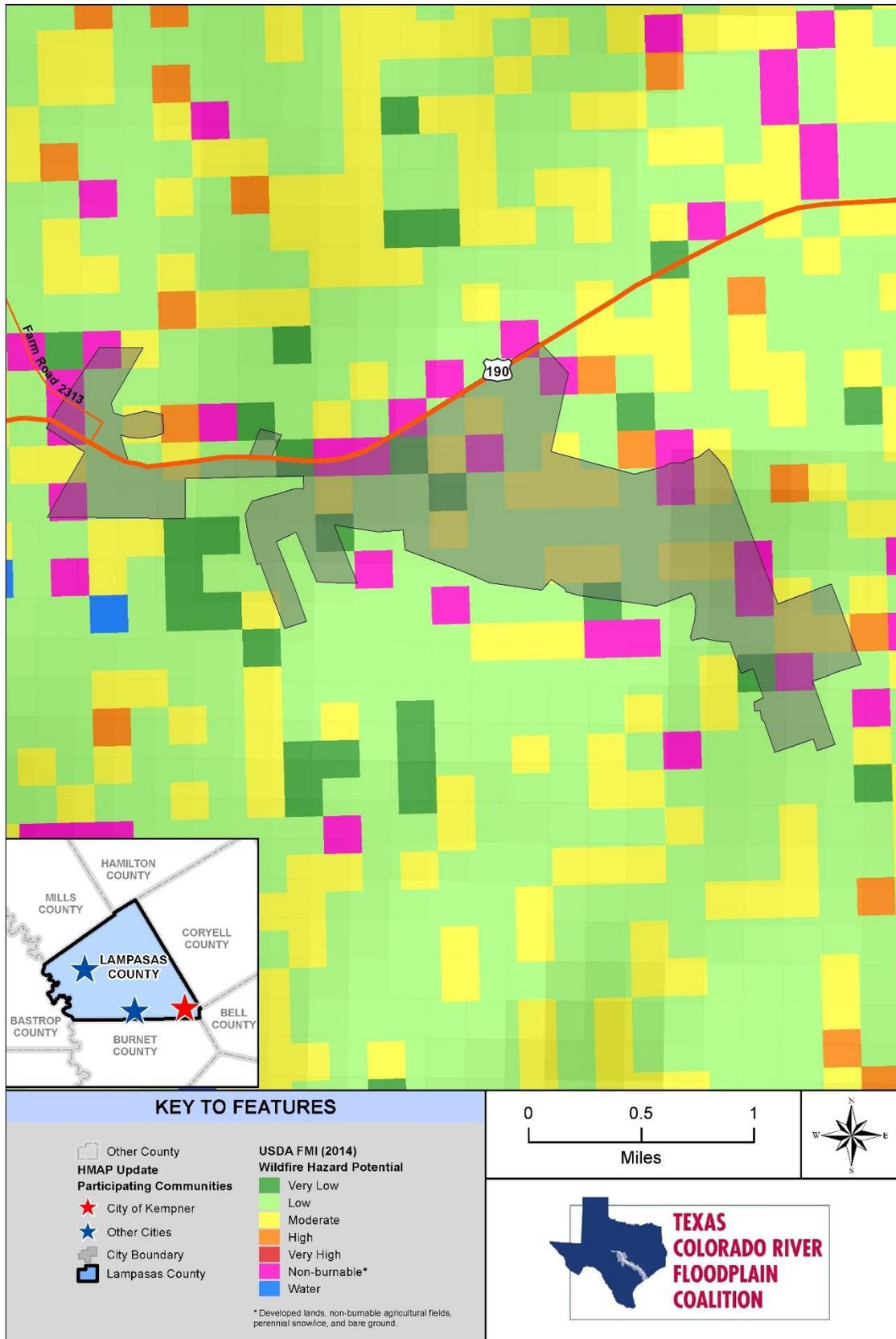


Figure 16-9. City of Kempner Wildfire Hazard Potential

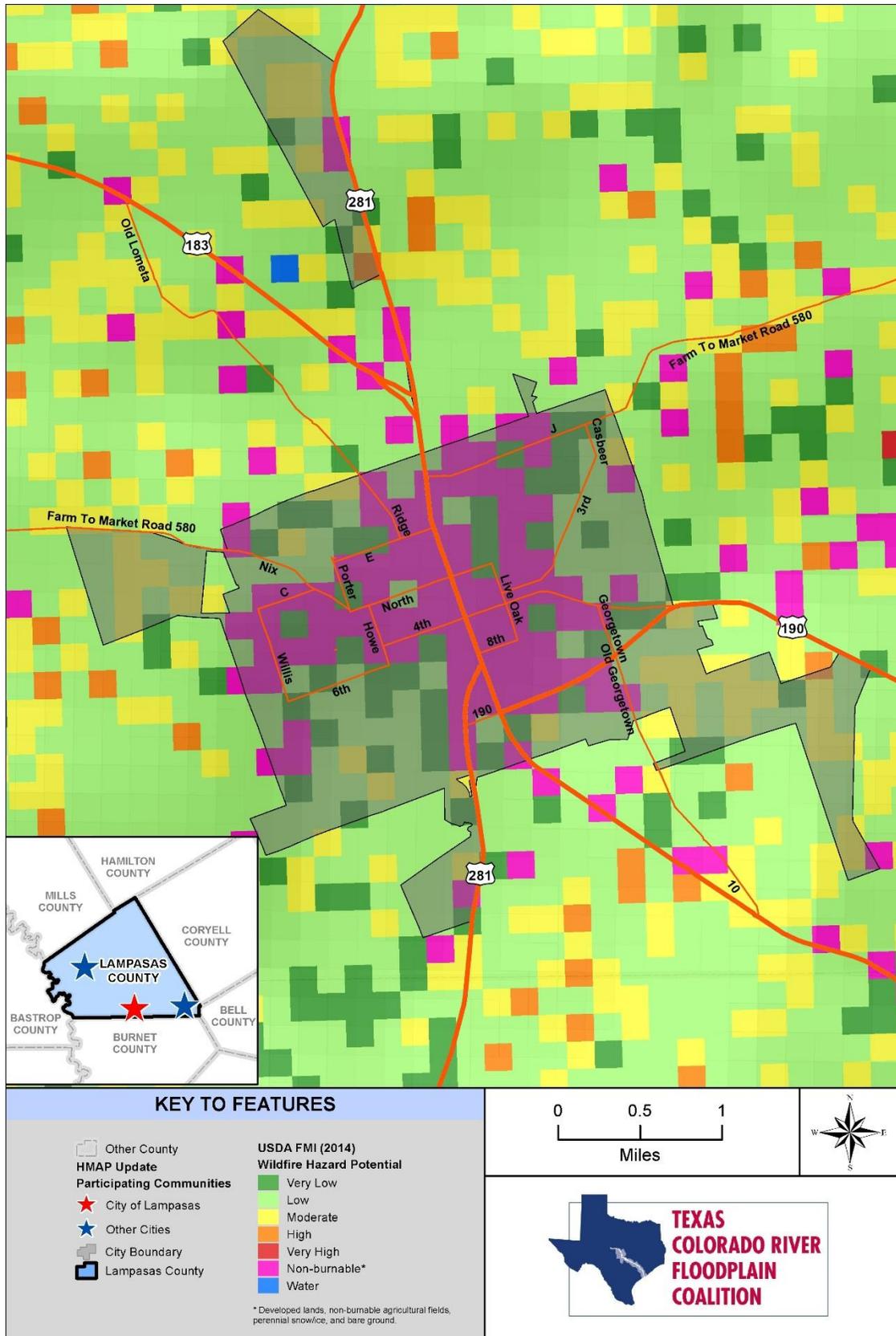


Figure 16-10. City of Lampasas Wildfire Hazard Potential

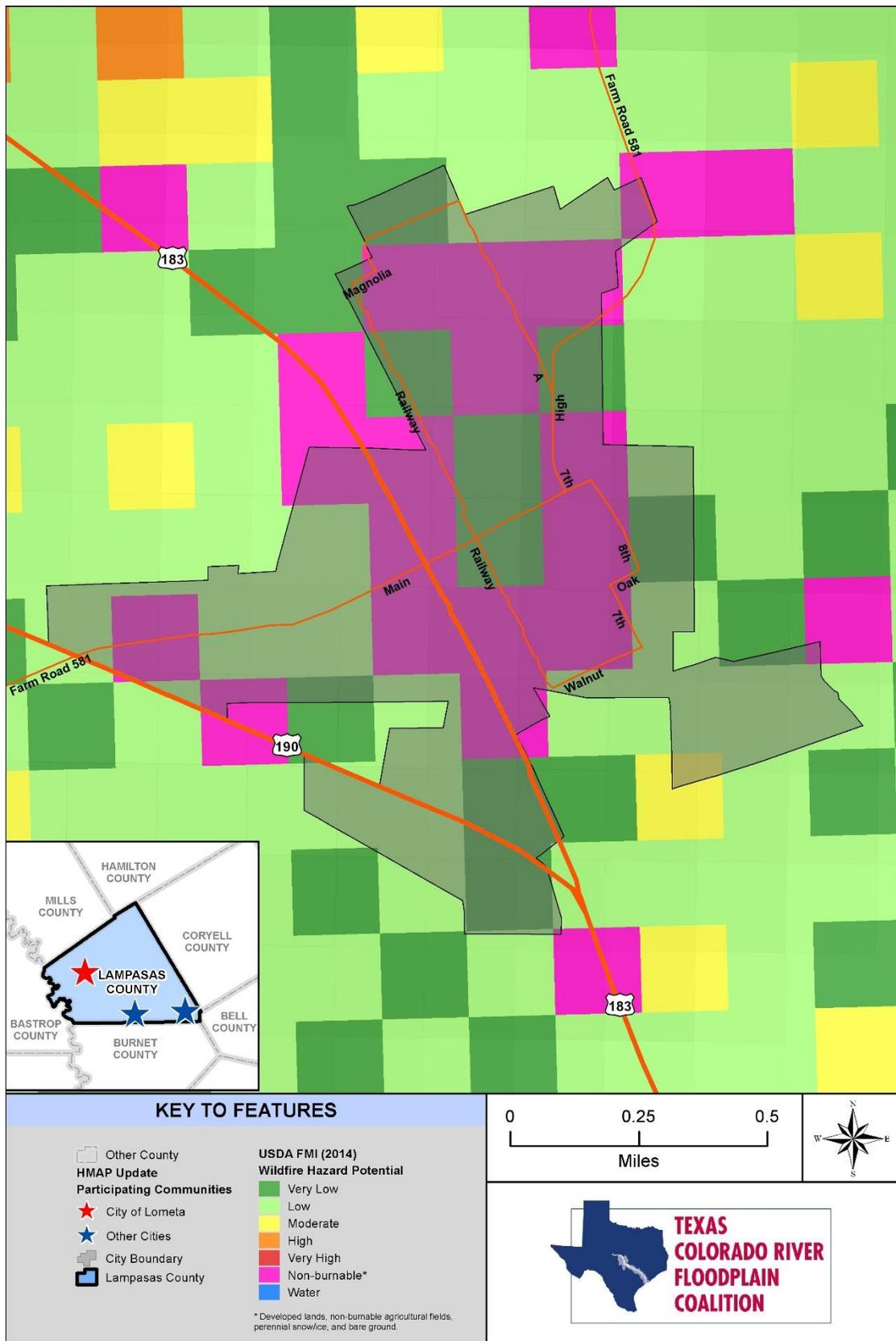


Figure 16-11. City of Lometa Wildfire Hazard Potential

### **16.2.3 Frequency**

According to the TFS, there is a 100% chance that at least one wildfire will occur each year in Lampasas 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.

	Non-Burnable*	Very Low	Low	Moderate	High	Very High	Total
City of Kempner	170	53	646	218	2	0	<b>1,089</b>
City of Lampasas	4,160	1,243	1,074	231	3	0	<b>6,711</b>
City of Lometa	395	211	251	0	0	0	<b>857</b>
Unincorporated Area	531	650	5,940	2,978	395	3	<b>10,497</b>
<b>Planning Area Total</b>	<b>5,256</b>	<b>2,157</b>	<b>7,911</b>	<b>3,427</b>	<b>400</b>	<b>3</b>	<b>19,154</b>

\* 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.

<b>TABLE 16-5. EXPOSURE AND VALUE OF STRUCTURES IN VERY LOW WILDFIRE RISK AREAS</b>					
	Exposed Buildings	Value Exposed (\$)			% of Total Assessed Value
		Structure	Contents	Total	
City of Kempner	24	4,854,800	2,947,534	<b>7,802,334</b>	4.92
City of Lampasas	466	116,410,890	66,687,861	<b>183,098,751</b>	15.48
City of Lometa	73	12,057,366	8,373,090	<b>20,430,456</b>	22.86
Unincorporated Area	334	63,194,026	35,500,552	<b>98,694,578</b>	7.19
<b>Planning Area Total</b>	<b>897</b>	<b>196,517,082</b>	<b>113,509,037</b>	<b>310,026,119</b>	<b>11.06</b>

<b>TABLE 16-6. EXPOSURE AND VALUE OF STRUCTURES IN LOW WILDFIRE RISK AREAS</b>					
	Exposed Buildings	Value Exposed (\$)			% of Total Assessed Value
		Structure	Contents	Total	
City of Kempner	278	55,173,745	30,323,842	<b>85,497,587</b>	53.89
City of Lampasas	448	113,856,668	68,377,163	<b>182,233,831</b>	15.40
City of Lometa	102	14,407,009	8,529,683	<b>22,936,692</b>	25.66
Unincorporated Area	2,693	509,960,501	272,076,841	<b>782,037,342</b>	56.97
<b>Planning Area Total</b>	<b>3,521</b>	<b>693,397,923</b>	<b>379,307,529</b>	<b>1,072,705,452</b>	<b>38.26</b>

**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 Kempner	100	20,021,931	12,017,618	<b>32,039,549</b>	20.19
City of Lampasas	76	18,310,652	10,185,801	<b>28,496,454</b>	2.41
City of Lometa	0	63	32	<b>95</b>	<0.01
Unincorporated Area	1,262	239,736,912	125,955,108	<b>365,692,020</b>	26.64
<b>Planning Area Total</b>	<b>1,438</b>	<b>278,069,558</b>	<b>148,158,558</b>	<b>426,228,118</b>	<b>15.20</b>

**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 Kempner	1	212,530	106,368	<b>318,898</b>	0.20
City of Lampasas	1	186,502	105,449	<b>291,952</b>	0.02
City of Lometa	0	0	0	<b>0</b>	0.00
Unincorporated Area	167	33,305,281	17,118,302	<b>50,423,582</b>	3.67
<b>Planning Area Total</b>	<b>169</b>	<b>33,704,313</b>	<b>17,330,119</b>	<b>51,034,432</b>	<b>1.82</b>

<b>TABLE 16-9. EXPOSURE AND VALUE OF STRUCTURES IN VERY HIGH WILDFIRE RISK AREAS</b>					
	Exposed Buildings	Value Exposed (\$)			% of Total Assessed Value
		Structure	Contents	Total	
City of Kempner	0	0	0	<b>0</b>	0.00
City of Lampasas	0	0	0	<b>0</b>	0.00
City of Lometa	0	0	0	<b>0</b>	0.00
Unincorporated Area	1	246,951	135,056	<b>382,007</b>	0.03
<b>Planning Area Total</b>	<b>1</b>	<b>246,951</b>	<b>135,056</b>	<b>382,007</b>	<b>0.01</b>

**Present Land Use**

Present land use for each wildfire risk area is described in Table 16-10.

<b>TABLE 16-10. WILDFIRE RISK AREAS IN PRESENT LAND COVERAGE FOR LAMPASAS COUNTY</b>					
Present Land Cover Class	Wildfire Risk Class and Area (acres)				
	Very Low	Low	Moderate	High	Very High
Barren Land (Rock/Sand/Clay)	24	295	77	10	0
Deciduous Forest	3,092	17,287	9,893	2,363	29
Developed Land	2,065	9,094	2,704	246	4
Evergreen Forest	11,363	31,930	15,843	3,765	34
Grassland	46,205	217,367	53,976	7,460	149
Marshland	246	693	319	27	0
Mixed Forest	2	6	5	1	0
Open Water	209	413	138	28	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	1	1	0	0	0
Protective Functions	0	0	0	0	0
Schools	1	0	0	0	0
Hazardous Materials	1	3	0	0	0
Bridges	7	37	16	2	0
Water Storage	0	0	0	0	0
Wastewater	0	0	0	0	0
Power	0	0	0	0	0
Communications	0	2	0	0	0
Transportation	0	0	0	0	0
Dams	2	6	3	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.

Jurisdiction	Exposed Value	Annualized Loss	Annualized Loss Percentage
City of Kempner	\$19,456,401	Negligible	Negligible
City of Lampasas	\$29,689,666	Negligible	Negligible
City of Lometa	\$2,498,005	Negligible	Negligible
Unincorporated Area	\$226,432,713	\$15,009	<0.01%
<b>Planning Area Total</b>	<b>\$278,076,785</b>	<b>\$15,009</b>	<b>&lt;0.01%</b>

### 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 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 combustibile 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	
Lampasas County	Low
City of Kempner	Low
City of Lampasas	Medium
City of Lometa	Low

## 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 Lampasas 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

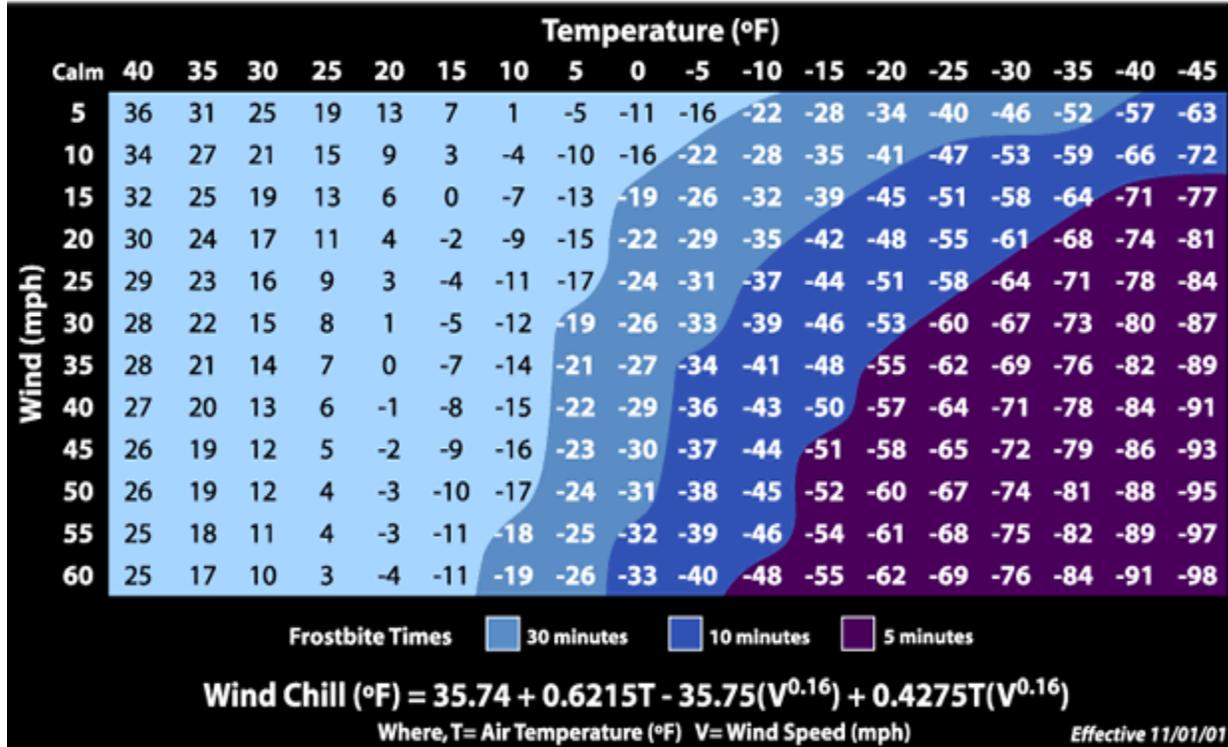


Figure 17-1. National Weather Service Wind Chill Chart

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 Lampasas weather station.

Statistic	Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High Annual Minimum	1910-2009	26	33	38	48	56	66	70	71	65	61	39	28
Low Annual Minimum	1910-2009	-12	-11	12	24	34	47	52	48	33	20	12	-7
Average Annual Minimum	1910-2009	15.7	19.4	25.3	33.6	45.4	57.2	63.3	61.7	49.1	36.0	24.7	18.5
Average Days Annually with Minimum Below 32	1897-2012	17.3	11.5	5.8	1.0	0.0	0.0	0.0	0.0	0.0	0.7	6.6	15.2

Note: All temperatures are in degrees Fahrenheit.

Few areas of Texas escape freezing weather in any winter. Lampasas 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 18 winter weather events that impacted Lampasas County between 1996 and 2014. These events and estimated damage costs are outlined in Table 17-2. Lampasas County does not experience severe winter weather events consistently, but winter storms can affect Lampasas County.

**TABLE 17-2.  
HISTORIC WINTER WEATHER EVENTS IN LAMPASAS COUNTY (1996-2014)**

Location	Date	Event Type	Estimated Damage Cost			
			Property	Crops	Injuries	Deaths
Lampasas (Zone)	11/24/1996	Winter Storm	\$0	\$0	0	0
Lampasas (Zone)	01/12/1997	Winter Weather	\$0	\$0	0	0
Lampasas (Zone)	12/22/1998	Ice Storm	\$0	\$0	0	0
Lampasas (Zone)	01/25/2000	Winter Storm	\$0	\$0	0	0
Lampasas (Zone)	12/12/2000	Winter Storm	\$0	\$0	0	0
Lampasas (Zone)	12/25/2000	Winter Storm	\$0	\$0	0	0
Lampasas (Zone)	12/31/2000	Winter Storm	\$0	\$0	0	0
Lampasas (Zone)	01/01/2001	Heavy Snow	\$0	\$0	0	0
Lampasas (Zone)	11/28/2001	Ice Storm	\$0	\$0	0	0
Lampasas (Zone)	02/24/2003	Winter Storm	\$271,500	\$0	0	0
Lampasas (Zone)	12/22/2004	Winter Weather	\$0	\$0	0	0
Lampasas (Zone)	12/07/2005	Winter Storm	\$0	\$0	0	0
Lampasas (Zone)	02/18/2006	Winter Weather	\$0	\$0	0	0
Lampasas (Zone)	01/14/2007	Ice Storm	\$21,746	\$0	0	0
Lampasas (Zone)	01/17/2007	Ice Storm	\$5,698	\$0	0	0
Lampasas (Zone)	04/07/2007	Winter Weather	\$2,727	\$0	0	0
Lampasas (Zone)	01/27/2009	Ice Storm	\$32,796	\$0	0	0
Lampasas (Zone)	12/24/2009	Winter Weather	\$64,935	\$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 58 freezing days annually. The average first freeze in Lampasas County usually occurs in early November and the last freeze occurs in late March to early April. 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. Highways 183, 190, and 281, FM 580, FM 581, FM 2313, and FM 2942 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 18 winter weather events from 1996 to 2014. Therefore, on average a winter storm occurs in the county once every year. In this region, the first autumn freeze ordinarily occurs in early November, and the last freeze in spring takes place in early April. 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 Lampasas 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 14-13). 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 Lampasas County HAZUS 2.2 inventory data (updated with 2010 U.S. Census data and 2014 RS Means Square Foot Costs), there are 8,457 buildings within the Lampasas County with an asset replaceable value of approximately \$1.8 billion (excluding contents). About 99% of these buildings (and 86% of the building value) are associated with residential housing. Within the participating communities, there are 7,771 buildings (residential, commercial, and other) with a total asset inventory value of over \$1.7 billion (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.

<b>TABLE 17-3. LOSS ESTIMATES FOR WINTER STORM EVENTS</b>			
	Exposed Value	Annualized Loss	Annualized Loss Percentage
City of Kempner	\$158,651,717	Negligible	Negligible
City of Lampasas	\$1,183,059,355	\$1,025	<0.01%
City of Lometa	\$89,375,627	Negligible	Negligible
Unincorporated Area	\$1,372,828,808	\$114,631	0.01%
<b>Planning Area Total</b>	<b>\$2,803,915,507</b>	<b>\$115,656</b>	<b>&lt;0.01%</b>

### 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 planning partners have 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**

Hazard	Lampasas County		City of Kempner		City of Lampasas		City of Lometa	
	High/Med/ Low/No	Probability Factor	High/Med/ Low/No	Probability Factor	High/Med/ Low/No	Probability Factor	High/Med/ Low/No	Probability Factor
Coastal Erosion	No	0	No	0	No	0	No	0
Dam/ Levee Failure	Medium	2	No	0	Medium	2	No	0
Drought	Medium	2	Medium	2	Medium	2	Medium	2
Earthquake	Low	1	Low	1	Low	1	Low	1
Expansive Soils	Low	1	Low	1	Low	1	Low	1
Extreme Heat	High	3	High	3	High	3	High	3
Flood	High	3	High	3	High	3	Medium	2
Hail	High	3	High	3	High	3	High	3
Hurricane/ Tropical Storm	Low	1	Low	1	Low	1	Low	1
Land Subsidence	Medium	2	Medium	2	Medium	2	Low	1
Lightning	High	3	High	3	High	3	High	3
Thunderstorm	High	3	High	3	High	3	High	3
Tornado	High	3	Medium	2	Medium	2	High	3

**TABLE 18-1.  
HAZARD PROBABILITY OF OCCURRENCE**

	Lampasas County		City of Kempner		City of Lampasas		City of Lometa	
Hazard	High/Med/ Low/No	Probability Factor	High/Med/ Low/No	Probability Factor	High/Med/ Low/No	Probability Factor	High/Med/ Low/No	Probability Factor
Wildfire	Medium	2	Medium	2	Medium	2	High	3
Wind	High	3	High	3	High	3	High	3
Winter Weather	Low	1	Medium	2	Low	1	Low	1

## 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								
	Lampasas County		City of Kempner		City of Lampasas		City of Lometa	
Hazard	High/Med /Low/No	Total Impact Factor	High/Med /Low/No	Total Impact Factor	High/Med /Low/No	Total Impact Factor	High/Med /Low/No	Total Impact Factor
Coastal Erosion	No	0	No	0	No	0	No	0
Dam/ Levee Failure	Low	3	No	0	High	9	No	0
Drought	Low	3	Low	3	Medium	6	High	9
Earthquake	Medium	6	Medium	6	High	9	Low	3
Expansive Soils	Low	3	Low	3	Low	3	Low	3
Extreme Heat	High	9	High	9	High	9	High	9
Flood	Medium	6	Medium	6	Medium	6	Low	3
Hail	Low	3	Low	3	Low	3	Low	3
Hurricane/ Tropical Storm	Low	3	Low	3	Low	3	Low	3
Land Subsidence	Low	3	Low	3	Low	3	Low	3
Lightning	Low	3	Low	3	Low	3	Low	3
Thunderstorm	Low	3	Low	3	Low	3	Medium	6
Tornado	High	9	High	9	High	9	High	9
Wildfire	Medium	6	Medium	6	Medium	6	Medium	6
Wind	Low	3	Low	3	Low	3	Medium	6
Winter Weather	Low	3	Low	3	Low	3	Low	3

<b>TABLE 18-3. IMPACT ON PROPERTY FROM HAZARDS</b>								
	Lampasas County		City of Kempner		City of Lampasas		City of Lometa	
Hazard	High/Med /Low/No	Total Impact Factor	High/Med /Low/No	Total Impact Factor	High/Med /Low/No	Total Impact Factor	High/Med /Low/No	Total Impact Factor
Coastal Erosion	No	0	No	0	No	0	No	0
Dam/ Levee Failure	Low	2	No	0	High	6	No	0
Drought	High	6	High	6	Low	2	High	6
Earthquake	High	6	High	6	High	6	Low	2
Expansive Soils	High	6	High	6	High	6	High	6
Extreme Heat	High	6	Medium	4	Low	2	Low	2
Flood	High	6	High	6	High	6	Low	2
Hail	Medium	4	Medium	4	Medium	4	Medium	4
Hurricane/ Tropical Storm	Low	2	Low	2	Low	2	Low	2
Land Subsidence	Low	2	Low	2	Low	2	Low	2
Lightning	Low	2	Low	2	Low	2	Low	2
Thunderstorm	Low	2	Low	2	Low	2	Low	2
Tornado	High	6	High	6	High	6	High	6
Wildfire	Medium	4	Medium	4	Medium	4	High	6
Wind	Medium	4	Medium	4	Medium	4	Medium	4
Winter Weather	Low	2	Low	2	Low	2	Low	2

<b>TABLE 18-4. IMPACT ON ECONOMY FROM HAZARDS</b>								
	Lampasas County		City of Kempner		City of Lampasas		City of Lometa	
Hazard	High/Med /Low/No	Total Impact Factor	High/Med /Low/No	Total Impact Factor	High/Med /Low/No	Total Impact Factor	High/Med /Low/No	Total Impact Factor
Coastal Erosion	No	0	No	0	No	0	No	0
Dam/ Levee Failure	Low	1	No	0	High	3	No	0
Drought	Medium	2	Medium	2	Medium	2	High	3
Earthquake	Low	1	Low	1	High	3	Low	1
Expansive Soils	High	3	High	3	High	3	High	3

**TABLE 18-4.  
IMPACT ON ECONOMY FROM HAZARDS**

	Lampasas County		City of Kempner		City of Lampasas		City of Lometa	
Hazard	High/Med /Low/No	Total Impact Factor						
Extreme Heat	Medium	2	Low	1	Medium	2	High	3
Flood	Medium	2	Medium	2	Medium	2	Low	1
Hail	Low	1	Low	1	Low	1	Low	1
Hurricane/ Tropical Storm	Low	1	Low	1	Low	1	Low	1
Land Subsidence	Low	1	Low	1	Low	1	Low	1
Lightning	Low	1	Low	1	Low	1	Low	1
Thunderstorm	Low	1	Low	1	Low	1	Low	1
Tornado	Medium	2	Medium	2	High	3	High	3
Wildfire	Low	1	Low	1	Medium	2	High	3
Wind	Low	1	Low	1	Low	1	Medium	2
Winter Weather	Low	1	Low	1	Low	1	Low	1

### 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 flood. Table 18-6 summarizes the hazard risk ranking.

**TABLE 18-5.  
HAZARD RISK RANKING CALCULATIONS**

	Lampasas County			City of Kempner			City of Lampasas			City of Lometa		
Hazard	Probability Factor	Impact Weighted Sum	Total	Probability Factor	Impact Weighted Sum	Total	Probability Factor	Impact Weighted Sum	Total	Probability Factor	Impact Weighted Sum	Total
Coastal Erosion	0	0	0	0	0	0	0	0	0	0	0	0
Dam/ Levee Failure	2	6	12	0	0	0	2	18	36	0	0	0
Drought	2	11	22	2	11	22	2	10	20	2	18	36
Earthquake	1	13	13	1	13	13	1	18	18	1	6	6

**TABLE 18-5.  
HAZARD RISK RANKING CALCULATIONS**

	Lampasas County			City of Kempner			City of Lampasas			City of Lometa		
Hazard	Probability Factor	Impact Weighted Sum	Total	Probability Factor	Impact Weighted Sum	Total	Probability Factor	Impact Weighted Sum	Total	Probability Factor	Impact Weighted Sum	Total
Expansive Soils	1	12	12	1	12	12	1	12	12	1	12	12
Extreme Heat	3	17	51	3	14	42	3	13	39	3	14	42
Flood	3	14	42	3	14	42	3	14	42	2	6	12
Hail	3	8	24	3	8	24	3	8	24	3	8	24
Hurricane/ Tropical Storm	1	6	6	1	6	6	1	6	6	1	6	6
Land Subsidence	2	6	12	2	6	12	2	6	12	1	6	6
Lightning	3	6	18	3	6	18	3	6	18	3	6	18
Thunderstorm	3	6	18	3	6	18	3	6	18	3	9	27
Tornado	3	17	51	2	17	34	2	18	36	3	18	54
Wildfire	2	11	22	2	11	22	2	12	24	3	15	45
Wind	3	8	24	2	8	16	3	11	33	3	12	36
Winter Weather	1	6	6	1	6	6	3	12	36	1	7	7

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	Lampasas County	City of Kempner	City of Lampasas	City of Lometa
Coastal Erosion	No Exposure	No Exposure	No Exposure	No Exposure
Dam/Levee Failure	Low	No Exposure	Medium	No Exposure
Drought	Medium	Medium	Medium	Medium
Earthquake	Low	Low	Low	Low
Expansive Soils	Low	Low	Low	Low
Extreme Heat	High	High	High	High
Flood	High	High	High	Low
Hail	Medium	Medium	Medium	Medium
Hurricane/ Tropical Storm	Low	Low	Low	Low
Land Subsidence	Low	Low	Low	Low
Lightning	Low	Low	Low	Low
Thunderstorm	Low	Low	Low	Medium
Tornado	High	Medium	Medium	High
Wildfire	Medium	Medium	Medium	High
Wind	Medium	Low	Medium	Medium
Winter Weather	Low	Low	Medium	Low



**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
<b>LAMPASAS COUNTY</b>																	
1	Dam/Levee Education	N/A	X														
2	Dam/Levee Monitoring	N/A	X														
3	Water Saving Techniques	N/A		X													
4	Drought Vulnerability	N/A		X													
5	Monitor At-Risk Areas	N/A			X	X					X						
6	Education for Earthquakes/Land Subsidence and Expansive Soils	N/A			X	X					X						
7	Extreme Weather Awareness	N/A					X										X
8	Heat Vulnerable Populations	N/A					X										
9	Drainage Issue on CR 1139	N/A						X									
10	Drainage/Flooding Issue on CR 4450	N/A						X									
11	Hazardous Weather Awareness	N/A							X	X		X	X	X		X	
12	Hurricane Community Risk	N/A								X							
13	Protecting Critical Facilities from Lightning	N/A										X					
14	Safe Room	N/A							X	X			X			X	
15	Reduce Roadway Impact/Winter Weather	N/A															X
16	Adopt Routine Fire Hydrant Maintenance	N/A													X		
17	County Burn Ban	N/A													X		
18	Ensure that Area Firefighters are Properly Trained in Current Firefighting Techniques, Covering both Urban and Wildland Fires	N/A													X		

**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
19	Mandate and Inspect to Ensure Standard Tie-down of Mobile Homes	N/A								X			X	X		X	
<b>CITY OF KEMPNER</b>																	
1	Wildfire Assistance	N/A														X	
2	Water Saving Techniques	N/A		X													
3	Monitor Water Supply	N/A		X													
4	Education for Earthquakes/Land Subsidence and Expansive Soils	N/A			X	X					X						
5	Monitor At-Risk Areas	N/A			X	X					X						
6	Extreme Weather Awareness	N/A					X										X
7	Heat Vulnerable Populations	N/A					X										
8	Curbing and Drainage	N/A						X									
9	Flood Insurance Program	N/A						X									
10	Hazardous Weather Awareness	N/A							X	X		X	X	X		X	
11	Hurricane Community Risk	N/A								X							
12	Protect Critical Facilities	N/A										X					
13	Safe Room	N/A							X	X			X	X		X	
14	Wildfire Education	N/A														X	
15	Develop a Mass Debris Removal Plan	N/A	X					X		X			X	X		X	X
16	National Weather Service's StormReady Program	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
17	Outdoor Warning Sirens	N/A											X	X		X	

**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
<b>CITY OF LAMPASAS</b>																	
1	Dam/Levee Education	N/A	X														
2	Revise Levee Standards	N/A	X														
3	Drought Education	N/A		X													
4	Drought Monitoring	N/A		X													
5	Natural Hazards Education	N/A			X	X	X	X	X	X	X	X	X	X	X	X	X
6	Enforcement of Building Codes	N/A	X		X	X		X	X	X	X	X	X	X	X	X	X
7	Create Areas of Refuge	N/A					X										
8	Low Water Crossing	N/A								X			X				
9	CERT	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
10	Adopt Routine Fire Hydrant Maintenance	N/A															X
11	Implement Burning Standards	N/A															X
12	Ensure that Area Firefighters are Properly Trained in Current Firefighting Techniques, Covering both Urban and Wildland Fires	N/A															X
13	Mandate and Inspect to Ensure Standard Tie-down of Mobile Homes	N/A								X			X	X			X
14	Secure Traffic Lights and Traffic Controls from High Winds	N/A								X							X
15	National Weather Service's StormReady Program	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<b>CITY OF LOMETA</b>																	
1	Water Saving Techniques	N/A	N/A	X													
2	Monitor Water Supply	N/A	N/A	X													

**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
3	Education for Earthquakes/Land Subsidence and Expansive Soils	N/A	N/A		X	X					X						
4	Monitor At-Risk Areas	N/A	N/A		X	X					X						
5	Extreme Weather Awareness	N/A	N/A				X										X
6	Heat Vulnerable Populations	N/A	N/A				X										
7	Curbing and Drainage	N/A	N/A					X					X				
8	National Flood Insurance Program	N/A	N/A					X									
9	Hazardous Weather Awareness	N/A	N/A						X	X		X	X	X		X	
10	Hurricane Community Risk	N/A	N/A							X							
11	Safe Room	N/A	N/A						X	X			X	X		X	
12	Wildfire Education	N/A	N/A														X
13	Wildfire Assistance MOUs	N/A	N/A														X
14	Protect Power Lines	N/A	N/A								X		X			X	X
15	Develop a Mass Debris Removal Plan	N/A	N/A					X		X			X	X		X	X
16	National Weather Service's StormReady Program	N/A	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X
17	Outdoor Warning Sirens	N/A	N/A							X			X	X		X	
18	Develop Evacuation Plans, Policies and Procedures	N/A	N/A							X			X	X		X	
19	CERT	N/A	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X
20	Xeriscape Planting	N/A	N/A	X			X										
CERT	Community Emergency Response Team																
MOU	Memorandum of Understanding																
N/A	Not Applicable																

**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
<b>LAMPASAS COUNTY</b>										
1	Dam/levee education	Encourage public awareness on local dam/levee structures and potential failures.	14	EAP	G1, G4, G6	1.1, 1.2, 1.3, 4.1, 4.3, 6.1, 6.4	<\$10,000	Grant Funding, General Revenue	Ongoing	Low
2	Dam/levee monitoring	Establish annual review of dam/levee conditions.	13	LPR	G1, G2, G4, G5, G6	1.2, 1.3, 2.3, 4.1, 5.1, 6.1	<\$10,000	Grant Funding, Donations	Ongoing	Low
3	Water saving techniques	Encourage residents to adopt water saving measures.	4	EAP	G3, G6	3.1, 3.2, 6.1, 6.2	<\$10,000	General Revenue, Grant Funding	Short Term	Medium
4	Drought vulnerability	Gathering and analyzing water and climate data to gain better understanding of local climate and drought history	7	LPR NSP	G1, G4, G6	1.2, 1.4, 4.1, 6.1, 6.2, 6.4	<\$10,000	General Revenue, Grant Funding	Long Term	Medium
5	Monitor risk areas	Monitor at-risk areas.	9	LPR	G1, G5, G6	1.1, 1.2, 5.2, 5.3, 6.1	>\$100,000	Grant Funding	Long Term	Low
6	Education for earthquakes/land subsidence and expansive soils	Encourage residents to participate in information sessions on risks to homes, businesses, and schools.	18	EAP	G1, G3, G4	1.1, 3.1, 3.2, 4.1	<\$10,000	Grant Funding	Long Term	Low
7	Extreme weather awareness	Encourage public education through local presentations and literature.	12	EAP	G1, G3, G6	1.1, 3.2, 6.1	< \$10,000	General Revenue, Grant Funding	Short Term	High

**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
8	Heat vulnerable populations	Prevent loss of life among the at-risk population located throughout the county.	8	LPR EAP	G1, G3, G4, G6	1.1, 3.1, 4.1, 4.2, 6.1	\$10,000 to \$100,000	General Revenue, Grant Funding, Donations	Ongoing	Low
9	Drainage issue on CR 1139	Survey drainage site and get cost estimate for replacement for larger capacity drainage.	2	NSP	G1, G4, G6	1.3, 4.3, 6.4	<\$10,000	General Revenue	Short Term	High
10	Drainage/flooding issue on CR 4450	Survey drainage site and get cost estimate for replacement for larger capacity drainage to prevent future flooding.	1	NSP	G1, G4, G6	1.3, 4.3, 6.4	<\$10,000	General Revenue	Short Term	High
11	Hazardous weather awareness	Increase public awareness of severe weather by encouraging participation in National Weather Service's SKYWARN training and providing take home materials.	11	EAP	G1, G3, G6	1.1, 1.2, 3.1, 3.2, 6.1	<\$10,000	General Revenue and Grants	Short Term	High
12	Hurricane community risk	Obtain weather information from local sources and the State Operations Center and determine local impact.	17	LPR	G1, G3, G5, G6	1.1, 1.2, 3.1, 5.1, 6.2	<\$10,000	N/A	Ongoing	Low
13	Protecting critical facilities from lightning	Protect critical facilities and equipment from lightning damage.	5	SIP	G4, G6	4.1, 4.3, 6.1	\$10,000 to \$100,000	General Revenue	Ongoing	Low
14	Safe room	Encourage residents to construct safe rooms inside and outside homes. Also require mobile home parks to provide safe storm shelters.	16	LPR	G4, G5, G6	4.1, 5.1, 6.1, 6.2, 6.4	>\$100,000	Private Funding, Grant Funding	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
15	Reduce roadway impact/winter weather	County Commissioners will acquire cost to purchase sanding equipment and storage sites for sand.	15	LPR	G1, G4, G5, G6	1.3, 4.3, 5.1, 6.4	>\$100,000	General Revenue	Short Term	Low
16	Adopt routine fire hydrant maintenance	Maintenance program is a risk reduction measure that combines prevention and mitigation strategies. A routine hydrant maintenance program will have a direct effect on the safety of firefighters.	6	SIP	G1	1.3, 1.4	<\$10,000	Fire Department Funding	Ongoing	High
17	County burn ban	County Fire Marshall will assess the conditions and advise the Commissioners' Court on appropriate action needed. This also includes establishing and implementing burning standards in community.	10	LPR EAP	G1, G3, G4, G6	1.1, 3.1, 3.1, 4.1, 6.1	<\$10,000	N/A	Ongoing	Medium
18	Ensure that area firefighters are properly trained in current firefighting techniques, covering both urban and wildland fires	Training will be routinely offered to firefighters.	3	LPR	G1, G4	1.4, 4.1	<\$10,000	County Funds, Grants	Ongoing	Medium
19	Mandate and inspect to ensure standard tie-down of mobile homes	Pass an ordinance that all mobile homes in the county must be tied-down and have annual inspections.	19	LPR SIP	G1, G4, G5, G6	1.3, 4.1, 4.3, 5.1, 6.2, 6.3, 6.4	<\$10,000	None Needed	Long Term	High

**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
<b>CITY OF KEMPNER</b>										
1	Wildfire assistance	Increase city's response to prevent further loss during wildfires.	9	LPR	G1, G4, G6	1.3, 1.4, 4.1, 6.1	Other	N/A	Long Term	High
2	Water saving techniques	Encourage residents to adopt water saving measures.	13	EAP	G3, G6	3.1, 3.2, 6.1, 6.2	<\$10,000	Grant Funding, Donations	Short Term	Medium
3	Monitor water supply	Provide early warning for a water shortage. Allows city officials to be proactive.	4	NSP	G1, G4, G6	1.2, 1.4, 4.1, 6.1, 6.2, 6.4	Other	General Revenue, Grant Funding	Ongoing	Medium
4	Education for earthquakes/land subsidence and expansive soils	Encourage residents to participate in information sessions on risks to homes, businesses, and schools.	17	LPR	G1, G3, G4	1.1, 3.1, 3.2, 4.1	<\$10,000	Grant Funding	Long Term	Low
5	Monitor risk areas	Monitor at-risk areas.	7	LPR	G1, G5, G6	1.1, 1.2, 5.2, 5.3, 6.1	Other	Grant Funding	Long Term	Low
6	Extreme weather awareness	Encourage public education through local presentations and literature. Develop a pamphlet and public awareness campaign including radio messages.	8	EAP	G1, G3, G6	1.1, 3.2, 6.1	<\$10,000	General Revenue, Grant Funding	Short Term	High
7	Heat vulnerable populations	Prevent loss of life among the at-risk population.	12	LPR	G1, G3, G4, G6	1.1, 3.1, 4.1, 4.2, 6.1	<\$10,000	General Revenue, Grant Funds, Donations	Ongoing	Low

**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
8	Curbing and drainage	City will assess the cost and engineering designs for future plans to install these infrastructure items.	1	SIP	G1, G2, G5, G6	1.3, 1.4, 2.1, 5.1, 6.1	>\$100,000	General Revenue, TXDOT Funding	Long Term	High
9	Flood Insurance Program	Reduce economic impact of floods. Meeting NFIP requirements will reduce the threat to life and property.	5	LPR	G1, G2, G4, G6	1.3, 1.4, 2.1, 4.1, 6.4	Other	General Revenue	Long Term	High
10	Hazardous weather awareness	Increase public awareness of severe weather by encouraging participation in National Weather Service's SKYWARN training and providing take home materials.	6	EAP	G1, G3, G6	1.1, 1.2, 3.1, 3.2, 6.1	<\$10,000	General Revenue and Grants	Short Term	High
11	Hurricane community risk	Obtain weather information from local sources and the State Operations Center and determine local impact.	16	LPR	G1, G3, G5, G6	1.1, 1.2, 3.1, 5.1, 6.2	Other	General Revenue	Long Term	Low
12	Protect critical facilities	Prevent city from losing critical facilities, for example, water plant.	2	SIP	G1, G4, G6	1.4, 4.1, 6.1	Other	Grant Funding	Long Term	Low
13	Safe room	Encourage residents to construct safe rooms inside and outside homes.	11	LPR	G4, G5, G6	4.1, 5.1, 6.1, 6.2, 6.4	\$10,000 to \$100,000	Private Funding, Grant Funding	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
14	Wildfire education	Local volunteer fire department will conduct education programs in communities and schools.	15	EAP	G1, G3, G4, G6	1.1, 3.1, 4.1, 6.1	<\$10,000	Grant Funding, General Revenue	Ongoing	Low
15	Develop a mass debris removal plan	Develop a mass debris removal plan in advance of a disaster event.	10	LPR	G1, G4, G5	1.3, 1.4, 4.3, 5.1	\$10,000 to \$100,000	Grant Funding	Short Term	Medium
16	National Weather Service's StormReady Program	Work to complete guidelines 1 to 6 to become a certified StormReady community.	14	LPR EAP	G3, G4	3.3, 4.1	<\$10,000	City Funds	Short Term	High
17	Outdoor warning sirens	Purchase and determine coverage area for placement of sirens. Install and test sirens.	3	SIP	G1, G3	1.1, 1.2, 1.3, 3.1	\$10,000 to \$100,000	City Funds, Grants	Short Term	High
<b>CITY OF LAMPASAS</b>										
1	Dam/levee education	Encourage public awareness on local dam/levee structures and potential failures. Have Power Point presentations at city meetings.	11	EAP	G1, G4, G6	1.1, 1.2, 1.3, 4.1, 4.3, 6.1, 6.4	<\$10,000	General Revenue	Short Term	High
2	Revise levee standards	Revise how the City of Lampasas maintains levee improvements. Work closely with the USACE to ensure maintenance and documentation is maintained.	5	EAP	G1, G4, G6	1.1, 1.3, 1.4, 4.1, 6.2	\$10,000 to \$100,000	General Revenue	Ongoing	High

**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
3	Drought education	Encourage residents to adopt water saving measures.	12	EAP	G3, G6	3.1, 3.2, 6.1, 6.2	<\$10,000	General Revenue	Long Term	High
4	Drought monitoring	Monitor drought conditions and use water stages to restrict water usages as needed.	13	LPR NSP	G1, G4, G6	1.2, 1.4, 4.1, 6.1, 6.2, 6.4	<\$10,000	General Revenue	Long Term	High
5	Natural hazards education	The city will use meetings and publications to educate the public about natural hazard events, promote life safety measures and how to minimize property damages.	10	EAP	G1, G3, G6	1.1, 1.3, 3.1, 3.2, 6.1, 6.2	<\$10,000	General Revenue	Long Term	Medium
6	Enforcement of building codes	Through the enforcement of building codes, drainage issues and GEO Tech services have to be completed for commercial properties to test soil content for expansive soils possibilities.	1	LPR	G1, G2	1.3, 2.3	\$10,000 to \$100,000	City Budget	Long Term	High
7	Create areas of refuge	Create areas of refuge including at public parks.	15	NSP	G1, G2	1.3, 2.2	<\$10,000	City Budget	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
8	Low water crossing	Signs at low water crossings and drainage improvements would help with flooded roads.	3	SIP	G1, G2	1.3, 1.4, 2.2	\$10,000 to \$100,000	City Revenue, Grants	Ongoing	Medium
9	Community Emergency Response Team (CERT)	The city would like to initiate a countywide CERT capable of responding and assisting during all natural hazard events.	6	LPR EAP	G1, G3, G4, G6	1.3, 1.4, 3.1, 3.2, 3.3, 4.1, 4.2, 6.2	<\$10,000	City Revenue, Non-Profit Organizations	Short Term	High
10	Adopt routine fire hydrant maintenance	Maintenance program is a risk reduction measure that combines prevention and mitigation strategies. A routine hydrant maintenance program will have a direct effect on the safety of firefighters.	2	SIP	G1	1.3, 1.4	<\$10,000	Fire Department Funding	Ongoing	High
11	Implement burning standards	This includes burn bans, code enforcement of clearing property, and burn permits.	9	LPR EAP	G1, G3, G4, G5, G6	1.1, 1.3, 1.4, 2.2, 2.3, 3.1, 3.2, 3.3, 4.1, 5.1, 6.2	<\$10,000	N/A	Ongoing	Medium
12	Ensure that area firefighters are properly trained in current firefighting techniques, covering both urban and wildland fires	Training will be routinely offered to firefighters.	4	LPR	G1, G4	1.4, 4.1	<\$10,000	County Funds, Grants	Ongoing	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
13	Mandate and inspect to ensure standard tie-down of mobile homes	Pass an ordinance that all mobile homes in the city must be tied-down and have annual inspections.	7	LPR SIP	G1, G4, G5, G6	1.3, 4.1, 4.3, 5.1, 6.2, 6.3, 6.4	<\$10,000	Not Needed	Long Term	High
14	Secure traffic lights and traffic controls from high winds	Secure traffic lights and traffic controls from high winds.	8	SIP	G1, G2	1.4, 2.2	>\$100,000	City Funds	Long Term	Medium
15	National Weather Service's StormReady Program	Work to complete guidelines 1 to 6 to become a certified StormReady community.	14	LPR EAP	G3, G4	3.3, 4.1, 4.3	<\$10,000	City Funds	Short Term	High
<b>CITY OF LOMETA</b>										
1	Water saving techniques	Encourage residents to adopt water saving measures.	9	EAP	G3, G6	3.1, 3.2, 6.1, 6.2	<\$10,000	AgriLife Extension, General Revenue, Grant Funding	Short Term	Medium
2	Monitor water supply	Provide early warning for a water shortage. Allows city officials to be proactive.	3	NSP	G1, G4, G6	1.2, 1.4, 4.1, 6.1, 6.2, 6.4	Other	General Revenue, Grant Funding	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
3	Education for earthquakes/land subsidence and expansive soils	Encourage residents to participate in information sessions on risks to homes, businesses, and schools.	20	LPR	G1, G3, G4	1.1, 3.1, 3.2, 4.1	<\$10,000	Grant Funding	Long Term	Low
4	Monitor risk areas	Monitor at-risk areas.	4	LPR	G1, G5, G6	1.1, 1.2, 5.2, 5.3, 6.1	>\$100,000	Grant Funding	Long Term	Low
5	Extreme weather awareness	Encourage public education through local presentations and literature.	8	EAP	G1, G3, G6	1.1, 3.2, 6.1	<\$10,000	General Revenue, Grant Funding	Short Term	High
6	Heat vulnerable populations	Prevent loss of life among the at-risk population.	5	LPR	G1, G3, G4, G6	1.1, 3.1, 4.1, 4.2, 6.1	<\$10,000	General Revenue, Grant Funds, Donations	Short Term	Low
7	Curbing and drainage	City will assess the cost and engineering designs for future plans.	1	SIP	G1, G2, G5, G6	1.3, 1.4, 2.1, 5.1, 6.1	>\$100,000	General Revenue, TXDOT Funding and Grants	Long Term	High
8	National Flood Insurance Program	Reduce economic impact of floods. Meeting NFIP requirements will reduce the threat to life and property.	6	LPR	G1, G2, G4, G6	1.3, 1.4, 2.1, 4.1, 6.4	Other	General Revenue, Grants	Long Term	High

**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
9	Hazardous weather awareness	Increase public awareness of severe weather by encouraging participation in National Weather Service's SKYWARN training and providing take home materials.	11	EAP	G1, G3, G6	1.1, 1.2, 3.1, 3.2, 6.1	<\$10,000	General Revenue, Grants	Short Term	Medium
10	Hurricane community risk	Obtain weather information from local sources and the State Operations Center and determine local impact.	19	LPR	G1, G3, G5, G6	1.1, 1.2, 3.1, 5.1, 6.2	<\$10,000	General Revenue	Long Term	Low
11	Safe room	Encourage residents to construct safe rooms inside and outside homes.	10	LPR	G1, G4, G5, G6	1.3, 4.1, 5.1, 6.1, 6.2, 6.4	>\$100,000	Private Funding, Grant Funding	Long Term	Medium
12	Wildfire education	Local volunteer fire department will conduct education programs in communities and schools on fire risks as well as wildland fire mitigation.	15	EAP	G1, G3, G4, G6	1.1, 3.1, 4.1, 6.1	<\$10,000	Grant Funding, General Revenue	Ongoing	Low
13	Wildfire assistance MOUs	Increase city's response to prevent further loss during wildfires with MOUs already established.	14	LPR	G1, G4, G6	1.3, 1.4, 4.1, 6.1	<\$10,000	N/A	Ongoing	High
14	Protect power lines	Create ordinance with allowable easements to prevent loss due to overhanging trees on power lines.	12	LPR	G1, G2, G4, G5, G6	1.3, 1.4, 2.2, 2.3, 4.1, 5.3, 6.1	<\$10,000	Hamilton Electric Coop., General Revenue	Ongoing	High
15	Develop a mass debris removal plan	Develop a mass debris removal plan in advance of a disaster event.	7	LPR	G1, G4, G5	1.3, 1.4, 4.3, 5.1	\$10,000 to \$100,000	Grant Funding	Short 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
16	National Weather Service's StormReady Program	Work to complete guidelines 1 to 6 to become a certified StormReady community.	13	LPR EAP	G3, G4	3.3, 4.1, 4.3	<\$10,000	City Funds	Short Term	High
17	Outdoor warning sirens	Purchase and determine coverage area for placement of sirens. Install and test sirens.	2	SIP	G1, G3	1.1, 1.2, 1.3, 3.1	\$10,000 to \$100,000	City Funds, Grants	Short Term	High
18	Develop evacuation plans, policies, and procedures	Develop main route evacuation plan with policies and procedures.	16	LPR	G1, G3	1.3, 3.3	<\$10,000	City Funds, Grants	Short Term	Medium
19	CERT	Create a countywide CERT with volunteers from the City of Lometa to train and provide support in safeguarding the city before, during, and after any disaster.	17	LPR EAP	G1, G3, G4	1.3, 3.2, 4.1, 4.2	<\$10,000	City and County Funds, Grants	Long Term	Medium
20	Xeriscape planting	Encourage xeriscape planting for drought/extreme heat-resistant landscaping.	18	EAP	G3	3.1, 3.2	<\$10,000	City Funds	Ongoing	Medium
CERT	Community Emergency Response Team		NFIP	National Flood Insurance Program						
EAP	Education and Awareness Programs		NSP	Natural Systems Protection						
LPR	Local Plans and Regulations		SIP	Structure and Infrastructure Project						
MOU	Memorandum of Understanding		TXDOT	Texas Department of Transportation						
N/A	Not Applicable		USACE	U.S. Army Corps of Engineers						



# **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 it 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 Lampasas 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 Lampasas 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 Lampasas 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 Lampasas 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 [Lampasas 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 Lampasas 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 Lampasas 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. This strategy will include the use of local media outlets within the planning area to notify the public of the implementation, monitoring, and evaluation of the plan. The public will be invited to participate in each stage by attending meetings and provide feedback to the planning team and new Steering Committee. The Steering Committee may include community stakeholders, such as prominent businesses, local action groups, etc.

### **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 Lampasas County regulations, ordinances, and plans (including the Lampasas County Emergency Operations Plan), and the comprehensive plans of the partner cities are considered to be integral parts of this plan. The county and partner cities, through adoption of comprehensive plans and zoning ordinances, have planned for the impact of natural hazards.

It will be the responsibility of the county and the cities to determine additional implementation procedures when appropriate. This includes integrating the requirements of the hazard mitigation plan into other local planning documents, processes, or mechanisms.

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:

- Comprehensive plans
- Strategic plans
- 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
- Growth management plans
- Ordinances, resolutions, and regulations
- Continuity of operations 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.

The previous *TCRFC Multi-Jurisdictional Hazard Mitigation Plan Update 2011-2016* identified mitigation actions for each participating community. These mitigation actions and their current status are listed in Table 2-2. Ongoing or delayed mitigation actions identified in the previous plan were carried forward into new mitigation actions for Lampasas County or the City of Kempner, the City of Lampasas, or the City of Lometa. The county and the cities did not actively track the linkage of the previous 2011 TCRFC plan into other local planning mechanisms. However, the annual progress report discussed in Chapter 20.2.3 and Appendix E will provide a framework for tracking future mitigation actions and the incorporation of this plan into other planning mechanisms.

Opportunities to integrate the requirements of this plan into other local planning mechanisms will continue to be identified through future meetings of the Steering Committee, by the individual communities and the county, and through the annual and five-year review processes as required by FEMA. The primary means for integrating mitigation strategies into other local planning mechanisms will be through the revision, update, and implementation of each jurisdiction's individual plans that require specific planning and administrative tasks (for example, plan amendments, ordinance revisions, capital improvement projects, etc.).

The previous Steering Committee representatives will remain charged with ensuring that the goals and strategies of new and updated local planning documents for their jurisdictions or agencies are consistent with the goals and actions of the Lampasas County Hazard Mitigation Plan Update and will not contribute to increased hazard vulnerability in Lampasas County, the City of Kempner, the City of Lampasas, or the City of Lometa. During the planning process for new and updated local planning documents, such as a comprehensive plan, capital improvements plan, or emergency management plan, the applicable jurisdiction will provide a copy of the Lampasas County Hazard Mitigation Plan Update to the appropriate parties and recommend that all goals and strategies of new and updated local planning documents are consistent with and support the goals of the Lampasas County plan and will not contribute to increased hazards in the affected jurisdiction(s).

Although it is recognized that there are many possible benefits to integrating components of this plan into other local planning mechanisms, the development and maintenance of this stand-alone hazard mitigation

plan is deemed by the Steering Committee to be the most effective and appropriate method to ensure implementation of local hazard mitigation actions at this time. All organizations will incorporate the Lampasas County Hazard Mitigation Plan Update into existing plans in an effort to mitigate the impact of future disasters. A list of the existing plans and procedures in which mitigation activities will be integrated is listed in **Error! Reference source not found.**

TABLE 20-1. INCORPORATION OF MITIGATION ACTIVITIES					
JURISDICTION	TYPE OF PLAN	DEPARTMENT	REVIEW TIMELINE	NEW OR EXISTING	ACTIONS TO BE INTEGRATED
Lampasas County	Lampasas County Subdivision Regulations (2012, as amended)	County Engineer, Commissioners' Court	3 years	Existing	Maintain current data on high risk areas via the mitigation plan and regularly incorporate information on high risk hazard areas into the subdivision requirements, thereby eliminating or reducing potential impacts on current and future development.
	Floodplain Ordinance, 1997 (as amended)	County Judge	5 years	Existing	Overlay high risk/flood prone areas with current and future floodplain regulations, thereby minimizing or reducing the impacts of flooding on current and future development.
	Site Plan Review Requirements	County Engineer, Commissioners' Court	Regularly	Existing	The Commissioners' Court a platting review process in accordance with the subdivision ordinance, and will consider the high hazard areas, integrating the mitigation plan data and proposed actions as applicable, into their decision making processes.
	Capital Improvements Plan	Commissioners' Court	Annual	Existing	During the annual budget cycle, bring the identified actions to the City Council for approval and eligibility for funding.
	Lampasas County Basic Emergency Operations Plan	Emergency Management Coordinator	2 years	Existing	The Lampasas County Basic Emergency Operations Plan covers the county and the Cities of Kempner, Lampasas, and Lometa. The County will integrate hazard mitigation plan data on high hazards and

Lampasas County Hazard Mitigation Plan Update

					applicable mitigation actions that are affected by or will affect the emergency operations plan on an annual basis.
City of Kempner	City of Kempner Subdivisions Ordinance (2001-11-20)	City Engineer (outsourced to Mitchel and Associates)	10 years	Existing	During the regular review and update of the subdivision regulations, the city will incorporate current data on high hazard areas thereby reducing or eliminating the potential negative impacts of high hazards on existing and future development.
	Flood Damage Prevention Ordinance (2002-01-22-001)	City Engineer (outsourced to Mitchel and Associates)	10 years	Existing	During the regular review process, the city engineer will bring any flood mitigation actions identified in the HMP to the City Council to recommend incorporation into the ordinance. The Council will approve or deny the actions.
	Capital Improvements funding	City Council	Annual	Existing	During the annual budget cycle, bring the identified actions to the City Council for approval and eligibility for funding.
City of Lampasas	Lampasas Comprehensive Planning and Capacity Study, 2009-2029	Planning and Zoning Commission	10 years	Existing	During the regular review process, the Planning and Zoning Commission and City Council will consider mitigation actions from the HMP for incorporation into the Comprehensive Plan Goals and Objectives elements.
	Lampasas Consolidated Zoning Ordinance, Ord. No. 878	Planning & Zoning Administrator	5 years	Existing	During the regular review and update of the zoning ordinance, the Planning and Zoning Administrator will incorporate current data on high hazard areas, thereby reducing or eliminating the potential negative impacts of high hazards on existing and future development.

	Chapter 70, Subdivisions	Building Official	5 years	Existing	During the regular review and update of the subdivision regulations, the city building official will incorporate current data on high hazard areas thereby reducing or eliminating the potential negative impacts of high hazards on existing and future development.
	Chapter 10, Flooding (Ord. No. 573)	Building Official, Engineering services (outsourced to Eckermann Engineering, Inc.)	5 years	Existing	During the regular review process, the City Planning and Zoning Administrator and City Building Inspector will bring the identified actions to the City Council for approval. The Council will approve or deny the actions.
	Erosion and Sediment Control Program	Engineering services (outsourced to Eckermann Engineering, Inc.)	2 years	Existing	During the regular review process, the City will consider mitigation actions from the HMP for incorporation into the erosion and sediment control program.
	Stormwater Management	Director of Planning and Development	Annual	Existing	The city will incorporate current data on high hazard areas presented in the HMP during the annual review of stormwater management priorities, and present proposed mitigation actions to the City Council for approval.
	Site Plan Review Process	City Building Official	Regularly	Existing	The City Building Official reviews site plans for all new development, and will consider the high hazard areas, integrating the mitigation plan data and proposed actions as applicable, into their decision making processes.
	5-year Capital Improvement Plan	City Council	Regularly	Existing	During the Capital Improvement Plan update, bring the identified actions to the City Council for approval and eligibility for funding.

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City of Lometa	Lometa Comprehensive Plan, 2013	City Council	10 years	Existing	During the regular review process, the City Council will consider mitigation actions from the HMP for incorporation into the Comprehensive Plan Goals and Objectives elements.
	Flood Damage Prevention Ordinance, Ordinance 06022003	Building Official	5 years	Existing	During the regular review process, the building official will bring the identified actions to the City Council for approval. The Council will approve or deny the actions.

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**APPENDIX A.**  
**ACRONYMS AND DEFINITIONS**

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# 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 Map
DMA	Disaster Mitigation Act of 2000
DPS	Department of Public Safety
EAP	Education and Awareness Program
EF	Enhanced Fujita
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 <sub>w</sub>	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
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 50,000°F. 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:

$$\text{Risk Ranking} = \text{Probability} + \text{Impact (people + property + economy)}$$

**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.



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**APPENDIX B.**  
**LOCAL MITIGATION PLAN REVIEW TOOL**

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## **APPENDIX B. LOCAL MITIGATION PLAN REVIEW TOOL**

This appendix presents the local mitigation action review tool for the Lampasas 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.



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**APPENDIX C.**  
**PUBLIC OUTREACH**

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## **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 Lampasas County Hazard Mitigation Plan questionnaire, as described in Section 3.7.2. The press releases announcing the update of the Lampasas County Hazard Mitigation Plan are shown in Section 3.7.4.



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**APPENDIX D.**  
**MENU OF MITIGATION ALTERNATIVES**

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# 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 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 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 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.

Lampasas County  
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**APPENDIX E.**  
**WORKSHEETS FOR RECOMMENDED MITIGATION ACTIONS**

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## **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.



Lampasas County  
**Hazard Mitigation Plan Update**

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**APPENDIX F.**  
**PLAN ADOPTION RESOLUTIONS FROM PLANNING PARTNERS**

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**APPENDIX F.  
PLAN ADOPTION RESOLUTIONS FROM PLANNING  
PARTNERS**

*To Be Provided With Final Release*



Lampasas County  
**Hazard Mitigation Plan Update**

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**APPENDIX G.**  
**EXAMPLE PROGRESS REPORT**

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# APPENDIX G. EXAMPLE PROGRESS REPORT

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## Lampasas County Hazard Mitigation Plan Update Annual Progress Report

**Reporting Period:** 2016-2020

**Background:** Lampasas County and the Cities of Kempner, Lampasas, and Lometa 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.lampasas.org/>

**Summary Overview of the Plan's Progress:** The performance period for the Hazard Mitigation Plan became effective on [REDACTED], 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 [REDACTED], 2020. As of this reporting period, the performance period for this plan is considered to be [REDACTED]% complete. The Hazard Mitigation Plan has targeted 71 hazard mitigation actions to be pursued during the 5-year performance period. As of the reporting period, the following overall progress can be reported:

- [REDACTED] out of [REDACTED] actions ([REDACTED]%) reported ongoing action toward completion
- [REDACTED] out of [REDACTED] actions ([REDACTED]%) were reported as being complete
- [REDACTED] out of [REDACTED] actions ([REDACTED]%) 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 Lampasas 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 Lampasas 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 [REDACTED], 201[REDACTED]. It was determined through the plan's development process that a Steering Committee would remain in service to oversee maintenance of the



**TABLE 2.  
ACTION PLAN MATRIX**

Action No.	Title	Action Taken? (Yes or No)	Timeline	Priority	Status	Status (√, O, X)
<b>LAMPASAS COUNTY</b>						
1	Dam/Levee Education					
2	Dam/Levee Monitoring					
3	Water Saving Techniques					
4	Drought Vulnerability					
5	Monitor At-Risk Areas					
6	Education for Earthquakes/Land Subsidence and Expansive Soils					
7	Extreme Weather Awareness					
8	Heat Vulnerable Populations					
9	Drainage Issue on CR 1139					
10	Drainage/Flooding Issue on CR 4450					
11	Hazardous Weather Awareness					
12	Hurricane Community Risk					
13	Protecting Critical Facilities from Lightning					
14	Safe Room					
15	Reduce Roadway Impact/Winter Weather					
16	Adopt Routine Fire Hydrant Maintenance					
17	County Burn Ban					
18	Ensure that Area Firefighters are Properly Trained in Current Firefighting Techniques, Covering Both Urban and Wildland Fires					
19	Mandate and Inspect to Ensure Standard Tie-down of Mobile Homes					
<b>CITY OF KEMPNER</b>						
1	Wildfire Assistance					
2	Water Saving Techniques					
3	Monitor Water Supply					

**TABLE 2.  
ACTION PLAN MATRIX**

Action No.	Title	Action Taken? (Yes or No)	Timeline	Priority	Status	Status (√, O, X)
4	Education for Earthquakes/Land Subsidence and Expansive Soils					
5	Monitor At-Risk Areas					
6	Extreme Weather Awareness					
7	Heat Vulnerable Populations					
8	Curbing and Drainage					
9	Flood Insurance Program					
10	Hazardous Weather Awareness					
11	Hurricane Community Risk					
12	Protect Critical Facilities					
13	Safe Room					
14	Wildfire Education					
15	Develop a Mass Debris Removal Plan					
16	National Weather Service's StormReady Program					
17	Outdoor Warning Sirens					
<b>CITY OF LAMPASAS</b>						
1	Dam/Levee Education					
2	Revise Levee Standards					
3	Drought Education					
4	Drought Monitoring					
5	Natural Hazards Education					
6	Enforcement of Building Codes					
7	Create Areas of Refuge					

**TABLE 2.  
ACTION PLAN MATRIX**

Action No.	Title	Action Taken? (Yes or No)	Timeline	Priority	Status	Status (√, O, X)
8	Low Water Crossing					
9	CERT					
10	Adopt Routine Fire Hydrant Maintenance					
11	Implement Burning Standards					
12	Ensure that Area Firefighters are Properly Trained in Current Firefighting Techniques, Covering Both Urban and Wildland Fires					
13	Mandate and Inspect to Ensure Standard Tie-down of Mobile Homes					
14	Secure Traffic Lights and Traffic Controls from High Winds					
15	National Weather Service's StormReady Program					
<b>CITY OF LOMETA</b>						
1	Water Saving Techniques					
2	Monitor Water Supply					
3	Education for Earthquakes/Land Subsidence and Expansive Soils					
4	Monitor At-Risk Areas					
5	Extreme Weather Awareness					
6	Heat Vulnerable Populations					
7	Curbing and Drainage					
8	National Flood Insurance Program					
9	Hazardous Weather Awareness					
10	Hurricane Community Risk					
11	Safe Room					
12	Wildfire Education					
13	Wildfire Assistance MOUs					
14	Protect Power Lines					

**TABLE 2.  
ACTION PLAN MATRIX**

Action No.	Title	Action Taken? (Yes or No)	Timeline	Priority	Status	Status (✓, O, X)
15	Develop a Mass Debris Removal Plan					
16	National Weather Service's StormReady Program					
17	Outdoor Warning Sirens					
18	Develop Evacuation Plans, Policies, and Procedures					
19	CERT					
20	Xeriscape Planting					
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 Lampasas County Hazard Mitigation Plan website. Any questions or comments regarding the contents of this report should be directed to:*

*Insert Contact Info Here*