Angelina County
Multi-Jurisdiction
Hazard Mitigation Action Plan

Angelina County Texas & Cities of Burke, Diboll, Hudson, Huntington, Lufkin & Zavalla

February 2019

Developed in accordance with PUBLIC LAW 106–390—OCT. 30, 2000 (Disaster Mitigation Act of 2000), et al. by the Angelina County Hazard Mitigation Team with assistance from MPTX Associates.

ACKNOWLEDGEMENTS

Preparation of this multi-jurisdiction hazard mitigation action plan involved collaboration among public, private and non-profit organizations including: Angelina County, City of Burke, City of Diboll, City of Huntington, City of Hudson, City of Lufkin, City of Zavalla, local Independent School Districts, Lufkin Chapter of the American Red Cross., the Deep East Texas Council of Governments, Texas Department of Transportation, Texas Forest Service, representatives of private industry, the Texas Division of Emergency Management, among numerous others.

The work of the Angelina County Hazard Mitigation Team (HMT) has made this project possible, led by the Angelina County Office of Emergency Management and Office of the County Judge. Numerous elected officials and city, county, regional and state personnel participated in the planning process and contributed greatly to this plan's development. Thanks go out to all HMT participants and their staff for their work, information sharing, and ideas. A complete listing of the Hazard Mitigation Team is provided in Section 2.1 (Hazard Mitigation Planning Team).

The Angelina County Commissioner's Court and participating community administration and staff deserve special recognition for their contributions to this project. And finally, thanks to the staff of MPTX for their work to facilitate the planning process, collect and compile data, and prepare this document.

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Table of Contents

CHAPTER 1. PREREQUISITES

1.1 INTRODUCTION

Angelina County is located in a region of Texas and United States which experiences relatively frequent impacts from natural hazards. The term natural hazard refers to occurrences such as flooding, hurricane, tornado, wildfire, etc. that can potentially damage structures or endanger people. The impacts of natural hazards directly affect the safety and well-being of the residents of the planning area, highlighting the importance of developing ways to eliminate or reduce future damages from natural hazards.

Hazard mitigation, or managing risk of natural hazards, is the subject of this planning document. A separate set of potentially damaging occurrences are referred to as technical hazards, with examples such as hazardous material incident, terrorism, or cyber-threat. Mitigation for technical hazards are not the subject of this plan. Mitigation for technical hazards is not the subject of this plan but these are addressed in plans and technical documents maintained by local, state and federal agencies.

The ultimate goal of the Angelina County Multi-Jurisdiction Hazard Mitigation Plan is to promote the health, safety, and welfare of all residents and local interests. The purview of this document includes the jurisdiction of Angelina County and the city of Burke, the city of Diboll, city of Huntington, city of Hudson, city of Lufkin and the city of Zavalla, commonly referred to hereafter as the 'planning area'.

The purpose of mitigation planning in general is to take proactive measures to reduce or prevent negative impacts of future events. The concept could be summarized with the saying, 'an ounce of prevention is worth a pound of cure'.

The State of Texas Hazard Mitigation Plan quotes from FEMA's Mitigation Directorate: "Mitigation is the cornerstone of emergency management. It's the ongoing effort to lessen the impact disasters have on people's lives and property through damage prevention and flood insurance. Through measures such as building safely within the floodplain or removing homes altogether; engineering buildings and infrastructures to withstand earthquakes; and creating and enforcing effective building codes to protect property from floods, hurricanes and other natural hazards, the impact on lives and communities are lessened."

A hazard mitigation plan is distinguishable from an emergency operations plan or disaster response plan to the extent that it plans for proactive implementation of mitigation actions prior to a hazard occurrence. Mitigation actions are long-term activities which reduce a community's vulnerability to hazard impact through various means including early warning, avoidance, and protection. The Angelina County Hazard Mitigation Plan (HMP, the Plan, or plan) is a 5-year blueprint for activities with the goal to protect the public and local assets by reducing the impacts of future disasters.

1.2 AUTHORITIES

Federal Authorities

The Angelina County Hazard Mitigation Action Plan was developed in accordance with the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), which is the primary authority for providing federal disaster recovery and hazard mitigation financial assistance to states and local governments.

The Stafford Act was last amended in October 2000 by Public Law (PL) 106-390 (Disaster Mitigation Act of 2000, DMA 2K) and incorporated as federal rules in Code of Federal Regulations (CFR) 44. Program requirements related to hazard mitigation are included in 44 CFR Parts 9, 10, 13, 14, 78, 201 and 206.

Provisions of DMA 2K are titled DISASTER RELIEF - THE PUBLIC HEALTH AND WELFARE. The chapter sets forth declarations and definitions relating to disaster relief and is used as a central document for the activities of the Federal Emergency Management Agency.

The intent of the Disaster Mitigation Act of 2000 is best summarized by the following Congressional findings and declarations:

§ 5121. CONGRESSIONAL FINDINGS AND DECLARATIONS {Sec. 101}

a) The Congress hereby finds and declares that--

1. because disasters often cause loss of life, human suffering, loss of income, and property loss and damage; and

2. because disasters often disrupt the normal functioning of governments and communities, and adversely affect individuals and families with great severity; special measures, designed to assist the efforts of the affected States in expediting the rendering of aid, assistance, and emergency services, and the reconstruction and rehabilitation of devastated areas, are necessary.

b) It is the intent of the Congress, by this Act, to provide an orderly and continuing means of assistance by the Federal Government to State and local governments in carrying out their responsibilities to alleviate the suffering and damage which result from such disasters by--

1. revising and broadening the scope of existing disaster relief programs;

2. encouraging the development of comprehensive disaster preparedness and assistance plans, programs, capabilities, and organizations by the States and by local governments;

3. achieving greater coordination and responsiveness of disaster preparedness and relief programs;

4. encouraging individuals, States, and local governments to protect themselves by obtaining insurance coverage to supplement or replace governmental assistance;

5. encouraging hazard mitigation measures to reduce losses from disasters, including development of land use and construction regulations; and

6. providing Federal assistance programs for both public and private losses sustained in disasters [.]

(Pub. L. 93-288, title I, § 101, May 22, 1974, 88 Stat. 143; Pub. L. 100-707, title I, § 103(a), Nov. 23, 1988, 102 Stat. 4689.)

Federal regulatory authority for hazard mitigation planning in the mid-southern region of the U.S. resides with FEMA's Region VI office in Denton, Texas.

State Authorities

The Texas Disaster Act of 1975, V.T.C.A., Government Code, Chapter 418, and the Executive Order of the Governor pertaining to Emergency Management are the primary authorizing statutes for mitigation planning at the state level. State regulatory authority for hazard mitigation planning resides with the Texas Department of Public Safety, Division of Emergency Management (TDEM), Mitigation Section based in Austin. The TDEM Regional Liaison Office for Angelina County is Sub 2B, based in Nacogdoches.

Local Authorities

Local authority for hazard mitigation resides with the Angelina County Judge, who reserves the right to appoint a Hazard Mitigation Director to oversee activities under the purview of this Plan in coordination with the Office of Emergency Management. The County Judge and local Hazard Mitigation Director appoints by invitation Hazard Mitigation Team members and will maintain direct oversight of mitigation activities through the current planning period (2018-2023).

1.3 LOCAL ADOPTION

All participating jurisdictions have formally adopted this plan by resolution. Copies of resolutions are in Appendix A.

1.4 DOCUMENT STRUCTURE

Chapter 1 includes prerequisites for hazard mitigation plans and describes the purpose, authorities, process of local adoption, etc., and provides general profiles of the participating jurisdictions.

Chapter 2 describes the process through which this plan was developed, via planning team and public meetings, and the input of citizens and local officials. Chapter 2 also outlines process for plan maintenance, monitoring, and integration into current and future planning activities by participating jurisdictions.

Chapter 3 includes the risk and vulnerability assessments for the County and participating jurisdictions, describing the hazards that occur within the planning area, and an inventory of local assets and critical facilities that represent varying degrees of vulnerability to hazard impacts.

Chapter 4 describes the mitigation strategy for the participating jurisdiction's, representing this Plan's primary function moving forward. It outlines the Plan's overarching goals, and intended activities and projects the jurisdictions intend to implement.

1.5 2017 UPDATE-VERSION 3.0

This multi-jurisdiction hazard mitigation plan is an update of the existing hazard mitigation plan for Angelina County and participating cities originally developed in 2007, and updated in 2012. Information about the planning area and recent hazard events was updated and incorporated into the current document.

1.6 PARTICIPATING JURISDICTIONS

The planning area is defined by the boundaries of the following governmental entities. Each of these independent jurisdictions participated in development of the original version of this hazard mitigation plan, participated in the process to update this plan, and has adopted this plan by formal resolution.

- Angelina County
- City of Burke
- City of Diboll
- City of Hudson
- City of Huntington
- City of Lufkin
- City of Zavalla

1.6.1 County Profile

General

Angelina County is located on U.S. Highways 59 and 69 northeast of Houston in the East Texas Timberlands region of Texas. Lufkin, the county seat and largest community, is 96 miles northwest of Beaumont and 120 miles northeast of Houston. The county is bounded on the north by the Angelina River and on the south by the Neches River. It comprises 807 square miles of gently rolling terrain and is densely forested with pine and large variety of hardwoods. Elevations range from 200 to 380 feet above sea level.

The Angelina River drains the northern and eastern portions of the county, and the Neches River drains the southern and western parts. The largest body of water is the Sam Rayburn Reservoir on the Angelina River. The lake which extends into Jasper, Sabine, Nacogdoches and San Augustine counties covers 114,500 acres and affords county residents good boating, fishing, and swimming, as well as water storage for municipal, agricultural and industrial needs, flood control and electric power.

The County is governed by a County Judge and four commissioners elected by precinct. The Texas State Legislature established Angelina County was organized in 1846, when Nacogdoches County was divided.

Highest categories of employment by industry type are: health care and social assistance (33 percent); retail trade (18 percent); education (11 percent); finance, insurance, professional services (10 percent). Unincorporated communities and places include: Bald Hill, Blix, Cedar Grove, Central, Clawson, Davisville, Dolan, Dunagan, Granville, Herty, Homer, Keltys, Manning, Moffitt, Nancy, Peavy, Pollok, Providence, Redland, Redtown, Rutland, Shady Grove and Woodlawn.

According to the 2016 U.S. Census, total population of Angelina County is 87,805, representing a 2.8 percent increase since 2010, and 36,226 housing units with average household size of 2.4 people.

Table 1-1 General Characteristics, Angelina County

Population	**86,771**
Land area (sq.mi.)	801.6
Elevation range (ft.)	102–480
Normal rainfall (in.)	46.6
July average max. temp.	93.5

Source: Texas State Historical Association; Texas Almanac; http://www.texasalmanac.com/topics/government/angelina-county; US Census

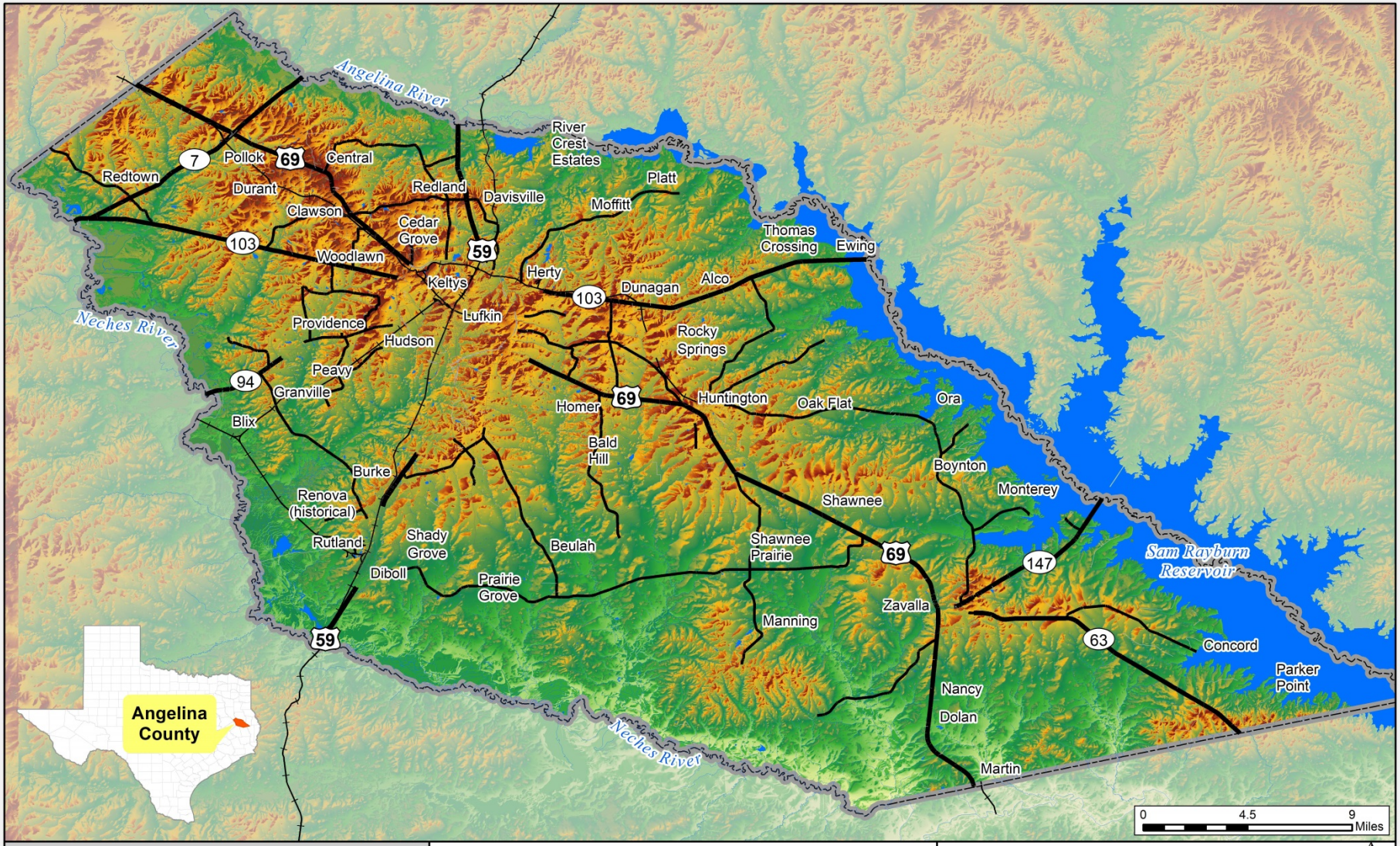
Geography

Angelina County is located in a humid subtropical climatic zone, characterized by moderate winters and hot summers. Rainfall in Angelina County averages 42.99 inches per year, greater than the Texas average of 28.1 inches per year.

There are portions of four watersheds in Angelina County: the Upper Angelina in the far northwestern corner of the county, the Lower Neches Watershed covering the eastern half of the county, the Middle Neches covering the western half and the Lower Neches Watershed in the far southeastern corner of Angelina County. Sam Rayburn Reservoir is the largest lake and forms the eastern boundary of the county. Major rivers and creeks include the Angelina River, Neches River, Crawford Creek, Jack Creek, Hurricane Creek, Bear Creek, Biloxi Creek, Buck Creek and Shawnee Creek.

Most of the county is surfaced by sand and mud containing lignite and bentonite. This soil underlies rangeland and cropland and is exploited for mineral production. The northernmost edge of the county (generally, the area north of Lufkin) is covered by thin to moderately thick clay-sands over steep slopes and rolling hills. In the piney woods area longleaf, shortleaf, loblolly, and slash pines provide excellent timber. Hardwoods in Angelina County include several types of gum, magnolia, elm, hickory and oak. Between 21 and 30 percent of the land is considered good for farming.

Figure 1-1 on the following page shows the location of communities, federal and state highways, primary water bodies, and the general topography of the planning area.



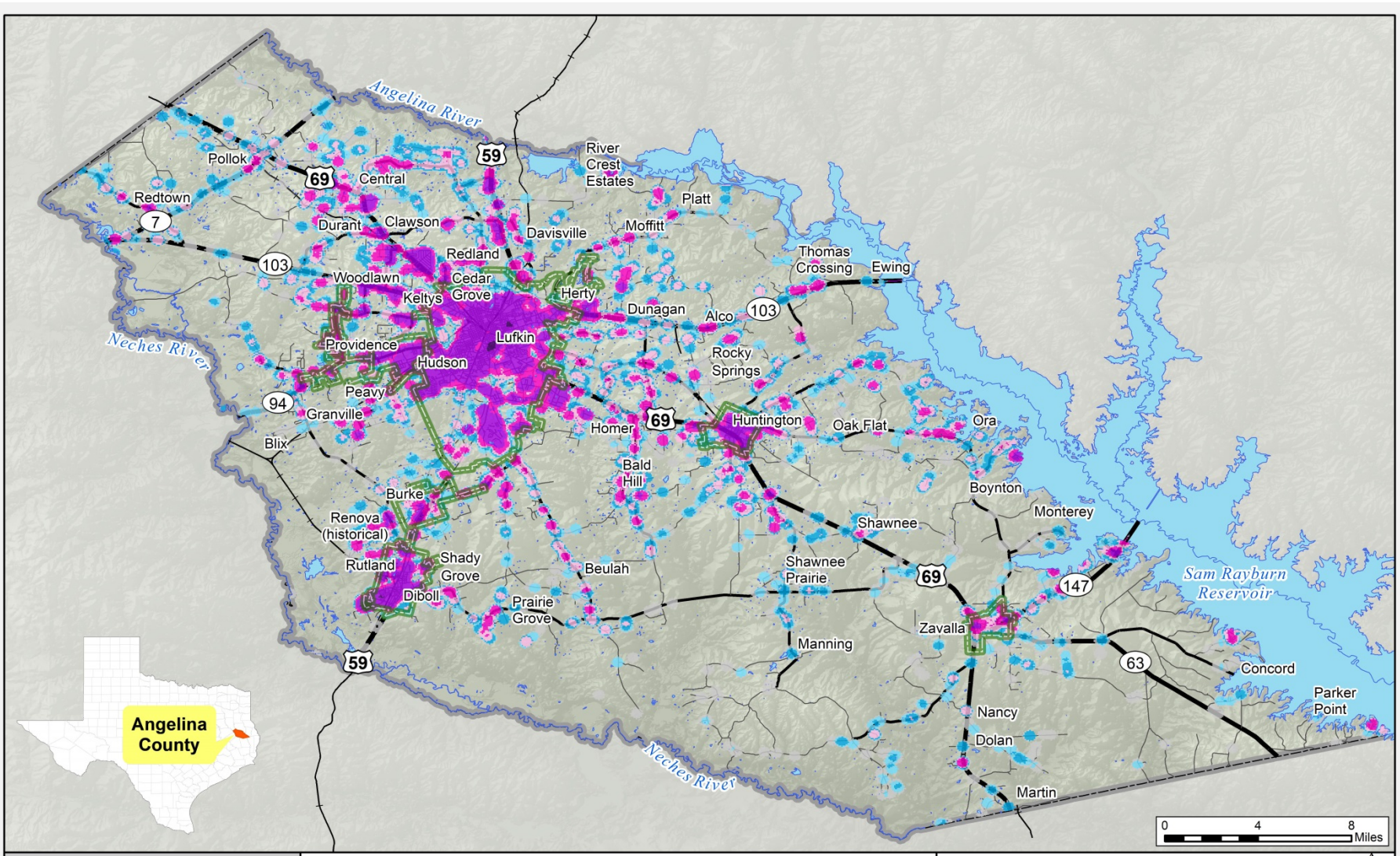
Angelina County Terrain and Communities

Angelina County
Multi-Jurisdiction
Hazard Mitigation Action Plan

- Major Highway
- Local Highway
- Local Road
- County Line
- Water Bodies
- Water Ways

Map intended for planning purposes only.
Information shown is subject to revision and/or update.

Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS


Angelina River
Neches River
Neches River
Sam Rayburn Reservoir
Pollok
Redtown
Central
Durant
Clawson
Davisville
Redland
Woodlawn
Cedar Grove
Keltys
Herty
Moffitt
River Crest Estates
Platt
Thomas Crossing
Ewing
Dunagan
Alco
Rocky Springs
Providence
Hudson
Lufkin
Peavy
Granville
Blix
Homer
Huntington
Oak Flat
Ora
Bald Hill
Boynton
Monterey
Shawnee
Burke
Renova (historical)
Rutland
Shady Grove
Diboll
Beulah
Prairie Grove
Shawnee Prairie
Zavalla
Manning
Concord
Parker Point
Nancy
Dolan
Martin
7
59
69
103
94
147
63
Angelina County
0
4
8
Miles
Angelina County Population Distribution
Angelina County Multi-Jurisdiction Hazard Mitigation Action Plan
Major Highway
Local Highway
Local Road
Rails
County Line
City Limits
Water Bodies
Where People Live
1 - LT 1 hs/40 ac
2 - 1 hs/40 to 1 hs/20 ac
3 - 1 hs/20 to 1 hs/10 ac
4 - 1 hs/10 to 1 hs/5 ac
5 - 1 hs/5 to 1 hs/2 ac
6 - 1 hs/2 to 3 hs/ac
7 - GT 3 hs/ac
Map intended for planning purposes only.
Information shown is subject to revision and/or update.
Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, Texas A&M Forest Service
MPTX

Disaster Declaration History

Presidential (Major) Disaster Declarations

Among many natural disaster occurrences in the region's history, since 1989 there have been 10 federal disaster declarations that included Angelina County. Five (5) of the 10 federal disaster declarations resulted from hurricanes and tropical storms. Four (4) of the 8 declarations were related to severe storms and flooding, and one (1) disaster declaration was related to severe wildfire threat.

For the disasters for which data is available, the total damage estimate that includes all affected Texas counties is over $7.4 billion (adjusted for inflation to 2009 dollars). Damage totals for DR-4223 and DR-4266 are still being calculated as of 2017 (current estimates include FEMA Individual Assistance and Public Assistance only). Table 1-2 outlines the history of federal disaster declarations for Angelina County.

Table 1-2 Federal Disaster Declarations, Angelina County

Declaration Number	Date	Disaster Description	*Statewide Damage Estimate ($)
4266	4/28/2016	Severe Storms and Flooding	*$39,982,498*
4223	8/5/2015	Severe Storms, Tornados, Flooding	*$217,635,735*
1791	9/13/2008	Hurricane Ike	$3,479,373,023
1624	1/11/2006	Severe Wildfire Threat	$46,966,613
1606	9/24/2005	Hurricane Rita	$2,120,536,475
1379	6/9/2001	Tropical Storm Allison	$1,435,994,008
1239	8/26/1998	Tropical Storm Charley	$37,955,276
1041	10/18/1994	Severe Storms and Flooding	$233,891,675
836	7/18/1989	Tropical Storm Allison	$14,300,028
828	5/19/1989	Severe Storms, Tornados, Flooding	$53,836,626
Total			**$7,680,471,957**

Source: FEMA, Public Entity Research Institute (PERI), http://www.peripresdecusa.org/mainframe.htm;
Note: Damage estimates include regional impacts across multiple counties/states.

1.6.2 City Profiles

City of Burke

The City of Burke is located in southwest Angelina County along highway 59. Burke is at an approximate elevation of 272 feet above sea level. The incorporated area encompasses 2.7 square miles. The 2016 U.S. Census population for Burke is 730, representing a small decrease 140 since 2010. A specific risk assessment for Burke is located in Section 3.xx. The following data is reported by the 2016 Census for the City of Burke, Texas:

Jurisdiction	2016 Population	Median Household Income	% Below Poverty Level	% High School Graduate or Higher	Median Housing Value	Total Housing Units	# Military Veterans
Burke	730	$44,286	14.2%	78.7%	$92,900	285	59

Source: US Census; https://www.census.gov/search-results.html?q=Burke%2C+Texas&page=1&stateGeo=none&searchtype=web&search.x=0&search.y=0

City of Diboll

The City of Diboll is located in southwest Angelina County along highway 59. Diboll is at an approximate elevation of 210 feet above sea level. The incorporated area encompasses 4.7 square miles. The 2016 U.S. Census population for Diboll is 5,369, representing a 12.4 percent increase since 2010. A specific risk assessment for Diboll is located in Section 3.xx. The following data is reported by the 2016 Census for the City of Diboll, Texas:

Jurisdiction	2016 Population	Median Household Income	% Below Poverty Level	% High School Graduate or Higher	Median Housing Value	Total Housing Units	# Military Veterans
Diboll	5,369	$37,656	25.2%	68.2%	$54,400	1,566	425

Source: US Census; https://www.census.gov/search-results.html?page=1&stateGeo=none&searchtype=web&cssp=&q=Diboll%2C+Texas&search.x=0&search.y=0

City of Hudson

The City of Hudson is located in western Angelina County on Highway 94. Hudson is at an approximate elevation of 335 feet above sea level. Incorporated area encompasses 5.1 square miles. The 2016 U.S. Census population for Hudson is 4,818 which represents a small increase since the 2010 Census. A specific risk assessment for Hudson is located in Section 3.xx.

The following data is reported by the 2016 Census for the City of Hudson, Texas:

Jurisdiction	2016 Population	Median Household Income	% Below Poverty Level	% High School Graduate or Higher	Median Housing Value	Total Housing Units	# Military Veterans
Hudson	4,818	$33,873	22.3%	80.4%	$109,700	1,703	178

Source: US Census; https://www.census.gov/search-results.html?page=1&stateGeo=none&searchtype=web&cssp=&q=Hudson%2C+Texas&search.x=0&search

City of Huntington

The City of Huntington is located in central Angelina County on Highway 69. Huntington is at an approximate elevation of 325 feet above sea level. Incorporated area encompasses 2.7 square miles.

The 2016 U.S. Census population for Huntington is 2,106 which is a small decrease since the 2010 Census. A specific risk assessment for Huntington is located in Section 3.xx. The following data is reported by the 2016 Census for the City of Huntington, Texas:

Jurisdiction	2016 Population	Median Household Income	% Below Poverty Level		% High School Graduate or Higher	Median Housing Value	Total Housing Units	# Militar Veteran
Huntington	2,106	$38,942	25.6%		78.7%	$72,300	946	123

Source: US Census; https://www.census.gov/search-results.html?page=1&stateGeo=none&searchtype=web&cssp=&q=Huntington%2C+Texas&search.x=0&search

City of Lufkin

The City of Lufkin is located in north central Angelina County at the junctions of Highway 59 and 69. Lufkin is at an approximate elevation of 312 feet above sea level. The incorporated area encompasses 33.7square miles.

The 2016 U.S. Census population for Lufkin is 36,159 which represents a 3.1 percent increase since the 2010 Census. A specific risk assessment for Lufkin is located in Section 3.xx. The following data is reported by the 2016 Census for the City of Lufkin, Texas:

Jurisdiction	2016 Population	Median Household Income	% Below Poverty Level	% High School Graduate or Higher	Median Housing Value	Total Housing Units	# Military Veterans
Lufkin	36,159	$41,138	21.7%	79.7%	$96,200	15,165	2,328

Source: US Census; https://www.census.gov/search-results.html?page=1&stateGeo=none&searchtype=web&cssp=&q=Lufkin%2C+Texas&search.x=0&search.y=0

City of Zavalla

The City of Zavalla is located in southern Angelina County at the junctions of Highway 69 and 63. Zavalla is at an approximate elevation of 223 feet above sea level. The incorporated area encompasses 2.1 square miles.

The 2016 U.S. Census population for Zavalla is 712 people, which is virtually unchanged since the 2010 Census. A specific risk assessment for Zavalla is located in Section 3.xx.

The following data is reported by the 2016 Census for the City of Zavalla, Texas:

Jurisdiction	2016 Population	Median Household Income	% Below Poverty Level	% High School Graduate or Higher	Median Housing Value	Total Housing Units	# Military Veterans
Zavalla	36,159	$29,236	35.1%	76.2%	$57,900	467	63

Source: US Census; https://www.census.gov/search-results.html?page=1&stateGeo=none&searchtype=web&cssp=&q=Zavalla%2C+Texas&search.x=0&search.y=0

CHAPTER 2. PLANNING PROCESS

44 CFR Requirement §201.6(b): *In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process **shall** include:*
(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and non-profit interests to be involved in the planning process;
(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.
Requirement §201.6(c) (1): *[The plan **shall** document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.*

Angelina County played the lead role in initiating the update of this plan. Federal funding for the plan update project was secured through a grant from the FEMA Hazard Mitigation Grant Program (HMGP). The local cash match for this grant was provided by Angelina County. Public participation was encouraged throughout all steps of the planning process.

Updated Prerequisites (Chapter 1)
This multi-jurisdiction hazard mitigation action plan is an update of the existing hazard mitigation plan for Angelina County and the incorporated cities. There are no changes in the entities represented in this updated plan, nor any changes in authorizing legislation or administrative agencies.

Updated Planning Process (Chapter 2)
In general, plan update meetings involved re-evaluation of goals, risk assessment, and the plan maintenance process from the previous plan, and recommended changes were incorporated into this updated document. Notably, sections regarding plan maintenance, adoption, incorporation, and opportunities for integration through other planning mechanisms was moved from Chapter 5 of the previous plan to Chapter 2.

Updated Risk Assessment (Chapter 3)
Information about the planning area and recent hazard events was updated and incorporated into the current document. Hazard occurrences of the last five years were the focus of the risk assessment. A comprehensive listing of all hazard events Participants captured hazard profile data which included dates and damages since the last plan was approved and looked specifically at what assets were impacted by these events. Specific impacts to specific assets were described when possible and the lists of past occurrences were updated. A structural change was made to move vulnerability assessment data and discussion to Section 3.2, hazard profile order of appearance was re-ordered from alphabetical appearance to relative hazard significance.

Updated Mitigation Strategy (Chapter 4)
Planning teams considered various actions to prevent future damage to their assets focusing on those assets that have received repeated damage over the years from the same hazard and those hazards that cause the most devastation for the planning area. The mitigation actions from the last version of the plan that had not yet been executed but were still considered valuable projects were kept as part of the update. New action items were created and prioritized by the Hazard Mitigation Team and are reported in the Mitigation Strategy (Chapter 4).

Updated Plan Maintenance (Chapter 5)
Moved to Chapter 2, see comments above.

2.1 HAZARD MITIGATION TEAM

Hazard Mitigation Team (HMT) membership for this plan update project included participants in previous mitigation plan processes, as well as new members. The Angelina County Judge served as chairman of the HMT, the Angelina County Emergency Management Coordinator served as director of day to day activities and presided over the plan update project from start to finish.

The HMT is comprised of a planning team with members from each of the participating cities and individual city teams comprised of staff personnel and other subject matter expert's familiar with the specific history and circumstances of the cities.

The hazard mitigation team represented a remarkable cross-section of local professionals, community leaders, agency staff and directors, and neighboring communities. These persons dedicated their time, expertise, and genuine interest in community advancement by participating in this planning process. Professional fields represented by the HMT include:

- City and County Administration and Elected Office (Regulatory Authority, Administration)
- Emergency Response and Management
- Floodplain Regulation
- Law Enforcement
- Public Works/Engineering
- School Administration
- Climatology and Geographic Information Systems
- Land Use Regulation and Community Development
- Local Media
- Neighboring Communities and Regional Agencies
- General Public, Non-Profits, and Interested Stakeholders

Listed below are members of the Angelina County Multi-Jurisdiction Hazard Mitigation Team.

Table 2-1 Core Hazard Mitigation Team

Representative	Jurisdiction	Agency	Title
The Hon. Wes Suiter	Angelina County	County Judge	County Judge
Ricky Conner	Angelina County	Emergency Management	EMC, FPA
Sarah Adams	Angelina County	Public Health Department	Preparedness Director
Kristina Childress	Angelina County	Public Health Department	Preparedness Planner
Sharon Shaw	Angelina County	Public Health Department	Director
Bobby Cheshire	Angelina County	Precinct 4	Commissioner
Greg Harrison	Angelina County	Precinct 1	Commissioner
Terry Pitts	Angelina County	Precinct 3	Commissioner
Eddie Gray	Angelina County	Auditor's Office	Chief
Mike Rankin	Private sector	CHI St. Luke's	Director of Security
John Thomas Jones	Burke	City Hall	Mayor
Steve Baker	Diboll	Police Department	Chief
James Freeman	Hudson	City Staff	City Manager
Bill Stewart	Huntington	City Staff	City Manager
Jason Arnold	Lufkin	Emergency Management	Assistant EMC
Steve Floyd	Lufkin	City Staff	Assistant City Manager
Stephanie Wade	Zavalla	Police Department	Chief
Gary Litton	Texas	South East Texas Regional Advisory Committee	EMO Coordinator
Randy Whittington	Texas	TDEM	District Coordinator
Weldon Dent	Texas	Texas Forest Service	WUI Specialist
Scott Brawley	US	Red Cross	Disaster Program Dir

Table 2-2 County Mitigation Planning Team

Representative	Jurisdiction	Agency/Dept	Title
Honorable Wes Suiter	County	County Judge	County Judge
Ricky Conner	County	Emergency Management	EMC
Eddie Gray	County	Auditors Office	Chief
Greg Harrison	County	Precinct 1	Commissioner
Terry Pitts	County	Precinct 3	Commissioner
Bobby Cheshire	County	Precinct 4	Commissioner
Teah Bowling	County	Emergency Management	911 Coordinator
Jason Kartye	County	Emergency Management	Parks Director
Randy Ware	County		Fixed Asset Manager
Clint Caton	County	Precinct 4	Foreman
Grady Courtney	County	Precinct 4	Road & Bridge

Table 2-3 Burke Mitigation Planning Team

Representative	Jurisdiction	Agency/Dept	Title
John Thomas Jones	Burke	City Hall	Mayor

Table 2-4 Diboll Mitigation Planning Team

Representative	Jurisdiction	Agency/Dept	Title
Gerry Boren	Diboll	Administration	City Manager
Steve Baker	Diboll	Police Department	Chief
Elvia Esteves-Garza	Diboll	Finance Dept.	Director
Gary Joner	Diboll	VFD	Chief
Josh Richard	Diboll	Public Works	Community Service Dir

Table 2-5 Hudson Mitigation Planning Team

Representative	Jurisdiction	Agency/Dept	Title
James M Freeman	Hudson	City	City Administrator
Jimmy Casper	Hudson	City	Chief of Police
Rodney McCarty	Hudson	City	Director Public Works
Joe Burton	Hudson	VFD	Fire Chief
James Young	Hudson	Hudson Water Supply	President
Barrett Lankford	Hudson	ISD	Chief Financial Officer

Table 2-6 Huntington Mitigation Planning Team

Representative	Jurisdiction	Agency/Dept	Title
Bill Stewart	Huntington	City Staff	City Manager
Bobby Epperly	Huntington	Police Dept.	Chief
David Flowers	Huntington	ISD	Superintendent
Shane Price	Huntington	Utility Dept.	Supervisor

Table 2-7 Lufkin Mitigation Planning Team

Representative	Jurisdiction	Agency/Dept	Title
Jason Arnold	Lufkin	Emergency Management	Assistant EMC
Steve Floyd	Lufkin	City Staff	Assistant City Manager
Scott Feaster	Lufkin	IT Dept.	IT Specialist
Sid Munlin	Lufkin	IT Dept.	IT Specialist
Duane Freeman	Lufkin	Fire Dept.	Assistant Chief
Gerald Williamson	Lufkin	Police Dept.	Chief
David Thomas	Lufkin	Police Dept.	Assistant Chief
Scott Cagnon	Lufkin	Police Dept.	Lieutenant

Table 2-8 Zavalla Mitigation Planning Team

Representative	Jurisdiction	Agency/Dept	Title
Chris Wade	Zavalla	Police & Fire	Chief
Waunesa Herrington	Zavalla	City Staff	City Secretary
Ricky Oliver	Zavalla	ISD	Superintendent
Jessie	Zavalla	Public Works	Director
Carl Freeman	Zavalla	Public Works	Foreman

2.2 MULTI-JURISDICTION PARTICIPATION

44 CFR Requirement §201.6(a) (3):
Multi-Jurisdiction plans (e.g., watershed plans) may be accepted, as appropriate, as long as each jurisdiction has participated in the process … Statewide plans will not be accepted as Multi-Jurisdiction plans.

Angelina County and the Cities of Burke, Diboll, Hudson, Huntington, Lufkin, and Zavalla are the formal participants in this hazard mitigation plan. As such, each entity provided information relevant to its jurisdiction and developed its own mitigation action item list.

Representatives from the participating jurisdictions provided:

List of existing planning documents

Hazard profile information including past hazard occurrences and damages

Updated critical assets listings

Repetitive loss property data

New construction numbers

Status of actions from previous version of plan

New actions

Neighboring jurisdictions and regional stakeholders were invited to participate in the process in order to bring additional levels of expertise and other perspectives into the process but also so that they might benefit from the process with the intent of reducing risk across the entire region. Stakeholders are public or private entities that are not formal jurisdictions of the County but have an interest in the county either geographically or by way of a business interest in the county that may be affected by the mitigation plan. Table 2-9 lists the stakeholders that were invited to participate in the planning process.

Table 2-9 Stakeholder Invite List

Title	Agency	Method of invitation
Director	County Public Health Dept.	Email
Disaster Program Director	American Red Cross	Email
Manager of Security	CHI St. Luke's	Email
EMO Coordinator	SETRAC	Email
District Coordinator	TDEM	Email
WUI Specialist	TAMU Forest Service	Email
Disaster Program Dir	Red Cross	Email

2.3 TEAM MEETINGS-PUBLIC INVOLVEMENT

44 CFR Requirement 201.6(b)
An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process. (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

The planning process began with an executive meeting December 19, 2016 to discuss the overarching goals and timelines for the plan development process, and to create a list of invitees to serve on the Hazard Mitigation Team (HMT). Invitation letters were subsequently sent to representatives of various agencies and jurisdictions outlined at the beginning of this chapter. The executive committee chose to execute a very aggressive planning schedule having five Core planning team meetings in the first two months of the process with the city teams meeting between and after these Core team meetings to discuss, compile and submit required data to the appropriate repository, conduct city and county risk analysis, and establish city and county mitigation strategies.

Core Team Meetings
Members of the Core team included representatives from the County and each of the participating cities. Representatives from Federal and State agencies sat on the core planning team as well.

HMT meetings and work sessions were held at the Angelina County Courthouse Annex, Commissioner's Court Meeting Room. Meetings in both the planning and public comment stages were advertised as open to the public in local publications.

The first of these meetings was held January 4, 2017. Main points covered in the meeting were:

- Orientation of attendees on the purpose and benefits of the hazard mitigation plan
- Federal Requirements
- Grant funded
- Overview of Planning Process
  - Review of goals
  - Hazard Identification
  - Data collection discussion
    - Inventory and review of planning mechanisms
    - New development and land use trends
    - Other data requirements

The HMT next convened February 7, 2017. Main points and work conducted included the following:

- Composition of city/county planning teams
- Identify and review existing planning mechanisms
- National Flood Insurance Program (NFIP) participation
- Review 2012 risk assessment summaries
- Hazard Profile Federal Requirements
  - Previous occurrences / Location
  - Extent – Strength or magnitude?
  - Impact – What did it damage?
  - Probability of future occurrence / Overall vulnerability
- Previous Impact Discussion
  - Photos, FEMA Project Worksheets (PW's)
  - Public buildings
  - Roads & bridges
  - Homes & Neighborhoods
  - Utility systems

The third meeting of the Angelina County HMT was February 15, 2017. Main agenda points and work conducted included the following:

- Building city/county planning teams
- Identify and review existing planning mechanisms
- National Flood Insurance Program (NFIP) participation
- Review 2012 risk assessment summaries
- Update critical asset inventory
- Previous plan action item status

- Project Update
  - Project schedule
  - Mitigation Projects / Mitigation Action Items description and definition.

- Mitigation Action Requirements (FEMA Standards)
  - Action
  - Hazard
  - Priority
  - Possible Funding
  - Responsible Department
  - Coordinating agencies
  - Timeframe for completion

- Mitigation Action Discussion
  - Flooding
  - Wildfire
  - High winds/Tornado
  - Hurricane

The fourth meeting of the Angelina County HMT was February 23, 2017. This meeting was open to the public. Main agenda points and work conducted included the following:

- City/county planning teams
- Update 2012 risk assessment summaries
- Update critical asset inventory
- Previous plan action item status

- FEMA Grants Overview
  - Disaster Declaration Grants
  - Non-Disaster Mitigation Grants

- Mitigation Project Prioritization Discussion
  - Requirements
  - Options for prioritization methods
  - Prioritized list of projects due: Friday, March 31, 2017

- Next Steps
  - Prioritization of each community's mitigation action items
  - Individual community work sessions
  - Public review draft presentation
  - Submittal of plan document to TDEM / FEMA for review
  - Adoption of the FEMA approved updated plan

Participant Team Meetings and Data Collection
The planning teams of the participants met as needed to discuss the specific data requirements of their jurisdiction and gather this data. Planning facilitators met with these teams as well to ensure understanding of the requirements and assist in compilation of the data and entry into the document. These meetings were more informal than the city staff meetings and were found to be very beneficial to overall understanding of the project goals and objectives. A general list of information discussed and gathered at these meetings follows:

- List of existing plans, policies, ordinances, etc.
- Previous hazard occurrences
- Critical assets review
- Specific damages from past hazard occurrences
- NFIP program participation
- Repetitive and severe repetitive loss properties
- # structures in floodplain
- New construction since last plan
    - Residential, Commercial, # built in floodplain
- Status of old actions

These jurisdiction specific workshops occurred on the following dates:

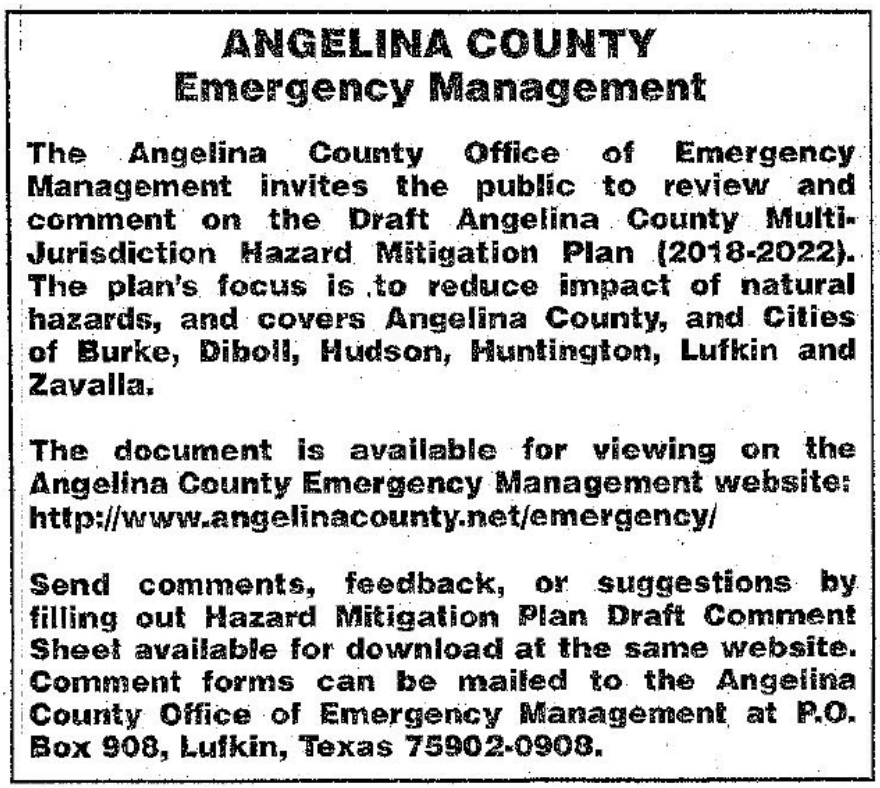
Jurisdiction	Date
Lufkin	February 20, 2017
Diboll	February 21, 2017
Hudson	March 1, 2017
County Commissioners Court	March 28, 2017
Hudson	March 28, 2017

Public Comment and Involvement

A strategy to involve the public in the update of the Angelina County Hazard Mitigation Plan was developed at an early stage in the planning process; both through announcements and invitations to public meetings and also by encouraging team members to carry on a dialogue with neighbors and colleagues for the purpose of capturing input for mitigation ideas and problem areas.

The fourth planning meeting held on February 23, 2017 was announced and the public was invited to attend. The main topic for this meeting was review of actions and prioritization of the actions. This meeting was chosen in the hope that citizens would attend and bring with them possible actions that had not been considered by the HMT. Unfortunately, no one attended.

A draft review and public comment period spanned late April into May 2018. A copy of the draft plan was made available to the HMT and general public to solicit feedback and recommendations.



ANGELINA COUNTY
Emergency Management

The Angelina County Office of Emergency Management invites the public to review and comment on the Draft Angelina County Multi-Jurisdiction Hazard Mitigation Plan (2018-2022). The plan's focus is to reduce impact of natural hazards, and covers Angelina County, and Cities of Burke, Diboll, Hudson, Huntington, Lufkin and Zavalla.

The document is available for viewing on the Angelina County Emergency Management website: http://www.angelinacounty.net/emergency/

Send comments, feedback, or suggestions by filling out Hazard Mitigation Plan Draft Comment Sheet available for download at the same website. Comment forms can be mailed to the Angelina County Office of Emergency Management at P.O. Box 908, Lufkin, Texas 75902-0908.

Source: Lufkin Daily News, May 2018

No public comments were received during the comment period. Additional opportunity for public comment is available at the plan adoption stage, and on an ongoing and continuing basis throughout the 5-year planning cycle as described in Section 2.6.

2.4 ADOPTION

44 CFR Requirement §201.6(c) (5):
*[The local hazard mitigation plan **shall** include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).*

44 CFR Requirement §201.6(c) (5):
*For multi-Jurisdiction plans, each jurisdiction requesting approval of the plan **must** document that it has been formally adopted.*

As stated in **Chapter 1. Prerequisites**, upon provisional approval of this plan document by the Texas Division of Emergency Management (TDEM) and the Federal Emergency Management Agency (FEMA), the governing bodies for Angelina County and the participating municipalities will formally adopt the plan in public session. Following local adoption, copies of each participating jurisdiction's local adoption instrument will be included in Appendix A of this document.

2.5 IMPLEMENTATION, MONITORING, EVALUATION, UPDATE

***Requirement §201.6(c) (4) (i):** [The plan maintenance process **shall** include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.*

Implementation
Angelina County and the Cities of Burke, Diboll, Hudson, Huntington, Lufkin, and Zavalla are committed to implementing this Hazard Mitigation Plan through execution of the action items listed herein. Action item execution will include a report to the Angelina County Office of Emergency Management at the outset and at the completion of each project to ensure oversight, to gather feedback for future updates and to ensure that project timelines are met. The Angelina County Office of Emergency Management will work in coordination with TDEM during post disaster operations to ensure that disaster response teams have access to information and to ensure mitigation opportunities are identified.

In addition, the participating jurisdictions are committed to utilizing this plan to access mitigation grant funds to assist the implementation of action items set forth in Chapter 4 (Mitigation Strategy). Implementation of high benefit/low cost action items will be encouraged in parallel with high priority action items that require grant funding to implement. Opportunities to partner and share costs with affiliated agencies and neighboring jurisdictions for multi-objective projects are encouraged.

Monitoring
The Hazard Mitigation Team (HMT) will monitor the actions items in the Plan Update in the intervening years between plan update cycles. The party responsible for the actions in the plan will be tasked with preparing an annual progress report to submit to the Angelina County Emergency Management Coordinator (EMC).

The EMC will be responsible for convening annual meetings with the HMT in order to present an overall progress report on the entire plan including but not limited to the following subject matter:

- Review of planning process including meetings and trainings held during prior year, progress made incorporating plan into other planning mechanisms, monitoring and evaluation methodology discussion, progress or updates on public involvement, etc.,
- Review of risk assessment including discussion of hazard or disaster occurrences, field observations, recent data collection, new reports and studies, etc.,
- Review of mitigation strategy including potential changes in action item prioritization, grant application opportunities and status, action item implementation progress, etc.

Evaluating
To reiterate, the EMC will be responsible for convening annual meetings of the HMC. The annual meetings will involve the gathering of hazard related data from the previous year and discussion of progress made toward action item implementation.

The HMT will evaluate the plan to assess if significant changes have occurred in the premises upon which the plan was developed such as the following:

- changes in data sources and/or methodology used to determine vulnerabilities and loss estimates, in terms of quality and availability
- changes in federal or state plans that could affect the continued implementation of any of the mitigation actions
- the identification of new hazards requiring new mitigation actions
- changes in community perception relative to specific hazards

In addition to these functions, the HMT agrees to work to educate and involve the public in hazard mitigation activities and to oversee the incorporation of this plan into future planning and public policy documents as these are updated or developed. The incorporation of this plan into other planning instruments will serve as an additional metric for success. This plan will ultimately be evaluated based on implementation of action items, the incorporation of mitigation principles into future public policy, improved public safety, and overall reduction of losses.

Update
The update of the Angelina County Hazard Mitigation Plan, was prepared in 2019 and is intended to remain current for the period 2019 through 2023. In the fourth year of the five year cycle, in accordance with 44CFR, Section 201.6, the Hazard Mitigation Team (HMT) will reconvene to update and amend the Hazard Mitigation Action Plan, allowing ample time for meetings, document drafting, revision and adoption within the required five year timeframe. The HMT will also identify and discuss new mitigation measures to be added to the plan, and discuss and document accomplishments and/or implementation problems and recommended solutions.

2.6 CONTINUED PUBLIC INVOLVEMENT

Requirement §201.6(c) (4) (iii): *[The plan maintenance process **shall** include a] discussion on how the community will continue public participation in the plan maintenance process.*

Throughout current and future planning cycles, city and county residents will be canvassed to solicit local information, continuing Angelina County's dedication to involving the public directly in annual review and cyclical updates of this Hazard Mitigation Action Plan. In addition to the annual monitoring and evaluation meetings of the HMT, meetings will be scheduled as deemed necessary by the Angelina County Office of Emergency Management to provide a forum for which the public can express its concerns, opinions, or ideas about the plan and/or its implementation. The HMT will publicize meetings under standard public notice procedures and through local media outlets.

Attendance at the HMT meetings is just the first level of public involvement planned for the local planning process. Members of the committee were encouraged to not only invite members of the public and local experts to future meetings, but also to carry on a dialogue outside of the formal meetings to develop a more comprehensive picture of the needs and concerns of county residents related to natural hazards and mitigation planning.

Copies of this plan will be catalogued and kept at all appropriate agencies and public libraries. There are also several mitigation action items that have been designed with involvement from the public in mind.

Many of the effects of natural hazards can be lessened by simply educating members of the public on actions they can take to minimize danger to themselves and their possessions. It is anticipated that these strategies will help develop ownership by the public in the plan, and that future iterations of the plan will include strategies that are developed via high levels of public participation.

CHAPTER 3. RISK ASSESSMENT

44 CFR Requirement §201.6(c) (2)
[The plan shall include] A risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

The purpose of the risk assessment is to identify and describe the hazards that affect the planning area and to inventory and analyze potential losses for human life and material assets. Through a better understanding of potential hazards and the degree of risk they pose to the participating jurisdictions, more successful mitigation strategies can be developed and implemented.

This risk assessment follows the four-step process described in the FEMA publication 386-2, *Understanding Your Risks: Identifying Hazards and Estimating Losses* (2002), listed as follows:

- Identify Hazards
- Profile Hazard Events
- Inventory Assets
- Estimate Losses

This chapter is organized into four (4) sub-sections that address the four steps in the risk assessment process.

The first, ***3.1 Identifying Hazards***, lists the hazards that were considered and ultimately profiled in the plan and the methods, definitions and data sources used for the hazard identification and profile process.

Section 3.2 Vulnerability Assessment provides a countywide overview of risk exposure. It includes eight subsections that identify potentially vulnerable assets in the planning area, and identifies opportunities and tools for current and future mitigation planning. Subsections of the vulnerability assessment include inventories of repetitive loss properties; National Flood Insurance Program status for the participating jurisdictions, vulnerable populations; critical facilities; potential dollar loss estimates; land use and development trends; a multi-jurisdiction risk assessment; vulnerable structures; an overview of existing planning mechanisms.

Section 3.3 Multi-Jurisdiction Risk Assessment outlines primary hazard risk types and unique vulnerability factors for each of the cities participating in this plan as differentiated from the county overall.

Section 3.4 Hazard Profiles presents a detailed outline for each identified hazard. Each hazard profile is addressed as a plan subsection and includes a general description; the affected geographic area; discussion of previous occurrences; probability of future occurrence; magnitude and severity; assessment of overall vulnerability to each hazard.

3.1 IDENTIFYING HAZARDS

44 CFR Requirement §201.6(c) (2) (i)
[The risk assessment shall include a] description of the type…of all natural hazards that can affect the jurisdiction.

The planning teams of each participating jurisdiction conducted analysis of past occurrences and equally importantly, the potential for future occurrences, of all natural hazards. From this foundation of analysis, the appointed jurisdictional representatives determined which hazards will be profiled for risk assessment and mitigation actions in their jurisdiction's respective sections of the document. This analysis included an overview of the hazards addressed in the State of Texas Hazard Mitigation Plan.

The chart that follows displays the results of this analysis and displays the hazards that each participant will address in this plan. Each of these hazard types relevant to Angelina County and participating cities are also identified in the State of Texas Hazard Mitigation Plan (2013).

Hazard Type	Angelina County	Burke	Diboll	Hudson	Huntington	Lufkin	Zavalla
Flood	X	X	X	X	X	X	X
Tornado	X	X	X	X	X	X	X
Hurricane	X	X	X	X	X	X	X
Wildfire	X	X	X	X	X	X	X
Lightning	X	X	X	X	X	X	X
Winter Storm	X	X	X	X	X	X	X
Drought	X	X	X	X	X	X	X
Earthquake	X	X	X	X	X	X	X
Dam Failure	X	X	X	X	X	X	X
Extreme Heat	X	X	X	X	X	X	X
Expansive Soils	X	X	X	X	X	X	X
Erosion	X	X	X	X	X	X	X

Source: Hazard Mitigation Team
Notes:

- Land subsidence is not addressed in this document due to a lack of history of impacts to buildings, public safety, or infrastructure.
- Wind damage is most often associated with tornados and hurricanes and therefore addressed in those hazard profiles and corresponding mitigation action items.
- Hail occurs but according to National Center of Environmental Information (NCEI) storm events database, out of 178 hail events recorded from 1958-2018, none produced injury, fatality, property or crop damage.
- Coastal erosion is not profiled due to geographic location.
- Volcanos were not profiled due to geographic location.
- Tsunami was not profiled due to geographic location.

3.1.1 Methods and Definitions

44 CFR Requirement §201.6(c) (2) (i):
[The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

The hazard profiles in Subsections 3.4.1 through 3.4.11 were developed from information provided by the State of Texas Hazard Mitigation Plan, FEMA, the National Weather Service, the previous version of the HMAP, and other referenced sources. Geographic information is provided for each hazard based on information on the impact areas of previous occurrences. For many hazards including drought, excessive heat, hurricane, thunderstorm, etc., geographic location of impacts is potentially any location in the county, and is noted accordingly.

A common set of definitions/classifications was established for the probability of future hazard occurrences and the magnitude and severity of impacts for the purpose of describing the identified hazards in a quantitative and qualitative way (to the extent that data allows). Every effort is made to use these definitions strictly and consistently, but note that some degree of overlap and generalizations may be present.

Classifications used to categorize probability of future occurrence were based on statistical assessments of previous occurrences (or recurrence interval), and equated to a percent probability of occurrence in a given year whenever possible. Probability of future occurrence classifications used for this plan are listed below and summarized in Section 3.3, Table 3-23.

Figure 3-1 Probability of Future Occurrence Classifications

- **High -** Greater than 50 percent probability of occurrence in a given year
- **Medium -** 10 to 50 percent probability of occurrence in a given year
- **Low –** Less than 10 percent probability of occurrence in a given year

Potential magnitude and severity for each hazard is classified based on a scenario where the most extreme documented event occurs in modern times. It is acknowledged here that the categories established may involve some degree of overlap and therefore classification of hazards in this manner is inherently subjective. The magnitude and severity classifications used in the hazard profiles for this plan are listed below and summarized in Section 3.3, Table 3-23.

Figure 3-2 Magnitude and Severity and Extent Classifications

- **Level 4-Catastrophic**—Severe property damage on a regional or metropolitan scale; shutdown of critical facilities, utilities & infrastructure for extended periods, and/or multiple injuries/fatalities
- **Level 3-Critical**—Severe property damage on a neighborhood scale; temporary shutdown of critical facilities, utilities and infrastructure, and/or injuries or fatalities
- **Level 2-Limited**—Isolated occurrences of moderate to severe property damage; brief shutdown of critical facilities, utilities and infrastructure, and/or potential injuries
- **Level 1-Negligible**— Isolated occurrences of minor property damage; minor disruption of critical facilities, utilities and infrastructure, and/or potential minor injuries

Definitions for overall vulnerability are subjective and based primarily on future probability and severity, with additional considerations for potential impacts to special needs populations and the location of buildings, critical facilities and infrastructure. Note: vulnerability classification criteria are general and may involve some degree of overlap. Definitions for overall vulnerability classifications used in this plan are listed below and summarized per hazard in Section 3.3 and Hazard Profiles.

Figure 3-3 Overall Vulnerability Classifications

- **High Vulnerability**— High probability of occurrence and Level-3 or Level-4 potential severity with significant potential effect on populations, structures, infrastructure, environment, and/or economy
- **Moderate Vulnerability**— Moderate/high probability and Level-1 or Level-2 potential severity with moderate potential effect on populations, structures, infrastructure, environment, and/or economy
- **Low Vulnerability**— Low probability and Level-1 or Level-2 potential severity with minor potential effect on populations, structures, infrastructure, environment, and/or economy

3.1.2 Data Sources and Data Limitations

Data Sources
Since the original hazard mitigation plan for Angelina County was developed (2005-2006), there have been significant advances in the availability of data relevant to risk and vulnerability assessment. In addition to information reported in the original version of hazard mitigation plan, the majority of information contained in the Hazard Profiles and Vulnerability Assessment sections came from the following agencies, plans, technical documents and data sources:

Agency Sources:

- Federal Emergency Management Agency (FEMA)
- Texas Division of Emergency Management (TDEM)
- National Flood Insurance Program (NFIP)
- National Weather Service-Lake Charles (NWS)
- National Oceanic and Atmospheric Administration (NOAA)
- National Climatic Data Center (NCDC)
- National Severe Storms Laboratory (NSSL)
- National Inventory of Dams (NID)
- U.S. Geological Survey (USGS)
- National Hurricane Center
- Local and regional media (current and historical)
- Participating jurisdictions

Technical Documents and Plans:

- Federal Emergency Management Agency (FEMA). Publication 386-2, *Understanding Your Risks: Identifying Hazards and Estimating Losses*; HAZUS Multi-Hazard Loss Estimation software; et al.
- FEMA Flood Insurance Study: Angelina County Texas and Incorporated Communities (Effective September 29. 2010)
- State of Texas Hazard Mitigation Plan (2010 Edition)

Software and Analysis Tools:

- FEMA 'D-FIRM' Flood Insurance Rate Map Shapefile
- ArcMap Geographic Information System (GIS) Software, Spatial Analyst

Data Limitations
Quality and availability of source data improved markedly since the original hazard mitigation plan was development though many limitations remain. Over time it is expected that hazard related information will continue to improve and will be included in future updates.

Also, the Hazard Mitigation Team notes that FEMA Flood Insurance Rate Maps (FIRMs) lack detailed data adequate for planning purposes.

Also, National Climatic Data Center information is used extensively as a reporting mechanism for hazard events of various types. It should be noted however that damage descriptions and totals provided by this source is not necessarily a full accounting of local impacts, and further, damage totals for certain hazard events may cover multi-county regions and may or may not accurately reflect direct impacts in the planning area.

3.2 VULNERABILITY ASSESSMENT

44 CFR Requirement §201.6(c) (2) (ii): *[The risk assessment **shall** include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c) (2) (i) of this section. This description **shall** include an overall summary of each hazard and its impact on the community.*

Overall vulnerability to each hazard was based on assessments of previous and potential occurrences regarding the scale of geographic area affected, future probability, and severity of impact considering a worst case scenario. Factors including risk exposure of special needs populations, medical special needs populations, the location of critical facilities, and key infrastructure were also considered.

Relative to many geographic regions of the U.S., overall vulnerability to natural hazard impacts is substantial for the region of east Texas that includes the planning area. For Angelina County, vulnerability by hazard type varies widely.

Based on these factors and the definitions established in Subsection 3.1.1 (listed below in the table notes), Table below shows the Hazard Mitigation Team's assessment of overall vulnerability to each of the identified hazards and categories of primary impacts (classified as human, property, infrastructure, economy, and/or environment).

Table 3-1 Overall Vulnerability and Impact by Hazard Type

HAZARD TYPE	VULNERABILITY	PRIMARY IMPACT CATEGORIES
Flood	High	Property, Infrastructure
Tornado	High	Public Safety, Property, Infrastructure
Hurricane	High	Public Safety, Infrastructure
Wildfire	High	Public Safety, Property, Infrastructure, Economy
Thunderstorm (Lightning)	High	Public Safety, Property, Infrastructure
Winter Storm	Moderate	Public safety, Infrastructure
Drought	Moderate	Public Safety, Property, Infrastructure, Economy
Earthquake	Low	Public Safety, Economy, Infrastructure
Dam Failure	Moderate	Public Safety, Property, Economy
Extreme Heat	Moderate	Public Safety, Property, Infrastructure, Economy
Expansive Soil	Low	Public Safety, Infrastructure, Environment
Streambed Erosion	Moderate	Property, Infrastructure

Source: Angelina County Hazard Mitigation Team

Table 3-23 summarizes the probability of occurrence and magnitude and severity assessments from the individual hazard profiles detailed in Subsections 3.2.1 through 3.2.13. Table 3-23 Probability of Occurrence and Magnitude/Severity by Hazard Type.

Table 3-2 Overall Probability and Magnitude by Hazard Type

HAZARD TYPE	PROBABILITY OF OCCURRENCE	POTENTIAL MAGNITUDE/SEVERITY/EXTENT
Flood	High	Level 3- Critical
Tornado	High	Level 3- Critical
Hurricane	High	Level 4- Catastrophic
Wildfire	High	Level 3- Critical
Thunderstorm (Lightning)	High	Level 3- Critical
Winter Storm	Medium	Level 2- Limited
Drought	High	Level 2- Limited
Earthquake	Low	Level 2- Limited
Dam Failure	Low	Level 3- Critical
Extreme Heat	Medium	Level 3- Critical
Expansive Soil	Medium	Level 2- Limited
Streambed Erosion	High	Level 2- Limited

Source: Angelina County Hazard Mitigation Team

3.3.1 Repetitive Loss Properties

44 CFR Requirement §201.6(c) (2) (ii): *[The risk assessment]* ***must*** *also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged by floods.*

National Repetitive Loss Strategy

The National Flood Insurance Program (NFIP) has developed a strategy to mitigate future losses related to repetitive loss properties. The primary objective of the Repetitive Loss Properties Strategy is to eliminate or reduce the damage to property and the disruption of life caused by repeated flooding of the same properties. A specific target group of repetitive loss properties is identified and serviced separately from other NFIP policies by the Special Direct Facility (SDF). The target group includes every NFIP-insured property that, since 1978 and regardless of any change(s) of ownership during that period, has experienced:

- Four or more paid flood losses of more than $1,000 each; or
- Two paid flood losses within a 10-year period that, in the aggregate, equal or exceed the current value of the insured property; or
- Three or more paid losses that, in the aggregate, equal or exceed the current value of the insured property.

Loss history is determined by counting all flood claims paid on an insured property, regardless of any change(s) of ownership, since the building's construction or back to 1978 if the building was constructed before 1978. Target group policies are afforded coverage, whether new or renewal, only through the SDF. Property owners affected by the repetitive loss strategy are notified at least 90 days before the policy renewal date. Affected property owners and their flood insurance agents are sent notice by their insurance company stating that the policy is ineligible for renewal and offering renewal in the SDF.

Angelina County Repetitive Loss Information

Forty (40) individual properties in Angelina County have flood insurance claim histories that meet one or both definitions for repetitive losses or severe repetitive losses. Eight (8) of the repetitive loss properties have been mitigated, leaving a remaining total of 32 non-mitigated properties. Thirty-one (31) repetitive loss properties are residential, and 3 are commercial. Six (6) of the 31 residential properties are in multi-unit structure/apartments. The 135 flood insurance claims on these repetitive loss properties represent 50 percent of the 270 total flood insurance claims for the county overall.

The highest number of paid flood insurance claims for an individual property is seven (7). One property has made six (6) flood insurance claims, and three properties each have had five (5) flood insurance claims paid. The property collecting the highest total in flood insurance payments received $198,545, spread across 3 separate claims. Notably, 13 of the 40 rep loss properties are located outside Special Flood Hazard Areas according to FEMA FIRMs.

Table 3-3 summarizes numbers of losses and amounts paid in insurance claims by category for the entire county. Available data shows a Lufkin, Texas address for all 40 repetitive loss properties, mapped on the following page. Accordingly, based on available data there are no repetitive loss properties for the unincorporated county, nor Burke, Diboll, Hudson, Huntington, or Zavalla.

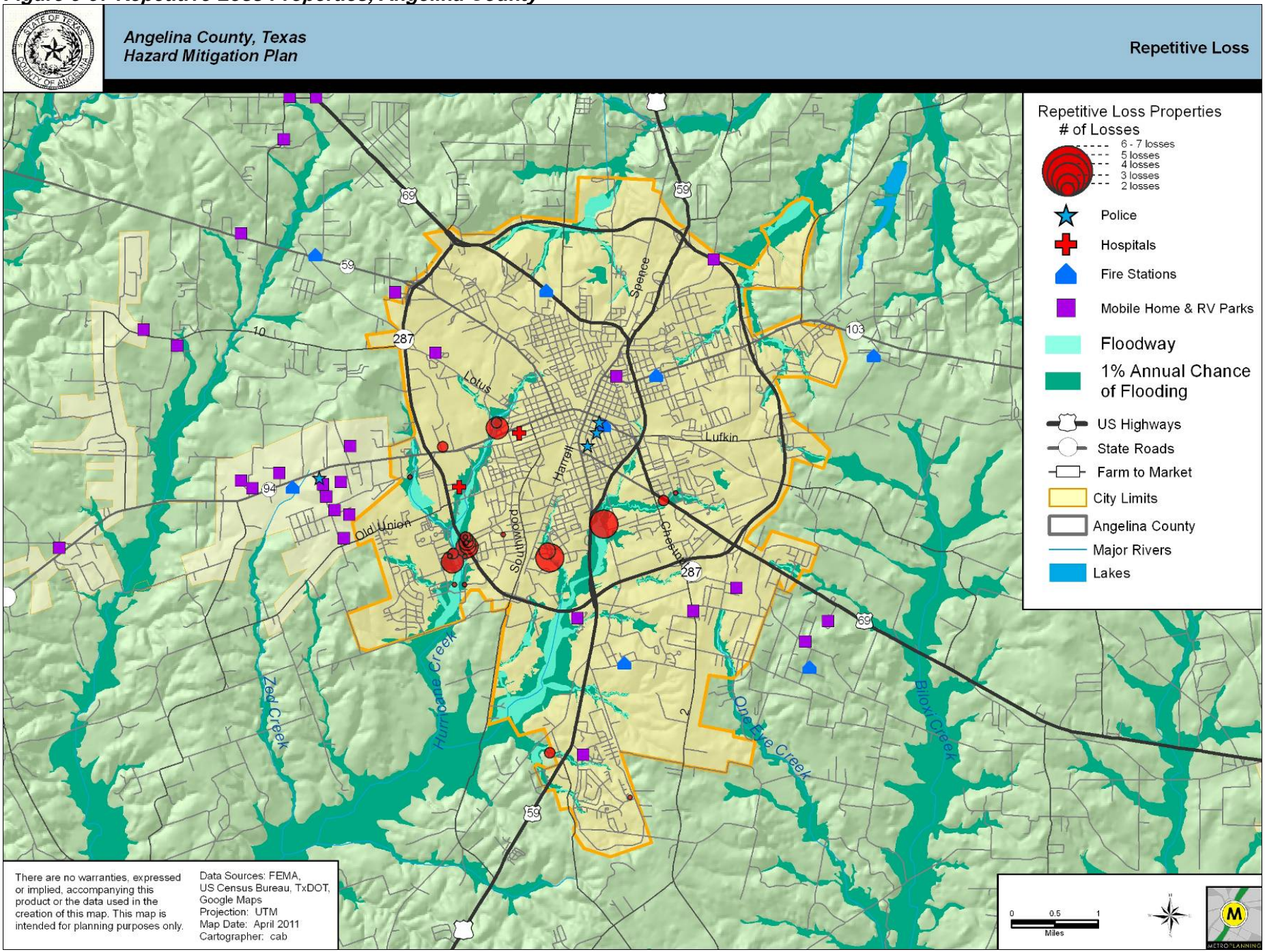
Table 3-3 Summary of Repetitive & Severe Repetitive Loss Claims, Lufkin

# of RL/SRL Properties	# of Claims	Total Payments	Average Payment Per Claim
40	135	$2,746,651	$20,345

Source: Angelina County Repetitive Loss Report (April 2017). Note: Eight (8) of the repetitive loss properties have been mitigated, leaving a remaining total of 32 non-mitigated properties.

Figure 3-37 on the following page shows the general locations of repetitive loss properties in Angelina County. Note: 9 properties have been mitigated via HMGP acquisition-demolition project. Flood insurance claim information for individual cities are noted in Section 3.3.2.

Figure 3-37 Repetitive Loss Properties, Angelina County



3.3.2 Community NFIP Status-Flood Insurance Claim Information

Community Participation in the National Flood Insurance Program

Nearly 20,000 communities across the United States participate in the National Flood Insurance Program (NFIP) by adopting and enforcing floodplain management ordinances to reduce future floodplain damage. In exchange, the NFIP makes federally backed flood insurance available to homeowners, residents and business owners in these communities. The following is a list of NFIP participating communities in Angelina County. Each of these jurisdictions are committed to continued participation in the NFIP, and each has developed an action item supporting continued participation that is included in Chapter 4 (Mitigation Strategy) in their respective action item sections.

Table 3-4 NFIP Status, Participating Communities, Angelina County

Community	CID Number	Current Effective Map Date
Angelina Co.	480007	9/29/2010
Burke*	480248	9/29/2010
Diboll	480008	9/29/2010
Hudson	480011	9/29/2010
Huntington	481077	9/29/2010
Lufkin	480009	9/29/2010
Zavalla	485527	9/29/2010

Source: FEMA National Flood Insurance Program, Community Status Report Book as of 3/30/2018
*The City of Burke does not currently participate in the NFIP, sanction date 9/29/2011

Table 3-5 below shows that there are 472 NFIP flood policies in force insuring over $107 million in property throughout Angelina County.

Table 3-5 Total Number of Flood Insurance Policies in Place, Insurance Coverage, Angelina County and Communities (as of 1/31/2018)

Community	Policies In-force	Insurance In-force	Premium In-Force
Angelina County	89	$19,889,600	$43,049
Diboll	31	$6,043,100	$22,052
Hudson	8	$2,250,000	$3,483
Huntington	3	$829,000	$2,906
Lufkin	341	$78,585,100	$310,206
Totals	**472**	**$107,596,800**	**$381,696**

Source: BureauNetNFIP through FEMA

Table 3-6 below shows over a 32 year period there have been a total of 231 losses claimed against NFIP policies totally over $3 million in payments throughout Angelina County. The table shows a comparison of statistics from 2011 to January 2018. Since the last plan update in 2011, 47 new flood claims were made resulting in $683,770 in payments.

Table 3-6 Total Number of Flood Insurance Claims and Total Payments, Angelina County and Communities from (12/27/1974 to 1/31/2018)

Community	Total Claims (through 2011)	Total Payments (through 2011)	Total Claims (through March 2018)	Total Payments (through March 2018)
Angelina County	7	$172,631	20	$464,133
Diboll	6	$42,530	9	$81,728
Huntington	0	0	1	$0
Lufkin	218	$2,947,623	248	$3,300,693
Total	**231**	**$3,162,784**	**278**	**$3,846,554**

Source: NFIP Statistics; https://bsa.nfipstat.fema.gov/reports/1040.htm#48; 1/31/2018

3.3.3 Vulnerable Populations

Vulnerable populations can be defined as persons that may not be able to assist themselves during an emergency. Vulnerable populations include persons under five (5) years of age, over 65, persons with disabilities, and below average income. Mitigation efforts that consider the needs, abilities, and location of vulnerable populations are important considerations.

Listed below in the following table is vulnerable population data from the 2016 U.S. Census. Vulnerable population data for Burke, Diboll, Hudson, Huntington, Lufkin and Zavalla are reported for each city in Section 3.3 (Multi-Jurisdiction Risk Assessment).

Table 3-7 Vulnerable Populations, Angelina County (2016)

Category	Number (#)	Percentage (%)	U.S. (%)	Angelina County - U.S. Difference (%)
Under Age 5	6,048	6.9	6.2	+0.7
Over Age 65	13,762	15.7	15.2	+0.5
Disabled	13.061	14.9	8.6	+6.3
Below Federal Poverty Level	16,665	19.0	12.7	+6.3

Source: US Census 2016

Notes: 2016 federal poverty level for one (1) person household is $11,770; and $24,250 for a four (4) person household.

The U.S. Census defines a person as having a work disability if one or more of the following conditions are met:

1. Persons with health problem or disability which prevents work or limits the kind or amount of work they can do
2. Persons who have retired or left a job for health reasons
3. Persons currently not in the labor force because of a disability.
4. Persons who did not work at all in the previous year because of illness or disability
5. Under 65 years old and covered by Medicare in previous year.
6. Under 65 years old and received Supplemental Security Income (SSI) in previous year.
7. Received VA disability income in previous year.

The map on the following page shows distribution of population across the county based on density of structures per acre.

3.3.4 Vulnerable Structures

Due to the location of the planning area within a region of the U.S. that experiences relatively frequent hazard events with catastrophic magnitude and geographic scale, all structures in Angelina County can be considered vulnerable to disaster impacts. A subset of the complete inventory of structures in the planning area are those with unique propensity to damage from hazard events, either due to architectural design, building material type, location, or combination of these factors.

This subsection discusses the location and concentrations of structures that fall into this subset, starting with estimates type and number of existing structures in hazard areas; followed by maps of address points in floodplains, mobile home parks, and an inventory of address points located in areas particularly vulnerable to wildfire impacts.

Vulnerable Structures (Existing)
Table 3-8 gives an approximation of total structures vulnerable to hazard impact by type. According to data provided by DETCOG, there are 28,899 total structures in Angelina County. 2016 median property value is estimated at $89,300.

These estimates reflect a combination of vulnerability based on location as well as structural vulnerability. Similar to potential dollar loss, these vulnerable structure estimates are premised on a 'most likely worst case scenario', a subjective approach that estimates losses resulting from the most severe event occurrence possible within roughly a 0-99 percent probability parameter. This definition was developed to exclude farfetched, though theoretically possible, estimates that exceed rational analysis for mitigation purposes.

Differentiation of impact across the various development types (residential, commercial, industrial, etc.) was not developed, but rather is reported as a static value for estimated loss based on total number of structures within each category. For some hazards such as winter storm, all structures are in the geographic region affected, but a relatively small percentage could be expected to sustain damage. For other hazards such as drought and extreme heat, structures are not impacted to a measurable degree. Other hazard types such as hurricanes and earthquakes affect broad regions when they occur, others such as flooding and dam failure have more clearly defined areas of potential hazard impact. Note: the following estimates do not take into account probability of occurrence.

Table 3-8 Estimated Total Structures Vulnerable to Hazard by Type (WCS/Major Event)

Hazard	Total Structures	% Structures Potentially Impacted	# of Structures Potentially Impacted	Typical Degree of Structure Damage	2016 Median Housing Value	Total Structure Damage Estimate
Flood	28,899	5.0%	1,445	40.0%	$89,300	$51,613,614
Tornado	28,899	5.0%	1,445	80.0%	$89,300	$103,227,228
Hurricane	28,899	50.0%	14,450	40.0%	$89,300	$516,136,140
Wildfire	28,899	8.0%	2,312	60.0%	$89,300	$123,872,674
Lightning	28,899	0.1%	29	10.0%	$89,300	$258,068
Winter Storm	28,899	20.0%	5,780	10.0%	$89,300	$51,613,614
Drought	28,899	0.0%	0	0.0%	$89,300	$0
Earthquake	28,899	50.0%	14,450	20.0%	$89,300	$258,068,070
Dam Failure	28,899	0.1%	29	40.0%	$89,300	$1,032,272
Extreme Heat	28,899	5.0%	1,445	10.0%	$89,300	$12,903,404
Expansive Soil	28,899	2.0%	578	20.0%	$89,300	$10,322,723
Erosion	28,899	0.1%	29	40.0%	$89,300	$1,035,880

Sources: Total structures (DETCOG), Hazard Estimates (HMT)

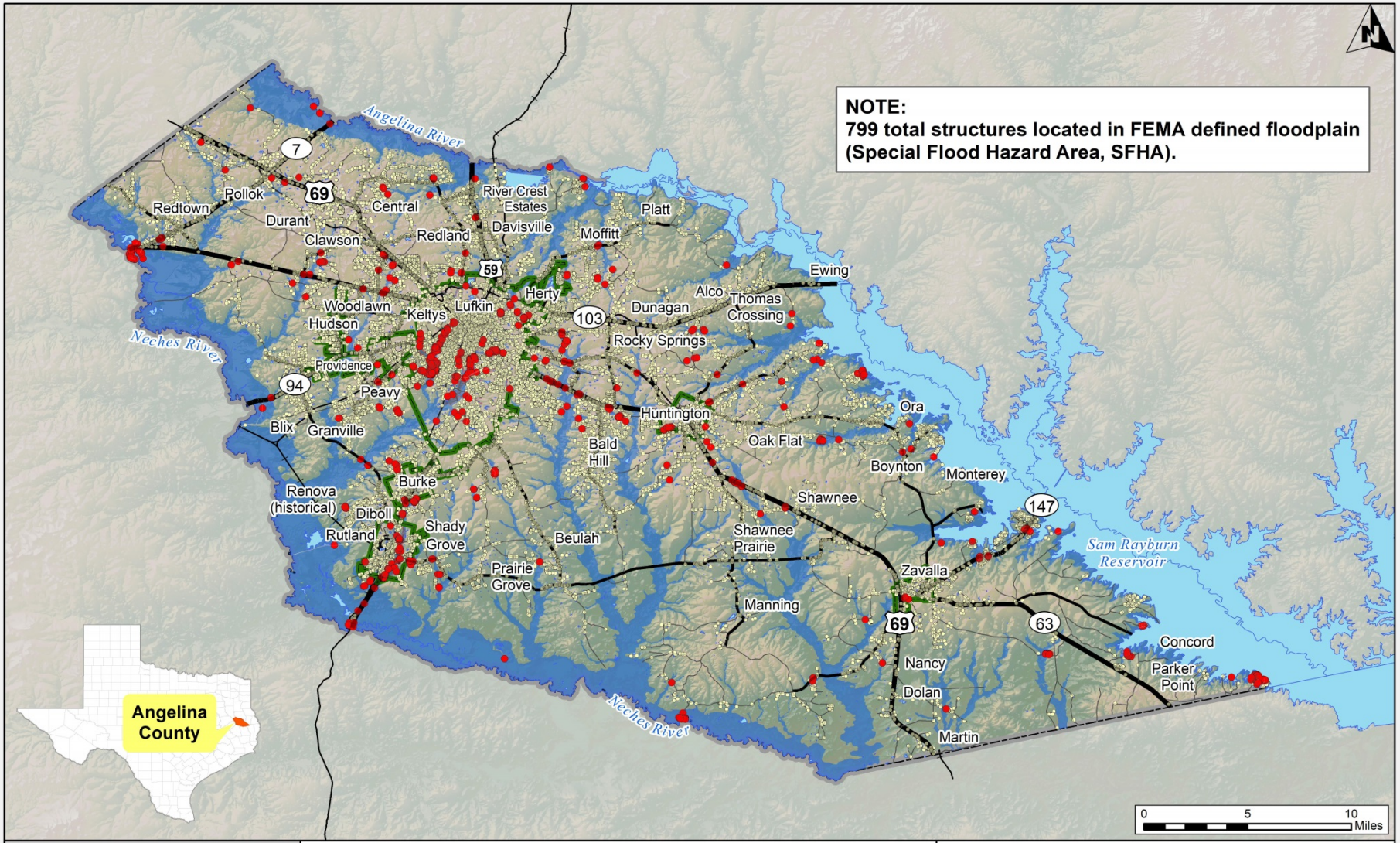
Note: WCS = anticipated worst case scenario.

Structures in Floodplain Areas

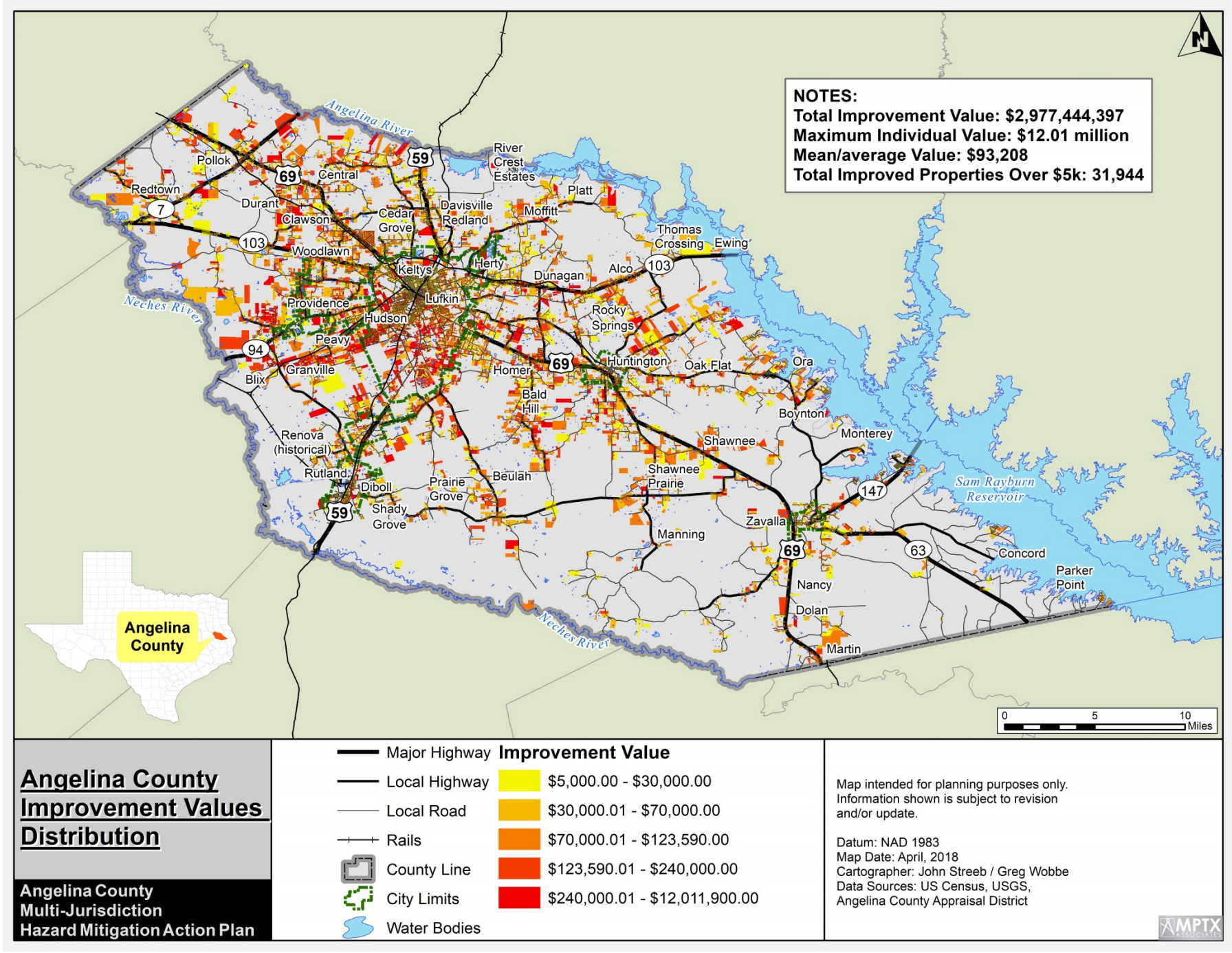
The map on the following page shows location of address points in relation to the FIRM defined floodplain. Number of address points in the floodplain is calculated at 799, representing approximately 2.8 percent of total structures in the county. The table below is a detailed breakdown of structures in relation to floodplain areas, accompanied by a map on the following page.

Location Category	Structures (#)	Percent of Total
In floodway	138	0.48%
In 1-percent annual flood probability (SFHA)	799	2.76%
Outside floodplain (Zone X)	28,100	97.24%
Total	28,899	100.00%

Source: FEMA (floodplain); Angelina Central Appraisal District (address points)


NOTE:
799 total structures located in FEMA defined floodplain
(Special Flood Hazard Area, SFHA).
Angelina River
Neches River
Sam Rayburn Reservoir
Redtown
Pollok
Durant
Clawson
Central
River Crest Estates
Davisville
Redland
Moffitt
Platt
Ewing
Alco
Thomas Crossing
Dunagan
Rocky Springs
Herty
Lufkin
Woodlawn
Keltys
Hudson
Providence
Peavy
Blix
Granville
Huntington
Ora
Oak Flat
Bald Hill
Boynton
Monterey
Shawnee
Shawnee Prairie
Burke
Renova (historical)
Diboll
Rutland
Shady Grove
Beulah
Prairie Grove
Zavalla
Manning
Nancy
Dolan
Martin
Concord
Parker Point
7
69
59
103
94
147
63
Angelina County
0
5
10
Miles
Angelina County Structures in Floodplain
Angelina County
Multi-Jurisdiction
Hazard Mitigation Action Plan
Major Highway
Local Highway
Local Road
County Line
City Limits
Rails
Water Bodies
Floodway
100yr Floodplain
Structures in Floodplain
Other Structures
Map intended for planning purposes only.
Information shown is subject to revision
and/or update.
Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, FEMA, ACAD
MPTX ASSOCIATES

The map below shows distribution of development value of structures across the planning area.



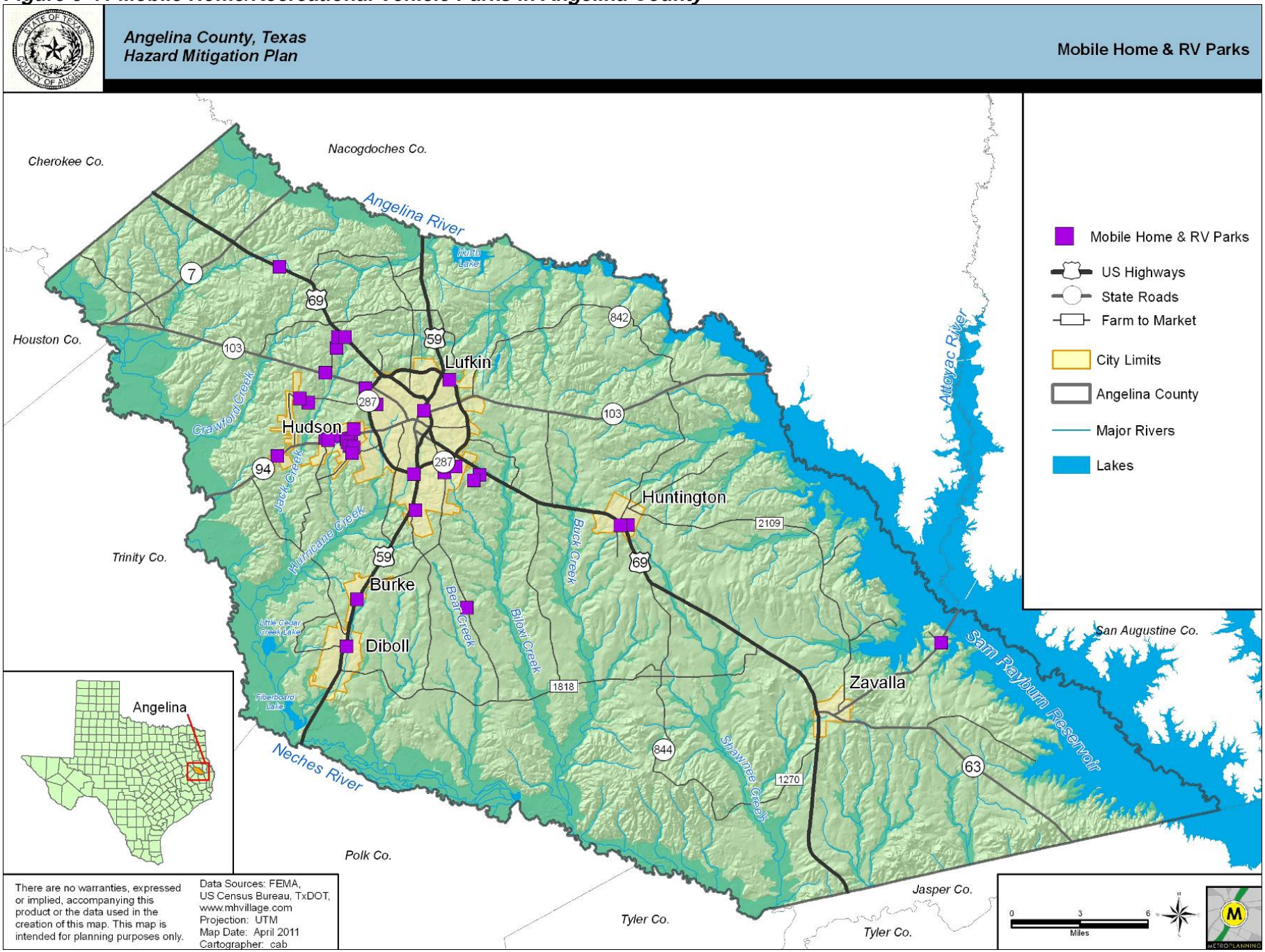
Mobile Home and Recreational Vehicle Parks

Based on a number of factors including the method used to fasten mobile homes to their foundation, weight to surface area ratios, and building material characteristics, mobile homes are considered more vulnerable to hazard impacts than certain other structure types.

The safety of inhabitants, bystanders, and first responders is the primary concern, as mobile homes can become dislodged from their foundation or break apart during hurricane, flooding, high wind, and tornado events. Other considerations regarding the unique vulnerability of mobile homes include secondary property and infrastructure damage, and environmental impacts of broken sewer lines.

Angelina County has at least 27 recreational vehicle parks, mobile home parks, or large clusters of mobile homes identified by review of available information and shown in relationship to the floodplain on the map on the following page. Note: this analysis is not a complete inventory, and numerous other individual mobile homes and recreational vehicles are dispersed throughout the county.

Figure 3-41 Mobile Home/Recreational Vehicle Parks in Angelina County



3.3 MULTI-JURISDICTION RISK ASSESSMENT

44 CFR Requirement §201.6(c) (2) (iii): *For multi-Jurisdiction plans, the risk assessment **must** assess each jurisdiction's risks where they vary from the risks facing the entire planning area.*

The multi-jurisdiction risk assessment section is intended to detail risk and vulnerability factors for the County and participating communities of Burke, Diboll, Hudson, Huntington, Lufkin and Zavalla. Certain identified hazards affect the planning area with more or less equally, such as thunderstorms, drought and excessive heat. Probability, severity, and vulnerability for other hazards may vary based on location, such as flooding, hurricanes, and wildfires. The following city specific subsection identifies risk characteristics that are unique to each of the participating communities noted above. Other hazard information can be found in the hazard profiles in Section 3.4 of this chapter.

3.3.1 City of Burke Risk-Vulnerability Assessment

The City of Burke is located in southwest Angelina County along Highway 59 at an elevation 273 feet above sea level. City limits cover 0.6 square miles. 2016 Census population was 730. The upper reaches of White Oak Creek skirt the eastern city limits. A mobile home park is located near the center of town, and a dense pine plantation stand is located just north and west of town.

Primary mitigation objectives are improvement of drainage channels. Table 3-9 below outlines vulnerable populations data. The maps on the following page of the relationship of FEMA defined floodplains to facilities and structures in Burke and surrounding areas, and locations of wildfire ignition density. Notably, 2 structures in the southern portion of the city appear to be situated in FEMA defined floodplains. Wildfire ignition density is most concentrated in north central portion of the city.

Table 3-9 Vulnerable Populations, City of Burke

Category	Burke (%)	U.S. (%)	Burke - U.S. Difference (%)
Under Age 5 (2010)	7.1	6.5	+0.6
Over Age 65 (2010)	10.6	13.0	-2.4
Disabled (2000)	25.5	19.3	+6.2
Below Federal Poverty Level (2016)	14.2	12.7	+1.6

Source: US Census 2000, 2010, and 2016
Notes: 2016 federal poverty level for one (1) person household is $11,770; and $24,250 for a four (4) person household.

The U.S. Census defines a person as having a work disability if one or more of the following conditions are met:

1. Persons with health problem or disability which prevents work or limits the kind or amount of work they can do
2. Persons who have retired or left a job for health reasons
3. Persons currently not in the labor force because of a disability.
4. Persons who did not work at all in the previous year because of illness or disability
5. Under 65 years old and covered by Medicare in previous year.
6. Under 65 years old and received Supplemental Security Income (SSI) in previous year.
7. Received VA disability income in previous year.

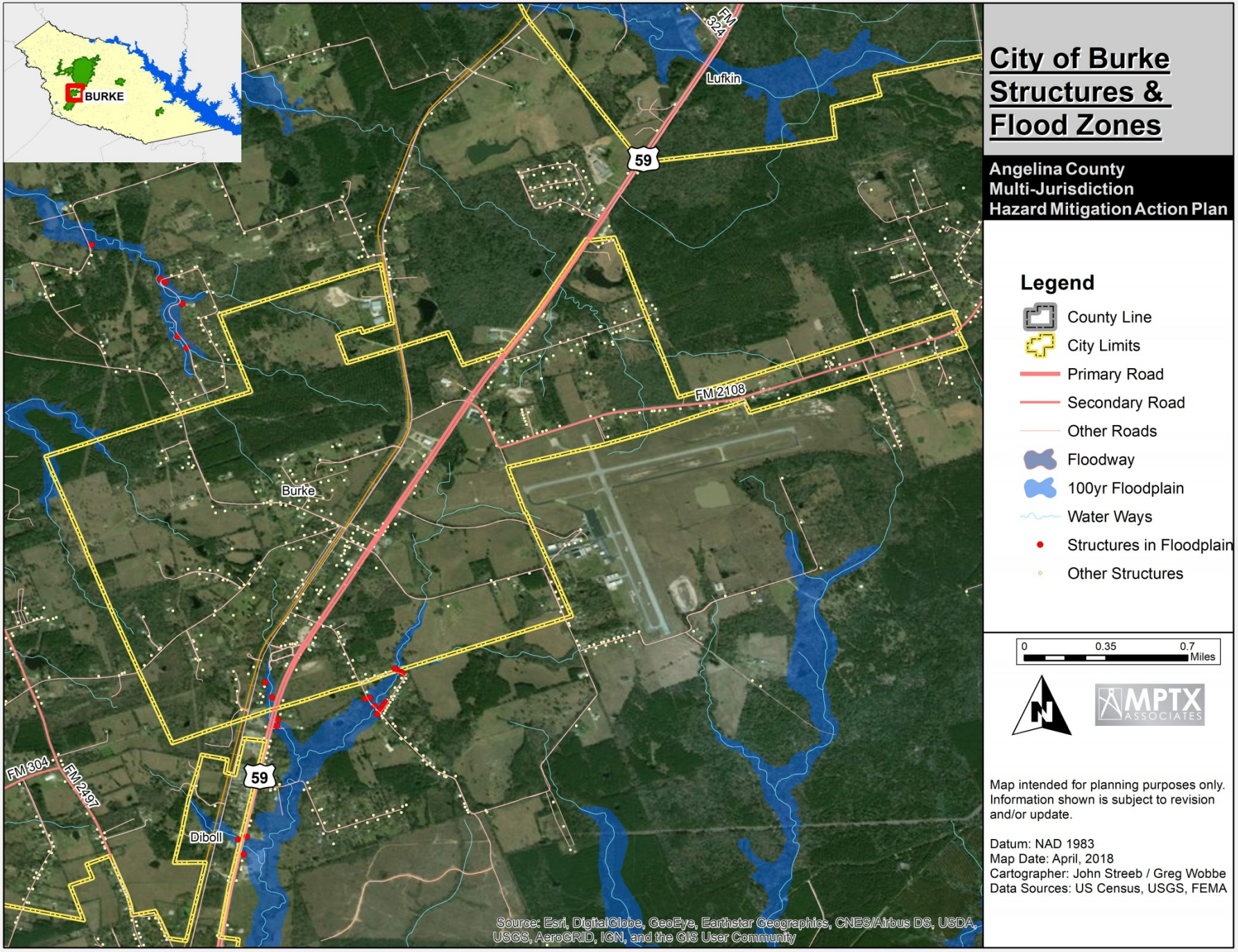
Based on definitions established in Subsection 3.1.1 (listed below in the table notes), Table 3-10 below shows an assessment of overall vulnerability, probability, and magnitude for the City of Burke for each of the identified hazards.

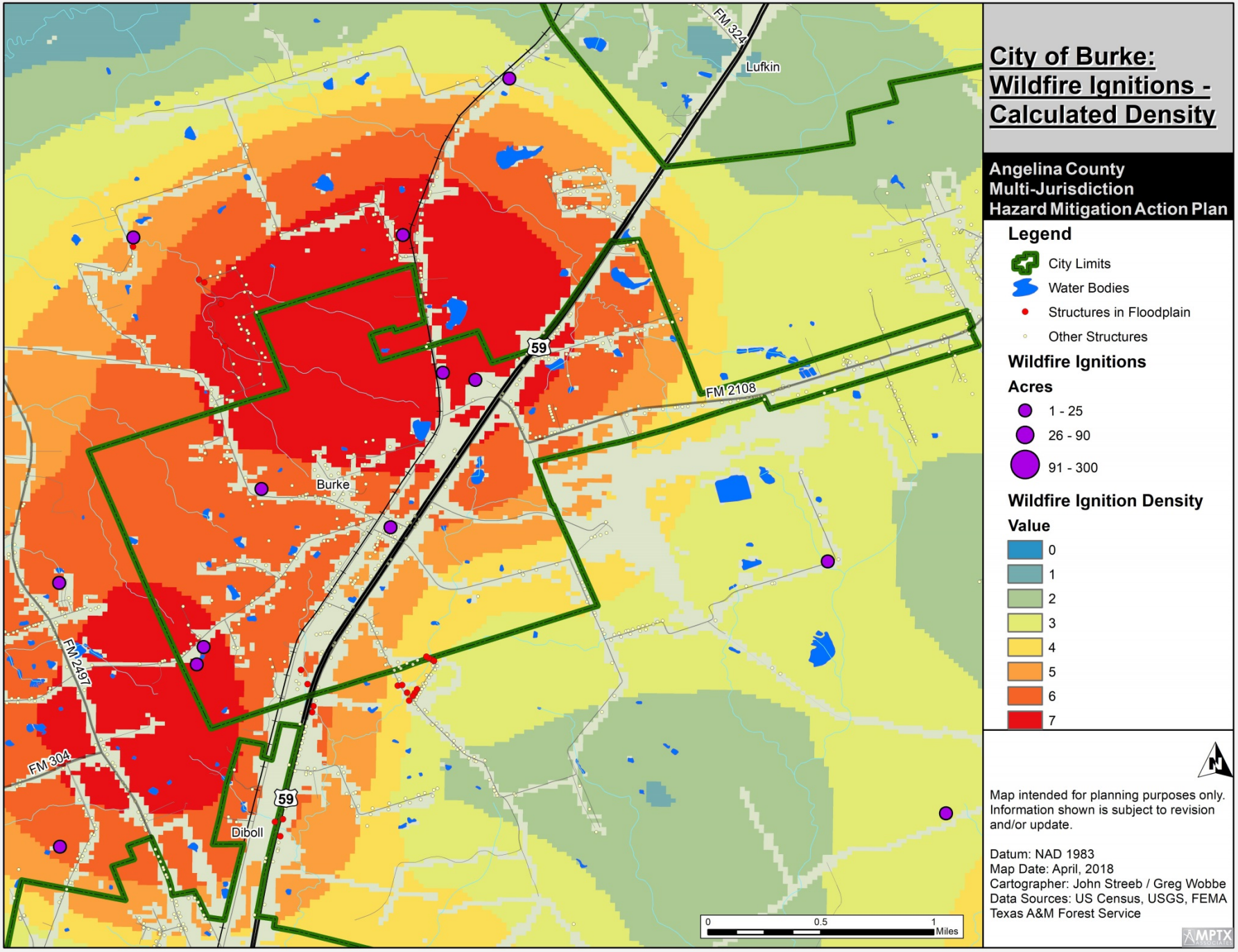
Table 3-10 Overall Vulnerability, Probability, and Extent by Hazard Type: Burke

HAZARD TYPE	VULNERABILITY	PROBABILITY	EXTENT
Flood	Moderate	Medium	1 – 18 inches
Tornado	High	High	EF1-EF3
Hurricane	High	High	TS-CAT 3
Wildfire	Moderate	Medium	Level 2- Limited
Lightning	High	High	T1 – T5
Drought	Moderate	High	-1 to -6 PHDI
Extreme Heat	Moderate	High	110 Heat Index
Winter Storm	Low	Medium	1-2 inches snow
Earthquake	Low	Low	1-3 Magnitude
Expansive Soils	Low	Low	0.3” SSC
Erosion	Low	Low	Negligible
Dam Failure	Low	Low	Negligible

Source: Hazard Mitigation Team, City of Burke
Notes: Definitions for vulnerability, probability, and magnitude classifications provided in Section 3.1.1. Negligible extent indicates magnitude too low to be measured using empirical scales. The City of Burke notes no new construction since 2011. SSC = Shrink-Swell Cycle

The map on the following page shows FEMA defined Special Flood Hazard Areas in relation to structures and major roads. .


BURKE
Lufkin
FM 324
59
FM 2108
Burke
FM 304
FM 2497
59
Diboll
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
City of Burke Structures & Flood Zones
Angelina County Multi-Jurisdiction Hazard Mitigation Action Plan
Legend
County Line
City Limits
Primary Road
Secondary Road
Other Roads
Floodway
100yr Floodplain
Water Ways
Structures in Floodplain
Other Structures
0
0.35
0.7
Miles
N
MPTX ASSOCIATES
Map intended for planning purposes only. Information shown is subject to revision and/or update.
Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, FEMA


City of Burke:
Wildfire Ignitions -
Calculated Density
Angelina County
Multi-Jurisdiction
Hazard Mitigation Action Plan
Legend
City Limits
Water Bodies
Structures in Floodplain
Other Structures
Wildfire Ignitions
Acres
1 - 25
26 - 90
91 - 300
Wildfire Ignition Density
Value
0
1
2
3
4
5
6
7
Map intended for planning purposes only.
Information shown is subject to revision
and/or update.
Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, FEMA
Texas A&M Forest Service
Lufkin
Burke
Diboll
FM 324
FM 2108
FM 2497
FM 304
59
0
0.5
1
Miles

3.3.2 City of Diboll Risk-Vulnerability Assessment

The City of Diboll is located in southwest Angelina County along Highway 59 at an elevation 212 feet above sea level. 2016 Census population is 5,369, representing significant population growth since 2010. Recent annexations have extended the city limits, and new wastewater facility was recently built. Secondary water pipeline coordinated with City of Lufkin under construction. Two new schools are under construction. The police station, fire station, and city hall are all located in central Diboll. The City permitted 27 new residential structures and one new commercial structure since 2012, none of which were built in the floodplain.

Flooding, hurricanes, and tornados are noted as primary hazard types, with particular vulnerability to mobile home parks. White Oak Creek runs through the center of town, including FEMA defined floodways, and areas of known flooding problems in the southern and eastern portions of town. Wildfire hazard is noted in pine plantation to the east, and present to south and west. Deer Trace subdivision is noted for expansive soils impacts. High priority mitigation projects include a generator for Harris St. Lift Station Grinder Pump #4, and storm protection for proposed and existing facilities.

Flooding is causing streambed erosion along Sewer Street. The stream bank erodes a little more with each heavy rainfall. Currently getting closer to the homes in the area at a rate of approximately five to ten inches per flood event over the last five years. Table 3-11 below outlines vulnerable population data for Diboll, updated with most recent available Census information from 2016.

Table 3-11 Vulnerable Populations, City of Diboll

Category	Diboll (%)	U.S. (%)	Diboll - U.S. Difference (%)
Under Age 5 (2010)	8.1	6.5	+2.6
Over Age 65 (2010)	10.4	13.0	-2.6
Disabled (2016)	16.4	8.6	+7.8
Below Federal Poverty Level (2016)	25.2	12.7	+12.5

Source: US Census 2010 and 2016
Notes: 2016 federal poverty level for one (1) person household is $11,770; and $24,250 for a four (4) person household.

The U.S. Census defines a person as having a work disability if one or more of the following conditions are met:

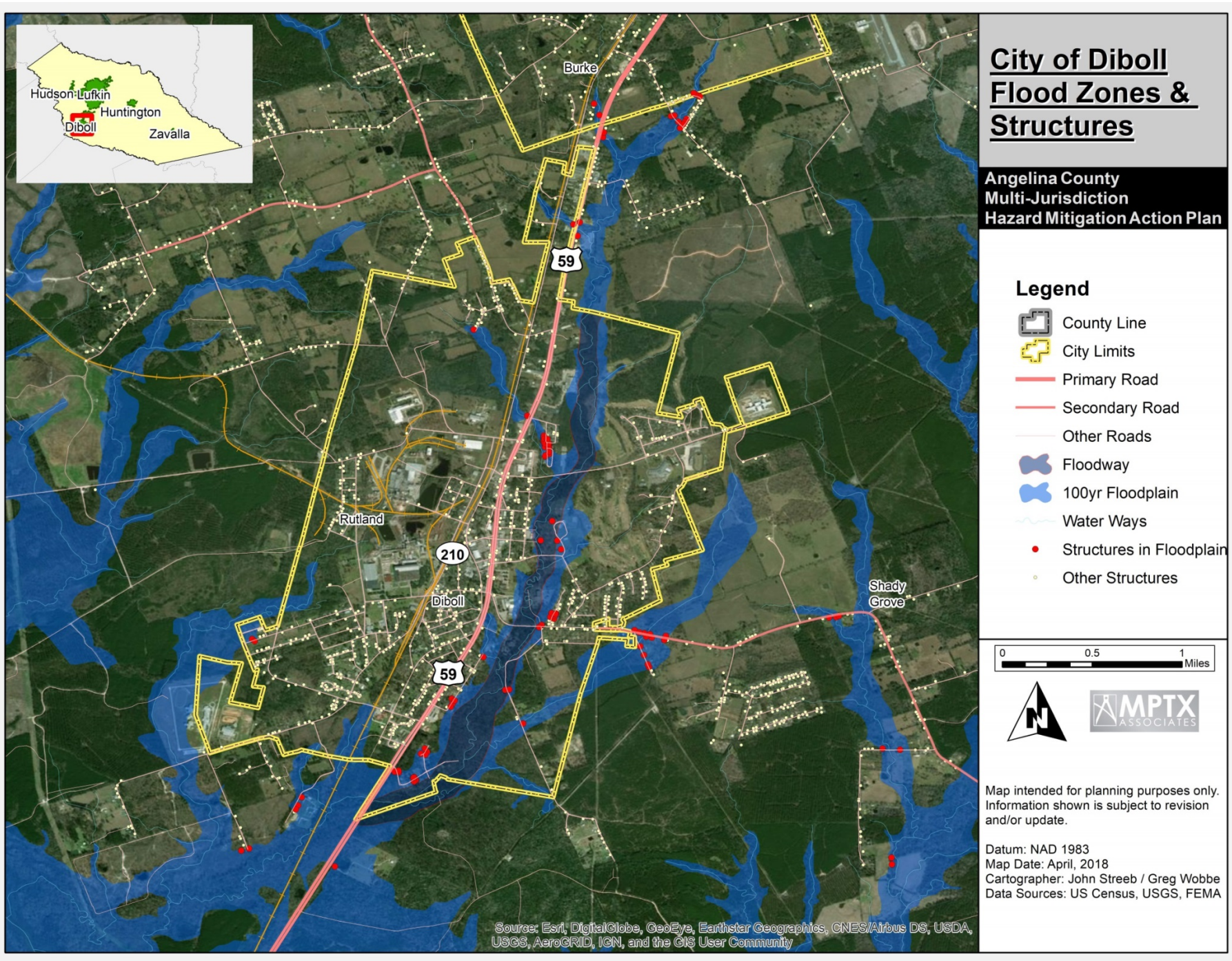
1. Persons with health problem or disability which prevents work or limits the kind or amount of work they can do
2. Persons who have retired or left a job for health reasons
3. Persons currently not in the labor force because of a disability.
4. Persons who did not work at all in the previous year because of illness or disability
5. Under 65 years old and covered by Medicare in previous year.
6. Under 65 years old and received Supplemental Security Income (SSI) in previous year.
7. Received VA disability income in previous year.

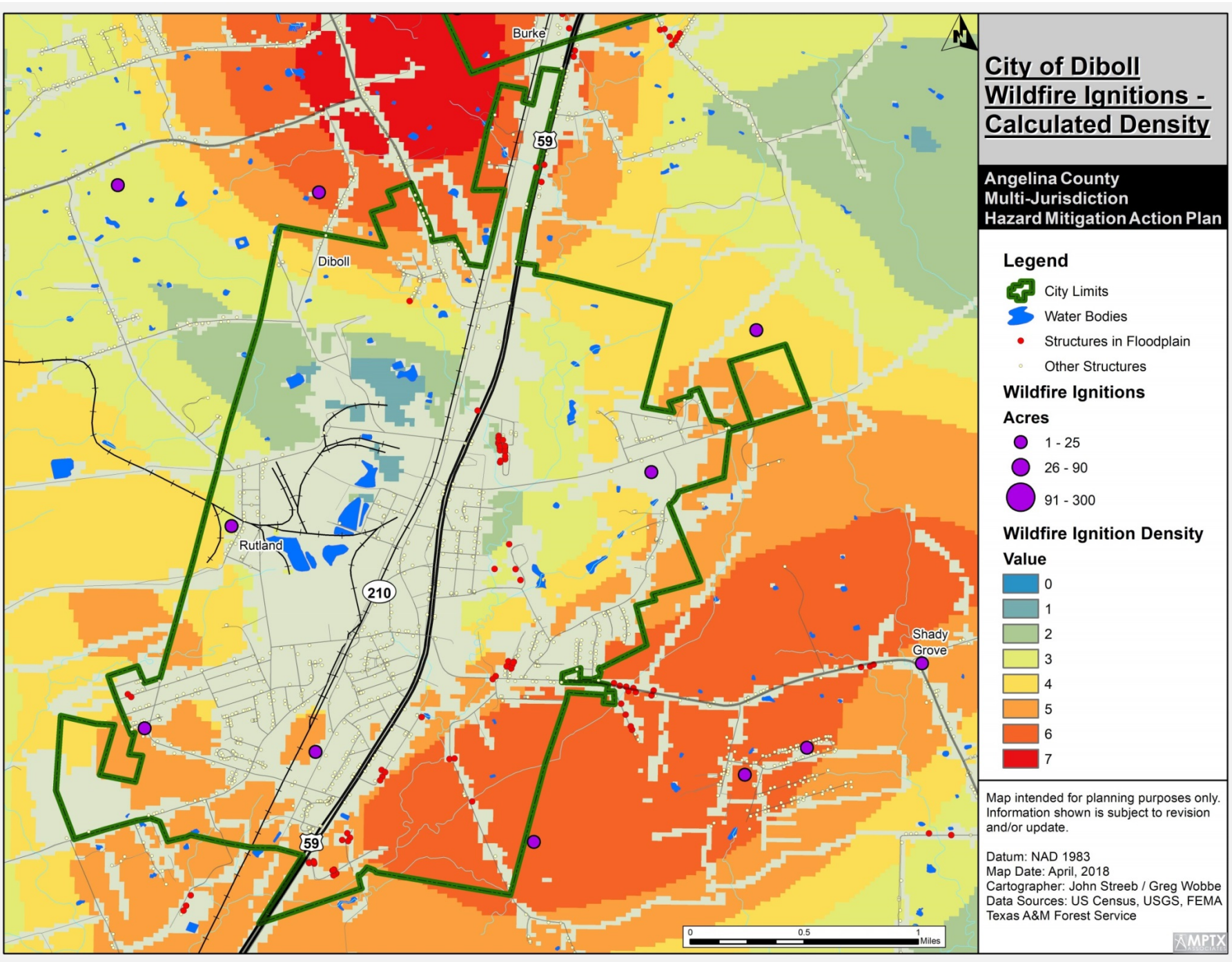
Based on definitions established in Subsection 3.1.1 (listed below in the table notes), Table 3-12 below shows an assessment of overall vulnerability, probability, and magnitude for Diboll for each of the identified hazards. The map on the following page of the relationship of FEMA defined floodplains to facilities, structures in the floodplain and residential structures in Diboll and surrounding areas.

Table 3-12 Overall Vulnerability, Probability, and Magnitude by Hazard Type: Diboll

HAZARD TYPE	VULNERABILITY	PROBABILITY	EXTENT
Flood	High	High	1 – 24 inches
Tornado	High	High	EF1-EF3
Hurricane	High	High	TS-CAT 3
Wildfire	Moderate	High	Level 3- Critical
Lightning	High	High	T1 – T5
Extreme Heat	Moderate	High	110 Heat Index
Erosion	Moderate	High	5-10 inches per flood
Expansive Soils	Low	Moderate	1” SSC
Winter Storm	Low	Moderate	1-2 inches snow
Drought	Low	Low	PDSI 4.5
Earthquake	Low	Low	1-3 Magnitude
Dam Failure	Low	Low	Negligible

Source: Hazard Mitigation Team, City of Diboll
Notes: Definitions for vulnerability, probability, and magnitude classifications provided in Section 3.1.1. Negligible extent indicates magnitude too low to be measured using empirical scales. SSC = Shrink-Swell Cycle


Hudson
Lufkin
Huntington
Diboll
Zavalla
Burke
59
Rutland
210
Diboll
Shady Grove
59
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
City of Diboll Flood Zones & Structures
Angelina County Multi-Jurisdiction Hazard Mitigation Action Plan
Legend
County Line
City Limits
Primary Road
Secondary Road
Other Roads
Floodway
100yr Floodplain
Water Ways
Structures in Floodplain
Other Structures
0
0.5
1
Miles
N
MPTX ASSOCIATES
Map intended for planning purposes only. Information shown is subject to revision and/or update.
Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, FEMA


Burke
59
Diboll
Rutland
210
Shady Grove
59
0
0.5
1
Miles
N
City of Diboll
Wildfire Ignitions -
Calculated Density
Angelina County
Multi-Jurisdiction
Hazard Mitigation Action Plan
Legend
City Limits
Water Bodies
Structures in Floodplain
Other Structures
Wildfire Ignitions
Acres
1 - 25
26 - 90
91 - 300
Wildfire Ignition Density
Value
0
1
2
3
4
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6
7
Map intended for planning purposes only.
Information shown is subject to revision
and/or update.
Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, FEMA
Texas A&M Forest Service
AMPTX

3.3.3 City of Hudson Risk-Vulnerability Assessment

The City of Hudson is located in central-western Angelina County on Highway 94 at an elevation 336 feet above sea level. 2016 Census population was 4,818, and land area of the city covers 4.6 square miles. The city of is split geographically into eastern and western portions. Zed Creek runs south from central Hudson, and the floodplain and channel of Jack Creek divides the eastern and western portions of town. The police station, fire station, and city hall are located in central (eastern) Hudson. Since 2011, Hudson has permitted 21 commercial buildings, 103 single family homes built, 129 mobile home move ins and two multi family developments of 80 units each. The City does not allow construction in SFHA.

Hurricanes and tornados are the primary hazard concerns for the city. The community wildfire protection plan for Angelina County rates Hudson as 'high' for overall wildfire risk. 5 mobile home parks and at least one nursing home are located within the city limits. Water is supplied by a private system. Highest priority mitigation projects include a storm warning siren, a back-up water line from Lufkin, and storm hardening city facilities. Flooding in recent years is causing streambed erosion along Jack Creek. Specifically, where Jack Creek flows under highway 94. (31.324232 -94.813054). The bank has receded approximately six inches during every major flood over the last ten years. As a result of this erosion, the creek increased in width leaving a sewer line passing over the creek channel unsupported and requiring relocation. At the current rate of erosion, the sewer line will have to be moved again in six years. Table 3-13 below outlines number and percentage of vulnerable populations for Hudson.

Table 3-13 Vulnerable Populations, City of Hudson

Category	Hudson (%)	U.S. (%)	Hudson - U.S. Difference (%)
Under Age 5 (2010)	8.9	6.5	+3.4
Over Age 65 (2010)	9.7	13.0	-3.3
Disabled (2000)	19.4	19.3	+0.1
Below Federal Poverty Level (2016)	22.3	12.7	+9.6

Source: US Census 2000, 2010, and 2016
Notes: 2016 federal poverty level for one (1) person household is $11,770; and $24,250 for a four (4) person household.

The U.S. Census defines a person as having a work disability if one or more of the following conditions are met:

1. Persons with health problem or disability which prevents work or limits the kind or amount of work they can do
2. Persons who have retired or left a job for health reasons
3. Persons currently not in the labor force because of a disability.
4. Persons who did not work at all in the previous year because of illness or disability
5. Under 65 years old and covered by Medicare in previous year.
6. Under 65 years old and received Supplemental Security Income (SSI) in previous year.
7. Received VA disability income in previous year.

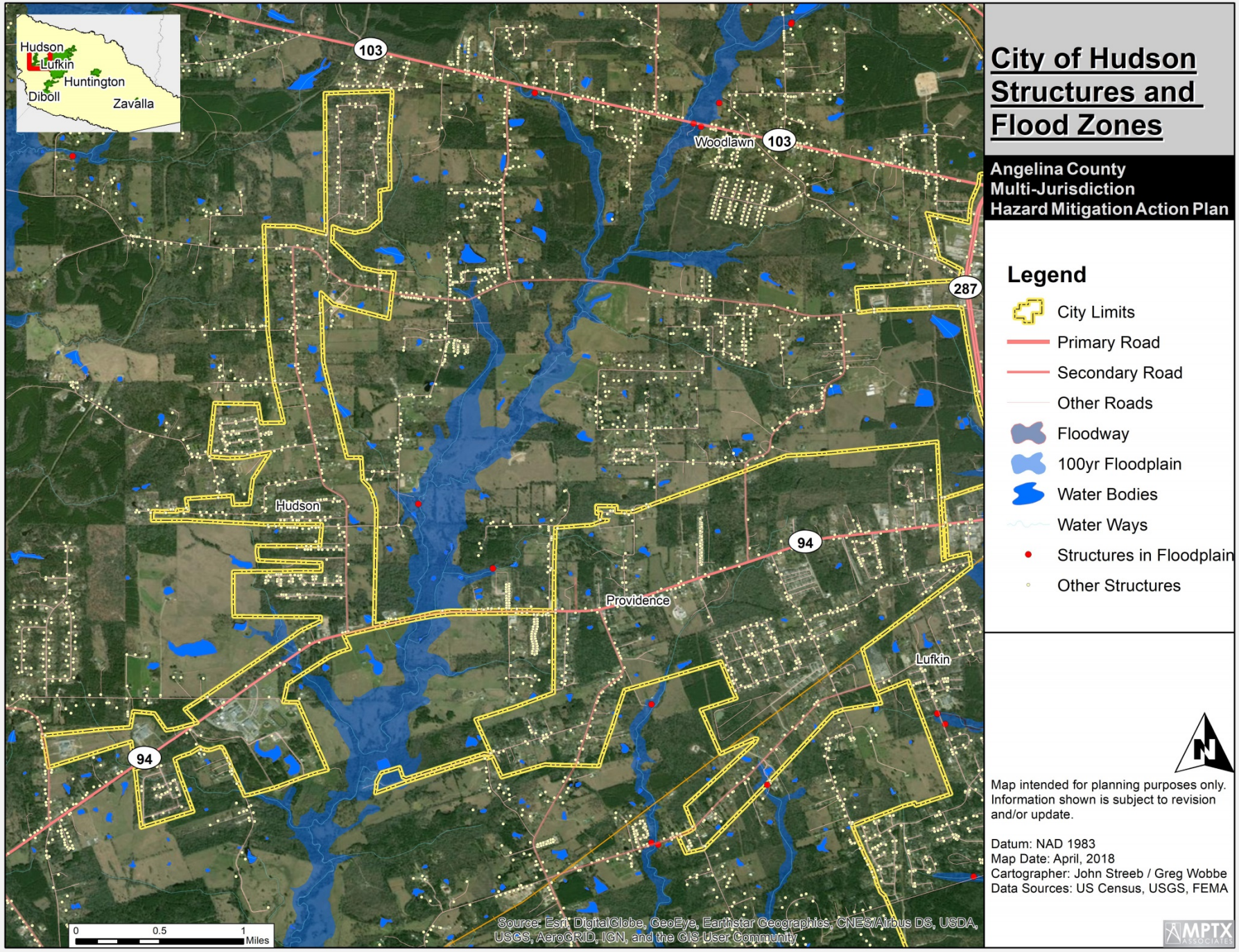
Table 3-14 below shows an assessment of overall vulnerability, probability, and magnitude for the City of Hudson for each of the identified hazards.

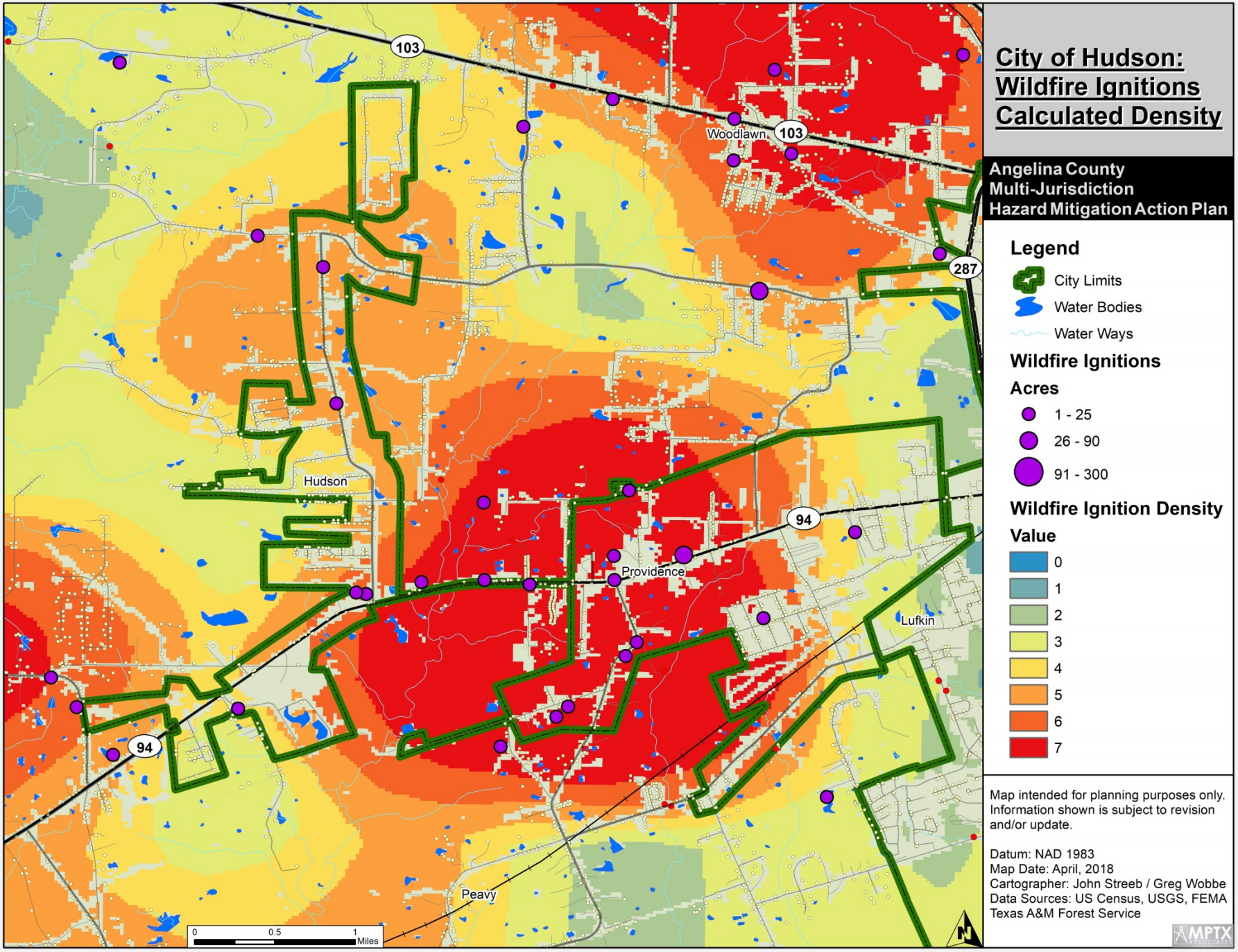
Table 3-14 Vulnerability, Probability, and Magnitude by Hazard Type: Hudson

HAZARD TYPE	VULNERABILITY	PROBABILITY	EXTENT
Flood	Moderate	Medium	1 – 18 inches
Tornado	High	High	EF1-EF3
Hurricane	High	High	TS-CAT 3
Wildfire	High	High	Level 3- Critical
Lightning	High	High	T1 – T5
Erosion	Moderate	High	6 inches per flood event
Winter Storm	Moderate	Medium	1-4 inches snow
Drought	Moderate	High	-1 to -6 PHDI
Dam Failure	Low	Low	Level 2- Limited
Extreme Heat	Moderate	High	105 Heat Index
Expansive Soils	Low	Low	1" SSC
Earthquake	Low	Low	Magnitude 1-3

Source: Hazard Mitigation Team, City of Hudson
Note: Definitions for vulnerability, probability, and magnitude provided in Section 3.1.1. SSC = Shrink-Swell Cycle

The map on the following page of the relationship of FEMA defined floodplains to structures in Hudson and surrounding areas.


Hudson
Lufkin
Huntington
Diboll
Zavalla
103
Woodlawn
103
287
Hudson
94
Providence
Lufkin
94
0
0.5
1
Miles
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
City of Hudson Structures and Flood Zones
Angelina County
Multi-Jurisdiction
Hazard Mitigation Action Plan
Legend
City Limits
Primary Road
Secondary Road
Other Roads
Floodway
100yr Floodplain
Water Bodies
Water Ways
Structures in Floodplain
Other Structures
N
Map intended for planning purposes only.
Information shown is subject to revision and/or update.
Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, FEMA
MPTX


City of Hudson:
Wildfire Ignitions
Calculated Density
Angelina County
Multi-Jurisdiction
Hazard Mitigation Action Plan
Legend
City Limits
Water Bodies
Water Ways
Wildfire Ignitions
Acres
1 - 25
26 - 90
91 - 300
Wildfire Ignition Density
Value
0
1
2
3
4
5
6
7
Map intended for planning purposes only. Information shown is subject to revision and/or update.
Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, FEMA Texas A&M Forest Service
MPTX
103
Woodlawn
287
Hudson
94
Providence
Lufkin
Peavy
0
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1
Miles
N

3.3.4 City of Huntington Risk-Vulnerability Assessment

The City of Huntington is located in central-eastern Angelina County on Highway 69, at an elevation 325 feet above sea level. 2000 Census population was 2,106, and land area is 2.7 square miles. Two fire stations and city hall are located in central sections of the city, and the police station is located in the southern portion of town. Two mobile home parks are located in the city limits.

Tornados, thunderstorms (particularly high winds) occurring with increasing frequency. Four tornados and 1 severe straight-line wind event have impacted Huntington since 1988. Wildfire hazard is present out FM 2109 east of town. Floodplains are present on the outskirts of town in each direction, and Porterville Rd. is noted for frequent closure due to inundation.

Flooding in recent years is causing streambed erosion along Shawnee Creek where it enters the city limits and is threatening to undercut Louisiana Street. Each major flood brings the streambank six to eight inches closer to the street. At the current rate of erosion, the bank will undercut the street with the occurrence of five to seven more floods.

Primary mitigation objectives include storm-hardening city facilities, re-evaluating point-of-distribution site for increased efficiency, road elevation and drainage improvement. Table 3-15 below outlines number and percentage of vulnerable populations for Huntington.

Table 3-15 Vulnerable Populations, City of Huntington

Category	Huntington (%)	U.S. (%)	Huntington- U.S. Difference (%)
Under Age 5 (2010)	8.2	6.5	+2.7
Over Age 65 (2010)	16.0	13.0	+3.0
Disabled (2000)	22.6	19.3	+3.3
Below Federal Poverty Level (2016)	25.6	12.7	+12.9

Source: US Census 2000, 2010, and 2016

Notes: 2016 federal poverty level for one (1) person household is $11,770; and $24,250 for a four (4) person household.

The U.S. Census defines a person as having a work disability if one or more of the following conditions are met:

1. Persons with health problem or disability which prevents work or limits the kind or amount of work they can do
2. Persons who have retired or left a job for health reasons
3. Persons currently not in the labor force because of a disability.
4. Persons who did not work at all in the previous year because of illness or disability
5. Under 65 years old and covered by Medicare in previous year.
6. Under 65 years old and received Supplemental Security Income (SSI) in previous year.
7. Received VA disability income in previous year.

Table 3-16 below shows an assessment of overall vulnerability, probability, and magnitude for the City of Huntington for each of the identified hazards.

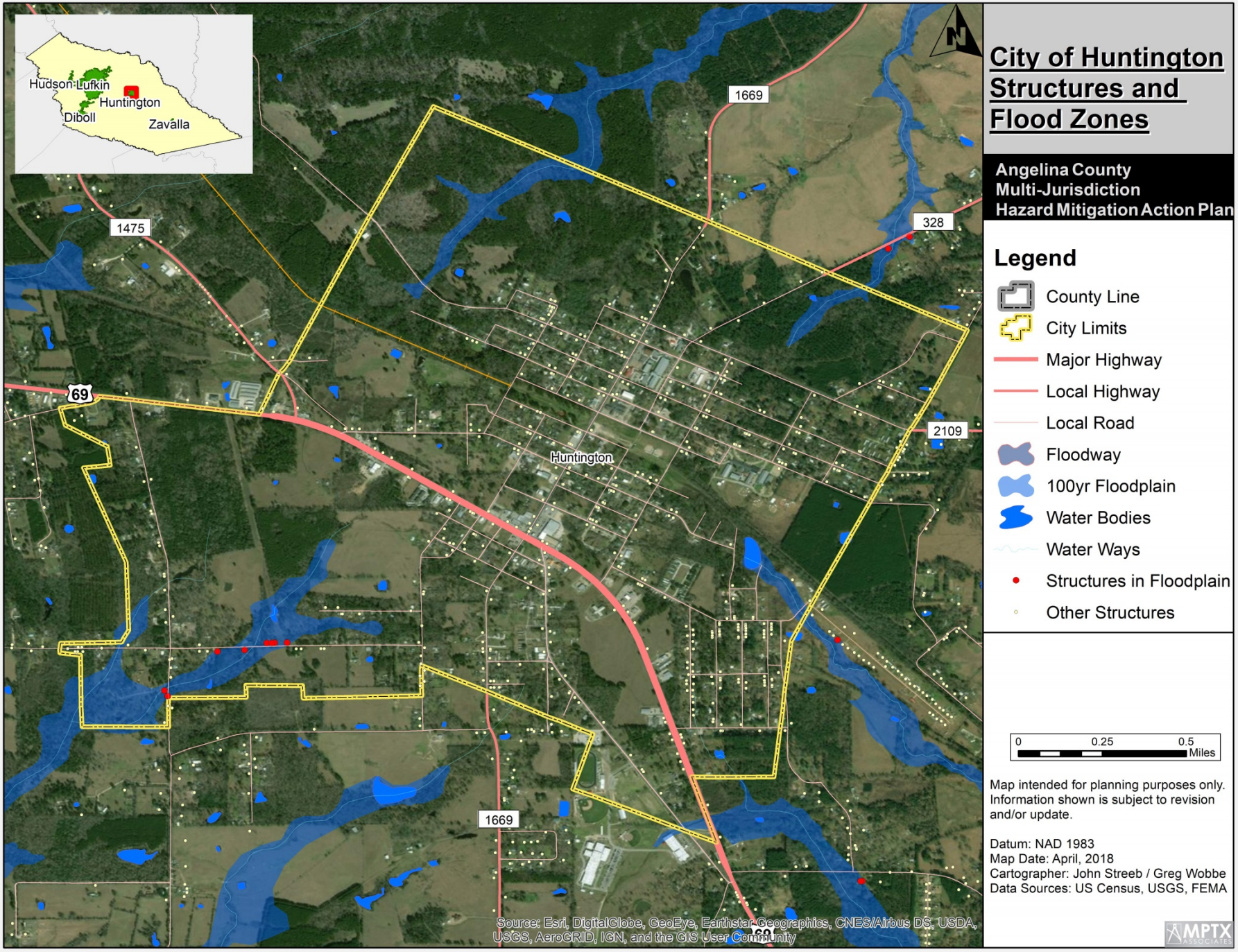
Table 3-16 Vulnerability, Probability, and Magnitude by Hazard Type: Huntington

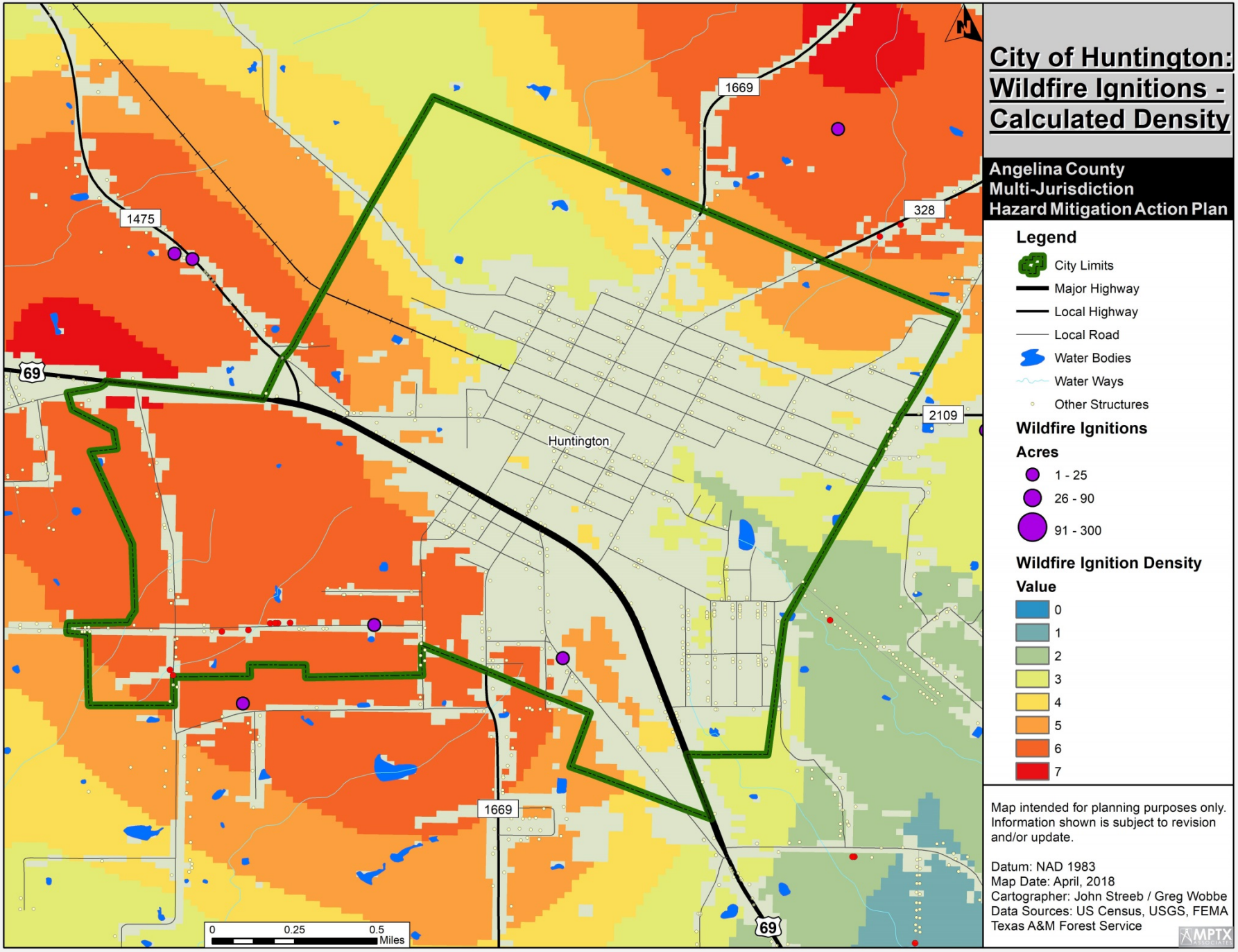
HAZARD TYPE	VULNERABILITY	PROBABILITY	EXTENT
Flood	**High**	**High**	1 – 36 inches
Tornado	**High**	**High**	EF1-EF3
Hurricane	**High**	**High**	TS-CAT 3
Wildfire	**Moderate**	**Medium**	Level 3- Critical
Erosion	**Moderate**	**High**	5-10 inches per flood event
Lightning	**High**	**High**	T1 – T5
Drought	Moderate	**High**	-1 to -6 PHDI
Winter Storm	Low	**Medium**	1-3 inches snow
Dam Failure	Low	Low	Negligible
Earthquake	Low	Low	Magnitude 1-3
Expansive Soils	Low	Low	0.5” SSC
Extreme Heat	Low	**Medium**	105 Heat Index

Source: Hazard Mitigation Team, City of Huntington

Note: Definitions for vulnerability, probability, and magnitude classifications provided in Section 3.1.1. Negligible extent indicates magnitude too low to be measured using empirical scales. SSC = Shrink-Swell Cycle.

The map on the following page shows FEMA defined floodplains and structure points for Huntington.


Hudson
Lufkin
Huntington
Diboll
Zavalla
1669
1475
328
69
2109
Huntington
1669
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
City of Huntington Structures and Flood Zones
Angelina County Multi-Jurisdiction Hazard Mitigation Action Plan
Legend
County Line
City Limits
Major Highway
Local Highway
Local Road
Floodway
100yr Floodplain
Water Bodies
Water Ways
Structures in Floodplain
Other Structures
0
0.25
0.5
Miles
Map intended for planning purposes only. Information shown is subject to revision and/or update.
Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, FEMA
MPTX


City of Huntington:
Wildfire Ignitions -
Calculated Density
Angelina County
Multi-Jurisdiction
Hazard Mitigation Action Plan
Legend
City Limits
Major Highway
Local Highway
Local Road
Water Bodies
Water Ways
Other Structures
Wildfire Ignitions
Acres
1 - 25
26 - 90
91 - 300
Wildfire Ignition Density
Value
0
1
2
3
4
5
6
7
Map intended for planning purposes only.
Information shown is subject to revision
and/or update.
Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, FEMA
Texas A&M Forest Service
Huntington
1669
328
1475
69
2109
1669
69
0
0.25
0.5
Miles

3.3.5 City of Lufkin Risk-Vulnerability Assessment

The City of Lufkin is located in central Angelina County at the junction of Highways 59 and 69. Elevation at Lufkin is approximately 312 feet above sea level, and the city covers 26.7 square miles. 2016 Census population is 36,159. Approximately 30 repetitive loss properties are located in the city, with the majority concentrated in southern portions of the city along Hurricane Creek. Approximately 11-12 repetitive loss properties have been acquired and demolished. FEMA defined floodways are located along east and west branches of Hurricane Creek in the southern portion of the city, and along branches of Mill Creek and Shirley Creek in the northern portion of the city. High concentrations of infrastructure, critical facilities, and residential, commercial, and industrial development are present in the city and surrounding area. The community wildfire protection plan for Angelina County rates Lufkin as 'high' for overall wildfire risk, with risk of impact focused on the city fringe and wildland-urban interface.

The city benefits from a secure and efficient water system, and highly developed infrastructure in general. High priority mitigation activities include drainage/stormwater management projects including expansion of retention pond network and debris removal from drainage channels, storm shelter hardening project, storm-hardening retrofits for critical facilities including tornado safe-rooms, portable generators, coordination of hurricane evacuee sheltering operations, and floodprone property mitigation via voluntary acquisition and/or elevation. Table 3-17 below outlines vulnerable population data for Lufkin, updated with most recent available Census information from 2016.

Table 3-17 Vulnerable Populations, City of Lufkin

Category	Lufkin (%)	U.S. (%)	Lufkin- U.S. Difference (%)
Under Age 5 (2010)	8.3	6.5	+1.8
Over Age 65 (2010)	14.4	13.0	+1.4
Disabled (2016)	12.5	8.6	+3.9
Below Federal Poverty Level (2016)	21.7	12.7	+9.0

Source: US Census 2010 and 2016
Notes: 2016 federal poverty level for one (1) person household is $11,770; and $24,250 for a four (4) person household.

The U.S. Census defines a person as having a work disability if one or more of the following conditions are met:

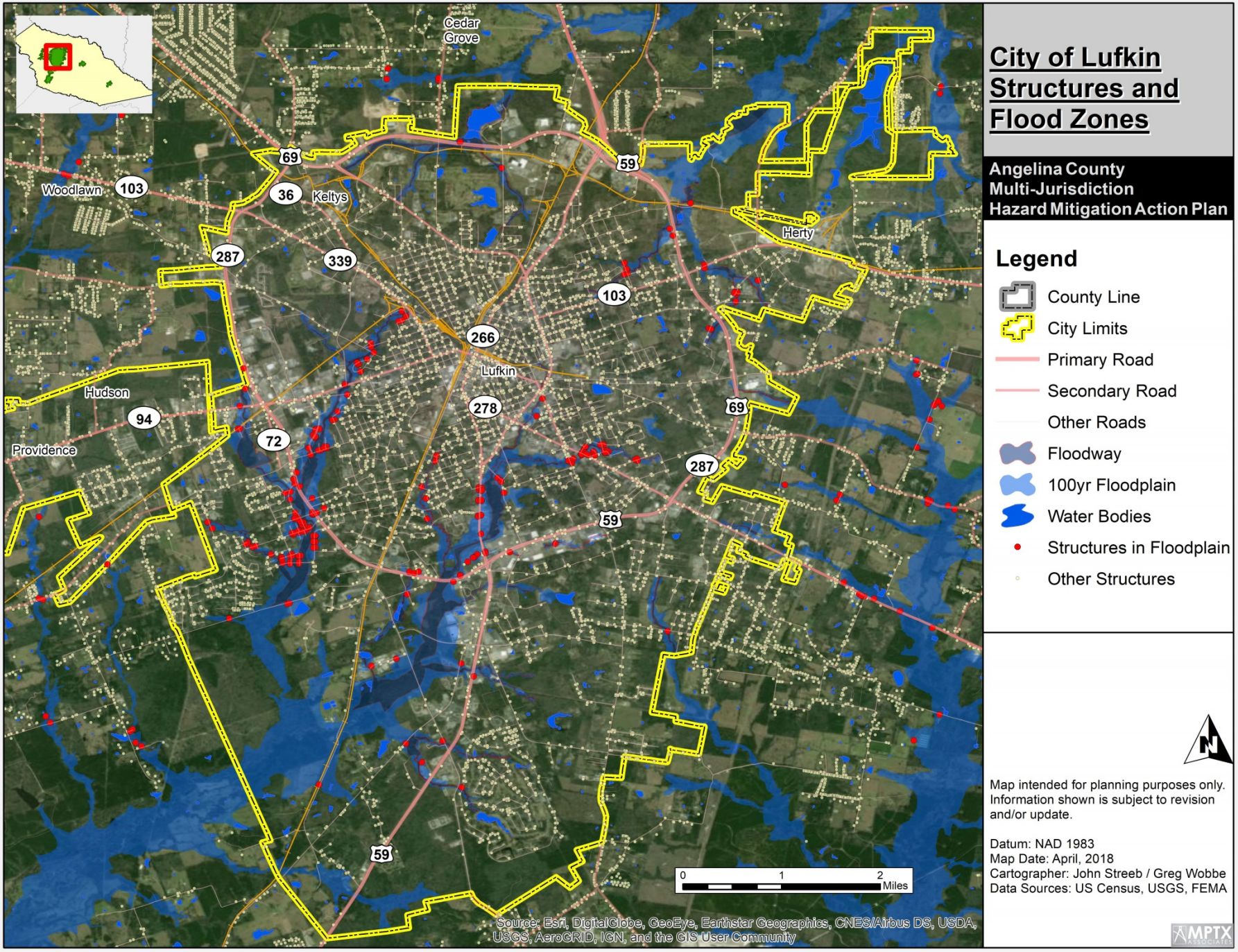
1. Persons with health problem or disability which prevents work or limits the kind or amount of work they can do
2. Persons who have retired or left a job for health reasons
3. Persons currently not in the labor force because of a disability.
4. Persons who did not work at all in the previous year because of illness or disability
5. Under 65 years old and covered by Medicare in previous year.
6. Under 65 years old and received Supplemental Security Income (SSI) in previous year.
7. Received VA disability income in previous year.

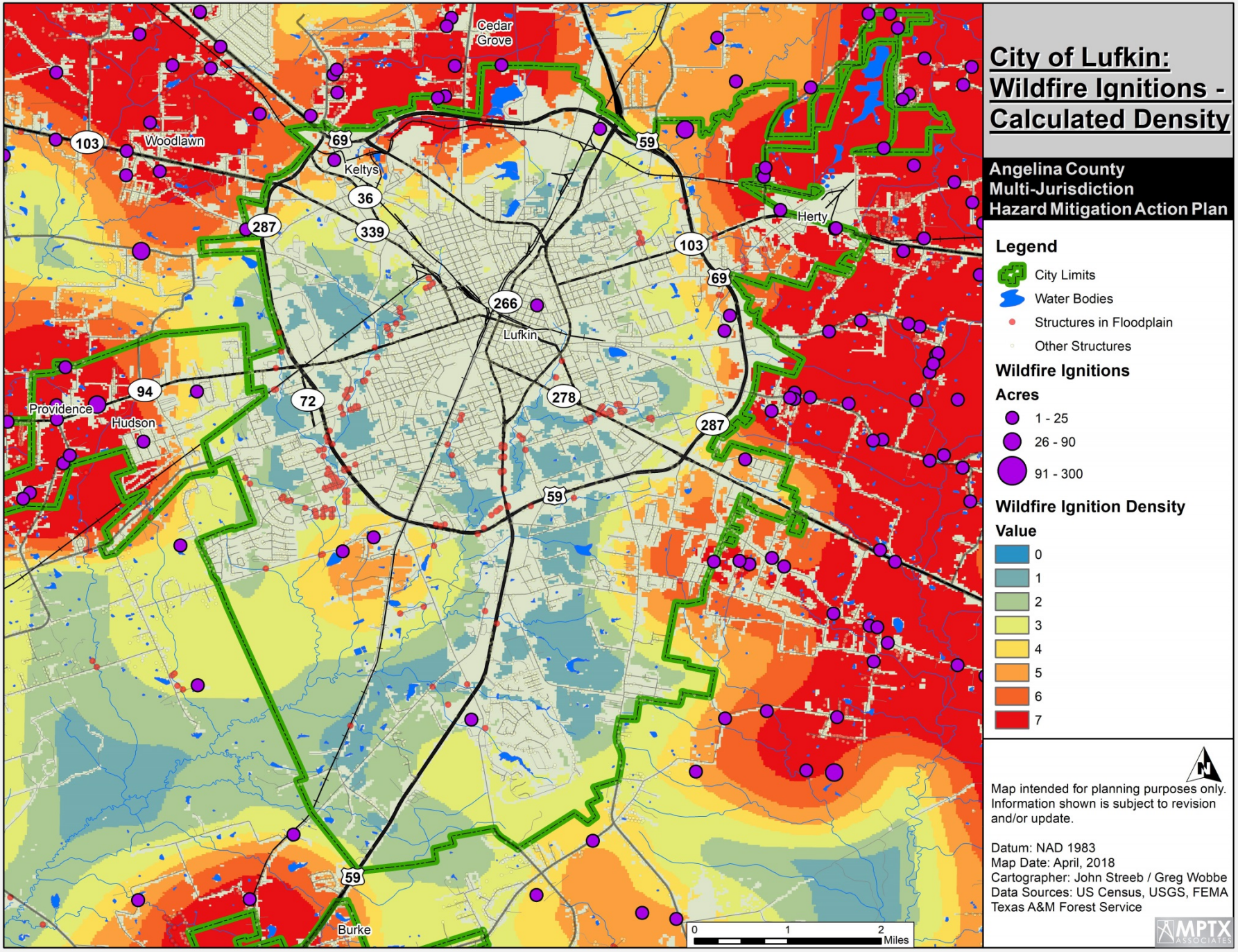
Based on definitions established in Subsection 3.1.1 (listed below in the table notes), Table 3-18 below shows an assessment of overall vulnerability, probability, and magnitude for the City of Lufkin for each of the identified hazards. The map on the following page of the relationship of FEMA defined floodplains to structures in Lufkin and surrounding areas.

Table 3-18 Vulnerability, Probability, and Magnitude by Hazard Type: Lufkin

HAZARD TYPE	VULNERABILITY	PROBABILITY	EXTENT
Flood	High	High	1 – 36 inches
Tornado	High	High	EF1-EF3
Hurricane	High	High	TS-CAT 3
Wildfire	High	High	Level 3- Critical
Lightning	High	High	T1 – T5
Winter Storm	Moderate	Medium	1-4 inches snow
Drought	Low	High	-1 to -6 PHDI
Dam Failure	Moderate	Negligible	Level 2- Limited
Extreme Heat	Moderate	High	110 Heat Index
Earthquake	Low	Low	Magnitude 1-3
Erosion	Low	Low	Negligible
Expansive Soils	Low	Low	0.5" SSC

Source: Hazard Mitigation Team, City of Lufkin. Note: Definitions for vulnerability, probability, and magnitude classifications provided in Section 3.1.1. Negligible extent indicates magnitude too low to be measured using empirical scales.


City of Lufkin
Structures and
Flood Zones
Angelina County
Multi-Jurisdiction
Hazard Mitigation Action Plan
Legend
County Line
City Limits
Primary Road
Secondary Road
Other Roads
Floodway
100yr Floodplain
Water Bodies
Structures in Floodplain
Other Structures
Cedar Grove
Woodlawn
Keltys
Herty
Lufkin
Hudson
Providence
69
59
103
36
287
339
266
278
94
72
0
1
2
Miles
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Map intended for planning purposes only. Information shown is subject to revision and/or update.
Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, FEMA


City of Lufkin:
Wildfire Ignitions -
Calculated Density
Angelina County
Multi-Jurisdiction
Hazard Mitigation Action Plan
Legend
City Limits
Water Bodies
Structures in Floodplain
Other Structures
Wildfire Ignitions
Acres
1 - 25
26 - 90
91 - 300
Wildfire Ignition Density
Value
0
1
2
3
4
5
6
7
Map intended for planning purposes only.
Information shown is subject to revision
and/or update.
Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, FEMA
Texas A&M Forest Service
MPTX ASSOCIATES
Cedar Grove
Woodlawn
Keltys
Herty
Lufkin
Providence
Hudson
Burke
103
69
59
36
339
287
266
278
72
94
0
1
2
Miles

City of Lufkin: Inventory of Critical Assets w/ Hazard Vulnerability Comments

City Hall – 300 East Shepherd Avenue: Houses the E.O.C., Police Department, and Emergency Dispatch in addition to the Mayor's Office, City Administration, and several departments. Back-up generators are 26 years old and too small. Vulnerable to High Winds, Hurricanes, and Tornados.

Fire Administration – 111 S. Third St.: Houses the Fire Administration. Vulnerable to High Winds, Hurricanes, and Tornados.

Lufkin Fire Station 1 - 314 E. Lufkin Ave: Houses emergency personnel and equipment. Vulnerable to High Winds, Hurricanes, and Tornados.

Lufkin Fire Station 2 - 408 Whitehouse Dr.: Houses emergency personnel and equipment. Vulnerable to High Winds, Hurricanes, and Tornados.

Lufkin Fire Station 3 - 1404 E. Lufkin Ave.: Houses emergency personnel and equipment. Vulnerable to High Winds, Hurricanes, and Tornados.

Lufkin Fire Station 4 - 802 Trailwood Dr.: Houses emergency personnel and equipment. Vulnerable to High Winds, Hurricanes, and Tornados.

Lufkin Fire Station 5 - 1408 Kurth Dr.: Houses emergency personnel and equipment. Vulnerable to High Winds, Hurricanes, and Tornados.

Public Utilities Buildings and Yard – 305 Davis Street: House the Water & Sewer Utilities Department and the Street Department. Vulnerable to High Winds, Hurricanes, Floods, and Tornados.

Public Works Buildings and Yard – 500 South Park: Houses the Solid Waste & Recycling Departments, and Fleet Maintenance Department. Vulnerable to High Winds, Hurricanes, Floods, and Tornados.

Pitser Garrison Convention Center – 601 North Second Street: Houses Convention Center Staff and serves as a Special Needs Shelter. Vulnerable to High Winds, Hurricanes, and Tornados.

The Pines Theatre – 113 South First Street - Vulnerable to High Winds, Hurricanes, and Tornados.

Ellen Trout Zoo – 402 Zoo Circle: Houses Zoo Staff and close to 700 reptiles, birds and mammals from around the world. Vulnerable to High Winds, Hurricanes, Floods, and Tornados.

Lufkin Parks and Recreation Department – 125 North First Street: Houses the Parks offices and provides services for recreation classes. Vulnerable to High Winds, Hurricanes, and Tornados.

Parks Maintenance - 513 Windsor Drive: Houses the Parks equipment including all vehicles and Maintenance staff. Vulnerable to High Winds, Hurricanes, and Tornados.

Morris Frank Park Boys and Girls Restrooms and Concession - 513 Windsor Drive: Houses concession equipment and restroom used during youth sporting events. Vulnerable to High Winds, Hurricanes, and Tornados.

Kit McConnico Park Concession, Restrooms and Maintenance Building - 903 Old Moffett Rd.: Houses the concession equipment, electrical room, restrooms, umpire office and maintenance equipment. Vulnerable to High Winds, Hurricanes, and Tornados.

Chambers Community Center-500 Pershing Avenue: Space available for rental. Vulnerable to High Winds, Hurricanes, and Tornados.

Brandon Community Center- 1612 Kelty's Street: Space available for rental. Vulnerable to High Winds, Hurricanes, and Tornados.

Kiwanis Park Spray Play and Equipment Building - 1117 S. Timberland Dr.: Houses computer equipment and pumps that run the spray play. Vulnerable to High Winds, Hurricanes, and Tornados.

Jones Park Spray Play and Equipment Building-1501 Martin Luther King Dr.: Houses computer equipment and pumps that run the spray play. Vulnerable to High Winds, Hurricanes, and Tornados.

Jones Park Basketball Court and Pavilion-1501 Martin Luther King Dr.: Vulnerable to High Winds, Hurricanes, and Tornados.

Figure 3-4 Lufkin Streets Prone to Flooding

City of Lufkin Maintained:

Freeman Street: East and West of McKinney Street Intersection.
Knight Avenue: Entire stretch.
Wood Avenue: Ridge Street to Walthers Street.
Englewood Drive: Cunningham Drive to Lakewind Drive.
Harbuck Avenue: The West half.
Whipporwill Drive: Valley Avenue intersection.
Finley Avenue: East Kerr Avenue intersection.
South Raguet Street: At Jefferson Avenue intersection.
Hanks Street: From Autumn Lane to Heather Street.
Centralia Avenue: At Palmore Road intersection.

TxDOT Maintained:

West Frank Avenue: South Broadmore Drive to North Bynum Street.
West Frank Avenue: Herndon Street to North First Street. Under Angelina Street overpass.
South Medford Drive: South 1st Street intersection.

Source: City of Lufkin

Figure 3-5 Lufkin Areas identified as Susceptible to Wildfire

South of 287 Loop: The most widespread area in Lufkin susceptible to wildfire lies south of Loop 287. From Centralia Avenue to the west end of Leslie Lane down to Slack Lane.

North East of 287 Loop: The area surrounding Kit McConnico Park.

North West Area: Area surrounding Ellen Trout Zoo and Water Plant #1.

South East Area: The area surrounding Morris Frank Park stretching down both sides of Lotus Lane to Hill Street.

Scattered Areas: Areas surrounding Grace Dunn Richardson Parks, Kiwanis Park, Chambers Park, the area between Lufkin Avenue and Paul Avenue crossing Wood Avenue, and several smaller areas with dense vegetation and underbrush.

Source: City of Lufkin

The City of Lufkin permitted 716 new structures since 2011. Of these, 47 were in a SFHA.

3.3.6 City of Zavalla Risk-Vulnerability Assessment

The City of Zavalla is located in south-eastern Angelina County at the junction of Highways 69 and 63, at an elevation 223 feet above sea level. 2016 Census population was 712, and land area is 2.1 square miles. Primary hazard types are tornados, straight-line winds, and wildfire potential in the vicinity. The floodplain of Sandy Creek is present in the southwestern portion of the city. Police and fire stations and city hall are located on or near Highway 63 as it runs east and west through town. High priority mitigation activities include storm-hardening retrofits, and emergency generators for critical facilities. Table 3-19 below outlines number and percentage of vulnerable populations for Zavalla.

Table 3-19 Vulnerable Populations, City of Zavalla

Category	Percentage (%)	U.S. (%)	Zavalla- U.S. Difference (%)
Under Age 5 (2010)	5.0	6.5	-1.5
Over Age 65 (2010)	16.3	13.0	+3.3
Disabled (2000)	40.0	19.3	+20.7
Below Federal Poverty Level (2016)	35.1	12.7	+22.4

Source: US Census 2000, 2010, and 2016

Notes: 2016 federal poverty level for one (1) person household is $11,770; and $24,250 for a four (4) person household.

The U.S. Census defines a person as having a work disability if one or more of the following conditions are met:

1. Persons with health problem or disability which prevents work or limits the kind or amount of work they can do
2. Persons who have retired or left a job for health reasons
3. Persons currently not in the labor force because of a disability.
4. Persons who did not work at all in the previous year because of illness or disability
5. Under 65 years old and covered by Medicare in previous year.
6. Under 65 years old and received Supplemental Security Income (SSI) in previous year.
7. Received VA disability income in previous year.

Based on definitions established in Subsection 3.1.1 (listed below in the table notes), Table 3-20 below shows an assessment of overall vulnerability, probability, and magnitude for the City of Zavalla for each of the identified hazards.

Table 3-20 Vulnerability, Probability, and Magnitude by Hazard Type: Zavalla

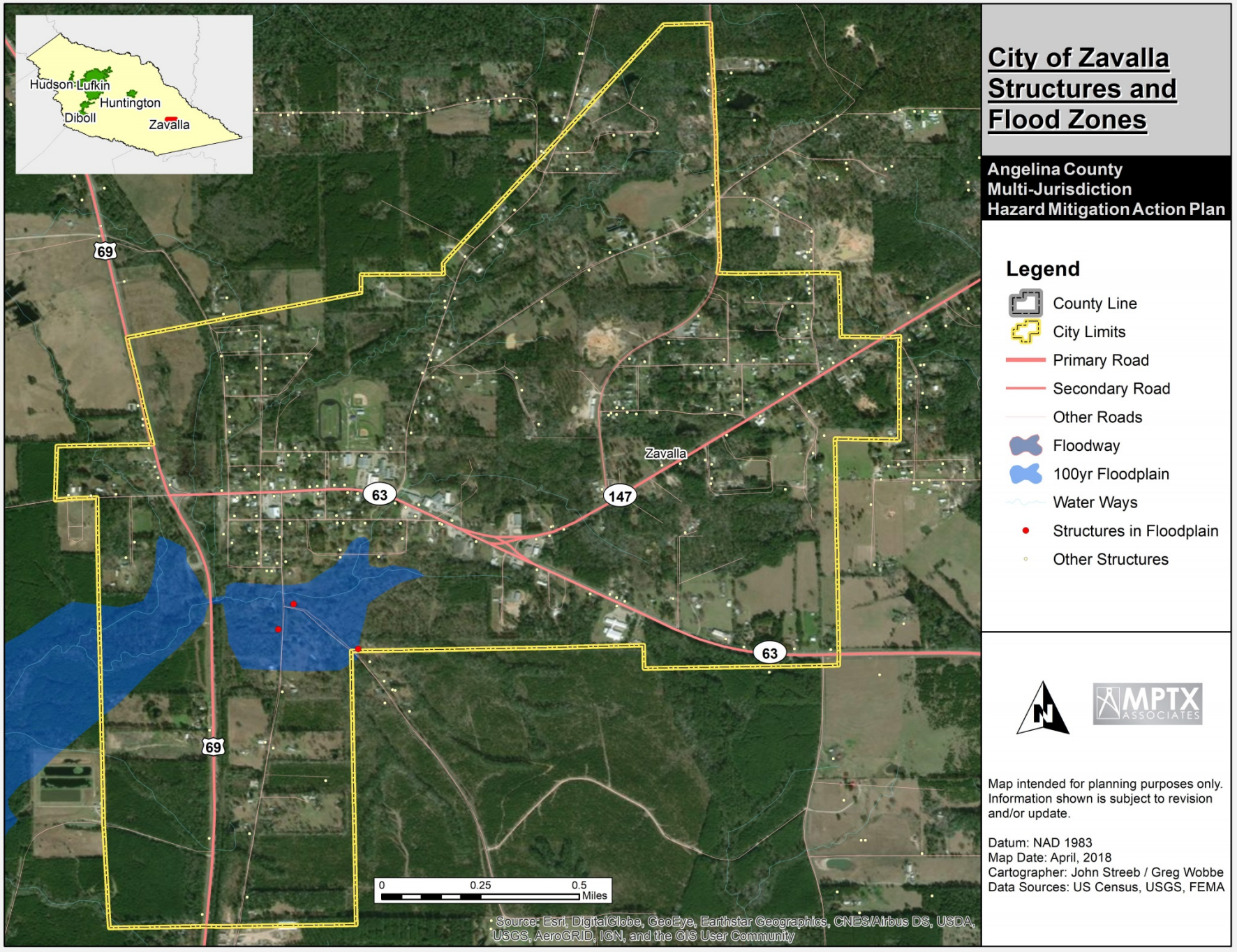
HAZARD TYPE	VULNERABILITY	PROBABILITY	EXTENT
Flood	High	High	1 – 36 inches
Tornado	High	High	EF1-EF3
Hurricane	Moderate	High	TS-CAT 3
Wildfire	High	High	Level 3- Critical
Lightning	High	High	T1 – T5
Winter Storm	Moderate	Medium	1-4 inches snow
Drought	Moderate	High	-1 to -6 PHDI
Extreme Heat	Moderate	High	110 Heat Index
Earthquake	Low	Low	Magnitude 1-3
Dam Failure	Low	Low	Negligible
Erosion	Low	Low	Negligible
Expansive Soils	Low	Low	0.3 SSC

Source: Hazard Mitigation Team, City of Zavalla

Note: Definitions for vulnerability, probability, and magnitude classifications provided in Section 3.1.1. Negligible extent indicates magnitude too low to be measured using empirical scales. SSC = Shrink-Swell Cycle

The map on the following page of the relationship of FEMA defined floodplains to facilities in Zavalla and surrounding areas.

The City permitted three new commercial structures since 2011. None of these were in a SFHA.


Hudson
Lufkin
Huntington
Diboll
Zavalla
69
63
147
Zavalla
69
63
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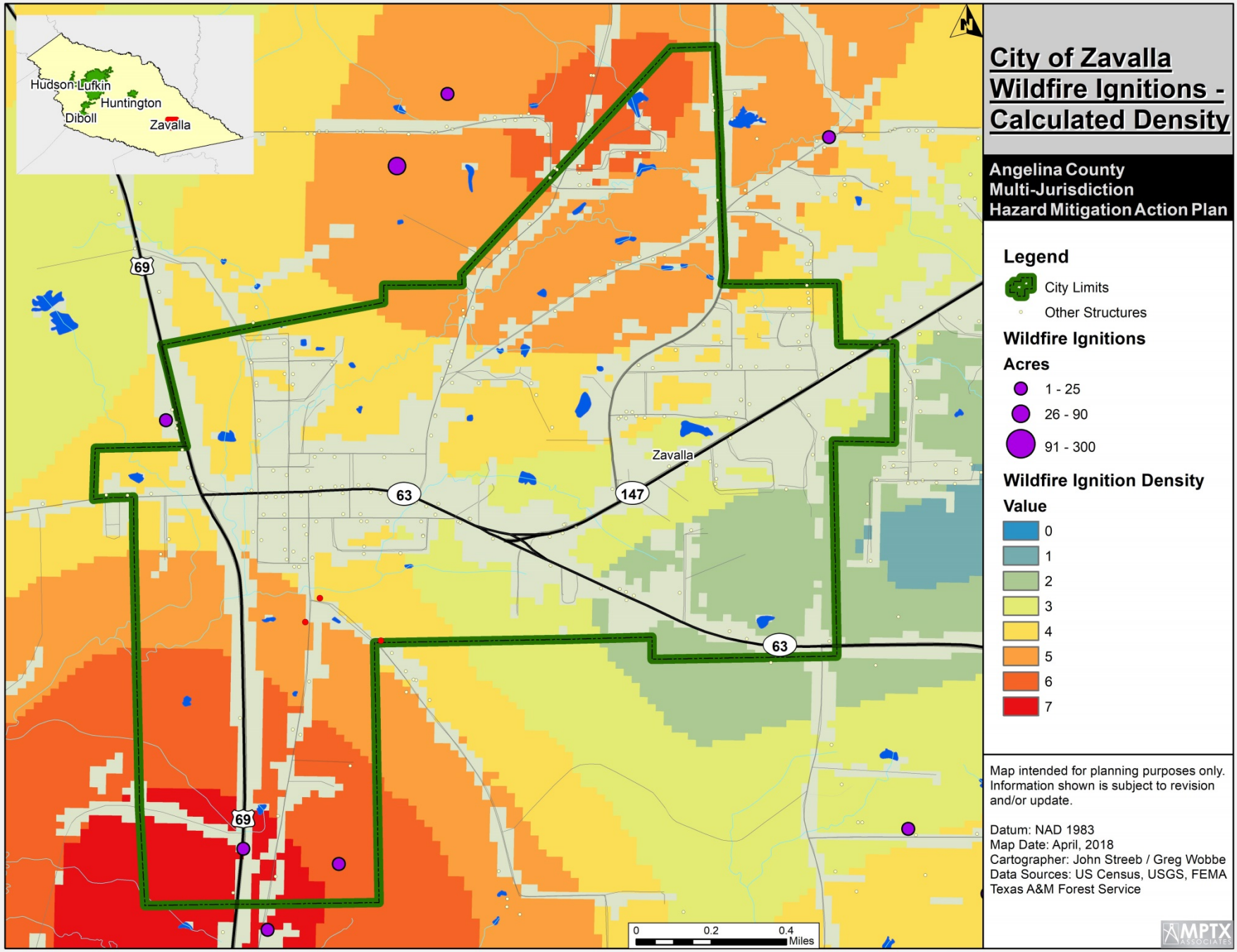
0.25
0.5
Miles
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
City of Zavalla Structures and Flood Zones
Angelina County Multi-Jurisdiction Hazard Mitigation Action Plan
Legend
County Line
City Limits
Primary Road
Secondary Road
Other Roads
Floodway
100yr Floodplain
Water Ways
Structures in Floodplain
Other Structures
N
MPTX ASSOCIATES
Map intended for planning purposes only. Information shown is subject to revision and/or update.
Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, FEMA


Hudson
Lufkin
Huntington
Diboll
Zavalla
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Zavalla
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Miles
City of Zavalla
Wildfire Ignitions -
Calculated Density
Angelina County
Multi-Jurisdiction
Hazard Mitigation Action Plan
Legend
City Limits
Other Structures
Wildfire Ignitions
Acres
1 - 25
26 - 90
91 - 300
Wildfire Ignition Density
Value
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Map intended for planning purposes only.
Information shown is subject to revision
and/or update.
Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, FEMA
Texas A&M Forest Service

3.3.7 Angelina County Risk-Vulnerability Assessment

Angelina County is located along the Highway 59 corridor, roughly halfway between Houston and Texarkana at an elevation 273 feet above sea level. City limits cover 0.6 square miles. 2016 Census population was 730. The upper reaches of White Oak Creek skirt the eastern city limits. A mobile home park is located near the center of town, and a dense pine plantation stand is located just north and west of town.

Primary mitigation objectives are improvement of drainage channels. Table 3-21 below outlines vulnerable populations data. The map on the following page of the relationship of FEMA defined floodplains to facilities and mobile home and RV parks in Burke and surrounding areas.

Table 3-21 Vulnerable Populations, Angelina County

Category	Angelina Co (%)	U.S. (%)	Angelina Co - U.S. Difference (%)
Under Age 5 (2016)	6.9	6.5	+0.6
Over Age 65 (2016)	15.7	13.0	-2.4
Disabled (2016)	15.8	12.6	+3.2
Below Federal Poverty Level (2016)	19.6	12.7	+1.6

Source: US Census 2016

Notes: 2016 federal poverty level for one (1) person household is $11,770; and $24,250 for a four (4) person household.

The U.S. Census defines a person as having a work disability if one or more of the following conditions are met:

1. Persons with health problem or disability which prevents work or limits the kind or amount of work they can do
2. Persons who have retired or left a job for health reasons
3. Persons currently not in the labor force because of a disability.
4. Persons who did not work at all in the previous year because of illness or disability
5. Under 65 years old and covered by Medicare in previous year.
6. Under 65 years old and received Supplemental Security Income (SSI) in previous year.
7. Received VA disability income in previous year.

Based on definitions established in Subsection 3.1.1 (listed below in the table notes), Table 3-22 below shows an assessment of overall vulnerability, probability, and magnitude for Angelina County for each of the identified hazards.

Table 3-22 Overall Vulnerability, Probability, and Magnitude by Hazard Type: Angelina County

HAZARD TYPE	VULNERABILITY	PROBABILITY	EXTENT
Flood	Moderate	Medium	1 – 36 inches
Tornado	High	High	EF1-EF3
Hurricane	High	High	TS-CAT 3
Wildfire	Moderate	Medium	Level 2- Limited
Lightning	High	High	T1 – T5
Winter Storm	Moderate	Medium	1-4 inches snow
Drought	Moderate	High	-1 to -6 PHDI
Dam Failure	Negligible	Negligible	Level 1- Negligible
Extreme Heat	Moderate	High	110 Heat Index
Earthquake	Low	Low	Magnitude 1-3
Erosion	Low	Low	Negligible
Expansive Soil	Low	Low	0.5 SSC

Source: Hazard Mitigation Team, City of Burke

Note: Definitions for vulnerability, probability, and magnitude classifications provided in Section 3.1.1. Negligible extent indicates magnitude too low to be measured using empirical scales. SSC = Shrink-Swell Cycle.

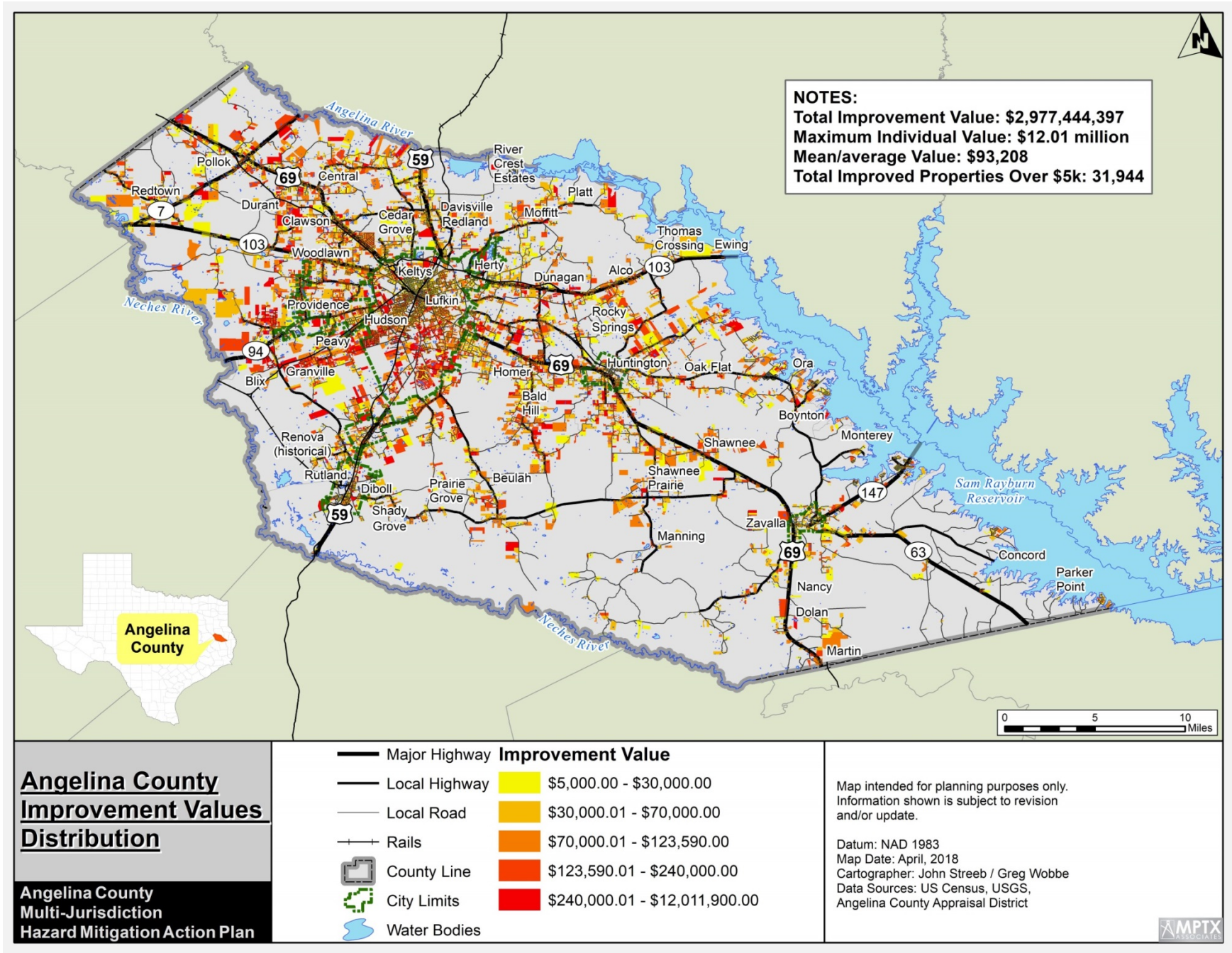
Table 3-23 Recorded Hazard Events: Angelina County 2012-2018

AREA AFFECTED	DATE	HAZARD TYPE	MAGNITUDE	DAMAGE NOTES	
ANGELINA (ZONE)	12/7/2017	Winter Weather		$0	Snowfall reports: 2.0 inches in Diboll, and 1.0 inches in Huntington, Lufkin, and Zavalla.
ANGELINA COUNTY, ZAVALLA, PEAVY, SHAWNEE, DUNAGAN STATION, BURKE, DOLAN, KURTH LAKE	8/26/2017 - 8/30/2017	Hurricane Harvey, Flash Flood, High Wind	56 kts. EG	$0	The persistent outer bands of Tropical Storm Harvey began consistently affecting Angelina County throughout the day on August 30th, resulting in reports of downed trees and power lines as some of the stronger squalls produced wind gusts to 35-40 mph with locally higher gusts atop already saturated grounds. Trees were blown down on FM 1818 near Biloxi Creek about 5 miles east southeast of Diboll. Trees and other debris were blown down in the Moffitt community. Ryan's Chapel Road (FM 2497) was flooded and closed. FM 1270 and Sandy Creek Road was closed due to high water. FM 1818 at Biloxi Creek, Bear Creek, and Little Buck Creek was flooded. FM 3150 at Jack Creek was washed out and closed. FM 2497, Old Johnson School Road, and Polly Branch Road was closed due to flooding. Four-day cumulative rainfall reports across Deep East Texas from Tropical Storm Harvey: In Angelina County, 2 ESE Zavalla 20.27 inches, 2 ENE Zavalla 17.32 inches, Huntington 13.94 inches, Lufkin Angelina Airport 12.11 inches, 1 SSE Lufkin 11.96 inches, 3 SW Lufkin 11.74 inches, 8 W Lufkin 10.17 inches, 5 WNW Lufkin 10.00 inches, 7 W Lufkin 9.60 inches, 2 WSW Hudson 9.09 inches.
ANGELINA (ZONE)	8/12/2017 - 8/19/2017	Heat		$0	Heat indices ranging from 105-109 degrees.
ANGELINA (ZONE)	7/19/2017 - 7/29/2017	Heat		$0	Heat indices ranged from 105-108 degrees.
POLLOK	7/8/2017	High Wind	56 kts. EG	$0	Trees were blown down on FM1819 near the Angelina/Cherokee County line.
PROSSER	5/28/2017	High Wind	61 kts. EG	$0	In the storms' wake, over 103,000 customers were left without power across East Texas and Western Louisiana in the AEP SWEPCO coverage area, which was the 4th worst storm (with outages) in the company's 105 year history. Several trees were snapped or uprooted just north of Lufkin.
LUFKIN, HERTY	5/20/2017	Hail	1.75 in.	$0	Golf ball size hail fell near Angelina College.
LUFKIN, HUNTINGTON, HERTY, DIBOLL, HOMER	5/3/2017	Torndado, High Wind, Hail, Flash Flood	EF0, 55 kts. EG, 1.00 in.	$100,000	An EF0 tornado first touched down at the intersection of Church Street and Grant Avenue and began to move east southeast through southeast Lufkin. During this stretch, several large trees were uprooted , knocking over power poles and taking down power lines. A few of these trees fell directly on to homes. The tornado crossed the 287 loop between Highway 69 and CR 841. Several large trees were uprooted and numerous large branches were broken off as it paralleled Fannie Carrell Road as it continued southeast, eventually crossing CR 841 near Fish Road. The tornado lifted near the intersection of Flen Gary Road and CR 326 but not before knocking over several more large trees there, with one on a home.
LUFKIN, HUNTINGTON, ZAVALLA, HOMER, PROSSER, POLLOK	4/26/2017	Hail	1.75 in.	$0	
HUNTINGTON, ZAVALLA	3/24/2017	High Wind	70 kts. EG	$0	Trees were blown down between Huntington and Zavalla.
LUFKIN	11/29/2016	Hail	1.00 in.	$0	
ANGELINA (ZONE)	11/1/2016	Drought		$0	
ANGELINA (ZONE)	7/3/2016 -	Heat		$0	heat index values near or above 105 degrees.

AREA AFFECTED	DATE	HAZARD TYPE	MAGNITUDE	DAMAGE NOTES	
	8/3/2016				
REDLAND, GILBERT	4/21/2016	High Wind	52 kts. EG	$0	Large trees were blown down across McGaughey Road near Hudson, and Fredonia Avenue just north of the Redland community.
REDLAND	1/8/2016	Hail	0.75 in.	$0	
ALCO	12/27/2015	Flash Flood		$0	Tom Holland Road east of Lufkin was flooded and closed.
LUFKIN, PROSSER	12/13/2015	High Wind	70 kts. EG	$100,000	Damaging swath of wind from exit ramp at North Raguet Street and Hwy. 103 across U.S. Highway 69 to FM 2251. Winds near initial damage path at North Raguet Street and Hwy. 103 estimated near 65 mph, snapping and uprooting trees. Winds accelerated to near 80 mph on Hwy. 103 just northeast of Old Mill Road and beneath the railroad overpass where 64 empty railroad cars were blown off the tracks, falling onto the roadway. These winds blew away billboards at the intersection of Highways 103 and 69 before ripping shingles off of several apartment homes at the Timber Point Apartments on Ellen Trout Drive. Metal covered parking structures were also blown away and several trees adjacent to the property were snapped or uprooted. FM 2251 had large trees snapped and uprooted.
POLLOK, GILBERT	11/17/2015	Flash Flood		$150,000	Several roads in the Hudson and Pollock communities were washed out due to flash flooding.
ANGELINA (ZONE)	9/1/2015 - 10/1/2015	Drought		$0	
LUFKIN	8/22/2015	High Wind	52 kts. EG	$0	Powerlines were downed at the intersection of Kurth Drive and Lakeview Street in Lufkin.
ANGELINA (ZONE)	7/13/2015, 8/5/2015	Heat		$0	Triple digit temperatures with Heat Index values at or near 105 degrees were common.
LUFKIN, PROSSER, HOMER, DUNAGAN STATION	6/17/2015 - 6/18/2015	Tropical Storm Bill, Flash Flood		$0	The remnants of Tropical Storm Bill continued to plague Northeast Texas on June 18th. A nocturnal feeder band developed across Northeast Texas and produced excessive heavy rainfall which produced flash flooding across several counties. Several highways were flooded in and around Lufkin, Texas. Those included FM 841, FM 2497, FM 324 and three different portions of FM 1818.
LUFKIN, BURKE, KURTH LAKE, PROSSER, CLAWSON, CENTRAL, REDLAND	5/18/2015 - 5/21/2015	Flash Flood, Hail, High Wind	0.75 in., 52 kts. EG	$0	Widespread city street flooding was reported across all of the Lufkin area resulting in numerous road closures. Flooding of Hwy. 69 was reported north northeast of Lufkin. A tree was downed on Porter Road just west of Lufkin. Flooding was reported along Rivercrest Road north northeast of Lufkin. Flooding was reported across Hwy. 69 between Central Elementary and Lufkin State Supported Living. Flash flooding was reported along FM. 706 and FM 20121 north of the Hudson community.
DIBOLL, DUNAGAN STATION	4/27/2015	Hail, Flash Flood	1.00 in.	$0	Flash flooding was reported in downtown Lufkin, Texas resulting in the closure of several city streets. Quarter size hail fell in the Beulah community.
DONOVAN	4/16/2015	High Wind	52 kts. EG	$0	Several trees were downed east of Huntington, Texas.
ANGELINA (ZONE)	2/23/2015 - 3/4/2015	Winter Weather		$0	Light freezing rain, sleet and snow across the region.
EWING, DIBOLL, HERTY	12/27/2014	Hail, High Wind	0.88 in., 52 kts. EG	$0	Large tree limbs greater than two inches in diameter were downed in Herty. Nickel size hail was reported in Kingtown Landing Store. Large tree limbs greater than 2 inches in diameter were downed southwest of Burke.

AREA AFFECTED	DATE	HAZARD TYPE	MAGNITUDE	DAMAGE NOTES	
HUNTINGTON, PROSSER, ALCO	7/17/2014	Flash Flood, Hail	0.88 in.	$5,000	Excessive heavy rainfall developed across portions of East Central Texas during the late evening hours of July 17th and continued into the predawn hours of July 18th. A vehicle was underwater on Hwy. 69 in Huntington in front of the Texas State Bank. Southwood Drive in Lufkin also flooded. Rainfall on the south side of town totaled in excess of 6 inches. Nickel size hail was reported north of Huntington.
LUFKIN, POLLOK	7/3/2014	High Wind, Hail	53 kts. EG, 1.00 in.	$0	Trees were downed on a powerline on FM. 819 east of Burke. Quarter size hail was reported on North Timberland Drive near the intersection of Kurth Drive. Trees and powerlines were downed in the Pollock community near the Hwy. 7 and Hwy. 69 intersection.
HERTY, PROSSER	5/12/2014	Flash Flood		$0	Numerous county roads in the northern section of the county were closed due to flooding. Lufkin Police Department reported a road closure on Frank Street from excessive heavy rainfall.
DUNAGAN STATION, DIBOLL	4/6/2014	Hail	1.75 in.	$0	
LUFKIN	3/28/2014	High Wind	57 kts. EG	$0	Widespread wind damage was reported across all of Angelina County. Numerous trees were downed, along with many powerlines resulting in widespread power outages. Some structural damage was also reported with roof damage either from the wind or from fallen trees, along with trees on automobiles.
HERTY, REDLAND	3/16/2014	Hail	1.00 in.	$0	
LUFKIN	2/20/2014	High Wind	53 kts. EG	$0	The local police department reported that a large tree top was blown onto Hwy. 69 in the southern portion of town just outside the loop.

Source: NCEI Storm Reports


NOTES:
Total Improvement Value: $2,977,444,397
Maximum Individual Value: $12.01 million
Mean/average Value: $93,208
Total Improved Properties Over $5k: 31,944
Angelina River
Neches River
Sam Rayburn Reservoir
Pollok
Redtown
Central
Durant
Clawson
Cedar Grove
Davisville
Redland
River Crest Estates
Platt
Moffitt
Thomas Crossing
Ewing
Woodlawn
Keltys
Herty
Dunagan
Alco
Lufkin
Providence
Hudson
Rocky Springs
Peavy
Granville
Blix
Homer
Huntington
Oak Flat
Ora
Bald Hill
Boynton
Monterey
Renova (historical)
Rutland
Diboll
Prairie Grove
Beulah
Shawnee
Shawnee Prairie
Shady Grove
Zavalla
Manning
Concord
Parker Point
Nancy
Dolan
Martin
7
59
69
103
94
147
63
Angelina County
0
5
10
Miles
Major Highway
Local Highway
Local Road
Rails
County Line
City Limits
Water Bodies
Improvement Value
$5,000.00 - $30,000.00
$30,000.01 - $70,000.00
$70,000.01 - $123,590.00
$123,590.01 - $240,000.00
$240,000.01 - $12,011,900.00
Angelina County Improvement Values Distribution
Angelina County Multi-Jurisdiction Hazard Mitigation Action Plan
Map intended for planning purposes only. Information shown is subject to revision and/or update.
Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, Angelina County Appraisal District
MPTX

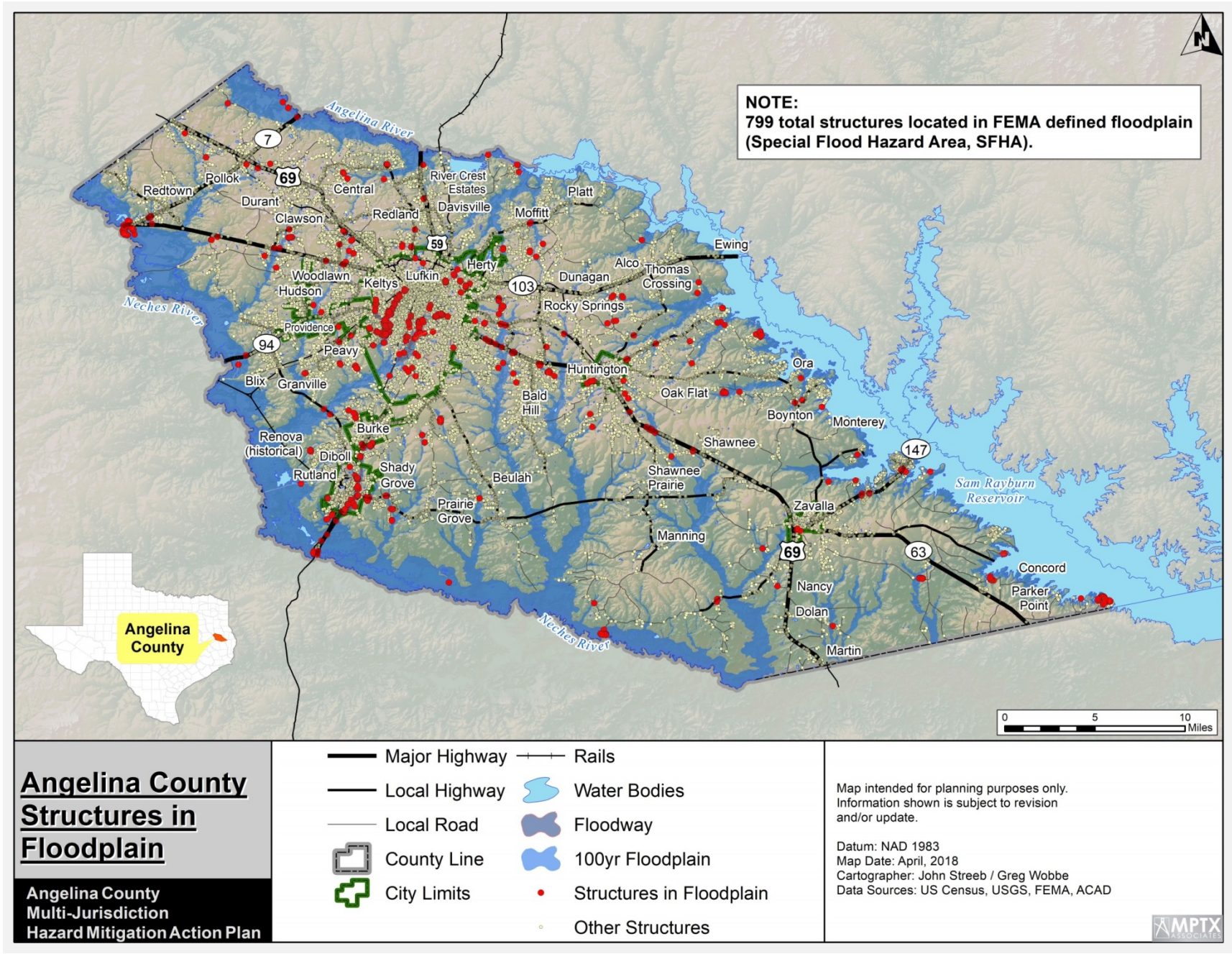
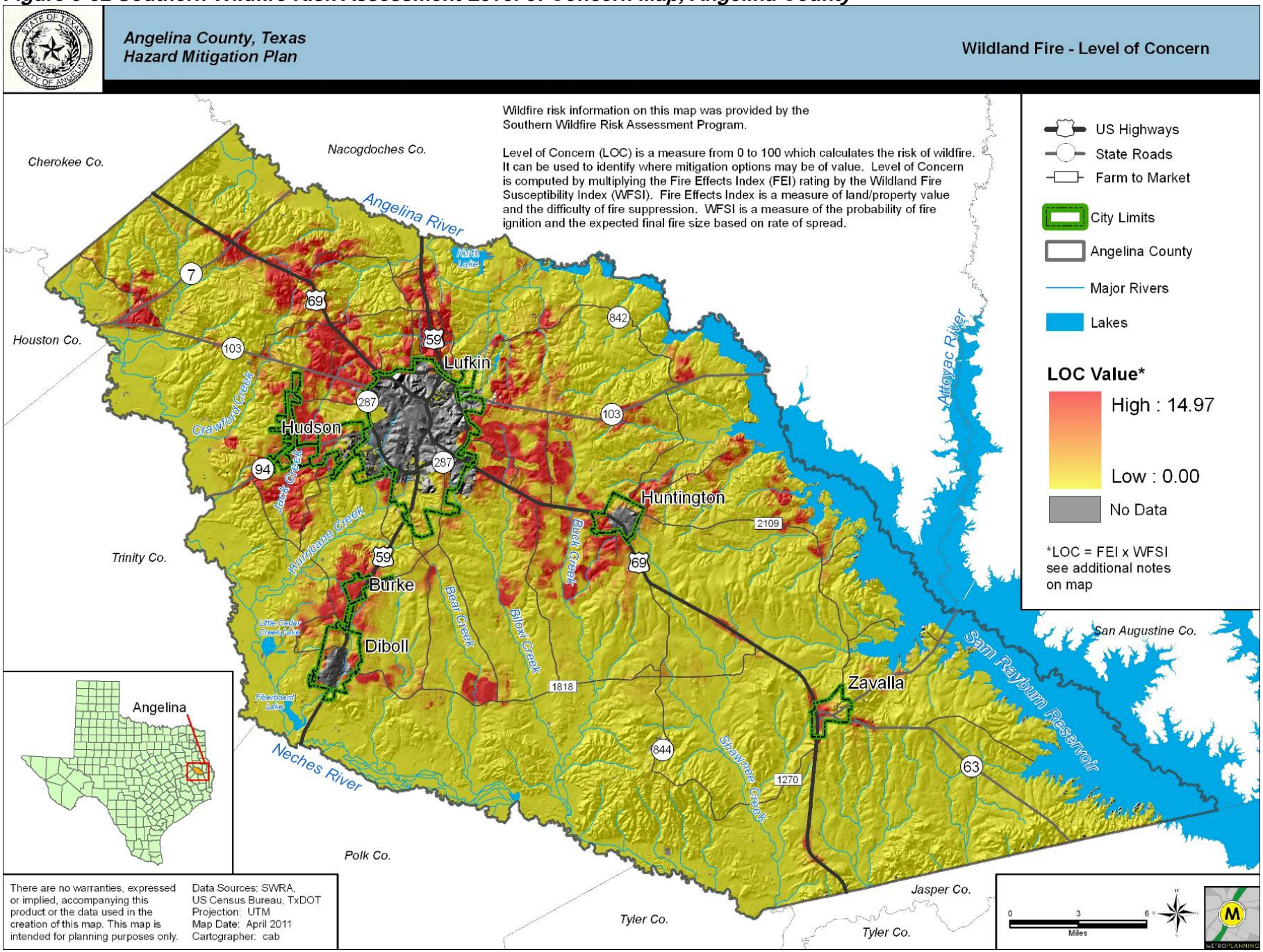

NOTE:
799 total structures located in FEMA defined floodplain
(Special Flood Hazard Area, SFHA).
Angelina River
Neches River
Sam Rayburn Reservoir
Redtown
Pollok
Durant
Clawson
Central
River Crest Estates
Davisville
Redland
Moffitt
Platt
Ewing
Alco
Thomas Crossing
Dunagan
Rocky Springs
Herty
Woodlawn
Keltys
Lufkin
Hudson
Providence
Peavy
Blix
Granville
Huntington
Ora
Oak Flat
Bald Hill
Boynton
Monterey
Shawnee
Burke
Renova (historical)
Diboll
Rutland
Shady Grove
Beulah
Shawnee Prairie
Prairie Grove
Zavalla
Manning
Concord
Nancy
Parker Point
Dolan
Martin
7
69
59
103
94
147
63
Angelina County
0 5 10 Miles
Angelina County Structures in Floodplain
Angelina County Multi-Jurisdiction Hazard Mitigation Action Plan
Major Highway
Local Highway
Local Road
County Line
City Limits
Rails
Water Bodies
Floodway
100yr Floodplain
Structures in Floodplain
Other Structures
Map intended for planning purposes only.
Information shown is subject to revision and/or update.
Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, FEMA, ACAD
MPTX ASSOCIATES

Figure 3-32 Southern Wildfire Risk Assessment Level of Concern Map, Angelina County



3.4 HAZARD PROFILES

44 CFR Requirement §201.6(c) (2) (ii):
[The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazard described in paragraph (c) (2) (i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

The hazard profiles that follow are those that were deemed relevant to the planning area by the Hazard Mitigation Team. Other hazards such as volcanoes and avalanches were not profiled due to general lack of potential to affect Angelina County. Information is presented in the most objective manner possible, with data sources and limitations of available information noted as appropriate.

Each profile includes a general description of the hazard, the geographic area affected, information regarding previous occurrences, and assessments of probability of future occurrence, magnitude and severity, and overall vulnerability to each hazard identified as relevant to the planning area. Hazard profiles are organized alphabetically for ease of reference and order should not infer relative importance.

3.4.1 Flood

Hazard Description

A flood is defined as the inundation of land by the rise and overflow of a body of water. Floods most commonly occur as a result of heavy rainfall causing a river system or stream to exceed its normal carrying capacity. Flood events can also occur due to dam failure or from hurricane storm surge from a hurricane or tropical storm. Flooding is one of the most pervasive natural hazard threats in Texas, with public safety, housing, property, and infrastructure all potentially impacted by flooding.

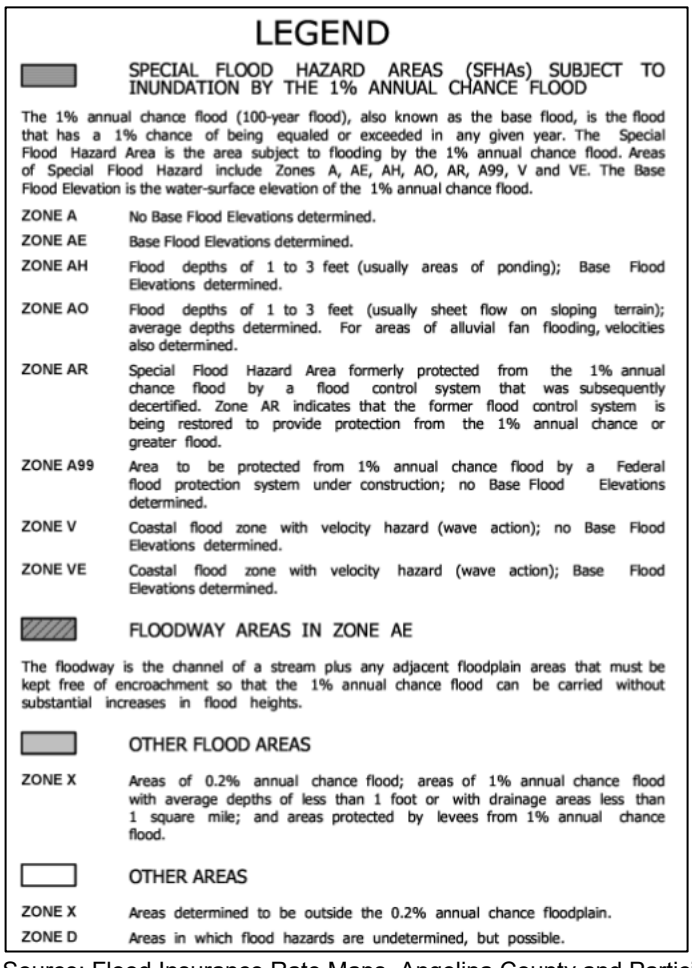
There are two types of flooding that can impact Angelina County: riverine flooding and flash floods. Riverine flooding is a natural occurrence where a waterway exceeds its 'bank full' capacity and inundates the adjacent floodplain. According to common usage, a floodplain is that area that is inundated by the 100-year flood (a flood that has a 1 percent chance in any given year of being equaled or exceeded). Riverine flooding is affected by the intensity and distribution of rainfall, soil moisture, seasonal variation in vegetation, and water-resistance of the surface areas caused by urbanization. Flash flooding is a localized flood that results from a short duration of intense rainfall across a limited geographic area. During extended periods of intense rainfall, storm water conveyance systems can be overwhelmed and flooding of surrounding neighborhoods can result.

Geographic Location

A flooding event can occur almost anywhere in Angelina County. The county is comprised of four watersheds: the Upper Angelina in the far northwestern corner of the county, the Lower Neches Watershed covering the eastern half of the county, the Middle Neches covering the western half and the Lower Neches Watershed in the far southeastern corner of Angelina County.

One method for identifying geographic locations of floodprone areas is FEMA Flood Insurance Rate Maps (FIRMs). Figure 3-6 below gives descriptions of the various flood zones as defined on FIRMs.

Figure 3-6 Flood Zone Definitions from Angelina County FIRMs



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

Source: Flood Insurance Rate Maps, Angelina County and Participating Jurisdictions (Legend)

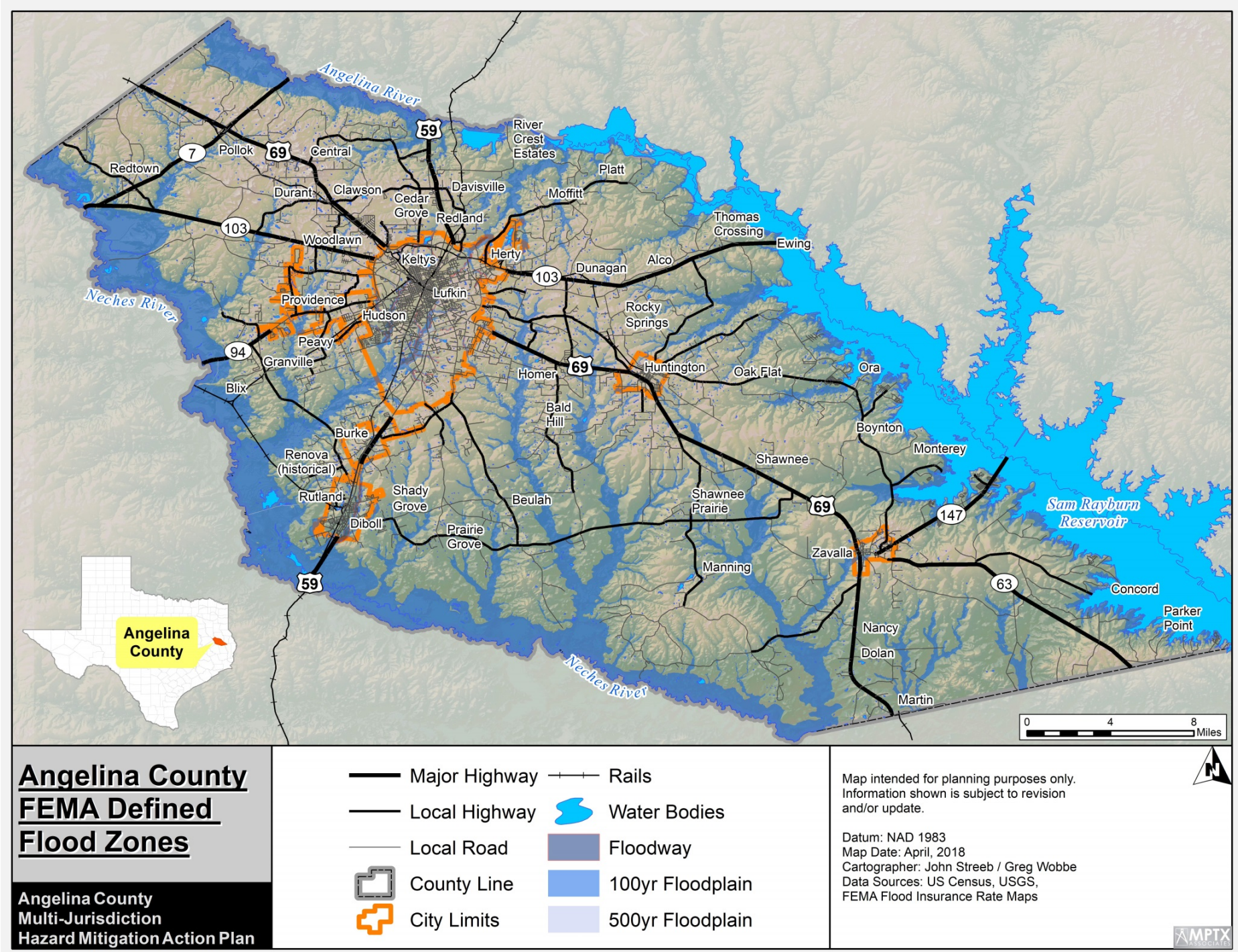
Table 3-24 Flood Insurance Rate Map: Special Flood Hazard Areas Summary (SFHAs)

ZONE	DESCRIPTION
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
AE	The base floodplain where base flood elevations are provided.
FLOODWAY / ZONE AE	The floodway is the channel of a stream (or river) plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood depths.

Source: FEMA Map Service Center: **Definitions of FEMA Flood Zone Designations; http://www.msc.fema.gov/webapp/wcs/stores/servlet/info?storeId=10001&catalogId=10001&langId=-1&content=floodZones&title=FEMA%20Flood%20Zone%20Designations**
FIRM panel for Angelina County Effective Date 9/29/2010.

According to the 2010 FEMA Flood Insurance Study (FIS) for Angelina County, major flooding produced by intense rainfall is usually associated with localized thunderstorms. These thunderstorms may occur at any given time during the year, but are more prevalent in the spring and summer months.

The map on the following page (Figure 3-17) is a generalization of the combined Flood Insurance Rate Map flood boundaries from the County's adopted D-FIRM. Specific flood depths, velocities and volumes are available at the local level through the individual Flood Insurance Rate Maps (FIRMs) and the community specific Flood Insurance Study (FIS), and are reported in the Magnitude/Severity/Extent section of this Flood Profile.



Angelina County FEMA Defined Flood Zones

Angelina County Multi-Jurisdiction Hazard Mitigation Action Plan

Map intended for planning purposes only. Information shown is subject to revision and/or update.

Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, FEMA Flood Insurance Rate Maps

Previous Occurrences / Impact

Source of flooding occurrences information is the national Storm Events Database, administered by National Oceanic and Atmospheric Administration (NOAA), National Center for Environmental Information (NCEI, previously the NCDC). Table below outlines flood reports from 2012 to 2018.

Table 3-25 Flooding Occurrences, March 2012 - March 2018

General Location	Date	Report / Event Description
Countywide	8/29/2017	Hwy 69 near Hubert Cryer Rd. Polly Branch Rd, Old Johnson School Road, FM 2497, Ryan Chapel Creek Rd, FM 3150 at Jack Creek, FM 1270, Sandy Creek Rd closed due to flooding. FM 1818 at Biloxi Creek, Bear Creek, and Little Buck Creek flooded.
Lufkin	5/3/2017	Low water crossings flooded 3 miles south of Lufkin on Hwy. 59.
Gilbert	11/17/2015	Several roads in Hudson and Pollock communities washed out due to flash flooding. Hwy. 7 west in the Pollock community flooded and closed along with Durrant Road and Old Bonner Road. Damage estimated at least $150,000.
Pollok	11/17/2015	Tom Holland Road east of Lufkin, Texas flooded and closed.
Homer	6/17/2015	Heavy rainfall resulted in high water over FM 1475 and 3 portions of FM 1818. FM 326 and U.S. Hwy 69 flooded south near Buck Creek southeast of Lufkin, and Tom Hollins...Box Car Road...FM 1475 and FM 841, FM 2497 and FM 324 also flooded.
Lufkin, Burke	5/21/2015	Highway 69 south of Lufkin was flooded and closed.
Lufkin, Hudson	5/18/2015	Flash flooding reported along FM 706 and FM 2021 north of Hudson. Flooding reported along Rivercrest Road N/NE of Lufkin. Flooding was reported across Hwy. 69 between Central Elementary and Lufkin State Supported Living, and on Hwy 69 N/NE of Lufkin
Dunagan Station	4/27/2015	Flash flooding reported in downtown Lufkin resulting in closure of several city streets.
Huntington, Lufkin	7/17/2014	Excessive heavy rainfall resulted in Southwood Drive in Lufkin, Texas being flooded. Rainfall on the south side of town totaled in excess of 6 inches. A vehicle was underwater on Hwy. 69 in Huntington in front of Texas State Bank.
Lufkin, Prosser	5/12/2014	Numerous county roads in the northern section of the county were closed due to flooding. Lufkin Police reported road closure on Frank Street from excessive heavy rainfall.
Countywide	10/31/2013	Several roads were closed due to high water across the county.
Burke	8/31/2012	Excessive heavy rainfall resulted in a creek overflowing its bank and flooding pastureland with rapid moving water near a home along Old Diboll Highway in Burke, Texas.
Homer	3/11/2012	Old Homer Alto Road southeast of Lufkin, Texas was completely washed out. A car ran across the high water and collapsed into the torrent of water that used to be the road. There were no reports of injuries, but damage was estimated at $60,000

Source: National Oceanic and Atmospheric Administration (NOAA) / National Center for Environmental Information (NCEI), National Storm Events Database, https://www.ncdc.noaa.gov/stormevents/

Flood reports from 1994 through 2011 are listed in Table 3-7 below.

Table 3-26 NCDC Flood Events: Angelina County, 1994-2012

Location	Date	Flood Type	*Property Damage
Lufkin	4/11/1994	Flash	$5,000
Angelina	10/16/1994	Flash	$500,000
Lufkin	4/10/1995	Flash	$0
Lufkin	7/19/1995	Flash	$0
Lufkin	9/19/1995	Flood	$0
Lufkin	2/12/1997	Flash	$0
Lufkin	2/20/1997	Flash	$0
Pollock	8/7/1997	Urban/Small Stream	$0
Lufkin	2/10/1998	Urban/Small Stream	$0
Lufkin	10/18/1998	Flash	$0
Lufkin	1/29/1999	Flash	$0
Lufkin	11/3/2000	Flash	$500,000
Diboll	6/8/2001	Flash	$0
Lufkin	11/4/2002	Flash	$0
Lufkin	12/23/2002	Flash	$10,000
Lufkin	2/21/2003	Flash	$0

Location	Date	Flood Type	*Property Damage
Lufkin	5/13/2004	Flash	$0
Lufkin	6/28/2004	Flash	$0
Lufkin	9/24/2004	Flash	$25,000
Lufkin	11/17/2004	Flash	$0
Lufkin	11/23/2004	Flash	$0
Lufkin	7/14/2005	Flash	$0
Lufkin	10/26/2006	Flash	$0
Diboll	1/14/2007	Flash	$0
Diboll	4/4/2008	Flash	$0
Zavalla	4/27/2009	Flash	$25,000
Countywide	10/29/2009	Flash	$250,000
Huntington	7/26/2010	Flash	$0
Total			**$1,290,000**

Source: National Climatic Data Center, NOAA. *Note: Zero (0) values may indicate missing data.

Descriptions of previous flood events Angelina County 1994-2009 listed below in Figure 3-7.

Figure 3-7 Descriptions of Angelina County Flood Occurrences, 1994-2009

County-wide (October 1994)
Up to 11.8 inches of rain fell from Sunday night to Monday morning causing county-wide flooding. Numerous county roads were flooded.

5 miles north of Lufkin (November 2000)
A two lane wood and steel bridge collapsed on County Road off Highway 69 due to excessive flooding.

5 miles south of Lufkin (June 2004)
High water on Highways 58, 59, 818, 819 and FM 324 caused considerable problems in and south of town. High water went into a few homes and flooded an automobile.

3 miles west of Diboll (October 2009)
Flooding was severe across northwest Louisiana and East Texas where flooding was reported in many homes and businesses. Area bayous, creeks, rivers and lakes were already at high levels from the excessive heavy rainfall that fell earlier in the month. Thus, some lakes and bayous approached and succeeded their all time record stage levels. Numerous roads were flooded and closed throughout the entire county. Some homes were also flooded near Hwy. 59 south near Diboll, Texas.

Source: NCDC

Probability of Future Occurrence

According to FEMA Flood Insurance Study for Angelina County, major flooding produced by intense rainfall is usually associated with localized thunderstorms. These thunderstorms may occur at any given time during the year, but are more prevalent in the spring and summer months. According to information provided by the NOAA National Center for Environmental Information (NCIE) Severe Storm Event database, there were 13 flood events reported in Angelina County between 2012-2018. This calculates to approximately 2.2 flood events per year, equating to a **High** probability of future occurrence classification as defined in Section 3.1.1 Methods and Definitions.

Magnitude/Severity/Extent

According to the NCDC database, over the past 15 years floods have caused over $1,290,000 in damage. Actual losses are likely to be much higher when factoring for unreported damages, infrastructure loss of function, and economic impacts. In terms of magnitude and severity of flooding events throughout Angelina County, a worst-case scenario such as a 500-year flood occurrence could be considered **Level-3 Critical** based on the definitions set forth in Section 3.1.1 Methodology and Definitions, with impacts on a neighborhood scale, temporary loss of use of facilities and infrastructure, and potential injuries or fatalities.

Analysis of potential impacts of flooding on population centers and estimated potential dollar loss due to flooding is presented in Sections 3.3.3 (Vulnerable Populations). Detailed analysis of the relationship of homes and critical facilities to these floodplains is presented in Section 3.3.4 (Vulnerable Structures).

Figure 3-8 Flooding Extent, Major Creeks, Angelina County Flood Insurance Study (FIS)

TABLE 2: SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% Annual-Chance	2% Annual-Chance	1% Annual-Chance	0.2% Annual-Chance
BILOXI CREEK NORTH TRIBUTARY					
Approximately 2,850 feet downstream of State Highway 287/ South Medford Drive	1.1	992	1,379	1,544	1,949
Approximately 1,420 feet downstream of State Highway 287/ South Medford Drive	0.3	311	421	472	588
BILOXI CREEK SOUTH TRIBUTARY					
At Lemans Drive	0.1	164	226	254	320
CEDAR CREEK					
Just Upstream of Gobbler Knob Road	7.7	3,520	4,080	4,800	6,390
Just downstream of confluence of Cedar Creek South Tributary	5.9	3,020	3,510	4,090	5,480
Just downstream of confluence of Cedar Creek North Tributary	2.4	1,640	1,880	2,130	2,700
Just Upstream of Union Pacific Railroad	0.6	850	970	1,100	1,390
CEDAR CREEK NORTH TRIBUTARY					
Just downstream of Union Pacific Railroad	1.2	520	590	670	840
At Lotus Lane	0.7	180	220	280	450
CEDAR CREEK SOUTH TRIBUTARY					
Just upstream of Old Union Railroad	2.0	950	1,130	1,390	2,040
Just downstream of Regional Basin # 7 Dam	1.8	920	1,090	1,350	2,000
Approximately 1,450 feet upstream of Berry Road	1.0	790	920	1,064	1,400
CEDAR CREEK TRIBUTARY 3					
Just downstream of Hanks Street	1.0	670	780	903	1,190
Just upstream of Live Oak Lane	0.4	400	470	550	740
Just upstream of Angelina and Neches River Railroad	1.1	467	894	1,000	—[1]
At confluence of East and West forks of East Branch Mill Creek	0.8	450	716	850	—[1]
EAST FORK OF EAST BRANCH MILL CREEK					
Just Upstream of Martin Luther King Jr. Drive	0.6	401	619	730	—[1]
Approximately 300 feet upstream of Martin Luther King Jr. Drive	0.1	87	159	195	—[1]

[1]Data Not Available

Source: FEMA, Angelina County Flood Insurance Study (FIS), 2011, continued on following page.

TABLE 2: SUMMARY OF DISCHARGES - *(Continued)*

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% Annual-Chance	2% Annual-Chance	1% Annual-Chance	0.2% Annual-Chance
EAST FORK OF WEST BRANCH MILL CREEK					
Just downstream of Angelina and Neches River Railroad	0.4	328	507	600	---[1]
Approximately 320 feet upstream of Minnie Lou Street	0.2	185	289	340	---[1]
HURRICANE CREEK					
Downstream of confluence with Unnamed Tributary To Hurricane Creek 3	10.1	3,520	5,030	5,910	7,760
Downstream of confluence with Hurricane Creek East Tributary (East)	9.2	3,340	4,740	5,590	7,320
Downstream of confluence with Unnamed Tributary To Hurricane Creek 2	7.7	3,110	4,340	5,040	6,500
Downstream of confluence with Hurricane Creek East Tributary (North)	6.4	2,880	4,020	4,650	5,990
At U.S. Highway 59	5.1	2,380	3,370	3,840	4,940
Downstream of confluence with Hurricane Creek East Tributary (North)	4.0	1,930	2,670	3,050	3,880
Upstream of confluence with Hurricane Creek East Tributary (North)	2.0	1,070	1,510	1,740	2,210
Upstream limit of Study	0.5	370	510	590	750
HURRICANE CREEK EAST TRIBUTARY (EAST)					
Upstream of the confluence with Hurricane Creek	1.3	840	1,160	1,340	1,720
HURRICANE CREEK EAST TRIBUTARY (EAST) TRIBUTARY					
Upstream of the confluence with Hurricane Creek East Tributary (East)	0.6	390	570	660	870
HURRICANE CREEK EAST TRIBUTARY (NORTH)					
Upstream of Confluence with Hurricane Creek	1.4	880	1,160	1,310	1,620
HURRICANE CREEK EAST TRIBUTARY (SOUTH)					
Upstream of Confluence with Hurricane Creek	2.0	1,140	1,710	1,970	2,630
At State Highway 35	0.7	810	720	910	1,030

[1] Data not available

Source: FEMA, Angelina County Flood Insurance Study (FIS), 2011, continued on following page.

TABLE 2: SUMMARY OF DISCHARGES- *(Continued)*

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% Annual-Chance	2% Annual-Chance	1% Annual-Chance	0.2% Annual-Chance
HURRICANE CREEK WEST TRIBUTARY					
Upstream of Confluence with Hurricane Creek	1.3	610	890	1,030	1,360
At Temple Street	0.5	360	510	580	760
MILL CREEK					
Just Downstream of Ellen Trout Dam	3.0	963	1,736	2,165	--[1]
At the confluences of East and West Branches of Mill Creek	2.7	952	1,694	2,110	--[1]
ONE EYE CREEK					
Approximately 2,110 feet downstream of Bartmess Drive	2.8	1,184	1,826	2,174	2,994
Approximately 3,910 feet upstream of Bartmess Drive	0.2	251	343	385	482
SHIRLEY CREEK					
Approximately 12, 550 feet downstream of Moffet Road	5.4	2,262	3,590	4,344	6,126
Just upstream of the confluence of Shirley Creek Tributary 2	1.4	850	1,282	1,488	1,998
Approximately 2,060 feet upstream of Oleta Street	0.7	566	818	963	1,274
SHIRLEY CREEK TRIBUTARY 2					
At Atkinson Drive/State Highway 103	1.3	894	1,248	1,383	1,740
SHIRLEY CREEK TRIBUTARY 2 EAST BRANCH					
Just downstream of Paul Avenue	0.6	443	549	762	1,014
UNNAMED TRIBUTARY 1 TO HURRICANE CREEK					
Upstream of confluence with Hurricane Creek	0.9	620	870	990	1,270
UNNAMED TRIBUTARY 2 TO HURRICANE CREEK					
Upstream of confluence with Hurricane Creek	0.5	340	470	520	650
UNNAMED TRIBUTARY 3 TO HURRICANE CREEK					
Upstream of confluence with Hurricane Creek	0.6	230	350	420	570

[1] Data not available

Source: FEMA, Angelina County Flood Insurance Study (FIS), 2011, continued on following page.

TABLE 2: SUMMARY OF DISCHARGES - *(Continued)*

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10% Annual-Chance	2% Annual-Chance	1% Annual-Chance	0.2% Annual-Chance
UNNAMED TRIBUTARY 4 TO HURRICANE CREEK					
Upstream of confluence with Hurricane Creek	1.1	670	990	1,140	1,510
WEST BRANCH MILL CREEK					
Just downstream of confluence of East and West Forks of West Branch Mil Creek	1.6	496	1,094	1,405	--[1]
WEST FORK OF WEST BRANCH MILL CREEK					
Approximately 580 feet upstream of Angelina and Neches River Railroad	0.5	557	853	1,000	--[1]
WHITE OAK CREEK					
At a point approximately 2,800 feet downstream of Southern Pacific Railroad	8.52	--[1]	--[1]	8,220	--[1]
At a point approximately 100 feet upstream of State Route 59	6.98	--[1]	--[1]	8,140	--[1]
At a point approximately 1,700 feet downstream of Right Bank Tributary, approximately 1,900 feet downstream of FM 1818	5.55	--[1]	--[1]	6,410	--[1]
At a point approximately 1,000 feet downstream of FM 1818	5.09	--[1]	--[1]	6,350	--[1]
At a point approximately 100 feet downstream of Hall Street	4.36	--[1]	--[1]	5,770	--[1]
At a point approximately 2,500 feet upstream of Harris Street	3.35	--[1]	--[1]	4,780	--[1]
At a point approximately 3,800 feet upstream of Harris Street	2.78	--[1]	--[1]	3,880	--[1]
At a point approximately 4,000 feet downstream of Unnamed Road	2.26	--[1]	--[1]	3,540	--[1]
At a point approximately 200 feet downstream of Unnamed Road	1.73	--[1]	--[1]	2,960	--[1]
At a point approximately 1,900 feet upstream of Unnamed Road	1.39	--[1]	--[1]	2,390	--[1]

[1] Data not available

11

Source: FEMA, Angelina County Flood Insurance Study (FIS), 2011, continued on following page.

Flood Overall Vulnerability

Based on frequency and extent of previous occurrences, the overall vulnerability assessment for flooding is considered **High Vulnerability**, and the classifications defined in Section 3.1.1. See also Section 3.3 Multi-Jurisdiction Risk Assessment for more information. Further assessments of vulnerability per community are located in Sections 3.3.1 – 3.3.7.

3.4.2 Tornado

Hazard Description

The National Weather Service defines a tornado as a "violently rotating column of air extending from a thunderstorm to the ground." Tornados are the most violent of all atmospheric storms and are capable of tremendous destruction. Wind speeds can exceed 250 mph, and damage paths can be more than one mile wide and 50 miles long. In an average year, more than 900 tornados are reported in the United States, resulting in approximately 80 deaths and more than 1,500 injuries.

Although tornados are documented on every continent, they occur most frequently in the central U.S. east of the continental divide. Atmospheric and topographic conditions cause warm and cold air masses to meet in the center of the country, creating unstable, fast moving air at high pressure that can cause a tornado to form. Tornados occur most frequently from April to June. While most tornados occur between 3:00 and 9:00 p.m., a tornado can occur at any time of day. Prior to 2007, tornado intensity was measured by the Fujita (F) scale shown below.

Table 3-27 Fujita Scale

Fujita Scale	Wind Estimate (Mph)	Typical Damage
F0	< 73	Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
F1	73-112	Moderate damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2	113-157	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
F3	158-206	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4	207-260	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
F5	261-318	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena.

Source: National Oceanic and Atmospheric Administration Storm Prediction Center,

An updated and revised version of the Fujita scale is the Enhanced Fujita scale. Both scales are sets of wind estimates (not measurements) based on damage. The new scale provides more damage indicators and associated degrees of damage, allowing for more detailed analysis and thus better correlation between damage and wind speed. It is also more precise because it takes into account the materials affected and the construction of structures damaged by a tornado. The Enhanced Fujita Scale is presented in Table 3-28.

Table 3-28 Enhanced Fujita Scale (EF)

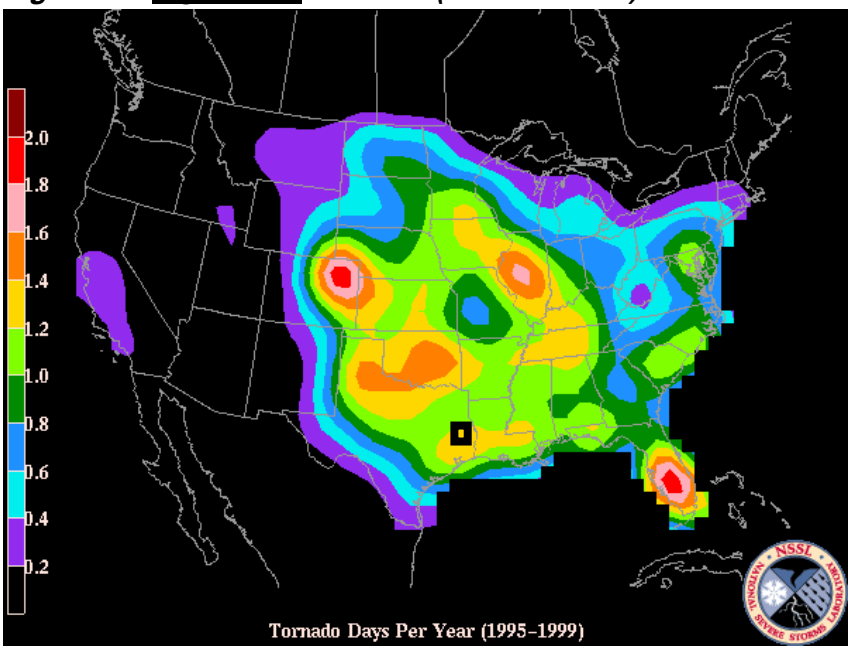
Enhanced Fujita Scale (EF)	EF Wind Estimate (MPH)
EF0	65-85
EF1	86-110
EF2	111-135
EF3	136-165
EF4	166-200
EF5	Over 200

Source: National Oceanic and Atmospheric Administration Storm Prediction Center, www.spc.noaa.gov/faq/tornado/ef-scale.html

Geographic Location

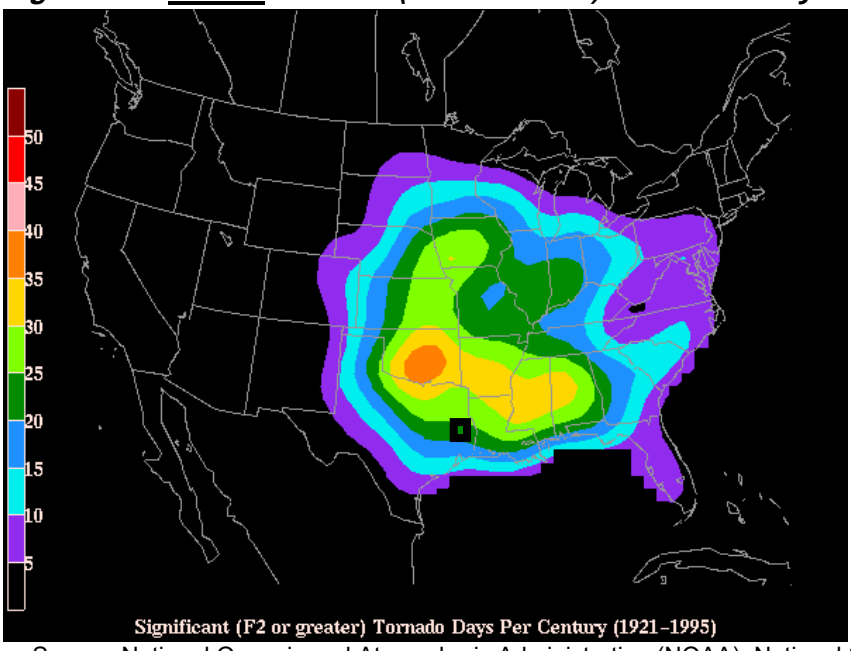
As a weather-based phenomenon, tornados can occur and impact any portion of the planning area. Based on analysis by the National Severe Storms Laboratory, Angelina County is located in a region of the U.S. that experiences a moderate to high frequency of tornado occurrences. The nationwide maps that follow show the location and frequency of 'significant' tornados and 'severe' tornados, and the map on the following page shows tornado tracks across the planning area from 1953-2008.

Figure 3-9 Significant Tornado (F0 or Greater) Occurrences by Location, 1995-1999

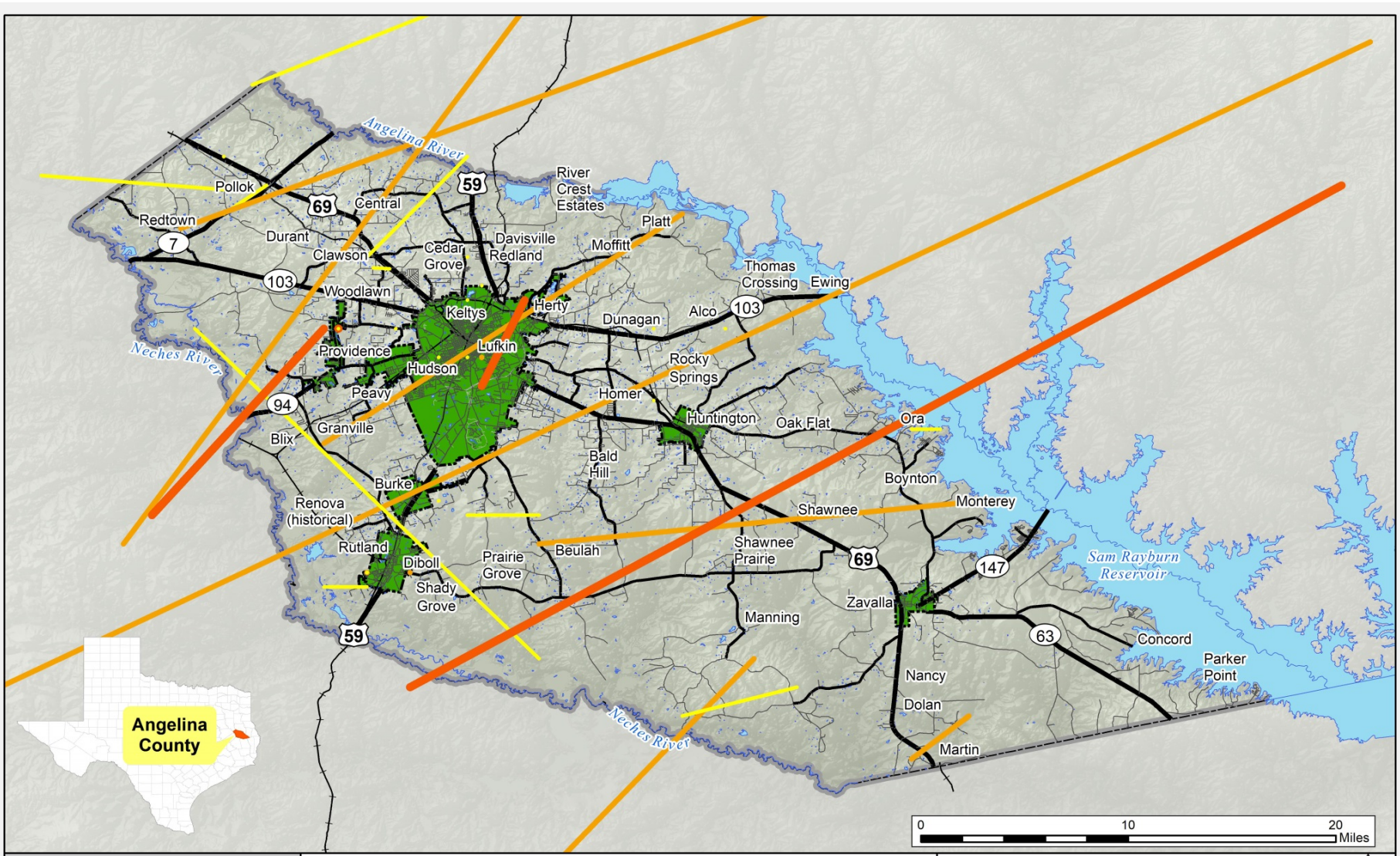


Source: National Oceanic and Atmospheric Administration (NOAA), National Severe Storm Laboratory (NSSL)
Note: Black rectangle indicates approximate location of Angelina County.

Figure 3-10 Severe Tornado (F2 or Greater) Occurrence by Location, 1921-1995



Source: National Oceanic and Atmospheric Administration (NOAA), National Severe Storm Laboratory (NSSL)
Note: Black rectangle indicates approximate location of Angelina County.


Angelina River
Neches River
Neches River
Sam Rayburn Reservoir
Pollok
Redtown
Durant
Clawson
Central
Cedar Grove
Davisville
Redland
River Crest Estates
Platt
Moffitt
Thomas Crossing
Ewing
Alco
Dunagan
Herty
Keltys
Woodlawn
Providence
Hudson
Lufkin
Peavy
Granville
Blix
Burke
Renova (historical)
Rutland
Diboll
Shady Grove
Prairie Grove
Beulah
Bald Hill
Homer
Rocky Springs
Huntington
Oak Flat
Ora
Boynton
Monterey
Shawnee
Shawnee Prairie
Zavalla
Manning
Nancy
Dolan
Martin
Concord
Parker Point
59
69
7
103
94
147
63
Angelina County
0
10
20
Miles
Angelina County Tornado Tracks - Magnitude
Angelina County
Multi-Jurisdiction
Hazard Mitigation Action Plan
Major Highway
Local Highway
Local Road
Rails
County Line
City Limits
Water Bodies
Magnitude
0 - 1
2
3
4 - 5
Map intended for planning purposes only.
Information shown is subject to revision and/or update.
Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, NOAA
N
MPTX ASSOCIATES

Previous Occurrences / Impact

As listed in the table below, the NOAA NCEI Storm Database reports 2 tornado outbreaks impacting the planning area from 2010 through January 2018.

Table 3-29 Tornados, Angelina County Planning Area (2010-January 2018)

Location	Date	Mag	Reported Damage	Description
LUFKIN	5/3/2017	EF0	$100,000	An EF0 tornado first touched down at the intersection of Church Street and Grant Avenue and began to move E/SE through southeast Lufkin. Several large trees were uprooted, knocking over power poles and lines. A few of these trees fell directly on to homes. The tornado crossed the 287 loop between Hwy 69 and CR 841. Several large trees were uprooted and numerous large branches were broken off as it paralleled Fannie Carrell Road as it continued southeast, eventually crossing CR 841 near Fish Road. The tornado lifted near the intersection of Flen Gary Road and CR 326 but not before knocking over several more large trees there, with one on a home.
POLLOK	4/25/2011	EF1	$302,000	This tornado was a continuation of the tornado that moved out of Cherokee County, Texas. A high end EF1 tornado began in extreme southeast Cherokee County just north of the Neches River where it caused roof damage to a home along CR 2829 and blew down several trees. The tornado continued east southeast into Angelina County where it snapped or uprooted dozens of trees and blew down powerlines along FM 1819. Several homes in this area also suffered roof damage and a few outbuildings were destroyed. The tornado crossed Choppin Road near Winter Lane where dozens of more trees were snapped or uprooted and additional homes and out buildings suffered damage. Turning NE, the tornado continued blowing down numerous trees as it moved over Cheeseland Road and Shirley Lane. The tornado lifted on the west side of Pollock just before crossing Hwy. 69. Winds were estimated near 110 mph. This same tornado outbreak touched down along Richardson Road northwest of Lufkin and moved eastward. Minor roof damage occurred to a mobile home at Royce Oliver Road and Richardson Road and several trees were blown down. Another home suffered minor roof damage and more trees were blown down at the FM 706/Hwy. 69 intersection.

Source: NOAA NCEI Storm Database

A listing of historical tornado events with recorded property damage from December 1953 through February 2011 is presented in Table 3-30 below. 37 tornadoes were reported over this period, resulting in 41 injuries and two deaths. Property damage is estimated at $26,344,000 attributed to these tornados.

Table 3-30 Angelina County Tornado Events 1953-2010

Location	Date	Magnitude (Fujita Scale)	Reported Property Damage
Angelina	12/2/1953	F1	$3,000
Angelina	4/30/1954	F2	$250,000
Angelina	5/19/1955	F2	$3,000
Angelina	3/5/1958	F1	$25,000
Angelina	4/14/1958	F1	$0
Angelina	5/3/1958	F1	$25,000
Angelina	6/26/1960	F2	$25,000
Angelina	9/22/1960	F2	$250,000
Angelina	7/24/1961	F2	$0
Angelina	2/23/1962	F1	$3,000
Angelina	3/24/1962	F1	$3,000
Angelina	11/19/1964	F1	$25,000
Angelina	4/21/1968	F2	$3,000
Angelina	3/28/1972	F2	$2,500,000
Angelina	11/13/1972	F2	$250,000
Angelina	3/20/1974	F3	$0
Angelina	3/30/1976	F1	$0
Angelina	4/20/1976	F1	$0
Angelina	11/26/1978	F1	$6,000
Angelina	11/21/1979	F1	$25,000
Angelina	4/19/1982	F1	$0

Location	Date	Magnitude (Fujita Scale)	Reported Property Damage
Angelina	12/10/1983	F2	$2,500,000
Angelina	11/4/1986	F1	$250,000
Angelina	11/19/1988	F1	$0
Angelina	1/19/1990	F3	$2,500,000
Angelina	2/27/1990	F1	$0
Huntington	11/28/1997	F1	$120,000
Diboll	11/3/2000	F1	$80,000
Diboll	3/30/2002	F3	$5,000,000
Pollock	4/6/2003	F2	$2,500,000
Lufkin	12/23/2009	F3	$10,000,000
Total			**$26,344,000**

Source: National Climatic Data Center (NCDC)
Note: No tornados were specifically reported for Zavalla during the period measured, though reports from 1953-1990 noted only county of occurrence (Angelina).

Listed below are narratives for selected tornado events. Note that storm narratives prior to 1997 in the NCDC for Angelina County are not available.

Figure 3-11 Description of Tornado Event, Angelina County

10 miles east of Huntington (2004)
The thunderstorm that produced the tornado formed along a squall line moving southeast across the area. Damage path consisted of numerous snapped and fallen trees. Twelve mobile homes were severely damaged from fallen trees and one mobile home was pushed off its foundation. Roofs were removed from two frame homes.

5 miles east north east of Diboll (2002)
Numerous trees and power lines broken, snapped, and pulled out of the ground along the entire track. Several barns were severely damaged and numerous homes were with missing roofs while others suffered severe roof and structural damage. South of the Ora Community one house was totally blown off its foundation and destroyed. This tornado moved into Angelina County, TX from Polk County, TX and continued into Nacogdoches County, TX and San Augustine County, TX.

Lufkin (2009)
An EF3 tornado touched down on the south side of Lufkin, on Loop 287 near Olive Garden just west of the intersections Loop 287 and South Chestnut Street. The tornado then tracked north northeast causing roof and tree damage to several homes behind Morgan Insurance Company on Loop 287. The tornado continued its north northeastward track then crossed South Chestnut causing major damage to Gibson Funeral Home. It then tracked northward through a residential neighborhood causing more tree and roof damage, before destroying Max Welding Shop on Denman Rd. The tornado crossed Denman Road moving through another residential area causing moderate to major tree and roof damage. The tornado then destroyed the VFW building just before crossing Lufkin Avenue. More residential damage was observed between Lufkin Avenue and Atkinson Drive. The tornado crossed Atkinson Drive causing major damage by tossing several 18-wheelers parked at a trucking company on Loop 287. The tornado then crossed Loop 287, damaging Goodyear Tires and Jim Walter Homes. The storm then tracked north into a wooded area before reaching Kit McConnico Park and causing moderate to major damage to the park. The tornado lifted on the northern end of Kit McConnico Park around 10:07 PM.

Source: National Climatic Data Center (NCDC)

Probability of Future Occurrence

The NCEI reports a total of 33 significant tornado events in the last 58 years in Angelina County. This recurrence interval equates to approximately a 57-percent change that a tornado will occur in Angelina County within a given year, and a **High** probability of future occurrence according to the definitions set forth in Section 3.1.1 Methods and Definitions.

Magnitude/Severity/Extent

Several F3 tornados have impacted Angelina County, and even more destructive tornados up to an EF5 are possible. When considering a worst-case scenario, tornados can produce impacts with **Level 4- Critical** magnitude and severity. Property damage can occur on a neighborhood or community-wide scale; a temporary shutdown of utilities and critical facilities can occur, and multiple injuries and fatalities can result.

Tornado Overall Vulnerability

Based on assessments of the severity of previous occurrences, the large area of potential occurrence and the probability of future occurrence, overall vulnerability to tornado impact are considered **High.** See also Section 3.3 Multi-Jurisdiction Risk Assessment. Further assessments of vulnerability per community are located in Sections 3.3.1 – 3.3.7.

3.4.3 Hurricane

Hazard Description

Hurricanes and tropical storms are types of cyclones. The basic difference between a hurricane and tropical storm is the intensity of the storm, measured by maximum sustained wind speed. A hurricane has surface winds in excess of 74 miles per hour (64 knots). The tropical storm has less intense winds than hurricanes, but greater than 39 miles per hour (34 knots). For locations in the Northern Hemisphere, hurricanes and tropical storms are accompanied by a counterclockwise wind circulation near the earth's surface.

A hurricane and tropical storm can be characterized by storm surges along a coast, high waves, severe winds, coastal erosion, extreme rainfall, thunderstorms, lightning, inland flooding, and the spawning of tornados and microbursts. Hurricanes and tropical storms typically lose strength over land; though extensive damage can occur several hundred miles inland.

Hurricanes are classified into five categories based on wind speed, central pressure, and damage potential. The classification system for hurricanes is referred to as the Saffir-Simpson Hurricane Scale shown in Table 3-31 below.

Table 3-31 Saffir-Simpson Hurricane Scale

Category	Wind Speed (mph)	Expected Damage
1	74-95	**Minimal:** Damage is primarily limited to shrubbery and trees, unanchored mobile homes and signs damaged, some signs, no real damage to structures.
2	96-110	**Moderate:** Some trees toppled, some roof coverings damaged, and major damage to mobile homes.
3	111-130	**Extensive:** Large trees toppled, some structural damage to roofs, mobile homes are destroyed, and structural damage is done to small homes and utility buildings.
4	131-155	**Extreme:** Extensive damage to roofs, windows, and doors; roof systems on small buildings completely fail; some curtain walls fail.
5	> 155	**Catastrophic:** Roof damage is considerable and widespread, window and door damage severe, extensive glass failures and entire buildings could fail.

Source: Understanding Your Risks: Identifying Hazards and Estimating Losses. FEMA. 2001.

The official season for hurricanes and tropical storms is from June 1 to November 30. Peak storm activity often occurs in September. Typical hurricanes are about 300 miles wide although they can vary considerably in size. The eye at a hurricane's center is a relatively calm, clear area approximately 20-40 miles across. The eyewall surrounding the eye is composed of dense clouds that contain the highest winds in the storm. The storm's outer rain-bands (often with hurricane or tropical storm-force winds) are made up of dense bands of thunderstorms ranging from a few miles to tens of miles wide and 50 to 300 miles long. Hurricane-force winds can extend outward to about 25 miles in a small hurricane and to more than 150 miles for a large one. Tropical storm-force winds can stretch out as far as 300 miles from the center of a large hurricane. A typical hurricane brings at least 6 to 12 inches of rainfall to the area it crosses.

The right side of a hurricane is the frequently, the most dangerous in terms of storm surge and winds. Hurricane forward speed averages 15-20 mph, but can also stall, causing devastating rainfall, or in rare cases accelerate to 60+ mph. Tropical storms display the same general characteristics of hurricanes but with lesser intensity.

Geographic Location

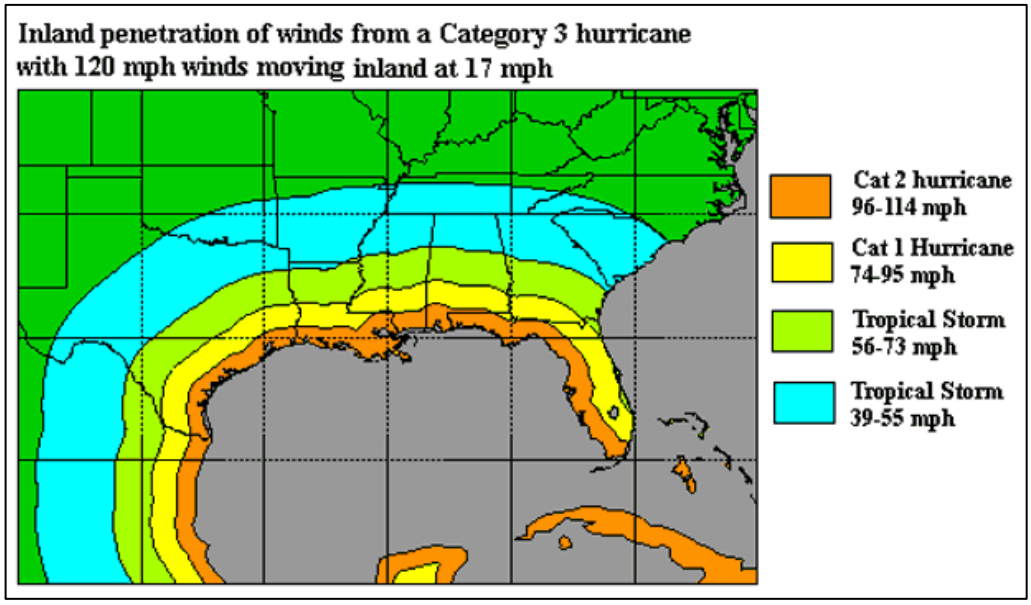
The entire planning area has the potential for hurricane impacts. The southern border of Angelina County is approximately 100 miles inland from the Gulf of Mexico, and numerous hurricanes and tropical storms have tracked across Angelina County in records dating back to 1851. Figure 3-12 shows the location of Angelina County in relation to all hurricanes in the Atlantic basin from 1851 to 2008, indicating the planning area is situated along the northern fringe of storm tracks moving northward from the Gulf. The yellow square depicts the approximate location of Angelina County.

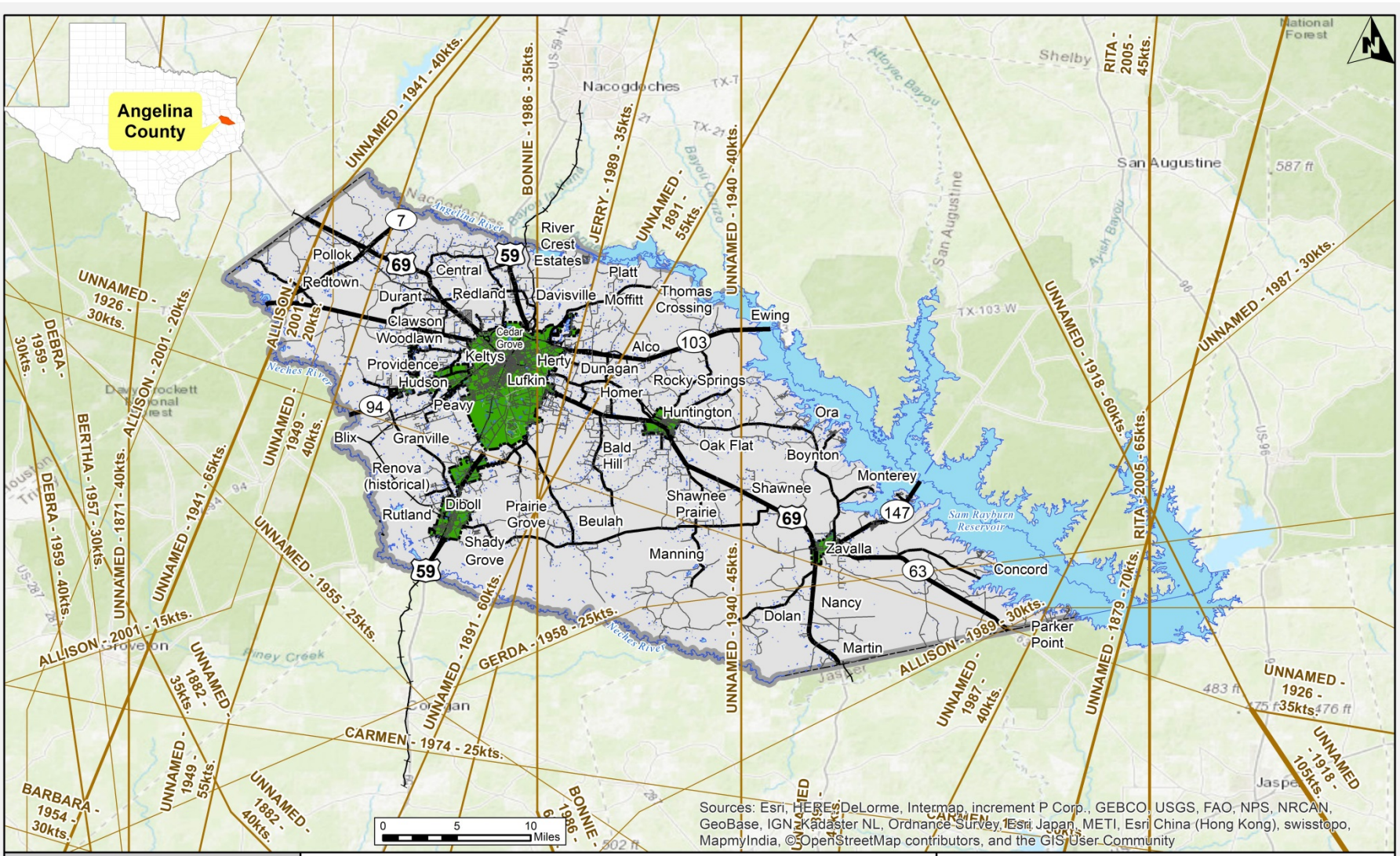
Figure 3-12 Atlantic Basin Hurricane Tracks 1851 – 2008

Source: NWS, National Hurricane Center

Based on more detailed data from the National Weather Service, the map on the following page shows hurricane and tropical storm tracks across Angelina County and in it nearby vicinity, for the period 1891-2008.

Also notable for inland counties is hurricane "wind decay" models. These wind forecasting tools model standard wind speeds for various categories of hurricanes ranging from Category 1 to 5. The following map produced by NOAA shows projected 'inland penetration of wind' from a hurricane making landfall as Category 3 with forward motion of 17 knots per hour. The result shows the Angelina County planning area is located in the band of yellow, indicating winds approximately 80 to 100 mph for this example hurricane event.





Angelina County Hurricane/Tropical Storm Events By Wind Speed

Angelina County Multi-Jurisdiction Hazard Mitigation Action Plan

Major Highway
Local Highway
Local Road
Rails
County Line
City Limits
Water Bodies

Wind Speed in Knots

< 34 (TD)
34 - 63 (TS)
64 - 82 (Cat. 1)
83 - 95 (Cat. 2)
96 - 112 (Cat. 3)
113 - 136 (Cat. 4)
> 136 (Cat. 5)

Map intended for planning purposes only. Information shown is subject to revision and/or update.

Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, NOAA National Hurricane Center

Previous Occurrences / Impact

According to the National Center for Environmental Information (NCEI), there have been three (3) hurricanes or tropical storms that have impacted Angelina County between 2005 and September 2017. Table 3-32 lists the hurricanes and tropical storms that have impacted the county.

Table 3-32 Hurricanes Impacting Angelina County, 2005 –2008

Storm Name	Date	Storm Type	Regional Property Damage
Harvey	8/30/2018	Hurricane	TBD
Ike	9/13/2008	Hurricane	$70,000,000
Rita	9/24/2005	Hurricane	$2,100,000,000

Source: NCEI

Note: Property damage may include totals across multi-county region.

HURRICANE HARVEY – 2017

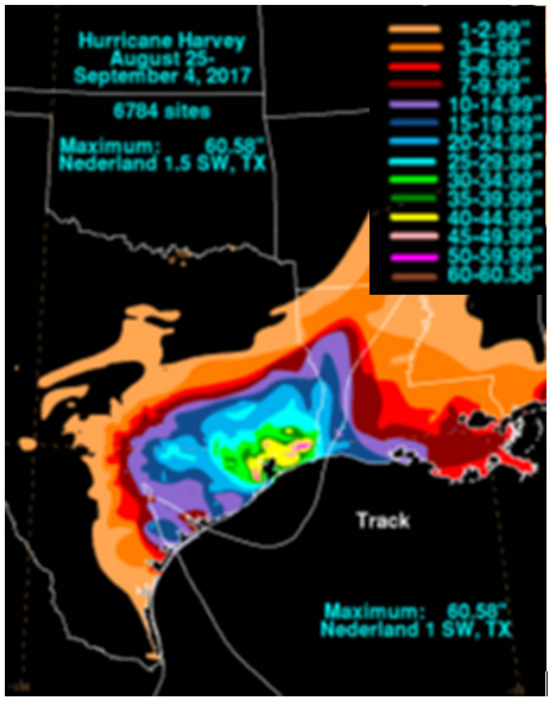
The definitive report published to date for Hurricane Harvey was released January 28, 2018 by the National Oceanic and Atmospheric Administration (NOAA), National Weather Service / National Hurricane Center. The report is titled TROPICAL CYCLONE REPORT, HURRICANE HARVEY (AL092017, Blake, Zelinsky).

According to this report Hurricane Harvey started as a weak August tropical storm that ultimately intensified into a Category 4 hurricane which made landfall along the middle Texas coast carrying 130 mph sustained winds. During the following 4-5 day period the storm dropped 50-60 inches of rain across a vast area of southeastern Texas (all-time record).

Catastrophic flooding resulted, making Harvey the 2nd most costly hurricane in U.S. history, behind only Katrina (2005). At least 68 people died from the direct effects of the storm in Texas, the largest number of fatalities from a tropical cyclone in Texas since 1919.

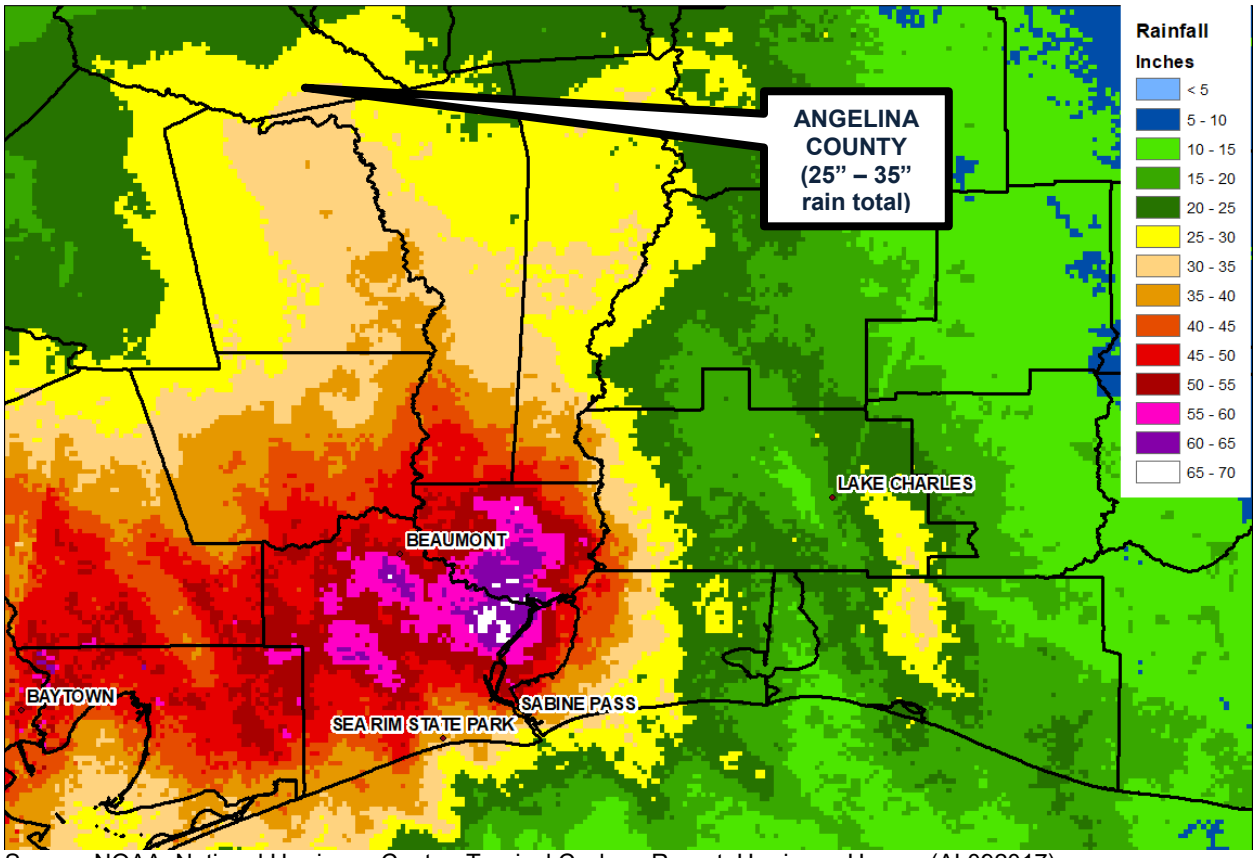
The latest NOAA damage estimate from Harvey is $125 billion, with the 90% confidence interval ranging from $90 to $160 billion. Over 300,000 structures and approximately 500,000 cars across the region were flooded. About 336,000 customers lost power during the hurricane. An estimated 40,000 people evacuated to shelters across Texas or Louisiana. FEMA reported that about 30,000 water rescues were conducted during Harvey.

Figure 3-13 Hurricane Harvey Path and Rain Totals



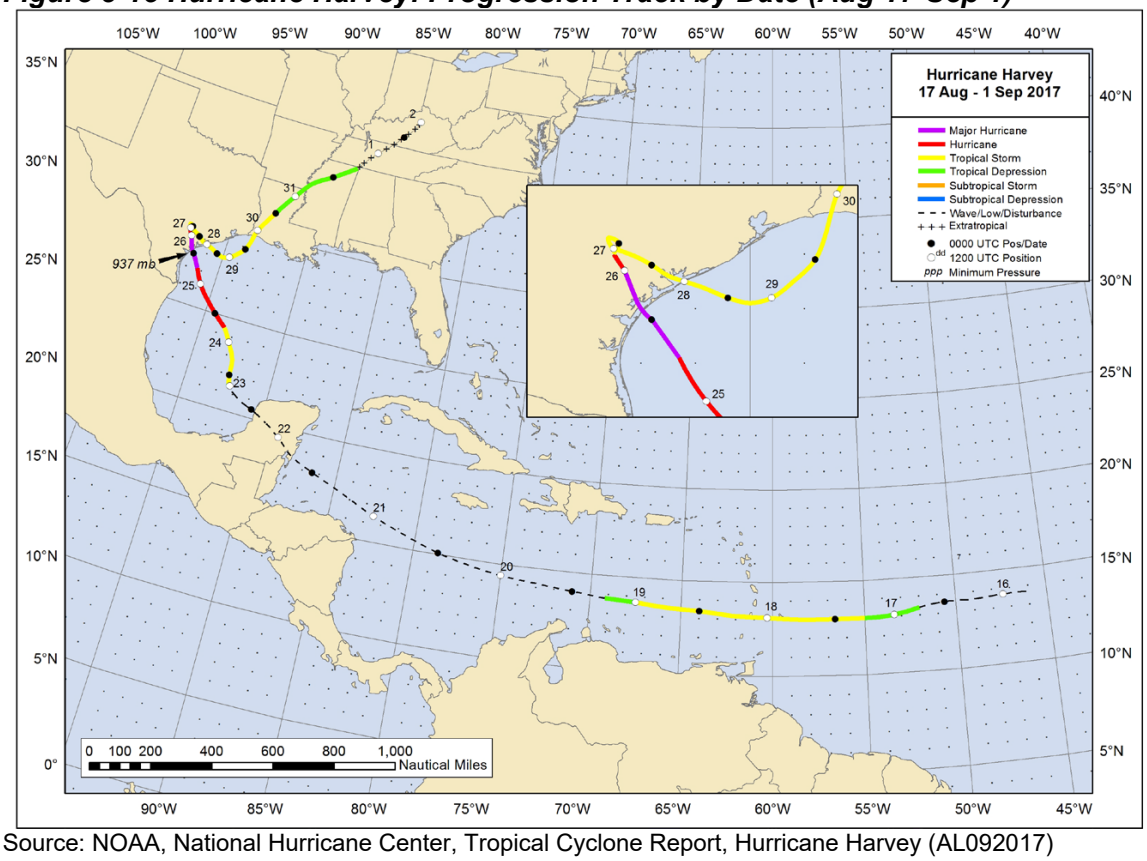
Source: NOAA, National Hurricane Center, Tropical Cyclone Report, Hurricane Harvey (AL092017)

Figure 3-14 Hurricane Harvey Rain Totals



Source: NOAA, National Hurricane Center, Tropical Cyclone Report, Hurricane Harvey (AL092017)

Figure 3-15 Hurricane Harvey: Progression Track by Date (Aug 17-Sep 1)



Source: NOAA, National Hurricane Center, Tropical Cyclone Report, Hurricane Harvey (AL092017)

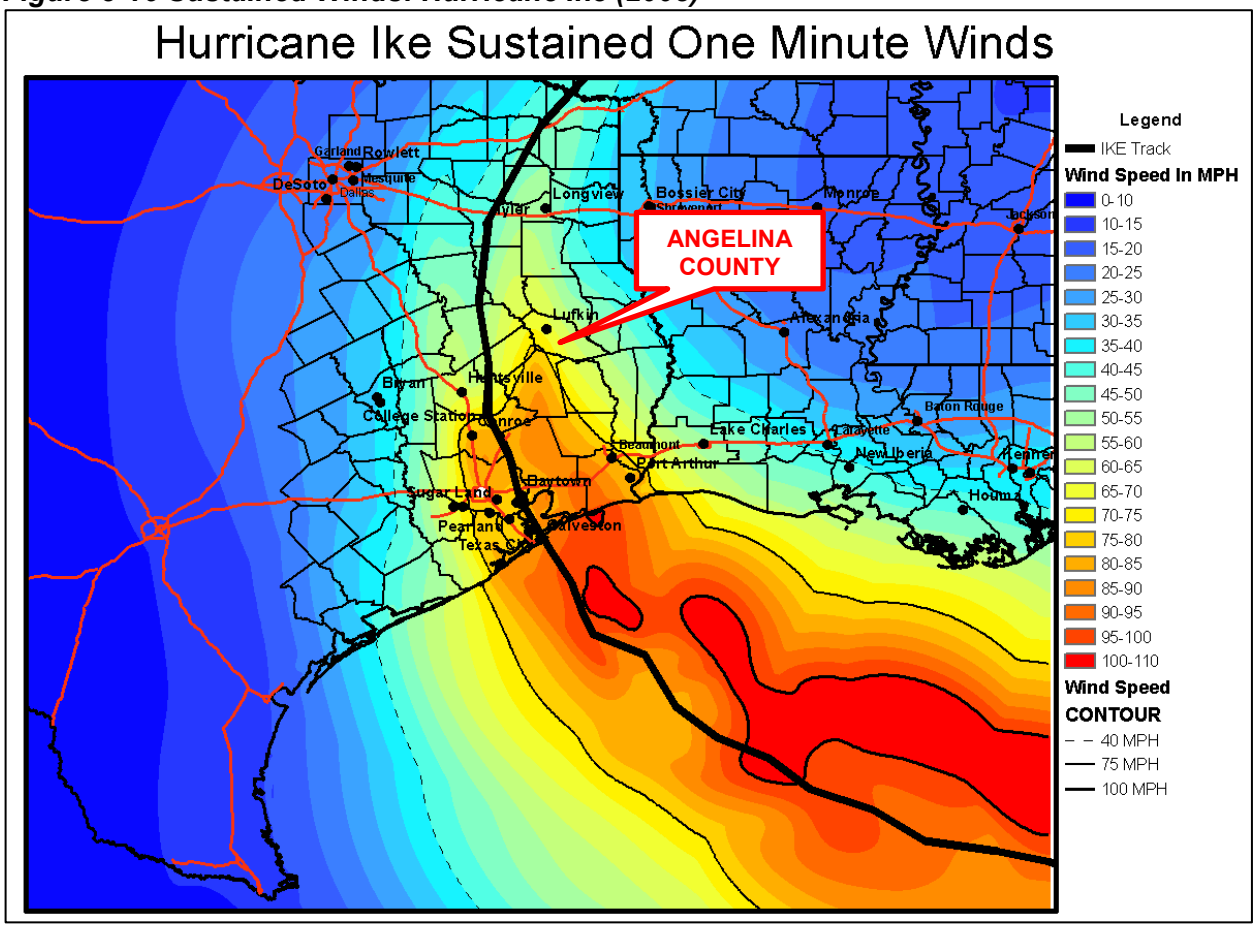
HURRICANE IKE – 2008

Pertaining to Hurricane Ike, the following excerpts (Figure 3-21) are taken from the Tropical Cyclone Report, Hurricane Ike 1-14 September 2008, updated May 2010, by the National Hurricane Center.

State-wide property damage from Hurricane Ike totaled $12.3 billion. The State of Texas Hazard Mitigation Plan (2010) notes somewhat higher damage totals and impacts, with 135 fatalities attributed to Hurricane Ike and over $29 billion in losses. Information source for Hurricane Ike profile is the websites of the National Weather Service and National Hurricane Center.

The map below shows sustained winds from Hurricane Ike exceeded 80 mph +/- in the southwestern portion of Angelina County, and exceeded 70 mph across the rest of the county. Maximum gusts were estimated at least 110 percent of sustained 1 minute winds, or approximately 88 mph.

Figure 3-16 Sustained Winds: Hurricane Ike (2008)



Source: National Weather Service

Figure 3-17 Hurricane Ike Event Details, Texas

Hurricane Ike (2008)
A wind gust of 69 mph was measured at the Lufkin ASOS before the sensor went out due to a power failure. Stronger winds sustained near 74 mph with higher gusts likely effected portions of Angelina County however the wind equipment at the Lufkin airport was inoperable at the time. EPISODE NARRATIVE: Hurricane Ike came onshore across extreme southeast Texas during the late night hours of September 12th and the pre-dawn hours of September 13th. The storm made good progress northward during the day of September 13th and brought Tropical Storm force winds to much of northeast Texas and northwest Louisiana and extreme southwest Arkansas. The storm produced widespread downed trees and power lines along with structural damage either from the winds or from downed trees which fell on top of structures. Power outages were widespread across a three state area of northeast Texas, northwest Louisiana and southwest Arkansas. Southwest Electric Power Company (SWEPCO) which provides electricity to a good portion of northeast Texas, northwest Louisiana and southwest Arkansas said that the number of outages peaked at 187,000 customers. Additional power companies were called in from far away as Indiana and Michigan to deal with the numerous power outages. This was the second most number of outages at one time reported in SWEPCO's 96 year history. The most number of outages was 234,000 during the ice storm of December 13th, 2000. The number of power outages in association with Hurricane Ike topped the September 2005 recovery from Hurricane Rita by nearly 1000 customers. The storm also produced tornadoes across portions of north central Louisiana as well as south central Arkansas and east central Texas.
Landfall Location

The center of the hurricane made landfall along the north end of Galveston Island, Texas. The hurricane's center continued up through Galveston Bay, just east of Houston, the northward across east Texas.

Wind Speeds Measured
The estimated Texas intensity of 95 knots (109 mph) is based on flight level winds of 105 knots (120 mph), Stepped Frequency Microwave Radiometer (SFMR) winds up to 90 knots (103 mph) and Doppler radar velocities from the Houston radar, which showed 114 knots (131 mph) at 6500 feet. The highest 1-minute sustained wind recorded by surface instruments was 83 knots (95 mph) from a WeatherFlow anemometer located at Crab Lake on the Bolivar Peninsula. A 1-minute sustained wind of 34 knots (39 mph) was recorded in Lufkin. A gust of 60 knots (69 mph) was also recorded in Lufkin.

Rain Events Measured
Ike produced a large amount of rainfall 3 inches or greater over much of southern Texas and extreme southwestern Louisiana. Measured rainfall in Angelina County included 2.59 inches in Lufkin.

Initial Damage Estimates
The Property Claims Services of the Insurance Services Office estimates that the insured damage (not including inland flooding or storm surge) from Ike in Texas, Louisiana and Arkansas is about $10 billion. The National Flood Insurance Program estimates that insured losses from inland flooding and storm surge is approximately $2.5 billion in the same three states. Because there is a $250,000 cap on each claim for inland flooding and storm surge, the actual dollar number is considerably higher. Total damage is estimated at about $24.9 billion.

Source: Tropical Cyclone Report Hurricane Ike 1-14 September 2008 National Hurricane Center (1/23/2009,), updated 2/4/2009, 3/18/2009 and 5/3/2010.

HURRICANE RITA – 2005

According to the Insurance Council of Texas in 2010 dollars, state-wide property damage sustained from Hurricane Rita totaled $3.19 billion. The following excerpt (Figure 3-20a) are taken from the Hurricane Rita Rapid Response, Coastal and Riverine High Water Mark Collection Final Report to FEMA (2006), National Climatic Data Center, and FEMA Disaster Summaries.

Figure 3-18 Hurricane Profile for Hurricane Rita , Angelina County

Hurricane Rita (2005)
Hurricane Rita moved onshore the Southeast Texas/Southwest Louisiana coast during early morning hours of September 24, 2005 and moved northward into portions of East Central Texas during predawn hours. The hurricane remained a Category 2 as it moved northward into extreme eastern Angelina County. A NWS Storm Survey was conducted of the hardest hit areas of East Central Texas and this region experienced widespread damage consistent of winds with a Category 2 hurricane. A few hundred homes experienced damage that varied from shingles off roofs to collapsed carports or awnings to damage caused by downed trees on top of homes, businesses and automobiles. Particularly hard hit areas were those surveyed near and east of the Sam Rayburn Reservoir of East Central Texas. This region experienced winds adjacent to the northern and eastern eyewall of Hurricane Rita and extensive damage was observed to many rural homes and communities along the storm path. Much of this region was without power during the height of the storm and for weeks afterward. There was one direct fatality resulting from the storm when a downed tree fell across a man outside his residence. There was one indirect fatality from the storm when a young woman touched a downed powerline.

Wind Speeds Measured
The strongest sustained wind reported from an official surface observing site was 71 knots (81 mph) as Sabine River, Texas near the Louisiana border. Sustained hurricane-force winds were also reported at the Southeast Texas Regional Airport in Beaumont, Texas at 70 knots (80 mph). A variety of temporary instrumental towers in extreme southeastern Texas also measured sustained hurricane-force winds, as strong as 82 knots (94 mph) with peak 3-second gusts up to 100 knots (115 mph). The maximum 2-minute sustained wind in Lufkin was 33 mph with a peak gust of 50 mph before equipment failure.

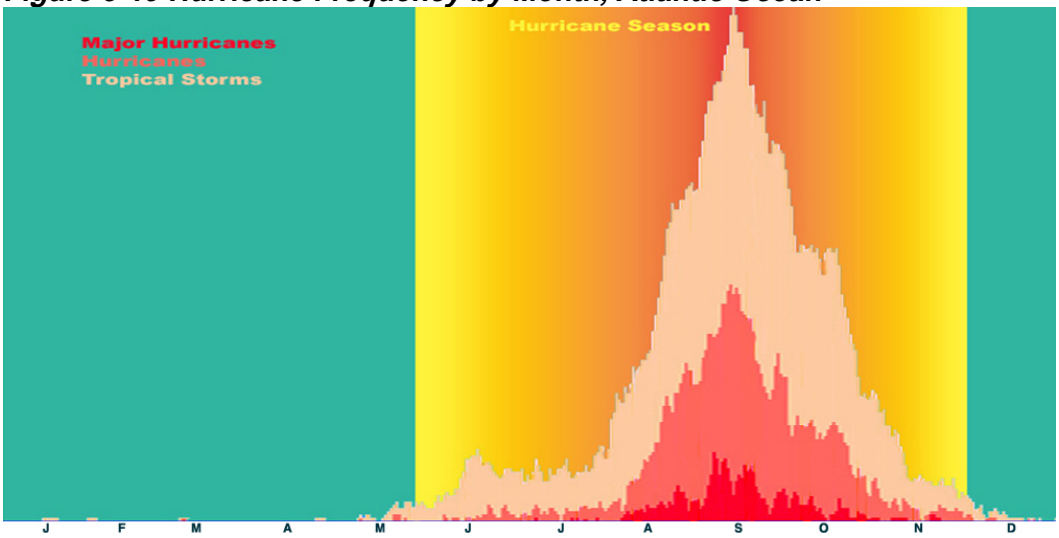
Rain Events Measured
Estimates between 5-6 inches fell in Lufkin, with three day estimates between 7-11 inches.

Initial Damage Estimates
Single family dwellings destroyed 35. Single family dwellings with major damage 330. Single family dwellings with minor damage 585. Mobile homes destroyed 35. Mobile homes with major damage 403. Mobile homes with minor damage 512. Apartments with major damage 25, minor damage 73.

Sources: Hurricane Rita Rapid Response Texas Coastal and Riverine High Water Mark Collection; Tropical Cyclone Report Hurricane Rita 18-26 September 2005 National Hurricane Center (3/17/2006), updated 8/14/2006; NWS Lake Charles, LA. National Climate Data Center and FEMA Disaster Summaries

Probability of Future Occurrence
Based on National Climatic Data Center records for the period 2005 to 2017, there were three hurricane events that impacted Angelina County. This frequency equates to 4-year return interval for that specific period, resulting in a **High** probability of future occurrence according to the definitions set forth in Section 3.1.1. Considering probability based on time of year, patterns of previous occurrences show probability of hurricane occurrence is highest in the month of September, as indicated by Figure 3-19.

Figure 3-19 Hurricane Frequency by Month, Atlantic Ocean



Source: Atlantic Oceanographic and Meteorological Laboratory (AOML)

Magnitude/Severity/Extent
The HMT assumes a worst case scenario hurricane to impact Angelina County would be a Category 3 hurricane due to quickly decaying winds as a more powerful hurricane moves inland. While hurricane winds decay as storms move inland, expected wind speeds are still likely to exceed 80 miles per hour for a Category 3.

According to definitions established in Section 3.1.1, the magnitude and severity of hurricanes/tropical storms across the planning area are considered **Level 4- Catastrophic**, particularly especially in the southern reaches of the county. This assessment is predicated on structural damage on a regional scale; loss of service for critical facilities, infrastructure and utilities for multiple weeks; and the potential for multiple injuries and fatalities. Two hurricanes with this degree of impact occurred during the previous 5-year planning cycle.

Hurricane Overall Vulnerability
Based on the probability and potential intensity of a strong hurricane impacting Angelina County, the overall vulnerability is considered **High Vulnerability**, according to subjective assessments and the classifications defined in Section 3.1.1.. In general, neighborhoods in southern portions of the planning area have the highest vulnerability to hurricanes and tropical storms. Winds can exceed 80 mph, enough to seriously damage non-hardened structures, knock down powerlines and disrupt service for days. Further assessments of vulnerability per community are located in Sections 3.3.1 – 3.3.7.

3.4.4 Wildfire

Hazard Description

A wildfire is an uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures. Wildfires often begin unnoticed, spread quickly, and are usually signaled by dense smoke that fills the area for miles around. Wildfires are caused through human acts such as arson or careless accidents, or through natural occurrences such as lightning. Wildfire danger is exacerbated by dry weather conditions and excessive heat. The majority of forest fires in Texas are caused by arson and other careless acts by people.

The urban-wildland interface is an area in which development meets wildland vegetation. Both vegetation and the built environment provide fuel for fires. Table 3-33 below lists fire danger rating classifications as defined by the U.S. Forest Service.

Table 3-33 U.S. Forest Service, Fire Danger Adjective Class Rating

Danger Rating	Basic Description	Detailed Description
Low	fires not easily started	Fuels do not ignite readily from small firebrands. Fires in open grassland may burn freely a few hours after rain, but wood fires spread slowly by smoldering and burn in irregular fingers. Low danger of spotting.
Moderate	fires start easily and spread at a moderate rate	Fires can start from most accidental causes. Fires in open cured grassland will burn briskly and spread rapidly on windy days. Forest fires will spread at slow to moderate speed. The average fire is of moderate intensity, although heavy concentrations of fuel may burn hot. Short-distance spotting may occur. Fires are not likely to become serious and control is relatively easy.
High	fires start easily and spread at a rapid rate	All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly and short-distance spotting is common. High intensity burning may develop on slopes or in concentrations of fuel. Fires may become serious and their control difficult, unless they are hit hard and fast while small.
Very High	fires start very easily and spread at a very fast rate	Fires start easily from all causes and immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high-intensity characteristics - such as long-distance spotting - and fire whirlwinds, when they burn into heavier fuels. Direct attack at the head of such fires is rarely possible after they have been burning more than a few minutes.
Extreme	fire situation is explosive and can result in extensive property damage	Fires start quickly, spread furiously and burn intensely. All fires are potentially serious. Development into high-intensity burning will usually be faster and occur from smaller fires than in the Very High Danger class (4). Direct attack is rarely possible and may be dangerous, except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions, the only effective and safe control action is on the flanks, until the weather changes or the fuel supply lessens.

Source: U.S. Forest Service, Wildland Fire Assessment System

Geographic Location

The risk of wildfire is not confined to a particular geographic region of the county, though, the risk of wildfire and damage from wildfire is highest in the urban-wildland interface. The urban-wildland interface is generally described as an area where development meets dense forest. Fires burning in this fuel type under drought conditions are extremely hard to contain, require concentrated fire fighting resources, and threaten all homes and facilities in its vicinity.

According to the Texas Forest Service Wildfire Risk Assessment for Angelina County, it is estimated that 67,067 people or 80 percent of the total planning area population (83,674) live within the wildland-urban interface (WUI).

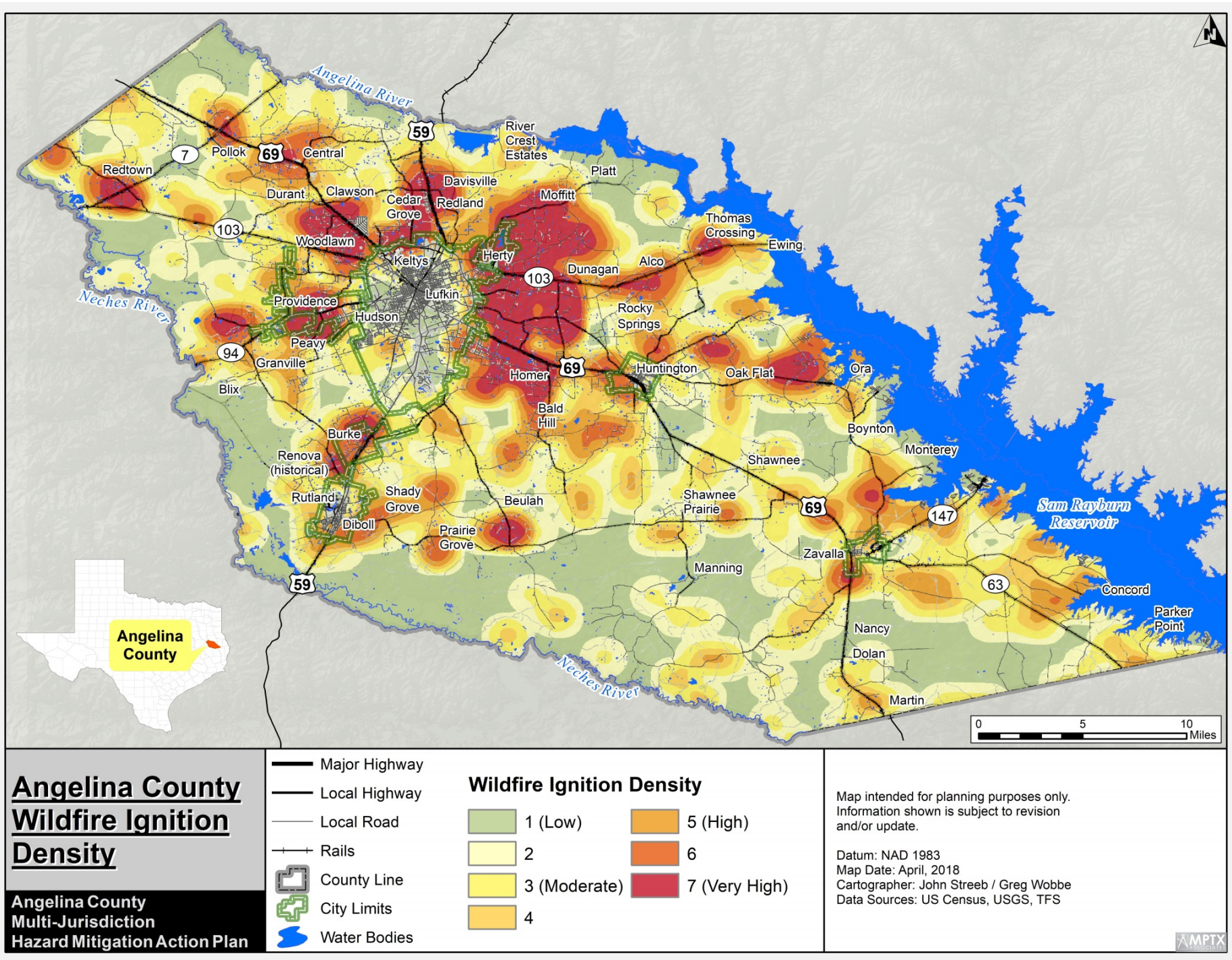
According to the Texas Forest Service's *2007 Economic Impact of the Texas Forest Sector*, Texas has more than 60 million acres of forestland of which 12.1 million acres in East Texas alone. Of the 60 million acres, timberland accounts for 24.3 percent, or about 14.6 million acres, and the majority –

around 82-percent – is located in East Texas. The economic influence of the forest sector is relevant in East Texas. About 37.8 percent of direction industrial output ($7.3 billion) and employed 33.8 percent of total workers (26,431) in the sector, mainly from the primary solid wood products manufacturing firms and logging industries in the region. Over two-thirds of all forestry and logging industries and the great majority of primary forest product manufacturing industries are in East Texas. The forest sector of East Texas had a total economic impact of $12.7 billion in total industry output, $6.1 billion in value-added and 56,031 jobs to the state economy.

Specific to Angelina County, models for wildfire potential have been developed by the Southern Group of State Foresters/Texas Forest Service and the Southern Wildfire Risk Assessment (SWRA) projects. The mapping projects simulate fire dynamics as a function of vegetation, topography, wild direction, speed, and frequency of dry years in relation to areas of development. The data can be used as a predictor of where there would be severe fires that could cause 75% or more replacement of the dominant over story above-ground biomass, through a Level of Concern (LOC) value.

The following maps (Figures 3-31 and 3-32) illustrate the results of these independent analyses, based on the variables listed above.

Further, Figure 3-33 illustrates the Mean Fire Return Interval (MFRI) with quantifies the average period between fires under the presumed historical fire regime. As illustrated, the majority of Angelina County can expect a fire return rate between 1 and 5 years. Areas with longer return intervals are near watercourses with a typically higher moisture content. Note: mean fire return interval within city limits will not mimic historic fire regimes due to development and forest clearing in these areas.


Angelina River
Neches River
Neches River
Sam Rayburn Reservoir
River Crest Estates
Platt
Davisville
Moffitt
Redland
Cedar Grove
Clawson
Durant
Redtown
Pollok
Central
Woodlawn
Keltys
Herty
Dunagan
Alco
Thomas Crossing
Ewing
Lufkin
Providence
Hudson
Rocky Springs
Peavy
Granville
Blix
Homer
Huntington
Oak Flat
Ora
Bald Hill
Boynton
Monterey
Burke
Renova (historical)
Shawnee
Rutland
Shady Grove
Beulah
Shawnee Prairie
Diboll
Prairie Grove
Zavalla
Manning
Concord
Parker Point
Nancy
Dolan
Martin
7
69
59
103
94
147
63
Angelina County
0
5
10
Miles
Angelina County Wildfire Ignition Density
Angelina County Multi-Jurisdiction Hazard Mitigation Action Plan
Major Highway
Local Highway
Local Road
Rails
County Line
City Limits
Water Bodies
Wildfire Ignition Density
1 (Low)
2
3 (Moderate)
4
5 (High)
6
7 (Very High)
Map intended for planning purposes only.
Information shown is subject to revision and/or update.
Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, TFS
AMPTX

Previous Occurrences / Impact

A dataset for wildfire activity at the statewide level is maintained by the National Interagency Fire Center (NFIC). Eight different organizations comprise the NFIC including; Bureau of Land Management, U.S. Fish and Wildlife Service, Department of Interior Bureau of Indian Affairs, National Parks Service, U.S. Forest Service, NOAA, National Business Center Aviation Management, U.S. Fire Administration and the National Association of State Foresters.

The following table lists the number of wildfires reported and acres burned. In addition, proactive, prescribed burns are also recorded including total acres.

Table 3-34 Texas Statewide Wildfire Reporting to the NFIC, State of Texas 2002-2010

Year	Number of Wildfires	Acres Burned	Number of Prescribed Burns	Acres Burned
2010*	6,691	203,891	125	159,947
2009	16,614	753,261	151	172,826
2008	16,713	1,570,586	35	15,315
2007	699	36,299	193	230,798
2006	3,062	1,564,170	159	138,167
2005	2,301	158,520	147	142,574
2004	609	24,328	102	119,873
2003	982	46,827	86	61,676
2002	1,183	35,044	114	86,412
TOTAL	**47,671**	**4,357,882**	**998**	**1,041,776**
Annual Average*	**5,959**	**544,735**	**125**	**130,147**

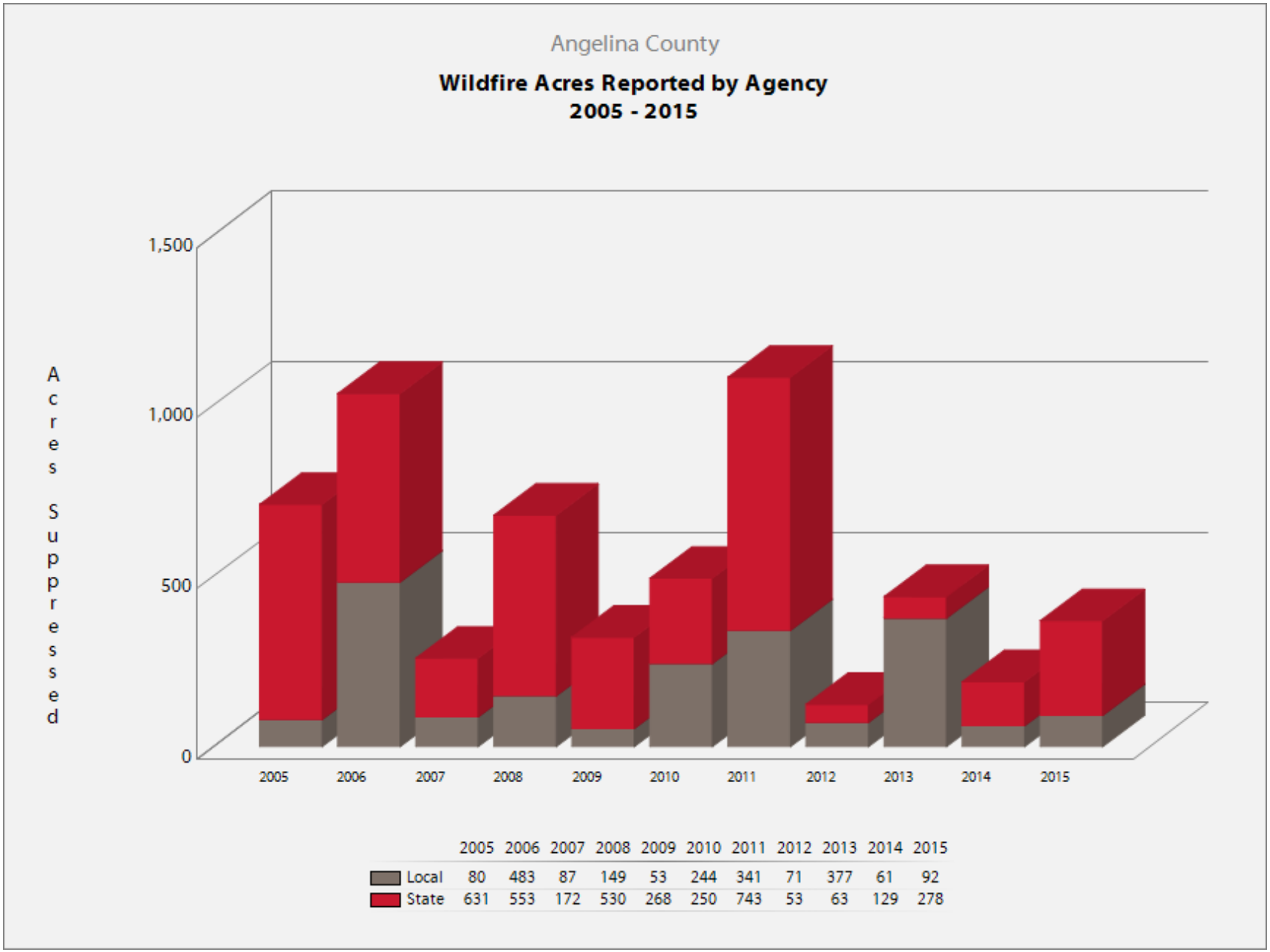
Source: National Interagency Fire Center. http://www.nifc/gov
*Reporting through November 4, 2010.

The State Fire Marshal's Office through its Fire Incident Reporting System prepares an Annual Fire Statistics publication. The 2009 annual report was released in early 2011. The report shows that for the three Angelina fire departments that reported, there were 140 "other" fires in Angelina County. "Other" fires are defined as including "rubbish, trees, brush and grass fires".

County data through the State Fire Marshal's Office was not available yet for 2010. However, according to the National Fire Incident Reporting System, part of the U.S Fire Administration, for the period January 1, 2010 to December 31, 2010, there were 144 outside fires reported by all reporting fire departments in Angelina County.

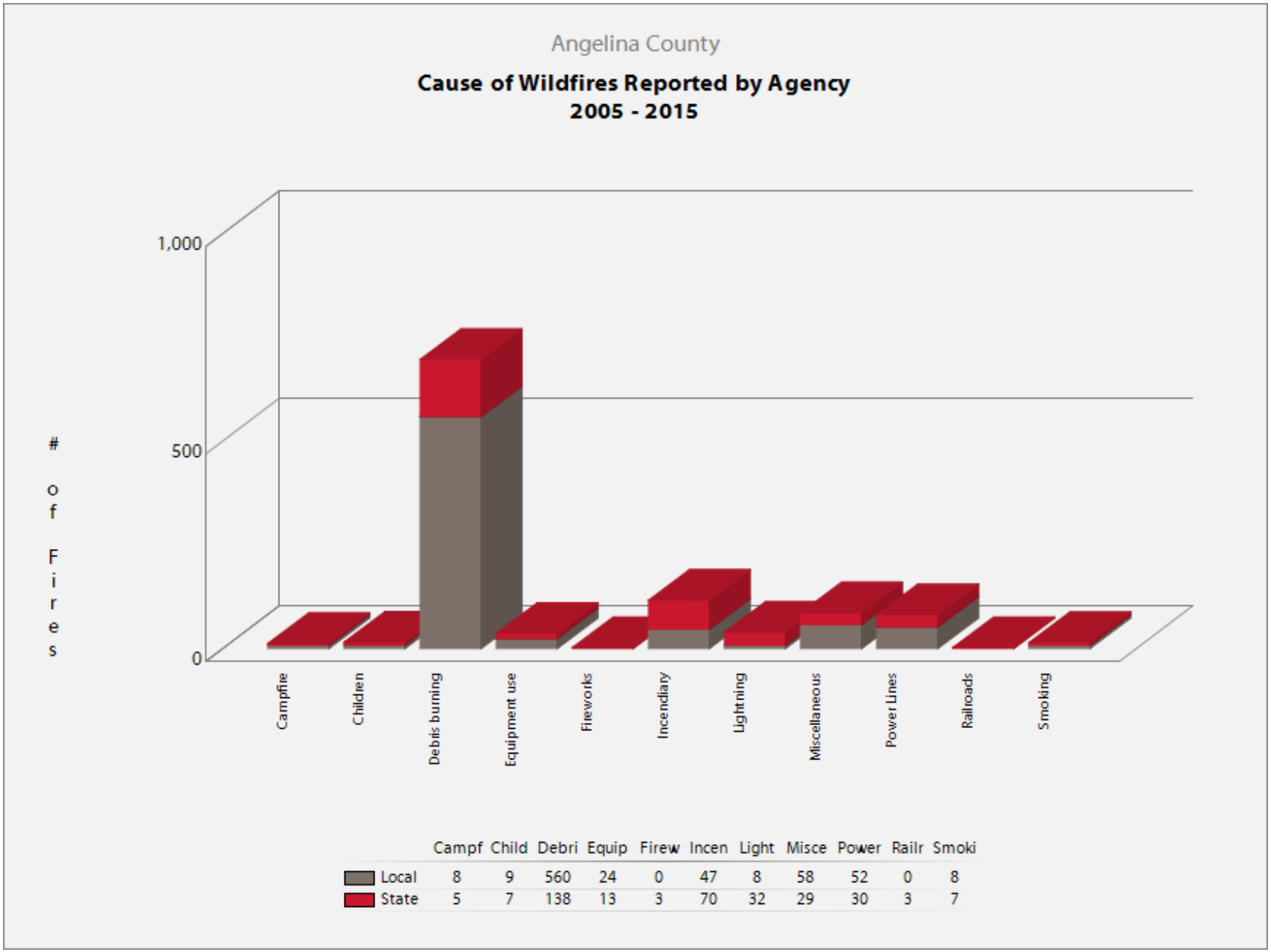
Charts on the following pages provided by the Texas Forest Service Wildfire Risk Assessment for Angelina County show acres burned per year from 2005 – 2015 as reported by state or local agencies, followed by a graph showing proportional cause of wildfires.

Chart below shows number of acres burned by wildfires per year from 2005-2015.



Source: Texas A&M Forest Service Wildfire Risk Assessment for Angelina County

Chart below shows number of wildfires per 'cause category' from 2005-2015. Debris burning was by far the most frequent cause of wildfires.



Source: Texas A&M Forest Service Wildfire Risk Assessment for Angelina County

The following maps illustrate wildfire location, acreage burned, value lost and cause in Angelina County from 2005 and 2006, and average (mean) fire return interval per area, respectively.

Figure 3-20 Angelina County Wildfires, Acreage, Value Lost and Cause

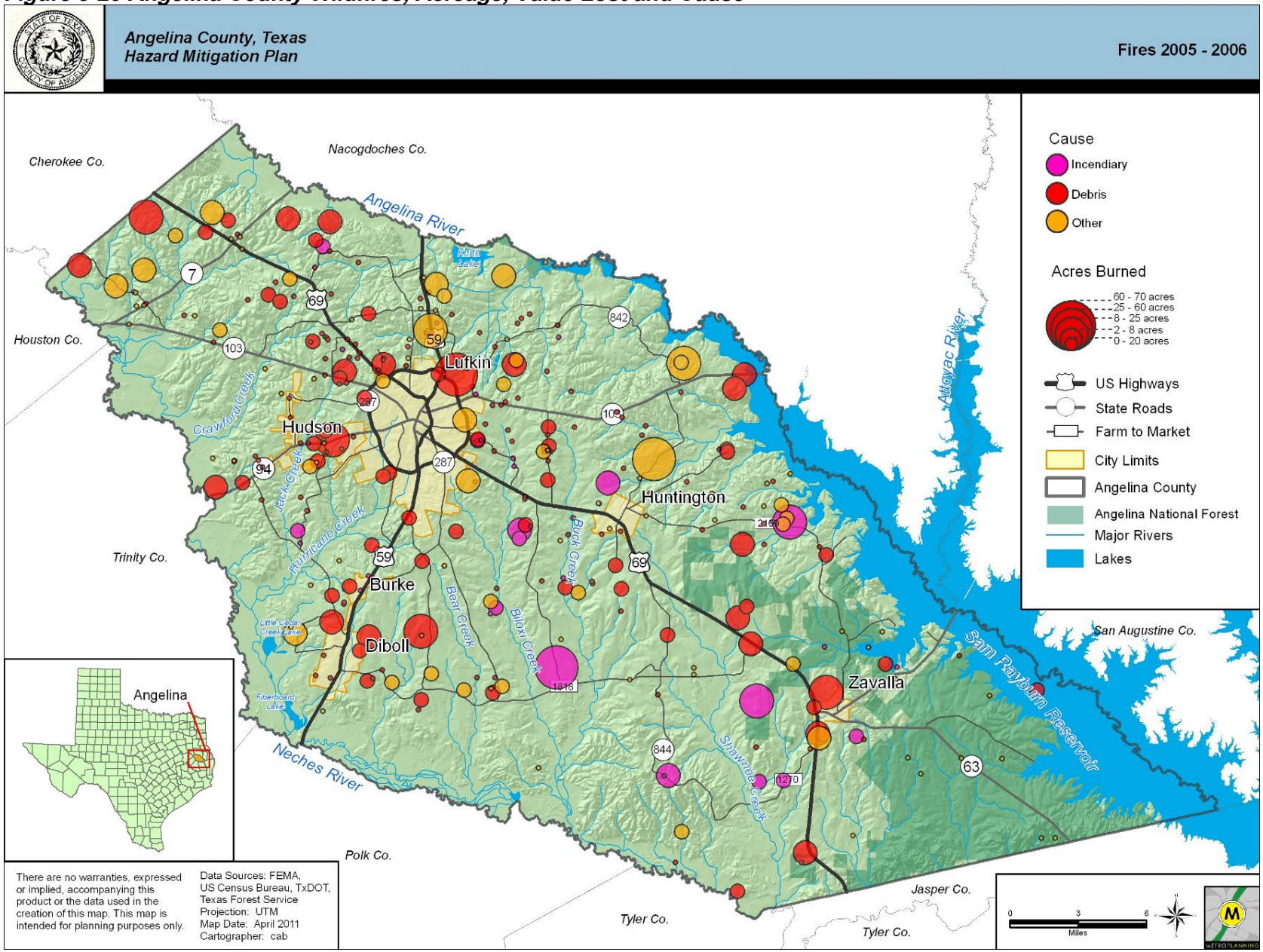
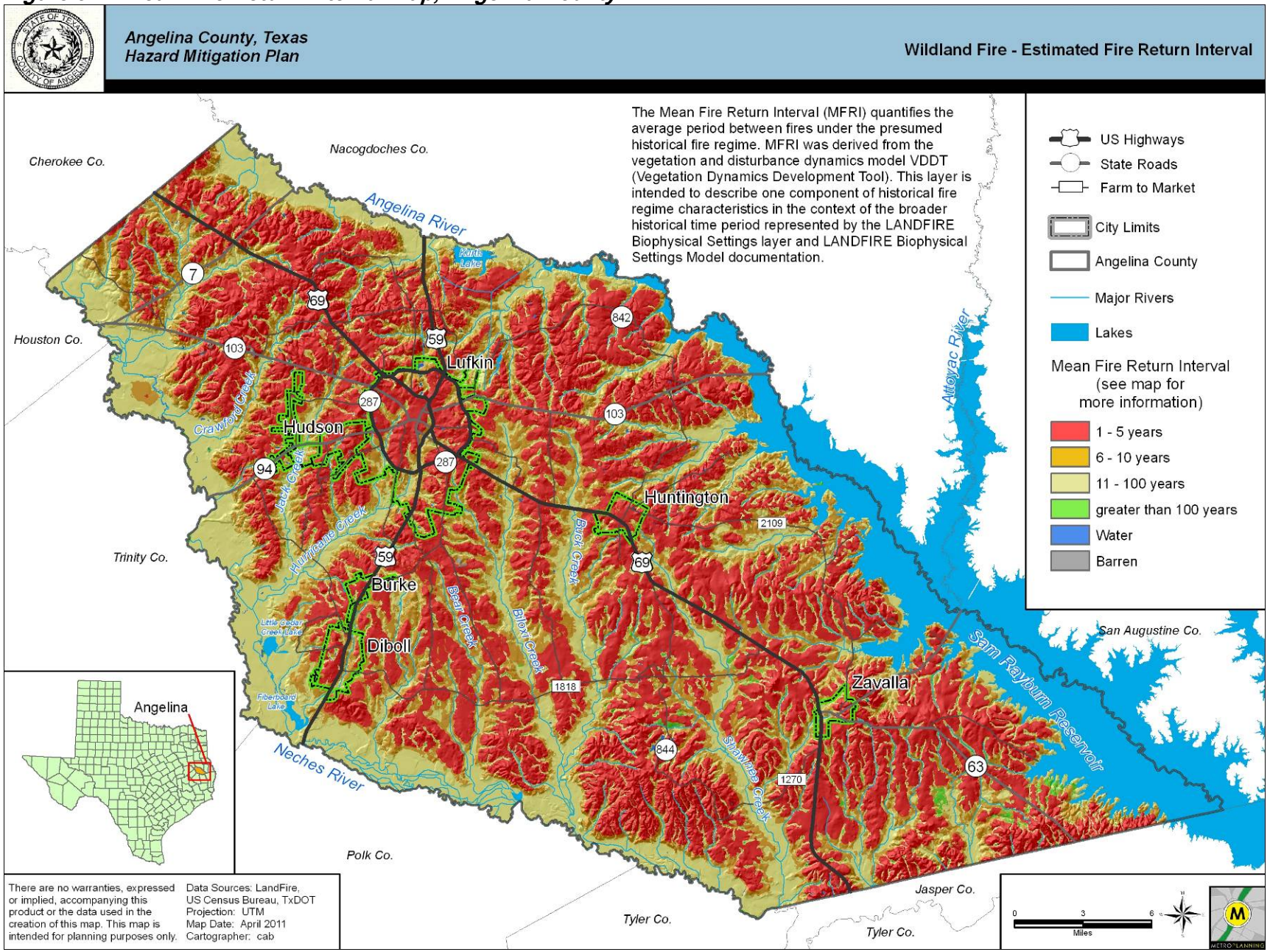


Figure 3-21 Mean Fire Return Interval Map, Angelina County



Probability of Future Occurrence
Wildfire danger can vary greatly season to season and is exacerbated by dry weather conditions. Based on patterns of previous occurrences, with many fires occurring in a typical year, probability of future occurrence is **High**.

A common method for rating wildfire probability over short timeframes is the Keetch-Byram Drought Index (KBDI). This index predicts the likelihood of wildfire based on soil moisture and other conditions related to drought. KBDI classes range from 0 (no drought) to 800 (extreme drought) and is based on the soil capacity in 8 inches (200 mm) of water. The depth of soil required to hold 8 inches of moisture varies. A prolonged drought (high KBDI) influences fire intensity largely because fuels have lower moisture content. Table 3-20 describes conditions

Magnitude/Severity/Extent
The extent of wildfire impacts in Angelina County is considered **Level 3- Critical** by the HMT. Most fires are extinguished with no structural damage occurring, and there is no record of injuries or fatalities. Temporary shutdown of facilities could potentially occur. Economic and environmental losses are the most common impacts.

According to Texas Forest Service wildfire extent reporting, a total of 2.8 percent of total land area of the county is subject to Class -6 or higher wildfire magnitude. Flame lengths in these areas can reach 180 feet or higher and structures may ignite and burn before response arrives.

Class (Extent)	Acres	Percent
-9 (Most Negative Impact)	0	0.0%
-8	588	0.2%
-7	1,917	0.7%
-6	4,911	1.9%
-5	9,601	3.7%
-4	50,809	19.4%
-3	37,757	14.4%
-2	50,876	19.5%
-1	100,626	38.5%
1 (Most Positive Impact)	4,372	1.7%
Total	**261,459**	**100.0%**

Source: TFS Texas Wildfire Risk Assessment for Angelina County and jurisdictions.

Wildfire Overall Vulnerability
Overall vulnerability to wildfire is considered **High Vulnerability**, based on subjective assessments and classifications defined in Section 3.1.1. This is due in part to relatively high fuel loads, extreme drought conditions, and existing wildfires throughout the region. Further assessments of vulnerability per community are located in Sections 3.3.1 – 3.3.7.

3.4.5 Lightning

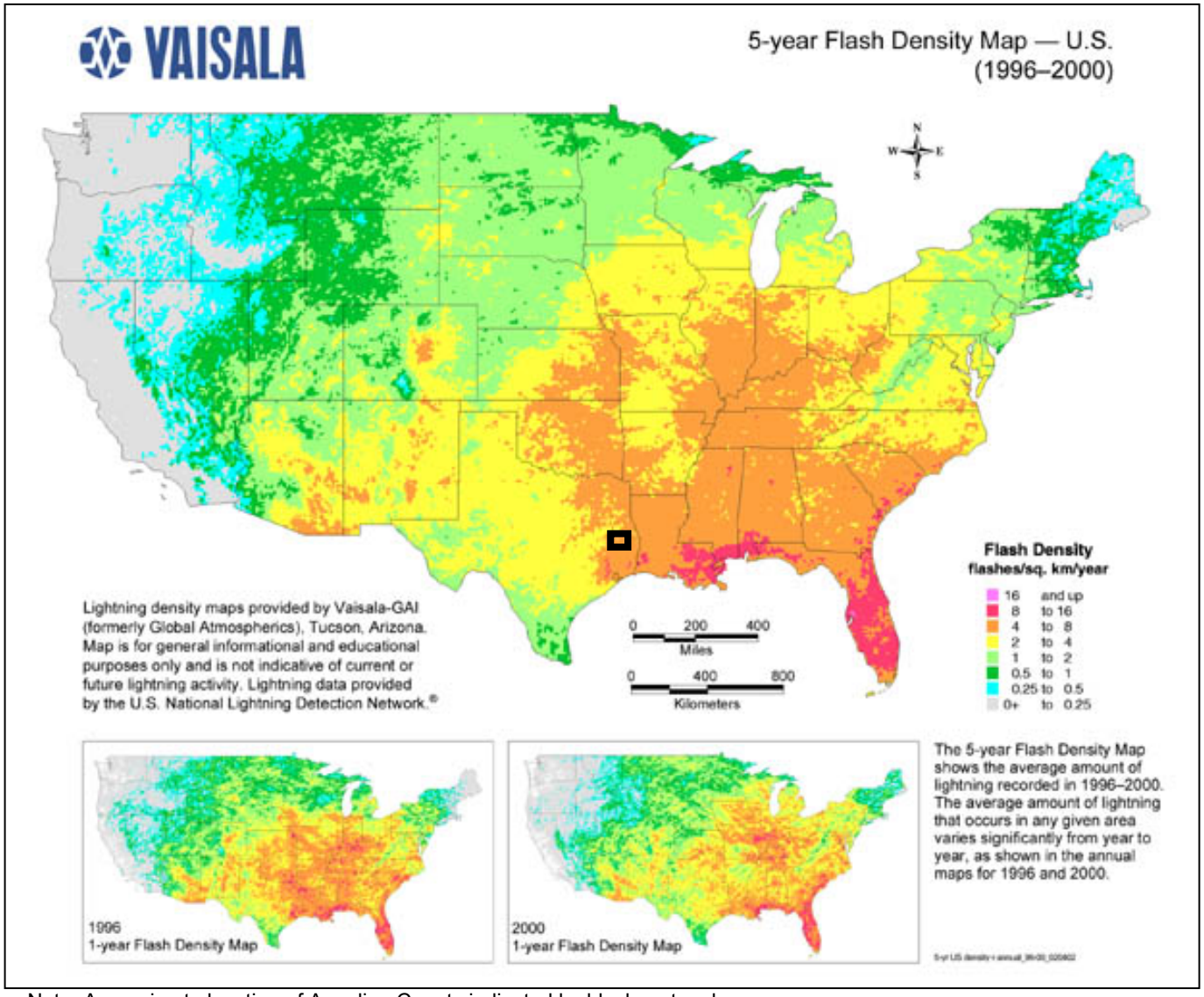
HAZARD DESCRIPTION

Lightning typically occurs as a by-product of a thunderstorm. The action of rising and descending air in the thunderstorm separates positive and negative charges. Lightning is the result of the buildup and discharge of energy between positive and negative charge areas. The hazard posed by lightning is underrated. According to NOAA, an average of 20 million cloud-to-ground lighting flashes is detected every year in the continental United States. About half of all flashes have more than one ground strike point, so at least 30 million points on the ground area are struck in an average year. Lightning is the most dangerous and frequently encountered weather hazard that most people in the United States experience annually. Lightning is the second most frequent killer in the U.S., behind floods and flash flood events, causing approximately 100 deaths and 500 injuries annually.

GEOGRAPHIC LOCATION

Lightning is known to impact all regions of the planning area. The map below shows eastern Texas has a relatively high frequency of lightning occurrence averaging 4 to 8 flash occurrences per square kilometer per year. With this is mind, it is safe to assume that every jurisdiction has had lightning impact within jurisdictional boundaries.

Figure 3-22 Lightning Flash Density per Square Kilometer per Year; Continental U.S.



Note: Approximate location of Angelina County indicated by black rectangle

IMPACT / PREVIOUS OCCURRENCES

According to reports by the NCEI, one lightning fatality occurred during the period of 2010 to 2017. On May 21, 2013 a victim was struck by lightning and killed outside an eating establishment during the nighttime hours of May 21st. According to a Lufkin Police spokesman, a chunk of concrete was blown out of the parking space near where the victim was hit.

Additionally, on a separate occasion several people were struck on the high school campus as they walked from a parking lot toward the buildings. They were treated and released from local hospital.

Electrical switch gear at the water treatment plant was hit destroying the entire electrical system of the plant. Replacement cost was around $15,000.

Electronic control panels were twice destroyed at the race track when lightning struck the building. Replacement cost was approximately $4,000 each time.

PROBABILITY OF FUTURE OCCURRENCE

Lightning is the most frequently encountered weather hazard that most people in the United States witness annually. According to patterns of lightning occurrence across the planning area, future probability is considered **HIGH**, according to the definitions set forth in Section 3.1.1.

MAGNITUDE/SEVERITY/EXTENT

The magnitude and severity of lightning impact broad geographical areas. The duration of lightning events typically is one or two hours. Based on the public safety risk and the scale of potential damage to infrastructure and economic loss, this hazard merits a severity rating of **Level 3- Critical.** Based on the chart below for lightning magnitude, maximum lightning CAPE index levels for the planning area are estimated at 2000-3500.

Lightning magnitude and probability can be indicated using “convective available potential energy” measurements (CAPE index), as shown in the following table:

Table 3-35 Lightning Risk / Magnitude Scale

CAPE Index	Lightning Risk
< 1000	Slight
1000 – 2500	Moderate
2500-3500	Very
> 3500	Extremely

Source: The Weather Window; http://weather.mailasail.com/Franks-Weather/Cape

Overall Vulnerability

For all participating jurisdictions, overall vulnerability to lightning is considered **Moderate Vulnerability**, based on subjective assessments and the classifications set forth in Section 3.1.1. This assessment is based on the frequency of occurrence at any one given point, weighted against potential damage, and is considered equal for all participating jurisdictions. Further assessments of vulnerability per community are located in Sections 3.3.1 – 3.3.7.

3.4.6 Winter Storm

Hazard Description

Severe winter storms may be categorized as sleet, ice storms or freezing rain, heavy snowfall, or blizzards. Characteristics of severe winter storms are determined by the amount and extent of snow or ice, air temperature, wind speed, and event duration. Severe winter storms in the southeast Texas region are relatively rare, and typically create disruption of regional systems such as public utilities, telecommunications, and transportation routes. Because severe winter weather are relatively rare in southeast Texas, compared to northern states where winter events are expected and states tend to be better equipped to handle them, occurrences tend to be very disruptive to transportation and commerce. Trees, cars, roads, and other surfaces develop a coating of ice, making even small accumulations of ice extremely hazardous.

An ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication. These accumulations of ice affect transportation routes making walking and driving extremely dangerous. Significant ice accumulations are usually accumulations of ¼" or greater. Extreme cold often accompanies a winter storm, though this is a less common impact in the southern states. Exposure to extreme cold can lead to life-threatening frostbite, hypothermia or illness. With regard to property and infrastructure, pipes can freeze and/or burst in buildings that are poorly insulated or without heat, causing water damage and disruption of water supply.

In 2001, the National Weather Service implemented an updated Wind Chill Temperature index. This index, shown as Figure 3-35 below, was developed to describe the relative discomfort/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.

Figure 3-23 National Weather Service Wind Chill Chart

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

Frostbite Times: 30 minutes | 10 minutes | 5 minutes

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

Where, T= Air Temperature (°F) V= Wind Speed (mph) *Effective 11/01/01*

Source: National Weather Service, www.nws.noaa.gov/om/windchill/index.shtml

Geographic Location

East Texas generally and Angelina County specifically is a region of the country known for mild winter temperatures, but does experience severe winter weather. Risks associated with winter storm are region wide, not confined to a particular area, and potentially impact all participating jurisdictions more or less equally.

Previous Occurrences

Figure 3-24 below illustrates recent winter storm events that have impacted Angelina County and the region. The most prevalent impacts of winter storms are vehicle accidents; fallen trees, broken limbs from heavy ice and snow loads; downed electrical and telephone lines, and broken plumbing pipes.

Figure 3-24 Descriptions of Angelina County Winter Storm Occurrences, 1994-2011

Region (February 1994)
An arctic cold front moved into Northern Texas during the afternoon of the 8th, causing temperatures to drop 60 degrees within 48 hours in many locations. Up to four inches of ice and sleet accumulated, making this the most significant ice storm across East Texas in two years. Numerous highways, businesses, and schools were closed. Over 30,000 homes suffered power outages, and damage from falling trees was widespread to homes and businesses. Two indirect fatalities occurred as icy roads caused traffic accidents.

Region (January 1997)
Freezing rain with sleet accumulated to depths of 1/4 to 1/2 inch across the region. Several highways were closed and numerous traffic accidents occurred. Isolated power outages from fallen power lines also occurred.

Region (December 1998)
A shallow artic air mass spread across northeast and east Texas while low pressure formed in the Gulf of Mexico. This allowed overrunning of warm moist air over the cold dome producing widespread freezing rain and sleet. Overall ice accumulations were less than one inch. The ice accumulated mainly across exposed surfaces such as trees and powerlines as well as bridges and overpasses. A few automobile accidents and downed trees and powerlines were the worst result of the storm.

Region (February 2006)
Much of the region was entrenched in an arctic airmass during the weekend of the 18th through the 20th of February. A weak storm system moved into the southern plains and into the lower Mississippi valley with light freezing rain and freezing drizzle falling across much of the region. Ice accumulations were very light...mainly less than one quarter of an inch across most places. While road surfaces remained wet from ground warmth, most elevated bridges and overpasses saw some ice accumulation which resulted in numerous traffic accidents. Many elevated bridges and overpasses had to be closed due to the ice accumulation.

Region (February 2010)
Snow began accumulating during the morning hours of February 11th and did not end until the afternoon hours of February 12th. Snowfall totals across the county ranged from 1 to 2 inches with 2 inches being reported near Lufkin, Texas.

Region (February 2011)
A cold arctic airmass was in place across the four state region the night of February 3rd as a strong upper level storm system moved quickly out of the southern Great Basin and into the West Texas Hill Country. A large area of precipitation, mostly in the form of snow, developed across Central Texas during the late night hours of February 3rd and moved quickly northeast into Northeast Texas, Southeast Oklahoma and Southwest Arkansas during the early morning hours of February 4th. Accumulating snow was the result across much of the area with a mixture of sleet and freezing rain across portions of East Central Texas and Central Louisiana. These counties saw mostly freezing rain with a brief mixture of sleet. There ice depth are as follows: Angelina County: 0.25 inches…

Source: NCDC with regional information edits.

The following table illustrates the lowest temperatures in Lufkin, Texas since 1906.

Table 3-36 Low Ambient Temperature Records in Lufkin Texas since 1906

Date	Temperature (F)
1930, 1989	-2° (F)
1952	0° (F)
1932	2 ° (F)
1907	4 ° (F)
1982	5 ° (F)
1932, 1935	7 ° (F)
1911, 1916	8 ° (F)

Source: National Weather Service-Lufkin Texas

Probability of Future Occurrence

Based on the storm events listed by the National Climatic Data Center, Angelina County has experienced six winter storm events since 1994. That recurrence internal is approximately a 35-percent annual chance of having a severe winter storm event. This frequency of previous occurrence

equates to a **Medium** probability of future occurrence according to the definitions set forth in Section 3.1.1 Methods and Definitions.

Magnitude/Severity/Extent
The magnitude and severity of winter storms impact broad geographical areas. The duration of winter storm events typically is one or two days. Due to the far southern location of the planning area and mild winter temperatures, the magnitude and severity of the winter storms are limited. Road ways may become icy causing some traffic accidents. Based on the public safety risk and the scale of potential damage to infrastructure and economic loss, this hazard merits a severity rating of **Level 2-Limited.**

Winter Storm Overall Vulnerability
Overall vulnerability to winter storm is considered **Moderate Vulnerability**, based on subjective assessments and the classifications set forth in Section 3.1.1. This assessment is based on the recurrence interval for winter and the severity of the impacts to infrastructure and the threat to human life posed by this hazard. Further assessments of vulnerability per community are located in Sections 3.3.1 – 3.3.7.

3.4.7 Drought

Hazard Description

As defined by the NOAA Weather Service, drought is "a period of abnormally dry weather sufficiently prolonged for the lack of water to cause serious hydrologic imbalance in the affected area." More simply, a drought is a period of persistent dry weather lasting long enough to cause serious problems such as crop damage and/or water supply shortages. The severity of the drought depends upon the degree of moisture deficiency, duration, and size of affected area.

Short term effects of drought include excessively dry soil causing plants stress and crop failure. When rainfall is less than normal for several weeks, months, or years; the following may occur: the flow of streams and rivers declines; water levels in lakes and reservoirs fall; the water 3drops, i.e. the depth to reach groundwater in water wells increases. Drought is a unique type of disaster because it is not a discreet event but rather is the cumulative result of a persistent period of below average precipitation. In the continental U.S. drought occurrence generally does not require evacuation nor does it constitute an immediate threat to life or property. The effects of drought may not be noticed immediately but only become apparent after weeks or months. The effect to the water table may take up to a year or more to be realized.

The most common impacts include economic hardship due to lost revenue from crops or loss of livestock. Non-irrigated croplands are most susceptible to moisture shortages. Grazing land and irrigated agricultural lands are not impacted quickly as the non-irrigated, cultivated acreage, but their yields can also be greatly reduced. Reductions in yields due to moisture shortages are often aggravated by wind-induced soil erosion. Under extreme drought conditions, lakes, reservoirs, and rivers can be subject to severe water shortages, restricting their use for municipal water supplies. Table 3-37 illustrates the Drought Monitor's drought intensity rating of "abnormally dry", "moderate drought", "severe drought", "severe drought", "extreme drought", and "exceptional drought" followed by a description of possible impacts.

Table 3-37 Drought Monitor: Drought Severity Classification

Description	Possible Impacts	Palmer Drought Index	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Satellite Vegetation Health Index
Abnormally Dry	Going into drought, short-term dryness slowing planting, growth of crops or pastures; fire risk above average. Coming out of drought; some lingering water deficits; pastures or crops not fully recovered.	-1.0 to -1.9	21-30	21-30	-0.5 to -0.7	36-45
Moderate Drought	Some damage to crops, pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing or imminent, voluntary water use restrictions requested.	-2.0 to -2.9	11-20	11-20	-0.8 to -1.2	26-35
Severe Drought	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed.	-3.0 to -3.9	6-10	6-10	-1.3 to -1.5	16-25
Extreme Drought	Major crop/pasture losses; extreme fire danger; widespread shortages or restrictions	-4.0 to -4.9	3-5	3-5	-1.6 to -1.9	6-15
Exceptional Drought	Exceptional and widespread crop/pasture losses; exceptional fire risk; shortages of water in reservoirs, streams and wells, creating water emergencies.	-5.0 or less	0-2	0-2	-2.0 or less	1-5

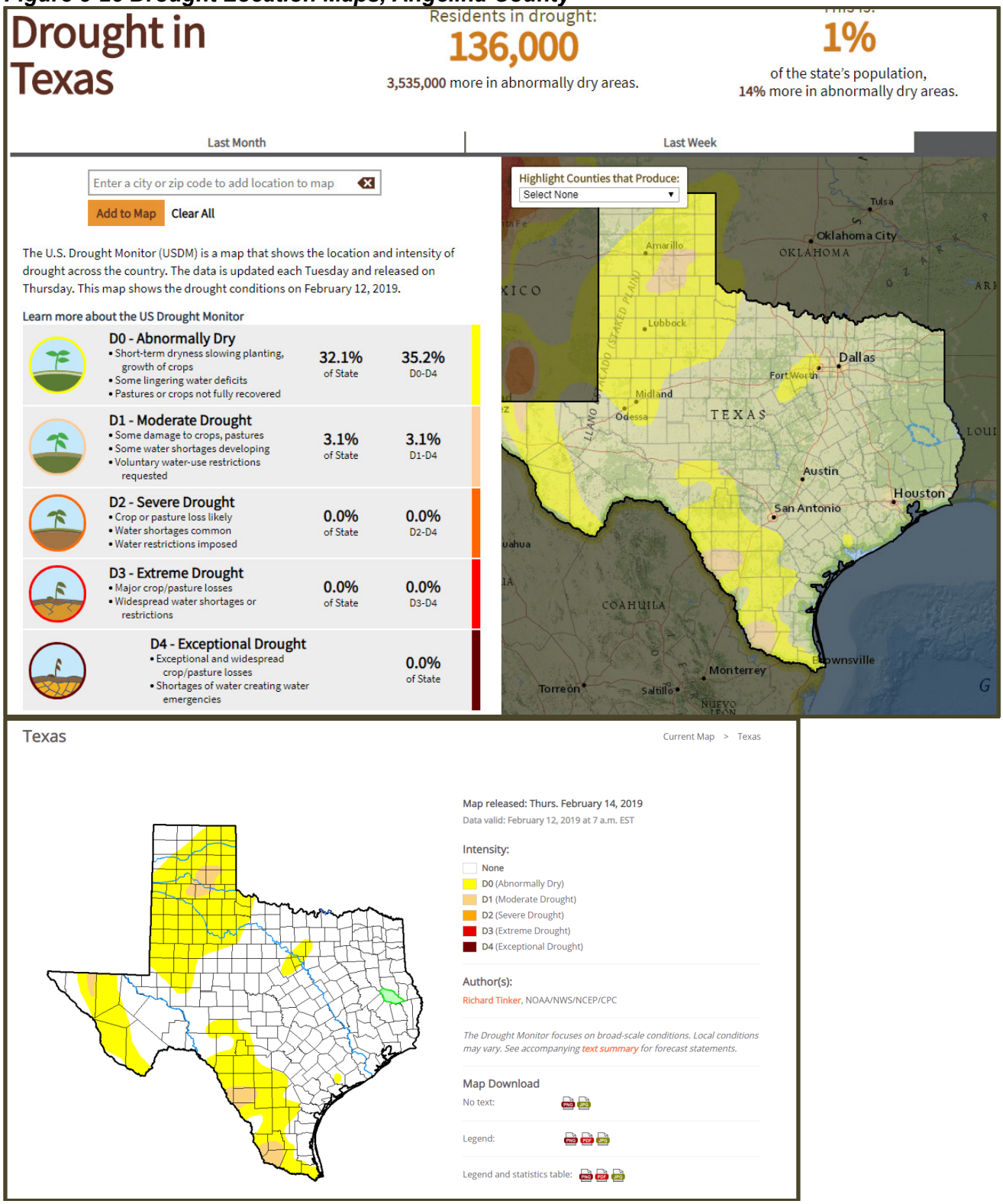
Source: Drought Monitor http://drought.unl.edu

Geographic Location

The geography of drought affects includes all portions of the planning area equally, including all of the participating jurisdictions.

Drought is a normal part of virtually all-climatic regimes, including areas with high and low average rainfall. Texas generally and Angelina County specifically, are not immune from the occurrence or effects of drought. Agricultural irrigators and municipal water supplies are primarily dependent on groundwater resources. As severe droughts may affect the groundwater table, the risks associated with drought are county wide and not confined to any particular community or discreet geographic region of the county. The maps below show Angelina County within a region of east Texas with no current drought impacts (Angelina County outlined in blue, and green, respectively).

Figure 3-25 Drought Location Maps, Angelina County



Source: https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?TX

Previous Occurrences

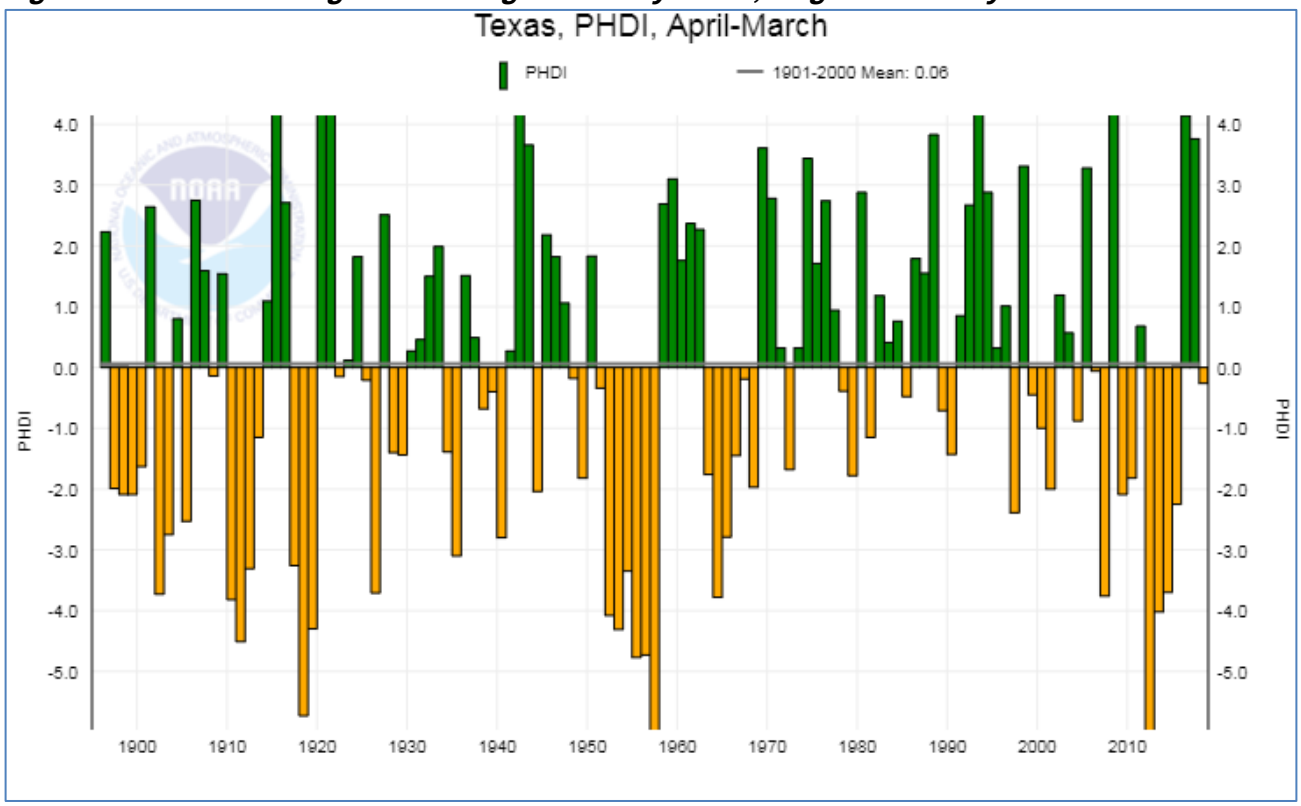
Since 2011-2012, there have been no major droughts involving extended periods of severe impacts. However, beginning in 2010 and extending through 2011, the State of Texas and greater southern states region including the all participating jurisdictions experienced one of most severe droughts in many decades. The U.S. Drought Monitor has assigned its most serious drought classification to current conditions, 'Exceptional Drought', and this classification has extended for an extended duration (see figures and maps on the following pages).

Historically, Texas has experienced occasional severe drought conditions. Western counties especially have experienced agricultural droughts, leading to severe soil-moisture decreases with serious consequences for crop production. Historical review indicates that a highly significant relationship exists between precipitation in Texas and the establishment of La Niña weather patterns. La Niña, characterized by unusually cold ocean temperatures in the Pacific, can bring abnormally warm and dry weather conditions to Texas. For example, during the mid-1998 to 2000 period, the state shifted to a drier weather pattern. Year 2000 was the driest winter in over 100 years. During roughly 80 percent of past La Niña occurrences, winter and spring rainfall has been below normal.

Tracking drought is challenging due to the numerous definitions and measurement protocols. The online website *Drought Monitor*; a partnership between Federal agencies and the National Drought Mitigation Center at the University of Nebraska-Lincoln has been tracking drought conditions across the country and provides drought information maps illustrated down to the county level. The Drought Monitor is an attempt to synthesize multiple drought related indices and impacts which represents a consensus of federal and academic scientists. Some of those indices include: the Palmer Drought Severity Index, the Climatic Prediction Center's Soil Moisture Model, the USGS weekly stream flow map (based on an average of daily stream flow), the National Climatic Data Center's Standardized Precipitation Index and the NOAA/NESDIC Vegetation Heath Index.

The Palmer Drought Severity Index (PDSI) is a commonly used measure for moisture depletion or abundance on a regional scale. Based on PDSI results for Angelina County, Figure 3-26 below indicates that extended periods of severe drought occurred in 1918-1919, 1950's, and 2011.

Figure 3-26 Palmer Long Term Drought Severity Index, Angelina County 1900-2018



Source: National Weather Service Climate Prediction Center

A review of historical drought events from 2005 to 2011, presented below identifies five drought events reported by the National Climactic Data Center.

Figure 3-27 Notable Droughts, Angelina County and East Texas

December 2005 – High fire danger continued across all of Northeast & East Texas throughout December, a continuation of devastating drought that impacted much of eastern Texas in 2005. Many lakes and reservoirs remained near or set all time record low levels and a series of dry cold fronts blew through the region exacerbated already dry conditions. Several small fires broke out across the region during the month but the resulting damage was minimal. Burn bans continue for many counties across Northeast Texas as most of the region experienced rainfall deficits of some 15 to 20 inches in a year.

December 2010 – While much of Northeast Texas was downgraded to D1 Moderate Drought category during the month of November, a very dry December resulted in much of Northeast Texas being upgraded to D2 Severe Drought and D3 Extreme Drought categories during the month of December. Once again, many counties saw burn bans throughout the month as the fire danger was very high across the region. Lufkin monthly rainfall was 0.86. The departure from normal was -3.58. The yearly rainfall through December was 30.01. The yearly departure from normal through December was -16.61.

January 2011 - After a very dry December of 2010, portions of Northeast Texas saw surplus rainfall for the first month of 2011. While the surplus rainfall was something this region had not seen in a while, it still did very little to quench the drought that was ongoing across the region when the year began. Much of the region remained in D2 Severe Drought and D3 Extreme Drought categories through the end of January. Once again, many counties saw burn bans throughout the month as the fire danger was very high across the region. Lufkin monthly rainfall was 7.14. The departure from normal was 2.69.

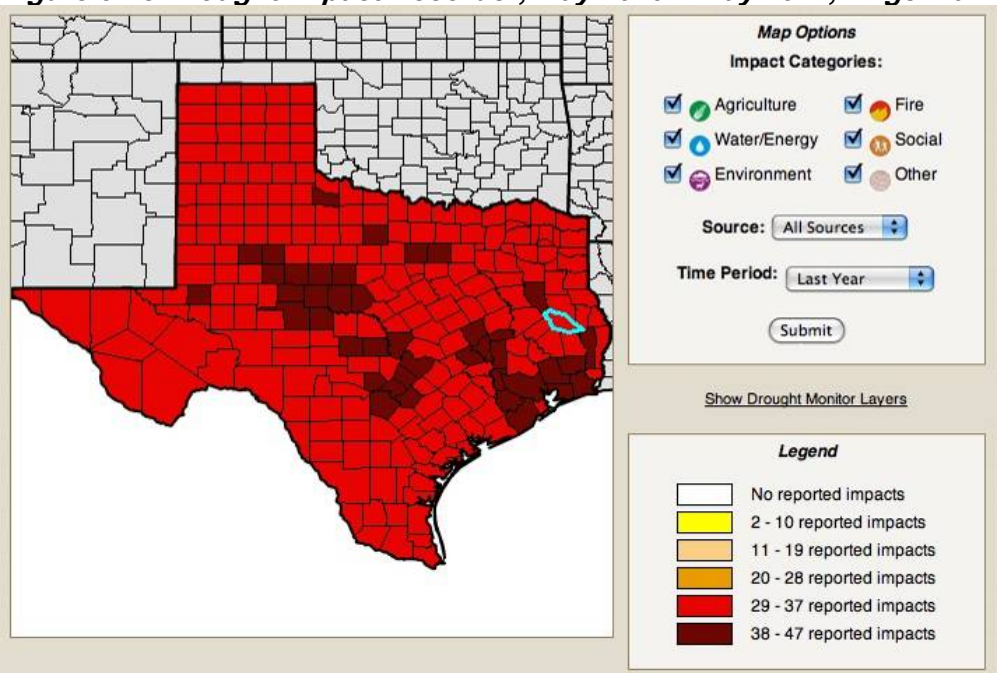
March 2011 - The month of March, 2011 remained on the dry side across all of East Texas. While the month did see some appreciable rainfall, it was not enough to stifle the ongoing drought conditions across the northeast half of the state. In fact, by the end of the month...all of Northeast Texas was classified as being under D3 Extreme Drought conditions. Burn bans began going up across a few counties in Northeast Texas during the month of March. Lufkin March rainfall was 0.75. The departure from normal was -2.78. Lufkin yearly rainfall was 8.65. The departure from normal was -2.50.

July 2011 – Angelina County rainfall year to date departure from normal minus 6-10", or 50-75% normal.

Source: National Climatic Data Center; Advanced Hydrologic Prediction Center

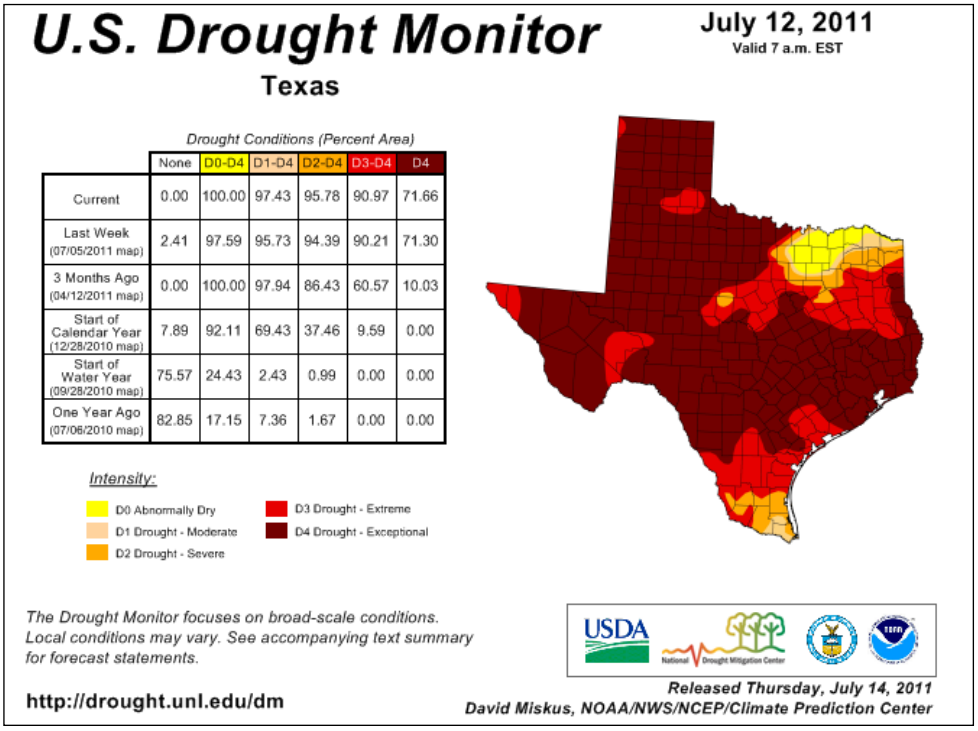
According to the Drought Impact Recorder, for the 12-month period May 2010 to May 2011, there were twenty-three (23) reported impacts for drought in Angelina County. Sixteen impacts are related to fire, three are categorized as agricultural, three are categorized as water and one is categorized as social. (See Figure 3-28 below).

Figure 3-28 Drought Impact Recorder, May 2010 – May 2011, Angelina County



Source: National Drought Mitigation Center, Drought Impact Recorder

The map below is yet another indication of the severity of the 2011 drought across Texas.



Source: US Drought Monitor

Since the last plan update, minor droughts occurred in 2015 and 2013 as shown in the following table. Particularly, in late October 2015 4 percent of the planning area was D4 drought designation, but this stretch of dry weather was alleviated by subsequent rains. The period of 2016-current have been extraordinarily wet and no extended drought conditions have developed.

Table 3-38 Drought Conditions 2013-2018, Angelina County Planning Area

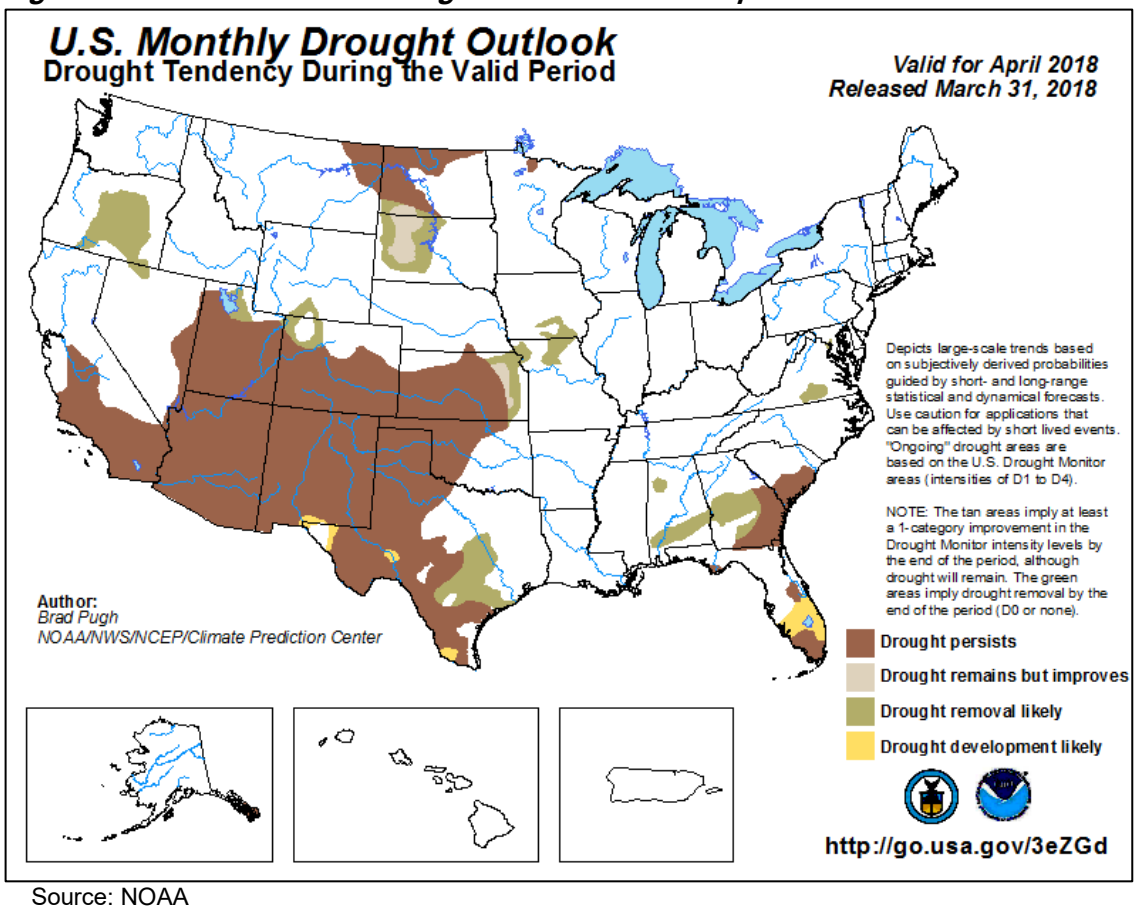
Week	D0-D4	D1-D4	D2-D4	D3-D4	D4
October 20, 2015	100%	100%	100%	35%	4%
October 13, 2015	100%	100%	100%	22%	0%
October 6, 2015	100%	100%	73%	22%	0%
September 29, 2015	100%	100%	50%	7%	0%
September 22, 2015	100%	100%	100%	7%	0%
September 15, 2015	100%	100%	89%	7%	0%
September 17, 2013	100%	100%	88%	48%	0%
September 10, 2013	100%	100%	88%	48%	0%

Source: US Drought Monitor

Probability of Future Occurrence

Based on all the data sets above, drought conditions do occur somewhat regularly in east Texas. Using the *Drought Monitor* data sets detailed above as the best available, there is approximately a 24 percent chance drought in a given week. This probability assessment equates a **High** probability of future occurrence classification according to the definitions set forth in Section 3.1.1 Methods and Definitions. Projecting forward, Figure 3-29 shows the drought outlook for the U.S. for the period March through April 2018. Angelina County is in an area of Texas where no drought is anticipated.

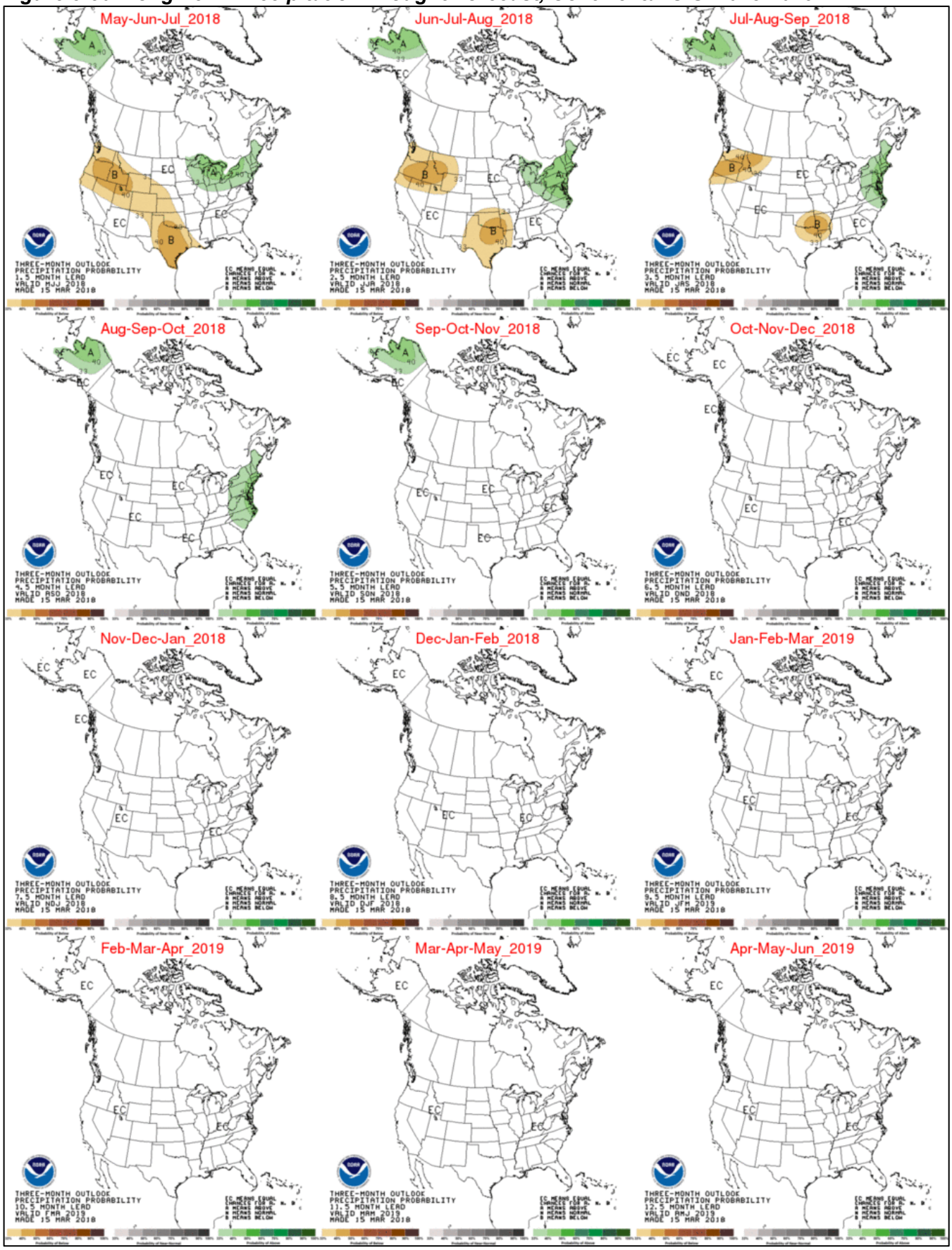
Figure 3-29 U.S. Seasonal Drought Outlook: March-April 2018



Source: NOAA

Extended drought forecasting in terms of probability is shown on the following page. The series of maps show predicted rainfall across the U.S. for the period May 2018 through June 2019. The forecast indicates slightly below average levels of rain though August-September 2018, then normalizing through the remainder of the forecast period.

Figure 3-30 Long Term Precipitation/Drought Forecast, Continental U.S. 2018-2019



Source: NOAA

Magnitude/Severity/Extent
It is expected a worst case scenario for drought across the planning area is a D5 (Exceptional Drought) according to definitions set by the Palmer Drought Severity Index (PDSI). The severity of drought is typically experienced in terms of economic impacts, and direct public health and safety impacts are rare. Patterns of previous droughts generally involve relatively isolated and broadly distributed moderate property damage, mostly attributed to crop loss (including tree plantations) and wildfire. Based on these assessments, magnitude and severity of drought on a county scale is considered **Level 2-Limited** based on the definitions outlined in Section 3.1.1. Assessments for individual cities are provided in Section 3.3 (Multi-Jurisdiction Risk Assessment)

Drought Overall Vulnerability
A number of the municipalities of Angelina County benefit from relatively secure and stable water supplies, and current efforts are underway to expand the cooperative water supply infrastructure. This factor offsets the prevalent concerns of drought impacts in unincorporated areas including cattle production and forage, and significantly increased probability of wildfire impacts.

Based on this assessment, vulnerability to drought is considered **Moderate Vulnerability**, relative to other hazards that may occur in Angelina County. This assessment is based on the recurrence interval for drought; weighted against the magnitude of the impacts to the industrial forestry sector, agriculture, the needs of city residents (including industrial users), and the needs unincorporated county residents who rely on wells for their household water supply source. Further assessments of vulnerability per community are located in Sections 3.3.1 – 3.3.7.

3.4.8 Earthquake

Hazard Description

An earthquake is a sudden motion or trembling of the earth caused by an abrupt release of stored energy in the rocks beneath the earth's surface. The energy released results in vibrations known as seismic waves that are responsible for the trembling and shaking of the ground during an earthquake. Ground motion is expressed as peak ground acceleration (PGA, peak change in speed of ground surface horizontal motion during an earthquake). PGA is expressed as a percent of gravity or "g".

Earthquakes are typically described in terms of magnitude and intensity. The traditional measurement of amplitude of the seismic wave through the assignment of a single number to quantify the amount of seismic energy released by an earthquake is the Richter scale. The intensity of how strong the shock was felt at a particular location is the Modified Mercalli Intensity (MMI) scale. The scale quantifies the effects of an earthquake on the Earth's surface, humans, objects of nature and man-made structures. Table 3-39 below is a combined earthquake magnitude and intensity comparison from the United States Geological Survey.

Table 3-39 Earthquake Magnitude / Intensity Comparison

PGA (% g)	Magnitude (Richter)	Intensity (MMI) & Label	MMI Description
< 0.17	1.0 – 3.0	I. Instrumental	**I.** Not felt by many people unless in favorable conditions.
0.17 – 1.4	3.0 – 3.9	II. – III. Feeble/Slight	**II.** Felt only by a few persons at rest, especially on building upper floors. **III.** Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibrations similar to the passing of a truck.
1.4 – 9.2	4.0 – 4.9	IV. – V. Moderate/Rather Strong	**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 heavy truck striking building. Parked cars rock noticeably. **V.** Felt by nearly everyone: many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
9.2 – 34	5.0 – 5.9	VI – VII Strong/Very Strong	**VI.** Felt by all. Some heavy furniture moved. Damage slight. **VII.** Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built of badly designed structures; some chimneys broken.
34 – 124	6.0 – 6.9	VIII – IX Destructive/Ruinous	**VIII.** Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, and 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.
> 124	7.0 and higher	X, XI and XII Disastrous/Very Disastrous/ Catastrophic	**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. **XII.** Damage total. Line of sight & level distorted. Objects thrown in the air.

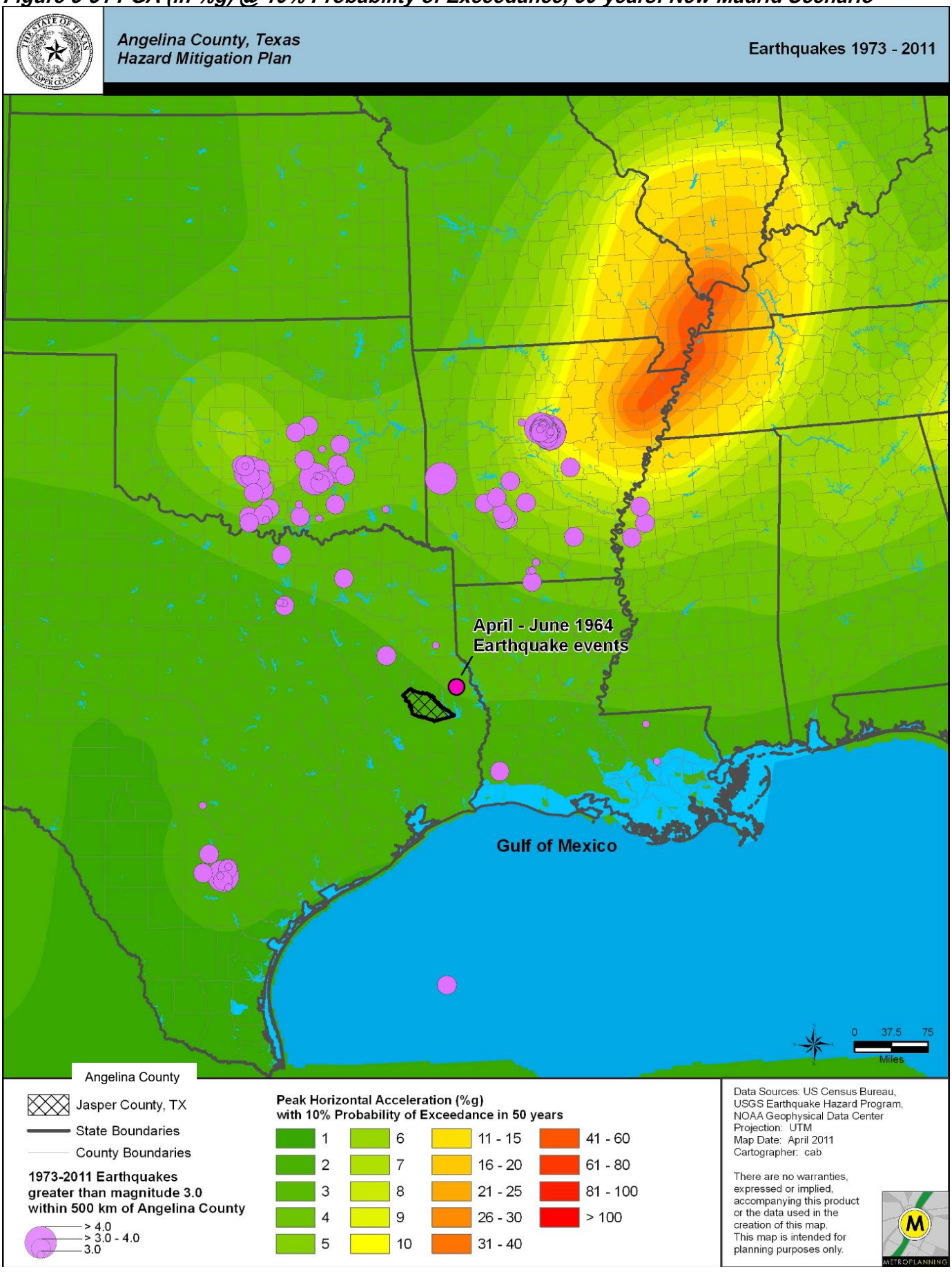
Source: USGS, Earthquake Hazards Program. http://earthquake.usgs.gov

Geographic Location

Earthquakes typically originate miles below ground and when they occur effect vast areas at the earth's surface level. This is particularly true for east Texas whereas frequency and probability are low. Therefore the County and each participating city has roughly an equal chance of earthquake occurrence.

The New Madrid seismic zone is in Missouri is thought to be the most likely source of potential earthquake events that could be strong enough to affect the planning area, though minor-moderate quakes occurred to the east in Sabine County as recently as 1964. Figure 3-31 on the following page puts this geographic factor in context. The map illustrates PGA for a 2-percent probability of exceedance in 50-years, referenced in units of percent of the force of gravity (%g). Angelina County is located in the 4-percent g zone, corresponding to a magnitude earthquake of approximately 4.0 on the Richter scale. Note: the earthquake map is just one possible earthquake scenario used as a reference for discussion of earthquakes with significant magnitude.

Figure 3-31 PGA (in %g) @ 10% Probability of Exceedance, 50-years: New Madrid Scenario



Previous Occurrences

There are no recorded earthquakes with epicenters in Angelina County or the participating cities. The planning area is roughly 300 miles east, southeast of the region of recent (minor) seismic activity in north central Texas near Abilene. Although the State of Texas is generally considered an area of low seismic risk, the University of Texas Institute of Geophysics records 100 3+ magnitude earthquakes during the twentieth century. Four of these earthquakes had magnitudes between 5 and 6 on the Richter Scale.

The closest earthquake to Angelina County in the last 50 years in Sabine County to the east of Angelina County and is described below in Figure 3-32.

Figure 3-32 Earthquake Activity Description: East Texas 1964

April 23-28, 1964 Sabine County, Texas: A series of moderate earthquakes occurred near Hemphill between Toledo Bend Reservoir and Sam Rayburn Reservoir starting on April 23, 1964. Epicenters were determined on April 23, 24, 27 and 28. Numerous aftershocks were felt at Pineland, Hemphill and Milam. The only damage report was from the magnitude 4.4 earthquake on April 28 – wall paper and plaster cracked at Hemphill (intensity V). The magnitude of the other epicenters changed from 3.4 to 3.7. Shocks were also felt at Pineland on April 30 and May 7. On June 2, three more shocks were reported in the same area. The strongest was measured at magnitude 4.3; intensities did not exceed IV. Another moderate earthquake on August 16 woke several people at Hemphill and resulted in minor surface damage to walls. The shock from this earthquake was also felt at Bronson, Geneva, Milam and Pineland.

These earthquakes were felt over small areas, with shallow apparent epicenters (less than 5 kilometers deep). At the time of these events, the Sam Rayburn Reservoir was being filled, and the Toledo Bend Dam was being constructed. Deployment of portable seismograph instrumentation from July to September 1964 recorded more than 70 micro-earthquakes. Earthquake activity in this area abruptly decreased in frequency, intensity, and magnitude after the three-month period, with the last reported event occurring on August 19, 1964.

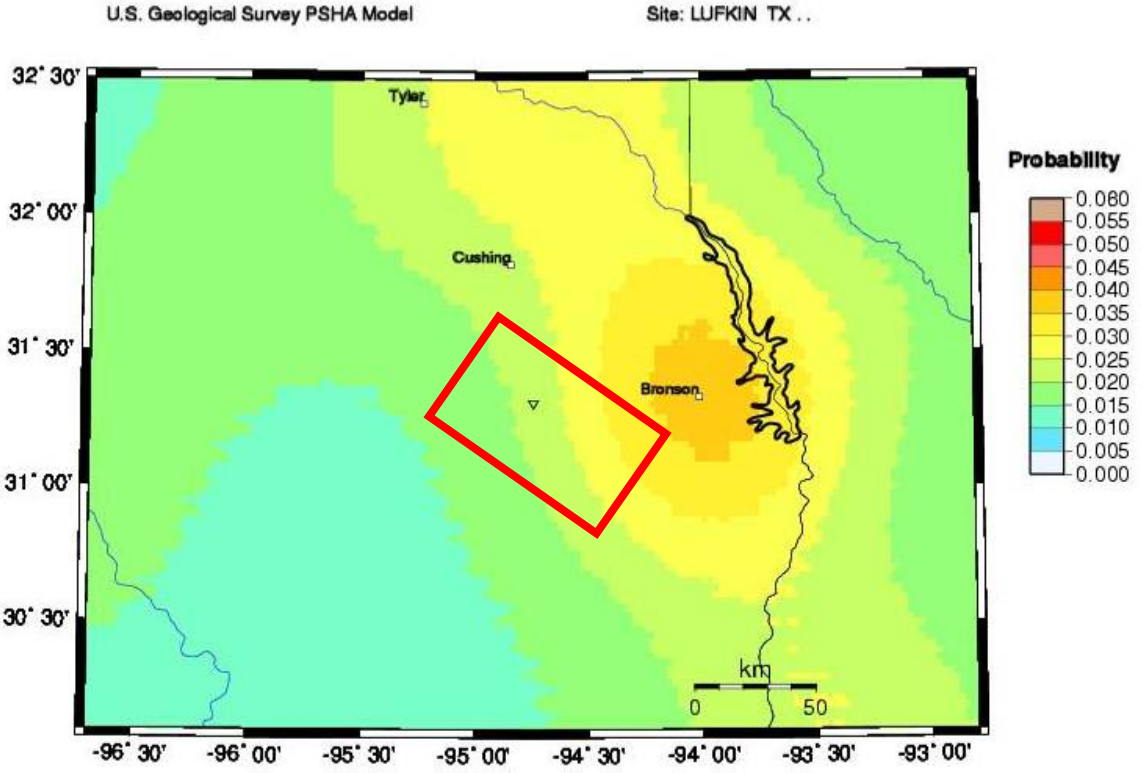
Source: USGS, Texas Earthquake History

Probability of Future Occurrence

According to the University of Texas at Austin, there are limited continuously recording seismograph stations in the state, which makes an accurate recording of both the number and intensity of earthquakes problematic.

Annual probability for earthquakes capable of structural damage in the planning area is considered low. USGS modeling of earthquake probability within 50 kilometers of Lufkin resulted in roughly a 2.5 percent probability for a 4.75 magnitude or larger quake over a 100 year time span, as shown in Figure 3-13 on the following page. The associated recurrence interval for this probability is 4,000 years. Based on these assessments, future probability for damaging earthquakes is assigned a **Low** classification according to the definitions set forth in Section 3.1.1 Methods and Definitions.

Figure 3-33 Prob. for ≥4.75 Mag. Earthquake within 50 Km/100-years: Lufkin, TX



Source: USGS
Note: Approximate boundaries of Angelina County indicated by red rectangle

While no definitive research has been conducted, there is speculation that hydraulic fracturing methods for natural gas drilling is related to recent (minor) earthquake activity in north Texas. Any future findings relevant to earthquake probability relationships will be evaluated in future updates of this plan.

Impact/Magnitude/Severity/Extent
As stated above, the magnitude of an earthquake is measured in the amplitude of the seismic wave and is expressed in the Richter scale; intensity is expressed as peak ground acceleration (PGA) relative the earth's gravity or "g", and is a measure of how strong the shock was felt at a particular location, expressed in Modified Mercalli Intensity (MMI) scale.

Figure 3-13 maps ground shaking intensity (expressed relative to gravity, or "g") at various locations in the eastern U.S. at 10-percent probability of exceedance in 50 years. The highest PGA nearest the New Madrid seismic zone as expected. As one moves further south, the PGA diminishes to a PGA value near zero across southern Texas. Eastern Texas including Angelina County and participating cities falls within the 0.01 g zone. This would correspond to an earthquake of approximately 1.0 to 3.0 on the Richter scale, (unnoticeable unless in favorable conditions).

Based on these assessments the extent and severity of such as seismic event would be considered **Level 2- Limited** across the planning area, with potential for noticeable shaking, but a low likelihood of extensive structural damage.

Earthquake Overall Vulnerability
Based on the probability of future occurrences and magnitude/severity the overall vulnerability rating would be **Low Vulnerability**, according to subjective assessments and the classifications defined in Section 3.1.1. Further assessments of vulnerability per community are located in Sections 3.3.1 – 3.3.7.

3.4.9 Dam Failure

Hazard Description

Dams are water storage or diversion barriers that impound water upstream in reservoirs. Dam failure is a collapse, breach or overtopping of the structure. While most dams have storage volumes small enough that failures have relatively minor repercussions, dams with large storage volumes can cause significant flooding at lower relative elevations.

The failure of dams or levees can result in injuries, loss of life, and damage to property and environment. While levees are built solely for flood protection, dams often serve multiple purposes such as hydroelectric generation, flood control and recreation. Dams and levees are usually engineered to withstand a flood with a calculated risk of occurrence. Severe flooding can increase the potential of dam or levee failure as a result of the physical force of the flood waters or overtopping. Failed dams can create floods that are catastrophic to life and property, in part because of the tremendous energy of the released water.

The hazard potential for dam failure is classified according to the following definitions accepted by the Interagency Team on Dam Safety. *Note: hazard ratings for individual dams are not made available to the public.*

- Low Hazard Potential—Failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.
- Significant Hazard Potential—Failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or other impacts. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
- High Hazard Potential—Failure or mis-operation will probably cause loss of human life.

Dam failure can be caused by simple structural failure, or a combination of the following factors:

- earthquake
- flood conditions leading to overtopping
- internal erosion
- inadequate spillway capacity
- improper operation or maintenance
- arson
- failure of upstream dams

Warning time for dam failure varies widely and depends on the causal factors. Dam failure can occur in as little as a few minutes or slowly over the course of months. Catastrophic failure of a large dam would result in short evacuation times for locations directly downstream. Topography and floodplain characteristics determine warning time for locations further downstream.

Geographic Location

There are 21 dams listed in the National Inventory of Dams (NID) database for the planning area. A dam is listed in the NID database if it meets one or more of the following criteria:

1) It has High Hazard classification – loss of one human life is likely if the dam fails,
2) It has Significant hazard classification – possible lost of human life and likely significant property or environmental destruction,
3) Equal or exceed 25 feet in height and exceed 15 acre-feet in storage,
4) Equal or exceed 50 acre-feet storage and exceed 6 feet in height.

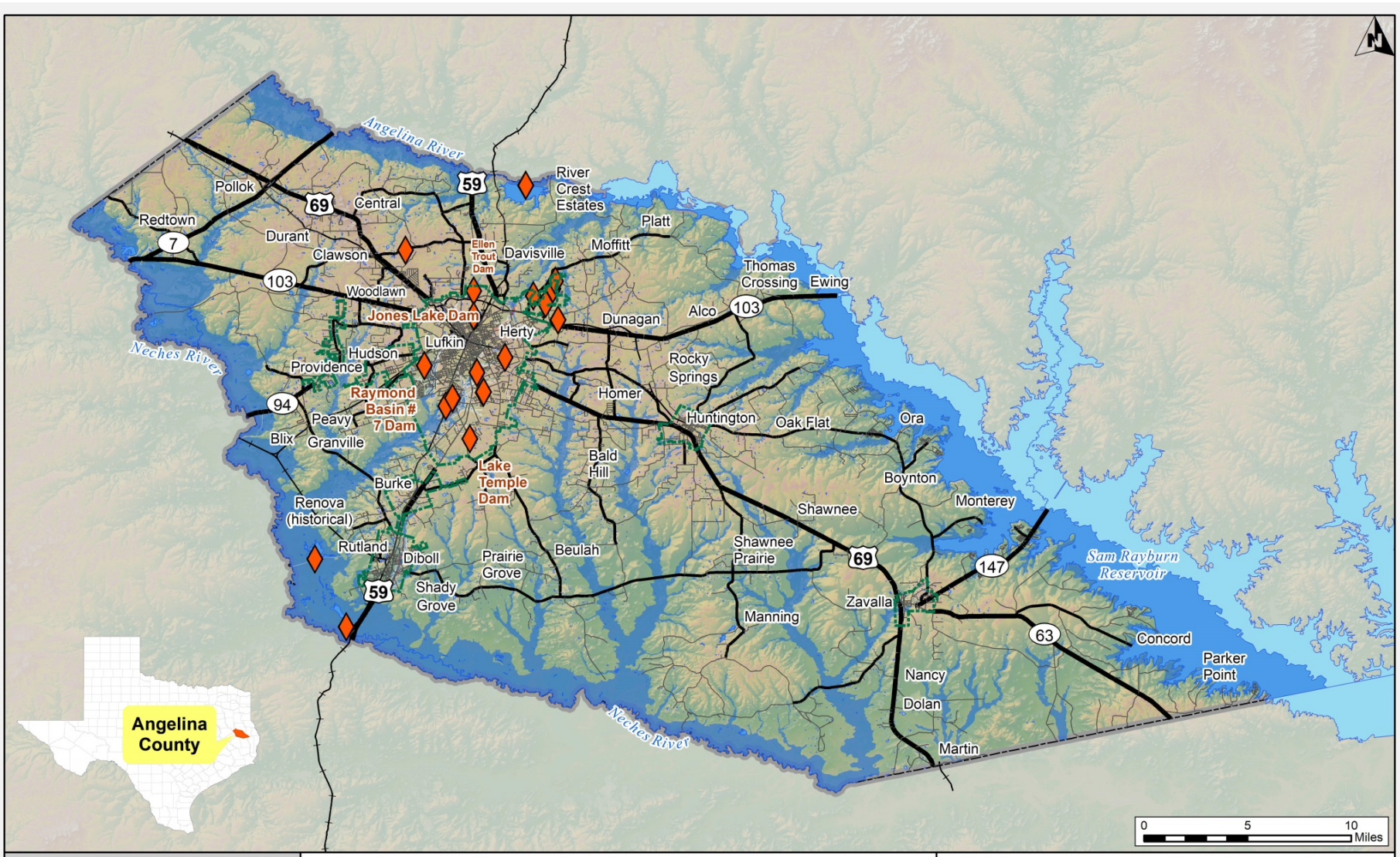
Table 3-41 below outlines the dams listed by the NID for Angelina County. Table corresponds with map on following page.

Table 3-41 Dams of Angelina County

# on Map	Dam Name	Height (ft.)	Storage (acre-ft.)	River-Tributary
1	MM FLOURNOY DAM	14	210	BUSHY CREEK
2	MANNING CLUB LAKE DAM	16	276	BUSHY CREEK
3	FIBERBOARD LAKE DAM	13	2,500	WHITE OAK CREEK
4	BLACKBURN LAKE DAM	18	137	CONNER SPRING BRANCH
5	CLEAR LAKE DAM	25	225	TR-PROCELLA CR
6	HANS LAKE DAM	14	87	TR-LINSTON CREEK
7	CASTLEBERRY DAM	16	385	LINSTON CREEK
8	KOON LAKE DAM	23	165	TR-BILOXI CREEK
9	ELLEN TROUT MEMORIAL LAKE DAM	16	441	TR-MILL CREEK
10	LAKE KURTH DAM	38	27,360	TR-ANGELINA RIVER
11	RAY LAKE DAM	20	93	ROCKY CREEK
12	JONES LAKE DAM	18	75	TR-MILL CREEK
13	LAKE TEMPLE DAM	18	170	TR-HURRICANE CREEK
14	NORTHERN CHIPMILL POND NO 2 DAM	35	60	TR-WISE BRANCH
15	LUFKIN REGIONAL DETENTION POND NO 3 DAM	19	343	TR-CEDAR CREEK
16	LUFKIN COUNTRY CLUB LAKE DAM	33	460	TR-MILL CREEK
17	LUFKIN REGIONAL DETENTION BASIN NO 8 DAM	15.2	127	TR-HURRICANE CREEK
18	LUFKIN REGIONAL DETENTION POND NO 1 DAM	17.8	107	TR-HURRICANE CREEK
19	LUFKIN REGIONAL DETENTION POND NO 4 DAM	15	60	TR-HURRICANE CREEK
20	LUFKIN REGIONAL DETENTION POND NO 7 DAM	21	307	TR-CEDAR CREEK
21	LUNA DAM	13	20	TR-ANGELINA RIVER

Source: National Inventory of Dams (NID). Note: Sam Rayburn Dam is located in neighboring Jasper County at a location downstream on the Angelina River.

Figure 3-4 on the following page illustrates the locations of the 21 dams identified in the National Inventory of Dams, and their geographic relationship to the participating jurisdictions.



Angelina County Dam Locations - Flood Zones

Angelina County Multi-Jurisdiction Hazard Mitigation Action Plan

County Line
City Limits
Water Bodies
Dams

FEMA Flood Zones

Floodway
AE
A
500yr

Map intended for planning purposes only. Information shown is subject to revision and/or update.

Datum: NAD 1983
Map Date: April, 2018
Cartographer: John Streeb / Greg Wobbe
Data Sources: US Census, USGS, FEMA, DHS

MPTX ASSOCIATES

Previous Occurrences
There are no reported previous occurrences of dam failure in Angelina County.

Probability of Future Occurrence
Due to the lack of data regarding previous occurrences, probability of future occurrence is based on speculative forecasts rather than recurrence intervals. Estimated future probability of a major occurrence of dam and/or levee failure is less than 0.5 percent over a 10-year timeframe and less than 25 percent over a 50-year timeframe. This probability assessment equates to a **Low** probability of future occurrence classification according to the definitions set forth in Section 3.1.1 Methods and Definitions.

Impact/Magnitude/Severity/Extent
Considering the worst case scenario and in the absence of mitigation measures, magnitude and severity for dam failure is considered **Level-3 Critical,** with potential for severe property damage on a neighborhood scale; temporary shutdown of critical facilities, utilities and infrastructure; and/or injuries or fatalities.

One of the more relevant concerns with hypothetical failure at Kurth Lake Dam is development at the north end of Duncan Slough Rd. and Angelina Rd. in the northern portion of the county. In the case of potential failure at Kurth Lake Dam, potential impacts depend on a number of factors including: type and cause of failure; reservoir storage volume at time of failure; volume and flow rate of downstream water bodies; soil saturation levels; precipitation levels during and after failure, et al. Qualified for the numerous variables, the magnitude of a major failure of Kurth Lake Dam could be expected to approximate inundation areas, depth, and velocities for a 1.0% annual probability flood event (see note below) along the Angelina River as outlined on Flood Insurance Rate Maps and detailed in the September 29, 2010 Flood Insurance Study for Angelina County.

Note, the following definition of 1% annual probability flood event excerpted from Flood Insurance Study: Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year.

See Appendix F. for additional analysis of relationships of location, storage capacity and dam height, and relative elevations of nearby structures.

Dam Failure Overall Vulnerability
Flooding impacts with higher than normal velocity is the primary concern with regard to dam failure. Overall vulnerability to dam and levee failure is considered **Moderate Vulnerability**, Due to a lack of previous occurrences from which to draw data, this assessment is based on speculative estimates that factor location of dams in relation to population centers and critical facilities, probability of occurrence, and potential magnitude and severity of an event occurrence, and classifications defined in Section 3.1.1. Further assessments of vulnerability per community are located in Sections 3.3.1 – 3.3.7.

3.2.10 Extreme Heat

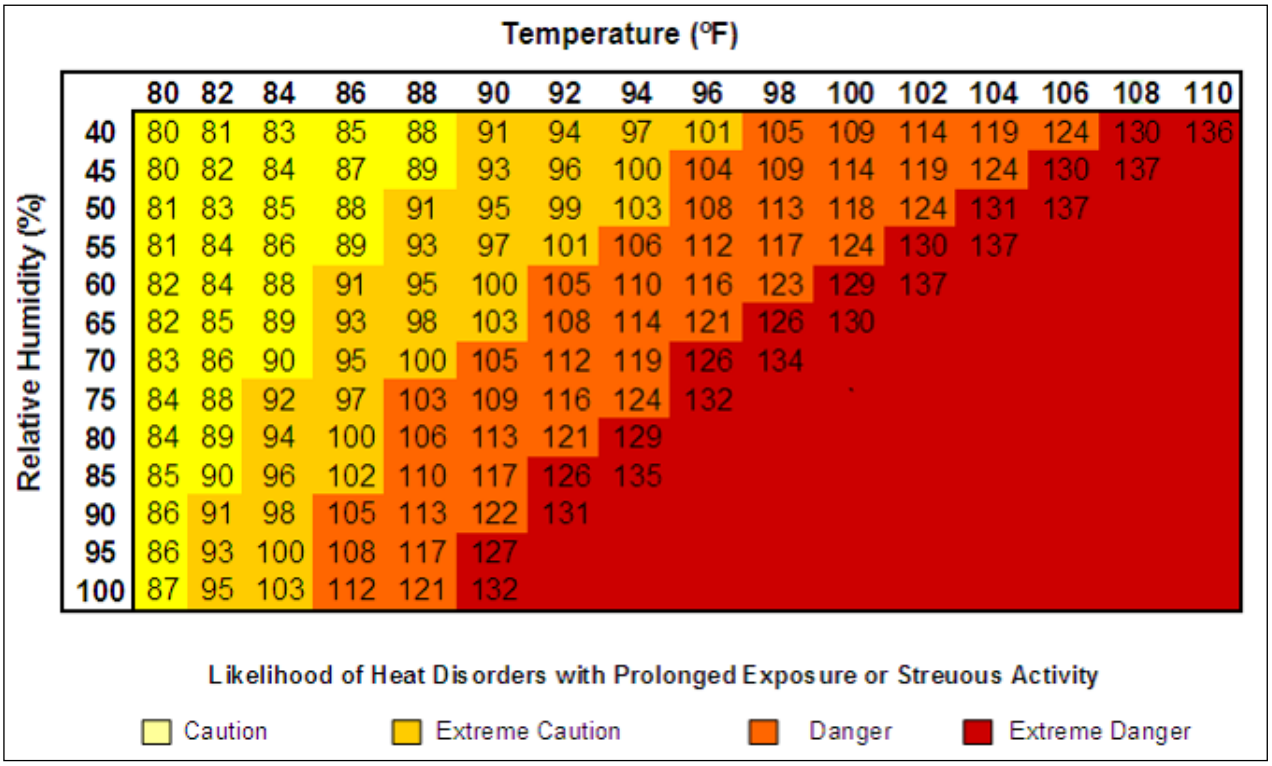
Hazard Description

Extreme heat is a persistent period of high temperatures (significantly above normal) which is often accompanied by high humidity. Extreme heat can cause the heat induced illness hyperthermia, better known as “heat stroke.” Heat stroke affects the ability to maintain proper body temperatures and in severe cases may result in death. Children, elderly people, persons without air conditioning, the sick, disabled and the overweight are at greatest risk of heat stroke though anyone may be affected. In addition to human health impacts, extreme heat can stress agricultural crops and livestock thus reducing yields and may cause widespread power outages as a result of increased demand for electricity to power air-conditioning systems.

The "Heat Index" is a measure of the effect of the combined elements of heat and humidity on the human body. The Heat Index (HI) or the "Apparent Temperature" is an accurate measure of how hot it really feels when the Relative Humidity (RH) is added to the actual air temperature. An Excessive Heat Warning is issued within 12 hours of the onset of a heat index of at least 105°F for more than 3 hours per day for 2 consecutive days, or heat index more than 115°F for any period of time. An Excessive Heat Watch is issued by the National Weather Service when heat indices in excess of 105ºF (41ºC) during the day combined with nighttime low temperatures of 80ºF (27ºC) or higher are forecast to occur for two consecutive days.

The Heat Index Chart shown below (Figure 3-34) was provided by the National Weather Service and indicates the relationship of ambient air temperature and relative humidity to the likelihood of heat disorder and health risk.

Figure 3-34 Heat Index Chart



Source: National Weather Service

Extreme heat can cause heat stroke or heat exhaustion. Heat stroke is the more serious of the two heat-related illnesses. It occurs when the body becomes unable to control its temperature: the body's temperature rises rapidly, the body loses its ability to sweat, and it is unable to cool down. Body temperatures can rise to 106(°F) or higher within 10 to 15 minutes. Heat stroke can cause death or permanent disability if emergency treatment is not provided. Heat exhaustion is a milder form of heat-

related illness that can develop after several days of exposure to high temperatures and inadequate or unbalanced replacement of fluids.

According to data provided by the National Weather Service, for the period 1979 to 1999, extreme heat exposure caused 8,015 deaths in the United States (annual mean: approximately 400 deaths). During this period, more people in this country died from extreme heat than from hurricanes, lightning, tornados, floods, and earthquakes combined. From 1999 to 2003, a total of 3,442 deaths resulting from exposure to extreme heat were reported to the Center for Disease Control (annual mean: 688). For 2,239 (65 percent) of these deaths, the underlying cause of death was recorded as exposure to extreme heat; for the remaining 1,203 (35 percent), hyperthermia was recorded as a contributing factor. Deaths among males accounted for 66 percent of deaths and outnumbered deaths among females in all age groups. Of the 3,401 decedents for whom age information was available, 228 (7 percent) were aged under 15 years, 1,810 (53 percent) were aged 15--64 years, and 1,363 (40 percent) were aged 65 years.

The National Oceanic and Atmospheric Administration (NOAA) states that more than 1,500 people in the United States die each year from excessive heat. The Texas Department of State Health Services analyzed death certificates for cause of death due to extreme temperatures from 1999-2004. Over the 5-year reporting period there were 258 deaths due to exposure to heat as the underlying cause. During this reporting period there was one reported death in Angelina County. For geographical context, there was only one heat related death in the counties surrounding Angelina County during the 5-year reporting period (Cherokee in 2000). More recently there have been two additional heat related deaths in Angelina County, both in August 2010.

The elderly, children, and people with certain medical conditions, such as heart disease are at greater risk to extreme heat impacts. However, even young and healthy individuals can succumb to heat if they participate in strenuous physical activities during hot weather. Factors that increase risk of impact include drinking alcohol, strenuous outdoor physical activity, and medications that impair the body's ability to regulate its temperature or inhibit perspiration.

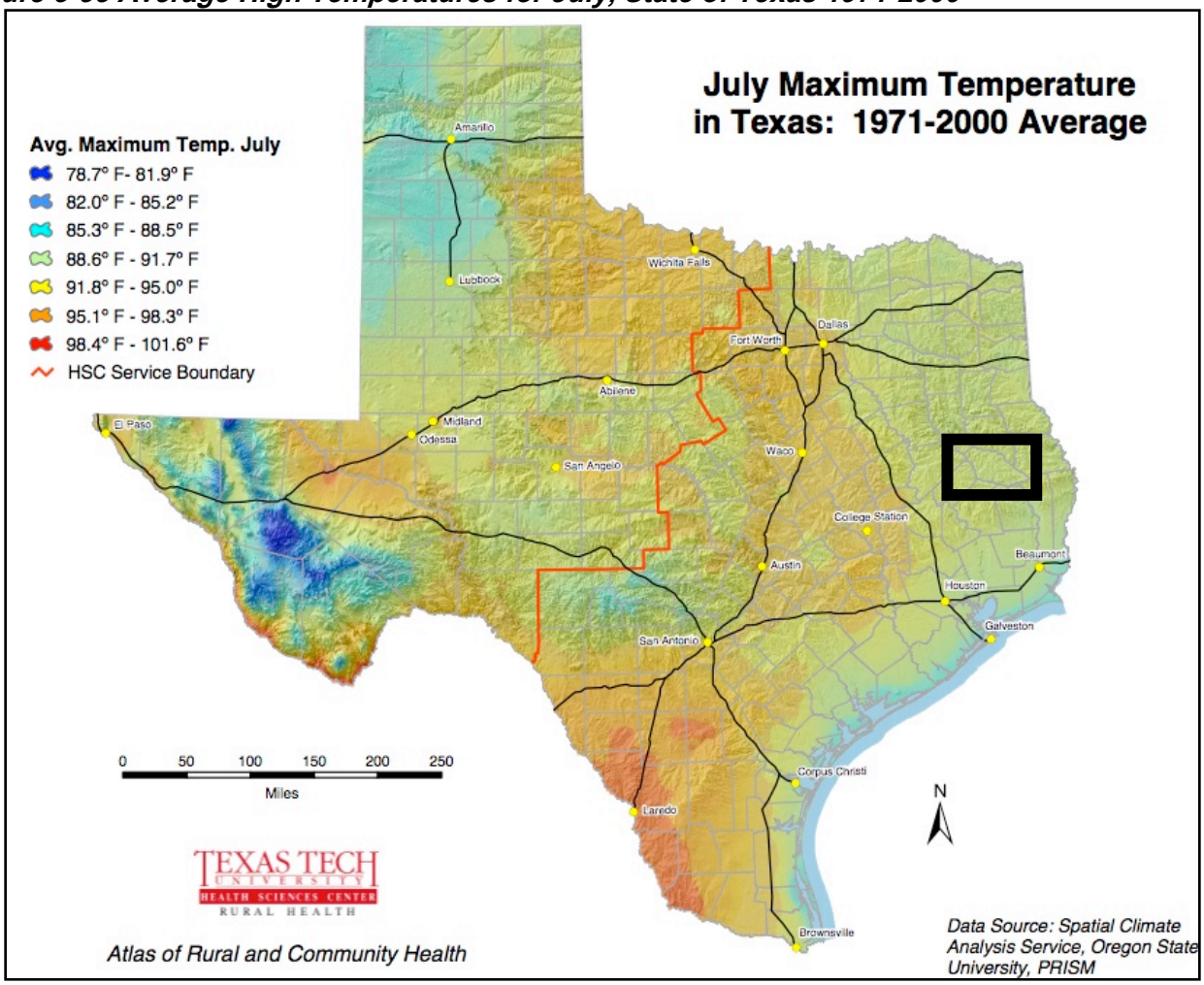
Air-conditioning is the number one protective factor against heat-related illness and death. If a home is not air-conditioned, people can reduce their risk for heat-related illness by spending time in public facilities or private facilities that are air-conditioned. Suggestions for preventing a heat-related illness include frequently drinking water or non-alcoholic fluids; wearing lightweight, light-colored, loose-fitting clothing; reducing or eliminating strenuous activities or doing them during cooler parts of the day. Periodically checking on neighbors who do not have air conditioning is also recommended.

Geographic Location

The eastern third of the State of Texas is classified climatologically as subtropical humid, as is most noted for warm summers. The relatively wet climate is largely due to the influence of weather patterns driven by proximity to the Gulf of Mexico.

Angelina County and each participating city has roughly an equal propensity to extreme heat. The map below shows Angelina County in a zone of east Texas with an average high temperature for July ranging from 88.6° to 91.7° Fahrenheit for the period 1971 to 2000. During this period, the east Texas region was cooler on average that the strip running through central Texas from Laredo in the south to Wichita Falls in the north, though it was warmer than most portions of west Texas.

Figure 3-35 Average High Temperatures for July, State of Texas 1971-2000



Source: Texas Tech Rural Health Sciences Center
Note: Black rectangle indicates location of Angelina County

Previous Occurrences

Climate data is available through the National Weather Service for the city of Lufkin since 1906. The average monthly high temperatures for the summer months are as follows: June 90.0° (F), July 93.5° (F), and August 93.6° (F).

As it pertains to extreme high temperatures, the following table illustrates the dates the maximum temperature was at or exceeded 105° (F) in Lufkin, Texas during the traditional summer months.

Table 3-42 Temperatures at or above 105° (F) in Lufkin Texas 1906-Present

Year	Max. Daily Temperature
1909, 2000	110° (F)
1909, 2000 (x3)	109° (F)
1917, 1934, 1935, 1962, 1998, 2000	108° (F)
1909, 1932 (x2), 1935, 1939, 1954, 1998 (x2)	107° (F)
1930, 1936, 1948, 1964, 2000	106° (F)
1909, 1914, 1917, 1918, 1925, 1932 (x3), 1933, 1934 (x4), 1943 (x2), 1948, 1951 (x2), 1962, 1998	105° (F)

Source: National Weather Service

The following four extreme heat events were recorded by the NCDC for Angelina County.

Figure 3-56 Notable Extreme Heat Events, Angelina County

June, 1998 – June continued where May left off. Excessive heat continued across northeast Texas making June the hottest since 1980.

July, 1998 – Northeast Texas saw much of the same heat in July as they did in June with record or near record heat. July was the hottest month for most of northeast Texas since 1980.

August 2010 – Excessive heat resulted in the death of a 61 year old person during the afternoon of August 2nd. This person died of heat stroke while outside. A large ridge of high pressure both at the surface and aloft allowed for excessively hot temperatures across northeast Texas through much of August. Daily afternoon temperatures often climbed above 100 degrees with heat index values climbing between 105 and 110 degrees in the afternoon.

August 2010 – The ambient temperature in the Lufkin, Texas area during the afternoon of August 24th was 103 degrees. An infant was left inside a vehicle a and was later found that afternoon deceased from the excessive heat inside the vehicle.

Source: National Climatic Data Center

Probability of Future Occurrence

Climate data is available through the National Weather Service for the city of Lufkin from the period 1906 to the present. In general, the summer months are consistently warm, with maximum temperatures at or above 90 degrees 89 days a year (Lufkin, Texas). The high heat coupled with the high summer time humidity associated with subtropical climates, makes for annual oppressive heat events resulting in a **High** probability of future occurrence classification according to the definitions set forth in Section 3.1.1 Methods and Definitions.

Magnitude/Severity/Extent

Since 2004 there have been three reported deaths due to heat in Angelina County. As an area known for high summer temperatures and humidity, significant health related impacts and/or economic impacts from extreme heat likely have been underreported. Extreme heat can be combated through the use of air conditioning. However, persistent heat also increases demand on energy infrastructure. Extreme heat also increases the risk of wildfire and typically compounds the effects of drought. Based on these assessments, magnitude and severity is classified as **Level 3-Critical.**

Extreme Heat Overall Vulnerability

Overall vulnerability to extreme heat is considered **Moderate Vulnerability**, based on subjective assessments of diminished productively and well being including the possibility of life threatening heat to vulnerable populations that may not have access to air conditioning, and the classifications defined in Section 3.1.1. Further assessments of vulnerability per community are located in Sections 3.3.1 – 3.3.7.

3.4.11 Expansive Soil

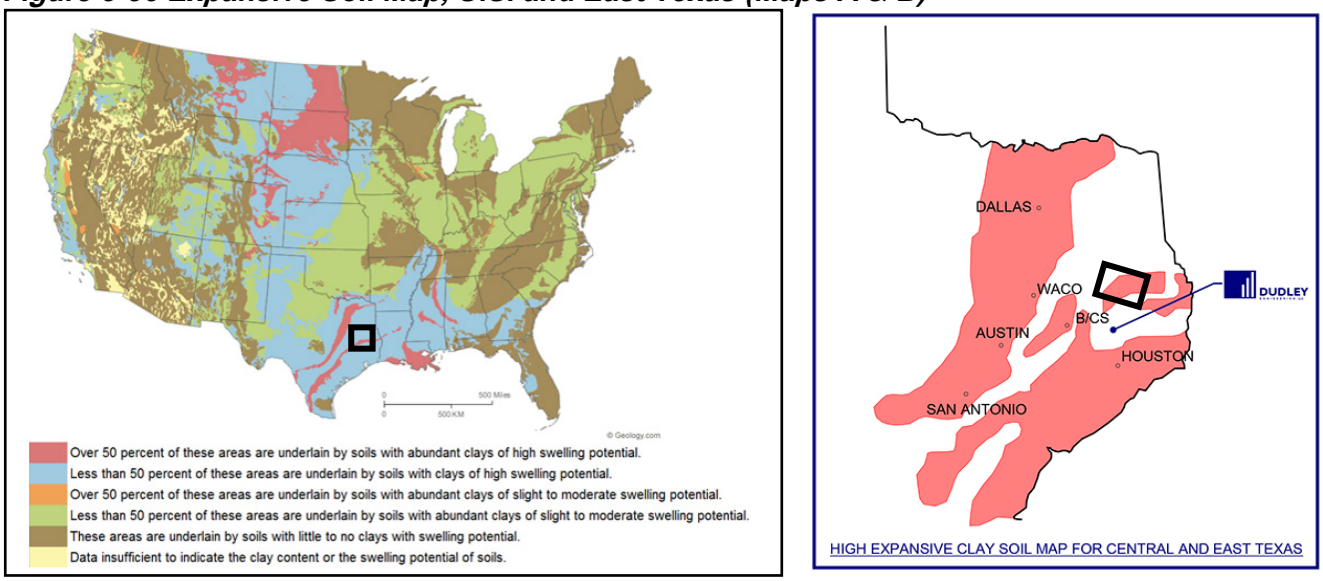
Hazard Description

Expansive soils are fine-grained clays that occur naturally and are generally found in areas that were historically floodplains or lake beds. These soil types are subject to swelling and shrinkage, varying in proportion to the amount of moisture present. Expansive soils are one of the nation's most prevalent causes of damage to buildings and construction. Annual losses are estimated in the range of $2 billion. The losses include severe structural damage, cracked driveways, sidewalks and basement floors, heaving of roads and highway structures, condemnation of buildings, and disruption of pipelines and sewer lines. The destructive forces may be upward, horizontal, or both.

Geographic Location

As shown in the maps below, a band stretching east-west across central Angelina County contains soil types with more than 50 percent of soils with clays and high swelling potential. Black rectangles indicate approximate location of Angelina County.

Figure 3-36 Expansive Soil Map, U.S. and East Texas (Maps A & B)



Sources: Map A: "Swelling Clays Map of the Conterminous United States" by W. Olive, A. Chleborad, C. Frahme, J. Shlocker, R. Schneider and R. Schuster. Map B: Greater Houston Builders Association, Dudley Engineering

Previous Occurrences/Impacts

Regarding expansive soils impacts, buckling pavement and cracked sidewalks and foundations are noted for certain newly developed subdivisions south of Lufkin.

Probability of Future Occurrence

There are no substantive data sets available for tracking probability of expansive soils in Angelina County or the cities. Based on the definitions for probability set forth in Section 3.1.1, and the ongoing/frequent nature of erosion and moderate presence of expansive soils in the region, probability of future occurrence for expansive soil is considered within a range of low to high depending on location.

Magnitude/Severity/Extent

Impacts of expansive soils in Angelina County are not well documented. Due to relatively isolated occurrence of impacts and no recorded occurrence of public health impacts, magnitude and severity is considered **Level 2- Limited.**

Regarding extent scale for expansive soils, according to research by T.S. Nagaraj and B.R. Srinivasa Murthy in their publication *Rational Approach to Predict Swelling Soil Behavior*, on the basis of the truncated double layer theory applicable to a partly saturated soil system, a phenomenological model was generated to define the swelling behavior of soils. Using experimental test data, a semiempirical model analogous to the phenomenological model was developed. The semiempirical model involving

(e0 /eL), p, Ps• and Per has been solved for the possible range of values of (e0 /eL) and p. The results have been represented in the form of (e0 /eL) versus log Ps plot for various values of p . The Ps value can be predicted using the foregoing plot for known values of (e0 /eL) and p. The validity of the approach has been substantiated in relation to the published data.

Figure 3-37 Expansive Soils Extent Scale

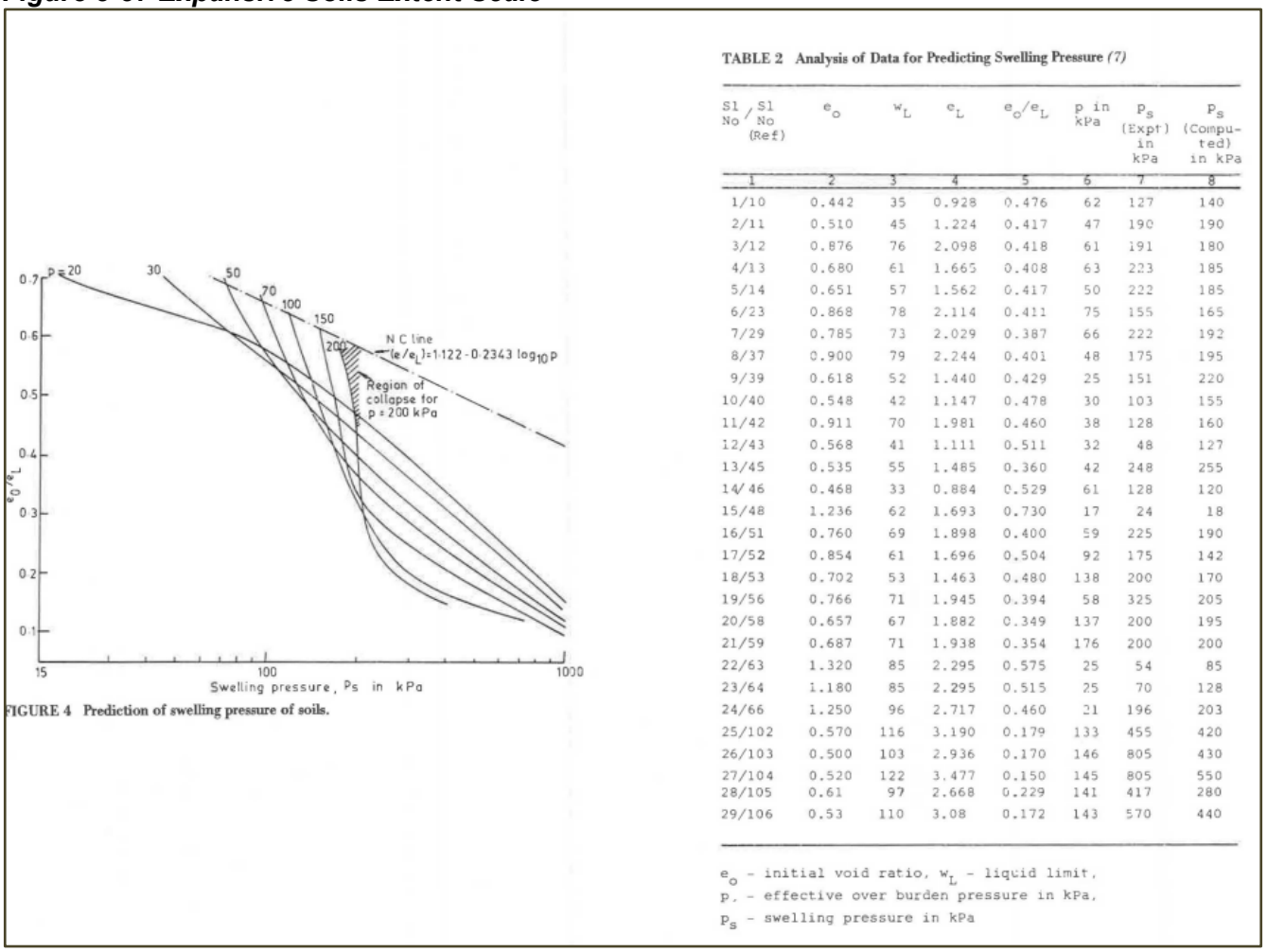


FIGURE 4 Prediction of swelling pressure of soils.

TABLE 2 Analysis of Data for Predicting Swelling Pressure *(7)*

Sl No / Sl No (Ref)	e_o	w_L	e_L	e_o/e_L	p in kPa	P_s (Expt) in kPa	P_s (Computed) in kPa
1	2	3	4	5	6	7	8
1/10	0.442	35	0.928	0.476	62	127	140
2/11	0.510	45	1.224	0.417	47	190	190
3/12	0.876	76	2.098	0.418	61	191	180
4/13	0.680	61	1.665	0.408	63	223	185
5/14	0.651	57	1.562	0.417	50	222	185
6/23	0.868	78	2.114	0.411	75	155	165
7/29	0.785	73	2.029	0.387	66	222	192
8/37	0.900	79	2.244	0.401	48	175	195
9/39	0.618	52	1.440	0.429	25	151	220
10/40	0.548	42	1.147	0.478	30	103	155
11/42	0.911	70	1.981	0.460	38	128	160
12/43	0.568	41	1.111	0.511	32	48	127
13/45	0.535	55	1.485	0.360	42	248	255
14/46	0.468	33	0.884	0.529	61	128	120
15/48	1.236	62	1.693	0.730	17	24	18
16/51	0.760	69	1.898	0.400	59	225	190
17/52	0.854	61	1.696	0.504	92	175	142
18/53	0.702	53	1.463	0.480	138	200	170
19/56	0.766	71	1.945	0.394	58	325	205
20/58	0.657	67	1.882	0.349	137	200	195
21/59	0.687	71	1.938	0.354	176	200	200
22/63	1.320	85	2.295	0.575	25	54	85
23/64	1.180	85	2.295	0.515	25	70	128
24/66	1.250	96	2.717	0.460	21	196	203
25/102	0.570	116	3.190	0.179	133	455	420
26/103	0.500	103	2.936	0.170	146	805	430
27/104	0.520	122	3.477	0.150	145	805	550
28/105	0.61	97	2.668	0.229	141	417	280
29/106	0.53	110	3.08	0.172	143	570	440

e_o - initial void ratio, w_L - liquid limit,
p_o - effective over burden pressure in kPa,
p_s - swelling pressure in kPa

Source: T.S. Nagaraj and B.R. Srinivasa Murthy, *Rational Approach to Predict Swelling Soil Behavior*

Expansive Soil Overall Vulnerability

Based on assessments of probability and the relative severity of impacts, overall vulnerability to expansive soil is considered **Low Vulnerability**, according to subjective assessments and the classifications defined in Section 3.1.1. Further assessments of vulnerability per community are located in Sections 3.3.1 – 3.3.7.

3.4.12 Erosion

Hazard Description

Erosion in east Texas is typically caused by water pressure dislodging and moving earth and sediment. This can occur in stream and river channels caused by water velocity or also on lakeshores caused by wave action. In other regions of the U.S., wind is an additional source of erosion. The U.S. Geological Survey (USGS) and USDA Natural Resource Conservation Service (NRCS) serve as the primary data sources for documenting erosion.

Geographic Location

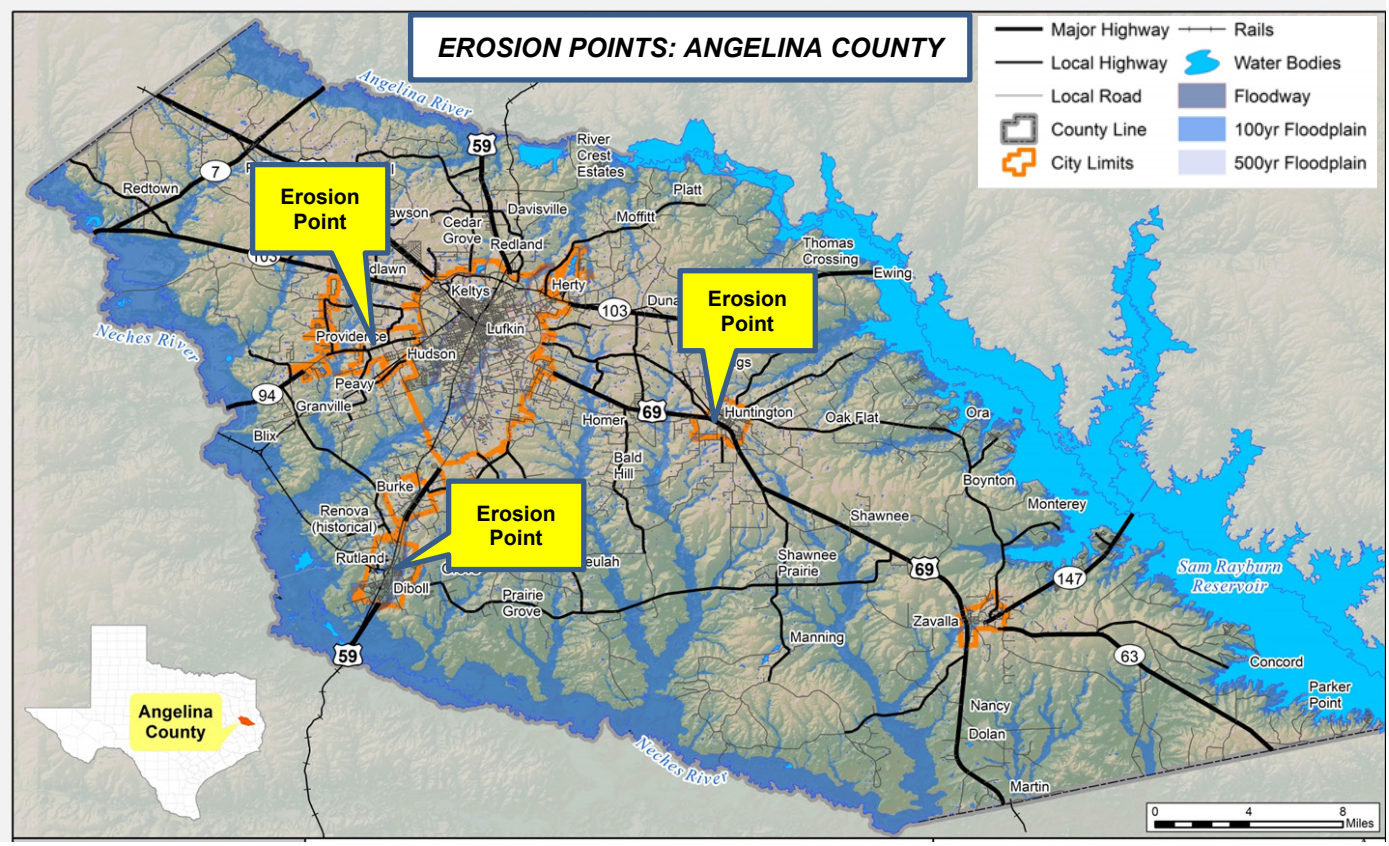
Occurrence of riverine and lake erosion in the planning area are generally concentrated in floodplains along steep banks of rivers, lakes, and creeks. Notably, the Cities of Diboll, Hudson and Huntington have documented erosion occurrences along creeks and drainage channels running through the city. The City of Hudson has documented erosion occurrences along Jack Creek where it flows under Highway 94. (31.324232 -94.813054) as shown in the aerial map below. Also see maps FEMA Defined Flood Zones, and City of Diboll Flood Zones and Structures in flood profile for more information and approximate locations of areas vulnerable to erosion.

Figure 3.36C Erosion Location: Jack Creek / Highway 94 (Ted Trout Dr.) Crossing

Source: HMT, Google Earth

Figure 3.36D Erosion Location: Lumberjack Drive / Diboll (0.32 miles East of Hwy 59)

Source: HMT, Google Earth



Source: HMT (points), FEMA (SFHA)

Previous Occurrences/Impacts

Riverine erosion occurs on an ongoing basis and is accelerated during flooding events and periods of rapid drop in water surface levels of rivers.

In the City of Diboll, a waterway running along Sewer Street has documented occurrences of erosion. The bank has receded approximately six inches during every major flood over the last ten years. As a result of this erosion, the creek increased in width leaving a sewer line passing over the creek channel unsupported and requiring relocation. At the current rate of erosion, the sewer line will have to be moved again in six years.

Streambed erosion has also occurred along Shawnee Creek where it enters the city limits and is threatening to undercut Louisiana Street. Each major flood brings the streambank six to eight inches closer to the street. At the current rate of erosion, the bank will undercut the street with the occurrence of five to seven more floods.

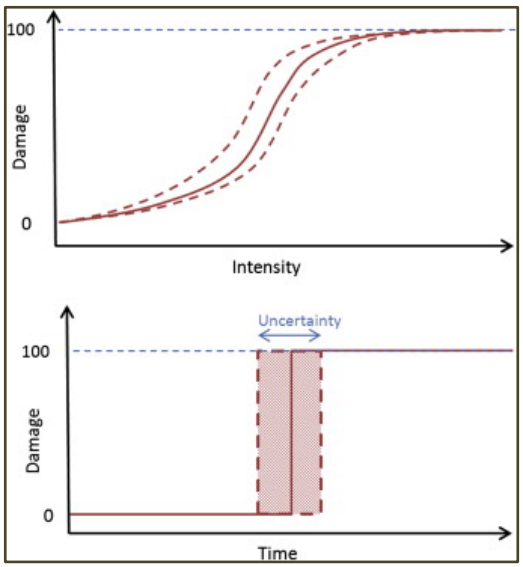
Two areas in the Angelina National Forest (southern portion of county) were being monitored as of 2008 by the NRCS for severe road and trail erosion: an area east of Graham Creek and an area west of Cypress Creek. Lakeside erosion is known to occur in areas bordering Sam Rayburn Reservoir.

Probability of Future Occurrence

There are no substantive data sets for tracking probability of erosion in planning area. Based on limited information and definitions for probability set forth in Section 3.1.1, and the ongoing/frequent nature of erosion, probability of future occurrence for erosion is considered **High** for the Cities of Diboll, Hudson, and Huntington, and **Low** for Angelina County, Lufkin, and Zavalla.

Magnitude/Severity/Extent

The following standardized magnitude scale for erosion was developed in 2014 in journal article *Assessment of Vulnerability to Natural Hazards* (Tedim, Rohmer, et al).



Source: Dr. Fantina Tedim, Dr. Jeremy Rohmer, Assessment of Vulnerability to Natural Hazards, 2014

Impacts of erosion in Angelina County have not been well documented. Due to relatively isolated occurrence of impacts and no recorded occurrence of public health impacts, magnitude and severity is considered **Level 2- Limited.** At its most extreme, streambank caving and erosion could exceed 3-6 feet in a single occurrence.

Erosion Overall Vulnerability

Based on assessments of probability and the relative severity of impacts, overall vulnerability to erosion is considered **Low Vulnerability** for the planning area overall, and **High Vulnerability** for Cities of Diboll, Hudson, and Huntington, according to subjective assessments and the classifications defined in Section 3.1.1.

CHAPTER 4. MITIGATION STRATEGY

44 CFR Requirement 201.6(c) (3):
The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

The mitigation strategy creates a planning framework to reduce the impact of future hazard events. The structure of this mitigation strategy is intentionally straightforward:

- Establish a set of agreed upon goals .
- Identify problems.
- Identify and implement feasible activities that support the goals and solve identified problems.

This chapter begins by defining the goals established early in the planning process, outlined in ***Section 4.1 (Local Hazard Mitigation Goals)***.

Section 4.2 (Action Item Identification and Prioritization) describes the process through which mitigation actions were decided upon and ranked by relative priority.

Section 4.3 (Mitigation Action Items) lists mitigation activities to be pursued by the County and the participating jurisdictions in congruence. This section is organized in 2 parts, Subsection 4.3.1 lists action items pertaining to a single jurisdiction, Subsection 4.3.2 lists action items pertaining to multiple jurisdictions.

Section 4.4 (Continued National Flood Insurance Program Participation) details the current and future commitment to participation in the NFIP.

Section 4.5 (Incorporating Mitigation Strategy into Existing and Future Planning Mechanisms) Outlines process and opportunities for incorporating this plan's mitigation strategy into existing or future planning mechanisms.

4.1 LOCAL HAZARD MITIGATION GOALS

44 CFR Requirement §201.6(c) (3) (i): *[The hazard mitigation strategy **shall** include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.*

The overarching goal of the Angelina County Hazard Mitigation Action Plan is to promote sound public policy designed to protect the health, safety and welfare of County residents and community assets.

These goals are in close correspondence with the goals of the State of Texas Hazard Mitigation Plan (2009), listed below in Figure 4-1 and 4-2.

Figure 4-1 Goals from the State of Texas Hazard Mitigation Plan (2013)

- Reduce or eliminate hazardous conditions that cause loss of life
- Reduce or eliminate hazardous conditions that inflict injuries
- Reduce or eliminate hazardous conditions that cause property damage
- Reduce or eliminate hazardous conditions that degrade important natural resources

During the planning process, the HMT had an opportunity to re-evaluate the goals from the 2011 Plan. Upon review the team determined the goals from the 2011 Mitigation Action Plan were still appropriate and did not change them.

Figure 4-2 Goals of the Angelina County Multi-Jurisdiction Hazard Mitigation Plan (2018)

1) Reduce or eliminate vulnerability to natural hazards that cause loss of life;
2) Reduce or eliminate vulnerability to natural hazards that cause injury;
3) Reduce or eliminate vulnerability to natural hazards that cause property damage;
4) Reduce or eliminate vulnerability to natural hazards that cause the degradation of natural resources
5) Reduce or eliminate potential damage to critical facilities and infrastructure.

Pursuant to the above stated goals, the Hazard Mitigation Team developed mitigation action items (measurable activities targeted at mitigating disaster events) for each hazard assigned a 'Moderate' or 'High' overall vulnerability ranking. Mitigation action items, implementation strategies, and methods for identification and prioritization are described in the following sections.

4.2 ACTION ITEM IDENTIFICATION AND PRIORITIZATION

44 CFR Requirement §201.6(c) (3) (ii)
The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

This Hazard Mitigation Action Plan provides a list of proposed mitigation actions that will assist the County to reduce potential losses. The remainder of this chapter describes the mitigation strategy developed by the HMT to implement action items in support of the above stated goals. It is expected that with sound and thorough implementation of these action items, significant reductions in future losses to county residents and assets will result.

4.2.1 Action Item Prioritization Criteria and Process

Prioritization Process

In general, the Hazard Mitigation Team emphasized the cost effectiveness, technical feasibility, and environmental soundness of each action item to determine its relative priority. More specifically, the HMT considered the predicted social impacts of mitigation project implementation, its technical feasibility, administrative barriers, political or legal considerations, economic impacts, and environmental soundness. These criteria, organized under the STAPLE-E acronym, are listed below, followed by the method for benefit-cost review:

STAPLE-E Criteria

- **S**ocial Effects
- **T**echnical Feasibility
- **A**dministrative Barriers/Considerations
- **P**olitical Considerations
- **L**egal Ramifications
- **E**conomic Impacts
- **E**nvironmental Soundness

Cost-Effectiveness/Benefit-Cost Ratio

An overall evaluation of an action item's expected benefits versus costs was also considered during action item identification and prioritization.

Items with estimated benefits that outweighed expected costs (>1:1 BCR) were generally given favorable consideration over those action items with negative benefit-cost ratios (<1:1 BCR).

Prioritization Process

Generally, the participating jurisdictions prioritized actions based on the number of people affected by a given impact. Most of the chosen actions address specific hazard impacts/damages that have occurred or have the potential to occur. The hazard impacts that touched the most people were given a higher priority. In some cases, the additional factor of resource availability was combined with the number of people impacted. The thought process being that actions for which the capability and most of the resources are already on hand within the jurisdiction will by default be executed sooner.

At the 4th meeting of the HMT a worksheet (shown on following page) was distributed to each attendee. The purpose was to prioritize mitigation actions in a quantifiable way, while also allowing for new ideas to emerge. The worksheet results were aggregated and informed the prioritized action items for each participating jurisdiction which are listed in Section 4.3.

ANGELINA COUNTY HAZARD MITIGATION ACTION PLAN UPDATE (2017-2022)

Instructions: Please score the following list of project types based on your opinion of relative priority. For example, a Low Priority project would score a "1", a Medium Priority project would score a "5", and a High Priority project would score a "10".

If you have specific ideas for a project location or examples of where it is needed, note it on the right side.

If you have other ideas for hazard mitigation projects list them at the bottom.

Return completed forms to: Mitch Osburn, CFM // MPTX Associates // mitchell.osburn@mptx-inc.com // or Ricky Conner, Angelina County EMC, emcpolk@livingston.net, 936-327-6826

County/City Buildings & Facilities	Priority Score (circle one)										Specific Ideas, Examples
Safe Rooms (tornado, hurricane, etc.)	1	2	3	4	5	6	7	8	9	10	
Window Protection	1	2	3	4	5	6	7	8	9	10	
Roof upgrades	1	2	3	4	5	6	7	8	9	10	
Door upgrades (including roll-up doors)	1	2	3	4	5	6	7	8	9	10	
Generators	1	2	3	4	5	6	7	8	9	10	
Underground utilities	1	2	3	4	5	6	7	8	9	10	
Ignition resistant materials	1	2	3	4	5	6	7	8	9	10	
Roads	**Priority Score (circle one)**										**Specific Ideas, Examples**
Elevate low road sections	1	2	3	4	5	6	7	8	9	10	
Culvert install or upgrade	1	2	3	4	5	6	7	8	9	10	
Bridge install or upgrade	1	2	3	4	5	6	7	8	9	10	
Drainage	**Priority Score (circle one)**										**Specific Ideas, Examples**
Enlarge drainage channels	1	2	3	4	5	6	7	8	9	10	
Headwall reinforcement	1	2	3	4	5	6	7	8	9	10	
Install stormwater retention ponds	1	2	3	4	5	6	7	8	9	10	
Residential Homes	**Priority Score (circle one)**										**Specific Ideas, Examples**
Acquire flood prone properties	1	2	3	4	5	6	7	8	9	10	
Elevate flood prone structures	1	2	3	4	5	6	7	8	9	10	
Wildfire fuels removal near homes	1	2	3	4	5	6	7	8	9	10	
Safe room rebates for homeowners	1	2	3	4	5	6	7	8	9	10	
General	**Priority Score (circle one)**										**Specific Ideas, Examples**
Storm warning sirens	1	2	3	4	5	6	7	8	9	10	
Controlled burns to reduce wildfire fuels	1	2	3	4	5	6	7	8	9	10	
Burn ban notice and enforcement	1	2	3	4	5	6	7	8	9	10	
Public education	1	2	3	4	5	6	7	8	9	10	
Other Hazard Mitigation Project Ideas	**Priority Score (circle one)**										**Specific Ideas, Examples**
	1	2	3	4	5	6	7	8	9	10	
	1	2	3	4	5	6	7	8	9	10	
	1	2	3	4	5	6	7	8	9	10	

Contact Information (voluntary)	
Name	
Agency/Title/Affiliation	
Phone	
Email	

4.3 MITIGATION ACTION ITEMS

Taking into account past hazard occurrences and damages and the vulnerability of identified assets, the participants identified actions to reduce future damage and risk associated with the hazards that pose the biggest threat to the individual jurisdictions.

The outline for each action item includes the following information:

- Hazard(s) addressed — hazard types mitigated by project
- Priority ranking —
- Estimated cost — estimated expense to carry an action item through to completion
- Implementation schedule — estimated period to complete action item
- Responsible agency — departments and agencies involved in action item implementation
- Coordinating Agencies --
- Potential funding sources — Potential grant funding sources. Hazard Mitigation Grant Program (HMGP); Repetitive Flood Claims Program (RFC); Severe Repetitive Loss Program (SRL); Pre-Disaster Mitigation Program (PDM); Flood Mitigation Assistance Program (FMA); Cooperating Technical Partners Grant Program (CTPGP); Emergency Performance Management Grant Program (EPMG)

Order of appearance of actions implies but does not specifically designate relative importance. The following matrices summarize action items per hazard addressed and relevant jurisdiction.

Table 4-1 Matrix of Action Items by <u>Hazards Addressed</u>

Action Item #	Flood	Tornado	Hurricane	Wildfire	Lightning	Winter Storm	Drought	Earthquake	Dam Failure	Extreme Heat	Expansive Soil	Erosion
1	X								X			
2	X								X			
3				X								
4	X											
5				X								
6		X	X									
7	X											
8												X
9												X
10											X	
11											X	
12				X								
13												X
14												X
15	X											
16				X								
17												X
18												X
19		X	X									
20	X											
21				X								
22		X	X			X						
23		X	X		X							
24		X	X		X	X						
25				X								
26	X											
27	X											
28				X								
29	X	X	X	X	X	X	X	X		X	X	X
30							X		X			
31		X	X									
32		X	X	X								
33					X							
34					X							
35		X	X			X						
36	X	X	X	X		X						
37							X					
38							X					
39										X		
40								X				
41								X				

Table 4-1 Matrix of Action Items by <u>Jurisdiction</u>

Action Item Number	Angelina County	Burke	Diboll	Hudson	Huntington	Lufkin	Zavalla
1	X						
2	X	X	X	X	X	X	X
3	X						
4	X	X	X	X	X	X	X
5		X					
6		X					
7			X				
8			X				
9	X	X	X	X	X	X	X
10			X				
11			X				
12				X			
13				X			
14				X			
15					X		
16					X		
17					X		
18					X		
19					X		
20						X	
21						X	
22						X	
23						X	
24	X	X	X	X	X	X	X
25							X
26	X			X		X	X
27	X	X	X	X	X	X	X
28	X	X	X	X	X	X	X
29	X	X	X	X	X	X	X
30	X	X	X	X	X	X	X
31	X	X	X	X	X	X	X
32	X	X	X	X	X	X	X
33	X	X	X	X	X	X	X
34	X	X	X	X	X	X	X
35	X	X	X	X	X	X	X
36	X	X	X	X	X	X	X
37	X	X	X	X	X	X	X
38	X	X	X	X	X	X	X
39	X	X	X	X	X	X	X
40	X	X	X	X	X	X	X
41	X	X	X	X	X	X	X

Source: Angelina County Hazard Mitigation Committee

4.3.1 Mitigation Action Items

Action 1: Replace bridges over Willie Nerron Road and Gillan Creek.

Hazards Addressed	Flood, Dam Failure
Estimated Cost:	$350,000 – $600,000
Project timeline	18 months
Responsible Department	Precinct 3
Coordinating Agency	County Commissioners
Potential Funding Sources	HMGP, PDM, FMA, CDBG, budget
Jurisdiction	Angelina County

Action 2: Elevate structures susceptible to flooding.

Hazards Addressed	Flood, Dam Failure
Estimated Cost:	$500,000 – $600,000
Project timeline	72 months
Responsible Department	EMC
Coordinating Agency	County Commissioners
Potential Funding Sources	HMGP, PDM, FMA, CDBG, budget
Jurisdiction	Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla, Angelina County

Action 3: Create defensible space around precinct barns.

Hazards Addressed	Wildfire
Estimated Cost:	$500,000--$600,000
Project timeline	36 months
Responsible Department	County Emergency Manager
Coordinating Agency	Texas A&M Forest Service, Local VFD
Potential Funding Sources	HMGP, PDM, budget
Jurisdiction	Angelina County

Action 4: Increase the capacity of drainage ditches along city streets and county roads.

Hazards Addressed	Flood
Estimated Cost:	$500,000 – $600,000
Project timeline	1 month
Responsible Department	ISD
Coordinating Agency	Public Works, City Council, City Administrator, land owner
Potential Funding Sources	HMGP, PDM, FMA, CDBG, budget
Jurisdiction	Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla, Angelina County

Action 5: Create defensible space around homes on Stinger Road**.**

Hazards Addressed	Wildfire
Estimated Cost:	$150,000 – $200,000
Project timeline	1 month
Responsible Department	City Administrator
Coordinating Agency	Texas A&M Forest Service, Public Works, Housing Authority
Potential Funding Sources	HMGP, PDM, CDBG, budget
Jurisdiction	Burke

Action 6: Adopt building code with more stringent requirements for wind resistant building techniques**.**

Hazards Addressed	Hurricane, Tornado
Estimated Cost:	$5,000
Project timeline	6 months
Responsible Department	City Administrator
Coordinating Agency	Public Works, City Council
Potential Funding Sources	HMGP, PDM, budget
Jurisdiction	Burke

Action 7: Elevate bridge over White Oak Creek on Hall St going into the park.

Hazards Addressed	Flood
Estimated Cost:	$400,000
Project timeline	6 months
Responsible Department	City Administrator
Coordinating Agency	Public Works, City Council
Potential Funding Sources	HMGP, PDM, FMA, budget
Jurisdiction	Diboll

Action 8: Stream bed restoration project along Sewer Street.

Hazards Addressed	Erosion
Estimated Cost:	$500,000
Project timeline	1 month
Responsible Department	City Administrator
Coordinating Agency	Public Works, City Council
Potential Funding Sources	NRCS-EWP, HMGP, PDM, FMA, budget,
Jurisdiction	Diboll

Action 9: Update building code and subdivision ordinance to include restrictions on the distance a structure can be built from active streams and creeks.

Hazards Addressed	Erosion
Estimated Cost:	$5,000
Project timeline	24 months
Responsible Department	City Administrator
Coordinating Agency	Public Works, City Council
Potential Funding Sources	NRCS-EWP, HMGP, PDM, FMA, budget,
Jurisdiction	Angelina Co, Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla

Action 10: Update building code to require new construction foundations to be built using proven techniques to prevent cracking due to expansive soils.

Hazards Addressed	Expansive Soils
Estimated Cost:	$5,000
Project timeline	36 months
Responsible Department	City Administrator
Coordinating Agency	Public Works, City Council
Potential Funding Sources	HMGP, PDM, FMA, budget,
Jurisdiction	Angelina Co, Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla

Action 11: Educate home owners and builders on the locations of expansive soils and mitigation measures that can be taken to prevent structural damage including subgrade irrigation systems and calcium soil stabilizers.

Hazards Addressed	Expansive Soils
Estimated Cost:	$5,000
Project timeline	72 months
Responsible Department	City Administrator
Coordinating Agency	Public Works, City Council, Public Information Office
Potential Funding Sources	HMGP, budget,
Jurisdiction	Angelina Co, Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla

Action 12: Defensible space projects around homes on Hwy 54 off of Peavy Switch Road and mobile home park on Green Acres Drive.

Hazards Addressed	Wildfire
Estimated Cost:	$250,000 – $300,000
Project timeline	10 months
Responsible Department	City Administrator
Coordinating Agency	Texas A&M Forest Service, Public Works, City Council
Potential Funding Sources	HMGP, PDM, budget
Jurisdiction	Hudson

Action 13: Streambed restoration project for Jack Creek along HWY 94 where it has eroded away causing sewer line to be moved.

Hazards Addressed	Erosion
Estimated Cost:	$500,000
Project timeline	18 months
Responsible Department	City Administrator
Coordinating Agency	Public Works, City Council
Potential Funding Sources	NRCS-EWP, HMGP, PDM, budget
Jurisdiction	Hudson

Action 14: Identity key locations and educate the property owners on suggested techniques to mitigate streambed erosion on privately owned property.

Hazards Addressed	Erosion
Estimated Cost:	$25,000
Project timeline	12 months
Responsible Department	City Administrator, County Commissioners
Coordinating Agency	Public Works, City Council, Public Information Office
Potential Funding Sources	NRCS-EWP, HMGP, budget
Jurisdiction	Angelina Co, Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla

Action 15: Raise bridges on Gibsonville St. and Porterville Road to increase clearance above creek.

Hazards Addressed	Flood
Estimated Cost:	$2,500,000
Project timeline	36 months
Responsible Department	City Administrator
Coordinating Agency	Public Works, City Council
Potential Funding Sources	HMGP, PDM, FMA, CDBG, budget
Jurisdiction	Huntington

Action 16: Defensible space project around timber plantation south of Huntington Loop**.**

Hazards Addressed	Wildfire
Estimated Cost:	$50,000 – $60,000
Project timeline	1 month
Responsible Department	City Administrator
Coordinating Agency	Texas A&M Forest Service, Public Works, City Council
Potential Funding Sources	HMGP, PDM, budget
Jurisdiction	Huntington

Action 17: Stabilize Shawnee creek bank to prevent under cutting Louisiana Street

Hazards Addressed	Erosion
Estimated Cost:	$500,000
Project timeline	1 month
Responsible Department	City Administrator
Coordinating Agency	Public Works, City Council
Potential Funding Sources	NRCS-EWP, HMGP, PDM, FMA, budget,
Jurisdiction	Huntington

Action 18: Construct concrete canal for Shawnee Creek from Louisiana Street to 6th Street.

Hazards Addressed	Erosion
Estimated Cost:	$1,500,000
Project timeline	24 months
Responsible Department	City Administrator
Coordinating Agency	Public Works, City Council
Potential Funding Sources	NRCS-EWP, HMGP, PDM, FMA, budget,
Jurisdiction	Huntington

Action 19: Update city building code to require more stringent requirements for mobile home tie down and anchoring. (old action #9)

Hazards Addressed	Hurricane, Tornado
Estimated Cost:	$5,000
Project timeline	1 month
Responsible Department	City Administrator
Coordinating Agency	Public Works, City Council
Potential Funding Sources	HMGP, PDM, budget
Jurisdiction	Huntington

Action 20: Construct retention pond behind Inez Timms property**.** Increase holding capacity of existing retention ponds throughout the city.

Hazards Addressed	Flood, Hurricane
Estimated Cost:	$300,000 – $400,000
Project timeline	24 months
Responsible Department	Mayor
Coordinating Agency	Public Works, City Council
Potential Funding Sources	HMGP, PDM, FMA, CDBG, budget
Jurisdiction	Lufkin

Action 21: Defensible space projects around homes near intersection of HWY 157 & Leslie Lane.

Hazards Addressed	Wildfire
Estimated Cost:	$50,000 – $60,000
Project timeline	1 month
Responsible Department	Mayor
Coordinating Agency	Texas A&M Forest Service, Public Works, City Council,
Potential Funding Sources	HMGP, PDM, budget
Jurisdiction	Lufkin

Action 22: Install frangible links (break away line power line connections) on electrical and telephone poles where appropriate.

Hazards Addressed	Hurricane, Tornado, Winter Storm
Estimated Cost	$1,000,000
Project timeline	36 months
Responsible Department	City Manager
Coordinating Agencies	City Council, local energy companies
Potential Funding Sources	PDM, HMGP, CDBG, budget
Jurisdiction	Lufkin

Action 23: Construct safe rooms in critical public facilities**.**

Hazards Addressed	Tornado, Hurricane, Lightning
Estimated Cost	$500,000
Project timeline	36 months
Responsible Department	Mayor
Coordinating Agency	Public Works, City Council
Potential Funding Sources	HMGP, PDM, budget
Jurisdiction	Angelina Co, Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla

Action 24: Install underground electrical & communication lines for future critical facilities & subdivisions.

Hazards Addressed	Hurricane, Tornado, Winter Storm, Lightning
Estimated Cost:	$1,500,000
Project timeline	24 months
Responsible Department	Mayor
Coordinating Agency	Public Works, City Council
Potential Funding Sources	HMGP, PDM, budget
Jurisdiction	Angelina Co, Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla

Action 25: Defensible space projects around homes on Hwy 54 off of Peavy Switch Road and mobile home park on Green Acres Drive.

Hazards Addressed	Wildfire
Estimated Cost:	$250,000 – $300,000
Project timeline	10 months
Responsible Department	City Administrator
Coordinating Agency	Texas A&M Forest Service, Public Works, City Council
Potential Funding Sources	HMGP, PDM, budget
Jurisdiction	Zavalla

Action 26: Acquire repetitive loss properties.

Hazards Addressed	Flood
Estimated Cost:	$500,000 – $2,000,000
Project timeline	72 months
Responsible Department	EMC
Coordinating Agency	County Commissioners, City Floodplain Offices
Potential Funding Sources	HMGP, PDM, FMA, CDBG, budget
Jurisdictions	Angelina Co, Hudson, Lufkin, Zavalla

Action 27: Enlarge culverts where water overtops the road or washes culverts out. Specific locations include but are not limited to: Diboll – X2 under Mockingbird Lane; Hudson – Lance Wood Circle Creek; Huntington – Gibsonville St.; Zavalla – Carpenter Road. New installation.

Hazards Addressed	Flood
Estimated Cost:	$50,000 – $60,000
Project timeline	1 month
Responsible Department	City Administrator
Coordinating Agency	Public Works, City Council
Potential Funding Sources	HMGP, PDM, FMA, CDBG, budget
Jurisdictions	Angelina Co, Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla

Action 28: Fuel reduction projects. Specific locations include but are not limited to: Angelina County – Wooded areas surrounding the hospital, nursing homes, and subdivisions in WUI. Burke – Wooded area between 2108 and Stringer Road. Diboll – WUI around city limits. Hudson – Wooded area north of Ted Trout between John Redditt and 1194. Surrounding subdivision north of Ted Trout off of Bethlehem Road. Huntington – WUI around city limits. Lufkin – Wooded area adjacent to Ellen Trout Zoo and water plant #1. Around Kit McConnico Park. Morris Frank Park. Grace Dunn Richardson Park. Kiwanis Park. Chambers Park. South of Loop 287. Zavalla – Between City Hall and Fire Station and behind Dollar General.

Hazards Addressed	Wildfire
Estimated Cost:	$250,000 – $300,000
Project timeline	1 month
Responsible Department	City Administrator/County EMC
Coordinating Agency	Public Works, Texas A&M Forest Service
Potential Funding Sources	HMGP, PDM, CDBG, budget
Jurisdictions	Angelina Co, Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla

Action 29: Publish educational materials to inform the public on methods of mitigating private property against natural hazard damage**.**

Hazards Addressed	Flood, Wildfire, Lightning, Hurricane, Tornado, Winter Storm, Extreme Heat, Drought, Earthquake, Expansive Soils
Estimated Cost:	$5,000
Project timeline	36 months
Responsible Department	City Administrator/County EMC
Coordinating Agency	Public Works, City Council/County commissioners, Public information office
Potential Funding Sources	HMGP, budget
Jurisdictions	Angelina Co, Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla

Action 30: Distribute publications regarding water saving techniques and dam failure.

Hazards Addressed	Drought, Dam Failure
Estimated Cost:	$5,000
Project timeline	36 months
Responsible Department	City Administrator/County EMC
Coordinating Agency	Public Works, Public information office
Potential Funding Sources	HMGP, budget
Jurisdictions	Angelina Co, Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla

Action 31: Retrofit windows, doors, and roof structures of public buildings to withstand intense wind impacts**.** Specific locations include but are not limited to: Angelina County – EOC, Courthouse windows, tax office roof, all precinct offices, and barns. Burke – EOC. Diboll – EOC, fire station/police station. Hudson – EOC.
Huntington – EOC. Lufkin – EOC.

Hazards Addressed	Hurricane, Tornado
Estimated Cost:	$150,000 – $300,000
Project timeline	1 month
Responsible Department	City Administrator
Coordinating Agency	Public Works, City Council
Potential Funding Sources	HMGP, PDM, budget
Jurisdictions	Angelina County, Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla

Action 32: Install warning siren system in strategic locations for wildfire, tornado, hurricane**.**

Hazards Addressed	Wildfire, Hurricane, Tornado
Estimated Cost:	$150,000 – $200,000
Project timeline	24 months
Responsible Department	City Administrator/County EMC
Coordinating Agency	Public Works, City Council/County commissioners
Potential Funding Sources	HMGP, CDBG, budget
Jurisdictions	Angelina Co, Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla

Action 33: Install lightning sensor systems for outdoor venues. Specific locations listed below. Specific coverage: Angelina County – Fairgrounds. Burke – Airport. Diboll – High School sports complex. Hudson – High School, Elementary and primary campus. Huntington – RV resorts. Lufkin – Lufkin High School, Brookhollow Elementary School, Morris Frank Park Sports Complex, Brandon Elementary, Dunbar Primary, Slack Elementary, Ecomet Burley Primary.
Zavalla – High School Sports complex.

Hazards Addressed	Lightning
Estimated Cost:	$150,000 – $200,000
Project timeline	2 months
Responsible Department	City Administrator/County EMC/ISDs
Coordinating Agency	Public Works, City Council/County commissioners
Potential Funding Sources	HMGP, budget
Jurisdictions	Angelina Co, Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla

Action 34: Install lightning rods and grounding systems. Specific locations include but are not limited to the following: Angelina County – Sheriff's office and courthouse. Burke – City hall. Diboll – Fire dispatch tower, water tower, pumps at treatment plant. Hudson – Water treatment plant and racetrack.

Huntington – Fire dispatch antenna and commo equipment. Lufkin – Police/Fire/EMS commo towers and equipment. Zavalla – City Hall.

Hazards Addressed	Lightning
Estimated Cost:	$50,000 – $60,000 per facility
Project timeline	6 months
Responsible Department	City Administrator
Coordinating Agency	Public Works, City Council, User Department
Potential Funding Sources	HMGP, PDM, budget
Jurisdictions	Angelina Co, Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla

Action 35: Establish & execute a program to remove limbs from trees that overhang power lines and public buildings**.**

Hazards Addressed	Hurricane, Tornado, Winter Storm
Estimated Cost:	$50,000-60,000
Project timeline	72 months
Responsible Department	City Administrator/County EMC
Coordinating Agency	Public Works, City Council/County commissioners, Tenant Dept.
Potential Funding Sources	HMGP, PDM, budget
Jurisdictions	Angelina Co, Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla

Action 36: Install generators for all City/County critical facilities**.**

Hazards Addressed	Flood, Wildfire, Hurricane, Tornado, Winter Storm
Estimated Cost:	$500,000
Project timeline	72 months
Responsible Department	City Administrator/County EMC
Coordinating Agency	Public Works, City Council/County commissioners, Tenant Dept.
Potential Funding Sources	HMGP, CDBG, budget
Jurisdictions	Angelina Co, Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla

Action 37: Install low flow water fixtures in all city/county facilities**.**

Hazards Addressed	Drought
Estimated Cost:	$200,000 – $250,000
Project timeline	1 month
Responsible Department	City Administrator/County EMC
Coordinating Agency	Public Works, City Council/County commissioners, Tenant Dept.
Potential Funding Sources	HMGP, PDM, CDBG, budget
Jurisdictions	Angelina Co, Diboll, Burke, Hudson, Huntington, Lufkin, Zavalla

Action 38: Adopt city policy to replace public landscaping with drought resistant plants**.**

Hazards Addressed	Drought
Estimated Cost:	$50,000-60,000
Project timeline	24 months
Responsible Department	City Administrator/County EMC
Coordinating Agency	Public Works, City Council/County commissioners, Tenant Dept.
Potential Funding Sources	HMGP, PDM, budget
Jurisdictions	Angelina Co, Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla

Action 39: Establish cooling centers in public facilities.

Hazards Addressed	Extreme Heat
Estimated Cost:	$10,000
Project timeline	6 months
Responsible Department	City Administrator/County EMC
Coordinating Agency	Public Works, City Council/County commissioners, Tenant Dept.
Potential Funding Sources	HMGP, PDM, budget
Jurisdictions	Angelina Co, Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla

Action 40: Secure furniture to walls in all public facilities where applicable.

Hazards Addressed	Earthquake
Estimated Cost:	5,000 per jurisdiction
Project timeline	1 month
Responsible Department	City Administrator/County EMC
Coordinating Agency	Public Works, City Council/County commissioners
Potential Funding Sources	HMGP, PDM, CDBG, budget
Jurisdictions	Angelina Co, Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla

Action 41: Adopt building code requirements for county/city buildings to ensure all future construction will withstand a 4.2 earthquake.

Hazards Addressed	Earthquake
Estimated Cost:	5,000 per jurisdiction
Project timeline	1 month
Responsible Department	City Administrator/County EMC
Coordinating Agency	Public Works, City Council/County commissioners
Potential Funding Sources	HMGP, PDM, CDBG, budget
Jurisdictions	Angelina Co, Burke, Diboll, Hudson, Huntington, Lufkin, Zavalla

4.4 CONTINUED NATIONAL FLOOD INSURANCE PROGRAM PARTICIPATION AND COMPLIANCE

CFR 44 Requirement: §201.6(c) (3) (ii):
[The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements, as appropriate.

The Hazard Mitigation Team considers continued participation in the NFIP as integral to future flood mitigation efforts. Angelina County and this plan's participating cities have a floodplain manager and are participants in good standing with the National Flood Insurance Program (NFIP), with the noted exception of the City of Burke. Larger cities such as Lufkin employ a city engineer who directs floodplain management activities and smaller cities direct floodplain management through either public works or building officials, supported on as needed basis by the county floodplain manager. Table 4-1 identifies the NFIP participation status for Angelina County and municipalities.

Table 4-1 Community NFIP Participation Status

Community	Initial FIRM	Current Effective Map Date	Status
Angelina County	07/01/98	09/29/10	Participating
City of Burke	09/29/10	09/29/10	Sanction date 9/29/11
City of Diboll	02/06/91	09/29/10	Participating
City of Hudson		09/29/10	Participating
City of Huntington	08/01/08	09/29/10	Participating
City of Lufkin	06/01/82	09/29/10	Participating
City of Zavalla		09/29/10	Participating

Source: FEMA National Flood Insurance Program as of 7/8/2011, FEMA Community Status Report Book

Each of the participating jurisdictions is committed to involvement in the National Flood Insurance Program (NFIP). As such, action items were drafted that supports and ensures the continued or initial participation in the NFIP for each jurisdiction that is party to this plan.

Projects implemented during the previous planning cycle that support NFIP participation include:

- flood prone property acquisition
- construction of stormwater detention and retention facilities
- adoption of updated D-FIRM maps in September 2010
- adoption of a countywide Green Infrastructure Plan, promoting a coordinated approach to mitigation, sustainability, and natural function of hydrologic and ecologic systems.

In the case of the community scheduled to be sanctioned in September 2011, steps have been taken to facilitate their consideration of NFIP participation, and city officials have stated an interest in taking the necessary steps to enter into participation and compliance with the NFIP. Section 1.3 (Coordination) of the Flood Insurance Study for Angelina County and Incorporated Areas dated September 29, 2010, notes the following as it relates to local coordination: "The initial Consultation Coordination Officer (CCO) meeting was held on May 18, 2007 and attended by representatives of FEMA, CF3R, community officials and other interested agencies and citizens. The results of the study were reviewed at the final CCO meeting held on February 23, 2009, and attended by representatives of FEMA, CF3R and community officials. All problems raised at that meeting have been addressed in this study."

4.5 INCORPORATING MITIGATION STRATEGY INTO EXISTING AND FUTURE PLANNING MECHANISMS

Requirement §201.6(c) (4) (ii): *[The plan **shall** include 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.*

4.5.1 Incorporating Mitigation Strategy - Overview

An integral element of the mitigation strategy is the incorporation of this plan's objectives into existing and future planning mechanisms and coordinating hazard mitigation goals and activities with existing departments and adjunct agencies. The following subsections highlight existing regulatory and administrative tools, and opportunities for integration of activities via improved coordination and information sharing.

In accordance with 44 CFR §201.6(c)(3), it is noted the plan shall include a mitigation strategy which provides a blueprint for reducing the potential losses, utilizing existing authorities, policies, programs, and resources, and the ability to expand on and improve these existing tools.

Pursuant to this concept, mitigation is most successful when it is codified and incorporated into the functions and priorities of government, planning and future development. Incorporating mitigation strategies into other planning documents is an effective way to leverage the support of affiliated agencies and departments while ensuring mutually supportive goals and policies.

Accordingly, the goals and mitigation strategies of this Hazard Mitigation Action Plan will be incorporated into other planning documents within the purview of participating jurisdictions as they are updated or are developed. Examples of local planning mechanisms are the County Emergency Operations Plan, the County Green Infrastructure Plan, The Lufkin Master Plan (1992), Subdivision Ordinances, Floodplain Ordinances, County Community Wildfire Protection Plan, and local zoning ordinances for Lufkin and Diboll. Other examples of such planning documents can be found in Section 4.5.2 (Existing Planning Mechanisms).

Significant progress during the last 5-year planning cycle was made implementing action items from the previous plan version. Examples include purchasing and implementing public notification system Blackboard Connect, and adding informational notes to Zoning Ordinance, Building Code & Subdivision Regulations. Additional progress notes on incorporation of the previous plan are found in Appendix C.

Development of future plans or update of existing plans will include a review of this Hazard Mitigation Action Plan for consideration and incorporation of pertinent elements. To ensure the incorporation of goals and actionable items of this plan, Hazard Mitigation Team members will be invited to sit on future plan development or existing plan update committees, and this Hazard Mitigation Plan will be cited as a technical reference and data source for these planning processes.

The process by which jurisdictions make additions and/or changes to existing planning mechanisms follows:

1. The recommended change is presented to the proponent or department responsible for the planning mechanism in question. If it is agreed that the change would be beneficial to the jurisdiction, the following will occur.
2. The proponent or responsible department will research and make the changes to the planning document following established internal procedures.
3. The draft document will then be presented to the County Commissioners or City Council as appropriate for review and approval. If required, Commissioners or Council will adopt by resolution the updated document.
4. Changes are made public and enforced as appropriate.

4.5.2 Planning Mechanism Inventory

The Hazard Mitigation Team is comprised of personnel with oversight into the development, update, and day-to-day implementation of these planning mechanisms, and will help to ensure the incorporation of this plan into updates of existing plans and ordinances and ones that are developed and adopted in the future. A detailed discussion of the process for incorporating this hazard mitigation plan into other planning mechanisms is presented in Section 4.5.1.

Table 4-2 lists planning mechanisms and regulatory tools applicable to the planning area.

Table 4-2 Planning Mechanism Checklist, Angelina County and Municipalities

Regulatory Tool (orders, ordinances, codes, plans)	Comments
Master Plan	No (most); Yes (Diboll, Lufkin)
Zoning Ordinance	No (most); Yes (Diboll, Huntington, Lufkin)
Subdivision Regulations	Yes: (cities) No: Burke
Floodplain Order/Ordinance	Yes: County. Cities follow County. CRS application underway for Lufkin
Transportation Plan	Yes: Lufkin, Huntington No: Burke
Other Orders/Ordinances	Yes: Burn Ban Order (county): Cities follow County
Building Code/Fire Code	No* (county) – Yes: (cities, IBC and IFC). Note: By statute, NFPA 101 (Life and Safety Code) applies to incorporated and unincorporated portions of the planning area.
Erosion or sediment control program	No:
Site plan review requirements	Yes (cities) No: Burke
Capital Improvements Plan	Yes: School Districts (ISDs), Huntington No: Burke, Huntington
Economic Development Plan	No:
Emergency Operations Plan (EOP)	Yes: County. School District also has EOP. Cities follow County
Other special plans	Community Wildfire Protection Plan (CWPP, county); Pandemic Plan and Implementation Protocols; Commodity Flow Study; Green Infrastructure Plan (county)
Flood Insurance Rate Map status	Yes: D-FIRM (county and cities, September 2010)
Flood Insurance Study (FIS)	Yes: Flood Insurance Study, (county and cites, September 2010)

Source: Hazard Mitigation Team, general sources

With regard to jurisdictional authority to regulate, the State of Texas Hazard Mitigation Plan states: "Texas does not give authority to counties for certain actions or enforcement activities such as zoning or building codes because there is no enabling legislation. Floodplain regulation is granted, as are certain fire measures."

With that noted, the following Texas Administrative Code excerpt outlines authority of the State Fire Marshal to regulate development for fire considerations, egress, and related general safety standards.

Excerpted from **Texas Administrative Code**
TITLE 28 : INSURANCE
PART 1 TEXAS DEPARTMENT OF INSURANCE
CHAPTER 34 STATE FIRE MARSHAL
SUBCHAPTER C STANDARDS FOR STATE FIRE MARSHAL INSPECTIONS
RULE §34.303 Adopted Standards

"The Commissioner adopts by reference: NFPA Life Safety Code 101-2009. These copyrighted standards and recommendations are adopted, except to the extent they are in conflict with sections of this chapter or any Texas statutes or federal law. The standards are published by and are available from the National Fire Protection Association, Quincy, Massachusetts."

Source Note:

The provisions of this §34.303 adopted to be effective February 27, 1996, 21 TexReg 1286; transferred effective September 1, 1997, as published in the Texas Register November 14, 1997, 22 TexReg 11091; amended to be effective July 19, 2000, 25 TexReg 6724; amended to be effective September 17, 2003, 28 TexReg 7994; amended to be effective October 5, 2006, 31 TexReg 8238; amended to be effective October 22, 2009, 34 TexReg 7204

Scope of NFPA Life Safety Code 101-2009:

1.1* Scope. 1.1.1 Title. NFPA 101, Life Safety Code, shall be known as the Life Safety Code®, is cited as such, and shall be referred to herein as “this Code” or “the Code.”

1.1.2 Danger to Life from Fire. The Code addresses those construction, protection, and occupancy features necessary to minimize danger to life from the effects of fire, including smoke, heat, and toxic gases created during a fire.

1.1.3 Egress Facilities. The Code establishes minimum criteria for the design of egress facilities so as to allow prompt escape of occupants from buildings or, where desirable, into safe areas within buildings.

1.1.4 Other Fire-Related Considerations. The Code addresses other considerations that are essential to life safety in recognition of the fact that life safety is more than a matter of egress. The Code also addresses protective features and systems, building services, operating features, maintenance activities, and other provisions in recognition of the fact that achieving an acceptable degree of life safety depends on additional safeguards to provide adequate egress time or protection for people exposed to fire.

1.1.5* Considerations Not Related to Fire. The Code also addresses other considerations that, while important in fire conditions, provide an ongoing benefit in other conditions of use, including non-fire emergencies.

1.1.6 Areas Not Addressed. The Code does not address the following: (1)*General fire prevention or building construction features that are normally a function of fire prevention codes and building codes.

The planning mechanisms were reviewed as part of this process to identify any information or processes could be incorporated into this plan update.

- The Flood Insurance Rate Maps and the Flood Insurance Study was used to validate digital floodplain data while developing the risk assessment for flooding for all jurisdictions in this plan.

- The Flood Damage Prevention Order was used as a crosswalk tool during flood mitigation strategy development. Specifically, when developing mitigation actions, the goals and objectives of the Flood Damage Prevention Order were referenced and held as the main focus of the actions in this plan.

4.5.3 Departments and Adjunct Agencies

Local Departments and Offices

Building Departments and Floodplain Offices: Local floodplain management offices and building departments in their day-to-day work administer activities supportive of hazard mitigation goals. For example, by guiding site locations for new or substantially improved construction, and enforcing building quality and design factors which improve life-safety and mitigate structural damage – these offices help produce mitigation results. In turn, this Hazard Mitigation Action Plan serves as technical reference, source for project ideas, and blueprint for future initiatives.

First Responders: Local law enforcement (city police and county sheriff), and fire services (volunteer and professional fire departments) often serve as a key source for first hand observation of hazard impacts. For example, initial reports of flooding, wind damage, and wildfire often originate as patrol reports to dispatch or fire department responses. This key information is useful in developing mitigation project ideas and benefit-cost analysis and thus helps guide mitigation project ideas and grant applications.

Public Health: The Angelina County & Cities Health District is a vital partner in life-safety aspects of hazard mitigation. This agency provides public education for disaster preparedness and maintains databases for vulnerable populations.

Infrastructure: City public works departments and county road and bridge often deal up close with disaster damage and are a vital source for damage data and mitigation ideas. This hazard mitigation plan can assist these departments by serving as a de facto 'wish-list' for future mitigation projects, and further provides eligibility for Hazard Mitigation Assistance funds.

Historical Commission: The Angelina Historical Commission serves the community by recognizing and helping maintain and protect cultural resources of Angelina County. They have developed an extensive database of structures and places with historic and/or architectural significance. This commission can serve as a useful data source for hazard mitigation planning and can support SHPO administrative elements of grant application processing. This hazard mitigation plan reciprocally can serve as a technical reference for past or future disaster events and help identify potential vulnerabilities.

Water Supply Agencies: Additionally, administrative scope of the Pineywoods Groundwater Conservation District and Angelina County Fresh Water Supply District No. 1 includes activities which support drought and land subsidence mitigation. In a reciprocal manner, data and analysis in this hazard mitigation plan can be used as a technical resource for these agencies, in addition to outlining existing or future water infrastructure and drought mitigation projects.

Public and Private Utilities: Electricity, internet/phone, and wastewater management are fundamental to our way of life and yet these services are vulnerable to natural disasters. Therefore, the information and ideas from these agencies significantly advances hazard mitigation planning, and this document can help these departments identify vulnerabilities and prioritize future projects.

State and Federal Agencies

The Texas A&M Forest Service (TFS), Angelina National Forest, U.S. Army Corps of Engineers (USACE), Texas Parks and Wildlife (TPW), Texas Department of Transportation (TxDOT), Texas Commission on Environmental Quality (TCEQ), and Texas Division of Emergency Management (TDEM) each maintain regional offices and operations in Angelina County. Their support for local hazard mitigation planning and data they provide is integral in the work of developing and maintaining this document.

Other Institutions Agencies

The involvement of commercial and private, non-profit agencies further strengthens the initiatives of this Angelina County Multi-Jurisdiction Hazard Mitigation Plan. Among the entities that contribute to the local planning process are the Red Cross, Southeast Texas Regional Advisory Council (SETRAC), et al.

4.5.4 Opportunities to Expand & Integrate

Opportunities to expand existing planning mechanisms can be seen where applicable in the comments section of the Previous Action Item Status charts found in Appendix C.

Improved accuracy of Flood Insurance Rate Maps (FIRMs) is identified as a key opportunity to advance flood mitigation.

A second measure to expand and integrate this plan into other documents is the process of updating Annex P, and the Basic Plan, of the Angelina County Emergency Operations Plan. This hazard mitigation plan will advise the risk assessment portions of Annex P and the Basic Plan.

A third opportunity to coordinate and integrate this plan into other planning documents is future updates of the County Flood Damage Prevention Order and City Floodplain Ordinances. Flood risk assessment details and other data will be helpful to guide those processes when they occur on a periodic basis.

A fourth opportunity to integrate this plan is in the consideration and adoption of City building codes as these exist or are developed in the future. Risk assessment factors outlined in this hazard mitigation plan will be helpful in supporting such efforts and updates.

APPENDICES

APPENDIX A. ADOPTION DOCUMENTS

NOTE: The following adoption instruments will be replaced with updated versions upon approval pending adoption by FEMA.

COPY

HAZARD MITIGATION ACTION PLAN

A COURT ORDER ADOPTING THE COUNTY OF ANGELINA HAZARD MITIGATION ACTION PLAN.

STATE OF TEXAS §

COUNTY OF ANGELINA §

WHEREAS, the County of Angelina has developed a Hazard Mitigation Action Plan to serve as a guiding document for local officials.

WHEREAS, the Hazard Mitigation Action Plan will be utilized by elected officials, county Staff, and Community Members to ensure continuity of future mitigation programs and policies.

NOW, THEREFORE BE IT ORDAINED by the Commissioners Court of the County of Angelina, Texas that the Hazard Mitigation Action Plan is hereby adopted.

PASSED AND APPROVED this the 25 day of September, 2012.

WES SUITER, COUNTY JUDGE
COUNTY OF ANGELINA

ATTEST:

JOANN CHASTAIN, COUNTY CLERK
ANGELINA COUNTY

Rhodes to Burke
1800 - 1966
Burke, Texas

City of Burke

Resolution 10-1-12

State of Texas §

City of Burke §

A RESOLUTION TO CONSIDER THE CITY OF BURKE'S HAZARD MITIGATION ACTION PLAN.

WHEREAS, the City of Burke, Texas has considered a Hazard Mitigation Action Plan to serve as a guiding document for local officials.

WHEREAS, the Hazard Mitigation Action Plan may be utilized by the officials, the City Staff, and the Community Members to ensure continuity of future mitigation programs and policies.

NOW, THEREFORE BE IT ORDAINED by the City Council of the City of Burke, Texas that the Hazard Mitigation Action Plan is not a tax participation and is hereby considered by resolution on these dates.

First Reading, this the 1st day of October, 2012

Second Reading, this the 3rd day of December, 2012

Bobby Glenn Ryan 10/1/12

Mayor, Burke Texas Angelina County

ATTEST:

Charlotte Morris 12/3/12

City Secretary

CITY OF DIBOLL

RESOLUTION 34-12

STATE OF TEXAS §

CITY OF DIBOLL §

A RESOLUTION ADOPTING THE CITY OF DIBOLL's HAZARD MITIGATION ACTION PLAN.

WHEREAS, the City of Diboll, Texas has developed a Hazard Mitigation Action Plan to serve as a guiding document for local officials.

WHEREAS, the Hazard Mitigation Action Plan will be utilized by the officials, the City Staff, and the Community Members to ensure continuity of future mitigation programs and policies.

NOW, THEREFORE BE IT ORDAINED by the City Council of the City of Diboll, Texas that the Hazard Mitigation Action Plan is hereby adopted by resolution on this date.

PASSED AND APPROVED this the 17 day of September, 2012.

Mayor

ATTEST:

City Secretary

CITY OF HUDSON

RESOLUTION 09202012

STATE OF TEXAS §

CITY OF HUDSON §

A RESOLUTION ADOPTING THE CITY OF HUDSON's HAZARD MITIGATION ACTION PLAN.

WHEREAS, the City of Hudson, Texas has developed a Hazard Mitigation Action Plan to serve as a guiding document for local officials.

WHEREAS, the Hazard Mitigation Action Plan will be utilized by the officials, the City Staff, and the Community Members to ensure continuity of future mitigation programs and policies.

NOW, THEREFORE BE IT ORDAINED by the City Council of the City of Hudson, Texas that the Hazard Mitigation Action Plan is hereby adopted by resolution on this date.

PASSED AND APPROVED this the 27 day of SEPTEMBER, 2012.

Robert Smith
Mayor

ATTEST:

Cheryl Everett
City Secretary

CITY OF HUNTINGTON

RESOLUTION 092512 HM

STATE OF TEXAS §

CITY OF HUNTINGTON §

A RESOLUTION ADOPTING THE CITY OF HUNTINGTON's HAZARD MITIGATION ACTION PLAN.

WHEREAS, the City of Huntington, Texas has developed a Hazard Mitigation Action Plan to serve as a guiding document for local officials.

WHEREAS, the Hazard Mitigation Action Plan will be utilized by the officials, the City Staff, and the Community Members to ensure continuity of future mitigation programs and policies.

NOW, THEREFORE BE IT ORDAINED by the City Council of the City of Huntington, Texas that the Hazard Mitigation Action Plan is hereby adopted by resolution on this date.

PASSED AND APPROVED this the 25 day of September, 2012.

Mayor

ATTEST:

City Secretary

16

Resolution # 4466

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF LUFKIN, TEXAS ADOPTING THE CITY OF LUFKIN'S HAZARD MITIGATION ACTION PLAN; AND PROVIDING AN EFFECTIVE DATE.

WHEREAS, the City of Lufkin, Texas has developed a Hazard Mitigation Action Plan as a guiding document for local officials.

WHEREAS, the Hazard Mitigation Action Plan will be utilized by the Officials, City Staff and Community Members to ensure continuity of future mitigation programs and policies.

THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF LUFKIN, TEXAS that the Hazard Mitigation Action Plan is hereby adopted by Resolution on this date.

This resolution shall be and become effective immediately upon and after its adoption and approval.

PASSED AND APPROVED this 18th day of September, 2012.

The City of Lufkin, Texas

By: Bob F. Brown
Bob F. Brown, Mayor

ATTEST:

Kara Atwood
Kara Atwood, City Secretary

CITY OF ZAVALLA

RESOLUTION 10-2012

STATE OF TEXAS §

CITY OF ZAVALLA §

A RESOLUTION ADOPTING THE CITY OF ZAVALLA's HAZARD MITIGATION ACTION PLAN.

WHEREAS, the City of Zavalla, Texas has developed a Hazard Mitigation Action Plan to serve as a guiding document for local officials.

WHEREAS, the Hazard Mitigation Action Plan will be utilized by the officials, the City Staff, and the Community Members to ensure continuity of future mitigation programs and policies.

NOW, THEREFORE BE IT ORDAINED by the City Council of the City of Zavalla, Texas that the Hazard Mitigation Action Plan is hereby adopted by resolution on this date.

PASSED AND APPROVED this the 15 day of October, 2012.

CITY OF ZAVALLA ANGELINA COUNTY

Jimmy Harris
Mayor

ATTEST:

Rhonda Pigg
City Secretary

APPENDIX B. (RESERVED)

APPENDIX C. PREVIOUS ACTION ITEM STATUS REPORT

Angelina county					Not Complete					
Action number		Complete	In Progress		No Funding	No political/public support	Have not got to it yet	Keep	No longer priority	Comment
1					X			X		
2					X				X	
3			X					X		
4					X			X		
5					X			X		
6					X			X		
7		X						X		
8		X								
9		X						X		
10		X								
11					X				X	
12										
13										
14										
15					X					Move to Annex C of EOP
16		X								Move to Annex H of EOP
17		X								
18					X			X		
19		X								
20		X								Move to Annex Q of EOP
21		X								Move to Annex Q of EOP
22										
23						X			X	
24					X				X	
25					X				X	
26									X	
27					X				X	
28									X	
29		X								Move to Annex B of EOP

30										
31										
32										
33										
34									X	
35									X	
36								X		Move to Annex C & E of EOP
37										
38			X							Critical personnel have received some training. Move to Annex H of EOP
39										
40										

Burke					Not Complete					
Action number		Complete	In Progress (start Date)		No Funding	No political/public support	Have not got to it yet	Keep	No longer priority	Comment
1					**X**					
2					**X**					
3					**X**					

Diboll				Not Complete					
Action number	Complete	In Progress	No Funding	No political/public support	Have not got to it yet	Keep	No longer priority	Comment
1			X			X		
2			X			X		
3		X	X			X		All but 2 lift stations have generators. Civic center still needs.
4			X			X		
5			X			X		
6		X				X		Purchased Blackboard connect. Add to Annex A of EOP.
7	X					X		Add to CWPP
8	X							Marquis, signs, enforcement through LEA.
9	X					X		
10	X					X		Add informational notes to Zoning Ordinance, Building Code & Subdivision Regulation
11			X			X		
12	X							Add to CWPP
13	X							Add to Annex Q of EOP
14				X			X	Add to zoning ordinance and subdivision regulation
15			X			X		
16				X			X	
17				X			X	
18	X							Add to Annex E, I & R of EOP
19	X							
20			X			X		

Hudson					Not Complete					
Action number		Complete	In Progress		No Funding	No political/public support	Have not got to it yet	Keep	No longer priority	Comment
1			X							Generators acquired for lift stations 2 & 11. Portable for grinders acquired.
2			X		X			X		Added email notification system. Add to Annex A of EOP
3					X			X		
4			X					X		Phase 1 complete. Public display of burn ban conditions. Funded by Keep Hudson Beautiful Foundation.
5					X			X		
6					X			X		
7					X			X		
8			X					X		Built retention ponds at these commercial facilities:
9							X	X		Add to CWPP
10					X			X		
11					X		X	X		Add to Annex Q of EOP
12			X					X		Began the process but did not complete. Add results to building codes
13							X	X		Add to Annex E, I & R of EOP
14					X			X		
15			X		X			X		City hall now equipped and used. Need more space. Fire Station 1 is next.

16		X						X		Completed 2008-2012 Education program. New action is develop and implement 2017-2022 education program. Add to CWPP
17		X						X		Update inventory annually. Add to Annex D, H & Q of EOP
18		?	?					X		Add to zoning ordinance and subdivision regulation
19			X		X			X		ONCORE trimmed all trees along main lines. Require funding to complete trimming private rights of way.
20		X								

Huntington				Not Complete					
Action number	Complete	In Progress	No Funding	No political/public support	Have not got to it yet	Keep	No longer priority	Comment
1			X			X		
2		X				X		One generator purchased
3		X				X		
4		X	X			X		Add to Annex Q of EOP
5	X						X	Update inventory annually. Add to Annex D, H & Q of EOP
6			X	X			X	Add to zoning ordinance and subdivision regulation
7			X	X			X	
8	X							Add to Annex E, I & R of EOP
9	X							Add results to building codes
10				X			X	
11				X			X	Add informational notes to Zoning Ordinance, Building Code & Subdivision Regulation
12							X	
13			X	X			X	
14			X		X			Add to Annex C & H of EOP
15	X							
16	X					X		
17			X			X		
18					X		X	Add to CWPP
19					X	X		Add to CWPP
20			X	X			X	
21			X	X			X	Add to CWPP
22	X							

Lufkin					Not Complete					
Action number		Complete	In Progress		No Funding	No political/public support	Have not got to it yet	Keep	No longer priority	Comment
1			X					X		City Hall new atrium roof that will withstand higher winds. Dispatch commo tower replaced with stronger tower.
2							X	X		First retention pond scheduled behind Inez Timms.
3					X			X		
4		X								Add to Annex A of EOP
5					X			X		
6		X						X		Update inventory annually. Add to Annex D, H & Q of EOP
7		X								
8					X	X		X		Add to zoning ordinance and subdivision regulation
9		X						X		Move to EOP.
10					X			X		
11		X						X		Move to Annex Q of EOP.
12					X	X		X		
13		X						X		
14					X				X	
15					X			X		
16		X								
17		X								
18										
19										

Zavalla					Not Complete					
Action number		Complete	In Progress		No Funding	No political/public support	Have not got to it yet	Keep	No longer priority	Comment
1			Jul-17		X			X		4272 application submitted
2			Jul-17		X			X		4272 application submitted. Add to Annex A of EOP
3					X				X	
4		X								Add to Annex Q of EOP
5					X				X	Add to Annex E, I & R of EOP
6					X				X	Update inventory annually. Add to Annex D, H & Q of EOP
7					X			X		
8					X	X			X	
9					X	X			X	
10					X			X		
11					X			X		
12					X			X		Add to Annex C & H of EOP
13					X				X	
14		X							X	

Angelina County Mitigation Action Items (Previous Plan)

Angelina County Mitigation Action 1

Storm harden/retrofit existing and new critical facilities. Actions can include but are not limited to: window screens and shutters, roof straps, flood proofing, roll-up door reinforcement (i.e. fire stations), seismic retrofit, data back-up systems, and Firewise construction methods.

Angelina County Mitigation Action 2

Construct new and/or upgrade and expand existing storm water detention ponds to improve storm water capacity, collect run-off for use as an alternate water source for agricultural and

firefighting resources, and as a mitigation measure for drought and wildfire. Ponds should be constructed to support natural ecosystem balance, keeping water cooler and slowing evaporation.

Angelina County Mitigation Action 3

Install electrical generators and/or emergency back-up power for existing and future critical facilities including but not limited to: lift stations, water/sewerage treatment plants, shelters, Texas Interagency Coordination Center, et al. This action should include the installation of permanent generators and/or portable generators to be used where appropriate.

Angelina County Mitigation Action 4

Acquire flood prone/repetitive loss properties and convert to open space, parks, boating access, trails, agriculture projects, and/or as a general community asset.

Angelina County Mitigation Action 5

Elevate roadways and reinforce bridges prone to flooding and vulnerable to seismic activity. Projects may include general roadway elevation; upgrading culverts and installing headwalls; upgrades and reinforcement of bridges and bridge footings; etc. Projects identified as needs include but are not limited to:

- Precinct 3, Willie Nerron Rd. (bridge replacement), Gillan Creek (bridge replacement and road elevation, 2 locations)
- Precinct 4, Weaver Bend Rd., Sandy Creek Rd., Flat Bottom Rd., Boulware Hudspeth Rd., Buttermilk Rd. (culvert replacement, headwall reinforcement, road elevation, and bridge replacement as needed).

Angelina County Mitigation Action 6

Improve public storm warning/notification system. Implement, upgrade, expand, and integrate digital methods for storm notification to include all methods of communication including: cell phones, text messages, land-lines, internet networking sites, television, and radio. Install warning sirens at strategic locations as needed. Coordinate periodically with National Weather Service to maintain information channels.

Angelina County Mitigation Action 7

Educate property owners on methods to reduce forest fire susceptibility for existing structures and improve firefighting access in the wildland-urban interface. Encourage new construction projects to use Firewise construction methods, materials, and site design.

Angelina County Mitigation Action 8

Work with State Fire Marshall and local fire departments and local law enforcement to enforce burn ban ordinances during times of drought.

Angelina County Mitigation Action 9

Minimize damage to existing structures and infrastructure from falling trees and limbs. Actions can include but are not limited to:

- Working with private homeowners for voluntary removal or trimming of hazardous trees or limbs on private property; encourage periodic homeowner maintenance of right-of-ways adjacent to their property to reduce need for major pruning and tree falling projects.
- Coordination between County Emergency Management and various utility companies that maintain tree removal/trimming program. This includes identifying highest priority needs for utility services (i.e. critical facilities) and right-of-way maintenance of and;
- Coordinating debris removal services using local maintenance or public works departments or private contracting during disaster response and recovery.

Angelina County Mitigation Action 10

Conduct clean-up of large and small debris in waterway channels that interfere with stormwater conveyance and can exacerbate flooding, impact public health, and creates a general nuisance.

Angelina County Mitigation Action 11

Construct facilities that withstand 200 miles per hour winds to serve as shelters of last resort, in correspondence with the Texas Safe Shelter Initiative. Proposed project will involve doubling the size of the local Civic Center. This shelter will be able to house 750 people short-term and 200 – 400 people long-term for those that are unable to return home.

Angelina County Mitigation Action 12

Retrofit and equip existing structures to act as cooling centers during extreme heat events, and warming centers during winter storms. Potential sites include school district facilities and the Lufkin Civic Center. Notification for availability of the cooling centers can be made via emergency notification systems as well as television and newspaper announcements.

Angelina County Mitigation Action 13

Conduct mechanical thinning to reduce fuels in the wildland-urban interface and wooded areas surrounding neighborhoods and facilities prone wildfire impacts. Priority neighborhoods and locations identified in Angelina County Community Wildfire Protection Plan.

Angelina County Mitigation Action 14

Educate homeowners and builders on the importance of maintaining defensible space surrounding structures to prevent damage due to wildfires.

Angelina County Mitigation Action 15

Construct new or retrofit existing structures to act as emergency shelters during hazard events.

Angelina County Mitigation Action 16

Develop and distribute educational materials to the public outlining how to prevent or mitigate the spread of a pandemic outbreak.

Angelina County Mitigation Action 17

Conduct detailed study of flood maps to identify and rectify inaccuracies.

Angelina County Mitigation Action 18

Upgrade stormwater conveyance capacity via drainage improvement projects. Actions can include but are not limited to: installing/upgrading culverts and headwalls; and enlarging storm water ditches and canals.

Angelina County Mitigation Action 19:

Continue participation in the National Flood Insurance Program (NFIP). Identify and implement necessary steps that complement the county's participation in the National Flood Insurance Program (NFIP), and enable potential participation in the Community Rating System (CRS). Implementation of this activity can include:

- Continued improvement of floodplain mapping and elevation data
- Mitigation for repetitive loss properties
- Instituting higher regulatory standards for future floodplain development
- Stormwater management plans and standards for future development to control runoff

Angelina County Mitigation Action 20

Conduct training for fire departments for responding to hazardous materials incidents.

Angelina County Mitigation Action 21

Develop inventory of hazardous materials handling and transport facilities with the potential to impact public safety if an accident were to occur and conduct periodic inspections of these sites.

Angelina County Mitigation Action 22

Install underground electrical and communications lines for future critical facilities and subdivisions. Encourage future commercial, industrial, and residential development to consider underground electric and communications lines.

Angelina County Mitigation Action 23

Install frangible links (break away line power line connections) on electrical and telephone poles where appropriate.

Angelina County Mitigation Action 24

Construct new structures or retrofit existing critical facilities and public buildings in accordance with FEMA Publication 320 and/or National Performance Criteria for Tornado Shelters specifications.

Angelina County Mitigation Action 25

Construct new or retrofit existing structures to act as safe rooms during tornados and other severe weather events. Safe rooms should be built in accordance to FEMA Publication 320 and/or National Performance Criteria for Tornado Shelters

Angelina County Mitigation Action 26

Develop incentives (i.e. partial rebates, etc.) and provide instruction for homeowners to install safe rooms to provide protection from tornados and straight line winds in accordance with FEMA Publication 320 and/or National Performance Criteria for Tornado Shelters specifications.

Angelina County Mitigation Action 27

Elevate existing flood prone structures and infrastructure above the base flood elevation.

Angelina County Mitigation Action 28

Develop inventory of equipment and facilities relating to hazard mitigation and emergency management and identify needs and areas for improvement.

Angelina County Mitigation Action 29

Upgrade contact info database for 1st responders, volunteers and special needs populations.

Angelina County Mitigation Action 30

Mitigate flooding at Black Forest by diverting water flowing into Black Forest and increasing storm water conveyance via increasing flow capacity and storage in culverts and ditches.

Angelina County Mitigation Action 31

Develop and implement SOP for data collection/sharing to provide extent for dam failure as funds become available. Compile and review existing and future dam failure studies and incorporate findings into future iterations of hazard mitigation plan.

Angelina County Mitigation Action 32

Educate homeowners on methods to reduce water consumption during drought periods and homebuilders on low water use appliances, drought resistant landscaping, and water recycling. Consider incorporating into municipal building codes.

Angelina County Mitigation Action 33

Develop local requirements for mobile home tie-down and anchoring systems for new construction and conduct periodic inspections by the County.

Angelina County Mitigation Action 34

Develop and implement policy to conduct soils map analysis for future public facilities, to determine local conditions and if expansive soils mitigation measures such as backfill replacement, pier and beam design, foundation expansion joints, etc. should be utilized.

Angelina County Mitigation Action 35

Create and implement policy requiring future development in known expansive soils areas to utilize mitigation measures as needed including but not limited to: pier foundations, depth of slab, expansion joints, backfill replacement, and/or methods for limiting surface runoff.

Angelina County Mitigation Action 36

Identify and pursue any mitigation activities that would assist efficient evacuations and sheltering operations.

Angelina County Mitigation Action 37

Construct tornado-safe shelters in low-moderate income manufactured home parks with more than 20 units, in compliance with Housing and Urban Development standards for CDBG funding assistance and National Performance Criteria for Tornado Shelters specifications.

Angelina County Mitigation Action 38

Coordinate with federal, state and local partners to provide pandemic preparation and response training for critical personnel, public employees, law enforcement, etc. Emphasis should be on training volunteers and first responders on how to aid in response to Pandemic based on the needs identified in the County Pandemic Plan.

Angelina County Mitigation Action 39

Develop warning/emergency notification system for homes and facilities within inundation areas of a potential dam failure.

Angelina County Mitigation Action 40

Develop water conservation guidelines that define allowable uses during severe drought and extended periods of extreme heat.

The following action items are identified as the highest mitigation priorities for the Cities of Burke, Diboll, Hudson, Huntington, Lufkin, and Zavalla. Order of listing may or may not infer relative importance.

City of Burke Mitigation Action Items

City of Burke Mitigation Action 1

Install electrical generators and/or emergency back-up power for critical facilities including but not limited to: lift stations, water/sewerage treatment plants, shelters. This action should include the installation of permanent generators as well as the purchase of portable generators to be used where appropriate.

City of Burke Mitigation Action 2

Storm harden/retrofit existing and new critical facilities. Actions can include but are not limited to: window screens and shutters, roof straps, flood proofing, roll-up door reinforcement (i.e. fire stations), and data back-up systems.

City of Burke Mitigation Action 3:

Consider participation in the National Flood Insurance Program (NFIP). Identify and implement necessary steps that complement the county's participation in the National Flood Insurance Program (NFIP), and enable potential participation in the Community Rating System (CRS). Implementation of this activity can include:

- Continued improvement of floodplain mapping and elevation data
- Mitigation for repetitive loss properties
- Instituting higher regulatory standards for future floodplain development
- Stormwater management plans and standards for future development to control runoff

City of Diboll Mitigation Action Items

City of Diboll Mitigation Action 1

Storm harden/retrofit existing and new critical facilities, with emphasis on schools. Actions can include but are not limited to: window screens and shutters, roof straps, flood proofing, roll-up door reinforcement (i.e. fire stations), and data back-up systems.

City of Diboll Mitigation Action 2

Construct water retention ponds to collect storm water run-off and use as an alternate water source for agricultural resources.

City of Diboll Mitigation Action 3

Install electrical generators and/or emergency back-up power for critical facilities including but not limited to: lift stations, water/sewerage treatment plants, shelters. This action should include the installation of permanent generators as well as the purchase of portable generators to be used where appropriate.

City of Diboll Mitigation Action 4

Acquire flood prone/repetitive loss properties and convert to open space, parks, boating access, trails, agriculture projects, and/or as a general community asset.

City of Diboll Mitigation Action 5

Elevate and reinforce roadways and bridges prone to inundation from flooding. Projects may include general roadway elevation; upgrading culverts and installing headwalls; upgrades and reinforcement of bridges and bridge footings; etc.

City of Diboll Mitigation Action 6

Implement public storm warning notification systems to improve warning time for the public.

City of Diboll Mitigation Action 7

Educate property owners on methods to reduce forest fire susceptibility and improve firefighting access in the wildland-urban interface.

City of Diboll Mitigation Action 8

Work with State Fire Marshall and local fire departments and local law enforcement to enforce burn ban ordinances during times of drought.

City of Diboll Mitigation Action 9

Minimize damage to structures and infrastructure from falling trees and limbs. Actions can include but are not limited to:

- Working with private homeowners for voluntary removal or trimming of hazardous trees or limbs on private property;
- Coordination between local government, County Emergency Management and various utility companies that maintain tree removal/trimming program. This includes identifying highest priority needs for utility services (i.e. critical facilities) and maintenance of roadways and;
- Coordinating debris removal services using local maintenance or public works departments or private contracting during disaster response and recovery.

City of Diboll Mitigation Action 10

Educate homebuilders of the location of expansive soils and mitigation measures including pier foundations, depth of slab, and/or methods for limiting surface runoff.

City of Diboll Mitigation Action 11

Construct new or retrofit existing structures to act as shelters during hurricanes.

City of Diboll Mitigation Action 12

Educate homeowners and builders on the importance of maintaining defensible space surrounding structures to prevent damage due to wildfires.

City of Diboll Mitigation Action 13

Conduct training for fire departments for responding to hazardous materials incidents.

City of Diboll Mitigation Action 14

Install underground electrical and communications lines for future critical facilities and subdivisions. Encourage future commercial, industrial, and residential development to consider underground electric and communications lines. Install frangible links (break away line power line connections) on electrical and telephone poles where underground lines are not possible.

City of Diboll Mitigation Action 15

Retrofit existing structures to act as safe rooms during tornados and other severe weather events. Safe rooms should be built in accordance to FEMA Publication 320 and/or National Performance Criteria for Tornado Shelters

City of Diboll Mitigation Action 16

Develop incentives (i.e. partial rebates, etc.) and provide instruction for homeowners to install safe rooms to provide protection from tornados and straight line winds in accordance with FEMA Publication 320 and/or National Performance Criteria for Tornado Shelters specifications.

City of Diboll Mitigation Action 17

Elevate existing flood prone structures and infrastructure above the base flood elevation.

City of Diboll Mitigation Action 18

Develop contact info database for 1st responders, volunteers and special needs populations.

City of Diboll Mitigation Action 19:

Continue participation in the National Flood Insurance Program (NFIP). Identify and implement necessary steps that complement the county's participation in the National Flood Insurance Program (NFIP), and enable potential participation in the Community Rating System (CRS). Implementation of this activity can include:

- Continued improvement of floodplain mapping and elevation data
- Mitigation for repetitive loss properties
- Instituting higher regulatory standards for future floodplain development
- Stormwater management plans and standards for future development to control runoff

City of Diboll Mitigation Action 20

Develop policy to conduct soils map analysis for future public facilities to determine local conditions and if expansive soils mitigation measures should be implemented.

City of Hudson Mitigation Action Items

City of Hudson Mitigation Action 1

Install electrical generators and/or emergency back-up power for critical facilities including but not limited to: lift stations, grinder pumps, Hudson EOC. This includes permanent generators for Lift Stations 1, 2, and 5 and portable generators for the grinders.

City of Hudson Mitigation Action 2

Install tornado-thunderstorm warning sirens at 2 to 3 strategic locations, and implement public notification systems (phone, text, email, etc) to improve warning time for severe storms.

City of Hudson Mitigation Action 3

Storm harden/retrofit existing and new critical facilities. Actions can include but are not limited to: window screens and shutters, roof straps, flood proofing, roll-up door reinforcement (i.e. fire stations), and data back-up systems. Actions may include hardening the Hudson Fire Station by replacing or reinforcing bay doors and harden City Hall using roof straps to secure the roof.

City of Hudson Mitigation Action 4

Work with State Fire Marshall and local fire departments and local law enforcement to enforce burn ban ordinances during times of drought.

City of Hudson Mitigation Action 5

Acquire flood prone/repetitive loss properties and convert to open space, parks, boating access, trails, agriculture projects, and/or as a general community asset. Possible locations include Cripple Creek and along Highway 94.

City of Hudson Mitigation Action 6

Elevate and reinforce roadways and bridges prone to inundation from flooding. Projects may include general roadway elevation; upgrading culverts and installing headwalls; upgrades and reinforcement of bridges and bridge footings; etc. Sites to be elevated include but are not limited to Evans Gann Rd-Will Heights subdivision at Cripple Creek.

City of Hudson Mitigation Action 7

Upgrade stormwater conveyance capacity via drainage improvement projects. Actions can include but are not limited to: installing/upgrading culverts and headwalls; and enlarging storm water ditches and canals. Locations identified as priorities include: Cripple Creek Addition, Will Heights subdivision (at entrances), Hwy 94 (two locations).

City of Hudson Mitigation Action 8

Construct water retention ponds to collect storm water run-off, and/or back-up water lines from Lufkin for use as an alternate water source.

City of Hudson Mitigation Action 9

Educate property owners on methods to reduce forest fire susceptibility and improve firefighting access in the wildland-urban interface.

City of Hudson Mitigation Action 10

Construct new or retrofit existing critical facilities and public buildings for use as safe rooms in accordance with FEMA Publication 320 and/or National Performance Criteria for Tornado Shelters specifications. Potential sites include City Hall and Fire Department.

City of Hudson Mitigation Action 11

Conduct training for fire departments for hazardous materials incident response.

City of Hudson Mitigation Action 12

Develop local requirements for mobile home tie-down and anchoring systems for new construction and conduct periodic inspections.

City of Hudson Mitigation Action 13

Develop-upgrade contact information database for 1st responders, volunteers and special needs populations. This database may be accessed or available through the "Ever Bridge" system.

City of Hudson Mitigation Action 14

Construct new or retrofit existing structures to act as shelters during hurricanes.

City of Hudson Mitigation Action 15

Retrofit existing structures to act as cooling centers during extreme heat events.

City of Hudson Mitigation Action 16

Educate homeowners and builders on the importance of maintaining defensible space surrounding structures to prevent damage due to wildfires.

City of Hudson Mitigation Action 17

Develop inventory of hazardous materials handling and transport facilities with the potential to impact public safety if an accident were to occur and conduct periodic inspections of these sites.

City of Hudson Mitigation Action 18

Install underground electrical and communications lines for future critical facilities and subdivisions. Encourage future commercial, industrial, and residential development to consider underground electric and communications lines. Install frangible links (break away line power line connections) on electrical and telephone poles where underground lines are not appropriate

City of Hudson Mitigation Action 19

Minimize damage to structures and infrastructure from falling trees and limbs. Actions can include but are not limited to:

- Working with private homeowners for voluntary removal or trimming of hazardous trees or limbs on private property;
- Coordination between local government, County Emergency Management and various utility companies that maintain tree removal/trimming program. This includes identifying highest priority needs for utility services (i.e. critical facilities) and maintenance of roadways and;

- Coordinating debris removal services using local maintenance or public works departments or private contracting during disaster response and recovery.

City of Hudson Mitigation Action 20

Continue participation in the National Flood Insurance Program (NFIP). Identify and implement necessary steps that complement the county's participation in the National Flood Insurance Program (NFIP), and enable potential participation in the Community Rating System (CRS). Implementation of this activity can include:

- Continued improvement of floodplain mapping and elevation data
- Mitigation for repetitive loss properties
- Instituting higher regulatory standards for future floodplain development
- Stormwater management plans and standards for future development to control runoff

City of Huntington Mitigation Action Items

City of Huntington Mitigation Action 1

Storm harden/retrofit existing and new critical facilities. Actions can include but are not limited to: window screens and shutters, roof straps, flood proofing, roll-up door reinforcement (i.e. fire stations), and data back-up systems.

City of Huntington Mitigation Action 2

Install electrical generators and/or emergency back-up power for critical facilities including but not limited to: 13 lift stations and other critical facilities. This action should include the installation of permanent generators and/or portable generators to be used where appropriate.

City of Huntington Mitigation Action 3

Minimize damage to structures and infrastructure from falling trees and limbs. Actions can include but are not limited to:

- Working with private homeowners for voluntary removal or trimming of hazardous trees or limbs on private property;
- Coordination between local government, emergency management and various utility companies that maintain tree removal/trimming program. This includes identifying highest priority needs for utility services (i.e. critical facilities), maintenance of roadways
- Coordinating debris removal services using local maintenance or public works departments or private contracting during disaster response and recovery.

City of Huntington Mitigation Action 4

Conduct training for fire departments for responding to hazardous materials incidents.

City of Huntington Mitigation Action 5

Develop inventory of hazardous materials handling and transport facilities with the potential to impact public safety if an accident were to occur and conduct periodic inspections of these sites.

City of Huntington Mitigation Action 6

Install underground electrical and communications lines for future critical facilities and subdivisions. Encourage future commercial, industrial, and residential development to consider underground electric and communications lines. Install frangible links (break away line power line connections) on electrical and telephone poles where underground lines are not appropriate.

City of Huntington Mitigation Action 7

Develop incentives (i.e. partial rebates, etc.) and provide instruction for homeowners to install safe rooms to provide protection from tornados and straight line winds in accordance with FEMA Publication 320 and/or National Performance Criteria for Tornado Shelters specifications.

City of Huntington Mitigation Action 8

Develop contact info database for 1st responders, volunteers and special needs populations.

City of Huntington Mitigation Action 9

Develop local requirements for mobile home tie-down and anchoring systems for new construction and conduct periodic inspections by city building inspectors.

City of Huntington Mitigation Action 10

Develop policy to conduct soils map analysis for future public facilities to determine local conditions and if expansive soils mitigation measures should be implemented.

City of Huntington Mitigation Action 11

Educate homebuilders of the location of expansive soils and mitigation measures including pier foundations, depth of slab, and/or methods for limiting surface runoff.

City of Huntington Mitigation Action 12

Identify and pursue any mitigation activities that would assist efficient evacuations and sheltering operations.

City of Huntington Mitigation Action 13

Construct tornado-safe shelters in low-moderate income manufactured home parks with more than 20 units, in compliance with Housing and Urban Development standards for CDBG funding assistance and National Performance Criteria for Tornado Shelters specifications.

City of Huntington Mitigation Action 14

Coordinate with federal, state and local partners to provide pandemic preparation and response training for critical personnel, public employees, law enforcement, etc. Emphasis should be on training volunteers and first responders on how to aid in response to Pandemic based on the needs identified in the local and County Pandemic Plans.

City of Huntington Mitigation Action 15

Develop and or update municipal water conservation ordinances that define allowable uses during severe drought.

City of Huntington Mitigation Action 16

Educate homeowners on methods to reduce water consumption during drought periods and homebuilders on low water use appliances, drought resistant landscaping, and water recycling.

City of Huntington Mitigation Action 17

Elevate and reinforce roadways, bridges, and homes prone to inundation from flooding. Projects may include general roadway elevation; upgrading culverts and installing headwalls; upgrades and reinforcement of bridges and bridge footings; etc.

City of Huntington Mitigation Action 18

Educate property owners on methods to reduce forest fire susceptibility and improve firefighting access in the wildland-urban interface.

City of Huntington Mitigation Action 19

Educate homeowners and builders on the importance of maintaining defensible space surrounding structures to prevent damage due to wildfires.

City of Huntington Mitigation Action 20

Construct new or retrofit existing structures to act as safe rooms during tornados and other severe weather events. Safe rooms should be built in accordance to FEMA Publication 320 and/or National Performance Criteria for Tornado Shelters

City of Huntington Mitigation Action 21

Conduct mechanical thinning to reduce fuels in the wildland-urban interface and wooded areas surrounding neighborhoods and facilities prone wildfire impacts

City of Huntington Mitigation Action 22

Continue participation in the National Flood Insurance Program (NFIP). Identify and implement necessary steps that complement the county's participation in the National Flood Insurance Program (NFIP), and enable potential participation in the Community Rating System (CRS). Implementation of this activity can include:

- Continued improvement of floodplain mapping and elevation data
- Mitigation for repetitive loss properties
- Instituting higher regulatory standards for future floodplain development
- Stormwater management plans and standards for future development to control runoff

City of Lufkin Mitigation Action Items

City of Lufkin Mitigation Action 1

Storm harden/retrofit existing and new critical facilities and hurricane evacuee shelter(s). Emphasis on existing Civic Center and EOC. Actions can include but are not limited to: window screens and shutters, roof straps, flood proofing, roll-up door reinforcement (i.e. fire stations), and data back-up systems.

City of Lufkin Mitigation Action 2

Construct new and expand existing network of water retention ponds to collect storm water run-off and use as an alternate water source for agricultural resources.

City of Lufkin Mitigation Action 3

Install electrical generators and/or emergency back-up power for critical facilities including but not limited to: critical facilities, lift stations, water/sewerage treatment plants, shelters. This action may include the installation of permanent generators as well as portable generators to be used where appropriate.

City of Lufkin Mitigation Action 4

Expand and integrate existing storm warning notification system (Everbridge) to network with existing and future notification systems for the county and neighboring cities.

City of Lufkin Mitigation Action 5

Construct safe rooms for existing and future critical facilities and public buildings in accordance with FEMA Publication 320 and/or National Performance Criteria for Tornado Shelters specifications.

City of Lufkin Mitigation Action 6

Maintain and continually update inventory of hazardous materials handling and transport facilities with the potential to impact public safety if an accident were to occur and conduct periodic inspections of these sites.

City of Lufkin Mitigation Action 7

Elevate existing flood prone structures and infrastructure above the base flood elevation.

City of Lufkin Mitigation Action 8

Install underground electrical and communications lines for future critical facilities and subdivisions. Encourage future commercial, industrial, and residential development to consider underground electric and communications lines.

City of Lufkin Mitigation Action 9

Develop-upgrade contact information database for 1st responders, volunteers and special needs populations. This may be linked to the existing Everbridge System.

City of Lufkin Mitigation Action 10

Acquire flood prone/repetitive loss properties and convert to open space, parks, boating access, trails, agriculture projects, and/or as a general community asset.

City of Lufkin Mitigation Action 11

Continue specialized training for fire departments responding to hazardous materials incidents.

City of Lufkin Mitigation Action 12

Install frangible links (break away line power line connections) on electrical and telephone poles where appropriate.

City of Lufkin Mitigation Action 13

Minimize damage to structures and infrastructure from falling trees and limbs. Actions can include but are not limited to:

- Working with private homeowners for voluntary removal or trimming of hazardous trees or limbs on private property;
- Coordination between local government, County Emergency Management and various utility companies that maintain tree removal/trimming program. This includes identifying highest priority needs for utility services (i.e. critical facilities) and maintenance of roadways and;
- Coordinating debris removal services using local maintenance or public works departments or private contracting during disaster response and recovery.

City of Lufkin Mitigation Action 14

Construct new or retrofit existing structures to act as safe rooms during tornados and other severe weather events. Safe rooms should be built in accordance to FEMA Publication 320 and/or National Performance Criteria for Tornado Shelters

City of Lufkin Mitigation Action 15

Elevate and reinforce roadways and bridges prone to inundation from flooding, with emphasis on evacuation and emergency access routes. Projects may include general roadway elevation; upgrading culverts and installing headwalls; upgrades and reinforcement of bridges and bridge footings; etc.

City of Lufkin Mitigation Action 16

Work with State Fire Marshall and local fire departments and local law enforcement to enforce burn ban ordinances during times of drought.

City of Lufkin Mitigation Action 17

Continue participation in the National Flood Insurance Program (NFIP). Identify and implement necessary steps that complement the county's participation in the National Flood Insurance Program (NFIP), and establish participation in the Community Rating System (CRS), to which application is underway. Implementation of this activity can include:

- Continued improvement of floodplain mapping and elevation data
- Mitigation for repetitive loss properties
- Instituting higher regulatory standards for future floodplain development
- Stormwater management plans and standards for future development to control runoff

City of Zavalla Mitigation Action Items

City of Zavalla Mitigation Action 1

Install electrical generators and/or emergency back-up power for critical facilities including but not limited to: medical-special needs facilities, nursing homes, schools and community shelters. This action should include the installation of permanent generators as well as the purchase of portable generators to be used where appropriate.

City of Zavalla Mitigation Action 2

Install tornado-thunderstorm warning sirens at strategic locations and implement public notification systems to improve warning time for the public.

City of Zavalla Mitigation Action 3

Elevate and reinforce roadways and bridges prone to inundation from flooding. Projects may include general roadway elevation; upgrading culverts and installing headwalls; upgrades and reinforcement of bridges and bridge footings; etc. Elevate homes as needed.

City of Zavalla Mitigation Action 4

Conduct training for fire departments for responding to hazardous materials incidents.

City of Zavalla Mitigation Action 5

Develop contact info database for 1st responders, volunteers and special needs populations.

City of Zavalla Mitigation Action 6

Develop inventory of hazardous materials handling and transport facilities with the potential to impact public safety if an accident were to occur and conduct periodic inspections of these sites.

City of Zavalla Mitigation Action 7

Install underground electrical and communications lines for future critical facilities and subdivisions. Encourage future commercial, industrial, and residential development to consider underground electric and communications lines.

City of Zavalla Mitigation Action 8

Install frangible links (break away line power line connections) on electrical and telephone poles.

City of Zavalla Mitigation Action 9

Construct new or retrofit existing structures to act as safe rooms during tornados and other severe weather events. Safe rooms should be built in accordance to FEMA Publication 320 and/or National Performance Criteria for Tornado Shelters

City of Zavalla Mitigation Action 10

Conduct mechanical thinning to reduce fuels in the wildland-urban interface and wooded areas surrounding neighborhoods and facilities prone wildfire impacts. Priority neighborhoods and locations identified in Angelina County Community Wildfire Protection Plan.

City of Zavalla Mitigation Action 11

Develop and distribute educational materials to the public outlining how to prevent or mitigate the spread of a pandemic outbreak.

City of Zavalla Mitigation Action 12

Coordinate with federal, state and local partners to provide pandemic preparation and response training for critical personnel, public employees, law enforcement, etc. Emphasis should be on training volunteers and first responders on how to aid in response to Pandemic based on the needs identified in the County Pandemic Plan.

City of Zavalla Mitigation Action 13

Construct new or retrofit existing structures to act as shelters during hurricanes.

City of Zavalla Mitigation Action 14

Continue participation in the National Flood Insurance Program (NFIP). Identify and implement necessary steps that complement the county's participation in the National Flood Insurance Program (NFIP), and enable potential participation in the Community Rating System (CRS). Implementation of this activity can include:

- Continued improvement of floodplain mapping and elevation data
- Mitigation for repetitive loss properties
- Instituting higher regulatory standards for future floodplain development
- Stormwater management plans and standards for future development to control runoff

APPENDIX D. HAZARD REPORTS, ARTICLES, AND DATA

Hazard Mitigation Project reports are to be prepared by or submitted to the local hazard mitigation officer at the start and completion of mitigation project implementation, or at various midpoints in the grant application, or implementation process. A template for this form is included on the following page.

Information collection during and after disaster occurrences is vital to mitigation planning and for coordination with state and federal emergency management officials. The following forms will be used to document damages following disasters are maintained on file by the local hazard mitigation officer and in this Appendix. :

- Disaster Summary Outline (Form DEM-93 revised 4/2000), or updated equivalent form
- FEMA Disaster Housing Program: Preliminary Damage Assessment
- TDEM Public Property Site Assessment Worksheet

Angelina County
Hazard Mitigation Project Report

Date:
Project Stage: Planning, Grant Application, Ongoing, Completed (circle one or comment)
Project Description:
Action Item Number and Page Number in Hazard Mitigation Plan (2011 Version):
Summary Analysis:
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Dam Failure Analysis

See also, Dam Failure hazard profile, Chapter 3, Section 3.2.1.

Excerpted from Chapter 3, Section 3.2.1, Table 3-2 below outlines the dams listed by the NID for Angelina County.

Table 3-2 Dams of Angelina County

Dam Name	Height (ft.)	Storage (acre-ft.)	River-Tributary
MM FLOURNOY DAM	14	210	BUSHY CREEK
MANNING CLUB LAKE DAM	16	276	BUSHY CREEK
FIBERBOARD LAKE DAM	13	2,500	WHITE OAK CREEK
BLACKBURN LAKE DAM	18	137	CONNER SPRING BRANCH
CLEAR LAKE DAM	25	225	TR-PROCELLA CR
HANS LAKE DAM	14	87	TR-LINSTON CREEK
CASTLEBERRY DAM	16	385	LINSTON CREEK
KOON LAKE DAM	23	165	TR-BILOXI CREEK
ELLEN TROUT MEMORIAL LAKE DAM	16	441	TR-MILL CREEK
LAKE KURTH DAM	38	27,360	TR-ANGELINA RIVER
RAY LAKE DAM	20	93	ROCKY CREEK
JONES LAKE DAM	18	75	TR-MILL CREEK
LAKE TEMPLE DAM	18	170	TR-HURRICANE CREEK
NORTHERN CHIPMILL POND NO 2 DAM	35	60	TR-WISE BRANCH
LUFKIN REGIONAL DETENTION POND NO 3 DAM	19	343	TR-CEDAR CREEK
LUFKIN COUNTRY CLUB LAKE DAM	33	460	TR-MILL CREEK
LUFKIN REGIONAL DETENTION BASIN NO 8 DAM	15.2	127	TR-HURRICANE CREEK
LUFKIN REGIONAL DETENTION POND NO 1 DAM	17.8	107	TR-HURRICANE CREEK
LUFKIN REGIONAL DETENTION POND NO 4 DAM	15	60	TR-HURRICANE CREEK
LUFKIN REGIONAL DETENTION POND NO 7 DAM	21	307	TR-CEDAR CREEK
LUNA DAM	13	20	TR-ANGELINA RIVER

Source: National Inventory of Dams (NID)

Analysis of relative elevation and reservoir storage capacity composed estimated inundation areas for hypothetical dam failure. Detailed descriptions of those could potentially affect structures and/or infrastructure is presented on the following pages.

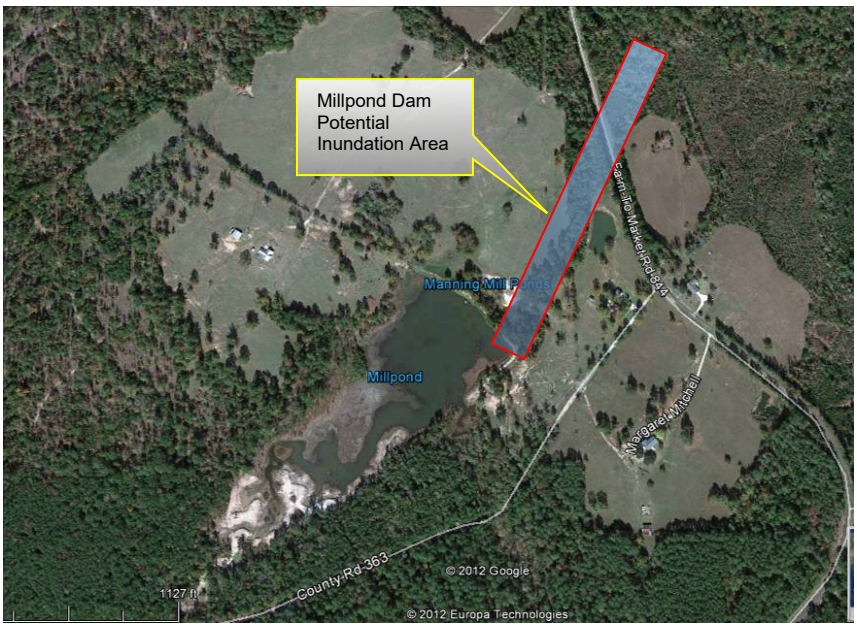
This analysis indicates that no apparent risk to structures or infrastructure is present for Fiberboard Lake Dam, Blackburn Lake Dam, Castleberry Dam, Koon Lake Dam, Lufkin Regional Detention Pond No 3 Dam, Northern Chipmill Pond No 2 Dam, Lufkin Regional Detention Basin No 8 Dam, Lufkin Regional Detention Pond No 1 Dam, Lufkin Regional Detention Pond No 4 Dam, and Lufkin Regional Detention Pond No 7 Dam.

Dam Name: MM Flournoy Dam (Millpond Dam).

General Location: southern Angelina County.

Potential structures, facilities, infrastructure at risk: 1 residential structure, 1 roadway

Analysis: Potential impacts depend on a number of factors including: type and cause of failure; reservoir storage volume at time of failure; volume and flow rate of downstream water bodies; soil saturation levels; precipitation levels during and after failure, et al. Qualified for the numerous variables, one (1) structure is located on east end of Millpond Dam at slightly lower relative elevation and roughly 0.1 mile from dam. Actual depth of inundation is not substantiated but is likely to not exceed 1 foot water depth in area directly surrounding structures. Inundation area could flow across FM 844 roughly 0.2 miles north of dam site, estimated road inundation depth ranging from 0-3 feet along 0.2 mile stretch. Note: Millpond Dam is located at lower relative elevation and downstream from Club Lake Dam, and could be impacted by an increase in water volume (and a correlated increase in failure potential) if failure were to occur at the Club Lake Dam location.

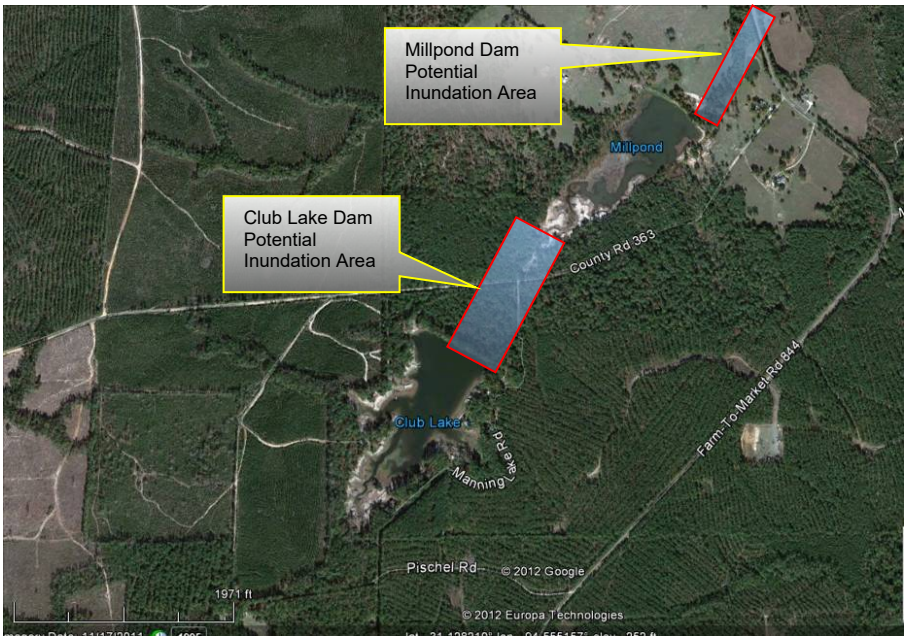


Dam Name: Manning Club Lake Dam (Club Lake Dam).

General Location: southern Angelina County.

Potential structures, facilities, infrastructure at risk: 1 roadway

Analysis: Potential impacts depend on a number of factors including: type and cause of failure; reservoir storage volume at time of failure; volume and flow rate of downstream water bodies; soil saturation levels; precipitation levels during and after failure, et al. Qualified for the numerous variables, no structures are located at lower relative elevation from dam. Actual risk of inundation is not substantiated but inundation area could flow across CR 363 roughly ¼ mile north of dam site, estimated road inundation depth ranging from 0-3 feet along 0.4 mile stretch. Note: Club Lake Dam is located at higher relative elevation and upstream from Millpond Dam, (see related analysis above).

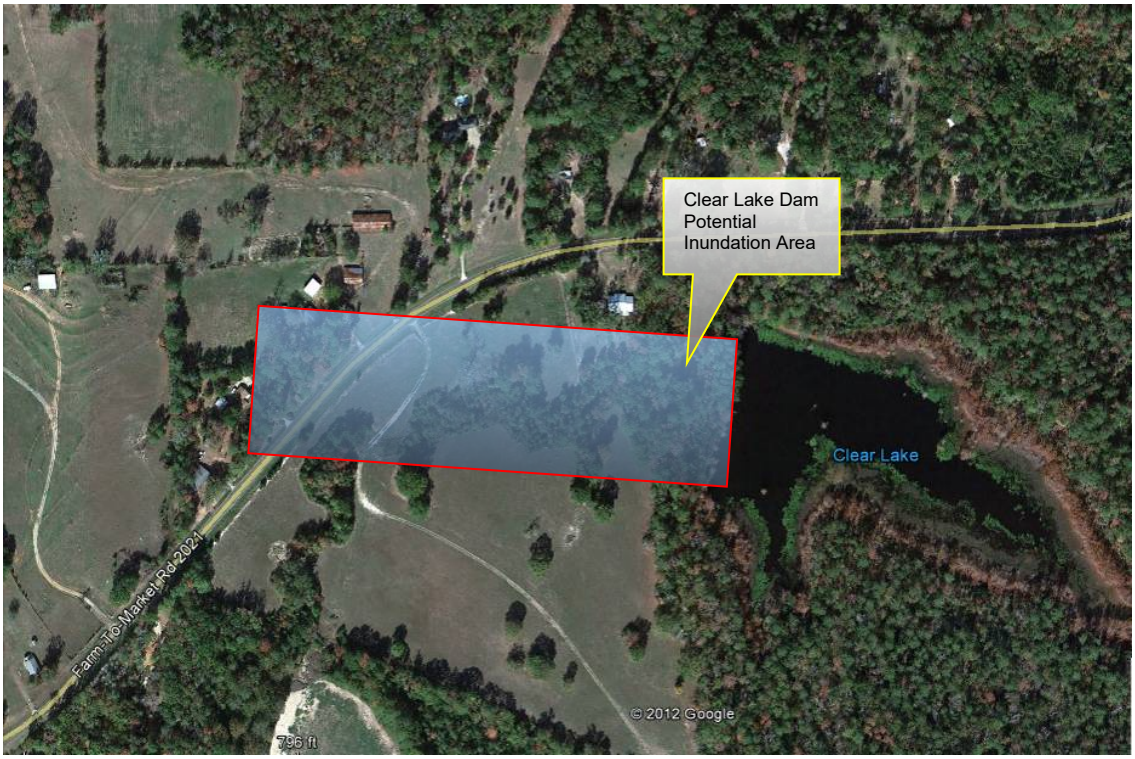


Dam Name: Clear Lake Dam

General Location: northern Angelina County

Potential structures, facilities, infrastructure at risk: 5-6 residential structures, 1 roadway

Analysis: Potential impacts depend on a number of factors including: type and cause of failure; reservoir storage volume at time of failure; volume and flow rate of downstream water bodies; soil saturation levels; precipitation levels during and after failure, et al. Qualified for the numerous variables, potential inundation area could cross FM 2021 at estimated depth of 0-4 feet. Inundation to various depths could occur for 5-6 structures located on west side of FM 2021 at lower relative elevation and roughly 0.3 miles from Clear Lake Dam.

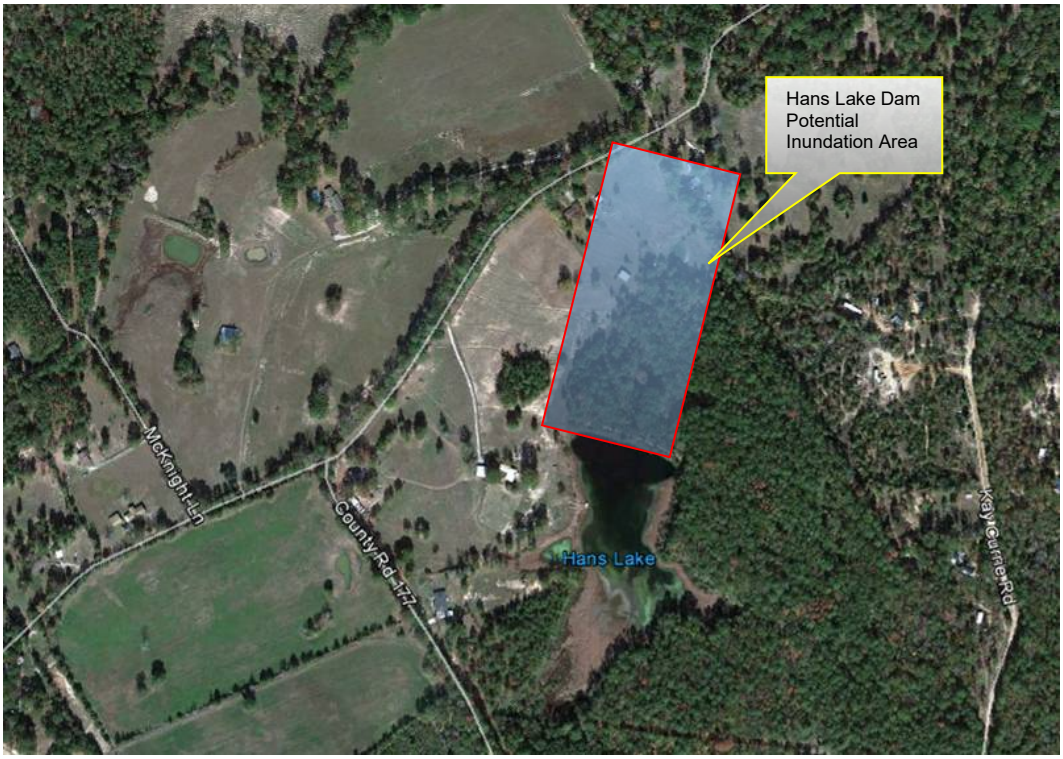


Dam Name: Hans Lake Dam

General Location: north central Angelina County

Potential structures, facilities, infrastructure at risk: 4-5 residential structures

Analysis: Potential impacts depend on a number of factors including: type and cause of failure; reservoir storage volume at time of failure; volume and flow rate of downstream water bodies; soil saturation levels; precipitation levels during and after failure, et al. Qualified for the numerous variables, inundation to various depths with estimates ranging from 0-2 feet could occur for 4-5 structures located on west side of FM 2021 at lower relative elevation and roughly 0.25 miles from Hans Lake Dam.



Dam Name: Ellen Trout Memorial Lake Dam (better known as City Lake

General Location: north Lufkin.

Potential structures, facilities, infrastructure at risk: 1 facility

Analysis: Potential impacts depend on a number of factors including: type and cause of failure; reservoir storage volume at time of failure; volume and flow rate of downstream water bodies; soil saturation levels; precipitation levels during and after failure, et al. Qualified for the numerous variables, the water treatment and supply facility on MLK Jr. Blvd in north Lufkin could see minor flooding in the case of failure, estimated at 0-1 foot. Actual risk of inundation is not substantiated.

Dam Name: Ray Lake Dam

General Location: western Angelina County west of Zavalla.

Potential structures, facilities, infrastructure at risk: 2 residential structures

Analysis: Potential impacts depend on a number of factors including: type and cause of failure; reservoir storage volume at time of failure; volume and flow rate of downstream water bodies; soil saturation levels; precipitation levels during and after failure, et al. Qualified for the numerous variables, two (2) structures are located on east end of CR 331A at lower relative elevation and roughly 0.3 miles from Ray Lake Dam. Actual risk of inundation is not substantiated but is likely to not exceed 1 foot water depth in area directly surrounding structures.

Dam Name: Jones Lake Dam

General Location: north Lufkin.

Potential structures, facilities, infrastructure at risk: 1 education facility, 1 multi-family residential facility, 1 roadway

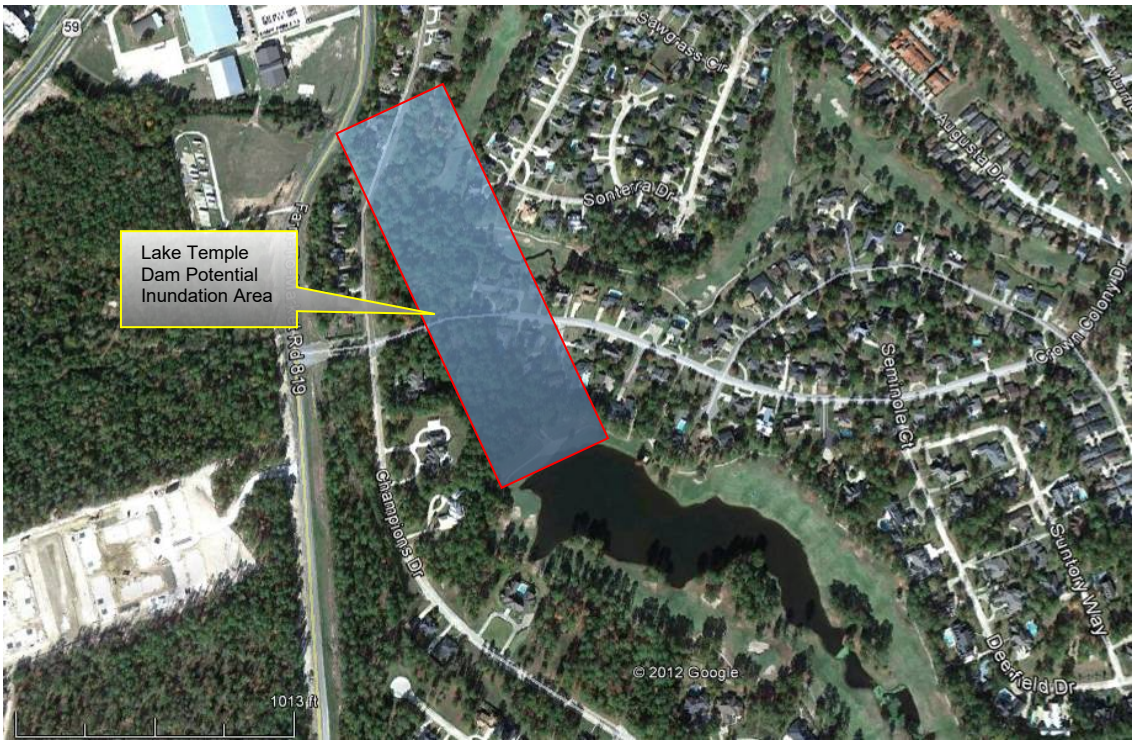
Analysis: Dunbar Primary School is situated roughly 0.15 miles in downstream direction from Jones Lake Dam at lower relative elevation, and an apartment complex slightly further from the dam also situated downstream at lower relative elevation. Potential impacts depend on a number of factors including: type and cause of failure; reservoir storage volume at time of failure; volume and flow rate of downstream water bodies; soil saturation levels; precipitation levels during and after failure, et al. Qualified for the numerous variables, it is projected that a failure inundation area could cross MLK Jr. Blvd and impact said facilities. Depth of inundation estimated at 0-4 feet.

Dam Name: Lake Temple Dam

General Location: south Lufkin.

Potential structures, facilities, infrastructure at risk: 16 residential structures, 2 roadways

Analysis: Potential impacts depend on a number of factors including: type and cause of failure; reservoir storage volume at time of failure; volume and flow rate of downstream water bodies; soil saturation levels; precipitation levels during and after failure, et al. Qualified for the numerous variables, approximately 16 residential structures and two stretches of roadway could be impacted to depths ranging from 0-4 feet.

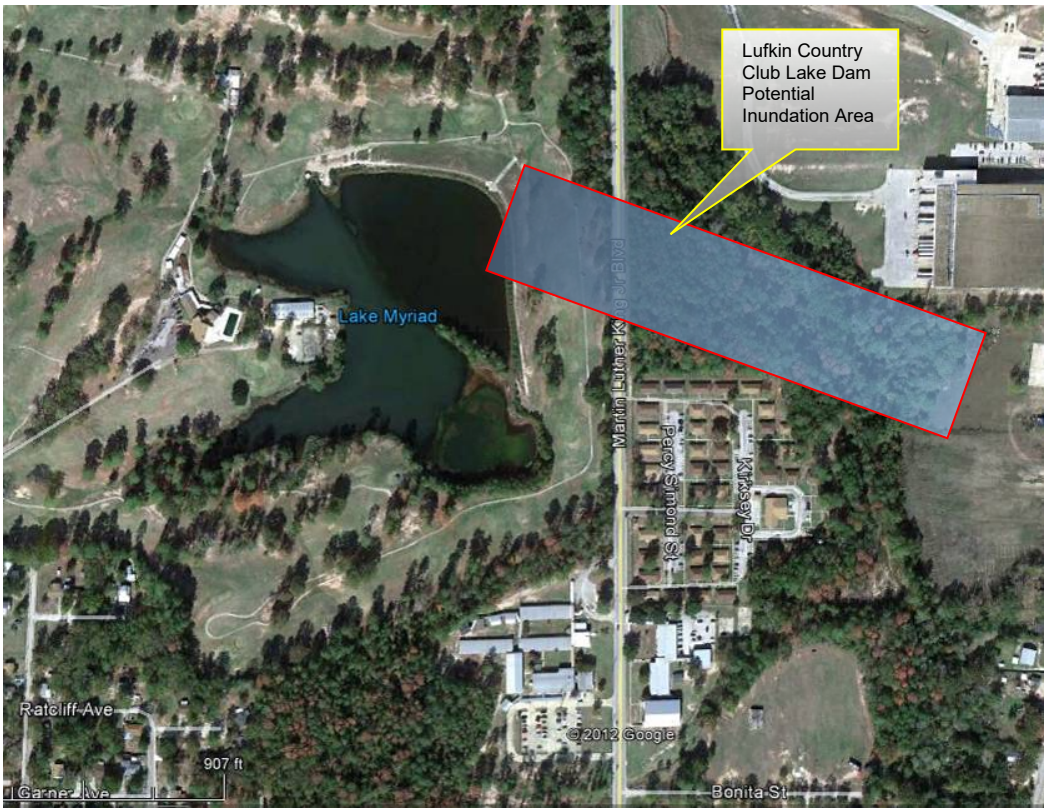


Dam Name: Lufkin Country Club Lake Dam (Lake Myriad)

General Location: north Lufkin.

Potential structures, facilities, infrastructure at risk: 1 roadway

Analysis: Potential impacts depend on a number of factors including: type and cause of failure; reservoir storage volume at time of failure; volume and flow rate of downstream water bodies; soil saturation levels; precipitation levels during and after failure, et al. Qualified for the numerous variables, MLK Jr. Blvd could be inundated by potential failure to depths estimated at 0-2 feet along 0.2 mile stretch of roadway.



Dam Name: Luna Dam

General Location: north Lufkin.

Potential structures, facilities, infrastructure at risk: 1 roadway, 1 residential structure

Analysis: Potential impacts depend on a number of factors including: type and cause of failure; reservoir storage volume at time of failure; volume and flow rate of downstream water bodies; soil saturation levels; precipitation levels during and after failure, et al. Qualified for the numerous variables, Rivercrest Rd. could be inundated by potential failure to depths estimated at 0-2 feet along 0.1 mile stretch of roadway, with potential impact to a residential structure on the north side of the road.

Dam Name: Lake Kurth Dam

General Location: north Angelina County.

Potential structures, facilities, infrastructure at risk: 1 roadway, 7-8 residential structures

Analysis: Potential impacts depend on a number of factors including: type and cause of failure; reservoir storage volume at time of failure; volume and flow rate of downstream water bodies; soil saturation levels; precipitation levels during and after failure, et al. Qualified for the numerous variables, 7-8 homes at the north end of Duncan Slough Rd. could be inundated by potential failure to depths estimated at 1-3 feet. Note: inundation area boundaries as indicated by aerial photo below are approximate.