

Tulsa County Oklahoma



Multi-Jurisdictional Multi-Hazard Mitigation Plan Update - 2015

Participating Jurisdictions:

Tulsa County
Town of Sperry
Berryhill Public School
Keystone Public School
Liberty Public School
Sperry Public School

Draft for Comments: May 18, 2015

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Draft for Comments

Table of Contents:

Table of Contents:	iii
Chapter 1:	1
Introduction	1
1.1 About the Plan	1
1.1.1 Purpose	1
1.1.2 Scope	1
1.1.3 Authority	2
1.1.4 Funding	2
1.1.5 Major Disaster Declarations	2
1.1.6 Goals	2
1.1.7 Point of Contact	5
1.2 Community Description	6
1.2.1 Geography	6
1.2.2 Climate	6
1.2.3 History	6
1.2.4 Population and Demographics	6
1.2.5 Local Utilities--Lifelines	7
1.2.6 Economy	7
1.2.7 Industry	7
1.2.8 Future Development	8
1.3.1 Comprehensive Planning and Zoning	9
1.3.2 Floodplain Management	10
1.3.3 Building Codes	10
1.3.4 Fire Protection and Insurance	10
1.4 Existing Plans Incorporating Hazard Mitigation	11
1.4.1 Emergency Operations Plans	11
1.4.2 Capital Improvement Plan	11
Chapter 2:	13
The Planning Process	13
2.1 Documentation of the Planning Process	13

2.1.1	Step One: Organize to Prepare the Plan	13
2.1.2	Step Two: Involve the Public	17
2.1.3	Step Three: Coordinate with Other Agencies and Organizations.....	18
2.1.4	Step Four: Assess the Hazard	21
2.1.5	Step Five: Assess the Problem.....	22
2.1.6	Step Six: Set Goals	22
2.1.7	Step Seven: Review Possible Activities	23
2.1.8	Step Eight: Draft an Action Plan	23
2.1.9	Step Nine: Adopt the Plan	23
2.1.10	Step Ten: Implement, Evaluate, and Revise.....	23
Chapter 3:.....		25
Risk Assessment and Vulnerability Analysis		25
3.1	Identifying Hazards.....	25
3.2	Profiling the Hazards	25
3.2.1	Flood Hazard	26
3.2.2	Tornado Hazard	30
3.2.3	High Wind Hazard.....	33
3.2.4	Lightning Hazard.....	36
3.2.5	Hail Storm Hazard	38
3.2.6	Winter Storm Hazard.....	39
3.2.7	Heat Hazard	41
3.2.8	Drought Hazard	43
3.2.9	Expansive Soils Hazard.....	45
3.2.10	Wildfire Hazard	47
3.2.11	Earthquake Hazard	49
3.2.12	Hazardous Material Hazard	51
3.2.13	Dam Break Hazard	54
3.3	Assessing Vulnerability: Identifying Assets.....	57
3.3.1	Flood Hazard	62
3.3.2	Tornado Hazard	64
3.3.3	Dam Break Hazard	64
3.3.4	High Wind Hazard.....	64
3.3.5	Lightning Hazard.....	64
3.3.6	Hail Storm Hazard	65

3.3.7	Winter Storm Hazard.....	65
3.3.8	Heat Hazard	65
3.3.9	Drought Hazard	65
3.3.10	Expansive Soils Hazard.....	65
3.3.11	Wildfire Hazard	66
3.3.12	Earthquake Hazard	67
3.3.13	Hazardous Material Hazard.....	67
3.4	Assessing Vulnerability: Estimating Potential Losses.....	68
3.4.1	Flood Hazard	68
3.4.2	Tornado Hazard	69
3.4.3	Dam Break Hazard	70
3.4.4	Hazardous Material Hazard.....	70
3.4.5	Expansive Soils.....	71
3.4.7	Wildfires	71
3.4.8	All Other Hazards	72
3.5	Assessing Vulnerability: Analyzing Development Trends.....	73
	Chapter 4:.....	75
	Mitigation Strategies.....	75
4.1	Hazard Mitigation Goals.....	75
4.2	Mitigation Categories.....	77
4.3	Research, Review, and Prioritization.....	83
	Chapter 5:.....	85
	Action Plan.....	85
5.1	Previous Tulsa County Plan.....	85
5.2	Mitigation Actions	88
	Chapter 6:.....	167
	Plan Maintenance and Adoption.....	167
6.1	Monitoring, Evaluating, Updating the Plan	167
6.2	Incorporating the Multi-Hazard Mitigation Plan	167
6.3	Public Involvement	168
	Appendix 1:.....	169
	Mapping.....	107
	Appendix 2:.....	203
	Committee Meetings.....	203

Appendix 3:..... 227
Sample Comment Letter 227
Appendix 4:..... 231
Questionnaire 231
Appendix 5:..... 235
Plan Adoption Resolutions 235
Appendix 6:..... 243
Hazard Summary 243

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Chapter 1:

Introduction

1.1 About the Plan

This document is the first phase of a multi-hazard mitigation plan for Tulsa County and the jurisdictions participating in this plan. It is a strategic planning guide developed in fulfillment of the Hazard Mitigation Grant Program requirements of the Federal Emergency Management Agency (FEMA), according to the Stafford Disaster Relief and Emergency Assistance Act. This act provides federal assistance to state and local governments to alleviate suffering and damage from disasters. It broadens existing relief programs to encourage disaster preparedness plans and programs, coordination and responsiveness, insurance coverage, and hazard mitigation measures.

This plan fulfills requirements for the Hazard Mitigation Grant Program (HMGP). The plan addresses natural hazards and hazardous materials events.

1.1.1 Purpose

The purpose of this plan is to:

1. Provide an overview of Tulsa County, its regulations and its plans (Chapter 1)
2. Outline the Planning Process used in completing this Multi-Hazard Mitigation Plan (Chapter 2)
3. Identify and assess the hazards that may pose a threat to citizens and property (Chapter 3)
4. Evaluate mitigation measures that should be undertaken to protect citizens and property (Chapter 4)
5. Outline a strategy for implementation of mitigation projects (Chapter 5)
6. Provide methodology for the plan's maintenance and adoption (Chapter 6)

The objective of this plan is to provide guidance for hazard mitigation activities for the next five years. It will ensure that Tulsa County and other participating jurisdictions implement activities that are most effective and appropriate for mitigating natural hazards and hazardous materials incidents.

1.1.2 Scope

The scope of the Tulsa County Multi-Hazard Mitigation Plan is county-wide, and includes Tulsa County, the Town of Sperry, Berryhill Public School, Keystone Public School, Liberty Public School, and Sperry Public School. It addresses natural hazards as well as hazardous-materials events deemed to be a threat to Tulsa County. Both short-term and long-term hazard mitigation opportunities are addressed beyond existing federal, state, and local funding programs.

The jurisdictions participating in this plan are Tulsa County, the Town of Sperry, Berryhill Public School, Keystone Public School, Liberty Public School, and Sperry Public School. The Berryhill Public Schools have five schools on four campuses, the Keystone Public School has one school, the Liberty Public School has three schools on one campus, and the Sperry Public School has four schools on one campus.

Town of Sperry, Berryhill Public School, Keystone Public School, Liberty Public School, and Sperry Public School.

Tulsa County	600 Civic Center, EOC	Tulsa
Town of Sperry	115 N Cincinnati Ave	Sperry
Berryhill High School	2901 S 65 th W Ave	Tulsa
Berryhill Middle School	2900 S 65 th W Ave	Tulsa
Berryhill North Elementary School	3128 S 63 rd W Ave	Tulsa
Berryhill South Elementary School	3129 S 63 rd W Ave	Tulsa
Berryhill Early Childhood Center	3128 S 63 rd W Ave	Tulsa
Liberty Public School PK – 3rd	2727 E 201 st St S	Mounds
Liberty Public School 4th – 6th	2727 E 201 st St S	Mounds
Liberty Public School 7 th – 12th	2727 E 201 st St S	Mounds
Keystone Public School	23810 W SH51	Sand Springs
Sperry Elementary School	400 W Main St	Sperry
Sperry Intermediate School	400 W Main St	Sperry
Sperry Middle School	400 W Main St	Sperry
Sperry High School	400 W Main St	Sperry

1.1.3 Authority

Section 409 of the *Robert T. Stafford Disaster Relief and Emergency Assistance Act*, (Public Law 93-288, as amended), Title 44 CFR, as amended by Section 102 of the *Disaster Mitigation Act of 2000*, provides the framework for state and local governments to evaluate and mitigate all hazards as a condition of receiving federal disaster assistance.

1.1.4 Funding

Funding for the Tulsa County Multi-Hazard Mitigation Plan was provided by a grant from the Federal Emergency Management Agency (FEMA) and Oklahoma Emergency Management (OEM). A 75% FEMA grant through the OEM, with a 25% local share. The Hazard Mitigation Grant Program grant was grant number FEMA-4109-DR-OK-022.

1.1.5 Major Disaster Declarations

The previous Tulsa County Hazard Mitigation Plan was approved September 23, 2010. Since then, there have been two federally declared disasters in Tulsa County.

1.1.6 Goals

The goals for the Tulsa County Multi-Hazard Mitigation Plan were developed by the Tulsa County Hazard Mitigation Planning Committee (TCHMPC), with input from adjacent jurisdictions, agencies, and interested citizens. The local goals were developed taking into account the hazard mitigation strategies and goals of the federal and state governments.

National Mitigation Strategy and Goal

FEMA has developed ten fundamental principles for the nation's mitigation strategy:

1. Risk reduction measures ensure long-term economic success for the community as a whole, rather than short-term benefits for special interests.
2. Risk reduction measures for one natural hazard must be compatible with risk reduction measures for other natural hazards.
3. Risk reduction measures must be evaluated to achieve the best mix for a given location.
4. Risk reduction measures for natural hazards must be compatible with risk reduction measures for technological hazards, and vice versa.
5. All mitigation is local.
6. Emphasizing proactive mitigation before emergency response can reduce disaster costs and the impacts of natural hazards. Both pre-disaster (preventive) and post-disaster (corrective) mitigation is needed.
7. Hazard identification and risk assessment are the cornerstones of mitigation.
8. Building new federal-state-local partnerships and public-private partnerships is the most effective means of implementing measures to reduce the impacts of natural hazards.
9. Those who knowingly choose to assume greater risk must accept responsibility for that choice.
- 10 Risk reduction measures for natural hazards must be compatible with the protection of natural and cultural resources.

FEMA's goal is to:

1. Substantially increase public awareness of natural hazard risk so that the public insists on having safer communities in which to live and work
2. Significantly reduce the risk of loss of life, injuries, economic costs, and destruction of natural and cultural resources that result from natural hazards

State of Oklahoma Mitigation Strategy and Goals

The State of Oklahoma has developed a Standard Hazards Mitigation Plan to guide all levels of government, business, and the public to reduce or eliminate the effects of natural disasters. The goals of the plan are:

1. To protect life
2. To protect property
3. To protect the environment
4. To increase public preparedness for disasters

The Tulsa County and participating jurisdictions' Goal

To improve the safety and well-being of the citizens residing and working in the Tulsa County, the Town of Sperry, the Berryhill Public School, the Keystone Public School, the Liberty Public School, and the Sperry Public School, by reducing the potential of death, injury, property damage, environmental and other losses from natural and technological hazards

Goals for mitigation of each of the hazards are presented in Chapter 4.

1.1.7 Point of Contact

The primary point of contact for information regarding this plan is:

Roger Jolliff
Director
Tulsa Area Emergency Management Agency
600 Civic Center, E.O.C.
Tulsa, OK 74103
Telephone: (918) 596-9898
e-mail: rjolliff@tulsacounty.org

The secondary point of contact is:

Jamie Ott
Deputy Director
Tulsa Area Emergency Management Agency
600 Civic Center, E.O.C.
Tulsa, OK 74103
Telephone: (918) 596-9891
e-mail: jott@tulsacounty.org

2015 Plan Update Contractor was:

INCOG
2 W Second Street, #800
Tulsa, OK 74103
Office: (918) 584-7526

The INCOG staff member for the plan update contract was John M^CElhenney
e-mail: info@incog.org

1.2 Community Description

Like most counties in the region, Tulsa County is faced with a variety of hazards, both natural and man-made. Any part of the county may be impacted by high winds, hail, extreme heat, severe winter storms, tornados, hazardous materials events, and other hazards. In some hazards such as flooding, dam break, wildfires and expansive soils, the areas most at risk have been mapped.

Tulsa County is located in the northeastern part of the State of Oklahoma.

1.2.1 Geography

Latitude: 36.1167N
Longitude: 95.9333W

Tulsa County is located in northeast Oklahoma, intersected by the Arkansas River. Tulsa County has an incorporated area of 570.3 square miles. The area is generally flat to mildly sloping terrain toward the river.

1.2.2 Climate

The Tulsa County climate is essentially continental, characterized by rapid changes in temperature. The winter months are usually mild and the summer months are hot. Temperatures of 100 degrees or higher are often experienced from late July to early September. January's average low temperature is 26.3 degrees Fahrenheit and July's average high is 93.8 degrees Fahrenheit. Tulsa County will receive a wide variety of precipitation throughout any given year. The average annual rainfall is 42.4 inches.

1.2.3 History

Located on the Arkansas River on lands that were once part of the Creek and Cherokee nations, Tulsa County was created at statehood and took its name from the town of Tulsa in the Creek Nation, Indian Territory. The name, Tulsa, is derived from Tulsey Town, an old Creek settlement in Alabama.

1.2.4 Population and Demographics

According to the U.S. Census 2012 American Community Survey 1-year estimates, Tulsa County had a population of 614,000. The median age was 35.3 years. Twenty five percent of the population is under 18 years and 13 percent was 65 years or older. Older populations are more vulnerable to certain hazards, such as extreme heat and cold. A map, showing the age 65 and older areas, is shown in Map Number 2 in Appendix 1. The median household income in Tulsa County was \$47,315. Fourteen percent of households had income below \$15,000. Low-income populations are also more vulnerable to extreme temperatures as they do not have the means to protect themselves from these extremes. The low-moderate income populations are shown on Map Number 3 in Appendix 1. The racial makeup of the County was 74% White, 11% African American, 5% Native American, 3% Asian, less than 0.5% Pacific Islander, 3% were of another race, and 8% were from two or more races.

1.2.5 Local Utilities--Lifelines

Lifelines are defined as those infrastructure facilities that are essential to the function of the community and the well-being of its residents. They generally include transportation and utility systems. Transportation systems include interstate, US, and state highways, and railroads. Utility systems include electric power, gas and liquid fuels, telecommunications, water, and wastewater. The following table shows utilities and the companies that service Tulsa County.

**Table 1-3:
Utility Suppliers for Tulsa County**

<i>UTILITY</i>	<i>SUPPLIER</i>
Electric	AEP/PSO
Water	Cities of Broken Arrow, Collinsville, Sand Springs, Skiatook, and Tulsa. And Rural Water Districts Creek #2, Tulsa #1, #2, #3, #4, and Washington #3.
Sewage Treatment	Cities of Broken Arrow, Bixby, Collinsville, Glenpool, Jenks, Owasso, Sand Springs, Skiatook, Sperry, and Tulsa.
Natural Gas	Oklahoma Natural Gas Company
Telephone, including Cellular	SBC, Sprint, Verizon, AT&T, US Cellular, T-Mobile, Cox and Bixby telephone
Railroad	BNSF railroad, Sand Springs railroad, Union Pacific railroad, South Kansas & Oklahoma railroad

1.2.6 Economy

According to the U.S. Census 2012 American Community Survey 1-year estimates, in Tulsa County, 62 % of the population 16 years and older were employed. Eight five percent of the people employed were private wage and salary workers, 9% were federal, state, or local government workers, and 6% were self-employed in their own not incorporated business. The median household income in Tulsa County was \$47,315.

1.2.7 Industry

The larger employers in the unincorporated Tulsa County area are:

- American Airlines
- EDS
- Bama Industries
- Holly Industries Oil Refinery
- Macy's Distribution
- Cherokee Industrial Park, including Whirlpool Corporation and NORDAM Group

1.2.8 Future Development

Outside of the large communities in Tulsa County, growth continues at a moderate pace. Eight residential subdivisions have been developed from 2010 through 2014, and four commercial developments have been developed or are in process of developing over this time period.

Growth Trends:

The Oklahoma Department of Commerce estimates that unincorporated Tulsa County will continue to grow at 0.83% per year over the next 20 years. Residential development activity will be concentrated in and around the larger communities of Tulsa and Broken Arrow, and commercial development activity is forecast to be primarily along SH 75 north of the City of Tulsa.

1.3 Regulatory Framework

Tulsa County is bound by Title 19, Oklahoma Statutes (Cities & Towns). The Town of Sperry is bound by the 'The Town of Sperry Ordinances,' and Title 11, Oklahoma Statutes (Cities & Towns). The four Public Schools are bound by Oklahoma Statute Title 70 (Schools), as well as state and federal laws as they relate to public schools. The Tulsa County Ordinances and the Town of Sperry Ordinances allows for and prescribe the methods for changing their existing codes, policies, and programs.

This section contains a summary of the current ordinances for land use, zoning, subdivision, and floodplains in Tulsa County and the Town of Sperry. These were reviewed by the Tulsa County Hazard Mitigation Planning Committee. It also lists the current building codes and fire insurance rating.

1.3.1 Comprehensive Planning and Zoning

The unincorporated portion of Tulsa County does not have a comprehensive plan. The Tulsa County subdivision regulations and Tulsa County zoning code are adopted by the County Commission. The Tulsa Metropolitan Area Planning Commission oversees the planning and zoning in the County. The zoning code and subdivision regulations with input from the land development department at INCOG were utilized as a reference in the development of this hazard mitigation plan.

Some unincorporated areas of Tulsa County are within the fence line of communities such as Broken Arrow, Sand Springs, Bixby Glenpool, Jenks, Sapulpa and Owasso. All of those cities have their own comprehensive plan that affects land use decisions within their fence line. Zoning and land use decisions are a collaborative effort with the appropriate cities and the Tulsa Metropolitan Area Planning Commission.

INCOG staff provides professional planning services to the Tulsa Metropolitan Area Planning Commission, Board of County Commissioners in Tulsa County and the Tulsa County Board of Adjustment.

The Town of Sperry has a comprehensive plan, zoning code, and subdivision regulations. The Town of Sperry Planning Committee oversees planning and zoning in the Town. The Zoning Code and Subdivision Regulations, and input by the Town, were utilized as a reference in the development of this Hazard Mitigation Plan.

The Tulsa County Zoning Code, last updated in 2008 is administered by Tulsa Metropolitan Area Planning Commission staff.

The Tulsa County Subdivision Regulations, last updated in 2005 is administered by the Tulsa County engineering staff.

The Town of Sperry comprehensive plan was last updated in 2013 and is administered by the Town staff.

The Town of Sperry Zoning Code, last updated in 2012 is administered by Town staff.

The Town of Sperry Subdivision Regulations, last updated in 2012 is administered by the Town staff.

1.3.2 Floodplain Management

Tulsa County and the Town of Sperry participate in the National Flood Insurance Program (NFIP). The County and the Town enforces each enforce their flood damage prevention ordinance. Their floodplain management regulations and mapping were utilized as a resource and reference in the development of this Hazard Mitigation Plan. The County's CRS rating is 6.

1.3.3 Building Codes

Both Tulsa County and the Town of Sperry use International Building Code, published by BOCA, as well as supplemental ordinances which cover areas where the International Codes are inadequate. This information was used as a reference in updating the hazard mitigation plan.

1.3.4 Fire Protection and Insurance

Tulsa County does not operate a fire department. Fire protection coverage is provided by the communities' fire departments in Tulsa County and by the other fire department in the County. These include the City of Bixby Fire Department, the City of Broken Arrow Fire Department, the City of Collinsville Fire Department, the City of Glenpool Fire Department, the City of Jenks Fire Department, the City of Owasso Fire Department, the City of Sand Springs Fire Department, the City of Sapulpa Fire Department, the City of Skiatook Fire Department, the City of Tulsa Fire Department, the Town of Sperry Fire Department, the Berryhill Fire Department, the Collinsville Rural Fire Department, the Keystone Volunteer Fire Department, the Liberty Volunteer Fire Department, and the Turley Volunteer Fire Department.

The Insurance Services Office (ISO) collects information on fire department's fire protection efforts. ISO assigns a rating from 1 to 10. Class 1 represents superior property fire protection, and Class 10 indicates that the area's protection doesn't meet ISO's minimum criteria. Primary factors related to the ISO rating involve how the department responds to alarms and notifies its personnel; the supply and distribution of water in the area; staffing; training and equipment. As of July 2014, the ISO ratings for the fire departments are as follows:

City of Bixby Fire Department is 5, City of Broken Arrow Fire Department is 2, City of Collinsville Fire Department is 5, City of Glenpool Fire Department is 3, City of Jenks Fire Department is 4, City of Owasso Fire Department is 4, City of Sand Springs Fire Department is 3, City of Sapulpa Fire Department is 3, City of Skiatook Fire Department is 6, Town of Sperry Fire Department is 6, City of Tulsa Fire Department is 3, Berryhill Fire Department is 3, Collinsville Rural Fire Department is 6, Keystone Volunteer Fire Department is 5, Liberty Volunteer Fire Department is 9, Turley Volunteer Fire Department is 6.

Fire Department statistics and information were used as a reference in the assessment of the wildfire hazard discussed in Chapter 3.

1.4 Existing Plans Incorporating Hazard Mitigation

All the participants in this mitigation plan update have existing plans that incorporate the goals, objectives and actions of hazard mitigation. The review of existing plans is important in the preparation of this hazard mitigation plan. The TCHMPC reviewed the existing plans to include information from these plans into the mitigation plan.

1.4.1 Emergency Operations Plans

Tulsa County has adopted an Emergency Operations Plan in 2014.

The Town of Sperry has adopted an Emergency Operations Plan in 2014.

The Berryhill Public School has an Emergency Operations Plan, adopted in 2014.

The Liberty Public School has an Emergency Operations Plan, adopted in 2014.

The Keystone Public School has an Emergency Operations Plan, adopted in 2014.

The Sperry Public School has an Emergency Operations Plan, adopted in 2014.

Their EOPs were used as reference in preparing this hazard mitigation plan update. As part of the municipalities' EOP, critical facilities were identified. These facilities include shelters, police and fire stations, schools, childcare centers, senior citizen centers, hospitals, disability centers, vehicle and equipment storage facilities, and emergency operations centers. The critical facilities in Tulsa County and Sperry are listed in Section 3.3. The vulnerability of critical facilities to various hazards is addressed in this study.

1.4.2 Capital Improvement Plan

The capital improvement plan (CIP) is the principle method of scheduling and financing future capital needs, and part of those needs could address hazard mitigation actions. Major updates to capital improvement plans occur as events warrant an update and plans receive a minor review during the annual budgeting process. Projects on a capital improvement plan could have a positive impact upon the community's ability to mitigate and respond to hazard events.

Tulsa County has a CIP. Their CIP was last updated in 2014. Projects on their plan include:

- New PC work stations for administrative services
- Upgrade the energy management system at the court house
- Resurface the election board parking lot
- Replace the highway department pole barn
- Replace the highway department dump trucks
- New juvenile bureau facility
- New picnic shelter at Chandler Park
- Replacement of Sheriff Department vehicles

The Town of Sperry has a CIP. The CIP was last updated in 2006. Projects on their plan include:

- Improvements at Sperry Lake Park
- Animal shelter at Sperry Lake Park

The Berryhill Public School has a CIP. Their CIP was last updated in 2007. Projects on their plan include:

- Eliminate existing lagoon sewerage system
- Develop and implement a flood elimination and excess run-off plan
- Expand/add to security cameras
- Add security lighting in parking areas
- Add safe-rooms to existing buildings

The Keystone Public School does not have a CIP.

The Liberty Public School has a CIP. Their CIP was last updated in 2009. Projects on their plan include:

- Repair high school gym and elementary roof
- Replace old gym floor
- Acquire the land and build a VO-AG building
- New windows at the elementary school
- New tile in hall and four elementary school classrooms

The Sperry Public School does not have a CIP.

Chapter 2: The Planning Process

2.1 Documentation of the Planning Process

The Tulsa County Multi-Hazard Mitigation Plan is a county-wide effort to coordinate the Tulsa County multi-hazard planning, development, and mitigation activities. The Indian Nations Council of Governments (INCOG) was responsible for overall coordination and preparation of the plan, aided by the Tulsa Area Emergency Management Agency, representatives of the four participating Public Schools, and the Tulsa County Hazard Mitigation Planning Committee (TCHMPC).

A mitigation plan is the product of a rational thought process that reviews the hazards, quantifies their impacts on the county, identifies alternative mitigation activities, and selects those activities that will work best for the jurisdiction.

This plan addresses the following hazards:

1. Floods
2. Tornados
3. High Winds
4. Lightning
5. Hailstorms
6. Severe Winter Storms
7. Extreme Heat
8. Drought
9. Expansive Soils
10. Wildfires
11. Earthquakes
12. Hazardous Materials Events
13. Dam Breaks

The approach for the Tulsa County multi-hazard mitigation plan update followed a ten-step process, based on the guidance and requirements of FEMA. The ten steps are described below.

2.1.1 Step One: Organize to Prepare the Plan

An open public process was established to give all Tulsa County residents and agencies in the County's regional area interested in hazard mitigation issues an opportunity to become involved in the planning process and make their views known. Citizens and community leaders; information from cities, counties, regional, state, and federal agencies; and professionals active in hazard mitigation planning provide important input in the development of the plan.

The planning process was conducted by the Tulsa County Hazard Mitigation Planning Committee (TCHMPC), made of representatives of the participating jurisdictions and other interested parties.

The TCHMPC was supported by INCOG. INCOG staff worked with the committee for this hazard mitigation plan update. INCOG staff met several times during the planning process with TCHMPC members and attended the meetings of the TCHMPC.

The TCHMPC met at the Tulsa Area Emergency Management Agency office during the planning process to review progress, identify issues, receive task assignments, and advise the INCOG staff. Local research and input was provided by committee members and the INCOG staff provided a

regional hazard mitigation perspective and direct access to state and federal hazard information resources and led the preparation of draft planning documents. INCOG staff outlined the plan and prepared a draft. Committee members reviewed the hazards, provided specific County information, conducted the public hazard awareness survey, evaluated mitigation activities, and selected the action plan activities. INCOG staff then prepared the final plan update for review. A list of TCHMPC members and meetings are shown in Table 2-1. The agendas, minutes, and sign-in sheets for these meetings are included in Appendix 2.

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**Table 2–1:
Tulsa County Hazard Mitigation Planning Committee**

NAME	AFFILIATION	TITLE	CONTRIBUTIONS
Roger Jolliff	Tulsa Area Emergency Mgmt Agency	Emergency Mgmt Director Committee Chair	Chaired the planning meetings, Contributed data on past hazards, Contributed information on past mitigation efforts, Reviewed draft plan Contributed to plan revisions, Coordinated survey within community, Provided information on County plans
Jamie Ott	Tulsa Area Emergency Mgmt Agency	Deputy Emergency Management Director	Provided information on the County Contributed data on past hazards Reviewed draft plan Contributed to plan revisions
Mike Smith	Town of Sperry	Emergency Management Director	Provided information on the Town Contributed data on past hazards Reviewed draft plan Contributed to plan revisions
Mike Campbell	Berryhill Schools	Superintendent	Provided information on the School Coordinated mitigation activities Reviewed draft plan Contributed to plan revisions
Jo Etta Terrell	Berryhill Schools	Assistant Superintendent	Provided information on the School Coordinated mitigation activities Reviewed draft plan Contributed to plan revisions
Rhett Bynum	Keystone Schools	Superintendent	Provided information on the School Coordinated mitigation activities Reviewed draft plan Contributed to plan revisions
Donna Campo	Liberty Schools	Superintendent	Provided information on the School Coordinated mitigation activities Reviewed draft plan Contributed to plan revisions
Brent Core	Sperry Schools	Assistant Superintendent	Provided information on the School Coordinated mitigation activities Reviewed draft plan Contributed to plan revisions
Mike Juby	Sperry Schools	School Safety Officer	Provided information on the School Coordinated mitigation activities Reviewed draft plan Contributed to plan revisions
Ann Domin	INCOG	Deputy Director	Reviewed draft plan Contributed to plan review Provided regulatory information
Duane Wilkerson	INCOG / Tulsa Metro Area Planning Commission	Tulsa County Land Development Administrator	Provided information on other County plans, Reviewed draft plan, Contributed to plan revisions Provided information on the area, Provided information on current and future development trends
Todd Kilpatrick	Tulsa Levee District 12	Commissioner	Provided information on County plans Contributed data on the levee system Reviewed draft plan Contributed to plan revisions

Terry West	Tulsa County Inspections Dept	Floodplain Administrator	Provided information on County plans Contributed data on past hazards Reviewed draft plan Contributed to plan revisions
Samantha Henry	Red Cross, Tulsa Chapter	Disaster Relief Specialist	Provided information on the general area Reviewed draft plan Contributed to plan revisions
Kelly Baker	Oklahoma Property Investors	Property Manager	Provided information on the general area Reviewed draft plan Contributed to plan revisions
Joe Kralicek	Tulsa Area Emergency Mgmt Agency	Communications Director	Provided information on County plans Contributed data on past hazards Reviewed draft plan Contributed to plan revisions
John M ^c Elhenney	INCOG	Senior Civil Engineer	Lead Contractor, Wrote the plan drafts, Contributed data on past hazards, Reduced and processed the data, Coordinated the planning meetings, Make presentations at the planning meetings, Reviewed draft plan, Made the plan revisions, Coordinate grant requirements

**Table 2–2:
Committee Meetings and Activities**

<i>Date</i>	<i>Activity</i>
First meeting 02/17/2015	TCHMPC meeting at the Tulsa County emergency management office to discuss the overall need for a plan, the jurisdictions to be included in the update, the planning process and plan outline, discussed the hazard identification and assessment issues and begin review of Draft Plan. Developed a hazard awareness survey.
Follow up to first meeting 02/20/2015 and 03/11/2015	Several participants were not able to attend the 02/17/2015 meeting due to school closings and inclement weather. Therefore, two follow up meetings were held for the participants to do the agenda from the 02/17/2015 meeting. The activities at these two meetings were the same as the activities for the 02/17/2015 meeting.
Second meeting 04/09/2015	TCHMPC meeting at the Tulsa County emergency management office to review the hazard awareness survey, review the hazard profiles, discuss mitigation goals and objectives, and discuss mitigation activities and the ranking process.
Third meeting 05/14/2015	TCHMPC meeting at the Tulsa County emergency management office to review the selection of mitigation activities for Tulsa County, Town of Sperry and the four participating schools. Also discuss the plan maintenance of the plan, and the adoption process.
Public Hearing 06/06/2015	A public hearing was held at the 06/08/2015 on the updated multi-jurisdictional multi-hazard mitigation plan.
Fourth meeting 06/18/2015	TCHMPC meeting at the Tulsa County emergency management office to receive comments from other communities and agencies, and Committee recommendation to approve the plan.

2.1.2 Step Two: Involve the Public

The TCHMPC took several activities to involve the public in preparing the plan. A hazard awareness survey was developed and circulated by TCHMPC members to solicit community input on hazard awareness and assessment of their level of concern. Feedback from these surveys was important to the development of the plan in that it let the committee know the general concern the public had to these hazards. The surveys were completed during the week of February 23, 2015. 165 responses were received. A copy of the survey and summary of the responses are included in Appendix 4. Public comments were also invited through a public hearing. A public hearing was held on June 8, 2015 to solicit public comments on the draft plan. A copy of the notice advertising the public hearing and minutes of the hearing are included in Appendix 2.

2.1.3 Step Three: Coordinate with Other Agencies and Organizations

As part of the plan update process and to collect data on the hazards that impact Tulsa County, the TCHMPC reviewed information sources: public agencies, private organizations, and businesses that contend with natural hazards. These sources included printed documents and internet web sites. The agencies and organizations included FEMA, the Corps of Engineers, the US Geological Survey, INCOG, the State Department of Environmental Quality, the National Climatic Data Center, the National Oceanic and Atmospheric Administration, and the Natural Resource Conservation Service. The following list of agencies was invited to participate in the planning process and comment on a draft of the updated plan prior to approval. Sample letters are included in Appendix 3.

Federal

US Army Corps of Engineers
Joe Remondini
Floodplain Coordinator

Natural Resources Conservation Service
Tulsa County Conservation District
Gary Bishop
District Conservationist

State

Oklahoma Emergency Management
Annie Vest
State Hazard Mitigation Officer

Oklahoma Water Resources Board
Gavin Brady
State NFIP Coordinator

Oklahoma Conservation Commission
Dan Sebert
District Operations Director

Oklahoma Dept of Wildlife Conservation
Richard Hatcher
Director

Oklahoma Dept of Environmental Quality
Scott Thompson
Executive Director

Regional

Indian Nation Council of Governments
Rich Brierre
Executive Director

City

City of Bixby
Ike Shirley
Police Chief

City of Broken Arrow
David Boggs
Police Chief

City of Collinsville
Russell Young
Fire Chief

City of Glenpool
Paul Newton
Fire Chief

City of Jenks
Mike Tinker
City Manager

City of Owasso
Cliff Motto
Director, Emergency Management

City of Sand Springs
Greg Fisher
Director, Emergency Management

City of Skiatook
Dan Yancey
City Manager

Town of Sperry
Mike Smith
Director, Emergency Management

City of Tulsa/Tulsa Area Emergency Management Agency
Roger Jolliff
Director

Business

Oklahoma Property Investors
Kelly Baker
Property Manager

Academia

Berryhill Schools
Mike Campbell
Superintendent

Keystone Schools
Rhett Bynum
Superintendent

Liberty Schools
Donna Compo
Superintendent

Sperry Schools
Brian Beagles
Superintendent

Non-Profit

American Red Cross, Tulsa Chapter
Regina Moon
Executive Director

Coordination with other county planning efforts is critical to the success of the hazard mitigation plan update. The TCHMPC used information included in the most current version of the County's Comprehensive Plan, Emergency Operations Plan, FIRM Maps, Building Codes and County Ordinances as part of the update process. The TCHMPC provided information in regard to the utilization of the initial Multi-Hazard Mitigation Plan as a resource for integrating action plan activities.. Through participation in the TCHMPC, the Town of Sperry, Berryhill Public Schools, Keystone Public Schools, Liberty Public Schools, and the Sperry Public Schools provided information to the plan update process.

2.1.4 Step Four: Assess the Hazard

The TCHMPC collected data on the hazards from available sources. Hazard assessment is included in Chapter 3, with the discussion of each hazard.

Table 2-3 lists the various hazards that affect Tulsa County. It describes how they were identified, and why they were identified. The location of each hazard with respect to the County and the Town of Sperry, Berryhill Public Schools, Keystone Public Schools, Liberty Public Schools, and the Sperry Public Schools will be addressed in the Risk Assessment chapter of the plan.

**Table 2–3:
How and Why Hazards Were Identified**

<i>Hazard</i>	<i>How Identified</i>	<i>Why Identified</i>
Floods	<ul style="list-style-type: none"> Review of FEMA and County floodplain maps Buildings in the floodplains Historical floods and damages 	<ul style="list-style-type: none"> Improved and unimproved property parcels in Tulsa County are located in the regulatory floodplain
Tornados	<ul style="list-style-type: none"> Review of recent disaster declarations Input from Emergency Manager Review of data from the NCDC 	<ul style="list-style-type: none"> Tulsa County is located in “Tornado Alley”
High Winds	<ul style="list-style-type: none"> NCDC information and statistics 	<ul style="list-style-type: none"> High wind-related events regularly occur in Tulsa County
Lightning	<ul style="list-style-type: none"> NCDC information and statistics 	<ul style="list-style-type: none"> Thunder and lightning occur regularly throughout the County.
Hailstorms	<ul style="list-style-type: none"> NCDC information and statistics 	<ul style="list-style-type: none"> Anecdotal evidence suggests hail damage accounts for the highest residential insurance claims. The hail hazard can occur anywhere in the County.
Severe Winter Storms	<ul style="list-style-type: none"> Review of past Disaster Declarations Input from County Emergency Management 	<ul style="list-style-type: none"> Severe snow and ice events seem to occur annually. The impact is felt regionally.
Extreme Heat	<ul style="list-style-type: none"> Review of data from NCDC Recent summers have seen above average temperatures 	<ul style="list-style-type: none"> Anecdotal evidence from committee. Extreme heat is extremely dangerous to the elderly and infirm.
Drought	<ul style="list-style-type: none"> Historical vulnerability to drought, the “Dust Bowl” era Water shortages in adjacent communities in recent years 	<ul style="list-style-type: none"> Need to ensure adequate long- term water resources for the County

Expansive Soils	<ul style="list-style-type: none"> • Input from INCOG • Review of NRCS data 	<ul style="list-style-type: none"> • Damage to buildings from expansive soils is difficult to determine. • Can be mitigated with building code provisions.
Earthquakes	<ul style="list-style-type: none"> • Historic records of earthquakes in Oklahoma. • Input from Oklahoma Geological Survey 	<ul style="list-style-type: none"> • Two major earthquakes within 80 miles of Tulsa County in 2011. • Oklahoma Geological Survey record suggest small events occur but go unfelt
Wildfires	<ul style="list-style-type: none"> • Input from TAEMA 	<ul style="list-style-type: none"> • Continuing loss of life and property due to fires • Other hazards (winds, heat, drought) compound this hazard
Dam Break	<ul style="list-style-type: none"> • Information from OWRB 	<ul style="list-style-type: none"> • There are six high hazard dams affecting Tulsa County.
Hazardous Materials Events	<ul style="list-style-type: none"> • Input from ODEQ • Input from the TAEMA 	<ul style="list-style-type: none"> • Hazard material storage sites are in Tulsa County. • Major traffic ways expose the County to potential traffic way hazardous materials incidents

2.1.5 Step Five: Assess the Problem

The hazard data was analyzed in light of what it means to public safety, health, buildings, transportation, infrastructure, critical facilities, and the economy. County and INCOG staff prepared several analyses using INCOG’s geographic information system. The discussion of the problem assessment is addressed for each hazard in Chapter 3.

DAMAGE ESTIMATION METHODOLOGY

The following methodologies were used in the development of damage cost estimated for buildings and contents for flooding and tornado/high wind damage, used in Tulsa County’s Multi-Hazard Mitigation Plan Update.

Structure Value: The value of the buildings within Tulsa County was obtained from the Tulsa County Assessor’s office.

Contents Value: Value of contents for all buildings was estimated using FEMA 386-2 *Understanding Your Risks*. Table, page 3-11, “Contents Value as Percentage of Building Replacement Value”.

2.1.6 Step Six: Set Goals

Hazard mitigation goals and objectives for Tulsa County were developed by the TCHMPC to guide the development of the plan. The hazard mitigation goals and objectives for the County and participating jurisdictions are listed in Chapter 4.

2.1.7 Step Seven: Review Possible Activities

A wide variety of measures that can affect hazards or the damage from hazards were examined. The mitigation activities were organized under the following six categories. A more detailed description of each category is located in “Chapter 4: Mitigation Strategies.”

1. **Preventive activities**—Zoning, building codes, County ordinances
2. **Structural Projects**—Levees, reservoirs, channel improvements
3. **Property protection**—Acquisition, retrofitting, insurance
4. **Emergency service**—Warning, sandbagging, evacuation
5. **Public information and education**—Outreach projects and technical assistance

2.1.8 Step Eight: Draft an Action Plan

The County and TCHMPC reviewed the list of recommended actions in the initial Tulsa County Multi-Hazard Mitigation Plan. The County reported to the committee the projects that were completed. Potential future hazard mitigation activities were reviewed and discussed by the committee. The County then selected mitigation projects and activities for the County to include in this update; for each project or activity identified for this update, it identified the party responsible for implementing the task, estimated the cost of the project, identified potential funding sources, and determined the target completion date for each activity. Each participating jurisdiction did the same for their own jurisdiction. Once all the jurisdiction’s action plans were drafted, they were inserted into the final draft of the County multi-hazard mitigation plan update.

2.1.9 Step Nine: Adopt the Plan

The TCHMPC reviewed the final draft approved the final plan and submitted it to the Tulsa County Board of County Commissioners, the Town of Sperry Town Board, and the Berryhill Public School’s Board of Education, the Keystone Public School Board of Education, the Liberty Public School Board of Education, and the Sperry Public School Board of Education, for adoption.

2.1.10 Step Ten: Implement, Evaluate, and Revise

Adoption of the Multi-Hazard Mitigation Plan is only the beginning of this effort. Tulsa County, the Town of Sperry, Berryhill Public Schools, Keystone Public Schools, and the Sperry Public School will proceed with implementation. The TCHMPC will monitor progress, evaluate the activities, and annually recommend revisions to the action items. This process will involve quarterly meetings in which the TCHMPC will monitor progress on the Action Plan and review other mitigation actions for inclusion in the Action Plan for Years 2 through 5. This monitoring and review process will also be coordinated so as to provide input into other appropriate County, Town, of Public School’s planning efforts; specifically updates to the County’s, Town’s, and the Schools’ Capital Improvement Plan and the Annual Budget.

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Draft for Comments

Chapter 3:

Risk Assessment and Vulnerability Analysis

3.1 Identifying Hazards

There were 13 hazards investigated by the TCHMPC. The hazards are listed in Table 2.2. Hazard information was obtained from the TAEMA, TCHMPC members, County records, regional planning agency (INCOG), flood insurance rate maps, NOAA, and public input. These were considered to all be relevant to Tulsa County, following the committee's hazard information search. Hazard identification was discussed at the initial hazard mitigation planning meetings, held on February 17, 2015.

The location of each hazard will be profiled in Section 3.2. Of the 13 hazards, four hazards vary in magnitude by location. These four hazards are the flood hazards, the dam break hazard, the wildfire hazard, and the expansive soils hazards. Their location will be discussed in each hazard's location sub-section in Section 3.2. The location of these four hazards with respect to the Town of Sperry and the four participating Schools will also be discussed in Section 3.2. The other nine hazards do not vary in their magnitude by location; they can occur of any magnitude anywhere in the County.

The Town of Sperry and the participating schools' buildings are all in the Tulsa County. Each school building is located at the address shown in Section 1.1.2. A map showing the location of the school buildings with respect to Tulsa County's county boundary, showing that the schools are all within the Tulsa County, is shown in on Map Number 1A in Appendix 1.

3.2 Profiling the Hazards

This section provides a profile of each hazard. In this section, the letter "X", when included in a subsection identification label, refers to a specific hazard's subsection, as follows:

X=1	Flood Hazard	X=8	Drought Hazard
X=2	Tornado Hazard	X=9	Expansive Soils Hazard
X=3	High Winds Hazard	X=10	Wildfire Hazard
X=4	Lightning Hazard	X=11	Earthquake Hazard
X=5	Hail Storm Hazard	X=12	Hazardous Material Hazard
X=6	Winter Storm Hazard	X=13	Dam Break
X=7	Heat Hazard		

Subsection 3.2.X.1 describes each hazard, subsection 3.2.X.2 identifies the location of the hazard, subsection 3.2.X.3 identifies the extent (such as severity or magnitude) of the hazard, subsection 3.2.X.4 provides information on previous occurrences, subsection 3.2.X.5 discusses the probability of future occurrences, and subsection 3.2.X.6 discusses vulnerability and impact.

Each hazard affects the County as a whole, except floods, wildfires, expansive soil and dam breaks which are location specific.

3.2.1 Flood Hazard

3.2.1.1 Flooding is defined as the accumulation of water within a water body and the overflow of the excess water onto adjacent lands. The floodplains are the lands adjoining the channel of a river, stream, lake, or other watercourse or water body that is susceptible to flooding.

Flooding can take many forms including river floods (riverine) and creeks. The most likely event for serious flooding would be due to storm water drainage backup caused by a large amount of rainfall. Floods can occur with little or no warning and can reach peak flow within a few minutes. Waters from floods move with great force and velocity and can roll boulders, tear out trees, destroy buildings, and sweep away bridges. These walls of water generally carry large amounts of debris.

3.2.1.2 The location of the flood hazard in Tulsa County is the regulatory floodplain, as shown on the Flood Insurance Rate Maps (FIRMs). The flood hazard is shown on Map Number 5 in Appendix 1. The County has specific flooding hazard at the following locations:

- At 56th St N and Yale Avenue with Bird Creek.
- At 105th St N and Peoria Avenue with Bird Creek.
- At 101st St S and Garnett Road with Haikey Creek.
- At 101st St S and 33rd W Avenue with Polecat Creek

The regulatory flood extends into the Town of Sperry as shown on the street level, Map Number 5A. The Town has specific flooding hazard at the following locations:

- At 96th St N between Peoria and Yale Avenues with Bird Creek
- At 98th St N and Peoria with Hominy Creek
- At 86th St N and Cincinnati Avenue with Delaware Creek

For the Berryhill Public Schools, the High School, Middle School, North and South Elementary Schools are located on property encroaching on the regulatory floodplain. The Keystone Public School, the Liberty Public Schools, and the Sperry Public Schools are located on properties that do not encroach onto the regulatory floodplain. Street level maps showing each school campus in relation to the regulatory floodplain is shown on maps as follows:

- | | |
|----------------------------|---------------|
| • Berryhill Public Schools | Map Number 5B |
| • Keystone Public Schools | Map Number 5C |
| • Liberty Public Schools | Map Number 5D |
| • Sperry Public Schools | Map Number 5E |

3.2.1.3 The severity of a flood is determined by several factors; including, rainfall intensity, duration, and location, and ground cover imperviousness and degree of saturation. The magnitude of the flood hazard is the regulatory floodplain. Tulsa County, the Town of Sperry, and the four Schools use the regulatory floodplain to measure of the extent of the flood hazard.

The regulatory floodplain is defined as the area inundated by the runoff from the rainfall having a one-percent chance of occurring in any given year. The regulatory floodplain is identified in the County's Flood Insurance Rate Maps (FIRMs) as Zone A and Zone AE. This is also for the Town of Sperry. The following chart describes the FIRM's flood zones.

**Table 3-1
FLOOD ZONES**

Zone A	The 100-year or Base Floodplain. There are seven types of A zones:	
	A	The base floodplains mapped by approximate methods, i.e., BFEs are not determined. This is often called an unnumbered A zone or an approximate A zone.
	A1-30	These are known as numbered A zones (e.g., A7 or A14). This is the base floodplain where the firm shows a BFE (old format).
	AE	The base floodplain where base flood elevations are provided. AE zones are now used on new format FIRMs instead of A1-30 zones.
	AO	The base floodplain with sheet flow, ponding, or shallow flooding. Base flood depths (feet above ground) are provided.
	AH	Shallow flooding base floodplain. BFE's are provided.
	A99	Area to be protected from base flood by levees or Federal flood protection systems under construction. BFEs are not determined.
	AR	The base floodplain that results from the de-certification of a previously accredited flood protection system that is in the process of being restored to provide a 100-year or greater level of flood protection
Zone V and VE	V	The coastal area subject to velocity hazard (wave action) where BFEs are not determined on the FIRM.
	VE	The coastal area subject to velocity hazard (wave action) where BFEs are provided on the FIRM.
Zone B and Zone X (shaded)	Area of moderate flood hazard, usually the area between the limits of the 100-year and the 500-year floods. B zones are also used to designate base floodplains or lesser hazards, such as areas protected by levees from the 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile.	
Zone C and Zone X (unshaded)	Area of minimal flood hazard, usually depiction FIRMs as exceeding the 500-year flood level. Zone C may have ponding and local drainage problems that do not warrant a detailed study or designation as base floodplain. Zone X is the area determined to be outside the 500-year flood.	
Zone D	Area of undetermined but possible flood hazards.	

Tulsa County, the Town of Sperry, and the four Schools consider runoff that stays within the creek banks and does not rise above the street curbs and causes no damage to be of minor severity. And Tulsa County, the Town of Sperry, and the four Schools consider runoff that fills the floodplain, blocks streets, overtops the street curbs, and gets into residences and businesses to be of major severity.

3.2.1.4 Historically, Tulsa County, the Town of Sperry, and the four Schools have recognized flooding as a hazard. The County joined the National Flood Insurance Program (NFIP) in 1981, adopting a Flood Damage Prevention Resolution, and requiring that all future development be built one foot above the 100-year base flood elevation. The Town of Sperry also joined the National Flood Insurance Program (NFIP) in 1981, adopting a Flood Damage Prevention Resolution, and requiring that all future development be built one foot above the 100-year base flood elevation. According to the National Climatic Data Center, from 2010 through 2014, the Tulsa County has had two flood events from 2010 through 2014, and the Town of Sperry has had zero flood events from 2010 through 2014.

The County floodplain administrator reports they are 29 repetitive loss structures in the County that are insured through the National Flood Insurance Program; 27 are single family residential structures and two are commercial. The Town of Sperry floodplain administrator reports they are

no repetitive loss structures in the Town that are insured through the National Flood Insurance Program.

The Berryhill Public Schools have not had a flood occurrence in the same 2010 through 2014 time frame. The Keystone Public Schools have not had a flood occurrence in the same 2010 through 2014 time frame. The Liberty Public Schools have not had a flood occurrence in the same 2010 through 2014 time frame. And the Sperry Public Schools also have not had a flood occurrence in the same 2010 through 2014 time frame.

Appendix 6 summarizes previous occurrences of this hazard for the Tulsa County and the Town of Sperry.

The previous Tulsa County Hazard Mitigation Plan was approved in 2010. Since the previous plan was approved, Tulsa County has been included in two federally declared disasters; DR-1985 and DR-1876 for severe winter storms. Neither federally declared disasters were for floods.

3.2.1.5 The probability of future flooding from the regulatory floodplain is statistically a one-percent chance of occurring in any given year, the 100-year floodplain. The County and the Town of Sperry requires all new development to develop in compliance with their flood damage prevention ordinance. Therefore, new development will not cause an increase in the flood hazard by not increasing the hazard on to adjacent property and building new structures above the regulatory flood elevation; both provisions of the ordinance. The probability of future flood damage should not increase with future development. According to the likelihood rating from Appendix 6 (the definition of the likelihood scale is shown in Appendix 6), the likelihood of a flood hazard in the County is “highly likely”. The likelihood of a flood hazard in the Town of Sperry is “unlikely”. The likelihood of the flood hazard on the Berryhill Public Schools is “unlikely”. And the likelihood of the flood hazard occurring at either of the Keystone Public Schools or the Liberty Public Schools or the Sperry Public Schools is “unlikely”.

3.2.1.6 The impact of this hazard in terms of the number of structures and buildings and the potential damage the hazard may cause to the structures and buildings is discussed in the following sections 3.3, and 3.4. The impact of the hazard in terms of the capabilities or activities on Tulsa County, the Town of Sperry, and the four Schools is discussed as follows.

The low-lying areas in the flood plains would be more susceptible to flooding than areas on higher ground. Roadways in the area are vulnerable and have a history of having to be closed during flooding events. This can cause temporary interruptions to the highway and road system and has the potential to isolate a community for a period of time.

**Table 3-2
CONTRIBUTING FACTORS TO THE FLOOD HAZARD**

Factor	Effect
Precipitation Rate	As the rate of precipitation increases, the ground's infiltration rate is exceeded. This is the dominant factor in flash flooding events, and can overwhelm any or all of the following factors.
Training Echoes	Storm cells that follow each other (much like box cars on a train) can repeatedly deposit large amounts of water on the same watershed, overwhelming its ability to handle runoff.
Slope of Watershed	Steeper topography (hills, canyons, etc.) will move runoff into waterways more quickly, resulting in a quicker, flashier response to precipitation.
Shape of Watershed	Longer, narrower watersheds will tend to "meter out" runoff so that water arrives from down shed (nearer to the mouth of the stream) areas faster than from up shed areas. In watersheds that are more square or circular than elongated, runoff tends to arrive in the main stem at the same time, intensifying the response. This factor becomes more significant with larger watersheds.
Saturation of Soils	Saturated or near-saturated soils can greatly reduce the rate at which water can soak into the ground. This can increase runoff dramatically.
Hardened Soils	Extremely dry soils can develop a pavement or "crust" that can be resistant to infiltration. This is especially true in areas of recent wildfire, where plant oils or resins may cause the soil to be even more water-resistant.
Urbanization	The urban environment usually intensifies the response to heavy precipitation. The two dominant urban factors are: 1) increased pavement coverage, which prevents infiltration and dramatically increases runoff; and 2) Urban systems are designed to remove water from streets and byways as quickly as possible. This accelerates the natural response to precipitation by placing runoff in waterways much more quickly.
Low-water crossings	The vast majority of flash flood related deaths occur in vehicles. Many of these deaths occur at low-water crossings where the driver is unaware of the depth of the water or the consequences of driving into it.

There are 1585 parcels of property with structures in the unincorporated Tulsa County that are in the 100 year floodplain. It is unknown the number of people that reside in these residences; these structures are valued at approximately 157 million dollars.

There are 23 parcels of property with structures in the Town of Sperry that are in the 100 year floodplain. It is unknown the number of people that reside in these residences; these structures are valued at approximately \$953,000.

For the Berryhill Public Schools, the High School, Middle School, North and South Elementary Schools are located on property encroaching on the regulatory floodplain. The Keystone Public School, the Liberty Public Schools, and the Sperry Public Schools are located on properties that do not encroach onto the regulatory floodplain.

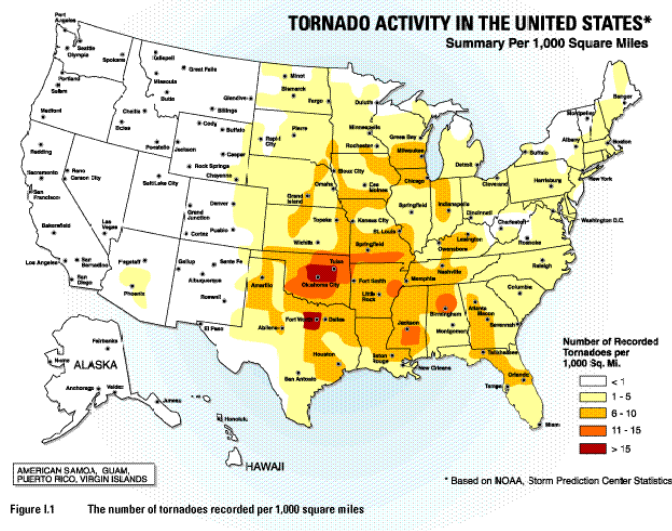
A typical flood hazard would be an event where rainfall causes runoff to exceed the creek channel capacity spilling runoff into the floodplain fringe, the area between the creek channel and the edge of the regulatory floodplain. This area of inundation would still be regulated by the County's Flood Damage Prevention Ordinance in the unincorporated Tulsa County and the Town of Sperry's Flood Damage Prevention Ordinance in the Town of Sperry. With both ordinances, new buildings are protected under the ordinance requirements and older structures are addressed below in section 3.2.1.4. The worst case flood event would be where runoff exceeds the regulatory floodplain, thereby inundating areas and possibly structures outside the areas regulated

by the Flood Damage Prevention Ordinances. Tulsa County, the Town of Sperry, and the four Schools consider the regulatory floodplain the extent of the flood hazard.

3.2.2 Tornado Hazard

3.2.2.1 A tornado is a rapidly rotating vortex or funnel of air extending to the ground from a cumulonimbus cloud. When the lower tip of a vortex touches earth, the tornado becomes a force of destruction. The path width of a tornado is generally less than a half-mile, but the path length can vary from a few hundred yards to dozens of miles. A tornado moves at speeds from 30 to 125 mph, but can generate winds exceeding 300 mph.

3.2.2.2 Tulsa County is located in the northeast part of Oklahoma. The following figure obtained from the FEMA web site shows central Oklahoma, along with the area around Fort Worth Texas, to be the area of highest number of recorded tornados per area in the country.



Within the County, no area of the County is at any more or less risk from the tornado hazard. This is true for the Town of Sperry and the four Schools participating in the plan.

3.2.2.3 The severity of tornados is measured on the Fujita tornado scale and Enhanced Fujita tornado scale. On February 1, 2007, the Fujita tornado scale was decommissioned in favor of the more accurate Enhanced Fujita tornado scale. None of the tornados recorded on or before January 31, 2007 will be re-categorized. Therefore maintaining the Fujita tornado scale will be necessary when referring to previous events.

The County, the Town, and the four participating Schools use these scales to measure the extent of the hazard.

**Table 3-3
FUJITA TORNADO SCALE**

Category	Wind Speed (mph)	Damage
F0	Gale tornado (40-72)	Light: Damage to chimneys, tree branches, shallow-root trees, sign boards
F1	Moderate tornado (73-112)	Moderate: Lower limit is beginning of hurricane wind speed—surfaces peeled off roofs, mobile homes pushed off foundations or overturned, cars pushed off roads
F2	Significant tornado (113-157)	Considerable: Roofs torn off frame houses, mobile homes demolished, boxcars pushed over, large trees snapped or uprooted, light-object missiles generated
F3	Severe tornado (158-206)	Severe: Roofs and some walls torn off well-constructed houses, trains overturned, most trees in forest uprooted, cars lifted off the ground and thrown
F4	Devastating tornado (207-260)	Devastating: Well-constructed houses leveled, structures with weak foundations blown off some distance, cars thrown and large missiles generated
F5	Incredible tornado (261-318)	Incredible: Strong frame houses lifted off foundations and carried considerable distance to disintegrate, automobile-sized missiles fly through the air in excess of 100 yards, trees debarked

**Table 3-4:
ENHANCED FUJITA TORNADO SCALE**

Enhanced Fujita Category	Wind Speed (mph)	Potential Damage
EF0	65-85	Light damage: Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF1	86-110	Moderate damage: Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	Considerable damage: Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136-165	Severe damage: Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	Devastating damage: Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF5	>200	Incredible damage: Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (109 yd.); high-rise buildings have significant structural deformation; incredible phenomena will occur.

source: http://en.wikipedia.org/wiki/Enhanced_Fujita_Scale

According to the National Climatic Data Center, since 2007 when the Enhanced Fujita Tornado Scale was instituted, 84% of all tornadoes in Oklahoma have either been EF0 or EF1 while less than 2% have been EF4 or EF5. However, two-thirds of the EF4 and EF5 tornadoes were fatal.

Tulsa County, the Town of Sperry, and the four Schools consider a tornado event measuring EF0 and EF1 to be of minor severity. And Tulsa County, the Town of Sperry, and the four Schools consider tornado events measuring EF2 through EF5 to be of major severity.

3.2.2.4 From 2010 through 2014, there were three tornadoes in Tulsa County. The Town of Sperry has not had a tornado event in their corporate limits in this same 2010 through 2014 time frame. And none of the four Schools have had a tornado on their properties during this 2010 through 2014 time frame. Map Number 6 in Appendix 1 shows previous tornado events around the Tulsa County area.

Appendix 6 summarizes previous occurrences of this hazard.

The previous Tulsa County Hazard Mitigation Plan was approved in 2010. Since the previous plan was approved, Tulsa County has been included in two federally declared disasters; DR-1985 and DR-1876 for severe winter storms. Neither federally declared disasters were for tornadoes.

3.2.2.5 Meteorological conditions have not changed, so future tornado events should occur at the same probability as previous events. No area of the County is any more or less at risk from the tornado hazard. According to the likelihood rating from Appendix 6 (the definition of the likelihood scale is shown in Appendix 6), the likelihood of a tornado hazard in the County is “highly likely”. The likelihood of a tornado hazard in the Town of Sperry is “unlikely”. The likelihood of the tornado hazard on the Berryhill Public Schools is “unlikely”. And the likelihood of the tornado hazard occurring at either of the Keystone Public Schools or the Liberty Public Schools or the Sperry Public Schools is “unlikely”.

3.2.2.6 The impact of this hazard in terms of the number of structures and buildings and the potential damage the hazard may cause to the structures and buildings is discussed in the following sections 3.3 and 3.4. The impact of the hazard in terms of the capabilities or activities on Tulsa County, the Town of Sperry, and the four Schools is discussed as follows.

Tulsa County, the Town of Sperry, and the four Schools are located in what is considered an active part of tornado alley. Every structure in the County is vulnerable to tornados. Structures, automobiles, persons, agriculture, and utilities can sustain damage from tornados. Utility service outages can affect large segments of the population for long periods of time.

On the lower end, damage from an EF0 tornado with winds from 65-85 mph can result in destruction of road signs, tall structures, trees, and possible damage to shingled roofs. Mid – range EF2 to EF4 tornados with winds from 86-200 mph will result in considerable damage. Roofs will be torn off structures, mobile homes completely demolished, most trees and plant life destroyed, objects as big as cars thrown small distances (as well as other light missiles being generated), and trains being blown over can result from these storms. The worst case is the EF5 tornado with winds greater than 200 mph. Total destruction will occur in the path of the tornados, which have been up to ½ mile wide in the past. Homes, automobiles, appliances, outbuildings, and anything outdoors can be picked up and thrown long distances as large missiles.

Utility infrastructure, such as power lines, substations, water towers, and water wells, is vulnerable and can be severely damage or destroyed from a tornado. Emergency vehicles responding to the devastated areas can have trouble responding due to down power lines and

debris in roadways. Livestock is vulnerable during tornado events and are often killed since there is little protection for the animals on the open range. People caught in the path of a tornado who don't take shelter have the potential of being injured or killed. Residents most vulnerable to tornados are those living in mobile homes.

Historically the tornado will move in a southwest to northeast direction, but can move in any direction. Consequently, vulnerability of humans and property is difficult to evaluate since the tornados form at different strengths, in random locations, and create narrow paths of destruction.

Advances in meteorology and the use of Doppler radar allow better prediction of tornado formation. A network of storm watchers attempt to identify funnel clouds and report to various networks to alert the population. Even though these advances have significantly improved the available response time, tornados can still occur unexpectedly and without warning.

Utilizing warning systems, County residents can take appropriate precautions prior to and during these events. As a result, casualty rates are low. The popularity of mobile/manufactured housing has increased susceptibility of existing structures to tornados. The use of better building techniques, tie-down systems and the availability of storm shelters all help mitigate losses in the County. The Town of Sperry also uses emergency warning sirens to warn its citizens. The four Schools use their public address systems to warn everyone in their buildings and on their grounds.

A typical tornado hazard would be an EF0 event, as defined in Table 3-4 above, the Enhanced Fujita tornado scale. The worst case tornado hazard would be an EF5 event, as defined in Table 3-4 above.

3.2.3 High Wind Hazard

3.2.3.1 Wind is defined as the motion of air relative to the earth's surface. Extreme windstorm events are associated with cyclones, severe thunderstorms, and accompanying phenomena such as tornados and downbursts. Winds vary from zero at ground level to 200 mph in the upper atmospheric jet stream at 6 to 8 miles above the earth's surface. The mean annual wind speed in the mainland United States is reported by FEMA to be 8 to 12 mph, with frequent speeds of 50 mph and occasional wind speeds of greater than 70 mph. Oklahoma wind speeds average 10 miles per hour.

3.2.3.2 The location of this hazard is uniform over the entire County area. No areas of the County, including the Town of Sperry and the four participating Schools, are any more or less at risk from a high wind hazard.

3.2.3.3 The magnitude of the high wind hazard is categorized on various wind scales, such as the Saffir-Simpson and the Beaufort Scales. Tulsa County, including the Town of Sperry and the four participating Schools, use these scales to measure the extent of the hazard. The tables below containing the Saffir-Simpson and Beaufort scales show that there is little consensus of opinion as to what wind speeds produce various damages. The National Weather Service (NWS) issues Severe Thunderstorm Warnings whenever a thunderstorm is forecast to produce wind gusts to 58 miles per hour (50 knots) or greater and/or hail one inch in diameter or larger. Hail size increased from $\frac{3}{4}$ inch to one inch on January 5, 2010, for warning issues. The hail hazard will be addressed in Section 3.2.5.

Table 3-5: Saffir-Simpson Scale

Category	Wind Speed (mph)	Storm Surge (feet)	Damages
1	74-95	4- 5	Minimal: Trees, shrubbery, unanchored mobile homes, and some signs damaged, no real damage to structures
2	96-110	6-8	Moderate: Some trees toppled, some roof coverings damaged, major damage to mobile homes
3	111-130	9-12	Extensive: Large trees are toppled, some structural damage to roofs, mobile homes destroyed, structural damage to small homes and utility buildings
4	131-155	13-18	Extreme: Extensive damage to roofs, windows, and doors, roof systems on small buildings completely fail, some curtain walls fall
5	155+	18+	Catastrophic: Roof damage is considerable and widespread, window and door damage is severe, extensive glass failure, entire buildings could fall

Table 3-6: Beaufort Scale

Force	Wind Speed (knots)	Description	Damages
0	Less than 1	Calm	Smoke rises vertically.
1	1-3	Light air	Smoke drift indicates wind direction. Leaves and wind vanes are stationary.
2	4-6	Light breeze	Wind felt on exposed skin. Leaves rustle. Wind vanes begin to move.
3	7-10	Gentle breeze	Leaves and small twigs constantly moving, light flags extended
4	11-16	Moderate breeze	Dust and loose paper are blown about. Small branches begin to move
5	17-21	Fresh breeze	Branches of a moderate size move. Small trees in leaf begin to sway.
6	22-27	Strong breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic bins tip over.
7	28-33	High wind, near gale	Whole trees in motion. Effort needed to walk against the wind.
8	34-40	Gale	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	41-47	Strong gale	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over.
10	48-55	Whole gale, storm	Trees are broken off or uprooted, structural damage likely.
11	56-63	Violent storm	Widespread vegetation and structural damage likely.
12	64+	Hurricane	Severe widespread damage to vegetation and structures. Debris and unsecured objects are hurled about

Tulsa County, including the Town of Sperry and the four participating Schools, consider a Saffir-Simpson Scale category 1 high wind event to be of minor severity. And Tulsa County, including the Town of Sperry and the four participating Schools consider Saffir-Simpson Scale categories 2 through 5 high wind events to be of major severity.

3.2.3.4 According to the National Climatic Data Center, Tulsa County has had two recorded high winds events during the period of 2010 through 2014. The NCDC did not report any high wind events in the Town of Sperry during this time period. The four participating Schools did not report any high wind events during this time period.

Appendix 6 summarizes previous occurrences of this hazard.

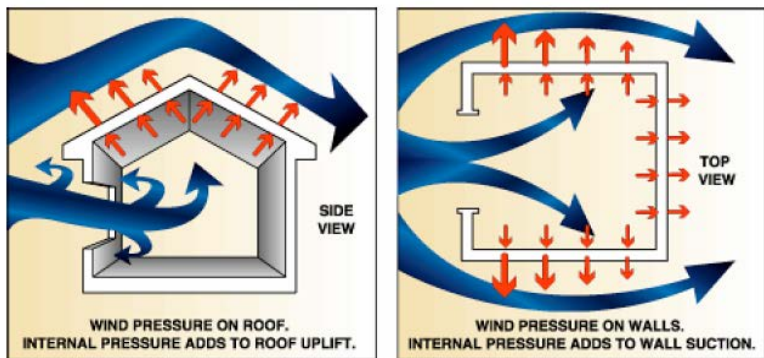
3.2.3.5 Meteorological conditions have not changed, so future high wind events should occur at the same probability as previous events. No area of the County is any more or less at risk from the high wind hazard. According to the likelihood rating from Appendix 6 (the definition of the likelihood scale is shown in Appendix 6), the likelihood of a high wind hazard in the County is “highly likely”. The likelihood of a high wind hazard in the Town of Sperry is “unlikely”. The likelihood of the high wind hazard on the Berryhill Public Schools is “unlikely”. And the likelihood of the high wind hazard occurring at either of the Keystone Public Schools or the Liberty Public Schools or the Sperry Public Schools is “unlikely”.

3.2.3.6 The impact of this hazard in terms of the number of structures and buildings and the potential damage the hazard may cause to the structures and buildings is discussed in the following sections 3.3 and 3.4. The impact of the hazard in terms of the capabilities or activities on the County, Sperry, and the four Schools is discussed as follows.

Winds are always part of severe storms such as tornados and thunderstorms, but do not have to accompany a storm to be dangerous. Straight-line winds and microbursts can all cause injury and damage. Very little available data exists separate from thunderstorms or tornado data. Any efforts made to mitigate for tornados or thunderstorm winds should address the hazard of high winds.

High winds can cause several kinds of damage to a building. The diagram below shows how extreme winds affect a building and helps explain why these winds cause buildings to fail. Wind speeds, even in these high wind events, rapidly increase and decrease. An obstruction, such as a house, in the path of the wind causes the wind to change direction. This change in wind direction increases pressure on parts of the house. The combination of increased pressures and fluctuating wind speeds creates stress on the house that frequently causes connections between building components to fail. For example, the roof or siding can be pulled off or the windows can be pushed in.

Diagram of Windstorm Effects



Buildings that fail under the effects of high winds often appear to have exploded, giving rise to the misconception that the damage is caused by unequal wind pressures inside and outside the building. This misconception has led to the myth that during an high wind event, the windows and doors in a building should be opened to equalize the pressure. In fact, opening a window or door allows wind to enter a building and increases the risk of building failure.

Damage can also be caused by flying debris. If wind speeds are high enough, debris can be thrown at a building with enough force to penetrate windows, walls, or the roof. A reinforced masonry wall can be penetrated unless it has been designed and constructed to resist debris impact during high winds. Because debris can severely damage, and even penetrate walls and roofs, they threaten not only buildings but the occupants as well.

In addition to structural issues, high winds can affect electrical and other utilities with service outages. Power lines can ground out or be knocked down causing loss of electrical service. There could also be loss of water, sewer, and communications abilities.

A typical high wind hazard would be a Saffir-Simpson Scale category 1 event, as defined in Table above, the Saffir-Simpson Scale. The worst case high wind hazard would be a Saffir-Simpson Scale category 5 event as defined in Table 3-6 above.

3.2.4 Lightning Hazard

3.2.4.1 Lightning is a discharge of atmospheric electricity, accompanied by a vivid flash of light, frequently from one cloud to another, sometimes from a cloud to the earth. The accompanying thunder sound is produced by the electricity passing rapidly through the atmosphere.

Within the thunderstorm clouds, rising and falling air causes turbulence which results in a buildup of a static charge. The negative charges concentrate in the base of the cloud. Since like charges repel, some of the negative charges on the ground are pushed down away from the surface, leaving a net positive charge on the surface. Opposite charges attract, so the positive and negative charges are pulled toward each other. This first, invisible stroke is called a stepped leader. As soon as the negative and positive parts of the stepped leader connect there is a conductive path from the cloud to the ground and the negative charges rush down it causing the visible stroke. Thunder is caused by extreme heat associated with the lightning flash. In less than a second, the air is heated from 15,000 to 60,000 degrees. When the air is heated to this temperature, it rapidly expands. When lightning strikes very close by, the sound will be a loud bang, crack or snap. Thunder can typically be heard up to 10 miles away. During heavy rain and

wind this distance will be less, but on quiet nights, when the storm is many miles away, thunder can be heard at longer distances.

3.2.4.2 The location of this hazard is uniform over the entire County area. No areas of the County, including the Town of Sperry and the four participating Schools, are any more or less at risk from a lightning hazard.

3.2.4.3 The type of lightning is a measure of the severity of the lightning hazard. Cloud-to-ground is the more severe type in terms of potential cause of damage. The table below from the National Climatic Data Center shows the types and frequency categories of lightning. The more severe type of lightning; coupled with an increased frequency, pose a greater lightning hazard.

**Table 3-7
TYPE OF LIGHTNING**

Type	Contraction	Definition
Cloud to Ground	CG	Lightning occurring between cloud and ground.
In Cloud	IC	Lightning occurring within the cloud.
Cloud to Cloud	CC	Streaks of lightning reaching from one cloud to another.
Cloud to Air	CA	Streaks of lightning which pass from a cloud to the air, but do not strike the ground.

**Table 3-8
FREQUENCY OF LIGHTNING**

Frequency	Contraction	Definition
Occasional	OCNL	Less than 1 flash per minute.
Frequent	FRQ	About 1 to 6 flashes per minute
Continuous	CONS	More than 6 flashes per minute.

Tulsa County, including the Town of Sperry and the four participating Schools consider any lightning event of less than 1 flash per minute as minor in severity, and any event of greater than 1 flash per minute as a major severity event.

3.2.4.4 For Tulsa County, the National Climatic Data Center (NCDC) reports six lightning events during the five year period from 2010 through 2014. The NCDC did not report any lightning events in the Town of Sperry during this time period. The four participating Schools did not report any lightning events during this time period.

Appendix 6 summarizes previous occurrences of this hazard.

3.2.4.5 Meteorological conditions have not changed, so future lightning events should occur at the same probability as previous events. No area of the County is any more or less at risk from the lightning hazard. According to the likelihood rating from Appendix 6 (the definition of the likelihood scale is shown in Appendix 6), the likelihood of a lightning hazard in the County is “highly likely”. The likelihood of a lightning hazard in the Town of Sperry is “unlikely”. The likelihood of the lightning hazard on the Berryhill Public Schools is “unlikely”. And the likelihood of the lightning hazard occurring at either of the Keystone Public Schools or the Liberty Public Schools or the Sperry Public Schools is “unlikely”.

3.2.4.6 The impact of this hazard in terms of the number of structures and buildings and the potential damage the hazard may cause to the structures and buildings is discussed in the following sections 3.3 and 3.4. The impact of the hazard in terms of the capabilities or activities on the County, Sperry, and the four Schools is discussed as follows.

Lightning strikes can cause high-voltage power surges that have the ability to seriously damage equipment. Property damage from power surges and resulting fires can destroy not only the electronics in private homes, but the structure itself.

The largest vulnerability to lightning is the potential loss of human life. Property damage can also occur to structures and electrical equipment. Anyone outdoors during a thunderstorm is exposed and at risk of injury from lightning.

A typical lightning hazard would be lightning that stays in the air, not touching the ground. The worst case lightning event would be a cloud to ground lightning type where the lightning strikes a large public gathering location which could result in mass casualties.

3.2.5 Hail Storm Hazard

3.2.5.1 Hail is frozen water droplets formed inside a thunderstorm cloud. They are formed during the strong updrafts of warm air and downdrafts of cold air, when the water droplets are carried well above the freezing level to temperatures below 32 degree F, and then the frozen droplet begins to fall, carried by cold downdrafts, and may begin to thaw as it moves into warmer air toward the bottom of the thunderstorm. This movement up and down inside the cloud, through cold then warmer temperatures, causes the droplet to add layers of ice and can become quite large, sometimes round or oval shaped and sometimes irregularly shaped, before it finally falls to the ground as hail.

3.2.5.2 The location of this hazard is uniform over the entire County area. No areas of the County, including the Town of Sperry and the four participating Schools, are any more or less at risk from a hail storm hazard.

3.2.5.3 The severity of damage caused by hail storms depends on the hailstone sizes (average and maximum), number of hailstones per unit area, and associated winds. The magnitude of a hail storm is as follows.

**Table 3-9
HAILSTONE SIZES**

Diameter	Example
1/4 inch	Pea
1/2 inch	Marble
3/4 inch	Penny
7/8 inch	Nickel
1 inch	Quarter
1 1/2 inches	Ping Pong Ball
1 3/4 inches	Golf Ball
2 1/2 inches	Tennis Ball
2 3/4 inches	Baseball
3 inches	Tea Cup
4 inches	Grapefruit
4 1/2 inches	Softball

The National Weather Service (NWS) issues Severe Thunderstorm Warnings whenever a thunderstorm is forecast to produce wind gusts of 58 miles per hour (50 knots) or greater and/or

hail size one inch in diameter or larger. Prior to January 5, 2010 the criteria for hail was ¾ inch or larger.

Tulsa County, including the Town of Sperry and the four participating Schools use the hailstone size as a measure of the extent of the hail hazard.

Tulsa County, including the Town of Sperry and the four participating Schools consider any hail event that causes major property damage or death to be a major severity, generally hail stone diameters one-inch and greater, and minor severity hail events are hail events that cause little property damage and no injuries, generally hail stones of less than one half inch in diameter.

3.2.5.4 According to the National Climatic Data Center, Tulsa County has had 40 hail hazard events of hail diameter ¾ inch and greater during the period from 2010 through 2014. The NCDC reports two hail hazard events in the Town of Sperry during this same time period. The four participating Schools did not report any hail damage at their areas during this same time period.

Appendix 6 summarizes previous occurrences of this hazard.

3.2.5.5 Meteorological conditions have not changed so future hail events should occur at the same probability as previous events. No area of the County is any more or less at risk from the hail hazard. According to the likelihood rating from Appendix 6 (the definition of the likelihood scale is shown in Appendix 6), the likelihood of a hail hazard in the County is “highly likely”. The likelihood of a hail hazard in the Town of Sperry is “occasional”. The likelihood of the hail hazard on the Berryhill Public Schools is “unlikely”. And the likelihood of the hail hazard occurring at either of the Keystone Public Schools or the Liberty Public Schools or the Sperry Public Schools is “unlikely”.

3.2.5.6 The impact of this hazard in terms of the number of structures and buildings and the potential damage the hazard may cause to the structures and buildings is discussed in the following sections 3.3 and 3.4. The impact of the hazard in terms of the capabilities or activities on the County, Sperry, and the four Schools is discussed as follows.

The impact of the hazard can range from damage through destruction of structures and personal property to bodily injury, depending on the diameter. The National Climatic Data Center has reported hail in the County up to 1 ¼ inches in diameter.

A typical hail storm hazard would be hailstones that are noticeable but cause no damage. The worst case hail storm event would be a hail storm event where the hailstones exceed the maximum diameter reported by a recording agency such as the National Climatic Data Center, causing wide-spread structure damage and at a time of a large public outdoor gathering causing injuries to persons not under cover of a substantial structure.

3.2.6 Winter Storm Hazard

3.2.6.1 All winter storms are accompanied by cold temperatures and blowing snow, which can severely reduce visibility. A severe winter storm is one that drops 4 or more inches of snow during a 12 –hour period, or 6 or more inches during a 24- hour span. An ice storm occurs when freezing rain falls and freezes immediately on impact. All winter storms make driving and walking extremely hazardous. The aftermath of a winter storm can impact a community or region for days, weeks, and even months. Winter storms are considered deceptive killers as they indirectly cause transportation accidents, and injury and death resulting from

exhaustion/overexertion, hypothermia and frostbite from wind chill, and asphyxiation; house fires occur more frequently in the winter due to the lack of proper safety precautions while using home heating equipment.

3.2.6.2 The location of this hazard is uniform over the entire County area. No areas of the County, including the Town of Sperry and the four participating Schools, are any more or less at risk from a winter storm hazard.

3.2.6.3 A winter storm can range from moderate snow (2 to 4 inches over 12 to 24 hours) to blizzard conditions (4 to 6 inches over 12 to 24 hours) with high winds, freezing rain or sleet, heavy snowfall with blinding wind-driven snow and extremely cold temperatures that last several days. Some winter storms may be large enough to affect several states while others may affect only a single community. All winter storms are accompanied by cold temperatures and blowing snow, which increases the severity of the winter storm.

The Sperry Piltz Ice Accumulation Index attempts to quantify the severity of the winter storm hazard. The scale is shown in Table 3-10.

Table 3-10

The Sperry-Piltz Ice Accumulation Index, or “SPIA Index” – Copyright, February, 2009

ICE DAMAGE INDEX	* AVERAGE NWS ICE AMOUNT (in inches) <small>*Revised-October, 2011</small>	WIND (mph)	DAMAGE AND IMPACT DESCRIPTIONS
0	< 0.25	< 15	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	0.10 – 0.25	15 - 25	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
	0.25 – 0.50	< 15	
2	0.10 – 0.25	25 - 35	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
	0.25 – 0.50	15 - 25	
	0.50 – 0.75	< 15	
3	0.10 – 0.25	> = 35	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
	0.25 – 0.50	25 - 35	
	0.50 – 0.75	15 - 25	
	0.75 – 1.00	< 15	
4	0.25 – 0.50	> = 35	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
	0.50 – 0.75	25 - 35	
	0.75 – 1.00	15 - 25	
	1.00 – 1.50	< 15	
5	0.50 – 0.75	> = 35	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.
	0.75 – 1.00	> = 25	
	1.00 – 1.50	> = 15	
	> 1.50	Any	

(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Tulsa County, including the Town of Sperry and the four participating Schools use this index to measure the extent of the hazard.

Tulsa County, including the Town of Sperry and the four participating Schools consider a SPIA index of 0 and 1 to be of minor severity. And Tulsa County, including the Town of Sperry and the four participating Schools, consider a SPIA index of 2 to 5 to be of major severity.

3.2.6.4 For Tulsa County, the National Climatic Data Center (NCDC) reports eight winter storm events during the five year period from 2010 through 2014. Winter storms are generally wide spread events so the Town of Sperry and the four participating Schools also experienced these eight winter storms from 2010 through 2014.

Appendix 6 summarizes previous occurrences of this hazard.

The previous Tulsa County Hazard Mitigation Plan was approved in 2010. Since the previous plan was approved, Tulsa County has been included in two federally declared disasters; DR-1985 and DR-1876 for severe winter storms.

3.2.6.5 Meteorological conditions have not changed so future events should occur at the same probability as the previous events. According to the likelihood rating from Appendix 6 (the definition of the likelihood scale is shown in Appendix 6), the likelihood of a winter storm hazard in Tulsa County is “highly likely” and the TCHMPC determined that is an appropriate probability for the Town of Sperry and the four participating Schools.

3.2.5.6 The impact of this hazard in terms of the number of structures and buildings and the potential damage the hazard may cause to the structures and buildings is discussed in the following sections 3.3 and 3.4. The impact of the hazard in terms of the capabilities or activities on the County, Sperry, and the four Schools is discussed as follows.

A typical winter storm hazard would be an ice damage index of 0, as defined by the Sperry Piltz Ice Accumulation Index. The worst case winter storm hazard would be an ice damage index of 5, as defined by the Sperry Piltz Ice Accumulation Index.

Tulsa County is affected periodically by heavy snow and ice that cause damage. Trees and power lines fall due to the weight of ice and snow causing power outages. Icy roads cause accident rates to increase and impair the ability for emergency vehicles to respond which can result in more injuries and a higher loss of life.

A major winter storm can be very dangerous. Preparing for cold weather conditions and responding to them effectively can reduce the dangers caused by winter storms.

3.2.7 Heat Hazard

3.2.7.1 A heat hazard is defined as when the temperature exceeds the body’s ability to cool itself. Humid conditions can worsen the hazard by limiting the body’s ability to cool itself. The National Weather Service issues an excessive heat warning when the heat index (a measure of the temperature combined with the relative humidity) is at least 105°F for more than 3 hours per day for 2 consecutive days, or if the heat index is greater than 115°F for any period of time.

3.2.7.2 The location of this hazard is uniform over the entire County area. No areas of the County, including the Town of Sperry and the four participating Schools, are any more or less at risk from the heat hazard.

3.2.7.3 The severity of the extreme heat is dependent on a combination of temperature and humidity. High temperatures, when combined with high humidity can put an area in the "Extreme Danger" category on the National Weather Service Heat Index scale. When extreme heat is combined with drought, excessively dry hot conditions that contribute to a high risk of life-threatening heat-related illnesses may result. The heat index is a measure of the severity of a

heat hazard. The heat index can be related to a range of specific heat disorders. Tulsa County can experience heat index reading into the heat stroke range.

**Table 3-11
HEAT INDEX**

Temperature (F) versus Relative Humidity (%)						
°F	90%	80%	70%	60%	50%	40%
80	85	84	82	81	80	79
85	101	96	92	90	86	84
90	121	113	105	99	94	90
95		133	122	113	105	98
100			142	129	118	109
105				148	133	121
110						135

Heat Index	Possible Heat Disorder:
80°F - 90°F	Fatigue possible with prolonged exposure and physical activity.
90°F - 105°F	Sunstroke, heat cramps and heat exhaustion possible.
105°F - 130°F	Sunstroke, heat cramps, and heat exhaustion likely, and heat stroke possible.
130°F or greater	Heat stroke highly likely with continued exposure.

Tulsa County, including the Town of Sperry and the four participating Schools use this scale to measure the extent of the hazard.

Tulsa County, including the Town of Sperry and the four participating Schools consider a heat index between 95 and 105 degrees to be of minor severity. And Tulsa County, including the Town of Sperry and the four participating Schools consider a heat event with a heat index above 105 degrees to be of major severity.

3.2.7.4 According to the National Climatic Data Center, one extreme heat event was reported in Tulsa County from 2010 through 2014. Extreme heat events are generally wide spread events so the Town of Sperry and the four participating Schools also experienced this one extreme heat event from 2010 through 2014. No structural damage was recorded for the heat hazard.

Appendix 6 summarizes previous occurrences of this hazard.

3.2.7.5 Meteorological conditions have not changed so future events should occur at the same probability as the previous events. According to the likelihood rating from Appendix 6 (the definition of the likelihood scale is shown in Appendix 6), the likelihood of a heat hazard in Tulsa County is “occasional” and the TCHMPC determined that is an appropriate probability for the Town of Sperry and the four participating Schools.

3.2.7.6 A typical heat hazard would be to persons experiencing heat indices between 90 and 105 degrees, as shown in table 3-11. The elderly population is most at risk from this heat hazard. The worst case heat hazard event would be to persons exposed to heat indices exceeding 130 degrees where heat stroke is likely.

In Oklahoma, the National Weather Service shows July is generally the hottest month of the year, followed by August.

Heat kills by pushing the human body beyond its limits. Under normal conditions, the body's internal thermostat produces perspiration that evaporates and cools the body. However, in extreme heat and high humidity, evaporation is slowed and the body must work extra hard to maintain a normal temperature.

Most heat disorders occur because the victim has been overexposed to heat or has over exercised for his or her age and physical condition. Other conditions that can induce heat-related illnesses include stagnant atmospheric conditions and poor air quality.

Extreme heat can have a serious economic impact on a community. Increased demand for water and electricity may result in shortages of resources. Moreover, damage to food supplies may occur as the heat damages agricultural crops and livestock are susceptible to heat related injuries or death.

Young children, elderly people, and those who are sick or overweight are more likely to become victims to extreme heat. Other conditions that can limit the ability to regulate temperature include fever, dehydration, heart disease, mental illness, poor circulation, sunburn, prescription drug use, and alcohol use. Another segment of the population at risk is those whose jobs consist of strenuous labor outside. When temperatures reach 90 degrees and above, people and animals are more likely to suffer sunstroke, heat cramps, and heat exhaustion.

Another extreme heat hazard is air pollution. During summer months, consistent high temperatures and stagnant airflow patterns cause a build-up of hydrocarbons to form a dome-like ceiling over large cities. The abundance of factories, automobiles, lawn equipment, and other internal combustion machines emit high particulate matter that builds and worsens with the increase in temperature. The resulting stagnant, dirty, and toxic air does not move away until a weather front arrives to disperse it. When the particulate matter reaches a pre-determined level, an ozone alert is issued for the Tulsa area and implementation measures are undertaken to reduce the use of cars and the output of the offending chemicals. Ozone alerts usually include advisories for the elderly and those with breathing difficulties to stay indoors in air-conditioned environments.

Extreme heat can have a structural impact. Roads can buckle during times of extreme heat. Tar becomes soft and can allow concrete to settle, creating gaps and uneven surfaces. Extreme heat leads to rapid evaporation of ponds and lakes, depleting water sources used by both farmers and the community. Often times, residents use additional water during extreme heat to counter the drying of soils and prevent vegetation from dying. This additional strain on water systems can lead to low water pressure, and can cause water shortages when firefighters are trying to save property and brush land dried out by the extreme heat.

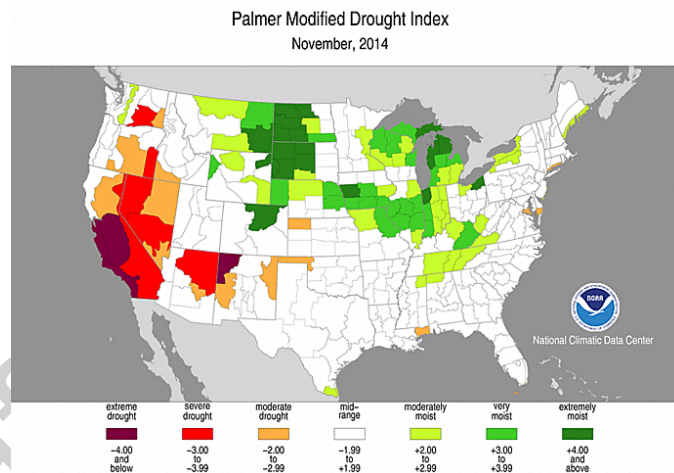
3.2.8 Drought Hazard

3.2.8.1 A drought is a period of drier-than-normal conditions that results in water-related problems. Precipitation (rain or snow) falls in uneven patterns across the country. When no rain or only a small amount of rain falls, soils can dry out and plants can die. When rainfall is less than normal for several weeks, months, or years; the flows in streams and rivers declines, water levels in lakes and reservoirs fall, and the depth to water in wells decreases. If dry weather persists and water supply problems develop, the dry period can become a drought. The first evidence of drought usually is seen in records of decreased rainfall. Within a short period of time, the amount of moisture in soils can begin to decrease. The effects of a drought on flow in streams and rivers or on water levels in lakes and reservoirs may not be noticed for several weeks or

months. Water levels in wells may not reflect a shortage of rainfall for a year or more after the drought begins. A period of below-normal rainfall does not necessarily result in drought conditions. Some areas of the United States are more likely to have droughts than other areas. In humid, or wet, regions, a drought of a few weeks is quickly reflected in a decrease in soil moisture and in declining flow in streams. In arid, or dry, regions, such as Oklahoma, people rely on ground water and water in reservoirs to supply their needs. They are protected from short-term droughts, but may have severe problems during long dry periods because they may have no other water source if wells or reservoirs go dry.

3.2.8.2 The location of this hazard is uniform over the entire County area. No areas of the County, including the Town of Sperry and the four participating Schools, are any more or less at risk from the drought hazard.

3.2.8.3 The Palmer Drought Index was developed in the 1960s and uses temperature and rainfall information in a formula to determine dryness. It has become the semi-official drought severity index. The Palmer Index is most effective in determining long term drought; a matter of several months. It uses a 0 as normal, and drought is shown in terms of minus numbers; for example, minus 2 is moderate drought, minus 3 is severe drought, and minus 4 is extreme drought. NOAA has used this index to classify the drought hazard through the continental United States. As of November 2014, Tulsa County was in the mid-range severity range of the Palmer Drought Index. The national map showing the November 2014 Palmer Drought Index is shown below.



Tulsa County, including the Town of Sperry and the four participating Schools use this scale to measure the extent of the hazard.

Tulsa County, including the Town of Sperry and the four participating Schools consider the drought hazard with a Palmer Drought Index of mid-range to be of minor severity. And Tulsa County, including the Town of Sperry and the four participating Schools consider the drought hazard with a Palmer Drought Index of severe drought and below to be of major severity.

3.2.8.4 One of the greatest natural disasters in U.S. history and the most severe and devastating to Oklahoma was the decade-long drought in the 1930s that has become known as the Dust Bowl. Reaching its peak from 1935 through 1938, high temperatures and low rainfall combined to destroy crops and livestock. High winds literally blew the land away, causing massive soil erosion. Hundreds of small rural communities were ruined and about 800,000

people were displaced. The total expenditure by the American Red Cross for drought relief in Oklahoma in 1930-1931 was the third largest ever in the nation.

According to the National Climatic Data Center, 16 drought events were reported in Tulsa County from 2010 through 2014. Drought events are generally wide spread events so the Town of Sperry and the four participating Schools also experienced these 16 drought events from 2010 through 2014. No structural damage was recorded for this hazard.

Appendix 6 summarizes previous occurrences of this hazard.

3.2.8.5 Meteorological conditions have not changed so future events should occur at the same probability as the previous events. According to the likelihood rating from Appendix 6 (the definition of the likelihood scale is shown in Appendix 6), the likelihood of a heat hazard in Tulsa County is “highly likely” and the TCHMPC determined that is an appropriate probability for the Town of Sperry and the four participating Schools.

3.2.8.6 A typical drought hazard would be a mid-range to moderate Palmer Drought Index, where some form of voluntary water rationing would be encouraged but not required, and the only damage would be to under watered lawns. The worst case drought hazard event would be a Palmer Drought index of negative 4.00 and below, an extreme drought, where it lasts for months to years.

Water shortages can also affect firefighting capabilities in both urban and rural settings through reduced water flows and pressures. Most droughts dramatically increase the danger of wildfires. Although droughts are most associated with summer and high temperatures, droughts can impact the County during winter months.

3.2.9 Expansive Soils Hazard

3.2.9.1 Soils and soft rock that tend to swell or shrink due to changes in moisture content are commonly known as expansive soils. Changes in soil volume present a hazard primarily to structures built on top of expansive soils. The most extensive damage occurs to highways and streets. The effect of expansive soils are most prevalent in regions of moderate to high precipitation, where prolonged periods of drought are followed by long periods of rainfall. Expansive soils can be recognized either by visual inspection in the field or by conducting laboratory analysis. Shale, clay shale, and residual soils containing smectite often have a characteristic "popcorn" texture, especially in semiarid areas.

3.2.9.2 The Natural Resources Conservation Service (NRCS) has identified the soils in Tulsa County. The expansive tendency of a soil is a function of its shrink-swell potential. The categories of shrink swell potential are discussed in Section 3.2.9.3.

The shrink swell potential of the soils in Tulsa County is shown on Map Number 7 in Appendix 1. The majority of the soils in Tulsa County are in the moderate and high shrink swell potential.

The shrink swell potential of the soils in the Town of Sperry is shown on Map Number 7A in Appendix 1. The majority of the soils in the Town of Sperry are in the high and very high shrink swell potential.

The shrink swell potential of the soils at the Berryhill Public Schools is shown on Map Number 7B in Appendix 1. The majority of the soils at the Berryhill Public Schools are in the moderate and high shrink swell potential.

The shrink swell potential of the soils at the Keystone Public Schools is shown on Map Number 7C in Appendix 1. The soils at the Keystone Public Schools are in the high shrink swell potential.

The shrink swell potential of the soils at the Liberty Public Schools is shown on Map Number 7D in Appendix 1. The majority of the soils at the Liberty Public Schools are in the moderate and high shrink swell potential.

The shrink swell potential of the soils at the Sperry Public Schools is shown on Map Number 7E in Appendix 1. The soils at the Sperry Public Schools are in the high shrink swell potential.

3.2.9.3 The NRCS sorts the shrink-swell potential soil property into five categories; very low, low, moderate, high, and very high. This is the range of magnitude of an expansive soils hazard. Shrink-swell potential categories are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The categories are very low, a change of less than 1%; low, 1 to 3%; moderate, 3 to 6%; high, 6 to 9%; and very high, greater than 9%. Map Number 7 in Appendix 1 illustrates the majority of the County is in the high shrink-swell potential.

Tulsa County, including the Town of Sperry and the four participating Schools use this scale to measure the extent of the hazard.

Tulsa County, including the Town of Sperry and the four participating Schools consider the expansive soils hazard's shrink-swell potential of very low to moderate to be of minor severity. And Tulsa County, including the Town of Sperry and the four participating Schools consider the expansive soils hazard's shrink-swell potential of high and very high to be of major severity.

3.2.9.4 No information is available for Tulsa County on how expansive soils have damaged structures. This hazard develops gradually and thus not usually reported, largely because a catastrophic expansive soils hazard event has not occurred. This is also for the Town of Sperry and the four participating Schools.

3.2.9.5 The soils properties have not changed so future occurrences of soils expansion and contraction will continue. An estimate of future occurrences is rated as "unlikely" for Tulsa County, as shown in the Likelihood Rating field in the Hazard Summary Table in Appendix 6 (the definition of the likelihood scale is shown in Appendix 6), because no data is reported for this hazard. And the TCHMPC determined that this "unlikely" likelihood rating is an appropriate probability for the Town of Sperry and the four participating Schools.

3.2.9.6 The impact of expansive soils is to foundations of structures, and occurs slowly over time, compared to a tornado. Structure foundations such as in homes and commercial buildings, concrete slabs in driveways and sidewalks, and parking lots, are at risk to this hazard. Asphalt surfaces such as highways and runways could be affected. These structures are affected because expansive soils cause uneven settlement of the soil under the structures' foundations. Excessive or uneven settlement can cause cracks in the foundation and damage to the structure above the foundation.

A typical expansive soils hazard would be to structures built in areas of high shrink-swell potential that were not built with any foundation displacement protection, such as post-tension reinforcing in foundations. The worst case expansive soils hazard event would be to structures as described above, but during extreme and extended drought conditions where the soils dry out to

such a depth causing voids to occur which would increase the circumstances for foundations to deflect causing foundation and structure damage.

Due to the generalized soils information, specific site analyses cannot be made for certain to determine if the County, Town, and the school properties have been impacted by the expansive soils hazard. Therefore, mitigation actions will be recommended to better quantify this hazard for each site.

3.2.10 Wildfire Hazard

3.2.10.1 Wildfires are defined as the uncontrolled burning of highly vegetated areas, usually in forests and wooded areas.

Wildfires are often referred to as grass fires in Tulsa County. The amount of control the fire department has on the burning vegetated area is a factor in calling the fire a wildfire. Also, the size of the burning vegetated area is a factor; a small area of burning vegetation is often referred to as a grass fire while a large area of burning vegetation is called a wildfire. Both size and control are factors in how this hazard is named, but specific criteria as when to refer to burning vegetation as a wildfire have not been established.

3.2.10.2 According to TAEMA, fire locations are more frequent around the boundary of the communities. This area is referred to as the wildland-urban interface. The amount of risk to this hazard can vary by location. The wildland-urban interface is where the main risk and vulnerability is to this wildfire hazard. This interface is defined as the area ½ mile either side of a community's corporate limits. Locations in the community inside their ½ mile wildland-urban interface are at less risk due to the reduction of vegetated area because of the community's homes, structures, and infrastructure. Areas outside the wildland-urban interface have a lower risk from the hazard because they are away from the populated areas.

This wildland-urban interface around the Tulsa County communities is shown on Map Number 8 in Appendix 1. When applying the ½ mile buffer to the Tulsa County communities, there are areas inside the larger communities' wildland-urban interface and areas in the unincorporated Tulsa County outside the communities' wildland-urban interface. The Town of Sperry's wildland-urban interface is shown on Map Number 8A in Appendix 1. All properties in the Town of Sperry are in Sperry's wildland-urban interface. The Sperry Public Schools are in the Town of Sperry wildland-urban interface, also shown on Map Number 8A in Appendix 1. The Berryhill Public Schools are in the City of Sand Springs' wildland-urban interface, as shown on Map Number 8B in Appendix 1. The Keystone Public School is not in a wildland-urban interface, also shown on Map Number 8B in Appendix 1. And the Liberty Public School is in the City of Glenpool wildland-urban interface, as shown on Map Number 8C in Appendix 1.

3.2.10.3 The extent of a hazard is the strength or magnitude of the hazard; a scale or way to quantify the magnitude of the hazard. The Keetch-Byram Drought Index (KBDI), created by John Keetch and George Byram, in 1968 for the United States Department of Agriculture's Forest Service, quantifies the probability of a wildfire based on soil moisture and other conditions related to drought. The index is designed as an assessment for fire potential. It is a continuous index, relating to the flammability of organic material in the ground. The KBDI attempts to measure the amount of precipitation necessary to return the soil to full field capacity. It is a closed system ranging from 0 to 800 units. Zero is the point of no moisture deficiency and 800 is the maximum drought that is possible. At any point along the scale, the index number indicates the amount of net rainfall that is required to reduce the index to zero, or saturation.

KBDI levels and its relationship to expected fire potential are reflected as follows:

- KBDI = 0 – 200: Soil moisture and large class fuel moistures are high and do not contribute much to fire intensity. This is typical of spring dormant season following winter precipitation.
- KBDI = 200 – 400: Typical of late spring, early growing season. Lower litter and duff layers are drying and beginning to contribute to fire intensity
- KBDI = 400 – 600: Typical of late summer, early fall. Lower litter and duff layers contribute to fire intensity and will burn actively.
- KBDI = 600 – 800: Often associated with more severe drought with increased wildfire occurrence. Intense, deep-burning fires with significant downwind spotting can be expected. Live fuels can also be expected to burn actively at these levels.

Tulsa County, including the Town of Sperry and the four participating Schools consider the wildfire hazard with a KBDI level of 0-400 to be of minor severity. And Tulsa County, including the Town of Sperry and the four participating Schools consider the wildfire hazard with a KBDI level of 400-800 to be of major severity.

3.2.10.4 The Sperry Fire Department responded to 165 grass fires from 2010 through 2014. The TCHMPC considered these responses to be indicative of all Tulsa County. Wildfires did not occur at the Berryhill Public Schools, the Keystone Public School, the Liberty Public Schools, or the Sperry Public Schools in this 2010 through 2014 time frame.

Appendix 6 summarizes previous occurrences of this hazard.

3.2.10.5 The fire departments in Tulsa County have continuing campaigns to educate the public on fire prevention. However, all fires cannot be prevented so this hazard will continue. The likelihood rating for wildfires in the County is “highly likely”. This estimate of future occurrences is taken from the Likelihood Rating scale in the Hazard Summary Table in Appendix 6 (the definition of the likelihood scale is shown in Appendix 6). The likelihood of a wildfire hazard in the Town of Sperry is “highly likely”. The likelihood of the hail hazard on the Berryhill Public Schools, the Keystone Public Schools, and the Liberty Public Schools is “unlikely”, because they have not had a wildfire event in the past years and are inside the interior of the wildland-urban interface in the unincorporated area of Tulsa County. And the likelihood of the wildfire hazard occurring at the Sperry Public Schools is “highly likely” because they are within the Town of Sperry which has a “highly likely” likelihood rating.

3.2.10.6 The impact of this hazard in terms of the number of structures and buildings and the potential damage the hazard may cause to the structures and buildings is discussed in the following sections 3.3 and 3.4. The impact of the hazard in terms of the capabilities or activities on Tulsa County, including the Town of Sperry and the four participating Schools is discussed as follows.

A typical wildfire hazard would be a grass fire, in which the Fire Department is dispatched to put out the fire before it causes any damage to crops, structures, or persons. The worst case wildfire scenario would be an event that could not be controlled before it overwhelms the fire department’s capabilities, causing damage to facilities, structures, and persons.

The number of structures in the Tulsa County communities’ wildland-urban interface, the area more vulnerable to a wildfire than the interior of the community, is shown in section 3.3.11 and the damage estimate for those structures is shown in section 3.4.6.

When wild lands are destroyed by fire, the resulting erosion can cause heavy silting of streams, rivers, and reservoirs. Serious damage to aquatic life, irrigation, and power production then occurs.

3.2.11 Earthquake Hazard

3.2.11.1 An earthquake is a sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the Earth's surface. For hundreds of millions of years, the forces of plate tectonics have shaped the Earth as the huge plates that form the Earth's surface move slowly over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free causing the ground to shake. Most earthquakes occur at the boundaries where the plates meet; however, some earthquakes occur in the middle of plates. Earthquakes strike suddenly, without warning. Earthquakes can occur at any time of the year and at any time of the day or night. On a yearly basis, 70 to 75 damaging earthquakes occur throughout the world. Estimates of losses from a future earthquake in the United States approach \$200 billion. There are 45 states and territories in the United States at moderate to very high risk from earthquakes, and they are located in every region of the country. California experiences the most frequent damaging earthquakes; however, Alaska experiences the greatest number of large earthquakes—most located in uninhabited areas. The largest earthquakes felt in the United States were along the New Madrid Fault in Missouri, where a three-month long series of quakes from 1811 to 1812 included three quakes larger than a magnitude of 8 on the Richter scale. These earthquakes were felt over the entire Eastern United States, with Missouri, Tennessee, Kentucky, Indiana, Illinois, Ohio, Alabama, Arkansas, and Mississippi experiencing the strongest ground shaking.

3.2.11.2 The faults most likely to affect Oklahoma are the New Madrid Fault, centered in the Missouri Bootheel region, the Meers Fault, located in southwestern Oklahoma near Lawton, and the Wilzetta Fault in central Oklahoma. The distance from the Missouri Bootheel region to Tulsa County is approximately 350 miles, and the distance from the Meers fault region to Tulsa County is approximately 180 miles.

3.2.11.3 The severity of an earthquake is expressed by the Richter scale. The Richter scale is a measure of the amplitude of the seismic waves. The Richter scale, named after Dr. Charles F. Richter of the California Institute of Technology, is the best known scale for measuring the magnitude of earthquakes. The scale is logarithmic. An earthquake of magnitude 2 is the smallest earthquake normally felt by people. Earthquakes with a Richter value of 6 or more are commonly considered major; great earthquakes have magnitude of 8 or more on the Richter scale.

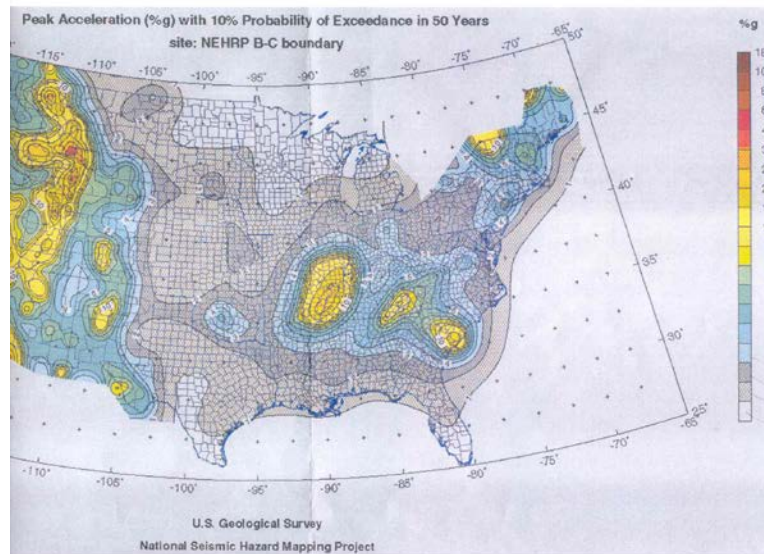
**Table 3-12
THE RICHTER SCALE**

Magnitude	Description
1 to 3	Recorded on local seismographs, but generally not felt.
3 to 4	Often felt, with little to no damage reported.
5	Felt widely, slight damage near epicenter.
6	Damage to poorly constructed buildings and other structures within 10 km.
7	"Major" earthquake. Causes serious damage up to 100 km (recent Taiwan, Turkey, Kobe, Japan, Iran and California earthquakes).
8	"Great" earthquake, great destruction, loss of life over several 100 km (1906 San Francisco, 1949 Queen Charlotte Islands).
9	Rare great earthquake, major damage over a large region over 1000 km (Chile 1960, Alaska 1964, and west coast of British Columbia, Washington, Oregon, 1700)

Tulsa County, including the Town of Sperry and the four participating Schools use this scale to measure the extent of the hazard.

Tulsa County, including the Town of Sperry and the four participating Schools consider an earthquake of magnitude 4 and below on the Richter scale to be a minor severity earthquake, and an earthquake greater than a magnitude 4 on the Richter scale to be of major severity.

The USGS National Seismic Hazard Mapping, shown below, shows Tulsa County in the 2%g (peak acceleration), 10% probability of exceedance in 50 years area. According to the FEMA document number 386-2, “Understanding Your Risks”, Step 1; areas with 2%g peak acceleration or less have a relatively low seismic risk, and an earthquake risk assessment is not warranted.



3.2.11.4 According to the U.S. Geological Survey, there have been no earthquake events in Tulsa County from 2010 through 2014, and none in the Town of Sperry nor the four participating Schools. On November 5, 2011, the state experienced its largest and third largest earthquakes in state history. A 4.8 magnitude earthquake occurred near Prague, and then a 5.6 magnitude earthquake occurred near Sparks. Both earthquakes were centered in Lincoln County, a county southwest of Tulsa County, in central Oklahoma. The later earthquake surpassed the then largest earthquake in state history, a 5.5 magnitude earthquake near El Reno on April 9, 1952.

There has been a noticeable increase in the number of earthquakes in Oklahoma in the past five years, according to U.S. Geological Survey records. From 1975 through 2009, there were 63 earthquakes in Oklahoma of magnitude 3.0 and greater. From 2010 through 2013, there were 249 earthquakes of magnitude 3.0 and greater. And in 2014, there were 585 earthquakes of magnitude 3.0 and greater. The majority of the earthquakes' epicenters are located in the central and northcentral part of the state. There are discussions amongst the geological agencies as to whether the increased number of earthquakes are naturally occurring or induced by man-made activities. The man-made activities of hydrofracturing and wastewater injection well injecting are oil and gas industry procedures that are included in the study of this increase in seismic activity.

3.2.11.5 According to the U.S. Geological Survey there have been no earthquake events in Tulsa County from 2010 through 2014, resulting in a likelihood rating of “unlikely”. This probability is appropriate for the Town of Sperry and the four participating Schools. The estimate

of future occurrences is shown in the Likelihood Rating field in the Hazard Summary Table in Appendix 6 (the definition of the likelihood scale is shown in Appendix 6).

3.2.11.6 The impact of this hazard in terms of the number of structures and buildings and the potential damage the hazard may cause to the structures and buildings is discussed in the following sections 3.3 and 3.4. The impact of the hazard in terms of the capabilities or activities on Tulsa County, including the Town of Sperry and the four participating Schools is discussed as follows.

A typical earthquake event would be a magnitude 1 to 3 on the Richter scale, which would be largely unfelt and would not cause noticeable damage. The worst case earthquake hazard would be a magnitude 9 on the Richter scale, causing a large amount of structure damage and personal injury.

All structures, homes, businesses and transportation infrastructure are vulnerable to an earthquake. Earthquakes occurring near the County can still impact the County. The timely notification of earthquake events can allow residents to take precautions in the event of an earthquake has not been developed. But notification of residents after an earthquake so they can be aware of aftershocks will be recommended as a mitigation activity to warn the public of a possible impending earthquake hazard.

3.2.12 Hazardous Material Hazard

3.2.12.1 Hazardous materials are chemical substances that, if released or misused, can pose a threat to the environment or human health. These chemicals are used in industry, agriculture, medicine, research, and consumer goods. Hazardous materials come in the form of explosives, flammable and combustible substances, poisons, and radioactive materials. These substances are most often released as a result of transportation accidents or chemical accidents at plant sites. In the State of Oklahoma, an owner or operator of a facility with storage of hazardous substances on-site are required to submit an inventory of those substances to ODEQ and the local fire department. These facilities are referred to as tier 2 facilities.

3.2.12.2 The tier II facilities within unincorporated Tulsa County and in the Town of Sperry are listed in the following table. Their general location is shown on Map Number 9 in Appendix 1, just for reference. There are no tier 2 sites at the four participating Schools' locations.

**Table 3-13
UNINCORPORATED TULSA COUNTY TIER 2 SITES**

Facility Name	Location	City
Airgas USA, LLC -	9741 E. 56th Street North	Tulsa
Bama Foods, Limited Partnership	5377 East 66th Street North	Tulsa
Da/Pro Owasso Plant	6712 North Canton Ave.	Tulsa
Dolese Brothers--Mohawk Plant	9510 East Mohawk Blvd	Tulsa
Fell Oil & Gas--Chisholm Lease	Sec 13-21N-12E	Tulsa
Greenhill Concrete Products, Inc.	East 76th Street North	Owasso
H&L Tooth Company	10055 East 56th Street	Tulsa
Hewlett-Packard Company	7400 North Lakewood Avenue	Tulsa
Honeywell Aerospace - Tulsa	6930 N. Lakewood Ave.	Tulsa
Hope Oil Co.--Thompson	SW/4 20-T21N-R13E	Sperry
Hope Oil Co.--Anna Koch	SW/4 SW/4 20-T21N-R13E	Sperry
Hope Oil Co.--Bertha Tiblow	N/2 NE/4 20-T21N-R13E,	Sperry
Hope Oil Co.--L. Gilstrap TR-1	N/2 NW/4 20-T21N-R13E,	Sperry
Hope Oil Co.--Painter & Scott	S/2, NE/4 NE/4 30-T21N-R13E	Sperry
Hope Oil Co.--RR Martin	NW/4 24-T21N-R12E,	Sperry
James H Burt--Burt Lease	SW/4 18-T21N-R13E,	Sperry
MCI- TUCBOK	6929 N LAKEWOOD AVE	Tulsa
NORDAM Manufacturing	6910 N. WHIRLPOOL DR	Tulsa
NORDAM Nacelle	6911 N. WHIRLPOOL DR	Tulsa
NORDAM Transparency Division	7018 N. Lakewood	Tulsa
PRL Manufacturing	4946 EAST 66TH STREET NORTH	Tulsa
PSO--Tulsa North	727 E. 86th Street North	Sperry
Ryerson - Tulsa	6434 North Erie Street	Tulsa
SH Production--Fugate	NW NE Sec 32-T21N-R13E	Tulsa
SH Production--Gate Emery	NW SE Sec 31-T21N-R13E	Tulsa
SH Production--Hinshaw	NE NE Sec 31-T21N-R13E	Tulsa
SH Production--Burgess	SE SE Sec 31-T21N-R13E	Tulsa
SH Production--Lantz	NE NW Sec 5-T20N-R13E	Tulsa
SH Production--Linehan,	SE SW Sec 32-T21N-R13E	Tulsa
SWBELL--SPERRY CO	120 1/2 W. MAIN	Sperry
Taylor Forge Engineered Systems	6333 N Erie Ave	Tulsa
Verdigris Valley Electric Coop	8901 E. 146 St. N.	Collinsville
Washington County RWD #3	17227 N. 129th East Ave	Collinsville
Whirlpool Corporation	7301 Whirlpool Drive	Tulsa
William Park--Bird Creek	SW SEC 29-T21N-R13E	Tulsa
William Park--Thelma	SW SEC 29-T21N-R13E	Tulsa
William Park--Wagner	SW SEC 29-T21N-R13E	Tulsa
Worstell--Chisholm Lease	Section 14 - T21N - R12E	Sperry
Worstell--May Lease	Section 18 - T21N - R13E	Sperry
Cartledge Oil--Allen/O'Hern	NE 11-16N-13E	Bixby
Citation Oil & Gas--Luvena	36°06'36.0"N 96°13'52.0"W	Tulsa
Corpro Companies	11616 W. 59th Street	Sand Springs
Corpro Companies	5750 S. 116th West Avenue	Sand Springs
FERRELLGAS--Bixby	13722 e 169st south	Bixby
Fullerton Finish Systems, Inc.	8645 W. 21ST STREET	Sand Springs
GREG SPARKS - Mayberry	NE SEC. 5 T-19N R-11E	Cleveland

Holly Energy Partners	1307 W. 35th Street	Tulsa
Holly Refining	902 West 25th Street	Tulsa
Holly Refining	1700 South Union	Tulsa
KLO--Bruner Vern Unit	Sec 5 19N 12E	Sand Springs
PSO--Wekiwa Substation	251 S. 209th W. Ave.	Sand Springs
SH Production--Offenbacher	NW SW Sec 32-T21N-R13E	Tulsa
SH Production--Sisler A Lease	SW SW Sec 32-T21N-R13E	Tulsa
SH Production--Sisler A1, B	NE SE Sec 31-T21N-R13E	Tulsa
SH Production--Story	SW NW Sec 32-T21N-R13E	Tulsa
Webco Industries	13701 W. Highway 51	Sand Springs
Xanadu Exploration Co.	NW/4 NW/4 SW/4 Sec. 13-T19N-10E	Tulsa
Xanadu Exploration Co	N2 N2 N2 NW/4 Sec. 24-T19N-R10E	Tulsa

3.2.12.3 The extent of the hazardous material hazard in Tulsa County is the tier 2 location sites. The sites include buildings or property where tier II materials are manufactured or stored, and are regulated nationally under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) by the U.S. Environmental Protection Agency (EPA), and in Oklahoma by the Department of Environmental Quality.

The hazardous material and location, as well as weather, population, topography, and ground vegetation, all could be factors in the event’s severity. But one gallon of gasoline spilled on a flat, impervious surface on a calm dry day in an unpopulated area would constitute an event of minor severity, where a tanker truck at a tier 2 facility carrying the tier II hazardous substance rupturing near a waterway on a hill in a populated area would constitute an event of major severity.

3.2.12.4 For the evaluation of previous occurrences of hazardous material events, traffic accidents with gasoline spills were included in the number of hazardous material events experienced by the County, in addition to responding to incidents at tier 2 facilities. The Fire Departments throughout Tulsa County are the first responders to hazardous material events in Tulsa County. As a representative number of historical hazardous material events in the County, the Sperry Fire Department was sampled. The Sperry Fire Department responded to 80 hazardous material spills during the 2010 through 2014 time frame. Appendix 6 summarizes previous occurrences of this hazard.

3.2.12.5 Chemicals and hazardous materials are used throughout our society today, and will continue to be used in the future. As such, Tulsa County will continue to be exposed to this hazard. The likelihood rating for hazardous material events for Tulsa County is “highly likely”. This estimate of future occurrences is taken from the Likelihood Rating scale in the Hazard Summary Table in Appendix 6 (the definition of the likelihood scale is shown in Appendix 6). The likelihood rating for hazardous material events for the Town of Sperry is “highly likely”. This estimate of future occurrences is taken from the Likelihood Rating scale in the Hazard Summary Table in Appendix 6 (the definition of the likelihood scale is shown in Appendix 6). The likelihood rating for the Berryhill Public Schools, the Keystone Public Schools, the Liberty Public Schools and the Sperry Public Schools is “unlikely” because none of the schools have had a hazardous material event on their property in the 2010-2014 time frame and none of the schools are tier 2 storage facilities.

3.2.12.6 Many parts of the County are susceptible to hazardous materials events due to the high number of highly traveled roads and highways. Potential impacts include disruptions in transportation if highways are shut-down. Local businesses and residences can be affected by the

roads being closed. Soils and waterways could become contaminated by spills. The County will follow its emergency operations plan in the event of any hazardous material event.

A typical hazardous material hazard scenario would be an automobile accident where gasoline (which is not a tier II) is spilled and the local fire department responds. The worst case scenario would be responding to facility that contains a hazardous material that has not been properly documented so the responders may not be properly prepared for the hazardous material they would be encountering. The quantity of a hazardous substance is not the sole factor in the severity of a hazardous material event. Location, weather, population, topography, vegetation all could be factors in the event's severity. But one gallon of gasoline spilled on a flat, impervious surface on a calm dry day in an unpopulated area would constitute an event of minor severity, where a tanker truck carrying a hazardous substance rupturing near a waterway on a hill in a populated area would constitute an event of major severity.

3.2.13 Dam Break Hazard

3.2.13.1 A dam is defined as a barrier constructed across a watercourse for the purpose of storage, control, or diversion of water. Dams typically are constructed of earth, rock, concrete, or mine tailings.

A dam break is the collapse, breach, or other failure resulting in downstream flooding. Dam breaks are primarily caused by hydrologic or structural deficiencies. A hydrologic deficiency is inadequate spillway capacity, caused by excessive runoff from a large amount of precipitation. Structural deficiencies include seepage, erosion, cracking, sliding, and overturning, mainly caused by the age of a dam and lack of maintenance.

3.2.13.2 The Oklahoma Water Resources Board (OWRB) coordinates the Oklahoma Dam Safety Program. OWRB categorize dams into three categories; low hazard, significant hazard, and high hazard. The location of the dam break hazard is the high hazard dams. The dams listed in Table 3-15 are the high hazard category dams in the unincorporated part of Tulsa County.

**Table 3-14
UNINCORPORATED TULSA COUNTY HIGH HAZARD DAMS**

NAME	CREEK/RIVER	HAZARD CATEGORY
Keystone Lake Dam	Arkansas River	H

An emergency action plan (EAP) is required by the OWRB for all high hazard category dams. An element of the EAP is an inundation map showing the area inundated in the event of its dam's break.

3.2.13.3 The Oklahoma Water Resources Board (OWRB) coordinates the Oklahoma Dam Safety. The dam safety program categorizes dams into three hazard categories; high, significant, and low. This would be the measure of the extent of the hazard. The OWRB defines these categories as follows. Low hazard dams are those where a break would result in no probable loss of human life and low economic losses. Significant hazard dams are those dams where a break would result in no probable loss of human life but can cause economic or disruption of lifeline facilities. High hazard dams are those dams where a break will probably cause loss of human life.

Tulsa County, including the Town of Sperry and the four participating Schools consider a partial collapse of a dam, limiting the area of dam water inundation to within the creek banks and not rise above the street curbs and that does not cause damage to be of minor severity. And Tulsa County, including the Town of Sperry and the four participating Schools consider a partial to total collapse of a dam, where dam water fills the inundation area, blocks streets, and gets into residences and businesses to be of major severity.

3.2.13.4 According to TAEMA and the National Climatic Data Center (NCDC), there have been no dam break events in Tulsa County from 2010 through 2014.

3.2.13.5 The likelihood of future hazard event occurrences is shown in the Likelihood Rating field in the Hazard Summary Table in Appendix 6 (the definition of the likelihood scale is shown in Appendix 6). As shown in the table, the likelihood rating for a dam break hazard in Tulsa County is “unlikely”. The likelihood of a dam break hazard in the Town of Sperry, or at the Berryhill Public Schools, Keystone Public Schools, Liberty Public Schools, and the Sperry Public Schools is “unlikely” because they are not downstream from one of the high hazard dams.

3.2.13.6 A typical dam break hazard scenario would be minor seepage through the dam, identified at the dam inspections and remedied. The worst case scenario of this dam break hazard would be an unexpected break of the dam, so emergency personnel could not effectively notify people downstream of the dam of the impending event.

The depth of water in a dam break could be measured from their respective dam break inundation maps. However, Keystone Dam is a federally regulated dam which falls under the jurisdiction of the US Army Corps of Engineers, is classified as a high hazard dam. The emergency action plan for this dam was prepared by the Corps of Engineers. Its maps are classified as “for official use only” and are not distributed to the general public. The addresses of the structures in the inundation area are on file with TAEMA.

Therefore, in order to illustrate the impact of the dam break hazard, water depths from the 100-year floodplain of the Arkansas River downstream of the Keystone dam were used to estimate the impact of the dam break hazard on Tulsa County. The Town of Sperry and the four participating schools are not located downstream of any of the dam so are not impacted by this hazard.

For the Keystone Dam, water depths in the Arkansas River from the 100-year flood stay below the SH97 Bridge over the Arkansas River. However, the 100-year flood depth in the Meadow Valley subdivision in Sand Springs at 26th and Bermuda is approximately 3.5 ft.

No critical facilities are in the 100-year floodplain area downstream of the high hazard dams.

Flood waters overtopping streets is a dangerous situation. Anytime a driver loses control of the vehicle could result in injury or death. As per FEMA flood facts, six inches of water will reach the bottom of most passenger cars causing loss of control and possible stalling. A foot of water will float many vehicles. Two feet of rushing water can carry away most vehicles including sport utility vehicles (SUV's) and pick-ups.

The hazard classifications are based upon current conditions, including population and land-use patterns below the dams. Such conditions can shift over time, such that a structure that is not considered high-hazard may receive such designation in the future, should, for example, dwellings built within the floodplain below the dam. Other high-hazard dams may have such designation lowered should land-use patterns change, reducing the threat of loss to life or

property. Mitigation aspects, such as relocations of vulnerable properties, can reduce the number and magnitude of high-hazard dams. To protect vulnerable populations the State of Oklahoma and Tulsa County, the following law is in place:

State Law 785:25-7. Warning and evacuation plans.

- Owners of existing or proposed dams classified as high hazard, regardless of the size of such dams, and any other dam as determined by the Board, shall provide an adequate warning system and written evacuation plan to protect downstream lives and property, with a written description of said system and written evacuation plan to be approved by and filed with the local Civil Defense authorities.
- Additionally, the written description of the warning system and approved evacuation plan shall be filed with the Board.

3.3 Assessing Vulnerability: Identifying Assets

This section describes vulnerability in terms of the type and number of existing buildings and critical facilities in the hazard location. This section describes vulnerability in terms of the number of existing school buildings in the hazard location.

The vulnerability analysis utilized FEMA document 386-2, “Understanding Your Risks,” Step 3, in order to determine the building value and contents value to determine a total value per building at risk from the hazard.

For Tulsa County and the Town of Sperry, the Tulsa County Assessor classifies properties into three (3) types; residential, commercial, and agricultural. A value for each property with a structure was determined by the assessor. The contents value was determined as a percentage of the building value, based on the Contents Value table in FEMA 386-2, Step 3.

For the Schools, the school buildings are inventoried below. The building value was estimated by the school. The contents value was determined as a percentage of the building value, based on the Contents Value table in FEMA 386-2, Step 3.

The following tables show this information for all buildings in the unincorporated Tulsa County. This table will be referred to for all hazards that do not vary by location throughout the County.

Table 3-15
TOTAL BUILDINGS IN UNINCORPORATED TULSA COUNTY

Category	Number of Structures	Structure Value (\$)
Residential	10821	913,019,351
Commercial	481	382,823,045
Agricultural	266	4,632,671
Total	11568	1,300,475,067

The following table shows this information for all buildings in the Town of Sperry. This table will be referred to for all hazards that do not vary by location throughout the Town.

Table 3-16
TOTAL BUILDINGS IN THE TOWN OF SPERRY

Category	Number of Structures	Structure Value (\$)
Residential	381	14,674,500
Commercial	79	4,445,200
Agricultural	0	n/a
Total	460	19,119,750

The following table shows this information for all the buildings for the Berryhill Public Schools. This table will be referred to for all hazards that do not vary by location.

**Table 3-17
TOTAL BUILDINGS AT BERRYHILL PUBLIC SCHOOLS**

Category	Number of Structures	Structure Value (\$\$)
Berryhill High School	9	\$9,050,662
Berryhill Middle School	7	\$2,657,950
Berryhill North Elementary School	3	\$2,267,983
Berryhill South Elementary School	4	\$4,005,480
Berryhill Early Childhood Center	1	\$678,300
Administration	2	\$562,800
Total		\$19,223,175

The following table shows this information for all the buildings for the Keystone Public Schools. This table will be referred to for all hazards that do not vary by location.

**Table 3-18
TOTAL BUILDINGS AT KEYSTONE PUBLIC SCHOOLS**

Category	Number of Buildings	Structure Value (\$\$)
Keystone Public School	7	\$7,701,112

The following table shows this information for all the buildings for the Liberty Public Schools. This table will be referred to for all hazards that do not vary by location. Structures include the school buildings, garage and storage buildings and support structures.

**Table 3-19
TOTAL BUILDINGS AT LIBERTY PUBLIC SCHOOLS**

Category	Number of Structures	Structure Value (\$\$)
Liberty Public School PK – 6 th and 7 th – 12th	43	\$12,615,029

The following table shows this information for all the buildings for the Sperry Public Schools. This table will be referred to for all hazards that do not vary by location.

**Table 3-20
TOTAL BUILDINGS AT SPERRY PUBLIC SCHOOLS**

Category	Number of Structures	Structure Value (\$\$)
Sperry Public School	52	32,567,940\$

Flood hazards, dam break hazards, wildfire hazards, and hazards from expansive soils are the four hazards that vary in magnitude by location. A hypothetical tornado was analyzed in the tornado hazard section. For these hazards, GIS models were used to determine the buildings in a hazard location when the hazard's location data is available as discussed in the hazard's vulnerability assessment section to follow.

For each hazard, the buildings at risk from that hazard are tabularized in each hazard's section, or refer to the above tables. The total number of buildings at risk, the building type, the building

value, its contents' value, and the total value is shown. These tables follow the format in FEMA 386-2, worksheets 3a "Inventory Assets".

This assessment also analyses the critical facilities at risk from each hazard. Where a hazard varies by location, these facilities' locations are shown in relation to the hazard. Information on mobile homes is not tracked by the Assessor; therefore, it is not included in the vulnerability assessment.

Facilities that are classified to be critical by the TCHMPC are listed in the following table, and shown on Map Number 4 in Appendix 1. These facilities are critical to the County in they provide public safety and emergency response services to the public in the event of a hazard occurrence or they are necessary to preserve the welfare and quality of life to the community or primarily house persons who will need emergency personnel to evacuate in the event of a hazard.

**Table 3-21
CRITICAL FACILITIES**

TYPE	NAME	LOCATION
Government	OK Dept of Transportation	4002 N Mingo Expressway
Government	TAEMA EOC	600 Civic Center
Government	Tulsa County Fairgrounds	4802 E 15th St
Government	Tulsa County Offices	500 S Denver
Government	Tulsa County District 1 Hwy Maintenance	3801 N Harvard
Government	Tulsa County District 2 Hwy Maintenance	3500 W 31 st
Government	Tulsa County District 3 Hwy Maintenance	5625 S Garnett
Government	Chandler Park	6500 W 21st St
Government	O'Brien Park	6149 N. Lewis Ave
Government	LaFortune Park	5801 S Yale Ave
Government	TAEMA Staging Facility	6601B N Lakewood
Government	Sperry Town Hall	115 N Cincinnati
Government	Sperry Police Department	115 N Cincinnati
Government	Sperry Fire Department	115 N Cincinnati
Government	Sperry wastewater facility	1700 E 106 th St N
Government	Sperry AT&T Substation	100 W Main
Government	Tulsa Levee District 12 Offices	1202 E Pecan
Government	Levee A Pump station 1	Levee A
Government	Levee A Pump station 2	Levee A
Government	Levee A Pump station 3	Levee A
Government	Levee B Pump station 4	Levee B
Government	Levee B Pump station 6	Levee B
Government	Levee C Pump station 6	Levee C
Government	Levee C Pump station 7	Levee C
Fire	Berryhill Fire Dept	2700 S 65 th W Ave
Fire	Collinsville Rural Fire Station	1018 S 12th St
Fire	Keystone Fire Dept	25505 W 41st St
Fire	Turley Fire and Rescue	6404 N Peoria
Sheriff	Tulsa County Corrections Facility	300 S Denver
Sheriff	Tulsa County Juvenile Detention Ctr	315 S Gilcrease
Sheriff	Tulsa County Sherriff	500 S Denver
Sheriff	Tulsa County Sherriff	303 W 1st
Sheriff	Tulsa County Training Center	6601 N Lakewood
Hazmat	Sooner Emergency Services	2131 S 49th W Ave

Medical	Tulsa City County Health Dept	5051 S 129th E Ave
Medical	Tulsa City County Health Dept	N Peoria
Medical	Tulsa City County Health Dept	315 S Utica
School	Addams Elementary School	5325 S 65th W Ave
School	Berryhill Early Childhood Center	3128 S 63rd W Ave
School	Berryhill High School	2701 S 65th W Ave
School	Berryhill Middle School	2900 S 65th W Ave
School	Berryhill North Elementary School	3128 S 63rd W Ave
School	Berryhill South Elementary School	3129 S 63rd W Ave
School	Cherokee Elementary School	6001 N Peoria
School	Gilcrease Intermediate School	5550 N Cincinnati
School	Gilcrease Middle School	5550 N Cincinnati
School	Greeley Elementary School	105 E 63rd St N
School	Houston Elementary School	5402 N Cincinnati
School	Keystone Public School	23810 Oklahoma 51
School	Liberty Daycare	2727 E 201st St S
School	Liberty Elementary School	2727 E 201st St S
School	Liberty High School	2727 E 201st St S
School	Liberty Middle School	2727 E 201st St S
School	Sperry Elementary School	400 W Main
School	Sperry High School	400 W Main
School	Sperry Intermediate School	400 W Main
School	Sperry Middle School	400 W Main

Note: some facilities are private and are included for reference.

3.3.1 Flood Hazard

Tulsa County

Tulsa County has had two flood events from 2010 through 2014. The County floodplain administrator reports they are 29 repetitive loss structures in unincorporated Tulsa County that are insured through the National Flood Insurance Program; 27 are single family residential structures and two are commercial. Damaged structures are rebuilt in conformance with the County’s flood damage prevention ordinance. As grant funds become available, the regulating jurisdiction is working with the property owner to remove the structure from the floodplain. For all structures at risk from a flood hazard, those buildings on property intersecting the regulatory floodplain are summarized below.

Table 3-22
UNINCORPORATED TULSA COUNTY: TOTAL BUILDINGS IN FLOODPLAIN

	Number of Buildings	Building Value (\$\$)	Contents Value (\$\$)	Total Value (\$\$)
Residential	1425	121,000,390	566,805	1,700,415
Commercial	70	35,523,965	35,523,965	71,047,930
Agricultural	90	1,133,610	121,000,390	242,000,780
TOTAL	1585	157,657,965	157,091,160	314,749,125

There are no critical facilities in the regulatory floodplain.

Any future building in a flood hazard will be built in conformance with the County Flood Damage Prevention Ordinance as part of the County’s membership in the NFIP; therefore, future buildings will not be considered by FEMA as at risk from the regulatory floodplain.

Town of Sperry

The Town of Sperry has had zero flood events from 2010 through 2014. The Town floodplain administrator reports they are no repetitive loss structures in the Town of Sperry that are insured through the National Flood Insurance Program. Damaged structures are rebuilt in conformance with the Town’s flood damage prevention ordinance. As grant funds become available, the regulating jurisdiction is working with the property owner to remove the structure from the floodplain. For all structures at risk from a flood hazard, those buildings on property intersecting the regulatory floodplain are summarized below.

Table 3-23
TOWN OF SPERRY: TOTAL BUILDINGS IN FLOODPLAIN

	Number of Buildings	Building Value (\$\$)	Contents Value (\$\$)	Total Value (\$\$)
Residential	17	671,700	335,650	1,006,950
Commercial	6	281,300	281,300	562,600
Agricultural	0	0	0	0
TOTAL	23	953,000	616,950	1,569,550

There are no critical facilities in the regulatory floodplain.

Any future building in a flood hazard will be built in conformance with the Town Flood Damage Prevention Ordinance as part of the Town’s membership in the NFIP; therefore, future buildings will not be considered by FEMA as at risk from the regulatory floodplain.

Berryhill Public Schools

Four of the five Berryhill Public Schools are on properties that extend onto the Berryhill Creek floodplain. However, the buildings have not been flooded in the time frame from 2010 through 2014. The values of these buildings are shown in the following table.

**Table 3-24
BERRYHILL PUBLIC SCHOOLS: TOTAL BUILDINGS ON PROPERTY WITH THE
FLOODPLAIN HAZARD**

Name	Number of Buildings	Building Value (\$)	Contents Value (\$)	Total Value (\$)
Berryhill High School	9	\$9,050,662	\$9,050,662	18,101,324
Berryhill Middle School	7	\$2,657,950	\$2,657,950	5,315,900
Berryhill North Elementary School	3	\$2,267,983	\$2,267,983	4,535,966
Berryhill South Elementary School	4	\$4,005,480	\$4,005,480	8,010,960
Administration	2	\$562,800	\$562,800	1,125,600
TOTAL		18,544,875	18,544,875	37,089,750

Keystone Public Schools

The Keystone Public Schools are not located in the regulatory floodplain so are not at risk from this flood hazard.

Liberty Public Schools

The Liberty Public Schools are not located in the regulatory floodplain so are not at risk from this flood hazard.

Sperry Public Schools

The Sperry Public Schools are not located in the regulatory floodplain so are not at risk from this flood hazard.

3.3.2 Tornado Hazard

To illustrate the damage a tornado could cause, a hypothetical tornado was located in the unincorporated area of Tulsa County, in northern Tulsa County, through a residential area. This hypothetical tornado is one-mile long with a damage width of 600 feet. This hypothetical tornado is shown in Map Number 13 in Appendix 1. The total number of buildings within this tornado example, at risk from this example, is shown in the following table.

**Table 3-25
BUILDINGS IN TORNADO SCENARIO**

Type	Number of Buildings	Building Value (\$\$)	Contents Value (\$\$)	Total Value (\$\$)
Residential	54	4,866,442	2,433,221	7,299,663
Commercial	0	0	0	0
Agricultural	0	0	0	0
Total	54	4,866,442	4,866,442	7,299,663

There are no critical facilities, including schools, within this tornado path.

The Town of Sperry was not located in the hypothetical tornado path.

None of the four participating schools are located in this hypothetical tornado path.

3.3.3 Dam Break Hazard

The dam break hazard in Tulsa County is the high hazard dams. High hazard dams prepare an emergency action plan (EAP) which would make a determination on the number of structures and infrastructure in each dam's dam break inundation area. For the Keystone Lake dam, their EAP identifies structures or infrastructure in the inundation areas. Their addresses are on file with TAEMA. Therefore, the number of structures is not included in this plan and an estimated damage is not done.

The Town of Sperry and the four participating schools are all not located downstream of the six high hazard dams so are not vulnerable to the dam break hazard.

3.3.4 High Wind Hazard

All areas, and all buildings, in the County, including the Town of Sperry and the four participating Schools, are at equal risk from this hazard. The total number of buildings, and value, in the County is shown in the table at the beginning of this section. And the total number of buildings, and value, in the Town of Sperry, and at the four participating Schools is also shown in the tables at the beginning of this section 3.3.

3.3.5 Lightning Hazard

All areas, and all buildings, in the County, including the Town of Sperry and the four participating Schools, are at equal risk from this hazard. The total number of buildings, and value, in the County is shown in the table at the beginning of this section. And the total number of buildings, and value, in the Town of Sperry, and at the four participating Schools is also shown in the tables at the beginning of this section 3.3.

3.3.6 Hail Storm Hazard

All areas, and all buildings, in the County, including the Town of Sperry and the four participating Schools, are at equal risk from this hazard. The total number of buildings, and value, in the County is shown in the table at the beginning of this section. And the total number of buildings, and value, in the Town of Sperry, and at the four participating Schools is also shown in the tables at the beginning of this section 3.3.

3.3.7 Winter Storm Hazard

All areas, and all buildings, in the County, including the Town of Sperry and the four participating Schools, are at equal risk from this hazard. The total number of buildings, and value, in the County is shown in the table at the beginning of this section. And the total number of buildings, and value, in the Town of Sperry, and at the four participating Schools is also shown in the tables at the beginning of this section 3.3.

3.3.8 Heat Hazard

All areas, and all buildings, in the County, including the Town of Sperry and the four participating Schools, are at equal risk from this hazard. The total number of buildings, and value, in the County is shown in the table at the beginning of this section. And the total number of buildings, and value, in the Town of Sperry, and at the four participating Schools is also shown in the tables at the beginning of this section 3.3.

3.3.9 Drought Hazard

All areas, and all buildings, in the County, including the Town of Sperry and the four participating Schools, are at equal risk from this hazard. The total number of buildings, and value, in the County is shown in the table at the beginning of this section. And the total number of buildings, and value, in the Town of Sperry, and at the four participating Schools is also shown in the tables at the beginning of this section 3.3.

3.3.10 Expansive Soils Hazard

The structures at risk from this hazard are properties located on high and very high shrink-swell potential soil types. The locations of expansive soils are shown in Map Number 7 in Appendix 1. The contents of the buildings are not at risk from this hazard. The number of buildings in unincorporated Tulsa County on each category of shrink-swell potential soils is shown below.

Structures with foundations such as homes and businesses, concrete slabs in driveways and sidewalks, and parking lots are vulnerable to this hazard because expansive soils cause the ground under the foundations to settle unevenly. Asphalt surfaces such as highways and runways could be affected. This settlement causes cracking and damage to the foundation and structure above the foundation, such as buildings wall and a road's pavement.

**Table 3-26
UNINCORPORATED TULSA COUNTY BUILDINGS' EXPANSIVE SOILS
BREAKDOWN**

Shrink-Swell Potential of Soils	# of Structures	Structure Value (\$)
Very Low	0	0
Low	1982	1,699,414,429
Moderate	2650	249,121,223
High	6465	823,605,420
Very High	471	57,806,995

The number of buildings in the Town of Sperry on each category of shrink-swell potential soils is shown below.

**Table 3-27
TOWN OF SPERRY BUILDINGS' EXPANSIVE SOILS BREAKDOWN**

Shrink-Swell Potential of Soils	# of Structures	Structure Value (\$)
Very Low	0	0
Low	0	0
Moderate	1	18,300
High	367	14,559,930
Very High	92	4,541,520

The Berryhill Public Schools' buildings are located on moderate and high shrink-swell potential soils. The number of buildings and their value is shown in the beginning of this section 3.3.

The Keystone Public Schools' buildings are located on high shrink-swell potential soils. The number of buildings and their value is shown in the beginning of this section 3.3.

The Liberty Public Schools' buildings are located on moderate and high shrink-swell potential soils. The number of buildings and their value is shown in the beginning of this section 3.3.

The Sperry Public Schools' buildings are located on high shrink-swell potential soils. The number of buildings and their value is shown in the beginning of this section 3.3.

3.3.11 Wildfire Hazard

The areas in the unincorporated Tulsa County in the communities' wildland-urban interface are at higher risk from a wildfire so are more vulnerable. The areas outside of the communities' wildland-urban interface can be at less risk, so less vulnerable to a wildfire.

Table 3-29 shows the numbers of structures in the unincorporated Tulsa County within the communities' wildland-urban interface.

**Table 3-28
UNINCORPORATED TULSA COUNTY STRUCTURES IN THE CITIES' WILDLAND-
URBAN INTERFACE**

Type	# of Structures	Structure Value (\$)
Residential	6900	591,826,587
Commercial	343	290,039,378
Agricultural	126	2,624,616
TOTAL	7369	884,490,581

All of the Town of Sperry is in the Town's wildland-urban interface. The total number of buildings, and value, in the Town is shown in the table at the beginning of this section 3.3.

The Berryhill Public School buildings are located in the City of Sand Springs' wildland-urban interface. The total number of school buildings, and their value, is shown in the table at the beginning of this section 3.3.

The Keystone Public School buildings are located outside wildland-urban interface. The total number of school buildings, and their value, is shown in the table at the beginning of this section 3.3.

The Liberty Public School buildings are located in the City of Glenpool's wildland-urban interface. The total number of school buildings, and their value, is shown in the table at the beginning of this section 3.3.

The Sperry Public School buildings are located in the Town of Sperry's wildland-urban interface. The total number of school buildings, and their value, is shown in the table at the beginning of this section 3.3.

Fires can also destroy non-structural assets such as agriculture, vegetation, and vehicles. Vulnerability of these non-structural assets, both in identifying these assets and estimating their damage potential was not quantified.

3.3.12 Earthquake Hazard

All areas, and all buildings, in the County, including the Town of Sperry and the four participating Schools, are at equal risk from this hazard. The total number of buildings, and value, in the County is shown in the table at the beginning of this section. And the total number of buildings, and value, in the Town of Sperry, and at the four participating Schools is also shown in the tables at the beginning of this section 3.3.

3.3.13 Hazardous Material Hazard

The public is most at risk from hazardous materials when they are being transported. The County has defined the State and US Highways, and the railroads, as the major transportation routes through the County. These are shown in Map Number 15 in Appendix 1.

3.4 Assessing Vulnerability: Estimating Potential Losses

For each hazard, an analysis was done to determine the potential dollar losses to vulnerable buildings identified in Section 3.3. The analysis followed the methodology discussed in FEMA document number 386-2, “Understanding your Risks”, step 4, and the format of FEMA 386-2 worksheet #4 “Estimate Losses” where applicable.

The flood hazard and the hypothetical tornado analyses identified structures with varying amounts of damage. The wildfire hazard section totaled structures and damages in the unincorporated Tulsa County within the communities’ wildland-urban interface.

3.4.1 Flood Hazard

For the flood hazard, for this planning exercise, all structures on property intersecting the regulatory floodplain are evaluated at one foot below the base flood elevation. (Actual first floor elevations were not surveyed and the best available topography has 10 foot contour intervals making windshield surveys plus and minus five feet.) Using FEMA 386-2, step 4, building damage with one foot of flood depth is estimated to be 14 percent of the building value, and content damage is estimated to be 21 percent of the building value.

For the unincorporated Tulsa County, the flood hazard damage estimate is shown below.

**Table 3-29
UNINCORPORATED TULSA COUNTY FLOOD HAZARD DAMAGE ESTIMATE
WITH ONE-FOOT FLOOD DEPTH**

Type	Number of Buildings	Building Value (\$)	Building Damage Value (\$)	Contents Damage Value (\$)	Total Damage Value (\$)
Agricultural	1425	121,000,390	16,940,055	12,705,041	29,645,096
Commercial	70	35,523,965	4,973,355	7,460,033	12,433,388
Residential	90	1,133,610	158,705	238,058	396,764
Total	1585	157,657,965	22,072,115	20,403,132	42,475,247

For the Town of Sperry, the flood hazard damage estimate is shown below.

**Table 3-30
TOWN OF SPERRY FLOOD HAZARD DAMAGE ESTIMATE WITH ONE-FOOT
FLOOD DEPTH**

Type	Number of Buildings	Building Value (\$)	Building Damage Value (\$)	Contents Damage Value (\$)	Total Damage Value (\$)
Agricultural	17	671,700	94,038	70,529	164,567
Commercial	6	281,300	39,382	59,073	98,455
Residential	0	0	0	0	0
Total	23	953,000	133,420	129,602	263,022

For the Berryhill Public Schools, the flood hazard damage estimate is shown below.

**Table 3-31
BERRYHILL PUBLIC SCHOOLS FLOOD HAZARD DAMAGE ESTIMATE WITH
ONE-FOOT FLOOD DEPTH**

Type	Number of Buildings	Building Value (\$\$)	Building Damage Value (\$\$)	Contents Damage Value (\$\$)	Total Damage Value (\$\$)
Berryhill High School	9	9,050,662	1,267,092.68	1,900,639.02	3,167,731.70
Berryhill Middle School	7	2,657,950	372,113.00	558,169.50	930,282.50
Berryhill North Elementary School	3	2,267,983	317,517.62	476,276.43	793,794.05
Berryhill South Elementary School	4	4,005,480	560,767.20	841,150.80	1,401,918.00
Administration	2	562,800	78,792.00	118,188.00	196,980.00

The Keystone Public School buildings are not in the floodplain so are not vulnerable to this hazard.

The Liberty Public School buildings are not in the floodplain so are not vulnerable to this hazard.

The Sperry Public School buildings are not in the floodplain so are not vulnerable to this hazard.

3.4.2 Tornado Hazard

For the tornado hazard, a hypothetical tornado was located across northern Tulsa County, through an unincorporated residential area. This hypothetical tornado is one-mile long with a damage width of 600 feet. The FEMA document number 386-2 states there are no standard loss estimation models and tables for tornados. For damage estimation purposes, those structures within 100 feet to the tornado path were assigned to be completely damaged, those structures between 100 to 200 feet from the tornado path were assigned to be 50 percent damaged, and those structures between 200 and the outside edge of the damage buffer were assigned to be 25 percent damaged.

**Table 3-32
TOTAL BUILDINGS IN TORNADO SCENARIO**

Bldgs within 100 ft of Tornado Path (100% Damaged)					
Type	Number	Bldg Value	Contents Value	Total Value	100% Damaged \$\$
All	32	2,689,451	1,344,726	4,034,177	4,034,177
Res	32	2,689,451	1,344,726	4,034,177	4,034,177
Ag	0	-	-	-	-
Comm	0	-	-	-	-
Bldgs between 100 and 200 ft of Tornado Path (50% Damaged)					
Type	Number	Bldg Value	Contents Value	Total Value	50% Damaged \$\$
All	11	1,078,891	539,446	1,618,337	809,168
Res	11	1,078,891	539,446	1,618,337	809,168
Ag	-	-	-	-	-
Comm	-	-	-	-	-
Bldgs between 200 and 300 ft of Tornado Path (25% Damaged)					
Type	Number	Bldg Value	Contents Value	Total Value	25% Damaged \$\$
All	11	1,098,100	549,050	1,647,150	411,788
Res	11	1,098,100	549,050	1,647,150	411,788
Ag	-	-	-	-	-
Comm	-	-	-	-	-
Total Damage within 300 ft Buffer					
Type	Number	Bldg Value	Contents Value	Total Value	TOTAL DAMAGE
All	54	4,866,442	2,433,221	7,299,663	5,255,132
Res	54	4,866,442	2,433,221	7,299,663	5,255,132
Ag	0	-	-	-	-
Comm	0	-	-	-	-

3.4.3 Dam Break Hazard

The dam break hazard in Tulsa County is the high hazard dams. High hazard dams prepare an emergency action plan (EAP) which would make a determination on the number of structures and infrastructure in each dam's dam break inundation area. For the Keystone Lake dam, their EAP identifies structures or infrastructure in the inundation areas. Their addresses are on file with TAEMA. Therefore, the number of structures is not included in this plan and an estimated damage is not done.

The Town of Sperry and the four participating schools are all not located downstream of the high hazard dam so are not vulnerable to the dam break hazard.

3.4.4 Hazardous Material Hazard

The locations of the major transportation routes within Tulsa County are shown on Map Number 16 in Appendix 1. The Town of Sperry is intersected by SH 11 as shown on Map Number 16 in Appendix 1. The locations of the four participating schools in relation to the major transportation routes are shown on Map Number 16 in Appendix 1.

3.4.5 Expansive Soils

The potential damage to structures and infrastructure located on high and very high shrink-swell potential soils is dependent on the design of its foundation and quality of the construction of the foundation. Both factors were beyond the scope of this multi-hazard mitigation plan. Pre-defined damage estimates based on a percentage of the structure value are not available because of the wide variation of the factors involved in a foundation's stability. Structures with foundations such as homes and businesses, concrete slabs in driveways and sidewalks, and parking lots, are vulnerable to this hazard because expansive soils causes the ground under foundations to settle unevenly. Asphalt surfaces such as highways and runways could be affected. This causes cracking and damage to the foundation and structure above the foundation, such as building's wall and a road's pavement.

3.4.7 Wildfires

For this vulnerability analysis of wildfires, the structures in the unincorporated Tulsa County within the communities' wildland-urban interface were inventoried and value estimated from the County Assessor database. The contents of the structure were estimated based on the structure value and total value is the sum of the structure's value and its contents value. For this planning process, the structure is considered a total loss if burned by the wildfire and the estimated value of the loss due to the wildfire is the total value, and also shown below.

**Table 3-33
UNINCORPORATED TULSA COUNTY STRUCTURES IN THE CITIES' WILDLAND-
URBAN INTERFACE**

Type	# of Structures	Structure Value (\$)	Contents Value (\$)	Total Value (\$)
Residential	6900	591,826,587	295,913,294	887,739,881
Commercial	343	290,039,378	290,039,378	580,078,756
Agricultural	126	2,624,616	2,624,616	5,249,232
TOTAL	7369	884,490,581	588,577,288	1,473,067,869

All of the buildings in the Town of Sperry are in the Sperry wildland-urban interface. The same vulnerability analysis as shown above for Tulsa County is shown below for the Town of Sperry.

**Table: 3-34
TOWN OF SPERRY STRUCTURES IN THE SPERRY'S WILDLAND-URBAN
INTERFACE**

Type	# of Structures	Structure Value (\$)	Contents Value (\$)	Total Value (\$)
Residential	381	14,674,500	7,337,250	22,011,750
Commercial	79	4,445,200	4,445,200	8,890,400
Agricultural	0	n/a	n/a	0
TOTAL	460	19,119,750	11,782,450	30,902,150

For the Berryhill Public Schools, all their buildings are in the City of Sand Springs' wildland-urban interface. The same vulnerability analysis as shown above for Tulsa County is shown below for the Berryhill Public Schools.

Name	Number of Buildings	Building Value (\$)	Contents Value (\$)	Total Value (\$)
Berryhill Public School	26	19,223,175	19,223,175	38,446,350

For the Keystone Public Schools, all their buildings are outside the communities' wildland-urban interface in unincorporated Tulsa County. If a wildfire were to impact Keystone, the same vulnerability analysis as shown above for Tulsa County is shown below for the Keystone Public Schools.

School	Number of Buildings	Building Value (\$)	Contents Value (\$)	Total Value (\$)
Keystone Public School	7	7,701,112	7,701,112	15,402,224

For the Liberty Public Schools, all their buildings are in the City of Glenpool's wildland-urban interface. The same vulnerability analysis as shown above for Tulsa County is shown below for the Liberty Public Schools.

School	Number of Buildings and Structures	Buildings and Structures Value (\$)	Contents Value (\$)	Total Value (\$)
Liberty Public Schools	43	12,615,029	3,030,405	15,645,434

For the Sperry Public Schools, all their buildings are in the Town of Sperry's wildland-urban interface. The same vulnerability analysis as shown above for Tulsa County is shown below for the Sperry Public Schools.

School	Number of Buildings and Structures	Building and Structure Value (\$)	Contents Value (\$)	Total Value (\$)
Sperry Public Schools	52	32,567,940	30,923,207	63,491,147

3.4.8 All Other Hazards

The magnitude of the damage to structures from all the other hazards does not vary by location. The total building and content value for all structures in the unincorporated Tulsa, the Town of Sperry, and the four participating schools is totaled and shown in their respective table in the beginning of Section 3.3.

3.5 Assessing Vulnerability: Analyzing Development Trends

This section discusses the County's land use and development trends so that mitigation options can be considered in future land use decisions. Three areas were analyzed. These are the types of existing land uses and the method for change; development in the hazard areas; and anticipated changes in land use and growth areas.

3.5.1 The Tulsa County Assessor assign three land use categories for their counties for tax purposes. These are residential, commercial and agricultural. Land use changes can occur, and are initiated by the property owner, usually to accommodate a new development. Tulsa County has a Board of Adjustment which reviews use change requests and takes into account hazards and hazard prone areas in ruling on any land use change request. They also set conditions of approval to help ameliorate any perceived impacts. The County also has a Planning Commission which is a recommending body to the Board of County Commissioners. The Planning Commission also reviews requests for change in zoning and makes recommendation to Board of County Commissioners.

3.5.2 There are 5431 undeveloped parcels of property in the unincorporated Tulsa County. And of these 5431 undeveloped parcels, 1136 are in the regulatory floodplain; 441 residential, 181 commercial, and 514 agricultural. Map Number 17 in Appendix 1 shows this information. It must be noted that new building development in the flood hazard area will conform to the County's Flood Damage Prevention Ordinance, which the County will continue to vigorously enforce. It will be recommended to builders of new construction to investigate the shrink-swell potential of its soils, and design and construct the foundation with the soils' properties as a consideration. And be aware of the wildland urban interface.

3.5.3 Changes in land use can occur throughout the County. However, residential growth is primarily anticipated to occur adjacent to the cities of Tulsa and Broken Arrow., and commercial growth is primarily anticipated along SH 75 north of the City of Tulsa.

Recent commercial development includes:

- Cornerstone Hardware
- 11400 Yale Center
- Macy's Subdivision

Recent residential development includes:

- Stone Lake Subdivision, phase II
- Sheridan Crossing subdivision, phase I

Recent development in the Town of Sperry includes:

- Dollar General Store
- Sperry Christian Church expansion

The Berryhill Public Schools has not added buildings on their campuses in the past five years, and does not have any building plans in the next five years.

The Keystone Public Schools has not added buildings on their campuses in the past five years, and does not have any building plans in the next five years.

The Liberty Public Schools made two building additions in 2011 and plans to build an agricultural-vocational building in the next 5 years.

The Sperry Public Schools has not added buildings on their campuses in the past five years, and does not have any building plans in the next five years.

Draft for Comments

Chapter 4:

Mitigation Strategies

This chapter identifies the hazard mitigation goals set by the TCHMPC, and discusses the mitigation projects or measures to be taken to achieve those goals.

4.1 Hazard Mitigation Goals

4.1.1 Mission Statement

To create a disaster-resistant community and improve the safety and well-being of the citizens of Tulsa County by reducing deaths, injuries, property damage, environmental losses, and other losses from natural and technological hazards in a manner that advances community goals, quality of life, and results in a more livable, viable, and sustainable community.

The mission statement and goals were determined by the committee at their initial meetings. Specific objectives were developed during the risk assessment phase and evaluated again as potential action steps were considered.

4.1.2 Specific Goals and Objectives

Goal 1 Flood Hazard: To reduce the risk of flood hazard in the County

Objectives:

1. Identify buildings at risk from the 100-year regulatory flood.
2. Ensure that development does not increase flooding downstream or have off-site adverse impacts.
3. Identify and maximize the natural and beneficial uses of the floodplain.
4. Implement the best flood control measures to reduce vulnerability of flood-prone properties.

Goal 2 Tornado Hazard: To reduce the risk from tornados in the County.

Objectives:

1. Encourage building of individual safe rooms and storm shelters.

Goal 3 High Winds Hazard: To reduce the risk from high winds in the County

Objectives:

1. Educate and encourage the building trades industry about construction standards that are adequate to withstand frequent high winds.

Goal 4 Lightning Hazard: To reduce the risk from lightning in the County.

Objectives:

1. Reduce loss of life and property, and injury due to lightning by increased public awareness of measures to prevent and reduce damage, including warnings.

Goal 5 Hailstorm Hazard: To reduce the risk from hailstorms in the County.

Objectives:

1. Promote construction of hail resistant roofs.

Goal 6 Winter Storm Hazard: To reduce the hazards from winter storms in the County.

Objectives:

1. Reduce property loss and community disruption due to severe winter cold and ice storms.

Goal 7 Extreme Heat: To reduce the risk from extreme heat in the County.

Objectives:

1. Lessen injury and potential loss of life to citizens during periods of extreme heat through education.

Goal 8 Drought Hazard: Reduce the economic impact of drought hazards to the County.

Objectives:

1. Reduce damage to property and building foundations due to drought by improving building codes.

Goal 9 Expansive Soil Hazard: Reduce structure's susceptibility to soil movement.

Objectives:

1. Reduce damage to property and building foundations due to expansive soils by improving building codes.

Goal 10 Wildfire Hazard: To reduce the threat of wildfire hazards and their financial impact to the County

Objectives:

1. Develop a County-wide fire response and support group to facilitate the provisioning of water to fires during large fires.

Goal 11 Earthquake Hazard: To reduce the risk from earthquakes in the County.

Objectives:

1. Educate and encourage the building trades industry about earthquake resistant construction.

Goal 12 Hazardous Materials Hazard: To reduce the risk from hazardous material storage facilities around the County.

Objectives:

1. Protect the public from exposure from hazardous materials events from sites within the community.

Goal 13 Dam Break Hazard: To reduce the risk of a dam break hazard in the County.

Objectives:

1. Identify dams that could impact the County.
2. Identify areas at risk.

Goal 14 General: To protect vulnerable populations and critical facilities from hazards.

Objectives:

1. Minimize the loss of life and damage to property and infrastructure from natural and man-made disasters.
2. Increase public awareness of risks from hazards and implement measures that can be taken to protect families and property from disasters.
3. Reduce the risk and effects of hazards and minimize disruption in the County.
4. Identify and protect vulnerable populations from natural and man-made hazards.
5. Identify and protect critical County and community facilities from hazards so that they can continue their missions in the event of a disaster.

4.2 Mitigation Categories

There are several types of measures that communities and individuals can use to protect themselves from, or mitigate the impacts of, natural and man-made hazards. Mitigation measures, for purposes of this study, fall into the following categories:

1. Preventive Measures
2. Structural Projects
3. Property Protection
4. Emergency Services
5. Public Information and Education

4.2.1 Preventive Measures

Preventive measures are designed to keep certain conditions from occurring or getting worse. The objective is to ensure that new development does not increase damage and that new construction is protected from those hazards. Preventive measures are usually administered by building, zoning, planning, and code enforcement offices. They typically include planning, zoning, building codes, and floodplain development regulations and storm water management.

Planning and zoning work to keep development out of the hazardous or sensitive areas. Zoning Ordinances regulates development by dividing the County into zones or districts and setting development criteria for each zone or district. A zoning ordinance is considered the primary tool to implement the comprehensive plan's guidelines for how land should be developed.

Tulsa County and the Town of Sperry participate in the National Flood Insurance Program (NFIP). The NFIP sets minimum requirements for subdivision regulations and building codes. Storm water management regulations require developers to mitigate any increase in runoff due to their development. Building codes require standards for new building construction.

4.2.1.1 Example Preventative Measure Activities

1. Planning and zoning help Tulsa County develop proactively so that the resulting infrastructure is laid out in a coherent and safe manner.
2. Building codes for foundations, sprinkler systems, masonry, and structural elements such as roofs and the exterior building envelope are prime mitigation measures for occurrences of floods, tornados, high winds, extreme heat and cold, and earthquakes.
3. Participation in the NFIP and using floodplain ordinances and subdivision regulations to regulate floodplain development is beneficial for Tulsa County.
4. Tree trimming adjacent to overhead power lines and placing new lines underground would help in preventing power outages during winter ice storms.

5. Better information about hazardous materials in the County and being transported through the County is desired for safety and contingency planning.

4.2.2 Structural Projects

Structural projects are usually designed by engineers or architects and constructed by both the public and private sector. Structural projects traditionally include storm water detention reservoirs, levees and floodwalls, channel modifications, and drainage and storm sewer improvements.

4.2.2.1 Example Structural Projects Activities

- Crossing and roadway drainage improvements must take into account additional detention or run-off reduction.
- Drainage and storm sewer improvements carry runoff from smaller, more frequent storms.
- Drainage system maintenance is an ongoing project of removing debris that decreases the effectiveness of detention ponds, channels, ditches, and culverts.

4.2.3 Property Protection Measures

Property protection measures are used to modify **existing** buildings or property subject to damage from various hazardous events. Property protection measures are normally implemented by the property owner. However, in some cases, technical and financial assistance can be provided by a governmental agency. Property protection measures from flooding typically include acquisition and relocation, flood-proofing, building elevation, and barriers. Property protection measures from other natural hazards include retrofitting, reinforced foundations, enhanced building codes with emphasis on the exterior building envelope, anchoring of roof and foundation, installation of safe rooms, hail resistant roofing, and insurance.

4.2.3.1 Example Property Protection Measure Activities

Floods

- Dry flood proofing (making walls watertight so floodwaters cannot get inside)
- Wet flood proofing (letting the water in and removing everything that could be damaged by a flood)
- Installing drain plugs, standpipes or backflow valves to stop sewer backup

Tornado

- Constructing an underground shelter or in-building “safe room”
- Securing roofs, walls and foundations with adequate fasteners or tie downs
- Strengthening garage doors and other large openings

High Winds

- Installing storm shutters and storm windows
- Burying utility lines
- Installing/incorporating backup power supplies

Hailstorms

- Installing hail resistant roofing materials

Lightning

- Installing lightning rods and lightning surge interrupters
- Burying utility lines
- Installing/incorporating backup power supplies

Winter Storms

- Adding insulation
- Relocating water lines from outside walls to interior spaces
- Sealing windows
- Burying utility lines
- Installing/incorporating backup power supplies

Extreme Heat and Drought

- Adding insulation
- Installing water saver appliances, such as shower heads and toilets

Wild Fires

- Replacing wood shingles with fire resistant roofing
- Adding spark arrestors on chimneys
- Landscaping to keep bushes and trees away from structures
- Installing sprinkler systems
- Installing smoke alarms

General Measures

From the above lists, it can be seen that certain approaches can help protect from more than one hazard. These include:

- Strengthening roofs and walls to protect from wind and earthquake forces
- Bolting or tying walls to the foundation protect from wind and earthquake forces and the effects of buoyancy during a flood
- Adding insulation to protect for extreme heat and cold
- Anchoring water heaters and tanks to protect from ground shaking and flotation
- Burying utility lines to protect from wind, ice and snow
- Installing backup power systems for power losses during storms
- Installing roofing that is hail resistant and fireproof

Insurance has the advantage that, as long as the policy is in force, the property is protected and no human intervention is needed for the measure to work. Although most homeowner's insurance policies do not cover a property for flood damage, an owner can insure a building for damage by surface flooding through the National Flood Insurance Program (NFIP).

4.2.4 Emergency Service Measures

Emergency services measures protect people during and after a hazard event. Locally, these measures are coordinated by the emergency management agencies of the individual communities. Measures include preparedness, threat recognition, warning, response, critical facilities protection, and post-disaster recovery and mitigation.

Threat recognition is the key. The first step in responding to a flood, tornado, storm or other natural hazard is knowing that one is coming. Without a proper and timely threat recognition system, adequate warnings cannot be disseminated.

After the threat recognition system tells the police department and/or County Emergency Management that a hazard is coming, the next step is to notify, **or warn**, the public and staff of other agencies and critical facilities. The following are the more common warning media:

- Outdoor warning sirens
- Sirens on public safety vehicles
- NOAA Weather Radio
- Commercial or public radio or TV stations
- Cable TV emergency news inserts
- Door-to-door contact
- Mobile public address systems
- Automated telephone calling
- E-mail alerts

Just as important as issuing a warning is telling people what to do. A warning program should have a public information aspect. People need to know the difference between a tornado warning (when they should seek shelter in a basement) and a flood warning (when they should stay out of basements).

4.2.4.1 Example Emergency Service Measures Activities

The protection of life and property is the foremost important task of emergency responders. Concurrent with threat recognition and issuing warnings, a community should respond with actions that can prevent or reduce damage and injuries. Typical actions and responding parties include the following:

Response Activities

- Activating the emergency operations room (Emergency Management)
- Closing streets or bridges (Sheriff/County/Sperry/Police)
- Shutting off power to threatened areas (OG&E/AEP/Rural Co-ops)
- Holding children at school/releasing children from school (School District)
- Passing out sand and sandbags (County/Sperry)
- Ordering an evacuation (Commission Chairman or Mayor)
- Opening evacuation shelters (Red Cross)
- Monitoring water levels (County)
- Security and other protection measures (Sheriff or Police)

After a disaster, communities should undertake activities to protect public health and safety, facilitate recovery, and prepare people and property for the next disaster. This is commonly referred to as Post-Disaster Recovery and Mitigation.

Recovery Activities

- Patrolling evacuated areas to prevent looting
- Providing safe drinking water
- Monitoring for diseases
- Vaccinating residents for tetanus
- Clearing streets
- Cleaning up debris and garbage
- Regulating reconstruction to ensure that it meets all code requirements, including the NFIP's substantial damage regulations

Mitigation Activities

- Conducting a public information effort to advise residents about mitigation measures they can incorporate into their reconstruction work
- Evaluating damaged public facilities to identify mitigation measures that can be included during repairs
- Acquiring substantially or repeatedly damaged properties from willing sellers
- Planning for long term mitigation activities
- Applying for post-disaster mitigation funds

Overall Emergency Service Activities

- Using solid, dependable threat recognition systems is first and foremost in emergency services.
- Following a threat recognition, multiple or redundant warning systems and instructions for action are most effective in protecting citizens.
- Good emergency response plans that are updated yearly ensure that well-trained and experienced people can quickly take the appropriate measures to protect citizens and property.
- To ensure effective emergency response, critical facilities protection must be part of the plan.
- Post-disaster recovery activities include providing neighborhood security, safe drinking water, appropriate vaccinations, and cleanup and regulated reconstruction.

4.2.5 Public Information and Education Measures

Successful public information and education measures involve both public and private sectors. Public information and education activities advise and educate citizens, property owners, renters, businesses, and local officials about hazards and ways to protect people and property from the hazards. Public information activities are among the least expensive mitigation measures, and at the same time are often the most effective thing a community can do to save lives and property. All mitigation activities begin with public information and education.

Many benefits stem from providing map information to inquirers. Residents and businesses that are aware of the potential hazards can take steps to avoid problems and reduce their exposure to flooding, dam break or releases, hazardous materials events, and other hazards that have a geographical distribution. These mapped hazards are included in this Hazard Mitigation study, and are discussed below. Flood Insurance Rate Maps (FIRMS) and Flood Hazard Boundary

maps are available to show the flood zones for each property. Flood insurance is always recommended for those properties subject to flooding, especially for those in Flood Zone A.

Hazardous materials sites, listed in the Oklahoma Department of Environmental Quality's Tier 2 list, are listed in Section 3.2.12. Transportation routes frequently used in the transport of hazardous materials include I-44 and US75. The railroad that runs through the County may also carry hazardous materials. High-pressure pipeline locations have been suppressed by the Federal government since 9/11.

4.2.5.1 Example Public Information and Education Measure Activities

- There are many ways that public information programs can be used so that people and businesses will be more aware of the hazards they face and how they can protect themselves.
- Most public information activities can be used to advise people about all hazards, not just floods.
- Other public information activities require coordination with other organizations, such as schools and real estate agents.
- There are several area organizations that can provide support for public information and educational programs.

4.3 Research, Review, and Prioritization

A wide range of literature searches and other sources were researched to identify mitigation measures for each hazard. Measures were identified to ascertain those that were most appropriate for Tulsa County. The public involvement process included a citizen hazard awareness survey conducted during the week of February 23, 2015. 165 responses were received. The survey and summary of the responses are included in Appendix 4. The public involvement process also included a public hearing on June 8, 2015. The results of the public participation and a list of potential mitigation measures were presented to the committee to stimulate debate and discussion.

The committee reviewed the mitigation activities. The committee incorporated the criteria and principles of the STAPLE+E project evaluation method in their consideration of the mitigation activities. While not referred to by name at the time of the mitigation activity review, the intent of the method was used. An explanation of each STAPLE+E criteria item is as follows:

- S: Social Mitigation actions are acceptable to the County, Town or School if they do not adversely affect a particular segment of the population, do not cause relocation of lower income people, and if they are compatible with their social and cultural values.
- T: Technical Mitigation actions are technically most effective if they provide long-term reduction of losses and have minimal secondary adverse impacts.
- A: Administrative Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding.
- P: Political Mitigation actions can truly be successful if all stakeholders have been offered an opportunity to participate in the planning process and if there is public support for the action.
- L: Legal It is critical that the jurisdiction or implementing agency have the legal authority to implement and enforce a mitigation action.
- E: Economic Budget constraints can significantly deter the implementation of mitigation actions. It is important to evaluate whether an action is cost-effective before an action is implemented.
- E: Environmental Sustainable mitigation actions that do not have an adverse effect on the environment, that comply with environmental regulations, and that are consistent with the County's environmental goals, have mitigation benefits while being environmentally sound.

Among the factors discussed for each activity was its economic impact on the County. A cost-benefit analysis was not done for each activity under consideration, but the committee decided to have a formal cost-benefit evaluation done for any selected activity that would follow the requirements of the funding source when funds are being sought and the TCHMPC would look for actions with a benefit greater than its cost.

While the committee did not select projects for Tulsa County, the Town of Sperry, or the four participating schools, it did offer recommendations. Tulsa County, the Town of Sperry, Berryhill Public Schools, Keystone Public Schools, Liberty Public Schools, and the Sperry Public Schools

Tulsa County, the Town of Sperry, and the four participating schools selected their own mitigation actions, with the criteria as outlined in this section

The potential social impact, implementation capabilities (County work force), and potential funding availability for each activity, and the other STAPLE+E criteria principles were considered in prioritizing the activities. The County's action plan, the Town's action plan, and the Schools' action plans will take into account the above factors and include at least two projects for each hazard.

Draft for Comments

Chapter 5:

Action Plan

5.1 Previous Tulsa County Plan

Tulsa County, the Town of Sperry, and the Berryhill Public Schools, Keystone Public Schools, Liberty Public Schools, and the Sperry Public Schools have reviewed and analyzed the risk assessment studies for the natural hazards and hazardous material events that may impact their jurisdiction. They also reviewed the list of recommended actions or projects were included in the previous Tulsa County plan to identify actions that had been completed, and what other actions should be continued, deferred, or cancelled. The results of this review are shown in Table 5-1.

Table 5-1
STATUS OF TULSA COUNTY MITIGATION ACTIONS FROM THE PREVIOUS PLAN

Action Plan #	Action Description	Progress on Action	Recommendation for the Action
1	Build new and retrofit facilities for 911 Center and EOC	Ongoing	
2	Provide employee shelters at County critical facilities to protect first responders	not started	
3	Educate residents, building professionals, and safe room vendors on the International Codes Council/National Storm Shelter Association's standard for the design and construction of storm shelters, and consider incorporating this standard into the current information and practices	started	
4	Prepare a comprehensive basin wide flood and drainage annex to the (previous) hazard mitigation plan for all watersheds in the county. The plan would identify all flooding problems in the county and recommend the most cost effective and politically acceptable solution to the flooding problems.	not started	
5	Acquire and remove floodplain and repetitive loss properties where the county's repetitive loss plan and flood and drainage annex to the (previous) identifies acquisitions as the most cost effective and desirable mitigation measure.	ongoing	
6	Continue compliance with and participation in the NFIP and CRS	On-going	
7	Evaluate, upgrade and maintain the community wide outdoor omni-directional voice/warning system	ongoing	
8	Develop a wildfire susceptibility analysis and wildfire mitigation plan for the vulnerable rural/urban interface areas of the county.	not started	
9	Develop an emergency back-up generator hazard mitigation plan annex for the county, assessing and prioritizing generator needs for the critical	not started	

	facilities. Assessment includes generator needs and costs.		
10	Provide wiring and transfer switches to accommodate the emergency generators during power outages.	started	
11	Obtain or identify sources of generators that are required as identified in the emergency back-up generator hazard mitigation plan annex.	not started	
12	Adopt and implement a plan for the continuity and restoration of power to the county and critical facilities as a result of power outages.	ongoing	
13	Identify and encourage privately owned critical facilities to have wiring/transfer switches for emergency back-up generators, or provisions for back-up generators, to provide continual operation of services.	ongoing	
14	Identify and encourage private privately owned service facilities to have wiring/transfer switches for emergency back-up generators, or provisions for back-up generators, to provide continual operation of essential services.	ongoing	
15	Develop a MOU with privately owned gasoline service facilities to provide priority fuel for emergency and critical vehicles during times of power outages.	ongoing	
16	Provide lightning warning systems for outdoor recreation facilities and the Fairgrounds.	not started	
17	Develop and distribute flood and flash flood safety tips to inform citizens of the danger.	ongoing	
18	Establish administrative procedures, and provide maps and information to inform builders about expansive soils when they apply for building permits.	not started	
19	Educate builders on appropriate foundation types for soils with varying shrink-swell potential.	not started	
20	Develop an all-hazard public information, education, and awareness strategy and program.	ongoing	
21	Modify /Adopt the county land use plan to guide development away from hazardous areas, reduce population densities in hazardous areas, implement stronger development restrictions, and encourage natural resource protection.	ongoing	
22	Develop and distribute a family emergency preparedness guide to all families.	started	
23	Educate the public on the importance of a family disaster plan and supply kit.	ongoing	
24	When replacing, install break resistant glass in government and critical facilities.	ongoing	
25	Obtain funding for the development and distribution of public information and education plans for responding to all-hazards to at-risk and vulnerable populations and contact agencies that distribute information to at-risk populations.	started	
26	Install a mass emergency telephone communication system for mass call-outs to targeted areas for emergency notification and information.	not started	

27	Provide surge and lightning protection for computer reliant critical facilities.	ongoing	
28	Train and educate builders. Developers, architects and engineers in techniques of disaster-resistant home building the blue print for safety guidelines developed by the Federal Alliance for Safe Rooms.	not started	
29	Develop/Review/Update the debris management plan.	ongoing	

Draft for Comments

5.2 Mitigation Actions

As part of the plan update process, this chapter includes the mitigation actions that Tulsa County, the Town of Sperry, Berryhill Public Schools, Keystone Public Schools, Liberty Public Schools, and the Sperry Public Schools selected to achieve the mitigation goals. The mitigation actions included at least two (2) specific mitigation actions per hazard. Each jurisdiction also selected non-mitigation actions relating to hazard prevention and communications for their own planning purposes. For each action, the hazard type it would be targeting is identified, the type of action is shown, the lead agency is identified, an anticipated time schedule and estimated cost is shown, identification of the possible funding sources are made, and the type of work product and expected outcome is discussed. Once funding is sought for an action, a detailed benefit/cost analysis will be done and will follow the requirements of the funding source.

The TCHMPC has reviewed and analyzed the risk assessment studies for all of the identified natural hazards and hazardous material events. Tulsa County, the Town of Sperry, Berryhill Public Schools, Keystone Public Schools, Liberty Public Schools, and the Sperry Public Schools were equally concerned about each identified hazard and have reviewed the mitigation strategies listed in Chapter 4. Tulsa County, the Town of Sperry, Berryhill Public Schools, Keystone Public Schools, Liberty Public Schools, and the Sperry Public Schools based their action items on this updated plan's risk and vulnerability analyses.

The following two tables identify which mitigation action is associated with each hazard for Tulsa County, the Town of Sperry, Berryhill Public Schools, Keystone Public Schools, Liberty Public Schools, and the Sperry Public Schools. Both jurisdictions also selected non-mitigation actions to be in their action plan, but only the mitigation actions are included in the table.

**Table 5-2
TULSA COUNTY AND TOWN OF SPERRY MITIGATION ACTIONS PER HAZARD
(two per hazard – minimum)**

Hazard Type	Tulsa County	Town of Sperry
Flood	1-2-3-4-5-6-9-10-12-13-14-15-17-19-21-23-24-25-26-27-28-29-30-33-35-38-39-40-41-48-50-51-52-54-56-57-58-59-60-61-62-63-64-65-66-73-75-77-79-81-82	1-2-3-4-5-6-8-10
Tornado	2-6-9-10-11-12-14-15-16-18-19-20-21-22-24-25-26-27-28-31-33-35-38-39-40-41-48-50-51-52-54-56-62-68-77-79-82	1-4-5-6-8-10
High Winds	2-6-9-10-11-12-14-15-16-18-19-20-21-22-24-25-26-27-28-31-33-35-38-39-40-46-48-51-54-56-62-77-79-82	1-4-5-6-8-10
Lightning	2-9-10-14-15-19-22-26-27-31-33-35-38-39-40-43-46+-48-51-54-55-56-62-77-79-82-83-84	1-4-5-6-8-10
Hail	2-9-10-15-18-19-21-26-27-33-35-38-40-48-51-53-54-56-62-77-79-80-82	1-4-5-6-8-10
Winter Storm	2-6-10-14-15-18-19-21-26-27-31-33-35-36-38-39-40-41-46-48-49-51-53-54-56-62-77-79-82	1-5-6-8-10
Extreme Heat	2-14-15-18-19-26-27-31-33-35-38-39-40-46-48-51-53-56-62-72-76-79-82-87	6-8-9-10
Expansive Soils	2-19-26-27-41-45-48-51-54-56-62-67-69-82	6-8-10
Drought	2-15-19-26-27-33-35-38-40-42-48-51-56-62-71-72-76-78-79-82	1-4-5-6-7-8-10
Wildfire	2-9-10-15-19-26-27-33-34-38-40-42-48-51-54-56-62-71-74-76-77-78-79-82	1-4-5-6-7-8-10
Earthquake	2-7-8-9-10-12-14-16-18-19-21-24-25-26-27-28-31-33-35-38-39-40-46-48-51-54-56-62-77-79-82	1-4-5-6-8-10
Hazardous Material Events	2-6-9-10-12-14-16-18-19-21-24-25-26-27-28-32-33-35-37-38-40-41-44-48-51-54-56-62-70-77-79-82	1-4-5-6-8-10
Dam Break	1-2-3-4-5-6-9-10-14-17-19-23-24-25-26-27-28-30-33-35-38-39-41-48-50-51-54-56-57-59-60-62-63-66-77-79-82-85-86-88-89	

**Table 5-3
SCHOOLS' MITIGATION ACTIONS PER HAZARD
(two per hazard – minimum)**

Hazard Type	Berryhill Public Schools	Keystone Public Schools	Liberty Public Schools	Sperry Public Schools
Flood	1-4-9	5-7-8	4-6-9-10-12-14-17-18-20	1-4
Tornado	3-4-5-9	1-2-3-4-5-6-7-8	1-2-3-9-4-6-7-10-11-12-16-17-18-20	1-4-5-6
High Winds	3-4-5-9	1-2-3-4-5-6-7-8	1-2-3-4-9-6-10-11-12-16-17-18-20	1-4-5
Lightning	4-5-9	3-4-5-6-7-8	1-3-4-6-7-8-9-10-11-12-13-19-17-18-20	1-4-6
Hail	4-5-9	2-3-4-5-6-7-8	1-2-3-4-6-9-10-11-12-15-16-17-18-20	1-4
Winter Storm	2-4-5-8-9	5-6-7-8	1-3-4-6-9-12-13-15-17-18-19-20	1-4-6
Extreme Heat	4-8	3-6-7-8	1-4-6-9-12-17-18-20	1-4
Expansive Soils	4-7	7-9	4-6-9-12-17-20	1-3
Drought	4-6	7-10	4-6-9-12-17-20	1-2
Wildfire	4-5-9	3-4-5-6-7	4-5-6-9-12-17-20-21	1-4
Earthquake	4-5	3-4-5-6-7-8	3-4-6-9-10-12-16-17-18-20	1-4-6
Hazardous Material Events	4-9	3-4-5-7	6-9-12-17-20	1-4
Dam Break	not applicable	not applicable	not applicable	not applicable

TULSA COUNTY has reviewed and analyzed the risk assessment studies for the natural hazards and hazardous material events that may impact their jurisdiction. They reviewed the mitigations activities listed in Chapter 4, incorporated the criteria and principles of the STAPLE+E project evaluation method in their consideration of the mitigation activities, and prioritized the activities as was detailed in Section 4.3. Once funding is sought, a detailed benefit/cost analysis will be done and will follow the requirements of the funding source.

Action Item # 1	TULSA COUNTY
Title	Levee Repair/Replacement
Hazard(s) Targeted	Floods Dam breaks
Project Type	Mitigation (Structural Project)
Lead and participating agencies	USACE, TAEMA, FEMA, Levee District 12, County Engineering, City of Tulsa Hydrology, OEM, Creek Nation
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$100 million
Funding source	Local and/or grants
Work product	Repair and Enhance levee A, B, and C to comply with current FEMA standards
Expected outcome	To help prevent or lessen the impact of flooding along the Arkansas River Corridor

Action Item # 2	TULSA COUNTY
Title	Regional Interactive Emergency Operations Center
Hazard(s) Targeted	Floods Tornadoes High winds Lightning Hail Winter storms Heat Drought Expansive soils Wildfires Earthquakes Hazard material events Dam breaks
Project Type	Mitigation (Structural Project)
Lead and participating agencies	TAEMA, County Engineering, County Commissioners, OEM, FEMA, Oklahoma Dept. of Homeland Security
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10 million
Funding source	Local and/or grants
Work product	Develop Tulsa County regional interactive Emergency Operations Center to provide all-hazards countywide (Oklahoma Homeland Security Region 7) warning, preparedness, response, recovery, and mitigation activities throughout Tulsa County
Expected outcome	Provide a modern EOC to better allow for more efficient handling of incidents and events that threaten Tulsa County

Action Item # 3	TULSA COUNTY
Title	Tulsa County Social Services Relocation
Hazard(s) Targeted	Floods, Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA, Tulsa County Social Services, County Engineering, Building Operations
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$15 million
Funding source	Local and/or grants
Work product	Move County Social Services out of the 100 year regulatory floodplain
Expected outcome	To allow for better continuity of operations for Tulsa County Social Services following a flood event

Action Item # 4	TULSA COUNTY
Title	Relocation of Tulsa County Garage
Hazard(s) Targeted	Floods, Dam breaks
Project Type	Mitigation (Preventative Measures)
Lead and participating agencies	TAEMA, Tulsa County Building Operations, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10 million
Funding source	Local and/or grants
Work product	Move County Garage out of the 100 year regulatory floodplain
Expected outcome	To provide for better continuity of operations during flood events for all Tulsa County departments that rely upon the Tulsa County Garage

Action Item # 5	TULSA COUNTY
Title	Relocation of Tulsa County Parks Administration
Hazard(s) Targeted	Floods, Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA, Tulsa County Parks, County Engineering, Building Operations
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10 million
Funding source	Local and/or grants
Work product	Move county parks administration out of the 100 year regulatory floodplain
Expected outcome	To provide for better continuity of operations for Tulsa County Parks following a flood event

Action Item # 6	TULSA COUNTY
Title	Outdoor Warning Sirens
Hazard(s) Targeted	Floods Tornados High winds Hazard material events Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA, City of Tulsa Radio Shop, Board of County Commissioners, INCOG
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$30,000 per siren
Funding source	Local and/or grants
Work product	Install additional outdoor warning sirens in order to expand coverage area to include all of the unincorporated area of Tulsa County.
Expected outcome	Expand coverage of the outdoor warning system in order to provide for greater warning capacity and decrease loss of life during hazardous incidents.

Action Item # 7	TULSA COUNTY
Title	Promote county employee awareness of the risk of nonstructural elements such as bookcases, file cabinets and other office equipment becoming hazardous during a seismic event
Hazard(s) Targeted	Earthquakes
Project Type	Mitigation (Education)
Lead and participating agencies	TAEMA, Tulsa County Building Operations, County Safety, County HR
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10,000
Funding source	Local and/or grants
Work product	Promote county employee awareness of the risk of nonstructural elements such as bookcases, file cabinets and other office equipment becoming hazardous during a seismic event
Expected outcome	Non-structural elements can fall onto people during seismic events, causing injury.

Action Item # 8	TULSA COUNTY
Title	Strapping Non-structural elements to walls
Hazard(s) Targeted	Earthquakes
Project Type	Mitigation
Lead and participating agencies	All County Departments
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10,000
Funding source	Local and/or grants
Work product	Provide equipment to county facilities to allow them to strap nonstructural elements to walls
Expected outcome	Securing non-structural elements to ensure that they do not become hazardous falling objects during seismic events.

Action Item # 9	TULSA COUNTY
Title	Departmental Continuity of Operations Planning
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Wildfires, Earthquakes Hazard material events Dam breaks
Project Type	Mitigation
Lead and participating agencies	All Tulsa County Departments, Municipal Departments
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10,000
Funding source	Local and/or grants
Work product	Develop a Continuity of Operations plan for each department within county government. Encourage each municipality within Tulsa County to develop COOP plans for each department.
Expected outcome	Clear delineation of responsibility for continuity of departmental operations in the event that current departmental leadership becomes unavailable during hazardous events.

Action Item # 10	TULSA COUNTY
Title	Exercising of Continuity of Operations plans
Hazard(s) Targeted	Floods Tornadoes High winds Lightning Hail Winter storms Wildfires Earthquakes Hazard material events Dam breaks
Project Type	Mitigation
Lead and participating agencies	All Tulsa County Departments
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10,000
Funding source	Local and/or grants
Work product	Develop exercise program to test and update COOP plans for all county departments and municipal departments within the county.
Expected outcome	To ensure that all responsible parties are familiar with the continuity of operations plan and the plan is workable.

Action Item # 11	TULSA COUNTY
Title	Provide locations of refuge for employees at critical facilities
Hazard(s) Targeted	Tornadoes, High winds
Project Type	Mitigation
Lead and participating agencies	All County Departments
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$15,000 per shelter
Funding source	Local and/or grants
Work product	Provide employee shelters/safe rooms at critical facilities, such as 911 Center, Fire stations and Sheriff's stations to protect first responders
Expected outcome	To protect lives of critical first responders during hazardous events

Action Item # 12	TULSA COUNTY
Title	Upgrade and maintain current outdoor warning system
Hazard(s) Targeted	Floods, Tornados, High Winds, Earthquakes, Hazardous material events
Project Type	Mitigation
Lead and participating agencies	TAEMA, City of Tulsa Radio Shop
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	Up to \$30,000 per siren
Funding source	Local and/or grants
Work product	Evaluate, upgrade, and maintain community-wide outdoor Omni-directional voice/siren warning systems
Expected outcome	To ensure that current outdoor warning system capabilities continue to meet population needs.

Action Item # 13	TULSA COUNTY
Title	Raising generator placement height
Hazard(s) Targeted	Floods
Project Type	Mitigation
Lead and participating agencies	All departments
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10,000 each
Funding source	Local and/or grants
Work product	Elevate all generators at county facilities so they are 1 foot above the 100 year regulatory floodplain
Expected outcome	Promote continuity of operations by ensuring that dedicated building generators will not be affected by floods within 100 year flood plain

Action Item # 14 | **TULSA COUNTY**

Title	Purchase dedicated generators
Hazard(s) Targeted	Floods Tornados High winds Lightning Winter storms Extreme Heat Earthquakes Dam breaks
Project Type	Mitigation
Lead and participating agencies	Tulsa County Building Operations, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$30,000 per generator
Funding source	Local and/or grants
Work product	Purchase and install backup generators for all county facilities
Expected outcome	Promote greater continuity of operations by ensuring that county facilities are not affected by disruptions to local power grid

Action Item # 15 | **TULSA COUNTY**

Title	Purchase NOAA Radios
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Heat Drought Wildfires
Project Type	Mitigation
Lead and participating agencies	TAEMA, all departments
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$ 100 per radio
Funding source	Local and/or grants
Work product	Purchase NOAA Weather radios with S.A.M.E technology for each county facility location and identify key staff to monitor radios
Expected outcome	To provide greater awareness and warnings to county facilities of incoming hazards, ensuring that staff has time to take life preserving measures.

Action Item # 16	TULSA COUNTY
Title	Strap water heaters to walls
Hazard(s) Targeted	Tornados High Winds Earthquakes
Project Type	Mitigation
Lead and participating agencies	Tulsa County Building Operations, County Safety Officer, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$200 each
Funding source	Local and/or grants
Work product	Strap all water heaters to nearest walls at county facilities
Expected outcome	Protect life and prevent property damage by helping to secure water heaters so that they do not move from their base during events preventing potential gas and/or water leaks.

Action Item # 17	TULSA COUNTY
Title	Install monitoring system at area dams
Hazard(s) Targeted	Floods, Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA, USACE, Homeland Security
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$ not determined
Funding source	Local and/or grants
Work product	Install remote visual monitoring system at area dams to allow for situation monitoring and awareness as well as to allow for early detection for warning vulnerable populations
Expected outcome	Allow for early detection of dam breaks or heavy release, promoting earlier warnings and greater life preservation.

Action Item # 18 | **TULSA COUNTY**

Title	Install Protective Window Films
Hazard(s) Targeted	Tornados High winds Hail Winter storms Extreme Heat Earthquakes
Project Type	Mitigation
Lead and participating agencies	TAEMA, Tulsa County Building Operations
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$300 per window
Funding source	Local and/or grants
Work product	Install protective window film on all county building windows to increase resistance to hazardous events
Expected outcome	To prevent broken glass causing further injury during hazardous events

Action Item # 19 | **TULSA COUNTY**

Title	Develop interoperable VHF communications system
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Heat Drought Expansive soils Wildfires Earthquakes Hazard material events Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA, Radio Shop, OEM, Homeland Security
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$15,000
Funding source	Local and/or grants
Work product	Develop and maintain a redundant countywide, all hazards, all community, interoperable VHF communications system
Expected outcome	To promote greater communication capabilities across jurisdictions during hazardous events

Action Item # 20	TULSA COUNTY
Title	Replace overhead/garage doors
Hazard(s) Targeted	Tornadoes, High Winds
Project Type	Mitigation
Lead and participating agencies	TAEMA, Tulsa County Building Operations
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$ 30,000 per door
Funding source	Local and/or grants
Work product	Replacement all garage doors at county buildings with wind rated doors and rails if door is not already rated to handle strong wind events
Expected outcome	Improve building capacity to maintain structural integrity during severe weather.

Action Item # 21	TULSA COUNTY
Title	Develop/review/update the debris management plan
Hazard(s) Targeted	Floods, tornadoes, high winds, hail, severe winter storms, earthquakes
Project Type	Mitigation
Lead and participating agencies	TAEMA, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10,000
Funding source	Local and/or grants
Work product	Develop/ Review/ Update the debris management plan
Expected outcome	Promote faster recovery and promote better health outcomes by efficiently removing debris from areas affected by hazardous events

Action Item # 22	TULSA COUNTY
Title	Purchase NOAA Radios for area schools
Hazard(s) Targeted	Tornadoes, High Winds, Lighting, Hail
Project Type	Mitigation
Lead and participating agencies	Local Area School Administration
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$ 100 per radio
Funding source	Local and/or grants
Work product	Designate individuals in area schools that are educated in storm spotting and safety and who have the authority to take proper action. Equip these individuals with NOAA weather radios.
Expected outcome	Promote greater warning and response time in order to promote actions necessary for life preservation

Action Item # 23	TULSA COUNTY
Title	Comply with national flood programs
Hazard(s) Targeted	Floods, dam failure
Project Type	Mitigation
Lead and participating agencies	TAEMA, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10,000
Funding source	Local and/or grants
Work product	Continue compliance with, and participation in the National Flood Insurance Program (MFIP) and Community Rating System (CRS)
Expected outcome	Ensuring that losses from flooding is covered helps to promote greater community resilience and lessen the overall long term impact of flooding events

Action Item # 24 | **TULSA COUNTY**

Title	Purchase Air burner system for debris removal
Hazard(s) Targeted	Floods High winds Earthquakes Dam breaks Tornados Winter storms Hazard material events
Project Type	Mitigation
Lead and participating agencies	TAEMA, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$120,000 each
Funding source	Local and/or grants
Work product	Purchase an air burner system to allow for more efficient debris removal
Expected outcome	Promote faster recovery and promote better health outcomes by efficiently removing debris from areas affected by hazardous events

Action Item # 25 | **TULSA COUNTY**

Title	Purchase debris load volume scanner
Hazard(s) Targeted	Floods High winds Earthquakes Dam breaks Tornados Winter storms Hazard material events
Project Type	Mitigation
Lead and participating agencies	TAEMA, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$100,000
Funding source	Local and/or grants
Work product	Purchase a debris load scanning system to allow for more efficient debris measurement.
Expected outcome	Promote faster recovery and promote better health outcomes by efficiently removing and tracking debris from areas affected by hazardous events

Action Item # 26 | **TULSA COUNTY**

Title	Implement computer vulnerability protection
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Heat Drought Expansive soils Wildfires Earthquakes Hazard material events Dam breaks
Project Type	Mitigation
Lead and participating agencies	Tulsa County Information Technology
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$20,000
Funding source	Local and/or grants
Work product	Consider and/or implement necessary measures in protecting computer based systems against cyber-attack and other security vulnerabilities during hazardous events.
Expected outcome	Promote continuity of operations and promoting incident stabilization by ensuring that computer system vulnerabilities are not exploited or created during other hazardous events

Action Item # 27 | **TULSA COUNTY**

Title	Purchase and adopt IPAWS system
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Heat Drought Expansive soils Wildfires Earthquakes Hazard material events Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA, OEM, FEMA
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$5,000
Funding source	Local and/or grants
Work product	Install a mass emergency telephone communication system such as reverse 911 or black board connect, for mass call-outs to targeted areas of the community for emergency notification and/or information
Expected outcome	Promote greater community warning capacity in order to deliver potentially lifesaving information in a timely manner.

Action Item # 28 | **TULSA COUNTY**

Title	Install outdoor warning system repeater
Hazard(s) Targeted	Floods Tornados High winds Earthquakes Hazardous material events Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA, City of Tulsa radio shop
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$25,000
Funding source	Local and/or grants
Work product	Install new repeater for outdoor warning system to extend coverage area to cover all the unincorporated area of Tulsa county
Expected outcome	Will promote greater capacity for current outdoor warning system as well as providing built in redundancy for sections of the current outdoor warning siren coverage area.

Action Item # 29 | **TULSA COUNTY**

Title	Floodplain property acquisition
Hazard(s) Targeted	Floods
Project Type	Mitigation
Lead and participating agencies	TAEMA
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$500,000
Funding source	Local and/or grants
Work product	Acquire and remove floodplain and repetitive loss properties where the community's repetitive loss plan and Flood and Drainage Annex to the Hazard Mitigation Plan identify acquisition as the most cost-effective and desirable mitigation measure
Expected outcome	Removal of these properties from usage that could endanger lives while serving to reduce overall community impact from flood events

Action Item # 30	TULSA COUNTY
Title	Create flood specific annex to mitigation plan
Hazard(s) Targeted	Floods Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA, INCOG, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$5,000
Funding source	Local and/or grants
Work product	Prepare a comprehensive basin wide Flood and Drainage Annex to the Hazard Mitigation Plan for all watersheds within the jurisdiction. The plan should identify all flooding problems within the jurisdiction and recommend the most cost-effective and politically acceptable solutions
Expected outcome	Will provide specialized guidance on flood mitigation activities throughout Tulsa County

Action Item # 31	TULSA COUNTY
Title	Install Surge Protection
Hazard(s) Targeted	Tornadoes, High Winds, Lightning, Severe Winter Weather, Extreme heat, Earthquakes
Project Type	Mitigation
Lead and participating agencies	Tulsa County Information Technology
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10,000
Funding source	Local and/or grants
Work product	Provide surge and lighting protection for computer reliant critical facilities
Expected outcome	Limit equipment losses from power spikes and lightning strikes

Action Item # 32	TULSA COUNTY
Title	Conduct a commodity flow study
Hazard(s) Targeted	Hazardous material events
Project Type	Mitigation
Lead and participating agencies	TAEMA, Tulsa County LEPC
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$ 10,000
Funding source	Local and/or grants
Work product	Coordinate with local LEPC to conduct a commodity flow study.
Expected outcome	Promote greater understanding for emergency response personnel which hazardous material incidents they are likely to face, allowing for greater preparation and promoting better life preservation activities

Action Item # 33	TULSA COUNTY
Title	Build greater relationships with Ham Radio Operators
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Heat Drought Wildfires Earthquakes Hazard material events Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10,000
Funding source	Local and/or grants
Work product	Develop use of Ham operators as communications source during hazardous events to be available for use of emergency management.
Expected outcome	Provide better situational awareness, allowing for more timely warnings to be issued to areas potentially affected by hazardous events

Action Item # 34 | **TULSA COUNTY**

Title	Develop a the Firewise program
Hazard(s) Targeted	Wildfires
Project Type	Mitigation
Lead and participating agencies	TAEMA, Area Fire Departments
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10,000
Funding source	Local and/or grants
Work product	Adopt the Firewise program for the vulnerable rural/urban interface area of the county
Expected outcome	Lessen the overall impact of urban interface fires on Tulsa county residents

Action Item # 35 | **TULSA COUNTY**

Title	Update information with 211
Hazard(s) Targeted	Floods High winds Hail Heat Expansive soils Earthquakes Dam breaks Tornados Lightning Winter storms Drought Wildfires Hazard material events
Project Type	Mitigation
Lead and participating agencies	TAEMA, 211
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$1,000
Funding source	Local and/or grants
Work product	Continue updating appropriate disaster safety information for the 211 system, such as cooling shelters in extreme heat, and heating shelters in severe winter storms.
Expected outcome	Providing better information distribution to the general public of potentially lifesaving information

Action Item # 36 | **TULSA COUNTY**

Title	Devise a more aggressive snow and ice removal plan
Hazard(s) Targeted	Winter Storms
Project Type	Mitigation
Lead and participating agencies	County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$100,000
Funding source	Local and/or grants
Work product	Create a more aggressive ice and snow removal plan
Expected outcome	Lessen the overall impact of winter storms on the general population of Tulsa County

Action Item # 37 | **TULSA COUNTY**

Title	Provide Tier II information to area Fire Chiefs
Hazard(s) Targeted	Hazard material events
Project Type	Mitigation
Lead and participating agencies	TAEMA, DEQ
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$2,500
Funding source	Local and/or grants
Work product	Provide maps and chemical details of local Tier II facilities to all fire chiefs operating within Tulsa county
Expected outcome	Allow for better response to Tier II facilities during hazardous events, promoting greater safety of first responders

Action Item # 38 | **TULSA COUNTY**

Title	Promote business continuity planning
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Heat Drought Wildfires Earthquakes Hazard material events Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA, Local Chambers of Commerce, All Departments
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$100,000
Funding source	Local and/or grants
Work product	Work with local chambers of commerce to educate businesses on the need for business continuity planning
Expected outcome	Create greater community resiliency against long term losses created by hazardous events.

Action Item # 39 | **TULSA COUNTY**

Title	Provide wiring and switches for emergency generators at critical facilities owned by Tulsa county
Hazard(s) Targeted	Floods Tornados High winds Lightning Winter storms Extreme Heat Earthquakes Dam breaks
Project Type	Mitigation
Lead and participating agencies	Tulsa County Building Operations
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$100,000
Funding source	Local and/or grants
Work product	Provide wiring and transfer switches to accommodate emergency generators during disaster power outages for critical facilities including Emergency Operation Centers, County court House, Dispatch, Sheriff's Offices, Community Centers used for emergency housing during disaster, critical facilities, lift stations, and community medical facilities
Expected outcome	Provide for continuity of operations during hazardous events.

Action Item # 40 | **TULSA COUNTY**

Title	Develop and test site emergency plans for correctional facilities
Hazard(s) Targeted	Floods Tornadoes High winds Lightning Hail Winter storms Heat Drought Wildfires Earthquakes Hazard material events
Project Type	Mitigation
Lead and participating agencies	TAEMA, Tulsa County Sheriffs
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10,000
Funding source	Local and/or grants
Work product	Develop and test site emergency plans for correctional facilities.
Expected outcome	To devise a system that will serve to help minimize loss of life during hazardous events.

Action Item # 41 | **TULSA COUNTY**

Title	Adopt/modify a land use plan to guide development away from hazardous areas
Hazard(s) Targeted	Floods Expansive soils Wildfires Hazard material events Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA, County Engineers
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$500,000
Funding source	Local and/or grants
Work product	Modify adopt a land use plan to guide development away from hazardous areas, reduce population density in hazardous areas, implement stronger development restrictions, and encourage natural resource protection
Expected outcome	To lessen the impact of hazardous events by lessening the likelihood that there are individuals, residences, or businesses in the impacted area

Action Item # 42	TULSA COUNTY
Title	Develop contingency plans for firefighting during periods of drought
Hazard(s) Targeted	Drought Wildfires
Project Type	Mitigation
Lead and participating agencies	TAEMA, Area Fire Departments
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$25,000
Funding source	Local and/or grants
Work product	Work with the fire department to develop contingency plans for firefighting during periods when drought conditions may produce decreased water pressure and supply
Expected outcome	Ensure that firefighting capacity is maintained in order despite drought conditions or other issues that might affect water supply.

Action Item # 43	TULSA COUNTY
Title	Construct lighting rods for protection of critical facilities
Hazard(s) Targeted	Lightning
Project Type	Mitigation
Lead and participating agencies	County Engineering, Building Operations, TAEMA
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$100,000
Funding source	Local and/or grants
Work product	Construct lighting rods for protection of critical facilities
Expected outcome	Protect facilities against lightning strikes

Action Item # 44	TULSA COUNTY
Title	Develop and reinforce hazardous materials emergency equipment and response teams.
Hazard(s) Targeted	Hazard material events
Project Type	Mitigation
Lead and participating agencies	TAEMA, Area Fire Departments, INCOG
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10,000
Funding source	Local and/or grants
Work product	Develop and reinforce hazardous materials emergency equipment and response teams.
Expected outcome	To provide better immediate response to hazardous material incidents, promoting life preservation and lessening long term impact

Action Item # 45	TULSA COUNTY
Title	Identify potential areas of soil subsidence
Hazard(s) Targeted	Expansive soils
Project Type	Mitigation
Lead and participating agencies	TAEMA, USGS, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$25,000
Funding source	Local and/or grants
Work product	Work with USGS to identify potential areas of soil subsidence and develop plans to address key infrastructure in identified areas
Expected outcome	Allow for development of key infrastructure to lessen the impact of soil subsidence

Action Item # 46	TULSA COUNTY
Title	Promote better disaster resilience with key private critical facilities
Hazard(s) Targeted	tornadoes, high winds, lightning, extreme heat, severe winter storms, earthquakes
Project Type	Mitigation
Lead and participating agencies	TAEMA, private industry
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	N/A
Funding source	Private businesses
Work product	Identify and/or encourage private critical facilities (gas stations, convenience stores, etc.) to have wiring/transfer switches and emergency back-up generators installed, or reliable contracts for the provision of back-up generators, in the event of disasters or power outages
Expected outcome	Promote greater community resiliency and lessen the impact of hazardous events on the community

Action Item # 47	TULSA COUNTY
Title	Develop a contingency plan for evacuating population endangered by a wildfire
Hazard(s) Targeted	Wildfires
Project Type	Mitigation
Lead and participating agencies	TAEMA, Area Fire Departments
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10,000
Funding source	Local and/or grants
Work product	Develop a contingency plan for evacuating population endangered by a wildfire
Expected outcome	Protect individuals from loss of life due to wildfire

Action Item # 48	TULSA COUNTY
Title	Develop an all-hazard public information, education, and awareness strategy program
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Heat Drought Expansive soils Wildfires Earthquakes Hazard material events Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$25,000
Funding source	Local and/or grants
Work product	Develop an all-hazard public information, education, and awareness strategy program
Expected outcome	To raise awareness

Action Item # 49	TULSA COUNTY
Title	Review the possible critical structural “snow load” thresholds on flat-roofed community or critical facilities.
Hazard(s) Targeted	Winter storms
Project Type	Mitigation
Lead and participating agencies	TAEMA, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$15,000
Funding source	Local and/or grants
Work product	Review the possible critical structural “snow load” thresholds on flat-roofed community or critical facilities.
Expected outcome	To ensure continuity of operations are not disrupted and that further costs are not incurred from snow load from severe winter weather.

Action Item # 50	TULSA COUNTY
Title	Develop and incorporate warning and evacuation plans and systems for areas at risk from dam failure or large release flooding
Hazard(s) Targeted	Floods Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA, all stakeholders
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$25,000
Funding source	Local and/or grants
Work product	Develop and incorporate warning and evacuation plans and systems for areas at risk from dam failure or large release flooding
Expected outcome	To decrease the likelihood that dam failure or flooding will result in catastrophic loss of life.

Action Item # 51	TULSA COUNTY
Title	Build or enhance partnerships involving local government officials, civic, business and volunteer groups to work together to mitigate all-hazards
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Heat Drought Expansive soils Wildfires Earthquakes Hazard material events Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10,000
Funding source	Local and/or grants
Work product	Build or enhance partnerships involving local government officials, civic, business and volunteer groups to work together to mitigate all-hazards.
Expected outcome	To create a more comprehensive, community wide, resiliency against hazardous events

Action Item # 52	TULSA COUNTY
Title	Construct all new and replacement bridges to pass 100 year regulatory floodplain without overtopping.
Hazard(s) Targeted	Floods
Project Type	Mitigation
Lead and participating agencies	Department of Transportation, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$ 50 million
Funding source	Local and/or grants
Work product	Construct all new and replacement bridges to pass 100 year regulatory floodplain without overtopping.
Expected outcome	To ensure that needed bridges and overpasses are available for both responders and evacuees during a flood event

Action Item # 53	TULSA COUNTY
Title	Provide covered shelter for county government vehicles
Hazard(s) Targeted	Hail, Severe Winter, extreme heat
Project Type	Mitigation
Lead and participating agencies	Tulsa Building Operations
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$500,000
Funding source	Local and/or grants
Work product	Provide covered shelter for county government vehicles
Expected outcome	Prevent damage to county vehicles from hazardous events

Action Item # 54 | **TULSA COUNTY**

Title	Inventory inadequate bridges.
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Expansive soils Wildfires Earthquakes Hazard material events Dam breaks
Project Type	Mitigation
Lead and participating agencies	Department of Transportation, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$500,000
Funding source	Local and/or grants
Work product	Inventory inadequate bridges.
Expected outcome	Allow for repairs to be made and evacuation routes to be devised that do not utilize these insufficient bridges.

Action Item # 55 | **TULSA COUNTY**

Title	Provide lightning warning systems for county owned outdoor sports areas, pools, golf courses, ball fields, parks, and fairgrounds
Hazard(s) Targeted	Lightning
Project Type	Mitigation
Lead and participating agencies	Tulsa County Parks, Expo Square
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$25,000
Funding source	Local and/or grants
Work product	Provide lightning warning systems for county owned outdoor sports areas, pools, golf courses, ball fields, parks, and fairgrounds
Expected outcome	Allow greater warning of lightning events, allowing for faster response and decreasing the likelihood that loss of life from lightning strikes will occur.

Action Item # 56 | **TULSA COUNTY**

Title	Train stakeholders in disaster resistant building methods
Hazard(s) Targeted	Floods High winds Hail Heat Expansive soils Earthquakes Dam breaks Tornados Lightning Winter storms Drought Wildfires Hazard material events
Project Type	Mitigation
Lead and participating agencies	TAEMA, County Engineers
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$25,000
Funding source	Local and/or grants
Work product	Train/educated builders, developers, architects and engineers in techniques of disaster-resistant homebuilding , such as the fortified home standards developed by the institute for business and home safety (IBHS), the Blueprint for Safety guidelines developed by the Federal Alliance for Safe Homes (FLASH)
Expected outcome	Prevent loss of life and minimize property damage through better building methods

Action Item # 57 | **TULSA COUNTY**

Title	Encourage effective use of regulated downstream areas from dams
Hazard(s) Targeted	Floods Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$25,000
Funding source	Local and/or grants
Work product	Encourage effective use of regulated downstream areas from dams
Expected outcome	Prevent loss of life and minimize property damage by ensuring that downstream areas are not utilized in a way that would compound issues from hazardous events

Action Item # 58 | **TULSA COUNTY**

Title	Compensate for the impacts of new bridges and channel improvements
Hazard(s) Targeted	Floods
Project Type	Mitigation
Lead and participating agencies	County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	Variable
Funding source	Local and/or grants
Work product	Compensate for the impacts of new bridges and channel improvements
Expected outcome	Prevent current projects from compounding issues caused by hazardous events.

Action Item # 59 | **TULSA COUNTY**

Title	Perform the FEMA Full Riverine Module for Cost/Benefit Analysis for Acquisition foot 100-year floodplain buildings with first finished floor below the Base Flood Elevation (BFE) to confirm potential candidates for acquisition and removal from the floodplain.
Hazard(s) Targeted	Floods Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$50,000
Funding source	Local and/or grants
Work product	Perform the FEMA Full Riverine Module for Cost/Benefit Analysis for Acquisition foot 100-year floodplain buildings with first finished floor below the Base Flood Elevation (BFE) to confirm potential candidates for acquisition and removal from the floodplain.
Expected outcome	Will provide a cost/benefit analysis to allow determination of what buildings need to be acquired for removal

Action Item # 60 | **TULSA COUNTY**

Title	Prepare elevation certificates for floodplain candidate properties for acquisition with positive benefit/cost ratios greater than 1.0
Hazard(s) Targeted	Floods Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$50,000
Funding source	Local and/or grants
Work product	Prepare elevation certificates for floodplain candidate properties for acquisition with positive benefit/cost ratios greater than 1.0
Expected outcome	Will provide elevation certificates for floodplain candidate properties for acquisition with positive benefit/cost ratios greater than 1.0

Action Item # 61 | **TULSA COUNTY**

Title	Obtain elevation certificates for pre-FIRM homes located in the floodplain.
Hazard(s) Targeted	Floods
Project Type	Mitigation
Lead and participating agencies	TAEMA, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$ 10,000
Funding source	Local and/or grants
Work product	Obtain elevation certificates for pre-FIRM homes located in the floodplain.
Expected outcome	Have elevation certificates for pre-FIRM homes located in the floodplain.

Action Item # 62	TULSA COUNTY
Title	Identify and encourage Private Critical Facilities (financial institutions, long term care facilities, Designated/Potential Community Emergency Shelters, Etc.) to have generator pad, wiring/transfer switches and Emergency Back-up Generators, or reliable contracts to provide back-up generators.
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Heat Drought Expansive soils Wildfires Earthquakes Hazard material events Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10,000
Funding source	Local and/or grants
Work product	Identify and encourage Private Critical Facilities (financial institutions, long term care facilities, Designated/Potential Community Emergency Shelters, Etc.) to have generator pad, wiring/transfer switches and Emergency Back-up Generators, or reliable contracts to provide back-up generators.
Expected outcome	Will promote greater community resiliency and lessen the impact of hazardous events.

Action Item # 63	TULSA COUNTY
Title	Develop and distribute flood and flash flood safety tips to inform citizens of the dangers of flood waters
Hazard(s) Targeted	Floods Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$5,000
Funding source	Local and/or grants
Work product	Develop and distribute flood and flash flood safety tips to inform citizens of the dangers of flood waters
Expected outcome	Decrease number of fatalities from floods

Action Item # 64	TULSA COUNTY
Title	Construct regional detention ponds to compensate for future urban development
Hazard(s) Targeted	Flood
Project Type	Mitigation
Lead and participating agencies	County Engineering
Time schedule	in 1-5 years or when funding becomes available_
Estimated Cost	\$2,000,000
Funding source	Local and/or grants
Work product	Construct regional detention ponds to compensate for future urban development
Expected outcome	Lessen the impact of heavy rains on the community by retaining potential flood waters

Action Item # 65	TULSA COUNTY
Title	Ensure that critical facilities are elevated or flood proofed to the 100 year flood elevation, be provided access above the 100 year flood elevation, and that new critical facilities are not located within the 100 year floodplain.
Hazard(s) Targeted	Floods
Project Type	Mitigation
Lead and participating agencies	TAEMA, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$20 million
Funding source	Local and/or grants
Work product	Ensure that critical facilities are elevated or flood proofed to the 100 year flood elevation, be provided access above the 100 year flood elevation, and that new critical facilities are not located within the 100 year floodplain.
Expected outcome	No critical facilities to be affected flooding within the 100 year floodplain

Action Item # 66 | **TULSA COUNTY**

Title	Inform floodplain residents of the availability of flood insurance to eligible NFIP communities
Hazard(s) Targeted	Floods Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$25,000
Funding source	Local and/or grants
Work product	Inform floodplain residents of the availability of flood insurance to eligible NFIP communities
Expected outcome	Increase participation in NFIP to provide individuals with resources to recover rapidly following a flood event.

Action Item # 67 | **TULSA COUNTY**

Title	Establish administrative procedures, and provide maps and information to inform builders about expansive soils when they apply for development and building permits
Hazard(s) Targeted	Expansive soils
Project Type	Mitigation
Lead and participating agencies	County engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$20,000
Funding source	Local and/or grants
Work product	Establish administrative procedures, and provide maps and information to inform builders about expansive soils when they apply for development and building permits
Expected outcome	To allow for informed decisions in building construction, preventing property damage from improper foundations during a hazardous event.

Action Item # 68	TULSA COUNTY
Title	Educate residents, building professionals and safe room vendors on the international codes council/national storm shelter association's "Standard for the Design and Construction of Storm Shelters" and consider incorporating this Standard into current information and practices
Hazard(s) Targeted	Tornados High winds
Project Type	Mitigation
Lead and participating agencies	TAEMA, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10,000
Funding source	Local and/or grants
Work product	Educate residents, building professionals and safe room vendors on the international codes council/national storm shelter association's "Standard for the Design and Construction of Storm Shelters" and consider incorporating this Standard into current information and practices
Expected outcome	Provide better standardization for storm shelters and safe rooms throughout the county; ensuring that all shelters are built to best industry practices

Action Item # 69	TULSA COUNTY
Title	Educate builders on appropriate foundation types for soils with different degrees of shrink-swell potential.
Hazard(s) Targeted	Expansive soils
Project Type	Mitigation
Lead and participating agencies	Tulsa Building Inspectors
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$30,000
Funding source	Local and/or grants
Work product	Educate builders on appropriate foundation types for soils with different degrees of shrink-swell potential.
Expected outcome	To allow for informed decisions in building construction, preventing property damage from improper foundations during a hazardous event

Action Item # 70	TULSA COUNTY
Title	Identify populations around potential fixed-site hazmat hazards, and distribute information and materials to support “Shelter-in-place” actions among home and business owners
Hazard(s) Targeted	Hazard material events
Project Type	Mitigation
Lead and participating agencies	TAEMA, LEPC
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$20,000
Funding source	Local and/or grants
Work product	Identify populations around potential fixed-site hazmat hazards, and distribute information and materials to support “Shelter-in-place” actions among home and business owners
Expected outcome	Prevent loss of life during hazardous events.

Action Item # 71	TULSA COUNTY
Title	Pre-identify and inventory water moving equipment, including pumps, pipeline, tanker trucks, “water buffaloes” and other resources.
Hazard(s) Targeted	Drought Wildfires
Project Type	Mitigation
Lead and participating agencies	TAEMA, Area Fire Departments, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$50,000
Funding source	Local and/or grants
Work product	Pre-identify and inventory water moving equipment, including pumps, pipeline, tanker trucks, “water buffaloes” and other resources.
Expected outcome	Allow for more efficient use of resources, providing better response communitywide.

Action Item # 72 | **TULSA COUNTY**

Title	Encourage usage of water conservation policies such as low flow plumbing devices, inverted block water rate structure, moisture sensors, and the use of grey water for irrigation.
Hazard(s) Targeted	Extreme Heat Drought
Project Type	Mitigation
Lead and participating agencies	Tulsa County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10,000
Funding source	Local and/or grants
Work product	Encourage usage of water conservation policies such as low flow plumbing devices, inverted block water rate structure, moisture sensors, and the use of grey water for irrigation.
Expected outcome	Ensure preservation of resources during scarcity by promoting reduction of use.

Action Item # 73 | **TULSA COUNTY**

Title	Maintain culverts to adequately allow storm water drainage
Hazard(s) Targeted	Floods
Project Type	Mitigation
Lead and participating agencies	County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$100,000
Funding source	Local and/or grants
Work product	Maintain culverts to adequately allow storm water drainage
Expected outcome	Promote better drainage, lessening the impact of flooding.

Action Item # 74	TULSA COUNTY
Title	Create fire breaks along fence rows to thwart road jumping, on county owned property
Hazard(s) Targeted	Wildfires
Project Type	Mitigation
Lead and participating agencies	Area Fire Departments, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$100,000
Funding source	Local and/or grants
Work product	Create fire breaks along fence rows to thwart road jumping
Expected outcome	Better containment of wildfires, limiting the impact in the community

Action Item # 75	TULSA COUNTY
Title	Conduct water way channel improvements to prevent sedimentation and improve the ability to transport or store floodwaters, utilizing appropriate native vegetation where management priorities and safety concerns allow.
Hazard(s) Targeted	Floods
Project Type	Mitigation
Lead and participating agencies	County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$100,000
Funding source	Local and/or grants
Work product	Conduct water way channel improvements to prevent sedimentation and improve the ability to transport or store floodwaters, utilizing appropriate native vegetation where management priorities and safety concerns allow.
Expected outcome	Allow better water flow throughout the community, lessening the likelihood of regular flooding.

Action Item # 76 | **TULSA COUNTY**

Title	Continue to work with county extension offices and others to develop information on drought tolerant grass varieties and xeriscapes
Hazard(s) Targeted	Extreme Heat Drought Wildfires
Project Type	Mitigation
Lead and participating agencies	TAEMA, OSU Extension, County Parks
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$200,000
Funding source	Local and/or grants
Work product	Continue to work with county extension offices and others to develop information on drought tolerant grass varieties and xeriscapes
Expected outcome	Promote better choices in fauna that requires less water and will stay green during long periods of drought or heat.

Action Item # 77 | **TULSA COUNTY**

Title	Install street addresses on county owned buildings and curbs
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Wildfires Earthquakes Hazard material events Dam breaks
Project Type	Mitigation
Lead and participating agencies	County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$5,000
Funding source	Local and/or grants
Work product	Install street addresses on buildings and curbs
Expected outcome	Provide faster response times for first responders by removing confusion regarding incident locations

Action Item # 78 | **TULSA COUNTY**

Title	Continue to monitor drought conditions and moisture measurements to alert officials of increased risk of drought and wildfire.
Hazard(s) Targeted	Drought Wildfires
Project Type	Mitigation
Lead and participating agencies	National Weather Service, Area Fire Departments, TAEMA
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10,000
Funding source	Local and/or grants
Work product	Continue to monitor drought conditions and moisture measurements to alert officials of increased risk of drought and wildfire.
Expected outcome	Allow for emergency steps to be taken during periods of drought or high fire likelihood that would lessen the impact of hazards on the community

Action Item #79 | **TULSA COUNTY**

Title	Educate the public on the importance of a family disaster plan and supply kit
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Heat Drought Wildfires Earthquakes Hazard material events Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10,000
Funding source	Local and/or grants
Work product	Educate the public on the importance of a family disaster plan and supply kit
Expected outcome	Promote greater community resiliency and lessen the impact on individuals

Action Item # 80	TULSA COUNTY
Title	Provide hail resistant measures/materials to protect existing public infrastructure improvements.
Hazard(s) Targeted	Hail
Project Type	Mitigation
Lead and participating agencies	Building Operations, County Engineering
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$100,000
Funding source	Local and/or grants
Work product	Provide hail resistant measures/materials to protect existing public infrastructure improvements.
Expected outcome	Prevent damage to public infrastructure from hail events.

Action Item # 81	TULSA COUNTY
Title	Control erosion during development with vegetation or sediment capture, reducing sedimentation which may fill in channels and lakes, reducing their ability to carry or store floodwaters.
Hazard(s) Targeted	Floods
Project Type	Mitigation
Lead and participating agencies	County Engineering,
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$25,000
Funding source	Local and/or grants
Work product	Control erosion during development with vegetation or sediment capture, reducing sedimentation which may fill in channels and lakes, reducing their ability to carry or store floodwaters.
Expected outcome	To help lessen the severity of flood events on the community by ensuring rapid water removal from developed areas.

Action Item # 82	TULSA COUNTY
Title	Develop and implement a Capital Improvement Plan that includes hazards considerations.
Hazard(s) Targeted	Floods Tornadoes High winds Lightning Hail Winter storms Heat Drought Expansive soils Wildfires Earthquakes Hazard material events Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA, All county departments
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$50,000
Funding source	Local and/or grants
Work product	Develop and implement a Capital Improvement Plan that includes hazard mitigation considerations for flooding, expansive soils, earthquakes, severe winter storms, high winds, tornadoes, and hazardous materials events.
Expected outcome	To promote hazard mitigation considerations in all future capital improvement projects

Action Item # 83	TULSA COUNTY
Title	Continue to Educate the community about lightening safety through public service announcements and other media outlets
Hazard(s) Targeted	Lighting
Project Type	Mitigation
Lead and participating agencies	TAEMA
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	Not determined
Funding source	Local and/or grants
Work product	Continue to Educate the community about lightening safety through public service announcements and other media outlets
Expected outcome	To help prevent loss of life from lighting strikes

Action Item # 84	TULSA COUNTY
Title	Encourage utilities to provide lightning damage prevention information materials and programs to their customers
Hazard(s) Targeted	Lightning
Project Type	Mitigation
Lead and participating agencies	TAEMA
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$10,000
Funding source	Local and/or grants
Work product	Encourage utilities to provide lightning damage prevention information materials and programs to their customers
Expected outcome	Lessen the impact of direct lightning strikes on the community

Action Item # 85	TULSA COUNTY
Title	Prepare and distribute a public information document letting people know that they reside or work in a dam failure inundation area
Hazard(s) Targeted	Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA, USACE
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$250,000
Funding source	Local and/or grants
Work product	Prepare and distribute a public information document letting people know that they reside or work in a dam failure inundation area
Expected outcome	Raise public awareness of hazards so that they can make preparatory actions.

Action Item # 86	TULSA COUNTY
Title	Annually review municipal dam inspections and ensure that emergency action plan up to date and on file at OWRB
Hazard(s) Targeted	Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA, County Engineering, OWRB
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$15,000
Funding source	Local and/or grants
Work product	Annually review municipal dam inspections and ensure that emergency action plan up to date and on file at OWRB
Expected outcome	Raise awareness of issues prior to emergency situations in order to allow for preparatory actions to be taken to protect infrastructure and lessen the severity of potential dam breaks

Action Item # 87	TULSA COUNTY
Title	Identify the vulnerable population and individuals at risk from extreme heat.
Hazard(s) Targeted	Heat
Project Type	Mitigation
Lead and participating agencies	TAEMA, Tulsa County Social Services, RMRS, EMSA
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$25,000
Funding source	Local and/or grants
Work product	Identify the vulnerable population and individuals at risk from extreme heat.
Expected outcome	Identify those populations that will require the most resources during heat events so that lifesaving actions can be taken

Action Item # 88 | **TULSA COUNTY**

Title	Develop computer assisted modeling flood inundation mapping, applying GIS modeling for cubic feet per second dam release rates
Hazard(s) Targeted	Dam breaks
Project Type	Mitigation
Lead and participating agencies	TAEMA, USACE, County Engineering, INCOG
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$150,000
Funding source	Local and/or grants
Work product	Develop computer assisted modeling flood inundation mapping, applying GIS modeling for cubic feet per second dam release rates
Expected outcome	Allow for mitigation actions to be taken in inundation areas to prevent loss of life and/or lessen the impact

Action Item # 89 | **TULSA COUNTY**

Title	Prepare contingency plans for terrorist attacks on local dams
Hazard(s) Targeted	Dam Break
Project Type	Mitigation
Lead and participating agencies	TAEMA, USACE, Oklahoma Department of Homeland Security, Local Law Enforcement, Department of Public Safety.
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$500,000
Funding source	Local and/or grants
Work product	Prepare contingency plans for terrorist attacks on local dams
Expected outcome	Lessen the impact of intentionally caused dam break events on the community.

The TOWN OF SPERRY has reviewed and analyzed the risk assessment studies for the natural hazards and hazardous material events that may impact their jurisdiction. They reviewed the mitigations activities listed in Chapter 4, incorporated the criteria and principles of the STAPLE+E project evaluation method in their consideration of the mitigation activities, and prioritized the activities as the County did as was detailed in Section 4.3.

Action Item # 1	TOWN OF SPERRY
Title	Safe Room and improved EOC/Communication Center in the Town Hall
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Wildfires Earthquakes Hazard material events
Project Type	Mitigation
Lead and participating agencies	Administration
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$70,000
Funding source	Local and/or grants
Work product	A multi-person safe room for essential personnel and first responders at the Town Hall.
Expected outcome	To protect personnel during a hazard event. This room will also function as an emergency operations center in response to an emergency incident.

Action Item # 2	TOWN OF SPERRY
Title	Master Drainage Plan
Title	Floods
Hazard(s) Targeted	Mitigation
Project Type	Administration
Lead and participating agencies	Administration
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$65,000
Funding source	Local and/or grants
Work product	Prepare a comprehensive master drainage plan for the Town
Expected outcome	A comprehensive master drainage plan will identify the flooding problems and provide guidance for actions to rectify the problems, and address future development impacts

Action Item # 3	TOWN OF SPERRY
Title	Maintain and install road side culverts in drainage ditches for local stormwater control
Hazard(s) Targeted	Floods
Project Type	Mitigation
Lead and participating agencies	Administration
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$367,027
Funding source	Local and/or grants
Work product	Maintain and install road side culverts in drainage ditches
Expected outcome	Creation of a safe internal stormwater drainage system based on the master drainage plan which will provide effective local drainage, and develop a means to adequately maintain the system.

Action Item # 4	TOWN OF SPERRY
Title	Upgrade the community wide outdoor warning siren systems
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Wildfires Earthquakes Hazard material events
Project Type	Mitigation
Lead and participating agencies	Administration
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$50,000
Funding source	Local and/or grants
Work product	Continue to upgrade the community wide outdoor emergency warning system
Expected outcome	To provide an up to date emergency notification system to the community

Action Item # 5	TOWN OF SPERRY
Title	Emergency equipment for Sperry emergency response personnel
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Wildfires Earthquakes Hazard material events
Project Type	Mitigation
Lead and participating agencies	Emergency Management, Administration
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$42,000
Funding source	Local and/or grants
Work product	Operation Center Trailer and equipment
Expected outcome	To equip a mobile emergency response trailer to respond to local emergencies, to manage the emergency response on-site.

Action Item # 6	TOWN OF SPERRY
Title	Develop a Town emergency response and operations procedures plan and coordinate the plan with emergency operations plan with the Sperry Public Schools.
Hazard(s) Targeted	Floods, Tornados High winds, Lightning Hail, Winter storms Heat, Drought Expansive soils Wildfires, Earthquakes Hazard material events
Project Type	Mitigation
Lead and participating agencies	Administration, Emergency Management
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	not determined
Funding source	Local and/or grants
Work product	A Town of Sperry emergency response and operations procedures plan
Expected outcome	An up to date emergency response plan and EOP will effectively plan for emergency response procedures and coordinate with the Sperry Public School system

Action Item # 7	TOWN OF SPERRY
Title	Upgrade to the Town water system
Hazard(s) Targeted	Drought Wildfires
Project Type	Mitigation
Lead and participating agencies	Administration, Public Works
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	Not determined
Funding source	Local and/or grants
Work product	An improved water distribution system
Expected outcome	An improved water distribution system will adequately provide water and water pressure town wide and adequately provide a flow to all the fire hydrants, and construct a connection to the City of Tulsa water system to provide a secondary source of water.

Action Item # 8	TOWN OF SPERRY
Title	Street address signs
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Heat Wildfires Earthquakes Hazard material events
Project Type	Mitigation
Lead and participating agencies	Administration
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$15,000
Funding source	Local and/or grants
Work product	Street signs at all street intersections
Expected outcome	Adequate signage will aid emergency response personnel in location addresses, and install E-911 addresses on all buildings for emergency response. The ability to quickly and correctly locate addresses is imperative in life threatening situations

Action Item # 9	TOWN OF SPERRY
Title	Develop an extreme heat annex to the emergency operations plan
Hazard(s) Targeted	Heat
Project Type	Mitigation
Lead and participating agencies	Administration
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$2,000
Funding source	Local and/or grants
Work product	An annex to the Town of Sperry EOP devoted to extreme heat situations
Expected outcome	An annex to the Town of Sperry EOP to mitigate the effect of extreme heat by working with community service agencies and institutions to develop a plan for identifying times of extreme heat and notifying the citizens to take appropriate actions

Action Item # 10 | **TOWN OF SPERRY**

Title	Safety guidance for natural and manmade hazards
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Heat Drought Expansive soils Wildfires Earthquakes Hazard material events
Project Type	Mitigation
Lead and participating agencies	Administration
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$5,000
Funding source	Local and/or grants
Work product	Informational literature
Expected outcome	Emergency preparedness and response information and educational material to be disseminated to town residents

SPERRY SCHOOLS has reviewed and analyzed the risk assessment studies for the natural hazards and hazardous material events that may impact their jurisdiction. They reviewed the mitigations activities listed in Chapter 4, incorporated the criteria and principles of the STAPLE+E project evaluation method in their consideration of the mitigation activities, and prioritized the activities as the County did as was detailed in Section 4.3.

Action Item # 1	SPERRY SCHOOLS
Title	Have media program to educate stakeholders on Hazards
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Heat Drought Expansive soils Wildfires Earthquakes Hazard material events
Project Type	Mitigation
Lead and participating agencies	Sperry Public Schools
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$1,200
Funding source	Local and/or grants
Work product	Purchase a tri-fold colored brochure that provides information on all Hazards.
Expected outcome	Educate all stakeholders on potential hazards for our school district.

Action Item # 2	SPERRY SCHOOLS
Title	Install water saving fixtures throughout district
Hazard(s) Targeted	Drought
Project Type	Mitigation
Lead and participating agencies	Sperry Public Schools
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$25,500
Funding source	Local and/or grants
Work product	Install water saving fixtures on outdoor faucets or hydrants, toilets and urinals.
Expected outcome	Aid in saving water and water costs throughout the year.

Action Item # 3 | **SPERRY SCHOOLS**

Title	Soils Map
Hazard(s) Targeted	Expansive Soils
Project Type	Mitigation
Lead and participating agencies	Sperry Public Schools
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	Approx. \$150.00/acre to create digital Soils Map
Funding source	Local and/or grants
Work product	Create a digital soils map
Expected outcome	Help in determining location of new structures and runoff of existing slopes created by these structures.

Action Item # 4 | **SPERRY SCHOOLS**

Title	Outdoor PA System
Hazard(s) Targeted	Floods Winter Storms Tornado Extreme Heat High Winds Wildfires Lightning Haz Mat Event Hail Earthquake
Project Type	Mitigation
Lead and participating agencies	Sperry Public Schools
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	Approx. \$40,000
Funding source	Local and/or grants
Work product	Outdoors PA system on all campuses
Expected outcome	Have the ability to notify students of impending hazard when outside of the regular classroom building.

Action Item # 5	SPERRY PUBLIC SCHOOLS
Title	Safe Room
Hazard(s) Targeted	Tornados High winds
Project Type	Mitigation
Lead and participating agencies	Administration
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$2,500,000 per campus
Funding source	Local and/or grants
Work product	A large capacity safe room at each school for on-site students and staff
Expected outcome	A safe facility for students and staff to shelter in during the hazard event

Action Item # 6	SPERRY PUBLIC SCHOOLS
Title	Backup generators for each school building
Hazard(s) Targeted	Tornado Lightning Winter storms Wildfires Earthquakes
Project Type	Mitigation
Lead and participating agencies	Administration
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$1,000,000
Funding source	Local and/or grants
Work product	Purchase and installation of backup generators and transfer switches at each school building
Expected outcome	Provide power to each facility when electric service is out

BERRYHILL PUBLIC SCHOOLS has reviewed and analyzed the risk assessment studies for the natural hazards and hazardous material events that may impact their jurisdiction. They reviewed the mitigations activities listed in Chapter 4, incorporated the criteria and principles of the STAPLE+E project evaluation method in their consideration of the mitigation activities, and prioritized the activities as the County did as was detailed in Section 4.3.

Action Item # 1	BERRYHILL PUBLIC SCHOOLS
Title	Connect to City of Tulsa Sewer System
Hazard(s) Targeted	Floods
Project Type	Mitigation
Lead and participating agencies	Berryhill Public Schools/City of Tulsa
Time schedule	FY 2017
Estimated Cost	\$1,200,000
Funding source	Local and/or Grants
Work product	Reclaim existing lagoons, install needed lift station, install sewer line and connect to Tulsa.
Expected outcome	Replace the wastewater lagoon with a connection to the City's sanitary sewer system.

Action Item #2	BERRYHILL PUBLIC SCHOOLS
Title	Snow removal equipment
Hazard(s) Targeted	Winter storms
Project Type	Mitigation
Lead and participating agencies	Berryhill Public Schools
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$100,000
Funding source	Local and/or grants
Work product	Snow plows
Expected outcome	To more quickly and efficiently bring facilities back into operation after a winter storm event

Action Item #3	BERRYHILL PUBLIC SCHOOLS
Title	Safe Rooms
Hazard(s) Targeted	Tornado, high wind
Project Type	Mitigation
Lead Agency	Berryhill Public Schools
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$ 5,000,000
Funding source	Local and/or grants
Work product	Safe rooms, number and size appropriate, for each building without safe rooms.
Expected outcome	Safe rooms will provide protected areas for students, faculty, and staff in the event of a tornado or high wind hazard.

Action Item #4	BERRYHILL PUBLIC SCHOOLS
Title	Develop curriculum to educate the school staff, students, and parents about mitigating the risk of life and property associated with the occurrence of hazards
Hazard(s) Targeted	Flood, tornados, high winds, lightning, hail, winter storms, extreme heat, drought, expansive soils, wildfires, earthquakes, hazard material events
Project Type	Mitigation
Lead Agency	Berryhill Public Schools
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$20,000
Funding source	Local and/or grants
Work product	Dissemination of information about mitigating the risk associated with hazards.
Expected outcome	School staff, students, and parents residents become less at risk and less vulnerable from hazards.

Action Item # 5	BERRYHILL PUBLIC SCHOOLS
Title	Emergency Power Generators, Surge Protectors, and Battery Backups
Hazard(s) Targeted	Tornados High winds Lightning Hail Wildfires Winter storms Earthquakes
Project Type	Mitigation
Lead and participating agencies	Berryhill Public Schools
Time schedule	in 1-3 years or when funding becomes available
Estimated Cost	\$300,000
Funding source	Local and/or grants
Work product	Surge protectors to protect large mechanical power equipment, emergency power generators to restore power during an outage
Expected outcome	To keep facilities running during power outages

Action Item #6	BERRYHILL PUBLIC SCHOOLS
Title	Water saving fixtures
Hazard(s) Targeted	Drought
Project Type	Mitigation
Lead Agency	Berryhill Public Schools
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$50 to \$500 per fixture
Funding source	Local/Grants
Work product	Installation of water saving fixtures in School facilities
Expected outcome	Reduce the amount of water used in all times of the year, including times of drought

Action Item #7	BERRYHILL PUBLIC SCHOOLS
Title	Map expansive soils risk area
Hazard(s) Targeted	Expansive soils
Project Type	Mitigation
Lead Agency	Berryhill Public Schools
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$100,000
Funding source	Local and/or grants
Work product	Develop detailed soils maps
Expected outcome	Identification of the soils' construction properties, including shrink-swell potential, to ensure proper foundation design and construction of future improvements and buildings at each school site

Action Item #8	BERRYHILL PUBLIC SCHOOLS
Title	Energy efficient windows
Hazard(s) Targeted	Heat, winter storm
Project Type	Mitigation
Lead Agency	Berryhill Public Schools
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$5,000.00 per window
Funding source	Local/Grants
Work product	Energy efficient windows
Expected outcome	Improved energy efficiency in the school buildings. Keeps the heat out better during extreme heat events and keeps the cold out during the cold of the winter

Action Item # 9**BERRYHILL PUBLIC SCHOOLS**

Title	Outdoor warning system
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Wildfire Hazardous Material Event
Project Type	Mitigation
Lead Agency	Administration
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$25,000
Funding source	Local and/or grants
Work product	Outdoor public address system
Expected outcome	System will provide immediate notification to students and staff outside of the school buildings of an approaching hazard

KEYSTONE PUBLIC SCHOOLS has reviewed and analyzed the risk assessment studies for the natural hazards and hazardous material events that may impact their jurisdiction. They reviewed the mitigations activities listed in Chapter 4, incorporated the criteria and principles of the STAPLE+E project evaluation method in their consideration of the mitigation activities, and prioritized the activities as the County did as was detailed in Section 4.3.

Action Item # 1	KEYSTONE PUBLIC SCHOOLS
Title	Safe Room
Hazard(s) Targeted	Tornados, High winds
Project Type	Mitigation
Lead Agency	Keystone Public School
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$2,500,000
Funding source	Local and/or grants
Work product	Safe Room for students and staff.
Expected outcome	To provide protection for students and staff during a tornado or high wind event

Action Item # 2	KEYSTONE PUBLIC SCHOOLS
Title	Steel Reinforced Doors
Hazard(s) Targeted	Tornados High winds Hail
Project Type	Mitigation
Lead Agency	Keystone Public School
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$1,000 per door
Funding source	Local and/or grants
Work product	Replace existing doors with reinforced doors
Expected outcome	Improve protection from doors that may break during a hazard

Action Item # 3 | **KEYSTONE PUBLIC SCHOOLS**

Title	Speaker System
Hazard(s) Targeted	Tornados High winds Lightning Hail Heat Wildfires Earthquakes Hazard material events
Project Type	Mitigation
Lead Agency	Keystone Public School
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$35,000
Funding source	Local and/or grants
Work product	Install speaker systems inside and outdoors
Expected outcome	To provide real time information to students and staff of impending hazard

Action Item # 4 | **KEYSTONE PUBLIC SCHOOLS**

Title	Emergency Warning Sirens
Hazard(s) Targeted	Tornados High winds Lightning Hail Wildfires Earthquakes Hazard material events
Project Type	Mitigation
Lead Agency	Keystone Public School
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$35,000
Funding source	Local and/or grants
Work product	Emergency Warning Sirens
Expected outcome	Provide emergency notification to students and staff on a hazard event

Action Item # 5	KEYSTONE PUBLIC SCHOOLS
Title	Two Way Radio – VHF system
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Wildfires Earthquakes Hazard material events
Project Type	Mitigation
Lead Agency	Keystone Public School
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$5,000 for base station and \$500 per radio, \$50,000 for VHF system
Funding source	Local and/or grants
Work product	Installation of radio communication equipment in buses and each building and a baser station
Expected outcome	To communication for each building and to each bus to provide hazard information, both in relaying hazard response information and in reporting a hazard

Action Item # 6	KEYSTONE PUBLIC SCHOOLS
Title	Electric Generators
Hazard(s) Targeted	Tornados High winds Lightning Hail Winter storms Heat Wildfires Earthquakes
Project Type	Mitigation
Lead Agency	Keystone Public School
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$1,000,000
Funding source	Local and/or grants
Work product	Emergency generators at each school
Expected outcome	To provide backup power at each school to keep the school in operation in the event of a power outage

Action Item # 7	KEYSTONE PUBLIC SCHOOLS
Title	All Media Program to educate students and staff and parents about the risks and mitigation actions associated with hazards.
Hazard(s) Targeted	Floods, Tornados High winds, Lightning Hail, Winter storms Heat, Drought Expansive soils Wildfires Earthquakes Hazard material events Dam breaks
Project Type	Mitigation
Lead Agency	Administration
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$25,000
Funding source	Local and/or grants
Work product	Dissemination of information about mitigating the risk associated with hazards
Expected outcome	School staff, students, and parents become less at risk and less vulnerable to hazards

Action Item # 8	KEYSTONE PUBLIC SCHOOLS
Title	Installation of NOAA weather radios in School facilities
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Heat Earthquakes
Project Type	Mitigation
Lead Agency	Administration
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$100 per radio
Funding source	Local and/or grants
Work product	Purchase and install NOAA weather radios in School facilities
Expected outcome	To provide an increased awareness and improved warning for approaching hazard events and hazard notification at school facilities

Action Item # 9	KEYSTONE PUBLIC SCHOOLS
Title	Map expansive soils risk area
Hazard(s) Targeted	Expansive Soils
Project Type	Mitigation
Lead Agency	Administration
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$100,000
Funding source	Local and/or grants
Work product	Develop detailed soils maps
Expected outcome	Identification of the soils' construction properties, including shrink-swell potential, to ensure proper foundation design and construction of future improvements and buildings

Action Item # 10	KEYSTONE PUBLIC SCHOOLS
Title	Water saving fixtures
Hazard(s) Targeted	Drought
Project Type	Mitigation
Lead Agency	Administration
Time schedule	in 1-5 years or when funding becomes available
Estimated Cost	\$50 to \$500 per fixture
Funding source	Local and/or grants
Work product	Installation of water saving fixtures in School facilities
Expected outcome	Reduce the amount of water used in all times of the year, including times of drought

LIBERTY PUBLIC SCHOOLS has reviewed and analyzed the risk assessment studies for the natural hazards and hazardous material events that may impact their jurisdiction. They reviewed the mitigations activities listed in Chapter 4, incorporated the criteria and principles of the STAPLE+E project evaluation method in their consideration of the mitigation activities, and prioritized the activities as the County did as was detailed in Section 4.3.

Action Item #1	LIBERTY PUBLIC SCHOOLS
Title	Construct dual purpose community safe room to serve campus during both emergency and non-emergency times
Hazard(s) Targeted	Tornados High winds Lightning Hail Winter storms Heat
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	1-3 years or when funding becomes available
Estimated Cost	\$2,500,000
Funding source	Local and/or grants
Work product	A safe room in or close to all public schools buildings to provide safe shelter for students and staff in the event of the hazard event.
Expected outcome	Reduces the effects of the hazard, a safe location for students and staff to ride out the hazard

Action Item #2	LIBERTY PUBLIC SCHOOLS
Title	Install shatter resistant glass in school building windows
Hazard(s) Targeted	Tornados High winds Hail
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	1-3 years or when funding becomes available
Estimated Cost	\$1,500,000
Funding source	Local and/or grants
Work product	Shatter resistant glass windows in windows and doors in the school building
Expected outcome	Reduces the effect of hazard causing broken glass to spray from the windows

Action Item # 3	LIBERTY PUBLIC SCHOOLS
Title	Surge protectors and uninterruptable power sources for the school facilities. And install emergency power generators
Hazard(s) Targeted	Tornados High winds Lightning Hail Winter storms Earthquakes
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	1-3 years or when funding becomes available
Estimated Cost	\$200,000 over four sites
Funding source	Local and/or grants
Work product	Surge protectors to protect large mechanical power equipment, emergency power generators to restore power during an outage
Expected outcome	To keep facilities running during power outages

Action Item #4	LIBERTY PUBLIC SCHOOLS
Title	Weatherize existing facilities
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail Winter storms Heat Drought Expansive soils Wildfires Earthquakes
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	1-3 years or when funding becomes available
Estimated Cost	\$20,000
Funding source	Local and/or grants
Work product	Weather stripping and insulation and water proofing
Expected outcome	Retrofit the buildings and their interiors to protect from the hazards (keep the hazards outside the building)

Action Item # 5	LIBERTY PUBLIC SCHOOLS
Title	Inventory the flow at fire hydrants and prioritize facility improvements to increase water pressure
Hazard(s) Targeted	Wildfires
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	1-5 years or when funding becomes available
Estimated Cost	\$20,000
Funding source	Local and/or grants
Work product	Inventory and improvement plan for fire hydrants and water distribution system
Expected outcome	Low water pressure would be detrimental for firefighting. Maintaining water pressure by inventorying flow and performing needed maintenance will increase effective fire fighting.

Action Item # 6	LIBERTY PUBLIC SCHOOLS
Title	Educate staff and students about emergency preparedness and response procedures
Hazard(s) Targeted	Floods, Tornados High winds, Lightning Hail, Winter storms Heat, Drought Expansive soils, Wildfires Earthquakes, Hazard material events
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	annually
Estimated Cost	\$5,000
Funding source	Local and/or grants
Work product	Incorporate hazard mitigation practices into school curriculum
Expected outcome	Staff and students can respond appropriately in the event of a hazard occurrence

Action Item # 7	LIBERTY PUBLIC SCHOOLS
Title	Develop an emergency operations plan for tornadoes
Hazard(s) Targeted	Tornados
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	1-3 years or when funding becomes available
Estimated Cost	\$5,000
Funding source	Local and/or grants
Work product	A tornado emergency operations plan
Expected outcome	The plan will outline the procedures to take before, during and after a tornado event

Action Item # 8	LIBERTY PUBLIC SCHOOLS
Title	Lightning hazard alert system for outdoor areas
Hazard(s) Targeted	Lightning
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	1-3 years or when funding becomes available
Estimated Cost	\$150,000
Funding source	Local and/or grants
Work product	Outdoor lightning and warning system
Expected outcome	Provide a warning system to all outdoor areas where students and staff may be.

Action Item # 9 | **LIBERTY PUBLIC SCHOOLS**

Title	Update School's radio system
Hazard(s) Targeted	Floods, Tornados High winds, Lightning Hail, Winter storms Heat, Drought Expansive soils, Wildfires Earthquakes, Hazard material events
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	1-3 years or when funding becomes available
Estimated Cost	\$50,000
Funding source	Local and/or grants
Work product	NOAA weather radios at all school facilities, and 2-way radios for all buses to base station
Expected outcome	Improved communication to buses with improved weather information.

Action Item # 10 | **LIBERTY PUBLIC SCHOOLS**

Title	Replace or upgrade the intercom system in all school buildings
Hazard(s) Targeted	Tornados High winds Lightning Hail Earthquakes
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	1-5 years or when funding becomes available
Estimated Cost	\$50,000
Funding source	Local and/or grants
Work product	Intercom system in all school buildings
Expected outcome	During a hazard event, building will be able to receive immediate information

Action Item # 11	LIBERTY PUBLIC SCHOOLS
Title	Obtain mobile communication equipment the school's spotters and emergency response team
Hazard(s) Targeted	Floods Tornados High winds Lightning Hail
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	1-5 years or when funding becomes available
Estimated Cost	\$18,000
Funding source	Local and/or grants
Work product	Mobile communication equipment
Expected outcome	Storm spotters and emergency response teams will have the ability to be in contact with others and with school officials/emergency personnel during and after a hazard event

Action Item # 12	LIBERTY PUBLIC SCHOOLS
Title	Strengthen the school safety committees (district safety coordinator, additional school administrators, and other certified staff members)
Hazard(s) Targeted	Floods , Tornados High winds, Lightning Hail , Winter storms Heat, Drought Expansive soils Wildfires Earthquakes Hazard material events
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	1-3 years
Estimated Cost	\$5,000
Funding source	Local and/or grants
Work product	Stronger committees
Expected outcome	School safety teams will work more closely with administrators to review the school safety plans and recommendations, review potential hazards and risks, conduct campus walk through, and provide relevant information to the stakeholders. They will also develop a quick reference flip-chart for crisis management plans.

Action Item # 13 | **LIBERTY PUBLIC SCHOOLS**

Title	Construct new shelters for school owned vehicles to protect them from hail and storm debris.
Hazard(s) Targeted	Hail Winter storms
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	1-5 years or when funding becomes available
Estimated Cost	\$500,000
Funding source	Local and/or grants
Work product	Vehicle shelters
Expected outcome	Protection of parked vehicles from hail and storm debris

Action Item # 14 | **LIBERTY PUBLIC SCHOOLS**

Title	Increase drainage capacity in areas of the school grounds that are inadequate
Hazard(s) Targeted	Floods
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	1-5 years or when funding becomes available
Estimated Cost	\$300,000
Funding source	Local and/or grants
Work product	Effective drainage ways
Expected outcome	Channelize runoff away from buildings

Action Item # 15	LIBERTY PUBLIC SCHOOLS
Title	Covered walkways between buildings at to athletic facilities such as the baseball fields and football stadium.
Hazard(s) Targeted	Hail Winter storms
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	1-5 years or when funding becomes available
Estimated Cost	\$100,000
Funding source	Local and/or grants
Work product	Covered walkways
Expected outcome	The covered walkways will protect students and staff the must go between buildings during hazard events

Action Item # 16	LIBERTY PUBLIC SCHOOLS
Title	Preform natural hazard evaluation of schools to determine the most cost effective ways to retrofit or remodel buildings to make them more disaster resistant, specifically to tornadoes, high winds, and earthquakes
Hazard(s) Targeted	Tornados High winds Lightning Hail Earthquakes
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	1-3 years or when funding becomes available
Estimated Cost	\$20,000
Funding source	Local and/or grants
Work product	Evaluation plans and drills
Expected outcome	Will determine the appropriate retrofit or remodel to strengthen the existing buildings.

Action Item # 17	LIBERTY PUBLIC SCHOOLS
Title	Educate the public about various dangers associated with natural hazards, and the benefits of installing residential and commercial storm shelters and safe rooms
Hazard(s) Targeted	Floods, Tornados High winds, Lightning Hail, Winter storms Heat, Drought Expansive soils, Wildfires Earthquakes, Hazard material events
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	Annually
Estimated Cost	\$5,000/annually
Funding source	Local and/or grants
Work product	Education
Expected outcome	The public will better understand the procedures to take before, during, and after a hazard event

Action Item # 18	LIBERTY PUBLIC SCHOOLS
Title	Implement an AWOS weather station to provide accurate and current weather information to the school and community emergency management teams.
Hazard(s) Targeted	Floods, Tornados High winds, Lightning Hail, Winter storms Heat Earthquakes
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	1-5 years or when funding becomes available
Estimated Cost	\$10,000
Funding source	Local and/or grants
Work product	AWOS weather station
Expected outcome	An Automatic Weather Observing System (AWOS) can detect significant changes in weather and display meteorological data. The AWOS would also manage all communication protocols to allow remote access.

Action Item # 19 | **LIBERTY PUBLIC SCHOOLS**

Title	Snow removal equipment
Hazard(s) Targeted	Winter storms
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	1-3 years or when funding becomes available
Estimated Cost	\$50,000
Funding source	Local and/or grants
Work product	Snow removal equipment
Expected outcome	To more quickly and efficiently bring facilities back into operation after a winter storm event

Action Item # 20 | **LIBERTY PUBLIC SCHOOLS**

Title	Create and maintain a district wide database for tracking declared and non-declared natural disaster and other emergency events
Hazard(s) Targeted	Floods, Tornados High winds, Lightning Hail, Winter storms Heat, Drought Expansive soils, Wildfires Earthquakes, Hazard material events
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	Annually
Estimated Cost	\$500
Funding source	Local and/or grants
Work product	Record of hazards
Expected outcome	An historical record of hazards for future hazard mitigation plans and emergency operations plans. And record funding as appropriate

Action Item # 21**LIBERTY PUBLIC SCHOOLS**

Title	Secure shelved and wall mounted facilities; for example, computers, heavy objects, hot water tanks)
Hazard(s) Targeted	Earthquakes
Project Type	Mitigation
Lead and participating agencies	Liberty Public Schools
Time schedule	1-5 years or when funding becomes available
Estimated Cost	\$25,000
Funding source	Local and/or grants
Work product	Secure facilities to the building's structure
Expected outcome	Prevent facilities from falling and breaking while being shaken

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Draft for Comments

Chapter 6:

Plan Maintenance and Adoption

This chapter includes a discussion of the plan maintenance process and documentation of the adoption of the plan by the Tulsa County Hazard Mitigation Planning Committee and the Tulsa County Board of County Commissioners, the Town of Sperry Board of Trustees, and the Berryhill Public Schools Board of Education, Keystone Public Schools Board of Education, Liberty Public Schools Board of Education, and the Sperry Public Schools Board of Education.

6.1 Monitoring, Evaluating, Updating the Plan

The Tulsa Area Emergency Management Agency Director will oversee the day-to-day implementation of the plan. Monitoring will include getting reports from the Tulsa County departments involved in the mitigation activities for the County, and from the Town of Sperry Town Administrator, the Berryhill Public Schools Buildings Operations Manager, Keystone Public Schools Buildings Operations Manager, Liberty Public Schools Buildings Operations Manager, and the Sperry Public Schools Buildings Operations Manager for mitigation activities as to their progress in implementing the projects included the Action Plan that fall within Tulsa County's or the Town of Sperry's or the Schools' scope of responsibility.

The Tulsa County Hazard Mitigation Planning Committee will also evaluate the mitigation plan on an annual basis. The evaluation shall include reviewing the goals and objectives of the mitigation plan for any changes. The evaluation will also include a review of the hazards in the plan to determine if the risks or hazard locations have changed. The Tulsa County Hazard Mitigation Planning Committee will complete and provide an annual evaluation to the Tulsa County Board of County Commissioners, the Town of Sperry Board of Trustees, and the Berryhill Public Schools Board of Education, Keystone Public Schools Board of Education, Liberty Public Schools Board of Education, and the Sperry Public Schools Board of Education summarizing the accomplishments of the mitigation activities. The evaluation will include the responsible agency to oversee the mitigation action activity, the time schedule, and the funding source.

Tulsa County will make a comprehensive update to the Multi-Hazard Mitigation Plan within five years, from the approval date, as per FEMA requirements, and will be re-submitted to OEM and FEMA for approval as required. The Multi-Hazard Mitigation Plan is a multi-jurisdiction plan and the Town of Sperry, Berryhill Public Schools, Keystone Public Schools, Liberty Public Schools, and Sperry Public Schools will be invited to participate in the plan and planning process.

6.2 Incorporating the Multi-Hazard Mitigation Plan

The Tulsa County Multi-Hazard Mitigation Plan has been adopted by the Tulsa County Board of County Commissioners, the Town of Sperry Board of Trustees, and the Berryhill Public Schools Board of Education, Keystone Public Schools Board of Education, Liberty Public Schools Board

of Education, and the Sperry Public Schools Board of Education as a guide to mitigation activities for each jurisdiction. Appropriate Action Plan activities will be incorporated into the planning process, and in the annual County, Town, and School budgets. As stated in section 6.1, the Tulsa Area Emergency Management Agency Director will oversee the day-to-day implementation of the plan with input from the Town of Sperry Town Administrator, the Berryhill Public Schools Buildings Operations Manager, Keystone Public Schools Buildings Operations Manager, Liberty Public Schools Buildings Operations Manager, and the Sperry Public Schools Buildings Operations Manager.

They will work with the TCHMPC to monitor how mitigation activities are incorporated into other County, Town, and School plans. Members of the TCHMPC are also Department Heads charged with the responsibility of updating and enforcing key plans and policies of the County. Tulsa County, the Town of Sperry, and the Berryhill, Keystone, Liberty, and Sperry Public Schools currently have capital improvement plans to guide development and future improvements. These plans have mitigation strategy components in them, and the County, Town and Schools will incorporate any approved mitigation plan strategies into those plans when their particular plan is updated. All plans are updated as needed. The inspections department of the County enforces the building codes in Tulsa County. Selection of future CIP projects will include consideration of the goals and objectives of the mitigation plan. After adoption of the mitigation plan, the inspections department will continue to enforce the building codes on new construction.

6.3 Public Involvement

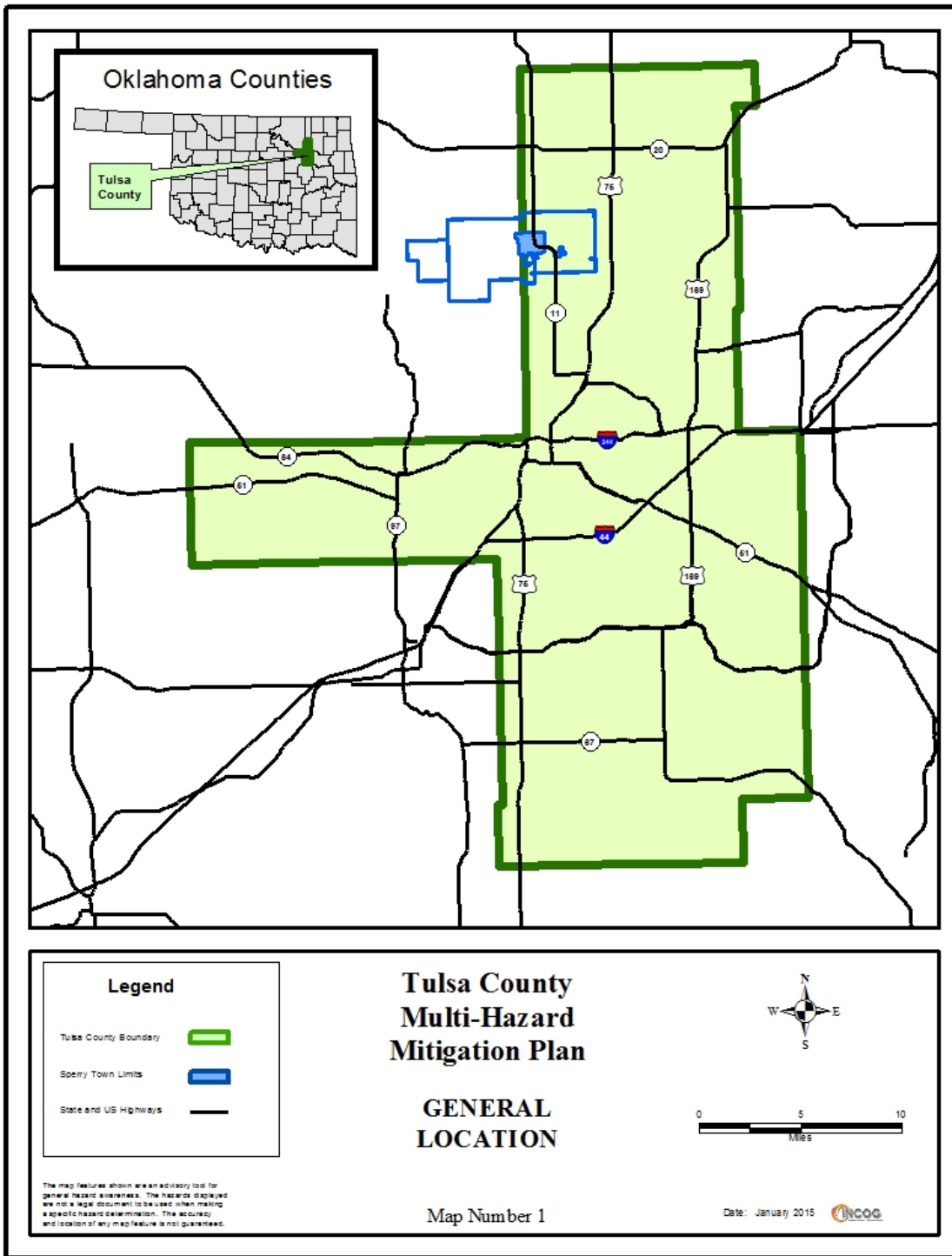
Tulsa County, the Town of Sperry, and the Berryhill, Keystone, Liberty, and Sperry Public Schools are committed to involving the public directly in updating and maintaining the Multi-Hazard Mitigation Plan. Copies of the Plan will be available at the Tulsa Area Emergency Management Agency Office, the Town of Sperry Town Hall, and each school's administration office. Input from citizens will be encouraged, particularly at the annual evaluation to each governing Board. Board meetings and their agendas are posted and open to the public where the public is invited to comment on this or any agenda item. At any time of the year, comments can be made directly to the Tulsa Area Emergency Management Agency Director.

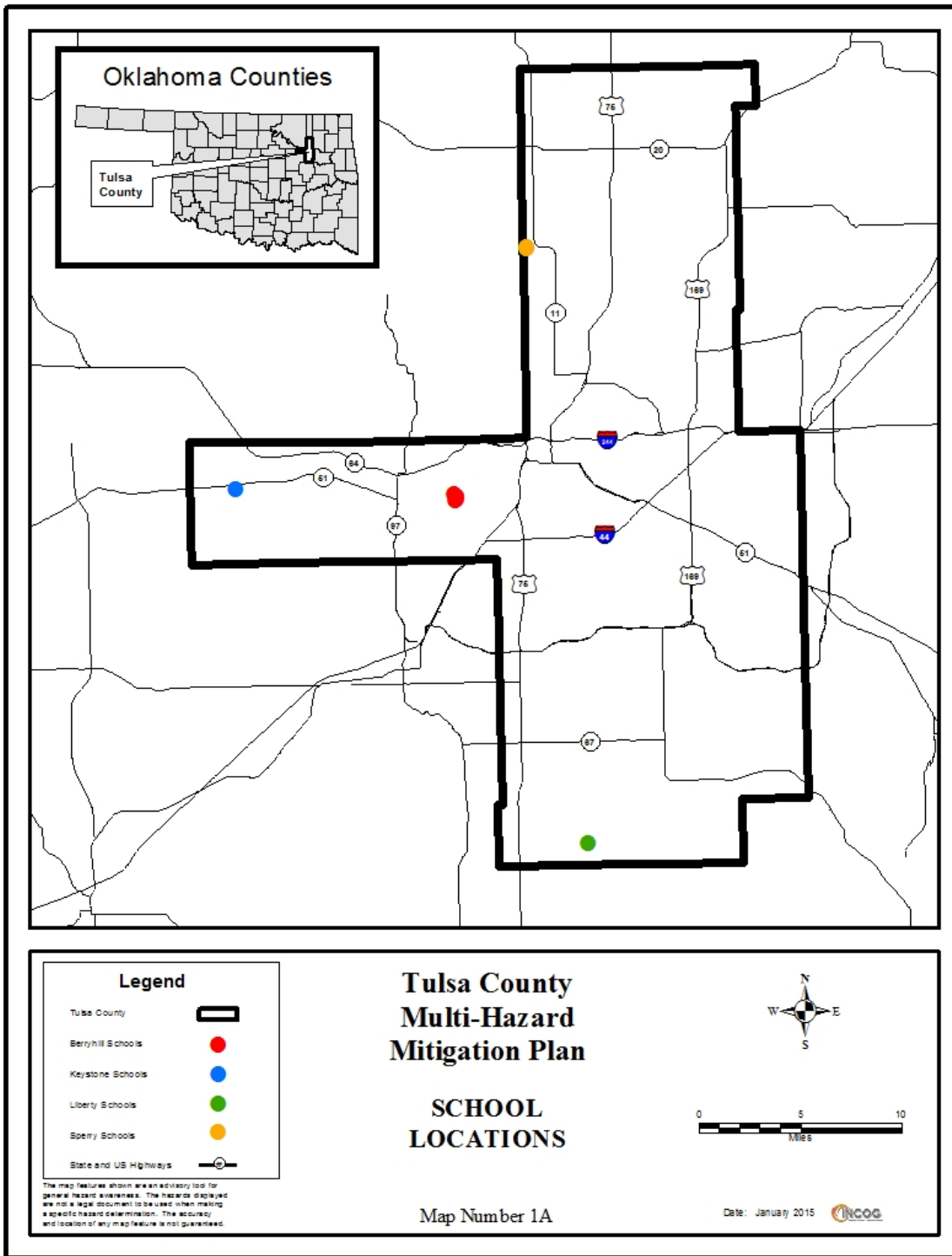
Appendix 1: Mapping

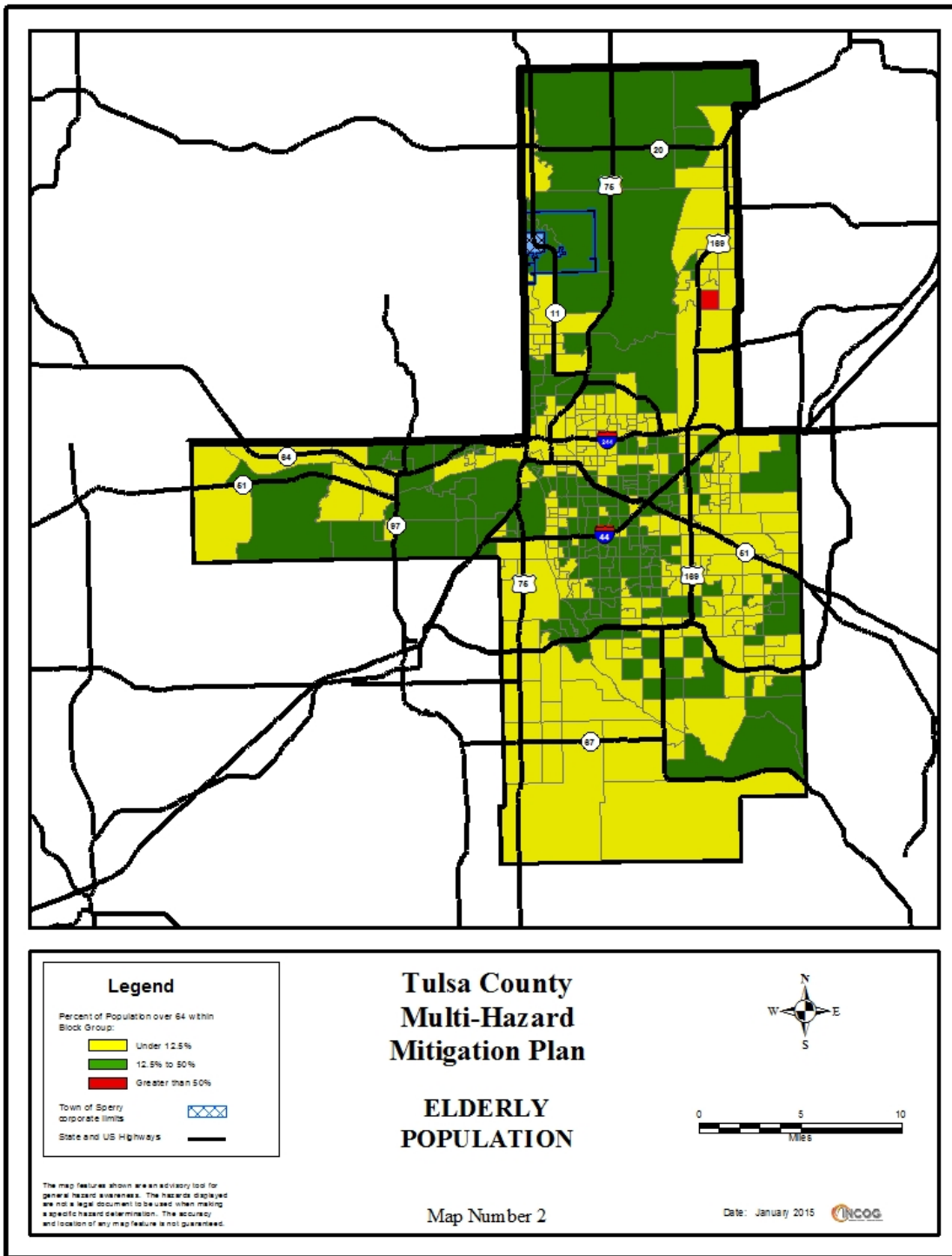
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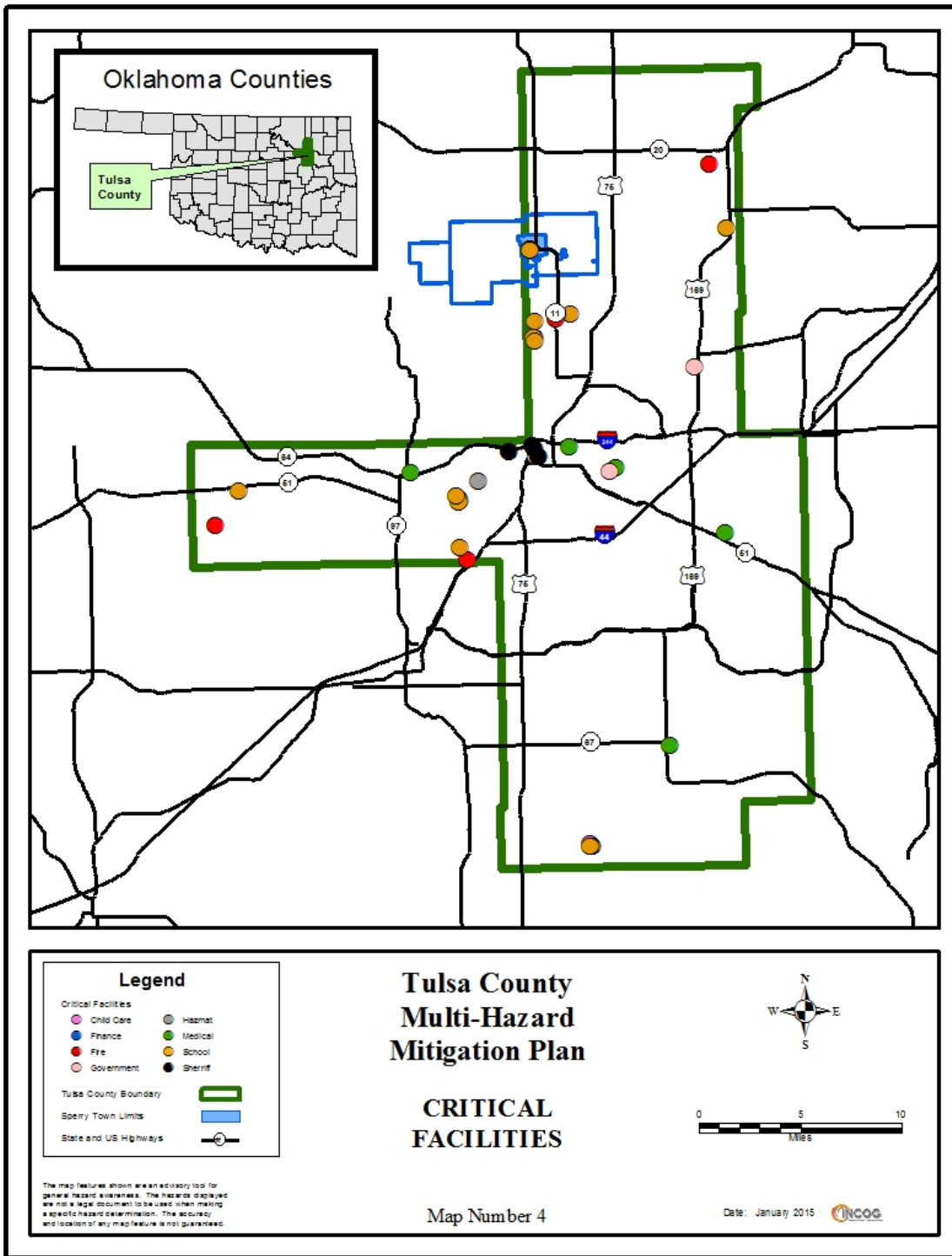


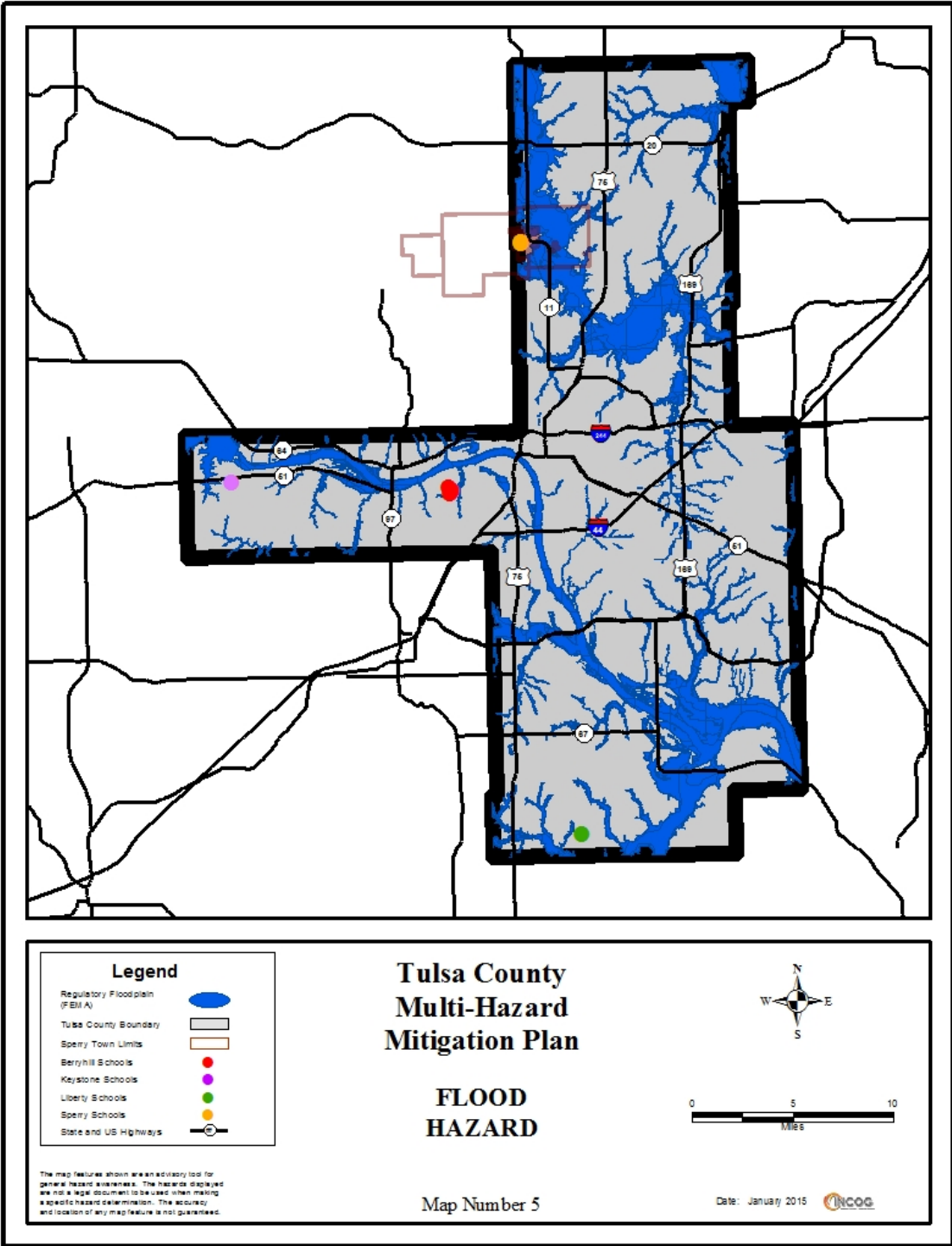


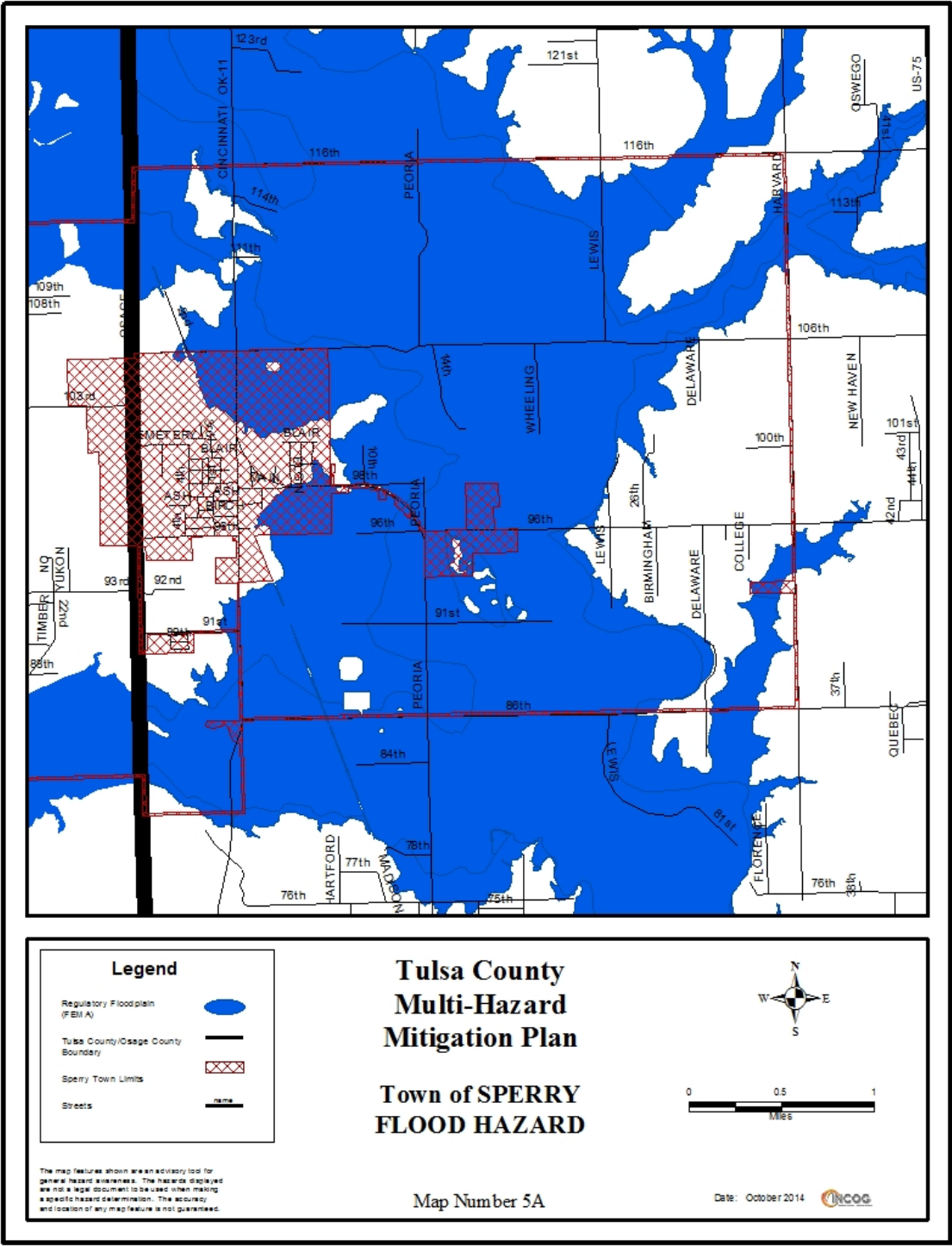


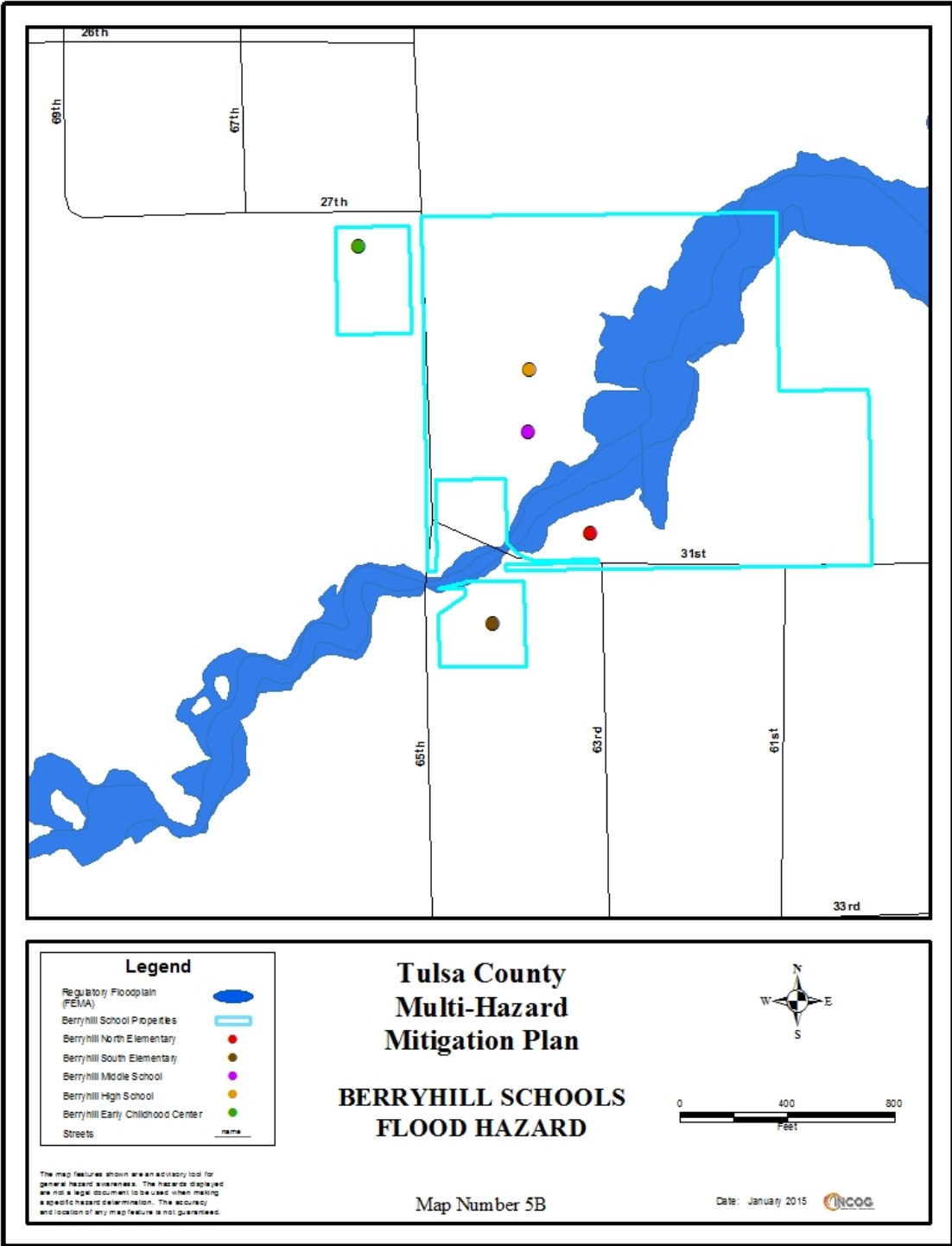
Map number 3 reserved for future use

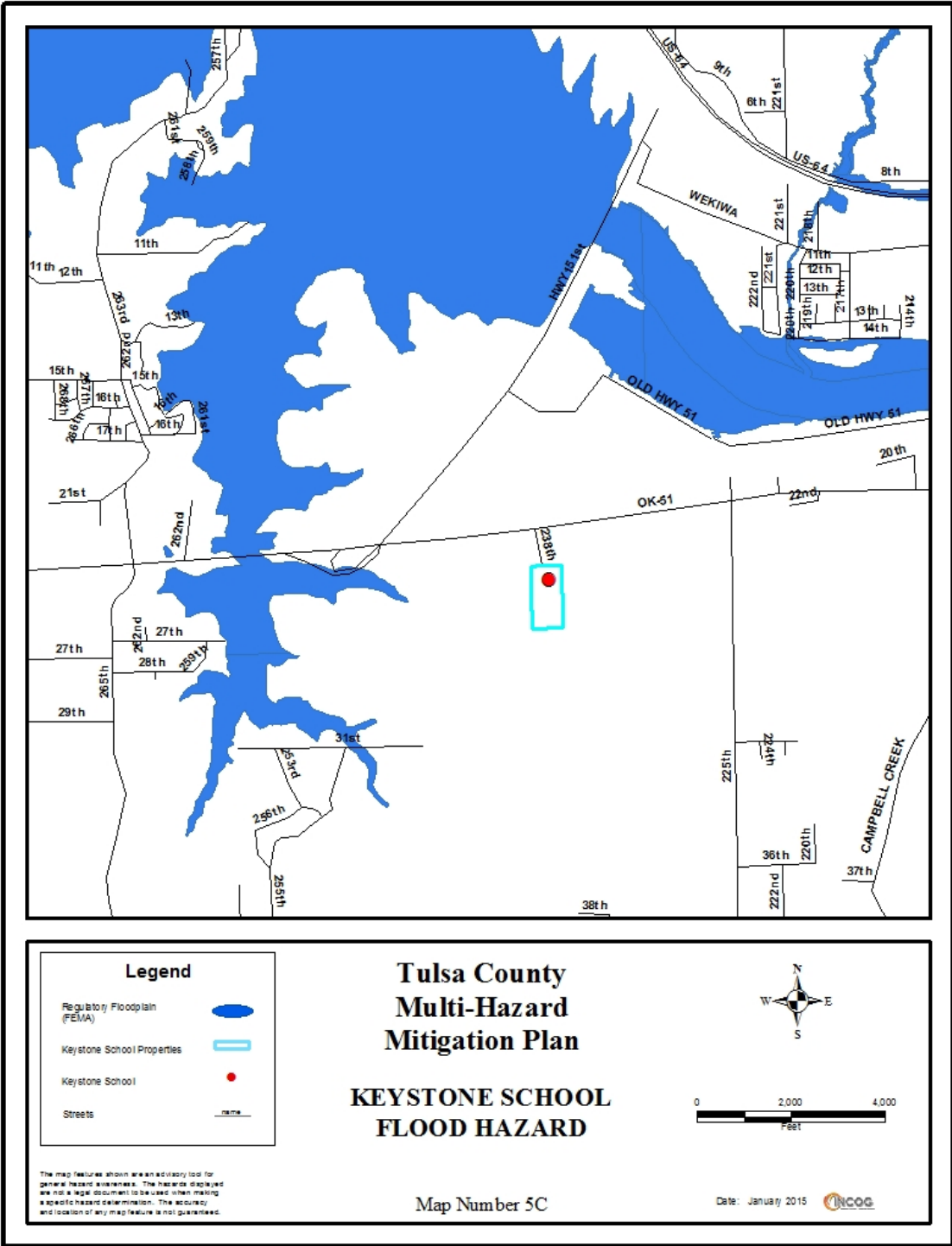
Draft for Comments

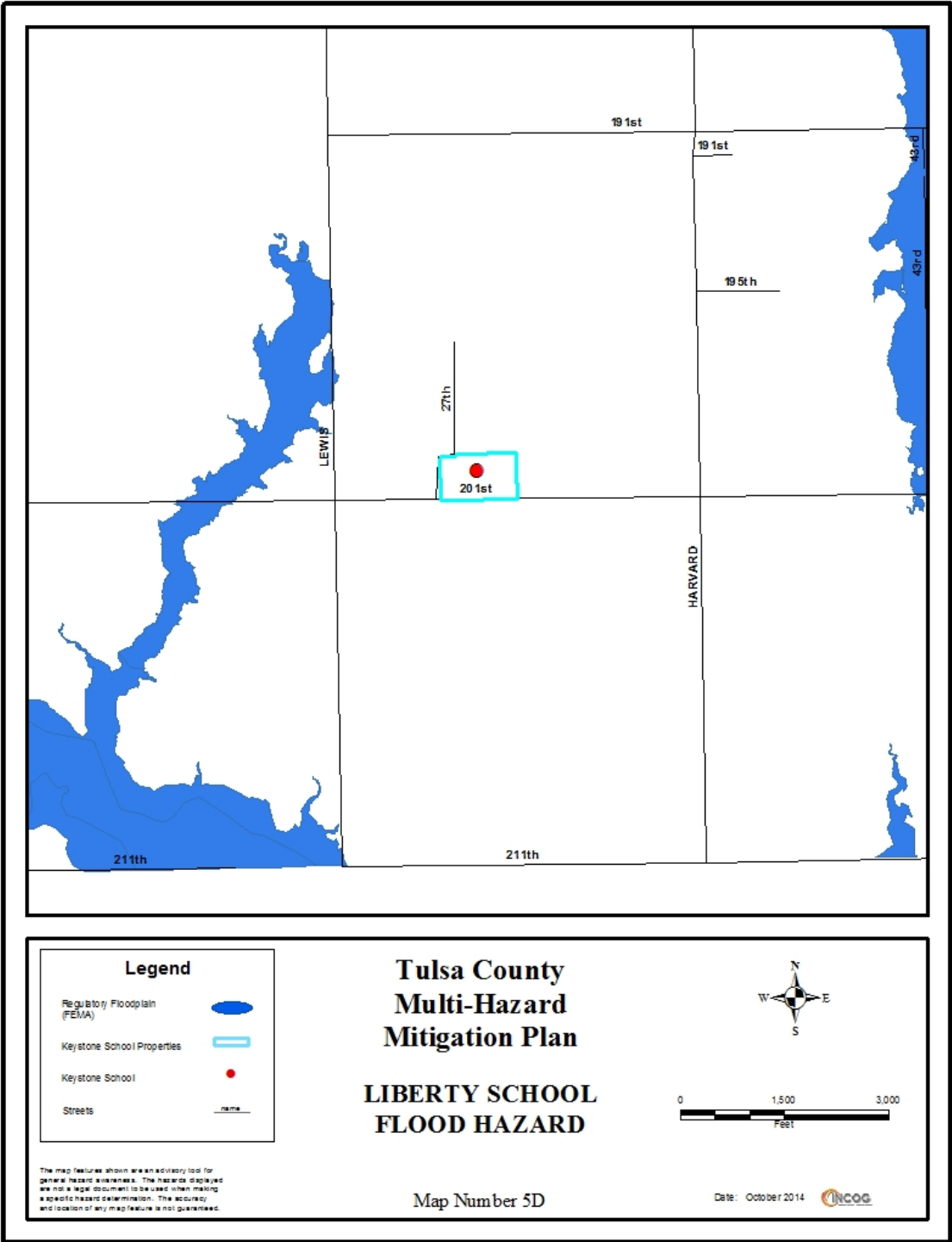


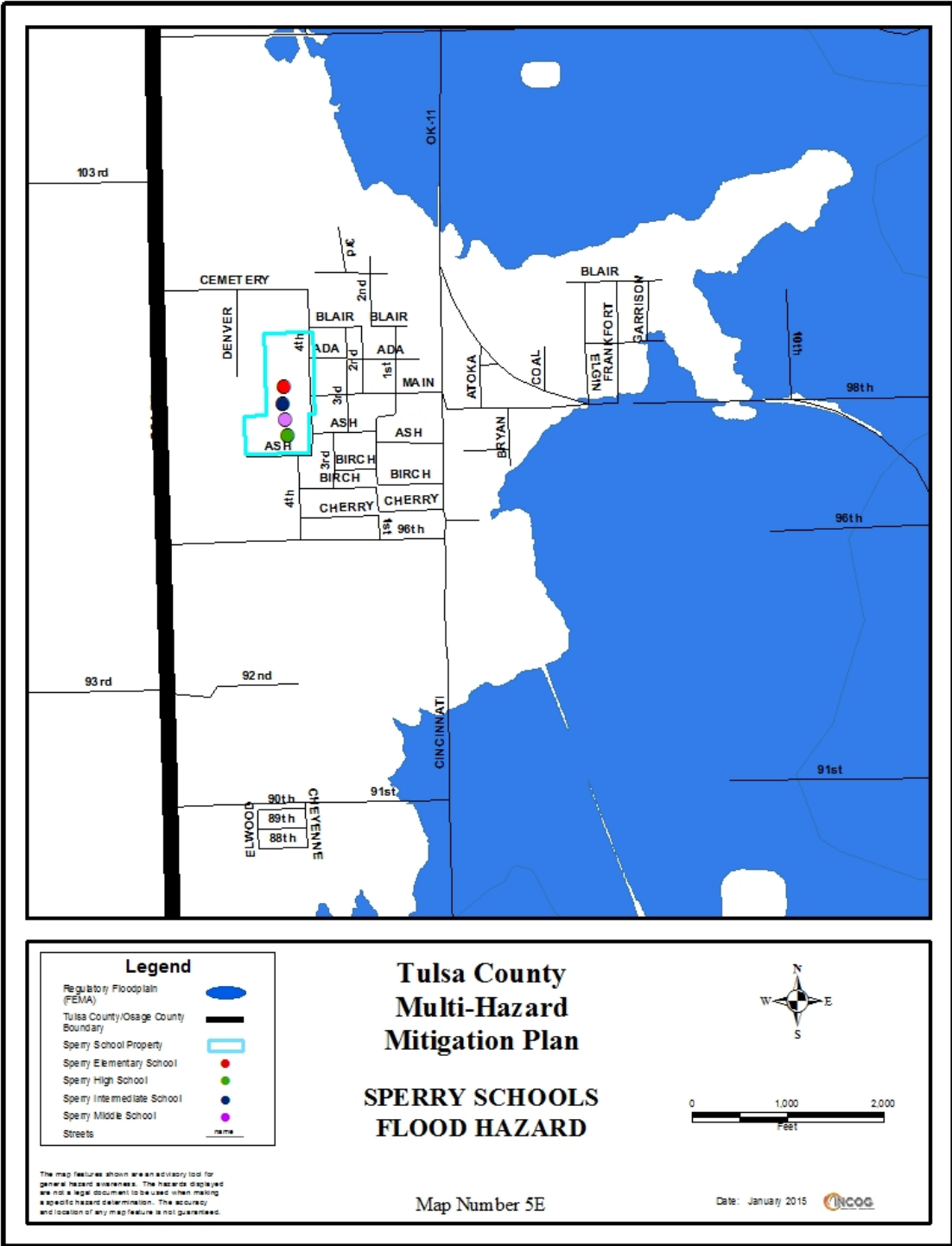


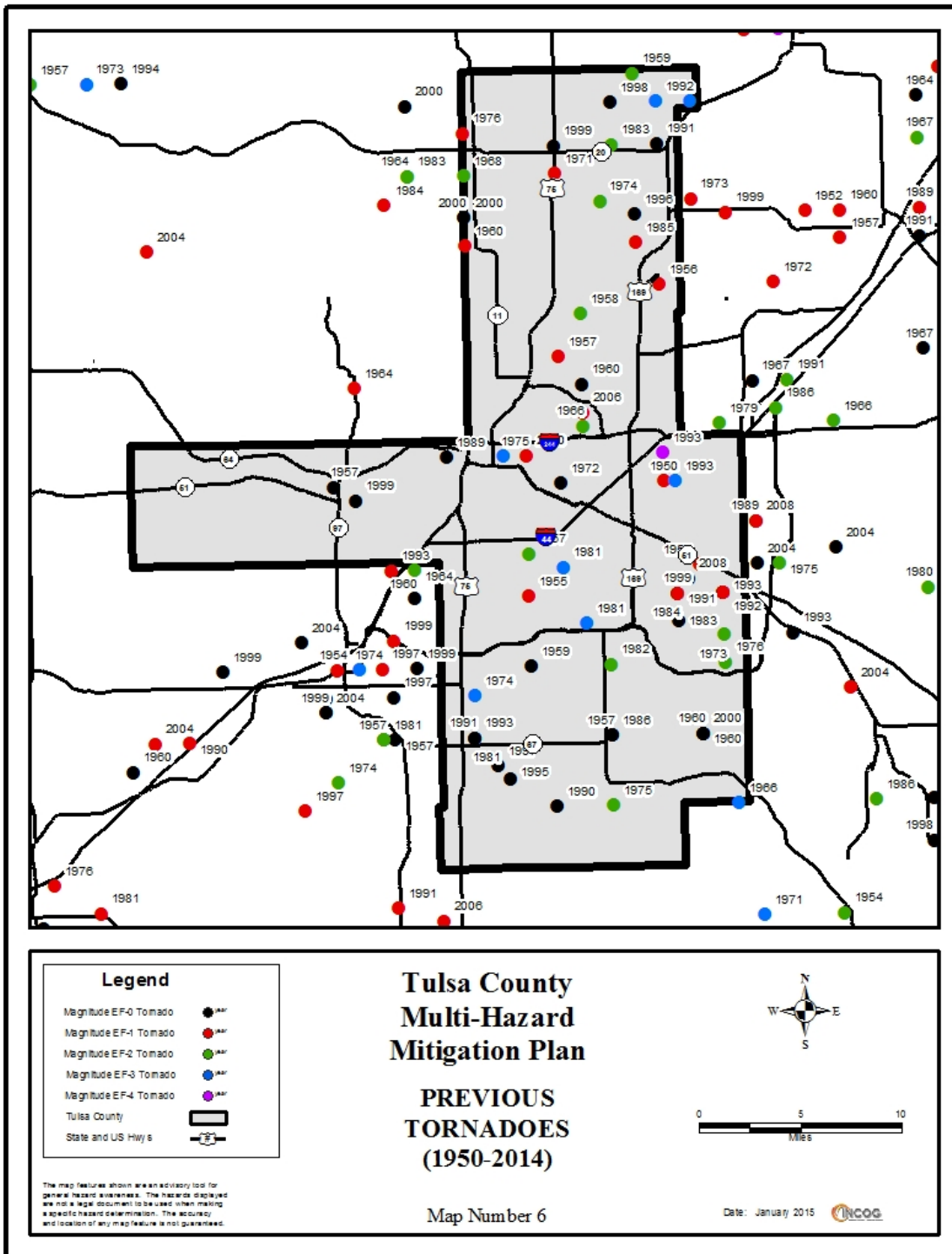


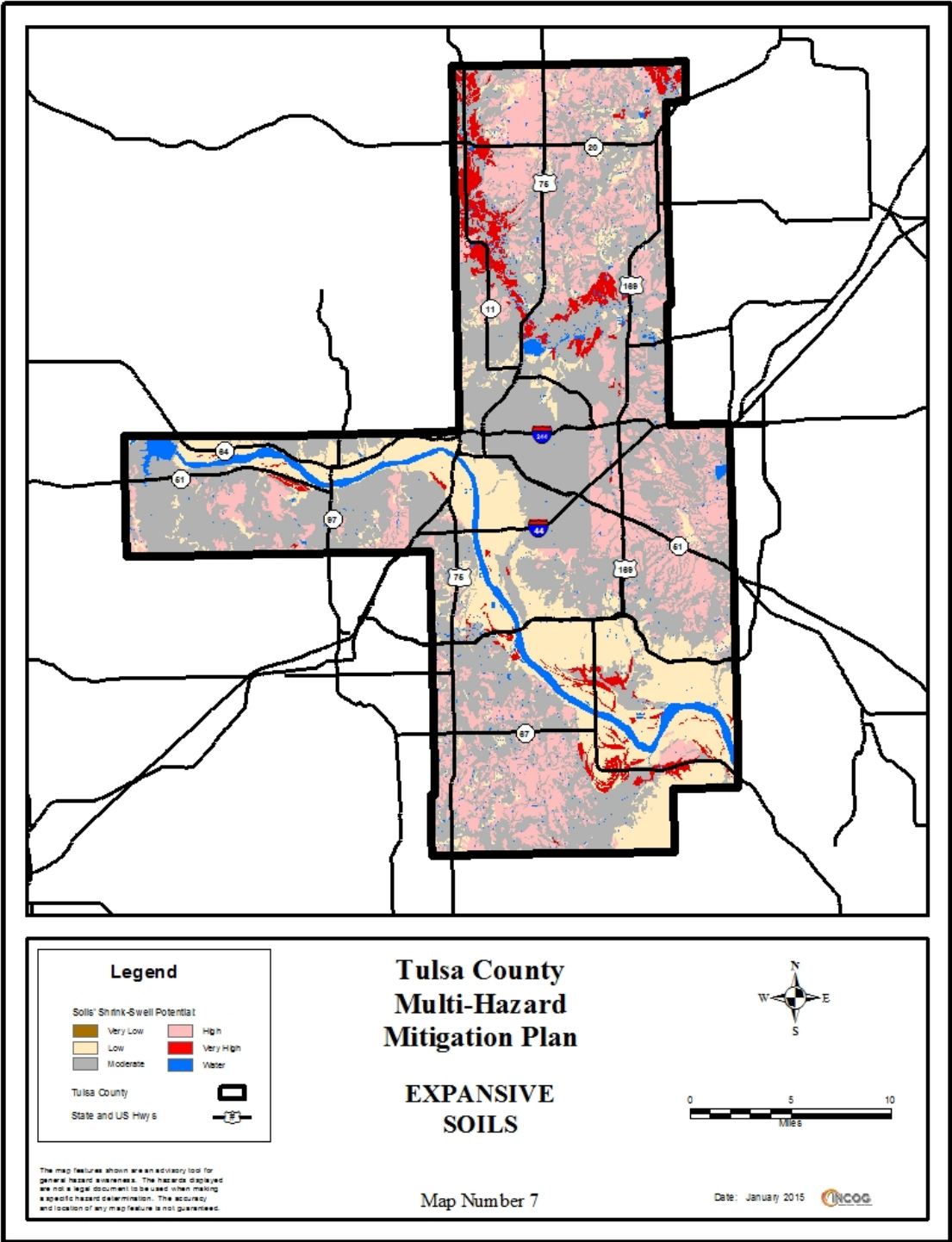


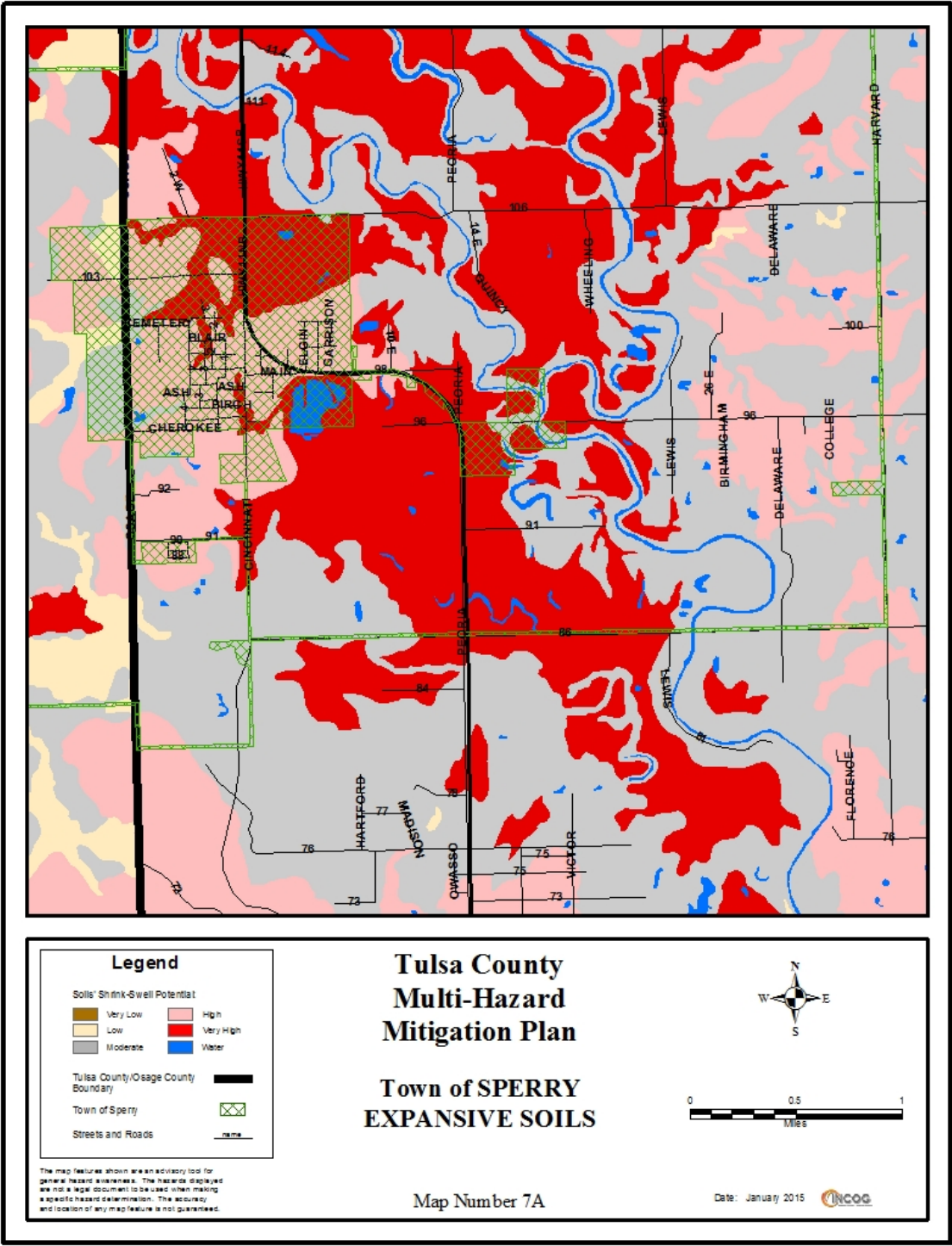


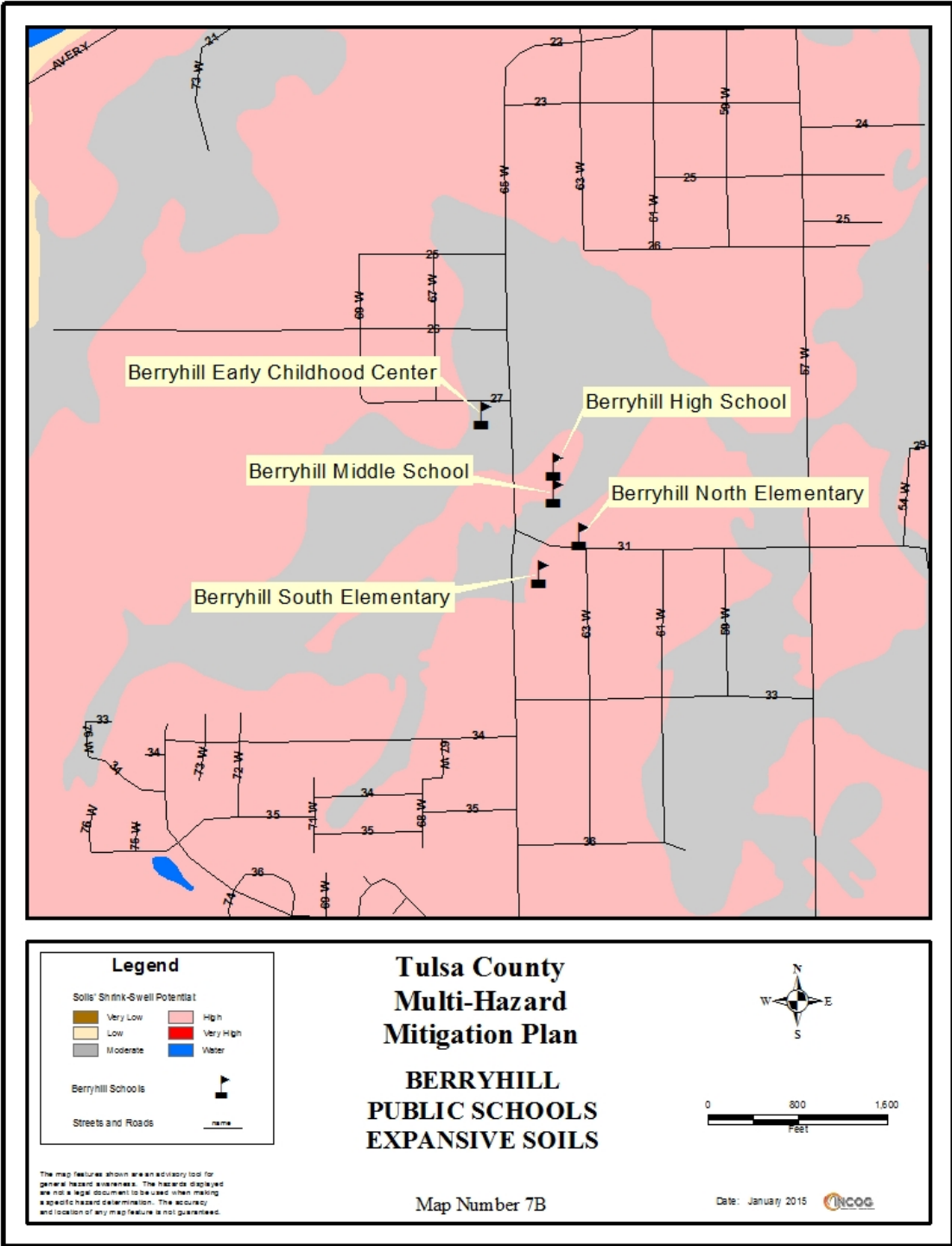


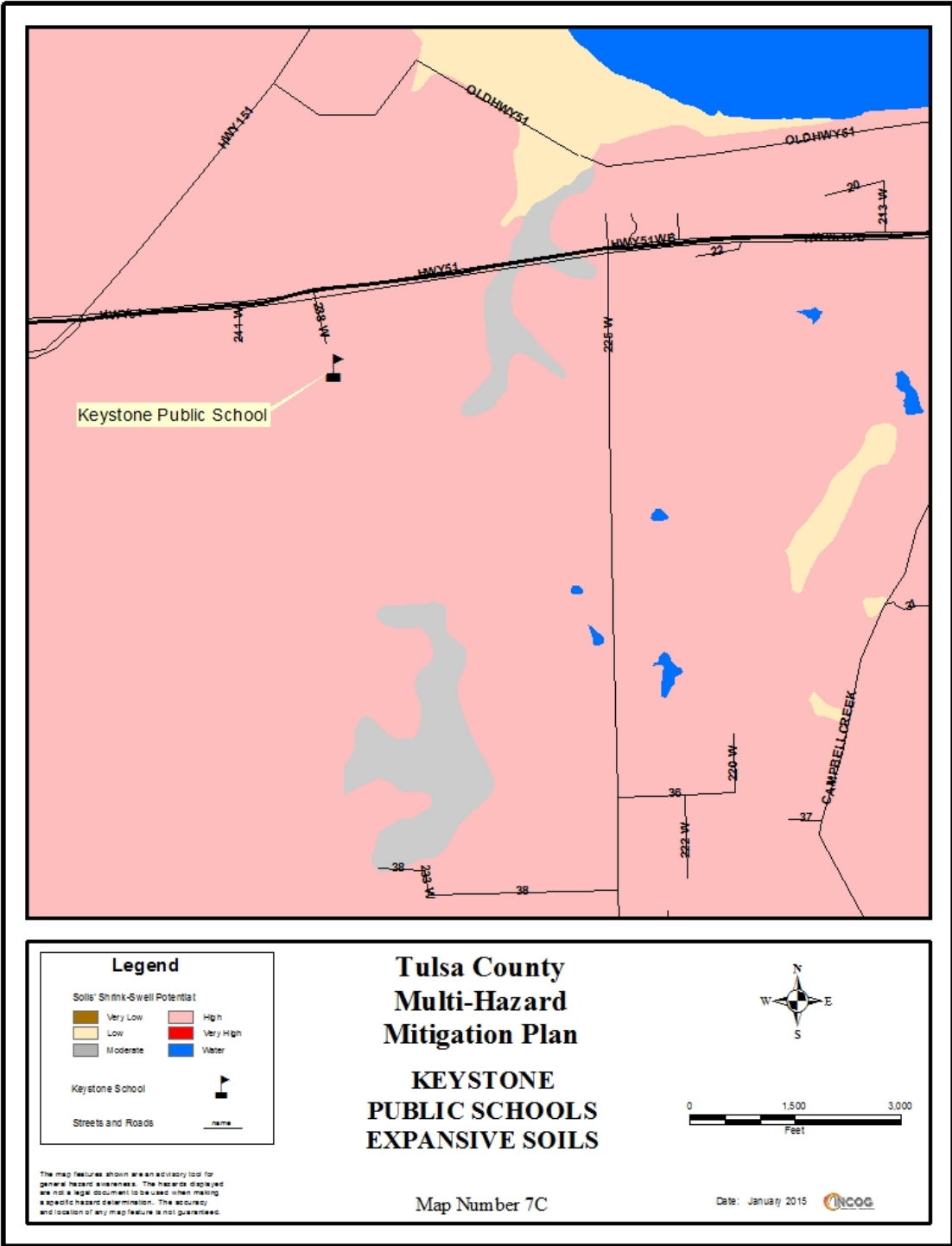


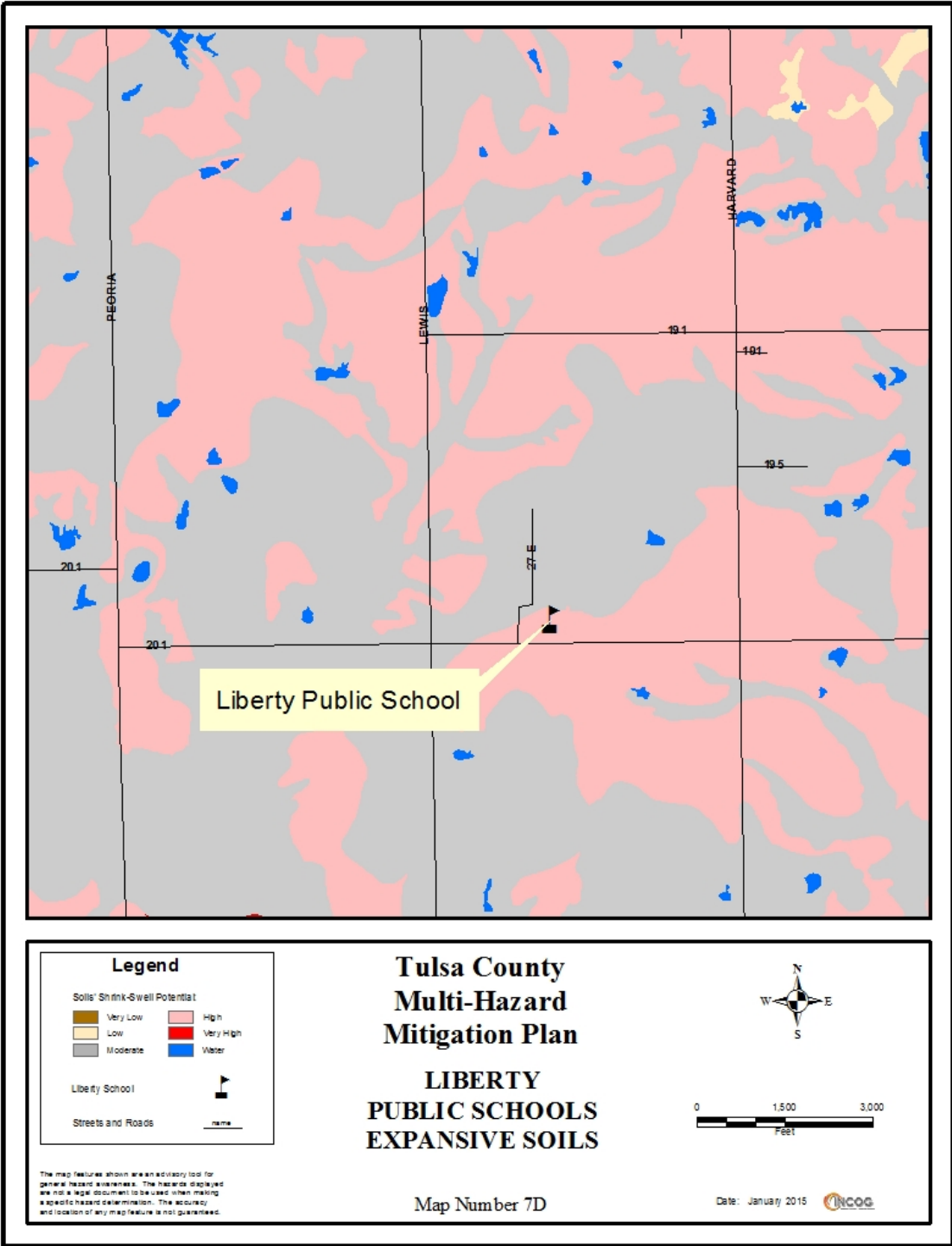


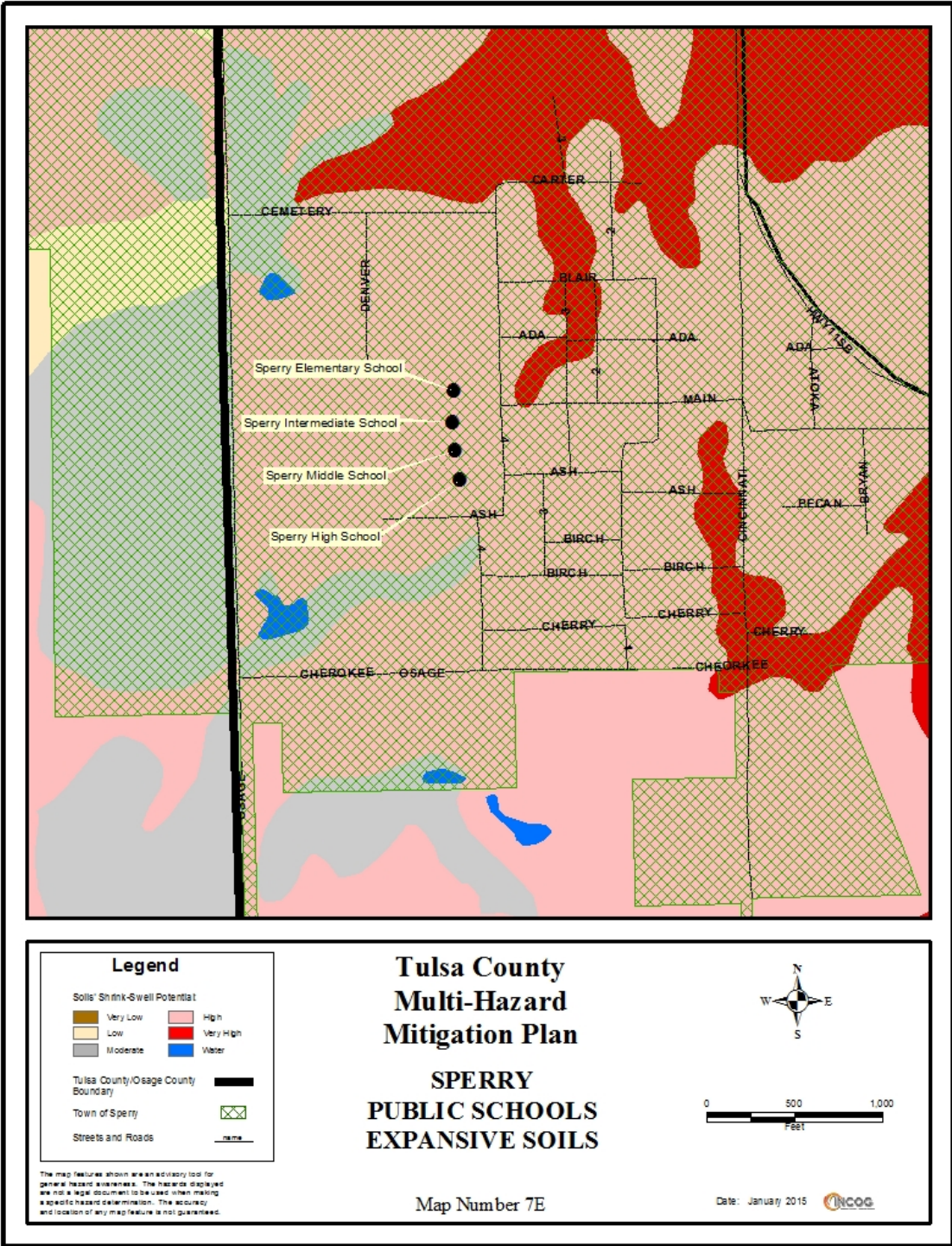


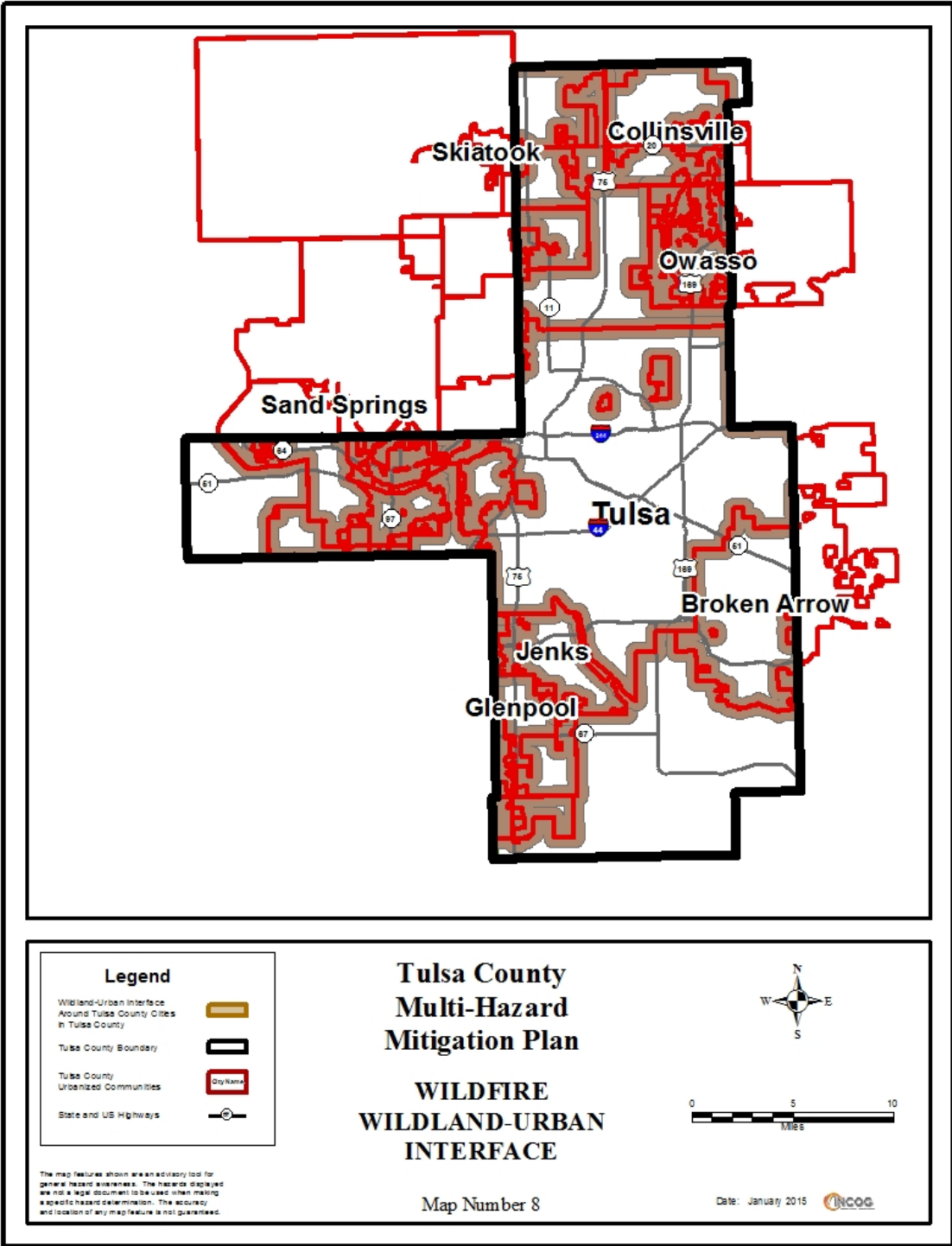


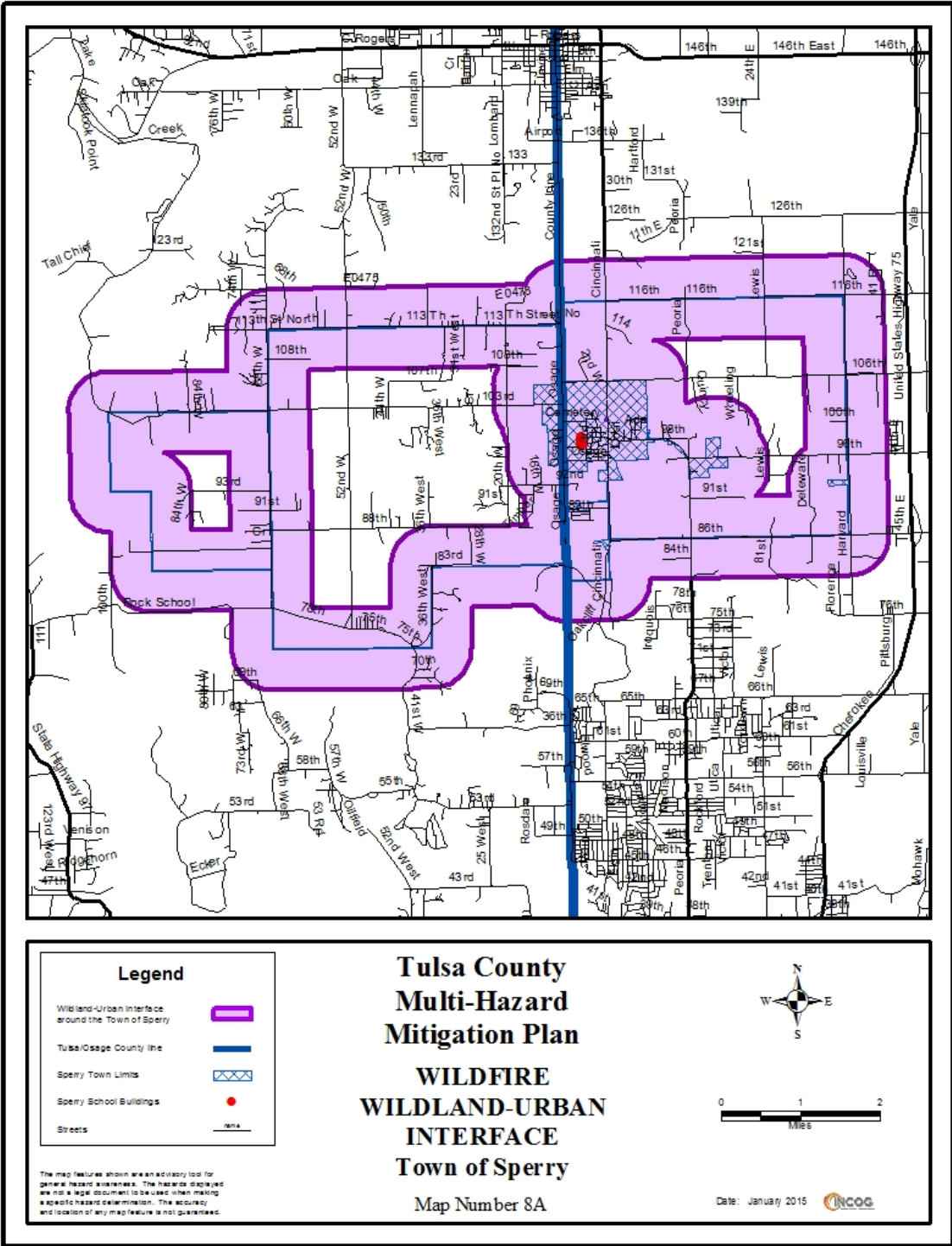


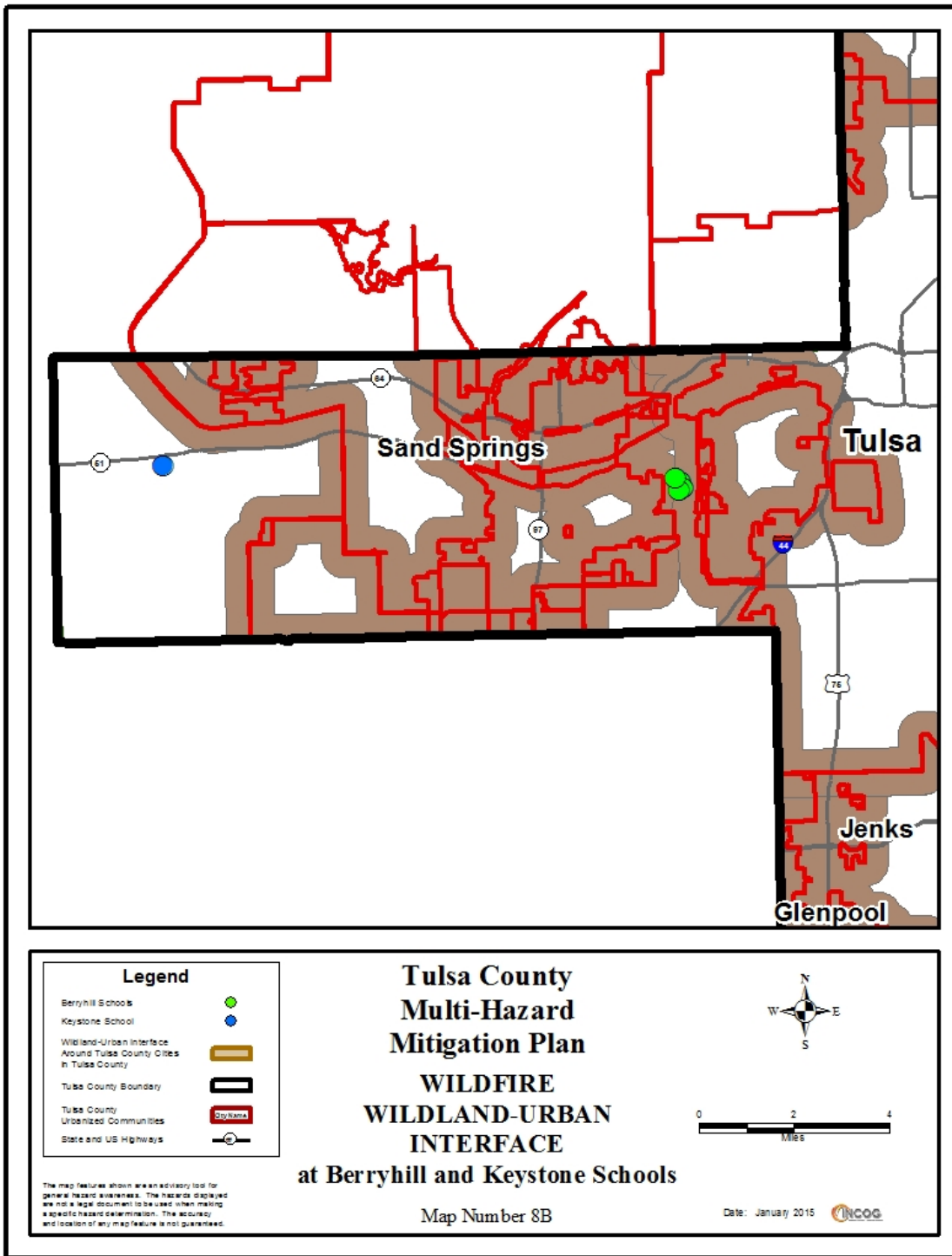


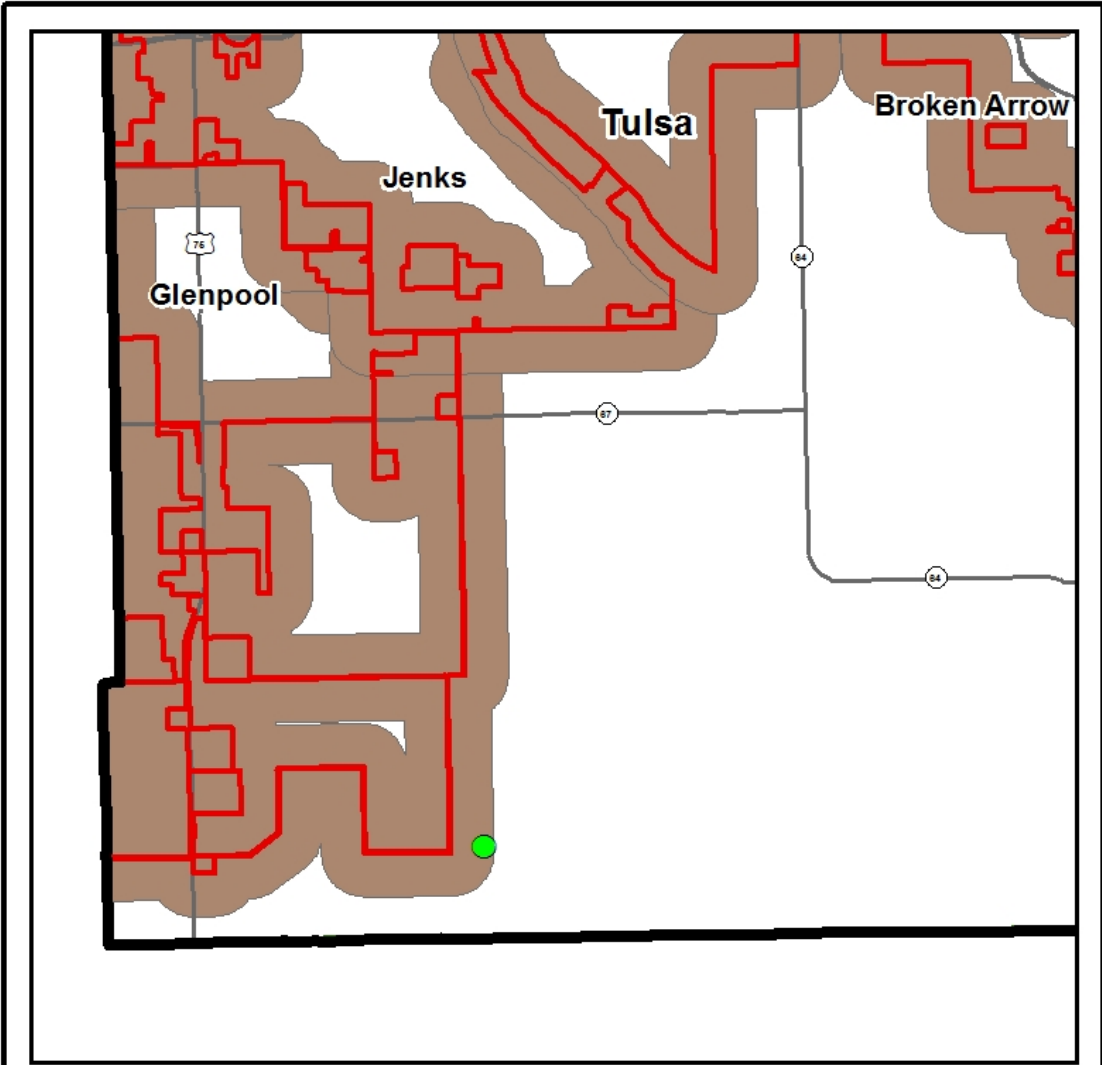










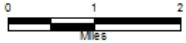


Legend	
Liberty School	
Wildland-Urban Interface Around Tulsa County Cities in Tulsa County	
Tulsa County Boundary	
Tulsa County Urbanized Communities	
State and US Highways	

The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.

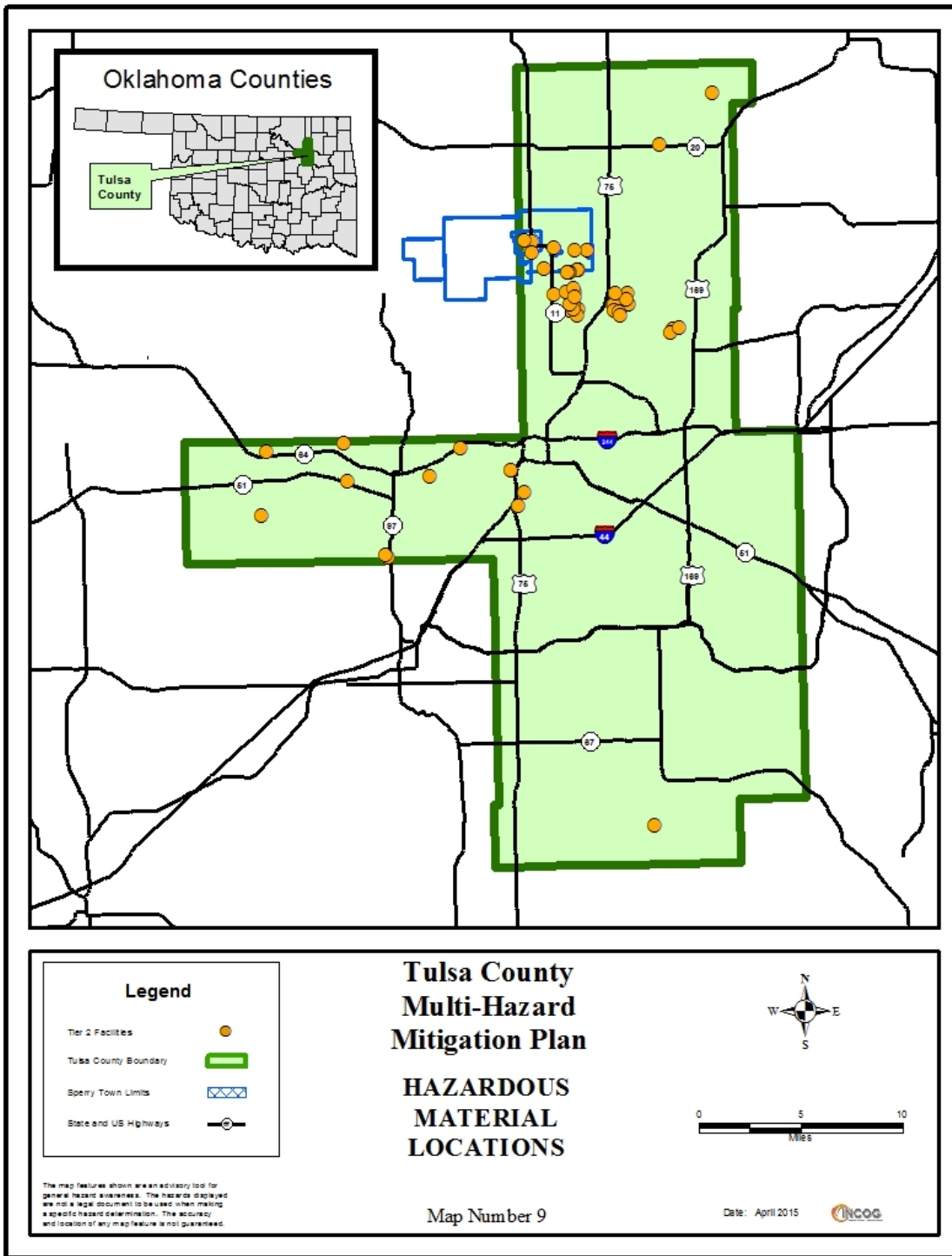
**Tulsa County
Multi-Hazard
Mitigation Plan**

**WILDFIRE
WILDLAND-URBAN
INTERFACE
at Liberty School**



Map Number 8C

Date: January 2015



Map number 10 reserved for future use

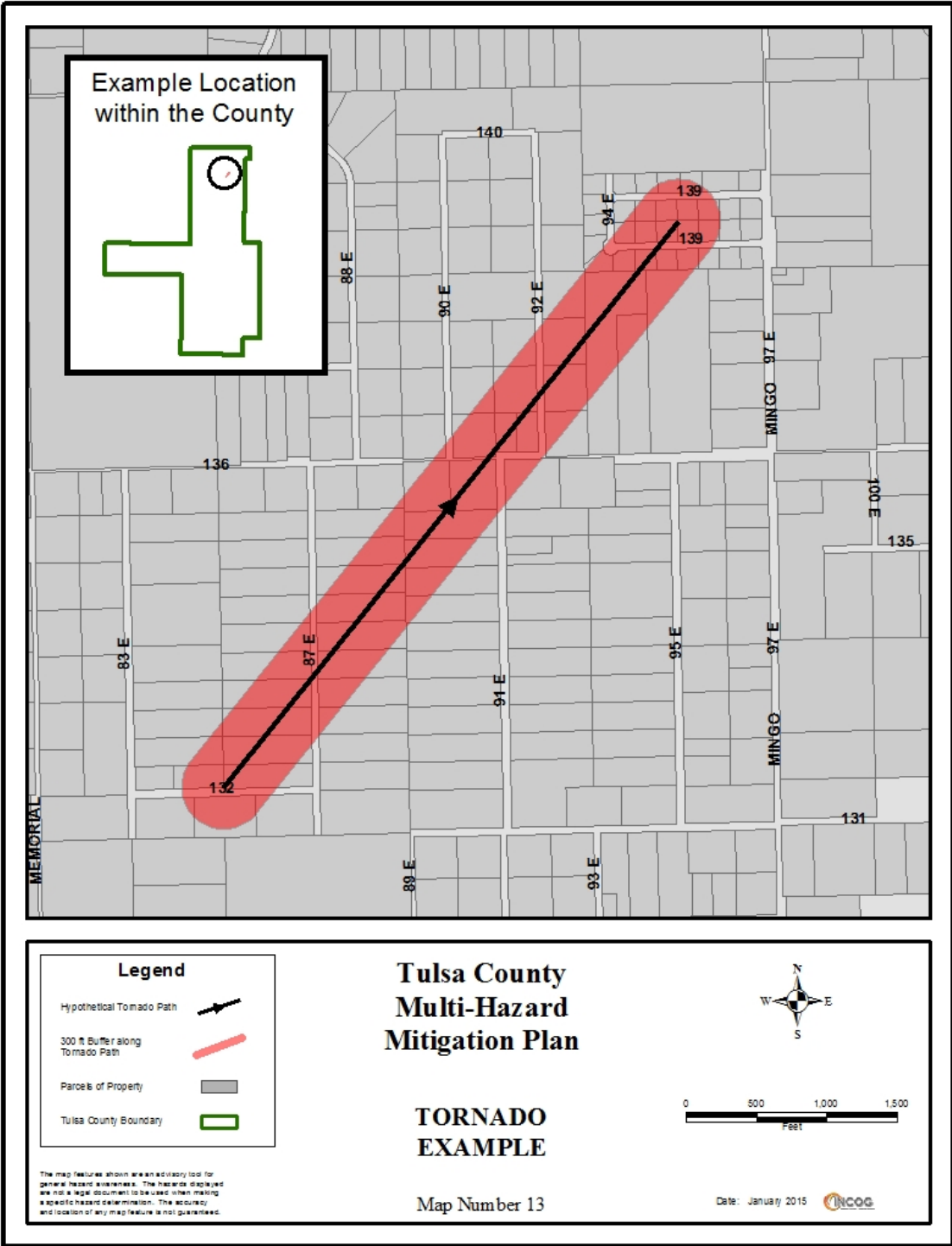
Draft for Comments

Map number 11 reserved for future use

Draft for Comments

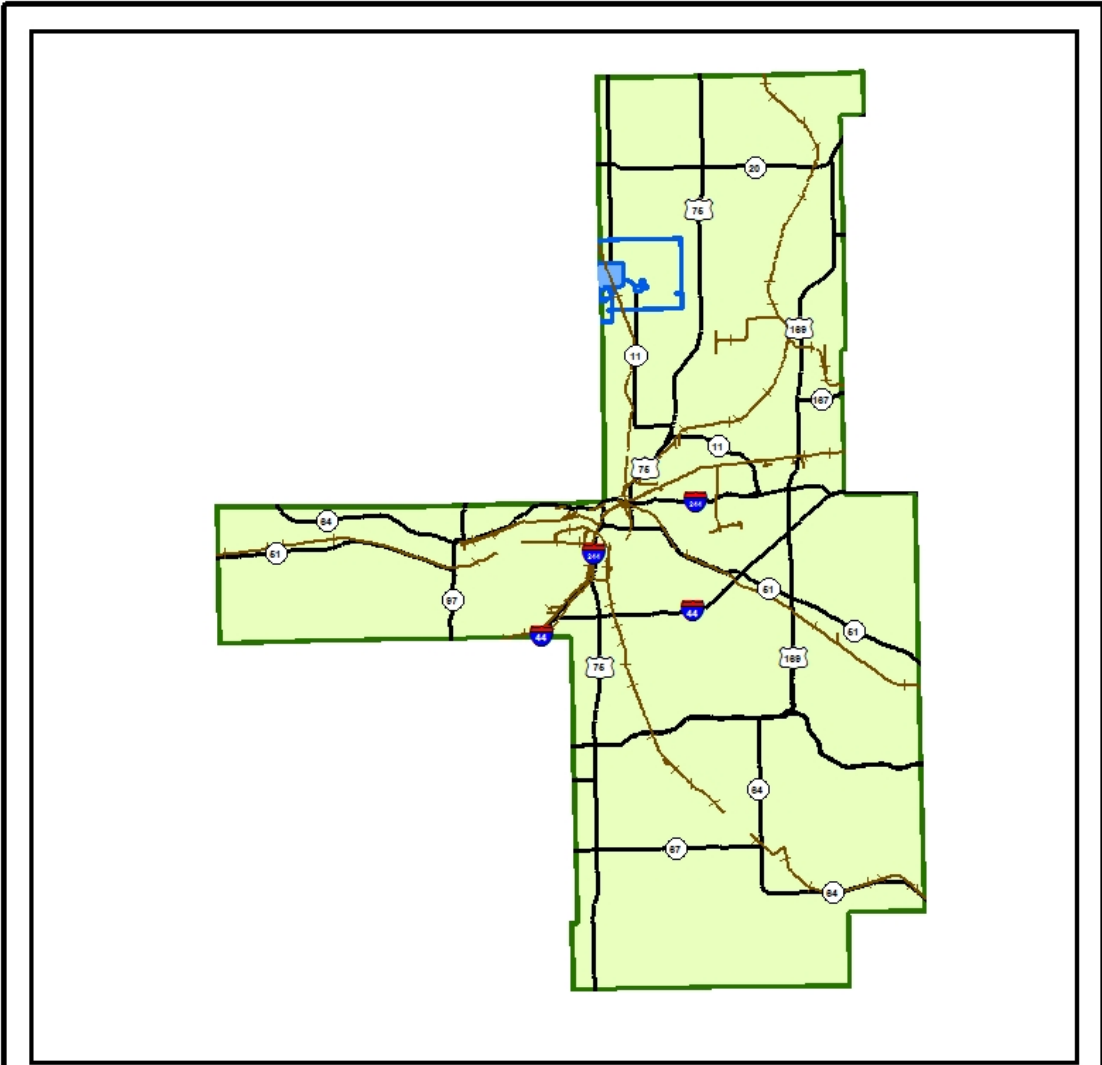
Map number 12 reserved for future use

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Map number 14 reserved for future use

Draft for Comments



Legend

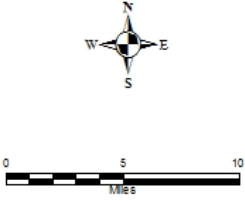
- Tulsa County Boundary 
- Sperry Town Limits 
- State and US Highways 
- Railroads 


The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.

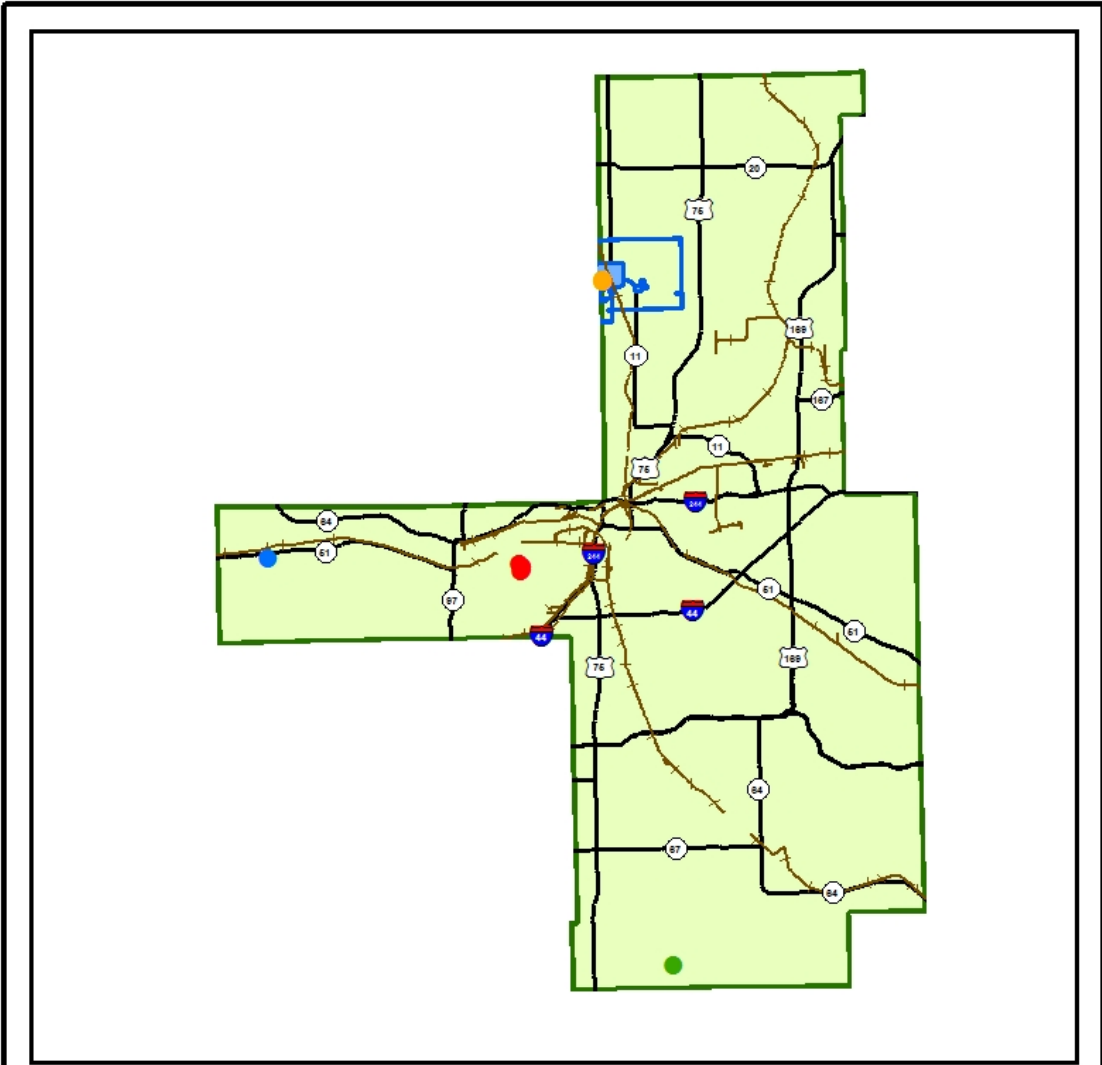
**Tulsa County
Multi-Hazard
Mitigation Plan**

**TULSA COUNTY
MAJOR
TRANSPORTATION
ROUTES**

Map Number 15



Date: January 2015 



Legend

Major Transportation Routes:

- Highways
- Railroads

Schools:

- Berryhill Schools
- Keystone Schools
- Liberty Schools
- Sperry Schools

Tulsa County Boundary

Sperry Town Limits

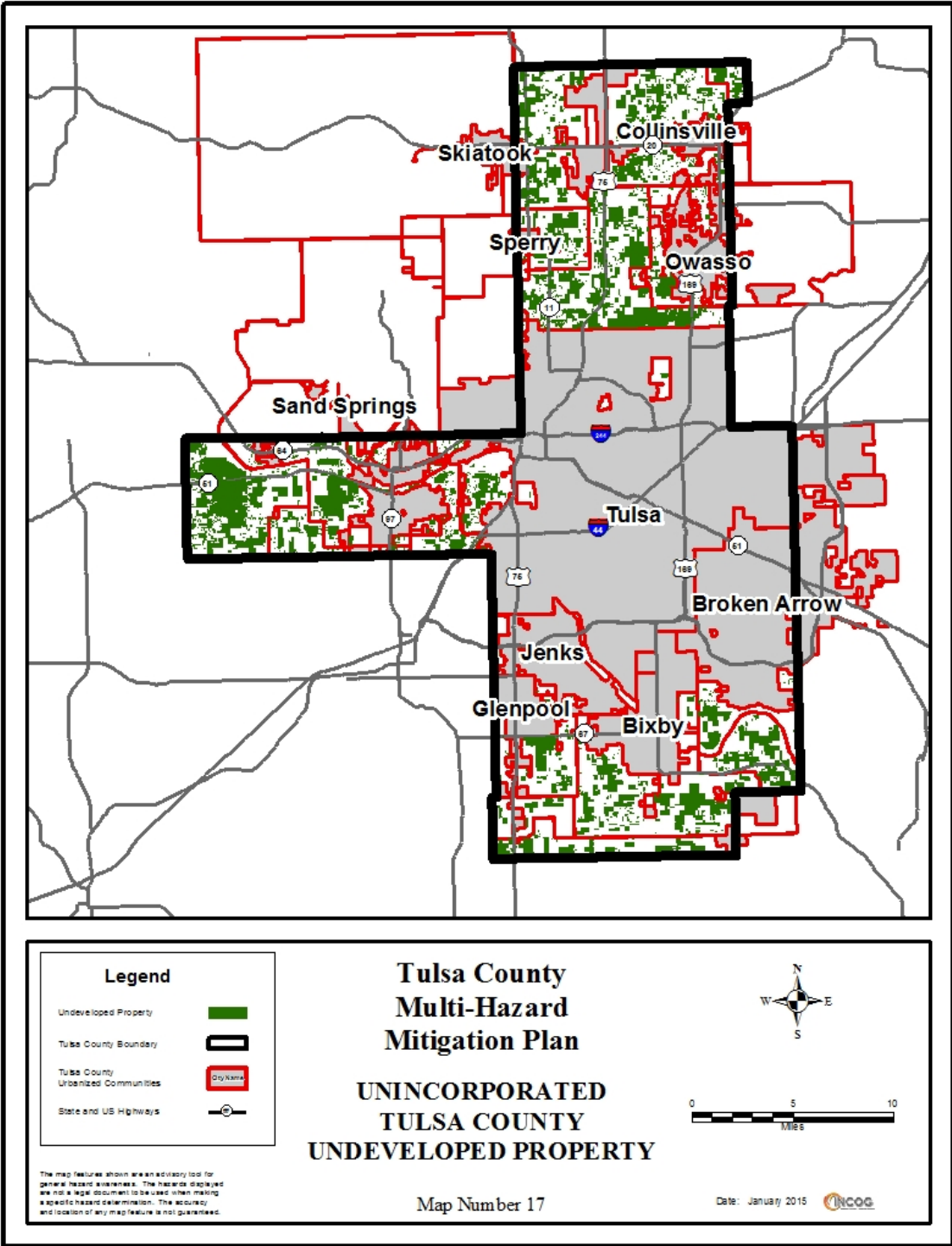
**Tulsa County
Multi-Hazard
Mitigation Plan
MAJOR
TRANSPORTATION
ROUTES
and Schools**



The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.

Map Number 16

Date: January 2015



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Appendix 2: Committee Meetings

Draft for Comments

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Draft for Comments

Meeting #1 Notice

Meeting Notice

Tulsa County Multi-Jurisdictional Multi-Hazard Mitigation Plan Update Meeting

Tulsa County has received a grant from the Oklahoma Department of Emergency Management to update the Tulsa County multi-jurisdictional multi-hazard mitigation plan. The initial meeting in the planning process to update the Tulsa County multi-jurisdictional multi-hazard mitigation plan will be held February 17, 2015, at 10:00 am at the Tulsa Area Emergency Management Agency office, 600 Civic Center, EOC, Tulsa, OK. Topics planned to be discussed include the need for a multi-jurisdictional multi-hazard mitigation plan, the jurisdictions to be involved, establishment of a committee to facilitate the update of the Tulsa County multi-jurisdictional multi-hazard mitigation plan, review of the introduction to the plan and the planning process. The meeting is open to the public. Contacts for this update of the Tulsa County multi-jurisdictional multi-hazard mitigation plan can be made to Roger Jolliff, Tulsa Area Emergency Management Agency Director, at 918-596-9898 or to John McElhenney, INCOG, at 918-584-7526.

Posted at: 600 Civic Center

Posted Date: 02/12/15

Posted by: Joe Kravale

STATE OF OKLAHOMA
TULSA COUNTY
RECEIVED
2015 FEB 10 PM 1:12
PAT KEY
TULSA COUNTY CLERK

Meeting #1 Agenda

Tulsa County Hazard Mitigation Plan Update Meeting

TAEMA

600 Civic Center, EOC

Tulsa, OK

February 17, 2015

10:00 am

Meeting Agenda

1. Call to order.
2. Introductions.
3. Discussion on the need for a multi-hazard mitigation plan.
4. Discussion on the involvement of the jurisdictions participating in the plan.
5. Establishment of a committee to facilitate the update of the Tulsa County Multi-Jurisdictional Multi-Hazard Mitigation Plan, and select a chair person.
6. Review the draft introduction to the plan. Gather information to complete the introduction
7. Review the planning process. Discuss the required planning process for the plan update, and prepare a general population hazard awareness survey and determine how to disseminate and collect the survey.
8. Summarize the information needed from the participating jurisdictions.
9. Set date and time for next meeting.
10. Adjourn.

Meeting #1 Attendance



Event: TULSA COUNTY HAZARD MITIGATION PLAN MEETING

Date: FEB 17, 2015

NAME	AGENCY	CONTACT NUMBER	EMAIL
Rosanne Wilkerson	INCOG	918-584-7526	rwilkerson@incog.org
ROBERT JOLIFF	TAEEMA	918-596-9898	RJOLIFF@TULSA-COUNTY.ORG
Jamie Ott	TAEEMA	918-596-9891	jott@tulsa-county.org
John P. McElhenney	INCOG	918-579-9440	JMCELHENNEY@INC.G.ORG
Terry West	Tulsa Co. Insp	918-596-5296	twest@tulsa-county.org
Joe Krulick	TAEEMA	918-596-9897	SKrulick@Tulsa-county.org
M. Todd Kipphut	Tulsa Law 12	918-591-6116	TKIPPATRICK@Tulsa-county.org
Aria Dawn	INCOG	918-584-7526	adawn@incog.org
Kelly Baker	OKLAHOMA PROPERTY INVESTORS	918-906-7102	kelly@OKLAHOMA-PROPERTY-INVESTORS.COM

Meeting #1 Attendance
Follow up meeting

Tulsa County Hazard Mitigation Plan Update
Follow up meeting to the February 17, 2015 Committee Meeting
February 20, 2015
Attendance Sheet

Name	Organization	Job Title	telephone number	e-mail address
John McElhenney	INCOG	Senior Civil Engineer	918-579-9440	jmcElhenney@incog.org
Rhett Bynum	Keystone School	Superintendent	918-231-9600	rbynum@keystone.K12.ok.us
Michael Smith	Town of Sperry	EM Director	918-697-5828	sperryemd@gmail.com
Jamie Ott	TAEMA	Deputy Director	918-596-9891	jott@tulsacounty.org
Doana Campo	Liberty School	Superintendent	918-366-8496	dcampo@liberty.K12.ok.us
Brent Core	Sperry School	Assistant Superintendent	918-288-7213	bcore@sperry.K12.ok.us
Roger Jolliff	TAEMA	Director	918-536-9898	rjolliff@tulsacounty.org

Draft for

Meeting #1 Attendance
Follow up meeting

Tulsa County Hazard Mitigation Plan Update
Follow up meeting to the February 17, 2015 Committee Meeting
March 11, 2015
Attendance Sheet

Name	Organization	Job Title	telephone number	e-mail address
Jamie Ott	TAEMA	Deputy Director	918-596-9891	jott@tulsacounty.org
John McElhenney	INCOG	Senior Civil Engineer	918-579-9440	jmcelhenney@incog.org
Samantha Henry	American Red Cross	Disaster Program Manager	918-831-1272	samantha.henry@redcross.org
Mike Campbell	Berryhill Schools	Superintendent	918-445-6000	mike.campbell@berryhillschools.org
Jo Etta Terrell	Berryhill Schools	Assistant Superintendent	918-445-6017	joetta.terrell@berryhillschools.org

Draft for

Meeting #1 Minutes

Tulsa County Hazard Mitigation Plan Update Meeting Tulsa Area Emergency Management Agency Emergency Operations Center 600 Civic Center, EOC

Minutes of the February 17, 2015 Meeting

1. The meeting was called to order at 10:05 am by Roger Jolliff.
2. Introductions were made around the room. Mr. Jolliff. turned the agenda over to John M^cElhenney
3. Mr. M^cElhenney discussed the need for the Tulsa County multi-hazard mitigation plan, to understand the hazards that could affect the County, and also for Tulsa County, the Town of Sperry, and the four participating schools to be eligible for mitigation grant funds.
4. Mr. M^cElhenney explained why the four public schools were participating in the County hazard plan update, to reap the benefit of having a plan; in this case, being a part of the County plan.
5. The Tulsa County hazard mitigation planning committee was re-established, and named Roger Jolliff, TAEMA Director, as Chairman of the committee.
6. Mr. M^cElhenney reviewed the draft of the update of Chapter 1, Introduction, with the committee and requested information from committee members to complete the chapter.
7. Mr. M^cElhenney reviewed the draft of the update to Chapter 2, the planning process, with the committee. Questions arose on why specific hazards were and were not included in the plan. Mr. M^cElhenney answered that the hazards listed were the hazards that FEMA wanted addressed. Mr. M^cElhenney then discussed the need for a citizen hazard awareness survey. The committee accepted the draft survey form, and will distribute the survey forms starting next week. The completed surveys will be collected and sent to Mr. M^cElhenney at INCOG to compile and present the results at the next committee meeting.
8. Mr. M^cElhenney reiterated the information needed to complete chapters 1 and 2.
9. The next meeting of the Tulsa County hazard mitigation planning committee was set for Thursday, March 26, 2015 at 10 o'clock in the morning. Mr. M^cElhenney discussed the need to schedule follow up meetings for the participating community and schools that were not able to attend this meeting. The follow up meetings should be held prior to the March 26, 2015 committee meeting.
10. Mr. Jolliff adjourned the committee meeting at 11:35 am.

Meeting #2 Notice

Meeting Notice
Tulsa County Hazard Mitigation Plan Update Meeting

Tulsa County has received a grant from the Oklahoma Department of Emergency Management to update the Tulsa County Multi-Jurisdictional Multi-Hazard Mitigation Plan. The next meeting in the planning process to update the Tulsa County multi-jurisdictional multi-hazard mitigation plan will be held on April 9, 2015, at 10:00 am at the Tulsa County Sheriff Faulkner Building, 303 W. 1st, Tulsa, OK. Topics planned for discussion include reviewing the general hazard awareness survey, the risk and vulnerability analyses to the hazards, and mitigation strategies. The meeting is open to the public. Contacts for this update of the Tulsa County multi-jurisdictional multi-hazard mitigation plan can be made to Roger Jolliff, Tulsa Area Emergency Management Agency Director, at 918-596-9899 or to John McElhenney, INCOG, at 918-584-7526.

Posted at: _____

Posted Date: _____

Posted by: _____

PAT KEY
TULSA COUNTY CLERK
2015 MAR 31 PM 1:33
STATE OF OKLAHOMA
TULSA COUNTY
RECEIVED

Meeting #2 Agenda

Tulsa County Hazard Mitigation Plan Update Meeting

Tulsa County Sheriff Faulkner Building

303 W 1st St, Tulsa, OK

April 9, 2015

10:00 am

Meeting Agenda

1. Call to order.
2. Introductions.
3. Review and Approve minutes of February 17, 2015 committee meeting.
4. Discuss outstanding data to complete Chapter 1.
5. Present general population hazard awareness survey.
6. Review draft of Chapter 3, Risk and Vulnerability Analysis.
7. Review draft of Chapter 4, Mitigation Strategies.
 - a. Discuss goals and objectives of the hazards' mitigation actions.
 - b. Discuss mitigation activities. Identify activities for each jurisdiction.
8. Set date and time for next meeting.
9. Adjourn.

Meeting #2 Attendance

TULSA COUNTY HAZARD MITIGATION MEETING

Attendance Sheet

Name	Organization	Job Title	e-mail	Mtg #2 4/9/2015
Roger Jolliff	TAEMA	Director	rjolliff@tulsacounty.org	√
Joe Kralicek	TAEMA	Finance and Grants Coordinator	jkralicek@tulsacounty.org	√
Kelly Baker	Oklahoma Property Investors	Property Manager	kelly@oklahomapropertyinvestors.com	√
Terry West	Tulsa County	Floodplain Administrator	twest@tulsacounty.org	√
M. Todd Kilpatrick	Tulsa Levee District 12	Commissioner	tkilpatrick@tulsacounty.org	√
Mike Smith	Town of Sperry	Emergency Management Director	sperryend@gmail.com	√
Rhett Bynum	Keystone Schools	Superintendent	rbynum@keystone.K12.ok.us	√
Mike Juby	Sperry Schools	School Safety Officer	mjuby@sperry.k12.ok.us	√
John McElhenney	INCOG	Senior Civil Engineer	jmcElhenney@incog.org	√

Draft for

Meeting #2 Minutes

Tulsa County Hazard Mitigation Plan Update Meeting

Tulsa County Sheriff Faulkner Building

303 W 1st St, Tulsa, OK

Minutes of the April 9, 2015 Meeting

1. The meeting was called to order at 10:05 pm.
2. The minutes of the February 17, 2015 meeting were approved as written.
3. John McElhenney discussed the revisions to Chapter 1. The dates for the Schools' CIPs were added; the Schools' CIP projects were added.
4. The results of the general population hazard awareness survey were distributed.
5. The draft of Chapter 3, the risk and vulnerability analysis was distributed. John McElhenney summarized the chapter.

Additional information to complete the chapter was identified, as follows:

- Mike Smith will get recent grass fire and haz mat run totals
- Terry West will get specific areas for flooding within the city.
- The Schools will get the number of buildings per school and their building value and content value if available.

This additional information should be sent to John McElhenney as it is completed so it can be entered into the plan prior to the next meeting.

6. A draft of chapter 4, mitigation strategies, was distributed. John McElhenney summarized the goals and objectives of mitigation strategies for each hazard. John McElhenney then discussed the categories of mitigation activities, and examples of specific mitigation activities.
7. John McElhenney said all participants are required to identify at least two mitigation activities per hazard to include in their respective mitigation action portion of the plan. He then distributed a list of the previous plan's mitigation activities, a list of the activities considered from the previous plan and examples of mitigation activities from OEM. These lists were for reference and not required to be used by the County, Town or the Schools, nor are mitigation activities limited to the activities on the lists.

The County, Sperry, and the four Schools will need to identify mitigation activities prior to the next meeting and these will be discussed at the next meeting. These activities were requested to be delivered to John McElhenney by April 30, 2015 so they can be distributed and discussed at the next meeting.

8. The next meeting of the Tulsa County hazard mitigation plan planning committee was set for May 14, 2015 at 10:00 am back here.
9. The committee meeting was adjourned at 12:10 pm.

Meeting #3 Notice

Meeting Notice
Tulsa County Hazard Mitigation Plan Update Meeting

PAT KEY
TULSA COUNTY CLERK

2015 MAY 14 AM 8:33

Tulsa County has received a grant from the Oklahoma Department of Emergency Management to update the Tulsa County Multi-Jurisdictional Multi-Hazard Mitigation Plan. The next meeting in the planning process to update the Tulsa County Multi-Jurisdictional Multi-Hazard Mitigation Plan will be held May 14, 2015, at 10:00 am at the Tulsa County Sheriff Faulkner Building, 303 W. 1st Street, Tulsa, OK. Topics planned for discussion will include the mitigation activities proposed by the jurisdictions for inclusion in the updated plan, Maintenance of the plan, and the requirements for adopting the updated plan by each participation jurisdiction. All Tulsa County citizens are invited. Contacts for this update to the Tulsa County Multi-Jurisdictional Multi-Hazard Mitigation Plan can be made to Roger Jolliff, TAEMA Director, at 918-596-9899, or to John McElhenney, INCOG at 918-584-7526.

STATE OF OKLAHOMA
TULSA COUNTY
RECEIVED

Posted Location: _____

Posted Date: _____

Posted by: _____

Meeting #3 Agenda

Tulsa County Hazard Mitigation Plan Update Meeting

Tulsa County Sheriff Office Faulkner Building
303 W 1st St, Tulsa, OK

May 14, 2015

10:00 am

Meeting Agenda

1. Call to order.
2. Introductions.
3. Review and Approve minutes of April 9, 2015 committee meeting.
4. Review the mitigation actions from the previous Tulsa County hazard mitigation plan.
5. Discuss new mitigation activities to include in the updated hazard mitigation plan for the County, Sperry, and Schools.
6. Review of draft of Chapter 6; Plan Maintenance and Adoption.
7. Discuss information that may be needed to complete Chapters 1-6.
8. Develop a request for comments on the final draft of the plan update letter.
9. Set time and date for a public hearing.
10. Set date and time for next meeting.
11. Adjourn.

Meeting #3 Attendance

TULSA COUNTY HAZARD MITIGATION MEETING

Attendance Sheet

Name	Organization	Job Title	e-mail	Mtg #3 5/14/2015
Roger Jolliff	TAEMA	Director	rjolliff@tulsacounty.org	√
Jamie Ott	TAEMA	Deputy Director	jott@tulsacounty.org	√
Joe Kralicek	TAEMA	Finance and Grants Coordinator	jkralicek@tulsacounty.org	
Kelly Baker	Oklahoma Property Investors	Property Manager	kelly@oklahomapropertyinvestors.com	√
Terry West	Tulsa County	Floodplain Administrator	twest@tulsacounty.org	√
M. Todd Kilpatrick	Tulsa Levee District 12	Commissioner	tkilpatrick@tulsacounty.org	√
Mike Smith	Town of Sperry	Emergency Management Director	sperryemd@gmail.com	√
Mike Campbell	Berryhill Schools	Superintendent	mcampbell@berryhill.k12.ok.us	
Jo Etta Terrell	Berryhill Schools	Assistant Superintendent	joetta.terrell@berryhillschools.org	√
Rhett Bynum	Keystone Schools	Superintendent	rbynum@keystone.K12.ok.us	√
Donna Campo	Liberty Schools	Superintendent	dcampo@liberty.K12.ok.us	√
Brent Core	Sperry Schools	Assistant Superintendent	bcore@sperry.K12.ok.us	
Mike Juby	Sperry Schools	School Safety Officer	mjuby@sperry.k12.ok.us	√
Samantha Henry	Tulsa Red Cross	Disaster Relief Coordinator	samantha.henry@redcross.org	
Ann Domin	INCOG	Deputy Director	adomin@incog.org	√
Dwayne Wilkerson	INCOG	Assistant Director, Land Dev Svcs	dwilkerson@incog.org	
John McElhenney	INCOG	Senior Civil Engineer	jncelhenney@incog.org	√

Draft for

Meeting #3 Minutes

Tulsa County Hazard Mitigation Plan Update Meeting

Tulsa County Sheriff Faulkner Building

303 W 1st St, Tulsa, OK

Minutes of the May 14, 2015 Meeting

1. The meeting was called to order at 10:00 am by Roger Jolliff.
2. Introductions of all the committee members were made.
3. The minutes of the April 9, 2015 were approved as written.
4. The committee reviewed the mitigation actions from the previous mitigation plan and identified whether each action had been completed, started or not started.
5. The committee reviewed the proposed mitigation actions proposed by the County, Sperry, and the four Schools.
6. The committee reviewed the plan maintenance chapter on keeping the plan current, updating the plan regularly, incorporating mitigation actions into other plan, and keeping the public involved.
7. The committee reviewed a draft of a letter to be sent in interested parties inviting comments on the final draft of the Tulsa County hazard mitigation plan update.
8. The committee recommended holding a public hearing to receive comments from the public on the Tulsa County hazard mitigation plan update at the County Commission meeting on June 8, 2015 at 9:30 am.
9. The next planning meeting will be on June 18, 2015 at 10:00 am, back here at the Faulkner Building.
10. The meeting was adjourned at 11:10 am

Public Hearing Notice

Public Hearing Notice
Tulsa County Hazard Mitigation Plan Update

Tulsa County has received a grant from the Oklahoma Department of Emergency Management to update the Tulsa County Hazard Mitigation Plan. A public hearing on the final draft of the plan update shall be held on June 8, 2015, at 9:30 am at the Tulsa County Commission Room at 500 S Denver, Tulsa, OK, to receive public comments on the final draft of the updated plan. The final draft of the updated Tulsa County Multi-Jurisdictional Multi-Hazard Mitigation Plan is available for public inspection at the Tulsa Area Emergency Management Agency office by calling 918-596-9899 for an appointment, or at the INCOG web site at www.incog.org/Community_Economic_Development/commdev_hazard_mitigation. Public comments can be made at the Tulsa Area Emergency Management Agency office prior to the public hearing and will be delivered to the public hearing. For information regarding the plan update, contact Roger Jolliff, TAEMA, at 918-596-9899, or John McElhenney, INCOG, at 918-584-7526. Comments received will be considered by the Tulsa County Hazard Mitigation Planning Committee when finalizing the update to the Tulsa County Multi-Jurisdictional Multi-Hazard Mitigation Plan.

Posted at: _____

Posted Date: _____

Posted by: _____

Anyone requiring special accommodations pursuant to the Americans with Disabilities Act should call the Tulsa Area Emergency Management Agency office at 918-596-9899 by noon of the business day before the hearing.

Public Hearing Attendance

Tulsa County Commission Meeting

June 8, 2015

9:30 am

Draft for Comments

Public Hearing Minutes

Tulsa County Commission Meeting
June 8, 2015
9:30 am

Draft for Comments

Meeting #4 Notice

Draft for Comments

Meeting #4 Agenda

Tulsa County Hazard Mitigation Plan Update Meeting

Tulsa County Sheriff Faulkner Building

303 W 1st St, Tulsa, OK

June 18, 2015

10:00 am

Meeting Agenda

Draft for Comments

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Draft for Comments

***Appendix 3:
Sample Comment Letter***

Draft for Comments

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Draft for Comments



cc: John III

Tulsa Area Emergency Management Agency
600 Civic Center, E.O.C
Tulsa, OK 74103

January 12, 2015

Rich Brierre
Executive Director
INCOG
2 W Second Street, Suite 800
Tulsa, OK 74103

RE: Tulsa County Hazard Mitigation Plan

Dear Mr. Brierre:

The Federal Emergency Management Agency through the Oklahoma Department of Emergency Management has awarded Tulsa County a grant through the hazard mitigation grant program to update the County's Multi-Hazard Mitigation Plan.

The initial meeting in the planning process to update the Tulsa County multi hazard mitigation plan will be held at the Tulsa County Emergency Operations Center, 600 Civic Center, EOC, Tulsa OK, on February 17, 2015, at 10:00 am. You are invited to attend and participate in the planning process.

If you have any questions, please contact me at (918) 596-9898, or John McElhenney, INCOG, at (918) 584-7526.

Sincerely,

Roger Jolliff
Director, TAEMA



Tulsa Area Emergency Management Agency
600 Civic Center, E.O.C
Tulsa, OK 74103

May 18, 2015

Rich Brierr
Executive Director
INCOG
2 W Second Street, Suite 800
Tulsa, OK 74103

RE: Tulsa County Hazard Mitigation Plan

Dear Mr. Brierr:

The Federal Emergency Management Agency through the Oklahoma Department of Emergency Management has awarded Tulsa County a grant through the hazard mitigation grant program to update the County's Multi-Hazard Mitigation Plan.

The planning process began in February, 2015, and the final draft of the updated plan is now under review by the planning committee. The final draft of the updated plan is available for public review at the INCOG web site, www.incog.org/Community and Economic Development. The final draft is also available for review at the Tulsa Area Emergency Management Agency Office, 600 Civic Center EOC, Tulsa, OK, during normal business hours.

You are invited to participate in the review process and comment on the plan. The next meeting in the planning process is to be held on June 18, 2015, at 10:00 am at the Tulsa County Sheriff Office Faulkner Building, 303 W 1st Street, Tulsa, OK. You are welcome to attend. Please submit any comments on the draft plan to me prior to the meeting.

If you have any questions, please contact me at (918) 596-9898, or John McElhenney, INCOG, at (918) 584-7526.

Sincerely,

Roger Jolliff
Director, TAEMA

Appendix 4: Questionnaire

Draft for Comments

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Draft for Comments

HAZARD MITIGATION SURVEY

Tulsa County is in the process updating its Multi-Hazard Mitigation Plan. This plan is a strategic planning guide to reduce the impact of natural hazards and hazardous material events on the County. This survey is intended to understand the citizen’s awareness and level of concern of hazards that could impact the Tulsa County area.

For each of the following hazards, please check the corresponding box indicating how concerned you are about each of these hazards.

HAZARD	Not Concerned	Somewhat Concerned	Concerned	Very Concerned
Dam Breaks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drought	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Earthquakes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Expansive Soils	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Extreme Heat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Floods	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hailstorms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hazardous Materials Events	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High Winds	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lightning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Severe Winter Storms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tornados	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wildfires	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other Hazard: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other Hazard: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If you have any comments, suggestions, or additional concerns, please note them on the back of this survey.

Survey Results

Hazard	Average Survey Score
Dam Break	0.6
Drought	1.3
Earthquakes	1.3
Expansive Soils	0.5
Extreme Heat	1.5
Floods	1.3
Hailstorms	1.2
Haz Mat Events	1.1
High Winds	1.4
Lightning	1.3
Severe Winter Storms	1.7
Tornados	2.2
Wildfires	1.7

Scoring:

Not concerned = 0 point (minimum score per hazard)
Somewhat concerned = 1 points
Concerned = 2 points
Very concerned = 3 points (maximum score per hazard)

Results:

Responses: 165
Hazard of Most Concern are tornados
Hazard of Least Concern are expansive soils

Appendix 5: Plan Adoption Resolutions

Draft for Comments

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Appendix 6: Hazard Summary

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Draft for Comments

Natural Hazard Assessments

Each hazard is assigned a likelihood rating based on the criteria and methods described below.

Likelihood of Event "Rating" is based on the following definitions	
Highly likely (HL)	Event is probable within the calendar year.
Likely (L)	Event is probable within the next three years.
Occasional (O)	Event is probable within the next five years.
Unlikely (UL)	Event is possible within the next ten years.

Based on History, and using the information described above, Likelihood of Event is "Quantified" as follows:		
Highly Likely (HL)	Event has 1 in 1 year chance of occurring	1/1 = 100%
Likely (L)	Event has 1 in 3 years chance of occurring	1/3 = 33%
Occasional (O)	Event has 1 in 5 years chance of occurring	1/5 = 20%
Unlikely (UL)	Event has 1 in 10 years chance of occurring	1/10 = 10%

Which results in the following "Ranges" of Likelihood:
Event is "Highly Likely" to occur – History of events is greater than 33%.
Event is "Likely" to occur – History of events is greater than 20%, but less than or equal to 33%.
Event could "Occasionally" occur – History of events is greater than 10%, but less than or equal to 20%.
Event is "Unlikely," but is possible of occurring – History of events is less than 10%.

Example: NWS-NCDC records show that 38 tornados were reported in Example County between 01/01/1950 and 12/31/2003. 38 events divided by 53 years = 0.72(72%) which would make future occurrences "Highly Likely" to happen.

This table's format, categories, and the criteria for completing the table, was supplied by the Oklahoma Department of Emergency Management, 06/29/2004.

Hazard Summary Tulsa County

Summary of Hazards for the Tulsa County Multi-Hazard Mitigation Plan
Source: NOAA national climatic data center, except wildfires and hazmat events which came from Tulsa Area Emergency Management Agency

Hazard Event	History	Estimated Total Dollar Loss (\$\$)	Average Cost Per Event (\$\$)	Likelihood Percentage	Likelihood Rating
Floods	Two County events, 2010 thru 2014	0	0	2/5=40%	HL
Tornado	Three County events, 2010 thru 2014	950000	316666	3/5=60%	HL
High Wind	Two County events, 2010 thru 2014	10000	5000	2/5=40%	HL
Lightning	Six County events, 2010 thru 2014	750000	125000	6/5>100%	HL
Hail	40 County events, 2010 thru 2014	460000	11500	40/5>100%	HL
Winter Storms	Eight County events, 2010 thru 2014	0	0	8/5>100%	HL
Extreme Heat	One County event, 2010 thru 2014	0	0	1/5=20%	O
Drought	16 County events, 2010 thru 2014	0	0	16/5>100%	HL
Expansive Soils (1)	Zero County events, 2010 thru 2014	0	0	0/5=0%	UL
Wildfire (2)	165 events, 2010 thru 2014	0	0	165/5>100%	HL
Earthquake	Zero County events, 2010 thru 2014	0	0	0/5=0%	UL
Hazmat Events (2)	80 events, 2010 thru 2014	0	0	80/5>100%	HL
Dam Break	Zero County events, 2010 thru 2014	0	0	0/5=0%	UL

Note: where zero events or zero dollar amounts are shown, this means there was no data reported for the hazard event.

- (1) No reports of this hazard
- (2) No County data available, use Sperry data

Natural Hazard Assessments

Each hazard is assigned a likelihood rating based on the criteria and methods described below.

Likelihood of Event "Rating" is based on the following definitions	
Highly likely (HL)	Event is probable within the calendar year.
Likely (L)	Event is probable within the next three years.
Occasional (O)	Event is probable within the next five years.
Unlikely (UL)	Event is possible within the next ten years.

Based on History, and using the information described above, Likelihood of Event is "Quantified" as follows:		
Highly Likely (HL)	Event has 1 in 1 year chance of occurring	1/1 = 100%
Likely (L)	Event has 1 in 3 years chance of occurring	1/3 = 33%
Occasional (O)	Event has 1 in 5 years chance of occurring	1/5 = 20%
Unlikely (UL)	Event has 1 in 10 years chance of occurring	1/10 = 10%

Which results in the following "Ranges" of Likelihood:	
Event is "Highly Likely" to occur	– History of events is greater than 33%.
Event is "Likely" to occur	– History of events is greater than 20%, but less than or equal to 33%.
Event could "Occasionally" occur	– History of events is greater than 10%, but less than or equal to 20%.
Event is "Unlikely," but is possible of occurring	– History of events is less than 10%.

Example: NWS-NCDC records show that 38 tornados were reported in Example County between 01/01/1950 and 12/31/2003. 38 events divided by 53 years = 0.72(72%) which would make future occurrences "Highly Likely" to happen.

This table's format, categories, and the criteria for completing the table, was supplied by the Oklahoma Department of Emergency Management, 06/29/2004.

Hazard Summary Town of Sperry

Summary of Hazards for the Town of Sperry in the Tulsa County Multi-Hazard Mitigation Plan Source: NOAA national climatic data center

Hazard Event	History	Estimated Total Dollar Loss (\$\$)	Average Cost Per Event (\$\$)	Likelihood Percentage	Likelihood Rating
Floods	Zero Sperry events, 2010 thru 2014	0	0	0/5=0%	UL
Tornado	Zero Sperry events, 2010 thru 2014	0	0	0/5=0%	UL
High Wind	Zero Sperry events, 2010 thru 2014	0	0	0/5=0%	UL
Lightning/Thunderstorm	Zero Sperry events, 2010 thru 2014	0	0	0/5=0%	UL
Hail	Two Sperry events, 2010 thru 2014	0	0	2/5=20%	O
Winter Storms (1)	Eight Sperry events, 2010 thru 2014	0	0	8/5>100%	HL
Extreme Heat (1)	One Sperry event, 2010 thru 2014	0	0	1/5=20%	O
Drought (1)	16 Sperry events, 2010 thru 2014	0	0	16/5>100%	HL
Expansive Soils (2)	Zero Sperry events, 2010 thru 2014	0	0	0/5=0%	UL
Wildfire	165 Sperry events, 2010 thru 2014	0	0	165/5>100%	HL
Earthquake	Zero Sperry events, 2010 thru 2014	0	0	0/5=0%	UL
Hazmat Events	80 Sperry events, 2010 thru 2014	0	0	80/5>100%	HL
Dam Break	Zero Sperry events, 2010 thru 2014	0	0	0/5=0%	UL

Note: where zero events or zero dollar amounts are shown, this means there was no data reported for the hazard event.

1. County wide event, includes Sperry
2. No events reported in County; therefore, none in Town

Draft for Comments